Calculations required to be provided by the Permittee on site for all Inspections

# ENGINEERING ANALYSIS FOR: EASTTOWN CROSSING LOT 2 COMMERCIAL PIONEER & SHAW PUYALLUP

## DESIGN CRITERIA

BUILDING CODE: 2018 INTERNATIONAL BUILDING CODE (IBC) AS AMENDED BY THE LOCAL JURISDICTION.

VERTICAL LOADS

| | |
|---|---|
| ROOF LIVE LOAD: | 25 PSF (SNOW) |
| ROOF DEAD LOAD: | 20 PSF |
| RESTAURANT FLOOR LIVE LOAD: | 100 PSF (REDUCIBLE) |
| FLOOR DEAD LOAD: | 15 PSF |

SNOW DESIGN DATA (ASCE 7-16)

FLAT SNOW LOAD: N/A
SNOW EXPOSURE FACTOR, Ce=1.0,
SNOW IMPORTANCE FACTOR, Is=1.0,
THERMAL FACTOR, Ct=1.1

WIND DESIGN DATA (ASCE 7-16)

BASIC WIND SPEED (ASD) V= 85MPH
ULTIMATE WIND SPEED V= 110MPH
RISK CATEGORY: II EXPOSURE: B
IMPORTANCE FACTOR, Iw= 1.0
TOPOGRAPHIC FACTOR, Kzt= 1.0

SEISMIC DESIGN DATA (ASCE7-16)

SEISMIC RESPONSE SYSTEM: WOOD SHEARWALLS
EQUIVALENT LATERAL FORCE PROCEDURE (ASCE 7-16)
RISK CATEGORY: II SEISMIC IMPORTANCE FACTOR, Ie= 1.0
MAPPED SPECTRAL RESPONSE ACCELERATION: Ss=1.42, S1=1.43
DESIGN SPECTRAL RESPONSE ACCELERATION: Sds=1.03, Sd1=0.61
SITE CLASS: D SEISMIC DESIGN CATEGORY: D
SEISMIC RESPONSE COEFFICIENT: Cs= 0.113
DESIGN BASE SHEAR: 20,374#

SOIL PROPERTIES:

BEARING CAPACITY: 2,000 PSF
LATERAL CAPACITY: 250 PSF/FT

## REVISION 1

REVISED VERTICAL AND LATERAL ANALYSIS DUE TO ARCHITECTURAL CHANGES CREATED FROM CITY REVIEW COMMENTS DATED MARCH 19TH, 2024

01

City of Puyallup
Development & Permitting Services
ISSUED PERMIT
Building | Planning
Engineering | Public Works
Fire | Traffic

PRCNC20231714

City of Puyallup
Building
REVIEWED FOR COMPLIANCE
BSnowden
03/18/2024
3:58:21 PM

CITY OF PUYALLUP STATE OF WASHINGTON

PIERUCCIONI E&C, LLC
CHON PIERUCCIONI, PE
3128 N. BENNETT ST.
TACOMA, WA 98407



EASTTOWN CROSSING
LOT TWO COMMERCIAL
PIONEER & SHAW PUYALLUP

REVISIONS

| | |
|---|---|
| 01 | REVIEW 1 2024.03.19 |

REVISIONS

| | |
|---|---|
| ENGINEER: | CP |
| CHECKED BY: | CP |
| DATE: | 2023.11.15 |
| TITLE: | STRUCTURAL ANALYSIS |
| PROJECT # : | ---- |

| Roof Framing | | | |
|---|---|---|---|
| **Member Name** | **Results (Max UTIL %)** | **Current Solution** | **Comments** |
| Typical Roof Rafter Sloped | Passed (74% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid A.7 Roof Rafter (1-2.5) | Passed (51% R) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid C.4 Roof Rafter (1-2.5) | Passed (69% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid C-D diagonal wall support beam | Passed (32% R) | 1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam | |
| Grid D Roof Rafter (1-2.5) Flat | Passed (79% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid D.2 Roof Rafter (1-2.5) Flat | Passed (49% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid D.4 Roof Rafter (1-2.5) Flat | Passed (66% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid D.6 Roof Rafter (1-2.5) Flat | Passed (53% R) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid D.8 Roof Rafter (1-2.5) Flat | Passed (30% R) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid D.9 Roof Rafter (1-2.5) Flat | Passed (27% R) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid D.6-E Diagonal Roof Beam Flat | Passed (18% R) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid D.6 Roof Rafter (1-2.5) Sloped | Passed (41% R) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid D.8 Roof Rafter (1-2.5) Sloped | Passed (49% M+) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid E Roof Rafter (1-2.5) Sloped | Passed (49% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid E.1 Roof Rafter (1-2.5) Sloped | Passed (52% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid E.9 Roof Rafter (1-2.5) Sloped | Passed (48% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid F Roof Rafter (1-2.5) Sloped | Passed (14% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid F Roof Rafter (1-2.5) Flat | Passed (49% M-) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid F.2 Roof Rafter (1-2.5) Flat | ~~Failed (55% M-)~~ Passed | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | An excessive uplift of -1111 lbs at support located at 5 1/2" failed this product. |
| Grid F.4 Roof Rafter (1-2.5) Flat | ~~Failed (55% M-)~~ Passed | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | An excessive uplift of -1111 lbs at support located at 5 1/2" failed this product. |
| Grid F.6 Roof Rafter (1-2.5) Flat | Passed (33% M-) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid F.8 Roof Rafter (1-2.5) Flat | Passed (16% M-) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid F.9 Roof Rafter (1-2.5) Flat | Passed (12% R) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid 3 Roof Rafter (F-G) Flat | ~~Failed (10% R)~~ Passed | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | An excessive uplift of -1519 lbs at support located at 5' 2" failed this product. |
| Grid C.4 Roof Rafter (2.5-5) Sloped | Passed (56% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid D.2 Roof Rafter (2.5-5) Sloped | Passed (31% R) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid D.5 Roof Rafter (2.5-5) Sloped | Passed (31% R) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid D.8 Roof Rafter (2.5-5) Sloped | Passed (47% M+) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid F.2 Roof Rafter (2.5-5) Sloped | Passed (59% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid F.4 Roof Rafter (2.5-5) Sloped | Passed (73% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid F.6 Roof Rafter (2.5-5) Sloped | Passed (78% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Grid F.8 Roof Rafter (2.5-5) Sloped | Passed (56% ΔT) | 1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam | |
| Ridge Beam (Grid A-C.2) | Passed (66% M+) | 1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam | |
| Ridge Beam (Grid C.2-D.5) | Passed (44% R) | 1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam | |
| Ridge Beam (Grid D.5-E.3) | Passed (47% R) | 1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam | |

| **ForteWEB Software Operator** | **Job Notes** |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

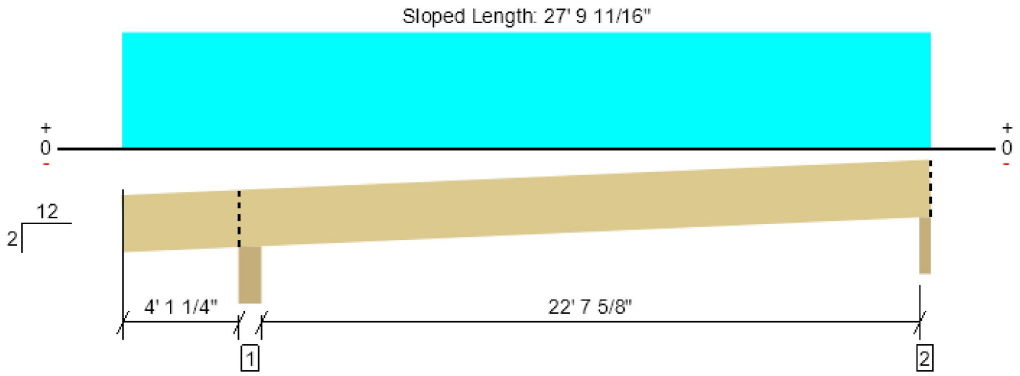
Weyerhaeuser

4/2/2024 8:44:52 PM UTC
ForteWEB v3.7
File Name: Easttown Crossing - Commercial Lot 2

| | | | |
|---|---|---|---|
| Ridge Beam (Grid E.3-E.7) | Passed (40% R) | 1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam | |
| Ridge Beam (Grid E.7-F) | Passed (46% R) | 1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam | |
| Ridge Beam (Grid F-G) | Passed (97% M+) | 1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam | |
| Grid 2.5A Post | Passed (75% $f_c$) | 1 piece(s) 6 x 8 DF No.2 | |
| Grid 2.5C.3 Post | Passed (82% $f_c$) | 1 piece(s) 8 x 8 DF No.2 | |
| Grid 2.5D.5 Post | Passed (66% $f_c$) | 1 piece(s) 8 x 8 DF No.2 | |
| Grid 2.5E.3 Post | Passed (70% $f_c$) | 1 piece(s) 8 x 8 DF No.2 | |
| Grid 2.5E.7 Post | Passed (86% $f_c$) | 1 piece(s) 6 x 8 DF No.2 | |
| Grid 2.5F Post | Passed (85% $f_c$) | 1 piece(s) 8 x 10 DF No.2 | |
| Grid 2.5G Post | Passed (57% $f_c$) | 1 piece(s) 8 x 8 DF No.2 | |
| 12'-6" Window Header (2A-1B) | Passed (73% M+) | 1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam | |
| 12'-6" Window Header (1B.2-1B.8) | Passed (83% ΔT) | 1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam | |
| 7'-10" Window Header (1D.1-1D.4) | Passed (35% M+) | 1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam | |
| 8'-6" Window Header (1D.6-1D.9) | Passed (65% M+) | 1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam | |
| 8'-6" Window Header (1E-1E.3) | Passed (59% M+) | 1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam | |
| 8'-6" Window Header (1E.4-1E.5) | Passed (64% M+) | 1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam | |
| 8'-6" Window Header (1E.6-1E.7) | Passed (67% V) | 1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam | |
| 8'-6" Window Header (1E.8-1E.9) | Passed (41% V) | 1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam | |
| 6'-11" Window Header (1F.1-1F.3) | Passed (43% M+) | 1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam | |
| 10'-6" Window Header (1F.4-1.8F.6) | Passed (37% M+) | 1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam | |
| 10'-6" Window Header (1.8F.6-2.3F.9) | Passed (16% R) | 1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam | |
| 7'-10" Window Header (5F.3-5F.5) | Passed (99% M+) | 1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam | |
| 7'-0" Window/Door Header (5E.9-5F.2) | Passed (51% R) | 1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam | |
| 7'-10" Window Header (5E.7-5E.9) | Passed (62% V) | 1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam | |
| 7'-10" Window Header (5E.3-5E.5) | Passed (69% M+) | 1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam | |
| 7'-0" Window/Door Header (5E.1-5E.2) | Passed (53% R) | 1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam | |
| 7'-10" Window Header (4D.7-5E.9) | Passed (60% M+) | 1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam | |
| 7'-0" Window/Door Header (5C-4D) | Passed (47% M+) | 1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam | |
| 4'-0" Window Header (5B.7-5B.9) | Passed (55% R) | 1 piece(s) 5 1/2" x 6" 24F-V4 DF Glulam | |
| 7'-10" Window Header (5A.2-5A.8) | Passed (87% M+) | 1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam | |
| King Stud (8'-6") 17'-0" Plate | Passed (69% $\Delta T_{lat}$) | 3 piece(s) 2 x 6 DF No.2 | |
| King Stud (10'-6") 17'-0" Plate | Passed (83% B/C) | 3 piece(s) 2 x 6 DF No.2 | |
| King Stud (8'-6") 11'-0" Plate | Passed (56% $f_{cp}$) | 3 piece(s) 2 x 6 DF No.2 | |
| King Stud (12'-6") 17'-0" Plate | Passed (71% B/C) | 1 piece(s) 6 x 8 DF No.2 | |

Roof Framing, Typical Roof Rafter Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 6235 @ 4' 4" | 12420 (5.50") | Passed (50%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 4057 @ 5' 8 1/16" | 15085 | Passed (27%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 24052 @ 16' 1 9/16" | 37416 | Passed (64%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -3605 @ 4' 4" | 29619 | Passed (12%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.609 @ 15' 10 3/4" | 1.165 | Passed (L/459) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 1.145 @ 15' 11 3/16" | 1.554 | Passed (L/244) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 27' 11 15/16"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Upward deflection on left cantilever exceeds overhang deflection criteria.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 22' 8 5/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 5' 2 5/8".
- Upward deflection on left cantilever exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beveled Plate - HF | 5.50" | 5.50" | 2.76" | 2987 | 2598 | 3247 | 6235 | Blocking |
| 2 - Beam - DF | 2.75" | 2.75" | 1.50" | 2059 | 1823 | 2279 | 4338 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 27' 10" o/c | |
| Bottom Edge (Lu) | 27' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 27' 5 1/8" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 27' 5 1/8" | 8' | 20.4 | 20.0 | 25.0 | Default Load |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

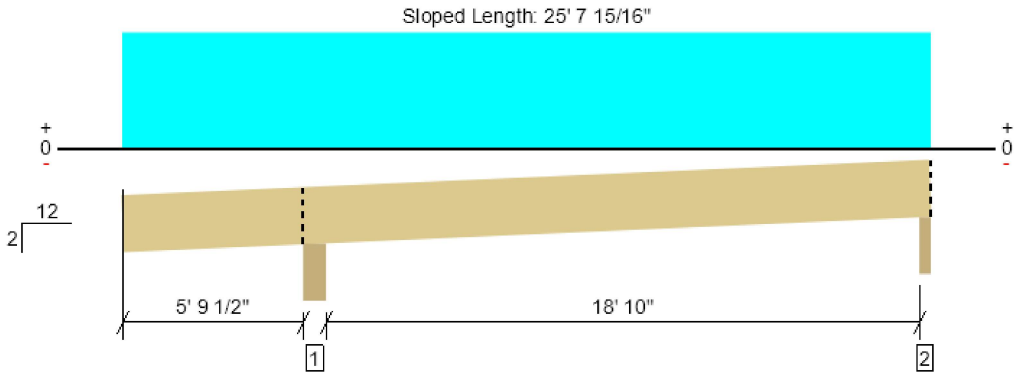
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid A.7 Roof Rafter (1-2.5)

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 6359 @ 6' 1/4" | 12420 (5.50") | Passed (51%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 3532 @ 7' 4 5/16" | 15085 | Passed (23%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 15191 @ 16' 3 3/4" | 38285 | Passed (40%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -6960 @ 6' 1/4" | 29619 | Passed (23%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.272 @ 15' 9 7/16" | 0.973 | Passed (L/857) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.490 @ 15' 10 9/16" | 1.297 | Passed (L/477) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 25' 10 3/16"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 18' 7/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beveled Plate - HF | 5.50" | 5.50" | 2.82" | 3047 | 2649 | 3312 | 6359 | Blocking |
| 2 - Beam - DF | 2.75" | 2.75" | 1.50" | 1610 | 1476 | 1845 | 3456 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 25' 8" o/c | |
| Bottom Edge (Lu) | 25' 8" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 25' 3 3/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 25' 3 3/4" | 8' | 20.4 | 20.0 | 25.0 | Default Load |

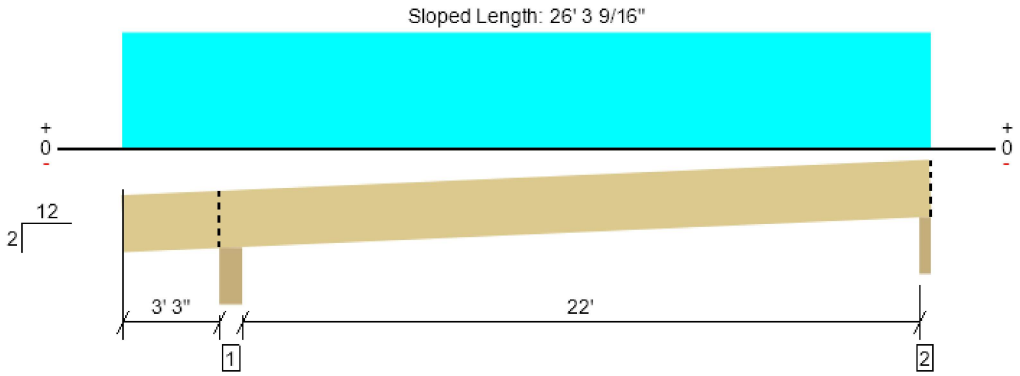
**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid C.4 Roof Rafter (1-2.5)

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 5732 @ 3' 5 3/4" | 12420 (5.50") | Passed (46%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 3882 @ 4' 9 13/16" | 15085 | Passed (26%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 23133 @ 14' 10 1/4" | 37489 | Passed (62%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -2324 @ 3' 5 3/4" | 29619 | Passed (8%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.552 @ 14' 8 7/16" | 1.133 | Passed (L/492) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 1.045 @ 14' 8 11/16" | 1.511 | Passed (L/260) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 26' 5 13/16"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Upward deflection on left cantilever exceeds overhang deflection criteria.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.98 that was calculated using length L = 22' 3 1/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 15/16".
- Upward deflection on left cantilever exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beveled Plate - HF | 5.50" | 5.50" | 2.54" | 2746 | 2388 | 2985 | 5732 | Blocking |
| 2 - Beam - DF | 2.75" | 2.75" | 1.50" | 2026 | 1783 | 2229 | 4255 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 26' 4" o/c | |
| Bottom Edge (Lu) | 26' 4" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 25' 11 1/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 25' 11 1/4" | 8' | 20.4 | 20.0 | 25.0 | Default Load |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

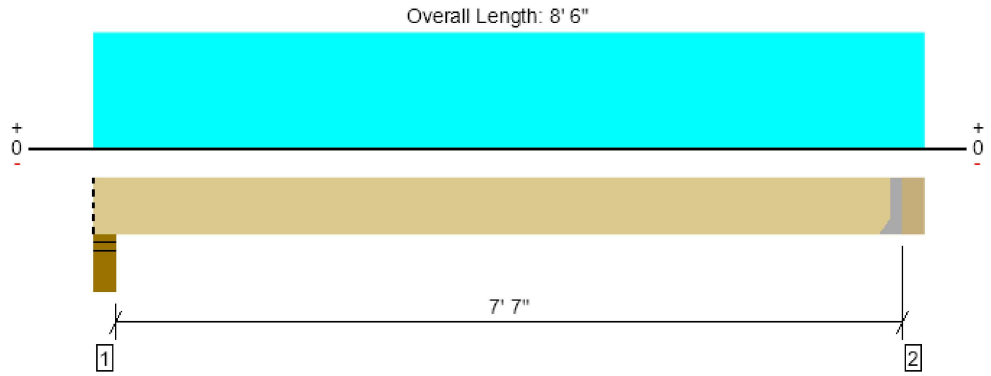
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid C-D diagonal wall support beam

**1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1725 @ 8' 1/2" | 5363 (1.50") | Passed (32%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 1333 @ 7' 2" | 11733 | Passed (11%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 3324 @ 4' 2 1/4" | 23244 | Passed (14%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.016 @ 4' 2 1/4" | 0.385 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.037 @ 4' 2 1/4" | 0.514 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 8' 1/2"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 7' 8 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Stud wall - HF | 5.50" | 5.50" | 1.50" | 1089 | 628 | 785 | 1874 | Blocking |
| 2 - Hanger on 10 1/2" GLB beam | 5.50" | Hanger[1] | 1.50" | 1115 | 647 | 809 | 1924 | See note [1] |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 8' 1" o/c | |
| Bottom Edge (Lu) | 8' 1" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie | | | | | | |
|---|---|---|---|---|---|---|
| Support | Model | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
| 2 - Face Mount Hanger | U610 | 2.00" | N/A | 14-10d | 6-10d | |

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 8' 1/2" | N/A | 14.0 | -- | -- | |
| 1 - Uniform (PLF) | 0 to 8' 6" (Front) | N/A | 96.0 | - | - | Default Load |
| 2 - Uniform (PSF) | 0 to 8' 6" (Front) | 7' 6" | 20.0 | 20.0 | 25.0 | |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

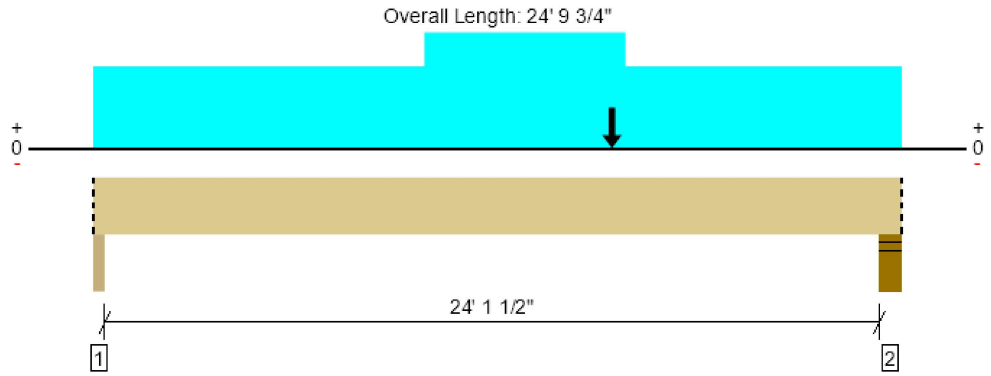
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid D Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3129 @ 1 1/4" | 9831 (2.75") | Passed (32%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 3508 @ 23' 2 3/4" | 15085 | Passed (23%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 25535 @ 15' 3/16" | 37149 | Passed (69%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.530 @ 12' 7 11/16" | 1.219 | Passed (L/552) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 1.277 @ 12' 7 15/16" | 1.625 | Passed (L/229) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 24' 9 3/4"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 24' 4 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1757 | 1098 | 1373 | 3129 | Blocking |
| 2 - Stud wall - HF | 5.50" | 5.50" | 1.70" | 2155 | 1307 | 1633 | 3789 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 24' 10" o/c | |
| Bottom Edge (Lu) | 24' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 24' 9 3/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 24' 9 3/4" (Front) | 3' 6 1/2" | 20.0 | 20.0 | 25.0 | Roof |
| 2 - Uniform (PLF) | 10' 2" to 16' 4" (Front) | N/A | 96.0 | - | - | Wall |
| 3 - Point (lb) | 15' 11" (Front) | N/A | 1115 | 647 | 809 | Linked from: Grid C-D diagonal wall support beam, Support 2 |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

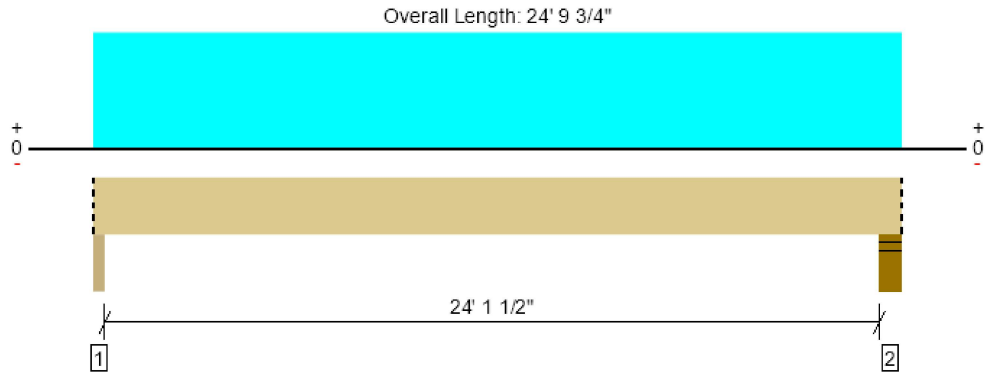
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid D.2 Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 2480 @ 1 1/4" | 9831 (2.75") | Passed (25%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 2207 @ 1' 4 1/4" | 15085 | Passed (15%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 14987 @ 12' 3 1/2" | 37149 | Passed (40%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.399 @ 12' 3 1/2" | 1.219 | Passed (L/732) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.790 @ 12' 3 1/2" | 1.625 | Passed (L/370) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 24' 9 3/4"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 24' 4 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1226 | 1004 | 1255 | 2480 | Blocking |
| 2 - Stud wall - HF | 5.50" | 5.50" | 1.50" | 1248 | 1023 | 1278 | 2527 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 24' 10" o/c | |
| Bottom Edge (Lu) | 24' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 24' 9 3/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 24' 9 3/4" (Front) | 4' 1" | 20.0 | 20.0 | 25.0 | Roof |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

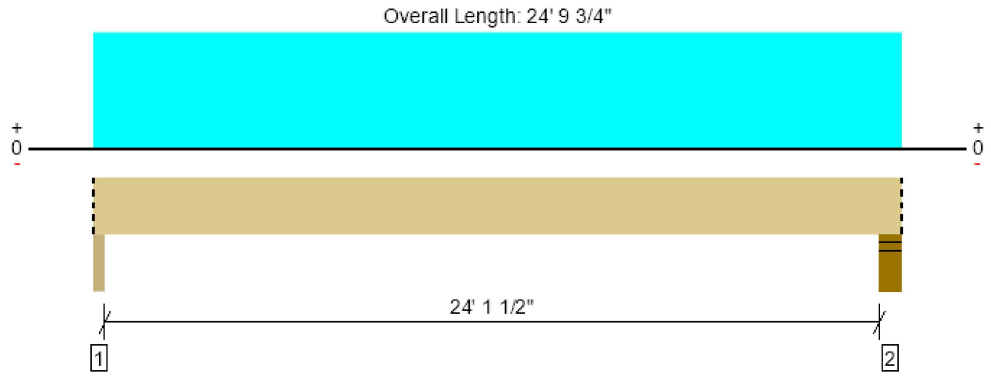
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid D.4 Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3356 @ 1 1/4" | 9831 (2.75") | Passed (34%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 2986 @ 1' 4 1/4" | 15085 | Passed (20%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 20279 @ 12' 3 1/2" | 37149 | Passed (55%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.554 @ 12' 3 1/2" | 1.219 | Passed (L/528) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 1.068 @ 12' 3 1/2" | 1.625 | Passed (L/274) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 24' 9 3/4"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 24' 4 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1615 | 1393 | 1741 | 3356 | Blocking |
| 2 - Stud wall - HF | 5.50" | 5.50" | 1.53" | 1645 | 1419 | 1774 | 3419 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 24' 10" o/c | |
| Bottom Edge (Lu) | 24' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 24' 9 3/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 24' 9 3/4" (Front) | 5' 8" | 20.0 | 20.0 | 25.0 | Roof |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

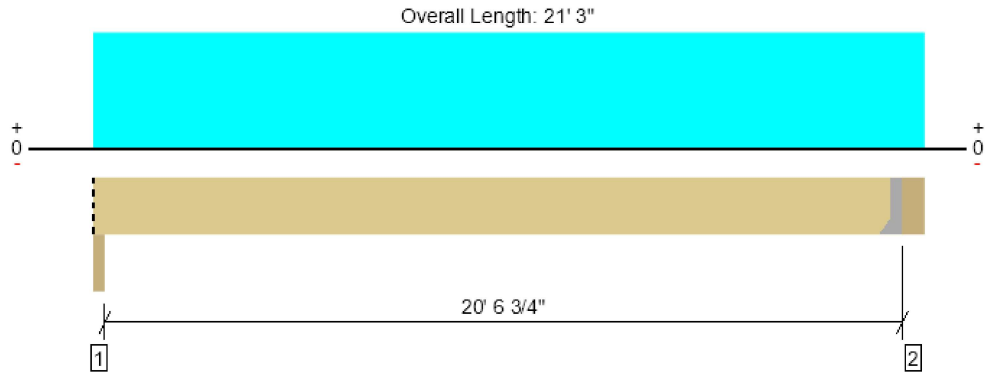
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid D.6 Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 2824 @ 20' 9 1/2" | 5363 (1.50") | Passed (53%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 2517 @ 19' 8" | 15085 | Passed (17%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 14607 @ 10' 5 3/8" | 37764 | Passed (39%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.288 @ 10' 5 3/8" | 1.034 | Passed (L/863) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.554 @ 10' 5 3/8" | 1.379 | Passed (L/448) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 20' 9 1/2"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.98 that was calculated using length L = 20' 8 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1373 | 1184 | 1480 | 2853 | Blocking |
| 2 - Hanger on 13 1/2" GLB beam | 5.50" | Hanger[1] | 1.50" | 1411 | 1224 | 1530 | 2941 | See note [1] |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 20' 10" o/c | |
| Bottom Edge (Lu) | 20' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

**Connector: Simpson Strong-Tie**

| Support | Model | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
|---|---|---|---|---|---|---|
| 2 - Face Mount Hanger | HU612 | 2.50" | N/A | 22-10d | 8-10d | |

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 20' 9 1/2" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 21' 3" (Front) | 5' 8" | 20.0 | 20.0 | 25.0 | Roof |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

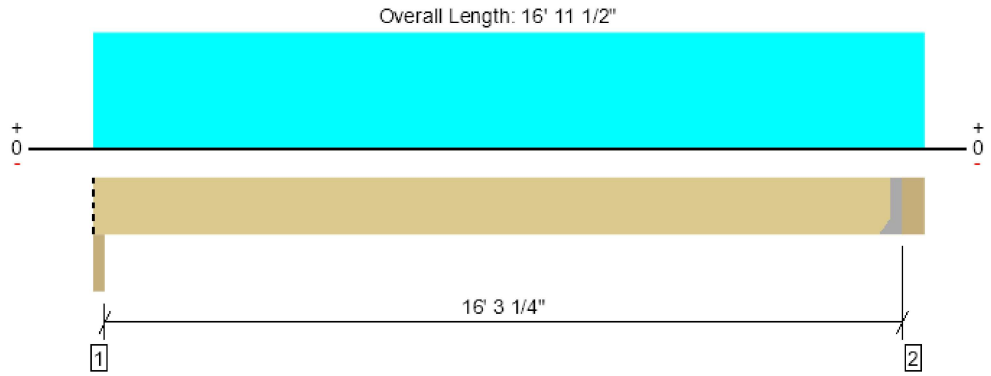
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid D.8 Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1624 @ 16' 6" | 5363 (1.50") | Passed (30%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 1401 @ 15' 4 1/2" | 15085 | Passed (9%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 6655 @ 8' 3 5/8" | 38424 | Passed (17%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.080 @ 8' 3 5/8" | 0.820 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.159 @ 8' 3 5/8" | 1.093 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 16' 6"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 16' 4 3/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 814 | 664 | 830 | 1644 | Blocking |
| 2 - Hanger on 13 1/2" GLB beam | 5.50" | Hanger[1] | 1.50" | 840 | 693 | 866 | 1706 | See note [1] |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 16' 6" o/c | |
| Bottom Edge (Lu) | 16' 6" o/c | |

•Maximum allowable bracing intervals based on applied load.

**Connector: Simpson Strong-Tie**

| Support | Model | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
|---|---|---|---|---|---|---|
| 2 - Face Mount Hanger | U610 | 2.00" | N/A | 14-10d | 6-10d | |

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 16' 6" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 16' 11 1/2" (Front) | 4' | 20.0 | 20.0 | 25.0 | Roof |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

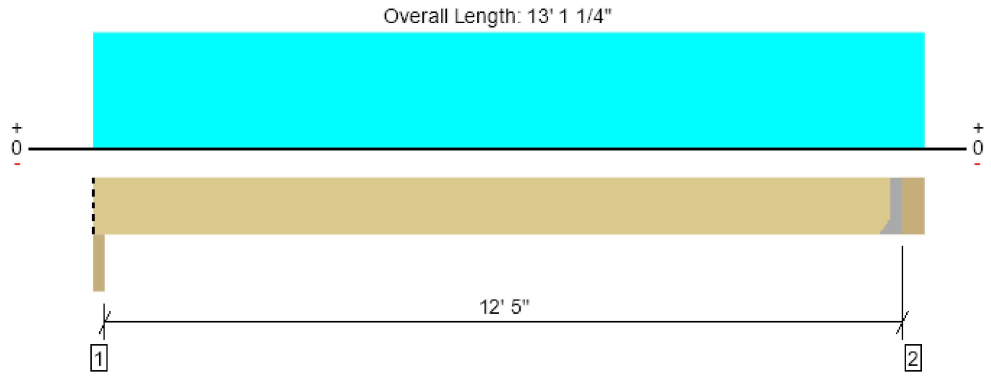
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid D.9 Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1430 @ 12' 7 3/4" | 5363 (1.50") | Passed (27%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 1173 @ 11' 6 1/4" | 15085 | Passed (8%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 4484 @ 6' 4 1/2" | 38424 | Passed (12%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.032 @ 6' 4 1/2" | 0.627 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.063 @ 6' 4 1/2" | 0.836 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 12' 7 3/4"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 12' 6 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 710 | 595 | 744 | 1454 | Blocking |
| 2 - Hanger on 13 1/2" GLB beam | 5.50" | Hanger[1] | 1.50" | 741 | 628 | 785 | 1526 | See note [1] |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 12' 8" o/c | |
| Bottom Edge (Lu) | 12' 8" o/c | |

•Maximum allowable bracing intervals based on applied load.

**Connector: Simpson Strong-Tie**

| Support | Model | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
|---|---|---|---|---|---|---|
| 2 - Face Mount Hanger | U610 | 2.00" | N/A | 14-10dx1.5 | 6-10d | |

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 12' 7 3/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 13' 1 1/4" (Front) | 4' 8" | 20.0 | 20.0 | 25.0 | Roof |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

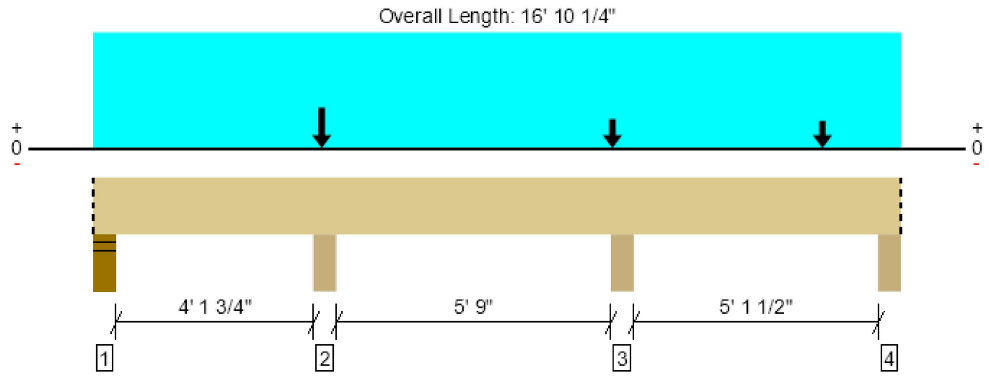
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid D.6-E Diagonal Roof Beam Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3491 @ 4' 10" | 19663 (5.50") | Passed (18%) | -- | 1.0 D + 1.0 S (Adj Spans) |
| Shear (lbs) | 1176 @ 15' 3 1/4" | 15085 | Passed (8%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Pos Moment (Ft-lbs) | 1616 @ 15' 2 5/8" | 38424 | Passed (4%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -869 @ 11' 1/2" | 29619 | Passed (3%) | 1.15 | 1.0 D + 1.0 S (Adj Spans) |
| Live Load Defl. (in) | 0.001 @ 14' 2 3/16" | 0.274 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.003 @ 14' 2 5/16" | 0.365 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 16' 10 1/4"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 4 3/4".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 1 7/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Stud wall - HF | 5.50" | 5.50" | 1.50" | 128 | 101 | 126 | 254 | Blocking |
| 2 - Column - DF | 5.50" | 5.50" | 1.50" | 1688 | 1442 | 1803 | 3491 | None |
| 3 - Column - DF | 5.50" | 5.50" | 1.50" | 1490 | 1189 | 1486 | 2976 | None |
| 4 - Column - DF | 5.50" | 5.50" | 1.50" | 663 | 547 | 684 | 1347 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 16' 10" o/c | |
| Bottom Edge (Lu) | 16' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 16' 10 1/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 16' 10 1/4" (Front) | 2' | 20.0 | 20.0 | 25.0 | Roof |
| 2 - Point (lb) | 4' 9 1/4" (Front) | N/A | 1411 | 1224 | 1530 | Linked from: Grid D.6 Roof Rafter (1-2.5) Flat, Support 2 |
| 3 - Point (lb) | 10' 10" (Front) | N/A | 840 | 693 | 866 | Linked from: Grid D.8 Roof Rafter (1-2.5) Flat, Support 2 |
| 4 - Point (lb) | 15' 2 5/8" (Front) | N/A | 741 | 628 | 785 | Linked from: Grid D.9 Roof Rafter (1-2.5) Flat, Support 2 |

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

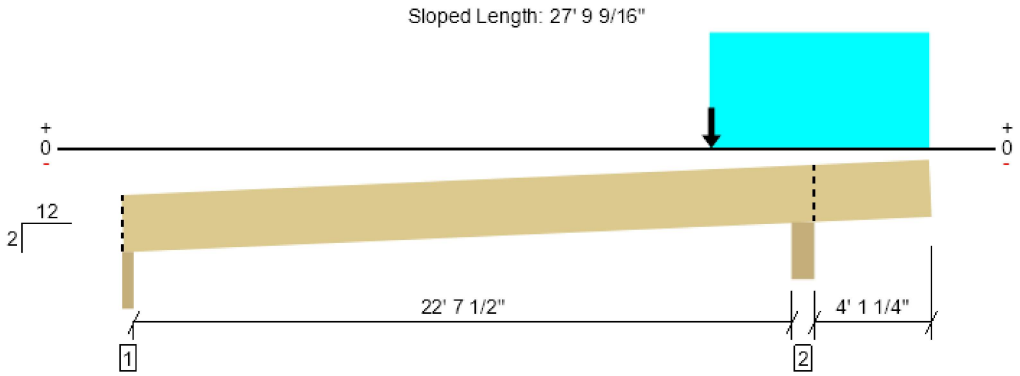
## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid D.6 Roof Rafter (1-2.5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 5045 @ 23' 1" | 12420 (5.50") | Passed (41%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 3657 @ 21' 8 15/16" | 15085 | Passed (24%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 9401 @ 19' 11 3/4" | 37390 | Passed (25%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -2297 @ 23' 1" | 29619 | Passed (8%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.162 @ 13' 2 5/8" | 1.165 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.351 @ 12' 11 5/16" | 1.553 | Passed (L/797) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 27' 11 13/16"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 22' 10 1/4".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 11 7/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 413 | 195 | 244 | 657 | Blocking |
| 2 - Beveled Plate - HF | 5.50" | 5.50" | 2.23" | 2531 | 2011 | 2514 | 5045 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 27' 10" o/c | |
| Bottom Edge (Lu) | 27' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 27' 5" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 19' 11" to 27' 4 1/2" | 5' | 20.0 | 20.0 | 25.0 | Roof |
| 2 - Point (lb) | 19' 11 3/4" | N/A | 1688 | 1442 | 1803 | Linked from: Grid D.6-E Diagonal Roof Beam Flat, Support 2 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

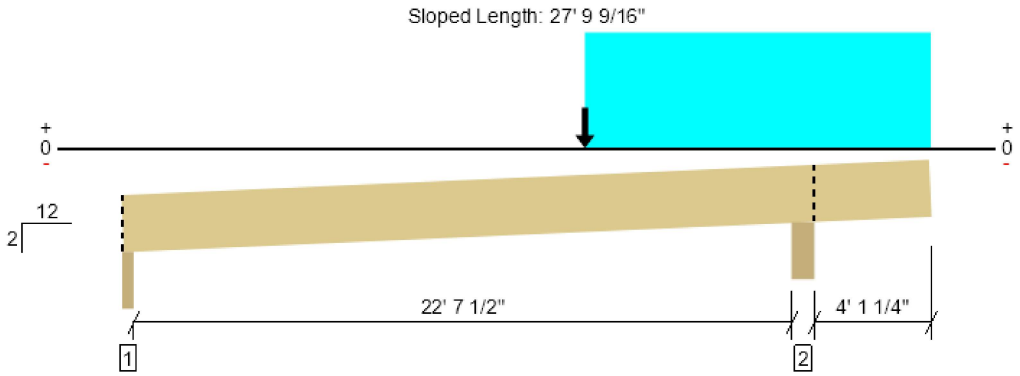
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid D.8 Roof Rafter (1-2.5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 4298 @ 23' 1" | 12420 (5.50") | Passed (35%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 3167 @ 21' 8 15/16" | 15085 | Passed (21%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 18388 @ 15' 8 1/4" | 37386 | Passed (49%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -1872 @ 23' 1" | 29619 | Passed (6%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.337 @ 12' 8 5/16" | 1.165 | Passed (L/829) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.705 @ 12' 7 1/16" | 1.553 | Passed (L/396) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 27' 11 13/16"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 22' 10 1/2".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 11 7/16".
- Upward deflection on right cantilever exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 748 | 462 | 577 | 1324 | Blocking |
| 2 - Beveled Plate - HF | 5.50" | 5.50" | 1.90" | 2195 | 1682 | 2102 | 4298 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 27' 10" o/c | |
| Bottom Edge (Lu) | 27' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 27' 5" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 15' 8 1/4" to 27' 5" | 4' | 20.0 | 20.0 | 25.0 | Roof |
| 2 - Point (lb) | 15' 8 1/4" | N/A | 1490 | 1189 | 1486 | Linked from: Grid D.6-E Diagonal Roof Beam Flat, Support 3 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

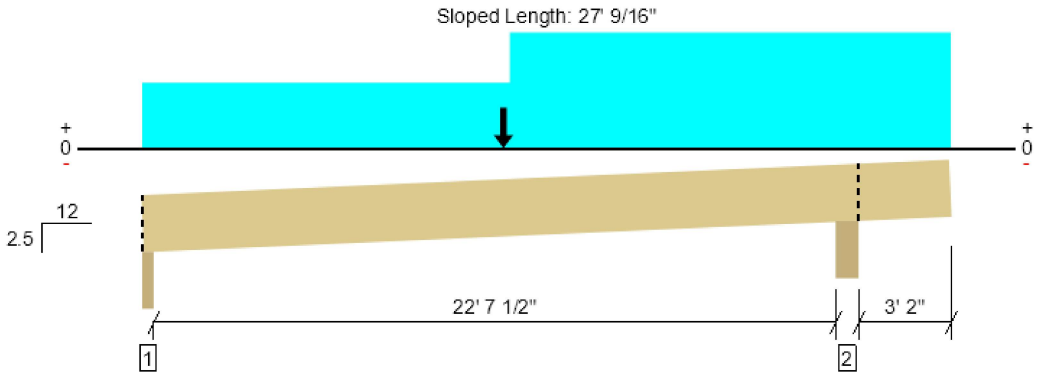
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid E Roof Rafter (1-2.5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3368 @ 23' 1" | 12514 (5.50") | Passed (27%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 2458 @ 21' 9 1/16" | 15085 | Passed (16%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 17375 @ 11' 10" | 37341 | Passed (47%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -1110 @ 23' 1" | 29619 | Passed (4%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.383 @ 11' 8 15/16" | 1.174 | Passed (L/735) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.769 @ 11' 8 9/16" | 1.565 | Passed (L/366) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 27' 3 3/8"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2.5/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 23' 1 13/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 3' 10 11/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1118 | 849 | 1061 | 2179 | Blocking |
| 2 - Beveled Plate - HF | 5.50" | 5.50" | 1.50" | 1697 | 1336 | 1671 | 3368 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 27' 1" o/c | |
| Bottom Edge (Lu) | 27' 1" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 26' 5 3/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 12' 1/2" to 26' 5 3/4" | 1' 8" | 20.0 | 20.0 | 25.0 | Roof |
| 2 - Uniform (PSF) | 0 to 26' 5 3/4" | 2' 2" | 20.0 | 20.0 | 25.0 | Roof |
| 3 - Point (lb) | 11' 10" | N/A | 663 | 547 | 684 | Linked from: Grid D.6-E Diagonal Roof Beam Flat, Support 4 |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

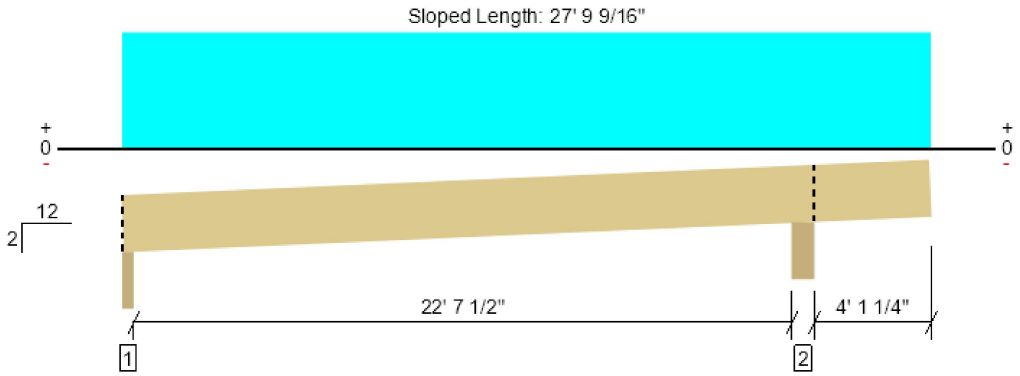
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid E.1 Roof Rafter (1-2.5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 4431 @ 23' 1" | 12420 (5.50") | Passed (36%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 2882 @ 21' 8 15/16" | 15085 | Passed (19%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 17079 @ 11' 3 1/2" | 37418 | Passed (46%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -2563 @ 23' 1" | 29619 | Passed (9%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.428 @ 11' 6 5/16" | 1.165 | Passed (L/654) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.812 @ 11' 5 7/8" | 1.553 | Passed (L/344) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 27' 11 13/16"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 22' 8 3/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 5' 2 5/8".
- Upward deflection on right cantilever exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1480 | 1281 | 1602 | 3082 | Blocking |
| 2 - Beveled Plate - HF | 5.50" | 5.50" | 1.96" | 2148 | 1826 | 2283 | 4431 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 27' 10" o/c | |
| Bottom Edge (Lu) | 27' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 27' 5" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 27' 5" | 5' 7 1/2" | 20.0 | 20.0 | 25.0 | Roof |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

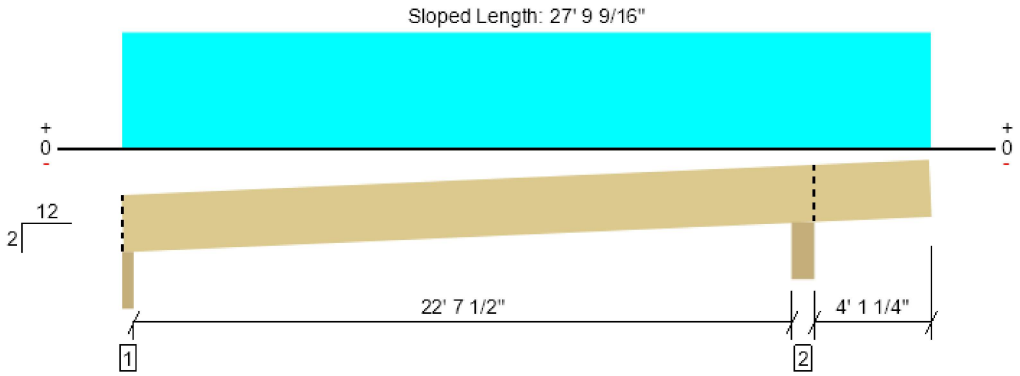
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid E.9 Roof Rafter (1-2.5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 4033 @ 23' 1" | 12420 (5.50") | Passed (32%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 2623 @ 21' 8 15/16" | 15085 | Passed (17%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 15542 @ 11' 3 1/2" | 37418 | Passed (42%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -2333 @ 23' 1" | 29619 | Passed (8%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.386 @ 11' 6 5/16" | 1.165 | Passed (L/723) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.739 @ 11' 5 7/8" | 1.553 | Passed (L/378) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 27' 11 13/16"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 22' 8 1/8".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 5' 2 5/8".
- Upward deflection on right cantilever exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1357 | 1158 | 1447 | 2805 | Blocking |
| 2 - Beveled Plate - HF | 5.50" | 5.50" | 1.79" | 1970 | 1650 | 2063 | 4033 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 27' 10" o/c | |
| Bottom Edge (Lu) | 27' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 27' 5" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 27' 5" | 5' 1" | 20.0 | 20.0 | 25.0 | Roof |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

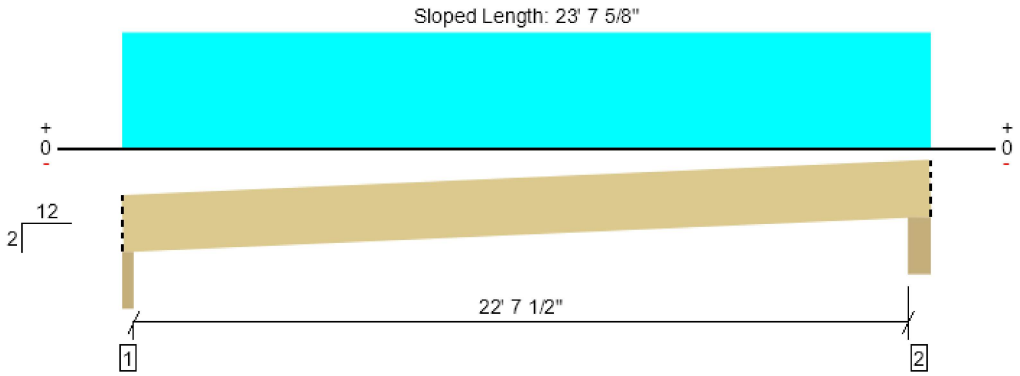
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid F Roof Rafter (1-2.5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 777 @ 1 1/4" | 9831 (2.75") | Passed (8%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 687 @ 1' 4 1/16" | 15085 | Passed (5%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 4405 @ 11' 6 1/2" | 37335 | Passed (12%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.084 @ 11' 6 1/2" | 1.160 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.210 @ 11' 6 1/2" | 1.546 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 23' 9 7/8"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 23' 2 5/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beam - GLB | 2.75" | 2.75" | 1.50" | 465 | 250 | 313 | 777 | Blocking |
| 2 - Beveled Plate - HF | 5.50" | 5.50" | 1.50" | 474 | 255 | 319 | 793 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 23' 8" o/c | |
| Bottom Edge (Lu) | 23' 8" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 23' 3 3/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 23' 3 3/4" | 1' 1" | 20.0 | 20.0 | 25.0 | Roof |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

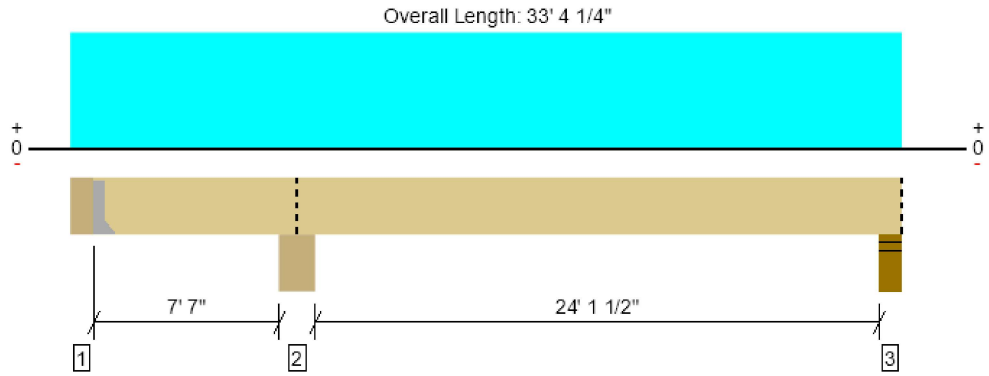
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid F Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 2493 @ 33' 1/4" | 12251 (5.50") | Passed (20%) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Shear (lbs) | 3214 @ 9' 10 3/4" | 15085 | Passed (21%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 11967 @ 23' 1 3/16" | 37921 | Passed (32%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Neg Moment (Ft-lbs) | -14383 @ 8' 4 7/8" | 29619 | Passed (49%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.278 @ 21' 11 1/2" | 1.231 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.537 @ 21' 11 11/16" | 1.641 | Passed (L/550) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 32' 10 3/4"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.99 that was calculated using length L = 19' 10 3/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 12' 9 1/16".
- -974 lbs uplift at support located at 5 1/2". Strapping or other restraint may be required.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Hanger on 13 1/2" GLB beam | 5.50" | Hanger[1] | 1.50" | -364 | 59/-488 | 74/-610 | -974 | See note [1] |
| 2 - Beam - GLB | 8.75" | 8.75" | 1.78" | 3085 | 2613 | 3266 | 6351 | Blocking |
| 3 - Stud wall - HF | 5.50" | 5.50" | 1.50" | 1208 | 1028 | 1284 | 2493 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 32' 11" o/c | |
| Bottom Edge (Lu) | 32' 11" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie | | | | | | |
|---|---|---|---|---|---|---|
| Support | Model | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
| 1 - Face Mount Hanger | HU612 | 2.50" | N/A | 22-10dx1.5 | 8-10d | |

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 5 1/2" to 33' 4 1/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 33' 4 1/4" (Front) | 5' | 20.0 | 20.0 | 25.0 | Roof |

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

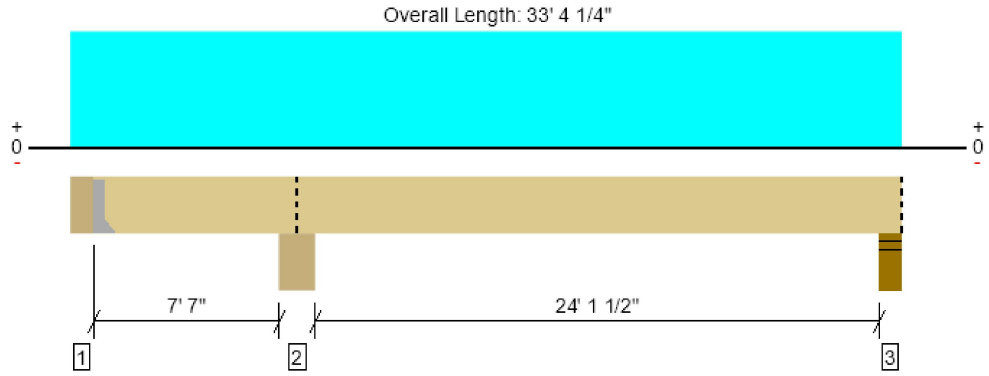
~~FAILED~~

PASSED

Roof Framing, Grid F.2 Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**

An excessive uplift of -1111 lbs at support located at 5 1/2" failed this product. Uplift resisted by HUC610-SDS Hanger




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 2839 @ 33' 1/4" | 12251 (5.50") | Passed (23%) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Shear (lbs) | 3660 @ 9' 10 3/4" | 15085 | Passed (24%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 13629 @ 23' 1 3/16" | 37921 | Passed (36%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -16380 @ 8' 4 7/8" | 29619 | Passed (55%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.320 @ 21' 11 1/2" | 1.231 | Passed (L/924) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.612 @ 21' 11 11/16" | 1.641 | Passed (L/483) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 32' 10 3/4"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.99 that was calculated using length L = 19' 10 3/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 12' 9 1/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Hanger on 13 1/2" GLB beam | 5.50" | Hanger[1] | 1.50" | -409 | 68/-561 | 85/-701 | -1111 | See note [1] |
| 2 - Beam - GLB | 8.75" | 8.75" | 2.02" | 3477 | 3005 | 3756 | 7233 | Blocking |
| 3 - Stud wall - HF | 5.50" | 5.50" | 1.50" | 1362 | 1182 | 1477 | 2839 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 32' 11" o/c | |
| Bottom Edge (Lu) | 32' 11" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie | | | | | | |
|---|---|---|---|---|---|---|
| Support | Model | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
| 1 - Face Mount Hanger | HU612 | 2.50" | N/A | 22-16d | 8-16d | |

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 5 1/2" to 33' 4 1/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 33' 4 1/4" (Front) | 5' 9" | 20.0 | 20.0 | 25.0 | Roof |

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

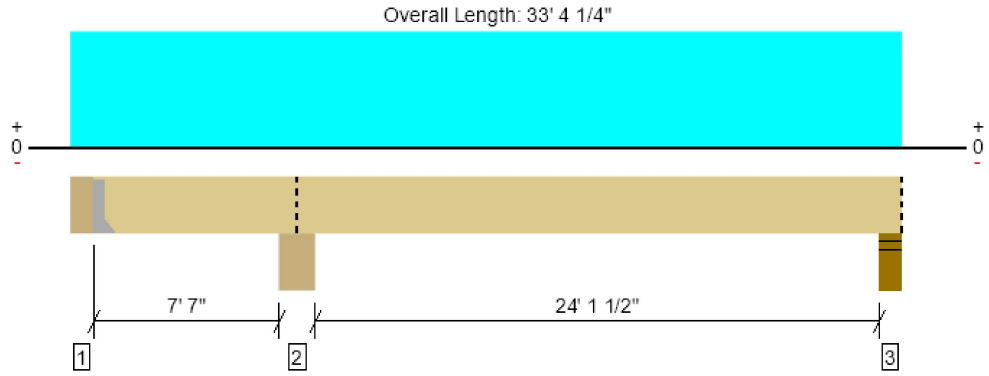
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid F.4 Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**

An excessive uplift of -1111 lbs at support located at 5 1/2" failed this product.

Uplift resisted by HUCQ610-SDS Hanger




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 2839 @ 33' 1/4" | 12251 (5.50") | Passed (23%) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Shear (lbs) | 3660 @ 9' 10 3/4" | 15085 | Passed (24%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 13629 @ 23' 1 3/16" | 37921 | Passed (36%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -16380 @ 8' 4 7/8" | 29619 | Passed (55%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.320 @ 21' 11 1/2" | 1.231 | Passed (L/924) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.612 @ 21' 11 11/16" | 1.641 | Passed (L/483) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 32' 10 3/4"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.99 that was calculated using length L = 19' 10 3/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 12' 9 1/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Hanger on 13 1/2" GLB beam | 5.50" | Hanger[1] | 1.50" | -409 | 68/-561 | 85/-701 | -1111 | See note [1] |
| 2 - Beam - GLB | 8.75" | 8.75" | 2.02" | 3477 | 3005 | 3756 | 7233 | Blocking |
| 3 - Stud wall - HF | 5.50" | 5.50" | 1.50" | 1362 | 1182 | 1477 | 2839 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 32' 11" o/c | |
| Bottom Edge (Lu) | 32' 11" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie | | | | | | |
|---|---|---|---|---|---|---|
| Support | Model | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
| 1 - Face Mount Hanger | HU612 | 2.50" | N/A | 22-16d | 8-16d | |

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 5 1/2" to 33' 4 1/4" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 33' 4 1/4" (Front) | 5' 9" | 20.0 | 20.0 | 25.0 | Roof |

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

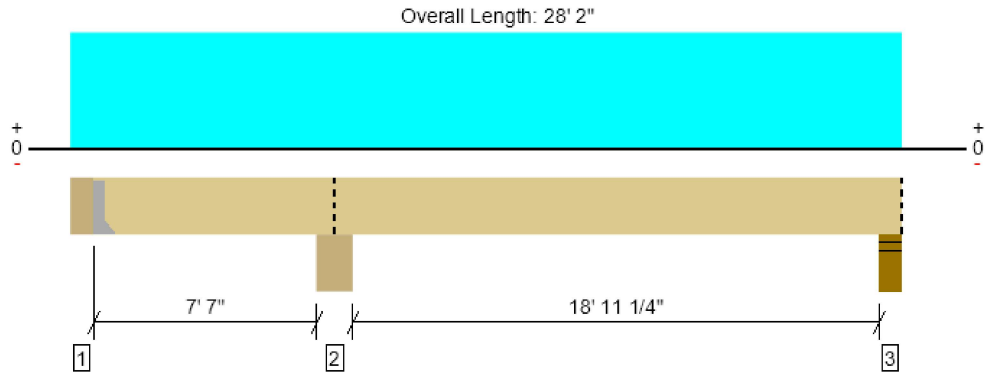
## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid F.6 Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 2280 @ 27' 10" | 12251 (5.50") | Passed (19%) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Shear (lbs) | 2786 @ 9' 10 3/4" | 15085 | Passed (18%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 8644 @ 19' 11 3/16" | 38424 | Passed (22%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -9902 @ 8' 4 7/8" | 29619 | Passed (33%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.129 @ 19' 7/16" | 0.971 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.245 @ 19' 11/16" | 1.295 | Passed (L/953) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 27' 8 1/2"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 15' 9 11/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 11' 7 9/16".
- -292 lbs uplift at support located at 5 1/2". Strapping or other restraint may be required.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Hanger on 13 1/2" GLB beam | 5.50" | Hanger[1] | 1.50" | -17 | 234/-220 | 293/-275 | 276/-292 | See note [1] |
| 2 - Beam - GLB | 8.75" | 8.75" | 1.55" | 2665 | 2303 | 2879 | 5544 | Blocking |
| 3 - Stud wall - HF | 5.50" | 5.50" | 1.50" | 1092 | 950 | 1188 | 2280 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 27' 9" o/c | |
| Bottom Edge (Lu) | 27' 9" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie | | | | | | |
|---|---|---|---|---|---|---|
| Support | Model | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
| 1 - Face Mount Hanger | U610 | 2.00" | N/A | 14-10dx1.5 | 6-10d | |

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 5 1/2" to 28' 2" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 28' 2" (Front) | 5' 9" | 20.0 | 20.0 | 25.0 | Roof |

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

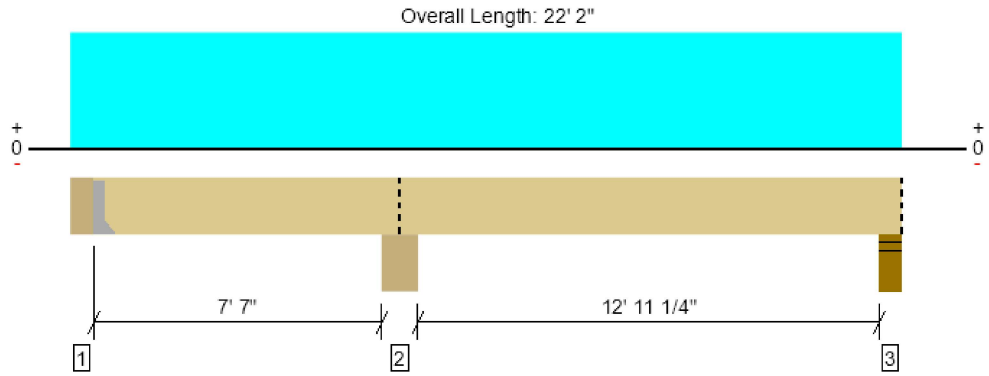
## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid F.8 Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1614 @ 21' 10" | 12251 (5.50") | Passed (13%) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Shear (lbs) | 1798 @ 9' 10 3/4" | 15085 | Passed (12%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 4183 @ 16' 4 1/16" | 38424 | Passed (11%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -4731 @ 8' 4 7/8" | 29619 | Passed (16%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.031 @ 15' 8 5/16" | 0.671 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.057 @ 15' 8 13/16" | 0.895 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 21' 8 1/2"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 10' 11 15/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 6' 10 3/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Hanger on 13 1/2" GLB beam | 5.50" | Hanger[1] | 1.50" | 295 | 365 | 456 | 751 | See note [1] |
| 2 - Beam - GLB | 8.75" | 8.75" | 1.50" | 1877 | 1623 | 2028 | 3906 | Blocking |
| 3 - Stud wall - HF | 5.50" | 5.50" | 1.50" | 768 | 677 | 846 | 1614 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 21' 9" o/c | |
| Bottom Edge (Lu) | 21' 9" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie | | | | | | |
|---|---|---|---|---|---|---|
| Support | Model | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
| 1 - Face Mount Hanger | U610 | 2.00" | N/A | 14-10dx1.5 | 6-10d | |

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 5 1/2" to 22' 2" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 22' 2" (Front) | 5' 9" | 20.0 | 20.0 | 25.0 | Roof |

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

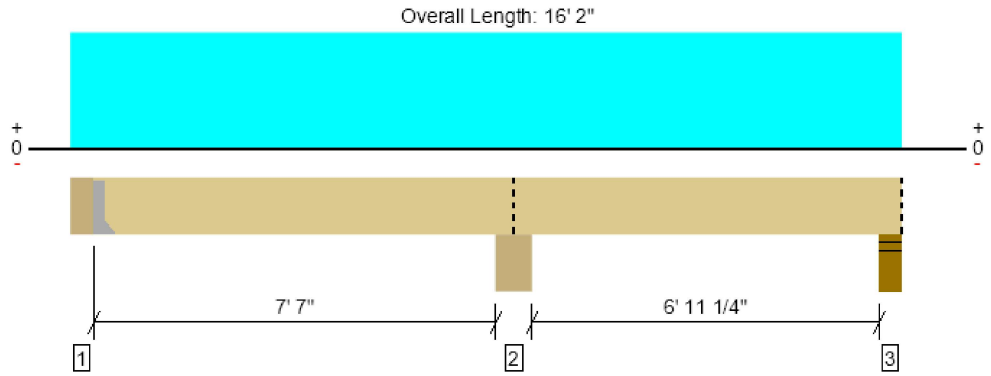
## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid F.9 Roof Rafter (1-2.5) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 659 @ 5 1/2" | 5363 (1.50") | Passed (12%) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Shear (lbs) | 715 @ 6' 11" | 15085 | Passed (5%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Pos Moment (Ft-lbs) | 1037 @ 3' 7 1/4" | 38424 | Passed (3%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -1551 @ 8' 4 7/8" | 29619 | Passed (5%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Live Load Defl. (in) | 0.003 @ 4' 1 1/8" | 0.397 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.005 @ 4' 1/16" | 0.530 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 15' 8 1/2"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 6' 3 9/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 3' 10 5/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Hanger on 13 1/2" GLB beam | 5.50" | Hanger[1] | 1.50" | 352 | 315 | 394 | 746 | See note [1] |
| 2 - Beam - GLB | 8.75" | 8.75" | 1.50" | 991 | 818 | 1022 | 2013 | Blocking |
| 3 - Stud wall - HF | 5.50" | 5.50" | 1.50" | 314 | 283 | 353 | 667 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 15' 9" o/c | |
| Bottom Edge (Lu) | 15' 9" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie | | | | | | |
|---|---|---|---|---|---|---|
| Support | Model | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
| 1 - Face Mount Hanger | U610 | 2.00" | N/A | 14-10dx1.5 | 6-10d | |

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 5 1/2" to 16' 2" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 16' 2" (Front) | 4' 3" | 20.0 | 20.0 | 25.0 | Roof |

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

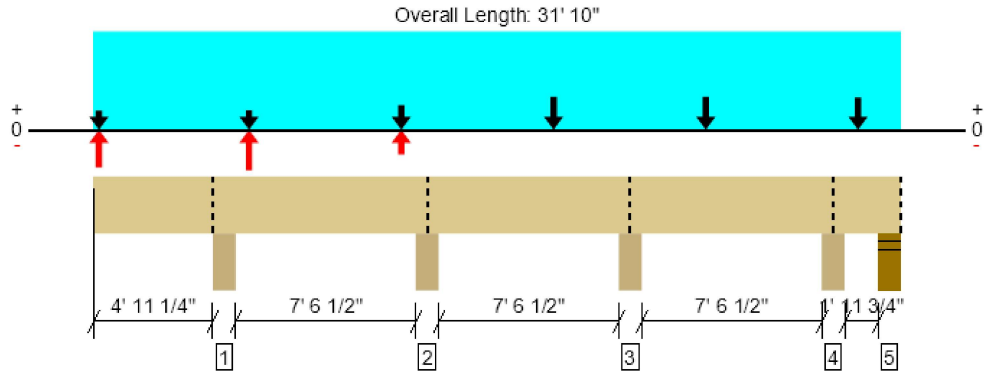
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid 3 Roof Rafter (F-G) Flat

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**

An excessive uplift of -1519 lbs at support located at 5' 2" failed this product.

Uplift resisted by H6 ties




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) [Group] |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 2056 @ 21' 2" | 19663 (5.50") | Passed (10%) | -- | 1.0 D + 1.0 S (Adj Spans) [1] |
| Shear (lbs) | 986 @ 6' 6 1/4" | 15085 | Passed (7%) | 1.15 | 1.0 D + 1.0 S (All Spans) [8] |
| Pos Moment (Ft-lbs) | 3267 @ 5' 2" | 38424 | Passed (9%) | 1.15 | 1.0 D + 1.0 S (All Spans) [8] |
| Neg Moment (Ft-lbs) | -1636 @ 21' 2" | 29619 | Passed (6%) | 1.15 | 1.0 D + 1.0 S (Adj Spans) [1] |
| Live Load Defl. (in) | 0.017 @ 0 | 0.517 | Passed (2L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) [1] |
| Total Load Defl. (in) | 0.008 @ 8' 4 1/16" | 0.533 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Adj Spans) [8] |

Member Length : 31' 10"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 10' 9 11/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 3' 6 7/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Column - DF | 5.50" | 5.50" | 1.50" | -367 | 637/-922 | 796/-1152 | 430/-1519 | Blocking |
| 2 - Column - DF | 5.50" | 5.50" | 1.50" | 741 | 691 | 864 | 1605 | Blocking |
| 3 - Column - DF | 5.50" | 5.50" | 1.50" | 885 | 937 | 1171 | 2056 | Blocking |
| 4 - Column - DF | 5.50" | 5.50" | 1.50" | 805 | 746 | 933 | 1738 | Blocking |
| 5 - Stud wall - HF | 5.50" | 5.50" | 1.50" | 42 | 145/-109 | 181/-136 | 223/-94 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 31' 10" o/c | |
| Bottom Edge (Lu) | 31' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 31' 10" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 31' 10" (Front) | 2' 2" | 20.0 | 20.0 | 25.0 | Roof |
| 2 - Point (lb) | 2 3/4" (Back) | N/A | -364 | 59/-488 | 74/-610 | Linked from: Grid F Roof Rafter (1-2.5) Flat, Support 1 |
| 3 - Point (lb) | 6' 1 3/4" (Back) | N/A | -409 | 68/-561 | 85/-701 | Linked from: Grid F.2 Roof Rafter (1-2.5) Flat, Support 1 |
| 4 - Point (lb) | 12' 1 3/4" (Back) | N/A | -17 | 234/-220 | 293/-275 | Linked from: Grid F.6 Roof Rafter (1-2.5) Flat, Support 1 |
| 5 - Point (lb) | 18' 1 3/4" (Back) | N/A | 295 | 365 | 456 | Linked from: Grid F.8 Roof Rafter (1-2.5) Flat, Support 1 |
| 6 - Point (lb) | 24' 1 3/4" (Back) | N/A | 295 | 365 | 456 | Linked from: Grid F.8 Roof Rafter (1-2.5) Flat, Support 1 |
| 7 - Point (lb) | 30' 1 3/4" (Back) | N/A | 352 | 315 | 394 | Linked from: Grid F.9 Roof Rafter (1-2.5) Flat, Support 1 |

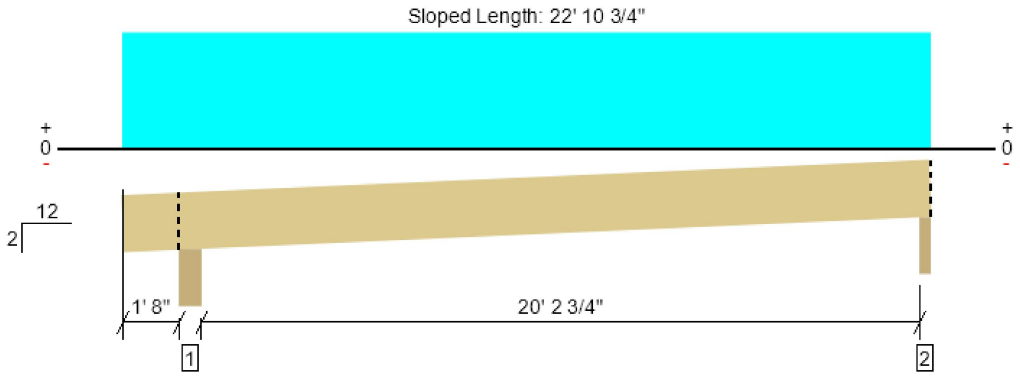
## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid C.4 Roof Rafter (2.5-5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3967 @ 22' 5 3/4" | 9453 (2.75") | Passed (42%) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Shear (lbs) | 3471 @ 3' 2 13/16" | 15085 | Passed (23%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 20081 @ 12' 3" | 37755 | Passed (53%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -690 @ 1' 10 3/4" | 29619 | Passed (2%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.405 @ 12' 2 7/16" | 1.043 | Passed (L/619) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.773 @ 12' 2 1/2" | 1.391 | Passed (L/324) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 23' 1"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.98 that was calculated using length L = 20' 8 13/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 2' 1 3/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beveled Plate - HF | 5.50" | 5.50" | 2.09" | 2258 | 1964 | 2455 | 4713 | Blocking |
| 2 - Beam - DF | 2.75" | 2.75" | 1.50" | 1897 | 1656 | 2070 | 3967 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 22' 11" o/c | |
| Bottom Edge (Lu) | 22' 11" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 22' 7" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 22' 7" | 8' | 20.4 | 20.0 | 25.0 | Default Load |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

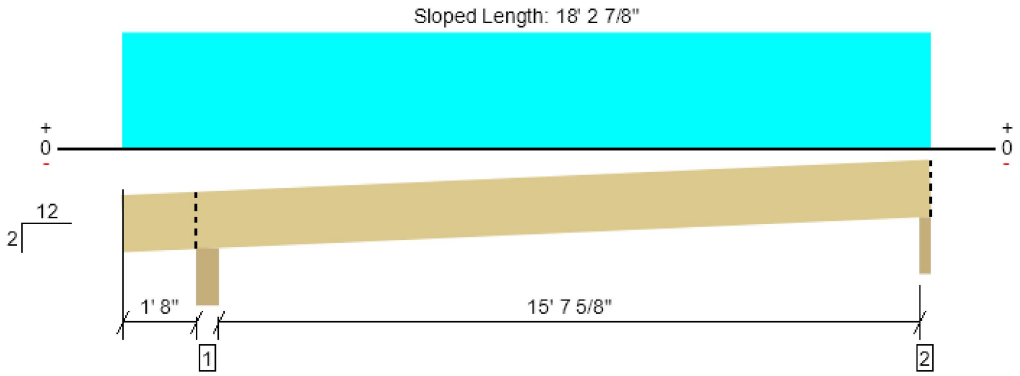
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid D.2 Roof Rafter (2.5-5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3078 @ 17' 10 5/8" | 9831 (2.75") | Passed (31%) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Shear (lbs) | 2599 @ 3' 2 13/16" | 15085 | Passed (17%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 12018 @ 9' 11 11/16" | 38424 | Passed (31%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Neg Moment (Ft-lbs) | -690 @ 1' 10 3/4" | 29619 | Passed (2%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.146 @ 9' 10 15/16" | 0.811 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.279 @ 9' 11" | 1.081 | Passed (L/698) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 18' 5 1/8"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 16' 1/2".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 2' 1 13/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beveled Plate - HF | 5.50" | 5.50" | 1.70" | 1840 | 1600 | 2001 | 3841 | Blocking |
| 2 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1469 | 1287 | 1609 | 3078 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 18' 3" o/c | |
| Bottom Edge (Lu) | 18' 3" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 17' 11 7/8" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 17' 11 7/8" | 8' | 20.4 | 20.0 | 25.0 | Default Load |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

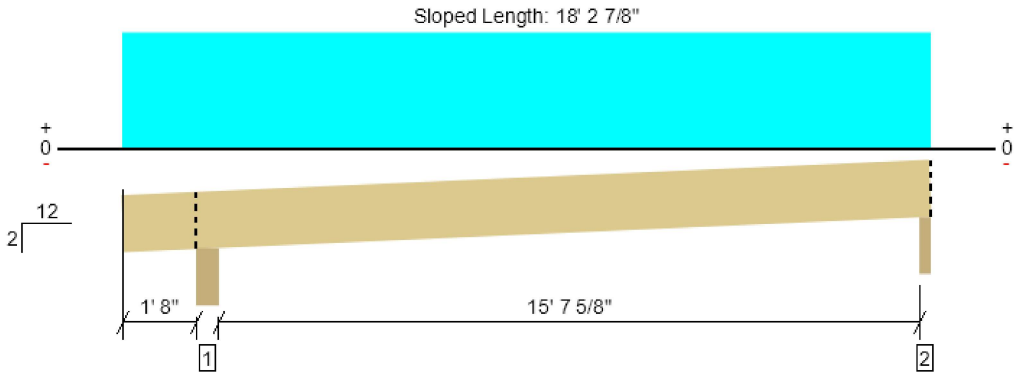
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid D.5 Roof Rafter (2.5-5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3078 @ 17' 10 5/8" | 9831 (2.75") | Passed (31%) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Shear (lbs) | 2599 @ 3' 2 13/16" | 15085 | Passed (17%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 12018 @ 9' 11 11/16" | 38424 | Passed (31%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Neg Moment (Ft-lbs) | -690 @ 1' 10 3/4" | 29619 | Passed (2%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.146 @ 9' 10 15/16" | 0.811 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.279 @ 9' 11" | 1.081 | Passed (L/698) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 18' 5 1/8"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 16' 1/2".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 2' 1 13/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beveled Plate - HF | 5.50" | 5.50" | 1.70" | 1840 | 1600 | 2001 | 3841 | Blocking |
| 2 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1469 | 1287 | 1609 | 3078 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 18' 3" o/c | |
| Bottom Edge (Lu) | 18' 3" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 17' 11 7/8" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 17' 11 7/8" | 8' | 20.4 | 20.0 | 25.0 | Default Load |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

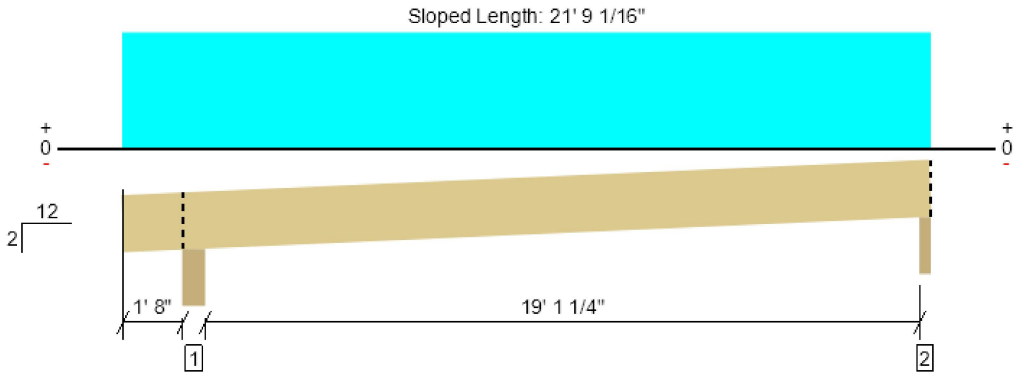
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid D.8 Roof Rafter (2.5-5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3750 @ 21' 4 1/4" | 9831 (2.75") | Passed (38%) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Shear (lbs) | 3257 @ 3' 2 13/16" | 15085 | Passed (22%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 17919 @ 11' 8 5/16" | 37971 | Passed (47%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Neg Moment (Ft-lbs) | -690 @ 1' 10 3/4" | 29619 | Passed (2%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.323 @ 11' 7 11/16" | 0.986 | Passed (L/733) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.617 @ 11' 7 3/4" | 1.315 | Passed (L/384) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 21' 11 5/16"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.99 that was calculated using length L = 19' 7 1/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 2' 1 5/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beveled Plate - HF | 5.50" | 5.50" | 1.99" | 2156 | 1875 | 2343 | 4499 | Blocking |
| 2 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1792 | 1566 | 1957 | 3750 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 21' 9" o/c | |
| Bottom Edge (Lu) | 21' 9" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 21' 5 1/2" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 21' 5 1/2" | 8' | 20.4 | 20.0 | 25.0 | Default Load |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

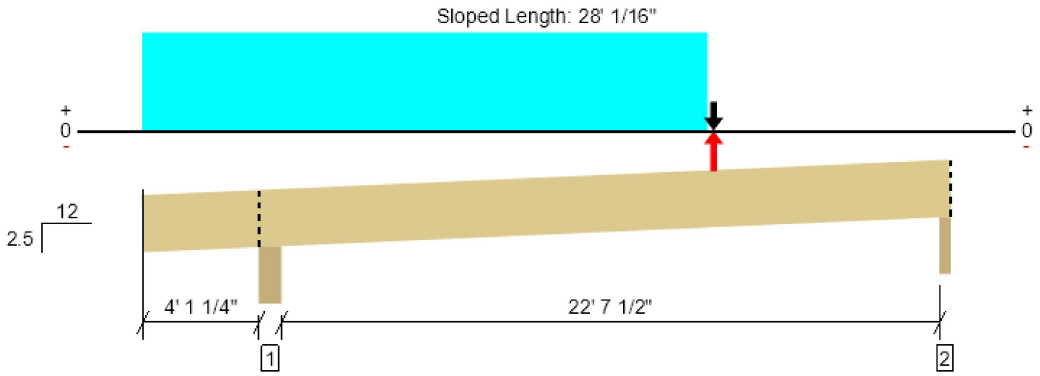
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid F.2 Roof Rafter (2.5-5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) [Group] |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 5874 @ 4' 4" | 12514 (5.50") | Passed (47%) | -- | 1.0 D + 1.0 S (All Spans) [1] |
| Shear (lbs) | 3691 @ 5' 7 15/16" | 15085 | Passed (24%) | 1.15 | 1.0 D + 1.0 S (All Spans) [1] |
| Pos Moment (Ft-lbs) | 19804 @ 15' 1 5/8" | 37399 | Passed (53%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) [1] |
| Neg Moment (Ft-lbs) | -3618 @ 4' 4" | 29619 | Passed (12%) | 1.15 | 1.0 D + 1.0 S (All Spans) [1] |
| Live Load Defl. (in) | 0.595 @ 15' 9 3/16" | 1.174 | Passed (L/473) | -- | 1.0 D + 1.0 S (Alt Spans) [1] |
| Total Load Defl. (in) | 0.922 @ 15' 7 3/16" | 1.565 | Passed (L/306) | -- | 1.0 D + 1.0 S (Alt Spans) [1] |

Member Length : 28' 2 7/8"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2.5/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 22' 9 1/2".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 5' 4 1/8".
- Upward deflection on left cantilever exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beveled Plate - HF | 5.50" | 5.50" | 2.58" | 2641 | 2586 | 3232 | 5874 | Blocking |
| 2 - Beam - DF | 2.75" | 2.75" | 1.50" | 697 | 1150 | 1438 | 2135 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 28' o/c | |
| Bottom Edge (Lu) | 28' o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 27' 5" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 19' 2" | 8' | 20.4 | 20.0 | 25.0 | Default Load |
| 2 - Point (lb) | 19' 4 1/2" | N/A | -367 | 637/-922 | 796/-1152 | Linked from: Grid 3 Roof Rafter (F-G) Flat, Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

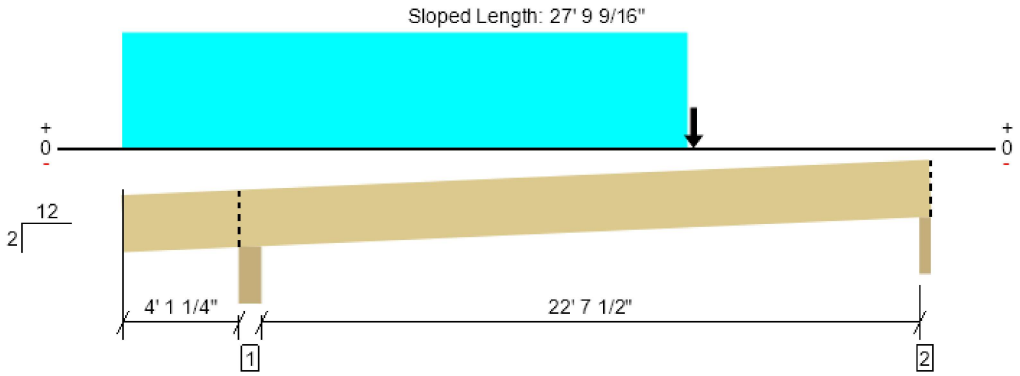
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid F.4 Roof Rafter (2.5-5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 6259 @ 4' 4" | 12420 (5.50") | Passed (50%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 4081 @ 5' 8 1/16" | 15085 | Passed (27%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 24342 @ 16' 2 5/16" | 37417 | Passed (65%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -3605 @ 4' 4" | 29619 | Passed (12%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.599 @ 15' 9 7/16" | 1.165 | Passed (L/467) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 1.131 @ 15' 10" | 1.553 | Passed (L/247) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 27' 11 13/16"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Upward deflection on left cantilever exceeds overhang deflection criteria.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 22' 8 1/4".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 5' 2 5/8".
- Upward deflection on left cantilever exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beveled Plate - HF | 5.50" | 5.50" | 2.77" | 3003 | 2605 | 3256 | 6259 | Blocking |
| 2 - Beam - DF | 2.75" | 2.75" | 1.50" | 1415 | 1186 | 1482 | 2897 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 27' 10" o/c | |
| Bottom Edge (Lu) | 27' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 27' 5" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 19' 2" | 8' | 20.4 | 20.0 | 25.0 | Default Load |
| 2 - Point (lb) | 19' 4 1/2" | N/A | 741 | 691 | 864 | Linked from: Grid 3 Roof Rafter (F-G) Flat, Support 2 |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

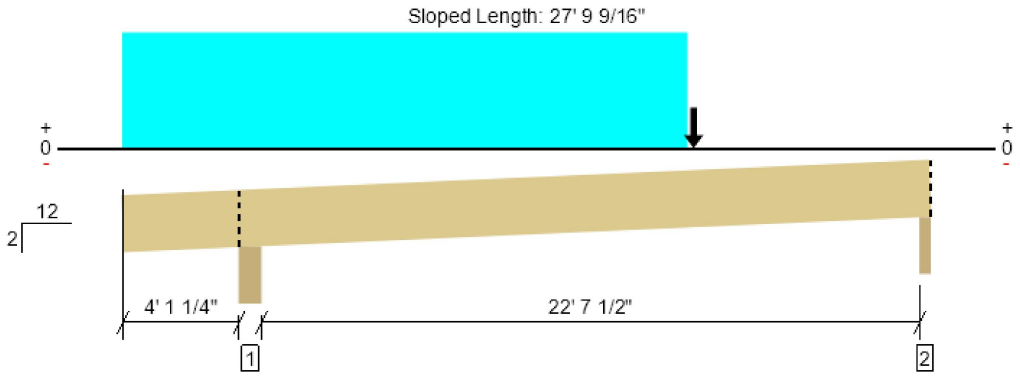
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid F.6 Roof Rafter (2.5-5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 6415 @ 4' 4" | 12420 (5.50") | Passed (52%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 4237 @ 5' 8 1/16" | 15085 | Passed (28%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 26221 @ 16' 7 3/16" | 37413 | Passed (70%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -3605 @ 4' 4" | 29619 | Passed (12%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.658 @ 15' 10 9/16" | 1.165 | Passed (L/425) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 1.218 @ 15' 10 13/16" | 1.553 | Passed (L/229) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 27' 11 13/16"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Upward deflection on left cantilever exceeds overhang deflection criteria.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 22' 8 1/2".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 5' 2 1/4".
- Upward deflection on left cantilever exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beveled Plate - HF | 5.50" | 5.50" | 2.84" | 3053 | 2690 | 3362 | 6415 | Blocking |
| 2 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1509 | 1347 | 1683 | 3193 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 27' 10" o/c | |
| Bottom Edge (Lu) | 27' 10" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 27' 5" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 19' 2" | 8' | 20.4 | 20.0 | 25.0 | Default Load |
| 2 - Point (lb) | 19' 4 1/2" | N/A | 885 | 937 | 1171 | Linked from: Grid 3 Roof Rafter (F-G) Flat, Support 3 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

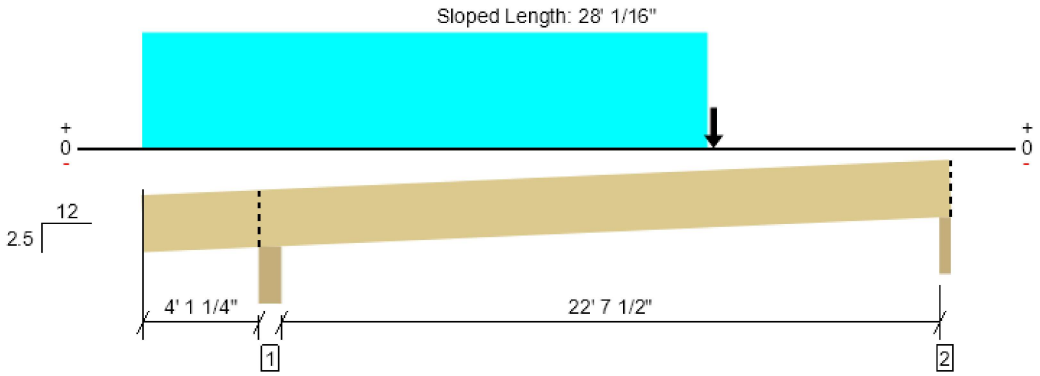
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Grid F.8 Roof Rafter (2.5-5) Sloped

**1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 4291 @ 4' 4" | 12514 (5.50") | Passed (34%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 2888 @ 5' 7 15/16" | 15085 | Passed (19%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 18818 @ 17' 2 9/16" | 37381 | Passed (50%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Neg Moment (Ft-lbs) | -2326 @ 4' 4" | 29619 | Passed (8%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.457 @ 15' 11 1/2" | 1.174 | Passed (L/616) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.884 @ 15' 11 7/8" | 1.565 | Passed (L/319) | -- | 1.0 D + 1.0 S (Alt Spans) |

Member Length : 28' 2 7/8"
System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2.5/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 22' 10 13/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 5' 2 1/4".
- Upward deflection on left cantilever exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Beveled Plate - HF | 5.50" | 5.50" | 1.89" | 2120 | 1736 | 2171 | 4291 | Blocking |
| 2 - Beam - GLB | 2.75" | 2.75" | 1.50" | 1190 | 947 | 1184 | 2374 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 28' o/c | |
| Bottom Edge (Lu) | 28' o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 27' 5" | N/A | 18.0 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 19' 2" | 5' | 20.4 | 20.0 | 25.0 | Default Load |
| 2 - Point (lb) | 19' 4 1/2" | N/A | 805 | 746 | 933 | Linked from: Grid 3 Roof Rafter (F-G) Flat, Support 4 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

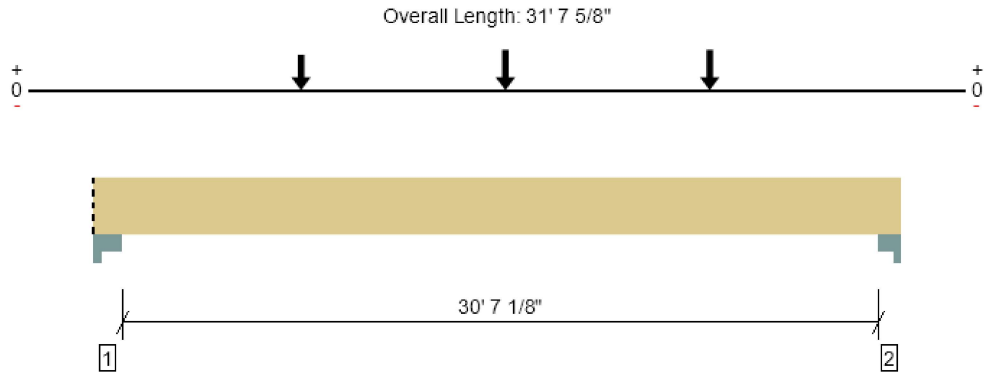
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, Ridge Beam (Grid A-C.2)

**1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 13923 @ 31' 3 5/8" | 31281 (5.50") | Passed (45%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 13767 @ 28' 11 1/8" | 47998 | Passed (29%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 134724 @ 16' 1 3/4" | 205668 | Passed (66%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.422 @ 15' 11 7/16" | 1.542 | Passed (L/876) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.848 @ 15' 11 7/16" | 2.056 | Passed (L/437) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 31' 7 5/8"
System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.84 that was calculated using length L = 30' 10 1/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Column Cap - steel | 7.00" | 7.00" | 2.29" | 6645 | 5114 | 6393 | 13039 | Blocking |
| 2 - Column Cap - steel | 5.50" | 5.50" | 2.45" | 7076 | 5477 | 6847 | 13923 | None |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 31' 8" o/c | |
| Bottom Edge (Lu) | 31' 8" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 31' 7 5/8" | N/A | 57.4 | -- | -- | |
| 1 - Point (lb) | 8' 1 3/4" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 2 - Point (lb) | 16' 1 3/4" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 3 - Point (lb) | 16' 1 3/4" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 4 - Point (lb) | 24' 1 3/4" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 5 - Point (lb) | 24' 1 3/4" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 6 - Point (lb) | 8' 1 3/4" (Top) | N/A | 1610 | 1476 | 1845 | Linked from: Grid A.7 Roof Rafter (1-2.5), Support 2 |

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

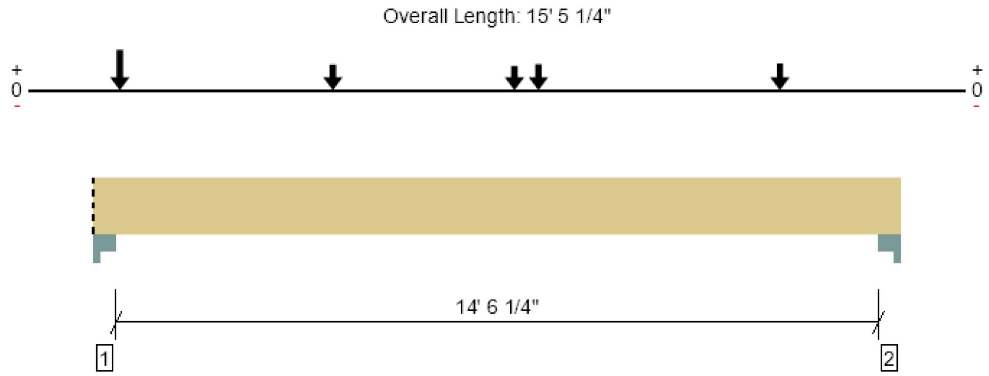
## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Ridge Beam (Grid C.2-D.5)

**1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 13804 @ 4" | 31281 (5.50") | Passed (44%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 6682 @ 12' 8 3/4" | 47998 | Passed (14%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 31829 @ 8' 5/8" | 221383 | Passed (14%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.021 @ 7' 9 1/4" | 0.739 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.045 @ 7' 8 7/8" | 0.985 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 15' 5 1/4"
System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.91 that was calculated using length L = 14' 9 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Column Cap - steel | 5.50" | 5.50" | 2.43" | 7028 | 5420 | 6776 | 13804 | Blocking |
| 2 - Column Cap - steel | 5.50" | 5.50" | 1.50" | 3848 | 2801 | 3501 | 7349 | None |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 15' 5" o/c | |
| Bottom Edge (Lu) | 15' 5" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 15' 5 1/4" | N/A | 57.4 | -- | -- | |
| 1 - Point (lb) | 6 1/8" (Top) | N/A | 2026 | 1783 | 2229 | Linked from: Grid C.4 Roof Rafter (1-2.5), Support 2 |
| 2 - Point (lb) | 4' 7" (Top) | N/A | 1757 | 1098 | 1373 | Linked from: Grid D Roof Rafter (1-2.5) Flat, Support 1 |
| 3 - Point (lb) | 8' 5/8" (Top) | N/A | 1226 | 1004 | 1255 | Linked from: Grid D.2 Roof Rafter (1-2.5) Flat, Support 1 |
| 4 - Point (lb) | 13' 1 1/2" (Top) | N/A | 1615 | 1393 | 1741 | Linked from: Grid D.4 Roof Rafter (1-2.5) Flat, Support 1 |
| 5 - Point (lb) | 6 1/8" (Top) | N/A | 1897 | 1656 | 2070 | Linked from: Grid C.4 Roof Rafter (2.5-5) Sloped, Support 2 |
| 6 - Point (lb) | 8' 6 1/8" (Top) | N/A | 1469 | 1287 | 1609 | Linked from: Grid D.2 Roof Rafter (2.5-5) Sloped, Support 2 |

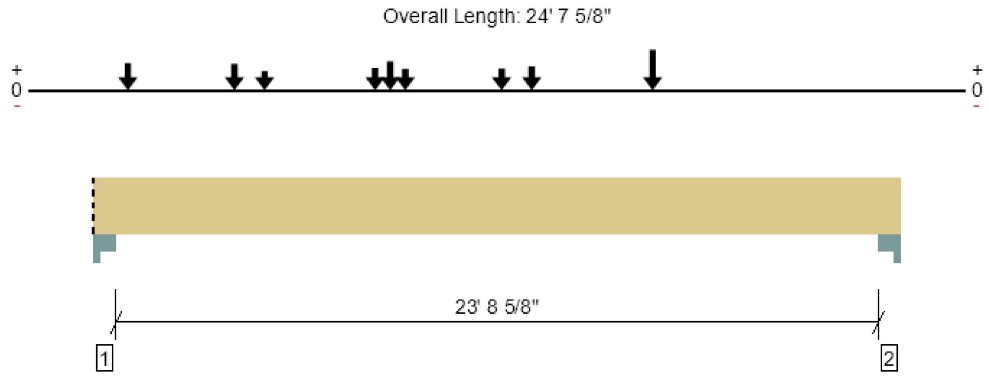
## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Ridge Beam (Grid D.5-E.3)

**1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 14824 @ 4" | 31281 (5.50") | Passed (47%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 12486 @ 2' 8 1/2" | 47998 | Passed (26%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 89266 @ 12' 5 1/2" | 210921 | Passed (42%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.171 @ 12' 3 7/16" | 1.198 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.354 @ 12' 3 1/4" | 1.598 | Passed (L/813) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 24' 7 5/8"
System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.86 that was calculated using length L = 23' 11 5/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Column Cap - steel | 5.50" | 5.50" | 2.61" | 7669 | 5725 | 7156 | 14824 | Blocking |
| 2 - Column Cap - steel | 5.50" | 5.50" | 1.93" | 5722 | 4181 | 5227 | 10949 | None |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 24' 8" o/c | |
| Bottom Edge (Lu) | 24' 8" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 24' 7 5/8" | N/A | 57.4 | -- | -- | |
| 1 - Point (lb) | 17' 3/4" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 2 - Point (lb) | 4' 3 3/4" (Top) | N/A | 1373 | 1184 | 1480 | Linked from: Grid D.6 Roof Rafter (1-2.5) Flat, Support 1 |
| 3 - Point (lb) | 8' 7 1/4" (Top) | N/A | 814 | 664 | 830 | Linked from: Grid D.8 Roof Rafter (1-2.5) Flat, Support 1 |
| 4 - Point (lb) | 12' 5 1/2" (Top) | N/A | 710 | 595 | 744 | Linked from: Grid D.9 Roof Rafter (1-2.5) Flat, Support 1 |
| 5 - Point (lb) | 5' 2 3/4" (Top) | N/A | 413 | 195 | 244 | Linked from: Grid D.6 Roof Rafter (1-2.5) Sloped, Support 1 |
| 6 - Point (lb) | 9' 6 1/4" (Top) | N/A | 748 | 462 | 577 | Linked from: Grid D.8 Roof Rafter (1-2.5) Sloped, Support 1 |
| 7 - Point (lb) | 13' 4 1/2" (Top) | N/A | 1118 | 849 | 1061 | Linked from: Grid E Roof Rafter (1-2.5) Sloped, Support 1 |
| 8 - Point (lb) | 17' 3/4" (Top) | N/A | 1480 | 1281 | 1602 | Linked from: Grid E.1 Roof Rafter (1-2.5) Sloped, Support 1 |
| 9 - Point (lb) | 1' 3/4" (Top) | N/A | 1469 | 1287 | 1609 | Linked from: Grid D.5 Roof Rafter (2.5-5) Sloped, Support 2 |
| 10 - Point (lb) | 9' 3/4" (Top) | N/A | 1792 | 1566 | 1957 | Linked from: Grid D.8 Roof Rafter (2.5-5) Sloped, Support 2 |

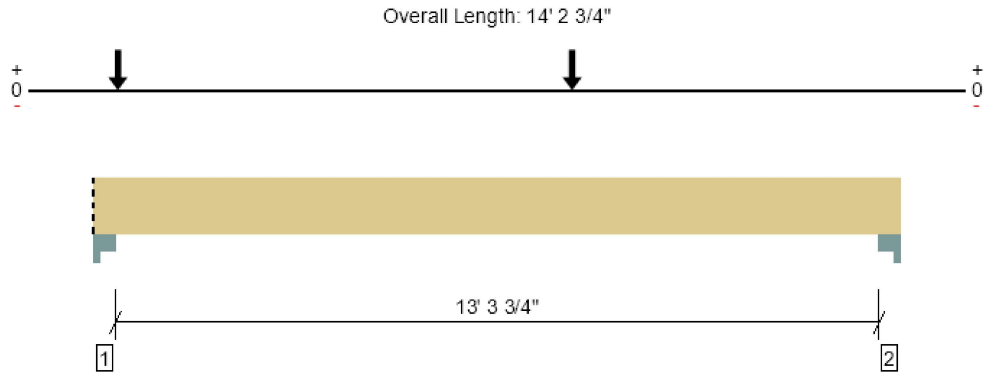
## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Ridge Beam (Grid E.3-E.7)

**1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 12576 @ 4" | 31281 (5.50") | Passed (40%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 5437 @ 11' 6 1/4" | 47998 | Passed (11%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 29568 @ 8' 5 1/4" | 223280 | Passed (13%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.015 @ 7' 5 1/2" | 0.678 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.030 @ 7' 5 5/16" | 0.904 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 14' 2 3/4"
System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.91 that was calculated using length L = 13' 6 3/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Column Cap - steel | 5.50" | 5.50" | 2.21" | 6184 | 5113 | 6392 | 12576 | Blocking |
| 2 - Column Cap - steel | 5.50" | 5.50" | 1.50" | 2869 | 2179 | 2724 | 5593 | None |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 14' 3" o/c | |
| Bottom Edge (Lu) | 14' 3" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 14' 2 3/4" | N/A | 57.4 | -- | -- | |
| 1 - Point (lb) | 5 1/4" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 2 - Point (lb) | 5 1/4" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 3 - Point (lb) | 8' 5 1/4" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 4 - Point (lb) | 8' 5 1/4" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |

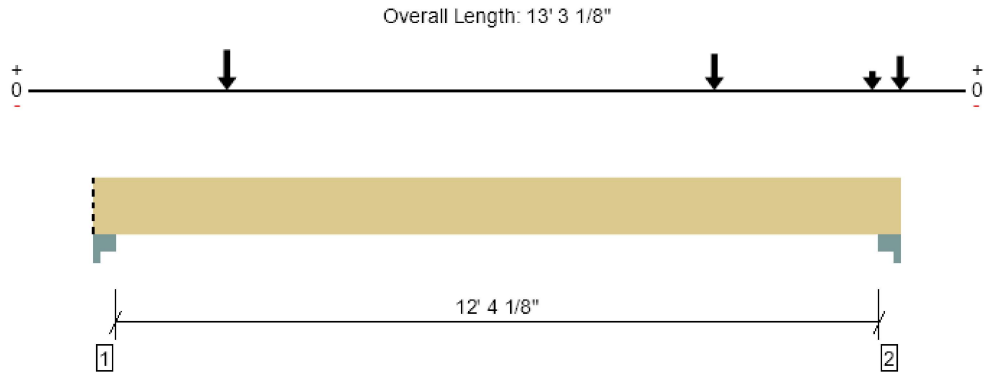
## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Ridge Beam (Grid E.7-F)

**1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 14380 @ 12' 11 1/8" | 31281 (5.50") | Passed (46%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 7496 @ 2' 8 1/2" | 47998 | Passed (16%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 19629 @ 10' 2 3/8" | 224941 | Passed (9%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.012 @ 6' 7 7/8" | 0.630 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.024 @ 6' 7 15/16" | 0.840 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 13' 3 1/8"
System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.92 that was calculated using length L = 12' 7 1/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Column Cap - steel | 5.50" | 5.50" | 1.64" | 4634 | 3755 | 4694 | 9328 | Blocking |
| 2 - Column Cap - steel | 5.50" | 5.50" | 2.53" | 7211 | 5735 | 7169 | 14380 | None |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 13' 3" o/c | |
| Bottom Edge (Lu) | 13' 3" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 13' 3 1/8" | N/A | 57.4 | -- | -- | |
| 1 - Point (lb) | 2' 2 3/8" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 2 - Point (lb) | 2' 2 3/8" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 3 - Point (lb) | 10' 2 3/8" (Top) | N/A | 2059 | 1823 | 2279 | Linked from: Typical Roof Rafter Sloped, Support 2 |
| 4 - Point (lb) | 10' 2 3/8" (Top) | N/A | 1357 | 1158 | 1447 | Linked from: Grid E.9 Roof Rafter (1-2.5) Sloped, Support 1 |
| 5 - Point (lb) | 12' 9 1/2" (Top) | N/A | 465 | 250 | 313 | Linked from: Grid F Roof Rafter (1-2.5) Sloped, Support 1 |
| 6 - Point (lb) | 13' 3" (Top) | N/A | 3085 | 2613 | 3266 | Linked from: Grid F Roof Rafter (1-2.5) Flat, Support 2 |

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

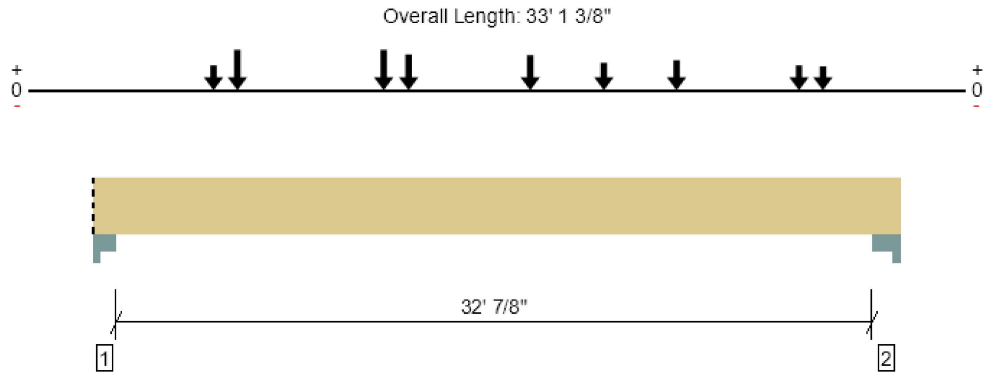
## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Ridge Beam (Grid F-G)

**1 piece(s) 8 3/4" x 27" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 22122 @ 4" | 31281 (5.50") | Passed (71%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 21967 @ 2' 8 1/2" | 47998 | Passed (46%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 198785 @ 12' 11 1/4" | 204707 | Passed (97%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.710 @ 16' 1 15/16" | 1.616 | Passed (L/546) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 1.413 @ 16' 2 1/4" | 2.155 | Passed (L/275) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 33' 1 3/8"
System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.84 that was calculated using length L = 32' 3 7/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Column Cap - steel | 5.50" | 5.50" | 3.89" | 10869 | 9003 | 11253 | 22122 | Blocking |
| 2 - Column Cap - steel | 7.00" | 7.00" | 3.38" | 9745 | 7567 | 9457 | 19202 | None |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 18' 11" o/c | |
| Bottom Edge (Lu) | 33' 1" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 33' 1 3/8" | N/A | 57.4 | -- | -- | |
| 1 - Point (lb) | 5' 11" (Top) | N/A | 3477 | 3005 | 3756 | Linked from: Grid F.2 Roof Rafter (1-2.5) Flat, Support 2 |
| 2 - Point (lb) | 11' 11" (Top) | N/A | 3477 | 3005 | 3756 | Linked from: Grid F.4 Roof Rafter (1-2.5) Flat, Support 2 |
| 3 - Point (lb) | 17' 11" (Top) | N/A | 2665 | 2303 | 2879 | Linked from: Grid F.6 Roof Rafter (1-2.5) Flat, Support 2 |
| 4 - Point (lb) | 23' 11" (Top) | N/A | 1877 | 1623 | 2028 | Linked from: Grid F.8 Roof Rafter (1-2.5) Flat, Support 2 |
| 5 - Point (lb) | 29' 11" (Top) | N/A | 991 | 818 | 1022 | Linked from: Grid F.9 Roof Rafter (1-2.5) Flat, Support 2 |
| 6 - Point (lb) | 4' 11 1/4" (Top) | N/A | 697 | 1150 | 1438 | Linked from: Grid F.2 Roof Rafter (2.5-5) Sloped, Support 2 |
| 7 - Point (lb) | 12' 11 1/4" (Top) | N/A | 1415 | 1186 | 1482 | Linked from: Grid F.4 Roof Rafter (2.5-5) Sloped, Support 2 |
| 8 - Point (lb) | 12' 11 1/4" (Top) | N/A | 1415 | 1186 | 1482 | Linked from: Grid F.4 Roof Rafter (2.5-5) Sloped, Support 2 |
| 9 - Point (lb) | 20' 11 1/4" (Top) | N/A | 1509 | 1347 | 1683 | Linked from: Grid F.6 Roof Rafter (2.5-5) Sloped, Support 2 |
| 10 - Point (lb) | 28' 11 1/4" (Top) | N/A | 1190 | 947 | 1184 | Linked from: Grid F.8 Roof Rafter (2.5-5) Sloped, Support 2 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid 2.5A Post

**1 piece(s) 6 x 8 DF No.2**

Post Height: 12' 7"

*Drawing is Conceptual*

| Design Results | Actual | Allowed | Result | LDF | Load: Combination |
|---|---|---|---|---|---|
| Slenderness | 27 | 50 | Passed (55%) | -- | -- |
| Compression (lbs) | 13038 | 17348 | Passed (75%) | 1.15 | 1.0 D + 1.0 S |
| Base Bearing (lbs) | 13038 | 1225125 | Passed (1%) | -- | 1.0 D + 1.0 S |
| Bending/Compression | N/A | 1 | Passed (N/A) | -- | N/A |

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

| Supports | Type | Material |
|---|---|---|
| Base | Plate | Steel |

| Max Unbraced Length | Comments |
|---|---|
| Full Member Length | No bracing assumed. |

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

| Vertical Load | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|
| 1 - Point (lb) | 6645 | 5114 | 6393 | Linked from: Ridge Beam (Grid A -C.2), Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid 2.5C.3 Post

**1 piece(s) 8 x 8 DF No.2**

Post Height: 12' 7"

*Drawing is Conceptual*

| Design Results | Actual | Allowed | Result | LDF | Load: Combination |
|---|---|---|---|---|---|
| Slenderness | 20 | 50 | Passed (40%) | -- | -- |
| Compression (lbs) | 27727 | 33778 | Passed (82%) | 1.15 | 1.0 D + 1.0 S |
| Base Bearing (lbs) | 27727 | 1670625 | Passed (2%) | -- | 1.0 D + 1.0 S |
| Bending/Compression | N/A | 1 | Passed (N/A) | -- | N/A |

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

| Supports | Type | Material |
|---|---|---|
| Base | Plate | Steel |

| Max Unbraced Length | Comments |
|---|---|
| Full Member Length | No bracing assumed. |

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

| Vertical Loads | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|
| 1 - Point (lb) | 7076 | 5477 | 6847 | Linked from: Ridge Beam (Grid A -C.2), Support 2 |
| 2 - Point (lb) | 7028 | 5420 | 6776 | Linked from: Ridge Beam (Grid C.2-D.5), Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid 2.5D.5 Post

**1 piece(s) 8 x 8 DF No.2**

Post Height: 12' 7"

*Drawing is Conceptual*

| Design Results | Actual | Allowed | Result | LDF | Load: Combination |
|---|---|---|---|---|---|
| Slenderness | 20 | 50 | Passed (40%) | -- | -- |
| Compression (lbs) | 22174 | 33778 | Passed (66%) | 1.15 | 1.0 D + 1.0 S |
| Base Bearing (lbs) | 22174 | 1670625 | Passed (1%) | -- | 1.0 D + 1.0 S |
| Bending/Compression | N/A | 1 | Passed (N/A) | -- | N/A |

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

| Supports | Type | Material |
|---|---|---|
| Base | Plate | Steel |

| Max Unbraced Length | Comments |
|---|---|
| Full Member Length | No bracing assumed. |

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

| Vertical Loads | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|
| 1 - Point (lb) | 3848 | 2801 | 3501 | Linked from: Ridge Beam (Grid C.2-D.5), Support 2 |
| 2 - Point (lb) | 7669 | 5725 | 7156 | Linked from: Ridge Beam (Grid D.5-E.3), Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid 2.5E.3 Post

**1 piece(s) 8 x 8 DF No.2**

Post Height: 12' 7"

*Drawing is Conceptual*

| Design Results | Actual | Allowed | Result | LDF | Load: Combination |
|---|---|---|---|---|---|
| Slenderness | 20 | 50 | Passed (40%) | -- | -- |
| Compression (lbs) | 23525 | 33778 | Passed (70%) | 1.15 | 1.0 D + 1.0 S |
| Base Bearing (lbs) | 23525 | 1670625 | Passed (1%) | -- | 1.0 D + 1.0 S |
| Bending/Compression | N/A | 1 | Passed (N/A) | -- | N/A |

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

| Supports | Type | Material |
|---|---|---|
| Base | Plate | Steel |

| Max Unbraced Length | Comments |
|---|---|
| Full Member Length | No bracing assumed. |

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

| Vertical Loads | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|
| 1 - Point (lb) | 5722 | 4181 | 5227 | Linked from: Ridge Beam (Grid D.5-E.3), Support 2 |
| 2 - Point (lb) | 6184 | 5113 | 6392 | Linked from: Ridge Beam (Grid E.3-E.7), Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid 2.5E.7 Post

**1 piece(s) 6 x 8 DF No.2**

Post Height: 12' 7"

*Drawing is Conceptual*

| Design Results | Actual | Allowed | Result | LDF | Load: Combination |
|---|---|---|---|---|---|
| Slenderness | 27 | 50 | Passed (55%) | -- | -- |
| Compression (lbs) | 14921 | 17348 | Passed (86%) | 1.15 | 1.0 D + 1.0 S |
| Base Bearing (lbs) | 14921 | 1225125 | Passed (1%) | -- | 1.0 D + 1.0 S |
| Bending/Compression | N/A | 1 | Passed (N/A) | -- | N/A |

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

| Supports | Type | Material |
|---|---|---|
| Base | Plate | Steel |

| Max Unbraced Length | Comments |
|---|---|
| Full Member Length | No bracing assumed. |

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

| Vertical Loads | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|
| 1 - Point (lb) | 2869 | 2179 | 2724 | Linked from: Ridge Beam (Grid E.3-E.7), Support 2 |
| 2 - Point (lb) | 4634 | 3755 | 4694 | Linked from: Ridge Beam (Grid E.7-F), Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid 2.5F Post

**1 piece(s) 8 x 10 DF No.2**

Post Height: 12' 7"

*Drawing is Conceptual*

| Design Results | Actual | Allowed | Result | LDF | Load: Combination |
|---|---|---|---|---|---|
| Slenderness | 20 | 50 | Passed (40%) | -- | -- |
| Compression (lbs) | 36502 | 42785 | Passed (85%) | 1.15 | 1.0 D + 1.0 S |
| Base Bearing (lbs) | 36502 | 2116125 | Passed (2%) | -- | 1.0 D + 1.0 S |
| Bending/Compression | N/A | 1 | Passed (N/A) | -- | N/A |

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

| Supports | Type | Material |
|---|---|---|
| Base | Plate | Steel |

| Max Unbraced Length | Comments |
|---|---|
| Full Member Length | No bracing assumed. |

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

| Vertical Loads | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|
| 1 - Point (lb) | 7211 | 5735 | 7169 | Linked from: Ridge Beam (Grid E.7-F), Support 2 |
| 2 - Point (lb) | 10869 | 9003 | 11253 | Linked from: Ridge Beam (Grid F-G), Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid 2.5G Post

**1 piece(s) 8 x 8 DF No.2**

Post Height: 12' 7"

*Drawing is Conceptual*

| Design Results | Actual | Allowed | Result | LDF | Load: Combination |
|---|---|---|---|---|---|
| Slenderness | 20 | 50 | Passed (40%) | -- | -- |
| Compression (lbs) | 19202 | 33778 | Passed (57%) | 1.15 | 1.0 D + 1.0 S |
| Base Bearing (lbs) | 19202 | 1670625 | Passed (1%) | -- | 1.0 D + 1.0 S |
| Bending/Compression | N/A | 1 | Passed (N/A) | -- | N/A |

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

| Supports | Type | Material |
|---|---|---|
| Base | Plate | Steel |

| Max Unbraced Length | Comments |
|---|---|
| Full Member Length | No bracing assumed. |

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

| Vertical Load | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|
| 1 - Point (lb) | 9745 | 7567 | 9457 | Linked from: Ridge Beam (Grid F-G), Support 2 |

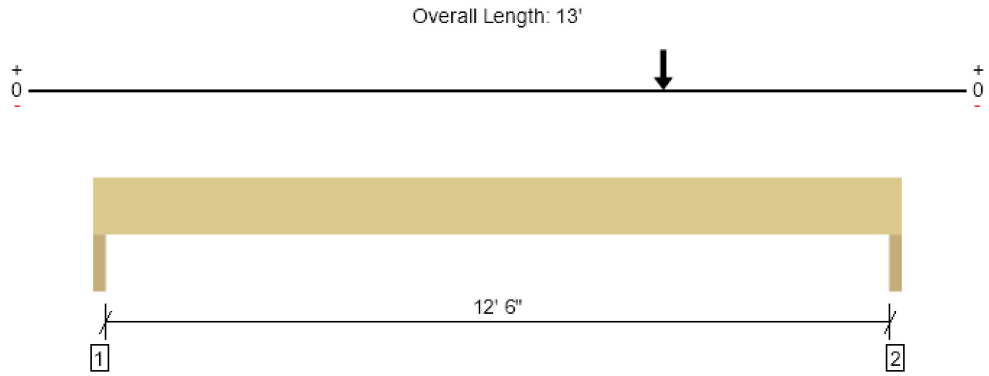
## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, 12'-6" Window Header (2A-1B)

**1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 4601 @ 12' 10 1/2" | 10725 (3.00") | Passed (43%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 4585 @ 11' 10 1/2" | 11733 | Passed (39%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 16958 @ 9' 2" | 23244 | Passed (73%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.203 @ 7' 1 9/16" | 0.425 | Passed (L/754) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.398 @ 7' 1 7/16" | 0.637 | Passed (L/384) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 13'
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 12' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 977 | 770 | 963 | 1941 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 2252 | 1879 | 2349 | 4601 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 13' o/c | |
| Bottom Edge (Lu) | 13' o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 13' | N/A | 14.0 | -- | -- | |
| 1 - Point (lb) | 9' 2" | N/A | 3047 | 2649 | 3312 | Linked from: Grid A.7 Roof Rafter (1-2.5), Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

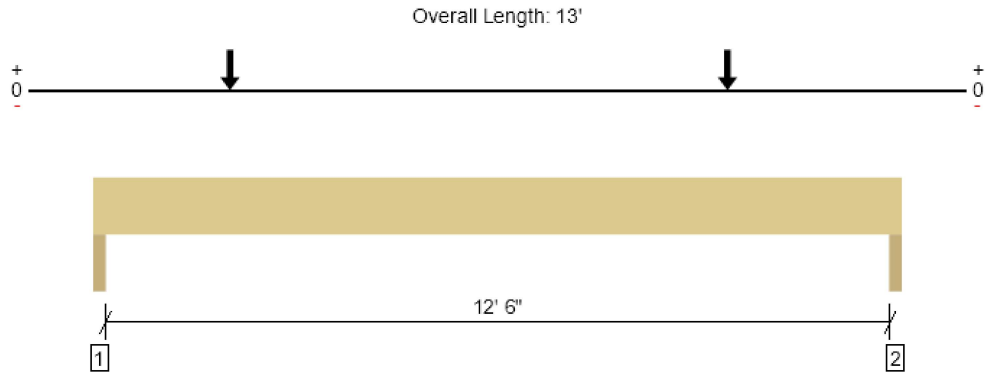
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 12'-6" Window Header (1B.2-1B.8)

**1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 6621 @ 1 1/2" | 10725 (3.00") | Passed (62%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 6605 @ 1' 1 1/2" | 11733 | Passed (56%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 16087 @ 10' 2 3/8" | 23244 | Passed (69%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.270 @ 6' 6 7/8" | 0.425 | Passed (L/567) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.527 @ 6' 6 7/8" | 0.637 | Passed (L/290) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 13'
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 12' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.85" | 3220 | 2721 | 3401 | 6621 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.69" | 2937 | 2475 | 3093 | 6030 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 13' o/c | |
| Bottom Edge (Lu) | 13' o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 13' | N/A | 14.0 | -- | -- | |
| 1 - Point (lb) | 2' 2 3/8" | N/A | 2987 | 2598 | 3247 | Linked from: Typical Roof Rafter Sloped, Support 1 |
| 2 - Point (lb) | 10' 2 3/8" | N/A | 2987 | 2598 | 3247 | Linked from: Typical Roof Rafter Sloped, Support 1 |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

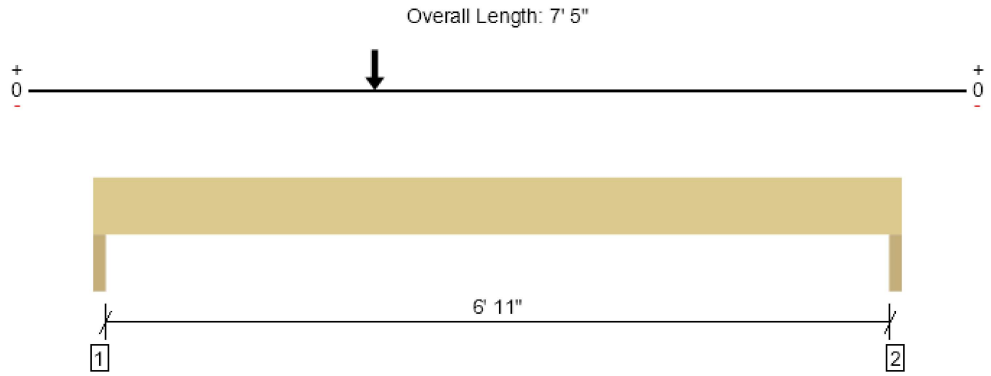
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 7'-10" Window Header (1D.1-1D.4)

**1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1697 @ 1 1/2" | 10725 (3.00") | Passed (16%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 1688 @ 10 1/2" | 8381 | Passed (20%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 4138 @ 2' 7" | 11859 | Passed (35%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.043 @ 3' 5 13/16" | 0.239 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.086 @ 3' 5 7/8" | 0.358 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 7' 5"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 7' 2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 857 | 672 | 840 | 1697 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 465 | 351 | 438 | 904 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 7' 5" o/c | |
| Bottom Edge (Lu) | 7' 5" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 7' 5" | N/A | 10.0 | -- | -- | |
| 1 - Point (lb) | 2' 7" | N/A | 1248 | 1023 | 1278 | Linked from: Grid D.2 Roof Rafter (1-2.5) Flat, Support 2 |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

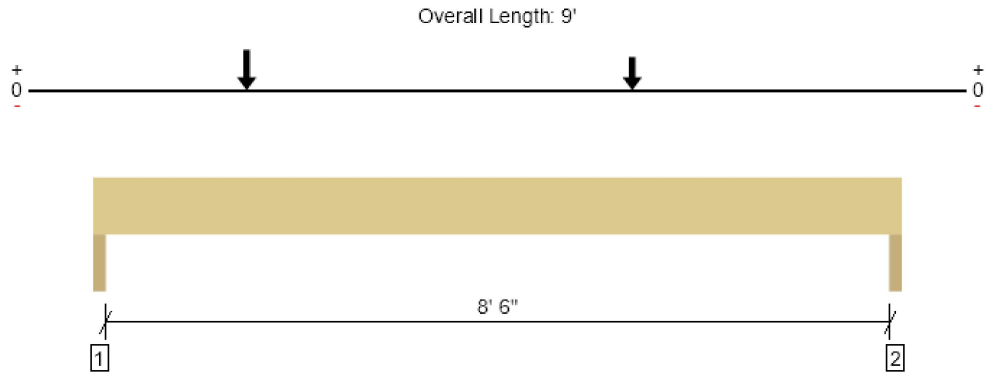
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 8'-6" Window Header (1D.6-1D.9)

**1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 5598 @ 1 1/2" | 10725 (3.00") | Passed (52%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 5586 @ 1' | 10057 | Passed (56%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 11021 @ 6' | 17078 | Passed (65%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.123 @ 4' 5 15/16" | 0.292 | Passed (L/850) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.253 @ 4' 6" | 0.438 | Passed (L/415) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 9'
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.57" | 2848 | 2200 | 2750 | 5598 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 1986 | 1493 | 1866 | 3852 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 9' o/c | |
| Bottom Edge (Lu) | 9' o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 9' | N/A | 12.0 | -- | -- | |
| 1 - Point (lb) | 1' 8 1/2" | N/A | 2531 | 2011 | 2514 | Linked from: Grid D.6 Roof Rafter (1-2.5) Sloped, Support 2 |
| 2 - Point (lb) | 6' | N/A | 2195 | 1682 | 2102 | Linked from: Grid D.8 Roof Rafter (1-2.5) Sloped, Support 2 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

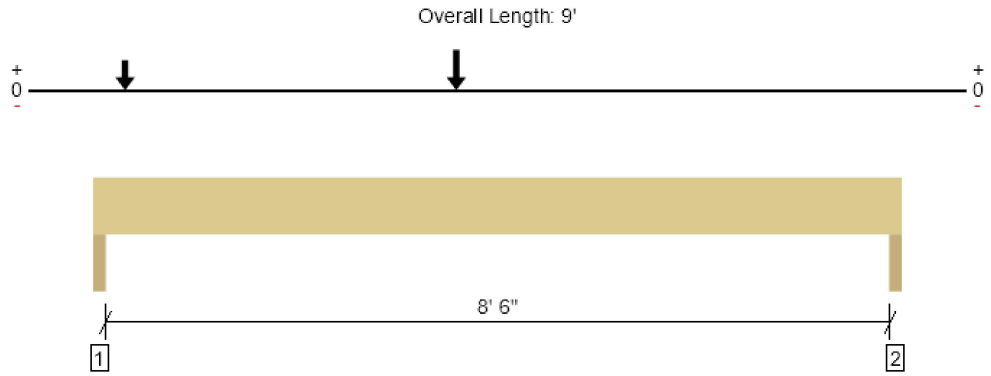
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 8'-6" Window Header (1E-1E.3)

**1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 5782 @ 1 1/2" | 10725 (3.00") | Passed (54%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 2945 @ 1' | 10057 | Passed (29%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 10127 @ 4' 1/2" | 17078 | Passed (59%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.096 @ 4' 4 9/16" | 0.292 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.188 @ 4' 4 5/8" | 0.438 | Passed (L/557) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 9'
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.62" | 2893 | 2310 | 2888 | 5782 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 1060 | 852 | 1066 | 2126 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 9' o/c | |
| Bottom Edge (Lu) | 9' o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 9' | N/A | 12.0 | -- | -- | |
| 1 - Point (lb) | 4 1/4" | N/A | 1697 | 1336 | 1671 | Linked from: Grid E Roof Rafter (1-2.5) Sloped, Support 2 |
| 2 - Point (lb) | 4' 1/2" | N/A | 2148 | 1826 | 2283 | Linked from: Grid E.1 Roof Rafter (1-2.5) Sloped, Support 2 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

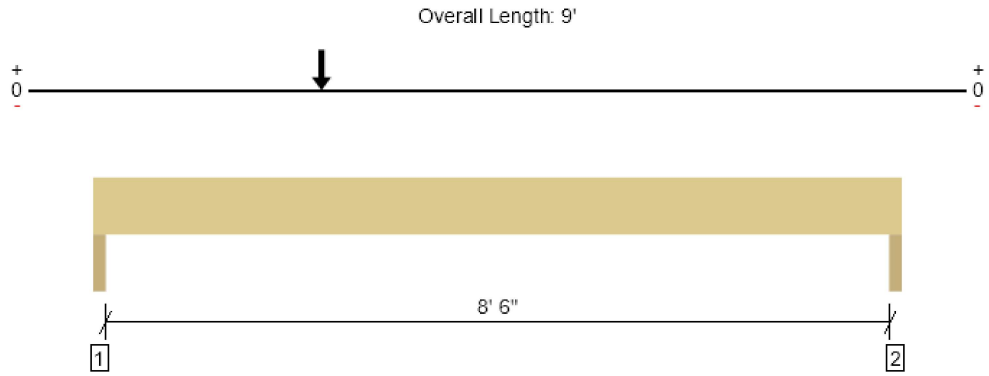
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 8'-6" Window Header (1E.4-1E.5)

**1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 4566 @ 1 1/2" | 10725 (3.00") | Passed (43%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 4554 @ 1' | 10057 | Passed (45%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 10997 @ 2' 6 1/2" | 17078 | Passed (64%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.098 @ 4' 3/8" | 0.292 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.191 @ 4' 1/2" | 0.438 | Passed (L/549) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 9'
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 2216 | 1880 | 2350 | 4566 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 879 | 718 | 897 | 1776 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 9' o/c | |
| Bottom Edge (Lu) | 9' o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 9' | N/A | 12.0 | -- | -- | |
| 1 - Point (lb) | 2' 6 1/2" | N/A | 2987 | 2598 | 3247 | Linked from: Typical Roof Rafter Sloped, Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

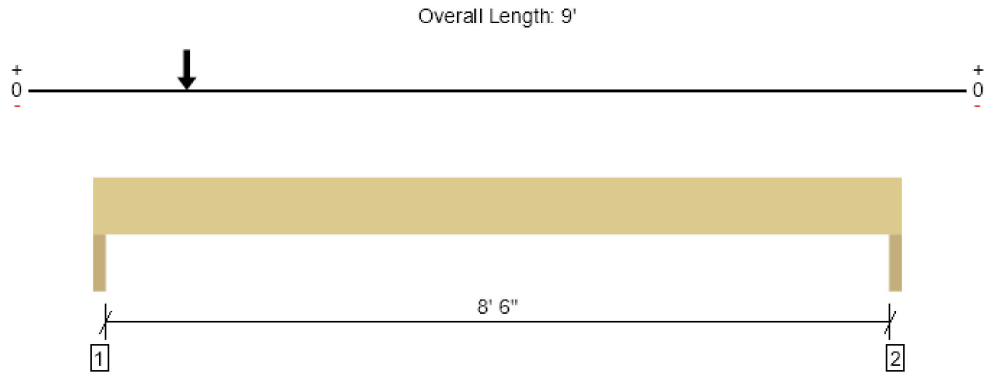
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 8'-6" Window Header (1E.6-1E.7)

**1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 5626 @ 1 1/2" | 10725 (3.00") | Passed (52%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 5617 @ 10 1/2" | 8381 | Passed (67%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 5152 @ 1' 1/2" | 11859 | Passed (43%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.071 @ 3' 10 5/8" | 0.292 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.141 @ 3' 10 13/16" | 0.438 | Passed (L/746) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 9'
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.57" | 2719 | 2326 | 2907 | 5626 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 358 | 272 | 340 | 698 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 9' o/c | |
| Bottom Edge (Lu) | 9' o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 9' | N/A | 10.0 | -- | -- | |
| 1 - Point (lb) | 1' 1/2" | N/A | 2987 | 2598 | 3247 | Linked from: Typical Roof Rafter Sloped, Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

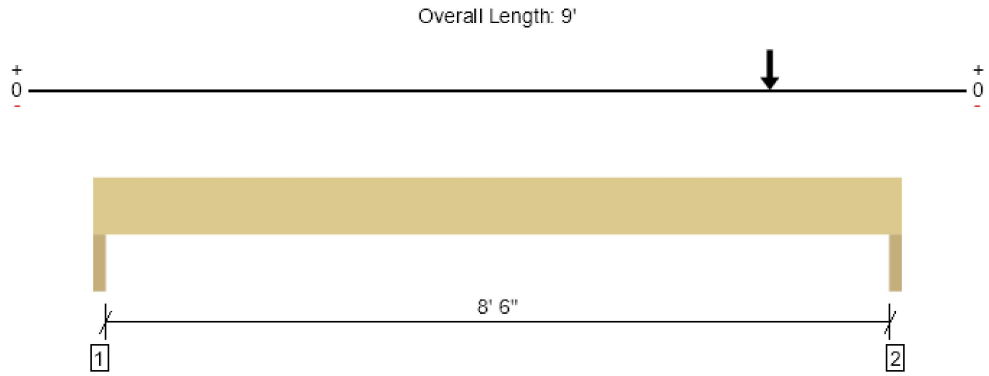
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 8'-6" Window Header (1E.8-1E.9)

**1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3459 @ 8' 10 1/2" | 10725 (3.00") | Passed (32%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 3450 @ 8' 1 1/2" | 8381 | Passed (41%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 4637 @ 7' 6 3/8" | 11859 | Passed (39%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.065 @ 5' 13/16" | 0.292 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.131 @ 5' 5/8" | 0.438 | Passed (L/800) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 9'
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 348 | 253 | 317 | 664 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 1713 | 1397 | 1746 | 3459 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 9' o/c | |
| Bottom Edge (Lu) | 9' o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 9' | N/A | 10.0 | -- | -- | |
| 1 - Point (lb) | 7' 6 3/8" | N/A | 1970 | 1650 | 2063 | Linked from: Grid E.9 Roof Rafter (1-2.5) Sloped, Support 2 |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

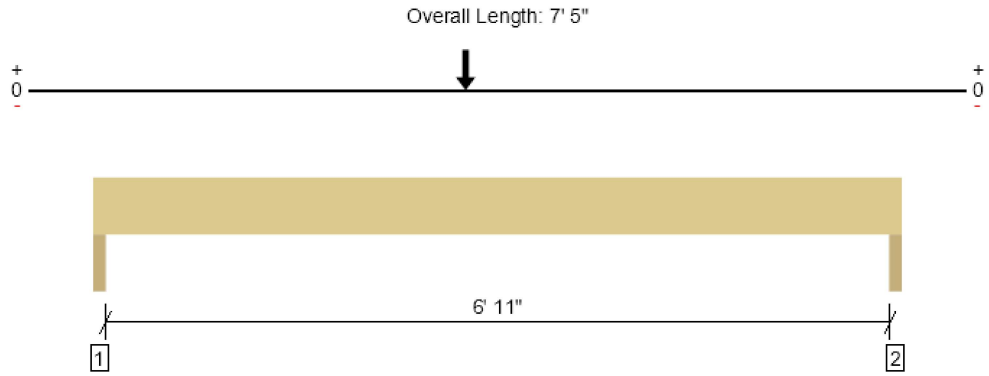
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 6'-11" Window Header (1F.1-1F.3)

**1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1572 @ 1 1/2" | 10725 (3.00") | Passed (15%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 1563 @ 10 1/2" | 8381 | Passed (19%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 5117 @ 3' 5" | 11859 | Passed (43%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.056 @ 3' 7 13/16" | 0.239 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.109 @ 3' 7 13/16" | 0.358 | Passed (L/790) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 7' 5"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 7' 2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 774 | 639 | 799 | 1572 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 663 | 543 | 678 | 1341 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 7' 5" o/c | |
| Bottom Edge (Lu) | 7' 5" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 7' 5" | N/A | 10.0 | -- | -- | |
| 1 - Point (lb) | 3' 5" | N/A | 1362 | 1182 | 1477 | Linked from: Grid F.2 Roof Rafter (1-2.5) Flat, Support 3 |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

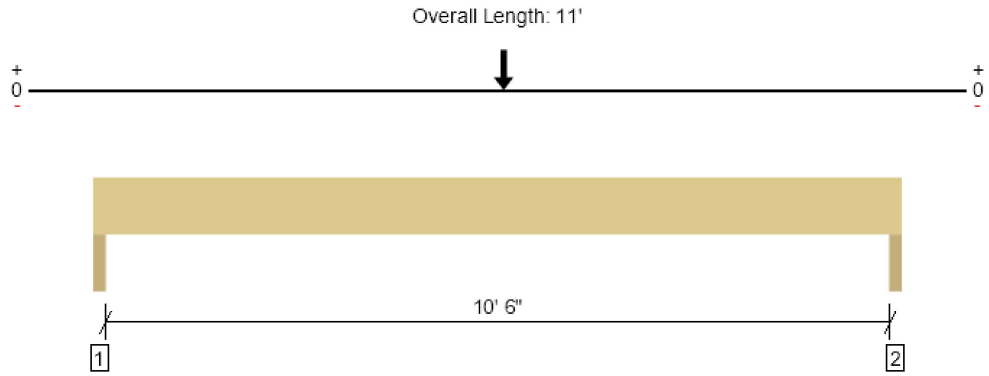
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 10'-6" Window Header (1F.4-1.8F.6)

**1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1224 @ 10' 10 1/2" | 10725 (3.00") | Passed (11%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 1212 @ 10' | 10057 | Passed (12%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 6300 @ 5' 7" | 17078 | Passed (37%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.088 @ 5' 6 1/4" | 0.358 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.175 @ 5' 6 1/4" | 0.538 | Passed (L/735) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 11'
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 10' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 604 | 468 | 585 | 1188 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 621 | 482 | 603 | 1224 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 11' o/c | |
| Bottom Edge (Lu) | 11' o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 11' | N/A | 12.0 | -- | -- | |
| 1 - Point (lb) | 5' 7" | N/A | 1092 | 950 | 1188 | Linked from: Grid F.6 Roof Rafter (1-2.5) Flat, Support 3 |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

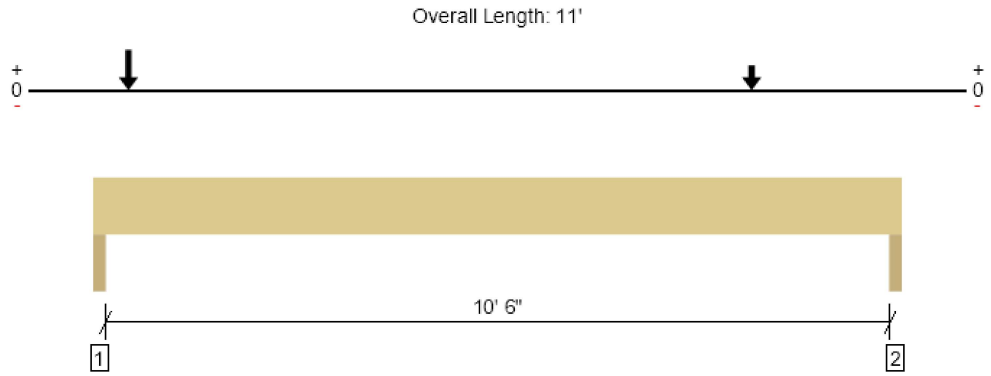
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 10'-6" Window Header (1.8F.6-2.3F.9)

**1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1735 @ 1 1/2" | 10725 (3.00") | Passed (16%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 738 @ 10 1/2" | 8381 | Passed (9%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 1237 @ 8' 11 1/2" | 11859 | Passed (10%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.034 @ 5' 9 1/16" | 0.358 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.073 @ 5' 8 5/8" | 0.538 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 11'
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 10' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 854 | 705 | 881 | 1735 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 338 | 255 | 318 | 656 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 11' o/c | |
| Bottom Edge (Lu) | 11' o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 11' | N/A | 10.0 | -- | -- | |
| 1 - Point (lb) | 5 3/4" | N/A | 768 | 677 | 846 | Linked from: Grid F.8 Roof Rafter (1-2.5) Flat, Support 3 |
| 2 - Point (lb) | 8' 11 1/2" | N/A | 314 | 283 | 353 | Linked from: Grid F.9 Roof Rafter (1-2.5) Flat, Support 3 |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

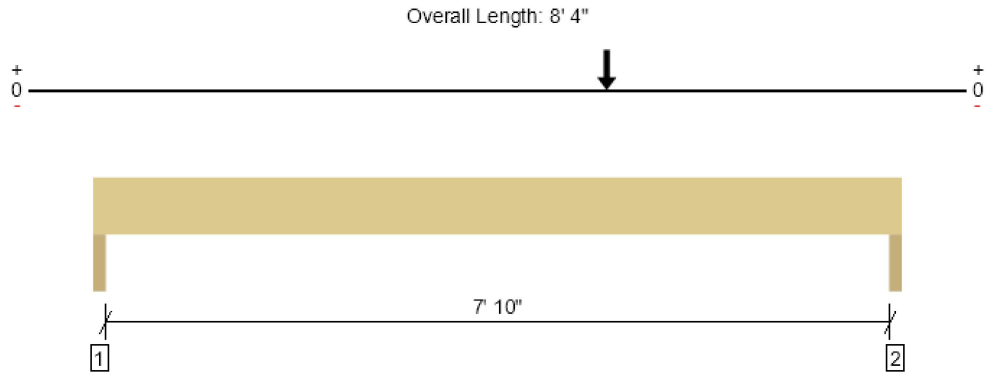
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 7'-10" Window Header (5F.3-5F.5)

**1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 4042 @ 8' 2 1/2" | 10725 (3.00") | Passed (38%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 4034 @ 7' 5 1/2" | 8381 | Passed (48%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 11744 @ 5' 3 1/2" | 11859 | Passed (99%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.160 @ 4' 5 3/16" | 0.269 | Passed (L/605) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.311 @ 4' 5 3/16" | 0.404 | Passed (L/312) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 8' 4"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 1".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 1125 | 940 | 1175 | 2300 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 1961 | 1665 | 2081 | 4042 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 8' 4" o/c | |
| Bottom Edge (Lu) | 8' 4" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 8' 4" | N/A | 10.0 | -- | -- | |
| 1 - Point (lb) | 5' 3 1/2" | N/A | 3003 | 2605 | 3256 | Linked from: Grid F.4 Roof Rafter (2.5-5) Sloped, Support 1 |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

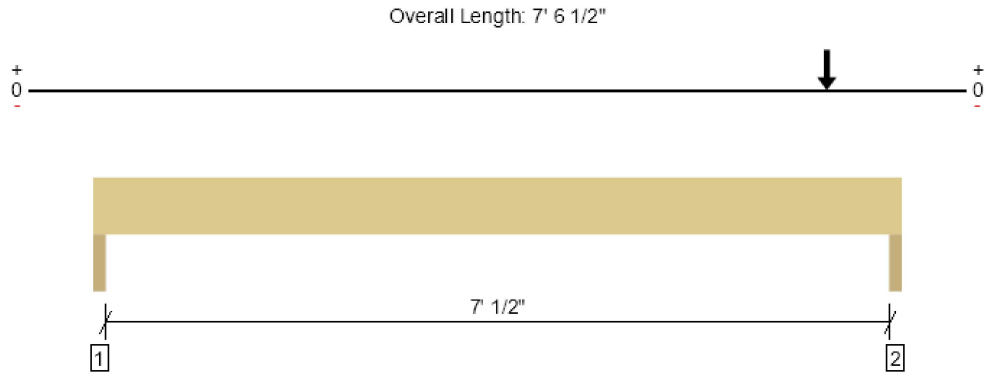
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 7'-0" Window/Door Header (5E.9-5F.2)

**1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 5449 @ 7' 5" | 10725 (3.00") | Passed (51%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 3907 @ 6' 8" | 8381 | Passed (47%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 3120 @ 6' 10 1/8" | 11859 | Passed (26%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.031 @ 4' 2 7/8" | 0.243 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.058 @ 4' 2 11/16" | 0.365 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 7' 6 1/2"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 7' 3 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 245 | 203 | 254 | 499 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.52" | 2471 | 2383 | 2978 | 5449 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 7' 7" o/c | |
| Bottom Edge (Lu) | 7' 7" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 7' 6 1/2" | N/A | 10.0 | -- | -- | |
| 1 - Point (lb) | 6' 10 1/8" | N/A | 2641 | 2586 | 3232 | Linked from: Grid F.2 Roof Rafter (2.5-5) Sloped, Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

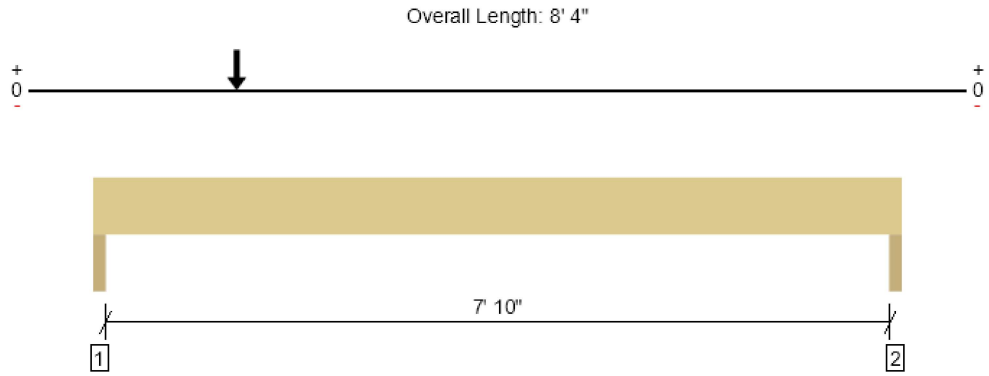
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 7'-10" Window Header (5E.7-5E.9)

**1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 5231 @ 1 1/2" | 10725 (3.00") | Passed (49%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 5223 @ 10 1/2" | 8381 | Passed (62%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 7073 @ 1' 5 3/4" | 11859 | Passed (60%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.088 @ 3' 8 1/16" | 0.269 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.171 @ 3' 8 3/16" | 0.404 | Passed (L/567) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 8' 4"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 1".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 2528 | 2163 | 2703 | 5231 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 542 | 435 | 544 | 1086 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 8' 4" o/c | |
| Bottom Edge (Lu) | 8' 4" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 8' 4" | N/A | 10.0 | -- | -- | |
| 1 - Point (lb) | 1' 5 3/4" | N/A | 2987 | 2598 | 3247 | Linked from: Typical Roof Rafter Sloped, Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

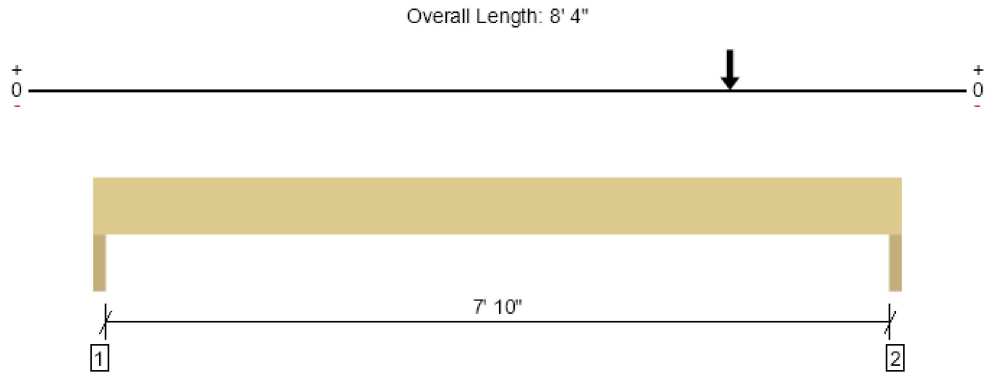
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 7'-10" Window Header (5E.3-5E.5)

**1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 5006 @ 8' 2 1/2" | 10725 (3.00") | Passed (47%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 4998 @ 7' 5 1/2" | 8381 | Passed (60%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 8224 @ 6' 6 3/4" | 11859 | Passed (69%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.104 @ 4' 7 13/16" | 0.269 | Passed (L/930) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.203 @ 4' 7 11/16" | 0.404 | Passed (L/478) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 8' 4"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 1".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 650 | 529 | 661 | 1311 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 2421 | 2069 | 2586 | 5006 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 8' 4" o/c | |
| Bottom Edge (Lu) | 8' 4" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 8' 4" | N/A | 10.0 | -- | -- | |
| 1 - Point (lb) | 6' 6 3/4" | N/A | 2987 | 2598 | 3247 | Linked from: Typical Roof Rafter Sloped, Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

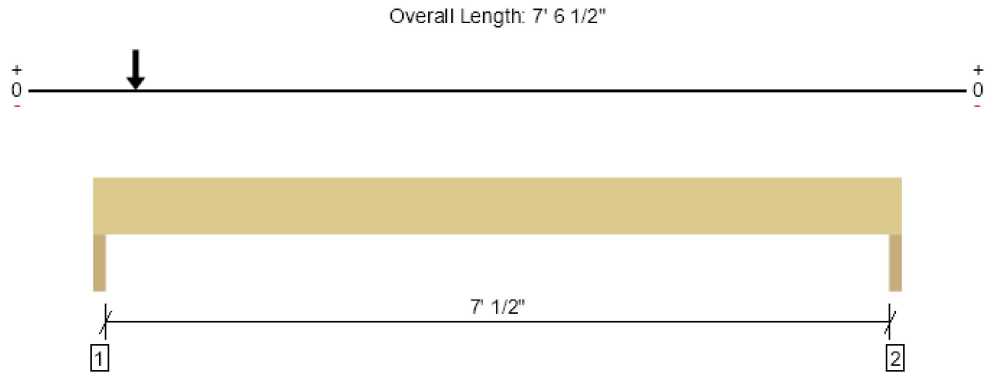
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 7'-0" Window/Door Header (5E.1-5E.2)

**1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 5693 @ 1 1/2" | 10725 (3.00") | Passed (53%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 1349 @ 10 1/2" | 8381 | Passed (16%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 1541 @ 4 3/4" | 11859 | Passed (13%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.015 @ 3' 2 1/2" | 0.243 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.029 @ 3' 3 1/16" | 0.365 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 7' 6 1/2"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 7' 3 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.59" | 2581 | 2490 | 3112 | 5693 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 136 | 96 | 120 | 256 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 7' 7" o/c | |
| Bottom Edge (Lu) | 7' 7" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 7' 6 1/2" | N/A | 10.0 | -- | -- | |
| 1 - Point (lb) | 4 3/4" | N/A | 2641 | 2586 | 3232 | Linked from: Grid F.2 Roof Rafter (2.5-5) Sloped, Support 1 |

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

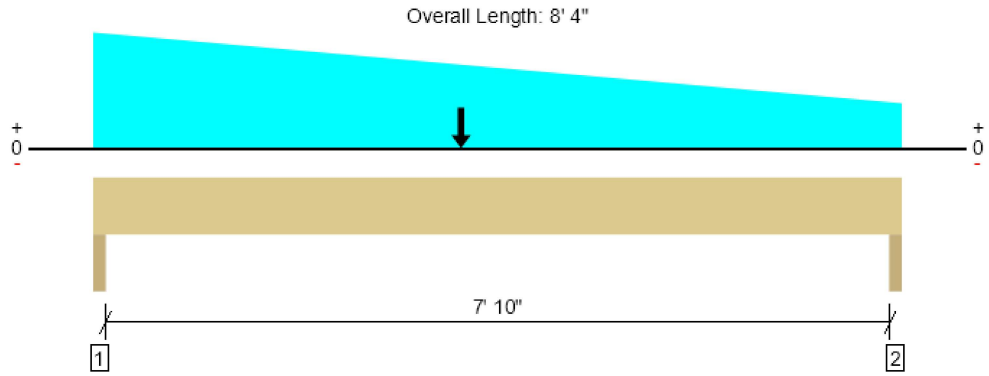
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 7'-10" Window Header (4D.7-5E.9)

**1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3183 @ 1 1/2" | 10725 (3.00") | Passed (30%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 2976 @ 1' | 10057 | Passed (30%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 10264 @ 3' 9 1/2" | 17078 | Passed (60%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.086 @ 4' 1 1/8" | 0.269 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.165 @ 4' 1 1/8" | 0.404 | Passed (L/588) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 8' 4"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 1".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 1528 | 1024 | 1655 | 3183 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 1249 | 851 | 1339 | 2588 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 8' 4" o/c | |
| Bottom Edge (Lu) | 8' 4" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 8' 4" | N/A | 12.0 | -- | -- | |
| 1 - Point (lb) | 3' 9 1/2" | N/A | 2156 | 1875 | 2343 | Linked from: Grid D.8 Roof Rafter (2.5-5) Sloped, Support 1 |
| 2 - Tapered (PSF) | 0 to 8' 4" | 4' 6" to 1' 9" | 20.0 | - | 25.0 | |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

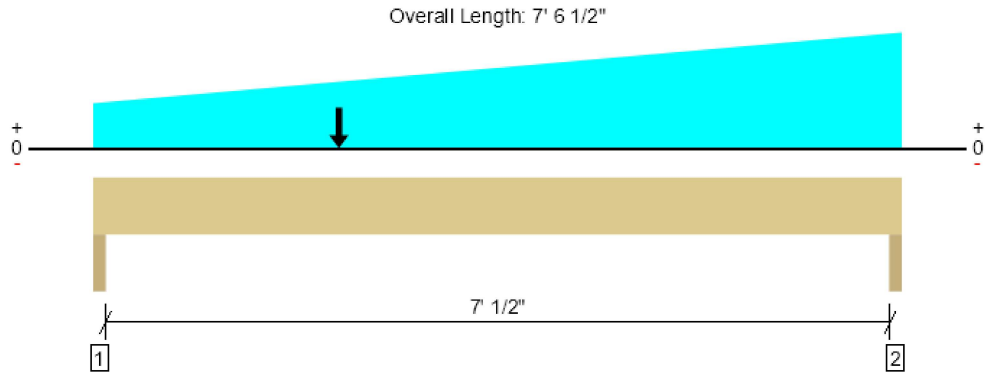
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 7'-0" Window/Door Header (5C-4D)

**1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3808 @ 1 1/2" | 10725 (3.00") | Passed (36%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 3709 @ 1' | 10057 | Passed (37%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 7980 @ 2' 3 1/2" | 17078 | Passed (47%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.054 @ 3' 5 11/16" | 0.243 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.103 @ 3' 5 11/16" | 0.365 | Passed (L/849) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 7' 6 1/2"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 7' 3 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 1832 | 1380 | 1976 | 3808 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 988 | 584 | 1069 | 2056 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 7' 7" o/c | |
| Bottom Edge (Lu) | 7' 7" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 7' 6 1/2" | N/A | 12.0 | -- | -- | |
| 1 - Point (lb) | 2' 3 1/2" | N/A | 2258 | 1964 | 2455 | Linked from: Grid C.4 Roof Rafter (2.5-5) Sloped, Support 1 |
| 2 - Tapered (PSF) | 0 to 7' 6 1/2" | 1' 9" to 4' 6" | 20.0 | - | 25.0 | |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

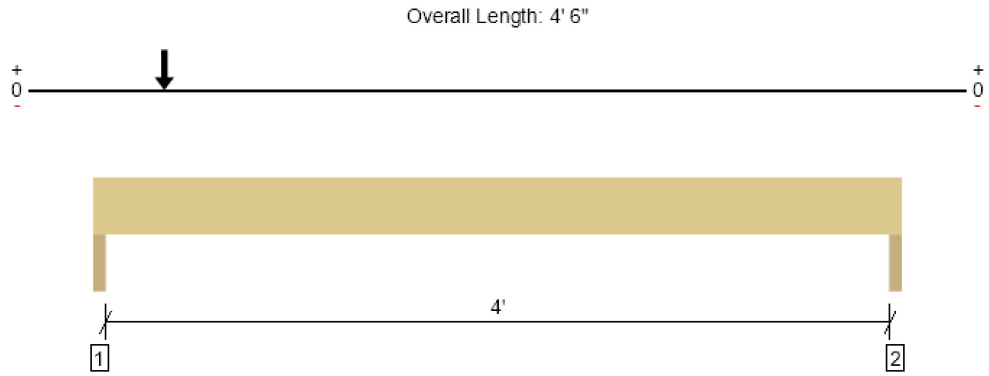
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 4'-0" Window Header (5B.7-5B.9)

**1 piece(s) 5 1/2" x 6" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 5855 @ 1 1/2" | 10725 (3.00") | Passed (55%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 1714 @ 9" | 6705 | Passed (26%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 1585 @ 4 3/4" | 7590 | Passed (21%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.010 @ 1' 11 13/16" | 0.142 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.019 @ 1' 11 7/8" | 0.213 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 4' 6"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.64" | 2815 | 2432 | 3040 | 5855 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 208 | 166 | 207 | 415 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 4' 6" o/c | |
| Bottom Edge (Lu) | 4' 6" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 4' 6" | N/A | 8.0 | -- | -- | |
| 1 - Point (lb) | 4 3/4" | N/A | 2987 | 2598 | 3247 | Linked from: Typical Roof Rafter Sloped, Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

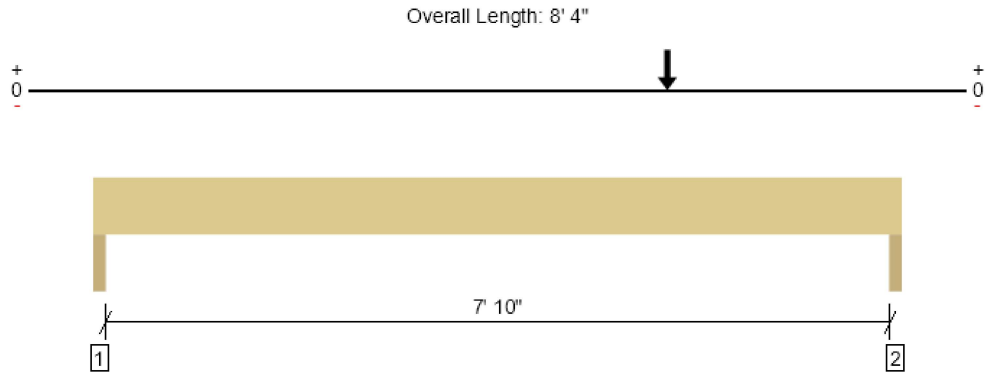
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, 7'-10" Window Header (5A.2-5A.8)

**1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam**




Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 4508 @ 8' 2 1/2" | 10725 (3.00") | Passed (42%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 4500 @ 7' 5 1/2" | 8381 | Passed (54%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Pos Moment (Ft-lbs) | 10303 @ 5' 11" | 11859 | Passed (87%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.137 @ 4' 7" | 0.269 | Passed (L/710) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.265 @ 4' 6 15/16" | 0.404 | Passed (L/366) | -- | 1.0 D + 1.0 S (All Spans) |

Member Length : 8' 4"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 1".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Roof Live | Snow | Factored | |
| 1 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 889 | 737 | 921 | 1809 | None |
| 2 - Trimmer - HF | 3.00" | 3.00" | 1.50" | 2182 | 1861 | 2326 | 4508 | None |

| Lateral Bracing | Bracing Intervals | Comments |
|---|---|---|
| Top Edge (Lu) | 8' 4" o/c | |
| Bottom Edge (Lu) | 8' 4" o/c | |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads | Location | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 8' 4" | N/A | 10.0 | -- | -- | |
| 1 - Point (lb) | 5' 11" | N/A | 2987 | 2598 | 3247 | Linked from: Typical Roof Rafter Sloped, Support 1 |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

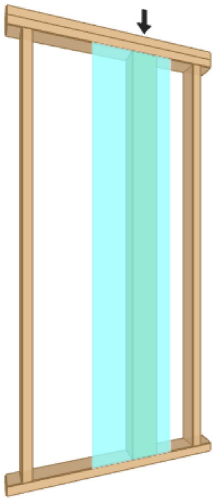
| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, King Stud (8'-6") 17'-0" Plate

**3 piece(s) 2 x 6 DF No.2**

Wall Height: 17' Member Height: 16' 7 1/2" Tributary Width: 5'



*Drawing is Conceptual*

| Design Results | Actual | Allowed | Result | LDF | Load: Combination |
|---|---|---|---|---|---|
| Slenderness | 36 | 50 | Passed (73%) | -- | -- |
| Compression (lbs) | 665 | 8536 | Passed (8%) | 1.15 | 1.0 D + 1.0 S |
| Plate Bearing (lbs) | 665 | 10024 | Passed (7%) | -- | 1.0 D + 1.0 S |
| Lateral Reaction (lbs) | 525 | -- | -- | 1.60 | 1.0 D + 0.6 W |
| Lateral Shear (lbs) | 496 | 4752 | Passed (10%) | 1.60 | 1.0 D + 0.6 W |
| Lateral Moment (ft-lbs) | 2180 @ mid-span | 3513 | Passed (62%) | 1.60 | 1.0 D + 0.6 W |
| Total Deflection (in) | 0.76 @ mid-span | 1.11 | Passed (L/262) | -- | 1.0 D + 0.6 W |
| Bending/Compression | 0.65 | 1 | Passed (65%) | 1.60 | 1.0 D + 0.6 W |

- Lateral deflection criteria: Wind (L/180)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- The column stability factor (Kf = 0.6) applied to this design assumes nailed built-up columns per NDS section 15.3.3. For Weyerhaeuser ELP products refer to the U.S. Wall Guide for multiple-member connection requirements.

| Supports | Type | Material |
|---|---|---|
| Top | Dbl 2X | Hem Fir |
| Base | 2X | Hem Fir |

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

| Max Unbraced Length | Comments |
|---|---|
| 8' | |

**Lateral Connections**

| Supports | Connector | Type/Model | Quantity | Connector Nailing |
|---|---|---|---|---|
| Top | Nails | 10d (0.128" x 3") (End) | 7 | N/A |
| Base | Nails | 10d (0.128" x 3") (End) | 7 | N/A |

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

| Vertical Loads | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 1 - Point (lb) | N/A | - | - | - | |
| 2 - Point (lb) | N/A | 348 | 253 | 317 | Linked from: 8'-6" Window Header (1E.8-1E.9), Support 1 |

| Lateral Load | Location | Tributary Width | Wind (1.60) | Comments |
|---|---|---|---|---|
| 1 - Uniform (PSF) | Full Length | 5' | 21.0 | |

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (110), Risk Category(II), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

**Weyerhaeuser Notes**

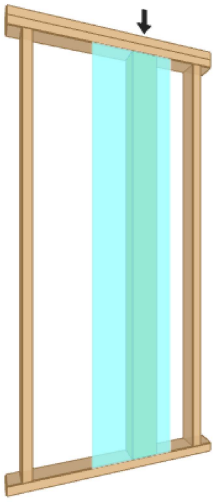
Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, King Stud (10'-6") 17'-0" Plate

**3 piece(s) 2 x 6 DF No.2**

Wall Height: 17' Member Height: 16' 7 1/2" Tributary Width: 6'



*Drawing is Conceptual*

| Design Results | Actual | Allowed | Result | LDF | Load: Combination |
|---|---|---|---|---|---|
| Slenderness | 36 | 50 | Passed (73%) | -- | -- |
| Compression (lbs) | 1735 | 8536 | Passed (20%) | 1.15 | 1.0 D + 1.0 S |
| Plate Bearing (lbs) | 1735 | 10024 | Passed (17%) | -- | 1.0 D + 1.0 S |
| Lateral Reaction (lbs) | 626 | -- | -- | 1.60 | 1.0 D + 0.6 W |
| Lateral Shear (lbs) | 592 | 4752 | Passed (12%) | 1.60 | 1.0 D + 0.6 W |
| Lateral Moment (ft-lbs) | 2602 @ mid-span | 3513 | Passed (74%) | 1.60 | 1.0 D + 0.6 W |
| Total Deflection (in) | 0.91 @ mid-span | 1.11 | Passed (L/220) | -- | 1.0 D + 0.6 W |
| Bending/Compression | 0.83 | 1 | Passed (83%) | 1.60 | 1.0 D + 0.6 W |

- Lateral deflection criteria: Wind (L/180)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- The column stability factor (Kf = 0.6) applied to this design assumes nailed built-up columns per NDS section 15.3.3. For Weyerhaeuser ELP products refer to the U.S. Wall Guide for multiple-member connection requirements.

| Supports | Type | Material |
|---|---|---|
| Top | Dbl 2X | Hem Fir |
| Base | 2X | Hem Fir |

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

| Max Unbraced Length | Comments |
|---|---|
| 8' | |

**Lateral Connections**

| Supports | Connector | Type/Model | Quantity | Connector Nailing |
|---|---|---|---|---|
| Top | Nails | 10d (0.128" x 3") (End) | 8 | N/A |
| Base | Nails | 10d (0.128" x 3") (End) | 8 | N/A |

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

| Vertical Loads | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 1 - Point (lb) | N/A | - | - | - | |
| 2 - Point (lb) | N/A | 854 | 705 | 881 | Linked from: 10'-6" Window Header (1.8F.6-2.3F.9), Support 1 |

| Lateral Load | Location | Tributary Width | Wind (1.60) | Comments |
|---|---|---|---|---|
| 1 - Uniform (PSF) | Full Length | 6' | 20.9 | |

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (110), Risk Category(II), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

**Weyerhaeuser Notes**

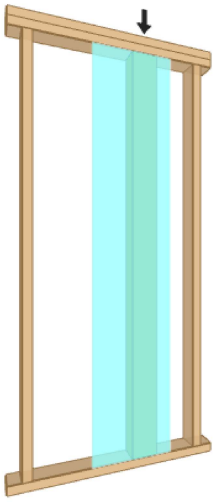
Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, King Stud (8'-6") 11'-0" Plate

**3 piece(s) 2 x 6 DF No.2**

Wall Height: 11' Member Height: 10' 7 1/2" Tributary Width: 5'



*Drawing is Conceptual*

| Design Results | Actual | Allowed | Result | LDF | Load: Combination |
|---|---|---|---|---|---|
| Slenderness | 23 | 50 | Passed (46%) | -- | -- |
| Compression (lbs) | 5626 | 12891 | Passed (44%) | 1.15 | 1.0 D + 1.0 S |
| Plate Bearing (lbs) | 5626 | 10024 | Passed (56%) | -- | 1.0 D + 1.0 S |
| Lateral Reaction (lbs) | 348 | -- | -- | 1.60 | 1.0 D + 0.6 W |
| Lateral Shear (lbs) | 318 | 4752 | Passed (7%) | 1.60 | 1.0 D + 0.6 W |
| Lateral Moment (ft-lbs) | 924 @ mid-span | 3513 | Passed (26%) | 1.60 | 1.0 D + 0.6 W |
| Total Deflection (in) | 0.13 @ mid-span | 0.71 | Passed (L/968) | -- | 1.0 D + 0.6 W |
| Bending/Compression | 0.38 | 1 | Passed (38%) | 1.60 | 1.0 D + 0.45 W + 0.75 L + 0.75 S |

- Lateral deflection criteria: Wind (L/180)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- The column stability factor (Kf = 0.6) applied to this design assumes nailed built-up columns per NDS section 15.3.3. For Weyerhaeuser ELP products refer to the U.S. Wall Guide for multiple-member connection requirements.

| Supports | Type | Material |
|---|---|---|
| Top | Dbl 2X | Hem Fir |
| Base | 2X | Hem Fir |

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

| Max Unbraced Length | Comments |
|---|---|
| 8' | |

**Lateral Connections**

| Supports | Connector | Type/Model | Quantity | Connector Nailing |
|---|---|---|---|---|
| Top | Nails | 10d (0.128" x 3") (End) | 5 | N/A |
| Base | Nails | 10d (0.128" x 3") (End) | 5 | N/A |

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

| Vertical Load | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 1 - Point (lb) | N/A | 2719 | 2326 | 2907 | Linked from: 8'-6" Window Header (1E.6-1E.7), Support 1 |

| Lateral Load | Location | Tributary Width | Wind (1.60) | Comments |
|---|---|---|---|---|
| 1 - Uniform (PSF) | Full Length | 5' | 21.8 | |

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (110), Risk Category(II), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

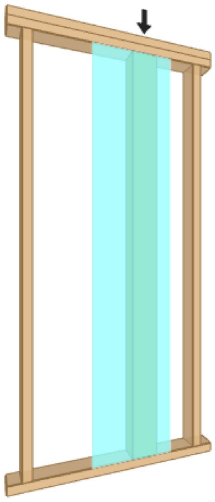
| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

Roof Framing, King Stud (12'-6") 17'-0" Plate

**1 piece(s) 6 x 8 DF No.2**

Wall Height: 17' Member Height: 16' 7 1/2" Tributary Width: 7'



*Drawing is Conceptual*

| Design Results | Actual | Allowed | Result | LDF | Load: Combination |
|---|---|---|---|---|---|
| Slenderness | 27 | 50 | Passed (53%) | -- | -- |
| Compression (lbs) | 6621 | 18149 | Passed (36%) | 1.15 | 1.0 D + 1.0 S |
| Plate Bearing (lbs) | 6621 | 16706 | Passed (40%) | -- | 1.0 D + 1.0 S |
| Lateral Reaction (lbs) | 723 | -- | -- | 1.60 | 1.0 D + 0.6 W |
| Lateral Shear (lbs) | 668 | 7480 | Passed (9%) | 1.60 | 1.0 D + 0.6 W |
| Lateral Moment (ft-lbs) | 3003 @ mid-span | 5129 | Passed (59%) | 1.60 | 1.0 D + 0.6 W |
| Total Deflection (in) | 0.42 @ mid-span | 1.11 | Passed (L/480) | -- | 1.0 D + 0.6 W |
| Bending/Compression | 0.71 | 1 | Passed (71%) | 1.60 | 1.0 D + 0.6 W |

- Lateral deflection criteria: Wind (L/180)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

| Supports | Type | Material |
|---|---|---|
| Top | Dbl 2X | Hem Fir |
| Base | 2X | Hem Fir |

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

| Max Unbraced Length | Comments |
|---|---|
| 8' | |

**Lateral Connections**

| Supports | Connector | Type/Model | Quantity | Connector Nailing |
|---|---|---|---|---|
| Top | Nails | 16d (0.135" x 3 1/2") (End) | 8 | N/A |
| Base | Nails | 16d (0.135" x 3 1/2") (End) | 8 | N/A |

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

| Vertical Load | Tributary Width | Dead (0.90) | Roof Live (1.25) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 1 - Point (lb) | N/A | 3220 | 2721 | 3401 | Linked from: 12'-6" Window Header (1B.2-1B.8), Support 1 |

| Lateral Load | Location | Tributary Width | Wind (1.60) | Comments |
|---|---|---|---|---|
| 1 - Uniform (PSF) | Full Length | 7' | 20.7 | |

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (110), Risk Category(II), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

**Weyerhaeuser Notes**

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|---|---|
| Chon Pieruccioni<br>Pieruccioni Engineering<br>(206) 949-7866<br>cpieru@hotmail.com | |

Weyerhaeuser

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

## GEOMETRY

| | | | |
|---|---|---|---|
| Footing Length (X-dir) ..... | 2.00 | ft | |
| Footing Width (Z-dir) ..... | 3.00 | ft | |
| Footing Thickness ..... | 8.0 | in | OK |
| Soil Cover ..... | 1.50 | ft | |
| Column Length (X-dir) ..... | 8.0 | in | |
| Column Width (Z-dir) ..... | 8.0 | in | |
| Offset (X-dir) ..... | 0.00 | in | OK |
| Offset (Z-dir) ..... | 0.00 | in | OK |
| Base Plate (L x W) ..... | 8.0 x 8.0 | in | |

## SOIL PRESSURES (D+S)

| | | | |
|---|---|---|---|
| Gross Allow. Soil Pressure ..... | 2.0 | ksf | |
| Soil Pressure at Corner 1 ..... | 1.2 | ksf | |
| Soil Pressure at Corner 2 ..... | 1.2 | ksf | |
| Soil Pressure at Corner 3 ..... | 1.2 | ksf | |
| Soil Pressure at Corner 4 ..... | 1.2 | ksf | |
| Bearing Pressure Ratio ..... | 0.59 | | OK |
| Ftg. Area in Contact with Soil ..... | 100.0 | % | |
| X-eccentricity / Ftg. Length ..... | 0.00 | | OK |
| Z-eccentricity / Ftg. Width ..... | 0.00 | | OK |

## APPLIED LOADS

| | Dead | Live | RLive | Snow | Wind | Seismic | |
|---|---|---|---|---|---|---|---|
| Axial Force P ..... | 2.8 | 0.0 | 0.0 | 3.0 | 0.0 | 0.0 | kip |
| Moment about X Mx .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Moment about Z Mz .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Shear Force Vx ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |
| Shear Force Vz ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 8.0 / 12 = 0.67 ft  Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.27 ft  Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 3.00 * 2.00 * 8.0 / 12 * 0.15 = 0.4 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 0.4 * 1.50 = 0.5 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft  Moment = 0.0 * 1.50 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0.6 * (3.00 * 2.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 0.6 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 0.6 * 1.50 = 0.8 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 3.00 * 2.00 * 62 * (0.67) = -0.1 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 0.1 * 1.50 = -0.2 k-ft
- Axial force P = 0.6 * 2.8 + 0.6 * 0.0 = 1.7 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft  Moment = 1.7 * 1.50 = 2.5 k-ft
- Resisting moment X-X = 0.5 + 0.0 + 0.8 + 2.5 + -0.2 = 3.7 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{3.7}{0.0}$ = 36.60 > 1.50 OK

- Overturning about Z-Z

- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft

- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft

- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft

- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z

- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 3.00 * 2.00 * 8.0 / 12 * 0.15 = 0.4 kip

Arm = *L / 2 =* 2.00 / 2 = 1.00 ft Moment = 0.4 * 1.00 = 0.4 k-ft

- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

Arm = *L / 2 - Offset =* 2.00 / 2 - 0.0 / 12 = 1.00 ft Moment = 0.0 * 1.00 = 0.0 k-ft

- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (3.00 * 2.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 0.6 kip

Arm = *L / 2 =* 2.00 / 2 = 1.00 ft Moment = 0.6 * 1.00 = 0.6 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 3.00 * 2.00 * 62 * (0.67) = -0.1 kip

Arm = *L / 2 =* 2.00 / 2 = 1.00 ft Moment = 0.1 * 1.00 = -0.1 k-ft

- Axial force P = 0.6 * 2.8 + 0.6 * 0.0 = 1.7 kip

Arm = *L / 2 - Offset =* 2.00 / 2 - 0.0 / 12 = 1.00 ft Moment = 1.7 * 1.00 = 1.7 k-ft

- Resisting moment Z-Z = 0.4 + 0.0 + 0.6 + 1.7 + -0.1 = 2.4 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{2.4}{0.0}$ = 24.40 > 1.50 OK

## SOIL BEARING PRESSURES (Comb: D+S)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 0.9 + 0.0 + 1.4 + -0.4 + 8.7 = 10.6 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 0.6 + 0.0 + 0.9 + -0.2 + 5.8 = 7.1 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 0.6 + 0.0 + 0.9 - 0.2 + 5.8 = 7.1 kip

X-coordinate of resultant from maximum bearing corner:

$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{7.1 - 0.0}{7.1}$ = 1.00 ft

Z-coordinate of resultant from maximum bearing corner:

$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{10.6 - 0.0}{7.1}$ = 1.50 ft

X-ecc = *Length / 2 - Xp* =2.00 / 2 - 1.00 = 0.00 ft

Z-ecc = *Width / 2 - Zp =* 3.00 / 2 - 1.50 = 0.00 ft

Area = *Width * Length =* 3.00 * 2.00 = 6.0 ft²

Sx = *Length * Width² / 6 =* 2.00 * 3.00² / 6 = 3.0 ft³

Sz = *Width * Length² / 6 =* 3.00 * 2.00² / 6 = 2.0 ft³

- Footing is in full bearing. Soil pressures are as follows:

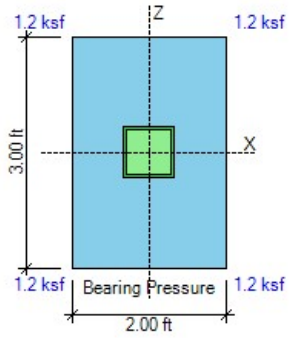
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 7.1 * (1 / 6.0 + 0.00 / 3.0 + 0.00 / 2.0) = 1.18 ksf

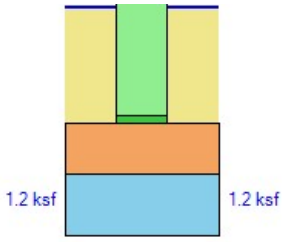
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 7.1 * (1 / 6.0 - 0.00 / 3.0 + 0.00 / 2.0) = 1.18 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 7.1 * (1 / 6.0 - 0.00 / 3.0 - 0.00 / 2.0) = 1.18 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 7.1 * (1 / 6.0 + 0.00 / 3.0 - 0.00 / 2.0) = 1.18 ksf

ASDIP Foundation 4.8.3.1 **SPREAD FOOTING DESIGN** www.asdipsoft.com




## SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33 (per Coulomb)*

Pressure at mid-depth = *kp * Density * (Cover + Thick / 2)* = 4.33 * 110 * (1.50 + 8.0 / 12 / 2) = 0.87 ksf

X-Passive force = *Pressure * Thick * Width* = 0.87 * 8.0 / 12 * 3.00 = 1.7 kip

Z-Passive force = *Pressure * Thick * Length* = 0.87 * 8.0 / 12 * 2.00 = 1.2 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 2.4 * 0.35) = 0.9 kip

*Use 100% of Passive + 100% of Friction for sliding resistance*

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 1.7 + 1.00 * 0.9}{0.0}$ = 25.99 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 1.2 + 1.00 * 0.9}{0.0}$ = 20.17 > 1.50 OK

## UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.4 + 0.6 - 0.1}{0.0}$ = 99.99 > 1.00 OK

## ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Concrete f'c = 2.5 ksi Steel fy = 40.0 ksi Soil density = 110 pcf

Use Plain Concrete Shear Strength

ϕVcx = *4/3 * ϕ * √(f'c) * Width * t / 1000* = 4/3 * 0.60 * √(2500) * 3.0 * 12 * 8.0 / 1000 = 11.5 kip ACI 14.5.5.1

ϕVcz = *4/3 * ϕ * √(f'c) * Length * t / 1000* = 4/3 * 0.60 * √(2500) * 2.0 * 12 * 8.0 / 1000 = 7.7 kip

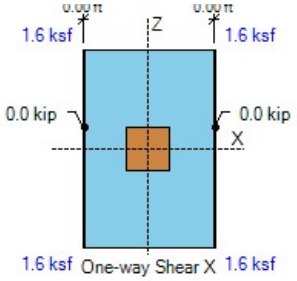
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

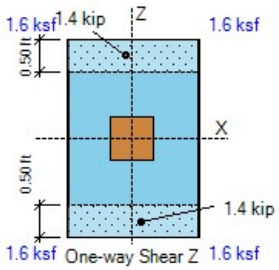
One-way shear Vux (- Side) = 0.0 kip < 11.5 kip OK

One-way shear Vux (+ Side) = 0.0 kip < 11.5 kip OK

One-way shear Vuz (- Side) = 1.4 kip < 7.7 kip OK

One-way shear Vuz (+ Side) = 1.4 kip < 7.7 kip OK




## FLEXURE CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Plain ϕMnx = *5 * ϕ * √(f'c) * L * Thick² / 6* = 5 * 0.60 * √(2500) * 2.00 * 8.0² / 6 / 1000 = 0.9 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * √(f'c) * W * Thick² / 6* = 5 * 0.60 * √(2500) * 3.00 * 8.0² / 6 / 1000 = 1.3 k-ft

- Top Bars

*No Top Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Top

- Top moments calculated as the overburden minus the bearing pressures times the lever arm:

Top moment -Mux (- Side) = 0.0 k-ft < 3.2 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 3.2 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 4.8 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 4.8 k-ft OK

- Bottom Bars

*No Bottom Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Bottom

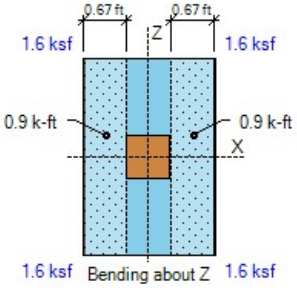
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

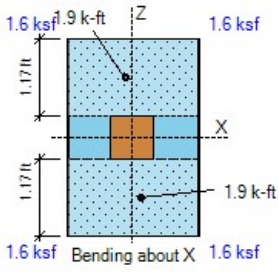
Bottom moment Mux (- Side) = 1.9 k-ft < 3.2 k-ft OK ratio = 0.58

Bottom moment Mux (+ Side) = 1.9 k-ft < 3.2 k-ft OK ratio = 0.58

Bottom moment Muz (- Side) = 0.9 k-ft < 4.8 k-ft OK ratio = 0.19

Bottom moment Muz (+ Side) = 0.9 k-ft < 4.8 k-ft OK ratio = 0.19



LOAD TRANSFER CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Area *A1 = col L * col W =* 8.0 * 8.0 = 64.0 in²

Sx = *col W * col L² / 6 =* 8.0 * 8.0² / 6 = 85.3 in³

Sz = *col L * col W² / 6 =* 8.0 * 8.0² / 6 = 85.3 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz =* 8.2 / 64.0 + 0.0 * 12 / 85.3 + 0.0 * 12 / 85.3 = 0.1 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (2.00 * 12 / 2 - 0.0 - 8.0 / 2, 3.00 * 12 / 2 - 0.0 - 8.0 / 2 = 8.0 in

Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [2.00 * 12 * 3.0 * 12, (8.0 + 2 * 8.0) * (8.0 + 2 * 8.0)] = 576.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)] =* 0.65 * 0.85 * 2.5 * Min [2, √(576.0 / 64.0)] = 2.8 ksi

Footing *ϕPns = ϕ * As * Fy / A1 =* 0.0 ksi ACI 22.8.3.2

Footing bearing *ϕPn = ϕPnc + ϕPns =* 2.8 + 0.0 = 2.8 ksi > 0.1 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.03) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.0 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

## PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

X-Edge = *Length / 2 - Offset - Col / 2* = 2.00 * 12 / 2 - 0.0 - 8.0 / 2 = 8.0 in αsx = 10

Z-Edge = *Width / 2 - Offset - Col / 2* = 3.00 * 12 / 2 - 0.0 - 8.0 / 2 = 14.0 in αsz = 10

αs = *αsx + αsz* = 10 + 10 = 20 Col type = Corner β = *L / W* = 8.0 / 8.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 10 / 10 * (8.0 + 8.0 / 2 + 8.0) + 10 / 10 * (8.0 + 8.0 / 2 + 14.0) = 46.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (8.0 + 8.0 / 2 + 8.0) * (8.0 + 8.0 / 2 + 14.0) = 520.0 in²

Use Plain Concrete Shear Strength

ϕVc = *ϕ * Min (1 + 2 / β, 2) * 4/3 * √(f'c)* ACI 14.5.5.1

ϕVc = 0.60 * Min (1 + 2 / 1.00, 2) * 4/3 √(2500) = 80.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 8.2 + 0.25 * 520.0 / 144 - 2.9 = 6.2 kip

b1 = *L + d / 2 + X-Edge* = 8.0 + 8.0 / 2 + 8.0 = 20.0 in b2 = *W + d / 2 + Z-Edge* = 8.0 + 8.0 / 2 + 14.0 = 26.0 in

$$\gamma vx \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(26.0 / 20.0)}} = 0.43$$ ACI Eq. (8.4.4.2.2)

$$\gamma vz \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(20.0 / 26.0)}} = 0.37$$ ACI Eq. (8.4.2.3.2)

X2z = $b1^2 / 2 / (b1 + b2)$ = 20.0² / 2 / (20.0 + 26.0) = 4.3 in X2x = $b2^2 / 2 / (b2 + b1)$ = 7.3 in

Jcz = $b1 * d^3 / 12 + b1^3 * d / 12 + b1 * d * (b1 / 2 - X2z)^2 + b2 * d * X2z^2$ ACI R8.4.4.2.3

Jcz = 20.0 * 8.0³ / 12 + 20.0³ * 8.0 / 12 + 20.0 * 8.0 * (20.0 / 2 * 4.3)² + 26.0 * 8.0 * 4.3² = 15230 in⁴

Jcx = $b2 * d^3 / 12 + b2^3 * d / 12 + b2 * d * (b2 / 2 - X2x)^2 + b1 * d * X2x^2$ ACI R8.4.4.2.3

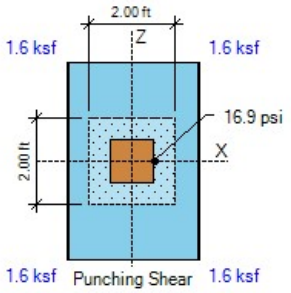
Jcz = 26.0 * 8.0³ / 12 + 26.0³ * 8.0 / 12 + 26.0 * 8.0 * (26.0 / 2 * 7.3)² + 20.0 * 8.0 * 7.3² = 28110 in⁴

Stress due to P = *F / (bo * d) * 1000* = 6.2 / (46.0 * 8.0) * 1000 = 16.9 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.43 * 0.0 * 12 * 7.3 / 28110 * 1000 = 0.0 psi

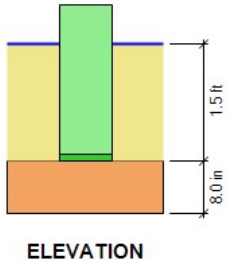
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.43 * 0.0 * 12 * 4.3 / 15230 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 16.9 + 0.0 + 0.0 = 16.9 psi < 80.0 psi OK

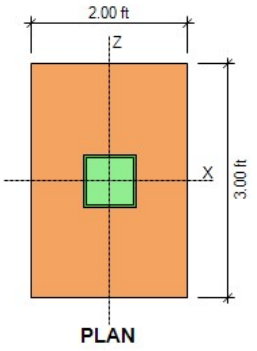


DESIGN CODES

| | |
|---|---|
| Concrete Design ..... | ACI 318-14 |
| Load Combinations ..... | ASCE 7-10/16 |




ELEVATION




PLAN

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

## GEOMETRY

| | | | |
|---|---|---|---|
| Footing Length (X-dir) ..... | 2.00 | ft | |
| Footing Width (Z-dir) ..... | 3.00 | ft | |
| Footing Thickness ..... | 8.0 | in | OK |
| Soil Cover ..... | 1.50 | ft | |
| Column Length (X-dir) ..... | 8.0 | in | |
| Column Width (Z-dir) ..... | 8.0 | in | |
| Offset (X-dir) ..... | 0.00 | in | OK |
| Offset (Z-dir) ..... | 0.00 | in | OK |
| Base Plate (L x W) ..... | 8.0 x 8.0 | in | |

## SOIL PRESSURES (D+S)

| | | | |
|---|---|---|---|
| Gross Allow. Soil Pressure ..... | 2.0 | ksf | |
| Soil Pressure at Corner 1 ..... | 1.3 | ksf | |
| Soil Pressure at Corner 2 ..... | 1.3 | ksf | |
| Soil Pressure at Corner 3 ..... | 1.3 | ksf | |
| Soil Pressure at Corner 4 ..... | 1.3 | ksf | |
| Bearing Pressure Ratio ..... | 0.66 | | OK |
| Ftg. Area in Contact with Soil ..... | 100.0 | % | |
| X-eccentricity / Ftg. Length ..... | 0.00 | | OK |
| Z-eccentricity / Ftg. Width ..... | 0.00 | | OK |

## APPLIED LOADS

| | Dead | Live | RLive | Snow | Wind | Seismic | |
|---|---|---|---|---|---|---|---|
| Axial Force P ..... | 3.3 | 0.0 | 0.0 | 3.4 | 0.0 | 0.0 | kip |
| Moment about X Mx .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Moment about Z Mz .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Shear Force Vx ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |
| Shear Force Vz ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 8.0 / 12 = 0.67 ft  Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.27 ft  Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 3.00 * 2.00 * 8.0 / 12 * 0.15 = 0.4 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 0.4 * 1.50 = 0.5 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft  Moment = 0.0 * 1.50 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0.6 * (3.00 * 2.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 0.6 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 0.6 * 1.50 = 0.8 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 3.00 * 2.00 * 62 * (0.67) = -0.1 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 0.1 * 1.50 = -0.2 k-ft
- Axial force P = 0.6 * 3.3 + 0.6 * 0.0 = 2.0 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft  Moment = 2.0 * 1.50 = 3.0 k-ft
- Resisting moment X-X = 0.5 + 0.0 + 0.8 + 3.0 + -0.2 = 4.1 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{4.1}{0.0}$ = 41.10 > 1.50 OK

- Overturning about Z-Z

- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft

- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft

- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft

- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z

- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 3.00 * 2.00 * 8.0 / 12 * 0.15 = 0.4 kip

Arm = *L / 2 =* 2.00 / 2 = 1.00 ft Moment = 0.4 * 1.00 = 0.4 k-ft

- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

Arm = *L / 2 - Offset =* 2.00 / 2 - 0.0 / 12 = 1.00 ft Moment = 0.0 * 1.00 = 0.0 k-ft

- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (3.00 * 2.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 0.6 kip

Arm = *L / 2 =* 2.00 / 2 = 1.00 ft Moment = 0.6 * 1.00 = 0.6 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 3.00 * 2.00 * 62 * (0.67) = -0.1 kip

Arm = *L / 2 =* 2.00 / 2 = 1.00 ft Moment = 0.1 * 1.00 = -0.1 k-ft

- Axial force P = 0.6 * 3.3 + 0.6 * 0.0 = 2.0 kip

Arm = *L / 2 - Offset =* 2.00 / 2 - 0.0 / 12 = 1.00 ft Moment = 2.0 * 1.00 = 2.0 k-ft

- Resisting moment Z-Z = 0.4 + 0.0 + 0.6 + 2.0 + -0.1 = 2.7 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{2.7}{0.0}$ = 27.40 > 1.50 OK

## SOIL BEARING PRESSURES (Comb: D+S)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 0.9 + 0.0 + 1.4 + -0.4 + 10.1 = 12.0 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 0.6 + 0.0 + 0.9 + -0.2 + 6.7 = 8.0 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 0.6 + 0.0 + 0.9 - 0.2 + 6.7 = 8.0 kip

X-coordinate of resultant from maximum bearing corner:

$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{8.0 - 0.0}{8.0}$ = 1.00 ft

Z-coordinate of resultant from maximum bearing corner:

$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{12.0 - 0.0}{8.0}$ = 1.50 ft

X-ecc = *Length / 2 - Xp* =2.00 / 2 - 1.00 = 0.00 ft

Z-ecc = *Width / 2 - Zp =* 3.00 / 2 - 1.50 = 0.00 ft

Area = *Width * Length =* 3.00 * 2.00 = 6.0 ft²

Sx = *Length * Width² / 6 =* 2.00 * 3.00² / 6 = 3.0 ft³

Sz = *Width * Length² / 6 =* 3.00 * 2.00² / 6 = 2.0 ft³

- Footing is in full bearing. Soil pressures are as follows:

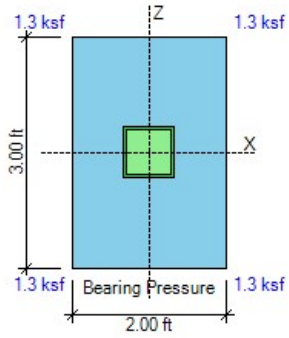
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 8.0 * (1 / 6.0 + 0.00 / 3.0 + 0.00 / 2.0) = 1.33 ksf

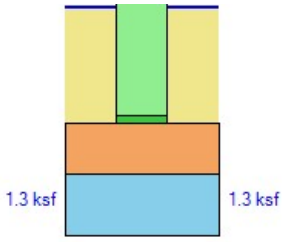
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 8.0 * (1 / 6.0 - 0.00 / 3.0 + 0.00 / 2.0) = 1.33 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 8.0 * (1 / 6.0 - 0.00 / 3.0 - 0.00 / 2.0) = 1.33 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 8.0 * (1 / 6.0 + 0.00 / 3.0 - 0.00 / 2.0) = 1.33 ksf

ASDIP Foundation 4.8.3.1 **SPREAD FOOTING DESIGN** www.asdipsoft.com




## SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33 (per Coulomb)*

Pressure at mid-depth = *kp * Density * (Cover + Thick / 2)* = 4.33 * 110 * (1.50 + 8.0 / 12 / 2) = 0.87 ksf

X-Passive force = *Pressure * Thick * Width* = 0.87 * 8.0 / 12 * 3.00 = 1.7 kip

Z-Passive force = *Pressure * Thick * Length* = 0.87 * 8.0 / 12 * 2.00 = 1.2 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 2.7 * 0.35) = 1.0 kip

*Use 100% of Passive + 100% of Friction for sliding resistance*

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 1.7 + 1.00 * 1.0}{0.0}$ = 27.04 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 1.2 + 1.00 * 1.0}{0.0}$ = 21.22 > 1.50 OK

## UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.4 + 0.6 - 0.1}{0.0}$ = 99.99 > 1.00 OK

## ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Concrete f'c = 2.5 ksi Steel fy = 40.0 ksi Soil density = 110 pcf

Use Plain Concrete Shear Strength

ϕVcx = *4/3 * ϕ * √(f'c) * Width * t / 1000* = 4/3 * 0.60 * √(2500) * 3.0 * 12 * 8.0 / 1000 = 11.5 kip ACI 14.5.5.1

ϕVcz = *4/3 * ϕ * √(f'c) * Length * t / 1000* = 4/3 * 0.60 * √(2500) * 2.0 * 12 * 8.0 / 1000 = 7.7 kip

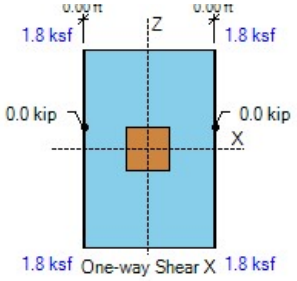
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

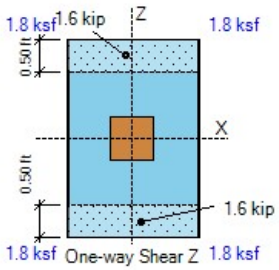
One-way shear Vux (- Side) = 0.0 kip < 11.5 kip OK

One-way shear Vux (+ Side) = 0.0 kip < 11.5 kip OK

One-way shear Vuz (- Side) = 1.6 kip < 7.7 kip OK

One-way shear Vuz (+ Side) = 1.6 kip < 7.7 kip OK




## FLEXURE CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Plain ϕMnx = *5 * ϕ * √(f'c) * L * Thick² / 6* = 5 * 0.60 * √(2500) * 2.00 * 8.0² / 6 / 1000 = 0.9 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * √(f'c) * W * Thick² / 6* = 5 * 0.60 * √(2500) * 3.00 * 8.0² / 6 / 1000 = 1.3 k-ft

- Top Bars

*No Top Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Top

- Top moments calculated as the overburden minus the bearing pressures times the lever arm:

Top moment -Mux (- Side) = 0.0 k-ft < 3.2 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 3.2 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 4.8 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 4.8 k-ft OK

- Bottom Bars

*No Bottom Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Bottom

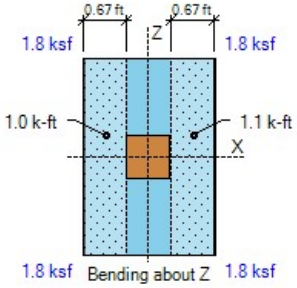
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

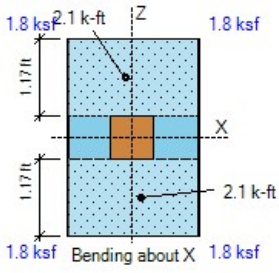
Bottom moment Mux (- Side) = 2.1 k-ft < 3.2 k-ft OK ratio = 0.67

Bottom moment Mux (+ Side) = 2.1 k-ft < 3.2 k-ft OK ratio = 0.67

Bottom moment Muz (- Side) = 1.0 k-ft < 4.8 k-ft OK ratio = 0.22

Bottom moment Muz (+ Side) = 1.1 k-ft < 4.8 k-ft OK ratio = 0.22



LOAD TRANSFER CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Area *A1 = col L * col W =* 8.0 * 8.0 = 64.0 in²

Sx = *col W * col L² / 6 =* 8.0 * 8.0² / 6 = 85.3 in³

Sz = *col L * col W² / 6 =* 8.0 * 8.0² / 6 = 85.3 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz =* 9.4 / 64.0 + 0.0 * 12 / 85.3 + 0.0 * 12 / 85.3 = 0.1 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (2.00 * 12 / 2 - 0.0 - 8.0 / 2, 3.00 * 12 / 2 - 0.0 - 8.0 / 2 = 8.0 in

Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [2.00 * 12 * 3.0 * 12, (8.0 + 2 * 8.0) * (8.0 + 2 * 8.0)] = 576.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)] =* 0.65 * 0.85 * 2.5 * Min [2, √(576.0 / 64.0)] = 2.8 ksi

Footing *ϕPns = ϕ * As * Fy / A1 =* 0.0 ksi ACI 22.8.3.2

Footing bearing *ϕPn = ϕPnc + ϕPns =* 2.8 + 0.0 = 2.8 ksi > 0.1 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.04) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.0 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

## PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

X-Edge = *Length / 2 - Offset - Col / 2* = 2.00 * 12 / 2 - 0.0 - 8.0 / 2 = 8.0 in αsx = 10

Z-Edge = *Width / 2 - Offset - Col / 2* = 3.00 * 12 / 2 - 0.0 - 8.0 / 2 = 14.0 in αsz = 10

αs = *αsx + αsz* = 10 + 10 = 20 Col type = Corner β = *L / W* = 8.0 / 8.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 10 / 10 * (8.0 + 8.0 / 2 + 8.0) + 10 / 10 * (8.0 + 8.0 / 2 + 14.0) = 46.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (8.0 + 8.0 / 2 + 8.0) * (8.0 + 8.0 / 2 + 14.0) = 520.0 in²

Use Plain Concrete Shear Strength

ϕVc = *ϕ * Min (1 + 2 / β, 2) * 4/3 * √(f'c)* ACI 14.5.5.1

ϕVc = 0.60 * Min (1 + 2 / 1.00, 2) * 4/3 √(2500) = 80.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 9.4 + 0.25 * 520.0 / 144 - 3.2 = 7.1 kip

b1 = *L + d / 2 + X-Edge* = 8.0 + 8.0 / 2 + 8.0 = 20.0 in b2 = *W + d / 2 + Z-Edge* = 8.0 + 8.0 / 2 + 14.0 = 26.0 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(26.0 / 20.0)}} = 0.43$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(20.0 / 26.0)}} = 0.37$ ACI Eq. (8.4.2.3.2)

X2z = *b1² / 2 / (b1 + b2)* = 20.0² / 2 / (20.0 + 26.0) = 4.3 in X2x = *b2² / 2 / (b2 + b1)* = 7.3 in

Jcz = *b1 * d³ / 12 + b1³ * d / 12 + b1 * d * (b1 / 2 - X2z)² + b2 * d * X2z²* ACI R8.4.4.2.3

Jcz = 20.0 * 8.0³ / 12 + 20.0³ * 8.0 / 12 + 20.0 * 8.0 * (20.0 / 2 * 4.3)² + 26.0 * 8.0 * 4.3² = 15230 in⁴

Jcx = *b2 * d³ / 12 + b2³ * d / 12 + b2 * d * (b2 / 2 - X2x)² + b1 * d * X2x²* ACI R8.4.4.2.3

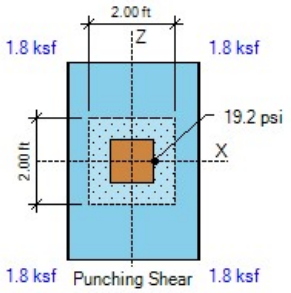
Jcz = 26.0 * 8.0³ / 12 + 26.0³ * 8.0 / 12 + 26.0 * 8.0 * (26.0 / 2 * 7.3)² + 20.0 * 8.0 * 7.3² = 28110 in⁴

Stress due to P = *F / (bo * d) * 1000* = 7.1 / (46.0 * 8.0) * 1000 = 19.2 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.43 * 0.0 * 12 * 7.3 / 28110 * 1000 = 0.0 psi

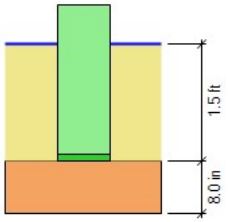
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.43 * 0.0 * 12 * 4.3 / 15230 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 19.2 + 0.0 + 0.0 = 19.2 psi < 80.0 psi OK

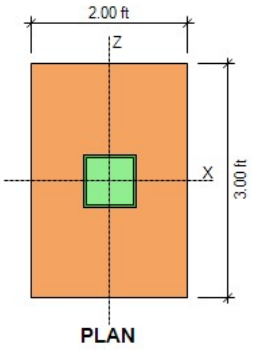


DESIGN CODES

| | |
|---|---|
| Concrete Design ..... | ACI 318-14 |
| Load Combinations ..... | ASCE 7-10/16 |




ELEVATION




PLAN

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

## GEOMETRY

| | | | |
|---|---|---|---|
| Footing Length (X-dir) ..... | 3.00 | ft | |
| Footing Width (Z-dir) ..... | 3.00 | ft | |
| Footing Thickness ..... | 8.0 | in | OK |
| Soil Cover ..... | 1.50 | ft | |
| Column Length (X-dir) ..... | 8.0 | in | |
| Column Width (Z-dir) ..... | 8.0 | in | |
| Offset (X-dir) ..... | 0.00 | in | OK |
| Offset (Z-dir) ..... | 0.00 | in | OK |
| Base Plate (L x W) ..... | 8.0 x 8.0 | in | |

## SOIL PRESSURES (D+S)

| | | | |
|---|---|---|---|
| Gross Allow. Soil Pressure ..... | 2.0 | ksf | |
| Soil Pressure at Corner 1 ..... | 1.7 | ksf | |
| Soil Pressure at Corner 2 ..... | 1.7 | ksf | |
| Soil Pressure at Corner 3 ..... | 1.7 | ksf | |
| Soil Pressure at Corner 4 ..... | 1.7 | ksf | |
| Bearing Pressure Ratio ..... | 0.84 | | OK |
| Ftg. Area in Contact with Soil ..... | 100.0 | % | |
| X-eccentricity / Ftg. Length ..... | 0.00 | | OK |
| Z-eccentricity / Ftg. Width ..... | 0.00 | | OK |

## APPLIED LOADS

| | Dead | Live | RLive | Snow | Wind | Seismic | |
|---|---|---|---|---|---|---|---|
| Axial Force P ..... | 6.7 | 0.0 | 0.0 | 6.4 | 0.0 | 0.0 | kip |
| Moment about X Mx .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Moment about Z Mz .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Shear Force Vx ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |
| Shear Force Vz ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 8.0 / 12 = 0.67 ft  Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.27 ft  Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 3.00 * 3.00 * 8.0 / 12 * 0.15 = 0.5 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 0.5 * 1.50 = 0.8 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft  Moment = 0.0 * 1.50 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0.6 * (3.00 * 3.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 0.8 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 0.8 * 1.50 = 1.3 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 3.00 * 3.00 * 62 * (0.67) = -0.2 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 0.2 * 1.50 = -0.3 k-ft
- Axial force P = 0.6 * 6.7 + 0.6 * 0.0 = 4.0 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft  Moment = 4.0 * 1.50 = 6.0 k-ft
- Resisting moment X-X = 0.8 + 0.0 + 1.3 + 6.0 + -0.3 = 7.8 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{7.8}{0.0}$ = 77.74 > 1.50 OK

- Overturning about Z-Z

- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft

- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft

- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft

- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z

- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 3.00 * 3.00 * 8.0 / 12 * 0.15 = 0.5 kip

Arm = *L / 2* = 3.00 / 2 = 1.50 ft Moment = 0.5 * 1.50 = 0.8 k-ft

- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

Arm = *L / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft Moment = 0.0 * 1.50 = 0.0 k-ft

- Soil cover = *0.6 * W * L * SC * Density* = 0.6 * (3.00 * 3.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 0.8 kip

Arm = *L / 2* = 3.00 / 2 = 1.50 ft Moment = 0.8 * 1.50 = 1.3 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 3.00 * 3.00 * 62 * (0.67) = -0.2 kip

Arm = *L / 2* = 3.00 / 2 = 1.50 ft Moment = 0.2 * 1.50 = -0.3 k-ft

- Axial force P = 0.6 * 6.7 + 0.6 * 0.0 = 4.0 kip

Arm = *L / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft Moment = 4.0 * 1.50 = 6.0 k-ft

- Resisting moment Z-Z = 0.8 + 0.0 + 1.3 + 6.0 + -0.3 = 7.8 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{7.8}{0.0}$ = 77.74 > 1.50 OK

## SOIL BEARING PRESSURES (Comb: D+S)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 1.4 + 0.0 + 2.1 + -0.6 + 19.7 = 22.6 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 1.4 + 0.0 + 2.1 + -0.6 + 19.7 = 22.6 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 0.9 + 0.0 + 1.4 - 0.4 + 13.1 = 15.0 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{22.6 - 0.0}{15.0} = 1.50 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{22.6 - 0.0}{15.0} = 1.50 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =3.00 / 2 - 1.50 = 0.00 ft

Z-ecc = *Width / 2 - Zp* = 3.00 / 2 - 1.50 = 0.00 ft

Area = *Width * Length* = 3.00 * 3.00 = 9.0 ft²

Sx = *Length * Width² / 6* = 3.00 * 3.00² / 6 = 4.5 ft³

Sz = *Width * Length² / 6* = 3.00 * 3.00² / 6 = 4.5 ft³

- Footing is in full bearing. Soil pressures are as follows:

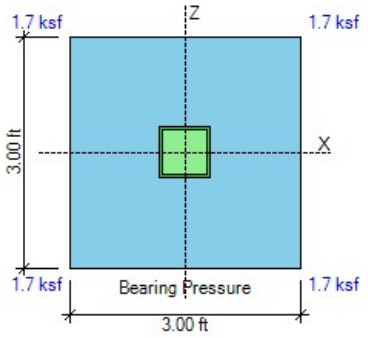
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 15.0 * (1 / 9.0 + 0.00 / 4.5 + 0.00 / 4.5) = 1.67 ksf

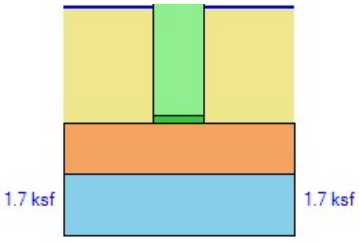
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 15.0 * (1 / 9.0 - 0.00 / 4.5 + 0.00 / 4.5) = 1.67 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 15.0 * (1 / 9.0 - 0.00 / 4.5 - 0.00 / 4.5) = 1.67 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 15.0 * (1 / 9.0 + 0.00 / 4.5 - 0.00 / 4.5) = 1.67 ksf

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*




## SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33 (per Coulomb)*

Pressure at mid-depth = *kp * Density * (Cover + Thick / 2)* = 4.33 * 110 * (1.50 + 8.0 / 12 / 2) = 0.87 ksf

X-Passive force = *Pressure * Thick * Width* = 0.87 * 8.0 / 12 * 3.00 = 1.7 kip

Z-Passive force = *Pressure * Thick * Length* = 0.87 * 8.0 / 12 * 3.00 = 1.7 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 5.2 * 0.35) = 1.8 kip

*Use 100% of Passive + 100% of Friction for sliding resistance*

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 1.7 + 1.00 * 1.8}{0.0}$ = 35.58 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 1.7 + 1.00 * 1.8}{0.0}$ = 35.58 > 1.50 OK

## UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.5 + 0.8 - 0.2}{0.0}$ = 99.99 > 1.00 OK

## ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Concrete f'c = 2.5 ksi Steel fy = 40.0 ksi Soil density = 110 pcf

Use Plain Concrete Shear Strength

ϕVcx = *4/3 * ϕ * √(f'c) * Width * t / 1000* = 4/3 * 0.60 * √(2500) * 3.0 * 12 * 8.0 / 1000 = 11.5 kip ACI 14.5.5.1

ϕVcz = *4/3 * ϕ * √(f'c) * Length * t / 1000* = 4/3 * 0.60 * √(2500) * 3.0 * 12 * 8.0 / 1000 = 11.5 kip

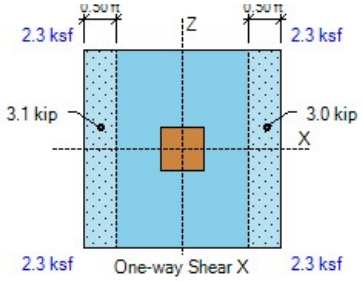
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

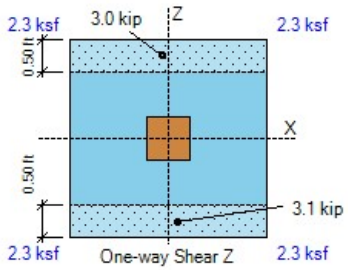
One-way shear Vux (- Side) = 3.1 kip < 11.5 kip OK

One-way shear Vux (+ Side) = 3.0 kip < 11.5 kip OK

One-way shear Vuz (- Side) = 3.1 kip < 11.5 kip OK

One-way shear Vuz (+ Side) = 3.0 kip < 11.5 kip OK




## FLEXURE CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Plain ϕMnx = *5 * ϕ * √(f'c) * L * Thick² / 6* = 5 * 0.60 * √(2500) * 3.00 * 8.0² / 6 / 1000 = 1.3 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * √(f'c) * W * Thick² / 6* = 5 * 0.60 * √(2500) * 3.00 * 8.0² / 6 / 1000 = 1.3 k-ft

- Top Bars

*No Top Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Top

- Top moments calculated as the overburden minus the bearing pressures times the lever arm:

Top moment -Mux (- Side) = 0.0 k-ft < 4.8 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 4.8 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 4.8 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 4.8 k-ft OK

- Bottom Bars

*No Bottom Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Bottom

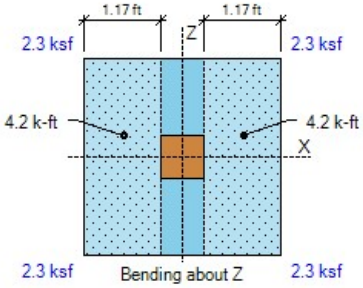
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

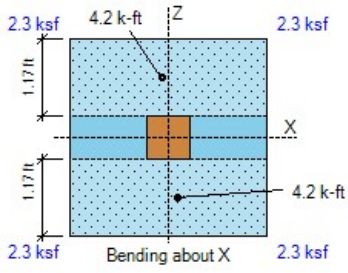
Bottom moment Mux (- Side) = 4.2 k-ft < 4.8 k-ft OK ratio = 0.87

Bottom moment Mux (+ Side) = 4.2 k-ft < 4.8 k-ft OK ratio = 0.87

Bottom moment Muz (- Side) = 4.2 k-ft < 4.8 k-ft OK ratio = 0.87

Bottom moment Muz (+ Side) = 4.2 k-ft < 4.8 k-ft OK ratio = 0.87



LOAD TRANSFER CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Area *A1 = col L * col W =* 8.0 * 8.0 = 64.0 in²

Sx = *col W * col L² / 6 =* 8.0 * 8.0² / 6 = 85.3 in³

Sz = *col L * col W² / 6 =* 8.0 * 8.0² / 6 = 85.3 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz =* 18.3 / 64.0 + 0.0 * 12 / 85.3 + 0.0 * 12 / 85.3 = 0.3 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (3.00 * 12 / 2 - 0.0 - 8.0 / 2, 3.00 * 12 / 2 - 0.0 - 8.0 / 2 = 14.0 in

Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [3.00 * 12 * 3.0 * 12, (8.0 + 2 * 14.0) * (8.0 + 2 * 14.0)] = 1296.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)] =* 0.65 * 0.85 * 2.5 * Min [2, √(1296.0 / 64.0)] = 2.8 ksi

Footing *ϕPns = ϕ * As * Fy / A1 =* 0.0 ksi ACI 22.8.3.2

Footing bearing *ϕPn = ϕPnc + ϕPns =* 2.8 + 0.0 = 2.8 ksi > 0.3 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.08) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.0 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

## PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

X-Edge = *Length / 2 - Offset - Col / 2* = 3.00 * 12 / 2 - 0.0 - 8.0 / 2 = 14.0 in αsx = 10

Z-Edge = *Width / 2 - Offset - Col / 2* = 3.00 * 12 / 2 - 0.0 - 8.0 / 2 = 14.0 in αsz = 10

αs = *αsx + αsz* = 10 + 10 = 20 Col type = Corner β = *L / W* = 8.0 / 8.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 10 / 10 * (8.0 + 8.0 / 2 + 14.0) + 10 / 10 * (8.0 + 8.0 / 2 + 14.0) = 52.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (8.0 + 8.0 / 2 + 14.0) * (8.0 + 8.0 / 2 + 14.0) = 676.0 in²

Use Plain Concrete Shear Strength

ϕVc = *ϕ * Min (1 + 2 / β, 2) * 4/3 * √(f'c)* ACI 14.5.5.1

ϕVc = 0.60 * Min (1 + 2 / 1.00, 2) * 4/3 √(2500) = 80.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 18.3 + 0.26 * 676.0 / 144 - 4.1 = 15.4 kip

b1 = *L + d / 2 + X-Edge* = 8.0 + 8.0 / 2 + 14.0 = 26.0 in b2 = *W + d / 2 + Z-Edge* = 8.0 + 8.0 / 2 + 14.0 = 26.0 in

$$\gamma vx \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(26.0 / 26.0)}} = 0.40$$ ACI Eq. (8.4.4.2.2)

$$\gamma vz \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(26.0 / 26.0)}} = 0.40$$ ACI Eq. (8.4.2.3.2)

X2z = $b1^2 / 2 / (b1 + b2)$ = $26.0^2$ / 2 / (26.0 + 26.0) = 6.5 in X2x = $b2^2 / 2 / (b2 + b1)$ = 6.5 in

Jcz = $b1 * d^3 / 12 + b1^3 * d / 12 + b1 * d * (b1 / 2 - X2z)^2 + b2 * d * X2z^2$ ACI R8.4.4.2.3

Jcz = 26.0 * $8.0^3$ / 12 + $26.0^3$ * 8.0 / 12 + 26.0 * 8.0 * (26.0 / 2 * 6.5)² + 26.0 * 8.0 * $6.5^2$ = 30403 in⁴

Jcx = $b2 * d^3 / 12 + b2^3 * d / 12 + b2 * d * (b2 / 2 - X2x)^2 + b1 * d * X2x^2$ ACI R8.4.4.2.3

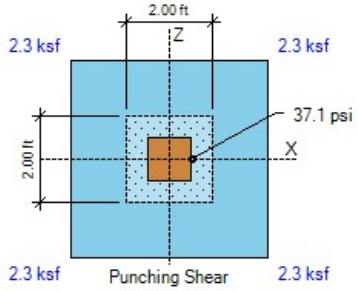
Jcz = 26.0 * $8.0^3$ / 12 + $26.0^3$ * 8.0 / 12 + 26.0 * 8.0 * (26.0 / 2 * 6.5)² + 26.0 * 8.0 * $6.5^2$ = 30403 in⁴

Stress due to P = *F / (bo * d) * 1000* = 15.4 / (52.0 * 8.0) * 1000 = 37.1 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 6.5 / 30403 * 1000 = 0.0 psi

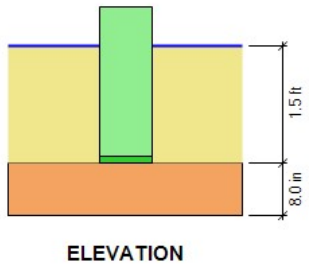
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 6.5 / 30403 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 37.1 + 0.0 + 0.0 = 37.1 psi < 80.0 psi OK

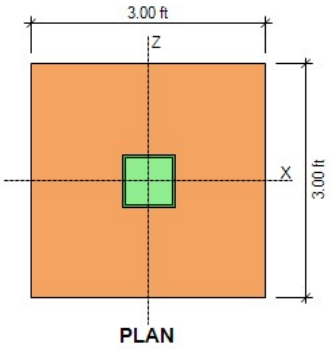


DESIGN CODES

| | |
|---|---|
| Concrete Design ..... | ACI 318-14 |
| Load Combinations ..... | ASCE 7-10/16 |




ELEVATION




PLAN

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

## GEOMETRY

| | | | |
|---|---|---|---|
| Footing Length (X-dir) ..... | 4.00 | ft | |
| Footing Width (Z-dir) ..... | 4.00 | ft | |
| Footing Thickness ..... | 10.0 | in | OK |
| Soil Cover ..... | 1.00 | ft | |
| Column Length (X-dir) ..... | 10.0 | in | |
| Column Width (Z-dir) ..... | 10.0 | in | |
| Offset (X-dir) ..... | 0.00 | in | OK |
| Offset (Z-dir) ..... | 0.00 | in | OK |
| Base Plate (L x W) ..... | 10.0 x 10.0 | in | |

## SOIL PRESSURES (D+S)

| | | | |
|---|---|---|---|
| Gross Allow. Soil Pressure ..... | 2.0 | ksf | |
| Soil Pressure at Corner 1 ..... | 1.9 | ksf | |
| Soil Pressure at Corner 2 ..... | 1.9 | ksf | |
| Soil Pressure at Corner 3 ..... | 1.9 | ksf | |
| Soil Pressure at Corner 4 ..... | 1.9 | ksf | |
| Bearing Pressure Ratio ..... | 0.95 | | OK |
| Ftg. Area in Contact with Soil ..... | 100.0 | % | |
| X-eccentricity / Ftg. Length ..... | 0.00 | | OK |
| Z-eccentricity / Ftg. Width ..... | 0.00 | | OK |

## APPLIED LOADS

| | Dead | Live | RLive | Snow | Wind | Seismic | |
|---|---|---|---|---|---|---|---|
| Axial Force P ..... | 14.1 | 0.0 | 0.0 | 13.6 | 0.0 | 0.0 | kip |
| Moment about X Mx .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Moment about Z Mz .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Shear Force Vx ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |
| Shear Force Vz ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 10.0 / 12 = 0.83 ft  Moment = 0.0 * 0.83 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.33 ft  Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 4.00 * 4.00 * 10.0 / 12 * 0.15 = 1.2 kip

  Arm = *W / 2* = 4.00 / 2 = 2.00 ft  Moment = 1.2 * 2.00 = 2.4 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 10.0 / 12 * 10.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft  Moment = 0.0 * 2.00 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0.6 * (4.00 * 4.00 - 10.0 / 12 * 10.0 / 12) * 1.0 * 110 = 1.0 kip

  Arm = *W / 2* = 4.00 / 2 = 2.00 ft  Moment = 1.0 * 2.00 = 2.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 4.00 * 4.00 * 62 * (0.83) = -0.5 kip

  Arm = *W / 2* = 4.00 / 2 = 2.00 ft  Moment = 0.5 * 2.00 = -1.0 k-ft
- Axial force P = 0.6 * 14.1 + 0.6 * 0.0 = 8.5 kip

  Arm = *W / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft  Moment = 8.5 * 2.00 = 16.9 k-ft
- Resisting moment X-X = 2.4 + 0.0 + 2.0 + 16.9 + -1.0 = 20.3 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{20.3}{0.0}$ = 99.99 > 1.50 OK

- Overturning about Z-Z

- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft

- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

Arm = 0.00 + 10.0 / 12 = 0.83 ft Moment = 0.0 * 0.83 = 0.0 k-ft

- Passive Force = 0.0 kip Arm = 0.33 ft Moment = 0.0 k-ft

- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z

- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 4.00 * 4.00 * 10.0 / 12 * 0.15 = 1.2 kip

Arm = *L / 2* = 4.00 / 2 = 2.00 ft Moment = 1.2 * 2.00 = 2.4 k-ft

- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 10.0 / 12 * 10.0 / 12 * 0.0 * 0.15 = 0.0 kip

Arm = *L / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft Moment = 0.0 * 2.00 = 0.0 k-ft

- Soil cover = *0.6 * W * L * SC * Density* = 0.6 * (4.00 * 4.00 - 10.0 / 12 * 10.0 / 12) * 1.0 * 110 = 1.0 kip

Arm = *L / 2* = 4.00 / 2 = 2.00 ft Moment = 1.0 * 2.00 = 2.0 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 4.00 * 4.00 * 62 * (0.83) = -0.5 kip

Arm = *L / 2* = 4.00 / 2 = 2.00 ft Moment = 0.5 * 2.00 = -1.0 k-ft

- Axial force P = 0.6 * 14.1 + 0.6 * 0.0 = 8.5 kip

Arm = *L / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft Moment = 8.5 * 2.00 = 16.9 k-ft

- Resisting moment Z-Z = 2.4 + 0.0 + 2.0 + 16.9 + -1.0 = 20.3 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{20.3}{0.0}$ = 99.99 > 1.50 OK

## SOIL BEARING PRESSURES (Comb: D+S)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 4.0 + 0.0 + 3.4 + -1.7 + 55.4 = 61.1 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 4.0 + 0.0 + 3.4 + -1.7 + 55.4 = 61.1 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 2.0 + 0.0 + 1.7 - 0.8 + 27.7 = 30.6 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{61.1 - 0.0}{30.6} = 2.00 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{61.1 - 0.0}{30.6} = 2.00 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =4.00 / 2 - 2.00 = 0.00 ft

Z-ecc = *Width / 2 - Zp* = 4.00 / 2 - 2.00 = 0.00 ft

Area = *Width * Length* = 4.00 * 4.00 = 16.0 ft²

Sx = *Length * Width² / 6* = 4.00 * 4.00² / 6 = 10.7 ft³

Sz = *Width * Length² / 6* = 4.00 * 4.00² / 6 = 10.7 ft³

- Footing is in full bearing. Soil pressures are as follows:

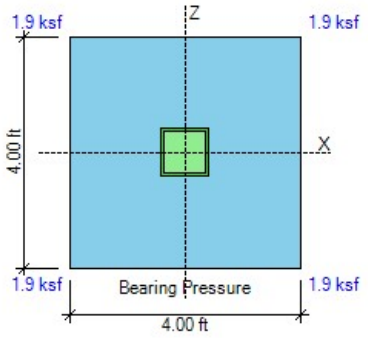
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 30.6 * (1 / 16.0 + 0.00 / 10.7 + 0.00 / 10.7) = 1.91 ksf

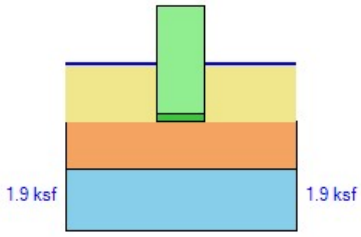
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 30.6 * (1 / 16.0 - 0.00 / 10.7 + 0.00 / 10.7) = 1.91 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 30.6 * (1 / 16.0 - 0.00 / 10.7 - 0.00 / 10.7) = 1.91 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 30.6 * (1 / 16.0 + 0.00 / 10.7 - 0.00 / 10.7) = 1.91 ksf

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*




## SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33 (per Coulomb)*

Pressure at mid-depth = *kp * Density * (Cover + Thick / 2)* = 4.33 * 110 * (1.00 + 10.0 / 12 / 2) = 0.67 ksf

X-Passive force = *Pressure * Thick * Width* = 0.67 * 10.0 / 12 * 4.00 = 2.2 kip

Z-Passive force = *Pressure * Thick * Length* = 0.67 * 10.0 / 12 * 4.00 = 2.2 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 10.2 * 0.35) = 3.6 kip

*Use 100% of Passive + 100% of Friction for sliding resistance*

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 2.2 + 1.00 * 3.6}{0.0}$ = 58.07 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 2.2 + 1.00 * 3.6}{0.0}$ = 58.07 > 1.50 OK

## UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 1.2 + 1.0 - 0.5}{0.0}$ = 99.99 > 1.00 OK

## ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Concrete f'c = 2.5 ksi Steel fy = 40.0 ksi Soil density = 110 pcf

d Top X-dir = *Thick - Cover - X-diameter / 2* = 10.0 - 2.0 - 0.8 / 2 = 7.6 in

d Top Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 10.0 - 2.0 - 0.8 - 0.8 / 2 = 6.9 in

d Bot X-dir = *Thick - Cover - X-diameter / 2* = 10.0 - 3.0 - 0.6 / 2 = 6.7 in

d Bot Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 10.0 - 3.0 - 0.6 - 0.6 / 2 = 6.1 in

$\phi Vcx = 2 * \phi * \sqrt{f'c} * Width * d / 1000$ = 2 * 0.75 * √(2500) * 4.0 * 12 * 6.7 / 1000 = 24.1 kip ACI Eq. (22.5.5.1)

$\phi Vcz = 2 * \phi * \sqrt{f'c} * Length * d / 1000$ = 2 * 0.75 * √(2500) * 4.0 * 12 * 6.1 / 1000 = 21.8 kip

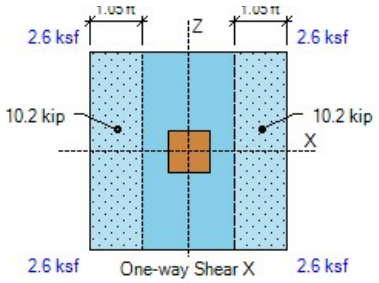
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

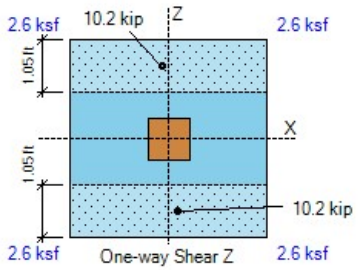
One-way shear Vux (- Side) = 10.2 kip < 24.1 kip OK

One-way shear Vux (+ Side) = 10.2 kip < 24.1 kip OK

One-way shear Vuz (- Side) = 10.2 kip < 21.8 kip OK

One-way shear Vuz (+ Side) = 10.2 kip < 21.8 kip OK




## FLEXURE CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Plain ϕMnx = *5 * ϕ * √(f'c) * L * Thick² / 6* = 5 * 0.60 * √(2500) * 4.00 * 10.0² / 6 / 1000 = 2.7 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * √(f'c) * W * Thick² / 6* = 5 * 0.60 * √(2500) * 4.00 * 10.0² / 6 / 1000 = 2.7 k-ft

- Top Bars

*No Top Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Top

- Top moments calculated as the overburden minus the bearing pressures times the lever arm:

Top moment -Mux (- Side) = 0.0 k-ft < 10.0 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 10.0 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 10.0 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 10.0 k-ft OK

- Bottom Bars

*Use 5 #5 Z-Bars* *ρ = As / b d* = 1.6 / (4.00 * 12 * 6.1) = 0.0053 q = 0.0053 * 40 / 2.5 = 0.085

*Use 5 #5 X-Bars* *ρ = As / b d* = 1.6 / (4.00 * 12 * 6.7) = 0.0048 q = 0.0048 * 40 / 2.5 = 0.077

*β = L / W* = 4.00 / 4.00 = 1.00 *γs = 2 * β / (β + 1)* = 2 * 1.00 / (1.00 + 1) = 1.00 ACI 13.3.3.3

Bending strength *ϕMn = ϕ * b * d² * f'c * q * (1 - 0.59 * q)* ACI 22.2.2

ϕMnx = 0.90 * 4.00 * 12 * 6.1² * 2.5 * 0.085 * (1 - 0.59 * 0.085) = 26.8 k-ft

ϕMnz = 0.90 * 4.00 * 12 * 6.7² * 2.5 * 0.077 / 1.00 * (1 - 0.59 * 0.077 / 1.00) = 29.7 k-ft

- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

Bottom moment Mux (- Side) = 12.1 k-ft < 26.8 k-ft OK ratio = 0.45

Bottom moment Mux (+ Side) = 12.2 k-ft < 26.8 k-ft OK ratio = 0.45

Bottom moment Muz (- Side) = 12.1 k-ft < 29.7 k-ft OK ratio = 0.41

Bottom moment Muz (+ Side) = 12.2 k-ft < 29.7 k-ft OK ratio = 0.41

X-As min = *0.0018 * Width * Thick* = 0.0018 * 4.00 * 12 * 10.0 = 0.9 in² < 1.6 in² OK ACI 8.6.1.1

Z-As min = *0.0018 * Length * Thick* = 0.0018 * 4.00 * 12 * 10.0 = 0.9 in² < 1.6 in² OK ACI 8.6.1.1

X-As max for 0.005 tension strain = 5.18 in² > 1.55 in² OK ACI 21.2.2

Z-As max for 0.005 tension strain = 5.18 in² > 1.55 in² OK ACI 21.2.2

X-Cover factor = *Min (2.5, (Cover + db /2, Spacing / 2) / db)* = Min (2.5, (3.0 + 0.63 / 2, 10.5 / 2) / 0.63) = 2.5

Straight *X-Ld = Max (12.0, 3 / 40 * fy / (f'c)½ * Grade * Size * Casting / Cover * db * ratio)* ACI Eq. (25.4.2.3a)

X-Ld = Max (12.0, 3 / 40 * 40.0 * 1000 / (2500)½ * 1.0 * 0.8 * 1.0 / 2.5 * 0.63 * 0.41) = 12.0 in

Hooked *X-Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* = ACI 25.4.3

X-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.63 * 0.41) = 6.0 in

-X Ld provided = *(Length - Col) / 2 + Offset - Cover* = 4.00 * 12 / 2 + 0.0 - 10.0 / 2 - 2.5 = 16.5 in > 12.0 in OK

+X Ld provided = *(Length - Col) / 2 - Offset - Cover* = 4.00 * 12 / 2 - 0.0 - 10.0 / 2 - 2.5 = 16.5 in > 12.0 in OK

Z-Cover factor = *Min (2.5, (Cover + db /2, Spacing / 2) / db)* = Min (2.5, (3.0 + 0.63 / 2, 10.5 / 2) / 0.63) = 2.5

Straight *Z-Ld = Max (12.0, 3 / 40 * fy / (f'c)½ * Grade * Size * Casting / Cover * db * ratio)* ACI Eq. (25.4.2.3a)

Z-Ld = Max (12.0, 3 / 40 * 40.0 * 1000 / (2500)½ * 1.0 * 0.8 * 1.0 / 2.5 * 0.63 * 0.41) = 12.0 in

Hooked *Z-Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* = ACI 25.4.3

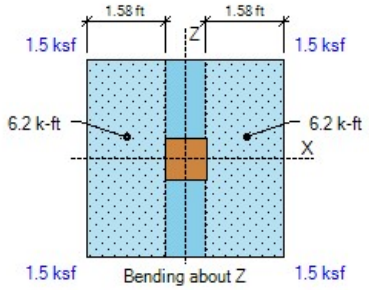
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.63 * 0.45) = 6.0 in

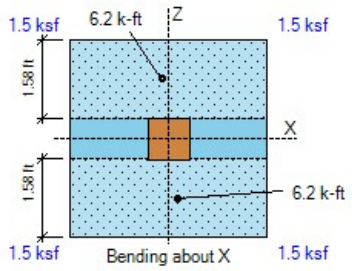
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 4.00 * 12 / 2 + 0.0 - 10.0 / 2 - 2.5 = 16.5 in > 12.0 in OK

+Z Ld provided = *(Width - Col) / 2 - Offset - Cover* = 4.00 * 12 / 2 - 0.0 - 10.0 / 2 - 2.5 = 16.5 in > 12.0 in OK

X-bar spacing = 10.5 in < Min ( 3 * t, 18.0) = 18.0 in OK ACI 7.7.2.3

Z-bar spacing = 10.5 in < Min ( 3 * t, 18.0) = 18.0 in OK




## LOAD TRANSFER CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Area *A1 = col L * col W* = 10.0 * 10.0 = 100.0 in²

Sx = *col W * col L² / 6* = 10.0 * 10.0² / 6 = 166.7 in³

Sz = *col L * col W² / 6* = 10.0 * 10.0² / 6 = 166.7 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz* = 38.7 / 100.0 + 0.0 * 12 / 166.7 + 0.0 * 12 / 166.7 = 0.4 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (4.00 * 12 / 2 - 0.0 - 10.0 / 2, 4.00 * 12 / 2 - 0.0 - 10.0 / 2 = 19.0 in

Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [4.00 * 12 * 4.0 * 12, (10.0 + 2 * 19.0) * (10.0 + 2 * 19.0)] = 2304.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)]* = 0.65 * 0.85 * 2.5 * Min [2, √(2304.0 / 100.0)] = 2.8 ksi

Footing *ϕPns = ϕ * As * Fy / A1* = 0.0 ksi ACI 22.8.3.2

Footing bearing *ϕPn = ϕPnc + ϕPns* = 2.8 + 0.0 = 2.8 ksi > 0.4 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.13) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.0 in OK

Ldh provided = *Footing thickness - Cover* = 10.00 - 3.0 = 7.0 in > 6.0 in OK

## PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

X-Edge = *d /2* = 6.4 / 2 = 3.2 in αsx = 20

Z-Edge = *d /2* = 6.4 / 2 = 3.2 in αsz = 20

αs = *αsx + αsz* = 20 + 20 = 40 Col type = Interior β = *L / W* = 10.0 / 10.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 20 / 10 * (10.0 + 6.4 / 2 + 3.2) + 20 / 10 * (10.0 + 6.4 / 2 + 3.2) = 65.5 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (10.0 + 6.4 / 2 + 3.2) * (10.0 + 6.4 / 2 + 3.2) = 268.1 in²

ϕVc = *ϕ * Min (2 + 4 / β, αs * d / bo + 2, 4) * √(f'c)* ACI 22.6.5.2

ϕVc = 0.75 * Min (2 + 4 / 1.00, 40 * 6.4 / 65.5 + 2, 4) * √(2500) = 150.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 38.7 + 0.21 * 268.1 / 144 - 4.9 = 34.2 kip

b1 = *L + d / 2 + X-Edge* = 10.0 + 6.4 / 2 + 3.2 = 16.4 in b2 = *W + d / 2 + Z-Edge* = 10.0 + 6.4 / 2 + 3.2 = 16.4 in

$$\gamma vx \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(16.4 / 16.4)}} = 0.40$$ ACI Eq. (8.4.4.2.2)

$$\gamma vz \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(16.4 / 16.4)}} = 0.40$$ ACI Eq. (8.4.2.3.2)

X2z = *b1 / 2* = 16.4 / 2 = 8.2 in X2x = *b2 / 2* = 16.4 / 2 = 8.2 in

Jcz = *b1 * d³ / 6 + b1³ * d / 6 + b1² * b2 * d / 2* ACI R8.4.4.2.3

Jcz = 16.4 * 6.4³ / 6 + 16.4³ * 6.4 / 6 + 16.4² * 16.4 * 6.4 / 2 = 19368 in⁴

Jcx = *b2 * d³ / 6 + b2³ * d / 6 + b2² * b1 * d / 2* ACI R8.4.4.2.3

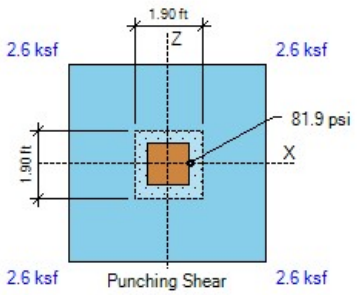
Jcx = 16.4 * 6.4³ / 6 + 16.4³ * 6.4 / 6 + 16.4² * 16.4 * 6.4 / 2 = 19368 in⁴

Stress due to P = *F / (bo * d) * 1000* = 34.2 / (65.5 * 6.4) * 1000 = 81.9 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 8.2 / 19368 * 1000 = 0.0 psi

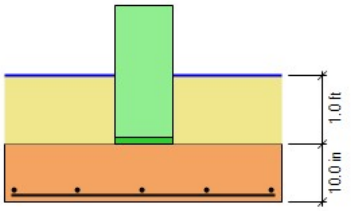
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 8.2 / 19368 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 81.9 + 0.0 + 0.0 = 81.9 psi < 150.0 psi OK

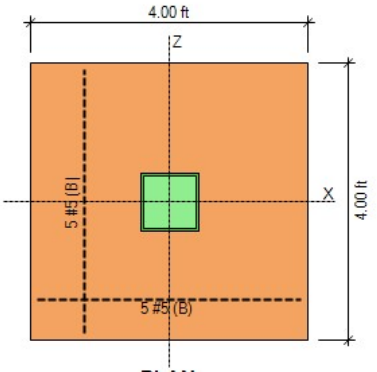


DESIGN CODES

| | |
|---|---|
| Concrete Design ..... | ACI 318-14 |
| Load Combinations ..... | ASCE 7-10/16 |




ELEVATION




PLAN

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

## GEOMETRY

| | | | |
|---|---|---|---|
| Footing Length (X-dir) ..... | 4.00 | ft | |
| Footing Width (Z-dir) ..... | 4.00 | ft | |
| Footing Thickness ..... | 10.0 | in | OK |
| Soil Cover ..... | 1.50 | ft | |
| Column Length (X-dir) ..... | 8.0 | in | |
| Column Width (Z-dir) ..... | 8.0 | in | |
| Offset (X-dir) ..... | 0.00 | in | OK |
| Offset (Z-dir) ..... | 0.00 | in | OK |
| Base Plate (L x W) ..... | 8.0 x 8.0 | in | |

## SOIL PRESSURES (D+S)

| | | | |
|---|---|---|---|
| Gross Allow. Soil Pressure ..... | 2.0 | ksf | |
| Soil Pressure at Corner 1 ..... | 1.6 | ksf | |
| Soil Pressure at Corner 2 ..... | 1.6 | ksf | |
| Soil Pressure at Corner 3 ..... | 1.6 | ksf | |
| Soil Pressure at Corner 4 ..... | 1.6 | ksf | |
| Bearing Pressure Ratio ..... | 0.81 | | OK |
| Ftg. Area in Contact with Soil ..... | 100.0 | % | |
| X-eccentricity / Ftg. Length ..... | 0.00 | | OK |
| Z-eccentricity / Ftg. Width ..... | 0.00 | | OK |

## APPLIED LOADS

| | Dead | Live | RLive | Snow | Wind | Seismic | |
|---|---|---|---|---|---|---|---|
| Axial Force P ..... | 11.5 | 0.0 | 0.0 | 10.7 | 0.0 | 0.0 | kip |
| Moment about X Mx .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Moment about Z Mz .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Shear Force Vx ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |
| Shear Force Vz ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 10.0 / 12 = 0.83 ft  Moment = 0.0 * 0.83 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.33 ft  Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 4.00 * 4.00 * 10.0 / 12 * 0.15 = 1.2 kip

  Arm = *W / 2* = 4.00 / 2 = 2.00 ft  Moment = 1.2 * 2.00 = 2.4 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft  Moment = 0.0 * 2.00 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0.6 * (4.00 * 4.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 1.5 kip

  Arm = *W / 2* = 4.00 / 2 = 2.00 ft  Moment = 1.5 * 2.00 = 3.1 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 4.00 * 4.00 * 62 * (0.83) = -0.5 kip

  Arm = *W / 2* = 4.00 / 2 = 2.00 ft  Moment = 0.5 * 2.00 = -1.0 k-ft
- Axial force P = 0.6 * 11.5 + 0.6 * 0.0 = 6.9 kip

  Arm = *W / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft  Moment = 6.9 * 2.00 = 13.8 k-ft
- Resisting moment X-X = 2.4 + 0.0 + 3.1 + 13.8 + -1.0 = 18.3 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{18.3}{0.0}$ = 99.99 > 1.50 OK

- Overturning about Z-Z
- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 10.0 / 12 = 0.83 ft  Moment = 0.0 * 0.83 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.33 ft  Moment = 0.0 k-ft
- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 4.00 * 4.00 * 10.0 / 12 * 0.15 = 1.2 kip

  Arm = *L / 2* = 4.00 / 2 = 2.00 ft  Moment = 1.2 * 2.00 = 2.4 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *L / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft  Moment = 0.0 * 2.00 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* = 0.6 * (4.00 * 4.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 1.5 kip

  Arm = *L / 2* = 4.00 / 2 = 2.00 ft  Moment = 1.5 * 2.00 = 3.1 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 4.00 * 4.00 * 62 * (0.83) = -0.5 kip

  Arm = *L / 2* = 4.00 / 2 = 2.00 ft  Moment = 0.5 * 2.00 = -1.0 k-ft
- Axial force P = 0.6 * 11.5 + 0.6 * 0.0 = 6.9 kip

  Arm = *L / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft  Moment = 6.9 * 2.00 = 13.8 k-ft
- Resisting moment Z-Z = 2.4 + 0.0 + 3.1 + 13.8 + -1.0 = 18.3 k-ft
- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{18.3}{0.0}$ = 99.99 > 1.50 OK

## SOIL BEARING PRESSURES (Comb: D+S)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 4.0 + 0.0 + 5.1 + -1.7 + 44.4 = 51.9 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 4.0 + 0.0 + 5.1 + -1.7 + 44.4 = 51.9 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 2.0 + 0.0 + 2.6 - 0.8 + 22.2 = 25.9 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{51.9 - 0.0}{25.9} = 2.00 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{51.9 - 0.0}{25.9} = 2.00 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =4.00 / 2 - 2.00 = 0.00 ft

Z-ecc = *Width / 2 - Zp* = 4.00 / 2 - 2.00 = 0.00 ft

Area = *Width * Length* = 4.00 * 4.00 = 16.0 ft²

Sx = *Length * Width² / 6* = 4.00 * 4.00² / 6 = 10.7 ft³

Sz = *Width * Length² / 6* = 4.00 * 4.00² / 6 = 10.7 ft³

- Footing is in full bearing. Soil pressures are as follows:

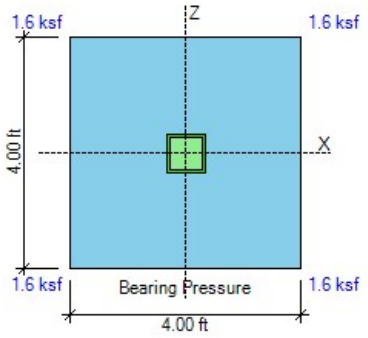
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 25.9 * (1 / 16.0 + 0.00 / 10.7 + 0.00 / 10.7) = 1.62 ksf

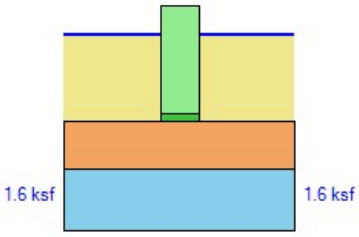
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 25.9 * (1 / 16.0 - 0.00 / 10.7 + 0.00 / 10.7) = 1.62 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 25.9 * (1 / 16.0 - 0.00 / 10.7 - 0.00 / 10.7) = 1.62 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 25.9 * (1 / 16.0 + 0.00 / 10.7 - 0.00 / 10.7) = 1.62 ksf

ASDIP Foundation 4.8.3.1 **SPREAD FOOTING DESIGN** www.asdipsoft.com




## SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33 (per Coulomb)*

Pressure at mid-depth = *kp * Density * (Cover + Thick / 2)* = 4.33 * 110 * (1.50 + 10.0 / 12 / 2) = 0.91 ksf

X-Passive force = *Pressure * Thick * Width* = 0.91 * 10.0 / 12 * 4.00 = 3.0 kip

Z-Passive force = *Pressure * Thick * Length* = 0.91 * 10.0 / 12 * 4.00 = 3.0 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 9.1 * 0.35) = 3.2 kip

*Use 100% of Passive + 100% of Friction for sliding resistance*

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 3.0 + 1.00 * 3.2}{0.0}$ = 62.39 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 3.0 + 1.00 * 3.2}{0.0}$ = 62.39 > 1.50 OK

## UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 1.2 + 1.5 - 0.5}{0.0}$ = 99.99 > 1.00 OK

## ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Concrete f'c = 2.5 ksi Steel fy = 40.0 ksi Soil density = 110 pcf

d Top X-dir = *Thick - Cover - X-diameter / 2* = 10.0 - 2.0 - 0.8 / 2 = 7.6 in

d Top Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 10.0 - 2.0 - 0.8 - 0.8 / 2 = 6.9 in

d Bot X-dir = *Thick - Cover - X-diameter / 2* = 10.0 - 3.0 - 0.6 / 2 = 6.7 in

d Bot Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 10.0 - 3.0 - 0.6 - 0.6 / 2 = 6.1 in

$\phi Vcx = 2 * \phi * \sqrt{f'c} * Width * d / 1000$ = 2 * 0.75 * √(2500) * 4.0 * 12 * 6.7 / 1000 = 24.1 kip ACI Eq. (22.5.5.1)

$\phi Vcz = 2 * \phi * \sqrt{f'c} * Length * d / 1000$ = 2 * 0.75 * √(2500) * 4.0 * 12 * 6.1 / 1000 = 21.8 kip

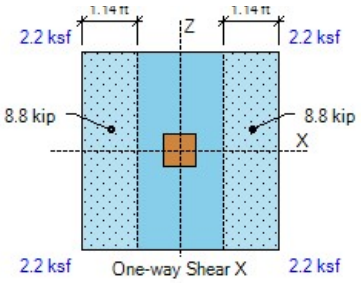
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

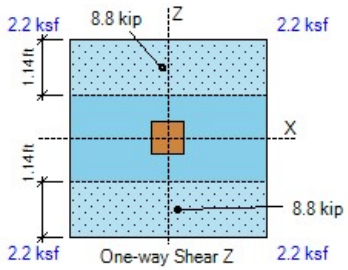
One-way shear Vux (- Side) = 8.8 kip < 24.1 kip OK

One-way shear Vux (+ Side) = 8.8 kip < 24.1 kip OK

One-way shear Vuz (- Side) = 8.8 kip < 21.8 kip OK

One-way shear Vuz (+ Side) = 8.8 kip < 21.8 kip OK




## FLEXURE CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Plain ϕMnx = *5 * ϕ * √(f'c) * L * Thick² / 6* = 5 * 0.60 * √(2500) * 4.00 * 10.0² / 6 / 1000 = 2.7 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * √(f'c) * W * Thick² / 6* = 5 * 0.60 * √(2500) * 4.00 * 10.0² / 6 / 1000 = 2.7 k-ft

- Top Bars

*No Top Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Top

- Top moments calculated as the overburden minus the bearing pressures times the lever arm:

Top moment -Mux (- Side) = 0.0 k-ft < 10.0 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 10.0 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 10.0 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 10.0 k-ft OK

- Bottom Bars

*Use 5 #5 Z-Bars* *ρ = As / b d* = 1.6 / (4.00 * 12 * 6.1) = 0.0053 q = 0.0053 * 40 / 2.5 = 0.085

*Use 5 #5 X-Bars* *ρ = As / b d* = 1.6 / (4.00 * 12 * 6.7) = 0.0048 q = 0.0048 * 40 / 2.5 = 0.077

*β = L / W* = 4.00 / 4.00 = 1.00 *γs = 2 * β / (β + 1)* = 2 * 1.00 / (1.00 + 1) = 1.00 ACI 13.3.3.3

Bending strength *ϕMn = ϕ * b * d² * f'c * q * (1 - 0.59 * q)* ACI 22.2.2

ϕMnx = 0.90 * 4.00 * 12 * 6.1² * 2.5 * 0.085 * (1 - 0.59 * 0.085) = 26.8 k-ft

ϕMnz = 0.90 * 4.00 * 12 * 6.7² * 2.5 * 0.077 / 1.00 * (1 - 0.59 * 0.077 / 1.00) = 29.7 k-ft

- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

Bottom moment Mux (- Side) = 10.8 k-ft < 26.8 k-ft OK ratio = 0.40

Bottom moment Mux (+ Side) = 10.8 k-ft < 26.8 k-ft OK ratio = 0.40

Bottom moment Muz (- Side) = 10.8 k-ft < 29.7 k-ft OK ratio = 0.36

Bottom moment Muz (+ Side) = 10.8 k-ft < 29.7 k-ft OK ratio = 0.36

X-As min = *0.0018 * Width * Thick* = 0.0018 * 4.00 * 12 * 10.0 = 0.9 in² < 1.6 in² OK ACI 8.6.1.1

Z-As min = *0.0018 * Length * Thick* = 0.0018 * 4.00 * 12 * 10.0 = 0.9 in² < 1.6 in² OK ACI 8.6.1.1

X-As max for 0.005 tension strain = 5.18 in² > 1.55 in² OK ACI 21.2.2

Z-As max for 0.005 tension strain = 5.18 in² > 1.55 in² OK ACI 21.2.2

X-Cover factor = *Min (2.5, (Cover + db /2, Spacing / 2) / db)* = Min (2.5, (3.0 + 0.63 / 2, 10.5 / 2) / 0.63) = 2.5

Straight *X-Ld = Max (12.0, 3 / 40 * fy / (f'c)½ * Grade * Size * Casting / Cover * db * ratio)* ACI Eq. (25.4.2.3a)

X-Ld = Max (12.0, 3 / 40 * 40.0 * 1000 / (2500)½ * 1.0 * 0.8 * 1.0 / 2.5 * 0.63 * 0.36) = 12.0 in

Hooked *X-Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* = ACI 25.4.3

X-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.63 * 0.36) = 6.0 in

-X Ld provided = *(Length - Col) / 2 + Offset - Cover* = 4.00 * 12 / 2 + 0.0 - 8.0 / 2 - 2.5 = 17.5 in > 12.0 in OK

+X Ld provided = *(Length - Col) / 2 - Offset - Cover* = 4.00 * 12 / 2 - 0.0 - 8.0 / 2 - 2.5 = 17.5 in > 12.0 in OK

Z-Cover factor = *Min (2.5, (Cover + db /2, Spacing / 2) / db)* = Min (2.5, (3.0 + 0.63 / 2, 10.5 / 2) / 0.63) = 2.5

Straight *Z-Ld = Max (12.0, 3 / 40 * fy / (f'c)½ * Grade * Size * Casting / Cover * db * ratio)* ACI Eq. (25.4.2.3a)

Z-Ld = Max (12.0, 3 / 40 * 40.0 * 1000 / (2500)½ * 1.0 * 0.8 * 1.0 / 2.5 * 0.63 * 0.36) = 12.0 in

Hooked *Z-Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* = ACI 25.4.3

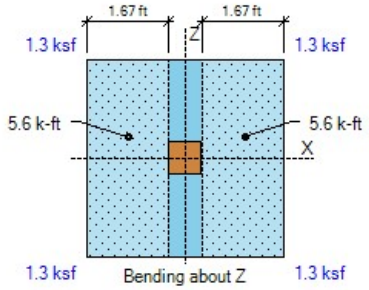
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.63 * 0.40) = 6.0 in

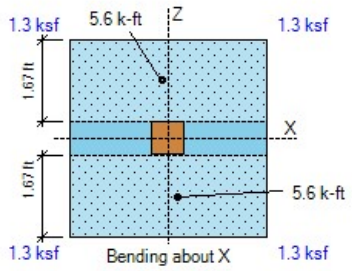
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 4.00 * 12 / 2 + 0.0 - 8.0 / 2 - 2.5 = 17.5 in > 12.0 in OK

+Z Ld provided = *(Width - Col) / 2 - Offset - Cover* = 4.00 * 12 / 2 - 0.0 - 8.0 / 2 - 2.5 = 17.5 in > 12.0 in OK

X-bar spacing = 10.5 in < Min ( 3 * t, 18.0) = 18.0 in OK ACI 7.7.2.3

Z-bar spacing = 10.5 in < Min ( 3 * t, 18.0) = 18.0 in OK




## LOAD TRANSFER CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Area *A1 = col L * col W* = 8.0 * 8.0 = 64.0 in²

Sx = *col W * col L² / 6* = 8.0 * 8.0² / 6 = 85.3 in³

Sz = *col L * col W² / 6* = 8.0 * 8.0² / 6 = 85.3 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz* = 30.9 / 64.0 + 0.0 * 12 / 85.3 + 0.0 * 12 / 85.3 = 0.5 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (4.00 * 12 / 2 - 0.0 - 8.0 / 2, 4.00 * 12 / 2 - 0.0 - 8.0 / 2 = 20.0 in

Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [4.00 * 12 * 4.0 * 12, (8.0 + 2 * 20.0) * (8.0 + 2 * 20.0)] = 2304.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)]* = 0.65 * 0.85 * 2.5 * Min [2, √(2304.0 / 64.0)] = 2.8 ksi

Footing *ϕPns = ϕ * As * Fy / A1* = 0.0 ksi ACI 22.8.3.2

Footing bearing *ϕPn = ϕPnc + ϕPns* = 2.8 + 0.0 = 2.8 ksi > 0.5 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.13) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.0 in OK

Ldh provided = *Footing thickness - Cover* = 10.00 - 3.0 = 7.0 in > 6.0 in OK

## PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

X-Edge = *d /2* = 6.4 / 2 = 3.2 in αsx = 20

Z-Edge = *d /2* = 6.4 / 2 = 3.2 in αsz = 20

αs = *αsx + αsz* = 20 + 20 = 40 Col type = Interior β = *L / W* = 8.0 / 8.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 20 / 10 * (8.0 + 6.4 / 2 + 3.2) + 20 / 10 * (8.0 + 6.4 / 2 + 3.2) = 57.5 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (8.0 + 6.4 / 2 + 3.2) * (8.0 + 6.4 / 2 + 3.2) = 206.6 in²

ϕVc = *ϕ * Min (2 + 4 / β, αs * d / bo + 2, 4) * √(f'c)* ACI 22.6.5.2

ϕVc = 0.75 * Min (2 + 4 / 1.00, 40 * 6.4 / 57.5 + 2, 4) * √(2500) = 150.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 30.9 + 0.28 * 206.6 / 144 - 3.2 = 28.1 kip

b1 = *L + d / 2 + X-Edge* = 8.0 + 6.4 / 2 + 3.2 = 14.4 in b2 = *W + d / 2 + Z-Edge* = 8.0 + 6.4 / 2 + 3.2 = 14.4 in

$$\gamma vx \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(14.4 / 14.4)}} = 0.40$$ ACI Eq. (8.4.4.2.2)

$$\gamma vz \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(14.4 / 14.4)}} = 0.40$$ ACI Eq. (8.4.2.3.2)

X2z = *b1 / 2* = 14.4 / 2 = 7.2 in X2x = *b2 / 2* = 14.4 / 2 = 7.2 in

Jcz = *b1 * d³ / 6 + b1³ * d / 6 + b1² * b2 * d / 2* ACI R8.4.4.2.3

Jcz = 14.4 * 6.4³ / 6 + 14.4³ * 6.4 / 6 + 14.4² * 14.4 * 6.4 / 2 = 13245 in⁴

Jcx = *b2 * d³ / 6 + b2³ * d / 6 + b2² * b1 * d / 2* ACI R8.4.4.2.3

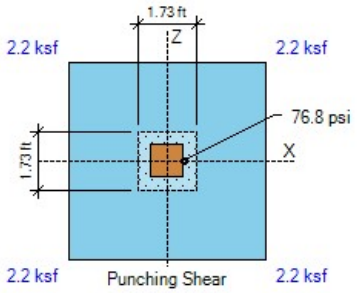
Jcx = 14.4 * 6.4³ / 6 + 14.4³ * 6.4 / 6 + 14.4² * 14.4 * 6.4 / 2 = 13245 in⁴

Stress due to P = *F / (bo * d) * 1000* = 28.1 / (57.5 * 6.4) * 1000 = 76.8 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 7.2 / 13245 * 1000 = 0.0 psi

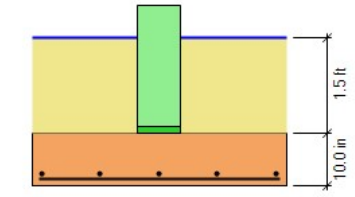
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 7.2 / 13245 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 76.8 + 0.0 + 0.0 = 76.8 psi < 150.0 psi OK

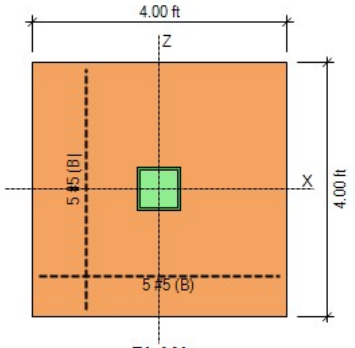


DESIGN CODES

| | |
|---|---|
| Concrete Design ..... | ACI 318-14 |
| Load Combinations ..... | ASCE 7-10/16 |




ELEVATION




PLAN

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

## GEOMETRY

| | | | |
|---|---|---|---|
| Footing Length (X-dir) ..... | 4.00 | ft | |
| Footing Width (Z-dir) ..... | 4.00 | ft | |
| Footing Thickness ..... | 10.0 | in | OK |
| Soil Cover ..... | 1.50 | ft | |
| Column Length (X-dir) ..... | 8.0 | in | |
| Column Width (Z-dir) ..... | 8.0 | in | |
| Offset (X-dir) ..... | 0.00 | in | OK |
| Offset (Z-dir) ..... | 0.00 | in | OK |
| Base Plate (L x W) ..... | 8.0 x 8.0 | in | |

## SOIL PRESSURES (D+S)

| | | | |
|---|---|---|---|
| Gross Allow. Soil Pressure ..... | 2.0 | ksf | |
| Soil Pressure at Corner 1 ..... | 1.7 | ksf | |
| Soil Pressure at Corner 2 ..... | 1.7 | ksf | |
| Soil Pressure at Corner 3 ..... | 1.7 | ksf | |
| Soil Pressure at Corner 4 ..... | 1.7 | ksf | |
| Bearing Pressure Ratio ..... | 0.85 | | OK |
| Ftg. Area in Contact with Soil ..... | 100.0 | % | |
| X-eccentricity / Ftg. Length ..... | 0.00 | | OK |
| Z-eccentricity / Ftg. Width ..... | 0.00 | | OK |

## APPLIED LOADS

| | Dead | Live | RLive | Snow | Wind | Seismic | |
|---|---|---|---|---|---|---|---|
| Axial Force P ..... | 11.9 | 0.0 | 0.0 | 11.6 | 0.0 | 0.0 | kip |
| Moment about X Mx .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Moment about Z Mz .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Shear Force Vx ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |
| Shear Force Vz ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 10.0 / 12 = 0.83 ft  Moment = 0.0 * 0.83 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.33 ft  Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 4.00 * 4.00 * 10.0 / 12 * 0.15 = 1.2 kip

  Arm = *W / 2* = 4.00 / 2 = 2.00 ft  Moment = 1.2 * 2.00 = 2.4 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft  Moment = 0.0 * 2.00 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0.6 * (4.00 * 4.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 1.5 kip

  Arm = *W / 2* = 4.00 / 2 = 2.00 ft  Moment = 1.5 * 2.00 = 3.1 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 4.00 * 4.00 * 62 * (0.83) = -0.5 kip

  Arm = *W / 2* = 4.00 / 2 = 2.00 ft  Moment = 0.5 * 2.00 = -1.0 k-ft
- Axial force P = 0.6 * 11.9 + 0.6 * 0.0 = 7.1 kip

  Arm = *W / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft  Moment = 7.1 * 2.00 = 14.3 k-ft
- Resisting moment X-X = 2.4 + 0.0 + 3.1 + 14.3 + -1.0 = 18.8 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{18.8}{0.0}$ = 99.99 > 1.50 OK

- Overturning about Z-Z

- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft

- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

Arm = 0.00 + 10.0 / 12 = 0.83 ft Moment = 0.0 * 0.83 = 0.0 k-ft

- Passive Force = 0.0 kip Arm = 0.33 ft Moment = 0.0 k-ft

- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z

- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 4.00 * 4.00 * 10.0 / 12 * 0.15 = 1.2 kip

Arm = *L / 2* = 4.00 / 2 = 2.00 ft Moment = 1.2 * 2.00 = 2.4 k-ft

- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

Arm = *L / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft Moment = 0.0 * 2.00 = 0.0 k-ft

- Soil cover = *0.6 * W * L * SC * Density* = 0.6 * (4.00 * 4.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 1.5 kip

Arm = *L / 2* = 4.00 / 2 = 2.00 ft Moment = 1.5 * 2.00 = 3.1 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 4.00 * 4.00 * 62 * (0.83) = -0.5 kip

Arm = *L / 2* = 4.00 / 2 = 2.00 ft Moment = 0.5 * 2.00 = -1.0 k-ft

- Axial force P = 0.6 * 11.9 + 0.6 * 0.0 = 7.1 kip

Arm = *L / 2 - Offset* = 4.00 / 2 - 0.0 / 12 = 2.00 ft Moment = 7.1 * 2.00 = 14.3 k-ft

- Resisting moment Z-Z = 2.4 + 0.0 + 3.1 + 14.3 + -1.0 = 18.8 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{18.8}{0.0}$ = 99.99 > 1.50 OK

## SOIL BEARING PRESSURES (Comb: D+S)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 4.0 + 0.0 + 5.1 + -1.7 + 47.0 = 54.5 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 4.0 + 0.0 + 5.1 + -1.7 + 47.0 = 54.5 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 2.0 + 0.0 + 2.6 - 0.8 + 23.5 = 27.2 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{54.5 - 0.0}{27.2} = 2.00 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{54.5 - 0.0}{27.2} = 2.00 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =4.00 / 2 - 2.00 = 0.00 ft

Z-ecc = *Width / 2 - Zp* = 4.00 / 2 - 2.00 = 0.00 ft

Area = *Width * Length* = 4.00 * 4.00 = 16.0 ft²

Sx = *Length * Width² / 6* = 4.00 * 4.00² / 6 = 10.7 ft³

Sz = *Width * Length² / 6* = 4.00 * 4.00² / 6 = 10.7 ft³

- Footing is in full bearing. Soil pressures are as follows:

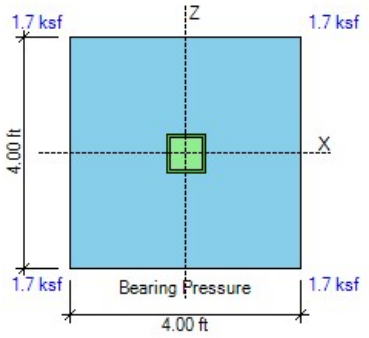
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 27.2 * (1 / 16.0 + 0.00 / 10.7 + 0.00 / 10.7) = 1.70 ksf

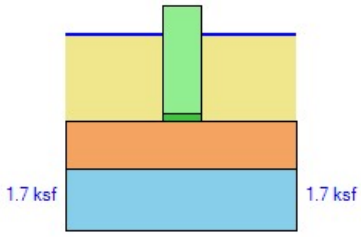
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 27.2 * (1 / 16.0 - 0.00 / 10.7 + 0.00 / 10.7) = 1.70 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 27.2 * (1 / 16.0 - 0.00 / 10.7 - 0.00 / 10.7) = 1.70 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 27.2 * (1 / 16.0 + 0.00 / 10.7 - 0.00 / 10.7) = 1.70 ksf

ASDIP Foundation 4.8.3.1 **SPREAD FOOTING DESIGN** www.asdipsoft.com




## SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33 (per Coulomb)*

Pressure at mid-depth = *kp * Density * (Cover + Thick / 2)* = 4.33 * 110 * (1.50 + 10.0 / 12 / 2) = 0.91 ksf

X-Passive force = *Pressure * Thick * Width* = 0.91 * 10.0 / 12 * 4.00 = 3.0 kip

Z-Passive force = *Pressure * Thick * Length* = 0.91 * 10.0 / 12 * 4.00 = 3.0 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 9.4 * 0.35) = 3.3 kip

*Use 100% of Passive + 100% of Friction for sliding resistance*

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 3.0 + 1.00 * 3.3}{0.0}$ = 63.23 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 3.0 + 1.00 * 3.3}{0.0}$ = 63.23 > 1.50 OK

## UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 1.2 + 1.5 - 0.5}{0.0}$ = 99.99 > 1.00 OK

## ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Concrete f'c = 2.5 ksi Steel fy = 40.0 ksi Soil density = 110 pcf

d Top X-dir = *Thick - Cover - X-diameter / 2* = 10.0 - 2.0 - 0.8 / 2 = 7.6 in

d Top Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 10.0 - 2.0 - 0.8 - 0.8 / 2 = 6.9 in

d Bot X-dir = *Thick - Cover - X-diameter / 2* = 10.0 - 3.0 - 0.6 / 2 = 6.7 in

d Bot Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 10.0 - 3.0 - 0.6 - 0.6 / 2 = 6.1 in

$\phi Vcx = 2 * \phi * \sqrt{f'c} * Width * d / 1000$ = 2 * 0.75 * √(2500) * 4.0 * 12 * 6.7 / 1000 = 24.1 kip ACI Eq. (22.5.5.1)

$\phi Vcz = 2 * \phi * \sqrt{f'c} * Length * d / 1000$ = 2 * 0.75 * √(2500) * 4.0 * 12 * 6.1 / 1000 = 21.8 kip

- Shear forces calculated as the volume of the bearing pressures under the effective areas:

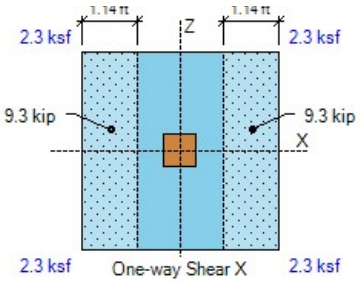
One-way shear Vux (- Side) = 9.3 kip < 24.1 kip OK

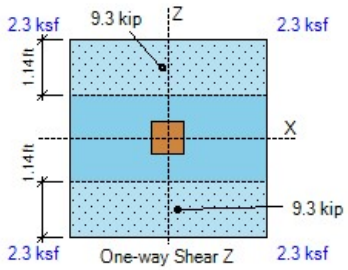
One-way shear Vux (+ Side) = 9.3 kip < 24.1 kip OK

One-way shear Vuz (- Side) = 9.3 kip < 21.8 kip OK

One-way shear Vuz (+ Side) = 9.3 kip < 21.8 kip OK

ASDIP Foundation 4.8.3.1 **SPREAD FOOTING DESIGN** www.asdipsoft.com




FLEXURE CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Plain ϕMnx = *5 * ϕ * √(f'c) * L * Thick² / 6* = 5 * 0.60 * √(2500) * 4.00 * 10.0² / 6 / 1000 = 2.7 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * √(f'c) * W * Thick² / 6* = 5 * 0.60 * √(2500) * 4.00 * 10.0² / 6 / 1000 = 2.7 k-ft

- Top Bars

*No Top Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Top

- Top moments calculated as the overburden minus the bearing pressures times the lever arm:

Top moment -Mux (- Side) = 0.0 k-ft < 10.0 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 10.0 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 10.0 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 10.0 k-ft OK

- Bottom Bars

*Use 5 #5 Z-Bars* *ρ = As / b d* = 1.6 / (4.00 * 12 * 6.1) = 0.0053 q = 0.0053 * 40 / 2.5 = 0.085

*Use 5 #5 X-Bars* *ρ = As / b d* = 1.6 / (4.00 * 12 * 6.7) = 0.0048 q = 0.0048 * 40 / 2.5 = 0.077

*β = L / W* = 4.00 / 4.00 = 1.00 *γs = 2 * β / (β + 1)* = 2 * 1.00 / (1.00 + 1) = 1.00 ACI 13.3.3.3

Bending strength *ϕMn = ϕ * b * d² * f'c * q * (1 - 0.59 * q)* ACI 22.2.2

ϕMnx = 0.90 * 4.00 * 12 * 6.1² * 2.5 * 0.085 * (1 - 0.59 * 0.085) = 26.8 k-ft

ϕMnz = 0.90 * 4.00 * 12 * 6.7² * 2.5 * 0.077 / 1.00 * (1 - 0.59 * 0.077 / 1.00) = 29.7 k-ft

- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

Bottom moment Mux (- Side) = 11.4 k-ft < 26.8 k-ft OK ratio = 0.43

Bottom moment Mux (+ Side) = 11.4 k-ft < 26.8 k-ft OK ratio = 0.43

Bottom moment Muz (- Side) = 11.4 k-ft < 29.7 k-ft OK ratio = 0.38

Bottom moment Muz (+ Side) = 11.4 k-ft < 29.7 k-ft OK ratio = 0.39

X-As min = *0.0018 * Width * Thick* = 0.0018 * 4.00 * 12 * 10.0 = 0.9 in² < 1.6 in² OK ACI 8.6.1.1

Z-As min = *0.0018 * Length * Thick* = 0.0018 * 4.00 * 12 * 10.0 = 0.9 in² < 1.6 in² OK ACI 8.6.1.1

X-As max for 0.005 tension strain = 5.18 in² > 1.55 in² OK ACI 21.2.2

Z-As max for 0.005 tension strain = 5.18 in² > 1.55 in² OK ACI 21.2.2

X-Cover factor = *Min (2.5, (Cover + db /2, Spacing / 2) / db)* = Min (2.5, (3.0 + 0.63 / 2, 10.5 / 2) / 0.63) = 2.5

Straight *X-Ld = Max (12.0, 3 / 40 * fy / (f'c)½ * Grade * Size * Casting / Cover * db * ratio)* ACI Eq. (25.4.2.3a)

X-Ld = Max (12.0, 3 / 40 * 40.0 * 1000 / (2500)½ * 1.0 * 0.8 * 1.0 / 2.5 * 0.63 * 0.39) = 12.0 in

Hooked *X-Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* = ACI 25.4.3

X-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.63 * 0.39) = 6.0 in

-X Ld provided = *(Length - Col) / 2 + Offset - Cover* = 4.00 * 12 / 2 + 0.0 - 8.0 / 2 - 2.5 = 17.5 in > 12.0 in OK

+X Ld provided = *(Length - Col) / 2 - Offset - Cover* = 4.00 * 12 / 2 - 0.0 - 8.0 / 2 - 2.5 = 17.5 in > 12.0 in OK

ASDIP Foundation 4.8.3.1 **SPREAD FOOTING DESIGN** www.asdipsoft.com

Z-Cover factor = *Min (2.5, (Cover + db /2, Spacing / 2) / db)* = Min (2.5, (3.0 + 0.63 / 2, 10.5 / 2) / 0.63) = 2.5

Straight *Z-Ld = Max (12.0, 3 / 40 * fy / (f'c)½ * Grade * Size * Casting / Cover * db * ratio)* ACI Eq. (25.4.2.3a)

Z-Ld = Max (12.0, 3 / 40 * 40.0 * 1000 / (2500)½ * 1.0 * 0.8 * 1.0 / 2.5 * 0.63 * 0.39) = 12.0 in

Hooked *Z-Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* = ACI 25.4.3

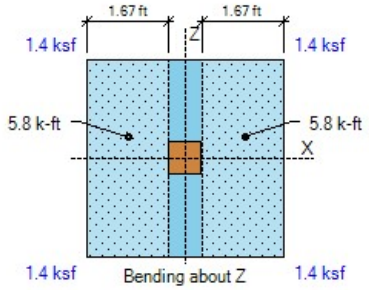
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.63 * 0.43) = 6.0 in

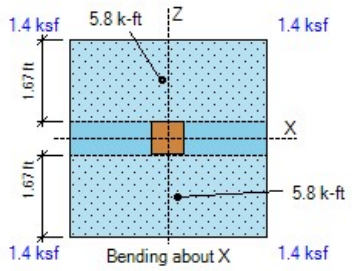
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 4.00 * 12 / 2 + 0.0 - 8.0 / 2 - 2.5 = 17.5 in > 12.0 in OK

+Z Ld provided = *(Width - Col) / 2 - Offset - Cover* = 4.00 * 12 / 2 - 0.0 - 8.0 / 2 - 2.5 = 17.5 in > 12.0 in OK

X-bar spacing = 10.5 in < Min ( 3 * t, 18.0) = 18.0 in OK ACI 7.7.2.3

Z-bar spacing = 10.5 in < Min ( 3 * t, 18.0) = 18.0 in OK




## LOAD TRANSFER CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Area *A1 = col L * col W* = 8.0 * 8.0 = 64.0 in²

Sx = *col W * col L² / 6* = 8.0 * 8.0² / 6 = 85.3 in³

Sz = *col L * col W² / 6* = 8.0 * 8.0² / 6 = 85.3 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz* = 32.8 / 64.0 + 0.0 * 12 / 85.3 + 0.0 * 12 / 85.3 = 0.5 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (4.00 * 12 / 2 - 0.0 - 8.0 / 2, 4.00 * 12 / 2 - 0.0 - 8.0 / 2 = 20.0 in

Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [4.00 * 12 * 4.0 * 12, (8.0 + 2 * 20.0) * (8.0 + 2 * 20.0)] = 2304.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)]* = 0.65 * 0.85 * 2.5 * Min [2, √(2304.0 / 64.0)] = 2.8 ksi

Footing *ϕPns = ϕ * As * Fy / A1* = 0.0 ksi ACI 22.8.3.2

Footing bearing *ϕPn = ϕPnc + ϕPns* = 2.8 + 0.0 = 2.8 ksi > 0.5 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.14) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.0 in OK

Ldh provided = *Footing thickness - Cover* = 10.00 - 3.0 = 7.0 in > 6.0 in OK

## PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

X-Edge = *d /2* = 6.4 / 2 = 3.2 in αsx = 20

Z-Edge = *d /2* = 6.4 / 2 = 3.2 in αsz = 20

αs = *αsx + αsz* = 20 + 20 = 40 Col type = Interior β = *L / W* = 8.0 / 8.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 20 / 10 * (8.0 + 6.4 / 2 + 3.2) + 20 / 10 * (8.0 + 6.4 / 2 + 3.2) = 57.5 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (8.0 + 6.4 / 2 + 3.2) * (8.0 + 6.4 / 2 + 3.2) = 206.6 in²

ϕVc = *ϕ * Min (2 + 4 / β, αs * d / bo + 2, 4) * √(f'c)* ACI 22.6.5.2

ϕVc = 0.75 * Min (2 + 4 / 1.00, 40 * 6.4 / 57.5 + 2, 4) * √(2500) = 150.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 32.8 + 0.28 * 206.6 / 144 - 3.3 = 29.9 kip

b1 = *L + d / 2 + X-Edge* = 8.0 + 6.4 / 2 + 3.2 = 14.4 in b2 = *W + d / 2 + Z-Edge* = 8.0 + 6.4 / 2 + 3.2 = 14.4 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(14.4 / 14.4)}} = 0.40$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(14.4 / 14.4)}} = 0.40$ ACI Eq. (8.4.2.3.2)

X2z = *b1 / 2* = 14.4 / 2 = 7.2 in X2x = *b2 / 2* = 14.4 / 2 = 7.2 in

Jcz = *b1 * d³ / 6 + b1³ * d / 6 + b1² * b2 * d / 2* ACI R8.4.4.2.3

Jcz = 14.4 * 6.4³ / 6 + 14.4³ * 6.4 / 6 + 14.4² * 14.4 * 6.4 / 2 = 13245 in⁴

Jcx = *b2 * d³ / 6 + b2³ * d / 6 + b2² * b1 * d / 2* ACI R8.4.4.2.3

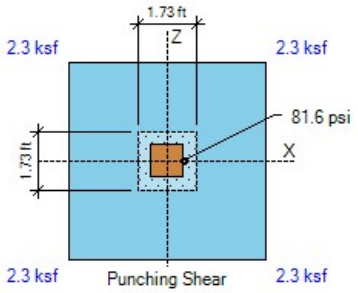
Jcx = 14.4 * 6.4³ / 6 + 14.4³ * 6.4 / 6 + 14.4² * 14.4 * 6.4 / 2 = 13245 in⁴

Stress due to P = *F / (bo * d) * 1000* = 29.9 / (57.5 * 6.4) * 1000 = 81.6 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 7.2 / 13245 * 1000 = 0.0 psi

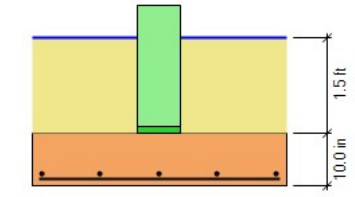
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 7.2 / 13245 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 81.6 + 0.0 + 0.0 = 81.6 psi < 150.0 psi OK

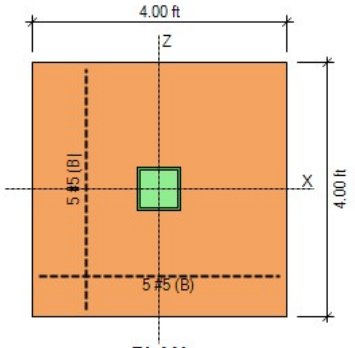


DESIGN CODES

| | |
|---|---|
| Concrete Design ..... | ACI 318-14 |
| Load Combinations ..... | ASCE 7-10/16 |




ELEVATION




PLAN

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

## GEOMETRY

| | | | |
|---|---|---|---|
| Footing Length (X-dir) ..... | 3.00 | ft | |
| Footing Width (Z-dir) ..... | 3.00 | ft | |
| Footing Thickness ..... | 15.0 | in | OK |
| Soil Cover ..... | 1.50 | ft | |
| Column Length (X-dir) ..... | 8.0 | in | |
| Column Width (Z-dir) ..... | 8.0 | in | |
| Offset (X-dir) ..... | 0.00 | in | OK |
| Offset (Z-dir) ..... | 0.00 | in | OK |
| Base Plate (L x W) ..... | 8.0 x 8.0 | in | |

## SOIL PRESSURES (D+S)

| | | | |
|---|---|---|---|
| Gross Allow. Soil Pressure ..... | 2.0 | ksf | |
| Soil Pressure at Corner 1 ..... | 1.9 | ksf | |
| Soil Pressure at Corner 2 ..... | 1.9 | ksf | |
| Soil Pressure at Corner 3 ..... | 1.9 | ksf | |
| Soil Pressure at Corner 4 ..... | 1.9 | ksf | |
| Bearing Pressure Ratio ..... | 0.96 | | OK |
| Ftg. Area in Contact with Soil ..... | 100.0 | % | |
| X-eccentricity / Ftg. Length ..... | 0.00 | | OK |
| Z-eccentricity / Ftg. Width ..... | 0.00 | | OK |

## APPLIED LOADS

| | Dead | Live | RLive | Snow | Wind | Seismic | |
|---|---|---|---|---|---|---|---|
| Axial Force P ..... | 7.5 | 0.0 | 0.0 | 7.4 | 0.0 | 0.0 | kip |
| Moment about X Mx .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Moment about Z Mz .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Shear Force Vx ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |
| Shear Force Vz ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 15.0 / 12 = 1.25 ft  Moment = 0.0 * 1.25 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.50 ft  Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 3.00 * 3.00 * 15.0 / 12 * 0.15 = 1.0 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 1.0 * 1.50 = 1.5 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft  Moment = 0.0 * 1.50 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0.6 * (3.00 * 3.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 0.8 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 0.8 * 1.50 = 1.3 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 3.00 * 3.00 * 62 * (1.25) = -0.4 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft  Moment = 0.4 * 1.50 = -0.6 k-ft
- Axial force P = 0.6 * 7.5 + 0.6 * 0.0 = 4.5 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft  Moment = 4.5 * 1.50 = 6.8 k-ft
- Resisting moment X-X = 1.5 + 0.0 + 1.3 + 6.8 + -0.6 = 8.9 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{8.9}{0.0}$ = 89.07 > 1.50 OK

- Overturning about Z-Z
- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 15.0 / 12 = 1.25 ft  Moment = 0.0 * 1.25 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.50 ft  Moment = 0.0 k-ft
- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z
- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 3.00 * 3.00 * 15.0 / 12 * 0.15 = 1.0 kip

  Arm = *L / 2 =* 3.00 / 2 = 1.50 ft  Moment = 1.0 * 1.50 = 1.5 k-ft
- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *L / 2 - Offset =* 3.00 / 2 - 0.0 / 12 = 1.50 ft  Moment = 0.0 * 1.50 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (3.00 * 3.00 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 0.8 kip

  Arm = *L / 2 =* 3.00 / 2 = 1.50 ft  Moment = 0.8 * 1.50 = 1.3 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 3.00 * 3.00 * 62 * (1.25) = -0.4 kip

  Arm = *L / 2 =* 3.00 / 2 = 1.50 ft  Moment = 0.4 * 1.50 = -0.6 k-ft
- Axial force P = 0.6 * 7.5 + 0.6 * 0.0 = 4.5 kip

  Arm = *L / 2 - Offset =* 3.00 / 2 - 0.0 / 12 = 1.50 ft  Moment = 4.5 * 1.50 = 6.8 k-ft
- Resisting moment Z-Z = 1.5 + 0.0 + 1.3 + 6.8 + -0.6 = 8.9 k-ft
- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{8.9}{0.0}$ = 89.07 > 1.50 OK

## SOIL BEARING PRESSURES (Comb: D+S)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 2.5 + 0.0 + 2.1 + -1.1 + 22.4 = 25.9 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 2.5 + 0.0 + 2.1 + -1.1 + 22.4 = 25.9 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 1.7 + 0.0 + 1.4 - 0.7 + 14.9 = 17.3 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{25.9 - 0.0}{17.3} = 1.50 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{25.9 - 0.0}{17.3} = 1.50 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =3.00 / 2 - 1.50 = 0.00 ft

Z-ecc = *Width / 2 - Zp =* 3.00 / 2 - 1.50 = 0.00 ft

Area = *Width * Length =* 3.00 * 3.00 = 9.0 ft²

Sx = *Length * Width² / 6 =* 3.00 * 3.00² / 6 = 4.5 ft³

Sz = *Width * Length² / 6 =* 3.00 * 3.00² / 6 = 4.5 ft³

- Footing is in full bearing. Soil pressures are as follows:

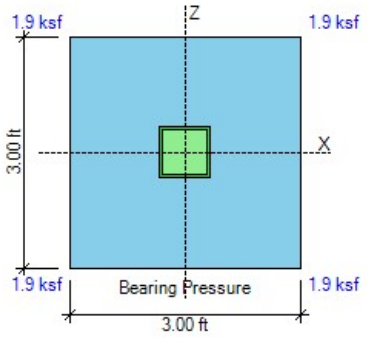
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 17.3 * (1 / 9.0 + 0.00 / 4.5 + 0.00 / 4.5) = 1.92 ksf

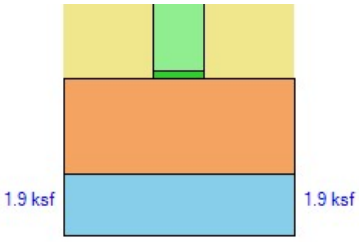
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 17.3 * (1 / 9.0 - 0.00 / 4.5 + 0.00 / 4.5) = 1.92 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 17.3 * (1 / 9.0 - 0.00 / 4.5 - 0.00 / 4.5) = 1.92 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 17.3 * (1 / 9.0 + 0.00 / 4.5 - 0.00 / 4.5) = 1.92 ksf

ASDIP Foundation 4.8.3.1 **SPREAD FOOTING DESIGN** www.asdipsoft.com




## SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33 (per Coulomb)*

Pressure at mid-depth = *kp * Density * (Cover + Thick / 2)* = 4.33 * 110 * (1.50 + 15.0 / 12 / 2) = 1.01 ksf

X-Passive force = *Pressure * Thick * Width* = 1.01 * 15.0 / 12 * 3.00 = 3.8 kip

Z-Passive force = *Pressure * Thick * Length* = 1.01 * 15.0 / 12 * 3.00 = 3.8 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 5.9 * 0.35) = 2.1 kip

*Use 100% of Passive + 100% of Friction for sliding resistance*

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 3.8 + 1.00 * 2.1}{0.0}$ = 58.70 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 3.8 + 1.00 * 2.1}{0.0}$ = 58.70 > 1.50 OK

## UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 1.0 + 0.8 - 0.4}{0.0}$ = 99.99 > 1.00 OK

## ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Concrete f'c = 2.5 ksi Steel fy = 40.0 ksi Soil density = 110 pcf

Use Plain Concrete Shear Strength

ϕVcx = *4/3 * ϕ * √(f'c) * Width * t / 1000* = 4/3 * 0.60 * √(2500) * 3.0 * 12 * 15.0 / 1000 = 21.6 kip ACI 14.5.5.1

ϕVcz = *4/3 * ϕ * √(f'c) * Length * t / 1000* = 4/3 * 0.60 * √(2500) * 3.0 * 12 * 15.0 / 1000 = 21.6 kip

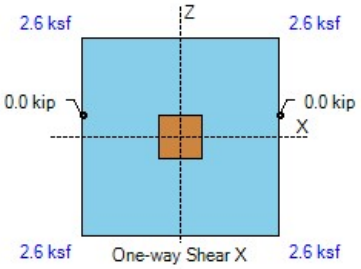
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

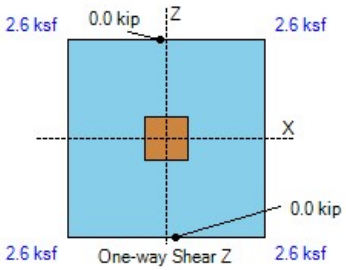
One-way shear Vux (- Side) = 0.0 kip < 21.6 kip OK

One-way shear Vux (+ Side) = 0.0 kip < 21.6 kip OK

One-way shear Vuz (- Side) = 0.0 kip < 21.6 kip OK

One-way shear Vuz (+ Side) = 0.0 kip < 21.6 kip OK




## FLEXURE CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Plain ϕMnx = $5 * \phi * \sqrt{f'c} * L * Thick^2 / 6$ = 5 * 0.60 * √(2500) * 3.00 * 15.0² / 6 / 1000 = 4.5 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = $5 * \phi * \sqrt{f'c} * W * Thick^2 / 6$ = 5 * 0.60 * √(2500) * 3.00 * 15.0² / 6 / 1000 = 4.5 k-ft

- Top Bars

*No Top Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Top

- Top moments calculated as the overburden minus the bearing pressures times the lever arm:

Top moment -Mux (- Side) = 0.0 k-ft < 16.9 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 16.9 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 16.9 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 16.9 k-ft OK

- Bottom Bars

*No Bottom Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Bottom

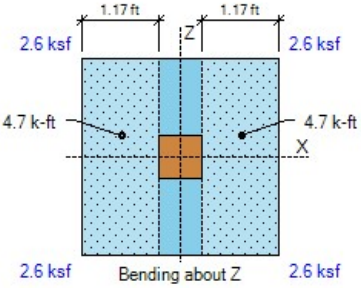
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

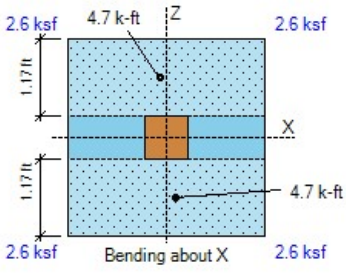
Bottom moment Mux (- Side) = 4.7 k-ft < 16.9 k-ft OK ratio = 0.28

Bottom moment Mux (+ Side) = 4.7 k-ft < 16.9 k-ft OK ratio = 0.28

Bottom moment Muz (- Side) = 4.7 k-ft < 16.9 k-ft OK ratio = 0.28

Bottom moment Muz (+ Side) = 4.7 k-ft < 16.9 k-ft OK ratio = 0.28



LOAD TRANSFER CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Area *A1 = col L * col W =* 8.0 * 8.0 = 64.0 in²

Sx = *col W * col L² / 6 =* 8.0 * 8.0² / 6 = 85.3 in³

Sz = *col L * col W² / 6 =* 8.0 * 8.0² / 6 = 85.3 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz =* 20.8 / 64.0 + 0.0 * 12 / 85.3 + 0.0 * 12 / 85.3 = 0.3 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (3.00 * 12 / 2 - 0.0 - 8.0 / 2, 3.00 * 12 / 2 - 0.0 - 8.0 / 2 = 14.0 in

Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [3.00 * 12 * 3.0 * 12, (8.0 + 2 * 14.0) * (8.0 + 2 * 14.0)] = 1296.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)] =* 0.65 * 0.85 * 2.5 * Min [2, √(1296.0 / 64.0)] = 2.8 ksi

Footing *ϕPns = ϕ * As * Fy / A1 =* 0.0 ksi ACI 22.8.3.2

Footing bearing *ϕPn = ϕPnc + ϕPns =* 2.8 + 0.0 = 2.8 ksi > 0.3 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.09) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.0 in OK

Ldh provided = *Footing thickness - Cover* = 15.00 - 3.0 = 12.0 in > 6.0 in OK

## PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

X-Edge = *Length / 2 - Offset - Col / 2* = 3.00 * 12 / 2 - 0.0 - 8.0 / 2 = 14.0 in αsx = 10

Z-Edge = *Width / 2 - Offset - Col / 2* = 3.00 * 12 / 2 - 0.0 - 8.0 / 2 = 14.0 in αsz = 10

αs = *αsx + αsz* = 10 + 10 = 20 Col type = Corner β = *L / W* = 8.0 / 8.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 10 / 10 * (8.0 + 15.0 / 2 + 14.0) + 10 / 10 * (8.0 + 15.0 / 2 + 14.0) = 59.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (8.0 + 15.0 / 2 + 14.0) * (8.0 + 15.0 / 2 + 14.0) = 870.3 in²

Use Plain Concrete Shear Strength

ϕVc = *ϕ * Min (1 + 2 / β, 2) * 4/3 * √(f'c)* ACI 14.5.5.1

ϕVc = 0.60 * Min (1 + 2 / 1.00, 2) * 4/3 √(2500) = 80.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 20.8 + 0.32 * 870.3 / 144 - 9.7 = 13.1 kip

b1 = *L + d / 2 + X-Edge* = 8.0 + 15.0 / 2 + 14.0 = 29.5 in b2 = *W + d / 2 + Z-Edge* = 8.0 + 15.0 / 2 + 14.0 = 29.5 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(29.5 / 29.5)}} = 0.40$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(29.5 / 29.5)}} = 0.40$ ACI Eq. (8.4.2.3.2)

X2z = $b1^2 / 2 / (b1 + b2)$ = 29.5² / 2 / (29.5 + 29.5) = 7.4 in X2x = $b2^2 / 2 / (b2 + b1)$ = 7.4 in

Jcz = $b1 * d^3 / 12 + b1^3 * d / 12 + b1 * d * (b1 / 2 - X2z)^2 + b2 * d * X2z^2$ ACI R8.4.4.2.3

Jcz = 29.5 * 15.0³ / 12 + 29.5³ * 15.0 / 12 + 29.5 * 15.0 * (29.5 / 2 * 7.4)² + 29.5 * 15.0 * 7.4² = 88523 in⁴

Jcx = $b2 * d^3 / 12 + b2^3 * d / 12 + b2 * d * (b2 / 2 - X2x)^2 + b1 * d * X2x^2$ ACI R8.4.4.2.3

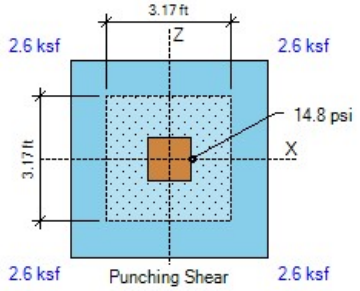
Jcz = 29.5 * 15.0³ / 12 + 29.5³ * 15.0 / 12 + 29.5 * 15.0 * (29.5 / 2 * 7.4)² + 29.5 * 15.0 * 7.4² = 88523 in⁴

Stress due to P = *F / (bo * d) * 1000* = 13.1 / (59.0 * 15.0) * 1000 = 14.8 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 7.4 / 88523 * 1000 = 0.0 psi

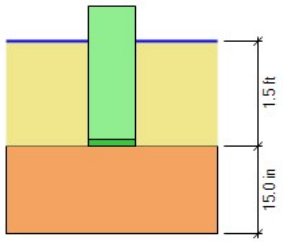
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 7.4 / 88523 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 14.8 + 0.0 + 0.0 = 14.8 psi < 80.0 psi OK

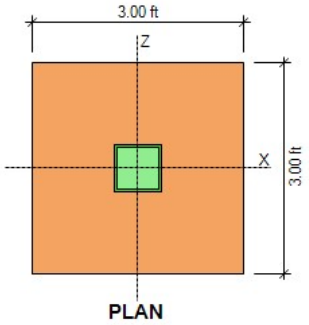


DESIGN CODES

| | |
|---|---|
| Concrete Design ..... | ACI 318-14 |
| Load Combinations ..... | ASCE 7-10/16 |




ELEVATION




PLAN

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

## GEOMETRY

| | | | |
|---|---|---|---|
| Footing Length (X-dir) ..... | 4.50 | ft | |
| Footing Width (Z-dir) ..... | 4.50 | ft | |
| Footing Thickness ..... | 10.0 | in | OK |
| Soil Cover ..... | 1.50 | ft | |
| Column Length (X-dir) ..... | 8.0 | in | |
| Column Width (Z-dir) ..... | 8.0 | in | |
| Offset (X-dir) ..... | 0.00 | in | OK |
| Offset (Z-dir) ..... | 0.00 | in | OK |
| Base Plate (L x W) ..... | 8.0 x 8.0 | in | |

## SOIL PRESSURES (D+S)

| | | | |
|---|---|---|---|
| Gross Allow. Soil Pressure ..... | 2.0 | ksf | |
| Soil Pressure at Corner 1 ..... | 2.0 | ksf | |
| Soil Pressure at Corner 2 ..... | 2.0 | ksf | |
| Soil Pressure at Corner 3 ..... | 2.0 | ksf | |
| Soil Pressure at Corner 4 ..... | 2.0 | ksf | |
| Bearing Pressure Ratio ..... | 0.98 | | OK |
| Ftg. Area in Contact with Soil ..... | 100.0 | % | |
| X-eccentricity / Ftg. Length ..... | 0.00 | | OK |
| Z-eccentricity / Ftg. Width ..... | 0.00 | | OK |

## APPLIED LOADS

| | Dead | Live | RLive | Snow | Wind | Seismic | |
|---|---|---|---|---|---|---|---|
| Axial Force P ..... | 18.1 | 0.0 | 0.0 | 17.0 | 0.0 | 0.0 | kip |
| Moment about X Mx .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Moment about Z Mz .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Shear Force Vx ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |
| Shear Force Vz ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 10.0 / 12 = 0.83 ft  Moment = 0.0 * 0.83 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.33 ft  Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 4.50 * 4.50 * 10.0 / 12 * 0.15 = 1.5 kip

  Arm = *W / 2* = 4.50 / 2 = 2.25 ft  Moment = 1.5 * 2.25 = 3.4 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 4.50 / 2 - 0.0 / 12 = 2.25 ft  Moment = 0.0 * 2.25 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0.6 * (4.50 * 4.50 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 2.0 kip

  Arm = *W / 2* = 4.50 / 2 = 2.25 ft  Moment = 2.0 * 2.25 = 4.4 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 4.50 * 4.50 * 62 * (0.83) = -0.6 kip

  Arm = *W / 2* = 4.50 / 2 = 2.25 ft  Moment = 0.6 * 2.25 = -1.4 k-ft
- Axial force P = 0.6 * 18.1 + 0.6 * 0.0 = 10.9 kip

  Arm = *W / 2 - Offset* = 4.50 / 2 - 0.0 / 12 = 2.25 ft  Moment = 10.9 * 2.25 = 24.4 k-ft
- Resisting moment X-X = 3.4 + 0.0 + 4.4 + 24.4 + -1.4 = 30.8 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{30.8}{0.0}$ = 99.99 > 1.50 OK

- Overturning about Z-Z

- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft

- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

Arm = 0.00 + 10.0 / 12 = 0.83 ft Moment = 0.0 * 0.83 = 0.0 k-ft

- Passive Force = 0.0 kip Arm = 0.33 ft Moment = 0.0 k-ft

- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z

- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 4.50 * 4.50 * 10.0 / 12 * 0.15 = 1.5 kip

Arm = *L / 2* = 4.50 / 2 = 2.25 ft Moment = 1.5 * 2.25 = 3.4 k-ft

- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

Arm = *L / 2 - Offset* = 4.50 / 2 - 0.0 / 12 = 2.25 ft Moment = 0.0 * 2.25 = 0.0 k-ft

- Soil cover = *0.6 * W * L * SC * Density* = 0.6 * (4.50 * 4.50 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 2.0 kip

Arm = *L / 2* = 4.50 / 2 = 2.25 ft Moment = 2.0 * 2.25 = 4.4 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 4.50 * 4.50 * 62 * (0.83) = -0.6 kip

Arm = *L / 2* = 4.50 / 2 = 2.25 ft Moment = 0.6 * 2.25 = -1.4 k-ft

- Axial force P = 0.6 * 18.1 + 0.6 * 0.0 = 10.9 kip

Arm = *L / 2 - Offset* = 4.50 / 2 - 0.0 / 12 = 2.25 ft Moment = 10.9 * 2.25 = 24.4 k-ft

- Resisting moment Z-Z = 3.4 + 0.0 + 4.4 + 24.4 + -1.4 = 30.8 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{30.8}{0.0}$ = 99.99 > 1.50 OK

## SOIL BEARING PRESSURES (Comb: D+S)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 5.7 + 0.0 + 7.4 + -2.4 + 79.0 = 89.7 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 5.7 + 0.0 + 7.4 + -2.4 + 79.0 = 89.7 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 2.5 + 0.0 + 3.3 - 1.1 + 35.1 = 39.8 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{89.7 - 0.0}{39.8} = 2.25 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{89.7 - 0.0}{39.8} = 2.25 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =4.50 / 2 - 2.25 = 0.00 ft

Z-ecc = *Width / 2 - Zp* = 4.50 / 2 - 2.25 = 0.00 ft

Area = *Width * Length* = 4.50 * 4.50 = 20.3 ft²

Sx = *Length * Width² / 6* = 4.50 * 4.50² / 6 = 15.2 ft³

Sz = *Width * Length² / 6* = 4.50 * 4.50² / 6 = 15.2 ft³

- Footing is in full bearing. Soil pressures are as follows:

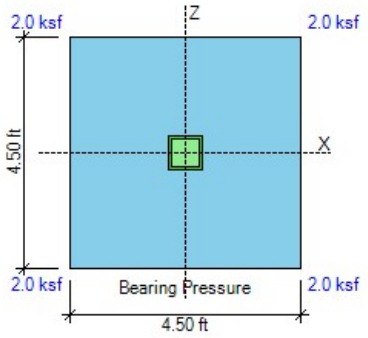
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 39.8 * (1 / 20.3 + 0.00 / 15.2 + 0.00 / 15.2) = 1.97 ksf

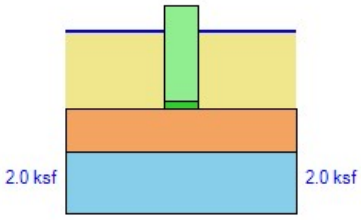
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 39.8 * (1 / 20.3 - 0.00 / 15.2 + 0.00 / 15.2) = 1.97 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 39.8 * (1 / 20.3 - 0.00 / 15.2 - 0.00 / 15.2) = 1.97 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 39.8 * (1 / 20.3 + 0.00 / 15.2 - 0.00 / 15.2) = 1.97 ksf

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*




## SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33 (per Coulomb)*

Pressure at mid-depth = *kp * Density * (Cover + Thick / 2)* = 4.33 * 110 * (1.50 + 10.0 / 12 / 2) = 0.91 ksf

X-Passive force = *Pressure * Thick * Width* = 0.91 * 10.0 / 12 * 4.50 = 3.4 kip

Z-Passive force = *Pressure * Thick * Length* = 0.91 * 10.0 / 12 * 4.50 = 3.4 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 13.7 * 0.35) = 4.8 kip

*Use 100% of Passive + 100% of Friction for sliding resistance*

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 3.4 + 1.00 * 4.8}{0.0}$ = 82.17 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 3.4 + 1.00 * 4.8}{0.0}$ = 82.17 > 1.50 OK

## UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 1.5 + 2.0 - 0.6}{0.0}$ = 99.99 > 1.00 OK

## ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Concrete f'c = 2.5 ksi Steel fy = 40.0 ksi Soil density = 110 pcf

d Top X-dir = *Thick - Cover - X-diameter / 2* = 10.0 - 2.0 - 0.8 / 2 = 7.6 in

d Top Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 10.0 - 2.0 - 0.8 - 0.8 / 2 = 6.9 in

d Bot X-dir = *Thick - Cover - X-diameter / 2* = 10.0 - 3.0 - 0.6 / 2 = 6.7 in

d Bot Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 10.0 - 3.0 - 0.6 - 0.6 / 2 = 6.1 in

$\phi Vcx = 2 * \phi * \sqrt{f'c} * Width * d / 1000$ = 2 * 0.75 * √(2500) * 4.5 * 12 * 6.7 / 1000 = 27.1 kip ACI Eq. (22.5.5.1)

$\phi Vcz = 2 * \phi * \sqrt{f'c} * Length * d / 1000$ = 2 * 0.75 * √(2500) * 4.5 * 12 * 6.1 / 1000 = 24.6 kip

- Shear forces calculated as the volume of the bearing pressures under the effective areas:

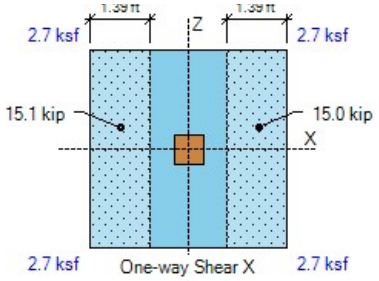
One-way shear Vux (- Side) = 15.1 kip < 27.1 kip OK

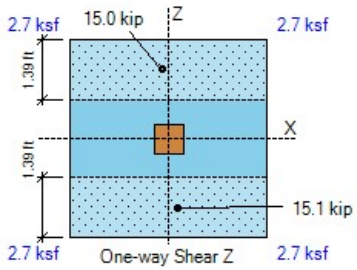
One-way shear Vux (+ Side) = 15.0 kip < 27.1 kip OK

One-way shear Vuz (- Side) = 15.1 kip < 24.6 kip OK

One-way shear Vuz (+ Side) = 15.0 kip < 24.6 kip OK

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*




FLEXURE CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Plain ϕMnx = *5 * ϕ * √(f'c) * L * Thick² / 6* = 5 * 0.60 * √(2500) * 4.50 * 10.0² / 6 / 1000 = 3.0 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * √(f'c) * W * Thick² / 6* = 5 * 0.60 * √(2500) * 4.50 * 10.0² / 6 / 1000 = 3.0 k-ft

- Top Bars

*No Top Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Top

- Top moments calculated as the overburden minus the bearing pressures times the lever arm:

Top moment -Mux (- Side) = 0.0 k-ft < 11.3 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 11.3 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 11.3 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 11.3 k-ft OK

- Bottom Bars

*Use 5 #5 Z-Bars* *ρ = As / b d* = 1.6 / (4.50 * 12 * 6.1) = 0.0047 q = 0.0047 * 40 / 2.5 = 0.076

*Use 5 #5 X-Bars* *ρ = As / b d* = 1.6 / (4.50 * 12 * 6.7) = 0.0043 q = 0.0043 * 40 / 2.5 = 0.069

*β = L / W* = 4.50 / 4.50 = 1.00 *γs = 2 * β / (β + 1)* = 2 * 1.00 / (1.00 + 1) = 1.00 ACI 13.3.3.3

Bending strength *ϕMn = ϕ * b * d² * f'c * q * (1 - 0.59 * q)* ACI 22.2.2

ϕMnx = 0.90 * 4.50 * 12 * 6.1² * 2.5 * 0.076 * (1 - 0.59 * 0.076) = 26.9 k-ft

ϕMnz = 0.90 * 4.50 * 12 * 6.7² * 2.5 * 0.069 / 1.00 * (1 - 0.59 * 0.069 / 1.00) = 29.8 k-ft

- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

Bottom moment Mux (- Side) = 20.0 k-ft < 26.9 k-ft OK ratio = 0.74

Bottom moment Mux (+ Side) = 20.0 k-ft < 26.9 k-ft OK ratio = 0.74

Bottom moment Muz (- Side) = 20.0 k-ft < 29.8 k-ft OK ratio = 0.67

Bottom moment Muz (+ Side) = 20.0 k-ft < 29.8 k-ft OK ratio = 0.67

X-As min = *0.0018 * Width * Thick* = 0.0018 * 4.50 * 12 * 10.0 = 1.0 in² < 1.6 in² OK ACI 8.6.1.1

Z-As min = *0.0018 * Length * Thick* = 0.0018 * 4.50 * 12 * 10.0 = 1.0 in² < 1.6 in² OK ACI 8.6.1.1

X-As max for 0.005 tension strain = 5.83 in² > 1.55 in² OK ACI 21.2.2

Z-As max for 0.005 tension strain = 5.83 in² > 1.55 in² OK ACI 21.2.2

X-Cover factor = *Min (2.5, (Cover + db /2, Spacing / 2) / db)* = Min (2.5, (3.0 + 0.63 / 2, 12.0 / 2) / 0.63) = 2.5

Straight *X-Ld = Max (12.0, 3 / 40 * fy / (f'c)½ * Grade * Size * Casting / Cover * db * ratio)* ACI Eq. (25.4.2.3a)

X-Ld = Max (12.0, 3 / 40 * 40.0 * 1000 / (2500)½ * 1.0 * 0.8 * 1.0 / 2.5 * 0.63 * 0.67) = 12.0 in

Hooked *X-Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* = ACI 25.4.3

X-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.63 * 0.67) = 6.0 in

-X Ld provided = *(Length - Col) / 2 + Offset - Cover* = 4.50 * 12 / 2 + 0.0 - 8.0 / 2 - 2.5 = 20.5 in > 12.0 in OK

+X Ld provided = *(Length - Col) / 2 - Offset - Cover* = 4.50 * 12 / 2 - 0.0 - 8.0 / 2 - 2.5 = 20.5 in > 12.0 in OK

Z-Cover factor = *Min (2.5, (Cover + db /2, Spacing / 2) / db)* = Min (2.5, (3.0 + 0.63 / 2, 12.0 / 2) / 0.63) = 2.5

Straight *Z-Ld = Max (12.0, 3 / 40 * fy / (f'c)½ * Grade * Size * Casting / Cover * db * ratio)* ACI Eq. (25.4.2.3a)

Z-Ld = Max (12.0, 3 / 40 * 40.0 * 1000 / (2500)½ * 1.0 * 0.8 * 1.0 / 2.5 * 0.63 * 0.67) = 12.0 in

Hooked *Z-Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* = ACI 25.4.3

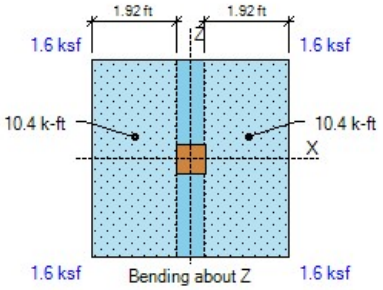
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.63 * 0.74) = 6.0 in

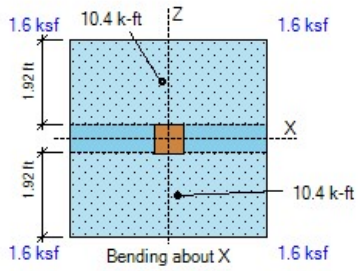
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 4.50 * 12 / 2 + 0.0 - 8.0 / 2 - 2.5 = 20.5 in > 12.0 in OK

+Z Ld provided = *(Width - Col) / 2 - Offset - Cover* = 4.50 * 12 / 2 - 0.0 - 8.0 / 2 - 2.5 = 20.5 in > 12.0 in OK

X-bar spacing = 12.0 in < Min ( 3 * t, 18.0) = 18.0 in OK ACI 7.7.2.3

Z-bar spacing = 12.0 in < Min ( 3 * t, 18.0) = 18.0 in OK




## LOAD TRANSFER CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Area *A1 = col L * col W* = 8.0 * 8.0 = 64.0 in²

Sx = *col W * col L² / 6* = 8.0 * 8.0² / 6 = 85.3 in³

Sz = *col L * col W² / 6* = 8.0 * 8.0² / 6 = 85.3 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz* = 48.9 / 64.0 + 0.0 * 12 / 85.3 + 0.0 * 12 / 85.3 = 0.8 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (4.50 * 12 / 2 - 0.0 - 8.0 / 2, 4.50 * 12 / 2 - 0.0 - 8.0 / 2 = 23.0 in

Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [4.50 * 12 * 4.5 * 12, (8.0 + 2 * 23.0) * (8.0 + 2 * 23.0)] = 2916.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)]* = 0.65 * 0.85 * 2.5 * Min [2, √(2916.0 / 64.0)] = 2.8 ksi

Footing *ϕPns = ϕ * As * Fy / A1* = 0.0 ksi ACI 22.8.3.2

Footing bearing *ϕPn = ϕPnc + ϕPns* = 2.8 + 0.0 = 2.8 ksi > 0.8 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.20) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 13.8 in OK

Ldh provided = *Footing thickness - Cover* = 10.00 - 3.0 = 7.0 in > 6.0 in OK

## PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

X-Edge = *d /2* = 6.4 / 2 = 3.2 in αsx = 20

Z-Edge = *d /2* = 6.4 / 2 = 3.2 in αsz = 20

αs = *αsx + αsz* = 20 + 20 = 40 Col type = Interior β = *L / W* = 8.0 / 8.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 20 / 10 * (8.0 + 6.4 / 2 + 3.2) + 20 / 10 * (8.0 + 6.4 / 2 + 3.2) = 57.5 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (8.0 + 6.4 / 2 + 3.2) * (8.0 + 6.4 / 2 + 3.2) = 206.6 in²

ϕVc = *ϕ * Min (2 + 4 / β, αs * d / bo + 2, 4) * √(f'c)* ACI 22.6.5.2

ϕVc = 0.75 * Min (2 + 4 / 1.00, 40 * 6.4 / 57.5 + 2, 4) * √(2500) = 150.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 48.9 + 0.28 * 206.6 / 144 - 3.9 = 45.5 kip

b1 = *L + d / 2 + X-Edge* = 8.0 + 6.4 / 2 + 3.2 = 14.4 in b2 = *W + d / 2 + Z-Edge* = 8.0 + 6.4 / 2 + 3.2 = 14.4 in

$$\gamma vx \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(14.4 / 14.4)}} = 0.40$$ ACI Eq. (8.4.4.2.2)

$$\gamma vz \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(14.4 / 14.4)}} = 0.40$$ ACI Eq. (8.4.2.3.2)

X2z = *b1 / 2* = 14.4 / 2 = 7.2 in X2x = *b2 / 2* = 14.4 / 2 = 7.2 in

Jcz = *b1 * d³ / 6 + b1³ * d / 6 + b1² * b2 * d / 2* ACI R8.4.4.2.3

Jcz = 14.4 * 6.4³ / 6 + 14.4³ * 6.4 / 6 + 14.4² * 14.4 * 6.4 / 2 = 13245 in⁴

Jcx = *b2 * d³ / 6 + b2³ * d / 6 + b2² * b1 * d / 2* ACI R8.4.4.2.3

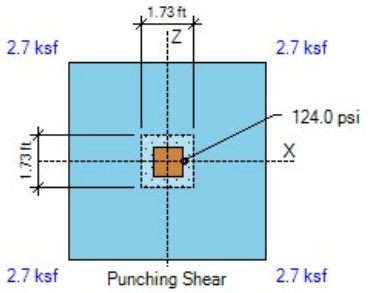
Jcx = 14.4 * 6.4³ / 6 + 14.4³ * 6.4 / 6 + 14.4² * 14.4 * 6.4 / 2 = 13245 in⁴

Stress due to P = *F / (bo * d) * 1000* = 45.5 / (57.5 * 6.4) * 1000 = 124.0 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 7.2 / 13245 * 1000 = 0.0 psi

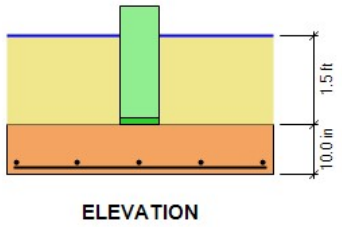
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 7.2 / 13245 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 124.0 + 0.0 + 0.0 = 124.0 psi < 150.0 psi OK

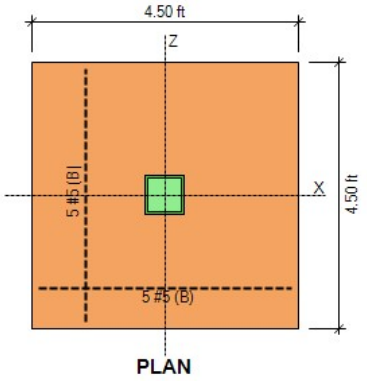


DESIGN CODES

| | |
|---|---|
| Concrete Design ..... | ACI 318-14 |
| Load Combinations ..... | ASCE 7-10/16 |




ELEVATION




PLAN

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

## GEOMETRY

| | | | |
|---|---|---|---|
| Footing Length (X-dir) ..... | 3.50 | ft | |
| Footing Width (Z-dir) ..... | 3.50 | ft | |
| Footing Thickness ..... | 8.0 | in | OK |
| Soil Cover ..... | 1.50 | ft | |
| Column Length (X-dir) ..... | 8.0 | in | |
| Column Width (Z-dir) ..... | 8.0 | in | |
| Offset (X-dir) ..... | 0.00 | in | OK |
| Offset (Z-dir) ..... | 0.00 | in | OK |
| Base Plate (L x W) ..... | 8.0 x 8.0 | in | |

## SOIL PRESSURES (D+S)

| | | | |
|---|---|---|---|
| Gross Allow. Soil Pressure ..... | 2.0 | ksf | |
| Soil Pressure at Corner 1 ..... | 1.8 | ksf | |
| Soil Pressure at Corner 2 ..... | 1.8 | ksf | |
| Soil Pressure at Corner 3 ..... | 1.8 | ksf | |
| Soil Pressure at Corner 4 ..... | 1.8 | ksf | |
| Bearing Pressure Ratio ..... | 0.90 | | OK |
| Ftg. Area in Contact with Soil ..... | 100.0 | % | |
| X-eccentricity / Ftg. Length ..... | 0.00 | | OK |
| Z-eccentricity / Ftg. Width ..... | 0.00 | | OK |

## APPLIED LOADS

| | Dead | Live | RLive | Snow | Wind | Seismic | |
|---|---|---|---|---|---|---|---|
| Axial Force P ..... | 9.8 | 0.0 | 0.0 | 9.5 | 0.0 | 0.0 | kip |
| Moment about X Mx .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Moment about Z Mz .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Shear Force Vx ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |
| Shear Force Vz ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 8.0 / 12 = 0.67 ft  Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.27 ft  Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 3.50 * 3.50 * 8.0 / 12 * 0.15 = 0.7 kip

  Arm = *W / 2* = 3.50 / 2 = 1.75 ft  Moment = 0.7 * 1.75 = 1.3 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft  Moment = 0.0 * 1.75 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0.6 * (3.50 * 3.50 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 1.2 kip

  Arm = *W / 2* = 3.50 / 2 = 1.75 ft  Moment = 1.2 * 1.75 = 2.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 3.50 * 3.50 * 62 * (0.67) = -0.3 kip

  Arm = *W / 2* = 3.50 / 2 = 1.75 ft  Moment = 0.3 * 1.75 = -0.5 k-ft
- Axial force P = 0.6 * 9.8 + 0.6 * 0.0 = 5.9 kip

  Arm = *W / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft  Moment = 5.9 * 1.75 = 10.3 k-ft
- Resisting moment X-X = 1.3 + 0.0 + 2.0 + 10.3 + -0.5 = 13.1 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{13.1}{0.0}$ = 99.99 > 1.50 OK

- Overturning about Z-Z

- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft

- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft

- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft

- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z

- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 3.50 * 3.50 * 8.0 / 12 * 0.15 = 0.7 kip

Arm = *L / 2 =* 3.50 / 2 = 1.75 ft Moment = 0.7 * 1.75 = 1.3 k-ft

- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

Arm = *L / 2 - Offset =* 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 k-ft

- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (3.50 * 3.50 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 1.2 kip

Arm = *L / 2 =* 3.50 / 2 = 1.75 ft Moment = 1.2 * 1.75 = 2.0 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 3.50 * 3.50 * 62 * (0.67) = -0.3 kip

Arm = *L / 2 =* 3.50 / 2 = 1.75 ft Moment = 0.3 * 1.75 = -0.5 k-ft

- Axial force P = 0.6 * 9.8 + 0.6 * 0.0 = 5.9 kip

Arm = *L / 2 - Offset =* 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 5.9 * 1.75 = 10.3 k-ft

- Resisting moment Z-Z = 1.3 + 0.0 + 2.0 + 10.3 + -0.5 = 13.1 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{13.1}{0.0}$ = 99.99 > 1.50 OK

## SOIL BEARING PRESSURES (Comb: D+S)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 2.1 + 0.0 + 3.4 + -0.9 + 33.8 = 38.4 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 2.1 + 0.0 + 3.4 + -0.9 + 33.8 = 38.4 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 1.2 + 0.0 + 1.9 - 0.5 + 19.3 = 22.0 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{38.4 - 0.0}{22.0} = 1.75 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{38.4 - 0.0}{22.0} = 1.75 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =3.50 / 2 - 1.75 = 0.00 ft

Z-ecc = *Width / 2 - Zp =* 3.50 / 2 - 1.75 = 0.00 ft

Area = *Width * Length =* 3.50 * 3.50 = 12.3 ft²

Sx = *Length * Width² / 6 =* 3.50 * 3.50² / 6 = 7.1 ft³

Sz = *Width * Length² / 6 =* 3.50 * 3.50² / 6 = 7.1 ft³

- Footing is in full bearing. Soil pressures are as follows:

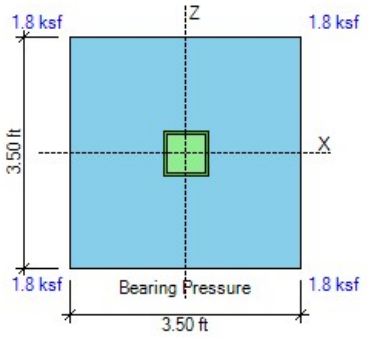
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 22.0 * (1 / 12.3 + 0.00 / 7.1 + 0.00 / 7.1) = 1.79 ksf

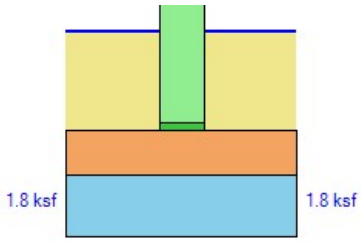
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 22.0 * (1 / 12.3 - 0.00 / 7.1 + 0.00 / 7.1) = 1.79 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 22.0 * (1 / 12.3 - 0.00 / 7.1 - 0.00 / 7.1) = 1.79 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 22.0 * (1 / 12.3 + 0.00 / 7.1 - 0.00 / 7.1) = 1.79 ksf

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*




## SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33 (per Coulomb)*

Pressure at mid-depth = *kp * Density * (Cover + Thick / 2)* = 4.33 * 110 * (1.50 + 8.0 / 12 / 2) = 0.87 ksf

X-Passive force = *Pressure * Thick * Width* = 0.87 * 8.0 / 12 * 3.50 = 2.0 kip

Z-Passive force = *Pressure * Thick * Length* = 0.87 * 8.0 / 12 * 3.50 = 2.0 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 7.5 * 0.35) = 2.6 kip

*Use 100% of Passive + 100% of Friction for sliding resistance*

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 2.0 + 1.00 * 2.6}{0.0}$ = 46.53 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 2.0 + 1.00 * 2.6}{0.0}$ = 46.53 > 1.50 OK

## UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.7 + 1.2 - 0.3}{0.0}$ = 99.99 > 1.00 OK

## ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Concrete f'c = 2.5 ksi Steel fy = 40.0 ksi Soil density = 110 pcf

d Top X-dir = *Thick - Cover - X-diameter / 2* = 8.0 - 2.0 - 0.8 / 2 = 5.6 in

d Top Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 8.0 - 2.0 - 0.8 - 0.8 / 2 = 4.9 in

d Bot X-dir = *Thick - Cover - X-diameter / 2* = 8.0 - 3.0 - 0.5 / 2 = 4.8 in

d Bot Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 8.0 - 3.0 - 0.5 - 0.5 / 2 = 4.3 in

$\phi Vcx = 2 * \phi * \sqrt{f'c} * Width * d / 1000$ = 2 * 0.75 * √(2500) * 3.5 * 12 * 4.8 / 1000 = 15.0 kip ACI Eq. (22.5.5.1)

$\phi Vcz = 2 * \phi * \sqrt{f'c} * Length * d / 1000$ = 2 * 0.75 * √(2500) * 3.5 * 12 * 4.3 / 1000 = 13.4 kip

- Shear forces calculated as the volume of the bearing pressures under the effective areas:

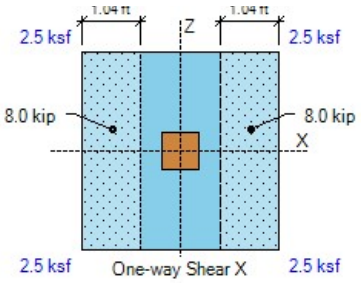
One-way shear Vux (- Side) = 8.0 kip < 15.0 kip OK

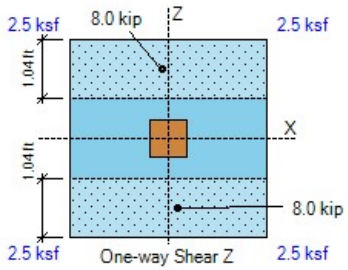
One-way shear Vux (+ Side) = 8.0 kip < 15.0 kip OK

One-way shear Vuz (- Side) = 8.0 kip < 13.4 kip OK

One-way shear Vuz (+ Side) = 8.0 kip < 13.4 kip OK

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*




FLEXURE CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Plain ϕMnx = *5 * ϕ * √(f'c) * L * Thick² / 6* = 5 * 0.60 * √(2500) * 3.50 * 8.0² / 6 / 1000 = 1.5 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * √(f'c) * W * Thick² / 6* = 5 * 0.60 * √(2500) * 3.50 * 8.0² / 6 / 1000 = 1.5 k-ft

- Top Bars

*No Top Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Top

- Top moments calculated as the overburden minus the bearing pressures times the lever arm:

Top moment -Mux (- Side) = 0.0 k-ft < 5.6 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 5.6 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 5.6 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 5.6 k-ft OK

- Bottom Bars

*Use 4 #4 Z-Bars* *ρ = As / b d* = 0.8 / (3.50 * 12 * 4.3) = 0.0045 q = 0.0045 * 40 / 2.5 = 0.072

*Use 4 #4 X-Bars* *ρ = As / b d* = 0.8 / (3.50 * 12 * 4.8) = 0.0040 q = 0.0040 * 40 / 2.5 = 0.064

*β = L / W* = 3.50 / 3.50 = 1.00 *γs = 2 * β / (β + 1)* = 2 * 1.00 / (1.00 + 1) = 1.00 ACI 13.3.3.3

Bending strength *ϕMn = ϕ * b * d² * f'c * q * (1 - 0.59 * q)* ACI 22.2.2

ϕMnx = 0.90 * 3.50 * 12 * 4.3² * 2.5 * 0.072 * (1 - 0.59 * 0.072) = 9.8 k-ft

ϕMnz = 0.90 * 3.50 * 12 * 4.8² * 2.5 * 0.064 / 1.00 * (1 - 0.59 * 0.064 / 1.00) = 11.0 k-ft

- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

Bottom moment Mux (- Side) = 7.7 k-ft < 9.8 k-ft OK ratio = 0.79

Bottom moment Mux (+ Side) = 7.8 k-ft < 9.8 k-ft OK ratio = 0.79

Bottom moment Muz (- Side) = 7.7 k-ft < 11.0 k-ft OK ratio = 0.71

Bottom moment Muz (+ Side) = 7.8 k-ft < 11.0 k-ft OK ratio = 0.71

X-As min = *0.0018 * Width * Thick* = 0.0018 * 3.50 * 12 * 8.0 = 0.6 in² < 0.8 in² OK ACI 8.6.1.1

Z-As min = *0.0018 * Length * Thick* = 0.0018 * 3.50 * 12 * 8.0 = 0.6 in² < 0.8 in² OK ACI 8.6.1.1

X-As max for 0.005 tension strain = 3.20 in² > 0.80 in² OK ACI 21.2.2

Z-As max for 0.005 tension strain = 3.20 in² > 0.80 in² OK ACI 21.2.2

X-Cover factor = *Min (2.5, (Cover + db /2, Spacing / 2) / db)* = Min (2.5, (3.0 + 0.50 / 2, 12.0 / 2) / 0.50) = 2.5

Straight *X-Ld = Max (12.0, 3 / 40 * fy / (f'c)½ * Grade * Size * Casting / Cover * db * ratio)* ACI Eq. (25.4.2.3a)

X-Ld = Max (12.0, 3 / 40 * 40.0 * 1000 / (2500)½ * 1.0 * 0.8 * 1.0 / 2.5 * 0.50 * 0.71) = 12.0 in

Hooked *X-Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* = ACI 25.4.3

X-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.71) = 6.0 in

-X Ld provided = *(Length - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 8.0 / 2 - 2.5 = 14.5 in > 12.0 in OK

+X Ld provided = *(Length - Col) / 2 - Offset - Cover* = 3.50 * 12 / 2 - 0.0 - 8.0 / 2 - 2.5 = 14.5 in > 12.0 in OK

Z-Cover factor = *Min (2.5, (Cover + db /2, Spacing / 2) / db)* = Min (2.5, (3.0 + 0.50 / 2, 12.0 / 2) / 0.50) = 2.5

Straight *Z-Ld = Max (12.0, 3 / 40 * fy / (f'c)½ * Grade * Size * Casting / Cover * db * ratio)* ACI Eq. (25.4.2.3a)

Z-Ld = Max (12.0, 3 / 40 * 40.0 * 1000 / (2500)½ * 1.0 * 0.8 * 1.0 / 2.5 * 0.50 * 0.71) = 12.0 in

Hooked *Z-Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* = ACI 25.4.3

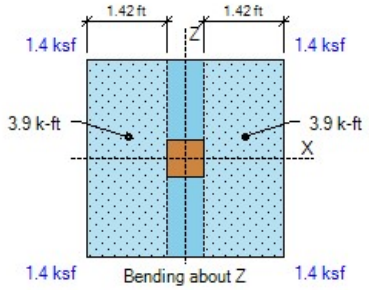
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.79) = 6.0 in

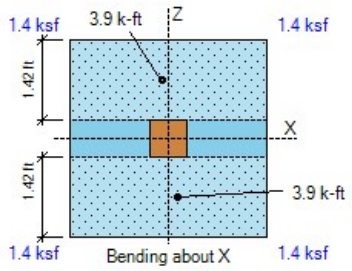
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 8.0 / 2 - 2.5 = 14.5 in > 12.0 in OK

+Z Ld provided = *(Width - Col) / 2 - Offset - Cover* = 3.50 * 12 / 2 - 0.0 - 8.0 / 2 - 2.5 = 14.5 in > 12.0 in OK

X-bar spacing = 12.0 in < Min ( 3 * t, 18.0) = 18.0 in OK ACI 7.7.2.3

Z-bar spacing = 12.0 in < Min ( 3 * t, 18.0) = 18.0 in OK




LOAD TRANSFER CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Area *A1 = col L * col W* = 8.0 * 8.0 = 64.0 in²

Sx = *col W * col L² / 6* = 8.0 * 8.0² / 6 = 85.3 in³

Sz = *col L * col W² / 6* = 8.0 * 8.0² / 6 = 85.3 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz* = 27.0 / 64.0 + 0.0 * 12 / 85.3 + 0.0 * 12 / 85.3 = 0.4 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (3.50 * 12 / 2 - 0.0 - 8.0 / 2, 3.50 * 12 / 2 - 0.0 - 8.0 / 2 = 17.0 in

Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [3.50 * 12 * 3.5 * 12, (8.0 + 2 * 17.0) * (8.0 + 2 * 17.0)] = 1764.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)]* = 0.65 * 0.85 * 2.5 * Min [2, √(1764.0 / 64.0)] = 2.8 ksi

Footing *ϕPns = ϕ * As * Fy / A1* = 0.0 ksi ACI 22.8.3.2

Footing bearing *ϕPn = ϕPnc + ϕPns* = 2.8 + 0.0 = 2.8 ksi > 0.4 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.11) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.0 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

## PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

X-Edge = *d /2* = 4.5 / 2 = 2.3 in αsx = 20

Z-Edge = *d /2* = 4.5 / 2 = 2.3 in αsz = 20

αs = *αsx + αsz* = 20 + 20 = 40 Col type = Interior β = *L / W* = 8.0 / 8.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 20 / 10 * (8.0 + 4.5 / 2 + 2.3) + 20 / 10 * (8.0 + 4.5 / 2 + 2.3) = 50.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (8.0 + 4.5 / 2 + 2.3) * (8.0 + 4.5 / 2 + 2.3) = 156.3 in²

ϕVc = *ϕ * Min (2 + 4 / β, αs * d / bo + 2, 4) * √(f'c)* ACI 22.6.5.2

ϕVc = 0.75 * Min (2 + 4 / 1.00, 40 * 4.5 / 50.0 + 2, 4) * √(2500) = 150.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 27.0 + 0.26 * 156.3 / 144 - 2.7 = 24.6 kip

b1 = *L + d / 2 + X-Edge* = 8.0 + 4.5 / 2 + 2.3 = 12.5 in b2 = *W + d / 2 + Z-Edge* = 8.0 + 4.5 / 2 + 2.3 = 12.5 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(12.5 / 12.5)}} = 0.40$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(12.5 / 12.5)}} = 0.40$ ACI Eq. (8.4.2.3.2)

X2z = *b1 / 2* = 12.5 / 2 = 6.3 in X2x = *b2 / 2* = 12.5 / 2 = 6.3 in

Jcz = *b1 * d³ / 6 + b1³ * d / 6 + b1² * b2 * d / 2* ACI R8.4.4.2.3

Jcz = 12.5 * 4.5³ / 6 + 12.5³ * 4.5 / 6 + 12.5² * 12.5 * 4.5 / 2 = 6049 in⁴

Jcx = *b2 * d³ / 6 + b2³ * d / 6 + b2² * b1 * d / 2* ACI R8.4.4.2.3

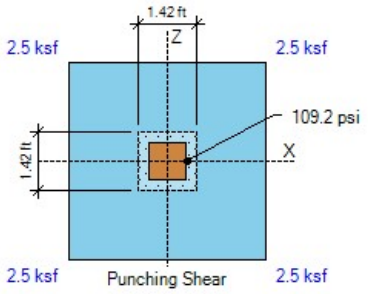
Jcx = 12.5 * 4.5³ / 6 + 12.5³ * 4.5 / 6 + 12.5² * 12.5 * 4.5 / 2 = 6049 in⁴

Stress due to P = *F / (bo * d) * 1000* = 24.6 / (50.0 * 4.5) * 1000 = 109.2 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 6.3 / 6049 * 1000 = 0.0 psi

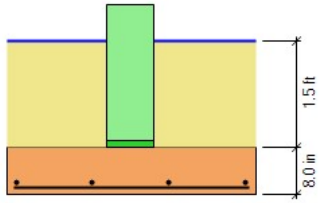
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 6.3 / 6049 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 109.2 + 0.0 + 0.0 = 109.2 psi < 150.0 psi OK

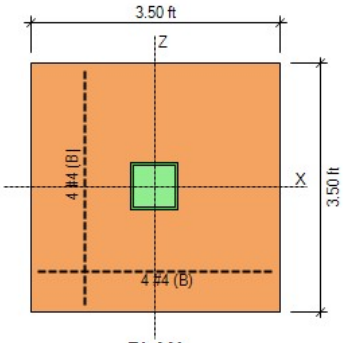


DESIGN CODES

| | |
|---|---|
| Concrete Design ..... | ACI 318-14 |
| Load Combinations ..... | ASCE 7-10/16 |




ELEVATION




PLAN

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

## GEOMETRY

| | | | |
|---|---|---|---|
| Footing Length (X-dir) ..... | 2.50 | ft | |
| Footing Width (Z-dir) ..... | 2.50 | ft | |
| Footing Thickness ..... | 8.0 | in | OK |
| Soil Cover ..... | 1.50 | ft | |
| Column Length (X-dir) ..... | 8.0 | in | |
| Column Width (Z-dir) ..... | 8.0 | in | |
| Offset (X-dir) ..... | 0.00 | in | OK |
| Offset (Z-dir) ..... | 0.00 | in | OK |
| Base Plate (L x W) ..... | 8.0 x 8.0 | in | |

## SOIL PRESSURES (D+S)

| | | |
|---|---|---|
| Gross Allow. Soil Pressure ..... | 2.0 | ksf |
| Soil Pressure at Corner 1 ..... | 1.3 | ksf |
| Soil Pressure at Corner 2 ..... | 1.3 | ksf |
| Soil Pressure at Corner 3 ..... | 1.3 | ksf |
| Soil Pressure at Corner 4 ..... | 1.3 | ksf |
| Bearing Pressure Ratio ..... | 0.66 | OK |
| Ftg. Area in Contact with Soil ..... | 100.0 | % |
| X-eccentricity / Ftg. Length ..... | 0.00 | OK |
| Z-eccentricity / Ftg. Width ..... | 0.00 | OK |

## APPLIED LOADS

| | Dead | Live | RLive | Snow | Wind | Seismic | |
|---|---|---|---|---|---|---|---|
| Axial Force P ..... | 4.1 | 0.0 | 0.0 | 2.8 | 0.0 | 0.0 | kip |
| Moment about X Mx .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Moment about Z Mz .. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | k-ft |
| Shear Force Vx ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |
| Shear Force Vz ..... | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | kip |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 8.0 / 12 = 0.67 ft  Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip  Arm = 0.27 ft  Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 2.50 * 2.50 * 8.0 / 12 * 0.15 = 0.4 kip

  Arm = *W / 2* = 2.50 / 2 = 1.25 ft  Moment = 0.4 * 1.25 = 0.5 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 2.50 / 2 - 0.0 / 12 = 1.25 ft  Moment = 0.0 * 1.25 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0=6 * (2.50 * 2.50 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 0.6 kip

  Arm = *W / 2* = 2.50 / 2 = 1.25 ft  Moment = 0.6 * 1.25 = 0.7 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 2.50 * 2.50 * 62 * (0.67) = -0.2 kip

  Arm = *W / 2* = 2.50 / 2 = 1.25 ft  Moment = 0.2 * 1.25 = -0.2 k-ft
- Axial force P = 0.6 * 4.1 + 0.6 * 0.0 = 2.5 kip

  Arm = *W / 2 - Offset* = 2.50 / 2 - 0.0 / 12 = 1.25 ft  Moment = 2.5 * 1.25 = 3.1 k-ft
- Resisting moment X-X = 0.5 + 0.0 + 0.7 + 3.1 + -0.2 = 4.1 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{4.1}{0.0}$ = 40.67 > 1.50 OK

- Overturning about Z-Z

- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft

- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft

- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft

- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z

- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 2.50 * 2.50 * 8.0 / 12 * 0.15 = 0.4 kip

Arm = *L / 2 =* 2.50 / 2 = 1.25 ft Moment = 0.4 * 1.25 = 0.5 k-ft

- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 8.0 / 12 * 8.0 / 12 * 0.0 * 0.15 = 0.0 kip

Arm = *L / 2 - Offset =* 2.50 / 2 - 0.0 / 12 = 1.25 ft Moment = 0.0 * 1.25 = 0.0 k-ft

- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (2.50 * 2.50 - 8.0 / 12 * 8.0 / 12) * 1.5 * 110 = 0.6 kip

Arm = *L / 2 =* 2.50 / 2 = 1.25 ft Moment = 0.6 * 1.25 = 0.7 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 2.50 * 2.50 * 62 * (0.67) = -0.2 kip

Arm = *L / 2 =* 2.50 / 2 = 1.25 ft Moment = 0.2 * 1.25 = -0.2 k-ft

- Axial force P = 0.6 * 4.1 + 0.6 * 0.0 = 2.5 kip

Arm = *L / 2 - Offset =* 2.50 / 2 - 0.0 / 12 = 1.25 ft Moment = 2.5 * 1.25 = 3.1 k-ft

- Resisting moment Z-Z = 0.5 + 0.0 + 0.7 + 3.1 + -0.2 = 4.1 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{4.1}{0.0}$ = 40.67 > 1.50 OK

## SOIL BEARING PRESSURES (Comb: D+S)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 0.8 + 0.0 + 1.2 + -0.3 + 8.6 = 10.3 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 0.8 + 0.0 + 1.2 + -0.3 + 8.6 = 10.3 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 0.6 + 0.0 + 1.0 - 0.3 + 6.9 = 8.2 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{10.3 - 0.0}{8.2} = 1.25 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{10.3 - 0.0}{8.2} = 1.25 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =2.50 / 2 - 1.25 = 0.00 ft

Z-ecc = *Width / 2 - Zp =* 2.50 / 2 - 1.25 = 0.00 ft

Area = *Width * Length =* 2.50 * 2.50 = 6.3 ft²

Sx = *Length * Width² / 6 =* 2.50 * 2.50² / 6 = 2.6 ft³

Sz = *Width * Length² / 6 =* 2.50 * 2.50² / 6 = 2.6 ft³

- Footing is in full bearing. Soil pressures are as follows:

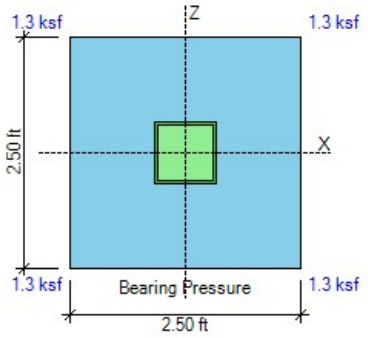
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 8.2 * (1 / 6.3 + 0.00 / 2.6 + 0.00 / 2.6) = 1.32 ksf

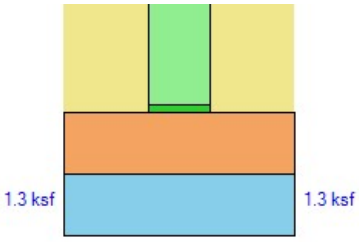
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 8.2 * (1 / 6.3 - 0.00 / 2.6 + 0.00 / 2.6) = 1.32 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 8.2 * (1 / 6.3 - 0.00 / 2.6 - 0.00 / 2.6) = 1.32 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 8.2 * (1 / 6.3 + 0.00 / 2.6 - 0.00 / 2.6) = 1.32 ksf

*ASDIP Foundation 4.8.3.1* **SPREAD FOOTING DESIGN** *www.asdipsoft.com*




## SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33 (per Coulomb)*

Pressure at mid-depth = *kp * Density * (Cover + Thick / 2)* = 4.33 * 110 * (1.50 + 8.0 / 12 / 2) = 0.87 ksf

X-Passive force = *Pressure * Thick * Width* = 0.87 * 8.0 / 12 * 2.50 = 1.5 kip

Z-Passive force = *Pressure * Thick * Length* = 0.87 * 8.0 / 12 * 2.50 = 1.5 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 3.3 * 0.35) = 1.1 kip

*Use 100% of Passive + 100% of Friction for sliding resistance*

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 1.5 + 1.00 * 1.1}{0.0}$ = 25.93 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 1.5 + 1.00 * 1.1}{0.0}$ = 25.93 > 1.50 OK

## UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.4 + 0.6 - 0.2}{0.0}$ = 99.99 > 1.00 OK

## ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Concrete f'c = 2.5 ksi Steel fy = 40.0 ksi Soil density = 110 pcf

Use Plain Concrete Shear Strength

ϕVcx = *4/3 * ϕ * √(f'c) * Width * t / 1000* = 4/3 * 0.60 * √(2500) * 2.5 * 12 * 8.0 / 1000 = 9.6 kip ACI 14.5.5.1

ϕVcz = *4/3 * ϕ * √(f'c) * Length * t / 1000* = 4/3 * 0.60 * √(2500) * 2.5 * 12 * 8.0 / 1000 = 9.6 kip

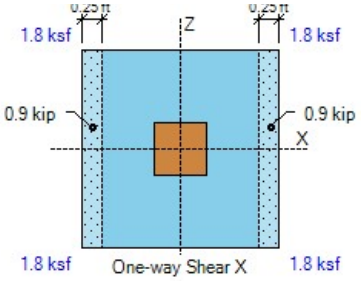
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

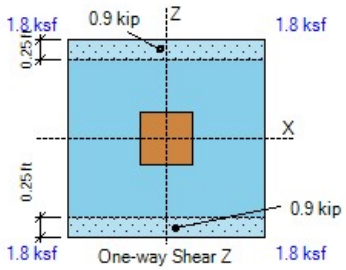
One-way shear Vux (- Side) = 0.9 kip < 9.6 kip OK

One-way shear Vux (+ Side) = 0.9 kip < 9.6 kip OK

One-way shear Vuz (- Side) = 0.9 kip < 9.6 kip OK

One-way shear Vuz (+ Side) = 0.9 kip < 9.6 kip OK




## FLEXURE CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Plain ϕMnx = *5 * ϕ * √(f'c) * L * Thick² / 6* = 5 * 0.60 * √(2500) * 2.50 * 8.0² / 6 / 1000 = 1.1 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * √(f'c) * W * Thick² / 6* = 5 * 0.60 * √(2500) * 2.50 * 8.0² / 6 / 1000 = 1.1 k-ft

- Top Bars

*No Top Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Top

- Top moments calculated as the overburden minus the bearing pressures times the lever arm:

Top moment -Mux (- Side) = 0.0 k-ft < 4.0 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 4.0 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 4.0 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 4.0 k-ft OK

- Bottom Bars

*No Bottom Reinforcement Provided at the Footing*

Use Plain Concrete Flexural Strength at Bottom

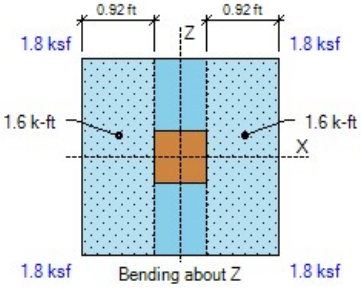
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

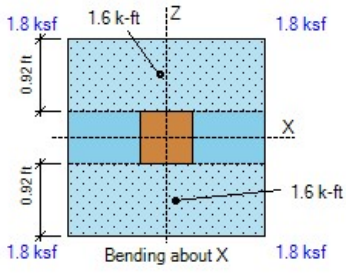
Bottom moment Mux (- Side) = 1.6 k-ft < 4.0 k-ft OK ratio = 0.40

Bottom moment Mux (+ Side) = 1.6 k-ft < 4.0 k-ft OK ratio = 0.40

Bottom moment Muz (- Side) = 1.6 k-ft < 4.0 k-ft OK ratio = 0.40

Bottom moment Muz (+ Side) = 1.6 k-ft < 4.0 k-ft OK ratio = 0.40



LOAD TRANSFER CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

Area *A1 = col L * col W =* 8.0 * 8.0 = 64.0 in²

Sx = *col W * col L² / 6 =* 8.0 * 8.0² / 6 = 85.3 in³

Sz = *col L * col W² / 6 =* 8.0 * 8.0² / 6 = 85.3 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz =* 9.4 / 64.0 + 0.0 * 12 / 85.3 + 0.0 * 12 / 85.3 = 0.1 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (2.50 * 12 / 2 - 0.0 - 8.0 / 2, 2.50 * 12 / 2 - 0.0 - 8.0 / 2 = 11.0 in

Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [2.50 * 12 * 2.5 * 12, (8.0 + 2 * 11.0) * (8.0 + 2 * 11.0)] = 900.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)] =* 0.65 * 0.85 * 2.5 * Min [2, √(900.0 / 64.0)] = 2.8 ksi

Footing *ϕPns = ϕ * As * Fy / A1 =* 0.0 ksi ACI 22.8.3.2

Footing bearing *ϕPn = ϕPnc + ϕPns =* 2.8 + 0.0 = 2.8 ksi > 0.1 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.04) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.0 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

## PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+0.5L+1.6S)

X-Edge = *Length / 2 - Offset - Col / 2* = 2.50 * 12 / 2 - 0.0 - 8.0 / 2 = 11.0 in αsx = 10

Z-Edge = *Width / 2 - Offset - Col / 2* = 2.50 * 12 / 2 - 0.0 - 8.0 / 2 = 11.0 in αsz = 10

αs = *αsx + αsz* = 10 + 10 = 20 Col type = Corner β = *L / W* = 8.0 / 8.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 10 / 10 * (8.0 + 8.0 / 2 + 11.0) + 10 / 10 * (8.0 + 8.0 / 2 + 11.0) = 46.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (8.0 + 8.0 / 2 + 11.0) * (8.0 + 8.0 / 2 + 11.0) = 529.0 in²

Use Plain Concrete Shear Strength

ϕVc = *ϕ * Min (1 + 2 / β, 2) * 4/3 * √(f'c)* ACI 14.5.5.1

ϕVc = 0.60 * Min (1 + 2 / 1.00, 2) * 4/3 √(2500) = 80.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 9.4 + 0.25 * 529.0 / 144 - 3.1 = 7.2 kip

b1 = *L + d / 2 + X-Edge* = 8.0 + 8.0 / 2 + 11.0 = 23.0 in b2 = *W + d / 2 + Z-Edge* = 8.0 + 8.0 / 2 + 11.0 = 23.0 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(23.0 / 23.0)}} = 0.40$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(23.0 / 23.0)}} = 0.40$ ACI Eq. (8.4.2.3.2)

X2z = *b1² / 2 / (b1 + b2)* = 23.0² / 2 / (23.0 + 23.0) = 5.8 in X2x = *b2² / 2 / (b2 + b1)* = 5.8 in

Jcz = *b1 * d³ / 12 + b1³ * d / 12 + b1 * d * (b1 / 2 - X2z)² + b2 * d * X2z²* ACI R8.4.4.2.3

Jcz = 23.0 * 8.0³ / 12 + 23.0³ * 8.0 / 12 + 23.0 * 8.0 * (23.0 / 2 * 5.8)² + 23.0 * 8.0 * 5.8² = 21260 in⁴

Jcx = *b2 * d³ / 12 + b2³ * d / 12 + b2 * d * (b2 / 2 - X2x)² + b1 * d * X2x²* ACI R8.4.4.2.3

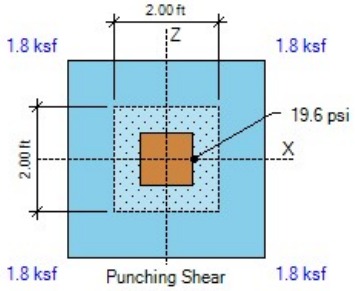
Jcz = 23.0 * 8.0³ / 12 + 23.0³ * 8.0 / 12 + 23.0 * 8.0 * (23.0 / 2 * 5.8)² + 23.0 * 8.0 * 5.8² = 21260 in⁴

Stress due to P = *F / (bo * d) * 1000* = 7.2 / (46.0 * 8.0) * 1000 = 19.6 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 5.8 / 21260 * 1000 = 0.0 psi

Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 5.8 / 21260 * 1000 = 0.0 psi

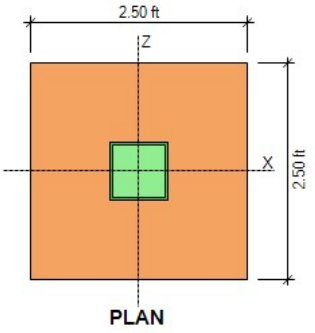
Punching stress = *P-stress + Mx-stress + Mz-stress* = 19.6 + 0.0 + 0.0 = 19.6 psi < 80.0 psi OK



DESIGN CODES

| | |
|---|---|
| Concrete Design ..... | ACI 318-14 |
| Load Combinations ..... | ASCE 7-10/16 |


ELEVATION




PLAN

WIND $V_{ASD}$ = 95MPH $V_{ULT}$ = 110MPH EXP B $K_{zt}$ = 1.0 SLOPE = 12°

ZONE 4 = ~~14.4~~ PSF 16.0 PSF MIN

ZONE B = ~~4.8~~ PSF 8.0 PSF MIN

ZONE C = ~~9.6~~ PSF 16.0 PSF MIN

ZONE D = ~~2.7~~ PSF 8.0 PSF MIN

SEISMIC $S_{DS}$ = 1.03 R = 6.5 $I_e$ = 1.0

$C_S = (1.03/(6.5/1.0))/1.4 = 0.113$

$W_{ROOF} = (25PSF \times 7,212SF) = 180,300^{\#}$

$V_S = 180,300^{\#} \times 0.113 = 20,374^{\#}$

GRID 1

$F_{WR} = (16.0 PSF \times 212 SF) = 3,392\#$

$F_{ER} = 20,374\# \times (1,847 SF / 7,212 SF) = 5,218\#$

GRID 2.5

$F_{WR} = (16.0 PSF \times 400 SF) = 6,400\#$

$F_{ER} = 20,374\# \times (3,226 SF / 7,212 SF) = 9,113\#$

GRID 5

$F_{WR} = (16.0 PSF \times 218 SF) = 3,488\#$

$F_{ER} = 20,449\# \times (2,139 SF / 7,212 SF) = 6,065\#$

GRID A

$F_{WR} = (16.0 PSF \times 326 SF) = 5,216\#$

$F_{ER} = 20,374\# \times (1,137 SF / 7,212 SF) = 3,212\#$

GRID D

$F_{WR} = (16.0 PSF \times 690 SF) + (8.0 PSF \times 70 SF) = 11,440\#$

$F_{ER} = 20,374\# \times (2,323 SF / 7,212 SF) = 6,563\#$

GRID E.6

$F_{WR} = (16.0 PSF \times 345 SF) + (8.0 PSF \times 128 SF) = 6,544\#$

$F_{ER} = 20,374\# \times (2,617 SF / 7,212 SF) = 7,393\#$

GRID G

$F_{WR} = (16.0 PSF \times 343 SF) = 5,488\#$

$F_{ER} = 20,374\# \times (1,135 SF / 7,212 SF) = 7,206\#$

GRID 1 (ROOF) FE = 5,218# USE 4 STRONG WALLS

2 - WSWH 18x16 STRONG WALLS
& 2 - WSWH 24x16 STRONG WALLS

SEE STRONG WALL DESIGN

GRID 2S (ROOF) FE = 9,113# 2 SEGMENTS L=10'-3" h=12'-7"
L=15'-11"
LT=26'-2"

VE = 9,113#/26.16' = 348 PLF

USE W2 VEALLOW = 353 PLF

HOLD DOWNS

TE = 348 PLF x 12.58' x 1.25 = 5,478#

USE HDU8-SDS2.5 w/ 3 STUDS TEALLOW = 6,580# x 1.4/1.6 = 5,759#

GRID 5 (ROOF) FE = 6,035# 3 SEGMENTS L=13'-9" h=12'-2"
L=8'-7" h=12'-2"
L=4'-6" h=12'-2"
LT=26'-4"

VE = 6,035#/26.33' = 229 PLF

USE W2 VEALLOW = 353 PLF x (1.25 - 0.125 x 13'/4.5') = 314 PLF

HOLD DOWNS

TE = 229 PLF x 12.16 x 1.25 = 2,785#

USE HDU4-SDS2.5 w/ 2 STUDS TEALLOW = 3,785# x 1.4/1.6 = 2,374#

GRID A (ROOF) $F_W = 5{,}216^{\#}$ $F_E = 3{,}212^{\#}$ 2 SEGMENTS $L = 10'-6"$ $h = 17'$
$L = 11'-6"$ $h = 14'$
$L = 22'-0"$

$V_W = 5{,}216^{\#} / 22.0' = 237$ PLF
$V_E = 3{,}212^{\#} / 22.0' = 146$ PLF

USE W1 $V_{W\,ALLOW} = 339$ PLF
$V_{E\,ALLOW} = 242$ PLF

## HOLD DOWNS

$L = 10'-6"$ $T_W = 237$ PLF $\times 17' = 4{,}029^{\#}$
$T_E = 146$ PLF $\times 17' \times 1.25 = 3{,}103^{\#}$

$L = 11'-6"$ $T_W = 237$ PLF $\times 14' = 3{,}318^{\#}$
$T_E = 146$ PLF $\times 14' \times 1.25 = 2{,}555^{\#}$

USE HDU5-SDS2.5 w/ 3STUDS $T_{W\,ALLOW} = 4{,}340^{\#}$
$T_{E\,ALLOW} = 4{,}340^{\#} \times 1.4/1.6 = 3{,}798^{\#}$

GRID D/ROOF $F_W = 11,440^{\#}$ $F_E = 6,563^{\#}$ (SEGMENT L = 21'-11" h = 17'-0"

$v_W = 11,440^{\#} / 21.92' = 522$ PLF
$v_E = 6,563^{\#} / 21.92' = 299$ PLF

USE W3 $v_{W\,ALLOW} = 627$ PLF
$v_{E\,ALLOW} = 456$ PLF

HOLD DOWNS

$T_W = 522\,PLF \times 17' = 8,874^{\#}$
$T_E = 299\,PLF \times 17' \times 1.25 = 6,354^{\#}$

USE HDU14-SDS2.5 w/3 STUDS $T_{W\,ALLOW} = 9,260^{\#}$
$T_{E\,ALLOW} = 9,260^{\#} \times 1.4 / 1.6 = 8,103^{\#}$

GRID E.6 (ROOF) $F_E = 7,393\#$ 1 SEGMENT $L = 15'-3"$ $L_T = 19'-9"$
$L = 12'-10"$
$L_T = 29'-1"$

$V_E = 7,393\#/28.08 = 263$ PLF

USE W7 $V_{EALLOW} = 353$ PLF

HOLD DOWNS

$T_E = 263$ PLF $\times 14.75' \times 1.25 = 4,854\#$

USE HDU8-SDS2.5 W/ 2STUDS $T_{EALLOW} = 5,820\# \times 1.4/1.6 = 5,093\#$

GRID G (ROOF) $F_W = 5,488\#$ $F_E = 3,206\#$ 2 SEGMENTS $L = 15'-0"$ $L = 15'-2"$
$L = 12'-10"$ $L = 14'-7"$
$L_T = 27'-10"$

$V_W = 5,488\#/27.83' = 197$ PLF
$V_E = 3,206\#/27.83' = 115$ PLF

USE W11 $V_{WALLOW} = 339$ PLF
$V_{EALLOW} = 242$ PLF

HOLD DOWNS

$L = 15'-0"$ $T_W = 197$ PLF $\times 15.16' = 2,987\#$
$T_E = 115$ PLF $\times 15.16' \times 1.25 = 2,183\#$

$L = 12'-10"$ $T_W = 197$ PLF $\times 14.58' = 2,872\#$
$T_E = 115$ PLF $\times 14.58' \times 1.25 = 2,096\#$

USE HDU4-SDS2.5 W/2STUDS $T_{WALLOW} = 3,235\#$
$T_{EALLOW} = 3,235\# \times 1.4/1.6 = 2,829\#$

**SIMPSON STRONG-TIE COMPANY INC.**
(800) 999-5099
5956 W. Las Positas Blvd., Pleasanton, CA 94588.
www.strongtie.com

**Job Name:** ETC - Commercial Lot 2
**Wall Name:** Grid 1
**Application:** Balloon Framed

## Design Criteria:

* 2018 International Bldg Code
* Seismic R=6.5
* 2500 psi concrete
* ASD Design Shear = 5218 lbs
* Nominal wall height = 16 ft

## Selected Strong-Wall® Panel Solution:

| Model | Type | W (in) | H (in) | T (in) | Sill Anchor | End Anchor Bolts | Total Axial Load (lbs) | Actual Uplift (lbs) |
|---|---|---|---|---|---|---|---|---|
| WSWH18x16 | Wood | 18 | 192 | 3.5 | N/A | 2 - 1" | 100 | 12622 lb |
| WSWH18x16 | Wood | 18 | 192 | 3.5 | N/A | 2 - 1" | 100 | 12622 lb |
| WSWH24x16 | Wood | 24 | 192 | 3.5 | N/A | 2 - 1" | 100 | 19523 lb |
| WSWH24x16 | Wood | 24 | 192 | 3.5 | N/A | 2 - 1" | 2800 | 18173 lb |

## Actual Shear & Drift Distribution:

| Model | RR Relative Rigidity | Actual Shear (lbs) | | Allowable Shear (lbs) | | Actual / Allow Shear | Actual Drift (in) | Drift Limit (in) |
|---|---|---|---|---|---|---|---|---|
| WSWH18x16 | 0.16 | 825 | ≤ | 985 | OK | 0.84 | 0.69 | 0.84 |
| WSWH18x16 | 0.16 | 825 | ≤ | 985 | OK | 0.84 | 0.69 | 0.84 |
| WSWH24x16 | 0.34 | 1784 | ≤ | 2130 | OK | 0.84 | 0.69 | 0.84 |
| WSWH24x16 | 0.34 | 1784 | ≤ | 2130 | OK | 0.84 | 0.69 | 0.84 |

## Notes:

1. Strong-Wall High-Strength Wood Shearwalls have been evaluated to the 2021 IBC/IRC. See www.strongtie.com for additional design and installation information.

2. Anchor templates are recommended for proper anchor bolt placement, and are required in some jurisdictions.

3. The applied vertical load shall be a concentric point load or a uniformly distributed load not exceeding the allowable vertical load. Alternatively, the load may be applied anywhere along the width of the panel if imposed by a continuous bearing vertical load transfer element such as a rimboard or beam. For eccentric axial loads applied directly to the panel, the allowable vertical load shall be divided by two.

4. Panels may be trimmed to a minimum height of 74½".

## Disclaimer:

**SIMPSON STRONG-TIE COMPANY INC.**
(800) 999-5099
5956 W. Las Positas Blvd., Pleasanton, CA 94588.
www.strongtie.com

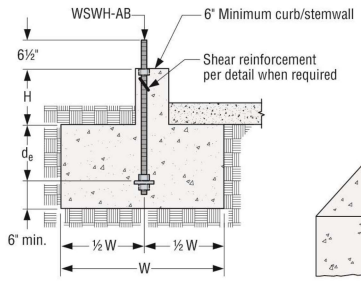
**Job Name:** ETC - Commercial Lot 2
**Wall Name:** Grid 1
**Application:** Balloon Framed

## Design Criteria:

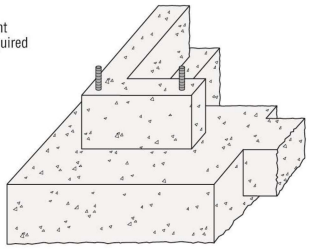
* Stemwall - Perimeter
* 2018 International Bldg Code
* Seismic R=6.5
* 2500 psi concrete

## Anchor Solution Details:

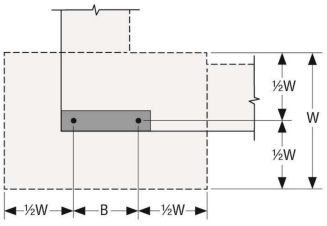
### Stemwall Installation




Stemwall Section View

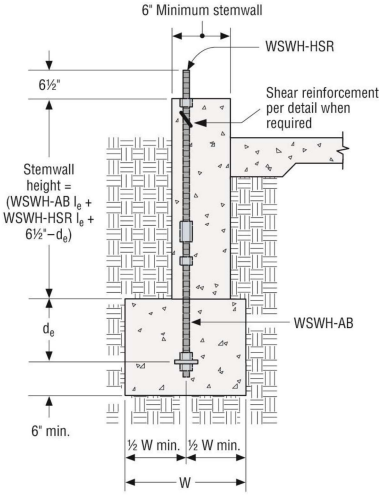


Perspective View
*(Slab not shown for clarity)*




Footing Plan

### Stemwall Extension Installation




Section at Stemwall
WSWH-AB and WSWH-HSR
Extension Application

**Anchor Solution Assuming Cracked Concrete Design:**

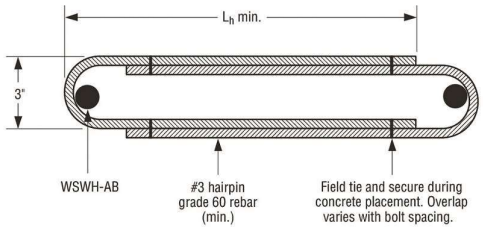
| Model | W | de | B | Anchor Bolt | Strength |
|---|---|---|---|---|---|
| WSWH18x16 | 33 | 11 | 14 | WSWH-AB | Standard |
| WSWH24x16 | 52 | 18 | 20 | WSWH-AB | High Strength |

**Anchor Solution Assuming Uncracked Concrete Design:**

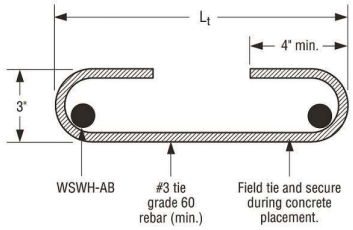
| Model | W | de | B | Anchor Bolt | Strength |
|---|---|---|---|---|---|
| WSWH18x16 | 28 | 10 | 14 | WSWH-AB | Standard |
| WSWH24x16 | 45 | 15 | 20 | WSWH-AB | High Strength |

## Notes:

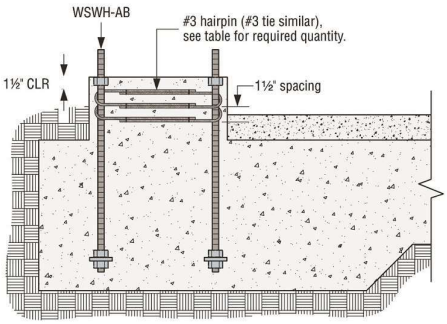
1. Anchorage designs conform to ACI 318-19, ACI 318-14 and 318-11 Appendix D with no supplementary reinforcement for cracked and uncracked concrete as noted.
2. Anchorage strength indicates required grade of anchor bolt. Standard (ASTM F1554 grade 36) or High Strength (HS)(ASTM A193 Grade B7).
3. Seismic indicates Seismic Design Category C though F. Detached 1 & 2 family dwellings in SDC C may use wind anchorage solutions. Seismic anchorage designs conform to ACI 318-11 section D.3.3.4.3 and ACI 318-14 section 17.2.3.4.3 and ACI 318-19 section 17.10.5.3.
4. Foundation dimensions are for anchorage only. Foundation design (size and reinforcement) by others. The registered design professional may specify alternate embedment, footing size or anchor bolt.




Hairpin Shear Reinforcement




Tie Shear Reinforcement




Hairpin Installation
*(Garage curb shown, other footing types similar)*

## Shear Anchorage Solutions

| Strong-Wall High-Strength Wood Shearwall Model No. | $L_t$ or $L_h$ (in.) | Seismic [3] | | Wind [4] | | | |
|---|---|---|---|---|---|---|---|
| | | Shear Reinforcement | Minimum Curb/ Stemwall Width (in.) | Shear Reinforcement | Minimum Curb/ Stemwall Width (in.) | ASD Allowable Shear Load, V (lb.) [7] | |
| | | | | | | Uncracked | Cracked |
| WSWH12 | 10¼ | (1) #3 Tie | 6 | See Note 7 | 6 | 1,080 | 770 |
| WSWH18 | 15 | (2) #3 hairpins[5,6] | 6 | (1) #3 hairpin | 6 | Hairpin reinforcement achieves maximum allowable shear load of the Strong-Wall® WSWH | |
| WSWH24 | 19 | (2) #3 hairpins[5] | 6 | (2) #3 hairpins[5] | 6 | | |

1. Shear anchorage designs conform to ACI 318-14 Chapter 17 and ACI 318-11 and assume minimum 2,500 psi concrete.
2. Shear reinforcement is not required for interior foundation applications (panel installed away from edge of concrete), or braced wall panel applications.
3. Seismic indicates seismic design category C through F. Detached one- and two-family dwellings in SDC C may use wind anchorage solutions. Seismic shear reinforcement designs conform to ACI 318-14, section 17.2.3.5.3 and ACI 318-11 section D.3.3.5.
4. Wind includes seismic design category A and B and detached one- and two-family dwellings in SDC C.
5. Additional ties may be required at garage curb or stemwall installations below anchor reinforcement per designer.
6. Use (1) #3 hairpin for WSWH18 when standard strength anchor is used.
7. Use (1) #3 tie for WSWH12 when panel design shear force exceeds tabulated anchorage allowable shear load.
8. No. 4 grade 40 shear reinforcement may be substituted for WSWH shear anchorage solutions.
9. Concrete edge distance for anchors must comply with ACI 318-14 section 17.7.2 and ACI 318-11 section D.8.2.
10. The designer may specify alternate shear anchorage.

# STRONG-WALL® WSWH SHEAR ANCHORAGE SCHEDULE AND DETAILS