PRMU20240139

ENGINEERING ANALYSIS FOR: EAST TOWN CROSSING APARTMENTS PIONEER & SHAW PUYALLUP, WA BUILDING B

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:	25 PSF
RESIDENTIAL FLOOR LIVE LOAD:	40 PSF (REDUCIBLE) : 60 PSF (FOR DECKS)
STAIRWAY LANDING AREAS:	150 PSF (INCLUDING Ip=1.5)
FLOOR DEAD LOAD:	30 PSF (INCLUDES 1 ½" GYP TOPPING)

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=1.24, S1=0.476
DESIGN SPECTRAL RESPONSE ACCELERATION: Sds=0.831, Sd1=0.476
SITE CLASS: D SEISMIC DESIGN CATEGORY: D
SEISMIC RESPONSE COEFFICIENT: Cs= 0.091
DESIGN BASE SHEAR: 111,513#

SOIL PROPERTIES:

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

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

City of Puyallup
Building
REVIEWED FOR COMPLIANCE
BSnowden
05/13/2024
2:32:50 PM

CITY OF PUYALLUP STATE OF WASHINGTON

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

EAST TOWN CROSSING
BUILDING "B"
PIONEER & SHAW PUYALLUP WA

REVISIONS

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REVISIONS

ENGINEER:	CP
CHECKED BY:	CP
DATE:	2024.01.12
TITLE:	STRUCTURAL ANALYSIS
PROJECT # :	----

2nd Floor Framing			
Member Name	**Results**	**Current Solution**	**Comments**
Floor Joist 16' and Under	Passed	1 piece(s) 11 7/8" TJI® 110 @ 16" OC	
Floor Joist 17'-8"	Passed	1 piece(s) 11 7/8" TJI® 210 @ 16" OC	
Floor Joist 19'-4"	Passed	1 piece(s) 11 7/8" TJI® 360 @ 16" OC	
Floor Joist 20'-7" (with offset 3rd flr.)	Passed	2 piece(s) 11 7/8" TJI® 560 @ 16" OC	
Short Stair Stringers	Passed	1 piece(s) 4 x 12 HF No.2	
Long Short Stair Stringers	Passed	1 piece(s) 3 1/2" x 12" 24F-V4 DF Glulam	
Top Landing Beam	Passed	1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam	
10'-10" Deck Joist	Passed	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Deck Cantilever Ledger 2'	Passed	2 piece(s) 2 x 12 HF No.2	
Grid 2.6 (F-G.3) Flush Beam	Passed	1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.6 (G.9-H.8) Flush Beam	Passed	1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.4 (H.8-I.8) Door Header	Passed	1 piece(s) 4 x 8 DF No.2	
Grid 2.4 (J.2-K.8) Door Header	Passed	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (H-H.8) Door Header	Passed	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (G.1-G.3) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid G.1 (5.2-5.3) Door Header	Passed	1 piece(s) 4 x 8 DF No.2	
Grid 6 (G.1-G.3) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.5 (D.4-D.6) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 3.3 (D.8-E.1) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 5.3 (D.5-E.2) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 6 (D.3-D.6) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
3rd Floor Framing			
Member Name	**Results**	**Current Solution**	**Comments**
Floor Joist 16' and Under	Passed	1 piece(s) 11 7/8" TJI® 110 @ 16" OC	
Floor Joist 17'-8"	Passed	1 piece(s) 11 7/8" TJI® 210 @ 16" OC	
Floor Joist 19'-4"	Passed	1 piece(s) 11 7/8" TJI® 360 @ 16" OC	
Floor Joist 20'-7"	Passed	1 piece(s) 11 7/8" TJI® 560 @ 16" OC	
7'-6" Landing Joists	Passed	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Top Landing Beam	Passed	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	
Short Stair Stringers	Passed	1 piece(s) 4 x 12 HF No.2	
4' Mid Landing Joists	Passed	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Mid Landing Beam	Passed	1 piece(s) 3 1/2" x 12" 24F-V4 DF Glulam	
10'-10" Deck Joist	Passed	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Deck Cantilever Ledger 2'	Passed	2 piece(s) 2 x 12 HF No.2	
6' Window Header	Passed	1 piece(s) 4 x 10 DF No.2	
Grid 2.6 (F-G.5) Flush Beam	Passed	1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.6 (H-H.8) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.4 (H.8-I.8) Door Header	Passed	1 piece(s) 4 x 8 DF No.2	
Grid 2.4 (J.2-K.8) Door Header	Passed	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (H-H.8) Door Header	Passed	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (G.4-G.8) Door Header	Passed	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (G.1-G.3) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid G.1 (5.2-5.3) Door Header	Passed	1 piece(s) 4 x 8 DF No.2	
Grid 6 (G.1-G.3) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.5 (D.4-D.6) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 3.3 (D.8-E.1) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 5.3 (D.5-E.2) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 6 (D.3-D.6) Flush Beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	

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

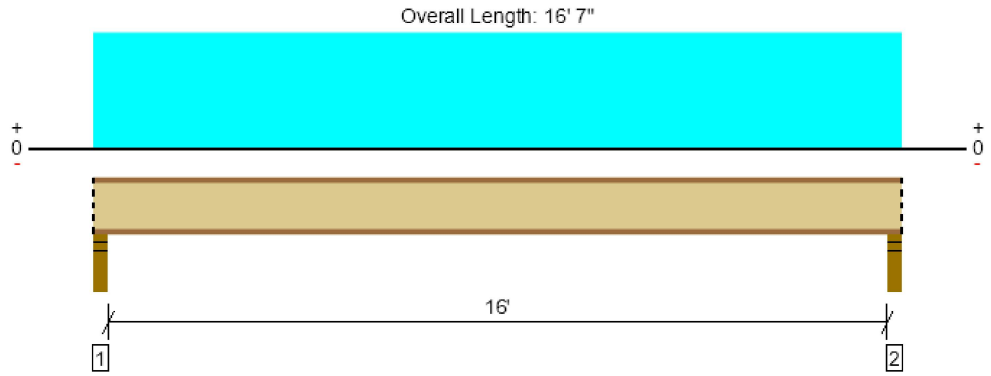
Weyerhaeuser

1/11/2024 11:18:17 PM UTC
ForteWEB v3.6
File Name: East Town Crossing Building B

Roof Framing			
Member Name	**Results**	**Current Solution**	**Comments**
Grid I Entry Roof Beam	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Grid L 10' Deck Roof Beam	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
6' Window Header	Passed	1 piece(s) 4 x 10 DF No.2	
Grid B 11' Deck Roof Beam	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Deck Roof Cantilever Beam	~~Failed~~ Passed	1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam	An excessive uplift of -2576 lbs at support located at 4" failed this product.

2nd Floor Framing, Floor Joist 16' and Under

1 piece(s) 11 7/8" TJI® 110 @ 16" OC



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)	774 @ 2 1/2"	1375 (3.50")	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	747 @ 3 1/2"	1560	Passed (48%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3049 @ 8' 3 1/2"	3160	Passed (96%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.275 @ 8' 3 1/2"	0.539	Passed (L/704)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.482 @ 8' 3 1/2"	0.808	Passed (L/403)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	48	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.75"	332	442	774	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.75"	332	442	774	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)	3' 1" o/c	
Bottom Edge (Lu)	16' 7" o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.
•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 16' 7"	16"	30.0	40.0	Default Load

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

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

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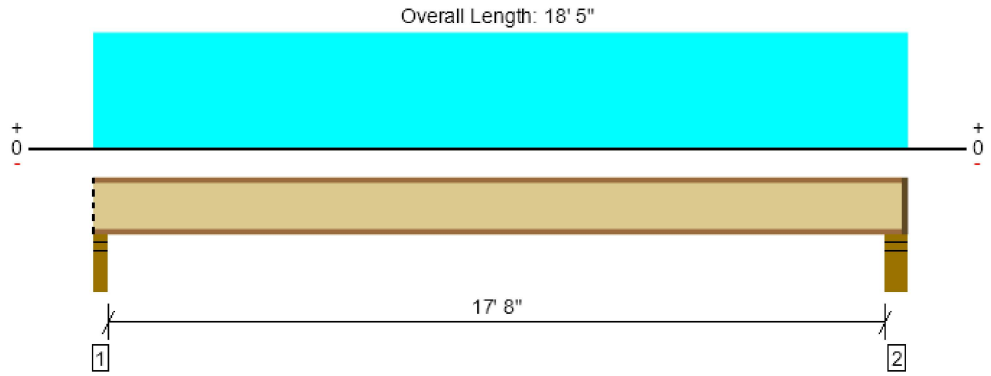
3rd Floor Framing, Floor Joist 17'-8"

1 piece(s) 11 7/8" TJI® 210 @ 16" OC



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)	856 @ 18' 1/2"	1460 (3.50")	Passed (59%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	824 @ 3 1/2"	1655	Passed (50%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3710 @ 9' 1 1/2"	3795	Passed (98%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.352 @ 9' 1 1/2"	0.594	Passed (L/609)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.615 @ 9' 1 1/2"	0.892	Passed (L/348)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	44	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.75"	365	487	852	Blocking
2 - Stud wall - HF	5.50"	4.00"	1.75"	372	496	867	1 1/2" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- 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)	3' 7" o/c	
Bottom Edge (Lu)	18' 4" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 18' 5"	16"	30.0	40.0	Default Load

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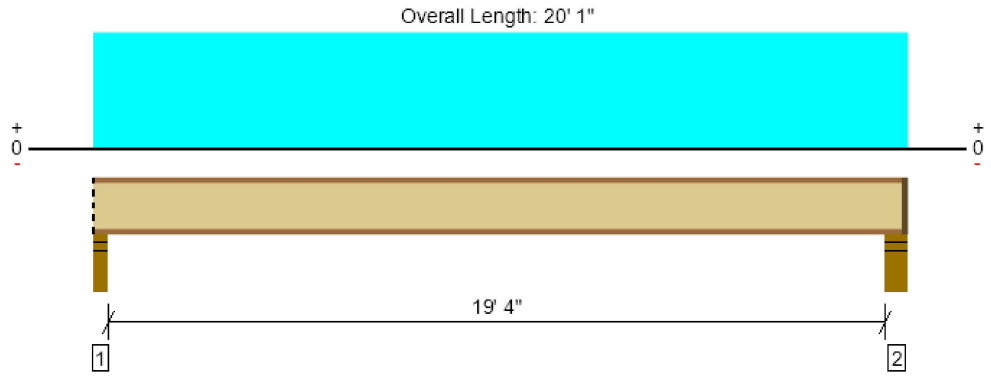
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

2nd Floor Framing, Floor Joist 19'-4"

1 piece(s) 11 7/8" TJI® 360 @ 16" OC



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)	933 @ 19' 8 1/2"	1505 (3.50")	Passed (62%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	902 @ 3 1/2"	1705	Passed (53%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4436 @ 9' 11 1/2"	6180	Passed (72%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.395 @ 9' 11 1/2"	0.650	Passed (L/593)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.691 @ 9' 11 1/2"	0.975	Passed (L/339)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	43	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.75"	398	531	929	Blocking
2 - Stud wall - HF	5.50"	4.00"	1.75"	405	540	945	1 1/2" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- 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)	4' 4" o/c	
Bottom Edge (Lu)	20' o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 20' 1"	16"	30.0	40.0	Default Load

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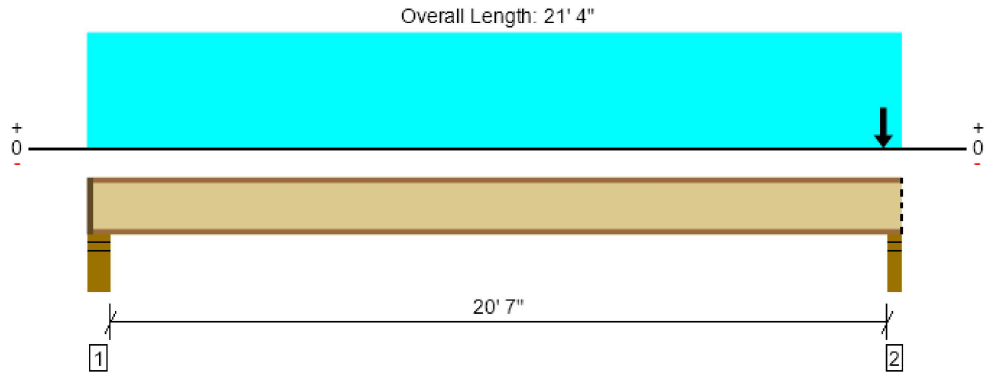
Weyerhaeuser

2nd Floor Framing, Floor Joist 20'-7" (with offset 3rd flr.)

2 piece(s) 11 7/8" TJI® 560 @ 16" OC



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)	2825 @ 21' 1 1/2"	3450 (3.50")	Passed (82%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2798 @ 21' 1/2"	4100	Passed (68%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5279 @ 11' 1/8"	19000	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.196 @ 10' 9 15/16"	0.692	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.343 @ 10' 9 15/16"	1.038	Passed (L/727)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	56	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	4.00"	1.75"	440	587	1028	1 1/2" Rim Board
2 - Stud wall - HF	3.50"	3.50"	2.31"	1211	1615	2825	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- 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)	11' o/c	
Bottom Edge (Lu)	21' 3" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 21' 4"	16"	30.0	40.0	2nd floor load
2 - Point (lb)	20' 10 1/4"	N/A	798	1064	3rd Floor offset wall load

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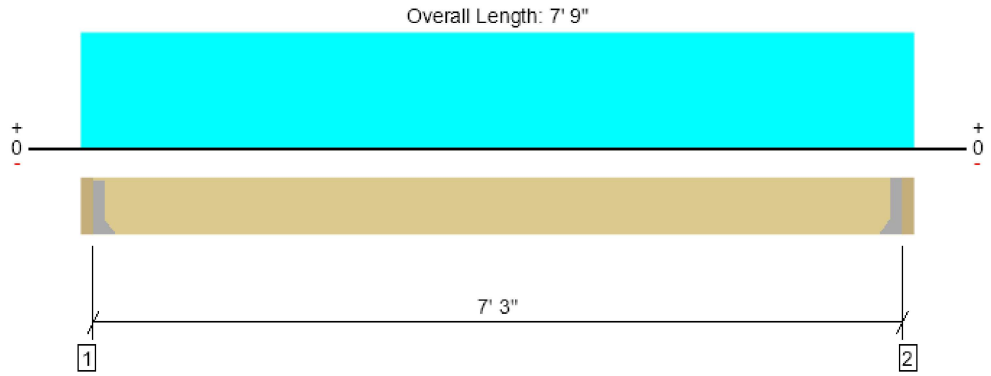
2nd Floor Framing, Short Stair Stringers

1 piece(s) 4 x 12 HF No.2



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)	1450 @ 3"	2126 (1.50")	Passed (68%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1075 @ 1' 2 1/4"	3938	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2628 @ 3' 10 1/2"	5752	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.035 @ 3' 10 1/2"	0.181	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.046 @ 3' 10 1/2"	0.363	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 1/4" GLB beam	3.00"	Hanger[1]	1.50"	385	1163	1547	See note [1]
2 - Hanger on 11 1/4" GLB beam	3.00"	Hanger[1]	1.50"	385	1163	1547	See note [1]

- 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)	7' 3" o/c	
Bottom Edge (Lu)	7' 3" 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	LUS410	2.00"	N/A	8-10d	6-10d	
2 - Face Mount Hanger	LUS410	2.00"	N/A	8-10d	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)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3" to 7' 6"	N/A	10.0	--	
1 - Uniform (PSF)	0 to 7' 9" (Front)	2'	45.0	150.0	Default Load

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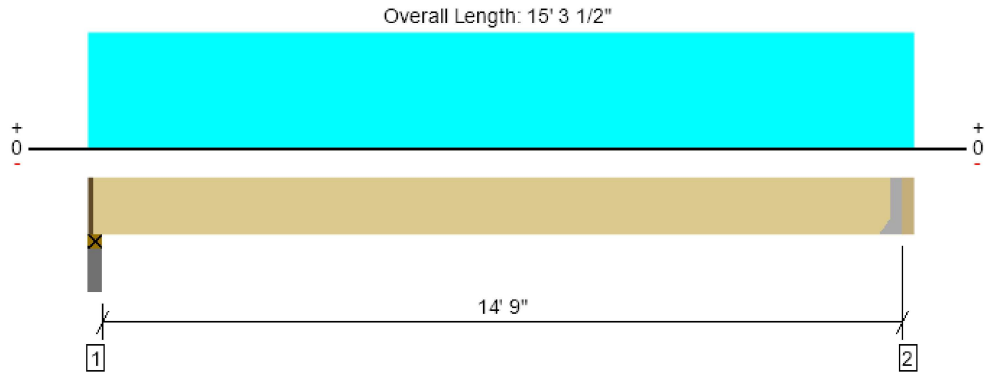
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

2nd Floor Framing, Long Short Stair Stringers

1 piece(s) 3 1/2" x 12" 24F-V4 DF Glulam



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)	3002 @ 2"	3189 (2.25")	Passed (94%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2576 @ 14' 1/2"	7420	Passed (35%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	11069 @ 7' 7 1/4"	16800	Passed (66%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.364 @ 7' 7 1/4"	0.372	Passed (L/490)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.486 @ 7' 7 1/4"	0.744	Passed (L/367)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 = 14' 10 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	Floor Live	Factored	
1 - Plate on concrete - HF	3.50"	2.25"	2.12"	761	2281	3042	1 1/4" Rim Board
2 - Hanger on 12" GLB beam	3.00"	Hanger[1]	1.50"	768	2306	3074	See note [1]

- Rim Board is assumed to carry all loads applied directly above it, bypassing 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)	14' 11" o/c	
Bottom Edge (Lu)	14' 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
2 - Face Mount Hanger	HHUS410	3.00"	N/A	30-10d	10-10d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	1 1/4" to 15' 1/2"	N/A	10.2	--	
1 - Uniform (PSF)	0 to 15' 3 1/2" (Front)	2'	45.0	150.0	Default Load

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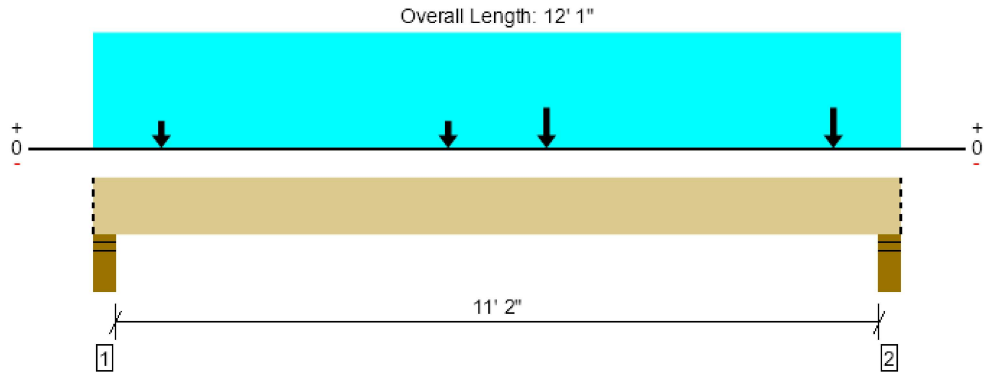
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

2nd Floor Framing, Top Landing Beam

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



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)	11985 @ 11' 9"	12251 (5.50")	Passed (98%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	8786 @ 10' 6"	13118	Passed (67%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	31091 @ 6' 8 3/4"	33413	Passed (93%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.261 @ 6' 1"	0.285	Passed (L/525)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.346 @ 6' 1"	0.571	Passed (L/396)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 = 11' 5".
- 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	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	4.69"	2563	7873	10437	Blocking
2 - Stud wall - HF	5.50"	5.50"	5.38"	2952	9033	11985	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)	12' 1" o/c	
Bottom Edge (Lu)	12' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 12' 1"	N/A	18.0	--	
1 - Uniform (PSF)	0 to 12' 1" (Front)	5' 6"	45.0	150.0	Default Load
2 - Point (lb)	5' 3 3/4" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1
3 - Point (lb)	1' 1/4" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1
4 - Point (lb)	6' 9 3/8" (Front)	N/A	768	2306	Linked from: Long Short Stair Stringers, Support 2
5 - Point (lb)	11' 7/8" (Front)	N/A	768	2306	Linked from: Long Short Stair Stringers, Support 2

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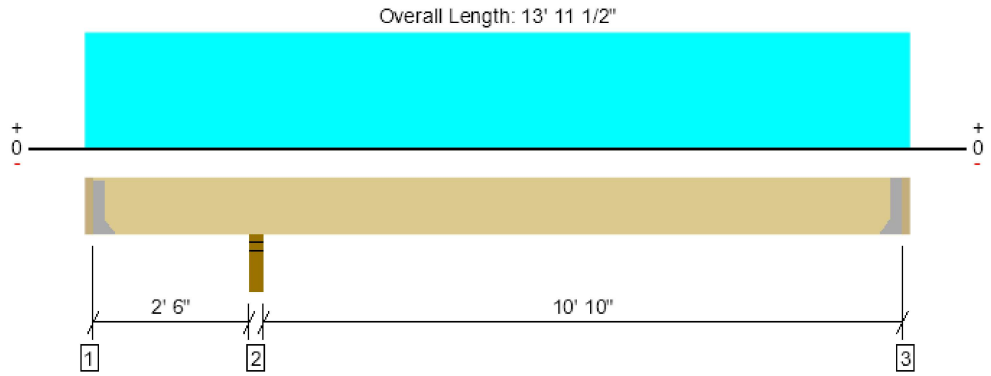
2nd Floor Framing, 10'-10" Deck Joist

1 piece(s) 2 x 12 HF No.2 @ 16" OC



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)	1510 @ 2' 9 3/4"	2126 (3.50")	Passed (71%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	663 @ 3' 10 3/4"	1688	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-1477 @ 2' 9 3/4"	2577	Passed (57%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.059 @ 8' 10 11/16"	0.366	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.089 @ 8' 10 3/4"	0.549	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
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.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- -480 lbs uplift at support located at 2". Strapping or other restraint may be required.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 1/4" HF beam	2.00"	Hanger[1]	1.50"	-127	114/-354	-480	See note [1]
2 - Stud wall - HF	3.50"	3.50"	2.49"	503	1007	1510	None
3 - Hanger on 11 1/4" HF beam	2.00"	Hanger[1]	1.50"	181	364	545	See note [1]

- 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)	11' o/c	
Bottom Edge (Lu)	7' 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	LUS28	1.75"	N/A	6-10dx1.5	3-10d	
3 - Face Mount Hanger	LUS28	1.75"	N/A	6-10dx1.5	3-10d	

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 13' 11 1/2"	16"	30.0	60.0	Default Load

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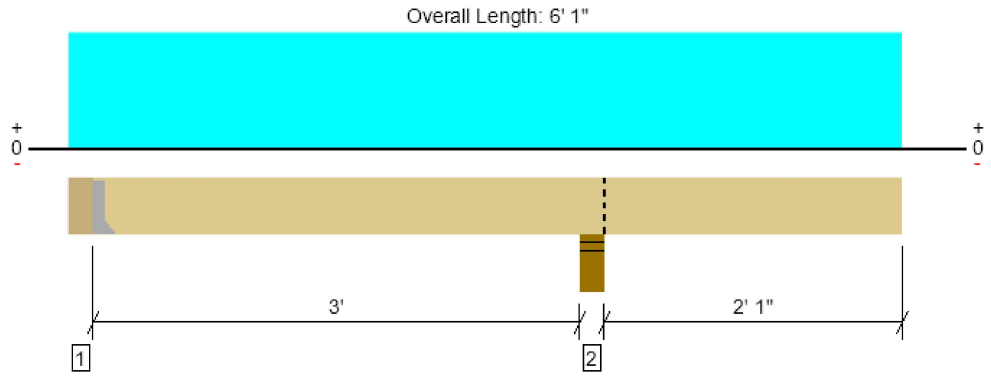
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

2nd Floor Framing, Deck Cantilever Ledger 2'

2 piece(s) 2 x 12 HF No.2



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)	855 @ 6"	1823 (1.50")	Passed (47%)	--	1.0 D + 1.0 L (Alt Spans)
Shear (lbs)	814 @ 2' 6 3/4"	3375	Passed (24%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-1738 @ 3' 9"	4482	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.017 @ 6' 1"	0.200	Passed (2L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.023 @ 6' 1"	0.233	Passed (2L/999+)	--	1.0 D + 1.0 L (Alt Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (0.2") and TL (2L/240).
- Right cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 1/4" HF beam	6.00"	Hanger[1]	1.50"	277	893/-142	1170	See note [1]
2 - Stud wall - HF	6.00"	6.00"	2.52"	1048	2014	3062	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)	5' 7" o/c	
Bottom Edge (Lu)	5' 7" 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	LUS28-2	2.00"	N/A	6-10d	3-10d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	6" to 6' 1"	N/A	8.6	--	
1 - Uniform (PSF)	0 to 6' 1" (Front)	7'	30.0	60.0	Default Load

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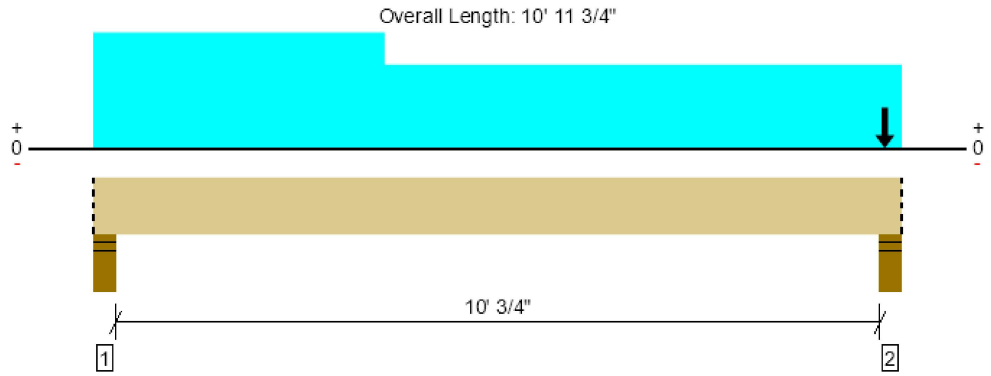
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

2nd Floor Framing, Grid 2.6 (F-G.3) Flush Beam

1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	10433 @ 10' 7 3/4"	12251 (5.50")	Passed (85%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3786 @ 1' 5 3/8"	11539	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	11612 @ 5' 3"	25853	Passed (45%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.091 @ 5' 5 3/16"	0.258	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.162 @ 5' 5 3/16"	0.516	Passed (L/764)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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' 3 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	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	2.41"	2354	3022	5376	Blocking
2 - Stud wall - HF	5.50"	5.50"	4.68"	4582	5850	10433	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)	11' o/c	
Bottom Edge (Lu)	11' o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 10' 11 3/4"	N/A	15.9	--	
1 - Uniform (PSF)	0 to 3' 11 1/2" (Front)	15' 5 1/2"	30.0	40.0	Default Load
2 - Uniform (PSF)	3' 11 1/2" to 10' 11 3/4" (Front)	11' 2"	30.0	40.0	Default Load
3 - Point (lb)	10' 9" (Top)	N/A	2574	3289	Linked from: Grid 2.6 (F-G.5) Flush Beam, Support 2

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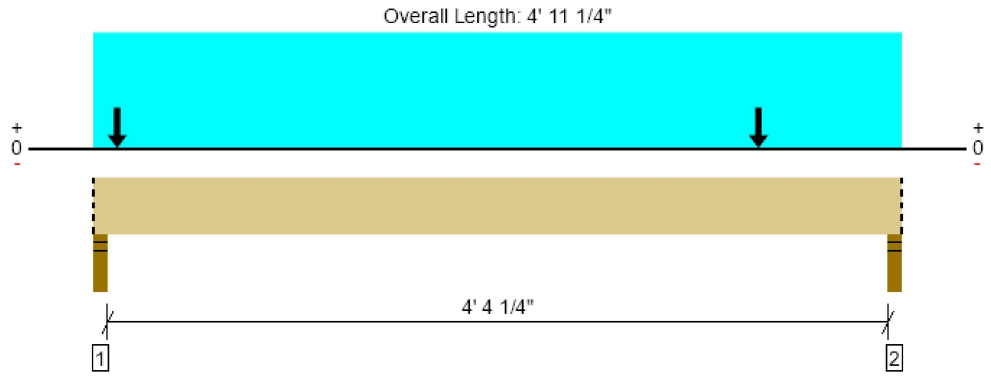
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

2nd Floor Framing, Grid 2.6 (G.9-H.8) Flush Beam

1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	7141 @ 2"	7796 (3.50")	Passed (92%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3257 @ 3' 7 7/8"	11539	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	4949 @ 2' 9 3/4"	25853	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.008 @ 2' 6 5/16"	0.115	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.014 @ 2' 6 5/16"	0.230	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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' 7 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.21"	3098	4043	7141	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.77"	2677	3491	6167	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)	4' 11" o/c	
Bottom Edge (Lu)	4' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 11 1/4"	N/A	15.9	--	
1 - Uniform (PSF)	0 to 4' 11 1/4" (Front)	19' 11 1/2"	30.0	40.0	Default Load
2 - Point (lb)	4' 3/4" (Top)	N/A	1370	1796	Linked from: Grid 2.6 (H-H.8) Flush Beam, Support 2
3 - Point (lb)	1 3/4" (Top)	N/A	1370	1796	Linked from: Grid 2.6 (H-H.8) Flush Beam, Support 1

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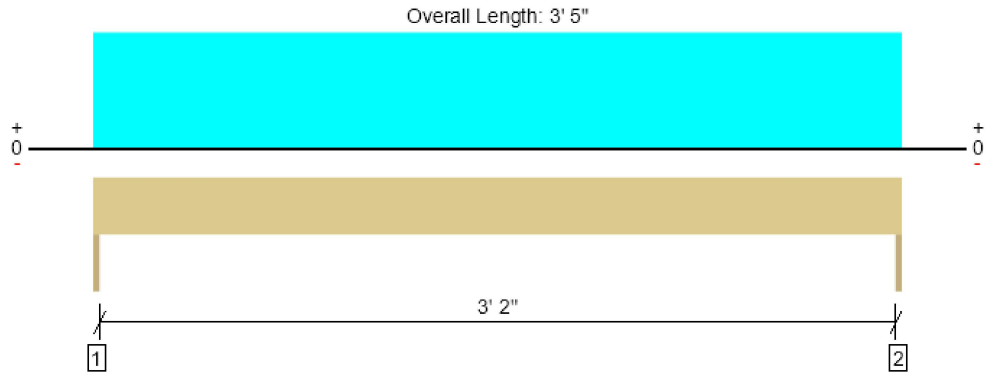
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

2nd Floor Framing, Grid 2.4 (H.8-I.8) Door Header

1 piece(s) 4 x 8 DF No.2



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)	1523 @ 0	3281 (1.50")	Passed (46%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	873 @ 8 3/4"	3045	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1301 @ 1' 8 1/2"	2989	Passed (44%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.009 @ 1' 8 1/2"	0.114	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.015 @ 1' 8 1/2"	0.171	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	659	864	1523	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	659	864	1523	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 5" o/c	
Bottom Edge (Lu)	3' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 3' 5"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 3' 5"	12' 7 3/4"	30.0	40.0	Default Load

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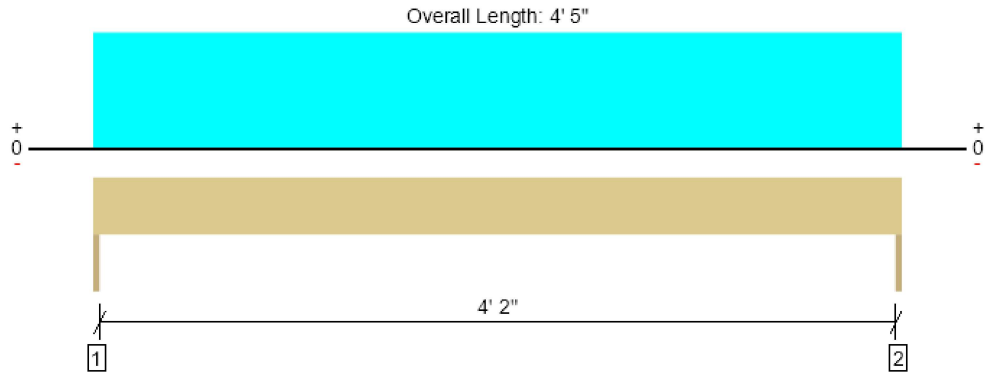
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

2nd Floor Framing, Grid 2.4 (J.2-K.8) Door Header

1 piece(s) 4 x 8 DF No.2



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)	1969 @ 0	3281 (1.50")	Passed (60%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1319 @ 8 3/4"	3045	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2174 @ 2' 2 1/2"	2989	Passed (73%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.024 @ 2' 2 1/2"	0.147	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.043 @ 2' 2 1/2"	0.221	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	852	1117	1969	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	852	1117	1969	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 5" o/c	
Bottom Edge (Lu)	4' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 5"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 4' 5"	12' 7 3/4"	30.0	40.0	Default Load

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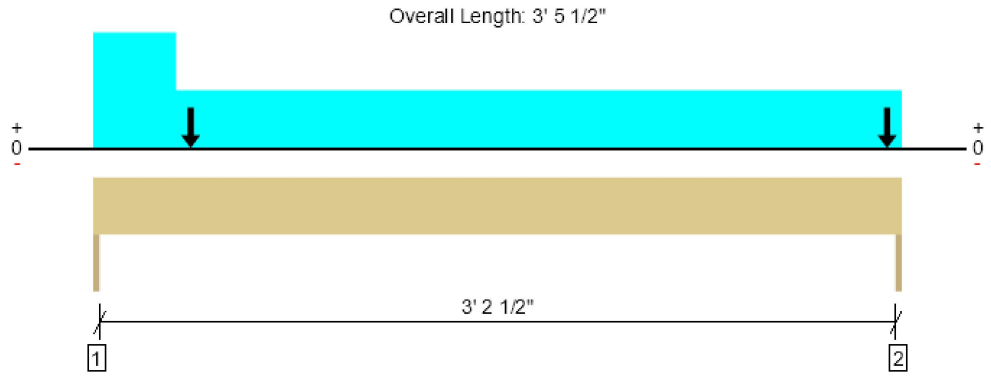
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

2nd Floor Framing, Grid 5.5 (H-H.8) Door Header

1 piece(s) 4 x 8 DF No.2



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)	2520 @ 3' 5 1/2"	3281 (1.50")	Passed (77%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1180 @ 8 3/4"	3045	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1362 @ 1' 6 1/4"	2989	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.010 @ 1' 8 5/16"	0.115	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.017 @ 1' 8 5/16"	0.173	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	1089	1425	2514	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	1093	1427	2520	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 6" o/c	
Bottom Edge (Lu)	3' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 3' 5 1/2"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 3' 5 1/2"	10' 3"	30.0	40.0	2nd Floor
2 - Uniform (PSF)	0 to 4 1/4"	10' 3"	30.0	40.0	3rd Floor
3 - Point (lb)	5"	N/A	484	632	Linked from: Grid 5.5 (H-H.8) Door Header, Support 1
4 - Point (lb)	3' 4 3/4"	N/A	484	632	Linked from: Grid 5.5 (H-H.8) Door Header, Support 2

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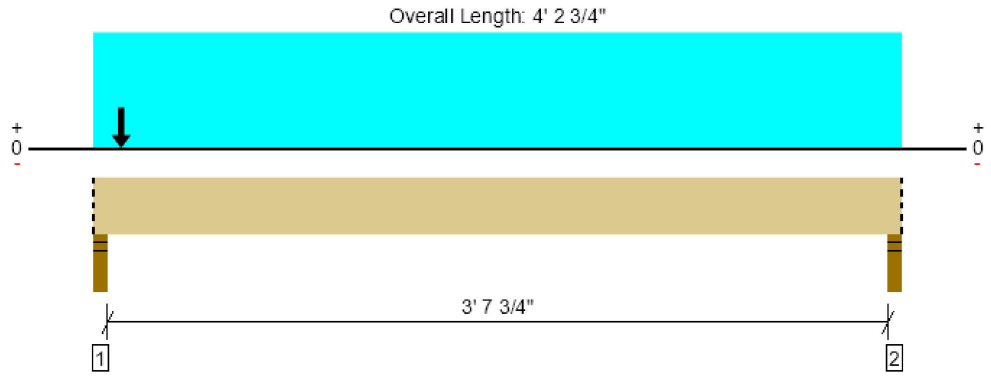
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

2nd Floor Framing, Grid 5.5 (G.1-G.3) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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 @ 2"	4961 (3.50")	Passed (62%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	606 @ 1' 3 3/8"	7343	Passed (8%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	1380 @ 2' 1 3/8"	16452	Passed (8%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.002 @ 2' 1 3/8"	0.097	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.004 @ 2' 1 3/8"	0.195	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 = 3' 10 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.17"	1344	1734	3078	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	672	867	1539	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)	4' 3" o/c	
Bottom Edge (Lu)	4' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 2 3/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 2 3/4" (Front)	10' 3"	30.0	40.0	Default Load
2 - Point (lb)	1 3/4" (Top)	N/A	672	867	Linked from: Grid 5.5 (G.1-G.3) Flush Beam, Support 1

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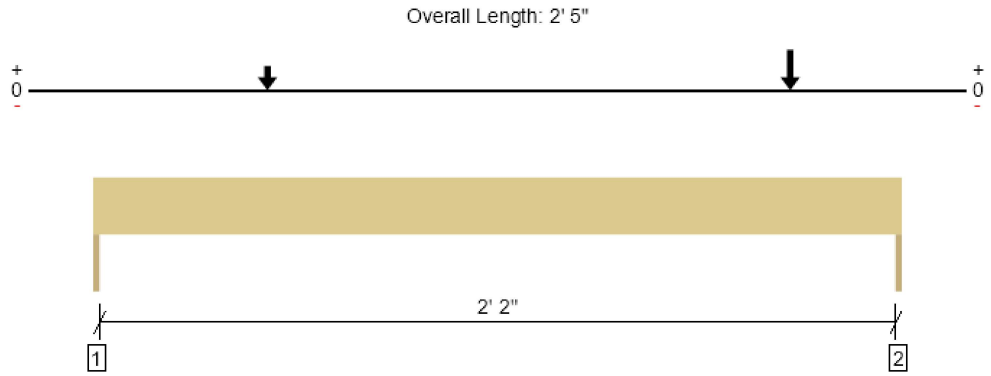
2nd Floor Framing, Grid G.1 (5.2-5.3) Door Header

1 piece(s) 4 x 8 DF No.2



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)	1462 @ 2' 5"	3281 (1.50")	Passed (45%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	588 @ 1' 8 1/4"	3045	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	487 @ 2' 1"	2989	Passed (16%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.002 @ 1' 3 1/8"	0.081	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.003 @ 1' 3 1/8"	0.121	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	307	378	684	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	644	818	1462	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	2' 5" o/c	
Bottom Edge (Lu)	2' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 2' 5"	N/A	6.4	--	
1 - Point (lb)	2' 1"	N/A	672	867	Linked from: Grid 5.5 (G.1-G.3) Flush Beam, Support 2
2 - Point (lb)	6 1/4"	N/A	263	329	Linked from: Grid G.1 (5.2-5.3) Door Header, Support 1

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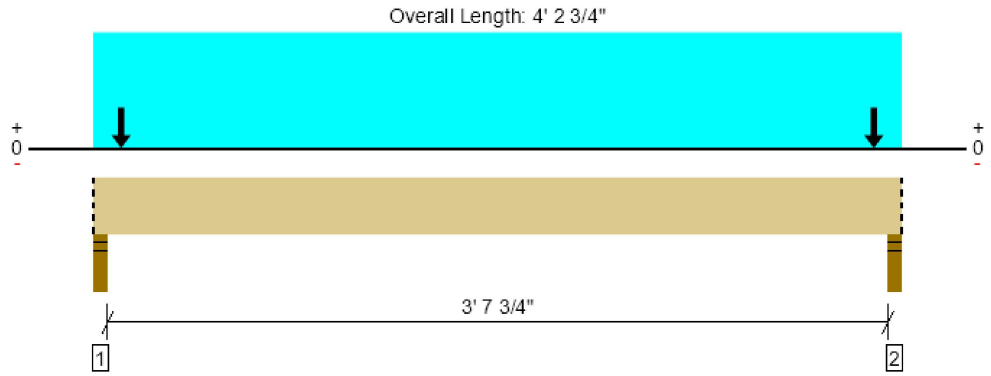
2nd Floor Framing, Grid 6 (G.1-G.3) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	3423 @ 2"	4961 (3.50")	Passed (69%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	674 @ 1' 3 3/8"	7343	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	1535 @ 2' 1 3/8"	16452	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.003 @ 2' 1 3/8"	0.097	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.005 @ 2' 1 3/8"	0.195	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 = 3' 10 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.42"	1492	1932	3423	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.42"	1492	1932	3423	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)	4' 3" o/c	
Bottom Edge (Lu)	4' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 2 3/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 2 3/4" (Front)	11' 5"	30.0	40.0	Default Load
2 - Point (lb)	1 3/4" (Top)	N/A	746	966	Linked from: Grid 6 (G.1-G.3) Flush Beam, Support 1
3 - Point (lb)	4' 1" (Top)	N/A	746	966	Linked from: Grid 6 (G.1-G.3) Flush Beam, Support 1

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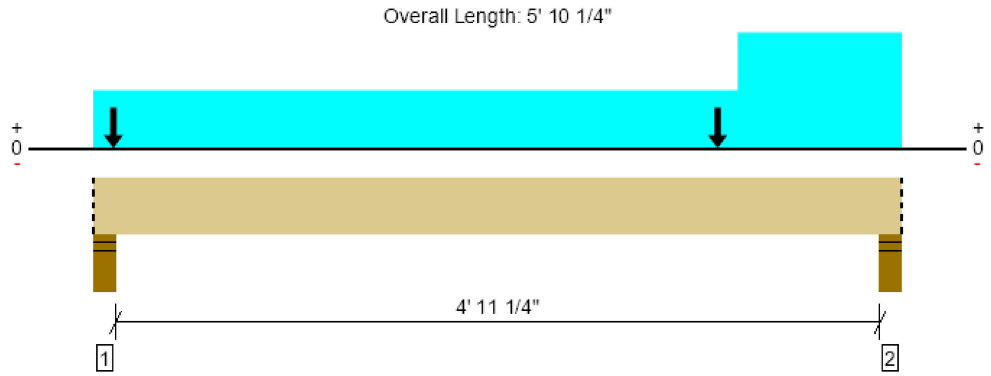
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

2nd Floor Framing, Grid 2.5 (D.4-D.6) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	6690 @ 5' 6 1/4"	7796 (5.50")	Passed (86%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3451 @ 4' 4 7/8"	7343	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	5483 @ 3' 5 3/16"	16452	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.017 @ 3' 1/4"	0.130	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.031 @ 3' 1/4"	0.259	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 = 5' 2 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	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	4.59"	2818	3682	6500	Blocking
2 - Stud wall - HF	5.50"	5.50"	4.72"	2894	3795	6690	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)	5' 10" o/c	
Bottom Edge (Lu)	5' 10" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 5' 10 1/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 5' 10 1/4" (Front)	16' 2"	30.0	40.0	2nd Floor
2 - Uniform (PSF)	4' 8" to 5' 10 1/4" (Front)	16' 2"	30.0	40.0	3rd Floor
3 - Point (lb)	1 3/4" (Top)	N/A	1119	1462	Linked from: Grid 2.5 (D.4-D.6) Flush Beam, Support 1
4 - Point (lb)	4' 6 1/4" (Top)	N/A	1119	1462	Linked from: Grid 2.5 (D.4-D.6) Flush Beam, Support 2

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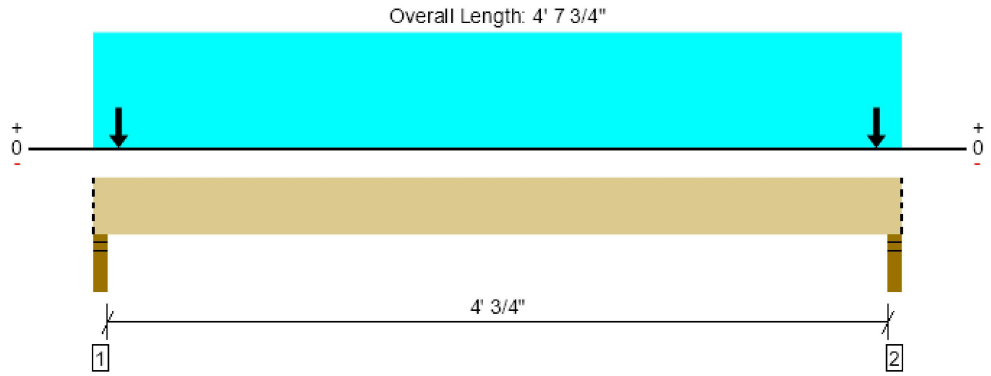
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

2nd Floor Framing, Grid 3.3 (D.8-E.1) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	4302 @ 2"	4961 (3.50")	Passed (87%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	965 @ 1' 3 3/8"	7343	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2153 @ 2' 3 7/8"	16452	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.005 @ 2' 3 7/8"	0.108	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.008 @ 2' 3 7/8"	0.216	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.03"	1870	2432	4302	Blocking
2 - Stud wall - HF	3.50"	3.50"	3.03"	1870	2432	4302	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)	4' 8" o/c	
Bottom Edge (Lu)	4' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 7 3/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 7 3/4" (Front)	13' 1"	30.0	40.0	Default Load
2 - Point (lb)	1 3/4" (Top)	N/A	935	1216	Linked from: Grid 3.3 (D.8-E.1) Flush Beam, Support 1
3 - Point (lb)	4' 6" (Top)	N/A	935	1216	Linked from: Grid 3.3 (D.8-E.1) Flush Beam, Support 2

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ForteWEB Software Operator	Job Notes
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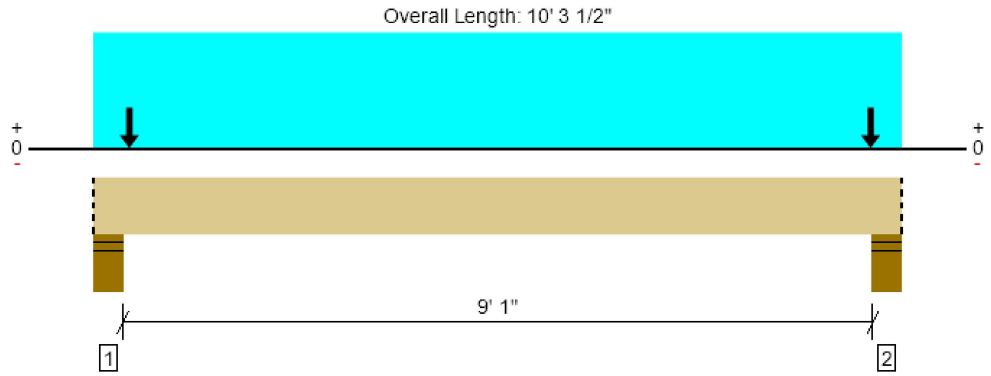
Weyerhaeuser

2nd Floor Framing, Grid 5.3 (D.5-E.2) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	9240 @ 5 3/4"	10277 (7.25")	Passed (90%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3289 @ 1' 7 1/8"	7343	Passed (45%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	10082 @ 5' 1 3/4"	16452	Passed (61%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.102 @ 5' 1 3/4"	0.233	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.180 @ 5' 1 3/4"	0.467	Passed (L/623)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 = 9' 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	Floor Live	Factored	
1 - Stud wall - HF	7.25"	7.25"	6.52"	4018	5222	9240	Blocking
2 - Stud wall - HF	7.25"	7.25"	6.52"	4018	5222	9240	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)	10' 4" o/c	
Bottom Edge (Lu)	10' 4" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 10' 3 1/2"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 10' 3 1/2" (Front)	13' 1"	30.0	40.0	Default Load
2 - Point (lb)	5 1/2" (Top)	N/A	1946	2529	Linked from: Grid 5.3 (D.5-E.2) Flush Beam, Support 1
3 - Point (lb)	9' 10 3/4" (Top)	N/A	1946	2529	Linked from: Grid 5.3 (D.5-E.2) Flush Beam, Support 2

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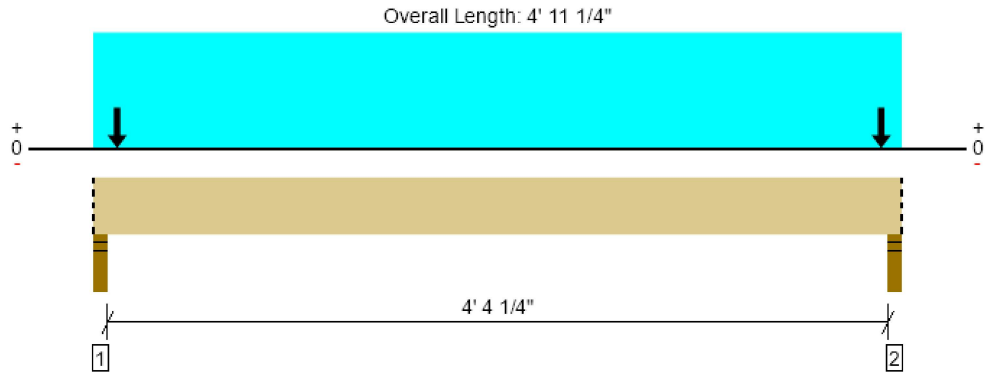
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

2nd Floor Framing, Grid 6 (D.3-D.6) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	4744 @ 2"	4961 (3.50")	Passed (96%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1141 @ 1' 3 3/8"	7343	Passed (16%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2546 @ 2' 5 5/8"	16452	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.006 @ 2' 5 5/8"	0.115	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 2' 5 5/8"	0.230	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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' 7 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.35"	2062	2682	4744	Blocking
2 - Stud wall - HF	3.50"	3.50"	3.35"	2062	2682	4744	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)	4' 11" o/c	
Bottom Edge (Lu)	4' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 11 1/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 11 1/4" (Front)	13' 7"	30.0	40.0	Default Load
2 - Point (lb)	1 3/4" (Top)	N/A	1031	1341	Linked from: Grid 6 (D.3-D.6) Flush Beam, Support 1
3 - Point (lb)	4' 9 3/4" (Back)	N/A	1031	1341	Linked from: Grid 6 (D.3-D.6) Flush Beam, Support 2

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ForteWEB Software Operator	Job Notes
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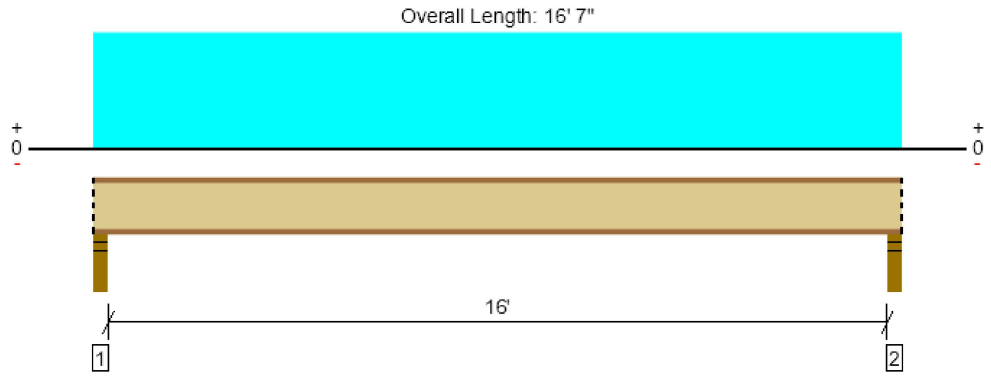
Weyerhaeuser

3rd Floor Framing, Floor Joist 16' and Under

1 piece(s) 11 7/8" TJI® 110 @ 16" OC



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)	774 @ 2 1/2"	1375 (3.50")	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	747 @ 3 1/2"	1560	Passed (48%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3049 @ 8' 3 1/2"	3160	Passed (96%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.275 @ 8' 3 1/2"	0.539	Passed (L/704)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.482 @ 8' 3 1/2"	0.808	Passed (L/403)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	48	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.75"	332	442	774	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.75"	332	442	774	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)	3' 1" o/c	
Bottom Edge (Lu)	16' 7" o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.
•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 16' 7"	16"	30.0	40.0	Default Load

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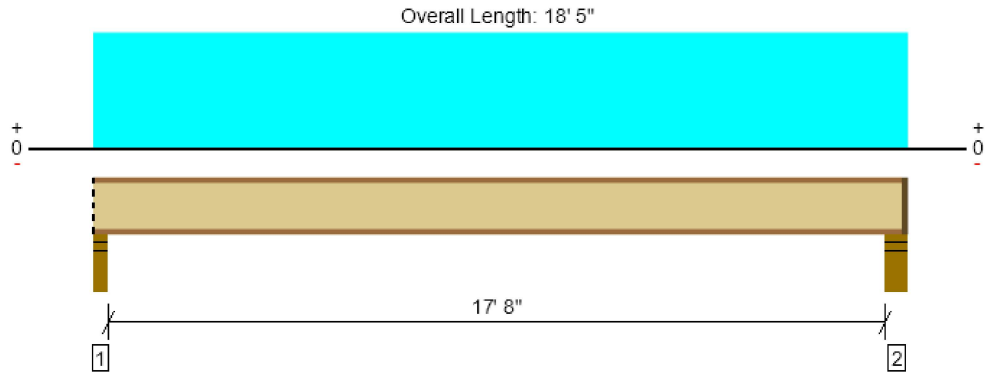
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

3rd Floor Framing, Floor Joist 17'-8"

1 piece(s) 11 7/8" TJI® 210 @ 16" OC



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)	856 @ 18' 1/2"	1460 (3.50")	Passed (59%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	824 @ 3 1/2"	1655	Passed (50%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3710 @ 9' 1 1/2"	3795	Passed (98%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.352 @ 9' 1 1/2"	0.594	Passed (L/609)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.615 @ 9' 1 1/2"	0.892	Passed (L/348)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	44	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.75"	365	487	852	Blocking
2 - Stud wall - HF	5.50"	4.00"	1.75"	372	496	867	1 1/2" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- 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)	3' 7" o/c	
Bottom Edge (Lu)	18' 4" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 18' 5"	16"	30.0	40.0	Default Load

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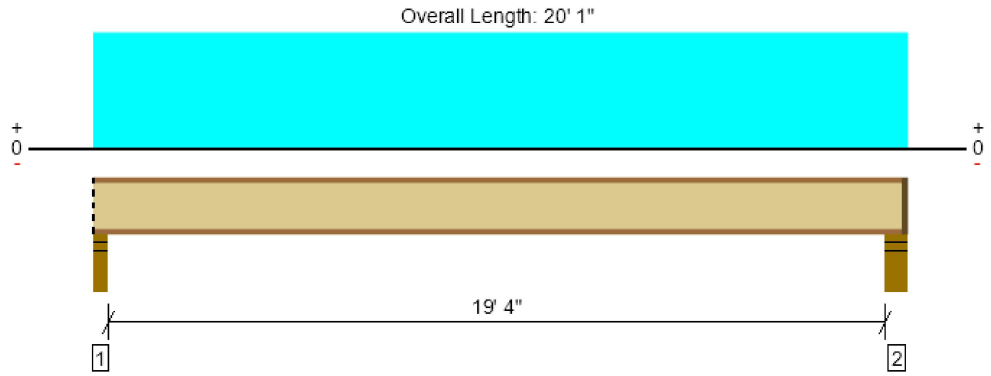
Weyerhaeuser

3rd Floor Framing, Floor Joist 19'-4"

1 piece(s) 11 7/8" TJI® 360 @ 16" OC



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)	933 @ 19' 8 1/2"	1505 (3.50")	Passed (62%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	902 @ 3 1/2"	1705	Passed (53%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4436 @ 9' 11 1/2"	6180	Passed (72%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.395 @ 9' 11 1/2"	0.650	Passed (L/593)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.691 @ 9' 11 1/2"	0.975	Passed (L/339)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	43	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.75"	398	531	929	Blocking
2 - Stud wall - HF	5.50"	4.00"	1.75"	405	540	945	1 1/2" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- 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)	4' 4" o/c	
Bottom Edge (Lu)	20' o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 20' 1"	16"	30.0	40.0	Default Load

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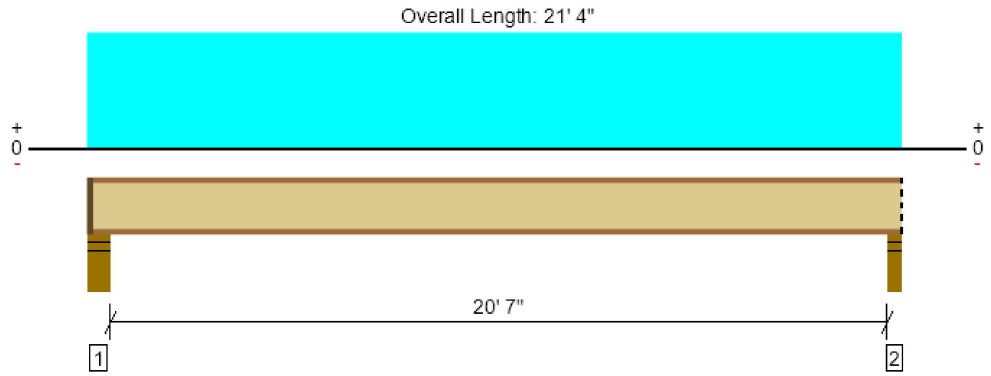
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

3rd Floor Framing, Floor Joist 20'-7"

1 piece(s) 11 7/8" TJI® 560 @ 16" OC



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)	992 @ 4 1/2"	1725 (3.50")	Passed (57%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	961 @ 5 1/2"	2050	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5023 @ 10' 9"	9500	Passed (53%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.353 @ 10' 9"	0.692	Passed (L/706)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.617 @ 10' 9"	1.038	Passed (L/404)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	46	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	4.00"	1.75"	430	573	1003	1 1/2" Rim Board
2 - Stud wall - HF	3.50"	3.50"	1.75"	423	564	988	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- 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)	7' 10" o/c	
Bottom Edge (Lu)	21' 3" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 21' 4"	16"	30.0	40.0	Default Load

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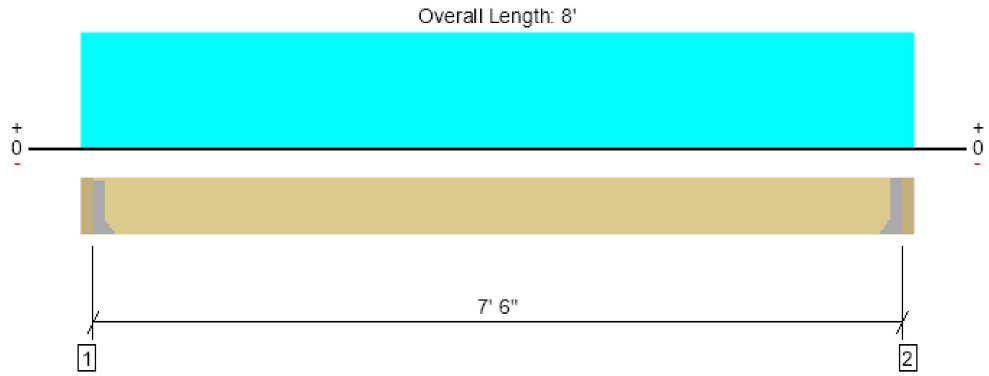
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

3rd Floor Framing, 7'-6" Landing Joists

1 piece(s) 2 x 12 HF No.2 @ 16" OC



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)	975 @ 3"	975 (1.60")	Passed (100%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	731 @ 1' 2 1/4"	1688	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1828 @ 4'	2577	Passed (71%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.062 @ 4'	0.250	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.080 @ 4'	0.375	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
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.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 1/4" LSL beam	3.00"	Hanger[1]	1.60"	240	800	1040	See note [1]
2 - Hanger on 11 1/4" LSL beam	3.00"	Hanger[1]	1.60"	240	800	1040	See note [1]

- 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)	5' 10" o/c	
Bottom Edge (Lu)	7' 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
1 - Face Mount Hanger	LUS28	1.75"	N/A	6-10dx1.5	4-10d	
2 - Face Mount Hanger	LUS28	1.75"	N/A	6-10dx1.5	4-10d	

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 8'	16"	45.0	150.0	Default Load

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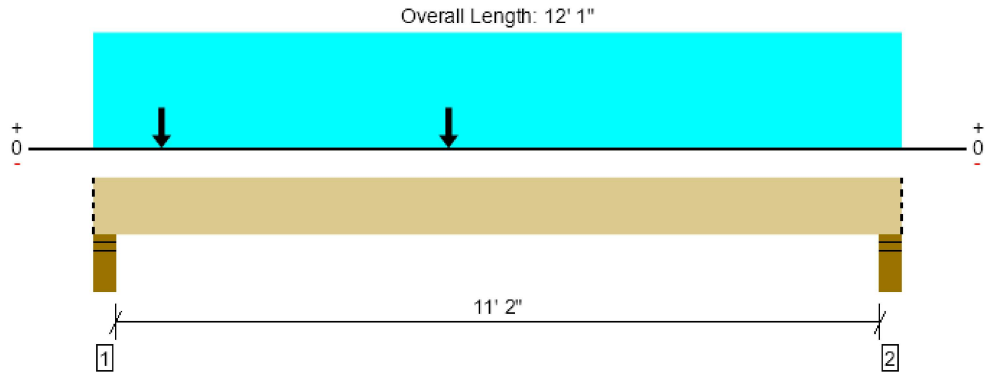
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

3rd Floor Framing, Top Landing Beam

1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam



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)	9199 @ 4"	12251 (5.50")	Passed (75%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	6904 @ 1' 5 1/2"	11660	Passed (59%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	23175 @ 5' 4 3/8"	26400	Passed (88%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.282 @ 5' 11 15/16"	0.285	Passed (L/486)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.372 @ 5' 11 15/16"	0.571	Passed (L/368)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 = 11' 5".
- 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	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	4.13"	2239	6960	9199	Blocking
2 - Stud wall - HF	5.50"	5.50"	3.43"	1851	5788	7639	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)	12' 1" o/c	
Bottom Edge (Lu)	12' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 12' 1"	N/A	16.0	--	
1 - Uniform (PSF)	0 to 12' 1" (Front)	5' 9"	45.0	150.0	Default Load
2 - Point (lb)	1' 1/4" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1
3 - Point (lb)	5' 3 3/4" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1

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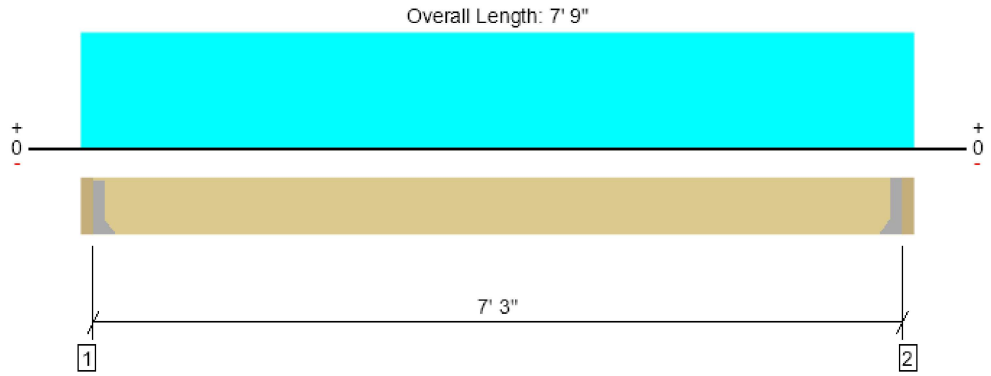
Weyerhaeuser

3rd Floor Framing, Short Stair Stringers

1 piece(s) 4 x 12 HF No.2



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)	1450 @ 3"	2126 (1.50")	Passed (68%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1075 @ 1' 2 1/4"	3938	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2628 @ 3' 10 1/2"	5752	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.035 @ 3' 10 1/2"	0.181	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.046 @ 3' 10 1/2"	0.363	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 1/4" GLB beam	3.00"	Hanger[1]	1.50"	385	1163	1547	See note [1]
2 - Hanger on 11 1/4" GLB beam	3.00"	Hanger[1]	1.50"	385	1163	1547	See note [1]

- 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)	7' 3" o/c	
Bottom Edge (Lu)	7' 3" 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	LUS410	2.00"	N/A	8-10d	6-10d	
2 - Face Mount Hanger	LUS410	2.00"	N/A	8-10d	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)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3" to 7' 6"	N/A	10.0	--	
1 - Uniform (PSF)	0 to 7' 9" (Front)	2'	45.0	150.0	Default Load

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ForteWEB Software Operator	Job Notes
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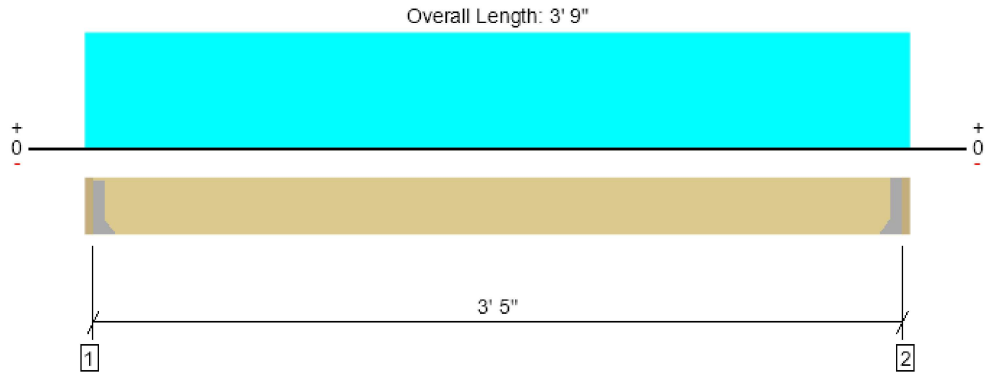
Weyerhaeuser

3rd Floor Framing, 4' Mid Landing Joists

1 piece(s) 2 x 12 HF No.2 @ 16" OC



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)	444 @ 2"	911 (1.50")	Passed (49%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	200 @ 1' 1 1/4"	1688	Passed (12%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	379 @ 1' 10 1/2"	2577	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.003 @ 1' 10 1/2"	0.114	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.003 @ 1' 10 1/2"	0.171	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
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.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 1/4" LSL beam	2.00"	Hanger[1]	1.50"	113	375	488	See note [1]
2 - Hanger on 11 1/4" LSL beam	2.00"	Hanger[1]	1.50"	113	375	488	See note [1]

- 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)	3' 5" o/c	
Bottom Edge (Lu)	3' 5" 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	LUS28	1.75"	N/A	6-10dx1.5	3-10d	
2 - Face Mount Hanger	LUS28	1.75"	N/A	6-10dx1.5	3-10d	

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 3' 9"	16"	45.0	150.0	Default Load

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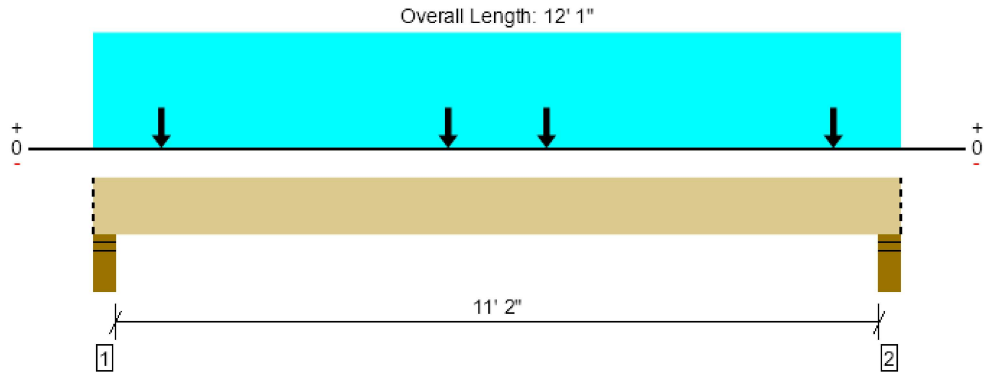
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

3rd Floor Framing, Mid Landing Beam

1 piece(s) 3 1/2" x 12" 24F-V4 DF Glulam



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)	5517 @ 11' 9"	7796 (5.50")	Passed (71%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4291 @ 1' 5 1/2"	7420	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	15276 @ 6' 7/16"	16800	Passed (91%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.285 @ 6' 1/2"	0.285	Passed (L/481)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.380 @ 6' 1/2"	0.571	Passed (L/361)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 = 11' 5".
- 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	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	3.89"	1375	4136	5511	Blocking
2 - Stud wall - HF	5.50"	5.50"	3.89"	1376	4141	5517	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)	12' 1" o/c	
Bottom Edge (Lu)	12' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 12' 1"	N/A	10.2	--	
1 - Uniform (PSF)	0 to 12' 1" (Front)	2'	45.0	150.0	Default Load
2 - Point (lb)	1' 1/4" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1
3 - Point (lb)	5' 3 3/4" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1
4 - Point (lb)	6' 9 3/8" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1
5 - Point (lb)	11' 7/8" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1

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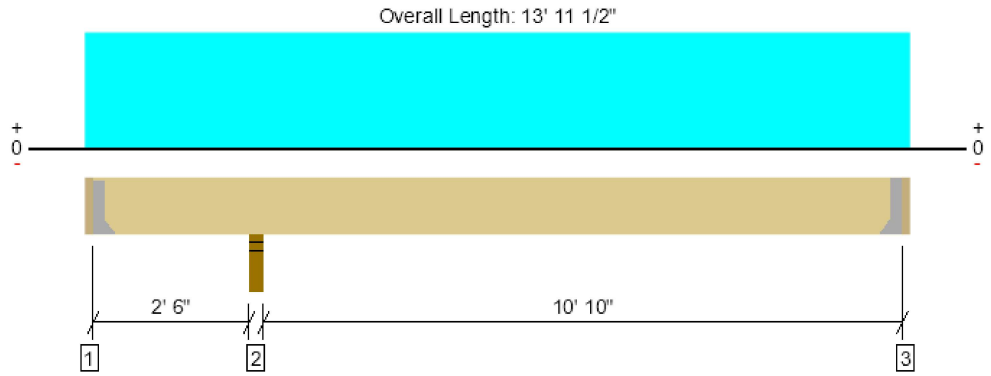
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

3rd Floor Framing, 10'-10" Deck Joist

1 piece(s) 2 x 12 HF No.2 @ 16" OC



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)	1510 @ 2' 9 3/4"	2126 (3.50")	Passed (71%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	663 @ 3' 10 3/4"	1688	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-1477 @ 2' 9 3/4"	2577	Passed (57%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.059 @ 8' 10 11/16"	0.366	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.089 @ 8' 10 3/4"	0.549	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
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.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- -480 lbs uplift at support located at 2". Strapping or other restraint may be required.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 1/4" HF beam	2.00"	Hanger[1]	1.50"	-127	114/-354	-480	See note [1]
2 - Stud wall - HF	3.50"	3.50"	2.49"	503	1007	1510	None
3 - Hanger on 11 1/4" HF beam	2.00"	Hanger[1]	1.50"	181	364	545	See note [1]

- 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)	11' o/c	
Bottom Edge (Lu)	7' 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	LUS28	1.75"	N/A	6-10dx1.5	3-10d	
3 - Face Mount Hanger	LUS28	1.75"	N/A	6-10dx1.5	3-10d	

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 13' 11 1/2"	16"	30.0	60.0	Default Load

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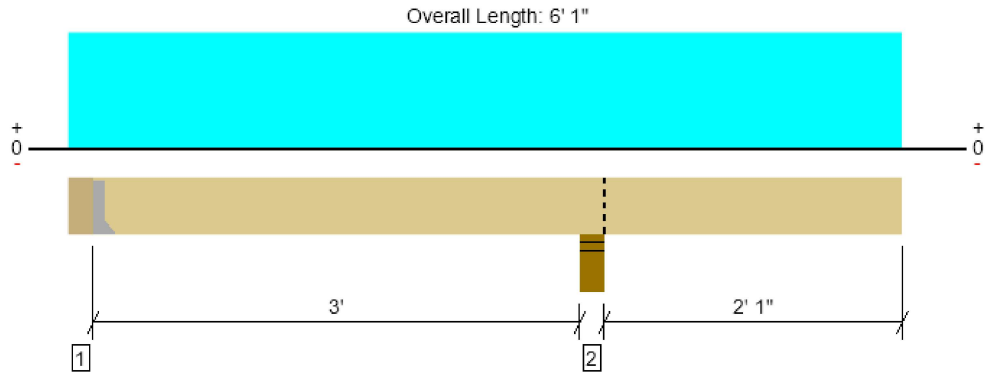
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

3rd Floor Framing, Deck Cantilever Ledger 2'

2 piece(s) 2 x 12 HF No.2



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)	855 @ 6"	1823 (1.50")	Passed (47%)	--	1.0 D + 1.0 L (Alt Spans)
Shear (lbs)	814 @ 2' 6 3/4"	3375	Passed (24%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-1738 @ 3' 9"	4482	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.017 @ 6' 1"	0.200	Passed (2L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.023 @ 6' 1"	0.233	Passed (2L/999+)	--	1.0 D + 1.0 L (Alt Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (0.2") and TL (2L/240).
- Right cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 1/4" HF beam	6.00"	Hanger[1]	1.50"	277	893/-142	1170	See note [1]
2 - Stud wall - HF	6.00"	6.00"	2.52"	1048	2014	3062	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)	5' 7" o/c	
Bottom Edge (Lu)	5' 7" 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	LUS28-2	2.00"	N/A	6-10d	3-10d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	6" to 6' 1"	N/A	8.6	--	
1 - Uniform (PSF)	0 to 6' 1" (Front)	7'	30.0	60.0	Default Load

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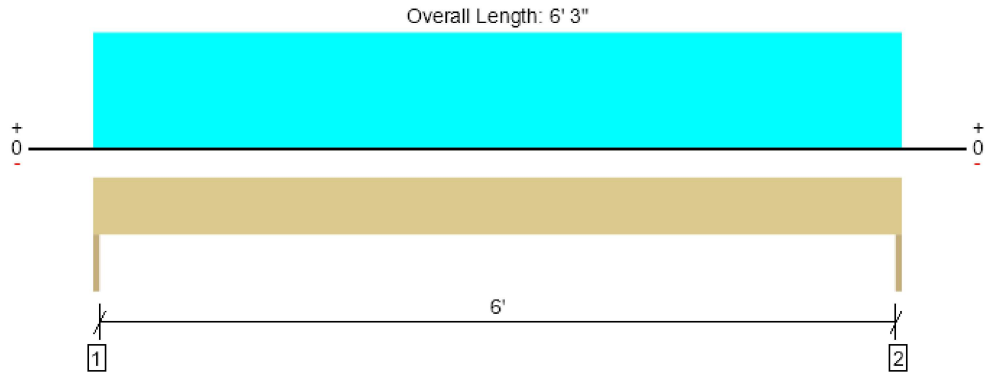
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

3rd Floor Framing, 6' Window Header

1 piece(s) 4 x 10 DF No.2



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)	478 @ 0	3281 (1.50")	Passed (15%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	341 @ 10 3/4"	3885	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	746 @ 3' 1 1/2"	4492	Passed (17%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.002 @ 3' 1 1/2"	0.208	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.014 @ 3' 1 1/2"	0.313	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	394	83	478	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	394	83	478	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 3" o/c	
Bottom Edge (Lu)	6' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 6' 3"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 6' 3"	8"	15.0	40.0	Floor
2 - Uniform (PLF)	0 to 6' 3"	N/A	108.0	-	Wall

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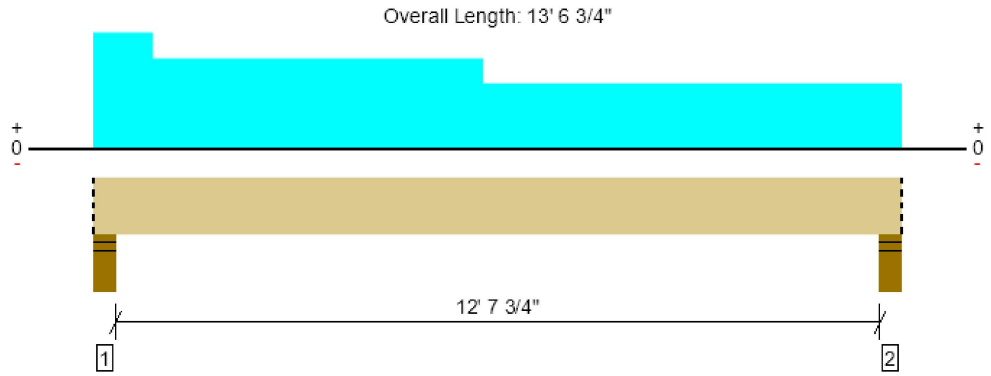
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

3rd Floor Framing, Grid 2.6 (F-G.5) Flush Beam

1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	7234 @ 4"	12251 (5.50")	Passed (59%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	5329 @ 1' 5 3/8"	11539	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	19626 @ 6' 3 5/8"	25853	Passed (76%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.238 @ 6' 8 3/8"	0.322	Passed (L/650)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.424 @ 6' 8 3/8"	0.645	Passed (L/365)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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' 10 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	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	3.25"	3162	4072	7234	Blocking
2 - Stud wall - HF	5.50"	5.50"	2.63"	2574	3289	5863	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)	13' 7" o/c	
Bottom Edge (Lu)	13' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 13' 6 3/4"	N/A	15.9	--	
1 - Uniform (PSF)	0 to 1' (Front)	19' 11 1/2"	30.0	40.0	Default Load
2 - Uniform (PSF)	1' to 6' 6 1/2" (Front)	15' 5 1/2"	30.0	40.0	Default Load
3 - Uniform (PSF)	6' 6 1/2" to 13' 6 3/4" (Front)	11' 2"	30.0	40.0	Default Load

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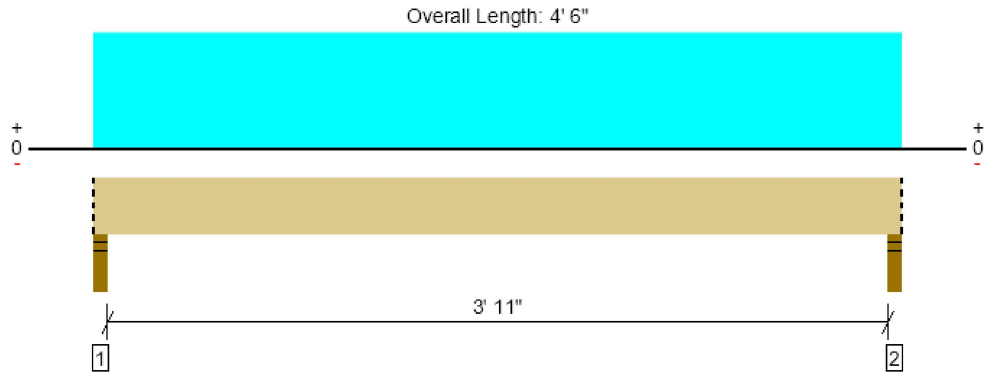
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

3rd Floor Framing, Grid 2.6 (H-H.8) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	3166 @ 2"	4961 (3.50")	Passed (64%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1363 @ 1' 3 3/8"	7343	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	3054 @ 2' 3"	16452	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.006 @ 2' 3"	0.104	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 2' 3"	0.208	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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' 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.23"	1370	1796	3166	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.23"	1370	1796	3166	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)	4' 6" o/c	
Bottom Edge (Lu)	4' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 6"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 6" (Front)	19' 11 1/2"	30.0	40.0	Default Load

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ForteWEB Software Operator	Job Notes
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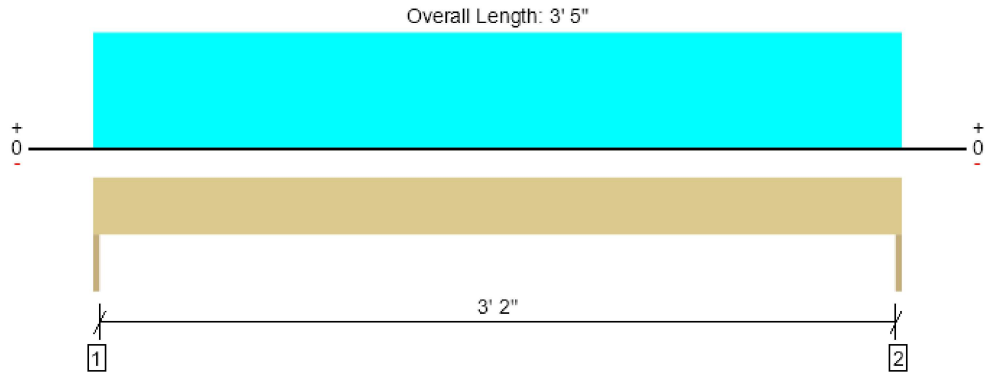
Weyerhaeuser

3rd Floor Framing, Grid 2.4 (H.8-I.8) Door Header

1 piece(s) 4 x 8 DF No.2



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)	1523 @ 0	3281 (1.50")	Passed (46%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	873 @ 8 3/4"	3045	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1301 @ 1' 8 1/2"	2989	Passed (44%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.009 @ 1' 8 1/2"	0.114	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.015 @ 1' 8 1/2"	0.171	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	659	864	1523	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	659	864	1523	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 5" o/c	
Bottom Edge (Lu)	3' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 3' 5"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 3' 5"	12' 7 3/4"	30.0	40.0	Default Load

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ForteWEB Software Operator	Job Notes
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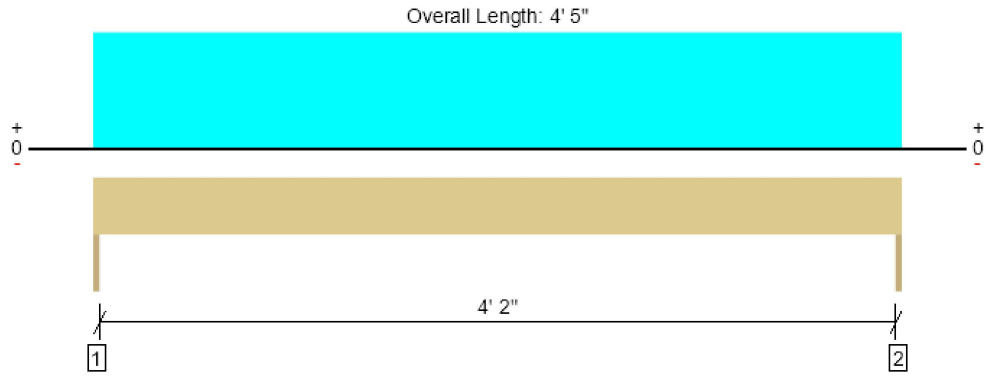
Weyerhaeuser

3rd Floor Framing, Grid 2.4 (J.2-K.8) Door Header

1 piece(s) 4 x 8 DF No.2



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)	1969 @ 0	3281 (1.50")	Passed (60%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1319 @ 8 3/4"	3045	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2174 @ 2' 2 1/2"	2989	Passed (73%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.024 @ 2' 2 1/2"	0.147	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.043 @ 2' 2 1/2"	0.221	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	852	1117	1969	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	852	1117	1969	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 5" o/c	
Bottom Edge (Lu)	4' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 5"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 4' 5"	12' 7 3/4"	30.0	40.0	Default Load

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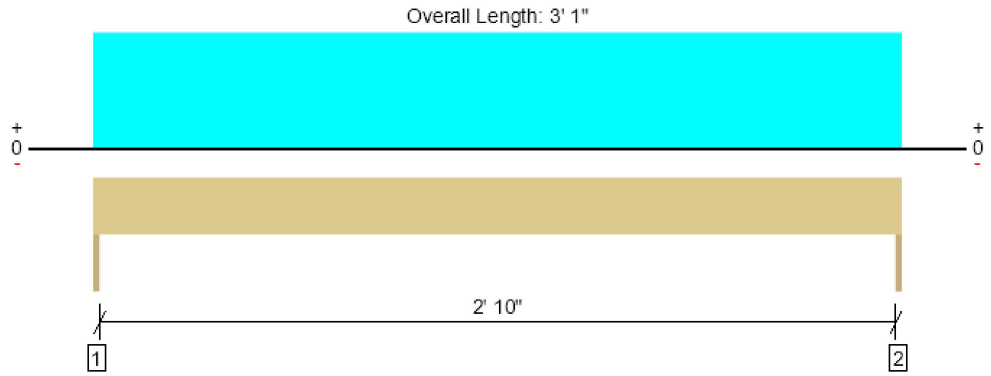
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

3rd Floor Framing, Grid 5.5 (H-H.8) Door Header

1 piece(s) 4 x 8 DF No.2



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)	1116 @ 0	3281 (1.50")	Passed (34%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	588 @ 8 3/4"	3045	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	860 @ 1' 6 1/2"	2989	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.005 @ 1' 6 1/2"	0.103	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.008 @ 1' 6 1/2"	0.154	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	484	632	1116	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	484	632	1116	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 1" o/c	
Bottom Edge (Lu)	3' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 3' 1"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 3' 1"	10' 3"	30.0	40.0	Default Load

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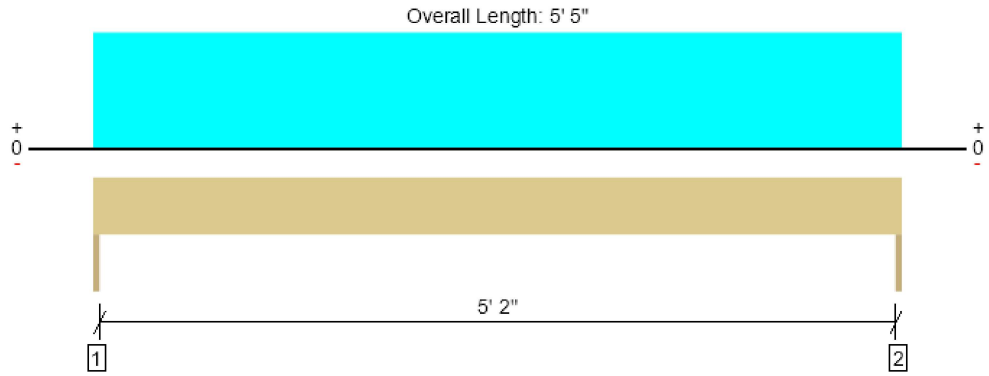
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

3rd Floor Framing, Grid 5.5 (G.4-G.8) Door Header

1 piece(s) 4 x 8 DF No.2



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)	1961 @ 0	3281 (1.50")	Passed (60%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1433 @ 8 3/4"	3045	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2655 @ 2' 8 1/2"	2989	Passed (89%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.045 @ 2' 8 1/2"	0.181	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.079 @ 2' 8 1/2"	0.271	Passed (L/824)	--	1.0 D + 1.0 L (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	850	1110	1961	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	850	1110	1961	None

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 5' 5"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 5' 5"	10' 3"	30.0	40.0	Default Load

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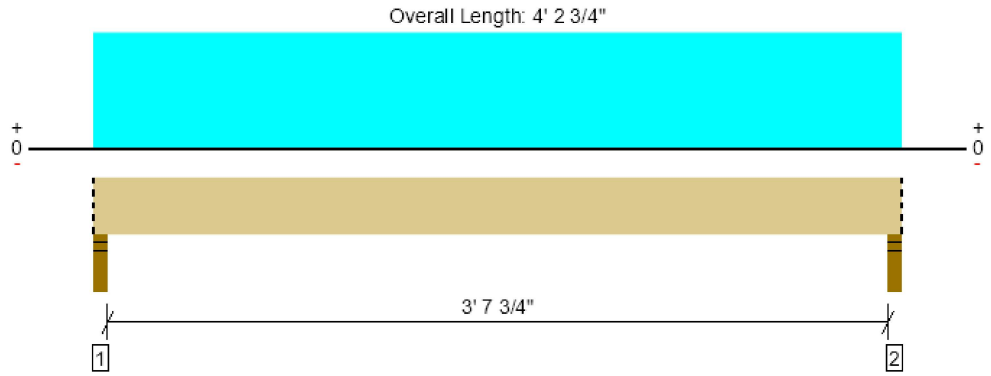
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

3rd Floor Framing, Grid 5.5 (G.1-G.3) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	1539 @ 2"	4961 (3.50")	Passed (31%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	606 @ 1' 3 3/8"	7343	Passed (8%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	1380 @ 2' 1 3/8"	16452	Passed (8%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.002 @ 2' 1 3/8"	0.097	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.004 @ 2' 1 3/8"	0.195	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 = 3' 10 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.50"	672	867	1539	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	672	867	1539	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)	4' 3" o/c	
Bottom Edge (Lu)	4' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 2 3/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 2 3/4" (Front)	10' 3"	30.0	40.0	Default Load

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

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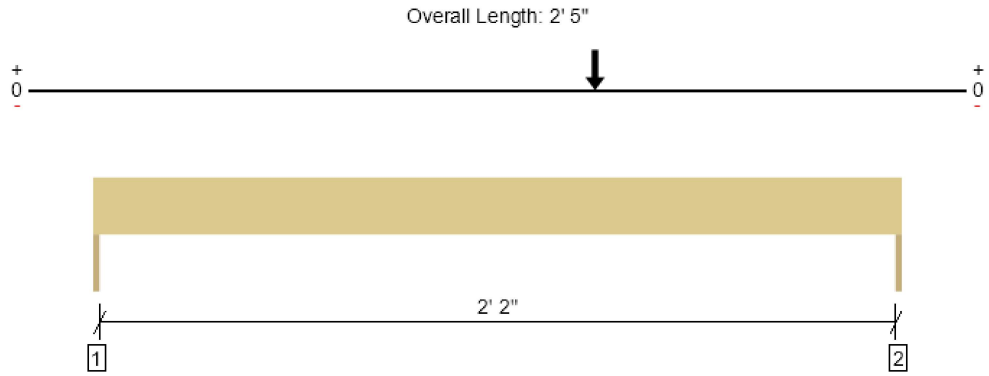
Weyerhaeuser

3rd Floor Framing, Grid G.1 (5.2-5.3) Door Header

1 piece(s) 4 x 8 DF No.2



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)	963 @ 2' 5"	3281 (1.50")	Passed (29%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	958 @ 1' 8 1/4"	3045	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	880 @ 1' 6"	2989	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.002 @ 1' 2 7/8"	0.081	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.004 @ 1' 2 7/8"	0.121	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	263	329	592	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	425	538	963	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	2' 5" o/c	
Bottom Edge (Lu)	2' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 2' 5"	N/A	6.4	--	
1 - Point (lb)	1' 6"	N/A	672	867	Linked from: Grid 5.5 (G.1-G.3) Flush Beam, Support 2

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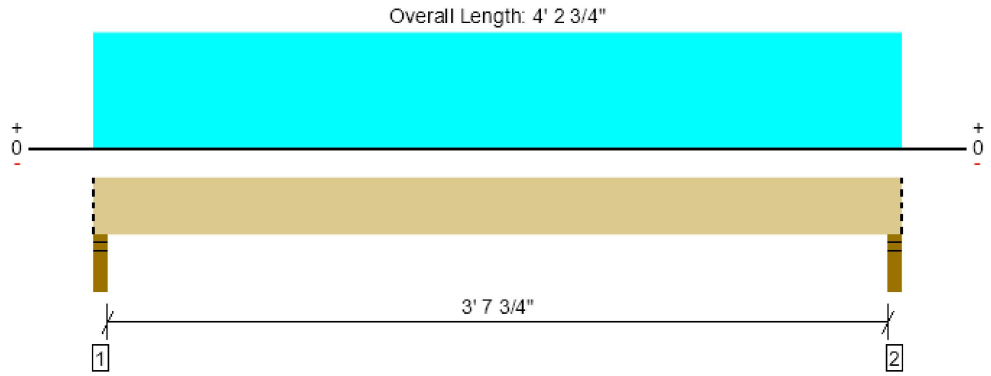
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

3rd Floor Framing, Grid 6 (G.1-G.3) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	1711 @ 2"	4961 (3.50")	Passed (34%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	674 @ 1' 3 3/8"	7343	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	1535 @ 2' 1 3/8"	16452	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.003 @ 2' 1 3/8"	0.097	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.005 @ 2' 1 3/8"	0.195	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 = 3' 10 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.50"	746	966	1711	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	746	966	1711	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)	4' 3" o/c	
Bottom Edge (Lu)	4' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 2 3/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 2 3/4" (Front)	11' 5"	30.0	40.0	Default Load

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

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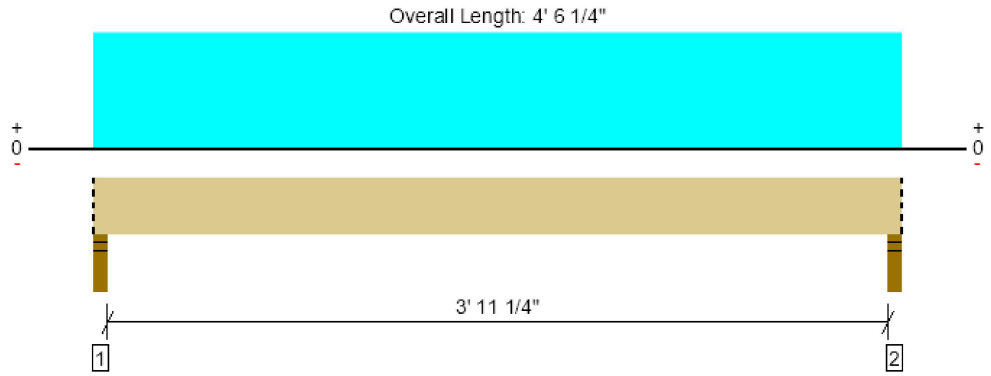
Weyerhaeuser

3rd Floor Framing, Grid 2.5 (D.4-D.6) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	2581 @ 2"	4961 (3.50")	Passed (52%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1118 @ 1' 3 3/8"	7343	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2503 @ 2' 3 1/8"	16452	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.005 @ 2' 3 1/8"	0.105	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.009 @ 2' 3 1/8"	0.209	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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' 2 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.82"	1119	1462	2581	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.82"	1119	1462	2581	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)	4' 6" o/c	
Bottom Edge (Lu)	4' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 6 1/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 6 1/4" (Front)	16' 2"	30.0	40.0	Default Load

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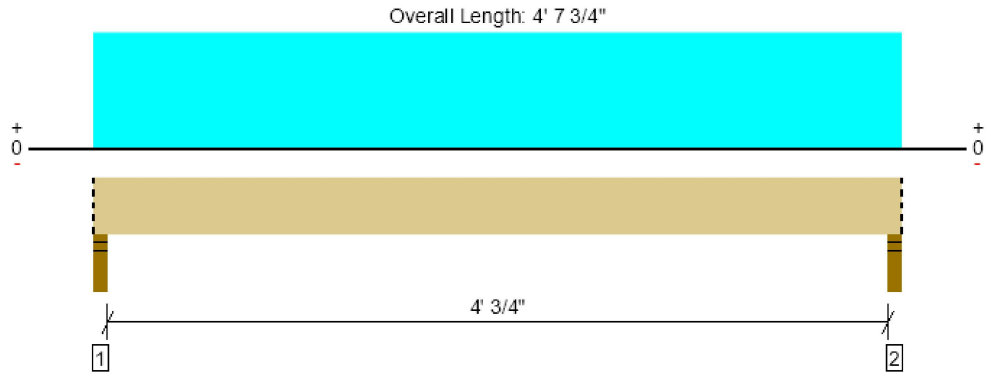
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

3rd Floor Framing, Grid 3.3 (D.8-E.1) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	2151 @ 2"	4961 (3.50")	Passed (43%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	965 @ 1' 3 3/8"	7343	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2153 @ 2' 3 7/8"	16452	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.005 @ 2' 3 7/8"	0.108	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.008 @ 2' 3 7/8"	0.216	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.52"	935	1216	2151	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.52"	935	1216	2151	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)	4' 8" o/c	
Bottom Edge (Lu)	4' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 7 3/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 7 3/4" (Front)	13' 1"	30.0	40.0	Default Load

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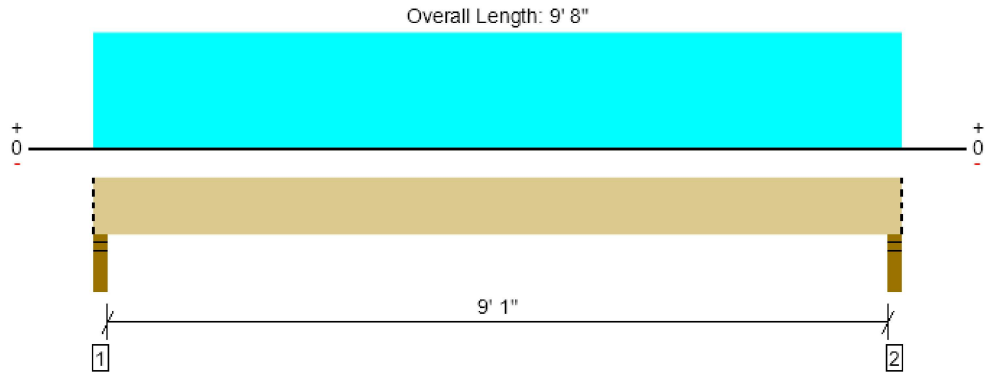
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

3rd Floor Framing, Grid 5.3 (D.5-E.2) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	4475 @ 2"	4961 (3.50")	Passed (90%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3289 @ 1' 3 3/8"	7343	Passed (45%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	10082 @ 4' 10"	16452	Passed (61%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.102 @ 4' 10"	0.233	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.180 @ 4' 10"	0.467	Passed (L/623)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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 = 9' 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.16"	1946	2529	4475	Blocking
2 - Stud wall - HF	3.50"	3.50"	3.16"	1946	2529	4475	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)	9' 8" o/c	
Bottom Edge (Lu)	9' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 9' 8"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 9' 8" (Front)	13' 1"	30.0	40.0	Default Load

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

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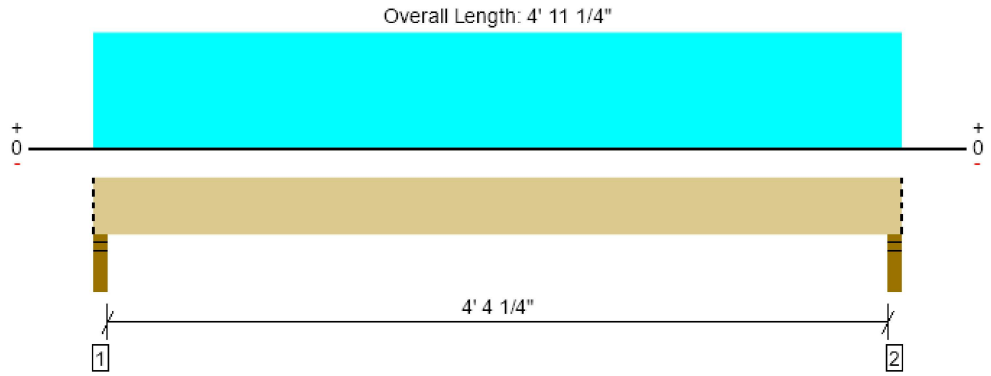
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

3rd Floor Framing, Grid 6 (D.3-D.6) Flush Beam

1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam



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)	2372 @ 2"	4961 (3.50")	Passed (48%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1141 @ 1' 3 3/8"	7343	Passed (16%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2546 @ 2' 5 5/8"	16452	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.006 @ 2' 5 5/8"	0.115	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 2' 5 5/8"	0.230	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) 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' 7 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	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.67"	1031	1341	2372	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.67"	1031	1341	2372	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)	4' 11" o/c	
Bottom Edge (Lu)	4' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 11 1/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 11 1/4" (Front)	13' 7"	30.0	40.0	Default Load

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

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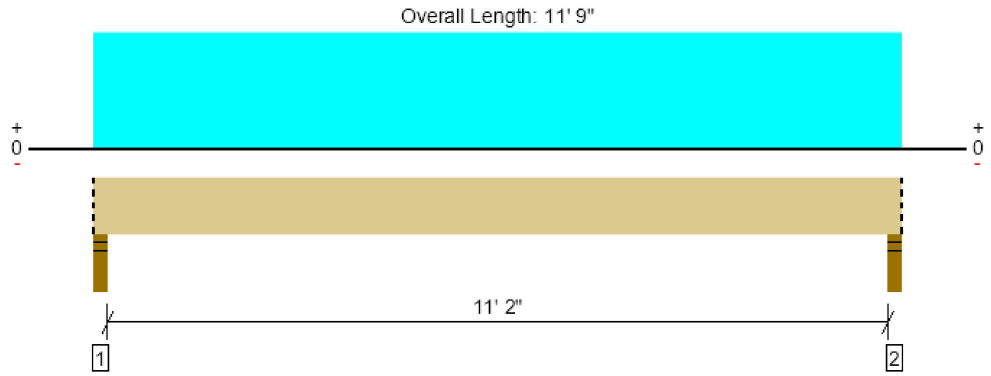
Weyerhaeuser

Roof Framing, Grid I Entry Roof Beam

1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam



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)	4533 @ 2"	4961 (3.50")	Passed (91%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3633 @ 1' 2"	7466	Passed (49%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	12571 @ 5' 10 1/2"	14792	Passed (85%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.240 @ 5' 10 1/2"	0.571	Passed (L/571)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.486 @ 5' 10 1/2"	0.761	Passed (L/282)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0.25/12

- 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 = 11' 5".
- 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	Snow	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.20"	2293	2240	4533	Blocking
2 - Stud wall - HF	3.50"	3.50"	3.20"	2293	2240	4533	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)	11' 9" o/c	
Bottom Edge (Lu)	11' 9" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 11' 9"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 11' 9" (Front)	15' 3"	25.0	25.0	Default Load

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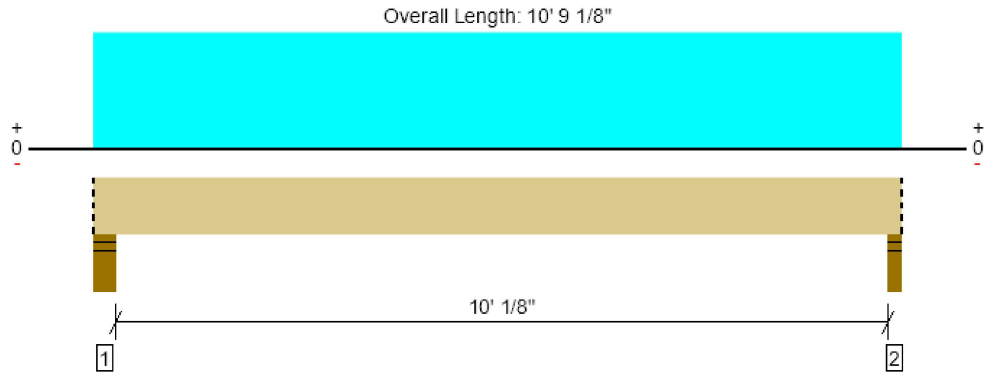
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Grid L 10' Deck Roof Beam

1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam



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)	4992 @ 10' 7 1/8"	4961 (3.50")	Passed (101%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3893 @ 1' 4"	7466	Passed (52%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	12402 @ 5' 5 9/16"	14792	Passed (84%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.192 @ 5' 5 9/16"	0.513	Passed (L/643)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.387 @ 5' 5 9/16"	0.684	Passed (L/318)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0.25/12

- 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' 3 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	Snow	Factored	
1 - Stud wall - HF	5.50"	5.50"	3.63"	2600	2550	5149	Blocking
2 - Stud wall - HF	3.50"	3.50"	3.52"	2520	2472	4992	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)	10' 9" o/c	
Bottom Edge (Lu)	10' 9" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 10' 9 1/8"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 10' 9 1/8" (Front)	18' 8"	25.0	25.0	Default Load

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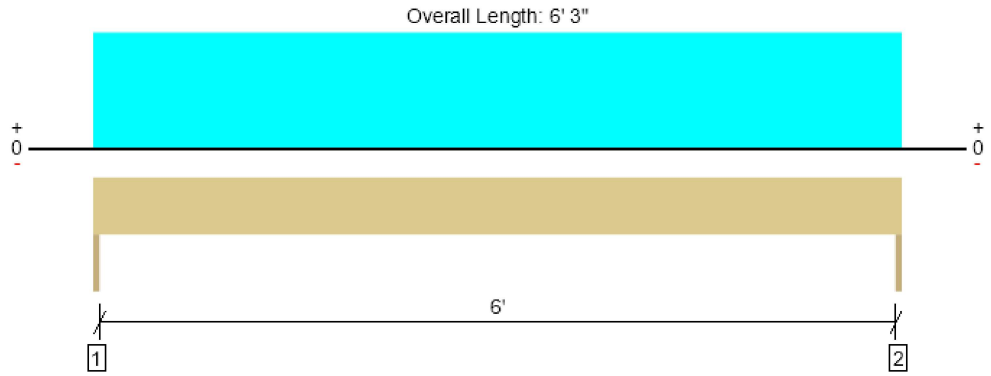
Roof Framing, 6' Window Header

1 piece(s) 4 x 10 DF No.2



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)	2956 @ 0	3281 (1.50")	Passed (90%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2108 @ 10 3/4"	4468	Passed (47%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	4618 @ 3' 1 1/2"	5166	Passed (89%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.044 @ 3' 1 1/2"	0.208	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.088 @ 3' 1 1/2"	0.313	Passed (L/853)	--	1.0 D + 1.0 S (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	1491	1465	2956	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	1491	1465	2956	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 3" o/c	
Bottom Edge (Lu)	6' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 6' 3"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 6' 3"	18' 9"	25.0	25.0	Default Load

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

ForteWEB Software Operator	Job Notes
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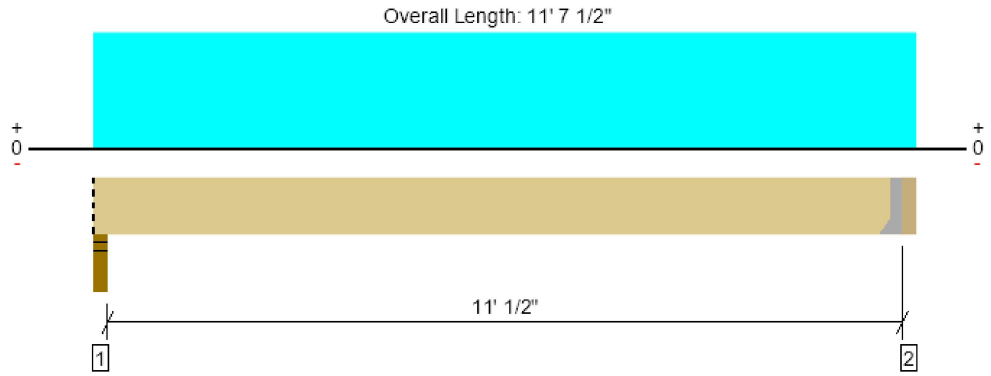
Weyerhaeuser

Roof Framing, Grid B 11' Deck Roof Beam

1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam



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)	4622 @ 11' 4"	4622 (2.03")	Passed (100%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3898 @ 10' 5 1/2"	7466	Passed (52%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	12904 @ 5' 9"	14792	Passed (87%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.236 @ 5' 9"	0.558	Passed (L/569)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.477 @ 5' 9"	0.745	Passed (L/281)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0.25/12

- 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 = 11' 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	Snow	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.36"	2406	2354	4760	Blocking
2 - Hanger on 10 1/2" GLB beam	3.50"	Hanger[1]	2.03"	2456	2405	4861	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)	11' 4" o/c	
Bottom Edge (Lu)	11' 4" 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	Connector not found	N/A	N/A	N/A	N/A	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 11' 4"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 11' 7 1/2" (Front)	16' 4 1/2"	25.0	25.0	Default Load

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

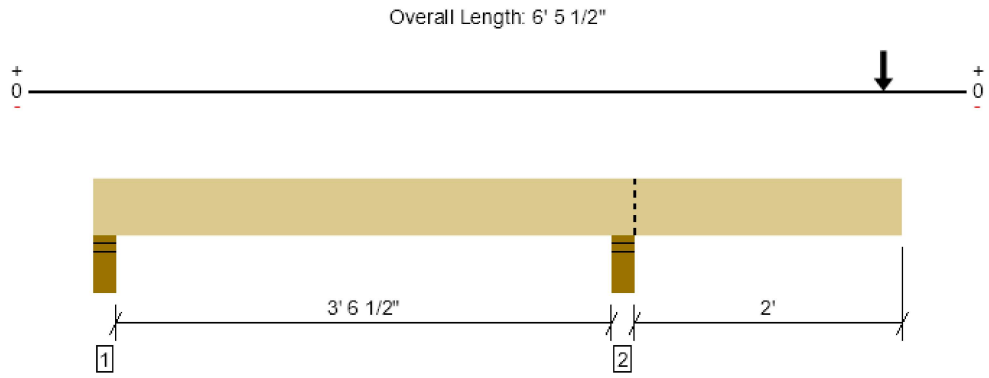
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

Roof Framing, Deck Roof Cantilever Beam

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

An excessive uplift of -2576 lbs at support located at 4" failed this product. Uplift resisted by (2) ST6215 straps



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)	7528 @ 4' 2 3/4"	12254 (5.50")	Passed (61%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	4877 @ 5' 4"	11733	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	0 @ N/A	N/A	Passed (N/A)	--	N/A
Neg Moment (Ft-lbs)	-10162 @ 4' 2 3/4"	17918	Passed (57%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.041 @ 6' 5 1/2"	0.223	Passed (2L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.082 @ 6' 5 1/2"	0.297	Passed (2L/648)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0.25/12

- 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 negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 6' 1 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	Snow	Factored	
1 - Stud wall - HF	5.50"	5.50"	1.50"	-1290	-1286	-2576	None
2 - Stud wall - HF	5.50"	5.50"	3.38"	3837	3691	7528	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)	6' 6" o/c	
Bottom Edge (Lu)	6' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 6' 5 1/2"	N/A	14.0	--	
1 - Point (lb)	6' 3 3/4" (Front)	N/A	2456	2405	Linked from: Grid A 14' Deck Roof Beam, Support 2

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ASDIP Foundation 4.8.2.1 **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	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

Gross Allow. Soil Pressure	2.0	ksf	
Soil Pressure at Corner 1	1.5	ksf	
Soil Pressure at Corner 2	1.5	ksf	
Soil Pressure at Corner 3	1.5	ksf	
Soil Pressure at Corner 4	1.5	ksf	
Bearing Pressure Ratio	0.77		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	4.4	13.7	0.0	0.0	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 * 3.50 * 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 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 * 4.4 + 0.6 * 0.0 = 2.6 kip

  Arm = *W / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 2.6 * 1.75 = 4.6 k-ft
- Resisting moment X-X = 1.3 + 0.0 + 0.0 + 4.6 + -0.5 = 5.4 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{5.4}{0.0}$ = 53.71 > 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

Arm = *L / 2 =* 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 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 * 4.4 + 0.6 * 0.0 = 2.6 kip

Arm = *L / 2 - Offset =* 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 2.6 * 1.75 = 4.6 k-ft

- Resisting moment Z-Z = 1.3 + 0.0 + 0.0 + 4.6 + -0.5 = 5.4 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{5.4}{0.0}$ = 53.71 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 2.1 + 0.0 + 0.0 + -0.9 + 31.7 = 32.9 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 2.1 + 0.0 + 0.0 + -0.9 + 31.7 = 32.9 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 1.2 + 0.0 + 0.0 - 0.5 + 18.1 = 18.8 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{32.9 - 0.0}{18.8} = 1.75 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{32.9 - 0.0}{18.8} = 1.75 \text{ ft}$$

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:

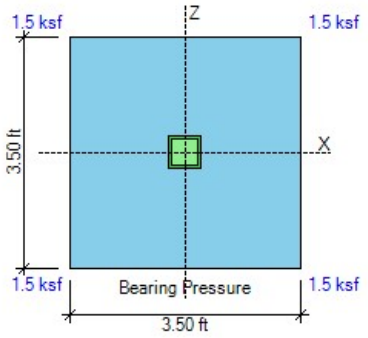
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 18.8 * (1 / 12.3 + 0.00 / 7.1 + 0.00 / 7.1) = 1.54 ksf

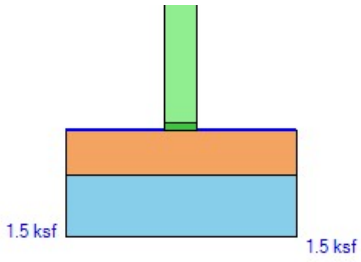
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 18.8 * (1 / 12.3 - 0.00 / 7.1 + 0.00 / 7.1) = 1.54 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 18.8 * (1 / 12.3 - 0.00 / 7.1 - 0.00 / 7.1) = 1.54 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 18.8 * (1 / 12.3 + 0.00 / 7.1 - 0.00 / 7.1) = 1.54 ksf

ASDIP Foundation 4.8.2.1 **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 * (0.00 + 8.0 / 12 / 2) = 0.16 ksf

X-Passive force = *Pressure * Thick * Width* = 0.16 * 8.0 / 12 * 3.50 = 0.4 kip

Z-Passive force = *Pressure * Thick * Length* = 0.16 * 8.0 / 12 * 3.50 = 0.4 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 3.1 * 0.35) = 1.1 kip

Use 100% of Passive + 100% of Friction for sliding resistance

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 0.4 + 1.00 * 1.1}{0.0}$ = 14.44 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 0.4 + 1.00 * 1.1}{0.0}$ = 14.44 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.7 + 0.0 - 0.3}{0.0}$ = 99.99 > 1.00 OK

ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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

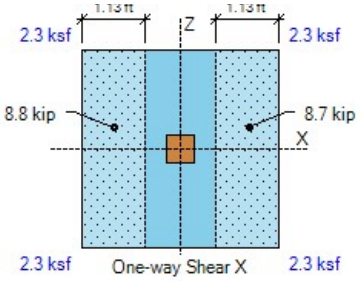
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

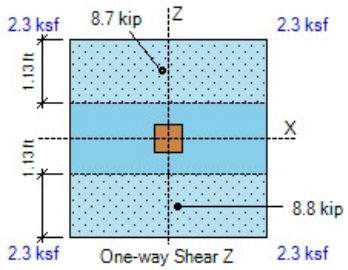
One-way shear Vux (- Side) = 8.8 kip < 15.0 kip OK

One-way shear Vux (+ Side) = 8.7 kip < 15.0 kip OK

One-way shear Vuz (- Side) = 8.8 kip < 13.4 kip OK

One-way shear Vuz (+ Side) = 8.7 kip < 13.4 kip OK





FLEXURE CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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 5 #4 Z-Bars *ρ = As / b d* = 1.0 / (3.50 * 12 * 4.3) = 0.0056 — q = 0.0056 * 40 / 2.5 = 0.090

Use 5 #4 X-Bars *ρ = As / b d* = 1.0 / (3.50 * 12 * 4.8) = 0.0050 — q = 0.0050 * 40 / 2.5 = 0.080

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 * 0.090 * (1 - 0.59 * 0.090) = 12.1 k-ft

ϕMnz = 0.90 * 3.50 * 12 * 4.8² * 2.5 * 0.080 / 1.00 * (1 - 0.59 * 0.080 / 1.00) = 13.6 k-ft

- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

Bottom moment Mux (- Side) = 8.8 k-ft < 12.1 k-ft OK ratio = 0.73

Bottom moment Mux (+ Side) = 8.8 k-ft < 12.1 k-ft OK ratio = 0.73

Bottom moment Muz (- Side) = 8.8 k-ft < 13.6 k-ft OK ratio = 0.65

Bottom moment Muz (+ Side) = 8.8 k-ft < 13.6 k-ft OK ratio = 0.65

X-As min = *0.0018 * Width * Thick* = 0.0018 * 3.50 * 12 * 8.0 = 0.6 in² < 1.0 in² OK — ACI 8.6.1.1

Z-As min = *0.0018 * Length * Thick* = 0.0018 * 3.50 * 12 * 8.0 = 0.6 in² < 1.0 in² OK — ACI 8.6.1.1

X-As max for 0.005 tension strain = 3.20 in² > 1.00 in² OK — ACI 21.2.2

Z-As max for 0.005 tension strain = 3.20 in² > 1.00 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, 9.0 / 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 * 0.65) = 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 * 0.65) = 6.0 in

-X Ld provided = *(Length - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+X Ld provided = *(Length - Col) / 2 - Offset - Cover* = 3.50 * 12 / 2 - 0.0 - 6.0 / 2 - 2.5 = 15.5 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, 9.0 / 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 * 0.65) = 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

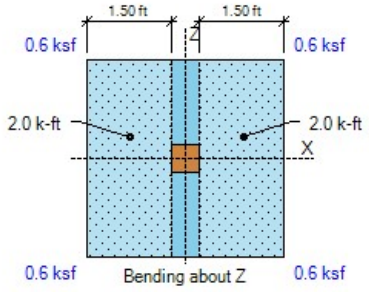
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.73) = 6.0 in

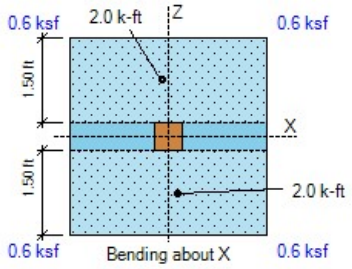
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+Z Ld provided = *(Width - Col) / 2 - Offset - Cover* = 3.50 * 12 / 2 - 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

X-bar spacing = 9.0 in < Min (3 * t, 18.0) = 18.0 in OK ACI 7.7.2.3

Z-bar spacing = 9.0 in < Min (3 * t, 18.0) = 18.0 in OK





LOAD TRANSFER CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

Area *A1 = col L * col W* = 6.0 * 6.0 = 36.0 in²

Sx = *col W * col L² / 6* = 6.0 * 6.0² / 6 = 36.0 in³

Sz = *col L * col W² / 6* = 6.0 * 6.0² / 6 = 36.0 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz* = 27.2 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.8 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 - 6.0 / 2, 3.50 * 12 / 2 - 0.0 - 6.0 / 2 = 18.0 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, (6.0 + 2 * 18.0) * (6.0 + 2 * 18.0)] = 1764.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)]* = 0.65 * 0.85 * 2.5 * Min [2, √(1764.0 / 36.0)] = 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 * 0.13) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 23.5 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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* = 6.0 / 6.0 = 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 * (6.0 + 4.5 / 2 + 2.3) + 20 / 10 * (6.0 + 4.5 / 2 + 2.3) = 42.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (6.0 + 4.5 / 2 + 2.3) * (6.0 + 4.5 / 2 + 2.3) = 110.3 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 / 42.0 + 2, 4) * √(2500) = 150.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 27.2 + 0.07 * 110.3 / 144 - 1.8 = 25.5 kip

b1 = *L + d / 2 + X-Edge* = 6.0 + 4.5 / 2 + 2.3 = 10.5 in b2 = *W + d / 2 + Z-Edge* = 6.0 + 4.5 / 2 + 2.3 = 10.5 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(10.5 / 10.5)}} = 0.40$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(10.5 / 10.5)}} = 0.40$ ACI Eq. (8.4.2.3.2)

X2z = *b1 / 2* = 10.5 / 2 = 5.3 in X2x = *b2 / 2* = 10.5 / 2 = 5.3 in

Jcz = *b1 * d³ / 6 + b1³ * d / 6 + b1² * b2 * d / 2* ACI R8.4.4.2.3

Jcz = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

Jcx = *b2 * d³ / 6 + b2³ * d / 6 + b2² * b1 * d / 2* ACI R8.4.4.2.3

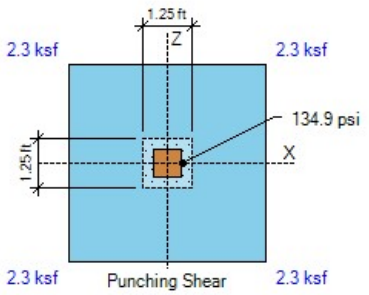
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

Stress due to P = *F / (bo * d) * 1000* = 25.5 / (42.0 * 4.5) * 1000 = 134.9 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

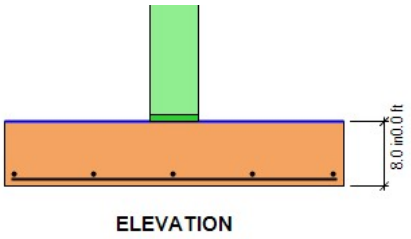
Punching stress = *P-stress + Mx-stress + Mz-stress* = 134.9 + 0.0 + 0.0 = 134.9 psi < 150.0 psi OK



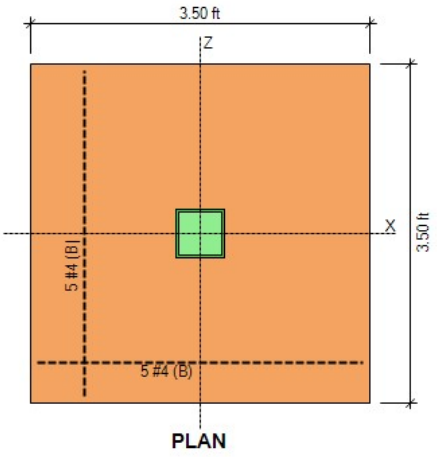
ASDIP Foundation 4.8.2.1 **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

DESIGN CODES

Concrete Design	ACI 318-14
Load Combinations	ASCE 7-10/16



ELEVATION



PLAN

ASDIP Foundation 4.8.2.1 **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	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

Gross Allow. Soil Pressure	2.0	ksf	
Soil Pressure at Corner 1	1.5	ksf	
Soil Pressure at Corner 2	1.5	ksf	
Soil Pressure at Corner 3	1.5	ksf	
Soil Pressure at Corner 4	1.5	ksf	
Bearing Pressure Ratio	0.76		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	8.0	5.2	0.0	0.0	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 * 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft Moment = 0.0 * 1.50 = 0.0 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 * 8.0 + 0.6 * 0.0 = 4.8 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft Moment = 4.8 * 1.50 = 7.2 k-ft
- Resisting moment X-X = 0.8 + 0.0 + 0.0 + 7.2 + -0.3 = 7.7 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{7.7}{0.0}$ = 76.73 > 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

Arm = *L / 2* = 3.00 / 2 = 1.50 ft Moment = 0.0 * 1.50 = 0.0 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 * 8.0 + 0.6 * 0.0 = 4.8 kip

Arm = *L / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft Moment = 4.8 * 1.50 = 7.2 k-ft

- Resisting moment Z-Z = 0.8 + 0.0 + 0.0 + 7.2 + -0.3 = 7.7 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{7.7}{0.0}$ = 76.73 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 1.4 + 0.0 + 0.0 + -0.6 + 19.8 = 20.6 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 1.4 + 0.0 + 0.0 + -0.6 + 19.8 = 20.6 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 0.9 + 0.0 + 0.0 - 0.4 + 13.2 = 13.7 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{20.6 - 0.0}{13.7} = 1.50 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{20.6 - 0.0}{13.7} = 1.50 \text{ ft}$$

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:

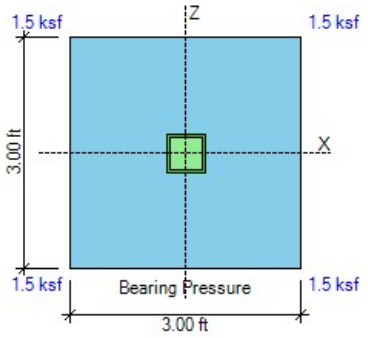
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 13.7 * (1 / 9.0 + 0.00 / 4.5 + 0.00 / 4.5) = 1.53 ksf

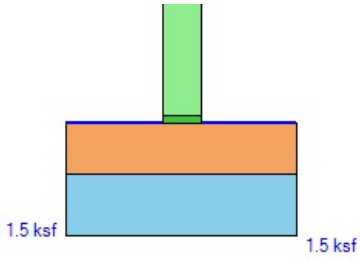
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 13.7 * (1 / 9.0 - 0.00 / 4.5 + 0.00 / 4.5) = 1.53 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 13.7 * (1 / 9.0 - 0.00 / 4.5 - 0.00 / 4.5) = 1.53 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 13.7 * (1 / 9.0 + 0.00 / 4.5 - 0.00 / 4.5) = 1.53 ksf

ASDIP Foundation 4.8.2.1 **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 * (0.00 + 8.0 / 12 / 2) = 0.16 ksf

X-Passive force = *Pressure * Thick * Width* = 0.16 * 8.0 / 12 * 3.00 = 0.3 kip

Z-Passive force = *Pressure * Thick * Length* = 0.16 * 8.0 / 12 * 3.00 = 0.3 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 5.1 * 0.35) = 1.8 kip

Use 100% of Passive + 100% of Friction for sliding resistance

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 0.3 + 1.00 * 1.8}{0.0}$ = 21.08 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 0.3 + 1.00 * 1.8}{0.0}$ = 21.08 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.5 + 0.0 - 0.2}{0.0}$ = 99.99 > 1.00 OK

ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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

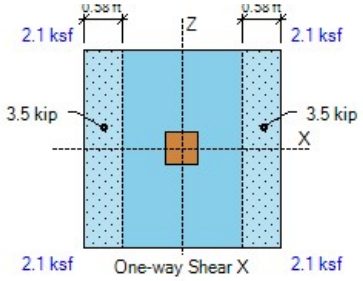
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

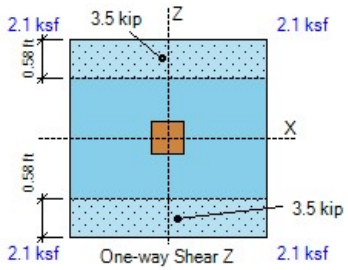
One-way shear Vux (- Side) = 3.5 kip < 11.5 kip OK

One-way shear Vux (+ Side) = 3.5 kip < 11.5 kip OK

One-way shear Vuz (- Side) = 3.5 kip < 11.5 kip OK

One-way shear Vuz (+ Side) = 3.5 kip < 11.5 kip OK





FLEXURE CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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

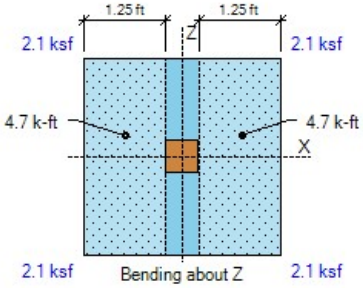
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

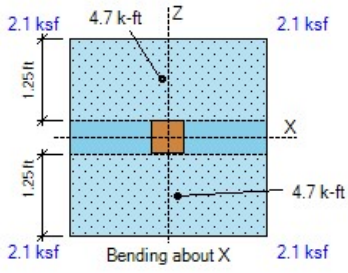
Bottom moment Mux (- Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.97

Bottom moment Mux (+ Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.98

Bottom moment Muz (- Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.97

Bottom moment Muz (+ Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.98





LOAD TRANSFER CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

Area *A1 = col L * col W =* 6.0 * 6.0 = 36.0 in²

Sx = *col W * col L² / 6 =* 6.0 * 6.0² / 6 = 36.0 in³

Sz = *col L * col W² / 6 =* 6.0 * 6.0² / 6 = 36.0 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz =* 17.9 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.5 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 - 6.0 / 2, 3.00 * 12 / 2 - 0.0 - 6.0 / 2 = 15.0 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, (6.0 + 2 * 15.0) * (6.0 + 2 * 15.0)] = 1296.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)] =* 0.65 * 0.85 * 2.5 * Min [2, √(1296.0 / 36.0)] = 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 * 0.09) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 15.5 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

X-Edge = *Length / 2 - Offset - Col / 2* = 3.00 * 12 / 2 - 0.0 - 6.0 / 2 = 15.0 in αsx = 10

Z-Edge = *Width / 2 - Offset - Col / 2* = 3.00 * 12 / 2 - 0.0 - 6.0 / 2 = 15.0 in αsz = 10

αs = *αsx + αsz* = 10 + 10 = 20 Col type = Corner β = *L / W* = 6.0 / 6.0 = 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 * (6.0 + 8.0 / 2 + 15.0) + 10 / 10 * (6.0 + 8.0 / 2 + 15.0) = 50.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (6.0 + 8.0 / 2 + 15.0) * (6.0 + 8.0 / 2 + 15.0) = 625.0 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 = 17.9 + 0.07 * 625.0 / 144 - 2.8 = 15.4 kip

b1 = *L + d / 2 + X-Edge* = 6.0 + 8.0 / 2 + 15.0 = 25.0 in b2 = *W + d / 2 + Z-Edge* = 6.0 + 8.0 / 2 + 15.0 = 25.0 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(25.0 / 25.0)}} = 0.40$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(25.0 / 25.0)}} = 0.40$ ACI Eq. (8.4.2.3.2)

X2z = $b1^2 / 2 / (b1 + b2)$ = 25.0² / 2 / (25.0 + 25.0) = 6.3 in X2x = $b2^2 / 2 / (b2 + b1)$ = 6.3 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 = 25.0 * 8.0³ / 12 + 25.0³ * 8.0 / 12 + 25.0 * 8.0 * (25.0 / 2 * 6.3)² + 25.0 * 8.0 * 6.3² = 27108 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

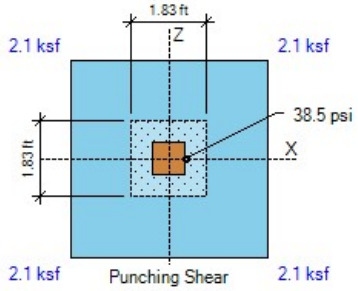
Jcz = 25.0 * 8.0³ / 12 + 25.0³ * 8.0 / 12 + 25.0 * 8.0 * (25.0 / 2 * 6.3)² + 25.0 * 8.0 * 6.3² = 27108 in⁴

Stress due to P = *F / (bo * d) * 1000* = 15.4 / (50.0 * 8.0) * 1000 = 38.5 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 6.3 / 27108 * 1000 = 0.0 psi

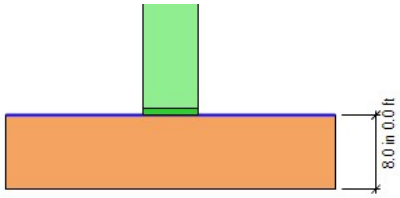
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 6.3 / 27108 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 38.5 + 0.0 + 0.0 = 38.5 psi < 80.0 psi OK

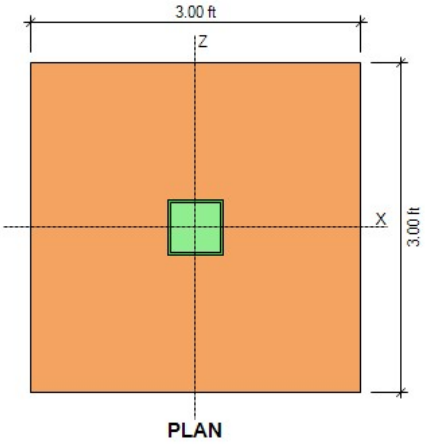


DESIGN CODES

Concrete Design	ACI 318-14
Load Combinations	ASCE 7-10/16



ELEVATION



PLAN

ASDIP Foundation 4.8.2.1 **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	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

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	0.89		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	5.2	16.0	0.0	0.0	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 * 3.50 * 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 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 * 5.2 + 0.6 * 0.0 = 3.1 kip

  Arm = *W / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 3.1 * 1.75 = 5.5 k-ft
- Resisting moment X-X = 1.3 + 0.0 + 0.0 + 5.5 + -0.5 = 6.2 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{6.2}{0.0}$ = 62.11 > 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

Arm = *L / 2* = 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 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 * 5.2 + 0.6 * 0.0 = 3.1 kip

Arm = *L / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 3.1 * 1.75 = 5.5 k-ft

- Resisting moment Z-Z = 1.3 + 0.0 + 0.0 + 5.5 + -0.5 = 6.2 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{6.2}{0.0}$ = 62.11 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 2.1 + 0.0 + 0.0 + -0.9 + 37.1 = 38.4 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 2.1 + 0.0 + 0.0 + -0.9 + 37.1 = 38.4 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 1.2 + 0.0 + 0.0 - 0.5 + 21.2 = 21.9 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{38.4 - 0.0}{21.9} = 1.75 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{38.4 - 0.0}{21.9} = 1.75 \text{ ft}$$

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:

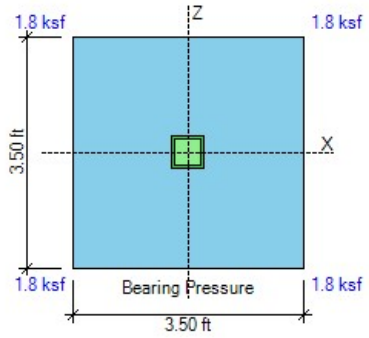
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 21.9 * (1 / 12.3 + 0.00 / 7.1 + 0.00 / 7.1) = 1.79 ksf

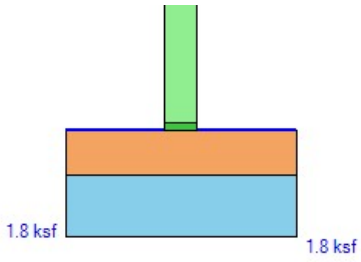
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 21.9 * (1 / 12.3 - 0.00 / 7.1 + 0.00 / 7.1) = 1.79 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 21.9 * (1 / 12.3 - 0.00 / 7.1 - 0.00 / 7.1) = 1.79 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 21.9 * (1 / 12.3 + 0.00 / 7.1 - 0.00 / 7.1) = 1.79 ksf

ASDIP Foundation 4.8.2.1 **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 * (0.00 + 8.0 / 12 / 2) = 0.16 ksf

X-Passive force = *Pressure * Thick * Width* = 0.16 * 8.0 / 12 * 3.50 = 0.4 kip

Z-Passive force = *Pressure * Thick * Length* = 0.16 * 8.0 / 12 * 3.50 = 0.4 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 3.5 * 0.35) = 1.2 kip

Use 100% of Passive + 100% of Friction for sliding resistance

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 0.4 + 1.00 * 1.2}{0.0}$ = 16.12 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 0.4 + 1.00 * 1.2}{0.0}$ = 16.12 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.7 + 0.0 - 0.3}{0.0}$ = 99.99 > 1.00 OK

ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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

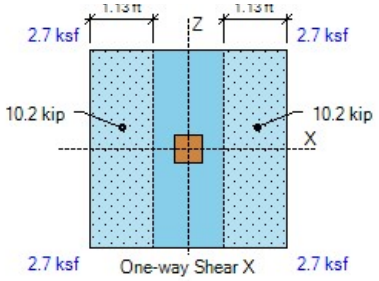
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

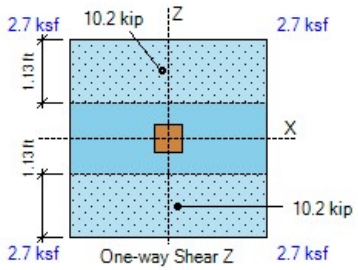
One-way shear Vux (- Side) = 10.2 kip < 15.0 kip OK

One-way shear Vux (+ Side) = 10.2 kip < 15.0 kip OK

One-way shear Vuz (- Side) = 10.2 kip < 13.4 kip OK

One-way shear Vuz (+ Side) = 10.2 kip < 13.4 kip OK





FLEXURE CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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 5 #4 Z-Bars *ρ = As / b d* = 1.0 / (3.50 * 12 * 4.3) = 0.0056 q = 0.0056 * 40 / 2.5 = 0.090

Use 5 #4 X-Bars *ρ = As / b d* = 1.0 / (3.50 * 12 * 4.8) = 0.0050 q = 0.0050 * 40 / 2.5 = 0.080

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 * 0.090 * (1 - 0.59 * 0.090) = 12.1 k-ft

ϕMnz = 0.90 * 3.50 * 12 * 4.8² * 2.5 * 0.080 / 1.00 * (1 - 0.59 * 0.080 / 1.00) = 13.6 k-ft

- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

Bottom moment Mux (- Side) = 10.3 k-ft < 12.1 k-ft OK ratio = 0.85

Bottom moment Mux (+ Side) = 10.3 k-ft < 12.1 k-ft OK ratio = 0.85

Bottom moment Muz (- Side) = 10.3 k-ft < 13.6 k-ft OK ratio = 0.76

Bottom moment Muz (+ Side) = 10.3 k-ft < 13.6 k-ft OK ratio = 0.76

X-As min = *0.0018 * Width * Thick* = 0.0018 * 3.50 * 12 * 8.0 = 0.6 in² < 1.0 in² OK ACI 8.6.1.1

Z-As min = *0.0018 * Length * Thick* = 0.0018 * 3.50 * 12 * 8.0 = 0.6 in² < 1.0 in² OK ACI 8.6.1.1

X-As max for 0.005 tension strain = 3.20 in² > 1.00 in² OK ACI 21.2.2

Z-As max for 0.005 tension strain = 3.20 in² > 1.00 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, 9.0 / 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 * 0.76) = 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 * 0.76) = 6.0 in

-X Ld provided = *(Length - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+X Ld provided = *(Length - Col) / 2 - Offset - Cover* = 3.50 * 12 / 2 - 0.0 - 6.0 / 2 - 2.5 = 15.5 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, 9.0 / 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 * 0.76) = 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

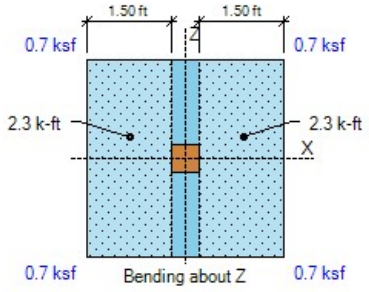
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.85) = 6.0 in

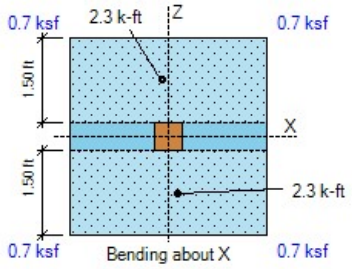
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+Z Ld provided = *(Width - Col) / 2 - Offset - Cover* = 3.50 * 12 / 2 - 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

X-bar spacing = 9.0 in < Min (3 * t, 18.0) = 18.0 in OK ACI 7.7.2.3

Z-bar spacing = 9.0 in < Min (3 * t, 18.0) = 18.0 in OK





LOAD TRANSFER CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

Area *A1 = col L * col W* = 6.0 * 6.0 = 36.0 in²

Sx = *col W * col L² / 6* = 6.0 * 6.0² / 6 = 36.0 in³

Sz = *col L * col W² / 6* = 6.0 * 6.0² / 6 = 36.0 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz* = 31.8 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.9 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 - 6.0 / 2, 3.50 * 12 / 2 - 0.0 - 6.0 / 2 = 18.0 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, (6.0 + 2 * 18.0) * (6.0 + 2 * 18.0)] = 1764.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)]* = 0.65 * 0.85 * 2.5 * Min [2, √(1764.0 / 36.0)] = 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 > 0.9 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 * 0.15) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 27.5 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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* = 6.0 / 6.0 = 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 * (6.0 + 4.5 / 2 + 2.3) + 20 / 10 * (6.0 + 4.5 / 2 + 2.3) = 42.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (6.0 + 4.5 / 2 + 2.3) * (6.0 + 4.5 / 2 + 2.3) = 110.3 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 / 42.0 + 2, 4) * √(2500) = 150.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 31.8 + 0.07 * 110.3 / 144 - 2.0 = 29.9 kip

b1 = *L + d / 2 + X-Edge* = 6.0 + 4.5 / 2 + 2.3 = 10.5 in b2 = *W + d / 2 + Z-Edge* = 6.0 + 4.5 / 2 + 2.3 = 10.5 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(10.5 / 10.5)}} = 0.40$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(10.5 / 10.5)}} = 0.40$ ACI Eq. (8.4.2.3.2)

X2z = *b1 / 2* = 10.5 / 2 = 5.3 in X2x = *b2 / 2* = 10.5 / 2 = 5.3 in

Jcz = *b1 * d³ / 6 + b1³ * d / 6 + b1² * b2 * d / 2* ACI R8.4.4.2.3

Jcz = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

Jcx = *b2 * d³ / 6 + b2³ * d / 6 + b2² * b1 * d / 2* ACI R8.4.4.2.3

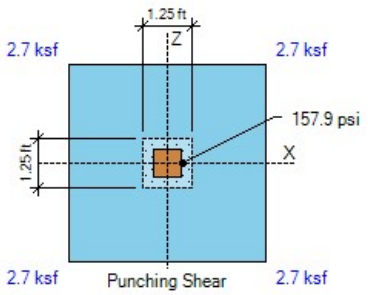
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

Stress due to P = *F / (bo * d) * 1000* = 29.9 / (42.0 * 4.5) * 1000 = 157.9 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

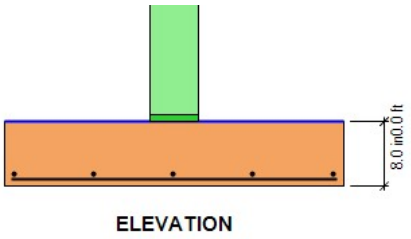
Punching stress = *P-stress + Mx-stress + Mz-stress* = 157.9 + 0.0 + 0.0 = 157.9 psi > 150.0 psi NG



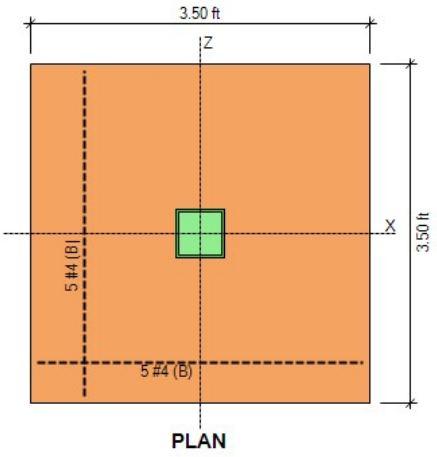
ASDIP Foundation 4.8.2.1 **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

DESIGN CODES

Concrete Design	ACI 318-14
Load Combinations	ASCE 7-10/16



ELEVATION



PLAN

ASDIP Foundation 4.8.2.1 **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	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

Gross Allow. Soil Pressure	2.0	ksf	
Soil Pressure at Corner 1	1.5	ksf	
Soil Pressure at Corner 2	1.5	ksf	
Soil Pressure at Corner 3	1.5	ksf	
Soil Pressure at Corner 4	1.5	ksf	
Bearing Pressure Ratio	0.76		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	8.0	5.2	0.0	0.0	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 * 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 3.00 / 2 = 1.50 ft Moment = 0.0 * 1.50 = 0.0 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 * 8.0 + 0.6 * 0.0 = 4.8 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft Moment = 4.8 * 1.50 = 7.2 k-ft
- Resisting moment X-X = 0.8 + 0.0 + 0.0 + 7.2 + -0.3 = 7.7 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{7.7}{0.0}$ = 76.73 > 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

Arm = *L / 2* = 3.00 / 2 = 1.50 ft Moment = 0.0 * 1.50 = 0.0 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 * 8.0 + 0.6 * 0.0 = 4.8 kip

Arm = *L / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft Moment = 4.8 * 1.50 = 7.2 k-ft

- Resisting moment Z-Z = 0.8 + 0.0 + 0.0 + 7.2 + -0.3 = 7.7 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{7.7}{0.0}$ = 76.73 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 1.4 + 0.0 + 0.0 + -0.6 + 19.8 = 20.6 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 1.4 + 0.0 + 0.0 + -0.6 + 19.8 = 20.6 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 0.9 + 0.0 + 0.0 - 0.4 + 13.2 = 13.7 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{20.6 - 0.0}{13.7} = 1.50 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{20.6 - 0.0}{13.7} = 1.50 \text{ ft}$$

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:

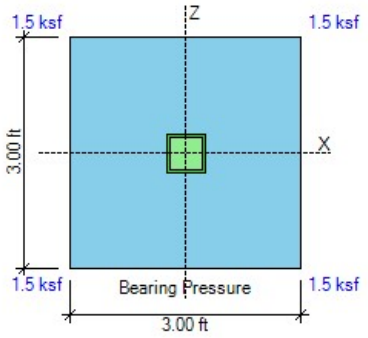
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 13.7 * (1 / 9.0 + 0.00 / 4.5 + 0.00 / 4.5) = 1.53 ksf

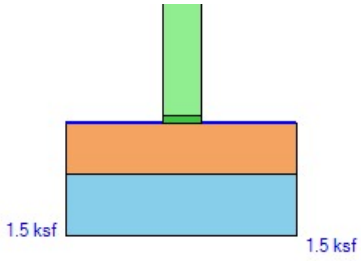
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 13.7 * (1 / 9.0 - 0.00 / 4.5 + 0.00 / 4.5) = 1.53 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 13.7 * (1 / 9.0 - 0.00 / 4.5 - 0.00 / 4.5) = 1.53 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 13.7 * (1 / 9.0 + 0.00 / 4.5 - 0.00 / 4.5) = 1.53 ksf

ASDIP Foundation 4.8.2.1 **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 * (0.00 + 8.0 / 12 / 2) = 0.16 ksf

X-Passive force = *Pressure * Thick * Width* = 0.16 * 8.0 / 12 * 3.00 = 0.3 kip

Z-Passive force = *Pressure * Thick * Length* = 0.16 * 8.0 / 12 * 3.00 = 0.3 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 5.1 * 0.35) = 1.8 kip

Use 100% of Passive + 100% of Friction for sliding resistance

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 0.3 + 1.00 * 1.8}{0.0}$ = 21.08 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 0.3 + 1.00 * 1.8}{0.0}$ = 21.08 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.5 + 0.0 - 0.2}{0.0}$ = 99.99 > 1.00 OK

ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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

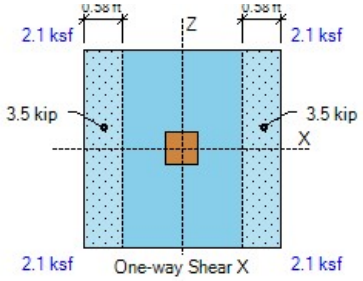
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

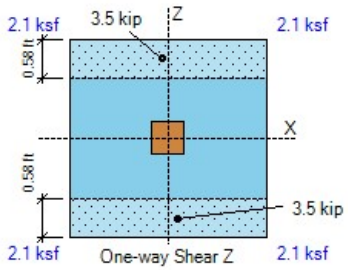
One-way shear Vux (- Side) = 3.5 kip < 11.5 kip OK

One-way shear Vux (+ Side) = 3.5 kip < 11.5 kip OK

One-way shear Vuz (- Side) = 3.5 kip < 11.5 kip OK

One-way shear Vuz (+ Side) = 3.5 kip < 11.5 kip OK





FLEXURE CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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

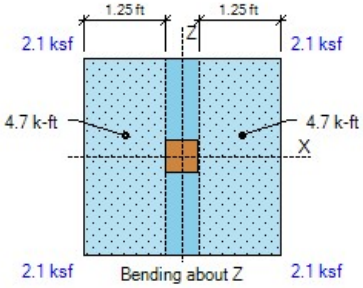
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

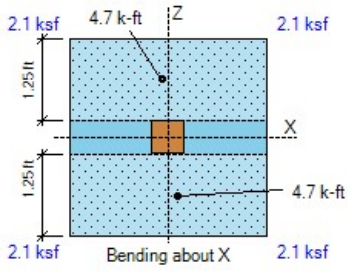
Bottom moment Mux (- Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.97

Bottom moment Mux (+ Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.98

Bottom moment Muz (- Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.97

Bottom moment Muz (+ Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.98





LOAD TRANSFER CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

Area *A1 = col L * col W =* 6.0 * 6.0 = 36.0 in²

Sx = *col W * col L² / 6 =* 6.0 * 6.0² / 6 = 36.0 in³

Sz = *col L * col W² / 6 =* 6.0 * 6.0² / 6 = 36.0 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz =* 17.9 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.5 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 - 6.0 / 2, 3.00 * 12 / 2 - 0.0 - 6.0 / 2 = 15.0 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, (6.0 + 2 * 15.0) * (6.0 + 2 * 15.0)] = 1296.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)] =* 0.65 * 0.85 * 2.5 * Min [2, √(1296.0 / 36.0)] = 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 * 0.09) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 15.5 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

X-Edge = *Length / 2 - Offset - Col / 2* = 3.00 * 12 / 2 - 0.0 - 6.0 / 2 = 15.0 in αsx = 10

Z-Edge = *Width / 2 - Offset - Col / 2* = 3.00 * 12 / 2 - 0.0 - 6.0 / 2 = 15.0 in αsz = 10

αs = *αsx + αsz* = 10 + 10 = 20 Col type = Corner β = *L / W* = 6.0 / 6.0 = 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 * (6.0 + 8.0 / 2 + 15.0) + 10 / 10 * (6.0 + 8.0 / 2 + 15.0) = 50.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (6.0 + 8.0 / 2 + 15.0) * (6.0 + 8.0 / 2 + 15.0) = 625.0 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 = 17.9 + 0.07 * 625.0 / 144 - 2.8 = 15.4 kip

b1 = *L + d / 2 + X-Edge* = 6.0 + 8.0 / 2 + 15.0 = 25.0 in b2 = *W + d / 2 + Z-Edge* = 6.0 + 8.0 / 2 + 15.0 = 25.0 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(25.0 / 25.0)}} = 0.40$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(25.0 / 25.0)}} = 0.40$ ACI Eq. (8.4.2.3.2)

X2z = *b1² / 2 / (b1 + b2)* = 25.0² / 2 / (25.0 + 25.0) = 6.3 in X2x = *b2² / 2 / (b2 + b1)* = 6.3 in

Jcz = *b1 * d³ / 12 + b1³ * d / 12 + b1 * d * (b1 / 2 - X2z)² + b2 * d * X2z²* ACI R8.4.4.2.3

Jcz = 25.0 * 8.0³ / 12 + 25.0³ * 8.0 / 12 + 25.0 * 8.0 * (25.0 / 2 * 6.3)² + 25.0 * 8.0 * 6.3² = 27108 in⁴

Jcx = *b2 * d³ / 12 + b2³ * d / 12 + b2 * d * (b2 / 2 - X2x)² + b1 * d * X2x²* ACI R8.4.4.2.3

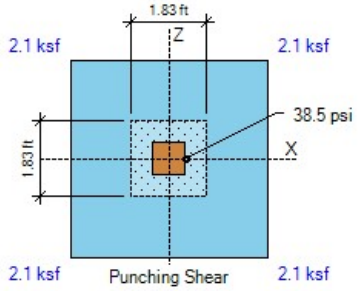
Jcz = 25.0 * 8.0³ / 12 + 25.0³ * 8.0 / 12 + 25.0 * 8.0 * (25.0 / 2 * 6.3)² + 25.0 * 8.0 * 6.3² = 27108 in⁴

Stress due to P = *F / (bo * d) * 1000* = 15.4 / (50.0 * 8.0) * 1000 = 38.5 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 6.3 / 27108 * 1000 = 0.0 psi

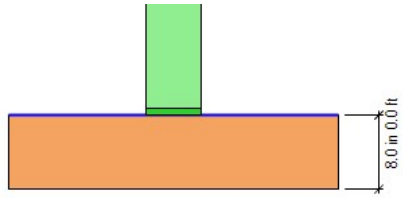
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 6.3 / 27108 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 38.5 + 0.0 + 0.0 = 38.5 psi < 80.0 psi OK



DESIGN CODES

Concrete Design	ACI 318-14
Load Combinations	ASCE 7-10/16



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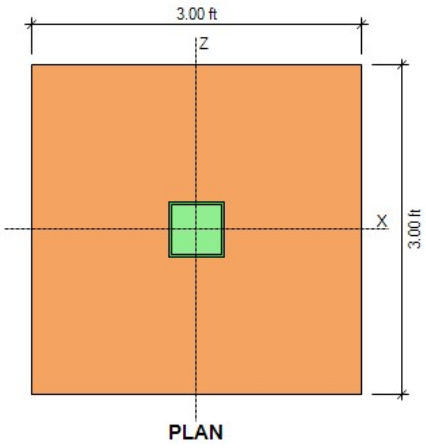

PLAN

ASDIP Foundation 4.8.2.1 **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	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

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	0.89		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	5.2	16.0	0.0	0.0	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 * 3.50 * 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 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 * 5.2 + 0.6 * 0.0 = 3.1 kip

  Arm = *W / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 3.1 * 1.75 = 5.5 k-ft
- Resisting moment X-X = 1.3 + 0.0 + 0.0 + 5.5 + -0.5 = 6.2 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{6.2}{0.0}$ = 62.11 > 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

Arm = *L / 2* = 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 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 * 5.2 + 0.6 * 0.0 = 3.1 kip

Arm = *L / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 3.1 * 1.75 = 5.5 k-ft

- Resisting moment Z-Z = 1.3 + 0.0 + 0.0 + 5.5 + -0.5 = 6.2 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{6.2}{0.0}$ = 62.11 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 2.1 + 0.0 + 0.0 + -0.9 + 37.1 = 38.4 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 2.1 + 0.0 + 0.0 + -0.9 + 37.1 = 38.4 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 1.2 + 0.0 + 0.0 - 0.5 + 21.2 = 21.9 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{38.4 - 0.0}{21.9} = 1.75 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{38.4 - 0.0}{21.9} = 1.75 \text{ ft}$$

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)* = 21.9 * (1 / 12.3 + 0.00 / 7.1 + 0.00 / 7.1) = 1.79 ksf

P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 21.9 * (1 / 12.3 - 0.00 / 7.1 + 0.00 / 7.1) = 1.79 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 21.9 * (1 / 12.3 - 0.00 / 7.1 - 0.00 / 7.1) = 1.79 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 21.9 * (1 / 12.3 + 0.00 / 7.1 - 0.00 / 7.1) = 1.79 ksf

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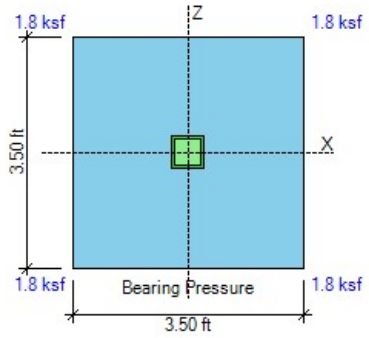
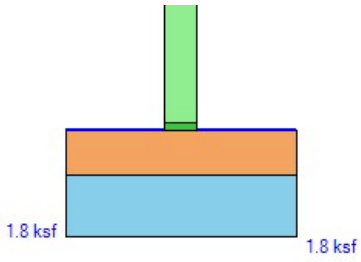




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

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 * (0.00 + 8.0 / 12 / 2) = 0.16 ksf

X-Passive force = *Pressure * Thick * Width* = 0.16 * 8.0 / 12 * 3.50 = 0.4 kip

Z-Passive force = *Pressure * Thick * Length* = 0.16 * 8.0 / 12 * 3.50 = 0.4 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 3.5 * 0.35) = 1.2 kip

Use 100% of Passive + 100% of Friction for sliding resistance

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 0.4 + 1.00 * 1.2}{0.0}$ = 16.12 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 0.4 + 1.00 * 1.2}{0.0}$ = 16.12 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.7 + 0.0 - 0.3}{0.0}$ = 99.99 > 1.00 OK

ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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

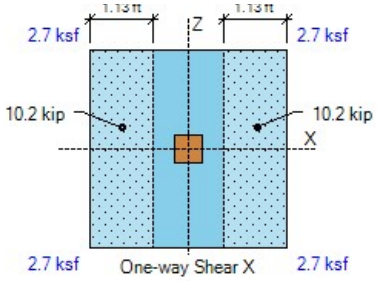
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

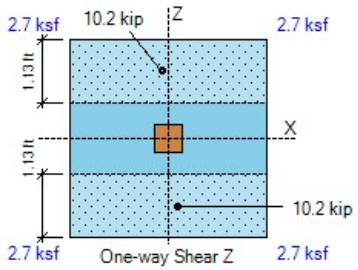
One-way shear Vux (- Side) = 10.2 kip < 15.0 kip OK

One-way shear Vux (+ Side) = 10.2 kip < 15.0 kip OK

One-way shear Vuz (- Side) = 10.2 kip < 13.4 kip OK

One-way shear Vuz (+ Side) = 10.2 kip < 13.4 kip OK





FLEXURE CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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 5 #4 Z-Bars *ρ = As / b d* = 1.0 / (3.50 * 12 * 4.3) = 0.0056 q = 0.0056 * 40 / 2.5 = 0.090

Use 5 #4 X-Bars *ρ = As / b d* = 1.0 / (3.50 * 12 * 4.8) = 0.0050 q = 0.0050 * 40 / 2.5 = 0.080

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 * 0.090 * (1 - 0.59 * 0.090) = 12.1 k-ft

ϕMnz = 0.90 * 3.50 * 12 * 4.8² * 2.5 * 0.080 / 1.00 * (1 - 0.59 * 0.080 / 1.00) = 13.6 k-ft

- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

Bottom moment Mux (- Side) = 10.3 k-ft < 12.1 k-ft OK ratio = 0.85

Bottom moment Mux (+ Side) = 10.3 k-ft < 12.1 k-ft OK ratio = 0.85

Bottom moment Muz (- Side) = 10.3 k-ft < 13.6 k-ft OK ratio = 0.76

Bottom moment Muz (+ Side) = 10.3 k-ft < 13.6 k-ft OK ratio = 0.76

X-As min = *0.0018 * Width * Thick* = 0.0018 * 3.50 * 12 * 8.0 = 0.6 in² < 1.0 in² OK ACI 8.6.1.1

Z-As min = *0.0018 * Length * Thick* = 0.0018 * 3.50 * 12 * 8.0 = 0.6 in² < 1.0 in² OK ACI 8.6.1.1

X-As max for 0.005 tension strain = 3.20 in² > 1.00 in² OK ACI 21.2.2

Z-As max for 0.005 tension strain = 3.20 in² > 1.00 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, 9.0 / 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 * 0.76) = 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 * 0.76) = 6.0 in

-X Ld provided = *(Length - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+X Ld provided = *(Length - Col) / 2 - Offset - Cover* = 3.50 * 12 / 2 - 0.0 - 6.0 / 2 - 2.5 = 15.5 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, 9.0 / 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 * 0.76) = 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

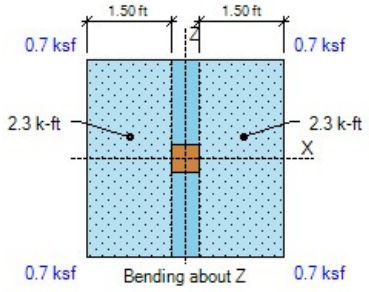
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.85) = 6.0 in

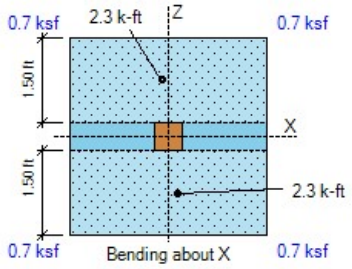
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+Z Ld provided = *(Width - Col) / 2 - Offset - Cover* = 3.50 * 12 / 2 - 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

X-bar spacing = 9.0 in < Min (3 * t, 18.0) = 18.0 in OK ACI 7.7.2.3

Z-bar spacing = 9.0 in < Min (3 * t, 18.0) = 18.0 in OK





LOAD TRANSFER CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

Area *A1 = col L * col W* = 6.0 * 6.0 = 36.0 in²

Sx = *col W * col L² / 6* = 6.0 * 6.0² / 6 = 36.0 in³

Sz = *col L * col W² / 6* = 6.0 * 6.0² / 6 = 36.0 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz* = 31.8 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.9 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 - 6.0 / 2, 3.50 * 12 / 2 - 0.0 - 6.0 / 2 = 18.0 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, (6.0 + 2 * 18.0) * (6.0 + 2 * 18.0)] = 1764.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)]* = 0.65 * 0.85 * 2.5 * Min [2, √(1764.0 / 36.0)] = 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 > 0.9 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 * 0.15) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 27.5 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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* = 6.0 / 6.0 = 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 * (6.0 + 4.5 / 2 + 2.3) + 20 / 10 * (6.0 + 4.5 / 2 + 2.3) = 42.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (6.0 + 4.5 / 2 + 2.3) * (6.0 + 4.5 / 2 + 2.3) = 110.3 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 / 42.0 + 2, 4) * √(2500) = 150.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 31.8 + 0.07 * 110.3 / 144 - 2.0 = 29.9 kip

b1 = *L + d / 2 + X-Edge* = 6.0 + 4.5 / 2 + 2.3 = 10.5 in b2 = *W + d / 2 + Z-Edge* = 6.0 + 4.5 / 2 + 2.3 = 10.5 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(10.5 / 10.5)}} = 0.40$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(10.5 / 10.5)}} = 0.40$ ACI Eq. (8.4.2.3.2)

X2z = *b1 / 2* = 10.5 / 2 = 5.3 in X2x = *b2 / 2* = 10.5 / 2 = 5.3 in

Jcz = *b1 * d³ / 6 + b1³ * d / 6 + b1² * b2 * d / 2* ACI R8.4.4.2.3

Jcz = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

Jcx = *b2 * d³ / 6 + b2³ * d / 6 + b2² * b1 * d / 2* ACI R8.4.4.2.3

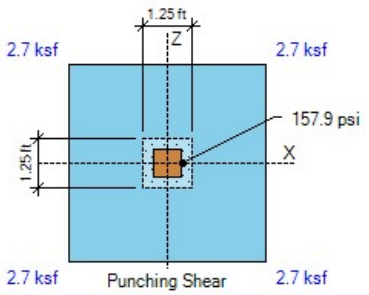
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

Stress due to P = *F / (bo * d) * 1000* = 29.9 / (42.0 * 4.5) * 1000 = 157.9 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 157.9 + 0.0 + 0.0 = 157.9 psi > 150.0 psi NG



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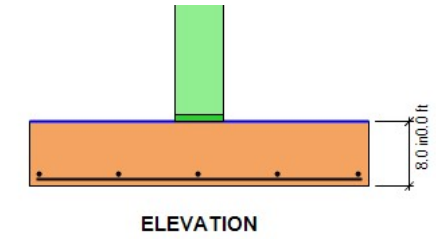
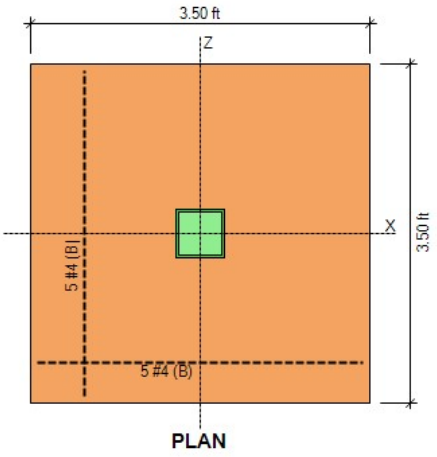
DESIGN CODES

Concrete Design	ACI 318-14
Load Combinations	ASCE 7-10/16



ELEVATION



PLAN

ASDIP Foundation 4.8.2.1 **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	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

Gross Allow. Soil Pressure	2.0	ksf	
Soil Pressure at Corner 1	1.5	ksf	
Soil Pressure at Corner 2	1.5	ksf	
Soil Pressure at Corner 3	1.5	ksf	
Soil Pressure at Corner 4	1.5	ksf	
Bearing Pressure Ratio	0.77		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	4.4	13.7	0.0	0.0	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 * 3.50 * 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 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 * 4.4 + 0.6 * 0.0 = 2.6 kip

  Arm = *W / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 2.6 * 1.75 = 4.6 k-ft
- Resisting moment X-X = 1.3 + 0.0 + 0.0 + 4.6 + -0.5 = 5.4 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{5.4}{0.0}$ = 53.71 > 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 * 6.0 / 12 * 6.0 / 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 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

Arm = *L / 2 =* 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 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 * 4.4 + 0.6 * 0.0 = 2.6 kip

Arm = *L / 2 - Offset =* 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 2.6 * 1.75 = 4.6 k-ft

- Resisting moment Z-Z = 1.3 + 0.0 + 0.0 + 4.6 + -0.5 = 5.4 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{5.4}{0.0}$ = 53.71 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 2.1 + 0.0 + 0.0 + -0.9 + 31.7 = 32.9 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 2.1 + 0.0 + 0.0 + -0.9 + 31.7 = 32.9 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 1.2 + 0.0 + 0.0 - 0.5 + 18.1 = 18.8 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{32.9 - 0.0}{18.8} = 1.75 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{32.9 - 0.0}{18.8} = 1.75 \text{ ft}$$

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) =* 18.8 * (1 / 12.3 + 0.00 / 7.1 + 0.00 / 7.1) = 1.54 ksf

P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 18.8 * (1 / 12.3 - 0.00 / 7.1 + 0.00 / 7.1) = 1.54 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 18.8 * (1 / 12.3 - 0.00 / 7.1 - 0.00 / 7.1) = 1.54 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 18.8 * (1 / 12.3 + 0.00 / 7.1 - 0.00 / 7.1) = 1.54 ksf

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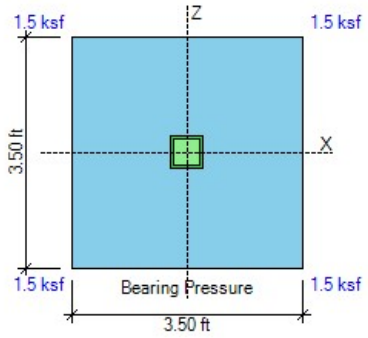
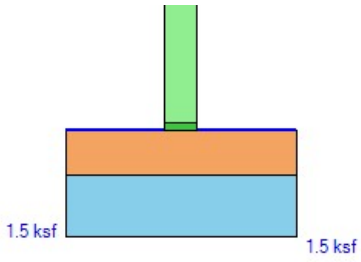




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

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 * (0.00 + 8.0 / 12 / 2) = 0.16 ksf

X-Passive force = *Pressure * Thick * Width* = 0.16 * 8.0 / 12 * 3.50 = 0.4 kip

Z-Passive force = *Pressure * Thick * Length* = 0.16 * 8.0 / 12 * 3.50 = 0.4 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 3.1 * 0.35) = 1.1 kip

Use 100% of Passive + 100% of Friction for sliding resistance

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 0.4 + 1.00 * 1.1}{0.0}$ = 14.44 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 0.4 + 1.00 * 1.1}{0.0}$ = 14.44 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.7 + 0.0 - 0.3}{0.0}$ = 99.99 > 1.00 OK

ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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

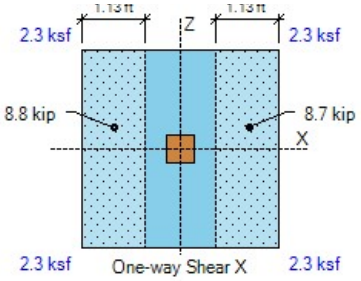
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

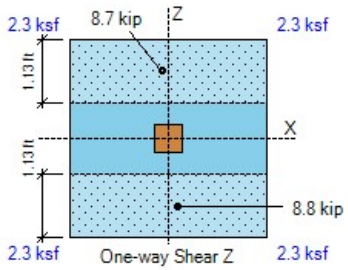
One-way shear Vux (- Side) = 8.8 kip < 15.0 kip OK

One-way shear Vux (+ Side) = 8.7 kip < 15.0 kip OK

One-way shear Vuz (- Side) = 8.8 kip < 13.4 kip OK

One-way shear Vuz (+ Side) = 8.7 kip < 13.4 kip OK





FLEXURE CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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 5 #4 Z-Bars *ρ = As / b d* = 1.0 / (3.50 * 12 * 4.3) = 0.0056 q = 0.0056 * 40 / 2.5 = 0.090

Use 5 #4 X-Bars *ρ = As / b d* = 1.0 / (3.50 * 12 * 4.8) = 0.0050 q = 0.0050 * 40 / 2.5 = 0.080

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 * 0.090 * (1 - 0.59 * 0.090) = 12.1 k-ft

ϕMnz = 0.90 * 3.50 * 12 * 4.8² * 2.5 * 0.080 / 1.00 * (1 - 0.59 * 0.080 / 1.00) = 13.6 k-ft

- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

Bottom moment Mux (- Side) = 8.8 k-ft < 12.1 k-ft OK ratio = 0.73

Bottom moment Mux (+ Side) = 8.8 k-ft < 12.1 k-ft OK ratio = 0.73

Bottom moment Muz (- Side) = 8.8 k-ft < 13.6 k-ft OK ratio = 0.65

Bottom moment Muz (+ Side) = 8.8 k-ft < 13.6 k-ft OK ratio = 0.65

X-As min = *0.0018 * Width * Thick* = 0.0018 * 3.50 * 12 * 8.0 = 0.6 in² < 1.0 in² OK ACI 8.6.1.1

Z-As min = *0.0018 * Length * Thick* = 0.0018 * 3.50 * 12 * 8.0 = 0.6 in² < 1.0 in² OK ACI 8.6.1.1

X-As max for 0.005 tension strain = 3.20 in² > 1.00 in² OK ACI 21.2.2

Z-As max for 0.005 tension strain = 3.20 in² > 1.00 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, 9.0 / 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 * 0.65) = 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 * 0.65) = 6.0 in

-X Ld provided = *(Length - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+X Ld provided = *(Length - Col) / 2 - Offset - Cover* = 3.50 * 12 / 2 - 0.0 - 6.0 / 2 - 2.5 = 15.5 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, 9.0 / 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 * 0.65) = 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

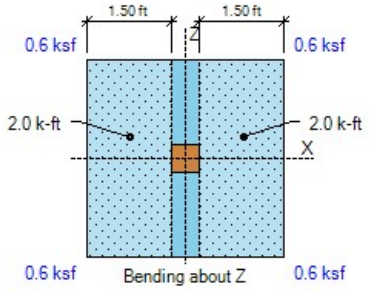
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.73) = 6.0 in

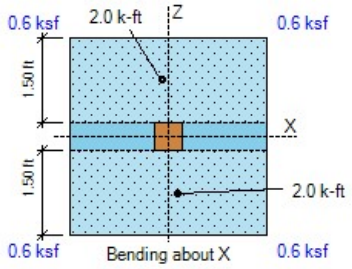
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+Z Ld provided = *(Width - Col) / 2 - Offset - Cover* = 3.50 * 12 / 2 - 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

X-bar spacing = 9.0 in < Min (3 * t, 18.0) = 18.0 in OK ACI 7.7.2.3

Z-bar spacing = 9.0 in < Min (3 * t, 18.0) = 18.0 in OK





LOAD TRANSFER CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

Area *A1 = col L * col W* = 6.0 * 6.0 = 36.0 in²

Sx = *col W * col L² / 6* = 6.0 * 6.0² / 6 = 36.0 in³

Sz = *col L * col W² / 6* = 6.0 * 6.0² / 6 = 36.0 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz* = 27.2 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.8 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 - 6.0 / 2, 3.50 * 12 / 2 - 0.0 - 6.0 / 2 = 18.0 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, (6.0 + 2 * 18.0) * (6.0 + 2 * 18.0)] = 1764.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)]* = 0.65 * 0.85 * 2.5 * Min [2, √(1764.0 / 36.0)] = 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 * 0.13) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 23.5 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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* = 6.0 / 6.0 = 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 * (6.0 + 4.5 / 2 + 2.3) + 20 / 10 * (6.0 + 4.5 / 2 + 2.3) = 42.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (6.0 + 4.5 / 2 + 2.3) * (6.0 + 4.5 / 2 + 2.3) = 110.3 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 / 42.0 + 2, 4) * √(2500) = 150.0 psi

Punching force *F = P + Overburden * Abo - Bearing*

F = 27.2 + 0.07 * 110.3 / 144 - 1.8 = 25.5 kip

b1 = *L + d / 2 + X-Edge* = 6.0 + 4.5 / 2 + 2.3 = 10.5 in b2 = *W + d / 2 + Z-Edge* = 6.0 + 4.5 / 2 + 2.3 = 10.5 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(10.5 / 10.5)}} = 0.40$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(10.5 / 10.5)}} = 0.40$ ACI Eq. (8.4.2.3.2)

X2z = *b1 / 2* = 10.5 / 2 = 5.3 in X2x = *b2 / 2* = 10.5 / 2 = 5.3 in

Jcz = *b1 * d³ / 6 + b1³ * d / 6 + b1² * b2 * d / 2* ACI R8.4.4.2.3

Jcz = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

Jcx = *b2 * d³ / 6 + b2³ * d / 6 + b2² * b1 * d / 2* ACI R8.4.4.2.3

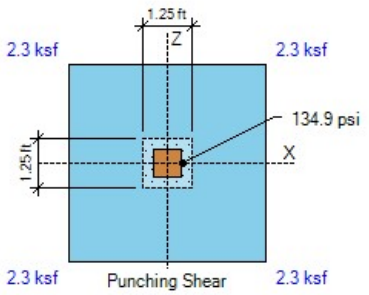
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

Stress due to P = *F / (bo * d) * 1000* = 25.5 / (42.0 * 4.5) * 1000 = 134.9 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

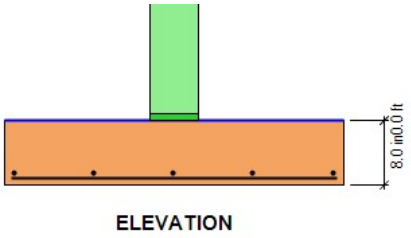
Punching stress = *P-stress + Mx-stress + Mz-stress* = 134.9 + 0.0 + 0.0 = 134.9 psi < 150.0 psi OK



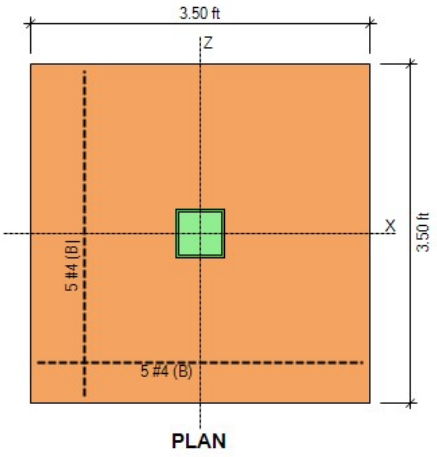
ASDIP Foundation 4.8.2.1 **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

DESIGN CODES

Concrete Design	ACI 318-14
Load Combinations	ASCE 7-10/16



ELEVATION



PLAN

ASDIP Foundation 4.8.2.1 **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

GEOMETRY

Footing Length (X-dir)	2.00	ft	
Footing Width (Z-dir)	2.60	ft	
Footing Thickness	8.0	in	OK
Soil Cover	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

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	0.99		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	4.5	5.5	0.0	0.0	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 * 2.60 * 2.00 * 8.0 / 12 * 0.15 = 0.3 kip

  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.3 * 1.30 = 0.4 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 2.60 / 2 - 0.0 / 12 = 1.30 ft Moment = 0.0 * 1.30 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0=6 * (2.60 * 2.00 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.0 * 1.30 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 2.60 * 2.00 * 62 * (0.67) = -0.1 kip

  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.1 * 1.30 = -0.2 k-ft
- Axial force P = 0.6 * 4.5 + 0.6 * 0.0 = 2.7 kip

  Arm = *W / 2 - Offset* = 2.60 / 2 - 0.0 / 12 = 1.30 ft Moment = 2.7 * 1.30 = 3.5 k-ft
- Resisting moment X-X = 0.4 + 0.0 + 0.0 + 3.5 + -0.2 = 3.7 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{3.7}{0.0}$ = 37.47 > 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 * 2.60 * 2.00 * 8.0 / 12 * 0.15 = 0.3 kip

Arm = *L / 2* = 2.00 / 2 = 1.00 ft Moment = 0.3 * 1.00 = 0.3 k-ft

- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 6.0 / 12 * 6.0 / 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 * (2.60 * 2.00 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

Arm = *L / 2* = 2.00 / 2 = 1.00 ft Moment = 0.0 * 1.00 = 0.0 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 2.60 * 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 * 4.5 + 0.6 * 0.0 = 2.7 kip

Arm = *L / 2 - Offset* = 2.00 / 2 - 0.0 / 12 = 1.00 ft Moment = 2.7 * 1.00 = 2.7 k-ft

- Resisting moment Z-Z = 0.3 + 0.0 + 0.0 + 2.7 + -0.1 = 2.9 k-ft
- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{2.9}{0.0}$ = 28.82 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 0.7 + 0.0 + 0.0 + -0.3 + 13.0 = 13.4 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 0.5 + 0.0 + 0.0 + -0.2 + 10.0 = 10.3 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 0.5 + 0.0 + 0.0 - 0.2 + 10.0 = 10.3 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{10.3 - 0.0}{10.3} = 1.00 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{13.4 - 0.0}{10.3} = 1.30 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =2.00 / 2 - 1.00 = 0.00 ft

Z-ecc = *Width / 2 - Zp* = 2.60 / 2 - 1.30 = 0.00 ft

Area = *Width * Length* = 2.60 * 2.00 = 5.2 ft²

Sx = *Length * Width² / 6* = 2.00 * 2.60² / 6 = 2.3 ft³

Sz = *Width * Length² / 6* = 2.60 * 2.00² / 6 = 1.7 ft³

- Footing is in full bearing. Soil pressures are as follows:

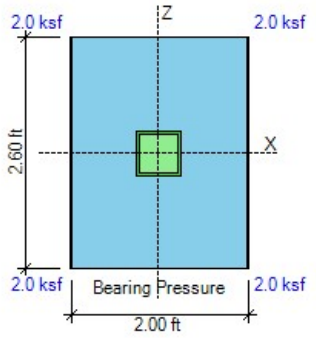
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 10.3 * (1 / 5.2 + 0.00 / 2.3 + 0.00 / 1.7) = 1.98 ksf

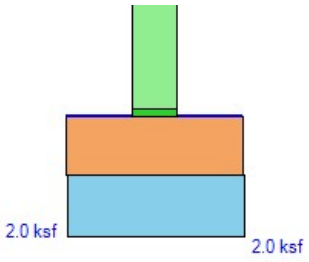
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 10.3 * (1 / 5.2 - 0.00 / 2.3 + 0.00 / 1.7) = 1.98 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 10.3 * (1 / 5.2 - 0.00 / 2.3 - 0.00 / 1.7) = 1.98 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 10.3 * (1 / 5.2 + 0.00 / 2.3 - 0.00 / 1.7) = 1.98 ksf

ASDIP Foundation 4.8.2.1 **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 * (0.00 + 8.0 / 12 / 2) = 0.16 ksf

X-Passive force = *Pressure * Thick * Width* = 0.16 * 8.0 / 12 * 2.60 = 0.3 kip

Z-Passive force = *Pressure * Thick * Length* = 0.16 * 8.0 / 12 * 2.00 = 0.2 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 2.9 * 0.35) = 1.0 kip

Use 100% of Passive + 100% of Friction for sliding resistance

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 0.3 + 1.00 * 1.0}{0.0}$ = 12.84 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 0.2 + 1.00 * 1.0}{0.0}$ = 12.20 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.3 + 0.0 - 0.1}{0.0}$ = 99.99 > 1.00 OK

ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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) * 2.6 * 12 * 8.0 / 1000 = 10.0 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

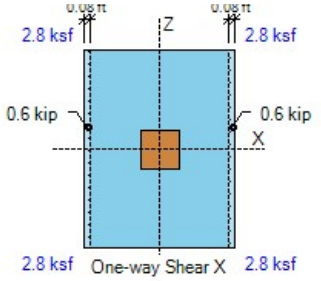
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

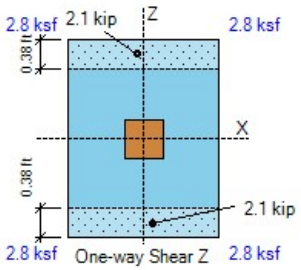
One-way shear Vux (- Side) = 0.6 kip < 10.0 kip OK

One-way shear Vux (+ Side) = 0.6 kip < 10.0 kip OK

One-way shear Vuz (- Side) = 2.1 kip < 7.7 kip OK

One-way shear Vuz (+ Side) = 2.1 kip < 7.7 kip OK





FLEXURE CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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) * 2.60 * 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 < 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 < 4.2 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 4.2 k-ft OK

- Bottom Bars

No Bottom Reinforcement Provided at the Footing

Use Plain Concrete Flexural Strength at Bottom

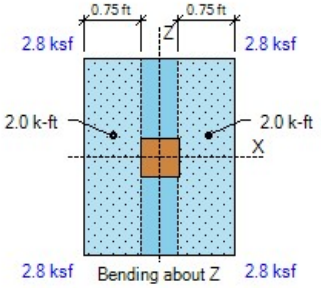
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

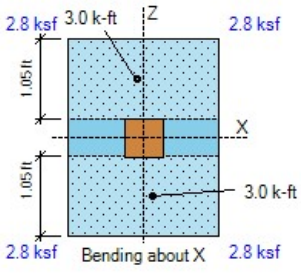
Bottom moment Mux (- Side) = 3.0 k-ft < 3.2 k-ft OK ratio = 0.94

Bottom moment Mux (+ Side) = 3.0 k-ft < 3.2 k-ft OK ratio = 0.94

Bottom moment Muz (- Side) = 2.0 k-ft < 4.2 k-ft OK ratio = 0.48

Bottom moment Muz (+ Side) = 2.0 k-ft < 4.2 k-ft OK ratio = 0.48





ASDIP Foundation 4.8.2.1 **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

LOAD TRANSFER CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

Area $A1 = col\ L * col\ W =$ 6.0 * 6.0 = 36.0 in²

Sx = $col\ W * col\ L^2 / 6 =$ 6.0 * 6.0² / 6 = 36.0 in³

Sz = $col\ L * col\ W^2 / 6 =$ 6.0 * 6.0² / 6 = 36.0 in³

Bearing $Pbu = P / A1 + Mz / Sx + Mx / Sz =$ 14.2 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.4 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 - 6.0 / 2, 2.60 * 12 / 2 - 0.0 - 6.0 / 2 = 9.0 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 * 2.6 * 12, (6.0 + 2 * 9.0) * (6.0 + 2 * 9.0)] = 576.0 in²

Footing $\phi Pnc = \phi * 0.85 * f'c * Min [2, \sqrt{(A2 / A1)}] =$ 0.65 * 0.85 * 2.5 * Min [2, √(576.0 / 36.0)] = 2.8 ksi

Footing $\phi Pns = \phi * As * Fy / A1 =$ 0.0 ksi ACI 22.8.3.2

Footing bearing $\phi Pn = \phi Pnc + \phi Pns =$ 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 * 0.07) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.3 in OK

Ldh provided = *Footing thickness - Cover* = 8.00 - 3.0 = 5.0 in < 6.0 in NG

PUNCHING SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

X-Edge = *Length / 2 - Offset - Col / 2* = 2.00 * 12 / 2 - 0.0 - 6.0 / 2 = 9.0 in αsx = 10

Z-Edge = *Width / 2 - Offset - Col / 2* = 2.60 * 12 / 2 - 0.0 - 6.0 / 2 = 12.6 in αsz = 10

αs = *αsx + αsz* = 10 + 10 = 20 Col type = Corner β = *L / W* = 6.0 / 6.0 = 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 * (6.0 + 8.0 / 2 + 9.0) + 10 / 10 * (6.0 + 8.0 / 2 + 12.6) = 41.6 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (6.0 + 8.0 / 2 + 9.0) * (6.0 + 8.0 / 2 + 12.6) = 429.4 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 = 14.2 + 0.07 * 429.4 / 144 - 3.8 = 10.6 kip

b1 = *L + d / 2 + X-Edge* = 6.0 + 8.0 / 2 + 9.0 = 19.0 in b2 = *W + d / 2 + Z-Edge* = 6.0 + 8.0 / 2 + 12.6 = 22.6 in

$$\gamma vx \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(22.6 / 19.0)}} = 0.42$$ ACI Eq. (8.4.4.2.2)

$$\gamma vz \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(19.0 / 22.6)}} = 0.38$$ ACI Eq. (8.4.2.3.2)

X2z = $b1^2 / 2 / (b1 + b2)$ = 19.0² / 2 / (19.0 + 22.6) = 4.3 in X2x = $b2^2 / 2 / (b2 + b1)$ = 6.1 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 = 19.0 * 8.0³ / 12 + 19.0³ * 8.0 / 12 + 19.0 * 8.0 * (19.0 / 2 * 4.3)² + 22.6 * 8.0 * 4.3² = 12836 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

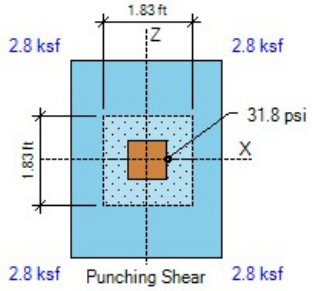
Jcz = 22.6 * 8.0³ / 12 + 22.6³ * 8.0 / 12 + 22.6 * 8.0 * (22.6 / 2 * 6.1)² + 19.0 * 8.0 * 6.1² = 19204 in⁴

Stress due to P = *F / (bo * d) * 1000* = 10.6 / (41.6 * 8.0) * 1000 = 31.8 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.42 * 0.0 * 12 * 6.1 / 19204 * 1000 = 0.0 psi

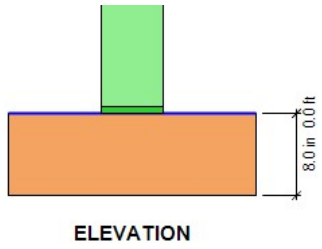
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.42 * 0.0 * 12 * 4.3 / 12836 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 31.8 + 0.0 + 0.0 = 31.8 psi < 80.0 psi OK

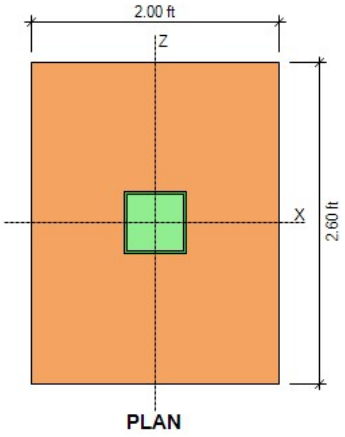


DESIGN CODES

Concrete Design	ACI 318-14
Load Combinations	ASCE 7-10/16



ELEVATION



PLAN

ASDIP Foundation 4.8.2.1 **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

GEOMETRY

Footing Length (X-dir)	1.50	ft	
Footing Width (Z-dir)	2.60	ft	
Footing Thickness	8.0	in	OK
Soil Cover	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

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	0.99		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	3.0	4.5	0.0	0.0	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 * 2.60 * 1.50 * 8.0 / 12 * 0.15 = 0.2 kip

  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.2 * 1.30 = 0.3 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 2.60 / 2 - 0.0 / 12 = 1.30 ft Moment = 0.0 * 1.30 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0=6 * (2.60 * 1.50 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.0 * 1.30 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 2.60 * 1.50 * 62 * (0.67) = -0.1 kip

  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.1 * 1.30 = -0.1 k-ft
- Axial force P = 0.6 * 3.0 + 0.6 * 0.0 = 1.8 kip

  Arm = *W / 2 - Offset* = 2.60 / 2 - 0.0 / 12 = 1.30 ft Moment = 1.8 * 1.30 = 2.3 k-ft
- Resisting moment X-X = 0.3 + 0.0 + 0.0 + 2.3 + -0.1 = 2.5 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{2.5}{0.0}$ = 25.18 > 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 * 2.60 * 1.50 * 8.0 / 12 * 0.15 = 0.2 kip

Arm = *L / 2* = 1.50 / 2 = 0.75 ft Moment = 0.2 * 0.75 = 0.2 k-ft

- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip

Arm = *L / 2 - Offset* = 1.50 / 2 - 0.0 / 12 = 0.75 ft Moment = 0.0 * 0.75 = 0.0 k-ft

- Soil cover = *0.6 * W * L * SC * Density* = 0.6 * (2.60 * 1.50 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

Arm = *L / 2* = 1.50 / 2 = 0.75 ft Moment = 0.0 * 0.75 = 0.0 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 2.60 * 1.50 * 62 * (0.67) = -0.1 kip

Arm = *L / 2* = 1.50 / 2 = 0.75 ft Moment = 0.1 * 0.75 = -0.1 k-ft

- Axial force P = 0.6 * 3.0 + 0.6 * 0.0 = 1.8 kip

Arm = *L / 2 - Offset* = 1.50 / 2 - 0.0 / 12 = 0.75 ft Moment = 1.8 * 0.75 = 1.4 k-ft

- Resisting moment Z-Z = 0.2 + 0.0 + 0.0 + 1.4 + -0.1 = 1.5 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{1.5}{0.0}$ = 14.52 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

Resisting moment X-X = 0.5 + 0.0 + 0.0 + -0.2 + 9.8 = 10.0 k-ft

Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

Resisting moment Z-Z = 0.3 + 0.0 + 0.0 + -0.1 + 5.6 = 5.8 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 0.4 + 0.0 + 0.0 - 0.2 + 7.5 = 7.7 kip

X-coordinate of resultant from maximum bearing corner:

$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{5.8 - 0.0}{7.7} = 0.75 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{10.0 - 0.0}{7.7} = 1.30 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =1.50 / 2 - 0.75 = 0.00 ft

Z-ecc = *Width / 2 - Zp* = 2.60 / 2 - 1.30 = 0.00 ft

Area = *Width * Length* = 2.60 * 1.50 = 3.9 ft²

Sx = *Length * Width² / 6* = 1.50 * 2.60² / 6 = 1.7 ft³

Sz = *Width * Length² / 6* = 2.60 * 1.50² / 6 = 1.0 ft³

- Footing is in full bearing. Soil pressures are as follows:

P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 7.7 * (1 / 3.9 + 0.00 / 1.7 + 0.00 / 1.0) = 1.98 ksf

P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 7.7 * (1 / 3.9 - 0.00 / 1.7 + 0.00 / 1.0) = 1.98 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 7.7 * (1 / 3.9 - 0.00 / 1.7 - 0.00 / 1.0) = 1.98 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 7.7 * (1 / 3.9 + 0.00 / 1.7 - 0.00 / 1.0) = 1.98 ksf

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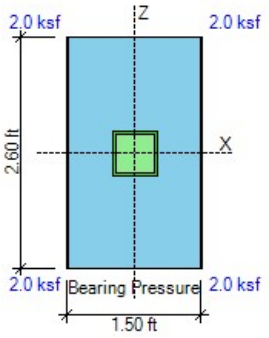
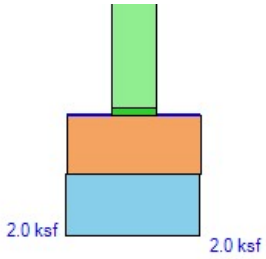




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

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 * (0.00 + 8.0 / 12 / 2) = 0.16 ksf

X-Passive force = *Pressure * Thick * Width* = 0.16 * 8.0 / 12 * 2.60 = 0.3 kip

Z-Passive force = *Pressure * Thick * Length* = 0.16 * 8.0 / 12 * 1.50 = 0.2 kip

Friction force = *Resisting force * Friction coeff.* = Max (0, 1.9 * 0.35) = 0.7 kip

Use 100% of Passive + 100% of Friction for sliding resistance

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 0.3 + 1.00 * 0.7}{0.0}$ = 9.53 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 0.2 + 1.00 * 0.7}{0.0}$ = 8.36 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \frac{0.0 + 0.2 + 0.0 - 0.1}{0.0}$ = 99.99 > 1.00 OK

ONE-WAY SHEAR CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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) * 2.6 * 12 * 8.0 / 1000 = 10.0 kip ACI 14.5.5.1

ϕVcz = *4/3 * ϕ * √(f'c) * Length * t / 1000* = 4/3 * 0.60 * √(2500) * 1.5 * 12 * 8.0 / 1000 = 5.8 kip

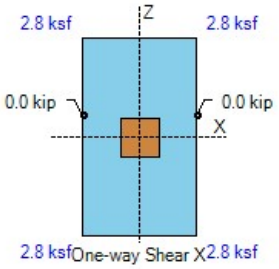
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

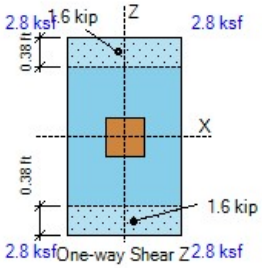
One-way shear Vux (- Side) = 0.0 kip < 10.0 kip OK

One-way shear Vux (+ Side) = 0.0 kip < 10.0 kip OK

One-way shear Vuz (- Side) = 1.6 kip < 5.8 kip OK

One-way shear Vuz (+ Side) = 1.6 kip < 5.8 kip OK





FLEXURE CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

Plain ϕMnx = *5 * ϕ * √(f'c) * L * Thick² / 6* = 5 * 0.60 * √(2500) * 1.50 * 8.0² / 6 / 1000 = 0.6 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * √(f'c) * W * Thick² / 6* = 5 * 0.60 * √(2500) * 2.60 * 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 < 2.4 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 2.4 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 4.2 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 4.2 k-ft OK

- Bottom Bars

No Bottom Reinforcement Provided at the Footing

Use Plain Concrete Flexural Strength at Bottom

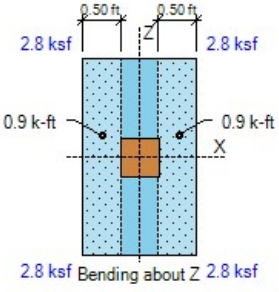
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

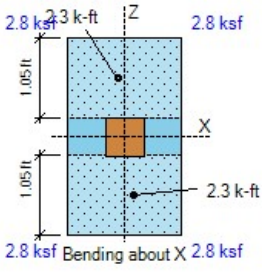
Bottom moment Mux (- Side) = 2.3 k-ft < 2.4 k-ft OK ratio = 0.96

Bottom moment Mux (+ Side) = 2.3 k-ft < 2.4 k-ft OK ratio = 0.96

Bottom moment Muz (- Side) = 0.9 k-ft < 4.2 k-ft OK ratio = 0.22

Bottom moment Muz (+ Side) = 0.9 k-ft < 4.2 k-ft OK ratio = 0.22





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LOAD TRANSFER CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

Area *A1 = col L * col W =* 6.0 * 6.0 = 36.0 in²

Sx = *col W * col L² / 6 =* 6.0 * 6.0² / 6 = 36.0 in³

Sz = *col L * col W² / 6 =* 6.0 * 6.0² / 6 = 36.0 in³

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz =* 10.8 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.3 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (1.50 * 12 / 2 - 0.0 - 6.0 / 2, 2.60 * 12 / 2 - 0.0 - 6.0 / 2 = 6.0 in

Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [1.50 * 12 * 2.6 * 12, (6.0 + 2 * 6.0) * (6.0 + 2 * 6.0)] = 324.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)] =* 0.65 * 0.85 * 2.5 * Min [2, √(324.0 / 36.0)] = 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 * 0.05) = 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+1.6L+0.5Lr)

X-Edge = *Length / 2 - Offset - Col / 2* = 1.50 * 12 / 2 - 0.0 - 6.0 / 2 = 6.0 in αsx = 10

Z-Edge = *Width / 2 - Offset - Col / 2* = 2.60 * 12 / 2 - 0.0 - 6.0 / 2 = 12.6 in αsz = 10

αs = *αsx + αsz* = 10 + 10 = 20 Col type = Corner β = *L / W* = 6.0 / 6.0 = 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 * (6.0 + 8.0 / 2 + 6.0) + 10 / 10 * (6.0 + 8.0 / 2 + 12.6) = 38.6 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (6.0 + 8.0 / 2 + 6.0) * (6.0 + 8.0 / 2 + 12.6) = 361.6 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 = 10.8 + 0.07 * 361.6 / 144 - 3.9 = 7.1 kip

b1 = *L + d / 2 + X-Edge* = 6.0 + 8.0 / 2 + 6.0 = 16.0 in b2 = *W + d / 2 + Z-Edge* = 6.0 + 8.0 / 2 + 12.6 = 22.6 in

γvx factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(22.6 / 16.0)}} = 0.44$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(16.0 / 22.6)}} = 0.36$ ACI Eq. (8.4.2.3.2)

X2z = *b1² / 2 / (b1 + b2)* = 16.0² / 2 / (16.0 + 22.6) = 3.3 in X2x = *b2² / 2 / (b2 + b1)* = 6.6 in

Jcz = *b1 * d³ / 12 + b1³ * d / 12 + b1 * d * (b1 / 2 - X2z)² + b2 * d * X2z²* ACI R8.4.4.2.3

Jcz = 16.0 * 8.0³ / 12 + 16.0³ * 8.0 / 12 + 16.0 * 8.0 * (16.0 / 2 * 3.3)² + 22.6 * 8.0 * 3.3² = 8210 in⁴

Jcx = *b2 * d³ / 12 + b2³ * d / 12 + b2 * d * (b2 / 2 - X2x)² + b1 * d * X2x²* ACI R8.4.4.2.3

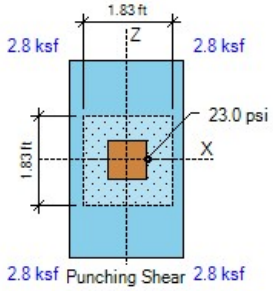
Jcz = 22.6 * 8.0³ / 12 + 22.6³ * 8.0 / 12 + 22.6 * 8.0 * (22.6 / 2 * 6.6)² + 16.0 * 8.0 * 6.6² = 18229 in⁴

Stress due to P = *F / (bo * d) * 1000* = 7.1 / (38.6 * 8.0) * 1000 = 23.0 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.44 * 0.0 * 12 * 6.6 / 18229 * 1000 = 0.0 psi

Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.44 * 0.0 * 12 * 3.3 / 8210 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 23.0 + 0.0 + 0.0 = 23.0 psi < 80.0 psi OK



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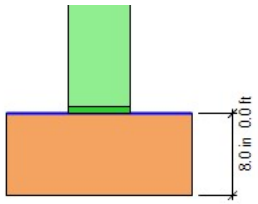
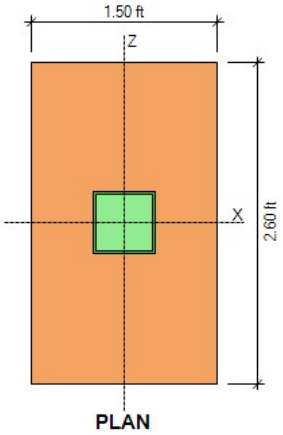
DESIGN CODES

Concrete Design	ACI 318-14
Load Combinations	ASCE 7-10/16



ELEVATION



PLAN

WIND $V_{ASD}=95$ MPH $V_{ULT}=110$ MPH EXP. B $K_{zt}=1.0$ SLOPE $=0°$ $34°$
$h=36'$ $\lambda=1.06$

ZONE A: 12.9 PSF × 1.06 = 13.7 PSF → 16.0 PSF MIN

ZONE B: 8.9 PSF × 1.06 = 9.3 PSF

ZONE C: 10.2 PSF × 1.06 = 10.8 PSF → 16.0 PSF MIN

ZONE D: 7.0 PSF × 1.06 = 7.4 PSF → 8.0 PSF MIN

SEISMIC $S_{DS}=0.831$ $R=6.5$ $I_e=1.0$

$$C_s=(0.831/(6.5/1.0))/1.4=0.091$$

$W_{ROOF}=(35\text{PSF}\times 11{,}333\text{SF})=396{,}655^{\#}$	$h=9'$	$h_R=29'$
$W_{LEVEL3}=(40\text{PSF}\times 10{,}229\text{SF})=409{,}160^{\#}$	$h=9'$	$h_3=20'$
$W_{LEVEL2}=(40\text{PSF}\times 10{,}490\text{SF})=419{,}600^{\#}$	$h=9'$	$h_2=10'$
$W_{TOTAL}=$ $1{,}225{,}415^{\#}$		

$V_S=1{,}225{,}415^{\#}\times 0.091=111{,}513^{\#}$ 23,392,305

$$F_{ROOF}=\left[\frac{(396{,}655^{\#}\times 29')}{(396{,}655^{\#}\times 29')+(409{,}160^{\#}\times 20')+(419{,}600^{\#}\times 10')}\right]\times 111{,}513^{\#}=44{,}412^{\#}$$

$$F_{LEVEL3}=\left[\frac{(409{,}160^{\#}\times 20')}{(396{,}655^{\#}\times 29')+(409{,}160^{\#}\times 20')+(419{,}600^{\#}\times 10')}\right]\times 111{,}513^{\#}=38{,}210^{\#}$$

$$F_{LEVEL2}=\left[\frac{}{(396{,}655^{\#}\times 29')+(409{,}160^{\#}\times 20')+(419{,}600^{\#}\times 10')}\right]\times 111{,}513^{\#}=28{,}891^{\#}$$

GRID 1 = 13

$F_{3W} = (16.0 PSF \times 203 SF) + (9.3 PSF \times 1222 SF) + (9.0 PSF \times 74 SF)$ $= 5,055^{\#}$

$F_{3E} = 44,412^{\#} \times (1,538 SF / 11,333 SF)$ $= 6,027^{\#}$

$F_{2W} = 5,055^{\#} + (16.0 PSF \times 239 SF)$ $= 8,863^{\#}$

$F_{2E} = 6,027^{\#} + 38,210^{\#} \times (1,372 SF / 10,229 SF)$ $= 11,152^{\#}$

$F_{1W} = 8,863^{\#} + (16.0 PSF \times 240 SF)$ $= 12,703^{\#}$

$F_{1E} = 11,152^{\#} + 28,891^{\#} \times (1,372 SF / 10,490 SF)$ $= 14,931^{\#}$

GRIDS 4/5 = 8/9

$F_{3W} = (16.0 PSF \times 460 SF) + (8.0 PSF \times 335 SF)$ $= 7,624^{\#}$

$F_{3E} = 44,412^{\#} \times (2,373 SF / 11,333 SF)$ $= 9,299^{\#}$

$F_{2W} = 7,624^{\#} + (16.0 PSF \times 442 SF)$ $= 14,696^{\#}$

$F_{2E} = 9,299^{\#} + 38,210^{\#} \times (2,048 SF / 10,229 SF)$ $= 16,950^{\#}$

$F_{1W} = 14,696^{\#} + (16.0 PSF \times 443 SF)$ $= 21,784^{\#}$

$F_{1E} = 16,950^{\#} + 28,891^{\#} \times (2,178 SF / 10,229 SF)$ $= 23,101^{\#}$

GRID 7

$F_{3W} = (16.0 PSF \times 526 SF)$ $= 8,416^{\#}$

$F_{3E} = 44,412^{\#} \times (2,777 SF / 11,333 SF)$ $= 10,893^{\#}$

$F_{2W} = 8,416^{\#} + (16.0 PSF \times 417 SF)$ $= 15,009^{\#}$

$F_{2E} = 10,993^{\#} + 38,210^{\#} \times (2,650 SF / 10,229 SF)$ $= 20,782^{\#}$

$F_{1W} = 15,009^{\#} + (16.0 PSF \times 413 SF)$ $= 21,616^{\#}$

$F_{1E} = 20,782^{\#} + 28,991^{\#} \times (2,650 SF / 10,490 SF)$ $= 28,080^{\#}$

GRIDS A-C

$F_{3W} = (16.0PSF \times 179SF) + (9.3PSF \times 111SF) + (8.0PSF \times 43SF)$ $= 4,240^{\#}$

$F_{3E} = 44,412^{\#} \times (2,611SF / 11,333SF)$ $= 10,232^{\#}$

$F_{2W} = 4,240^{\#} + (16.0PSF \times 201SF)$ $= 7,456^{\#}$

$F_{2E} = 10,232^{\#} + 39,210^{\#} \times (2,321SF / 10,229SF)$ $= 18,902^{\#}$

$F_{1W} = 7,456^{\#} + (16.0PSF \times 203SF)$ $= 10,704^{\#}$

$F_{1E} = 18,902^{\#} + 28,891^{\#} \times (2,321SF / 10,490SF)$ $= 25,299^{\#}$

GRID F

$F_{3W} = (16.0PSF \times 244SF)$ $= 3,904^{\#}$

$F_{3E} = 44,412^{\#} \times (5,352SF / 11,333SF)$ $= 20,974^{\#}$

$F_{2W} = 3,904^{\#} + (16.0PSF \times 319SF)$ $= 9,008^{\#}$

$F_{2E} = 20,974^{\#} + 39,210^{\#} \times (5,077SF / 10,229SF)$ $= 39,938^{\#}$

$F_{1W} = 9,009^{\#} + (16.0PSF \times 320SF)$ $= 14,129^{\#}$

$F_{1E} = 39,938^{\#} + 28,891^{\#} \times (5,265SF / 10,490SF)$ $= 54,439^{\#}$

GRIDS J-M

$F_{3W} = (16.0PSF \times 226SF) + (9.3PSF \times 65SF)$ $= 4,221^{\#}$

$F_{3E} = 44,412^{\#} \times (3,370SF / 11,333SF)$ $= 13,206^{\#}$

$F_{2W} = 4,221^{\#} + (16.0PSF \times 174SF)$ $= 7,005^{\#}$

$F_{2E} = 13,206^{\#} + 39,210^{\#} \times (2,883SF / 10,229SF)$ $= 23,782^{\#}$

$F_{1W} = 7,005^{\#} + (16.0PSF \times 174SF)$ $= 9,789^{\#}$

$F_{1E} = 23,782^{\#} + 28,891^{\#} \times (2,904SF / 10,490SF)$ $= 31,780^{\#}$

GRID 1 (LEVEL 3) F_E = 6,027 # 5 SEGMENTS L=4'-4" h=9'
L=4'-8"
L=4'-2"
L=4'-4"
L=10'-6"
L_T = 28'-2"

V_E = 6,027 #/28.17' = 214 PLF

USE W1 $V_{E\,Allow}$ = 242 PLF × (1.25 − 0.125 × 9'/4.08') = 236 PLF

HOLD DOWNS

T_E = 214 PLF × 9' × 1.25 − ½(15PSF × 1' × 2.04') − ½(12PSF × 4.5' × 2.04') = 2,337 #

USE MST 48 w/ 2 STUDS $T_{E\,Allow}$ = 3,425 # × 1.4/1.6 = 2,997 #

GRID 1 (LEVEL 2) F_E = 11,152 # 5 SEGMENTS L_T = 28'-2" h=9'

V_E = 11,152 #/28.17' = 396 PLF

USE W3 $V_{E\,Allow}$ = 456 PLF × (1.25 − 0.125 × 9'/4.08') = 442 PLF

HOLD DOWNS

T_E = 396 PLF × 9' × 1.25 + 2337 # − ½(15PSF × 6' × 20') − ½(12PSF × 9' × 2.04') = 6,590 #

USE CMST 12 w/ 2 STUDS T_E = 9215 # × 1.4/1.6 = 8,063 #

GRID 1 (LEVEL 1) F_E = 14,931 # 5 SEGMENTS L_T = 28'-2" h=9'

V_E 14,931 #/28.17' = 530 PLF

USE W4 $V_{E\,Allow}$ = 353 PLF × (1.25 − 0.125 × 9'/4.08') = 577 PLF

HOLD DOWNS

T_E = 530 PLF × 9' × 1.25 + 6,590 # − ½(15PSF × 6' × 20') − ½(12PSF × 9' × 2.04') = 12,351 #

USE HDU14-SDS2.5 w/ 4 OF #2 STUDS $T_{E\,Allow}$ = 14,445 # × 1.4/1.6 = 12,639 #

GRIDS 4/5=8/9 (LEVEL 3) FE = 9,299# 2 SEGMENTS L=25'-8" h=9'
L=29'-8"
L_T=55'-4"

$V_E = 9{,}299\#/55.33' = 168$ PLF

USE W1 $V_{ALLOW} = 242$ PLF

HOLD DOWNS

$T_E = 168\text{PLF} \times 9' \times 1.25 - \frac{1}{2}(15\text{PSF} \times 2' \times 12.33') - \frac{1}{2}(12\text{PSF} \times 4.5' \times 12.33') = 1{,}382\#$

USE MST37 w/ 2 STUDS $T_{ALLOW} = 2{,}140\# \times 1.4/1.6 = 1{,}873\#$

GRIDS 4/5=8/9 (LEVEL 2) FE = 16,950# 2 SEGMENTS L=55'-4" h=9'

$V_E = 16{,}950\#/55.33' = 306$ PLF

USE W2 $V_{ALLOW} = 353$ PLF

HOLD DOWNS

$T_E = 306\text{PLF} \times 9' \times 1.25 + 1{,}382\# - \frac{1}{2}(15\text{PSF} \times 5.7' \times 12.33') - \frac{1}{2}(12\text{PSF} \times 9' \times 12.33') = 3{,}587\#$

USE MST60W w/ 2 STUDS $T_{ALLOW} = 5{,}405\# \times 1.4/1.6 = 4{,}729\#$

GRIDS 4/5=8/9 (LEVEL 1) FE = 23,101# 2 SEGMENTS L=55'-4" h=9'

$V_E = 23{,}101\#/55.33' = 418$ PLF

USE W3 $V_{ALLOW} = 456$ PLF

HOLD DOWNS

$T_E = 418\text{PLF} \times 9' \times 1.25 + 3{,}587\# - \frac{1}{2}(15\text{PSF} \times 5.7' \times 12.33') - \frac{1}{2}(12\text{PSF} \times 9' \times 12.33') = 7{,}043\#$

USE HDU14-SDS25 w/ 3 STUDS $T_{ALLOW} = 9{,}260\# \times 1.4/1.6 = 8{,}103\#$

GRID 7 (LEVEL 3) $F_E = 10{,}883^{\#}$ 2 SEGMENTS $L = 27'-4''$ $h = 9'$
$L = 29'-9''$
$L_T = 57'-1''$

$v_E = 10{,}883^{\#} / 57.08' = 191 \text{ PLF}$

USE W1 $v_{EALLOW} = 242 \text{ PLF}$

HOLD DOWNS

$T_E = 191 \text{ PLF} \times 9' \times 1.25 - \frac{1}{2}(15 \text{ PSF} \times 1' \times 13.67') = 2{,}042^{\#}$

USE (2) HDQ4-SDS2.5 W/ 2 STUDS $T_{EALLOW} = 3{,}285^{\#} \times 1.4/1.6 = 2{,}874^{\#}$

GRID 7 (LEVEL 2) $F_E = 20{,}782^{\#}$ 2 SEGMENTS $L_T = 57'-1''$ $h = 9'$

$v_E = 20{,}782^{\#} / 57.08' = 364 \text{ PLF}$

USE W3 $v_{EALLOW} = 456 \text{ PLF}$

HOLD DOWNS

$T_E = 364 \text{ PLF} \times 9' \times 1.25 + 2042^{\#} - \frac{1}{2}(15 \text{ PSF} \times 6.83' \times 13.67') = 5{,}438^{\#}$

USE (2) HDQ8-SDS2.5 W/ 3 STUDS $T_{EALLOW} = 6{,}580^{\#} \times 1.4/1.6 = 5{,}758^{\#}$

GRID 7 (LEVEL 1) $F_E = 28{,}080^{\#}$ 2 SEGMENTS $L_T = 57'-1''$ $h = 9'$

$v_E = 28{,}080^{\#} / 57.09' = 492 \text{ PLF}$

USE W4 $v_{EALLOW} = 595 \text{ PLF}$

HOLD DOWNS

$T_E = 492 \text{ PLF} \times 9' \times 1.25 + 5{,}438^{\#} - \frac{1}{2}(15 \text{ PSF} \times 6.83' \times 13.67') = 10{,}272^{\#}$

USE HDU14-SDS2.5 W/ 4 STUDS $T_{EALLOW} = 12{,}425^{\#} \times 1.4/1.6 = 10{,}872^{\#}$

GRID B (LEVEL 3) FE = 6,027# 5 SEGMENTS L=4'-7" L=4'-8" L=4'-2" L=4'-9" L=10'-6" LT = 28'-8" h=9'

VE = 6,027#/28.67' = 210 PLF

USE W1 VERALLOW = 242 PLF x (1.25 - 0.125 x 9'/4.17') = 237 PLF

HOLD DOWNS

TE = 210 PLF x 9' x (1.25 - 1/2(15 PSF x 1' x 2.08') - 1/2(12 PSF x 4.5' x 2.08') = 2,291#

USE MST48 w/ 2 STUDS TERALLOW = 3,425# x 1.4/1.6 = 2997#

GRID 13 (LEVEL 2) FE = 11,152# 5 SEGMENTS LT = 28'-8" h=9'

VE = 11,152#/28.67' = 389 PLF

USE W3 VERALLOW = 456 PLF x (1.25 - 0.125 x 9'/4.17') = 447 PLF

HOLD DOWNS

TE = 389 PLF x 9' x 1.25 + 2,291# - 1/2(15 PSF x 6' x 2.08') - 1/2(12 PSF x 9' x 2.08') = 6,461#

USE CMST 12 w/ 2 STUDS TERALLOW = 9,215# x 1.4/1.6 = 8,063#

GRID 13 (LEVEL 1) FE = 14,931# 5 SEGMENTS LT = 28'-8" h=9'

VE = 14,931#/28.67' = 521 PLF

USE W4 VERALLOW = 595 PLF x (1.25 - 0.125 x 9'/4.17') = 583 PLF

HOLD DOWNS

TE = 521 PLF x 9' x 1.25 + 6,461# - 1/2(15 PSF x 6' x 2.08') - 1/2(12 PSF x 9' x 2.08') = 12,116#

USE HDU14-SDS2.5 w/ (4 OF #2 STUDS) TERALLOW = 19,445# x 1.4/1.6 = 12,639#

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GRIDS A-C (LEVEL 3) $F_E = 10,232^{\#}$ 13 SEGMENTS $L = 3'-10"$ $L = 5'-10"$ $h = 9'$
$L = 9'-2"$ $L = 3'-11"$
$L = 3'-11"$ $L = 8'-7"$
$L = 8'-7"$ $L = 3'-11"$
$L = 3'-11"$ $L = 9'-2"$
$L = 5'-10"$ $L = 3'-10"$
$L = 5'-7"$
$L_T = 75'-7"$

$v_E = 10,232^{\#} / 75.58' = 135 PLF$

USE W1 $v_E = 242 PLF \times (1.25 - 0.125 \times 9'/3.93') = 231 PLF$

HOLD DOWNS

$T_E = 135 PLF \times 9' \times 1.25 - 1/2(25 PSF \times 2' \times 1.92') - 1/2(12 PSF \times 4.5' \times 1.92') = 1,419^{\#}$

USE MST37 w/2 STUDS $T_{ALLOW} = 2,140^{\#} \times 1.4/1.6 = 1,873^{\#}$

GRIDS A-C (LEVEL 2) $F_E = 18,902^{\#}$ 13 SEGMENTS $L_T = 75'-7"$ $h = 9'$

$v_E = 18,902^{\#} / 75.58' = 250 PLF$

USE W2 $v_{ALLOW} = 353 PLF \times (1.25 - 0.125 \times 9'/3.93') = 337 PLF$

HOLD DOWNS

$T_E = 250 PLF \times 9' \times 1.25 + 1,419^{\#} - 1/2(12 PSF \times 9' \times 1.92') = 4,128^{\#}$

USE MST60 w/2 STUDS $T_{ALLOW} = 5,405^{\#} \times 1.4/1.6 = 4,729^{\#}$

GRIDS A-C (LEVEL 1) $F_E = 25,294^{\#}$ 13 SEGMENTS $L_T = 75'-7"$ $h = 9'$

$v_E = 25,294^{\#} / 75.58' = 335 PLF$

USE W2 $v_{ALLOW} = 353 PLF \times (1.25 - 0.125 \times 9'/3.93') = 337 PLF$

HOLD DOWNS

$T_E = 335 PLF \times 9' \times 1.25 + 4,128^{\#} - 1/2(12 PSF \times 9' \times 1.92') = 7,789^{\#}$

USE HDU14-SDS7.5 w/ 3 STUDS $T_{ALLOW} = 9,260^{\#} \times 1.4/1.6 = 8,103^{\#}$

GRID F (LEVEL 3) FE = 20,974# 4 SEGMENTS L = 30'-4" h=9'
L = 15'-8"
L = 15'-8"
L = 30'-4"
LT = 92'-0"

VE = 20,974#/92' = 228 PLF

USE W1 VEALLOW = 242 PLF

HOLD DOWNS

TE = 228 PLF x 9' x 1.25 - 1/2(25 PSF x 16.25' x 7.33') - 1/2(12 PSF x 4.5' x 7.33') = 714#

USE MST37 w/ 2 STUDS — TEALLOW = 2,140# x 1.4/1.6 = 1,873#
OR (2) HDU2-SDS2.5 w/ 2 STUDS — TEALLOW = 2,215# x 1.4/1.6 = 2,067#

GRID F (LEVEL 2) FE = 39,939# 4 SEGMENTS LT = 92'-0" h=9'

VE = 39,939#/92' = 434 PLF

USE W3 VEALLOW = 456 PLF

HOLD DOWNS

TE = 434 PLF x 9' x 1.25 + 714# = 5,598#

USE MST72 w/ 2 STUDS — TEALLOW = 6,475# x 1.4/1.6 = 5,666#
OR (2) HDU8-SDS2.5 w/ 3 STUDS — TEALLOW = 6580# x 1.4/1.6 = 5,758#

GRID F (LEVEL 1) FE = 54,439# 4 SEGMENTS LT = 92'-0" h=9'

VE = 54,439#/92' = 592 PLF

USE W4 VEALLOW = 595 PLF

HOLD DOWNS

TE = 592 PLF x 9' x 1.25 + 5,599# = 12,255#

USE HDU14-SDS2.5 w/ 4 OF #2 STUDS — TEALLOW = 14,445# x 1.4/1.6 = 12,639#

GRIDS J-M (LEVEL 3) FE = 13,206# 14 SEGMENTS

L=7'-7" L=6'-11"
L=9'-2" L=3'-3" h=9'
L=4'-7" L=2'-11"
L=4'-0" L=3'-2"
L=3'-2" L=3'-11"
L=2'-11" L=4'-7"
L=3'-3" L=9'-2"
L_T = 68'-7"

V_E = 13,206#/68.58' = 193 plf

USE W1 V_{ALLOW} = 242 plf x (1.25 - 0.125 x 9'/2.92') = 209 plf

HOLD DOWNS

T_{ALLOW} = 193 plf x 9' x 1.25 - ½(250 psf x 2' x 1.46') - ½(120 psf x 4.5' x 1.46') = 2,095#

USE MST48 W/ 2STUDS T_{ALLOW} = 3,425# x 1.4/1.6 = 2997#

GRIDS J-M (LEVEL 2) FE = 23,782# 14 SEGMENTS L_T = 69'-7" h = 9'

V_E = 23,782#/68.58' = 347 plf

USE W3 V_{ALLOW} = 456 plf x (1.25 - 0.125 x 9'/2.92') = 394 plf

HOLD DOWNS

T_E = 347 plf x 9' x 1.25 + 2,095# - ½(120 psf x 9' x 1.46') = 5,920#

USE CMST12 W/ 2STUDS T_{ALLOW} = 9,215# x 1.4/1.6 = 8,063#

GRIDS J-M (LEVEL 1) FE = 31,780# 14 SEGMENTS L_T = 69'-7" h = 9'

V_E = 31,780#/68.58' = 463 plf

USE W4 V_{ALLOW} = 595 plf x (1.25 - 0.125 x 9'/2.92') = 515 plf

HOLD DOWNS

T_{ALLOW} = 463 plf x 9' x 1.25 + 5,920# - ½(120 psf x 9' x 1.46') = 11,054#

USE HDU14-SDS2.5 W/ 4 DFTA2 STUDS T_{ALLOW} = 14,445# x 1.4/1.6 = 12,639#