PRMU20240400

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

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

City of Puyallup
Building
REVIEWED FOR COMPLIANCE
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PIERUCCIONI E&C, LLC
CHON PIERUCCIONI, PE
3128 N. BENNETT ST.
TACOMA, WA 98407

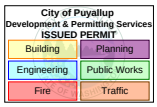
EAST TOWN CROSSING
BUILDING "C"
PIONEER & SHAW PUYALLUP WA

REVISIONS	
01	CITY REVIEW

REVISIONS

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

2nd Floor Framing			
Member Name	**Results (Max UTIL %)**	**Current Solution**	**Comments**
Floor Joist 16' and Under	Passed (96% M)	1 piece(s) 11 7/8" TJI® 110 @ 16" OC	
Floor Joist 17'-8"	Passed (98% M)	1 piece(s) 11 7/8" TJI® 210 @ 16" OC	
Floor Joist 19'-4"	Passed (72% M)	1 piece(s) 11 7/8" TJI® 360 @ 16" OC	
Floor Joist 20'-7" (with offset 3rd flr.)	Passed (82% R)	2 piece(s) 11 7/8" TJI® 560 @ 16" OC	
Cantilever Floor Joist (Grid 6-8)	Passed (60% R)	1 piece(s) 11 7/8" TJI® 110 @ 16" OC	
Cantilever Floor Joist (Grid 6-8)	Passed (54% R)	2 piece(s) 11 7/8" TJI® 110 @ 16" OC	
Short Stair Stringers	Passed (68% R)	1 piece(s) 4 x 12 HF No.2	
Long Short Stair Stringers	Passed (98% ΔL)	1 piece(s) 3 1/2" x 12" 24F-V4 DF Glulam	
Top Landing Beam	Passed (98% R)	1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam	
10'-10" Deck Joist	Passed (71% R)	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Deck Cantilever Ledger 2'	Passed (47% R)	2 piece(s) 2 x 12 HF No.2	
Grid 2.6 (F-G.3) Flush Beam	Passed (92% R)	1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.6 (G.9-H.8) Flush Beam	Passed (92% R)	1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.4 (H.8-I.8) Door Header	Passed (46% R)	1 piece(s) 4 x 8 DF No.2	
Grid 2.4 (J.2-K.8) Door Header	Passed (73% M)	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (H-H.8) Door Header	Passed (77% R)	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (G.1-G.3) Flush Beam	Passed (63% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid G.1 (5.2-5.3) Door Header	Passed (53% R)	1 piece(s) 4 x 8 DF No.2	
Grid 6 (G.1-G.3) Flush Beam	Passed (70% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.5 (D.4-D.6) Flush Beam	Passed (86% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 3.3 (D.8-E.1) Flush Beam	Passed (87% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 5.3 (D.5-E.2) Flush Beam	Passed (74% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 6 (D.3-D.6) Flush Beam	Passed (96% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid D.4 (6-8) Door Headers	Passed (29% R)	1 piece(s) 4 x 8 DF No.2	



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

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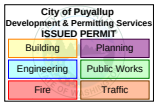
ForteWEB v3.8
File Name: East Town Crossing Building C

3rd Floor Framing			
Member Name	**Results (Max UTIL %)**	**Current Solution**	**Comments**
Floor Joist 16' and Under	Passed (96% M)	1 piece(s) 11 7/8" TJI® 110 @ 16" OC	
Floor Joist 17'-8"	Passed (98% M)	1 piece(s) 11 7/8" TJI® 210 @ 16" OC	
Floor Joist 19'-4"	Passed (72% M)	1 piece(s) 11 7/8" TJI® 360 @ 16" OC	
Floor Joist 20'-7"	Passed (59% ΔT)	1 piece(s) 11 7/8" TJI® 560 @ 16" OC	
7'-6" Landing Joists	Passed (100% R)	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Top Landing Beam	Passed (99% ΔL)	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	
Short Stair Stringers	Passed (68% R)	1 piece(s) 4 x 12 HF No.2	
4' Mid Landing Joists	Passed (77% R)	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Mid Landing Beam Inner	Passed (79% ΔL)	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	
Mid Landing Beam Outer	Passed (102% ΔL)	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
10'-10" Deck Joist	Passed (71% R)	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Deck Cantilever Ledger 2'	Passed (47% R)	2 piece(s) 2 x 12 HF No.2	
6' Window Header	Passed (17% M)	1 piece(s) 4 x 10 DF No.2	
Grid 2.6 (F-G.5) Flush Beam	Passed (92% ΔL)	1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.6 (H-H.8) Flush Beam	Passed (64% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.4 (H.8-I.8) Door Header	Passed (46% R)	1 piece(s) 4 x 8 DF No.2	
Grid 2.4 (J.2-K.8) Door Header	Passed (73% M)	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (H-H.8) Door Header	Passed (34% R)	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (G.4-G.8) Door Header	Passed (89% M)	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (G.1-G.3) Flush Beam	Passed (32% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid G.1 (5.2-5.3) Door Header	Passed (32% V)	1 piece(s) 4 x 8 DF No.2	
Grid 6 (G.1-G.3) Flush Beam	Passed (35% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.5 (D.4-D.6) Flush Beam	Passed (52% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 3.3 (D.8-E.1) Flush Beam	Passed (43% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 5.3 (D.5-E.2) Flush Beam	Passed (67% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 6 (D.3-D.6) Flush Beam	Passed (48% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Roof Framing			
Member Name	**Results (Max UTIL %)**	**Current Solution**	**Comments**
Grid I Entry Roof Beam	Passed (91% R)	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Grid L 10' Deck Roof Beam	Passed (101% R)	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
6' Window Header	Passed (90% R)	1 piece(s) 4 x 10 DF No.2	
Grid B 11' Deck Roof Beam	Passed (100% R)	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Deck Roof Cantilever Beam	Failed (61% R)	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.



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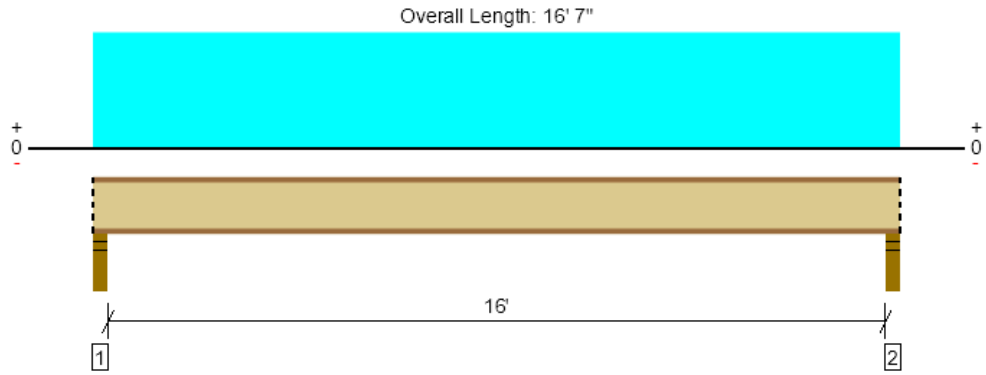
File Name: East Town Crossing Building C

2nd Floor Framing, Floor Joist 16' and Under

1 piece(s) 11 7/8" TJI® 110 @ 16" OC



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

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	--	--

Member Length : 16' 7"
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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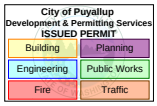
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator



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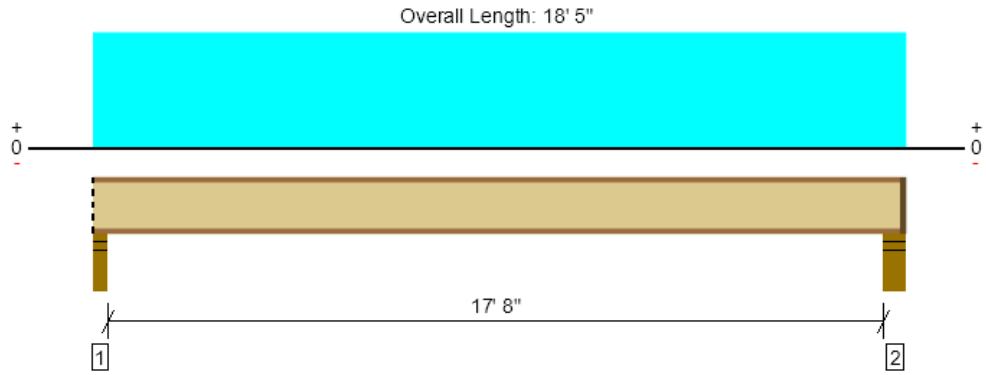
2nd Floor Framing, Floor Joist 17'-8"

1 piece(s) 11 7/8" TJI® 210 @ 16" OC



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

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	--	--

Member Length : 18' 3 1/2"
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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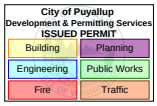
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator



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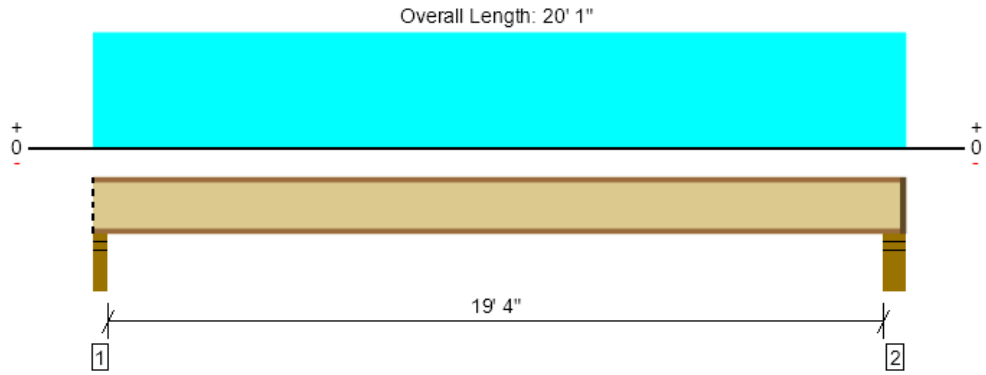
2nd Floor Framing, Floor Joist 19'-4"

1 piece(s) 11 7/8" TJI® 360 @ 16" OC



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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	--	--

Member Length : 19' 11 1/2"
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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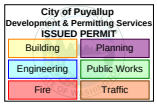

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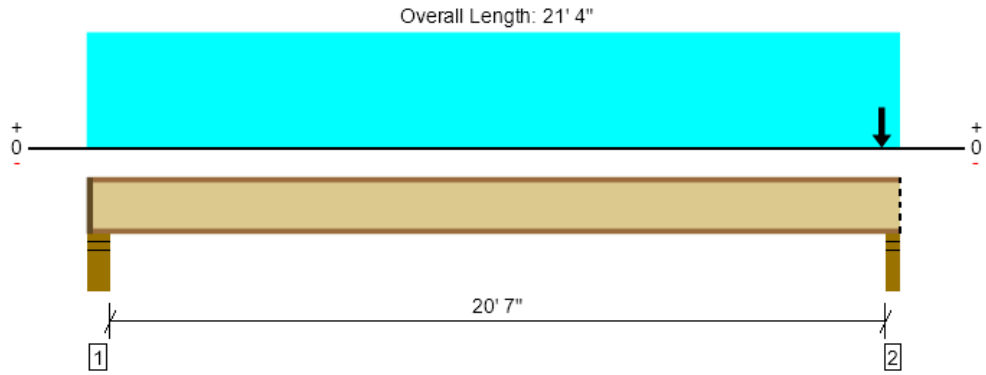
2nd Floor Framing, Floor Joist 20'-7" (with offset 3rd flr.)

2 piece(s) 11 7/8" TJI® 560 @ 16" OC



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

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	--	--

Member Length : 21' 2 1/2"
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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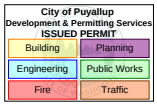
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

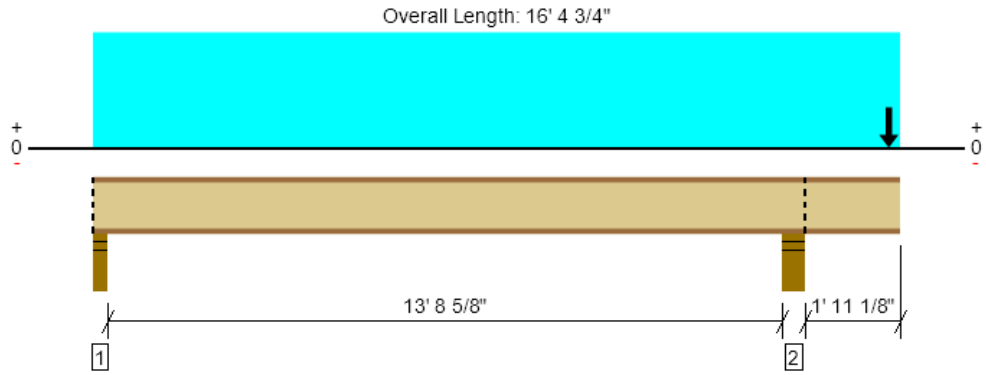


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

2nd Floor Framing, Cantilever Floor Joist (Grid 6-8)

1 piece(s) 11 7/8" TJI® 110 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1409 @ 14' 2 7/8"	2350 (5.25")	Passed (60%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	653 @ 14' 5 5/8"	1560	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1888 @ 6' 6 13/16"	3160	Passed (60%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.162 @ 7' 2 11/16"	0.468	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.230 @ 6' 11 1/2"	0.702	Passed (L/733)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	54	40	Passed	--	--

Member Length : 16' 4 3/4"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/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	Snow	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.75"	228	385/-19	-11	613	Blocking
2 - Stud wall - HF	5.50"	5.50"	3.50"	825	584	94	1409	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' 1" o/c	
Bottom Edge (Lu)	5' 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)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 16' 4 3/4"	16"	30.0	40.0	-	Level 2 Floor
2 - Point (lb)	16' 2"	N/A	83	40	83	Roof Loads
3 - Point (lb)	16' 2"	N/A	287	-	-	Walls
4 - Point (lb)	16' 2"	N/A	27	36	-	Level 3 Floor

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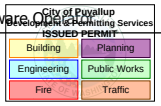
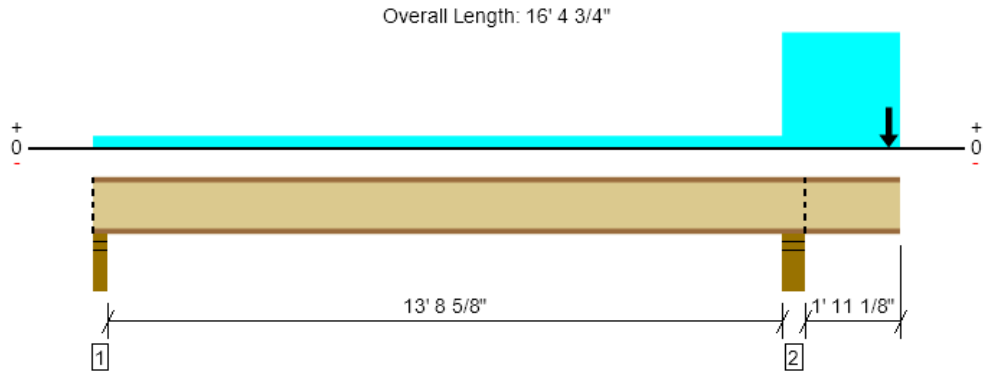


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

2nd Floor Framing, Cantilever Floor Joist (Grid 6-8)

2 piece(s) 11 7/8" TJI® 110 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2550 @ 14' 2 7/8"	4700 (5.25")	Passed (54%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1461 @ 14' 5 5/8"	3120	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-1851 @ 14' 2 7/8"	6320	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.087 @ 7' 2 3/4"	0.468	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.047 @ 16' 4 3/4"	0.216	Passed (2L/999+)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	62	40	Passed	--	--

Member Length : 16' 4 3/4"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/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	Snow	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.75"	209	386/-51	-11	594	Blocking
2 - Stud wall - HF	5.50"	5.50"	3.50"	1443	1107	94	2550	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' 1" o/c	
Bottom Edge (Lu)	6' 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)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 16' 4 3/4"	16"	30.0	40.0	-	Level 2 Floor
2 - Point (lb)	16' 2"	N/A	83	40	83	Roof Loads
3 - Uniform (PLF)	14' to 16' 4 3/4"	N/A	216.0	-	-	Walls
4 - Uniform (PLF)	14' to 16' 4 3/4"	N/A	165.0	220.0	-	Level 3 Floor

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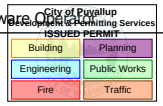
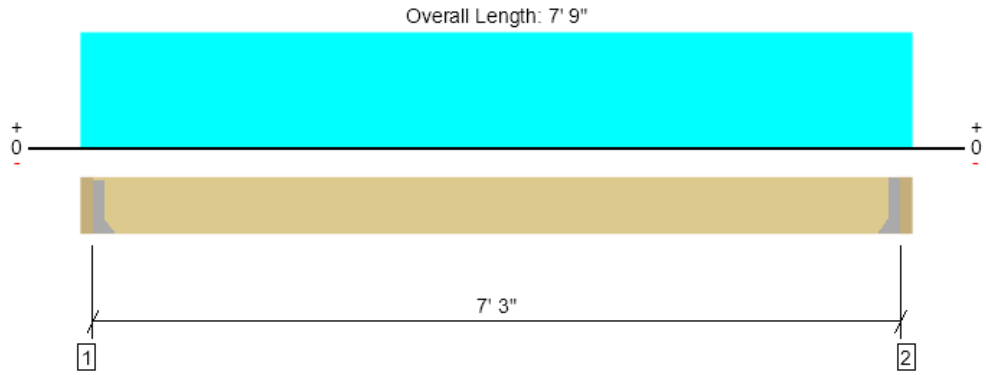


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

2nd Floor Framing, Short Stair Stringers

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



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

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)

Member Length : 7' 3"
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

- Side loads are assumed to not induce cross-grain tension.

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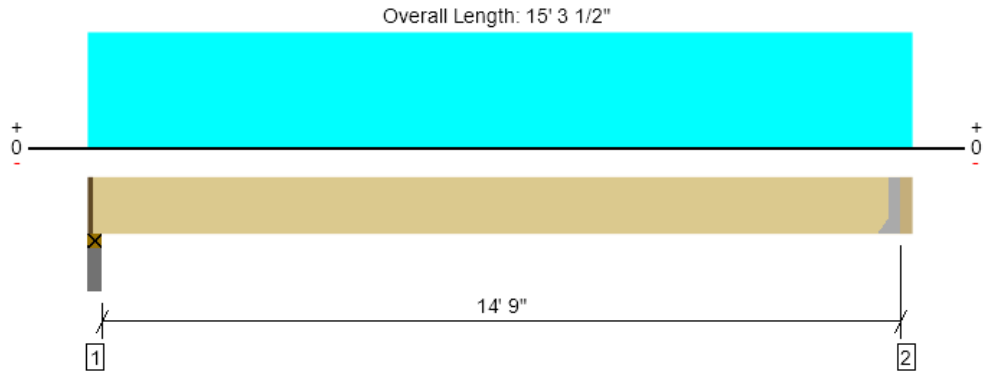
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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



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

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)

Member Length : 14' 11 1/4"
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	

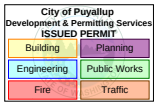
•Maximum allowable bracing intervals based on applied load.

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

- Side loads are assumed to not induce cross-grain tension.



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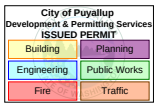
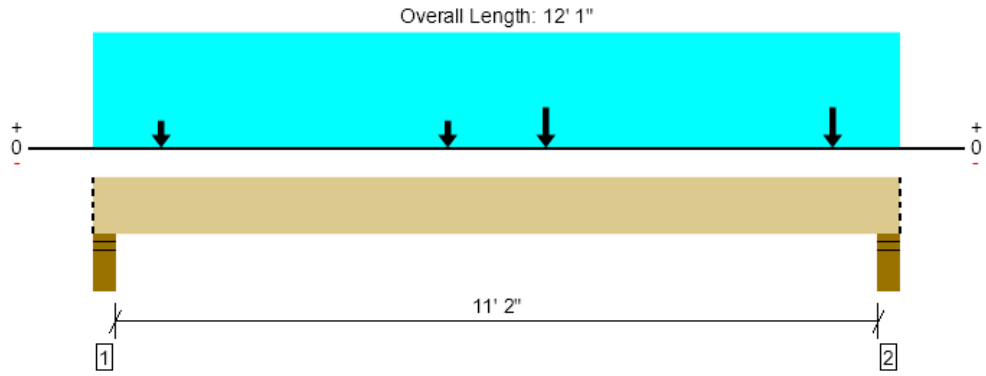


2nd Floor Framing, Top Landing Beam

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



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

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)

Member Length : 12' 1"
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

• Side loads are assumed to not induce cross-grain tension.

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

Weyerhaeuser

Weyerhaeuser Notes

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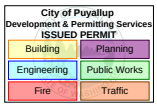
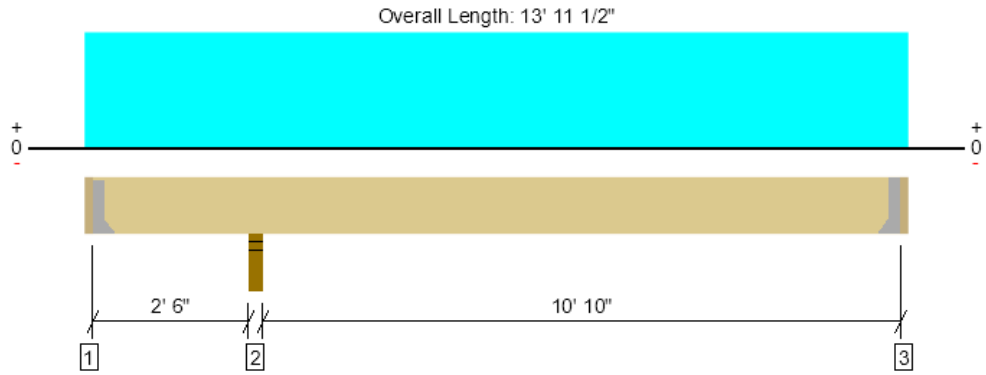
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator



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

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



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

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

Member Length : 13' 7 1/2"
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.

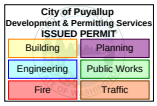
Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' o/c	
Bottom Edge (Lu)	7' 11" o/c	

•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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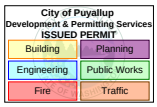
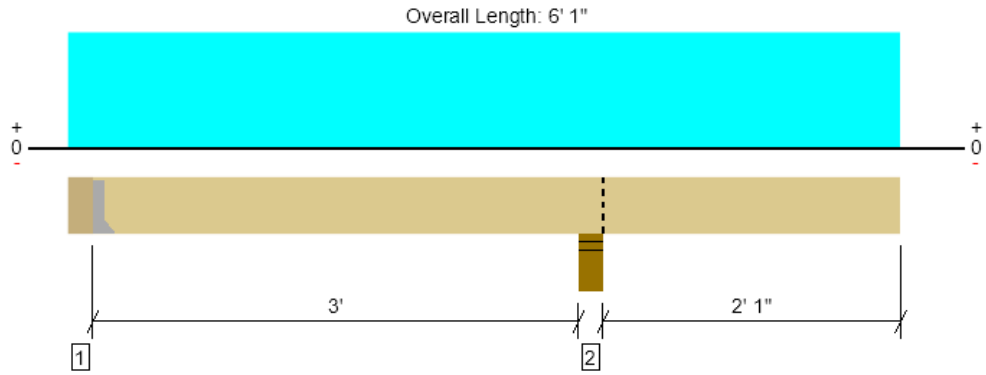


2nd Floor Framing, Deck Cantilever Ledger 2'

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



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

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)

Member Length : 5' 7"
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

- Side loads are assumed to not induce cross-grain tension.

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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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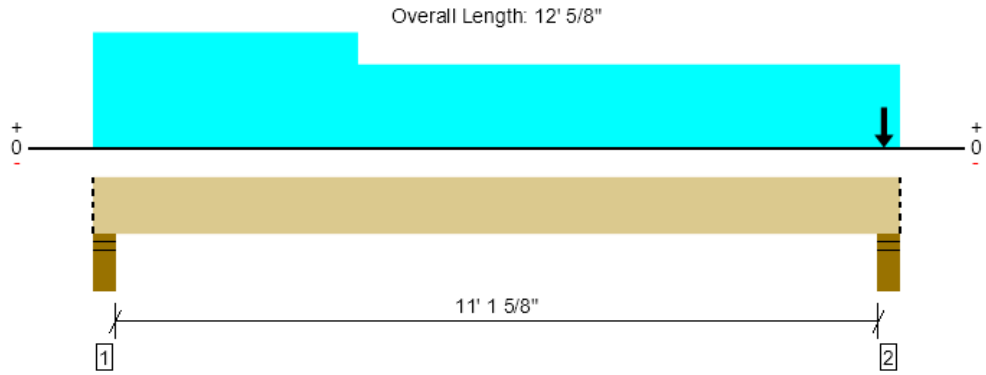
Weyerhaeuser

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	11234 @ 11' 8 5/8"	12251 (5.50")	Passed (92%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4232 @ 1' 5 3/8"	11539	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	13929 @ 5' 9 11/16"	25853	Passed (54%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.133 @ 5' 11 3/4"	0.285	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.237 @ 5' 11 3/4"	0.569	Passed (L/577)	--	1.0 D + 1.0 L (All Spans)

Member Length : 12' 5/8"
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' 4 5/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	2.61"	2550	3272	5822	Blocking
2 - Stud wall - HF	5.50"	5.50"	5.04"	4936	6299	11234	Blocking

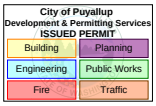
• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

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' 5/8"	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 12' 5/8" (Front)	11' 2"	30.0	40.0	Default Load
3 - Point (lb)	11' 9 3/4" (Top)	N/A	2747	3508	Linked from: Grid 2.6 (F-G.5) Flush Beam, Support 2

• Side loads are assumed to not induce cross-grain tension.



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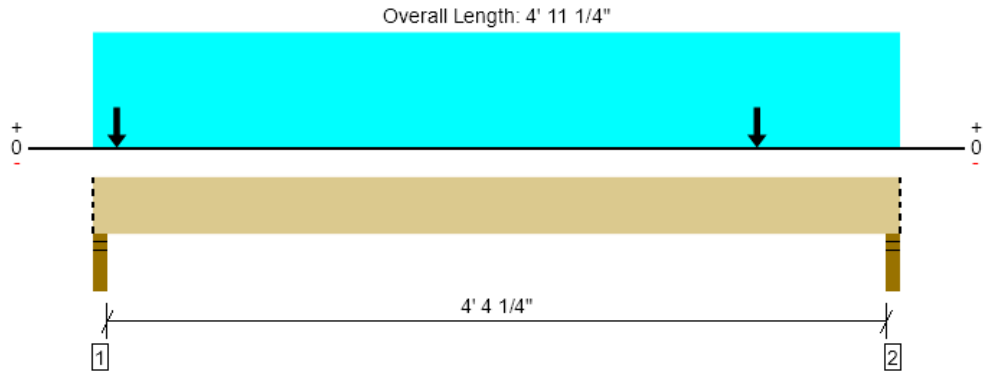
Weyerhaeuser

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



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

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)

Member Length : 4' 11 1/4"
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

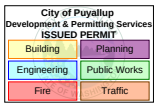
• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

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

• Side loads are assumed to not induce cross-grain tension.



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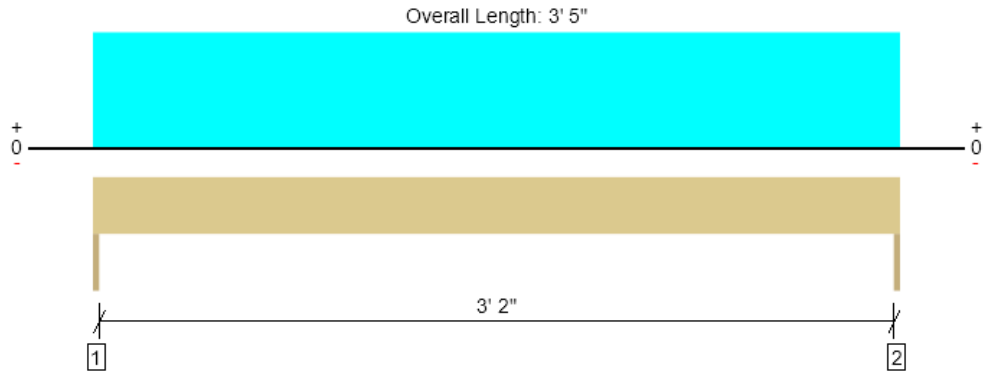
Weyerhaeuser

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

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



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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)

Member Length : 3' 5"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- 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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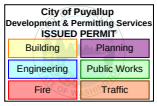

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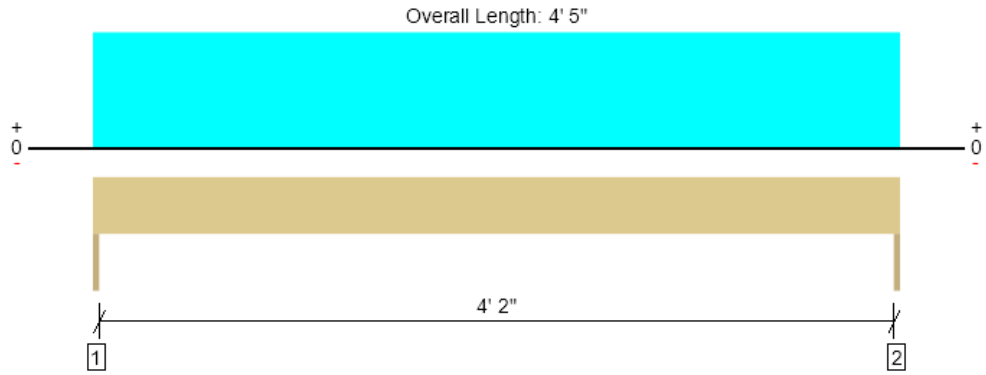
Weyerhaeuser

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

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



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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)

Member Length : 4' 5"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- 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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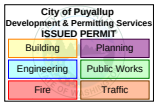
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

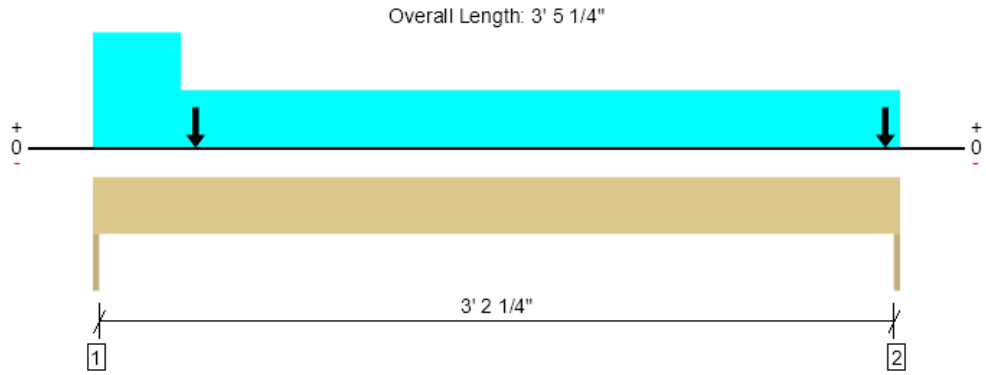


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2522 @ 3' 5 1/4"	3281 (1.50")	Passed (77%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1200 @ 8 3/4"	3045	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1366 @ 1' 5 15/16"	2989	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.009 @ 1' 7 13/16"	0.115	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.017 @ 1' 7 13/16"	0.172	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 3' 5 1/4"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- 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"	1088	1424	2512	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	1094	1429	2522	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 1/4"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 3' 5 1/4"	10' 3"	30.0	40.0	2nd Floor
2 - Uniform (PSF)	0 to 4 1/2"	10' 3"	30.0	40.0	3rd Floor
3 - Point (lb)	5 1/4"	N/A	484	632	Linked from: Grid 5.5 (H-H.8) Door Header, Support 1
4 - Point (lb)	3' 4 1/2"	N/A	484	632	Linked from: Grid 5.5 (H-H.8) Door Header, Support 2

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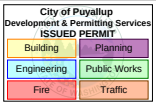
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

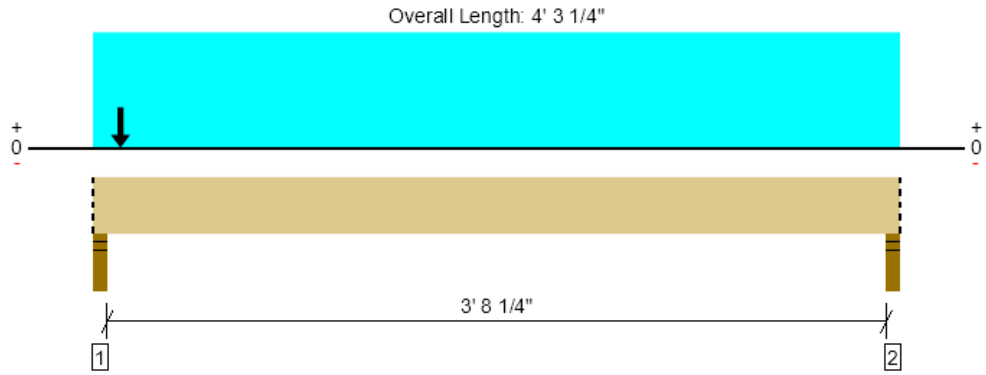


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3130 @ 2"	4961 (3.50")	Passed (63%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	621 @ 1' 3 3/8"	7343	Passed (8%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	1410 @ 2' 1 5/8"	16452	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.003 @ 2' 1 5/8"	0.098	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.004 @ 2' 1 5/8"	0.197	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 4' 3 1/4"
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' 11 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"	2.21"	1366	1764	3130	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	678	876	1554	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' 3 1/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 3 1/4" (Front)	10' 3"	30.0	40.0	Default Load
2 - Point (lb)	1 3/4" (Top)	N/A	688	888	Linked from: Grid 5.5 (G.1-G.3) Flush Beam, Support 1

• Side loads are assumed to not induce cross-grain tension.

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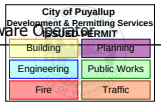
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

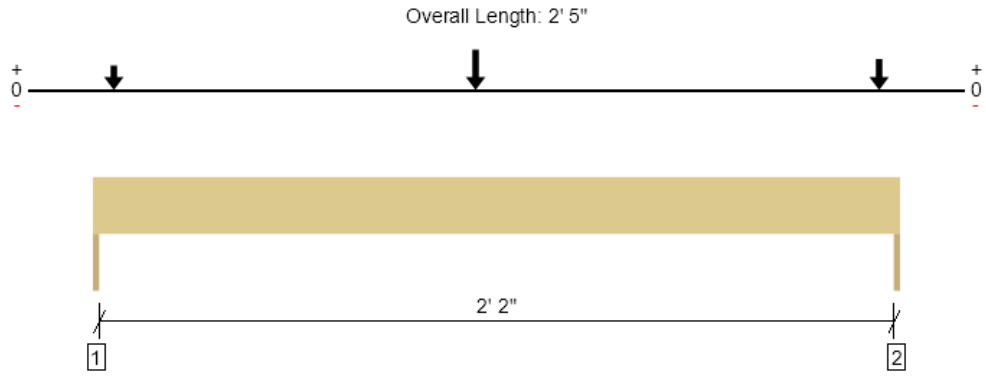


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1731 @ 2' 5"	3281 (1.50")	Passed (53%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	820 @ 8 3/4"	3045	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	941 @ 1' 1 3/4"	2989	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.002 @ 1' 2 7/16"	0.081	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.004 @ 1' 2 7/16"	0.121	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 2' 5"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- 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"	633	798	1431	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	764	966	1731	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' 1 3/4"	N/A	678	876	Linked from: Grid 5.5 (G.1-G.3) Flush Beam, Support 2
2 - Point (lb)	3/4"	N/A	269	337	Linked from: Grid G.1 (5.2-5.3) Door Header, Support 1
3 - Point (lb)	2' 4 1/4"	N/A	435	551	Linked from: Grid G.1 (5.2-5.3) Door Header, Support 2

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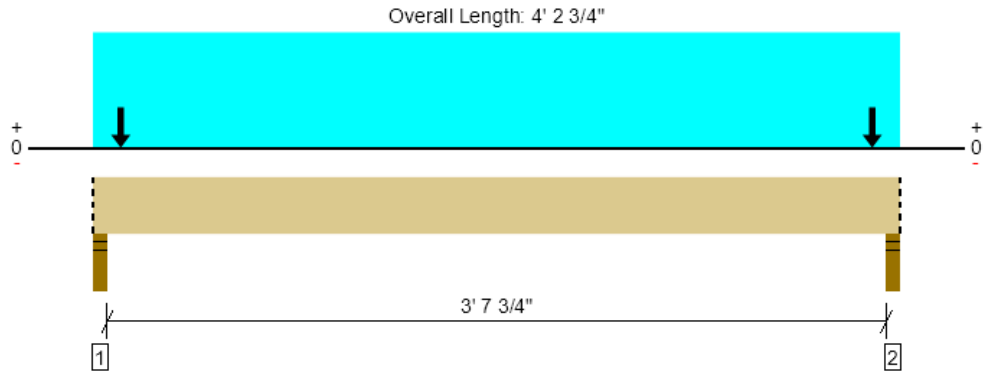
Weyerhaeuser

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3464 @ 2"	4961 (3.50")	Passed (70%)	--	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)

Member Length : 4' 2 3/4"
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"	2.44"	1510	1955	3464	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.44"	1510	1955	3464	Blocking

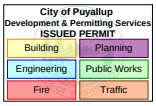
• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

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	764	989	Linked from: Grid 6 (G.1-G.3) Flush Beam, Support 1
3 - Point (lb)	4' 1" (Top)	N/A	764	989	Linked from: Grid 6 (G.1-G.3) Flush Beam, Support 1

• Side loads are assumed to not induce cross-grain tension.



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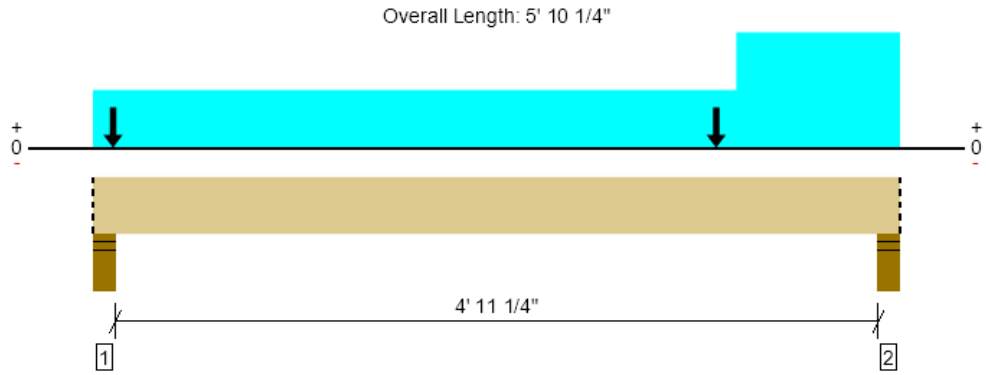
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

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



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

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)

Member Length : 5' 10 1/4"
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

• Side loads are assumed to not induce cross-grain tension.

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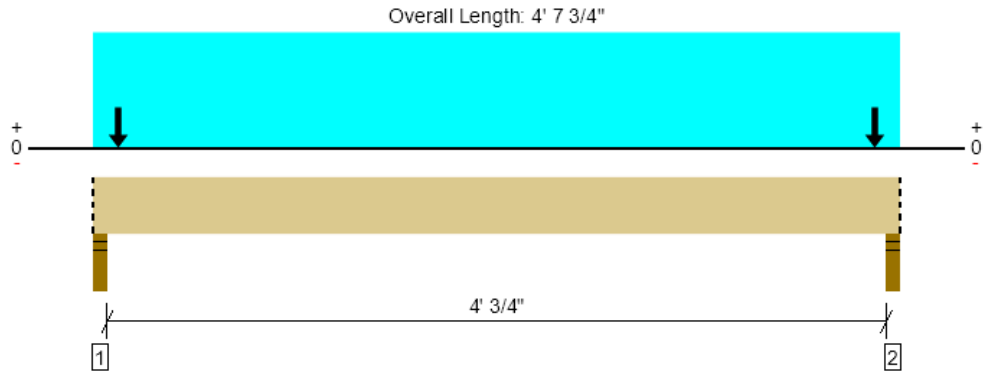
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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



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

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)

Member Length : 4' 7 3/4"
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

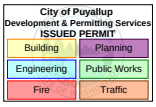
• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

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

• Side loads are assumed to not induce cross-grain tension.



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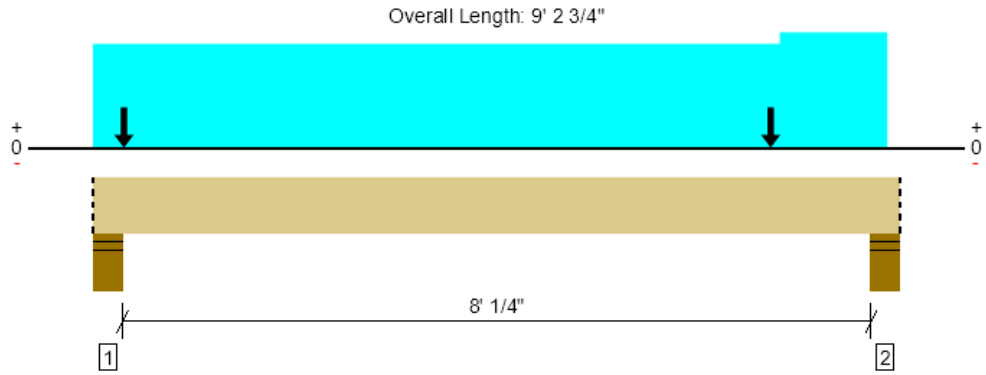
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

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

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7653 @ 5 3/4"	10277 (7.25")	Passed (74%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	5147 @ 7' 7 5/8"	7343	Passed (70%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	9047 @ 5' 1 1/8"	16452	Passed (55%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.073 @ 4' 8 3/4"	0.207	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.130 @ 4' 8 3/4"	0.414	Passed (L/766)	--	1.0 D + 1.0 L (All Spans)

Member Length : 9' 2 3/4"
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 = 8' 3 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	7.25"	7.25"	5.40"	3332	4322	7653	Blocking
2 - Stud wall - HF	7.25"	7.25"	4.82"	2975	3858	6833	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' 3" o/c	
Bottom Edge (Lu)	9' 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 9' 2 3/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 7' 10 1/4" (Front)	12'	30.0	40.0	Default Load
2 - Uniform (PSF)	7' 10 1/4" to 9' 1" (Front)	13' 4"	30.0	40.0	Default Load
3 - Point (lb)	4 1/4" (Top)	N/A	1447	1877	Linked from: Grid 5.3 (D.5-E.2) Flush Beam, Support 1
4 - Point (lb)	7' 9" (Top)	N/A	1447	1877	Linked from: Grid 5.3 (D.5-E.2) Flush Beam, Support 2

• Side loads are assumed to not induce cross-grain tension.

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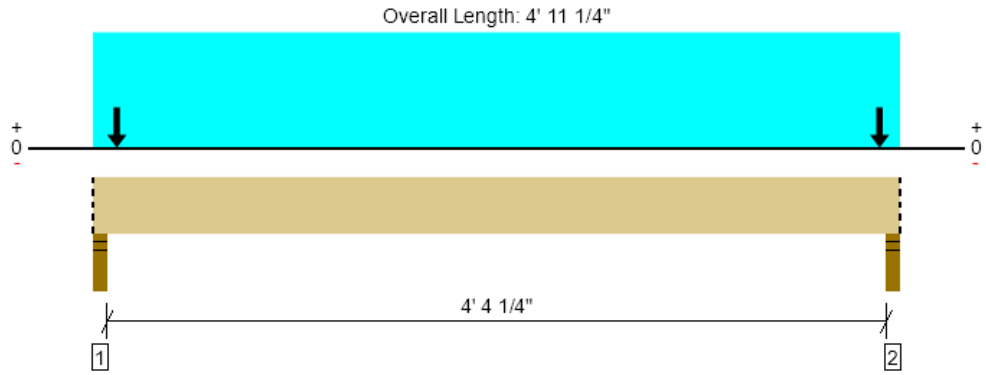
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

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

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



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

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)

Member Length : 4' 11 1/4"
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

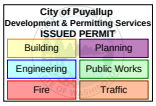
• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

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

• Side loads are assumed to not induce cross-grain tension.



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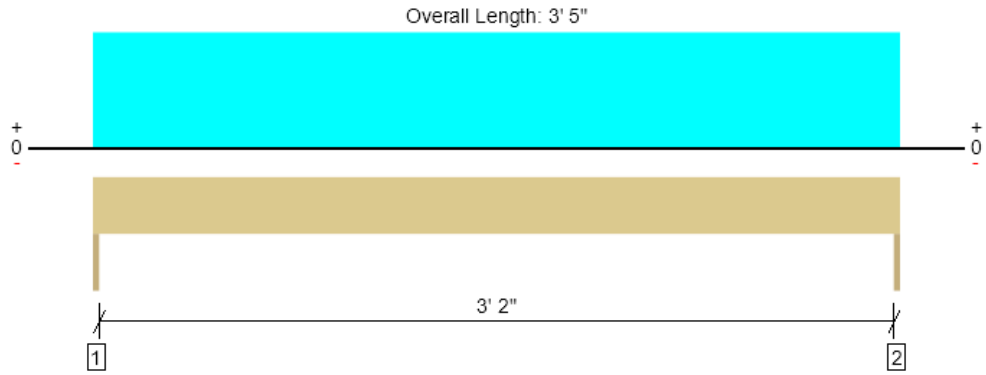
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

2nd Floor Framing, Grid D.4 (6-8) Door Headers

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	948 @ 0	3281 (1.50")	Passed (29%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	543 @ 8 3/4"	3502	Passed (16%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	810 @ 1' 8 1/2"	3438	Passed (24%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.005 @ 1' 8 1/2"	0.114	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.010 @ 1' 8 1/2"	0.171	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 3' 5"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- 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"	412	535	948	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	412	535	948	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)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 5"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 3' 5"	7' 10"	30.0	40.0	Default Load

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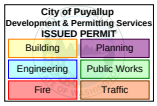

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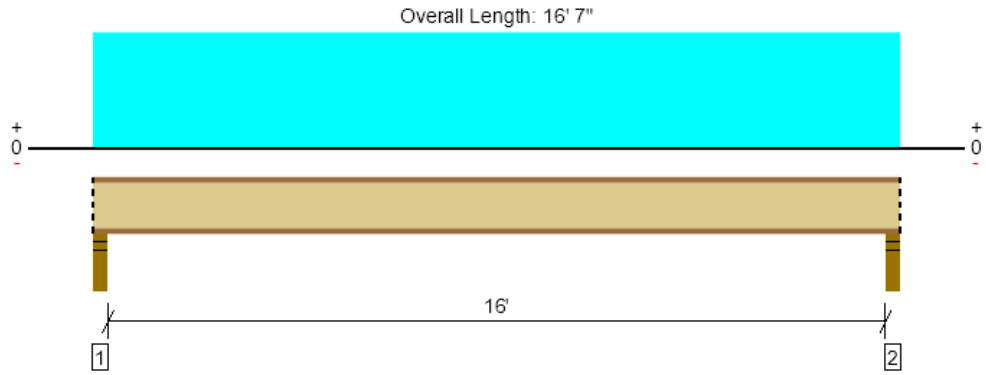
Weyerhaeuser

3rd Floor Framing, Floor Joist 16' and Under

1 piece(s) 11 7/8" TJI® 110 @ 16" OC



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

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	--	--

Member Length : 16' 7"
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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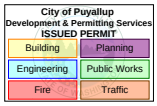
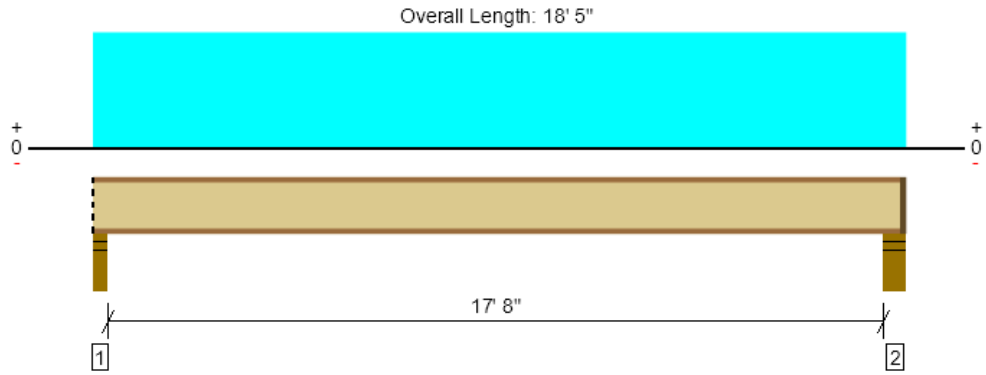


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

1 piece(s) 11 7/8" TJI® 210 @ 16" OC



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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	--	--

Member Length : 18' 3 1/2"
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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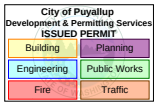
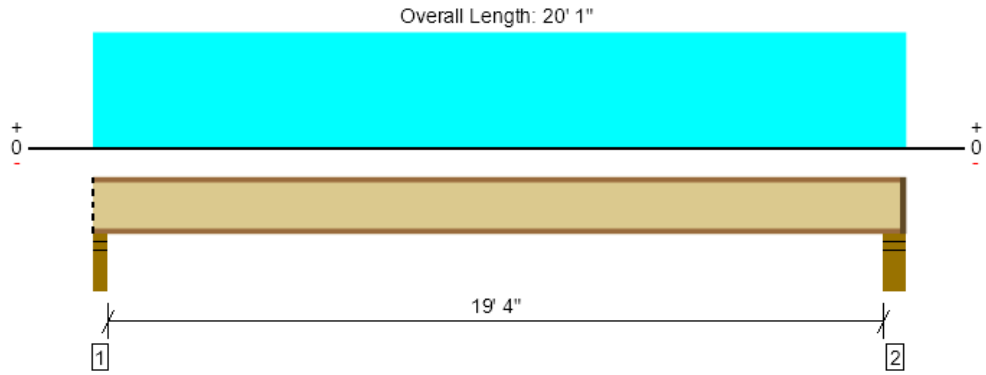


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

1 piece(s) 11 7/8" TJI® 360 @ 16" OC



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

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	--	--

Member Length : 19' 11 1/2"
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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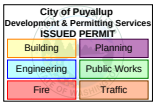
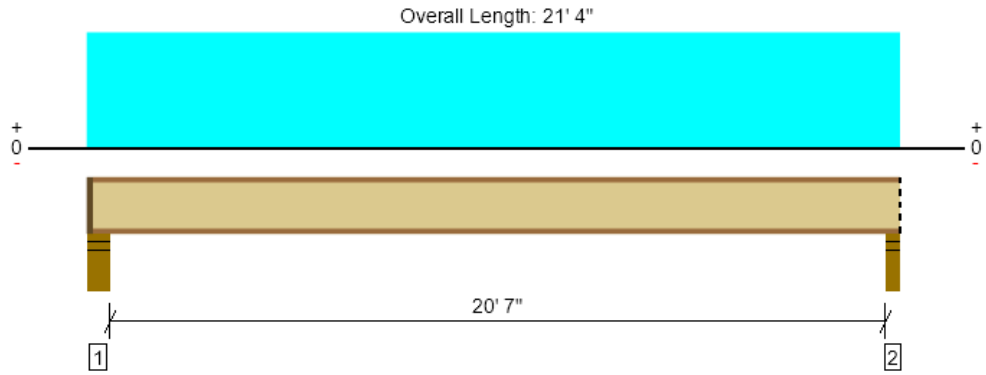


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

1 piece(s) 11 7/8" TJI® 560 @ 16" OC



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

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	--	--

Member Length : 21' 2 1/2"
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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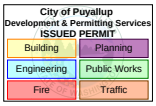
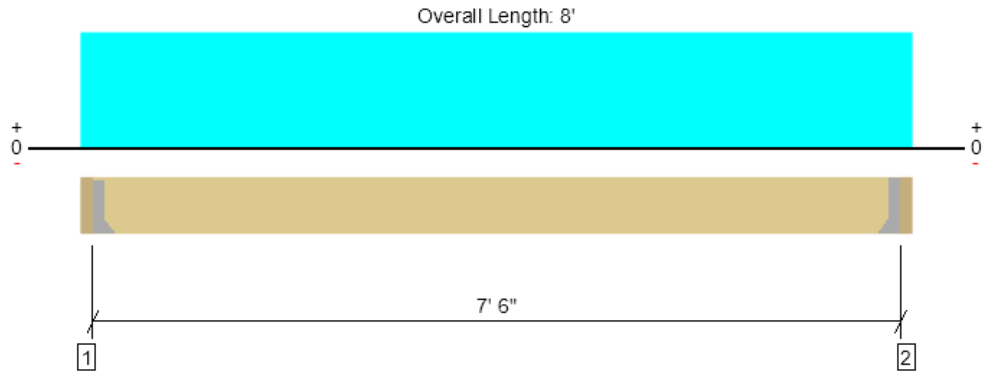


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

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



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

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

Member Length : 7' 6"
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	

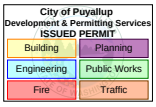
•Maximum allowable bracing intervals based on applied load.

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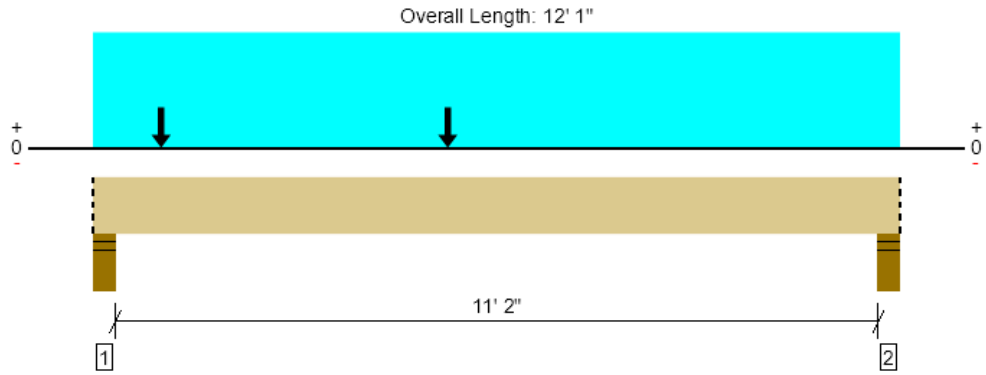
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

9/12/2024 5:52:24 PM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building C

3rd Floor Framing, Top Landing Beam

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



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

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)

Member Length : 12' 1"
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.

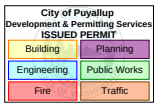
Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	4.13"	2239	6960	9199	Blocking
2 - Stud wall - HF	5.50"	5.50"	3.43"	1851	5788	7639	Blocking

• 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



• Side loads are assumed to not induce cross-grain tension.

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ForteWEB Software Operator	Job Notes
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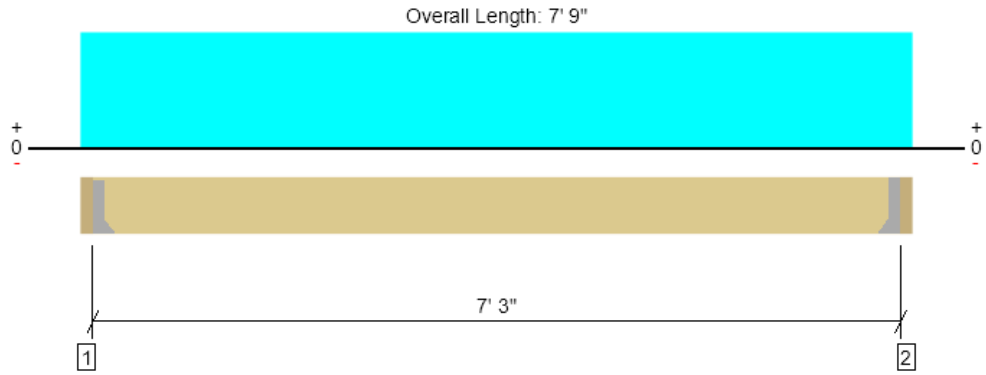
Weyerhaeuser

3rd Floor Framing, Short Stair Stringers

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



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

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)

Member Length : 7' 3"
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.

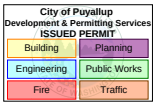
Connector: Simpson Strong-Tie

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

- Side loads are assumed to not induce cross-grain tension.



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ForteWEB Software Operator	Job Notes
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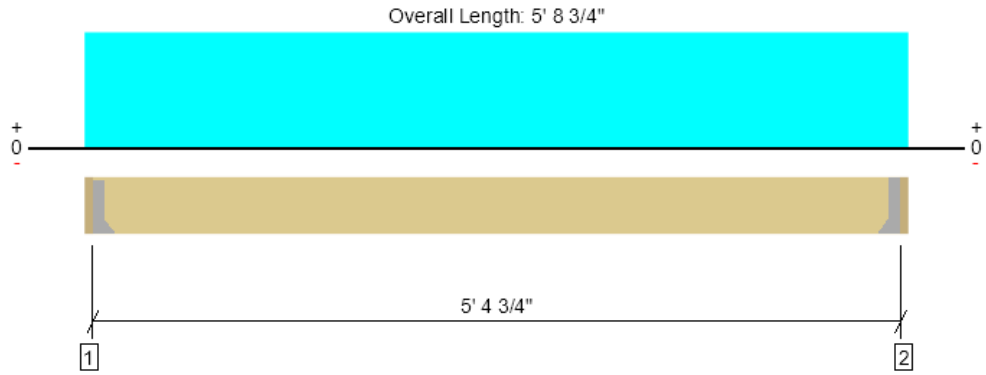
Weyerhaeuser

3rd Floor Framing, 4' Mid Landing Joists

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	701 @ 2"	911 (1.50")	Passed (77%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	458 @ 1' 1 1/4"	1688	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	946 @ 2' 10 3/8"	2577	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.016 @ 2' 10 3/8"	0.180	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.021 @ 2' 10 3/8"	0.270	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 5' 4 3/4"
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"	172	573	745	See note [1]
2 - Hanger on 11 1/4" LSL beam	2.00"	Hanger[1]	1.50"	172	573	745	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' 5" o/c	
Bottom Edge (Lu)	5' 5" o/c	

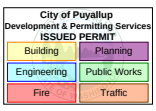
•Maximum allowable bracing intervals based on applied load.

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 5' 8 3/4"	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

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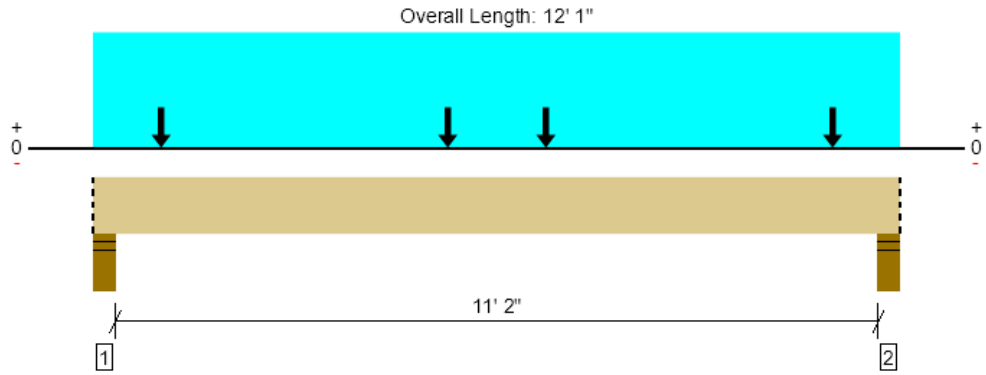
Weyerhaeuser

9/12/2024 5:52:24 PM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building C

3rd Floor Framing, Mid Landing Beam Inner

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	6828 @ 11' 9"	12251 (5.50")	Passed (56%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	5286 @ 1' 5 1/2"	11660	Passed (45%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	18813 @ 6' 7/16"	26400	Passed (71%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.225 @ 6' 1/2"	0.285	Passed (L/609)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.300 @ 6' 1/2"	0.571	Passed (L/457)	--	1.0 D + 1.0 L (All Spans)

Member Length : 12' 1"
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"	3.06"	1704	5118	6823	Blocking
2 - Stud wall - HF	5.50"	5.50"	3.07"	1706	5122	6828	Blocking

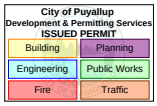
• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

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)	3' 1"	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

• Side loads are assumed to not induce cross-grain tension.



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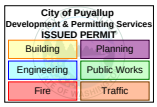
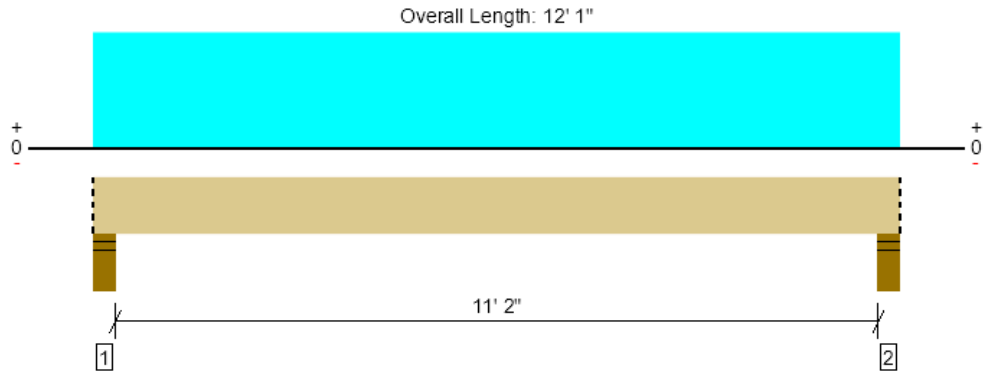


3rd Floor Framing, Mid Landing Beam Outer

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3687 @ 4"	7796 (5.50")	Passed (47%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2873 @ 1' 4"	6493	Passed (44%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	9941 @ 6' 1/2"	12863	Passed (77%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.291 @ 6' 1/2"	0.285	Passed (L/471)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.384 @ 6' 1/2"	0.571	Passed (L/357)	--	1.0 D + 1.0 L (All Spans)

Member Length : 12' 1"
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"	2.60"	892	2794	3687	Blocking
2 - Stud wall - HF	5.50"	5.50"	2.60"	892	2794	3687	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	8.9	--	
1 - Uniform (PSF)	0 to 12' 1" (Front)	3' 1"	45.0	150.0	Default Load

• Side loads are assumed to not induce cross-grain tension.

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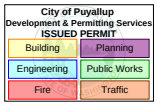

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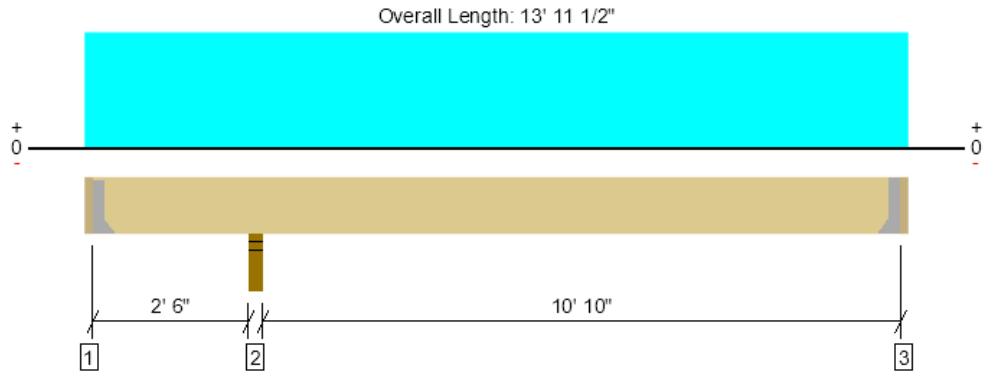
3rd Floor Framing, 10'-10" Deck Joist

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



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

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

Member Length : 13' 7 1/2"
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.

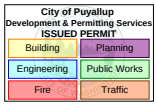
Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' o/c	
Bottom Edge (Lu)	7' 11" o/c	

•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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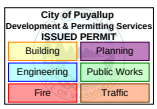
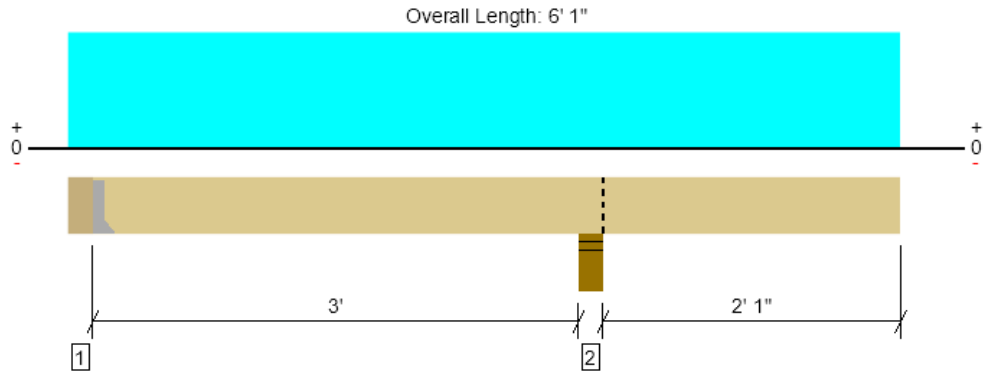


3rd Floor Framing, Deck Cantilever Ledger 2'

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



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

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)

Member Length : 5' 7"
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

- Side loads are assumed to not induce cross-grain tension.

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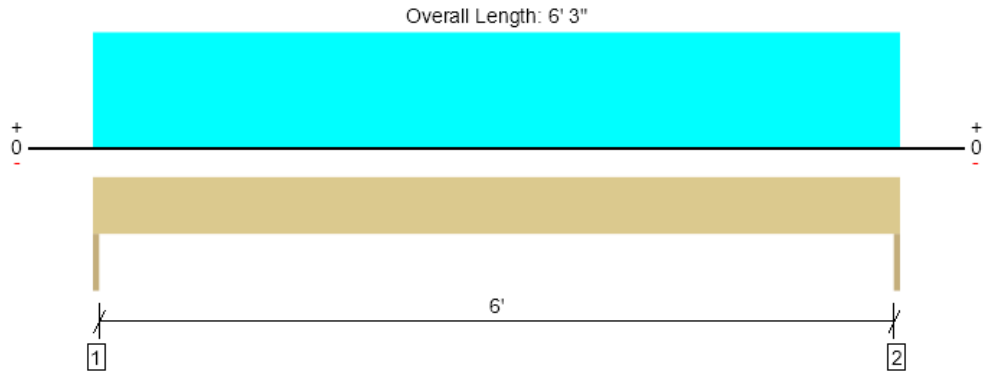
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building C

3rd Floor Framing, 6' Window Header

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



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

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)

Member Length : 6' 3"
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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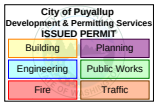
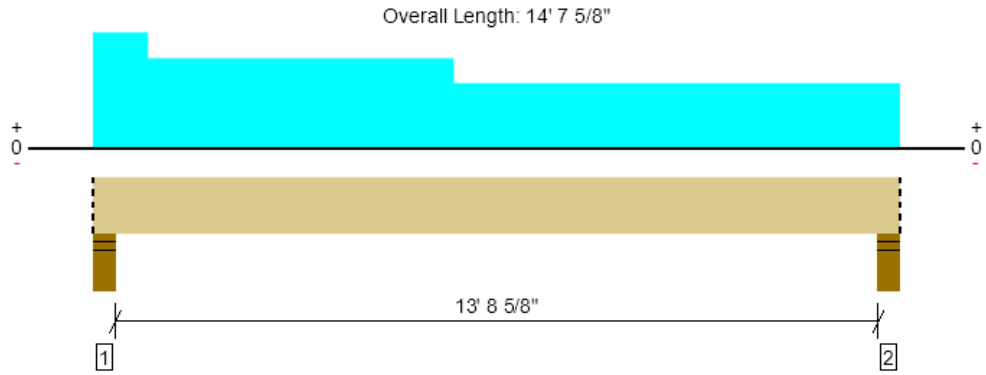


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7697 @ 4"	12251 (5.50")	Passed (63%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	5792 @ 1' 5 3/8"	11539	Passed (50%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	22493 @ 6' 9 1/2"	25853	Passed (87%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.321 @ 7' 2 3/4"	0.349	Passed (L/521)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.572 @ 7' 2 3/4"	0.698	Passed (L/293)	--	1.0 D + 1.0 L (All Spans)

Member Length : 14' 7 5/8"
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 = 13' 11 5/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	3.46"	3365	4332	7697	Blocking
2 - Stud wall - HF	5.50"	5.50"	2.81"	2747	3508	6256	Blocking

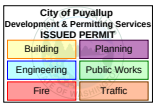
• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	14' 8" o/c	
Bottom Edge (Lu)	14' 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 14' 7 5/8"	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 14' 7 5/8" (Front)	11' 2"	30.0	40.0	Default Load

• Side loads are assumed to not induce cross-grain tension.



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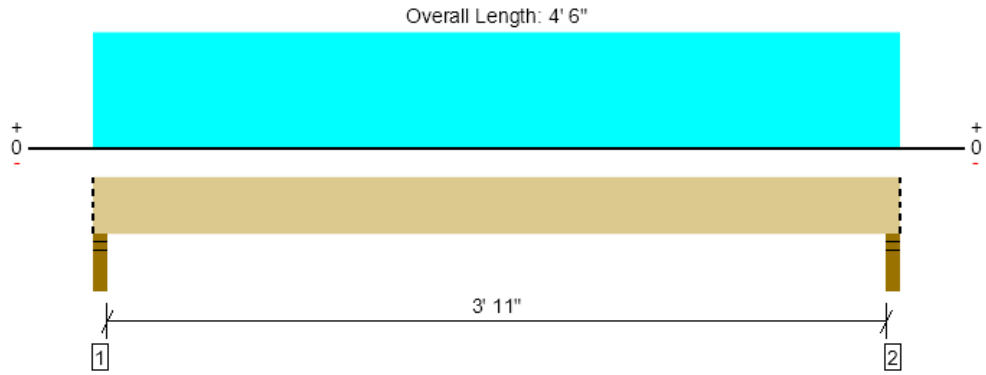
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

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

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



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

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)

Member Length : 4' 6"
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

• Side loads are assumed to not induce cross-grain tension.

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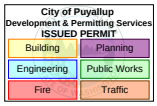

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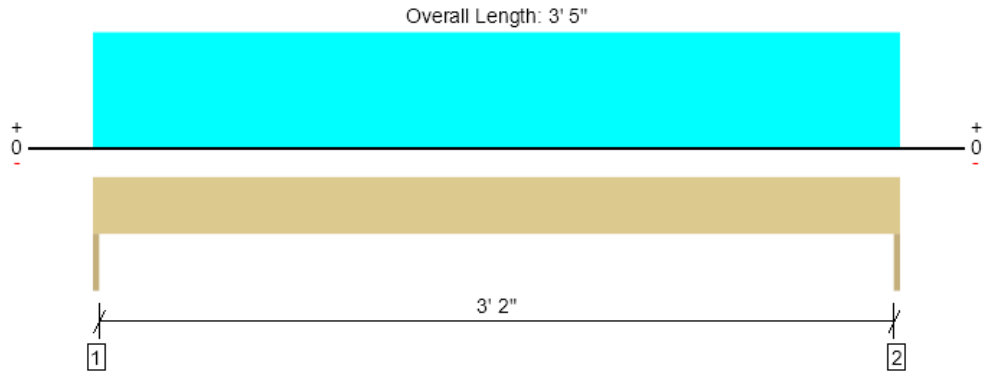
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

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



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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)

Member Length : 3' 5"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- 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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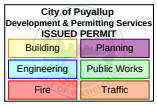

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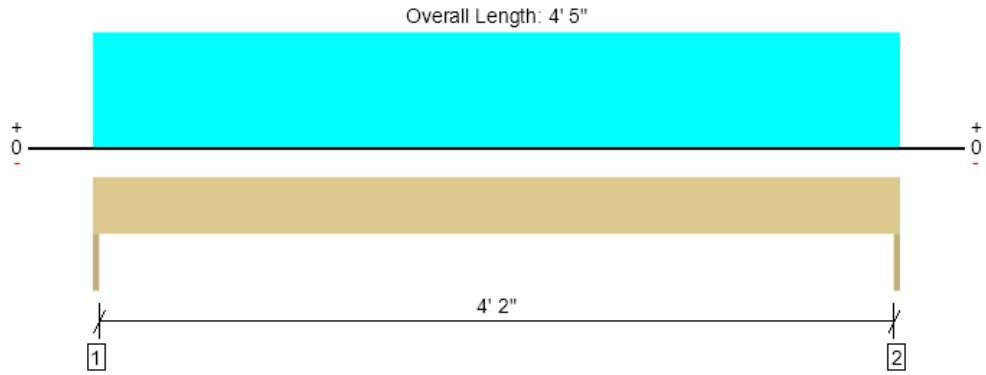
Weyerhaeuser

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

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



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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)

Member Length : 4' 5"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- 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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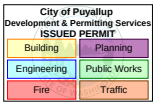

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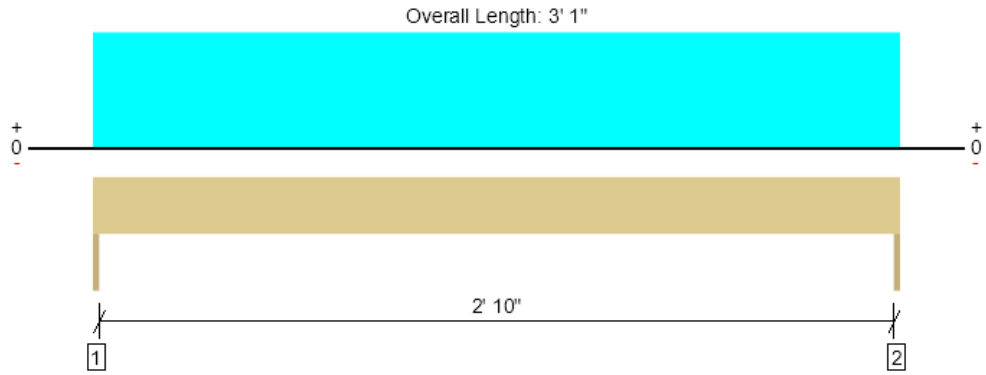
Weyerhaeuser

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

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



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

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)

Member Length : 3' 1"
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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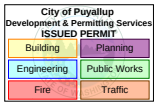

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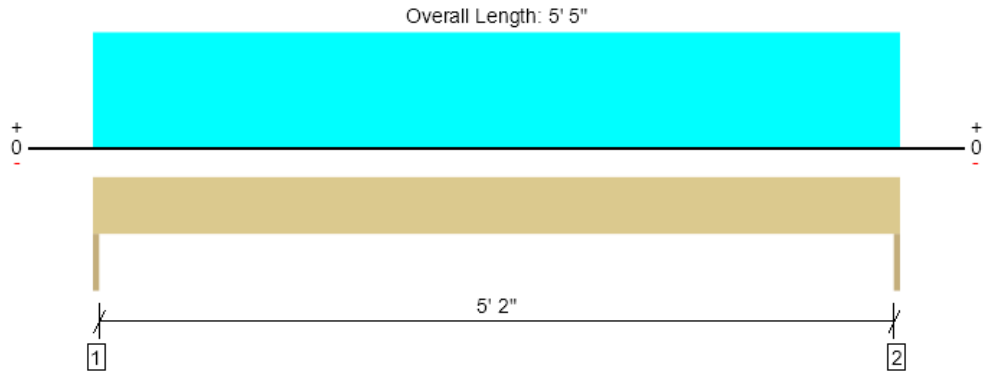
Weyerhaeuser

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

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



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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)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- 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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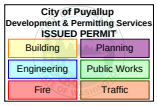
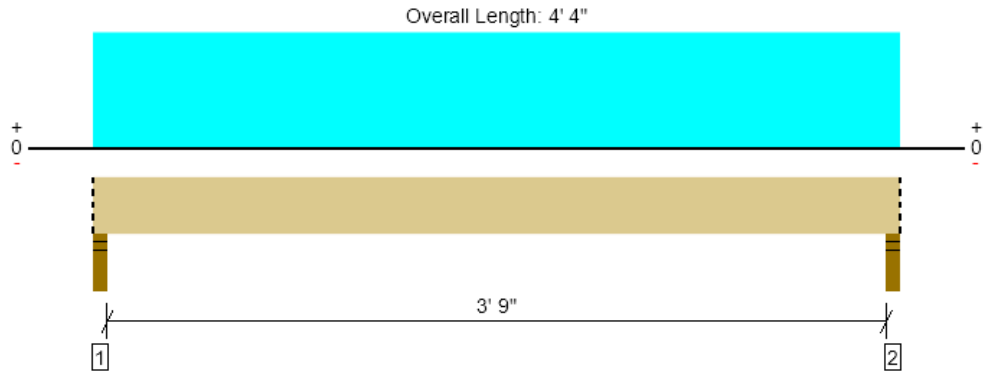


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1576 @ 2"	4961 (3.50")	Passed (32%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	644 @ 1' 3 3/8"	7343	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	1455 @ 2' 2"	16452	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.003 @ 2' 2"	0.100	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.005 @ 2' 2"	0.200	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 4' 4"
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'.
- 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"	688	888	1576	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	688	888	1576	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' 4" o/c	
Bottom Edge (Lu)	4' 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 4' 4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 4" (Front)	10' 3"	30.0	40.0	Default Load

• Side loads are assumed to not induce cross-grain tension.

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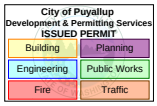
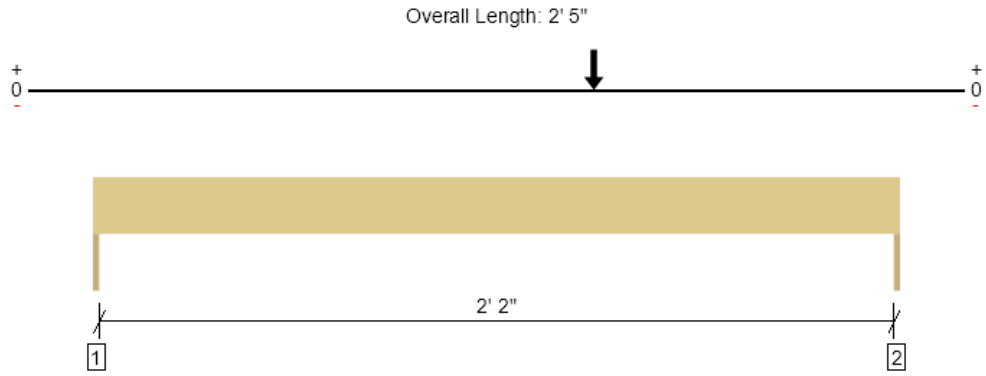


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	986 @ 2' 5"	3281 (1.50")	Passed (30%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	981 @ 1' 8 1/4"	3045	Passed (32%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	901 @ 1' 6"	2989	Passed (30%)	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)

Member Length : 2' 5"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- 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"	269	337	606	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	435	551	986	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	688	888	Linked from: Grid 5.5 (G.1-G.3) Flush Beam, Support 2

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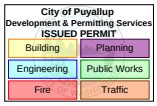

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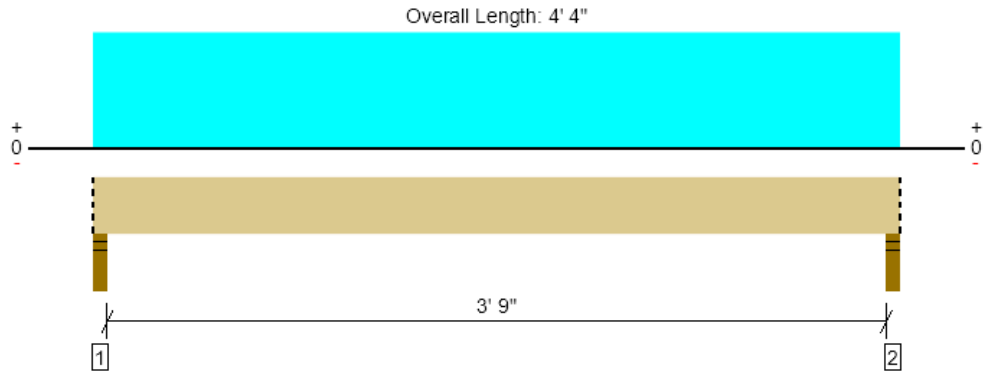
Weyerhaeuser

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1753 @ 2"	4961 (3.50")	Passed (35%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	717 @ 1' 3 3/8"	7343	Passed (10%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	1619 @ 2' 2"	16452	Passed (10%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.003 @ 2' 2"	0.100	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.005 @ 2' 2"	0.200	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 4' 4"
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'.
- 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"	764	989	1753	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	764	989	1753	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' 4" o/c	
Bottom Edge (Lu)	4' 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 4' 4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 4" (Front)	11' 5"	30.0	40.0	Default Load

• Side loads are assumed to not induce cross-grain tension.

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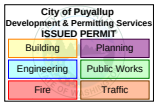
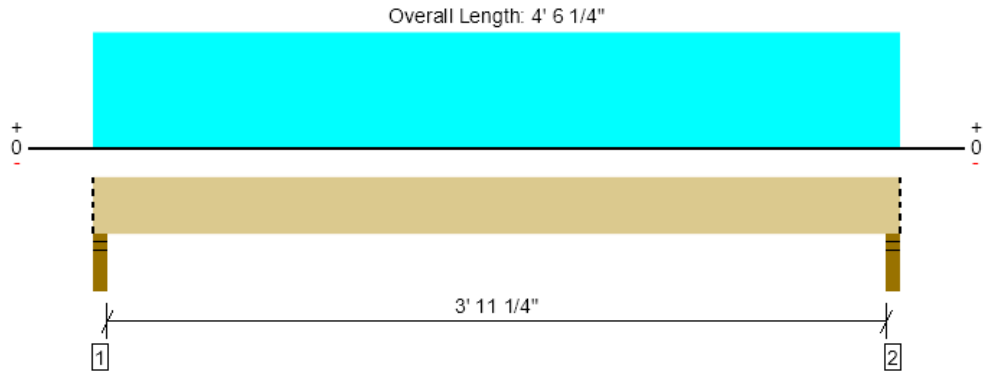


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

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



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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)

Member Length : 4' 6 1/4"
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

• Side loads are assumed to not induce cross-grain tension.

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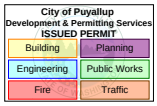
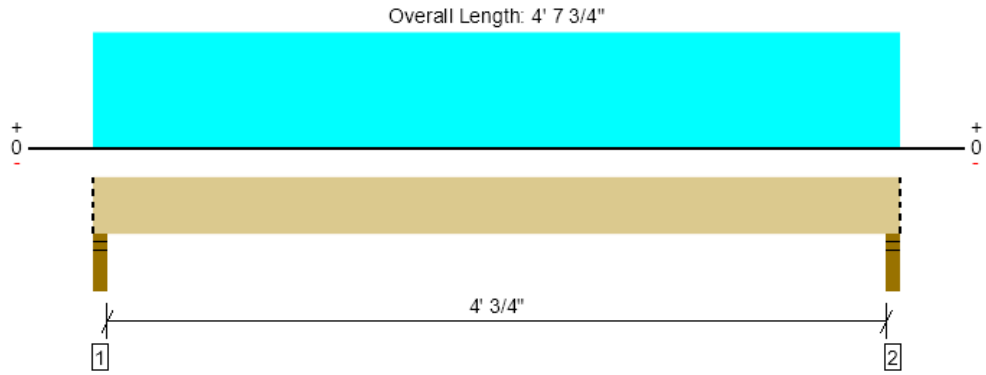


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

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



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

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)

Member Length : 4' 7 3/4"
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

• Side loads are assumed to not induce cross-grain tension.

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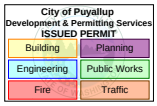

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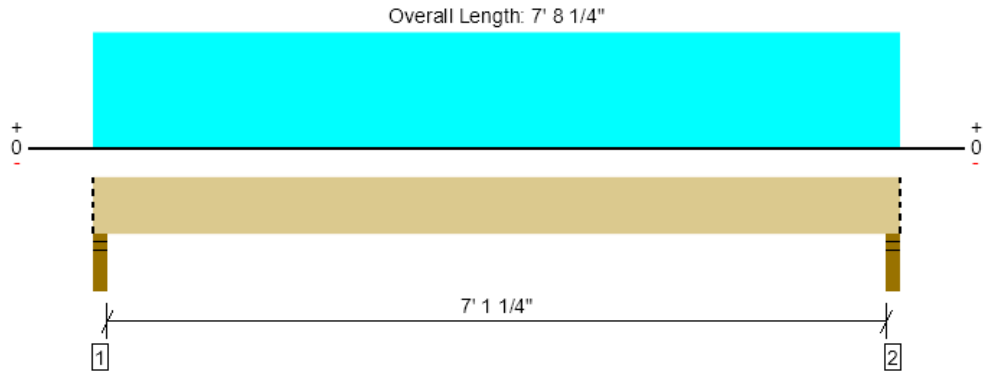
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3324 @ 2"	4961 (3.50")	Passed (67%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2216 @ 1' 3 3/8"	7343	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	5846 @ 3' 10 1/8"	16452	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.037 @ 3' 10 1/8"	0.184	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.065 @ 3' 10 1/8"	0.368	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 7' 8 1/4"
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 = 7' 4 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"	2.34"	1447	1877	3324	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.34"	1447	1877	3324	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)	7' 8" o/c	
Bottom Edge (Lu)	7' 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 7' 8 1/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 7' 8 1/4" (Front)	12' 2 1/2"	30.0	40.0	Default Load

• Side loads are assumed to not induce cross-grain tension.

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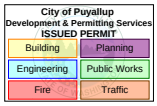
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

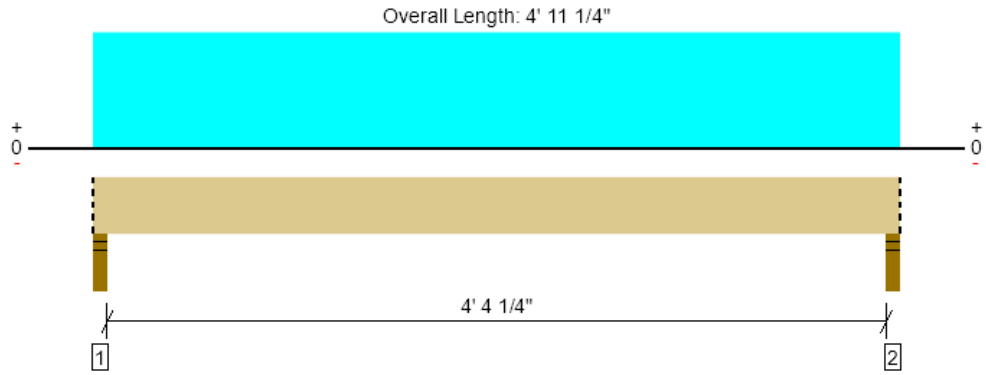


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

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



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

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)

Member Length : 4' 11 1/4"
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

• Side loads are assumed to not induce cross-grain tension.

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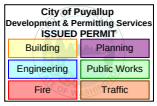

ForteWEB Software Operator	Job Notes
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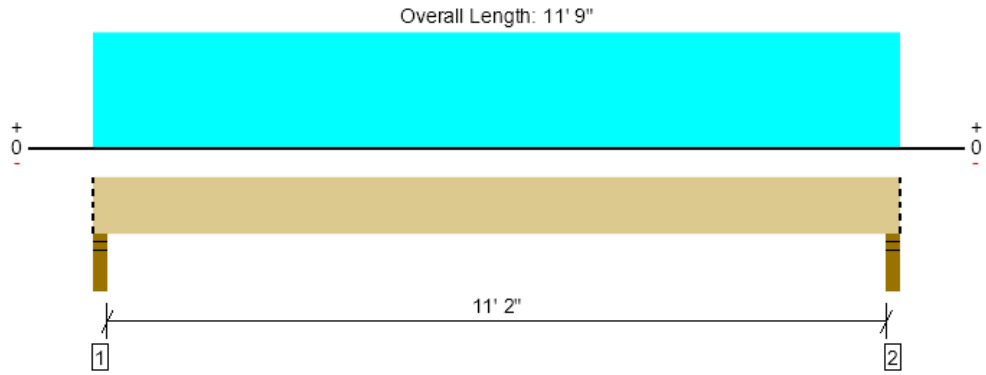
Weyerhaeuser

Roof Framing, Grid I Entry Roof Beam

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



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

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)

Member Length : 11' 9"
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

• Side loads are assumed to not induce cross-grain tension.

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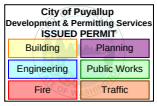

ForteWEB Software Operator	Job Notes
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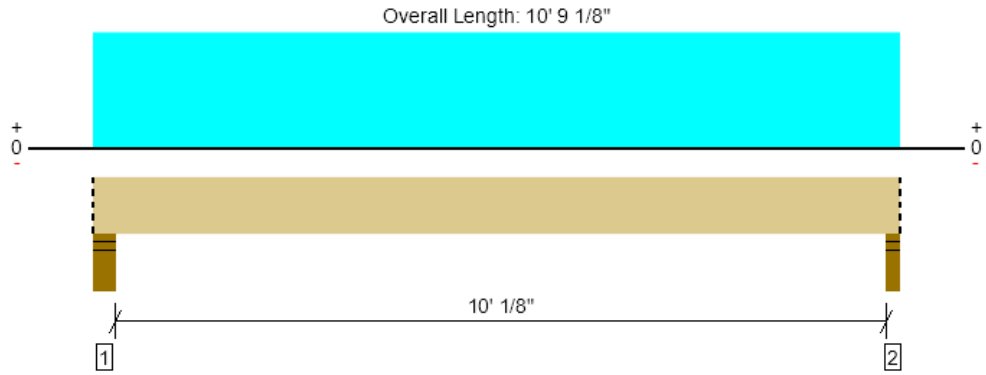
Weyerhaeuser

Roof Framing, Grid L 10' Deck Roof Beam

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



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

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)

Member Length : 10' 9 1/8"
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

• Side loads are assumed to not induce cross-grain tension.

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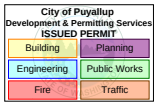
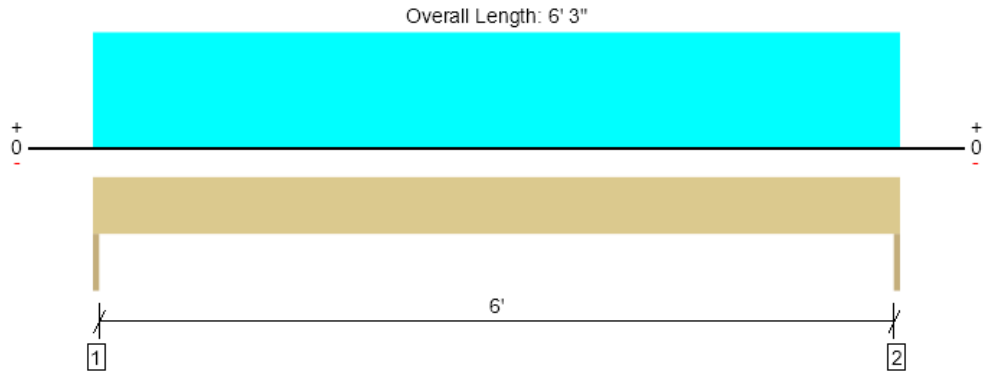


ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

Roof Framing, 6' Window Header

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



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

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)

Member Length : 6' 3"
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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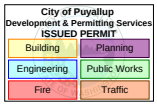

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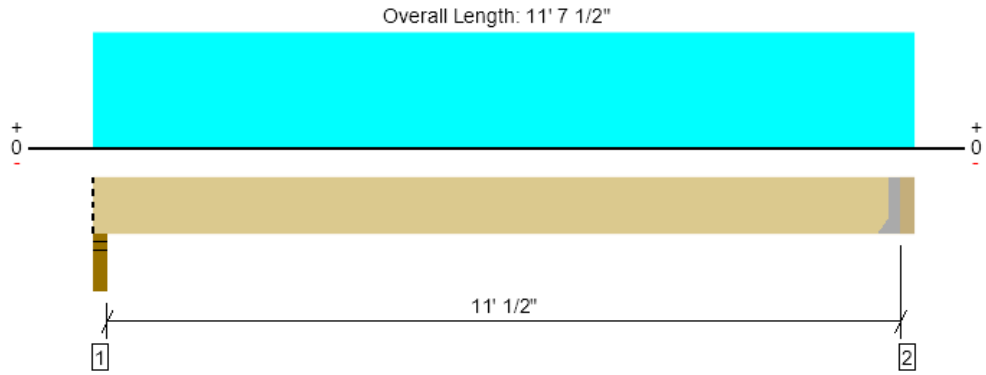
Weyerhaeuser

Roof Framing, Grid B 11' Deck Roof Beam

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



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

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)

Member Length : 11' 4"
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	

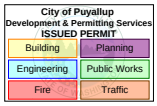
•Maximum allowable bracing intervals based on applied load.

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

- Side loads are assumed to not induce cross-grain tension.



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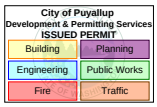

ForteWEB Software Operator	Job Notes
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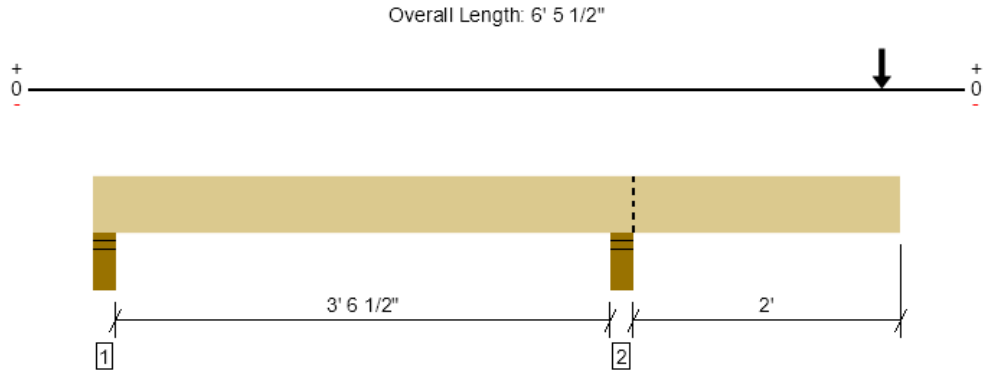
Weyerhaeuser

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.



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

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)

Member Length : 6' 5 1/2"
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

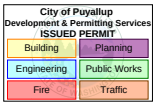
• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

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

• Side loads are assumed to not induce cross-grain tension.



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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

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 * 0.150 = 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 * 0.150 = 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

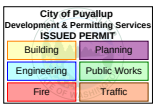
  Arm = *W / 2* = 3.50 / 2 = 1.75 ft Moment = 0.3 * 1.75 = -0.5 k-ft

- 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

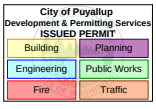
Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 1.2 + 0.0 + 0.0 - 0.5 + 18.1 = 18.8 kip

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 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 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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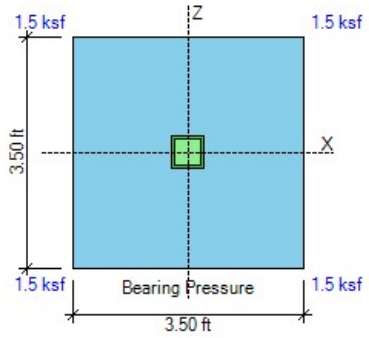
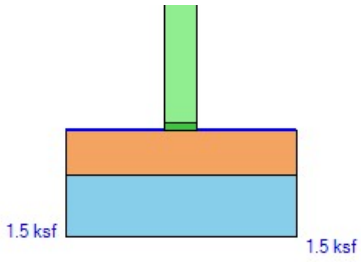




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

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

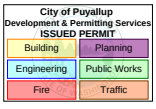
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

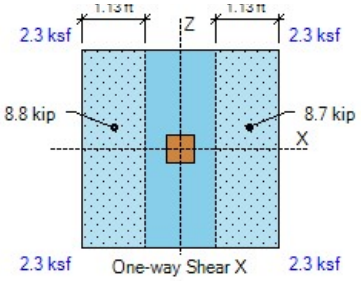
One-way shear Vux (- Side) = 8.8 kip < 15.0 kip OK

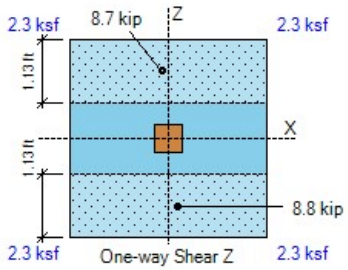
One-way shear Vux (+ Side) = 8.7 kip < 15.0 kip OK

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

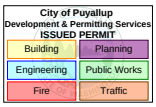
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

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

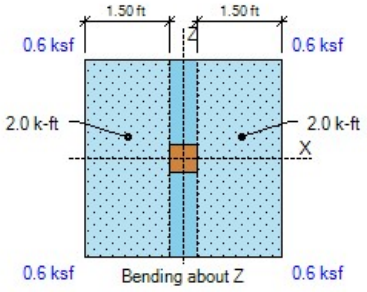
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.73) = 6.0 in

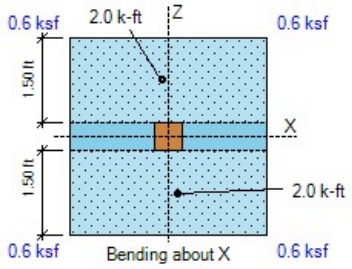
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+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

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

$$\gamma vz \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(10.5 / 10.5)}} = 0.40$$ 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

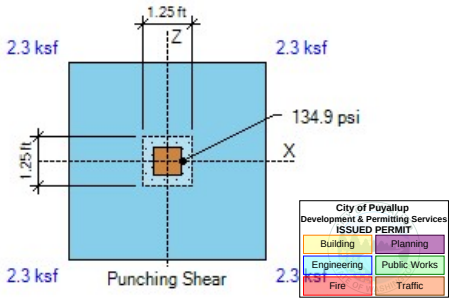
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

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

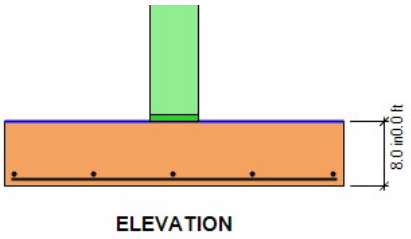


ASDIP Foundation 4.8.2.1 **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

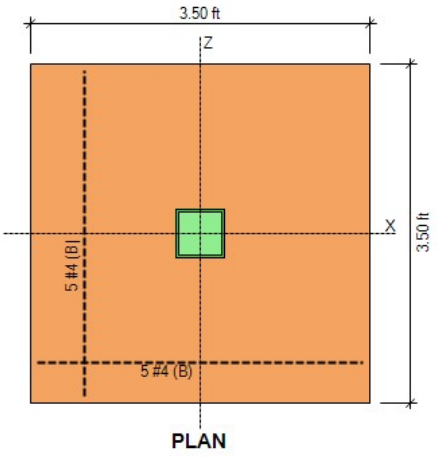
DESIGN CODES

Concrete Design ..... ACI 318-14

Load Combinations ..... ASCE 7-10/16



ELEVATION



PLAN

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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

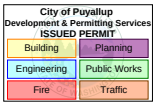
  Arm = *W / 2* = 3.00 / 2 = 1.50 ft Moment = 0.5 * 1.50 = 0.8 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip

  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:

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

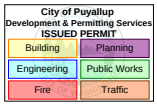
X-ecc = *Length / 2 - Xp* =3.00 / 2 - 1.50 = 0.00 ft

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

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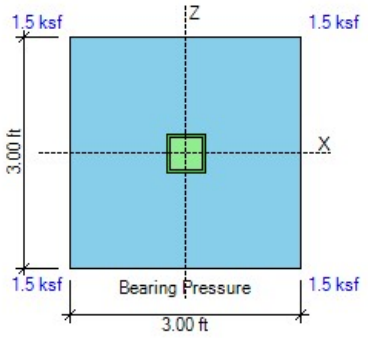
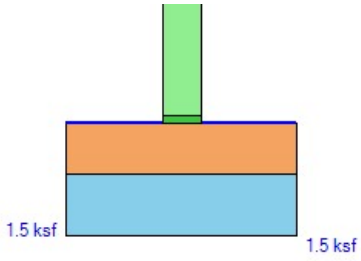




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

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 * 3.00 = 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

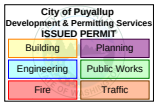
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

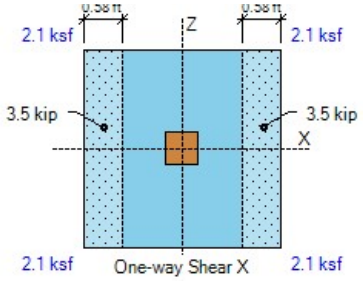
One-way shear Vux (- Side) = 3.5 kip < 11.5 kip OK

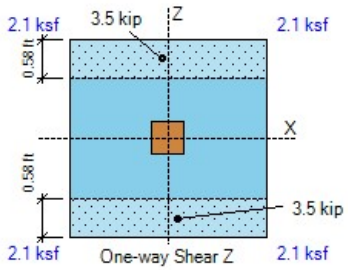
One-way shear Vux (+ Side) = 3.5 kip < 11.5 kip OK

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

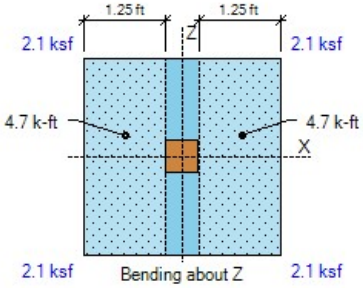
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

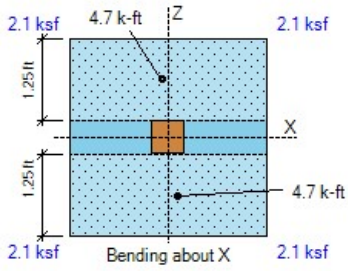
Bottom moment Mux (- Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.97

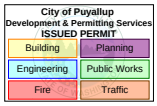
Bottom moment Mux (+ Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.98

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







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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 = $col\ W * col\ L^2 / 6 =$ 6.0 * 6.0² / 6 = 36.0 in³

Sz = $col\ L * col\ W^2 / 6 =$ 6.0 * 6.0² / 6 = 36.0 in³

Bearing $Pbu = P / A1 + Mz / Sx + Mx / Sz =$ 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

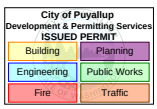
Area $A2 = Min [L * W, (col\ L + 2 * Min\ edge) * (col\ W + 2 * Min\ edge)]$ ACI R22.8.3.2

A2 = Min [3.00 * 12 * 3.0 * 12, (6.0 + 2 * 15.0) * (6.0 + 2 * 15.0)] = 1296.0 in²

Footing $\phi Pnc = \phi * 0.85 * f'c * Min [2, \sqrt{(A2 / A1)}] =$ 0.65 * 0.85 * 2.5 * Min [2, √(1296.0 / 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 > 0.5 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

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

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

X2z = $b1^2 / 2 / (b1 + b2)$ = 25.0^2 / 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 * 8.0^3 / 12 + 25.0^3 * 8.0 / 12 + 25.0 * 8.0 * (25.0 / 2 * 6.3)² + 25.0 * 8.0 * 6.3^2 = 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

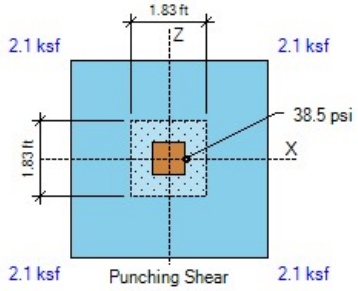
Jcz = 25.0 * 8.0^3 / 12 + 25.0^3 * 8.0 / 12 + 25.0 * 8.0 * (25.0 / 2 * 6.3)² + 25.0 * 8.0 * 6.3^2 = 27108 in⁴

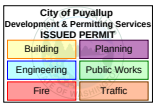
Stress due to P = *F / (bo * d) * 1000* = 15.4 / (50.0 * 8.0) * 1000 = 38.5 psi

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

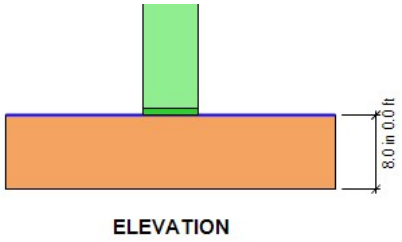
Punching stress = *P-stress + Mx-stress + Mz-stress* = 38.5 + 0.0 + 0.0 = 38.5 psi < 80.0 psi OK



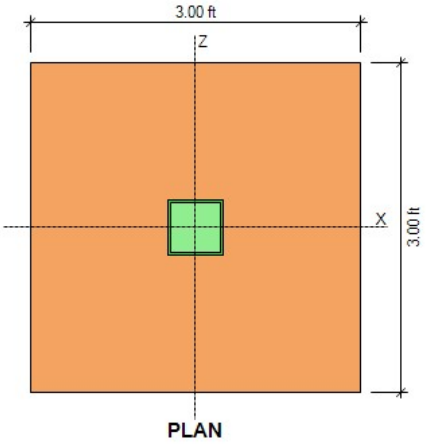


DESIGN CODES

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

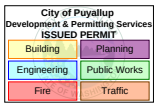
  Arm = *W / 2* = 3.50 / 2 = 1.75 ft Moment = 0.7 * 1.75 = 1.3 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip

  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:

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

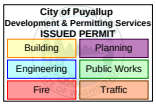
X-ecc = *Length / 2 - Xp* =3.50 / 2 - 1.75 = 0.00 ft

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

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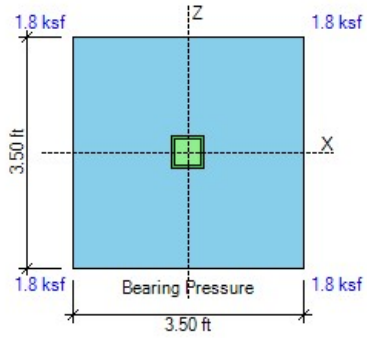
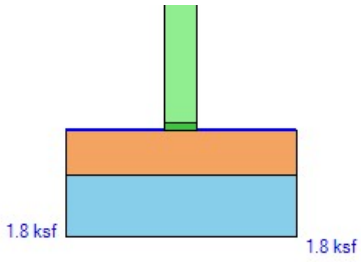




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

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

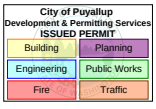
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

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



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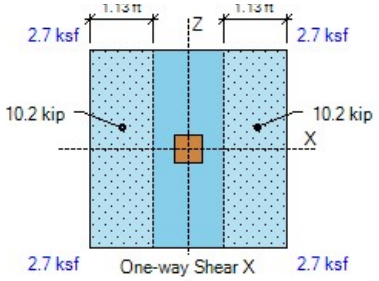
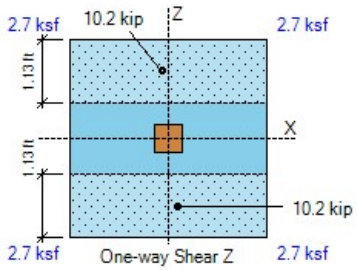




FLEXURE CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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

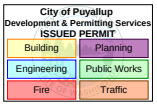
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

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

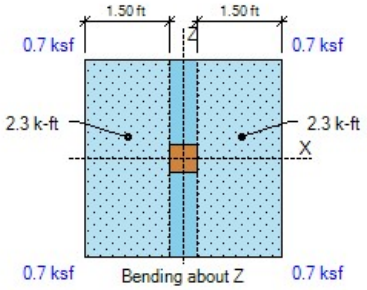
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.85) = 6.0 in

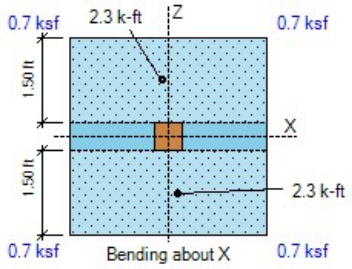
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+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

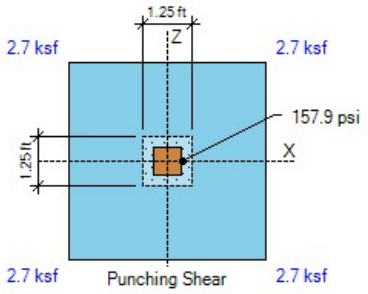
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

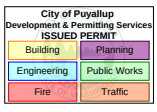
Stress due to P = *F / (bo * d) * 1000* = 29.9 / (42.0 * 4.5) * 1000 = 157.9 psi

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



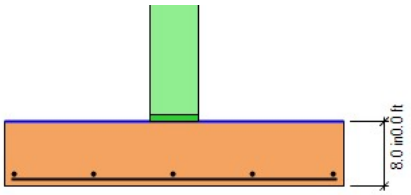


ASDIP Foundation 4.8.2.1 **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

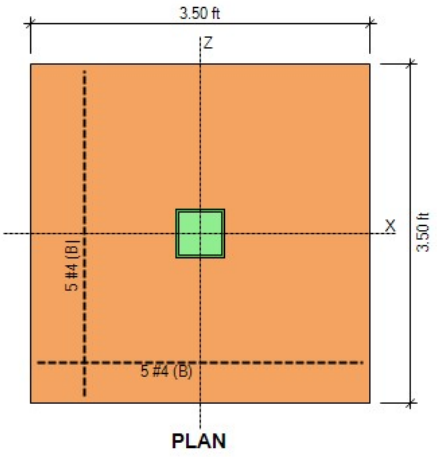
DESIGN CODES

Concrete Design ..... ACI 318-14

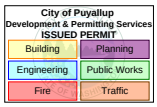
Load Combinations ..... ASCE 7-10/16



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:

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

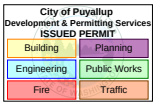
X-ecc = *Length / 2 - Xp* =3.00 / 2 - 1.50 = 0.00 ft

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

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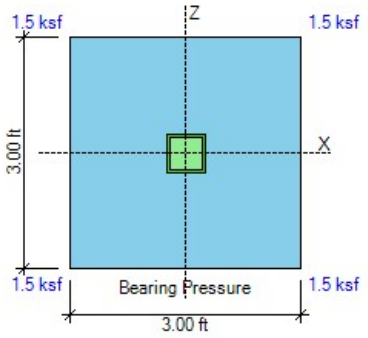
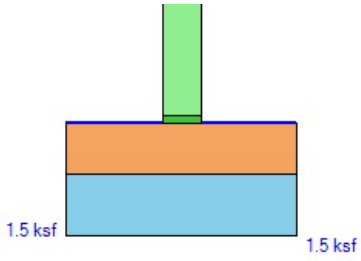




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

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 * 3.00 = 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

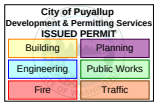
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

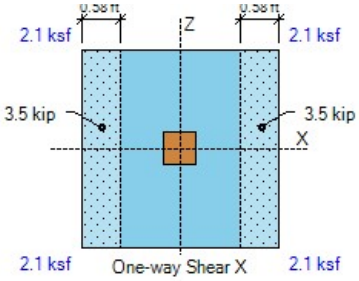
One-way shear Vux (- Side) = 3.5 kip < 11.5 kip OK

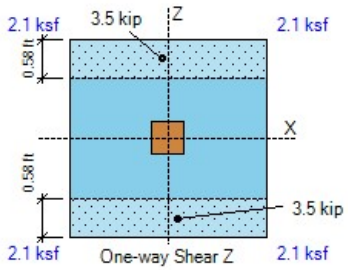
One-way shear Vux (+ Side) = 3.5 kip < 11.5 kip OK

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

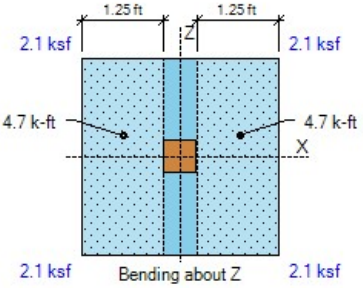
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

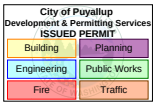
Bottom moment Mux (- Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.97

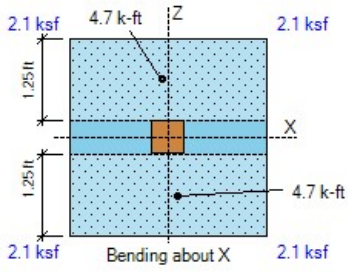
Bottom moment Mux (+ Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.98

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 = $col\ W * col\ L^2 / 6 =$ 6.0 * 6.0² / 6 = 36.0 in³

Sz = $col\ L * col\ W^2 / 6 =$ 6.0 * 6.0² / 6 = 36.0 in³

Bearing $Pbu = P / A1 + Mz / Sx + Mx / Sz =$ 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

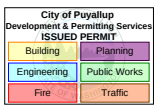
Area $A2 = Min [L * W, (col\ L + 2 * Min\ edge) * (col\ W + 2 * Min\ edge)]$ ACI R22.8.3.2

A2 = Min [3.00 * 12 * 3.0 * 12, (6.0 + 2 * 15.0) * (6.0 + 2 * 15.0)] = 1296.0 in²

Footing $\phi Pnc = \phi * 0.85 * f'c * Min [2, \sqrt{(A2 / A1)}] =$ 0.65 * 0.85 * 2.5 * Min [2, √(1296.0 / 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 > 0.5 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

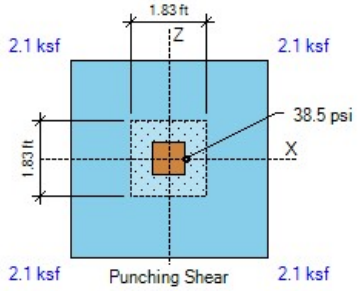
Jcz = 25.0 * 8.0³ / 12 + 25.0³ * 8.0 / 12 + 25.0 * 8.0 * (25.0 / 2 * 6.3)² + 25.0 * 8.0 * 6.3² = 27108 in⁴

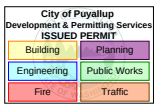
Stress due to P = *F / (bo * d) * 1000* = 15.4 / (50.0 * 8.0) * 1000 = 38.5 psi

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

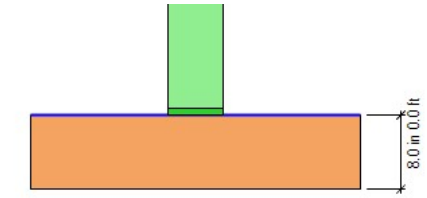
Punching stress = *P-stress + Mx-stress + Mz-stress* = 38.5 + 0.0 + 0.0 = 38.5 psi < 80.0 psi OK



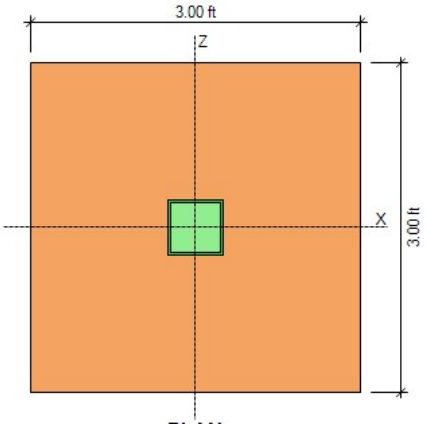


DESIGN CODES

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



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

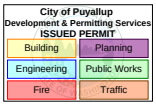
- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 3.50 * 3.50 * 8.0 / 12 * 0.15 = 0.7 kip

  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:

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

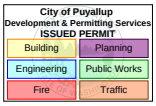
X-ecc = *Length / 2 - Xp* =3.50 / 2 - 1.75 = 0.00 ft

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

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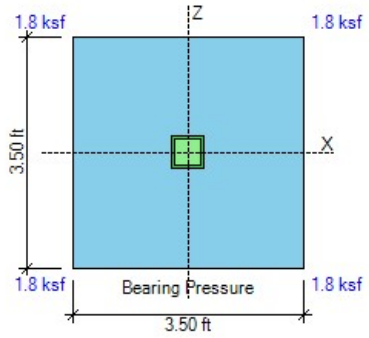
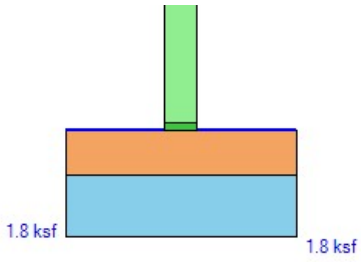




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

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

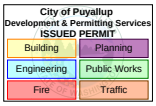
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

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



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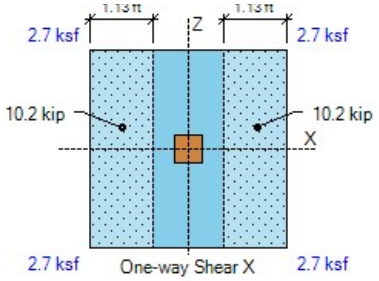
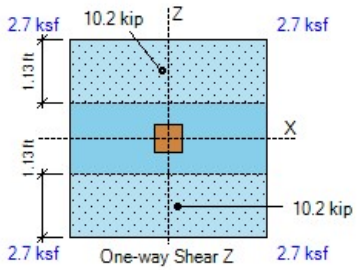




FLEXURE CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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

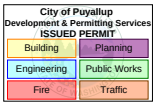
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

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

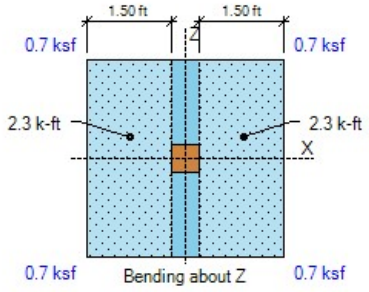
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.85) = 6.0 in

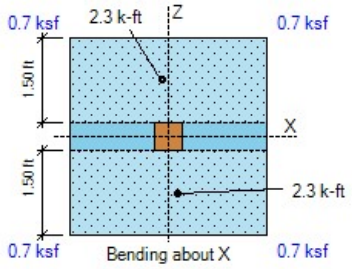
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+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

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

$$\gamma vz \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(10.5 / 10.5)}} = 0.40$$ 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

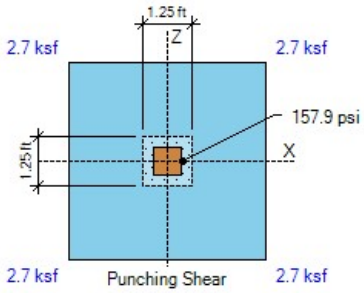
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

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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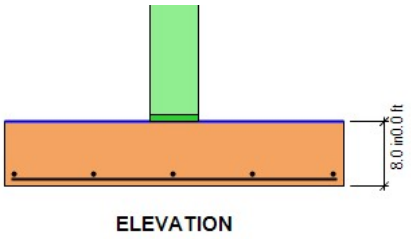
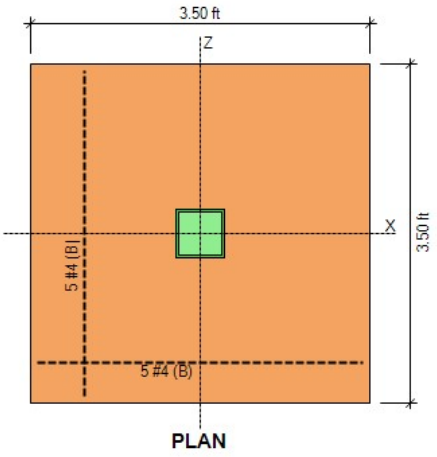
DESIGN CODES

Concrete Design ..... ACI 318-14

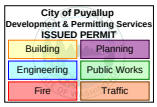
Load Combinations ..... ASCE 7-10/16



ELEVATION



PLAN



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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

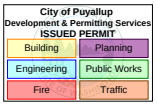
  Arm = *W / 2* = 3.50 / 2 = 1.75 ft Moment = 0.7 * 1.75 = 1.3 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip

  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:

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

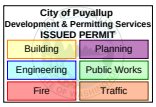
X-ecc = *Length / 2 - Xp* =3.50 / 2 - 1.75 = 0.00 ft

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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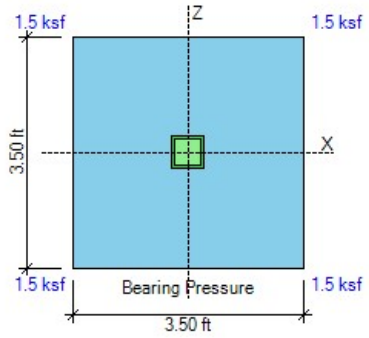
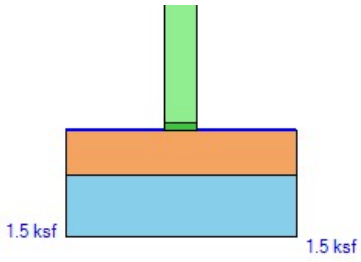




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

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)

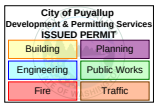
Concrete f'c = 2.5 ksi Steel fy = 40.0 ksi Soil density = 110 pcf

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

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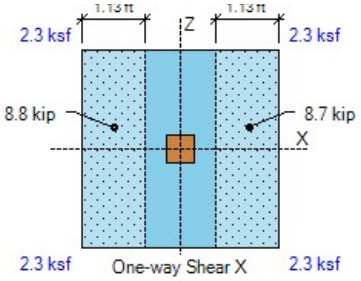
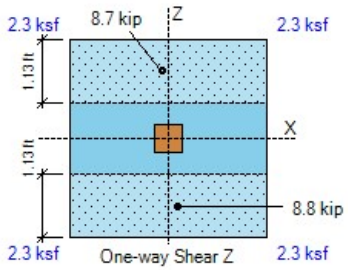




FLEXURE CALCULATIONS (Comb: 1.2D+1.6L+0.5Lr)

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

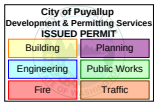
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

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

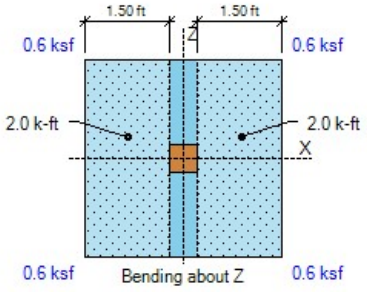
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.73) = 6.0 in

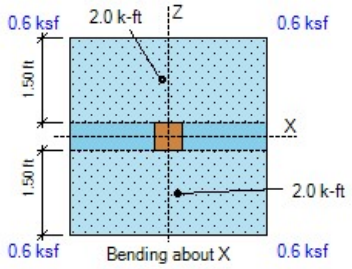
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+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

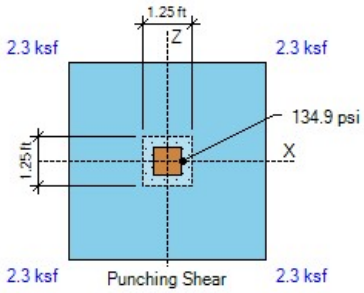
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

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

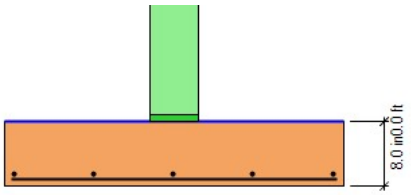
Punching stress = *P-stress + Mx-stress + Mz-stress* = 134.9 + 0.0 + 0.0 = 134.9 psi < 150.0 psi OK



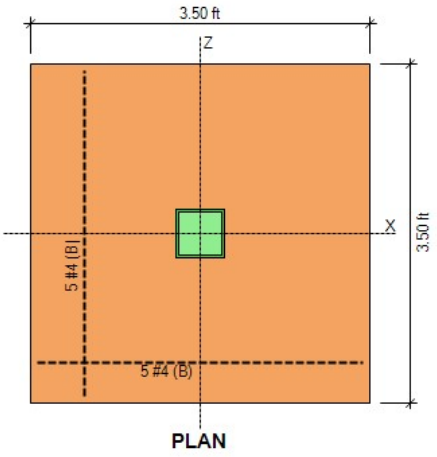
ASDIP Foundation 4.8.2.1 **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

DESIGN CODES

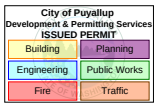
Concrete Design	ACI 318-14
Load Combinations	ASCE 7-10/16



ELEVATION



PLAN



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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

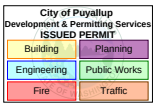
	Dead	Live	RLive	Snow	Wind	Seismic	
Axial Force P	4.5	5.5	0.0	0.0	0.0	0.0	kip
Moment about X Mx ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Moment about Z Mz ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Shear Force Vx	0.0	0.0	0.0	0.0	0.0	0.0	kip
Shear Force Vz	0.0	0.0	0.0	0.0	0.0	0.0	kip

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 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 ft

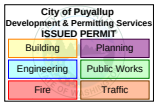
X-ecc = *Length / 2 - Xp* =2.00 / 2 - 1.00 = 0.00 ft

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

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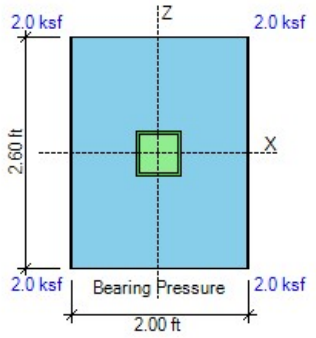
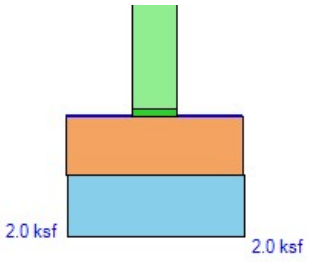




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

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 * 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

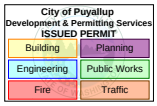
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

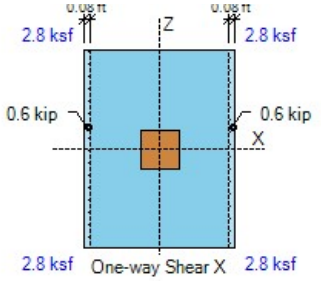
One-way shear Vux (- Side) = 0.6 kip < 10.0 kip OK

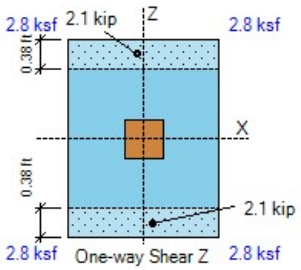
One-way shear Vux (+ Side) = 0.6 kip < 10.0 kip OK

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

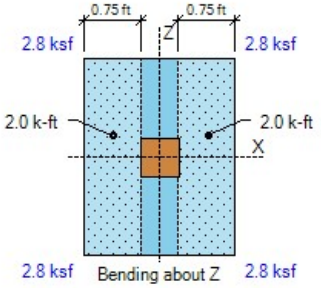
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

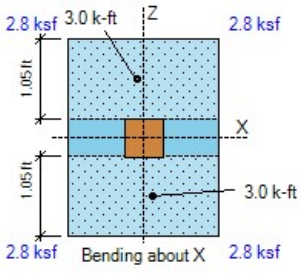
Bottom moment Mux (- Side) = 3.0 k-ft < 3.2 k-ft OK ratio = 0.94

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





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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 =* 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

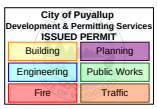
Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

A2 = Min [2.00 * 12 * 2.6 * 12, (6.0 + 2 * 9.0) * (6.0 + 2 * 9.0)] = 576.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)] =* 0.65 * 0.85 * 2.5 * Min [2, √(576.0 / 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 > 0.4 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

γvx 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)

γvz 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 = *b1² / 2 / (b1 + b2)* = 19.0² / 2 / (19.0 + 22.6) = 4.3 in X2x = *b2² / 2 / (b2 + b1)* = 6.1 in

Jcz = *b1 * d³ / 12 + b1³ * d / 12 + b1 * d * (b1 / 2 - X2z)² + b2 * d * X2z²* 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 * d³ / 12 + b2³ * d / 12 + b2 * d * (b2 / 2 - X2x)² + b1 * d * X2x²* ACI R8.4.4.2.3

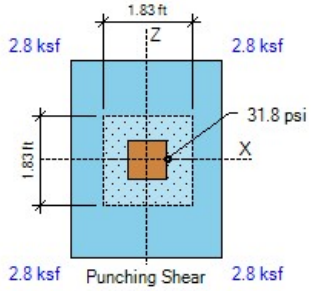
Jcz = 22.6 * 8.0³ / 12 + 22.6³ * 8.0 / 12 + 22.6 * 8.0 * (22.6 / 2 * 6.1)² + 19.0 * 8.0 * 6.1² = 19204 in⁴

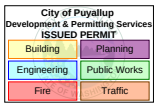
Stress due to P = *F / (bo * d) * 1000* = 10.6 / (41.6 * 8.0) * 1000 = 31.8 psi

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





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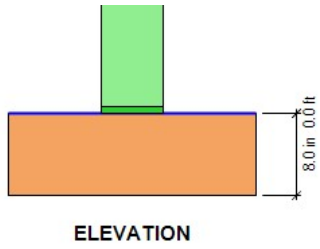
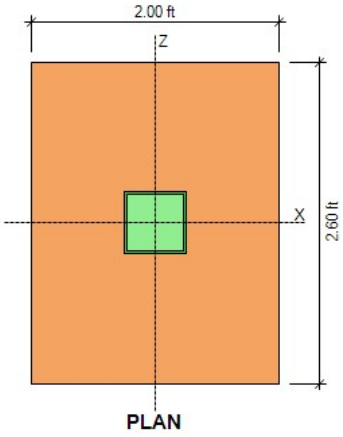
DESIGN CODES

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



ELEVATION



PLAN

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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

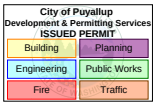
  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.2 * 1.30 = 0.3 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip

  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 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 ft

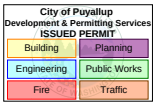
X-ecc = *Length / 2 - Xp* =1.50 / 2 - 0.75 = 0.00 ft

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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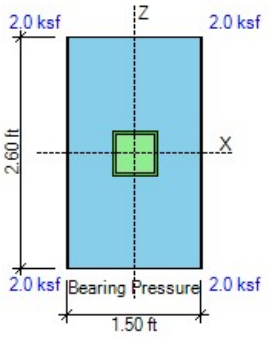
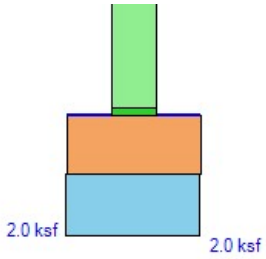




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

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

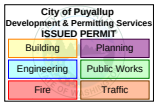
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

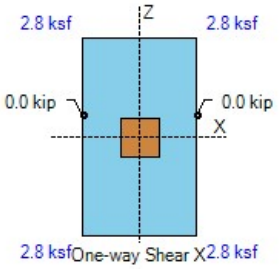
One-way shear Vux (- Side) = 0.0 kip < 10.0 kip OK

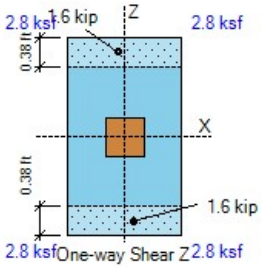
One-way shear Vux (+ Side) = 0.0 kip < 10.0 kip OK

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

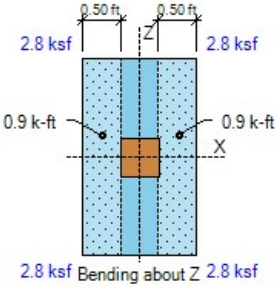
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

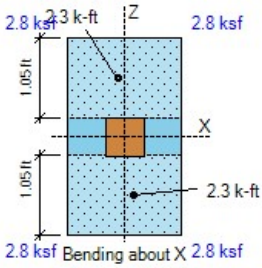
Bottom moment Mux (- Side) = 2.3 k-ft < 2.4 k-ft OK ratio = 0.96

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





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

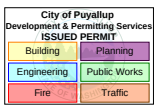
Area *A2 = Min [L * W, (col L + 2 * Min edge) * (col W + 2 * Min edge)]* ACI R22.8.3.2

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

$$\gamma vx \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b2 / b1)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(22.6 / 16.0)}} = 0.44$$ ACI Eq. (8.4.4.2.2)

$$\gamma vz \text{ factor} = 1 - \frac{1}{1 + (2/3)\sqrt{(b1 / b2)}} = 1 - \frac{1}{1 + (2/3)\sqrt{(16.0 / 22.6)}} = 0.36$$ ACI Eq. (8.4.2.3.2)

X2z = $b1^2 / 2 / (b1 + b2)$ = 16.0² / 2 / (16.0 + 22.6) = 3.3 in X2x = $b2^2 / 2 / (b2 + b1)$ = 6.6 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 = 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 = $b2 * d^3 / 12 + b2^3 * d / 12 + b2 * d * (b2 / 2 - X2x)^2 + b1 * d * X2x^2$ ACI R8.4.4.2.3

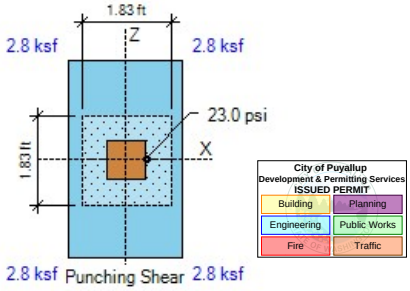
Jcz = 22.6 * 8.0³ / 12 + 22.6³ * 8.0 / 12 + 22.6 * 8.0 * (22.6 / 2 * 6.6)² + 16.0 * 8.0 * 6.6² = 18229 in⁴

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

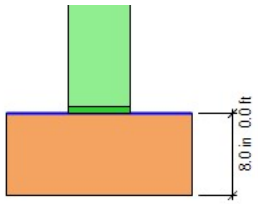
Punching stress = *P-stress + Mx-stress + Mz-stress* = 23.0 + 0.0 + 0.0 = 23.0 psi < 80.0 psi OK



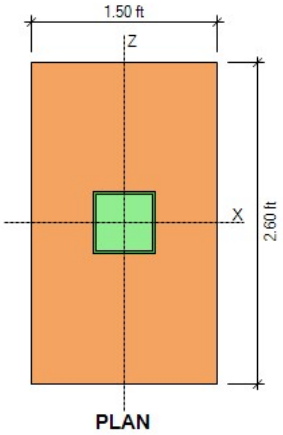
ASDIP Foundation 4.8.2.1 **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

DESIGN CODES

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



ELEVATION



PLAN

WIND V_{ASD} = 85MPH V_{ULT} = 110MPH EXP. B K_{Zt} = 1.0 $\leq$ LOI $\leq$ 0°-34°
h = 36' λ = 1.06

ZONE A = 12.9PSF × 1.06 = 13.7PSF 16.0PSF min

ZONE B = 9.8PSF × 1.06 = 9.3PSF

ZONE C = 10.2PSF × 1.06 = 10.8PSF 16.0PSF min

ZONE D = 7.0PSF × 1.06 = 7.4PSF 8.0PSF min

SEISMIC S_{DS} = 0.931 R = 6.5 I_e = 1.0

$C_S = (0.931 / (6.5/1.0)) / 1.4 = 0.091$

W_{ROOF} = (35PSF × 11,335SF) = 396,655# h = 9' h_n = 29'
W_{LEVEL3} = (40PSF × 10,229SF) = 409,160# h = 9' h_3 = 20'
W_{LEVEL2} = (40PSF × 10,490SF) = 419,600# h = 9' h_2 = 10'
W_{TOTAL} = 1,225,415#

$V_S = 1,225,415^{\#} \times 0.91 = 111,513^{\#}$

$$F_{ROOF} = \left[\frac{(396,655^{\#} \times 29')}{(396,655^{\#} \times 29') + (409,160^{\#} \times 20') + (419,600^{\#} \times 10')}\right] \times 111,513^{\#} = 44,412^{\#}$$

$$F_{LEVEL3} = \left[\frac{(409,160^{\#} \times 20')}{(396,655^{\#} \times 29') + (409,160^{\#} \times 20') + (419,600^{\#} \times 10')}\right] \times 111,513^{\#} = 38,210^{\#}$$

$$F_{LEVEL2} = \left[\frac{(419,600^{\#} \times 10')}{(396,655^{\#} \times 29') + (409,160^{\#} \times 20') + (419,600^{\#} \times 10')}\right] \times 111,513^{\#} = 28,891^{\#}$$

GRIDS 1&13

$F_{3W} = (16.0PSF \times 208SF) + (9.3PSF \times 116F) + (9.0PSF \times 80SF) = 5,047\#$

$F_{3E} = 44,412\# \times (11,538SF / 11,333SF) = 6,027\#$

$F_{2W} = 5,047\# + (16.0PSF \times 238SF) = 8,855\#$

$F_{2E} = 16,027\# + 38,210\# \times (1,322F / 10,229SF) = 11,152\#$

$F_{1W} = 8,855\# + (16.0PSF \times 240F) = 12,695\#$

$F_{1E} = 11,152\# + 28,991\# \times (1,372SF / 10,490SF) = 14,931\#$

GRIDS 4/5 & 8/9

$F_{3W} = (16.0PSF \times 252SF) = 4,032\#$

$F_{3E} = 44,412\# \times (2,373SF / 11,333SF) = 9,299\#$

$F_{2W} = 4,032\# + (16.0PSF \times 442SF) = 11,104\#$

$F_{2E} = 9,299\# + 38,210\# \times (2,048SF / 10,229SF) = 16,950\#$

$F_{1W} = 11,104\# + (16.0PSF \times 443SF) = 18,192\#$

$F_{1E} = 16,950\# + 28,991\# \times (2,178\# / 10,490SF) = 23,101\#$

GRID 7

$F_{3W} = (16.0PSF \times 526SF) = 8,416\#$

$F_{3E} = 44,412\# \times (2,727SF / 11,333SF) = 10,893\#$

$F_{2W} = 8,416\# + (16.0PSF \times 412SF) = 15,008\#$

$F_{2E} = 10,893\# + 38,210\# \times (1,650SF / 10,229SF) = 20,792\#$

$F_{1W} = 15,008\# + (16.0PSF \times 413SF) = 21,116\#$

$F_{1E} = 20,792\# + 28,991\# \times (2,650SF / 10,490SF) = 28,080\#$

GRIDS A-C

F_{3W} = (16 PSF x 178 SF) + (9.3 PSF x 111 SF) + (9.0 PSF x 46 SF) = 4,248 #

F_{3E} = 44,412 # x (7,611 SF / 11,333 SF) = 10,232 #

F_{2W} = 4,248 # + (16.0 PSF x 203 SF) = 7,496 #

F_{2E} = 10,232 # + 38,210 # x (2,321 SF / 10,229 SF) = 18,902 #

F_{1W} = 7,496 # + (16.0 PSF x 194 SF) = 10,600 #

F_{1E} = 18,902 # + 28,891 # x (2,321 SF / 10,490 SF) = 25,294 #

GRID F

F_{3W} = (16.0 PSF x 246 SF) = 3,936 #

F_{3E} = 44,412 # x (5,1552 SF / 11,333 SF) = 20,974 #

F_{2W} = 3,936 # + (16.0 PSF x 323 SF) = 9,104 #

F_{2E} = 20,974 # + 38,210 # x (5,077 SF / 10,229 SF) = 39,938 #

F_{1W} = 9,104 # + (16.0 PSF x 317 SF) = 14,176 #

F_{1E} = 39,938 # + 28,891 # x (5,765 # / 10,490 SF) = 54,439 #

GRIDS J-M

F_{3W} = (16.0 PSF x 237 SF) + (9.3 PSF x 65 SF) = 4,397 #

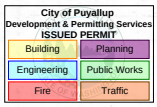
F_{3E} = 44,412 # x (3,370 SF / 11,333 SF) = 13,206 #

F_{2W} = 4,397 # + (16.0 PSF x 179 SF) = 7,265 #

F_{2E} = 13,206 # + 38,210 # x (2,331 SF / 10,229 SF) = 23,782 #

F_{1W} = 7,245 # + (16.0 PSF x 174 SF) = 10,029 #

F_{1E} = 23,782 # + 28,891 # x (2,904 SF / 10,490 SF) = 31,780 #



GRID 1B13 (LEVEL 3) FE = 6,027# 6 SEGMENTS L = 4'-7" h = 9'
L = 5'-9"
L = 4'-2"
L = 3'-2"
L = 9'-3"
L = 2'-9"
LT = 30'-1"

VE = 6,027#/30.08' = 200 PLF

USE W1 VEALLOW = 242 PLF x (1.25 - 0.125 x 9'/2.75') = 204 PLF

HOLD DOWNS

TE = 200 PLF x 9' x 1.25 - 1/2(115 PSF x 1' x 1.38') - 1/2(12 PSF x 4.5' x 1.38') = 2,202#

USE MST48 w/ 12 STUDS TEALLOW = 3,425# x 1.4/1.6 = 2,997#

GRID 1B (LEVEL 2) FE = 11,152# 5 SEGMENTS LT = 30'-4" h = 9'

VE = 11,152#/30.08' = 371 PLF

USE W3 VEALLOW = 456 PLF x (1.25 - 0.125 x 9'/2.75') = 383 PLF

HOLD DOWNS

TE = 371 PLF x 9' x 1.25 + 2,202# - 1/2(115 PSF x 6' x 1.38') - 1/2(12 PSF x 9' x 1.38') = 6,236#

USE CMST12 w/ 25 STUDS TEALLOW = 9,215# x 1.4/1.6 = 8,063#

GRID 1B3 (LEVEL 1) FE = 14,931# 6 SEGMENTS LT = 27'-4" h = 9'
2'-9"
LT = 30'-1"

VE = 14,931#/30.08' = 496 PLF

USE W4 VEALLOW = 595 PLF x (1.25 - 0.125 x 9'/2.75') = 500 PLF

HOLD DOWNS

TE = 496 PLF x 9' x 1.25 + 6236# - 1/2(195 PSF x 6' x 1.38') - 1/2(12 PSF x 9' x 1.38') = 11,679#

USE HDU14-SDS2.5 w/ 6x6 DF #2 POST TEALLOW = 14,425# x 1.4/1.6 = 12,689#

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GRID 4/5&8/A (LEVEL 3) FE=9,299# 2 SEGMENTS L=25'-8" h=9'
L=29'-8"
LT=55'-4"

VE = 9,299#/55.33' = 168 PLF

USE W1 VERTICAL = 242 PLF

HOLD DOWNS

TE = 168 PLF x 9' x 1.25 - ½(15 PSF x 2' x 12.83') - ½(12 PSF x 4.5' x 12.83') = 1,382#

USE MST37 w/ 2 STUDS TERATING = 2,140# x 1.4/1.6 = 1,873#

GRID 4/5&8/9 (LEVEL 2) FE=16,950# 2 SEGMENTS L=55'4" h=9'

VE = 16,950#/55.33' = 306 PLF

USE W2 VERTICAL = 353 PLF

HOLD DOWNS

TE = 306 PLF x 9' x 1.25 + 1,382# - ½(15 PSF x 5.7' x 12.83') - ½(12 PSF x 9' x 12.83') = 3,587#

USE MST60 w/ 2 STUDS TERATING = 5,405# x 1.4/1.6 = 4,729#

GRID 4/5 & 8/9 (LEVEL 1) FE=23,101# 2 SEGMENTS L=55'-4" h=9'

VE = 23,101#/55.33' = 418 PLF

USE W3 VERTICAL = 456 PLF

HOLD DOWNS

TE = 418 PLF x 9' x 1.25 + 3,587# - ½(15 PSF x 5.7' x 12.83') - ½(12 PSF x 9' x 12.83') = 7,043#

USE HDU14-SDS w/ 3 STUDS TERATING = 8,260# x 1.4/1.6 = 8,103#

GRID 7 (LEVEL 3) FE = 10,893# 2 SEGMENTS L=28'-5" h=9'
L=27'-9"
LT=56'-2"

VE = 10,893#/56.16' = 194 PLF

USE W1 VEALLOW = 242 PLF

HOLD DOWNS

TE = 194 PLF x 9' x 1.25 - ½(15 PSF x 1' x 13.88') = 2,076#

USE (2) HDU4-SDS2.5 W/ 2 STUDS TEALLOW = 3,295# x 1.4/1.6 = 2,874#

GRID 7 (LEVEL 2) FE = 20,782# 2 SEGMENTS LT=56'-2" h=9'

VE = 20,782#/56.16' = 370 PLF

USE W3 VEALLOW = 456 PLF

HOLD DOWNS

TE = 370 PLF x 9' x 1.25 + 2,076# - ½(15 PSF x 68% x 13.88') = 5,527#

USE (2) HDU8-SDS2.5 W/ 4 STUDS TEALLOW = 4,500# x 1.4/1.6 = 5,750#

GRID 7 (LEVEL 1) FE = 28,080# 2 SEGMENTS L=56'-2" h=9'

VE = 28,080#/56.16' = 500 PLF

USE W4 VEALLOW = 595 PLF

HOLD DOWNS

TE = 500 PLF x 9' x 1.25 + 5,527# - ½(15 PSF x 1' x 13.88') - ½(8 PSF x 22.5' x 13.88') = 9,799#

USE HDU14-SDS2.5 W/ 5 STUDS TEALLOW = 12,375# x 1.4/1.6 = 10,828#

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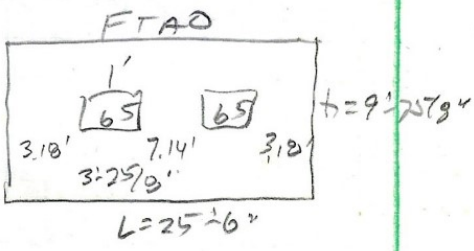
GRID A-C (5'-6" WALLS)

(LEVEL 3) FE = 10,232# x 25.5'/80.16' = 3,255#

VE = 280 PLF

USE W2 VE ALLOW = 350 PLF



HOLD DOWNS

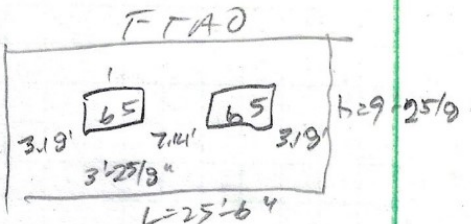
TE = 1,174# x 1.25 - 1/2(25PSF x 13.5' x 12.75') - 1/2(12PSF x 4.5' x 12.75') = -1,028#

80 NO HD'S REQ'D

(LEVEL 2) FE = 18,902# x 25.5'/80.16' = 6,013#

VE = 517 PLF

USE W4 VE ALLOW = 595 PLF



HOLD DOWNS

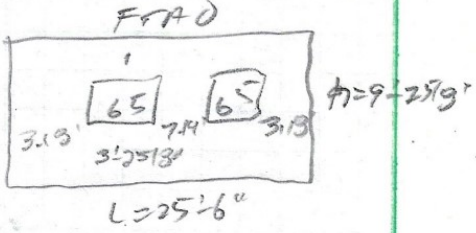
TE = 2,169# x 1.25 - 1,028# - 1/2(12PSF x 9' x 12.75') = 995#

USE MST37 W/ 2 STUPS TE ALLOW = 2,140# x 1.4/1.6 = 1,873#

(LEVEL 1) FE = 25,294# x 25.5'/80.16' = 8,046#

VE = 691 PLF

USE W8 VE ALLOW = 770 PLF



HOLD DOWNS

TE = 2903# x 1.25 + 995# - 1/2(12PSF x 9' x 12.75') = 3,935#

USE HDU8-SDS2.5 W/ 2 STORS TE ALLOW = 5,820# x 1.4/1.6 = 5,093#

GRIDLINE-C (14'-7" WALLS)

(LEVEL 3) FE = 10,232# x 14.59'/80.16' = 1,861#

VE = 280 PLF

USE W2 VEALLOW = 353 PLF

HOLD DOWNS

TE = 1,174# x 1.25 - 1/2(25PSF x 16' x 7.29') - 1/2(12PSF x 4.5' x 7.29') = -224#
∴ NO HD'S REQ'D

(LEVEL 2) FE = 18,902# x 14.58'/80.16' = 3,438#

VE = 517 PLF

USE W4 VEALLOW = 595 PLF

HOLD DOWNS

TE = 2,169# x 1.25 - 224# - 1/2(12PSF x 9' x 7.29') = 2,094#

USE MST48 W/ 2 STUDS TEALLOW = 3,425# x 1.4/1.6 = 2,997#

(LEVEL 1) FE = 25,294# x 14.58'/80.16' = 4,600#

VE = 691 PLF

USE W8 VEALLOW = 770 PLF

HOLD DOWNS

TE = 2,903# x 1.25 + 2,094# - 1/2(12PSF x 9' x 7.29') = 5,329#

USE HDU8-SDS2.5 W/ 3 STUDS TEALLOW = 6,590# x 1.4/1.6 = 5,750#

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GRID F (LEVEL 3) $F_E = 20,974^{\#}$ 4 SEGMENTS $L_T = 89'-6"$ $h = 9'$

$V_E = 20,974^{\#} / 89.5' = 234 plf$

L = 30'-4"
L = 14'-3"
L = 14'-6"
L = 30'-4"

USE W1 $V_{ALLOW} = 242 plf$

HOLD DOWNS

$T_E = 234 plf \times 9' \times 1.25 - \frac{1}{2}(25psf \times 16.75' \times 7.13') - \frac{1}{2}(20psf \times 4.5' \times 7.13') = 1,144^{\#}$

USE MST37 w/ 2 STUDS
OR (2) HDU2-SDS2.5 w/ 2 STUDS

$T_{ALLOW} = 2,140^{\#} \times 1.4/1.6 = 1,873^{\#}$
$T_{ALLOW} = 7,215^{\#} \times 1.4/1.6 = 1,938^{\#}$

GRID F (LEVEL 2) $F_E = 39,938^{\#}$ 4 SEGMENTS $L_T = 89'-6"$ $h = 9'$

$V_E = 39,938^{\#} / 89.5' = 446 plf$

USE W3 $V_{ALLOW} = 456 plf$

HOLD DOWNS

$T_E = 446 plf \times 9' \times 1.25 + 1,144^{\#} = 6,164^{\#}$

USE CMSTC2 w/ 2 STUDS
OR (2) HDU11-SDS2.5 w/ 4 STUDS

$T_{ALLOW} = 9,215^{\#} \times 1.4/1.6 = 8,063^{\#}$
$T_{ALLOW} = 8,030^{\#} \times 1.4/1.6 = 7,026^{\#}$

GRID F (LEVEL 1) $F_E = 54,439^{\#}$ 6 SEGMENTS $h = 9'$

$V_E = 54,439^{\#} / 138.83' = 392 plf$

L = 30'-4"
L = 14'-3"
L = 24'-8"
L = 24'-8"
L = 14'-3"
L = 30'-4"

USE W3 $V_{ALLOW} = 456 plf$

HOLD DOWNS

$L_T = 138'-10"$

STACKED $T_E = 392 plf \times 9' \times 1.25 + 6,164^{\#} + \frac{1}{2}(8psf \times 225' \times 15.16') = 9,270^{\#}$

USE HDU14-SDS2.5 w/ 4 STUDS
OR HDU14-SDS2.5 w/ 5 STUDS

$T_{ALLOW} = 12,125^{\#} \times 1.4/1.6 = 10,872^{\#}$
$T_{ALLOW} = 12,375^{\#} \times 1.4/1.6 = 10,828^{\#}$

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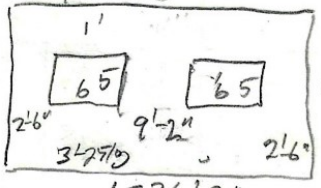
GRID J-M (26'-2" WALLS) 6 FTA0 WALLS / SEGMENT L = 131'-11" VE = 13,206#/124.83'

(LEVEL 3) FE = 13,206# x 26.16'/131.92' = 2619#

VE = 219 PLF

USE W1 VEALLOW = 242 PLF

FTA0



L=26'-2"

HOLD DOWNS

TE = 921# x 1.25 - 1/2(25PSF x 12' x 13.09') - 1/2(12PSF x 4.5' x 13.09') = -811#

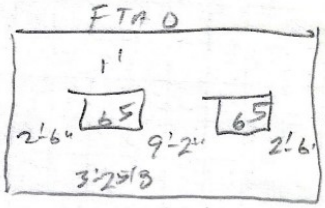
USE NO HDS REQ'D

(LEVEL 2) FE = 23,752# x 26.16'/131.92' = 4,716#

VE = 395 PLF

USE W3 VEALLOW = 456 PLF

FTA0



L=26'-2"

HOLD DOWNS

TE = 1,659# x 1.25 - 811# - 1/2(12PSF x 9' x 13.08') = 556#

USE MST37 W/ 2STUDS TEALLOW = 2,140# x 1.4/1.6 = 1,875#

(LEVEL 1) FE = 31,780# x 26.16'/131.92' = 6,302#

VE = 528 PLF

USE W4 VEALLOW = W4

HOLD DOWNS

TE = 2,216# x 1.25 + 556# - 1/2(12PSF x 9' x 13.08') = 2,620#

USE HDU4-SDS7.5 W/ 2STUDS TEALLOW = 3,255# x 1.4/1.6 = 2,374#

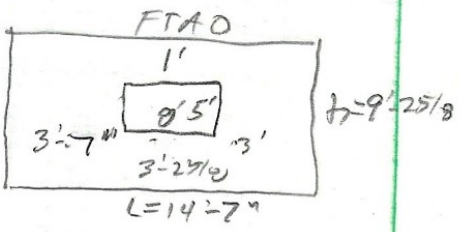
BELOW M (14'-7" WALLS)

(LEVEL 3) $F_E = 13{,}206^{\#} \times 14.59'/131.92' = 1{,}460^{\#}$

$V_E = 222 PLF$

USE W1 $V_{ALLOW} = 242 PLF$

HOLD DOWNS



$T_E = 921^{\#} \times 1.25 - 1/2(250SF \times 18.25' \times 7.29') - 1/2(12PSF \times 4.5' \times 7.29') = -709^{\#}$

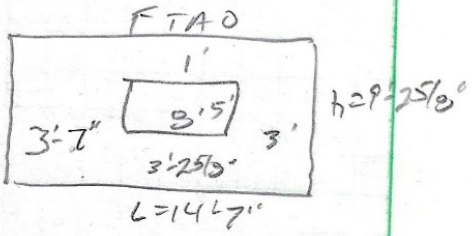
SO NO HDU REQ'D

(LEVEL 2) $F_E = 23{,}782^{\#} \times 14.58'/131.92' = 2{,}630^{\#}$

$V_E = 400 PLF$

USE W3 $V_{ALLOW} = 456 PLF$

HOLDDOWNS



$T_E = 1{,}660^{\#} \times 1.25 - 709^{\#} - 1/2(12PSF \times 9' \times 7.29') = 972^{\#}$

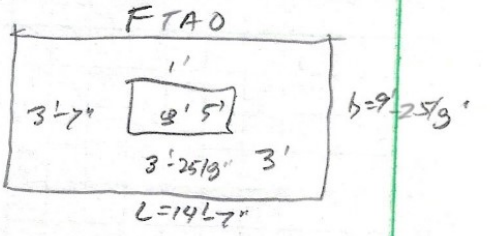
USE MST37 W/ 2 STUDS $T_{ALLOW} = 2{,}140^{\#} \times 1.4/1.6 = 1{,}873^{\#}$

(LEVEL 1) $F_E = 31{,}780^{\#} \times 14.58'/131.92' = 3{,}512^{\#}$

$V_E = 534 PLF$

USE W4 $V_{ALLOW} = 595 PLF$

HOLD DOWNS



$T_E = 2{,}216^{\#} \times 1.25 + 972^{\#} - 1/2(12PSF \times 9' \times 7.29') = 3{,}348^{\#}$

USE HDU5-SDS2.5 W/ 2 STUDS $T_{ALLOW} = 4{,}340^{\#} \times 1.4/1.6 = 3{,}798^{\#}$

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GRID J-A (21'-5" WALLS)

(LEVEL 3) $F_E = 13,206^{\#} \times 21.42'/131.92' = 2,144^{\#}$

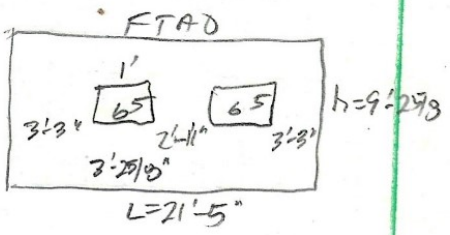
$V_E = 295 PLF$

USE W7 $V_{ALLOW} = 353 PLF$

HOLD DOWNS

$T_E = 921^{\#} \times 1.25 - 1/2(25PSF \times 19.75' \times 10.7') - 1/2(12PSF \times 4.5' \times 10.7') = -1,779^{\#}$

∴ NO HDU'S REQ'D



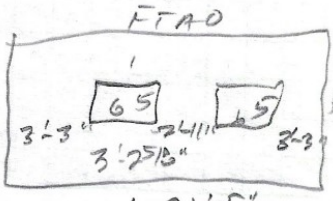
(LEVEL 2) $F_E = 23,782^{\#} \times 21.42'/131.92' = 3,862^{\#}$

$V_E = 531 PLF$

USE W4 $V_{ALLOW} = 595 PLF$

HOLD DOWNS

$T_E = 1,659^{\#} \times 1.25 - 1,779^{\#} - 1/2(12PSF \times 7' \times 10.7') = -293^{\#}$ ∴ NO HD'S REQ'D



(LEVEL 1) $F_E = 31,780^{\#} \times 21.42'/131.92' = 5,160^{\#}$

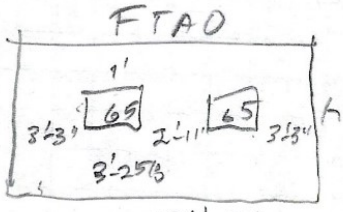
$V_E = 709 PLF$

USE W9 $V_{ALLOW} = 770 PLF$

HOLD DOWNS

$T_E = 2,216^{\#} \times 1.25 - 293^{\#} - 1/2(12PSF \times 9' \times 10.7') = 1,909^{\#}$

USE HDU4-SDS2.5 w/2 STUDS $T_{ALLOW} = 3,285^{\#} \times 1.4) \ldots L = 2,874^{\#}$



GRID J-A (7'-7" WALLS)

FE = 13,206# x 7.58'/131.92' = 759#

VE = 759#/7.59' = 100PLF

USE W1 VEALLOW = 242PLF

HOLD DOWNS

TE = 100PLF x 9' x 1.25 - 1/2(~~320PLF~~ x 4.5' x 3.79') = 920#

USE MST37 W/2 STUDS TEALLOW = 2,140# x 1.4/1.6 = 1,873#

GRID J-A (7'-7" WALLS)

FE = 23,792# x 7.59'/131.92' = 1,366#

VE = 1,366#/7.59' = 180PLF

USE W1 VEALLOW = 242PLF

HOLD DOWNS

TE = 180PLF x 9' x 1.25 + 920# - 1/2(120PLF x 9' x 3.79') = 2,743#

USE MST48 W/2 STUDS TEALLOW = 3,425# x 1.4/1.6 = 2,997#

GRID J-A (7'-7" WALLS)

FE = 31,780# x 7.59'/131.92' = 1,826#

VE = 1,826#/7.59' = 241PLF

USE W1 VEALLOW = 242PLF

HOLD DOWNS

TE = 241PLF x 9' x 1.25 + 2743# - 1/2(120PLF x 9' x 3.79') = 5,248#

USE HDU8-SDS2.5 W/3 STUDS TEALLOW = 4,590# x 1.4/1.6 = 5,758#

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Force Transfer Around Openings Calculator

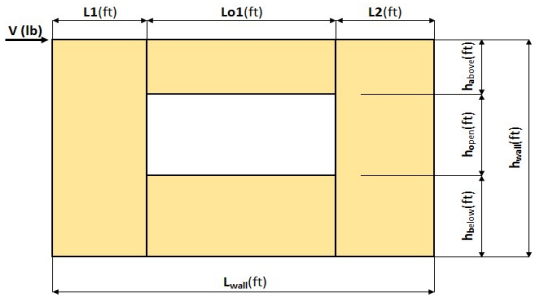
ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	2021 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid A-C (14'-7" Section) - (Level 1 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

V	4600 lbf	Opening 1	
L1	4.58 ft	h_a	1.00 ft
L2	7.00 ft	h_o	5.00 ft
h_{wall}	9.20 ft	h_b	3.20 ft
L_{wall}	14.58 ft	Lo1	3.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.09	N/A
P2=h_o/L2=	0.71	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2903 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 691 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2073 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 820 lbf

F2 = O1(L2)/(L1+L2) = 1253 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.19 ft

T2 = (L2*Lo1)/(L1+L2) = 1.81 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 397 plf

v2 = (V/L)(T2+L2)/L2 = 397 plf

Check v1*L1+v2*L2=V? 4600 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1819 lbf

R2 = v2*L2 = 2781 lbf

8. Difference corner force + resistance

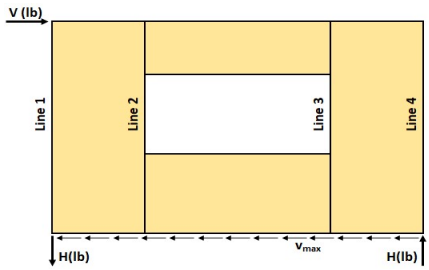
R1-F1 = 999 lbf

R2-F2 = 1527 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 218 plf

vc2 = (R2-F2)/L2 = 218 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		916	1986	2903 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2903	916	1986	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2903	916	1986	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		916	1986	2903 lbf

Design Summary*

Req. Sheathing Capacity	691 plf	**4-Term Deflection**	0.143 in.	**3-Term Deflection**	0.162 in.
Req. Strap Force	1253 lbf	**4-Term Story Drift %**	0.005 %	**3-Term Story Drift %**	0.006 %
Req. HD Force (H)	2903 lbf				
Req. Shear Wall Anchorage Force (v_{max})	316 plf				

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***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (14'-7" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4600 (lbf)

Sheathing Type: 15/32 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: DF#2
E: 1.60E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 10d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	397	397	397	397	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	(in.)
V_n:	66	66	66	66	(plf)
e_n:	0.0004	0.0004	0.0004	0.0004	(in.)
b:	4.58	4.58	7.00	7.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 15/32 OSB APA Rated Sheathing
Nail Type: 10d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.020	0.044	0.003	0.159	0.006	0.029	0.002	0.067
		Sum	0.225			Sum	0.103
Pier 2 (left)				**Pier 2 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.004	0.029	0.002	0.044	0.013	0.044	0.003	0.104
		Sum	0.078			Sum	0.164

Total Defl.	
0.143	(in.)
0.0052	%drift

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Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (14'-7" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4600 (lbf)

Wood End Post Values:

Sheathing Type: 15/32 OSB
Grade: APA Rated Sheathing
Species: DF#2
E: 1.60E+06 (psi)
Nail Type: 10d common (penny weight)

G_t Override:
G_a Override:
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	397	397	397	397	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	52.0	52.0	52.0	52.0	(kips/in.)
b:	4.58	4.58	7.00	7.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 15/32 OSB APA Rated Sheathing
Nail Type: 10d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.020	0.070	0.159	0.006	0.046	0.067
	Sum	0.249		Sum	0.119
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.004	0.046	0.044	0.013	0.070	0.104
	Sum	0.094		Sum	0.187

Total Defl.	
0.162	(in.)
0.0059	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

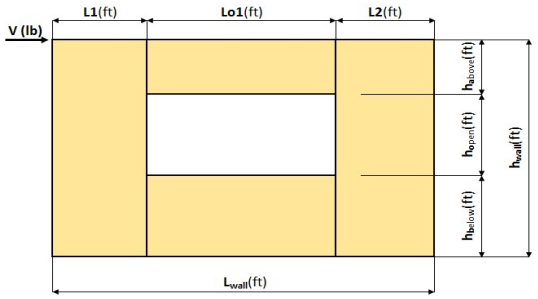
ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	2021 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid A-C (14'-7" Section) - (Level 2 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

V	3438 lbf	Opening 1	
L1	4.58 ft	h_a	1.00 ft
L2	7.00 ft	h_o	5.00 ft
h_{wall}	9.20 ft	h_b	3.20 ft
L_{wall}	14.58 ft	Lo1	3.00 ft

Adj. Factor Method =	2bs/h	
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.09	N/A
P2=h_o/L2=	0.71	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2169 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 517 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1550 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 613 lbf

F2 = O1(L2)/(L1+L2) = 937 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.19 ft

T2 = (L2*Lo1)/(L1+L2) = 1.81 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 297 plf

v2 = (V/L)(T2+L2)/L2 = 297 plf

Check v1*L1+v2*L2=V? 3438 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1360 lbf

R2 = v2*L2 = 2078 lbf

8. Difference corner force + resistance

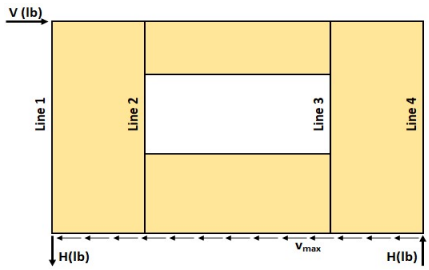
R1-F1 = 747 lbf

R2-F2 = 1142 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 163 plf

vc2 = (R2-F2)/L2 = 163 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		685	1484	2169 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2169	685	1484	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2169	685	1484	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		685	1484	2169 lbf

Design Summary*

Req. Sheathing Capacity	517 plf	**4-Term Deflection**	0.110 in.	**3-Term Deflection**	0.134 in.
Req. Strap Force	937 lbf	**4-Term Story Drift %**	0.004 %	**3-Term Story Drift %**	0.005 %
Req. HD Force (H)	2169 lbf				
Req. Shear Wall Anchorage Force (v_{max})	236 plf				

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***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3438 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	297	297	297	297	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	(in.)
V_n:	49	49	49	49	(plf)
e_n:	0.0006	0.0006	0.0006	0.0006	(in.)
b:	4.58	4.58	7.00	7.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.019	0.033	0.004	0.119	0.005	0.021	0.003	0.050
		Sum	0.174			Sum	0.080
Pier 2 (left)				**Pier 2 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.003	0.021	0.003	0.033	0.012	0.033	0.004	0.078
		Sum	0.060			Sum	0.127

Total Defl.	
0.110	(in.)
0.0040	%drift

Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3438 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing
Species: HF#2
E: 1.30E+06 (psi)
Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	297	297	297	297	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	42.0	42.0	42.0	42.0	(kips/in.)
b:	4.58	4.58	7.00	7.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.019	0.065	0.119	0.005	0.042	0.050
	Sum	0.202		Sum	0.098
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.003	0.042	0.033	0.012	0.065	0.078
	Sum	0.079		Sum	0.155

Total Defl.	
0.134	(in.)
0.0048	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

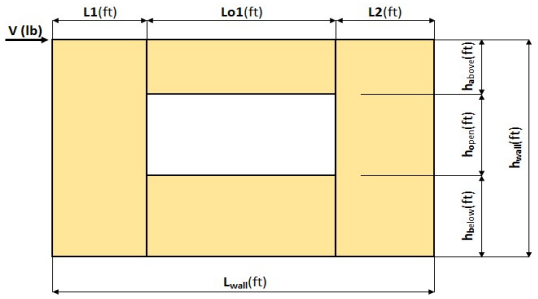
ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	2021 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid A-C (14'-7" Section) - (Level 3 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

V	1861 lbf	Opening 1	
L1	4.58 ft	h_a	1.00 ft
L2	7.00 ft	h_o	5.00 ft
h_{wall}	9.20 ft	h_b	3.20 ft
L_{wall}	14.58 ft	Lo1	3.00 ft

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 1.09	N/A
P2=h_o/L2= 0.71	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1174 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 280 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 839 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 332 lbf

F2 = O1(L2)/(L1+L2) = 507 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.19 ft

T2 = (L2*Lo1)/(L1+L2) = 1.81 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 161 plf

v2 = (V/L)(T2+L2)/L2 = 161 plf

Check v1*L1+v2*L2=V? 1861 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 736 lbf

R2 = v2*L2 = 1125 lbf

8. Difference corner force + resistance

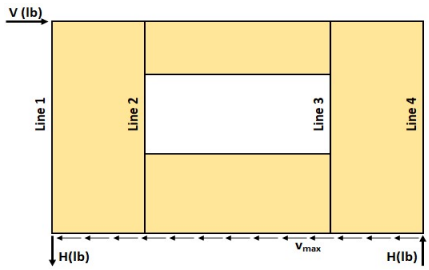
R1-F1 = 404 lbf

R2-F2 = 618 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 88 plf

vc2 = (R2-F2)/L2 = 88 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		371	804	1174 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1174	371	804	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1174	371	804	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		371	804	1174 lbf

Design Summary*

Req. Sheathing Capacity	280 plf	**4-Term Deflection**	0.058 in.	**3-Term Deflection**	0.072 in.
Req. Strap Force	507 lbf	**4-Term Story Drift %**	0.002 %	**3-Term Story Drift %**	0.003 %
Req. HD Force (H)	1174 lbf				
Req. Shear Wall Anchorage Force (v_{max})	128 plf				

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***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (14'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1861 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	161	161	161	161	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	(in.)
V_n:	27	27	27	27	(plf)
e_n:	0.0001	0.0001	0.0001	0.0001	(in.)
b:	4.58	4.58	7.00	7.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.010	0.018	0.001	0.064	0.003	0.012	0.000	0.027
		Sum	0.093			Sum	0.042
Pier 2 (left)				**Pier 2 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.002	0.012	0.000	0.018	0.007	0.018	0.001	0.042
		Sum	0.032			Sum	0.067

Total Defl.	
0.058	(in.)
0.0021	%drift

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Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (14'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1861 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing
Species: HF#2
E: 1.30E+06 (psi)
Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	161	161	161	161	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	42.0	42.0	42.0	42.0	(kips/in.)
b:	4.58	4.58	7.00	7.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.010	0.035	0.064	0.003	0.023	0.027
	Sum	0.110		Sum	0.053
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.002	0.023	0.018	0.007	0.035	0.042
	Sum	0.043		Sum	0.084

Total Defl.	
0.072	(in.)
0.0026	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

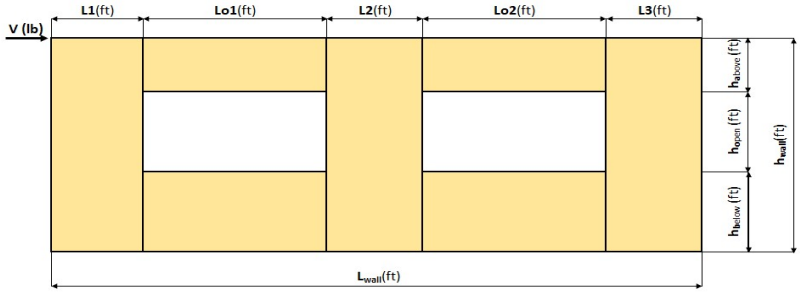
TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	IBC 2021
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid A-C (25'-6" Section) - (Level 1 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	8046 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	3.18 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	7.14 ft	h_b1	3.20 ft	h_b2	3.20 ft
L3	3.18 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.20 ft				
L_{wall}	25.50 ft				

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.57	N/A
P2=h_o/L2=	0.70	N/A
P3=h_o/L3=	1.57	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2903 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	691 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	691 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	4147 lbf
Second opening: O2 = va2 x (Lo2) =	4147 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	1278 lbf
F2 = O1(L2)/(L1+L2) =	2869 lbf
F3 = O2(L2)/(L2+L3) =	2869 lbf
F4 = O2(L3)/(L2+L3) =	1278 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.85 ft
T2 = (L2*Lo1)/(L1+L2) =	4.15 ft
T3 = (L2*Lo2)/(L2+L3) =	4.15 ft
T4 = (L3*Lo2)/(L2+L3) =	1.85 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	499 plf
v2 = (V/L)(T2+L2+T3)/L2 =	682 plf
v3 = (V/L)(T4+L3)/L3 =	499 plf
Check v1*L1+v2*L2+v3*L3=V?	8046 lbf **OK**

7. Resistance to corner forces

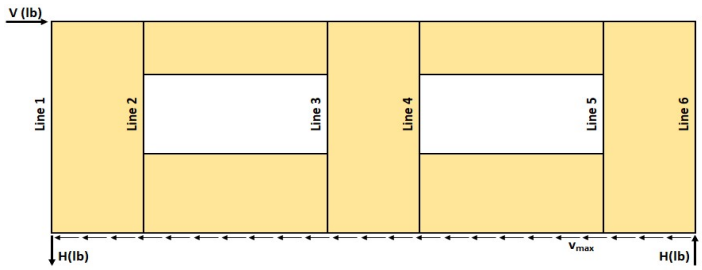
R1 = v1*L1 =	1587 lbf
R2 = v2*L2 =	4873 lbf
R3 = v3*L3 =	1587 lbf

8. Difference corner force + resistance

R1-F1 =	309 lbf
R2-F2-F3 =	-866 lbf
R3-F4 =	309 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	97 plf
vc2 = (R2-F2-F3)/L2 =	-121 plf
vc3 = (R3-F4)/L3 =	97 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		408	2495	2903 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	2903	408	2495	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-509	3412	2903	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	2903	3412	-509	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	2903	408	2495	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		408	2495	2903 lbf

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Design Summary*

Req. Sheathing Capacity	691 plf	**4-Term Deflection**	0.410 in	**3-Term Deflection**	0.431 in.
Req. Strap Force	2869 lbf	**4-Term Story Drift %**	0.015 %	**3-Term Story Drift %**	0.016 %
Req. HD Force	2903 lbf				
Req. Shear Wall Anchorage Force	316 plf				

***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (25'-6" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 8046 (lbf)

Sheathing Type: 15/32 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: DF#2
E: 1.60E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 10d common (penny weight)

	Pier 1	Pier 3	
Nail Spacing:	2	2	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	499	499	682	682	499	499	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	2	2	(in.)
V_n:	83	83	114	114	83	83	(plf)
e_n:	0.0008	0.0008	0.0023	0.0023	0.0008	0.0008	(in.)
b:	3.18	3.18	7.14	7.14	3.18	3.18	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 15/32 OSB APA Rated Sheathing
Nail Type: 10d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.037	0.055	0.006	0.603	0.010	0.036	0.004	0.256
		Sum	0.701			Sum	0.306
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.006	0.049	0.010	0.156	0.006	0.049	0.010	0.156
		Sum	0.222			Sum	0.222
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.010	0.036	0.004	0.256	0.037	0.055	0.006	0.603
		Sum	0.306			Sum	0.701

Total Defl.	
0.410	(in.)
0.0148	%drift

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

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (25'-6" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 8046 (lbf)

Wood End Post Values:

Sheathing Type: 15/32 OSB | Species: DF#2 | Nail Type: 10d common (penny weight)

Grade: APA Rated Sheathing | E: 1.60E+06 (psi)

G_t Override: | C_d: 4.00

G_a Override:

	Pier 1	Pier 3	
Nail Spacing:	2	2	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	499	499	682	682	499	499	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	52.0	52.0	52.0	52.0	52.0	52.0	(kips/in.)
b:	3.18	3.18	7.14	7.14	3.18	3.18	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 15/32 OSB APA Rated Sheathing

Nail Type: 10d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.037	0.088	0.603	0.010	0.058	0.256
	Sum	0.728		Sum	0.324
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.006	0.079	0.156	0.006	0.079	0.156
	Sum	0.241		Sum	0.241
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.010	0.058	0.256	0.037	0.088	0.603
	Sum	0.324		Sum	0.728

Total Defl.	
0.431	(in.)
0.0156	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

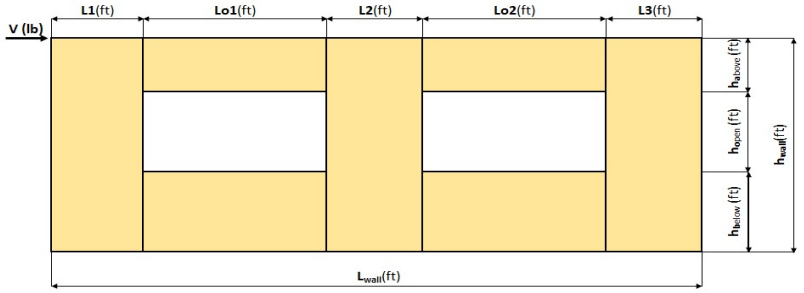
TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	IBC 2021
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid A-C (25'-6" Section) - (Level 2 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	6013 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	3.18 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	7.14 ft	h_b1	3.20 ft	h_b2	3.20 ft
L3	3.18 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.20 ft				
L_{wall}	25.50 ft				

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 1.57	N/A
P2=h_o/L2= 0.70	N/A
P3=h_o/L3= 1.57	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2169 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) = 517 plf

Second opening: va2 = vb2 = H/(h_a2+h_b2) = 517 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 3099 lbf

Second opening: O2 = va2 x (Lo2) = 3099 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 955 lbf

F2 = O1(L2)/(L1+L2) = 2144 lbf

F3 = O2(L2)/(L2+L3) = 2144 lbf

F4 = O2(L3)/(L2+L3) = 955 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.85 ft

T2 = (L2*Lo1)/(L1+L2) = 4.15 ft

T3 = (L2*Lo2)/(L2+L3) = 4.15 ft

T4 = (L3*Lo2)/(L2+L3) = 1.85 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 373 plf

v2 = (V/L)(T2+L2+T3)/L2 = 510 plf

v3 = (V/L)(T4+L3)/L3 = 373 plf

Check v1*L1+v2*L2+v3*L3=V? 6013 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1186 lbf

R2 = v2*L2 = 3641 lbf

R3 = v3*L3 = 1186 lbf

8. Difference corner force + resistance

R1-F1 = 231 lbf

R2-F2-F3 = -647 lbf

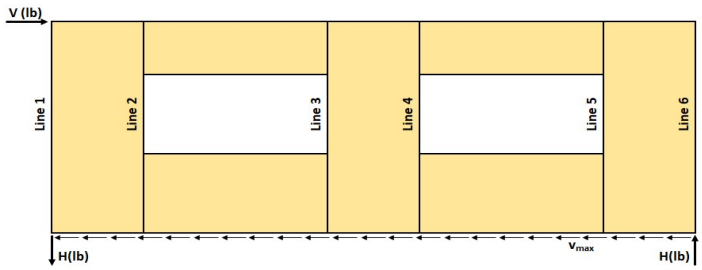
R3-F4 = 231 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 73 plf

vc2 = (R2-F2-F3)/L2 = -91 plf

vc3 = (R3-F4)/L3 = 73 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		305	1864	2169 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	2169	305	1864	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-381	2550	2169	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	2169	2550	-381	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	2169	305	1864	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		305	1864	2169 lbf

Design Summary*

Req. Sheathing Capacity	517 plf	**4-Term Deflection**	0.313 in	**3-Term Deflection**	0.339 in.
Req. Strap Force	2144 lbf	**4-Term Story Drift %**	0.011 %	**3-Term Story Drift %**	0.012 %
Req. HD Force	2169 lbf				
Req. Shear Wall Anchorage Force	236 plf				

***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (25'-6" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6013 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 3	
Nail Spacing:	2	2	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	373	373	510	510	373	373	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	2	2	(in.)
V_n:	62	62	85	85	62	62	(plf)
e_n:	0.0012	0.0012	0.0030	0.0030	0.0012	0.0012	(in.)
b:	3.18	3.18	7.14	7.14	3.18	3.18	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.034	0.041	0.008	0.451	0.009	0.027	0.005	0.192
		Sum	0.534			Sum	0.233
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.006	0.037	0.014	0.117	0.006	0.037	0.014	0.117
		Sum	0.173			Sum	0.173
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.009	0.027	0.005	0.192	0.034	0.041	0.008	0.451
		Sum	0.233			Sum	0.534

Total Defl.	
0.313	(in.)
0.0114	%drift

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (25'-6" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6013 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB — Species: HF#2 — Nail Type: 8d common (penny weight)

Grade: APA Rated Sheathing — E: 1.30E+06 (psi)

G_t Override: — G_a Override: — C_d: 4.00

	Pier 1	Pier 3	
Nail Spacing:	2	2	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	373	373	510	510	373	373	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	42.0	42.0	42.0	42.0	42.0	42.0	(kips/in.)
b:	3.18	3.18	7.14	7.14	3.18	3.18	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.034	0.082	0.451	0.009	0.053	0.192
	Sum	0.566		Sum	0.254
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.006	0.073	0.117	0.006	0.073	0.117
	Sum	0.195		Sum	0.195
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.009	0.053	0.192	0.034	0.082	0.451
	Sum	0.254		Sum	0.566

Total Defl.	
0.339	(in.)
0.0123	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

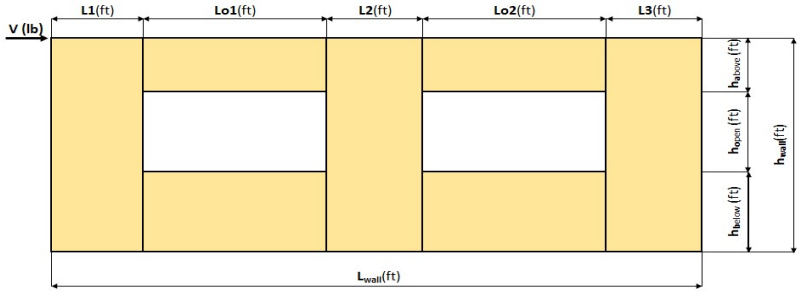
TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	IBC 2021
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid A-C (25'-6" Section) - (Level 3 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2	Adj. Factor Method =		2bs/h
V	3255 lbf	h_a1	1.00 ft	h_a2	1.00 ft	Wall Pier Aspect Ratio		Adj. Factor
L1	3.18 ft	h_o1	5.00 ft	h_o2	5.00 ft	P1=h_o/L1=	1.57	N/A
L2	7.14 ft	h_b1	3.20 ft	h_b2	3.20 ft	P2=h_o/L2=	0.70	N/A
L3	3.18 ft	Lo1	6.00 ft	Lo2	6.00 ft	P3=h_o/L3=	1.57	N/A
h_{wall}	9.20 ft							
L_{wall}	25.50 ft							

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1174 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	280 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	280 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	1678 lbf
Second opening: O2 = va2 x (Lo2) =	1678 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	517 lbf
F2 = O1(L2)/(L1+L2) =	1161 lbf
F3 = O2(L2)/(L2+L3) =	1161 lbf
F4 = O2(L3)/(L2+L3) =	517 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.85 ft
T2 = (L2*Lo1)/(L1+L2) =	4.15 ft
T3 = (L2*Lo2)/(L2+L3) =	4.15 ft
T4 = (L3*Lo2)/(L2+L3) =	1.85 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	202 plf
v2 = (V/L)(T2+L2+T3)/L2 =	276 plf
v3 = (V/L)(T4+L3)/L3 =	202 plf
Check v1*L1+v2*L2+v3*L3=V?	3255 lbf **OK**

7. Resistance to corner forces

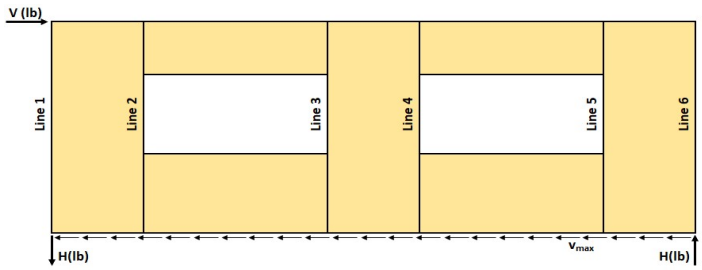
R1 = v1*L1 =	642 lbf
R2 = v2*L2 =	1971 lbf
R3 = v3*L3 =	642 lbf

8. Difference corner force + resistance

R1-F1 =	125 lbf
R2-F2-F3 =	-350 lbf
R3-F4 =	125 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	39 plf
vc2 = (R2-F2-F3)/L2 =	-49 plf
vc3 = (R3-F4)/L3 =	39 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		165	1009	1174 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	1174	165	1009	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-206	1380	1174	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	1174	1380	-206	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	1174	165	1009	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		165	1009	1174 lbf

Design Summary*

Req. Sheathing Capacity	280 plf	**4-Term Deflection**	0.176 in.	**3-Term Deflection**	0.217 in.
Req. Strap Force	1161 lbf	**4-Term Story Drift %**	0.006 %	**3-Term Story Drift %**	0.008 %
Req. HD Force	1174 lbf				
Req. Shear Wall Anchorage Force	128 plf				

***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (25'-6" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3255 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 3	
Nail Spacing:	4	4	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	202	202	276	276	202	202	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	4	4	(in.)
V_n:	67	67	92	92	67	67	(plf)
e_n:	0.0015	0.0015	0.0039	0.0039	0.0015	0.0015	(in.)
b:	3.18	3.18	7.14	7.14	3.18	3.18	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.018	0.022	0.010	0.244	0.005	0.015	0.007	0.104
		Sum	0.295			Sum	0.130
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.003	0.020	0.017	0.063	0.003	0.020	0.017	0.063
		Sum	0.104			Sum	0.104
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.005	0.015	0.007	0.104	0.018	0.022	0.010	0.244
		Sum	0.130			Sum	0.295

Total Defl.	
0.176	(in.)
0.0064	%drift

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid A-C (25'-6" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3255 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB | Species: HF#2 | Nail Type: 8d common (penny weight)

Grade: APA Rated Sheathing | E: 1.30E+06 (psi)

G_t Override: | C_d: 4.00

G_a Override:

	Pier 1	Pier 3	
Nail Spacing:	4	4	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	202	202	276	276	202	202	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	22.0	22.0	22.0	22.0	22.0	22.0	(kips/in.)
b:	3.18	3.18	7.14	7.14	3.18	3.18	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.018	0.084	0.244	0.005	0.055	0.104
	Sum	0.347		Sum	0.164
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.003	0.075	0.063	0.003	0.075	0.063
	Sum	0.142		Sum	0.142
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.005	0.055	0.104	0.018	0.084	0.244
	Sum	0.164		Sum	0.347

Total Defl.	
0.217	(in.)
0.0079	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

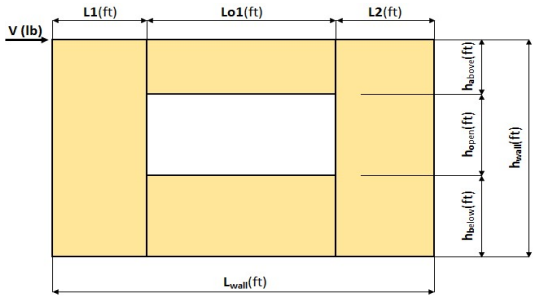
ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	2021 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid J-M (14'-7" Section) - (Level 1 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

V	3512 lbf	Opening 1	
L1	3.58 ft	h_a	1.00 ft
L2	3.00 ft	h_o	5.00 ft
h_{wall}	9.20 ft	h_b	3.20 ft
L_{wall}	14.58 ft	Lo1	8.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.40	N/A
P2=h_o/L2=	1.67	N/A

Note to Designer: The width-to-height ratio of sheathing above or below the openings exceeds 6.5:1. Exercise caution when assuming fixity at corner regions, as assumed in this calculator.

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2216 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 528 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 4221 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 2297 lbf

F2 = O1(L2)/(L1+L2) = 1925 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 4.35 ft

T2 = (L2*Lo1)/(L1+L2) = 3.65 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 534 plf

v2 = (V/L)(T2+L2)/L2 = 534 plf

Check v1*L1+v2*L2=V? 3512 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1911 lbf

R2 = v2*L2 = 1601 lbf

8. Difference corner force + resistance

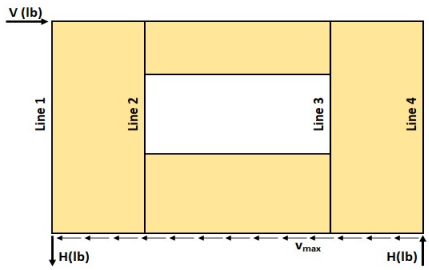
R1-F1 = -386 lbf

R2-F2 = -323 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = -108 plf

vc2 = (R2-F2)/L2 = -108 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		-453	2669	2216 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2216	-453	2669	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2216	-453	2669	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		-453	2669	2216 lbf

Design Summary*

Req. Sheathing Capacity	534 plf	**4-Term Deflection**	0.312 in.	**3-Term Deflection**	0.340 in.
Req. Strap Force	2297 lbf	**4-Term Story Drift %**	0.011 %	**3-Term Story Drift %**	0.012 %
Req. HD Force (H)	2216 lbf				
Req. Shear Wall Anchorage Force (v_{max})	241 plf				

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***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (14'-7" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3512 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	534	534	534	534	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	(in.)
V_n:	89	89	89	89	(plf)
e_n:	0.0035	0.0035	0.0035	0.0035	(in.)
b:	3.58	3.58	3.00	3.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.043	0.059	0.024	0.273	0.012	0.038	0.016	0.116
		Sum	0.399			Sum	0.182
Pier 2 (left)				**Pier 2 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.014	0.038	0.016	0.138	0.052	0.059	0.024	0.325
		Sum	0.207			Sum	0.460

Total Defl.	
0.312	(in.)
0.0113	%drift

Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (14'-7" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3512 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing
Species: HF#2
E: 1.30E+06 (psi)
Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	534	534	534	534	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	42.0	42.0	42.0	42.0	(kips/in.)
b:	3.58	3.58	3.00	3.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.043	0.117	0.273	0.012	0.076	0.116
	Sum	0.433		Sum	0.204
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.014	0.076	0.138	0.052	0.117	0.325
	Sum	0.229		Sum	0.494

Total Defl.	
0.340	(in.)
0.0123	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

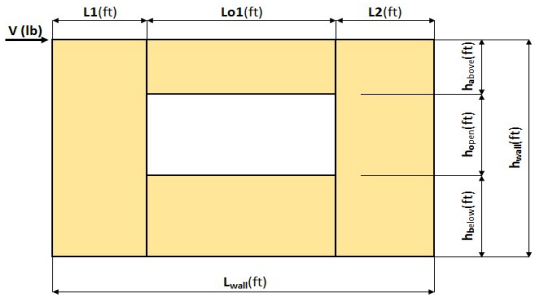
ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	2021 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid J-M (14'-7" Section) - (Level 2 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

V	2630 lbf	Opening 1	
L1	3.58 ft	h_a	1.00 ft
L2	3.00 ft	h_o	5.00 ft
h_{wall}	9.20 ft	h_b	3.20 ft
L_{wall}	14.58 ft	Lo1	8.00 ft

Adj. Factor Method =	2bs/h	
Wall Pier Aspect Ratio		Adj. Factor
$P1=h_o/L1=$	1.40	N/A
$P2=h_o/L2=$	1.67	N/A

Note to Designer: The width-to-height ratio of sheathing above or below the openings exceeds 6.5:1. Exercise caution when assuming fixity at corner regions, as assumed in this calculator.

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1660 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a+h_b)$ = 395 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 3161 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1720 lbf

F2 = O1(L2)/(L1+L2) = 1441 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 4.35 ft

T2 = (L2*Lo1)/(L1+L2) = 3.65 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 400 plf

v2 = (V/L)(T2+L2)/L2 = 400 plf

Check v1*L1+v2*L2=V? 2630 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1431 lbf

R2 = v2*L2 = 1199 lbf

8. Difference corner force + resistance

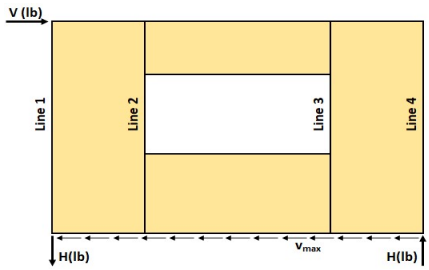
R1-F1 = -289 lbf

R2-F2 = -242 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = -81 plf

vc2 = (R2-F2)/L2 = -81 plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H$?		-339	1998	1660 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0$?	1660	-339	1998	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0$?	1660	-339	1998	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H$?		-339	1998	1660 lbf

Design Summary*

Req. Sheathing Capacity	400 plf	**4-Term Deflection**	0.247 in.	**3-Term Deflection**	0.291 in.
Req. Strap Force	1720 lbf	**4-Term Story Drift %**	0.009 %	**3-Term Story Drift %**	0.011 %
Req. HD Force (H)	1660 lbf				
Req. Shear Wall Anchorage Force (v_{max})	180 plf				

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***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2630 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	3	3	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	400	400	400	400	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	3	3	3	3	(in.)
V_n:	100	100	100	100	(plf)
e_n:	0.0050	0.0050	0.0050	0.0050	(in.)
b:	3.58	3.58	3.00	3.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.032	0.044	0.034	0.204	0.009	0.029	0.022	0.087
		Sum	0.315			Sum	0.147
Pier 2 (left)				**Pier 2 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.011	0.029	0.022	0.104	0.039	0.044	0.034	0.244
		Sum	0.165			Sum	0.360

Total Defl.	
0.247	(in.)
0.0089	%drift

Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2630 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing
Species: HF#2
E: 1.30E+06 (psi)
Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	3	3	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	400	400	400	400	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	28.0	28.0	28.0	28.0	(kips/in.)
b:	3.58	3.58	3.00	3.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.032	0.131	0.204	0.009	0.086	0.087
	Sum	0.368		Sum	0.181
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.011	0.086	0.104	0.039	0.131	0.244
	Sum	0.200		Sum	0.414

Total Defl.	
0.291	(in.)
0.0105	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

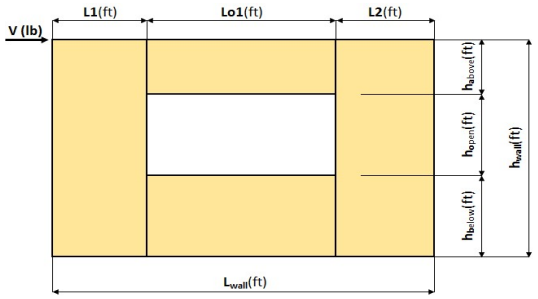
ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	2021 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid J-M (14'-7" Section) - (Level 3 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

V	1460 lbf	Opening 1	
L1	3.58 ft	h_a	1.00 ft
L2	3.00 ft	h_o	5.00 ft
h_{wall}	9.20 ft	h_b	3.20 ft
L_{wall}	14.58 ft	Lo1	8.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.40	N/A
P2=h_o/L2=	1.67	N/A

Note to Designer: The width-to-height ratio of sheathing above or below the openings exceeds 6.5:1. Exercise caution when assuming fixity at corner regions, as assumed in this calculator.

1. Hold-down forces: H = Vh_{wall}/L_{wall} 921 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 219 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1755 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 955 lbf

F2 = O1(L2)/(L1+L2) = 800 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 4.35 ft

T2 = (L2*Lo1)/(L1+L2) = 3.65 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 222 plf

v2 = (V/L)(T2+L2)/L2 = 222 plf

Check v1*L1+v2*L2=V? 1460 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 794 lbf

R2 = v2*L2 = 666 lbf

8. Difference corner force + resistance

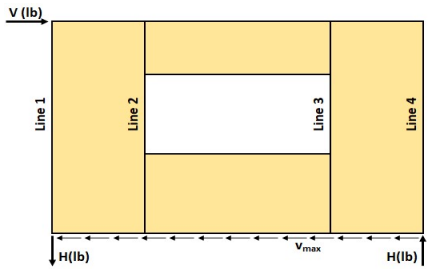
R1-F1 = -160 lbf

R2-F2 = -134 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = -45 plf

vc2 = (R2-F2)/L2 = -45 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		-188	1109	921 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	921	-188	1109	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	921	-188	1109	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		-188	1109	921 lbf

Design Summary*

Req. Sheathing Capacity	222 plf	**4-Term Deflection**	0.160 in.	**3-Term Deflection**	0.214 in.
Req. Strap Force	955 lbf	**4-Term Story Drift %**	0.006 %	**3-Term Story Drift %**	0.008 %
Req. HD Force (H)	921 lbf				
Req. Shear Wall Anchorage Force (v_{max})	100 plf				

City of Puyallup
Development & Permitting Services
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***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (14'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1460 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	222	222	222	222	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	6	6	6	6	(in.)
V_n:	111	111	111	111	(plf)
e_n:	0.0068	0.0068	0.0068	0.0068	(in.)
b:	3.58	3.58	3.00	3.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.018	0.024	0.047	0.113	0.005	0.016	0.031	0.048
		Sum	0.203			Sum	0.100
Pier 2 (left)				**Pier 2 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.006	0.016	0.031	0.058	0.021	0.024	0.047	0.135
		Sum	0.110			Sum	0.228

Total Defl.	
0.160	(in.)
0.0058	%drift

Project Information

Code:	2021 IBC	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (14'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1460 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing
Species: HF#2
E: 1.30E+06 (psi)
Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	222	222	222	222	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	9.20	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					($in.^2$)
A:	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	15.0	15.0	15.0	15.0	(kips/in.)
b:	3.58	3.58	3.00	3.00	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.018	0.136	0.113	0.005	0.089	0.048
	Sum	0.267		Sum	0.142
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.006	0.089	0.058	0.021	0.136	0.135
	Sum	0.152		Sum	0.293

Total Defl.	
0.214	(in.)
0.0077	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

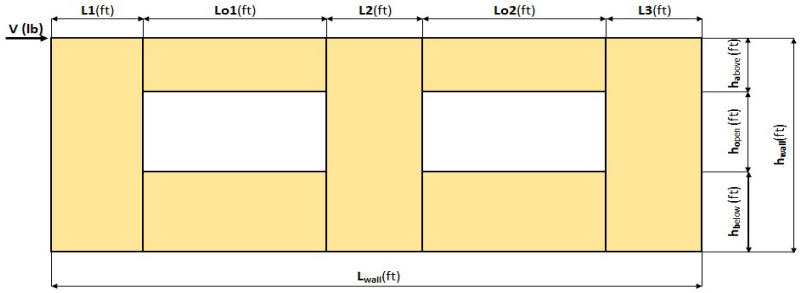
TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	IBC 2021
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid J-M (21'-5" Section) - (Level 1 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	5160 lbf	h_a	1.00 ft	h_a	1.00 ft
L1	3.25 ft	h_o	5.00 ft	h_o	5.00 ft
L2	2.92 ft	h_b	3.20 ft	h_b	3.20 ft
L3	3.25 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.20 ft				
L_{wall}	21.42 ft				

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 1.54	N/A
P2=h_o/L2= 1.71	N/A
P3=h_o/L3= 1.54	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2216 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) = 528 plf

Second opening: va2 = vb2 = H/(h_a2+h_b2) = 528 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 3166 lbf

Second opening: O2 = va2 x (Lo2) = 3166 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1668 lbf

F2 = O1(L2)/(L1+L2) = 1498 lbf

F3 = O2(L2)/(L2+L3) = 1498 lbf

F4 = O2(L3)/(L2+L3) = 1668 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.16 ft

T2 = (L2*Lo1)/(L1+L2) = 2.84 ft

T3 = (L2*Lo2)/(L2+L3) = 2.84 ft

T4 = (L3*Lo2)/(L2+L3) = 3.16 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 475 plf

v2 = (V/L)(T2+L2+T3)/L2 = 709 plf

v3 = (V/L)(T4+L3)/L3 = 475 plf

Check v1*L1+v2*L2+v3*L3=V? 5160 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1544 lbf

R2 = v2*L2 = 2071 lbf

R3 = v3*L3 = 1544 lbf

8. Difference corner force + resistance

R1-F1 = -123 lbf

R2-F2-F3 = -925 lbf

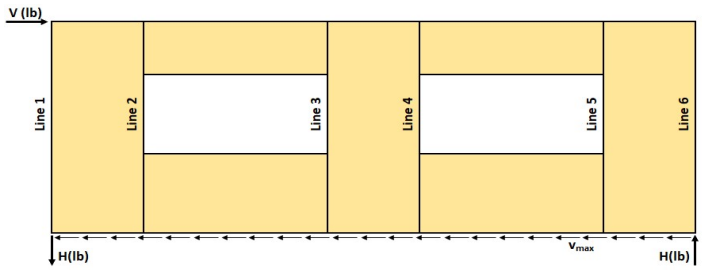
R3-F4 = -123 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = -38 plf

vc2 = (R2-F2-F3)/L2 = -317 plf

vc3 = (R3-F4)/L3 = -38 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		-160	2376	2216 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	2216	-160	2376	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-1331	3547	2216	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	2216	3547	-1331	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	2216	-160	2376	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		-160	2376	2216 lbf

Design Summary*

Req. Sheathing Capacity	709 plf	**4-Term Deflection**	0.351 in.	**3-Term Deflection**	0.369 in.
Req. Strap Force	1668 lbf	**4-Term Story Drift %**	0.013 %	**3-Term Story Drift %**	0.013 %
Req. HD Force	2216 lbf				
Req. Shear Wall Anchorage Force	241 plf				

***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (21'-5" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3862 (lbf)

Sheathing Type: 15/32 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: DF#2
E: 1.60E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 10d common (penny weight)

	Pier 1	Pier 3	
Nail Spacing:	2	2	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	356	356	531	531	356	356	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	2	2	(in.)
V_n:	59	59	88	88	59	59	(plf)
e_n:	0.0003	0.0003	0.0010	0.0010	0.0003	0.0003	(in.)
b:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 15/32 OSB APA Rated Sheathing
Nail Type: 10d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.026	0.039	0.002	0.421	0.007	0.026	0.001	0.179
		Sum	0.487			Sum	0.213
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.012	0.038	0.005	0.297	0.012	0.038	0.005	0.297
		Sum	0.352			Sum	0.352
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.007	0.026	0.001	0.179	0.026	0.039	0.002	0.421
		Sum	0.213			Sum	0.487

Total Defl.	
0.351	(in.)
0.0127	%drift

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

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (21'-5" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3862 (lbf)

Wood End Post Values:

Sheathing Type: 15/32 OSB
Grade: APA Rated Sheathing
Species: DF#2
E: 1.60E+06 (psi)
Nail Type: 10d common (penny weight)

G_t Override:
G_a Override:
C_d: 4.00

	Pier 1	Pier 3	
Nail Spacing:	2	2	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	356	356	531	531	356	356	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	52.0	52.0	52.0	52.0	52.0	52.0	(kips/in.)
b:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 15/32 OSB APA Rated Sheathing
Nail Type: 10d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.026	0.063	0.421	0.007	0.041	0.179
	Sum	0.509		Sum	0.227
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.012	0.061	0.297	0.012	0.061	0.297
	Sum	0.370		Sum	0.370
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.007	0.041	0.179	0.026	0.063	0.421
	Sum	0.227		Sum	0.509

Total Defl.	
0.369	(in.)
0.0134	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

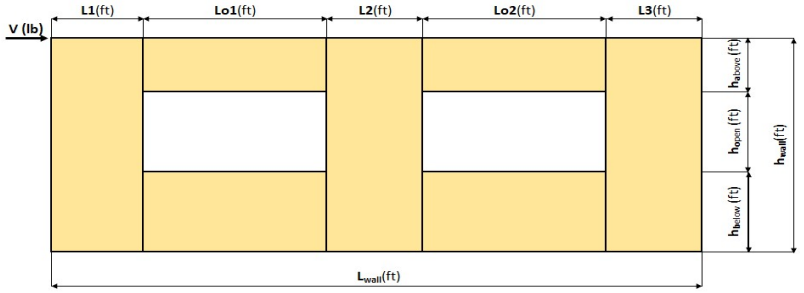
TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	IBC 2021
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid J-M (21'-5" Section) - (Level 2 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	3862 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	3.25 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	2.92 ft	h_b1	3.20 ft	h_b2	3.20 ft
L3	3.25 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.20 ft				
L_{wall}	21.42 ft				

Adj. Factor Method =	2lbs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 1.54	N/A
P2=h_o/L2= 1.71	N/A
P3=h_o/L3= 1.54	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1659 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) = 395 plf

Second opening: va2 = vb2 = H/(h_a2+h_b2) = 395 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2370 lbf

Second opening: O2 = va2 x (Lo2) = 2370 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1248 lbf

F2 = O1(L2)/(L1+L2) = 1121 lbf

F3 = O2(L2)/(L2+L3) = 1121 lbf

F4 = O2(L3)/(L2+L3) = 1248 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.16 ft

T2 = (L2*Lo1)/(L1+L2) = 2.84 ft

T3 = (L2*Lo2)/(L2+L3) = 2.84 ft

T4 = (L3*Lo2)/(L2+L3) = 3.16 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 356 plf

v2 = (V/L)(T2+L2+T3)/L2 = 531 plf

v3 = (V/L)(T4+L3)/L3 = 356 plf

Check v1*L1+v2*L2+v3*L3=V? 3862 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1156 lbf

R2 = v2*L2 = 1550 lbf

R3 = v3*L3 = 1156 lbf

8. Difference corner force + resistance

R1-F1 = -92 lbf

R2-F2-F3 = -692 lbf

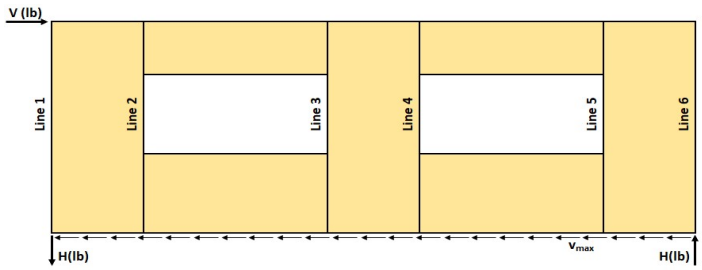
R3-F4 = -92 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = -28 plf

vc2 = (R2-F2-F3)/L2 = -237 plf

vc3 = (R3-F4)/L3 = -28 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		-119	1778	1659 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	1659	-119	1778	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-996	2655	1659	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	1659	2655	-996	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	1659	-119	1778	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		-119	1778	1659 lbf

Design Summary*

Req. Sheathing Capacity	531 plf	**4-Term Deflection**	0.361 in.	**3-Term Deflection**	0.385 in.
Req. Strap Force	1248 lbf	**4-Term Story Drift %**	0.013 %	**3-Term Story Drift %**	0.014 %
Req. HD Force	1659 lbf				
Req. Shear Wall Anchorage Force	180 plf				

***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (21'-5" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3862 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 3	
Nail Spacing:	2	2	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	356	356	531	531	356	356	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	2	2	(in.)
V_n:	59	59	88	88	59	59	(plf)
e_n:	0.0010	0.0010	0.0034	0.0034	0.0010	0.0010	(in.)
b:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.032	0.039	0.007	0.421	0.009	0.026	0.005	0.179
		Sum	0.499			Sum	0.218
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.015	0.038	0.015	0.297	0.015	0.038	0.015	0.297
		Sum	0.366			Sum	0.366
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.009	0.026	0.005	0.179	0.032	0.039	0.007	0.421
		Sum	0.218			Sum	0.499

Total Defl.	
0.361	(in.)
0.0131	%drift

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (21'-5" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3862 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB — Species: HF#2 — Nail Type: 8d common (penny weight)

Grade: APA Rated Sheathing — E: 1.30E+06 (psi)

G_t Override: — G_a Override: — C_d: 4.00

	Pier 1	Pier 3	
Nail Spacing:	2	2	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	356	356	531	531	356	356	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	42.0	42.0	42.0	42.0	42.0	42.0	(kips/in.)
b:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.032	0.078	0.421	0.009	0.051	0.179
	Sum	0.530		Sum	0.238
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.015	0.076	0.297	0.015	0.076	0.297
	Sum	0.388		Sum	0.388
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.009	0.051	0.179	0.032	0.078	0.421
	Sum	0.238		Sum	0.530

Total Defl.	
0.385	(in.)
0.0140	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

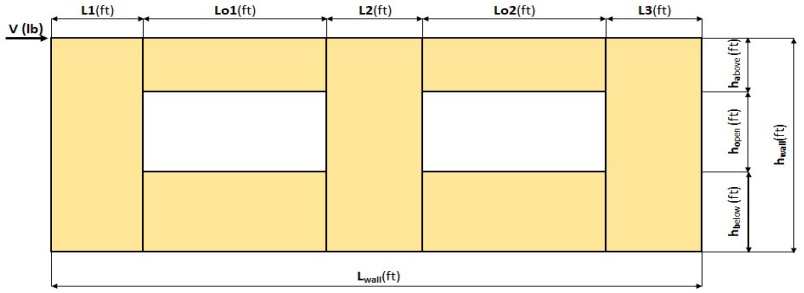
TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	IBC 2021
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid J-M (21'-5" Section) - (Level 3 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2	Adj. Factor Method =	2bs/h
V	2144 lbf	h_a1	1.00 ft	h_a2	1.00 ft	Wall Pier Aspect Ratio	Adj. Factor
L1	3.25 ft	h_o1	5.00 ft	h_o2	5.00 ft	P1=h_o/L1= 1.54	N/A
L2	2.92 ft	h_b1	3.20 ft	h_b2	3.20 ft	P2=h_o/L2= 1.71	N/A
L3	3.25 ft	Lo1	6.00 ft	Lo2	6.00 ft	P3=h_o/L3= 1.54	N/A
h_{wall}	9.20 ft						
L_{wall}	21.42 ft						

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 921 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	219 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	219 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	1316 lbf
Second opening: O2 = va2 x (Lo2) =	1316 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	693 lbf
F2 = O1(L2)/(L1+L2) =	623 lbf
F3 = O2(L2)/(L2+L3) =	623 lbf
F4 = O2(L3)/(L2+L3) =	693 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	3.16 ft
T2 = (L2*Lo1)/(L1+L2) =	2.84 ft
T3 = (L2*Lo2)/(L2+L3) =	2.84 ft
T4 = (L3*Lo2)/(L2+L3) =	3.16 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	197 plf
v2 = (V/L)(T2+L2+T3)/L2 =	295 plf
v3 = (V/L)(T4+L3)/L3 =	197 plf
Check v1*L1+v2*L2+v3*L3=V?	2144 lbf **OK**

7. Resistance to corner forces

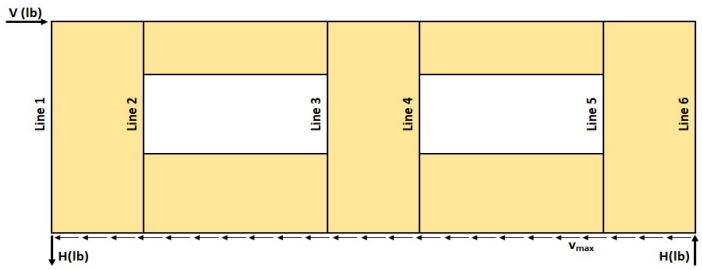
R1 = v1*L1 =	642 lbf
R2 = v2*L2 =	861 lbf
R3 = v3*L3 =	642 lbf

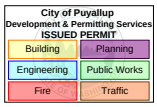
8. Difference corner force + resistance

R1-F1 =	-51 lbf
R2-F2-F3 =	-384 lbf
R3-F4 =	-51 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	-16 plf
vc2 = (R2-F2-F3)/L2 =	-132 plf
vc3 = (R3-F4)/L3 =	-16 plf





Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		-66	987	921 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	921	-66	987	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-553	1474	921	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	921	1474	-553	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	921	-66	987	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		-66	987	921 lbf

Design Summary*

Req. Sheathing Capacity	295 plf	**4-Term Deflection**	0.208 in.	**3-Term Deflection**	0.248 in.
Req. Strap Force	693 lbf	**4-Term Story Drift %**	0.008 %	**3-Term Story Drift %**	0.009 %
Req. HD Force	921 lbf				
Req. Shear Wall Anchorage Force	100 plf				

***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (21'-5" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2144 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 3	
Nail Spacing:	4	4	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	197	197	295	295	197	197	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	4	4	(in.)
V_n:	66	66	98	98	66	66	(plf)
e_n:	0.0014	0.0014	0.0047	0.0047	0.0014	0.0014	(in.)
b:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.018	0.022	0.010	0.233	0.005	0.014	0.006	0.099
		Sum	0.283			Sum	0.125
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.008	0.021	0.021	0.165	0.008	0.021	0.021	0.165
		Sum	0.216			Sum	0.216
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.005	0.014	0.006	0.099	0.018	0.022	0.010	0.233
		Sum	0.125			Sum	0.283

Total Defl.	
0.208	(in.)
0.0075	%drift

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (21'-5" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2144 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB — Species: HF#2 — Nail Type: 8d common (penny weight)

Grade: APA Rated Sheathing — E: 1.30E+06 (psi)

G_t Override: — G_a Override: — C_d: 4.00

	Pier 1	Pier 3	
Nail Spacing:	4	4	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	197	197	295	295	197	197	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	22.0	22.0	22.0	22.0	22.0	22.0	(kips/in.)
b:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.018	0.083	0.233	0.005	0.054	0.099
	Sum	0.334		Sum	0.158
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.008	0.080	0.165	0.008	0.080	0.165
	Sum	0.254		Sum	0.254
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.005	0.054	0.099	0.018	0.083	0.233
	Sum	0.158		Sum	0.334

Total Defl.	
0.248	(in.)
0.0090	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

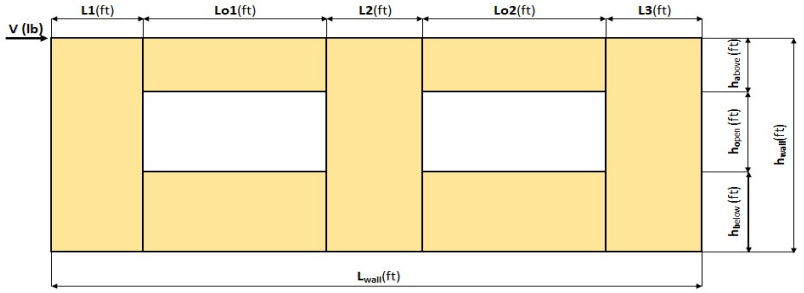
TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	IBC 2021
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid J-M (26'-2" Section) - (Level 1 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	6302 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	2.50 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	9.16 ft	h_b1	3.20 ft	h_b2	3.20 ft
L3	2.50 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.20 ft				
L_{wall}	26.16 ft				

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 2.00	N/A
P2=h_o/L2= 0.55	N/A
P3=h_o/L3= 2.00	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2216 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) = 528 plf

Second opening: va2 = vb2 = H/(h_a2+h_b2) = 528 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 3166 lbf

Second opening: O2 = va2 x (Lo2) = 3166 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 679 lbf

F2 = O1(L2)/(L1+L2) = 2487 lbf

F3 = O2(L2)/(L2+L3) = 2487 lbf

F4 = O2(L3)/(L2+L3) = 679 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.29 ft

T2 = (L2*Lo1)/(L1+L2) = 4.71 ft

T3 = (L2*Lo2)/(L2+L3) = 4.71 ft

T4 = (L3*Lo2)/(L2+L3) = 1.29 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 365 plf

v2 = (V/L)(T2+L2+T3)/L2 = 489 plf

v3 = (V/L)(T4+L3)/L3 = 365 plf

Check v1*L1+v2*L2+v3*L3=V? 6302 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 912 lbf

R2 = v2*L2 = 4478 lbf

R3 = v3*L3 = 912 lbf

8. Difference corner force + resistance

R1-F1 = 233 lbf

R2-F2-F3 = -497 lbf

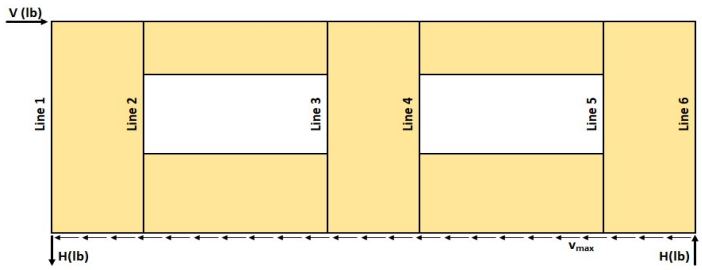
R3-F4 = 233 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 93 plf

vc2 = (R2-F2-F3)/L2 = -54 plf

vc3 = (R3-F4)/L3 = 93 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		392	1824	2216 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	2216	392	1824	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-228	2444	2216	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	2216	2444	-228	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	2216	392	1824	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		392	1824	2216 lbf

Design Summary*

Req. Sheathing Capacity	528 plf	**4-Term Deflection**	0.357 in.	**3-Term Deflection**	0.382 in.
Req. Strap Force	2487 lbf	**4-Term Story Drift %**	0.013 %	**3-Term Story Drift %**	0.014 %
Req. HD Force	2216 lbf				
Req. Shear Wall Anchorage Force	241 plf				

***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (26'-2" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6302 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 3	
Nail Spacing:	2	2	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	365	365	489	489	365	365	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	2	2	(in.)
V_n:	61	61	81	81	61	61	(plf)
e_n:	0.0011	0.0011	0.0027	0.0027	0.0011	0.0011	(in.)
b:	2.50	2.50	9.16	9.16	2.50	2.50	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.042	0.040	0.008	0.561	0.012	0.026	0.005	0.239
		Sum	0.651			Sum	0.282
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.004	0.035	0.012	0.087	0.004	0.035	0.012	0.087
		Sum	0.139			Sum	0.139
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.012	0.026	0.005	0.239	0.042	0.040	0.008	0.561
		Sum	0.282			Sum	0.651

Total Defl.	
0.357	(in.)
0.0129	%drift

Project Information

Code:	IBC 2021
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid J-M (26'-2" Section) - (Level 1 Seismic)

Date: 9/12/2024

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6302 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing
Species: HF#2
E: 1.30E+06 (psi)
Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:
C_d: 4.00

	Pier 1	Pier 3	
Nail Spacing:	2	2	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	365	365	489	489	365	365	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	42.0	42.0	42.0	42.0	42.0	42.0	(kips/in.)
b:	2.50	2.50	9.16	9.16	2.50	2.50	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.042	0.080	0.561	0.012	0.052	0.239
	Sum	0.683		Sum	0.302
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.004	0.070	0.087	0.004	0.070	0.087
	Sum	0.161		Sum	0.161
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.012	0.052	0.239	0.042	0.080	0.561
	Sum	0.302		Sum	0.683

Total Defl.	
0.382	(in.)
0.0139	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

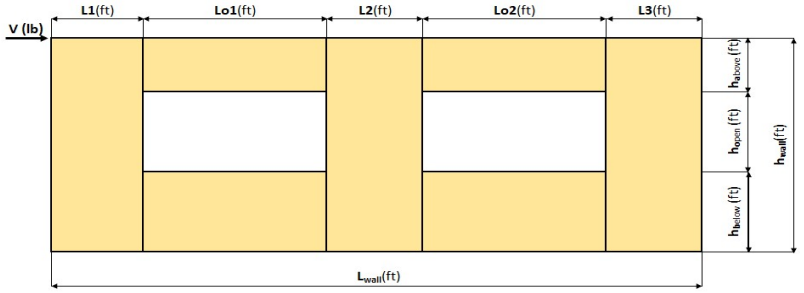
TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	IBC 2021
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid J-M (26'-2" Section) - (Level 2 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2	Adj. Factor Method =	2bs/h
V	4716 lbf					Wall Pier Aspect Ratio	Adj. Factor
L1	2.50 ft	h_a1	1.00 ft	h_a2	1.00 ft		
L2	9.16 ft	h_o1	5.00 ft	h_o2	5.00 ft	P1=h_o/L1= 2.00	N/A
L3	2.50 ft	h_b1	3.20 ft	h_b2	3.20 ft	P2=h_o/L2= 0.55	N/A
h_{wall}	9.20 ft	Lo1	6.00 ft	Lo2	6.00 ft	P3=h_o/L3= 2.00	N/A
L_{wall}	26.16 ft						

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1659 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	395 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	395 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	2369 lbf
Second opening: O2 = va2 x (Lo2) =	2369 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	508 lbf
F2 = O1(L2)/(L1+L2) =	1861 lbf
F3 = O2(L2)/(L2+L3) =	1861 lbf
F4 = O2(L3)/(L2+L3) =	508 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.29 ft
T2 = (L2*Lo1)/(L1+L2) =	4.71 ft
T3 = (L2*Lo2)/(L2+L3) =	4.71 ft
T4 = (L3*Lo2)/(L2+L3) =	1.29 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	273 plf
v2 = (V/L)(T2+L2+T3)/L2 =	366 plf
v3 = (V/L)(T4+L3)/L3 =	273 plf
Check v1*L1+v2*L2+v3*L3=V?	4716 lbf **OK**

7. Resistance to corner forces

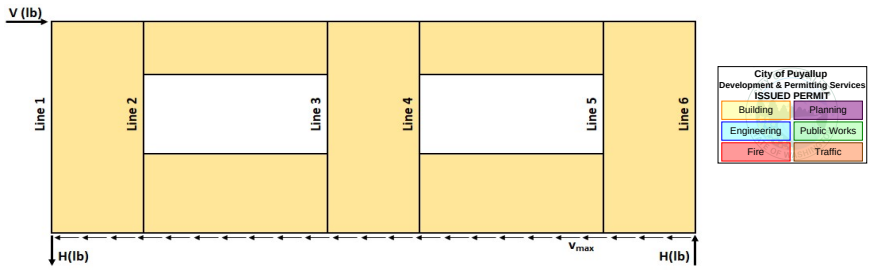
R1 = v1*L1 =	683 lbf
R2 = v2*L2 =	3351 lbf
R3 = v3*L3 =	683 lbf

8. Difference corner force + resistance

R1-F1 =	175 lbf
R2-F2-F3 =	-372 lbf
R3-F4 =	175 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	70 plf
vc2 = (R2-F2-F3)/L2 =	-41 plf
vc3 = (R3-F4)/L3 =	70 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		293	1365	1659 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	1659	293	1365	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-171	1829	1659	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	1659	1829	-171	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	1659	293	1365	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		293	1365	1659 lbf

Design Summary*

Req. Sheathing Capacity	395 plf	**4-Term Deflection**	0.273 in.	**3-Term Deflection**	0.311 in.
Req. Strap Force	1861 lbf	**4-Term Story Drift %**	0.010 %	**3-Term Story Drift %**	0.011 %
Req. HD Force	1659 lbf				
Req. Shear Wall Anchorage Force	180 plf				

***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (26'-2" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4716 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 3	
Nail Spacing:	3	3	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	273	273	366	366	273	273	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	3	3	3	3	3	3	(in.)
V_n:	68	68	91	91	68	68	(plf)
e_n:	0.0016	0.0016	0.0038	0.0038	0.0016	0.0016	(in.)
b:	2.50	2.50	9.16	9.16	2.50	2.50	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.032	0.030	0.011	0.420	0.009	0.020	0.007	0.179
		Sum	0.492			Sum	0.214
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.003	0.026	0.017	0.065	0.003	0.026	0.017	0.065
		Sum	0.112			Sum	0.112
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.009	0.020	0.007	0.179	0.032	0.030	0.011	0.420
		Sum	0.214			Sum	0.492

Total Defl.	
0.273	(in.)
0.0099	%drift

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

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (26'-2" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4716 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB — Species: HF#2 — Nail Type: 8d common (penny weight)

Grade: APA Rated Sheathing — E: 1.30E+06 (psi)

G_t Override: — G_a Override: — C_d: 4.00

	Pier 1	Pier 3	
Nail Spacing:	3	3	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	273	273	366	366	273	273	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	28.0	28.0	28.0	28.0	28.0	28.0	(kips/in.)
b:	2.50	2.50	9.16	9.16	2.50	2.50	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.032	0.090	0.420	0.009	0.059	0.179
	Sum	0.541		Sum	0.246
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.003	0.078	0.065	0.003	0.078	0.065
	Sum	0.147		Sum	0.147
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.009	0.059	0.179	0.032	0.090	0.420
	Sum	0.246		Sum	0.541

Total Defl.	
0.311	(in.)
0.0113	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

Force Transfer Around Openings Calculator

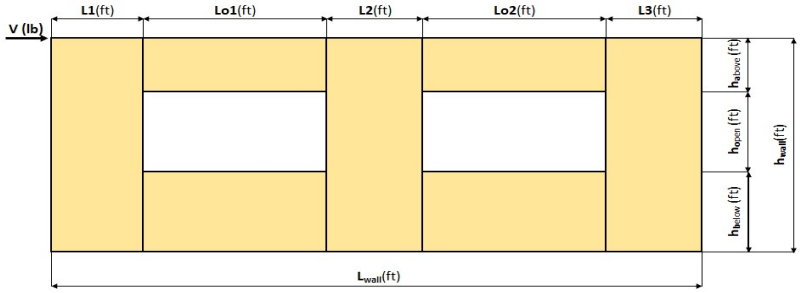
TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	IBC 2021
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building C
Wall Line:	Grid J-M (26'-2" Section) - (Level 3 Seismic)

Date: 9/12/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	2619 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	2.50 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	9.16 ft	h_b1	3.20 ft	h_b2	3.20 ft
L3	2.50 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.20 ft				
L_{wall}	26.16 ft				

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 2.00	N/A
P2=h_o/L2= 0.55	N/A
P3=h_o/L3= 2.00	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 921 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) = 219 plf

Second opening: va2 = vb2 = H/(h_a2+h_b2) = 219 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1316 lbf

Second opening: O2 = va2 x (Lo2) = 1316 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 282 lbf

F2 = O1(L2)/(L1+L2) = 1034 lbf

F3 = O2(L2)/(L2+L3) = 1034 lbf

F4 = O2(L3)/(L2+L3) = 282 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.29 ft

T2 = (L2*Lo1)/(L1+L2) = 4.71 ft

T3 = (L2*Lo2)/(L2+L3) = 4.71 ft

T4 = (L3*Lo2)/(L2+L3) = 1.29 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 152 plf

v2 = (V/L)(T2+L2+T3)/L2 = 203 plf

v3 = (V/L)(T4+L3)/L3 = 152 plf

Check v1*L1+v2*L2+v3*L3=V? 2619 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 379 lbf

R2 = v2*L2 = 1861 lbf

R3 = v3*L3 = 379 lbf

8. Difference corner force + resistance

R1-F1 = 97 lbf

R2-F2-F3 = -207 lbf

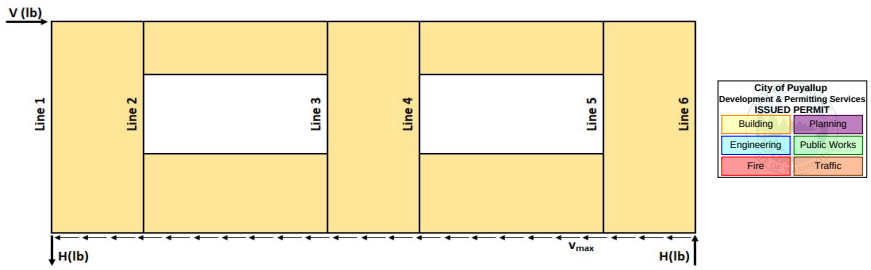
R3-F4 = 97 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 39 plf

vc2 = (R2-F2-F3)/L2 = -23 plf

vc3 = (R3-F4)/L3 = 39 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		163	758	921 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	921	163	758	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-95	1016	921	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	921	1016	-95	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	921	163	758	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		163	758	921 lbf

Design Summary*

Req. Sheathing Capacity	219 plf	**4-Term Deflection**	0.161 in.	**3-Term Deflection**	0.209 in.
Req. Strap Force	1034 lbf	**4-Term Story Drift %**	0.006 %	**3-Term Story Drift %**	0.008 %
Req. HD Force	921 lbf				
Req. Shear Wall Anchorage Force	100 plf				

***The Design Summary assumes that the shear wall is designed as blocked.**

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (26'-2" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2619 (lbf)

Sheathing Type: 7/16 OSB
Grade: APA Rated Sheathing

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.30E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 3	
Nail Spacing:	6	6	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	152	152	203	203	152	152	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_t:	83,500	83,500	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	6	6	6	6	6	6	(in.)
V_n:	76	76	102	102	76	76	(plf)
e_n:	0.0022	0.0022	0.0052	0.0052	0.0022	0.0022	(in.)
b:	2.50	2.50	9.16	9.16	2.50	2.50	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing
Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.018	0.017	0.015	0.233	0.005	0.011	0.010	0.099
		Sum	0.282			Sum	0.125
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.002	0.015	0.023	0.036	0.002	0.015	0.023	0.036
		Sum	0.076			Sum	0.076
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.005	0.011	0.010	0.099	0.018	0.017	0.015	0.233
		Sum	0.125			Sum	0.282

Total Defl.	
0.161	(in.)
0.0058	%drift

Project Information

Code:	IBC 2021	**Date:**	9/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building C		
Wall Line:	Grid J-M (26'-2" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2619 (lbf)

Wood End Post Values:

Sheathing Type: 7/16 OSB — Species: HF#2 — Nail Type: 8d common (penny weight)

Grade: APA Rated Sheathing — E: 1.30E+06 (psi)

G_t Override: — G_a Override: — C_d: 4.00

	Pier 1	Pier 3	
Nail Spacing:	6	6	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	152	152	203	203	152	152	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.20	6.00	6.00	6.00	6.00	9.20	(ft)
Qty:	2	2	2	2	2	2	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:							($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	15.0	15.0	15.0	15.0	15.0	15.0	(kips/in.)
b:	2.50	2.50	9.16	9.16	2.50	2.50	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.018	0.093	0.233	0.005	0.061	0.099
	Sum	0.344		Sum	0.165
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.002	0.081	0.036	0.002	0.081	0.036
	Sum	0.119		Sum	0.119
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.005	0.061	0.099	0.018	0.093	0.233
	Sum	0.165		Sum	0.344

Total Defl.	
0.209	(in.)
0.0076	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.