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

PRMU20240402

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

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

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: 113,012#
SOIL PROPERTIES:
BEARING CAPACITY: 2,000 PSF
LATERAL CAPACITY: 250 PSF/FT

FIELD REVISION FR1

REVISED FLOOR FRAMING FROM TJI TO DIMENSIONAL LUMBER

FR1

City of Puyallup
Building
REVIEWED FOR COMPLIANCE
BSnowden
02/21/2025
10:21:04 AM
CITY OF PUYALLUP STATE OF WASHINGTON

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

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

REVISIONS	
01	CITY REVIEW
FR1	2024.10.30

REVISIONS

ENGINEER:	CP
CHECKED BY:	CP
DATE:	2024.10.14
TITLE:	STRUCTURAL ANALYSIS
PROJECT # :	----

2nd Floor Framing			
Member Name	**Results (Max UTIL %)**	**Current Solution**	**Comments**
Floor Joist 15'-2" and Under	Passed (102% M)	1 piece(s) 2 x 12 DF No.2 @ 12" OC	
Floor Joist 15'-2" - 17'-8"	Passed (60% M)	1 piece(s) 11 7/8" TJI® 360 @ 16" OC	
Floor Joist 15'-7" (with offset 3rd flr.)	Passed (22% M)	2 piece(s) 4 x 12 DF No.2 @ 16" OC	
Floor Joist 19'-4"	Passed (81% M)	2 piece(s) 2 x 12 DF No.2 @ 16" OC	
19'-7" (with offset 3rd flr.)	Passed (88% M)	2 piece(s) 2 x 12 DF No.2 @ 16" OC	
Floor Joist 20'-7" (with offset 3rd flr.)	Passed (75% M)	1 piece(s) 4 x 12 DF No.2 @ 16" OC	
Cantilever Floor Joist (Grid 6-8)	Passed (69% M)	1 piece(s) 2 x 12 DF No.2 @ 16" OC	
Cantilever Floor Joist (Grid 1-2.6)	Passed (84% M)	1 piece(s) 2 x 12 DF No.2 @ 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 (E-G) Flush Beam	Passed (76% R)	4 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL	
Grid 10.8 (E-G) Flush Beam	Passed (99% R)	3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL	
Grid 2.6 (G.9-H.8) Flush Beam	Passed (95% R)	3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL	
Grid 10.8 (G.6-H) Flush Beam	Passed (96% R)	3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL	
Grid 2.4 (H-J) Door Header	Passed (46% R)	1 piece(s) 4 x 8 DF No.2	
Grid 2.4 (J-K) 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) 4 x 12 DF No.2	
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) 4 x 12 DF No.2	
Grid 2.5 (D.4-D.6) Flush Beam	Passed (80% R)	1 piece(s) 4 x 12 DF No.2	
Grid 11 (D.4-D.6) Flush Beam	Passed (90% M)	1 piece(s) 4 x 12 DF No.2	
Grid 3.3 (D.8-E.1) Flush Beam	Passed (89% R)	1 piece(s) 4 x 12 DF No.2	
Grid 5.3 (D.5-E.2) Flush Beam	Passed (75% R)	2 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL	
Grid 6 (D.3-D.6) Flush Beam	Passed (96% R)	1 piece(s) 4 x 12 DF No.2	
Grid D.4 (6-8) Door Headers	Passed (29% R)	1 piece(s) 4 x 8 DF No.2	
Grid D.3 (1-2.6) Cantilever Beam	Passed (69% M)	2 piece(s) 2 x 12 DF No.2	
Grid E (1-2.6) Cantilever Beam	Passed (69% M)	2 piece(s) 2 x 12 DF No.2	

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

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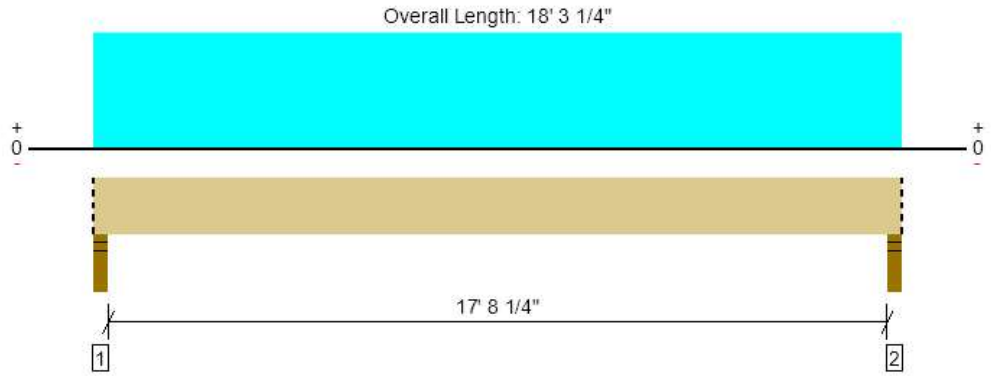
3rd Floor Framing			
Member Name	**Results (Max UTIL %)**	**Current Solution**	**Comments**
Floor Joist 15'-2" and Under	Passed (102% M)	1 piece(s) 2 x 12 DF No.2 @ 12" OC	
Floor Joist 15'-2" - 17'-8"	Passed (60% M)	1 piece(s) 11 7/8" TJI® 360 @ 16" OC	
Floor Joist 19'-4"	Passed (81% M)	2 piece(s) 2 x 12 DF No.2 @ 16" OC	
Floor Joist 19'-7"	Passed (83% M)	2 piece(s) 2 x 12 DF No.2 @ 16" OC	
Floor Joist 20'-3"	Passed (69% M)	1 piece(s) 4 x 12 DF No.2 @ 16" OC	
7'-6" Landing Joists	Passed (100% R)	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
8'-2" 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 (E-G.2) Flush Beam	Passed (88% ΔT)	4 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL	
Grid 10.8 (E-G.1) Flush Beam	Passed (97% ΔT)	3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL	
Grid 2.6 (G.6-H) Flush Beam	Passed (64% R)	1 piece(s) 4 x 12 DF No.2	
Grid 10.8 (G.6-H) Flush Beam	Passed (64% R)	1 piece(s) 4 x 12 DF No.2	
Grid 2.4 (H-J) Door Header	Passed (45% R)	1 piece(s) 4 x 8 DF No.2	
Grid 11.3 (H-J) Door Header	Passed (46% R)	1 piece(s) 4 x 8 DF No.2	
Grid 2.4 (J-L) Door Header	Passed (70% M)	1 piece(s) 4 x 8 DF No.2	
Grid 11.3 (J-L) 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) 4 x 12 DF No.2	
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) 4 x 12 DF No.2	
Grid 2.5 (D.4-D.6) Flush Beam	Passed (52% R)	1 piece(s) 4 x 12 DF No.2	
Grid 3.3 (D.7-D.9) Flush Beam	Passed (46% R)	1 piece(s) 4 x 12 DF No.2	
Grid 10.3 (D.7-D.9) Flush Beam	Passed (46% R)	1 piece(s) 4 x 12 DF No.2	
Grid 5.3 (D.5-E.2) Flush Beam	Passed (96% M)	1 piece(s) 4 x 12 DF No.2	
Grid 6 (D.3-D.6) Flush Beam	Passed (48% R)	1 piece(s) 4 x 12 DF No.2	
Roof Framing			
Member Name	**Results (Max UTIL %)**	**Current Solution**	**Comments**
Grid H 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 (86% M+)	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Grid M 17' Awning Roof Beam	Passed (65% ΔT)	1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam	
6' Window Header	Passed (95% 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)~~ Passed	1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam	An excessive uplift of -2576 lbs at support located at 4" failed this product.

2nd Floor Framing, Floor Joist 15'-2" and Under

1 piece(s) 2 x 12 DF No.2 @ 12" 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)	639 @ 2 1/2"	2126 (3.50")	Passed (30%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	553 @ 1' 2 3/4"	2025	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2789 @ 9' 1 5/8"	2729	Passed (102%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.321 @ 9' 1 5/8"	0.595	Passed (L/667)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.562 @ 9' 1 5/8"	0.893	Passed (L/381)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 18' 3 1/4"
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 - Stud wall - HF	3.50"	3.50"	1.50"	274	365	639	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	274	365	639	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" o/c	
Bottom Edge (Lu)	18' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 18' 3 1/4"	12"	30.0	40.0	Default Load

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

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

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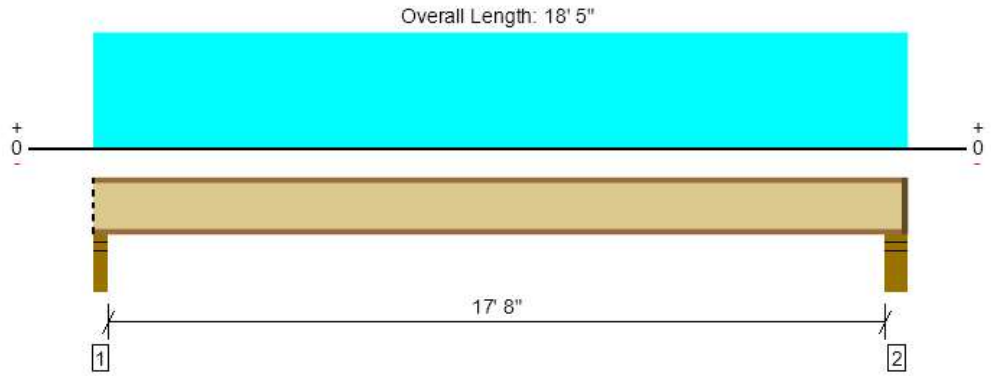
2nd Floor Framing, Floor Joist 15'-2" - 17'-8"

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)	856 @ 18' 1/2"	1505 (3.50")	Passed (57%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	824 @ 3 1/2"	1705	Passed (48%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3710 @ 9' 1 1/2"	6180	Passed (60%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.282 @ 9' 1 1/2"	0.594	Passed (L/758)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.494 @ 9' 1 1/2"	0.892	Passed (L/433)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	49	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)	4' 10" o/c	
Bottom Edge (Lu)	18' 4" o/c	

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

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

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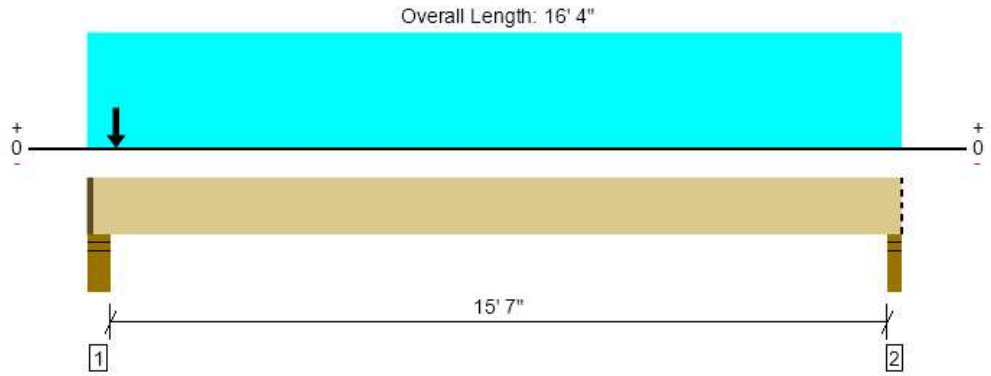
Weyerhaeuser

2nd Floor Framing, Floor Joist 15'-7" (with offset 3rd flr.)

2 piece(s) 4 x 12 DF No.2 @ 16" OC



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Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2006 @ 4 1/2"	11340 (4.00")	Passed (18%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	806 @ 1' 4 3/4"	9450	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3027 @ 8' 7/8"	14009	Passed (22%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.059 @ 8' 2 3/8"	0.525	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.103 @ 8' 2 3/8"	0.788	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 16' 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).
- 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 - Stud wall - HF	5.50"	4.00"	1.50"	865	1152	2017	1 1/2" Rim Board
2 - Stud wall - HF	3.50"	3.50"	1.50"	331	441	771	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)	Continuous	
Bottom Edge (Lu)	Continuous	

Vertical Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 16' 4"	16"	30.0	40.0	2nd floor load
2 - Point (lb)	7"	N/A	542	722	

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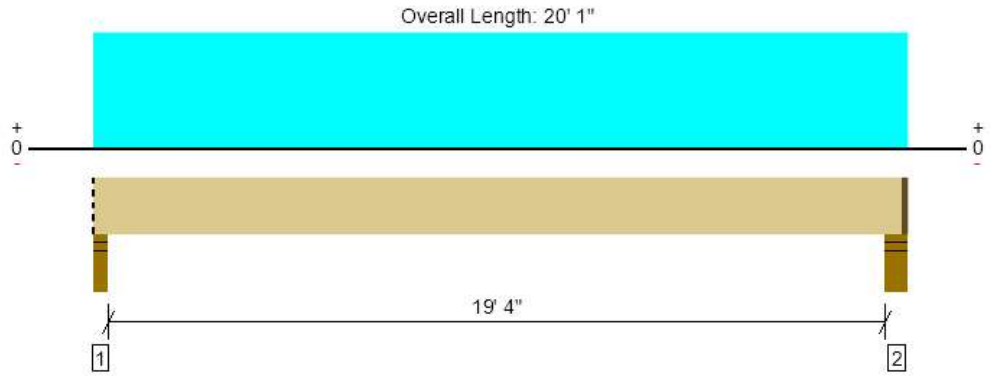
Weyerhaeuser

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

2 piece(s) 2 x 12 DF 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)	929 @ 2 1/2"	4253 (3.50")	Passed (22%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	815 @ 1' 2 3/4"	4050	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4436 @ 9' 11 1/2"	5458	Passed (81%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.305 @ 9' 11 1/2"	0.650	Passed (L/768)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.533 @ 9' 11 1/2"	0.975	Passed (L/439)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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 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 - Stud wall - HF	3.50"	3.50"	1.50"	398	531	929	Blocking
2 - Stud wall - HF	5.50"	4.00"	1.50"	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)	9' 4" o/c	
Bottom Edge (Lu)	20' o/c	

•Maximum allowable bracing intervals based on applied load.

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

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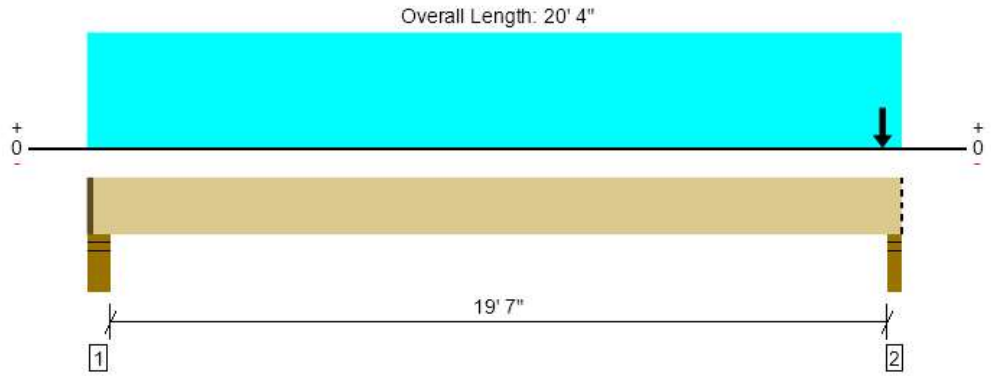
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

2nd Floor Framing, 19'-7" (with offset 3rd flr.)

2 piece(s) 2 x 12 DF 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)	2778 @ 20' 1 1/2"	4253 (3.50")	Passed (65%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1194 @ 19' 1 1/4"	4050	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4806 @ 10' 6 5/16"	5458	Passed (88%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.342 @ 10' 4"	0.658	Passed (L/693)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.598 @ 10' 4"	0.988	Passed (L/396)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 20' 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).
- 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 - Stud wall - HF	5.50"	4.00"	1.50"	421	561	982	1 1/2" Rim Board
2 - Stud wall - HF	3.50"	3.50"	2.29"	1190	1587	2778	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)	Continuous	
Bottom Edge (Lu)	Continuous	

Vertical Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 20' 4"	16"	30.0	40.0	2nd floor load
2 - Point (lb)	19' 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
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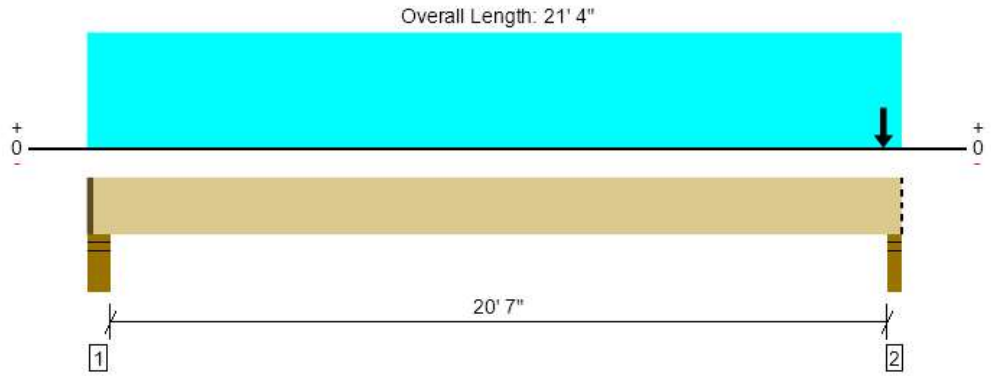
Weyerhaeuser

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

1 piece(s) 4 x 12 DF 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)	2825 @ 21' 1 1/2"	4961 (3.50")	Passed (57%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1241 @ 20' 1 1/4"	4725	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5279 @ 11' 1/8"	7004	Passed (75%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.355 @ 10' 9 15/16"	0.692	Passed (L/701)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.621 @ 10' 9 15/16"	1.038	Passed (L/401)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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).
- 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 - Stud wall - HF	5.50"	4.00"	1.50"	440	587	1028	1 1/2" Rim Board
2 - Stud wall - HF	3.50"	3.50"	1.99"	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)	Continuous	
Bottom Edge (Lu)	Continuous	

Vertical Loads	Location (Side)	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
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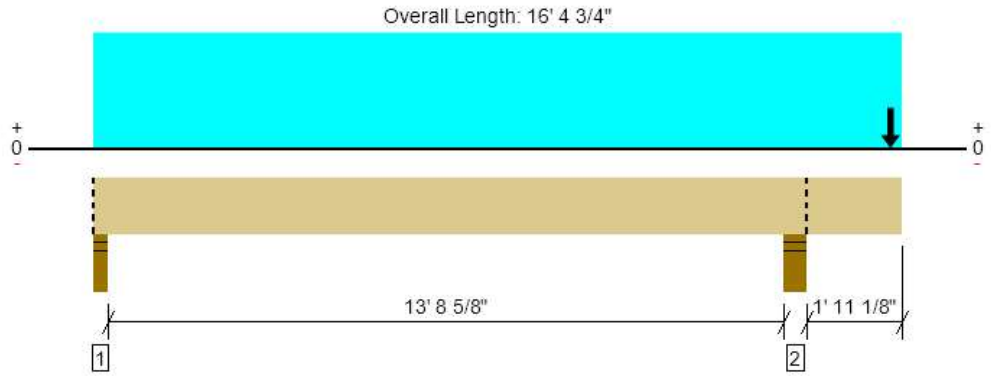
Weyerhaeuser

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

1 piece(s) 2 x 12 DF 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)	1409 @ 14' 2 7/8"	3341 (5.50")	Passed (42%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	626 @ 13' 7/8"	2025	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1888 @ 6' 6 13/16"	2729	Passed (69%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.163 @ 7' 2 11/16"	0.468	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.222 @ 6' 11 1/2"	0.702	Passed (L/758)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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 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	Snow	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.50"	228	385/-19	-11	613	Blocking
2 - Stud wall - HF	5.50"	5.50"	2.32"	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)	7' 3" o/c	
Bottom Edge (Lu)	13' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	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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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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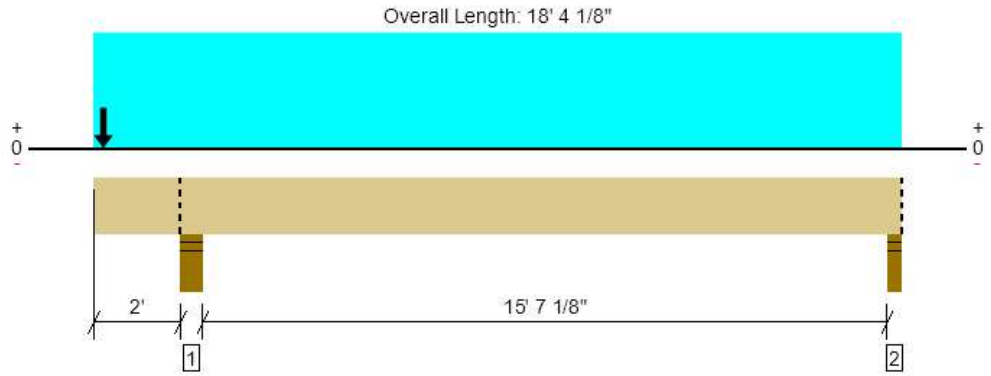
Weyerhaeuser

2nd Floor Framing, Cantilever Floor Joist (Grid 1-2.6)

1 piece(s) 2 x 12 DF 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)	2122 @ 2' 2 3/4"	3341 (5.50")	Passed (64%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1127 @ 1' 3/4"	2025	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2304 @ 11' 1 5/16"	2729	Passed (84%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.270 @ 10' 2 3/16"	0.530	Passed (L/708)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.341 @ 10' 6 7/8"	0.795	Passed (L/559)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 18' 4 1/8"
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 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	Snow	Factored	
1 - Stud wall - HF	5.50"	5.50"	3.49"	1132	990	65	2122	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	240	435/-57	-7	675	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' 1" o/c	
Bottom Edge (Lu)	5' 2" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 18' 4 1/8"	16"	30.0	40.0	-	Level 2 Floor
2 - Point (lb)	2 3/4"	N/A	58	-	58	Roof Loads
3 - Point (lb)	2 3/4"	N/A	287	-	-	Walls
4 - Point (lb)	2 3/4"	N/A	293	390	-	Level 3 Floor

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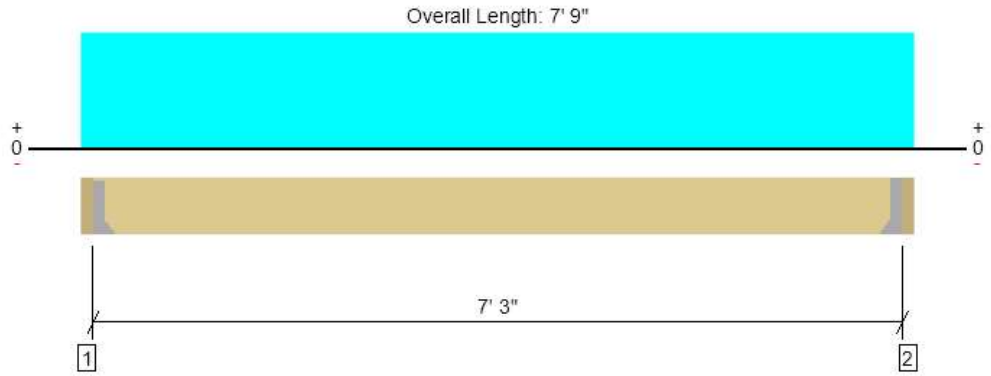
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

2nd Floor Framing, 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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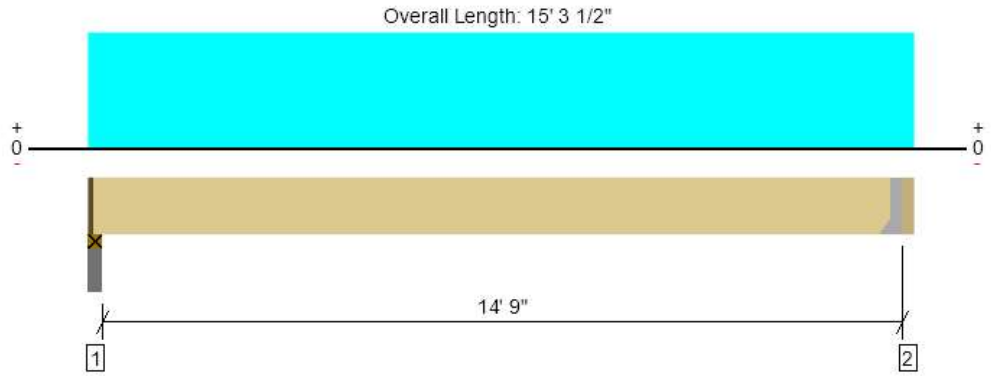
Weyerhaeuser

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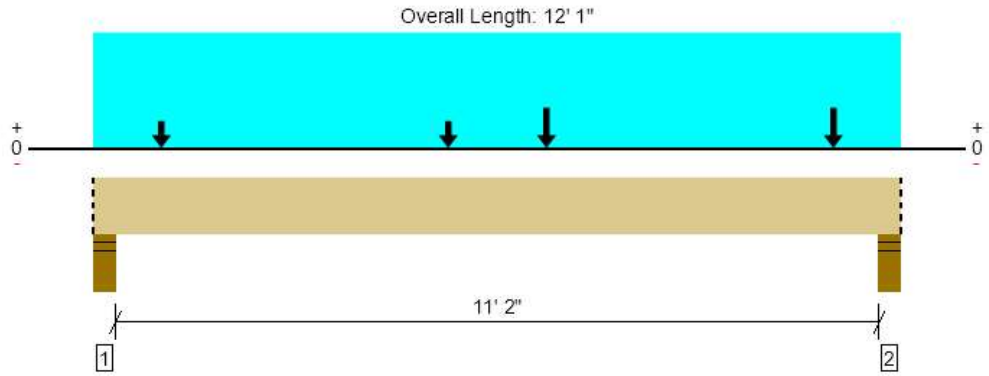
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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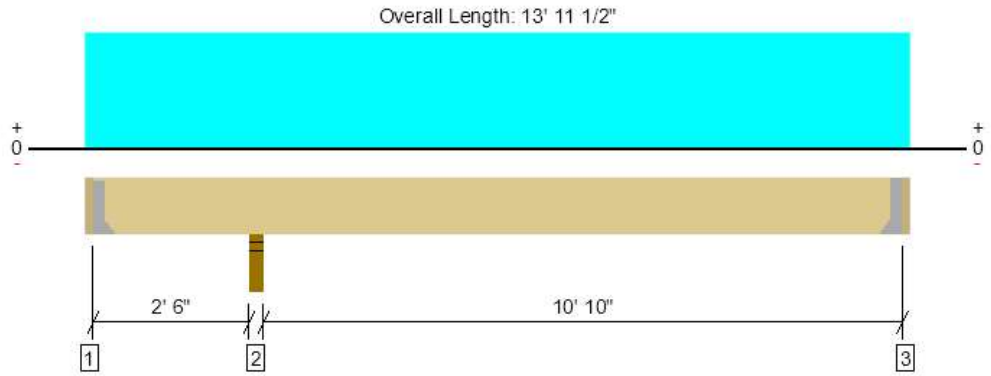
2nd Floor Framing, 10'-10" Deck Joist

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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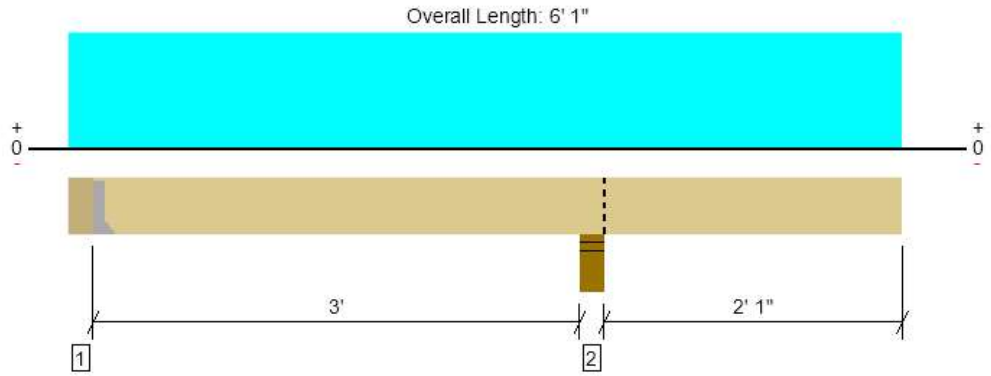
2nd Floor Framing, Deck Cantilever Ledger 2'

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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ForteWEB Software Operator	Job Notes
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2nd Floor Framing, Grid 2.6 (E-G) Flush Beam

4 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL

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)	11832 @ 12' 8 5/8"	15593 (5.50")	Passed (76%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4745 @ 1' 4 3/4"	14963	Passed (32%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	16355 @ 6' 2 3/8"	32274	Passed (51%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.165 @ 6' 5 7/16"	0.310	Passed (L/898)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.297 @ 6' 5 7/16"	0.619	Passed (L/500)	--	1.0 D + 1.0 L (All Spans)

Member Length : 13' 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.
- Member should be side-loaded from both sides of the member or braced to prevent rotation.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	2.20"	2760	3480	6239	Blocking
2 - Stud wall - HF	5.50"	5.50"	4.17"	5259	6573	11832	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	13' 1" o/c	
Bottom Edge (Lu)	13' 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 13' 5/8"	N/A	23.0	--	
1 - Uniform (PSF)	0 to 4' 10 5/8" (Front)	14' 11 1/2"	30.0	40.0	Default Load
2 - Uniform (PSF)	4' 10 5/8" to 13' 5/8" (Front)	10' 8"	30.0	40.0	Default Load
3 - Point (lb)	12' 9 3/4" (Top)	N/A	2913	3645	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 10.8 (E-G) Flush Beam

3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL

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)	11546 @ 11' 8 5/8"	11694 (5.50")	Passed (99%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4295 @ 1' 4 3/4"	11222	Passed (38%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	13951 @ 5' 9 11/16"	24206	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.163 @ 5' 11 3/4"	0.285	Passed (L/840)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.290 @ 5' 11 3/4"	0.569	Passed (L/471)	--	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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	2.74"	2558	3272	5830	Blocking
2 - Stud wall - HF	5.50"	5.50"	5.43"	5110	6436	11546	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	17.2	--	
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	2913	3645	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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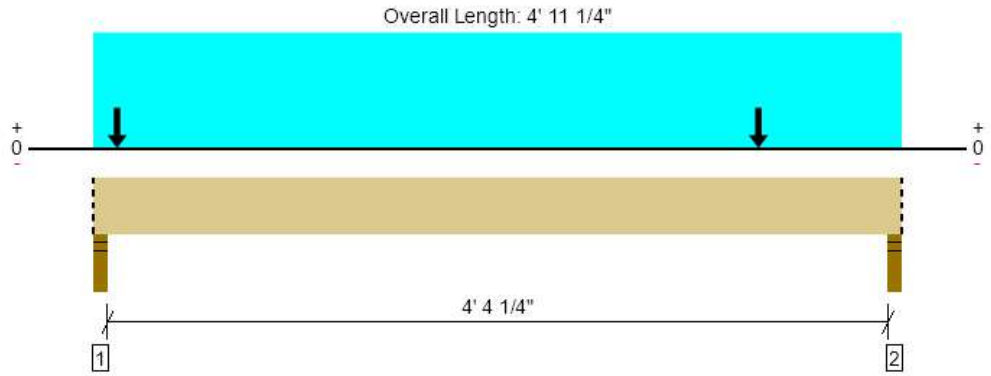
2nd Floor Framing, Grid 2.6 (G.9-H.8) Flush Beam

3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL



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Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7058 @ 2"	7442 (3.50")	Passed (95%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3377 @ 3' 8 1/2"	11222	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4862 @ 2' 9 7/8"	24206	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.014 @ 2' 6 3/8"	0.115	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.025 @ 2' 6 3/8"	0.230	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

Member Length : 4' 11 1/4"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.32"	3064	3994	7058	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.86"	2643	3441	6084	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	17.2	--	
1 - Uniform (PSF)	0 to 4' 11 1/4" (Front)	19' 5 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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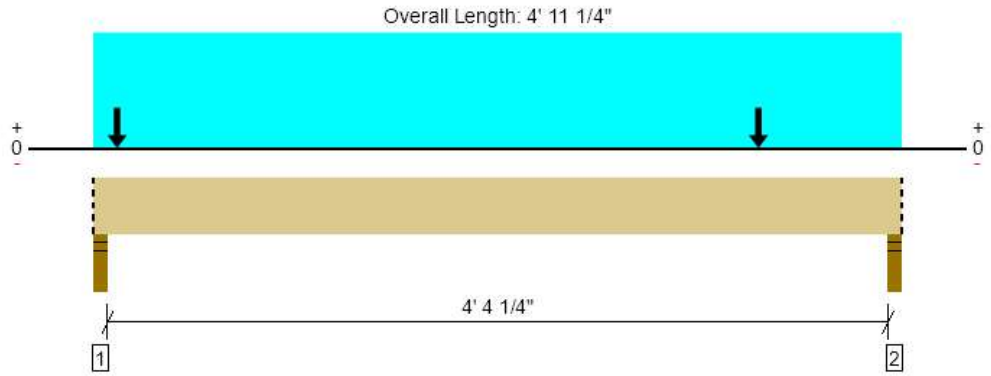
Weyerhaeuser

2nd Floor Framing, Grid 10.8 (G.6-H) Flush Beam

3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL



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)	7145 @ 2"	7442 (3.50")	Passed (96%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3420 @ 3' 8 1/2"	11222	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4953 @ 2' 9 3/4"	24206	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.014 @ 2' 6 5/16"	0.115	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.025 @ 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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.36"	3101	4043	7145	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.90"	2680	3491	6171	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	17.2	--	
1 - Uniform (PSF)	0 to 4' 11 1/4" (Front)	19' 11 1/2"	30.0	40.0	Default Load
2 - Point (lb)	1 3/4" (Top)	N/A	1370	1796	Linked from: Grid 10.8 (G.6-H) Flush Beam, Support 1
3 - Point (lb)	4' 3/4" (Top)	N/A	1370	1796	Linked from: Grid 10.8 (G.6-H) Flush Beam, Support 2

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

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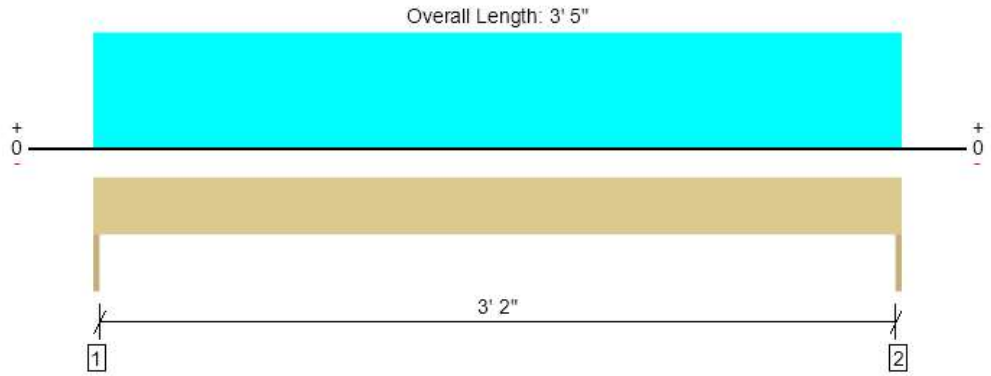
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

2nd Floor Framing, Grid 2.4 (H-J) 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)	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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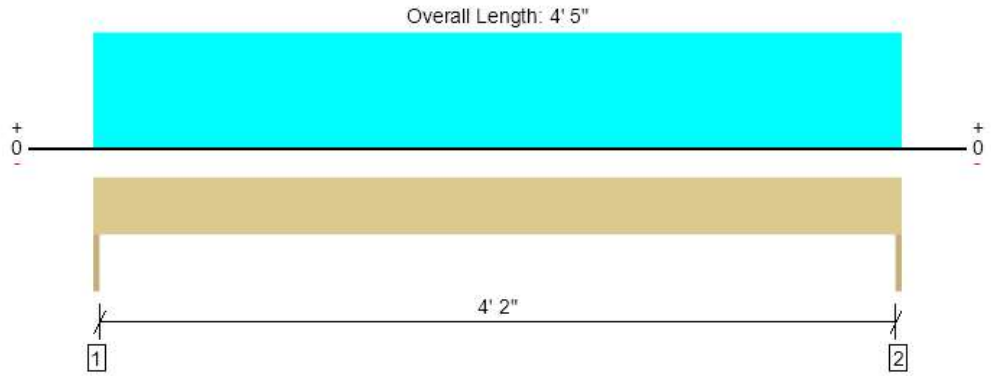
Weyerhaeuser

2nd Floor Framing, Grid 2.4 (J-K) 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)	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

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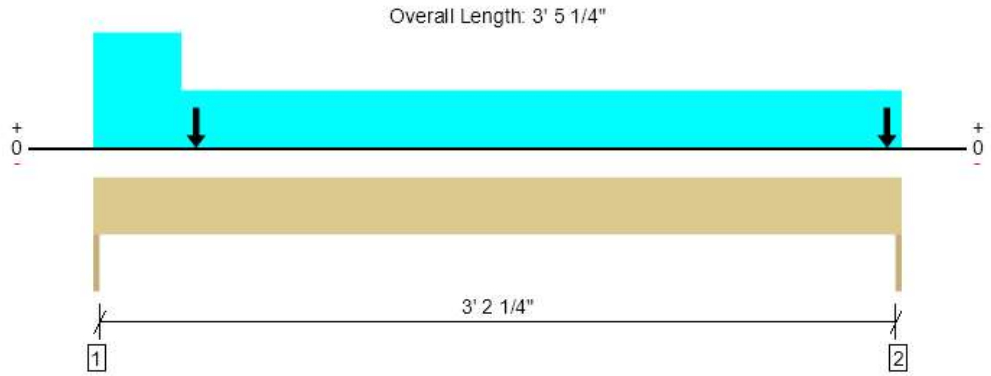
Weyerhaeuser

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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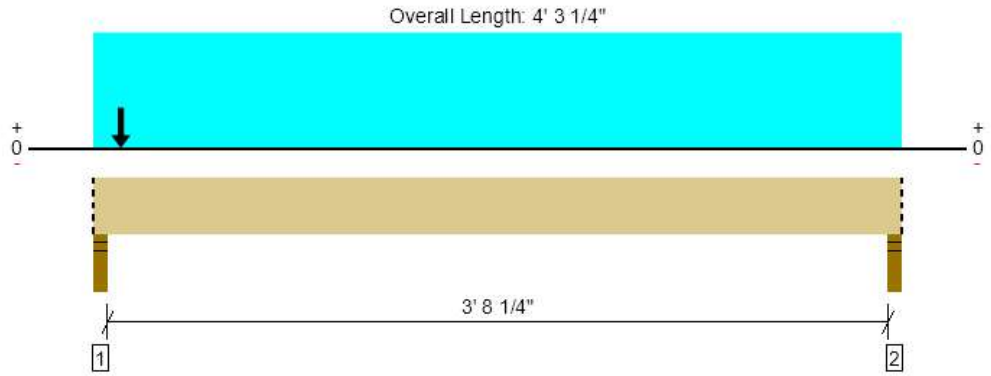
Weyerhaeuser

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

1 piece(s) 4 x 12 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)	3129 @ 2"	4961 (3.50")	Passed (63%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	659 @ 1' 2 3/4"	4725	Passed (14%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1410 @ 2' 1 5/8"	6091	Passed (23%)	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)	0.006 @ 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.
- 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	3129	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	678	876	1553	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	10.0	--	
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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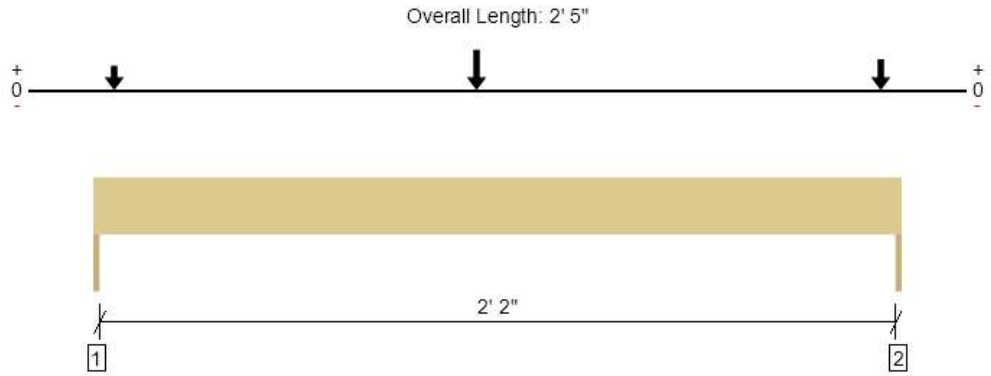
Weyerhaeuser

2nd Floor Framing, Grid G.1 (5.2-5.3) 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)	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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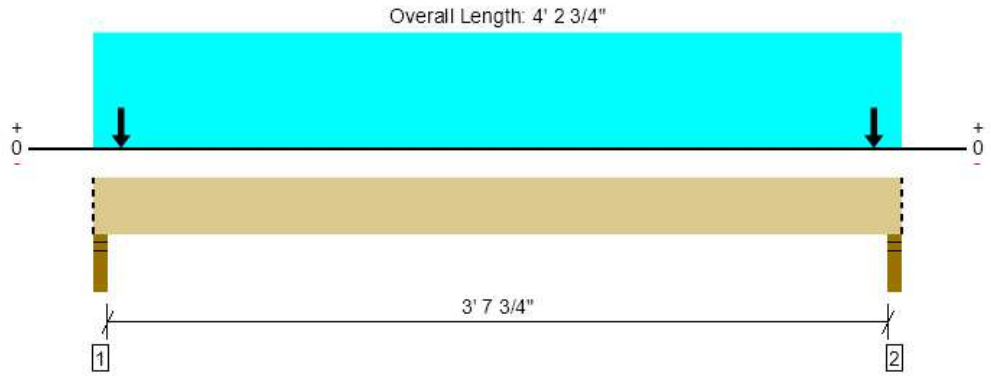
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

1 piece(s) 4 x 12 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)	3464 @ 2"	4961 (3.50")	Passed (70%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	716 @ 1' 2 3/4"	4725	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1535 @ 2' 1 3/8"	6091	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.004 @ 2' 1 3/8"	0.097	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.006 @ 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.
- 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"	1509	1955	3464	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.44"	1509	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	10.0	--	
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.

Weyerhaeuser Notes

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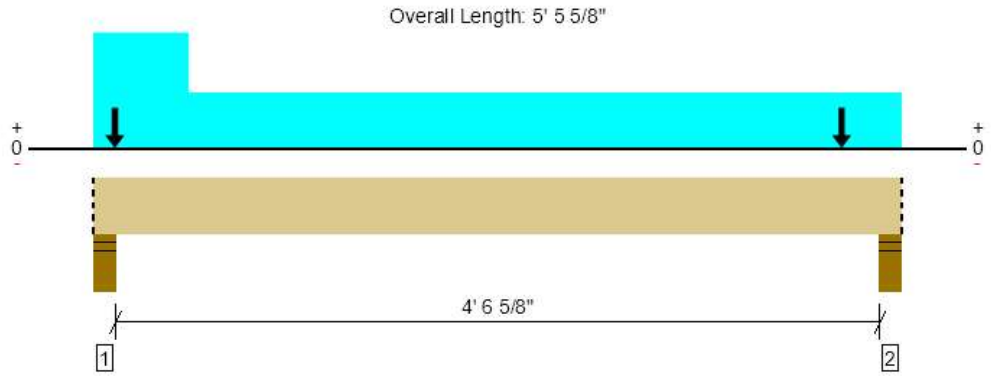
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

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

1 piece(s) 4 x 12 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)	6207 @ 4"	7796 (5.50")	Passed (80%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1434 @ 4' 7/8"	4725	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3091 @ 2' 8 11/16"	6091	Passed (51%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.011 @ 2' 8 7/8"	0.120	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.019 @ 2' 8 7/8"	0.240	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 5' 5 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.
- 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"	4.38"	2688	3518	6207	Blocking
2 - Stud wall - HF	5.50"	5.50"	3.88"	2385	3114	5499	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' 6" o/c	
Bottom Edge (Lu)	5' 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 5' 5 5/8"	N/A	10.0	--	
1 - Uniform (PSF)	0 to 5' 5 5/8" (Front)	15' 1/2"	30.0	40.0	2nd Floor
2 - Uniform (PSF)	0 to 7 3/4" (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)	5' 3/4" (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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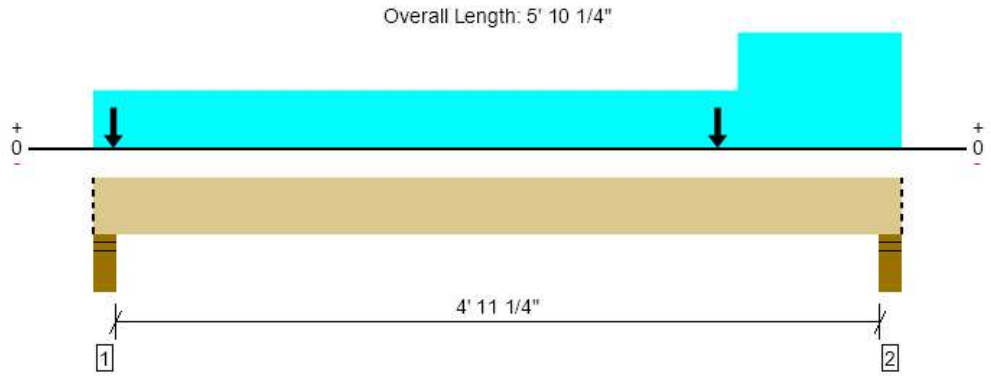
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

2nd Floor Framing, Grid 11 (D.4-D.6) Flush Beam

1 piece(s) 4 x 12 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)	6689 @ 5' 6 1/4"	7796 (5.50")	Passed (86%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3613 @ 4' 5 1/2"	4725	Passed (76%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5483 @ 3' 5 3/16"	6091	Passed (90%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.023 @ 3' 1/4"	0.130	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.041 @ 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.
- 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	6689	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	10.0	--	
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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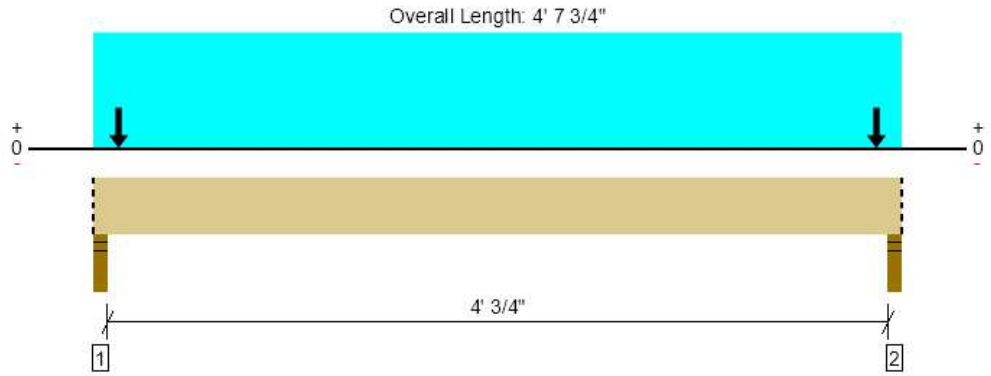
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

1 piece(s) 4 x 12 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)	4423 @ 2"	4961 (3.50")	Passed (89%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1013 @ 1' 2 3/4"	4725	Passed (21%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2152 @ 2' 3 7/8"	6091	Passed (35%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.006 @ 2' 3 7/8"	0.108	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 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.
- 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"	3.12"	1922	2501	4423	Blocking
2 - Stud wall - HF	3.50"	3.50"	3.12"	1922	2501	4423	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	10.0	--	
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	987	1285	Linked from: Grid 3.3 (D.8-E.1) Flush Beam, Support 1
3 - Point (lb)	4' 6" (Top)	N/A	987	1285	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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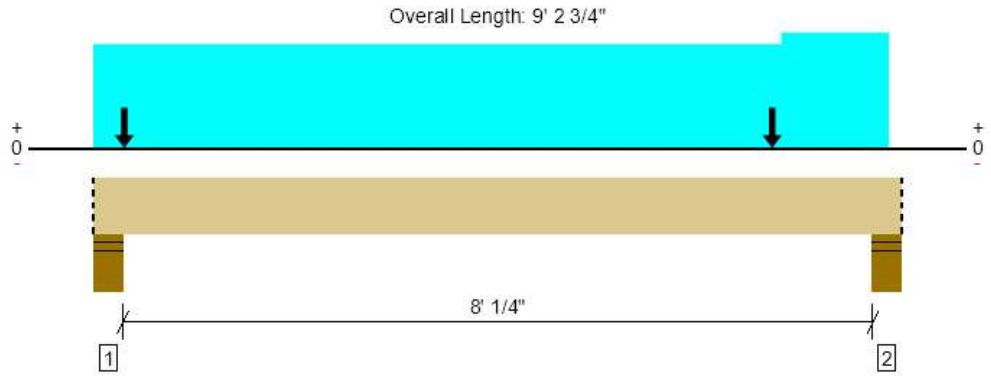
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

2 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL



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Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7659 @ 5 3/4"	10277 (7.25")	Passed (75%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	5338 @ 7' 8 1/4"	7481	Passed (71%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	9058 @ 5' 1 1/8"	16137	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.092 @ 4' 8 3/4"	0.207	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.164 @ 4' 8 3/4"	0.414	Passed (L/606)	--	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.

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"	3337	4322	7659	Blocking
2 - Stud wall - HF	7.25"	7.25"	4.82"	2980	3858	6838	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	11.5	--	
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	1446	1877	Linked from: Grid 5.3 (D.5-E.2) Flush Beam, Support 1
4 - Point (lb)	7' 9" (Top)	N/A	1446	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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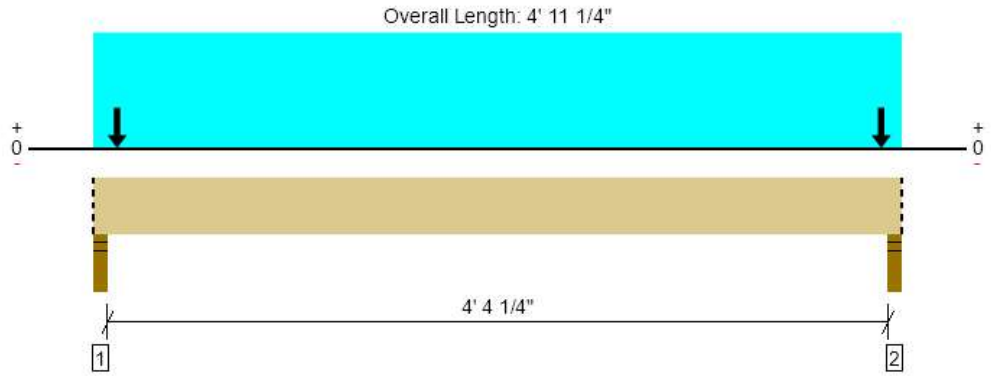
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

1 piece(s) 4 x 12 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)	4744 @ 2"	4961 (3.50")	Passed (96%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1191 @ 1' 2 3/4"	4725	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2546 @ 2' 5 5/8"	6091	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.008 @ 2' 5 5/8"	0.115	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.015 @ 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.
- 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	10.0	--	
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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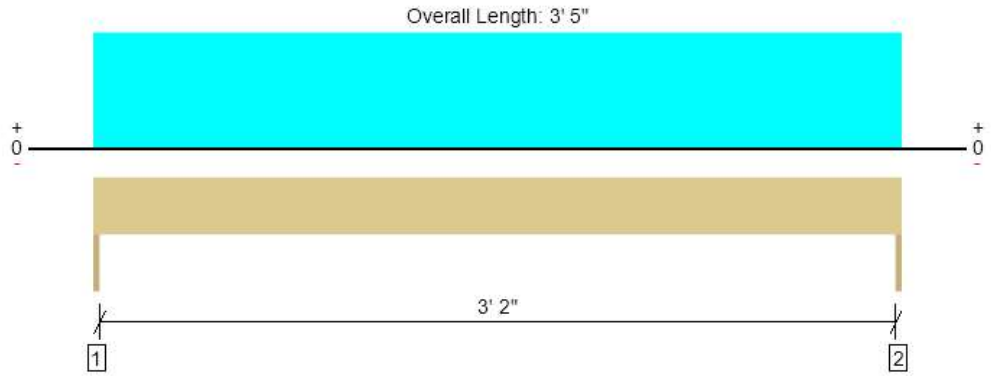
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

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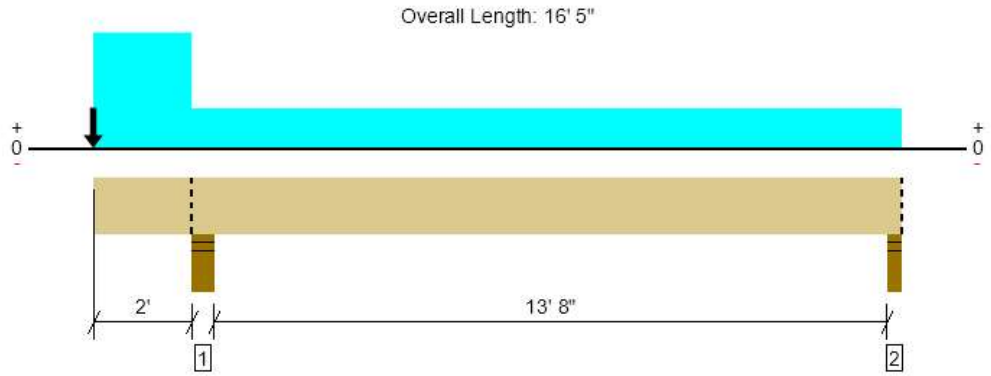
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

2nd Floor Framing, Grid D.3 (1-2.6) Cantilever Beam

2 piece(s) 2 x 12 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)	2625 @ 2' 2 3/4"	6683 (5.50")	Passed (39%)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	937 @ 3' 4 3/4"	4050	Passed (23%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3278 @ 9' 7 1/4"	4746	Passed (69%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.122 @ 9' 2 7/8"	0.351	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.198 @ 9' 4 1/2"	0.701	Passed (L/848)	--	1.0 D + 1.0 L (Alt Spans)

Member Length : 16' 5"
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).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- -427 lbs uplift at support located at 2' 2 3/4". Strapping or other restraint may be required.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Seismic	Factored	
1 - Stud wall - HF	5.50"	5.50"	2.16"	1171	753	54	1614/-1614	2625/-427	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	437	574/-14	-4	221/-221	1012	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' 5" o/c	
Bottom Edge (Lu)	16' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	0 to 16' 5"	N/A	8.6	--	--	--	
1 - Uniform (PSF)	0 to 16' 5" (Front)	1' 4"	30.0	40.0	-	-	Level 2
2 - Uniform (PSF)	0 to 16' 5" (Top)	8"	30.0	40.0	-	-	Level 3
3 - Uniform (PLF)	0 to 2' (Top)	N/A	216.0	-	-	-	Wall
4 - Uniform (PSF)	0 to 2' (Top)	1'	25.8	-	25.0	-	Roof
5 - Point (lb)	0 (Front)	N/A	-	-	-	1393	Seismic Strap

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

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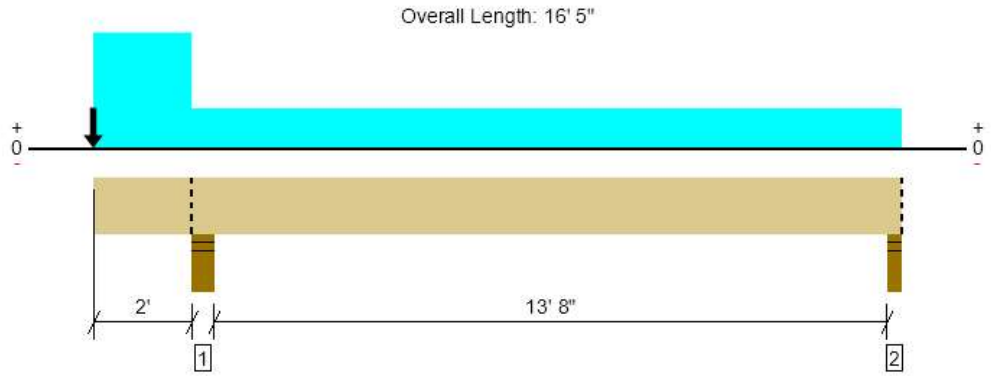
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

2nd Floor Framing, Grid E (1-2.6) Cantilever Beam

2 piece(s) 2 x 12 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)	2625 @ 2' 2 3/4"	6683 (5.50")	Passed (39%)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	937 @ 3' 4 3/4"	4050	Passed (23%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3278 @ 9' 7 1/4"	4746	Passed (69%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.122 @ 9' 2 7/8"	0.351	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.198 @ 9' 4 1/2"	0.701	Passed (L/848)	--	1.0 D + 1.0 L (Alt Spans)

Member Length : 16' 5"
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).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- -427 lbs uplift at support located at 2' 2 3/4". Strapping or other restraint may be required.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Seismic	Factored	
1 - Stud wall - HF	5.50"	5.50"	2.16"	1171	753	54	1614/-1614	2625/-427	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	437	574/-14	-4	221/-221	1012	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' 5" o/c	
Bottom Edge (Lu)	16' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	0 to 16' 5"	N/A	8.6	--	--	--	
1 - Uniform (PSF)	0 to 16' 5" (Front)	1' 4"	30.0	40.0	-	-	Level 2
2 - Uniform (PSF)	0 to 16' 5" (Top)	8"	30.0	40.0	-	-	Level 3
3 - Uniform (PLF)	0 to 2' (Top)	N/A	216.0	-	-	-	Wall
4 - Uniform (PSF)	0 to 2' (Top)	1'	25.8	-	25.0	-	Roof
5 - Point (lb)	0 (Front)	N/A	-	-	-	1393	Seismic Strap

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

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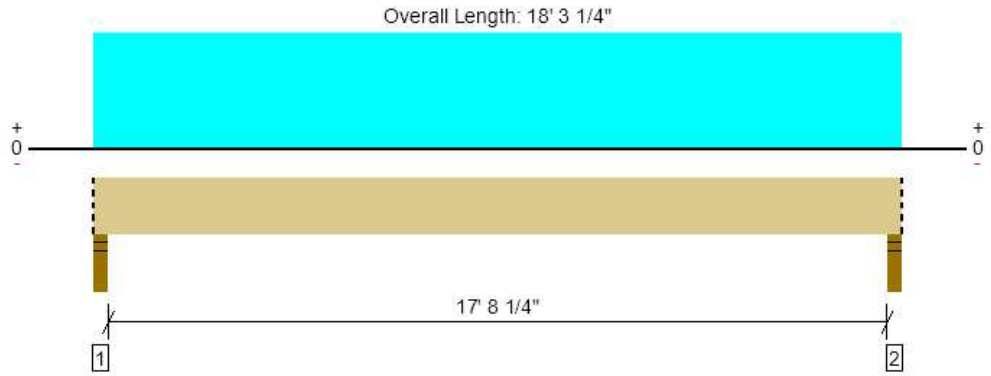
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

3rd Floor Framing, Floor Joist 15'-2" and Under

1 piece(s) 2 x 12 DF No.2 @ 12" 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)	639 @ 2 1/2"	2126 (3.50")	Passed (30%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	553 @ 1' 2 3/4"	2025	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2789 @ 9' 1 5/8"	2729	Passed (102%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.321 @ 9' 1 5/8"	0.595	Passed (L/667)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.562 @ 9' 1 5/8"	0.893	Passed (L/381)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 18' 3 1/4"
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 - Stud wall - HF	3.50"	3.50"	1.50"	274	365	639	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	274	365	639	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" o/c	
Bottom Edge (Lu)	18' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 18' 3 1/4"	12"	30.0	40.0	Default Load

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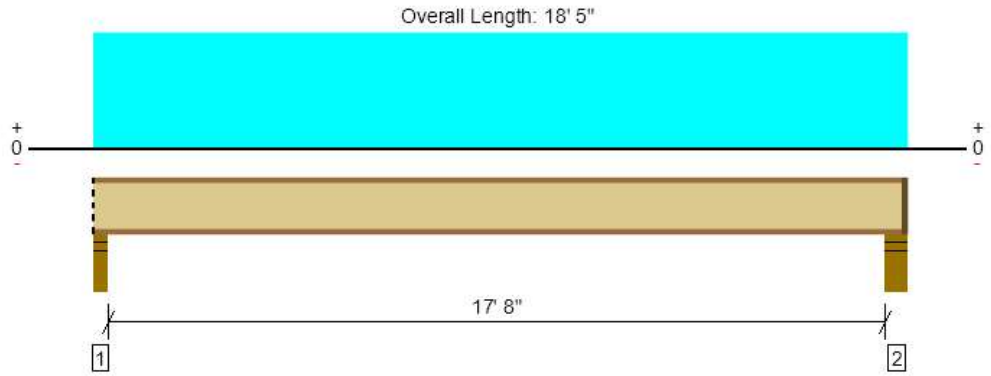
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

3rd Floor Framing, Floor Joist 15'-2" - 17'-8"

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)	856 @ 18' 1/2"	1505 (3.50")	Passed (57%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	824 @ 3 1/2"	1705	Passed (48%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3710 @ 9' 1 1/2"	6180	Passed (60%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.282 @ 9' 1 1/2"	0.594	Passed (L/758)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.494 @ 9' 1 1/2"	0.892	Passed (L/433)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	49	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)	4' 10" 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

ForteWEB Software Operator	Job Notes
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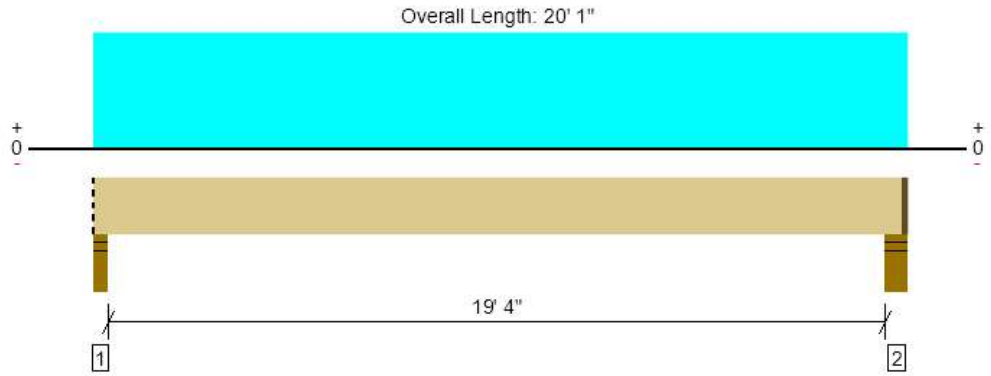
Weyerhaeuser

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

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



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Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	929 @ 2 1/2"	4253 (3.50")	Passed (22%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	815 @ 1' 2 3/4"	4050	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4436 @ 9' 11 1/2"	5458	Passed (81%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.305 @ 9' 11 1/2"	0.650	Passed (L/768)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.533 @ 9' 11 1/2"	0.975	Passed (L/439)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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 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 - Stud wall - HF	3.50"	3.50"	1.50"	398	531	929	Blocking
2 - Stud wall - HF	5.50"	4.00"	1.50"	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)	9' 4" o/c	
Bottom Edge (Lu)	20' o/c	

•Maximum allowable bracing intervals based on applied load.

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

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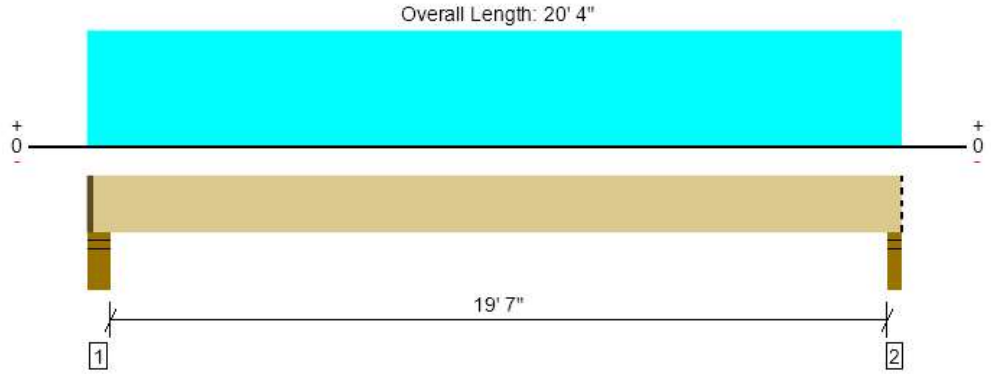
Weyerhaeuser

3rd Floor Framing, Floor Joist 19'-7"

2 piece(s) 2 x 12 DF 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)	941 @ 20' 1 1/2"	4253 (3.50")	Passed (22%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	826 @ 1' 4 3/4"	4050	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4551 @ 10' 3"	5458	Passed (83%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.321 @ 10' 3"	0.658	Passed (L/739)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.561 @ 10' 3"	0.988	Passed (L/422)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 20' 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 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 - Stud wall - HF	5.50"	4.00"	1.50"	410	547	957	1 1/2" Rim Board
2 - Stud wall - HF	3.50"	3.50"	1.50"	403	538	941	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)	8' 9" o/c	
Bottom Edge (Lu)	20' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 20' 4"	16"	30.0	40.0	Default Load

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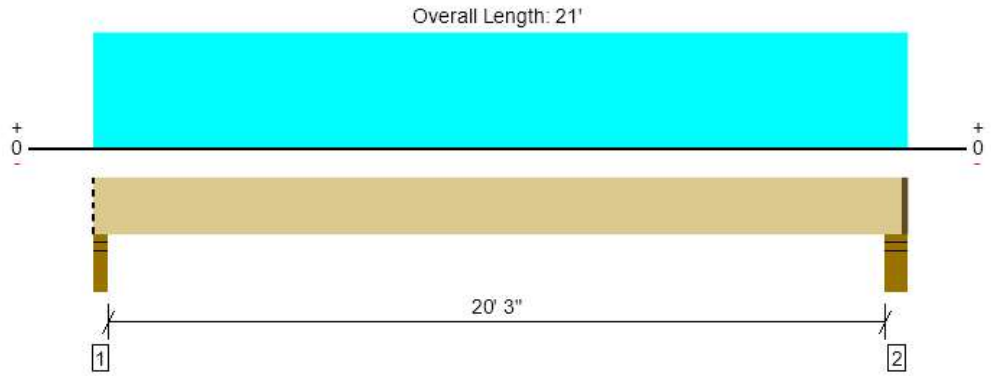
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

1 piece(s) 4 x 12 DF 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)	972 @ 2 1/2"	4961 (3.50")	Passed (20%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	858 @ 1' 2 3/4"	4725	Passed (18%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4863 @ 10' 5"	7004	Passed (69%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.314 @ 10' 5"	0.681	Passed (L/781)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.549 @ 10' 5"	1.021	Passed (L/446)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 20' 10 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.
- 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 - Stud wall - HF	3.50"	3.50"	1.50"	417	556	972	Blocking
2 - Stud wall - HF	5.50"	4.00"	1.50"	423	564	988	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)	20' 11" o/c	
Bottom Edge (Lu)	20' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

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

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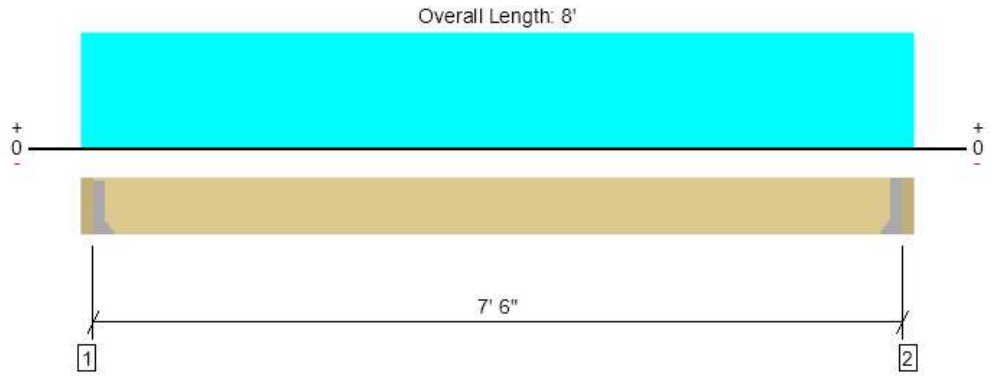
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

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

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



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

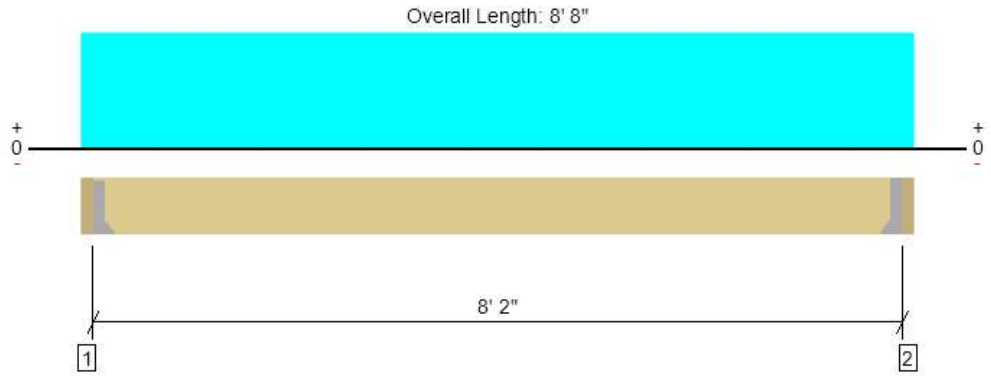
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

10/31/2024 4:28:32 PM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building E (2x12)

3rd Floor Framing, 8'-2" 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)	1062 @ 3"	1062 (1.75")	Passed (100%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	818 @ 1' 2 1/4"	1688	Passed (48%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2168 @ 4' 4"	2577	Passed (84%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.087 @ 4' 4"	0.272	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.112 @ 4' 4"	0.408	Passed (L/871)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 8' 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.
- 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]	1.75"	260	867	1127	See note [1]
2 - Hanger on 11 1/4" LSL beam	3.00"	Hanger[1]	1.75"	260	867	1127	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)	4' 5" o/c	
Bottom Edge (Lu)	8' 2" 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	6-10d	4-10d	
2 - Face Mount Hanger	LUS28	1.75"	N/A	6-10d	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' 8"	16"	45.0	150.0	Default Load

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

ForteWEB Software Operator	Job Notes
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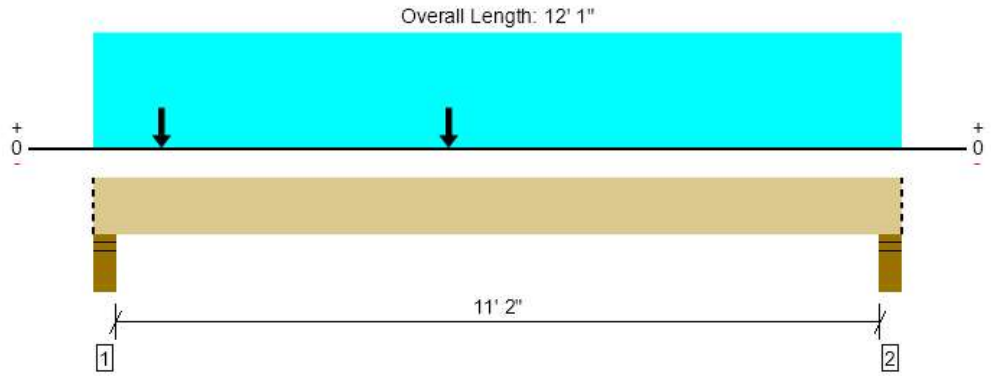
Weyerhaeuser

10/31/2024 4:28:32 PM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building E (2x12)

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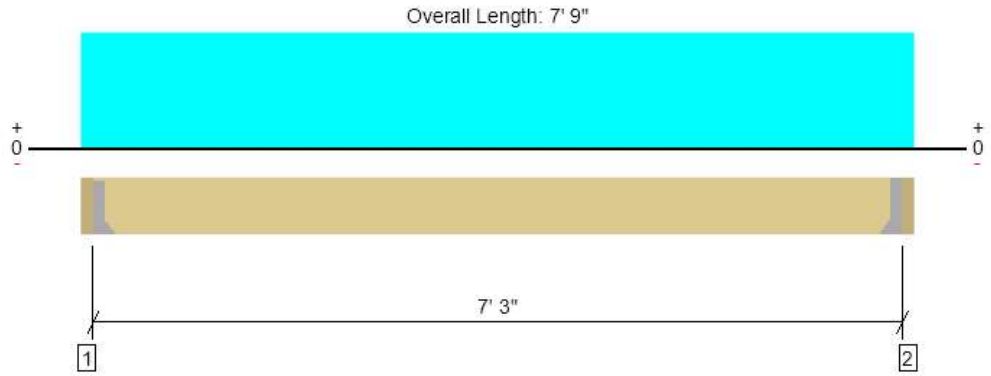
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

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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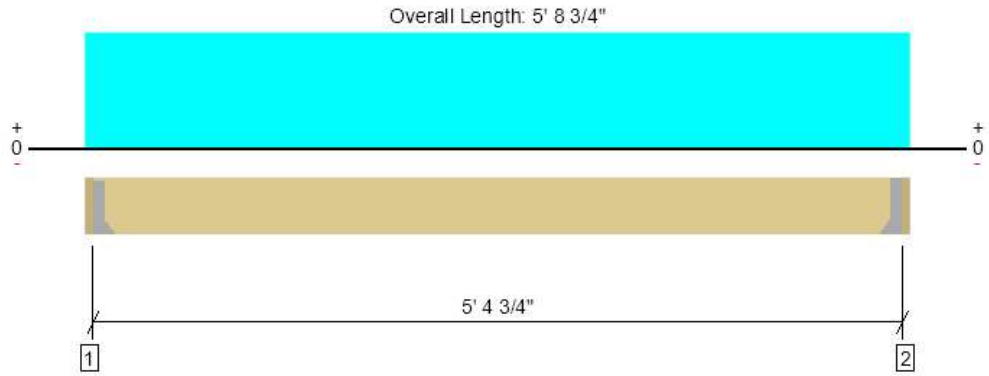
Weyerhaeuser

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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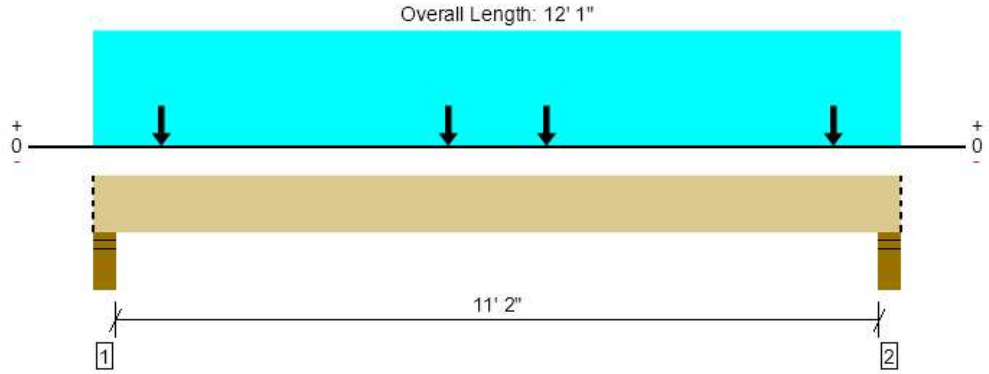
Weyerhaeuser

10/31/2024 4:28:32 PM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building E (2x12)

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.

ForteWEB Software Operator	Job Notes
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Weyerhaeuser

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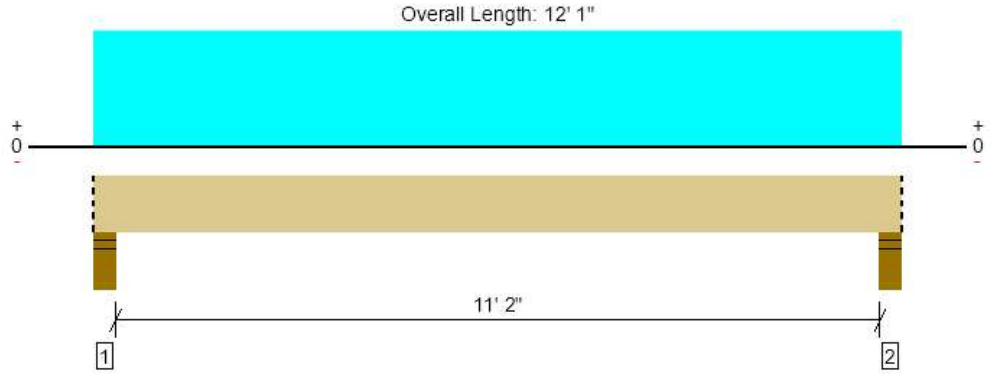
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

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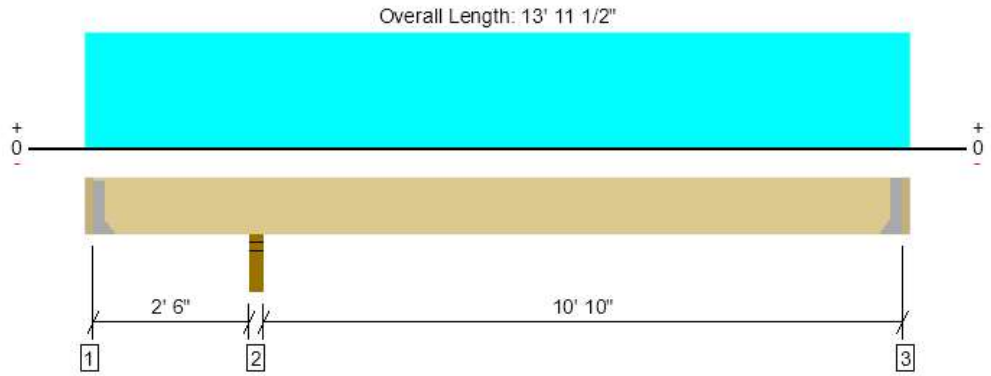
Weyerhaeuser

3rd Floor Framing, 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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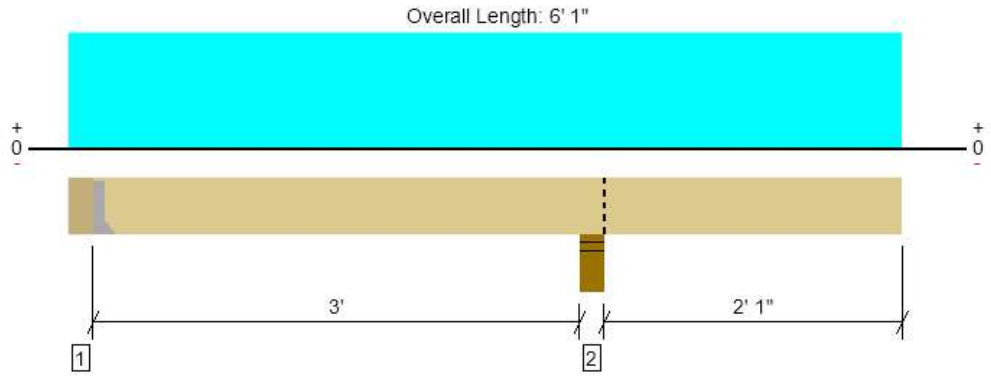
3rd Floor Framing, Deck Cantilever Ledger 2'

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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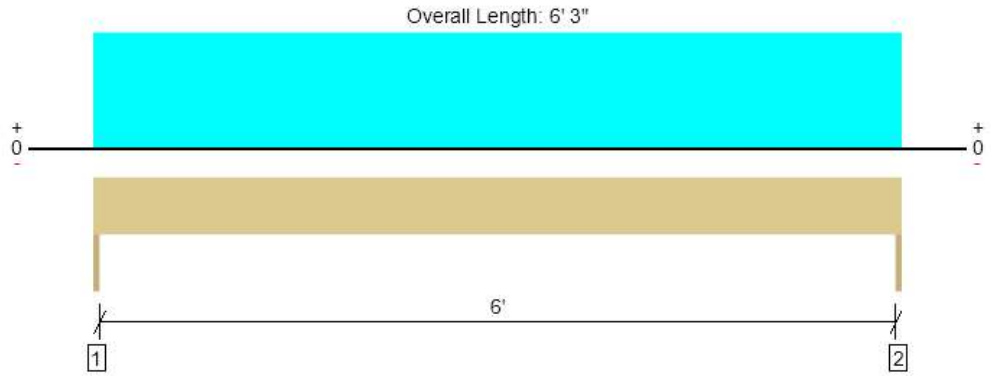
Weyerhaeuser

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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Weyerhaeuser

3rd Floor Framing, Grid 2.6 (E-G.2) Flush Beam

4 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL

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)	8275 @ 4"	15593 (5.50")	Passed (53%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	6343 @ 1' 4 3/4"	14963	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	25775 @ 7' 2 13/16"	32274	Passed (80%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.368 @ 7' 8 1/2"	0.499	Passed (L/487)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.661 @ 7' 8 9/16"	0.748	Passed (L/272)	--	1.0 D + 1.0 L (All Spans)

Member Length : 15' 7 5/8"
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).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Member should be side-loaded from both sides of the member or braced to prevent rotation.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	2.92"	3649	4626	8275	Blocking
2 - Stud wall - HF	5.50"	5.50"	2.31"	2913	3645	6558	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)	15' 1" o/c	
Bottom Edge (Lu)	15' 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 15' 7 5/8"	N/A	23.0	--	
1 - Uniform (PSF)	0 to 1' 8 3/8" (Front)	19' 5 3/8"	30.0	40.0	Default Load
2 - Uniform (PSF)	1' 8 3/8" to 7' 6 1/2" (Front)	14' 11 1/2"	30.0	40.0	Default Load
3 - Uniform (PSF)	7' 6 1/2" to 15' 7 5/8" (Front)	10' 8"	30.0	40.0	Default Load

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

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Weyerhaeuser

3rd Floor Framing, Grid 10.8 (E-G.1) Flush Beam

3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL

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)	7707 @ 4"	11694 (5.50")	Passed (66%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	5857 @ 1' 4 3/4"	11222	Passed (52%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	22526 @ 6' 9 1/2"	24206	Passed (93%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.381 @ 7' 2 3/4"	0.466	Passed (L/440)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.679 @ 7' 2 3/4"	0.698	Passed (L/247)	--	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/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	3.62"	3375	4332	7707	Blocking
2 - Stud wall - HF	5.50"	5.50"	2.95"	2757	3508	6266	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' 11" 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	17.2	--	
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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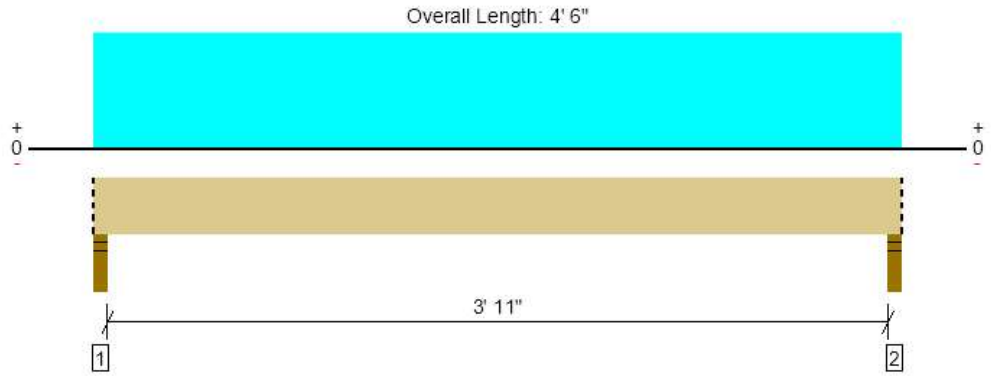
Weyerhaeuser

3rd Floor Framing, Grid 2.6 (G.6-H) Flush Beam

1 piece(s) 4 x 12 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)	3166 @ 2"	4961 (3.50")	Passed (64%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1436 @ 1' 2 3/4"	4725	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3054 @ 2' 3"	6091	Passed (50%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.008 @ 2' 3"	0.104	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.014 @ 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.
- 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	10.0	--	
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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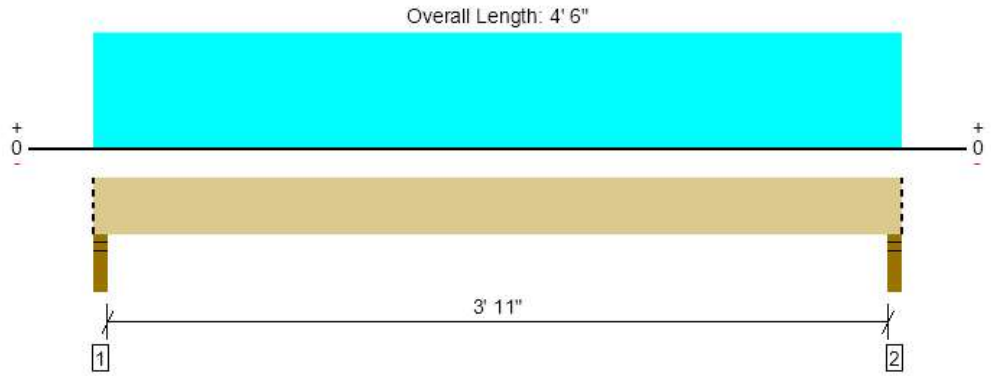
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

3rd Floor Framing, Grid 10.8 (G.6-H) Flush Beam

1 piece(s) 4 x 12 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)	3166 @ 2"	4961 (3.50")	Passed (64%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1436 @ 1' 2 3/4"	4725	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3054 @ 2' 3"	6091	Passed (50%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.008 @ 2' 3"	0.104	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.014 @ 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.
- 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	10.0	--	
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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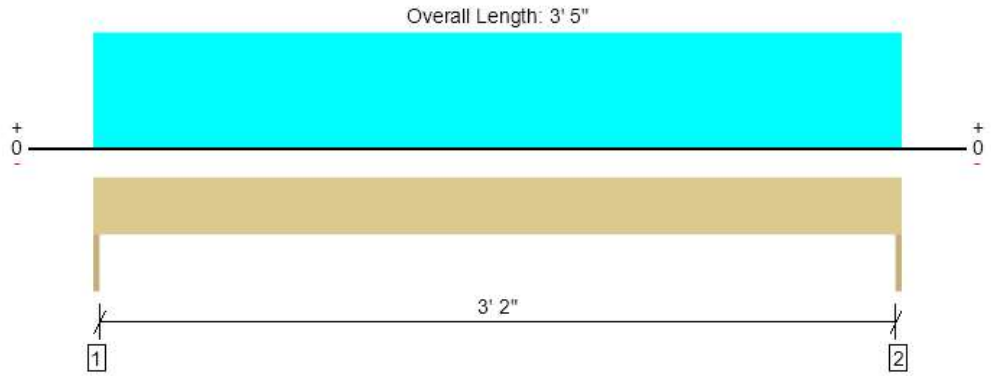
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

3rd Floor Framing, Grid 2.4 (H-J) 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)	1463 @ 0	3281 (1.50")	Passed (45%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	839 @ 8 3/4"	3045	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1250 @ 1' 8 1/2"	2989	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.008 @ 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"	633	830	1463	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	633	830	1463	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' 1 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

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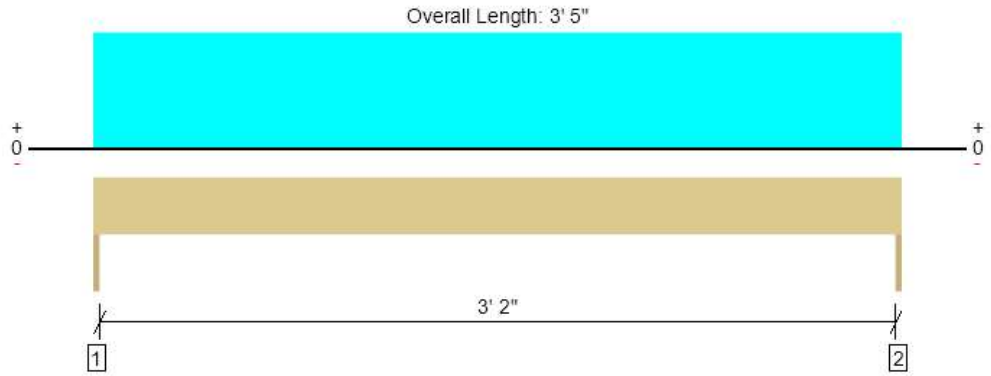
Weyerhaeuser

3rd Floor Framing, Grid 11.3 (H-J) 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)	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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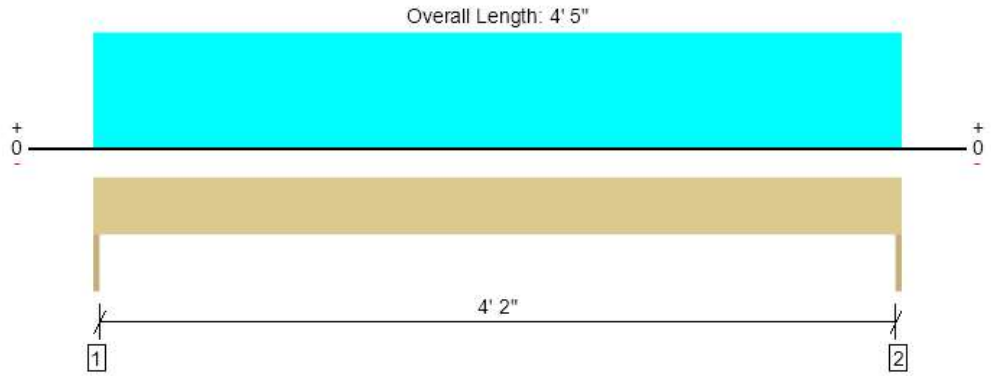
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

3rd Floor Framing, Grid 2.4 (J-L) 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)	1892 @ 0	3281 (1.50")	Passed (58%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1267 @ 8 3/4"	3045	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2089 @ 2' 2 1/2"	2989	Passed (70%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.023 @ 2' 2 1/2"	0.147	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.041 @ 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"	819	1073	1892	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	819	1073	1892	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' 1 3/4"	30.0	40.0	Default Load

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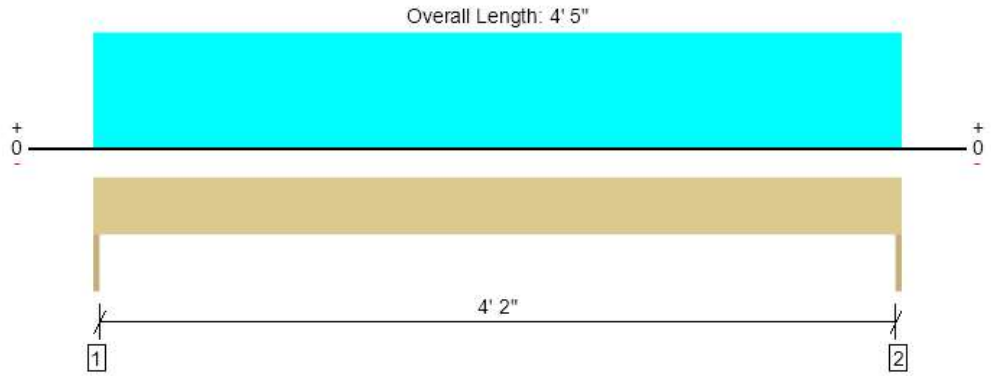
Weyerhaeuser

3rd Floor Framing, Grid 11.3 (J-L) 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)	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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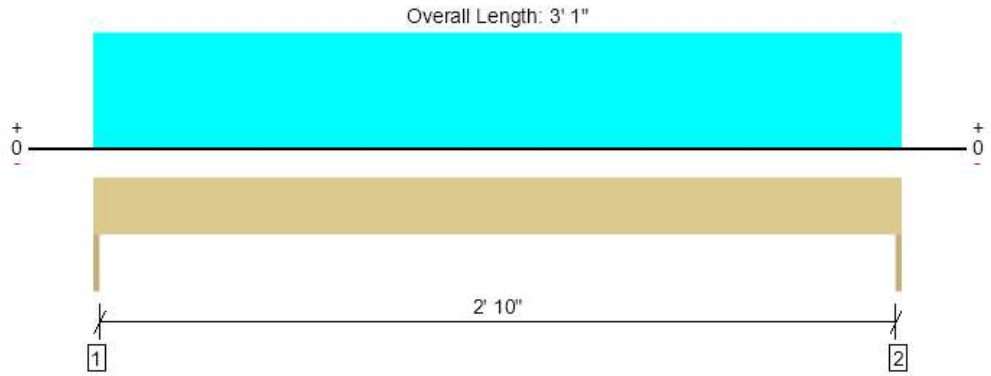
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

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



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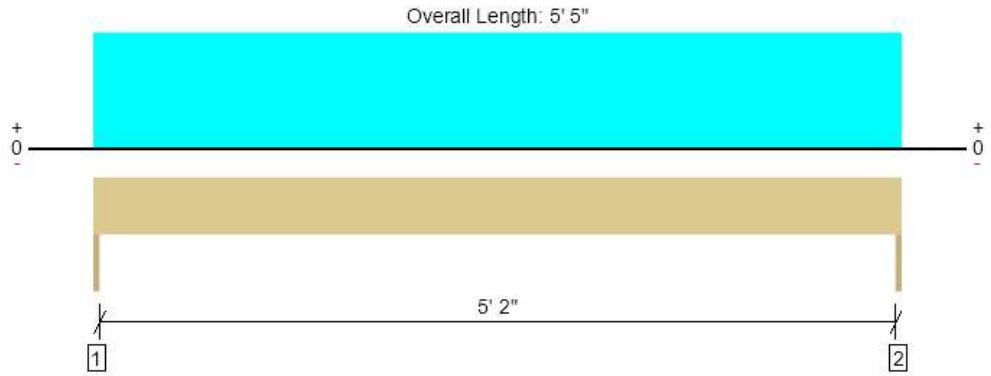
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

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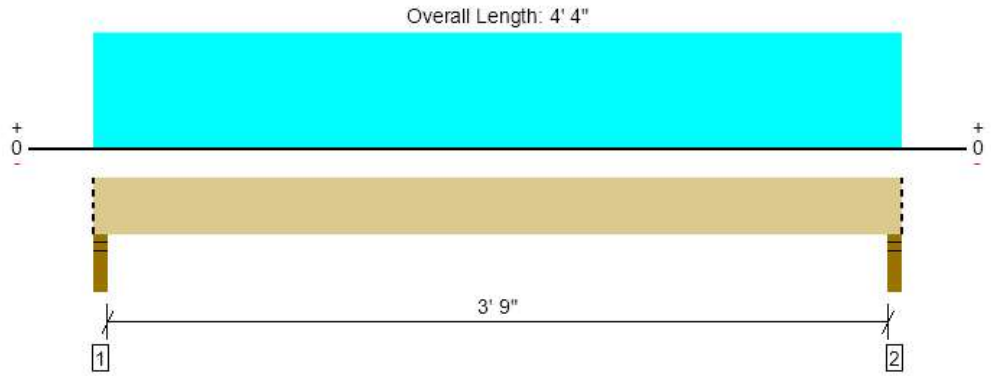
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

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

1 piece(s) 4 x 12 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)	1576 @ 2"	4961 (3.50")	Passed (32%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	682 @ 1' 2 3/4"	4725	Passed (14%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1455 @ 2' 2"	6091	Passed (24%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.004 @ 2' 2"	0.100	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.006 @ 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.
- 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	10.0	--	
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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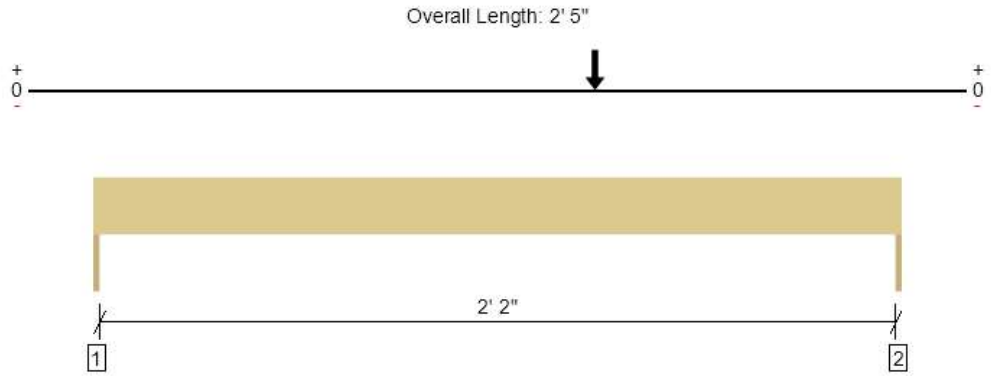
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

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

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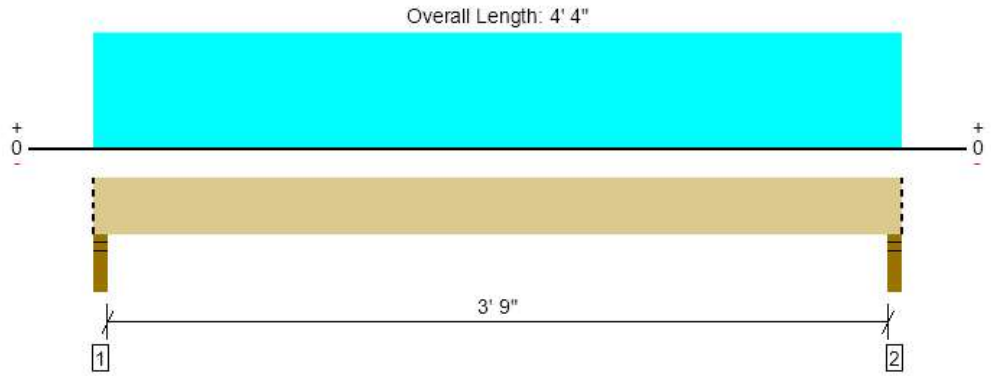
Weyerhaeuser

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

1 piece(s) 4 x 12 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)	1753 @ 2"	4961 (3.50")	Passed (35%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	759 @ 1' 2 3/4"	4725	Passed (16%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1618 @ 2' 2"	6091	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.004 @ 2' 2"	0.100	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.007 @ 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.
- 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	10.0	--	
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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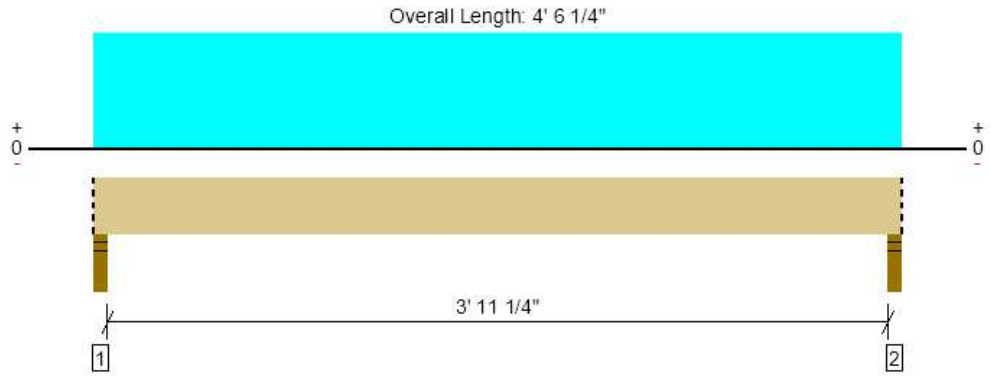
Weyerhaeuser

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

1 piece(s) 4 x 12 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)	2581 @ 2"	4961 (3.50")	Passed (52%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1177 @ 1' 2 3/4"	4725	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2502 @ 2' 3 1/8"	6091	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.007 @ 2' 3 1/8"	0.105	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.012 @ 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.
- 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	10.0	--	
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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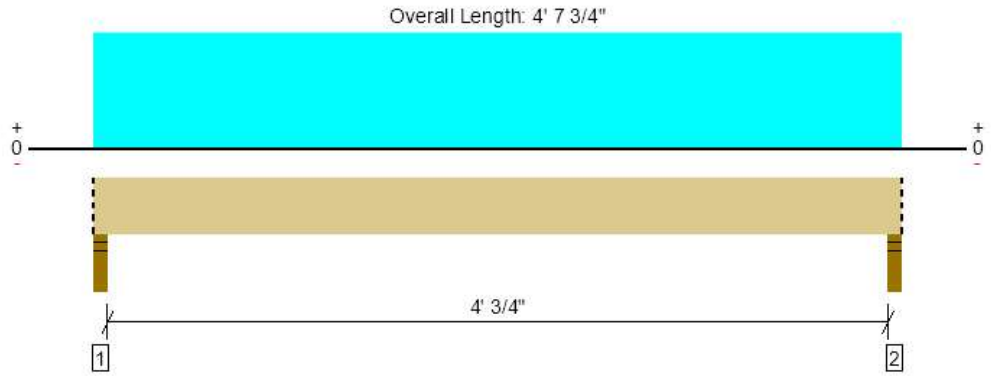
Weyerhaeuser

3rd Floor Framing, Grid 3.3 (D.7-D.9) Flush Beam

1 piece(s) 4 x 12 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)	2273 @ 2"	4961 (3.50")	Passed (46%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1070 @ 1' 2 3/4"	4725	Passed (23%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2274 @ 2' 3 7/8"	6091	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.006 @ 2' 3 7/8"	0.108	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 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.
- 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"	1.60"	987	1285	2273	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.60"	987	1285	2273	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	10.0	--	
1 - Uniform (PSF)	0 to 4' 7 3/4" (Front)	13' 10"	30.0	40.0	Default Load

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

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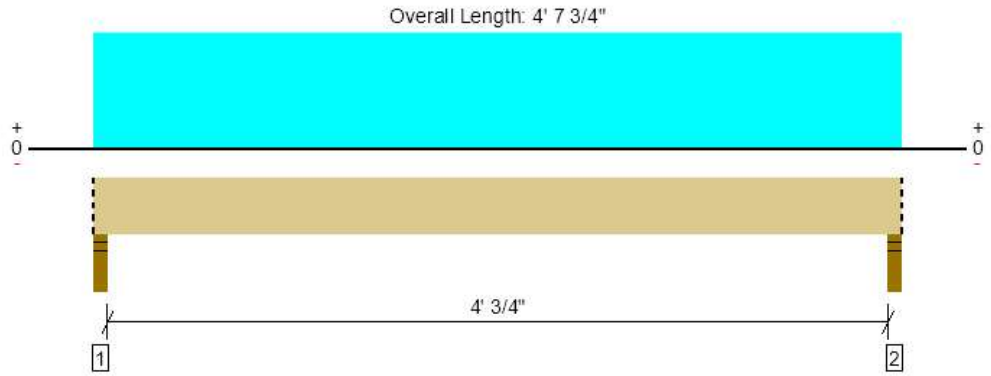
Weyerhaeuser

3rd Floor Framing, Grid 10.3 (D.7-D.9) Flush Beam

1 piece(s) 4 x 12 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)	2273 @ 2"	4961 (3.50")	Passed (46%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1070 @ 1' 2 3/4"	4725	Passed (23%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2274 @ 2' 3 7/8"	6091	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.006 @ 2' 3 7/8"	0.108	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 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.
- 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"	1.60"	987	1285	2273	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.60"	987	1285	2273	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	10.0	--	
1 - Uniform (PSF)	0 to 4' 7 3/4" (Front)	13' 10"	30.0	40.0	Default Load

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

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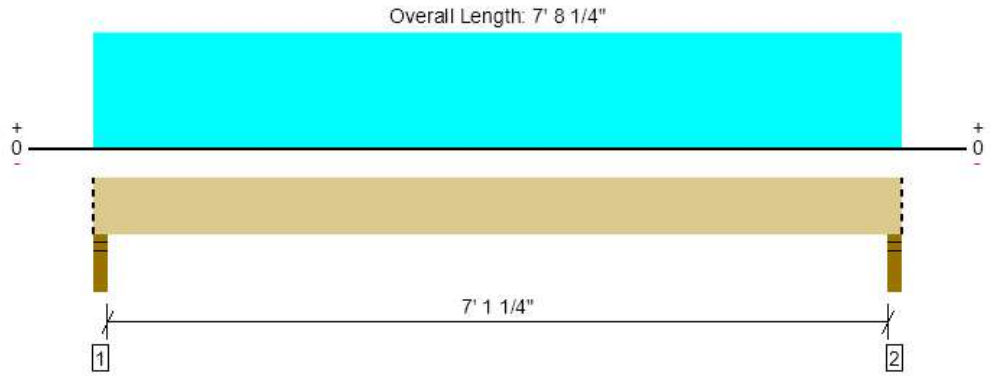
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

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

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



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Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3323 @ 2"	4961 (3.50")	Passed (67%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2260 @ 1' 2 3/4"	4725	Passed (48%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5845 @ 3' 10 1/8"	6091	Passed (96%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.048 @ 3' 10 1/8"	0.184	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.086 @ 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.
- 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"	1446	1877	3323	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.34"	1446	1877	3323	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	10.0	--	
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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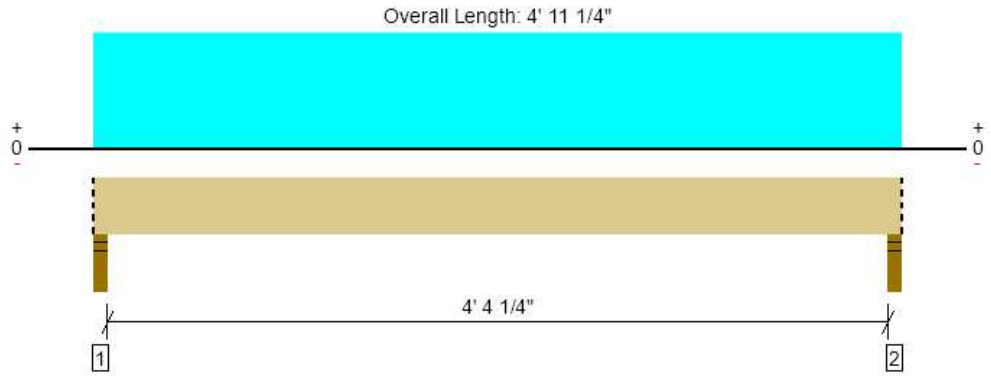
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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) 4 x 12 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)	2372 @ 2"	4961 (3.50")	Passed (48%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1191 @ 1' 2 3/4"	4725	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2546 @ 2' 5 5/8"	6091	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.008 @ 2' 5 5/8"	0.115	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.015 @ 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.
- 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	10.0	--	
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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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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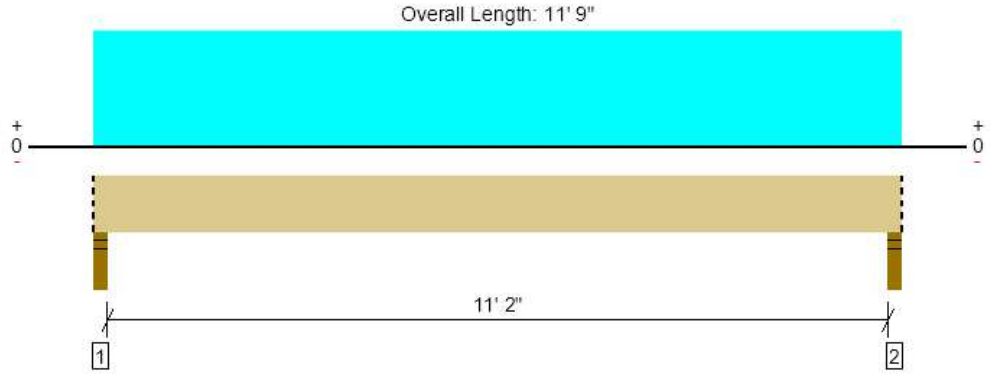
Weyerhaeuser

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

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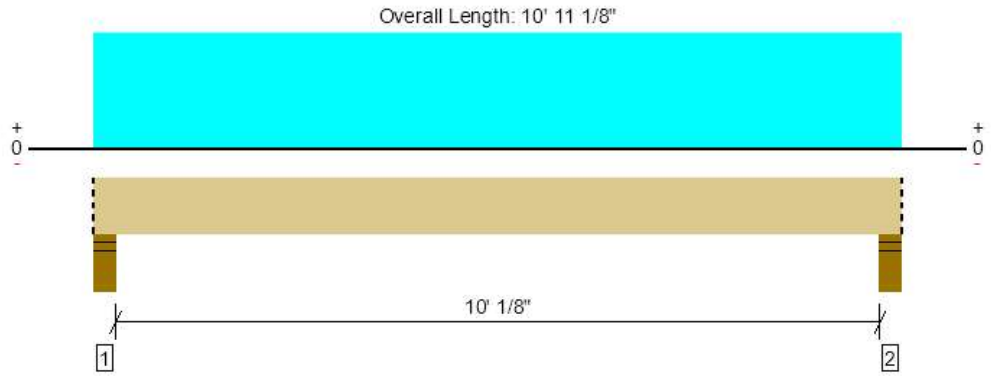
Weyerhaeuser

Roof Framing, Grid 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)	5263 @ 4"	7796 (5.50")	Passed (68%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3979 @ 1' 4"	7466	Passed (53%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	12677 @ 5' 5 9/16"	14792	Passed (86%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.196 @ 5' 5 9/16"	0.513	Passed (L/629)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.395 @ 5' 5 9/16"	0.684	Passed (L/311)	--	1.0 D + 1.0 S (All Spans)

Member Length : 10' 11 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"	3.71"	2657	2607	5263	Blocking
2 - Stud wall - HF	5.50"	5.50"	3.71"	2657	2607	5263	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' 11" o/c	
Bottom Edge (Lu)	10' 11" 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' 11 1/8"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 10' 11 1/8" (Front)	19' 1"	25.0	25.0	Default Load

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

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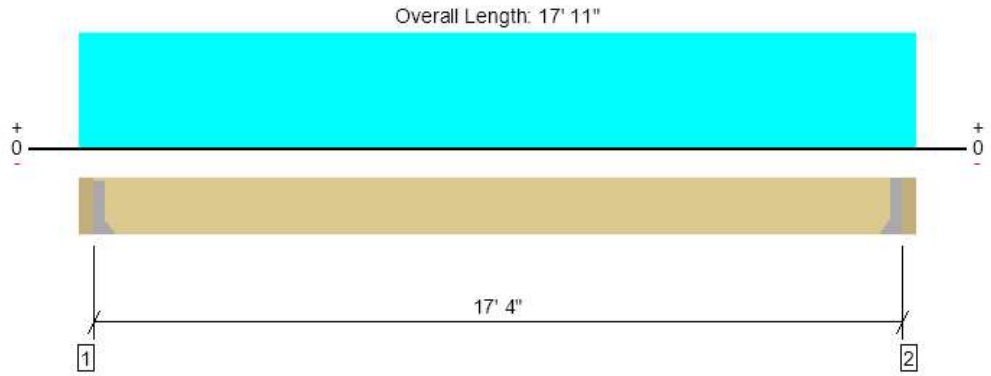
Weyerhaeuser

Roof Framing, Grid M 17' Awning Roof Beam

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	705 @ 3 1/2"	3413 (1.50")	Passed (21%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	655 @ 11"	5333	Passed (12%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	3057 @ 8' 11 1/2"	7547	Passed (41%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.344 @ 8' 11 1/2"	0.867	Passed (L/605)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.747 @ 8' 11 1/2"	1.156	Passed (L/279)	--	1.0 D + 1.0 S (All Spans)

Member Length : 17' 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 = 17' 4 1/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Hanger on 7 1/2" HF beam	3.50"	Hanger[1]	1.50"	391	336	727	See note [1]
2 - Hanger on 7 1/2" HF beam	3.50"	Hanger[1]	1.50"	391	336	727	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)	17' 4" o/c	
Bottom Edge (Lu)	17' 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
1 - Face Mount Hanger	U46X SLU1	2.00"	N/A	8-10dx1.5	4-10d	
2 - Face Mount Hanger	U46X SLD1	2.00"	N/A	8-10dx1.5	4-10d	

- 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)	3 1/2" to 17' 7 1/2"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 17' 11" (Front)	1' 6"	25.0	25.0	Default Load

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

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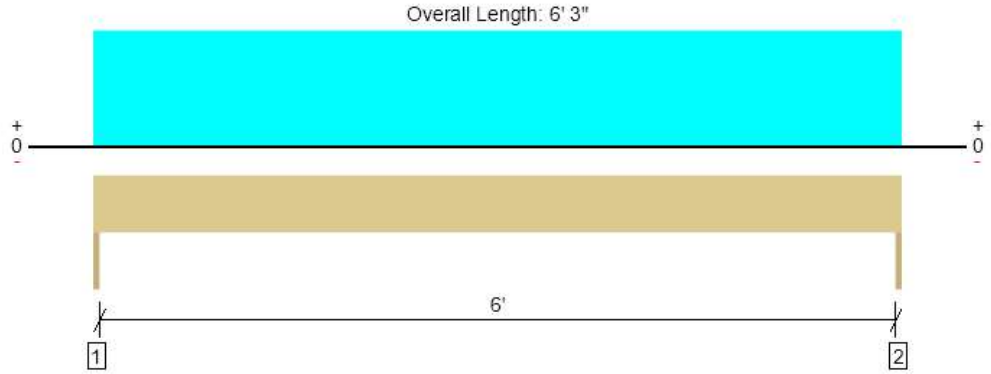
Roof Framing, 6' Window Header

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)	3115 @ 0	3281 (1.50")	Passed (95%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2222 @ 10 3/4"	4468	Passed (50%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	4867 @ 3' 1 1/2"	5166	Passed (94%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.046 @ 3' 1 1/2"	0.208	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.093 @ 3' 1 1/2"	0.313	Passed (L/809)	--	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"	1571	1545	3115	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	1571	1545	3115	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"	19' 9 1/4"	25.0	25.0	Default Load

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

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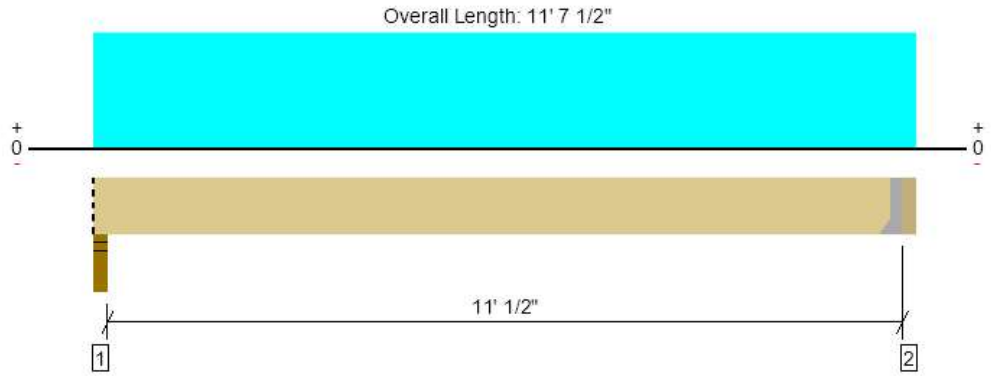
Weyerhaeuser

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.

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

Weyerhaeuser

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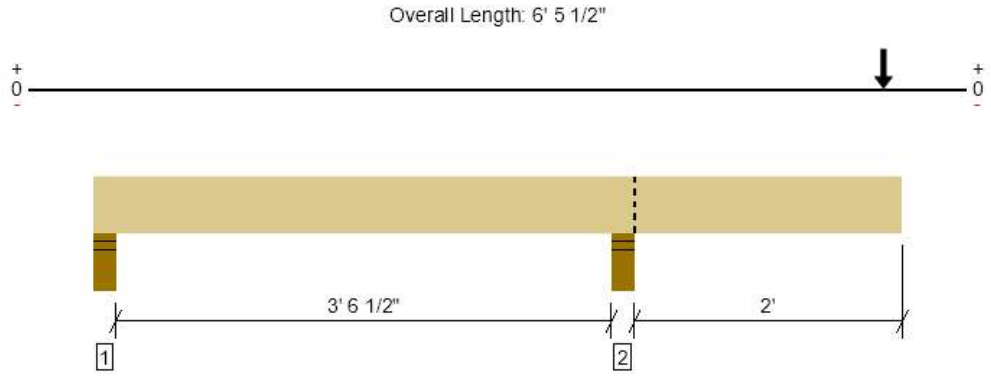
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Deck Roof Cantilever Beam

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

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



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

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Weyerhaeuser

ASDIP Foundation 5.3.1.0

SPREAD FOOTING DESIGN

www.asdipsoft.com

GEOMETRY

Footing Length (X-dir)	3.50	ft	
Footing Width (Z-dir)	3.50	ft	
Footing Thickness	8.0	in	OK
Soil Cover	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

Gross Allow. Soil Pressure	2.0	ksf	
Soil Pressure at Corner 1	1.5	ksf	
Soil Pressure at Corner 2	1.5	ksf	
Soil Pressure at Corner 3	1.5	ksf	
Soil Pressure at Corner 4	1.5	ksf	
Bearing Pressure Ratio	0.77		OK
Ftg. Area in Contact with Soil	100.0	%	
X-eccentricity / Ftg. Length	0.00		OK
Z-eccentricity / Ftg. Width	0.00		OK

APPLIED LOADS

	Dead	Live	RLive	Snow	Wind	Seismic	
Axial Force P	4.4	13.7	0.0	0.0	0.0	0.0	kip
Moment about X Mx ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Moment about Z Mz ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Shear Force Vx	0.0	0.0	0.0	0.0	0.0	0.0	kip
Shear Force Vz	0.0	0.0	0.0	0.0	0.0	0.0	kip

OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

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

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

  Arm = *W / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0=6 * (3.50 * 3.50 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 3.50 * 3.50 * 62 * (0.67) = -0.3 kip

  Arm = *W / 2* = 3.50 / 2 = 1.75 ft Moment = 0.3 * 1.75 = -0.5 k-ft
- Axial force P = 0.6 * 4.4 + 0.6 * 0.0 = 2.6 kip

  Arm = *W / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 2.6 * 1.75 = 4.6 k-ft
- Resisting moment X-X = 1.3 + 0.0 + 0.0 + 4.6 + -0.5 = 5.4 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{5.4}{0.0}$ = 53.71 > 1.50 OK

- Overturning about Z-Z
- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip
  Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft
- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z
- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 3.50 * 3.50 * 8.0 / 12 * 0.15 = 0.7 kip
  Arm = *L / 2 =* 3.50 / 2 = 1.75 ft Moment = 0.7 * 1.75 = 1.3 k-ft
- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip
  Arm = *L / 2 - Offset =* 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (3.50 * 3.50 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip
  Arm = *L / 2 =* 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 3.50 * 3.50 * 62 * (0.67) = -0.3 kip
  Arm = *L / 2 =* 3.50 / 2 = 1.75 ft Moment = 0.3 * 1.75 = -0.5 k-ft
- Axial force P = 0.6 * 4.4 + 0.6 * 0.0 = 2.6 kip
  Arm = *L / 2 - Offset =* 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 2.6 * 1.75 = 4.6 k-ft
- Resisting moment Z-Z = 1.3 + 0.0 + 0.0 + 4.6 + -0.5 = 5.4 k-ft
- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{5.4}{0.0}$ = 53.71 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

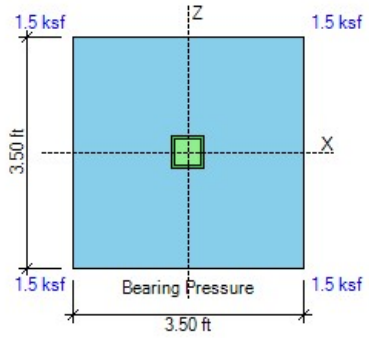
Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft
Resisting moment X-X = 2.1 + 0.0 + 0.0 + -0.9 + 31.7 = 32.9 k-ft
Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft
Resisting moment Z-Z = 2.1 + 0.0 + 0.0 + -0.9 + 31.7 = 32.9 k-ft
Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 1.2 + 0.0 + 0.0 - 0.5 + 18.1 = 18.8 kip
X-coordinate of resultant from maximum bearing corner:

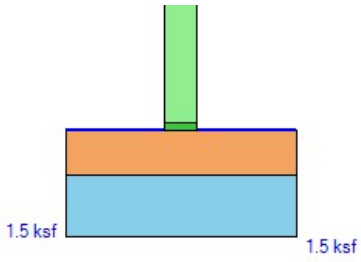
$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{32.9 - 0.0}{18.8} = 1.75 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

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

X-ecc = *Length / 2 - Xp* =3.50 / 2 - 1.75 = 0.00 ft
Z-ecc = *Width / 2 - Zp =* 3.50 / 2 - 1.75 = 0.00 ft
Area = *Width * Length =* 3.50 * 3.50 = 12.3 ft²
Sx = *Length * Width² / 6 =* 3.50 * 3.50² / 6 = 7.1 ft³
Sz = *Width * Length² / 6 =* 3.50 * 3.50² / 6 = 7.1 ft³
- Footing is in full bearing. Soil pressures are as follows:
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 18.8 * (1 / 12.3 + 0.00 / 7.1 + 0.00 / 7.1) = 1.54 ksf
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 18.8 * (1 / 12.3 - 0.00 / 7.1 + 0.00 / 7.1) = 1.54 ksf
P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 18.8 * (1 / 12.3 - 0.00 / 7.1 - 0.00 / 7.1) = 1.54 ksf
P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 18.8 * (1 / 12.3 + 0.00 / 7.1 - 0.00 / 7.1) = 1.54 ksf





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+0.5S)

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

*ϕVcx = 2 * ϕ * √(f'c) * Width * d / 1000* = 2 * 0.75 * √(2500) * 3.5 * 12 * 4.8 / 1000 = 15.0 kip ACI Eq. (22.5.5.1)

*ϕVcz = 2 * ϕ * √(f'c) * Length * d / 1000* = 2 * 0.75 * √(2500) * 3.5 * 12 * 4.3 / 1000 = 13.4 kip

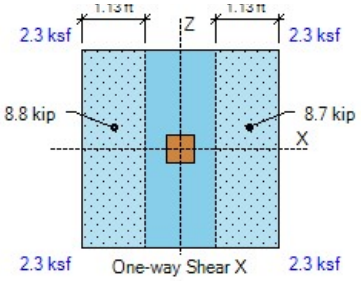
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

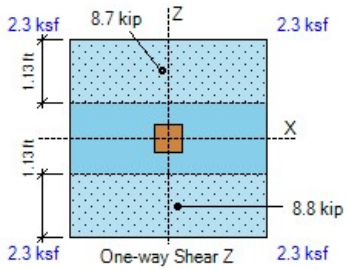
One-way shear Vux (- Side) = 8.8 kip < 15.0 kip OK

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+0.5S)

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

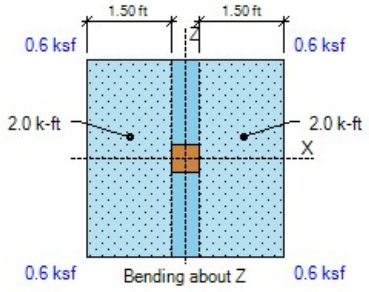
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.73) = 6.0 in

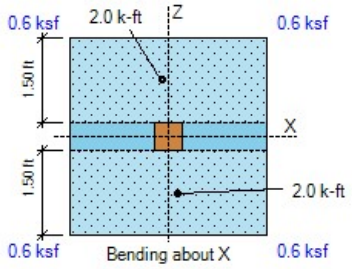
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+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+0.5S)

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

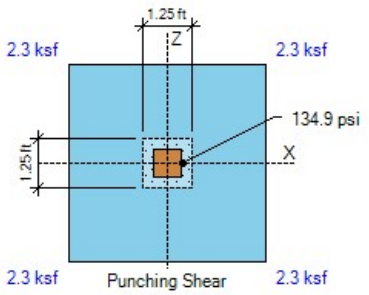
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

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

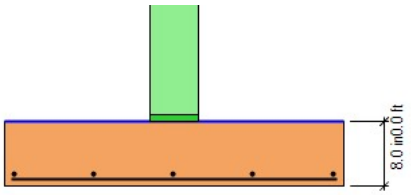
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

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

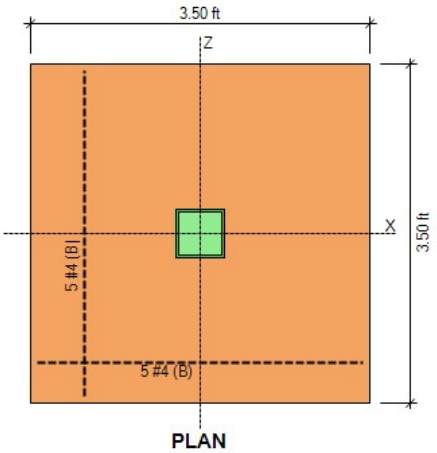


DESIGN CODES

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



ELEVATION



PLAN

ASDIP Foundation 5.3.1.0

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	0.8	ksf	
Soil Pressure at Corner 2	0.8	ksf	
Soil Pressure at Corner 3	0.8	ksf	
Soil Pressure at Corner 4	0.8	ksf	
Bearing Pressure Ratio	0.42		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	4.0	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 * 3.00 * 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 * 3.0 + 0.6 * 0.0 = 1.8 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft Moment = 1.8 * 1.50 = 2.7 k-ft
- Resisting moment X-X = 0.8 + 0.0 + 0.0 + 2.7 + -0.3 = 3.2 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{3.2}{0.0}$ = 31.73 > 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 * 3.0 + 0.6 * 0.0 = 1.8 kip
  Arm = *L / 2 - Offset =* 3.00 / 2 - 0.0 / 12 = 1.50 ft Moment = 1.8 * 1.50 = 2.7 k-ft
- Resisting moment Z-Z = 0.8 + 0.0 + 0.0 + 2.7 + -0.3 = 3.2 k-ft
- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{3.2}{0.0}$ = 31.73 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

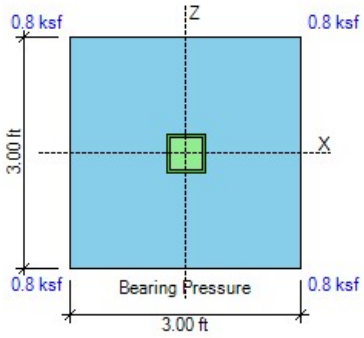
Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft
Resisting moment X-X = 1.4 + 0.0 + 0.0 + -0.6 + 10.5 = 11.3 k-ft
Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft
Resisting moment Z-Z = 1.4 + 0.0 + 0.0 + -0.6 + 10.5 = 11.3 k-ft
Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 0.9 + 0.0 + 0.0 - 0.4 + 7.0 = 7.5 kip
X-coordinate of resultant from maximum bearing corner:

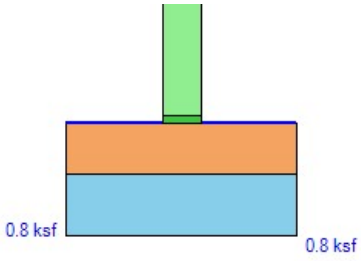
$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{11.3 - 0.0}{7.5} = 1.50 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{11.3 - 0.0}{7.5} = 1.50 \text{ ft}$$

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) =* 7.5 * (1 / 9.0 + 0.00 / 4.5 + 0.00 / 4.5) = 0.84 ksf
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 7.5 * (1 / 9.0 - 0.00 / 4.5 + 0.00 / 4.5) = 0.84 ksf
P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 7.5 * (1 / 9.0 - 0.00 / 4.5 - 0.00 / 4.5) = 0.84 ksf
P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 7.5 * (1 / 9.0 + 0.00 / 4.5 - 0.00 / 4.5) = 0.84 ksf





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, 2.1 * 0.35) = 0.7 kip

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

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 0.3 + 1.00 * 0.7}{0.0}$ = 10.58 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 0.3 + 1.00 * 0.7}{0.0}$ = 10.58 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

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

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

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

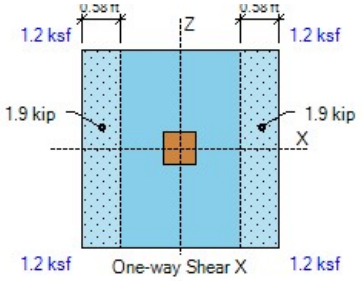
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

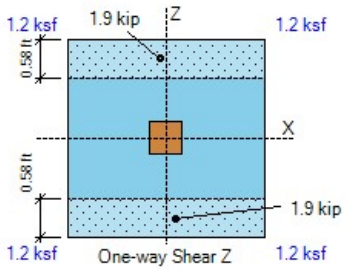
One-way shear Vux (- Side) = 1.9 kip < 11.5 kip OK

One-way shear Vux (+ Side) = 1.9 kip < 11.5 kip OK

One-way shear Vuz (- Side) = 1.9 kip < 11.5 kip OK

One-way shear Vuz (+ Side) = 1.9 kip < 11.5 kip OK





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

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

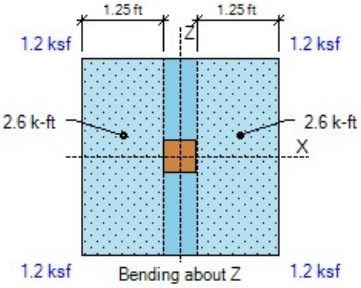
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

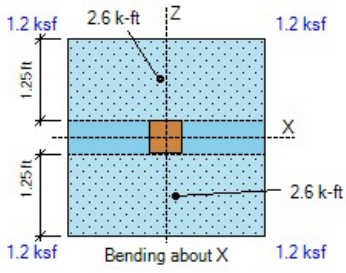
Bottom moment Mux (- Side) = 2.6 k-ft < 4.8 k-ft OK ratio = 0.54

Bottom moment Mux (+ Side) = 2.6 k-ft < 4.8 k-ft OK ratio = 0.54

Bottom moment Muz (- Side) = 2.6 k-ft < 4.8 k-ft OK ratio = 0.54

Bottom moment Muz (+ Side) = 2.6 k-ft < 4.8 k-ft OK ratio = 0.54





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

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 $Pbu = P / A1 + Mz / Sx + Mx / Sz =$ 10.0 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.3 ksi

Min edge = $Min\ (L / 2 - X\text{-}offset - col\ L / 2,\ W / 2 - Z\text{-}offset - col\ W / 2)$

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 > 0.3 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* = 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 = 10.0 + 0.07 * 625.0 / 144 - 1.6 = 8.7 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

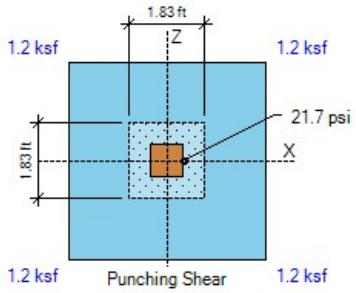
Jcz = 25.0 * 8.0³ / 12 + 25.0³ * 8.0 / 12 + 25.0 * 8.0 * (25.0 / 2 * 6.3)² + 25.0 * 8.0 * 6.3² = 27108 in⁴

Stress due to P = *F / (bo * d) * 1000* = 8.7 / (50.0 * 8.0) * 1000 = 21.7 psi

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

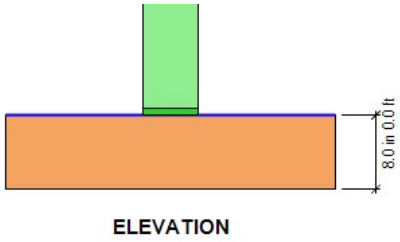
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 6.3 / 27108 * 1000 = 0.0 psi

Punching stress = *P-stress + Mx-stress + Mz-stress* = 21.7 + 0.0 + 0.0 = 21.7 psi < 80.0 psi OK

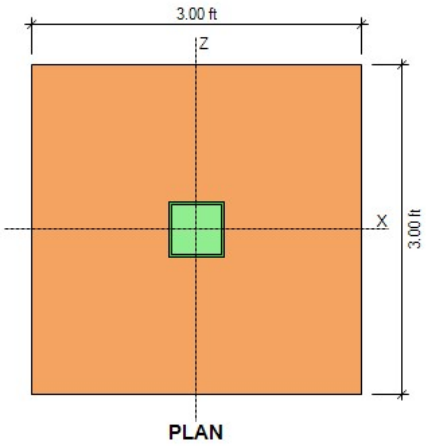


DESIGN CODES

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



ELEVATION



PLAN

ASDIP Foundation 5.3.1.0

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)

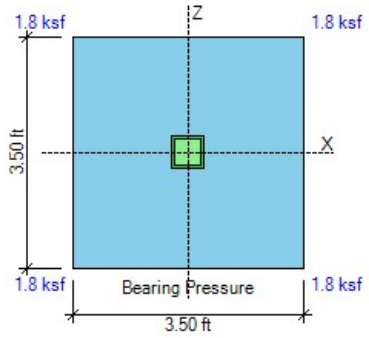
Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft
Resisting moment X-X = 2.1 + 0.0 + 0.0 + -0.9 + 37.1 = 38.4 k-ft
Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft
Resisting moment Z-Z = 2.1 + 0.0 + 0.0 + -0.9 + 37.1 = 38.4 k-ft
Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 1.2 + 0.0 + 0.0 - 0.5 + 21.2 = 21.9 kip
X-coordinate of resultant from maximum bearing corner:

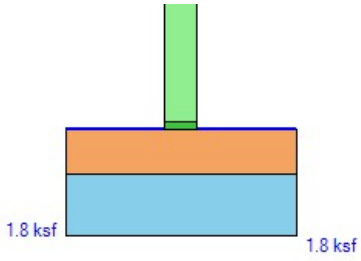
$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{38.4 - 0.0}{21.9} = 1.75 \text{ ft}$$

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





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+0.5S)

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

d Top X-dir = *Thick - Cover - X-diameter / 2* = 8.0 - 2.0 - 0.8 / 2 = 5.6 in

d Top Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 8.0 - 2.0 - 0.8 - 0.8 / 2 = 4.9 in

d Bot X-dir = *Thick - Cover - X-diameter / 2* = 8.0 - 3.0 - 0.5 / 2 = 4.8 in

d Bot Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 8.0 - 3.0 - 0.5 - 0.5 / 2 = 4.3 in

$\phi Vcx = 2 * \phi * \sqrt{f'c} * Width * d / 1000$ = 2 * 0.75 * √(2500) * 3.5 * 12 * 4.8 / 1000 = 15.0 kip ACI Eq. (22.5.5.1)

$\phi Vcz = 2 * \phi * \sqrt{f'c} * Length * d / 1000$ = 2 * 0.75 * √(2500) * 3.5 * 12 * 4.3 / 1000 = 13.4 kip

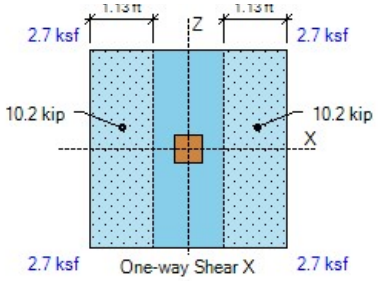
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

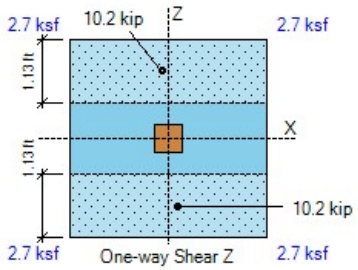
One-way shear Vux (- Side) = 10.2 kip < 15.0 kip OK

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

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

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





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

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

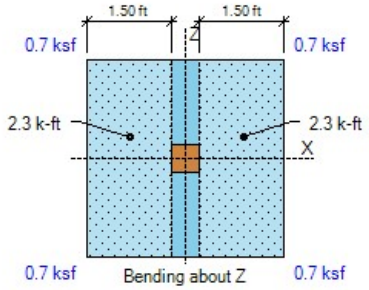
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.85) = 6.0 in

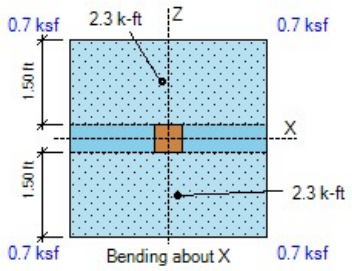
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+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+0.5S)

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

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

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

Bearing *Pbu = P / A1 + Mz / Sx + Mx / Sz* = 31.8 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.9 ksi

Min edge = *Min (L / 2 - X-offset - col L / 2, W / 2 - Z-offset - col W / 2)*

Min edge = Min (3.50 * 12 / 2 - 0.0 - 6.0 / 2, 3.50 * 12 / 2 - 0.0 - 6.0 / 2 = 18.0 in

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

A2 = Min [3.50 * 12 * 3.5 * 12, (6.0 + 2 * 18.0) * (6.0 + 2 * 18.0)] = 1764.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)]* = 0.65 * 0.85 * 2.5 * Min [2, √(1764.0 / 36.0)] = 2.8 ksi

Footing *ϕPns = ϕ * As * Fy / A1* = 0.0 ksi ACI 22.8.3.2

Footing bearing *ϕPn = ϕPnc + ϕPns* = 2.8 + 0.0 = 2.8 ksi > 0.9 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.15) = 6.0 in

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

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

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

X-Edge = *d /2* = 4.5 / 2 = 2.3 in αsx = 20

Z-Edge = *d /2* = 4.5 / 2 = 2.3 in αsz = 20

αs = *αsx + αsz* = 20 + 20 = 40 Col type = Interior β = *L / W* = 6.0 / 6.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

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

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (6.0 + 4.5 / 2 + 2.3) * (6.0 + 4.5 / 2 + 2.3) = 110.3 in²

ϕVc = *ϕ * Min (2 + 4 / β, αs * d / bo + 2, 4) * √(f'c)* ACI 22.6.5.2

ϕVc = 0.75 * Min (2 + 4 / 1.00, 40 * 4.5 / 42.0 + 2, 4) * √(2500) = 150.0 psi

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

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

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

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

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

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

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

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

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

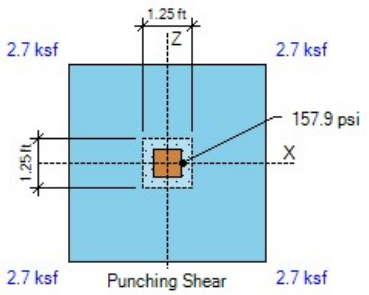
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

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

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

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

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



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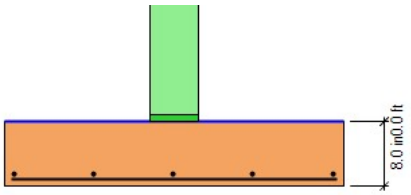
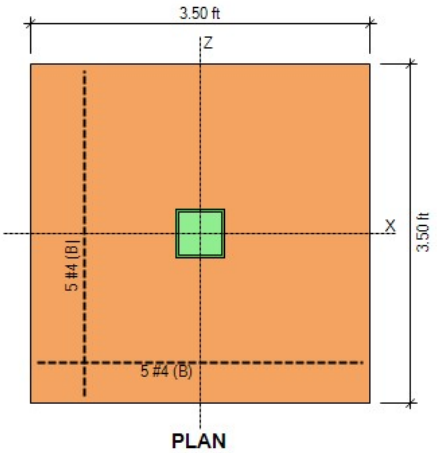


ELEVATION



PLAN

ASDIP Foundation 5.3.1.0

SPREAD FOOTING DESIGN

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	0.8	ksf	
Soil Pressure at Corner 2	0.8	ksf	
Soil Pressure at Corner 3	0.8	ksf	
Soil Pressure at Corner 4	0.8	ksf	
Bearing Pressure Ratio	0.42		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	4.0	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 * 3.00 * 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 * 3.0 + 0.6 * 0.0 = 1.8 kip

  Arm = *W / 2 - Offset* = 3.00 / 2 - 0.0 / 12 = 1.50 ft Moment = 1.8 * 1.50 = 2.7 k-ft
- Resisting moment X-X = 0.8 + 0.0 + 0.0 + 2.7 + -0.3 = 3.2 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{3.2}{0.0}$ = 31.73 > 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 * 3.0 + 0.6 * 0.0 = 1.8 kip
  Arm = *L / 2 - Offset =* 3.00 / 2 - 0.0 / 12 = 1.50 ft Moment = 1.8 * 1.50 = 2.7 k-ft
- Resisting moment Z-Z = 0.8 + 0.0 + 0.0 + 2.7 + -0.3 = 3.2 k-ft
- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{3.2}{0.0}$ = 31.73 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

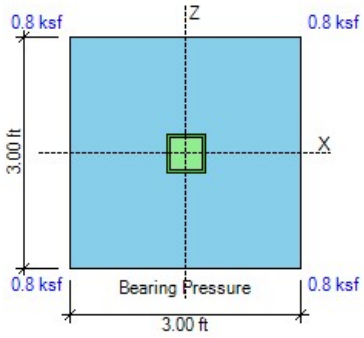
Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft
Resisting moment X-X = 1.4 + 0.0 + 0.0 + -0.6 + 10.5 = 11.3 k-ft
Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft
Resisting moment Z-Z = 1.4 + 0.0 + 0.0 + -0.6 + 10.5 = 11.3 k-ft
Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 0.9 + 0.0 + 0.0 - 0.4 + 7.0 = 7.5 kip
X-coordinate of resultant from maximum bearing corner:

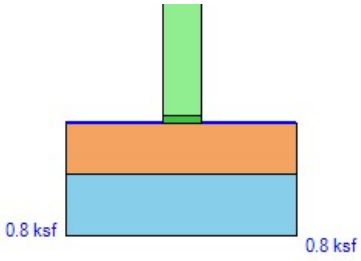
$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{11.3 - 0.0}{7.5} = 1.50 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{11.3 - 0.0}{7.5} = 1.50 \text{ ft}$$

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) =* 7.5 * (1 / 9.0 + 0.00 / 4.5 + 0.00 / 4.5) = 0.84 ksf
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 7.5 * (1 / 9.0 - 0.00 / 4.5 + 0.00 / 4.5) = 0.84 ksf
P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 7.5 * (1 / 9.0 - 0.00 / 4.5 - 0.00 / 4.5) = 0.84 ksf
P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 7.5 * (1 / 9.0 + 0.00 / 4.5 - 0.00 / 4.5) = 0.84 ksf





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, 2.1 * 0.35) = 0.7 kip

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

- Sliding safety factor X-X = $\frac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \frac{1.00 * 0.3 + 1.00 * 0.7}{0.0}$ = 10.58 > 1.50 OK

- Sliding safety factor Z-Z = $\frac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \frac{1.00 * 0.3 + 1.00 * 0.7}{0.0}$ = 10.58 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

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

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

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

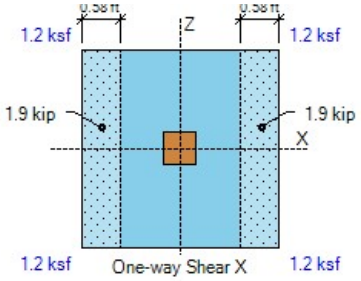
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

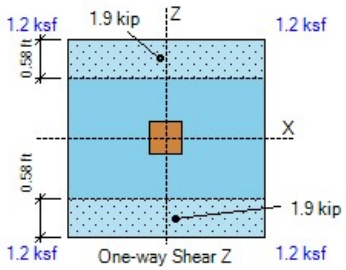
One-way shear Vux (- Side) = 1.9 kip < 11.5 kip OK

One-way shear Vux (+ Side) = 1.9 kip < 11.5 kip OK

One-way shear Vuz (- Side) = 1.9 kip < 11.5 kip OK

One-way shear Vuz (+ Side) = 1.9 kip < 11.5 kip OK





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

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

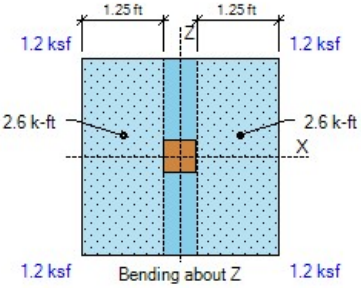
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

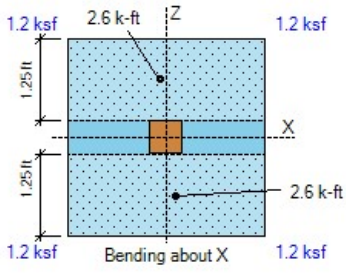
Bottom moment Mux (- Side) = 2.6 k-ft < 4.8 k-ft OK ratio = 0.54

Bottom moment Mux (+ Side) = 2.6 k-ft < 4.8 k-ft OK ratio = 0.54

Bottom moment Muz (- Side) = 2.6 k-ft < 4.8 k-ft OK ratio = 0.54

Bottom moment Muz (+ Side) = 2.6 k-ft < 4.8 k-ft OK ratio = 0.54





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

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 $Pbu = P / A1 + Mz / Sx + Mx / Sz =$ 10.0 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.3 ksi

Min edge = $Min\ (L / 2 - X\text{-}offset - col\ L / 2,\ W / 2 - Z\text{-}offset - col\ W / 2)$

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 > 0.3 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* = 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 = 10.0 + 0.07 * 625.0 / 144 - 1.6 = 8.7 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

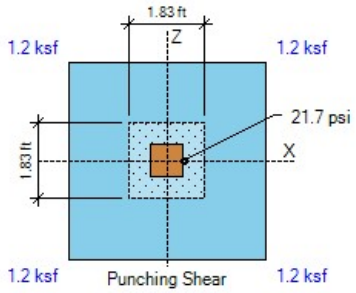
Jcz = 25.0 * 8.0³ / 12 + 25.0³ * 8.0 / 12 + 25.0 * 8.0 * (25.0 / 2 * 6.3)² + 25.0 * 8.0 * 6.3² = 27108 in⁴

Stress due to P = *F / (bo * d) * 1000* = 8.7 / (50.0 * 8.0) * 1000 = 21.7 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* = 21.7 + 0.0 + 0.0 = 21.7 psi < 80.0 psi OK



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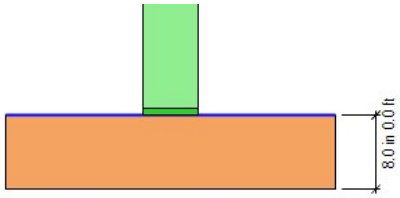
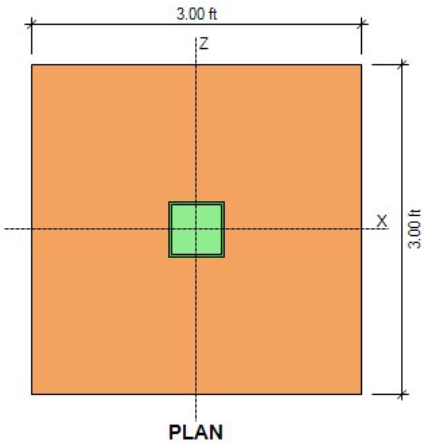


ELEVATION



PLAN

ASDIP Foundation 5.3.1.0

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)

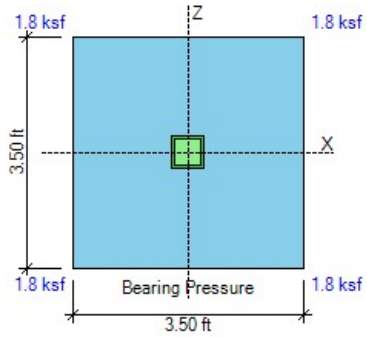
Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft
Resisting moment X-X = 2.1 + 0.0 + 0.0 + -0.9 + 37.1 = 38.4 k-ft
Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft
Resisting moment Z-Z = 2.1 + 0.0 + 0.0 + -0.9 + 37.1 = 38.4 k-ft
Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 1.2 + 0.0 + 0.0 - 0.5 + 21.2 = 21.9 kip
X-coordinate of resultant from maximum bearing corner:

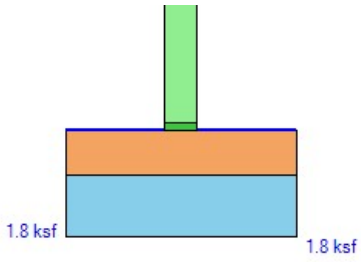
$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{38.4 - 0.0}{21.9} = 1.75 \text{ ft}$$

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





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+0.5S)

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

d Top X-dir = *Thick - Cover - X-diameter / 2* = 8.0 - 2.0 - 0.8 / 2 = 5.6 in

d Top Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 8.0 - 2.0 - 0.8 - 0.8 / 2 = 4.9 in

d Bot X-dir = *Thick - Cover - X-diameter / 2* = 8.0 - 3.0 - 0.5 / 2 = 4.8 in

d Bot Z-dir = *Thick - Cover - X-diameter - Z-diameter / 2* = 8.0 - 3.0 - 0.5 - 0.5 / 2 = 4.3 in

$\phi Vcx = 2 * \phi * \sqrt{f'c} * Width * d / 1000$ = 2 * 0.75 * √(2500) * 3.5 * 12 * 4.8 / 1000 = 15.0 kip ACI Eq. (22.5.5.1)

$\phi Vcz = 2 * \phi * \sqrt{f'c} * Length * d / 1000$ = 2 * 0.75 * √(2500) * 3.5 * 12 * 4.3 / 1000 = 13.4 kip

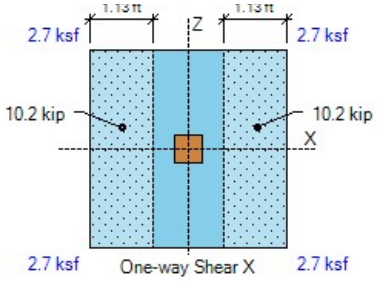
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

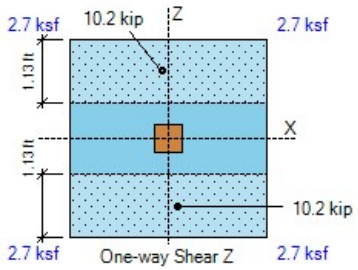
One-way shear Vux (- Side) = 10.2 kip < 15.0 kip OK

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

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

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





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

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

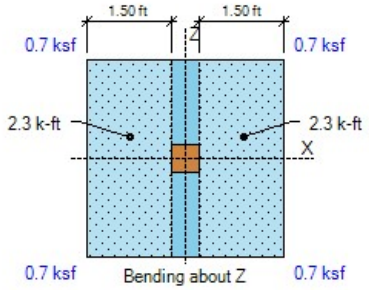
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.85) = 6.0 in

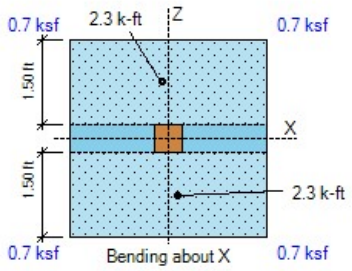
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+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+0.5S)

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

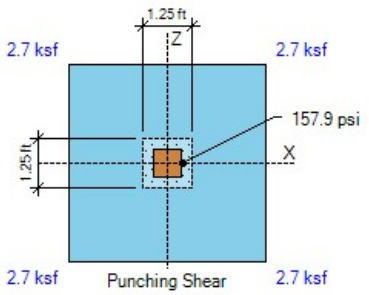
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

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

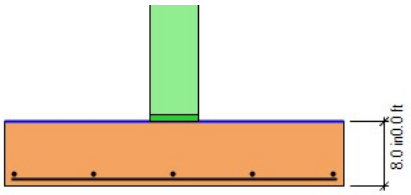
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

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

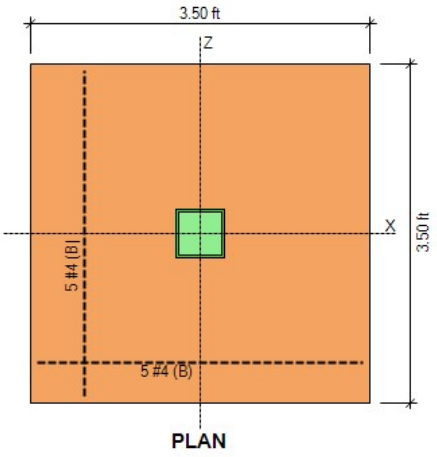


DESIGN CODES

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



ELEVATION



PLAN

ASDIP Foundation 5.3.1.0

SPREAD FOOTING DESIGN

www.asdipsoft.com

GEOMETRY

Footing Length (X-dir)	3.50	ft	
Footing Width (Z-dir)	3.50	ft	
Footing Thickness	8.0	in	OK
Soil Cover	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

Gross Allow. Soil Pressure	2.0	ksf	
Soil Pressure at Corner 1	1.5	ksf	
Soil Pressure at Corner 2	1.5	ksf	
Soil Pressure at Corner 3	1.5	ksf	
Soil Pressure at Corner 4	1.5	ksf	
Bearing Pressure Ratio	0.77		OK
Ftg. Area in Contact with Soil	100.0	%	
X-eccentricity / Ftg. Length	0.00		OK
Z-eccentricity / Ftg. Width	0.00		OK

APPLIED LOADS

	Dead	Live	RLive	Snow	Wind	Seismic	
Axial Force P	4.4	13.7	0.0	0.0	0.0	0.0	kip
Moment about X Mx ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Moment about Z Mz ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Shear Force Vx	0.0	0.0	0.0	0.0	0.0	0.0	kip
Shear Force Vz	0.0	0.0	0.0	0.0	0.0	0.0	kip

OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

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

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

  Arm = *W / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0.6 * (3.50 * 3.50 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 3.50 * 3.50 * 62 * (0.67) = -0.3 kip

  Arm = *W / 2* = 3.50 / 2 = 1.75 ft Moment = 0.3 * 1.75 = -0.5 k-ft
- Axial force P = 0.6 * 4.4 + 0.6 * 0.0 = 2.6 kip

  Arm = *W / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 2.6 * 1.75 = 4.6 k-ft
- Resisting moment X-X = 1.3 + 0.0 + 0.0 + 4.6 + -0.5 = 5.4 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{5.4}{0.0}$ = 53.71 > 1.50 OK

- Overturning about Z-Z
- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip
  Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft
- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 3.50 * 3.50 * 8.0 / 12 * 0.15 = 0.7 kip
  Arm = *L / 2* = 3.50 / 2 = 1.75 ft Moment = 0.7 * 1.75 = 1.3 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip
  Arm = *L / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* = 0.6 * (3.50 * 3.50 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip
  Arm = *L / 2* = 3.50 / 2 = 1.75 ft Moment = 0.0 * 1.75 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 3.50 * 3.50 * 62 * (0.67) = -0.3 kip
  Arm = *L / 2* = 3.50 / 2 = 1.75 ft Moment = 0.3 * 1.75 = -0.5 k-ft
- Axial force P = 0.6 * 4.4 + 0.6 * 0.0 = 2.6 kip
  Arm = *L / 2 - Offset* = 3.50 / 2 - 0.0 / 12 = 1.75 ft Moment = 2.6 * 1.75 = 4.6 k-ft
- Resisting moment Z-Z = 1.3 + 0.0 + 0.0 + 4.6 + -0.5 = 5.4 k-ft
- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{5.4}{0.0}$ = 53.71 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

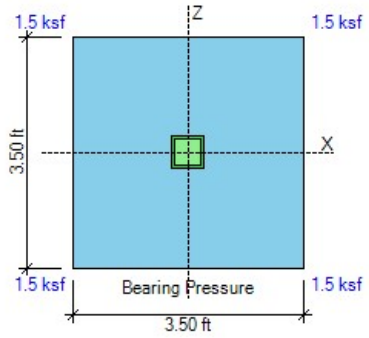
Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft
Resisting moment X-X = 2.1 + 0.0 + 0.0 + -0.9 + 31.7 = 32.9 k-ft
Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft
Resisting moment Z-Z = 2.1 + 0.0 + 0.0 + -0.9 + 31.7 = 32.9 k-ft
Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 1.2 + 0.0 + 0.0 - 0.5 + 18.1 = 18.8 kip
X-coordinate of resultant from maximum bearing corner:

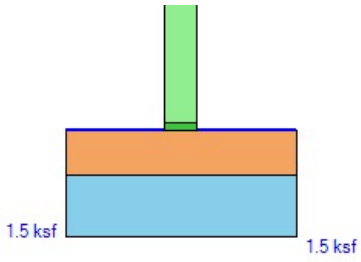
$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{32.9 - 0.0}{18.8} = 1.75 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

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

X-ecc = *Length / 2 - Xp* =3.50 / 2 - 1.75 = 0.00 ft
Z-ecc = *Width / 2 - Zp* = 3.50 / 2 - 1.75 = 0.00 ft
Area = *Width * Length* = 3.50 * 3.50 = 12.3 ft²
Sx = *Length * Width² / 6* = 3.50 * 3.50² / 6 = 7.1 ft³
Sz = *Width * Length² / 6* = 3.50 * 3.50² / 6 = 7.1 ft³
- Footing is in full bearing. Soil pressures are as follows:
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 18.8 * (1 / 12.3 + 0.00 / 7.1 + 0.00 / 7.1) = 1.54 ksf
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 18.8 * (1 / 12.3 - 0.00 / 7.1 + 0.00 / 7.1) = 1.54 ksf
P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 18.8 * (1 / 12.3 - 0.00 / 7.1 - 0.00 / 7.1) = 1.54 ksf
P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 18.8 * (1 / 12.3 + 0.00 / 7.1 - 0.00 / 7.1) = 1.54 ksf





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+0.5S)

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

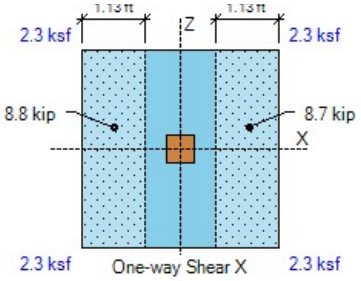
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

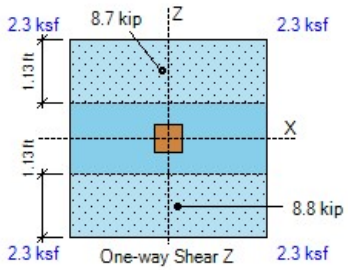
One-way shear Vux (- Side) = 8.8 kip < 15.0 kip OK

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+0.5S)

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

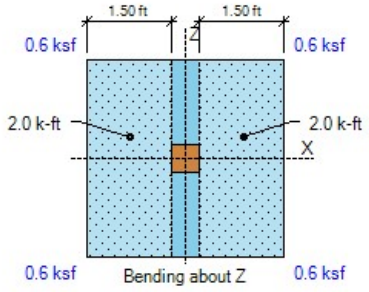
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.73) = 6.0 in

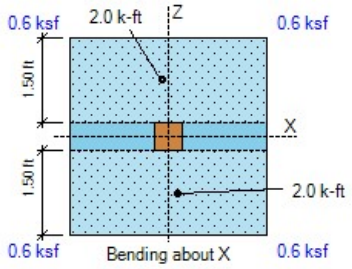
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover* = 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+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+0.5S)

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

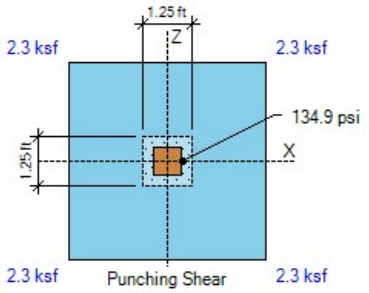
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

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

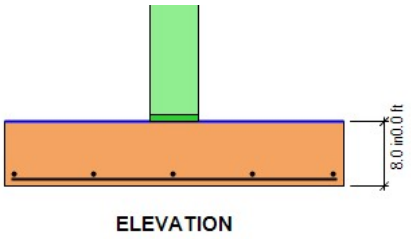
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

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

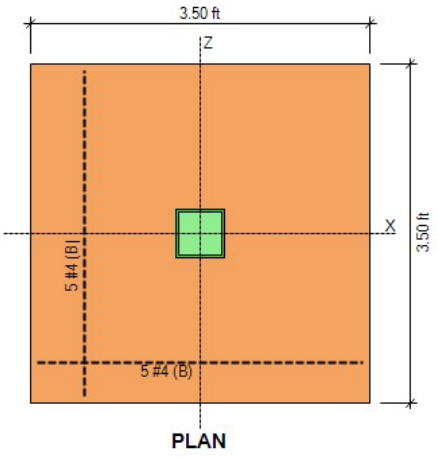


DESIGN CODES

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



ELEVATION



PLAN

ASDIP Foundation 5.3.1.0

SPREAD FOOTING DESIGN

www.asdipsoft.com

GEOMETRY

Footing Length (X-dir)	2.00	ft	
Footing Width (Z-dir)	2.60	ft	
Footing Thickness	8.0	in	OK
Soil Cover	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

Gross Allow. Soil Pressure	2.0	ksf	
Soil Pressure at Corner 1	2.0	ksf	
Soil Pressure at Corner 2	2.0	ksf	
Soil Pressure at Corner 3	2.0	ksf	
Soil Pressure at Corner 4	2.0	ksf	
Bearing Pressure Ratio	0.99		OK
Ftg. Area in Contact with Soil	100.0	%	
X-eccentricity / Ftg. Length	0.00		OK
Z-eccentricity / Ftg. Width	0.00		OK

APPLIED LOADS

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

OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 2.60 * 2.00 * 8.0 / 12 * 0.15 = 0.3 kip

  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.3 * 1.30 = 0.4 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip

  Arm = *W / 2 - Offset* = 2.60 / 2 - 0.0 / 12 = 1.30 ft Moment = 0.0 * 1.30 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0=6 * (2.60 * 2.00 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.0 * 1.30 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 2.60 * 2.00 * 62 * (0.67) = -0.1 kip

  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.1 * 1.30 = -0.2 k-ft
- Axial force P = 0.6 * 4.5 + 0.6 * 0.0 = 2.7 kip

  Arm = *W / 2 - Offset* = 2.60 / 2 - 0.0 / 12 = 1.30 ft Moment = 2.7 * 1.30 = 3.5 k-ft
- Resisting moment X-X = 0.4 + 0.0 + 0.0 + 3.5 + -0.2 = 3.7 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{3.7}{0.0}$ = 37.47 > 1.50 OK

- Overturning about Z-Z
- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip
  Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft
- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 2.60 * 2.00 * 8.0 / 12 * 0.15 = 0.3 kip
  Arm = *L / 2* = 2.00 / 2 = 1.00 ft Moment = 0.3 * 1.00 = 0.3 k-ft
- Pedestal weight = *0.6 * W * L * H * Density* = 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip
  Arm = *L / 2 - Offset* = 2.00 / 2 - 0.0 / 12 = 1.00 ft Moment = 0.0 * 1.00 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* = 0.6 * (2.60 * 2.00 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip
  Arm = *L / 2* = 2.00 / 2 = 1.00 ft Moment = 0.0 * 1.00 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 2.60 * 2.00 * 62 * (0.67) = -0.1 kip
  Arm = *L / 2* = 2.00 / 2 = 1.00 ft Moment = 0.1 * 1.00 = -0.1 k-ft
- Axial force P = 0.6 * 4.5 + 0.6 * 0.0 = 2.7 kip
  Arm = *L / 2 - Offset* = 2.00 / 2 - 0.0 / 12 = 1.00 ft Moment = 2.7 * 1.00 = 2.7 k-ft
- Resisting moment Z-Z = 0.3 + 0.0 + 0.0 + 2.7 + -0.1 = 2.9 k-ft
- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{2.9}{0.0}$ = 28.82 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

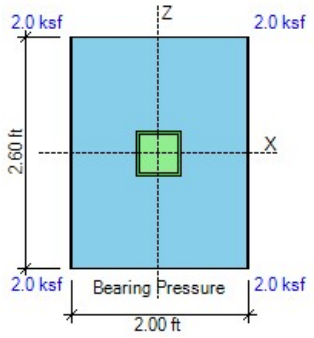
Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft
Resisting moment X-X = 0.7 + 0.0 + 0.0 + -0.3 + 13.0 = 13.4 k-ft
Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft
Resisting moment Z-Z = 0.5 + 0.0 + 0.0 + -0.2 + 10.0 = 10.3 k-ft
Resisting force = *Footing + Pedestal + Soil - Buoyancy + P* = 0.5 + 0.0 + 0.0 - 0.2 + 10.0 = 10.3 kip
X-coordinate of resultant from maximum bearing corner:

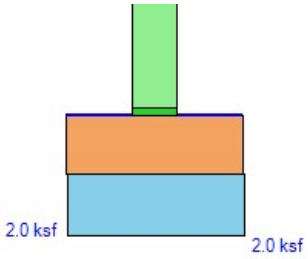
$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{10.3 - 0.0}{10.3} = 1.00 \text{ ft}$$

Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{13.4 - 0.0}{10.3} = 1.30 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =2.00 / 2 - 1.00 = 0.00 ft
Z-ecc = *Width / 2 - Zp* = 2.60 / 2 - 1.30 = 0.00 ft
Area = *Width * Length* = 2.60 * 2.00 = 5.2 ft²
Sx = *Length * Width² / 6* = 2.00 * 2.60² / 6 = 2.3 ft³
Sz = *Width * Length² / 6* = 2.60 * 2.00² / 6 = 1.7 ft³
- Footing is in full bearing. Soil pressures are as follows:
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz)* = 10.3 * (1 / 5.2 + 0.00 / 2.3 + 0.00 / 1.7) = 1.98 ksf
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz)* = 10.3 * (1 / 5.2 - 0.00 / 2.3 + 0.00 / 1.7) = 1.98 ksf
P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz)* = 10.3 * (1 / 5.2 - 0.00 / 2.3 - 0.00 / 1.7) = 1.98 ksf
P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz)* = 10.3 * (1 / 5.2 + 0.00 / 2.3 - 0.00 / 1.7) = 1.98 ksf





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+0.5S)

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

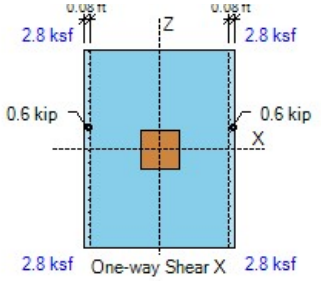
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

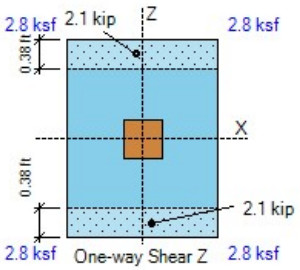
One-way shear Vux (- Side) = 0.6 kip < 10.0 kip OK

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+0.5S)

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

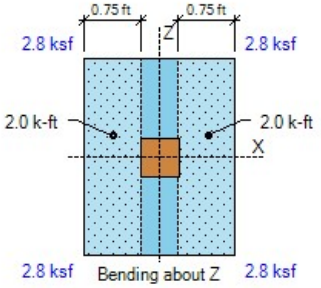
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

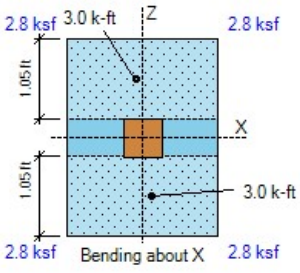
Bottom moment Mux (- Side) = 3.0 k-ft < 3.2 k-ft OK ratio = 0.94

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





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

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

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

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

Bearing $Pbu = P / A1 + Mz / Sx + Mx / Sz =$ 14.2 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.4 ksi

Min edge = $Min\ (L / 2 - X\text{-}offset - col\ L / 2,\ W / 2 - Z\text{-}offset - col\ W / 2)$

Min edge = Min (2.00 * 12 / 2 - 0.0 - 6.0 / 2, 2.60 * 12 / 2 - 0.0 - 6.0 / 2 = 9.0 in

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

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

Footing $\phi Pnc = \phi * 0.85 * f'c * Min\ [2,\ \sqrt{(A2 / A1)}] =$ 0.65 * 0.85 * 2.5 * Min [2, √(576.0 / 36.0)] = 2.8 ksi

Footing $\phi Pns = \phi * As * Fy / A1 =$ 0.0 ksi ACI 22.8.3.2

Footing bearing $\phi Pn = \phi Pnc + \phi Pns =$ 2.8 + 0.0 = 2.8 ksi > 0.4 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.07) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.3 in OK

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

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

X-Edge = *Length / 2 - Offset - Col / 2* = 2.00 * 12 / 2 - 0.0 - 6.0 / 2 = 9.0 in αsx = 10

Z-Edge = *Width / 2 - Offset - Col / 2* = 2.60 * 12 / 2 - 0.0 - 6.0 / 2 = 12.6 in αsz = 10

αs = *αsx + αsz* = 10 + 10 = 20 Col type = Corner β = *L / W* = 6.0 / 6.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 10 / 10 * (6.0 + 8.0 / 2 + 9.0) + 10 / 10 * (6.0 + 8.0 / 2 + 12.6) = 41.6 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (6.0 + 8.0 / 2 + 9.0) * (6.0 + 8.0 / 2 + 12.6) = 429.4 in²

Use Plain Concrete Shear Strength

ϕVc = *ϕ * Min (1 + 2 / β, 2) * 4/3 * √(f'c)* ACI 14.5.5.1

ϕVc = 0.60 * Min (1 + 2 / 1.00, 2) * 4/3 √(2500) = 80.0 psi

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

F = 14.2 + 0.07 * 429.4 / 144 - 3.8 = 10.6 kip

b1 = *L + d / 2 + X-Edge* = 6.0 + 8.0 / 2 + 9.0 = 19.0 in b2 = *W + d / 2 + Z-Edge* = 6.0 + 8.0 / 2 + 12.6 = 22.6 in

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

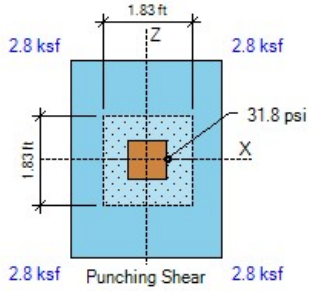
Jcz = 22.6 * 8.0³ / 12 + 22.6³ * 8.0 / 12 + 22.6 * 8.0 * (22.6 / 2 * 6.1)² + 19.0 * 8.0 * 6.1² = 19204 in⁴

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

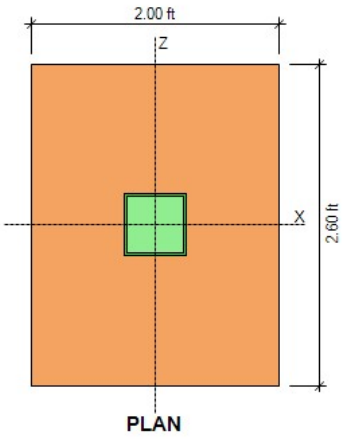
Punching stress = *P-stress + Mx-stress + Mz-stress* = 31.8 + 0.0 + 0.0 = 31.8 psi < 80.0 psi OK



DESIGN CODES

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

ELEVATION



PLAN

ASDIP Foundation 5.3.1.0 **SPREAD FOOTING DESIGN** www.asdipsoft.com

GEOMETRY

Footing Length (X-dir)	1.50	ft	
Footing Width (Z-dir)	2.60	ft	
Footing Thickness	8.0	in	OK
Soil Cover	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

Gross Allow. Soil Pressure	2.0	ksf	
Soil Pressure at Corner 1	2.0	ksf	
Soil Pressure at Corner 2	2.0	ksf	
Soil Pressure at Corner 3	2.0	ksf	
Soil Pressure at Corner 4	2.0	ksf	
Bearing Pressure Ratio	0.99		OK
Ftg. Area in Contact with Soil	100.0	%	
X-eccentricity / Ftg. Length	0.00		OK
Z-eccentricity / Ftg. Width	0.00		OK

APPLIED LOADS

	Dead	Live	RLive	Snow	Wind	Seismic	
Axial Force P	3.0	4.5	0.0	0.0	0.0	0.0	kip
Moment about X Mx ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Moment about Z Mz ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Shear Force Vx	0.0	0.0	0.0	0.0	0.0	0.0	kip
Shear Force Vz	0.0	0.0	0.0	0.0	0.0	0.0	kip

OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density* = 0.6 * 2.60 * 1.50 * 8.0 / 12 * 0.15 = 0.2 kip

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

  Arm = *W / 2 - Offset* = 2.60 / 2 - 0.0 / 12 = 1.30 ft Moment = 0.0 * 1.30 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density* 0=6 * (2.60 * 1.50 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.0 * 1.30 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT)* = 0.6 * 2.60 * 1.50 * 62 * (0.67) = -0.1 kip

  Arm = *W / 2* = 2.60 / 2 = 1.30 ft Moment = 0.1 * 1.30 = -0.1 k-ft
- Axial force P = 0.6 * 3.0 + 0.6 * 0.0 = 1.8 kip

  Arm = *W / 2 - Offset* = 2.60 / 2 - 0.0 / 12 = 1.30 ft Moment = 1.8 * 1.30 = 2.3 k-ft
- Resisting moment X-X = 0.3 + 0.0 + 0.0 + 2.3 + -0.1 = 2.5 k-ft
- Overturning safety factor X-X = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{2.5}{0.0}$ = 25.18 > 1.50 OK

- Overturning about Z-Z
- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip
  Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft
- Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft

- Resisting about Z-Z
- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 2.60 * 1.50 * 8.0 / 12 * 0.15 = 0.2 kip
  Arm = *L / 2 =* 1.50 / 2 = 0.75 ft Moment = 0.2 * 0.75 = 0.2 k-ft
- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip
  Arm = *L / 2 - Offset =* 1.50 / 2 - 0.0 / 12 = 0.75 ft Moment = 0.0 * 0.75 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (2.60 * 1.50 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip
  Arm = *L / 2 =* 1.50 / 2 = 0.75 ft Moment = 0.0 * 0.75 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 2.60 * 1.50 * 62 * (0.67) = -0.1 kip
  Arm = *L / 2 =* 1.50 / 2 = 0.75 ft Moment = 0.1 * 0.75 = -0.1 k-ft
- Axial force P = 0.6 * 3.0 + 0.6 * 0.0 = 1.8 kip
  Arm = *L / 2 - Offset =* 1.50 / 2 - 0.0 / 12 = 0.75 ft Moment = 1.8 * 0.75 = 1.4 k-ft
- Resisting moment Z-Z = 0.2 + 0.0 + 0.0 + 1.4 + -0.1 = 1.5 k-ft
- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{1.5}{0.0}$ = 14.52 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft
Resisting moment X-X = 0.5 + 0.0 + 0.0 + -0.2 + 9.8 = 10.0 k-ft
Overturning moment Z-Z = 0.0 + 0.0 = 0.0 k-ft
Resisting moment Z-Z = 0.3 + 0.0 + 0.0 + -0.1 + 5.6 = 5.8 k-ft
Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 0.4 + 0.0 + 0.0 - 0.2 + 7.5 = 7.7 kip
X-coordinate of resultant from maximum bearing corner:

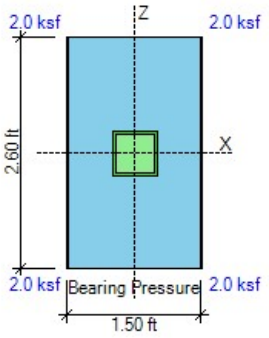
$$Xp = \frac{\textit{Z-Resisting moment - Z-Overturning moment}}{\textit{Resisting force}} = \frac{5.8 - 0.0}{7.7} = 0.75 \text{ ft}$$

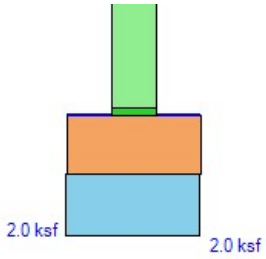
Z-coordinate of resultant from maximum bearing corner:

$$Zp = \frac{\textit{X-Resisting moment - X-Overturning moment}}{\textit{Resisting force}} = \frac{10.0 - 0.0}{7.7} = 1.30 \text{ ft}$$

X-ecc = *Length / 2 - Xp* =1.50 / 2 - 0.75 = 0.00 ft
Z-ecc = *Width / 2 - Zp =* 2.60 / 2 - 1.30 = 0.00 ft
Area = *Width * Length =* 2.60 * 1.50 = 3.9 ft²
Sx = *Length * Width² / 6 =* 1.50 * 2.60² / 6 = 1.7 ft³
Sz = *Width * Length² / 6 =* 2.60 * 1.50² / 6 = 1.0 ft³
- Footing is in full bearing. Soil pressures are as follows:
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 7.7 * (1 / 3.9 + 0.00 / 1.7 + 0.00 / 1.0) = 1.98 ksf
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 7.7 * (1 / 3.9 - 0.00 / 1.7 + 0.00 / 1.0) = 1.98 ksf
P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 7.7 * (1 / 3.9 - 0.00 / 1.7 - 0.00 / 1.0) = 1.98 ksf
P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 7.7 * (1 / 3.9 + 0.00 / 1.7 - 0.00 / 1.0) = 1.98 ksf

ASDIP Foundation 5.3.1.0 **SPREAD FOOTING DESIGN** www.asdipsoft.com





SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33 (per Coulomb)*

Pressure at mid-depth = *kp * Density * (Cover + Thick / 2)* = 4.33 * 110 * (0.00 + 8.0 / 12 / 2) = 0.16 ksf

X-Passive force = *Pressure * Thick * Width* = 0.16 * 8.0 / 12 * 2.60 = 0.3 kip

Z-Passive force = *Pressure * Thick * Length* = 0.16 * 8.0 / 12 * 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+0.5S)

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

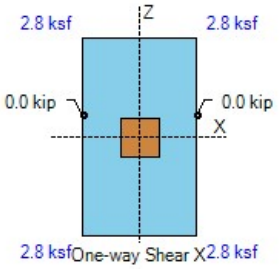
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

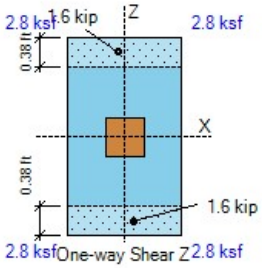
One-way shear Vux (- Side) = 0.0 kip < 10.0 kip OK

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+0.5S)

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

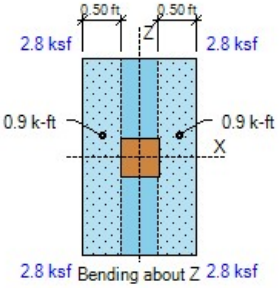
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

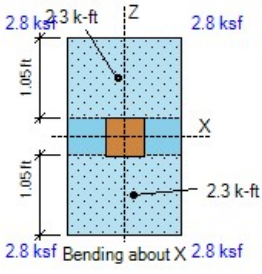
Bottom moment Mux (- Side) = 2.3 k-ft < 2.4 k-ft OK ratio = 0.96

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+0.5S)

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 $Pbu = P / A1 + Mz / Sx + Mx / Sz =$ 10.8 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.3 ksi

Min edge = $Min\ (L / 2 - X\text{-}offset - col\ L / 2,\ W / 2 - Z\text{-}offset - col\ W / 2)$

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 $\phi Pnc = \phi * 0.85 * f'c * Min\ [2,\ \sqrt{(A2 / A1)}] =$ 0.65 * 0.85 * 2.5 * Min [2, √(324.0 / 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 > 0.3 psi OK

Hooked *Ldh = Max (8 db, 6, 0.02 * fy / (f'c)½ * Confining * Location * Concrete * db * ratio)* ACI 25.4.3

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.05) = 6.0 in

Ld provided = *Dowel length* = 3.00 * 12 = 36.0 in > 12.0 in OK

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

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

X-Edge = *Length / 2 - Offset - Col / 2* = 1.50 * 12 / 2 - 0.0 - 6.0 / 2 = 6.0 in αsx = 10

Z-Edge = *Width / 2 - Offset - Col / 2* = 2.60 * 12 / 2 - 0.0 - 6.0 / 2 = 12.6 in αsz = 10

αs = *αsx + αsz* = 10 + 10 = 20 Col type = Corner β = *L / W* = 6.0 / 6.0 = 1.00 ACI 22.6.5.2

Perimeter *bo = αsz / 10 * (L + d / 2 + X-Edge) + αsx / 10 * (W + d / 2 + Z-Edge)* ACI 22.6.4.2

bo = 10 / 10 * (6.0 + 8.0 / 2 + 6.0) + 10 / 10 * (6.0 + 8.0 / 2 + 12.6) = 38.6 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge)* = (6.0 + 8.0 / 2 + 6.0) * (6.0 + 8.0 / 2 + 12.6) = 361.6 in²

Use Plain Concrete Shear Strength

ϕVc = *ϕ * Min (1 + 2 / β, 2) * 4/3 * √(f'c)* ACI 14.5.5.1

ϕVc = 0.60 * Min (1 + 2 / 1.00, 2) * 4/3 √(2500) = 80.0 psi

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

F = 10.8 + 0.07 * 361.6 / 144 - 3.9 = 7.1 kip

b1 = *L + d / 2 + X-Edge* = 6.0 + 8.0 / 2 + 6.0 = 16.0 in b2 = *W + d / 2 + Z-Edge* = 6.0 + 8.0 / 2 + 12.6 = 22.6 in

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

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

X2z = *b1² / 2 / (b1 + b2)* = 16.0² / 2 / (16.0 + 22.6) = 3.3 in X2x = *b2² / 2 / (b2 + b1)* = 6.6 in

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

Jcz = 16.0 * 8.0³ / 12 + 16.0³ * 8.0 / 12 + 16.0 * 8.0 * (16.0 / 2 * 3.3)² + 22.6 * 8.0 * 3.3² = 8210 in⁴

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

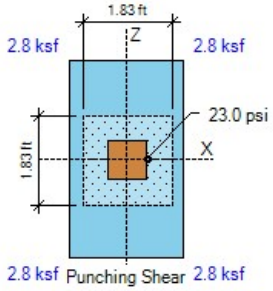
Jcz = 22.6 * 8.0³ / 12 + 22.6³ * 8.0 / 12 + 22.6 * 8.0 * (22.6 / 2 * 6.6)² + 16.0 * 8.0 * 6.6² = 18229 in⁴

Stress due to P = *F / (bo * d) * 1000* = 7.1 / (38.6 * 8.0) * 1000 = 23.0 psi

Stress due to Mx = *γvx * X-OTM * X2x / Jcx* = 0.44 * 0.0 * 12 * 6.6 / 18229 * 1000 = 0.0 psi

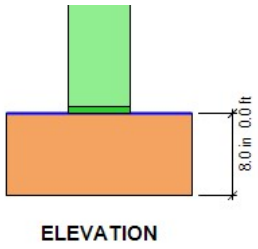
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz* = 0.44 * 0.0 * 12 * 3.3 / 8210 * 1000 = 0.0 psi

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

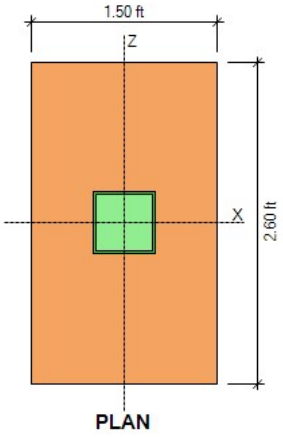


DESIGN CODES

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



ELEVATION



PLAN

WIND $V_{ASD}=95$ MPH $V_{ULT}=110$ MPH EXP. B $K_{zt}=1.0$ SLOPE $=0°$ $34°$
$h=36'$ $\lambda=1.06$

ZONE A: 12.9 PSF × 1.06 = 13.7 PSF → 16.0 PSF MIN

ZONE B: 8.9 PSF × 1.06 = 9.3 PSF

ZONE C: 10.2 PSF × 1.06 = 10.8 PSF → 16.0 PSF MIN

ZONE D: 7.0 PSF × 1.06 = 7.4 PSF → 8.0 PSF MIN

SEISMIC $S_{DS}=0.831$ $R=6.5$ $I_e=1.0$

$$C_s=(0.831/(6.5/1.0))/1.4=0.091$$

$W_{ROOF}=(35\text{PSF}\times 11{,}333\text{SF})=396{,}655^{\#}$	$h=9'$	$h_R=29'$
$W_{LEVEL3}=(40\text{PSF}\times 10{,}229\text{SF})=409{,}160^{\#}$	$h=9'$	$h_3=20'$
$W_{LEVEL2}=(40\text{PSF}\times 10{,}490\text{SF})=419{,}600^{\#}$	$h=9'$	$h_2=10'$
$W_{TOTAL}=$ $1{,}225{,}415^{\#}$		

$V_S=1{,}225{,}415^{\#}\times 0.091=111{,}513^{\#}$ 23,392,305

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

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

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

GRID 1 = 13

$F_{3W} = (16.0 PSF \times 203 SF) + (9.3 PSF \times 1222 SF) + (9.0 PSF \times 74 SF)$ $= 5,055^{\#}$

$F_{3E} = 44,412^{\#} \times (1,538 SF / 11,333 SF)$ $= 6,027^{\#}$

$F_{2W} = 5,055^{\#} + (16.0 PSF \times 239 SF)$ $= 8,863^{\#}$

$F_{2E} = 6,027^{\#} + 38,210^{\#} \times (1,372 SF / 10,229 SF)$ $= 11,152^{\#}$

$F_{1W} = 8,863^{\#} + (16.0 PSF \times 240 SF)$ $= 12,703^{\#}$

$F_{1E} = 11,152^{\#} + 28,891^{\#} \times (1,372 SF / 10,490 SF)$ $= 14,931^{\#}$

GRIDS 4/5 = 8/9

$F_{3W} = (16.0 PSF \times 460 SF) + (8.0 PSF \times 335 SF)$ $= 7,624^{\#}$

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

$F_{2W} = 7,624^{\#} + (16.0 PSF \times 442 SF)$ $= 14,696^{\#}$

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

$F_{1W} = 14,696^{\#} + (16.0 PSF \times 443 SF)$ $= 21,784^{\#}$

$F_{1E} = 16,950^{\#} + 28,891^{\#} \times (2,178 SF / 10,229 SF)$ $= 23,101^{\#}$

GRID 7

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

$F_{3E} = 44,412^{\#} \times (2,777 SF / 11,333 SF)$ $= 10,893^{\#}$

$F_{2W} = 8,416^{\#} + (16.0 PSF \times 417 SF)$ $= 15,009^{\#}$

$F_{2E} = 10,993^{\#} + 38,210^{\#} \times (2,650 SF / 10,229 SF)$ $= 20,782^{\#}$

$F_{1W} = 15,009^{\#} + (16.0 PSF \times 413 SF)$ $= 21,616^{\#}$

$F_{1E} = 20,782^{\#} + 28,991^{\#} \times (2,650 SF / 10,490 SF)$ $= 28,080^{\#}$

GRIDS A-C

$F_{3W} = (16.0PSF \times 179SF) + (9.3PSF \times 111SF) + (8.0PSF \times 43SF)$ $= 4,240^{\#}$

$F_{3E} = 44,412^{\#} \times (2,611SF / 11,333SF)$ $= 10,232^{\#}$

$F_{2W} = 4,240^{\#} + (16.0PSF \times 201SF)$ $= 7,456^{\#}$

$F_{2E} = 10,232^{\#} + 39,210^{\#} \times (2,321SF / 10,229SF)$ $= 18,902^{\#}$

$F_{1W} = 7,456^{\#} + (16.0PSF \times 203SF)$ $= 10,704^{\#}$

$F_{1E} = 18,902^{\#} + 28,891^{\#} \times (2,321SF / 10,490SF)$ $= 25,299^{\#}$

GRID F

$F_{3W} = (16.0PSF \times 244SF)$ $= 3,904^{\#}$

$F_{3E} = 44,412^{\#} \times (5,352SF / 11,333SF)$ $= 20,974^{\#}$

$F_{2W} = 3,904^{\#} + (16.0PSF \times 319SF)$ $= 9,008^{\#}$

$F_{2E} = 20,974^{\#} + 39,210^{\#} \times (5,077SF / 10,229SF)$ $= 39,938^{\#}$

$F_{1W} = 9,009^{\#} + (16.0PSF \times 320SF)$ $= 14,129^{\#}$

$F_{1E} = 39,938^{\#} + 28,891^{\#} \times (5,265SF / 10,490SF)$ $= 54,439^{\#}$

GRIDS J-M

$F_{3W} = (16.0PSF \times 226SF) + (9.3PSF \times 65SF)$ $= 4,221^{\#}$

$F_{3E} = 44,412^{\#} \times (3,370SF / 11,333SF)$ $= 13,206^{\#}$

$F_{2W} = 4,221^{\#} + (16.0PSF \times 174SF)$ $= 7,005^{\#}$

$F_{2E} = 13,206^{\#} + 39,210^{\#} \times (2,883SF / 10,229SF)$ $= 23,782^{\#}$

$F_{1W} = 7,005^{\#} + (16.0PSF \times 174SF)$ $= 9,789^{\#}$

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

GRID 1 (LEVEL 3) F_E = 6,027 # 5 SEGMENTS L=4'-4" h=9'
L=4'-8"
L=4'-2"
L=4'-4"
L=10'-6"
L_T = 28'-2"

V_E = 6,027 #/28.17' = 214 PLF

USE W1 $V_{E\,Allow}$ = 242 PLF × (1.25 − 0.125 × 9'/4.08') = 236 PLF

HOLD DOWNS

T_E = 214 PLF × 9' × 1.25 − ½(15PSF × 1' × 2.04') − ½(12PSF × 4.5' × 2.04') = 2,337 #

USE MST 48 w/ 2 STUDS $T_{E\,Allow}$ = 3,425 # × 1.4/1.6 = 2,997 #

GRID 1 (LEVEL 2) F_E = 11,152 # 5 SEGMENTS L_T = 28'-2" h=9'

V_E = 11,152 #/28.17' = 396 PLF

USE W3 $V_{E\,Allow}$ = 456 PLF × (1.25 − 0.125 × 9'/4.08') = 442 PLF

HOLD DOWNS

T_E = 396 PLF × 9' × 1.25 + 2337 # − ½(15PSF × 6' × 20') − ½(12PSF × 9' × 2.04') = 6,590 #

USE CMST 12 w/ 2 STUDS T_E = 9215 # × 1.4/1.6 = 8,063 #

GRID 1 (LEVEL 1) F_E = 14,931 # 5 SEGMENTS L_T = 28'-2" h=9'

V_E 14,931 #/28.17' = 530 PLF

USE W4 $V_{E\,Allow}$ = 353 PLF × (1.25 − 0.125 × 9'/4.08') = 577 PLF

HOLD DOWNS

T_E = 530 PLF × 9' × 1.25 + 6,590 # − ½(15PSF × 6' × 20') − ½(12PSF × 9' × 2.04') = 12,351 #

USE HDU14-SDS2.5 w/ 4 OF #2 STUDS $T_{E\,Allow}$ = 14,445 # × 1.4/1.6 = 12,639 #

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

$V_E = 9{,}299\#/55.33' = 168$ PLF

USE W1 $V_{ALLOW} = 242$ PLF

HOLD DOWNS

$T_E = 168\text{PLF} \times 9' \times 1.25 - \frac{1}{2}(15\text{PSF} \times 2' \times 12.33') - \frac{1}{2}(12\text{PSF} \times 4.5' \times 12.33') = 1{,}382\#$

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

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

$V_E = 16{,}950\#/55.33' = 306$ PLF

USE W2 $V_{ALLOW} = 353$ PLF

HOLD DOWNS

$T_E = 306\text{PLF} \times 9' \times 1.25 + 1{,}382\# - \frac{1}{2}(15\text{PSF} \times 5.7' \times 12.33') - \frac{1}{2}(12\text{PSF} \times 9' \times 12.33') = 3{,}587\#$

USE MST60W w/ 2 STUDS $T_{ALLOW} = 5{,}405\# \times 1.4/1.6 = 4{,}729\#$

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

$V_E = 23{,}101\#/55.33' = 418$ PLF

USE W3 $V_{ALLOW} = 456$ PLF

HOLD DOWNS

$T_E = 418\text{PLF} \times 9' \times 1.25 + 3{,}587\# - \frac{1}{2}(15\text{PSF} \times 5.7' \times 12.33') - \frac{1}{2}(12\text{PSF} \times 9' \times 12.33') = 7{,}043\#$

USE HDU14-SDS25 w/ 3 STUDS $T_{ALLOW} = 9{,}260\# \times 1.4/1.6 = 8{,}103\#$

GRID 7 (LEVEL 3) $F_E = 10,883^{\#}$ 2 SEGMENTS $L = 27'-4"$ $h = 9'$
$L = 29'-9"$
$L_T = 57'-1"$

$v_E = 10,883^{\#} / 57.08' = 191 \text{ plf}$

USE W1 $v_{allow} = 242 \text{ plf}$

HOLD DOWNS

$T_E = 191 \text{ plf} \times 9' \times 1.25 - 1/2(15 \text{ psf} \times 1' \times 13.67') = 2,042^{\#}$

USE (2) HDU4-SDS2.5 w/ 2 STUDS $T_{allow} = 3,285^{\#} \times 1.4/1.6 = 2,874^{\#}$

GRID 7 (LEVEL 2) $F_E = 20,782^{\#}$ 2 SEGMENTS $L = 57'-1"$ $h = 9'$

$v_E = 20,782^{\#} / 57.08' = 364 \text{ plf}$

USE W3 $v_{allow} = 456 \text{ plf}$

HOLD DOWNS

$T_E = 364 \text{ plf} \times 9' \times 1.25 + 2042^{\#} - 1/2(15 \text{ psf} \times 6.83' \times 13.67') = 5,438^{\#}$

USE (2) HDU8-SDS2.5 w/ 3 STUDS $T_{allow} = 6,580^{\#} \times 1.4/1.6 = 5,758^{\#}$

GRID 7 (LEVEL 1) $F_E = 28,080^{\#}$ 2 SEGMENTS $L_T = 57'-1"$ $h = 9'$

$v_E = 28,080^{\#} / 57.09' = 492 \text{ plf}$

USE W4 $v_{allow} = 595 \text{ plf}$

HOLD DOWNS

$T_E = 492 \text{ plf} \times 9' \times 1.25 + 5,438^{\#} - 1/2(15 \text{ psf} \times 6.83' \times 13.67') = 10,272^{\#}$

USE HDU14-SDS2.5 w/ 4 STUDS $T_{allow} = 12,425^{\#} \times 1.4/1.6 = 10,872^{\#}$

GRID B (LEVEL 3) FE = 6,027# 5 SEGMENTS L=4'-7" L=4'-8" L=4'-2" L=4'-9" L=10'-6" LT = 28'-8" h=9'

VE = 6,027#/28.67' = 210 PLF

USE W1 VERALLOW = 242 PLF x (1.25 - 0.125 x 9'/4.17') = 237 PLF

HOLD DOWNS

TE = 210 PLF x 9' x (1.25 - 1/2(15 PSF x 1' x 2.08') - 1/2(12 PSF x 4.5' x 2.08') = 2,291#

USE MST48 w/ 2 STUDS TERALLOW = 3,425# x 1.4/1.6 = 2997#

GRID 13 (LEVEL 2) FE = 11,152# 5 SEGMENTS LT = 28'-8" h=9'

VE = 11,152#/28.67' = 389 PLF

USE W3 VERALLOW = 456 PLF x (1.25 - 0.125 x 9'/4.17') = 447 PLF

HOLD DOWNS

TE = 389 PLF x 9' x 1.25 + 2,291# - 1/2(15 PSF x 6' x 2.08') - 1/2(12 PSF x 9' x 2.08') = 6,461#

USE CMST 12 w/ 2 STUDS TERALLOW = 9,215# x 1.4/1.6 = 8,063#

GRID 13 (LEVEL 1) FE = 14,931# 5 SEGMENTS LT = 28'-8" h=9'

VE = 14,931#/28.67' = 521 PLF

USE W4 VERALLOW = 595 PLF x (1.25 - 0.125 x 9'/4.17') = 583 PLF

HOLD DOWNS

TE = 521 PLF x 9' x 1.25 + 6,461# - 1/2(15 PSF x 6' x 2.08') - 1/2(12 PSF x 9' x 2.08') = 12,116#

USE HDU14-SDS2.5 w/ (4 OF #2 STUDS) TERALLOW = 19,445# x 1.4/1.6 = 12,639#

0956

GRIDS A-C (LEVEL 3) $F_E = 10,232^{\#}$ 13 SEGMENTS $L = 3'-10"$ $L = 5'-10"$ $h = 9'$
$L = 9'-2"$ $L = 3'-11"$
$L = 3'-11"$ $L = 8'-7"$
$L = 8'-7"$ $L = 3'-11"$
$L = 3'-11"$ $L = 9'-2"$
$L = 5'-10"$ $L = 3'-10"$
$L = 5'-7"$
$L_T = 75'-7"$

$v_E = 10,232^{\#} / 75.58' = 135 PLF$

USE W1 $v_E = 242 PLF \times (1.25 - 0.125 \times 9'/3.93') = 231 PLF$

HOLD DOWNS

$T_E = 135 PLF \times 9' \times 1.25 - 1/2(25 PSF \times 2' \times 1.92') - 1/2(12 PSF \times 4.5' \times 1.92') = 1,419^{\#}$

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

GRIDS A-C (LEVEL 2) $F_E = 18,902^{\#}$ 13 SEGMENTS $L_T = 75'-7"$ $h = 9'$

$v_E = 18,902^{\#} / 75.58' = 250 PLF$

USE W2 $v_{ALLOW} = 353 PLF \times (1.25 - 0.125 \times 9'/3.93') = 337 PLF$

HOLD DOWNS

$T_E = 250 PLF \times 9' \times 1.25 + 1,419^{\#} - 1/2(12 PSF \times 9' \times 1.92') = 4,128^{\#}$

USE MST60 w/2 STUDS $T_{ALLOW} = 5,405^{\#} \times 1.4/1.6 = 4,729^{\#}$

GRIDS A-C (LEVEL 1) $F_E = 25,294^{\#}$ 13 SEGMENTS $L_T = 75'-7"$ $h = 9'$

$v_E = 25,294^{\#} / 75.58' = 335 PLF$

USE W2 $v_{ALLOW} = 353 PLF \times (1.25 - 0.125 \times 9'/3.93') = 337 PLF$

HOLD DOWNS

$T_E = 335 PLF \times 9' \times 1.25 + 4,128^{\#} - 1/2(12 PSF \times 9' \times 1.92') = 7,789^{\#}$

USE HDU14-SDS7.5 w/ 3 STUDS $T_{ALLOW} = 9,260^{\#} \times 1.4/1.6 = 8,103^{\#}$

GRID F (LEVEL 3) FE = 20,974# 4 SEGMENTS L = 30'-4" h=9'
L = 15'-8"
L = 15'-8"
L = 30'-4"
LT = 92'-0"

VE = 20,974#/92' = 228 PLF

USE W1 VEALLOW = 242 PLF

HOLD DOWNS

TE = 228 PLF x 9' x 1.25 - 1/2(25 PSF x 16.25' x 7.33') - 1/2(12 PSF x 4.5' x 7.33') = 714#

USE MST37 w/ 2 STUDS — TEALLOW = 2,140# x 1.4/1.6 = 1,873#
OR (2) HDU2-SDS2.5 w/ 2 STUDS — TEALLOW = 2,215# x 1.4/1.6 = 2,067#

GRID F (LEVEL 2) FE = 39,939# 4 SEGMENTS LT = 92'-0" h=9'

VE = 39,939#/92' = 434 PLF

USE W3 VEALLOW = 456 PLF

HOLD DOWNS

TE = 434 PLF x 9' x 1.25 + 714# = 5,598#

USE MST72 w/ 2 STUDS — TEALLOW = 6,475# x 1.4/1.6 = 5,666#
OR (2) HDU8-SDS2.5 w/ 3 STUDS — TEALLOW = 6580# x 1.4/1.6 = 5,758#

GRID F (LEVEL 1) FE = 54,439# 4 SEGMENTS LT = 92'-0" h=9'

VE = 54,439#/92' = 592 PLF

USE W4 VEALLOW = 595 PLF

HOLD DOWNS

TE = 592 PLF x 9' x 1.25 + 5,599# = 12,255#

USE HDU14-SDS2.5 w/ 4 OF #2 STUDS — TEALLOW = 14,445# x 1.4/1.6 = 12,639#

GRIDS J-M (LEVEL 3) FE = 13,206# 14 SEGMENTS

L=7'-7" L=6'-11"
L=9'-2" L=3'-3" h=9'
L=4'-7" L=2'-11"
L=4'-0" L=3'-2"
L=3'-2" L=3'-11"
L=2'-11" L=4'-7"
L=3'-3" L=9'-2"
L_T = 68'-7"

V_E = 13,206#/68.58' = 193 plf

USE W1 V_{ALLOW} = 242 plf x (1.25 - 0.125 x 9'/2.92') = 209 plf

HOLD DOWNS

T_{ALLOW} = 193 plf x 9' x 1.25 - ½(250 psf x 2' x 1.46') - ½(120 psf x 4.5' x 1.46') = 2,095#

USE MST48 W/ 2STUDS T_{ALLOW} = 3,425# x 1.4/1.6 = 2997#

GRIDS J-M (LEVEL 2) FE = 23,782# 14 SEGMENTS L_T = 69'-7" h = 9'

V_E = 23,782#/68.58' = 347 plf

USE W3 V_{ALLOW} = 456 plf x (1.25 - 0.125 x 9'/2.92') = 394 plf

HOLD DOWNS

T_E = 347 plf x 9' x 1.25 + 2,095# - ½(120 psf x 9' x 1.46') = 5,920#

USE CMST12 W/ 2STUDS T_{ALLOW} = 9,215# x 1.4/1.6 = 8,063#

GRIDS J-M (LEVEL 1) FE = 31,780# 14 SEGMENTS L_T = 69'-7" h = 9'

V_E = 31,780#/68.58' = 463 plf

USE W4 V_{ALLOW} = 595 plf x (1.25 - 0.125 x 9'/2.92') = 515 plf

HOLD DOWNS

T_{ALLOW} = 463 plf x 9' x 1.25 + 5,920# - ½(120 psf x 9' x 1.46') = 11,054#

USE HDU14-SDS2.5 W/ 4 DFTA2 STUDS T_{ALLOW} = 14,445# x 1.4/1.6 = 12,639#

Force Transfer Around Openings Calculator

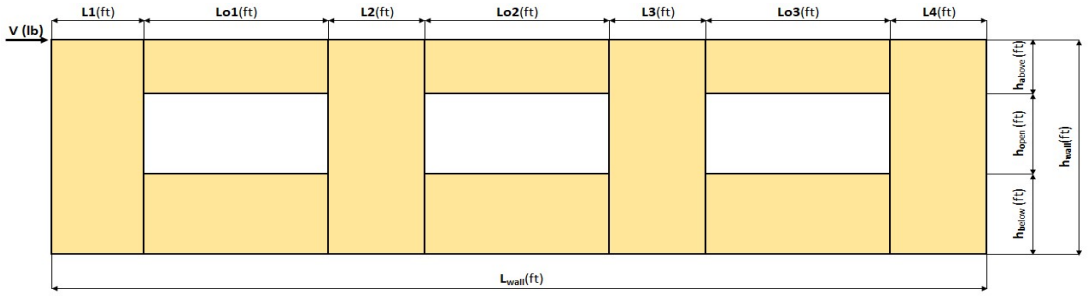
THREE OPENINGS

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:	7051 Portland Ave Apartments
Wall Line:	Grid 1 (B-C) Level 3 Seismic

Date: 7/6/2024



Shear Wall Calculation Variables

V	3675 lbf		Opening 1		Opening 2		Opening 3	Adj. Factor Method =	2bs/h
L1	2.20 ft	h_a1	1.80 ft	h_a2	1.80 ft	h_a3	1.80 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	1.53 ft	h_o1	4.00 ft	h_o2	4.00 ft	h_o3	4.00 ft	P1=h_o/L1= 1.82	N/A
L3	5.87 ft	h_b1	3.20 ft	h_b2	3.20 ft	h_b3	3.20 ft	P2=h_o/L2= 2.61	0.765
L4	3.69 ft	Lo1	5.00 ft	Lo2	5.00 ft	Lo3	2.54 ft	P3=h_o/L3= 0.68	N/A
h_{wall}	9.00 ft							P4=h_o/L4= 1.08	N/A
L_{wall}	25.83 ft								

Note to Designer: 2021 Special Design Provisions for Wind and Seismic (SDPWS) limits wall pier widths to 24 inches, but APA testing successfully utilized blocked pier widths as narrow as 18 inches.

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1280 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	256 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	256 plf
Third opening: va3 = vb3 = H/(h_a3+h_b3) =	256 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	1280 lbf
Second opening: O2 = va2 x (Lo2) =	1280 lbf
Third opening: O3 = va3 x (Lo3) =	650 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	755 lbf
F2 = O1(L2)/(L1+L2) =	525 lbf
F3 = O2(L2)/(L2+L3) =	265 lbf
F4 = O2(L3)/(L2+L3) =	1016 lbf
F5 = O3(L3)/(L3+L4) =	399 lbf
F6 = O3(L4)/(L3+L4) =	251 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	2.95 ft
T2 = (L2*Lo1)/(L1+L2) =	2.05 ft
T3 = (L2*Lo2)/(L2+L3) =	1.03 ft
T4 = (L3*Lo2)/(L2+L3) =	3.97 ft
T5 = (L3*Lo3)/(L3+L4) =	1.56 ft
T6 = (L4*Lo3)/(L3+L4) =	0.98 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	333 plf
v2 = (V/L)(T2+L2+T3)/L2 =	429 plf
v3 = (V/L)(T4+L3+T5)/L3 =	276 plf
v4 = (V/L)(T6+L4)/L4 =	180 plf
Check v1*L1+v2*L2+v3*L3+v4*L4=V?	3675 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 =	733 lbf
R2 = v2*L2 =	657 lbf
R3 = v3*L3 =	1621 lbf
R4 = v4*L4 =	664 lbf

8. Difference corner force + resistance

R1-F1 =	-23 lbf
R2-F2-F3 =	-133 lbf
R3-F4-F5 =	206 lbf
R4-F6 =	413 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	-10 plf
vc2 = (R2-F2-F3)/L2 =	-87 plf
vc3 = (R3-F4-F5)/L3 =	35 plf
vc4 = (R4-F6)/L4 =	112 plf

Project Information

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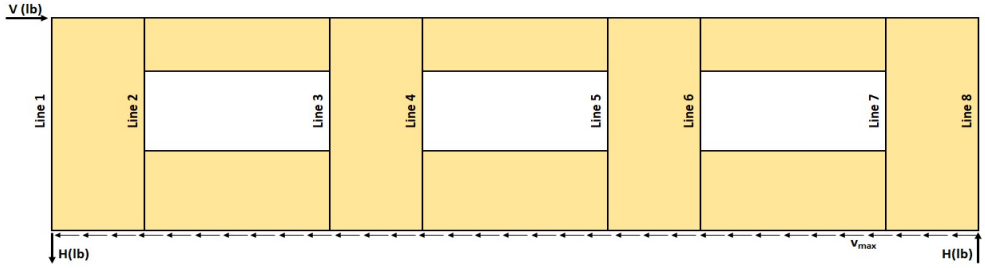

Check Summary of Shear Values for Three Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H$?		-51	1332	1280 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0$?	1280	-51	1332	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0$?	-436	1717	1280	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0$?	1280	1717	-436	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0$?	1280	176	1105	0
Line 6: $va3(h_a3+h_b3)-v3(h_o3)-vc3(h_a3+h_b3)=0$?	1280	1105	176	0
Line 7: $va3(h_a3+h_b3)-vc4(h_a3+h_b3)-v4(h_o3)=0$?	1280	560	720	0
Line 8: $vc4(h_a3+h_b3)+v4(h_o3)=H$?		560	720	1280 lbf

Design Summary*

Req. Sheathing Capacity	561 plf **	**4-Term Deflection**	0.176 in.	**3-Term Deflection**	0.189 in.
Req. Strap Force	1016 lbf	**4-Term Story Drift %**	0.007 %	**3-Term Story Drift %**	0.007 %
Req. HD Force (H)	1280 lbf				
Req. Shear Wall Anchorage Force (v_{max})	142 plf				

****Req. Sheathing Capacity has been adjusted per the Aspect Ratio Adjustment Factor**

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

Project Information

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Client:			
Project:	7051 Portland Ave Apartments		
Wall Line:	Grid 1 (B-C) Level 3 Seismic		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2142 (lbf)

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

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1500000 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 4	
Nail Spacing:	2	2	(in.)
HD Capacity:	1873	1873	(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	Pier 4-L	Pier 4-R	
$v_{unfactored}$:	194	194	250	250	161	161	105	105	(plf)
E:	1.50E+06	1.50E+06	1.50E+06	1.50E+06	1.50E+06	1.50E+06	1.50E+06	1.50E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	5.80	5.80	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:									($in.^2$)
A:	16.5	16.5	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	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	2	2	2	2	(in.)
V_n:	32	32	42	42	27	27	17	17	(plf)
e_n:	0.0002	0.0002	0.0004	0.0004	0.0001	0.0001	0.0000	0.0000	(in.)
b:	2.20	2.20	1.53	1.53	5.87	5.87	3.69	3.69	(ft)
HD Capacity:	1873	1873	1873	1873	1873	1873	1873	1873	(lbf)
HD Defl:	0.088	0.088	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
0.021	0.021	0.001	0.336	0.006	0.013	0.001	0.139
		Sum	0.379			Sum	0.159
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
0.010	0.017	0.002	0.258	0.010	0.017	0.002	0.258
		Sum	0.288			Sum	0.288
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
0.002	0.011	0.000	0.043	0.002	0.011	0.000	0.043
		Sum	0.057			Sum	0.057
Pier 4 (left)				Pier 4 (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	0.007	0.000	0.045	0.007	0.011	0.000	0.108
		Sum	0.054			Sum	0.126

Total Defl.	
0.176	(in.)
0.0065	%drift

Project Information

Code:	IBC 2021	**Date:**	7/6/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	7051 Portland Ave Apartments		
Wall Line:	Grid 1 (B-C) Level 3 Seismic		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2142 (lbf)

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

G_t Override:
G_a Override:

Wood End Post Values:
Species: HF#2
E: 1.50E+06 (psi)

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 4	
Nail Spacing:	2	2	(in.)
HD Capacity:	1873	1873	(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	Pier 4-L	Pier 4-R	
$v_{unfactored}$:	194	194	250	250	161	161	105	105	(plf)
E:	1.50E+06	1.50E+06	1.50E+06	1.50E+06	1.50E+06	1.50E+06	1.50E+06	1.50E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	5.80	5.80	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	2	2.00	2	2.00	
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6	2x6	2x6	
A Override:									($in.^2$)
A:	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
G_a:	42	42	42	42	42	42	42	42	(kips/in.)
b:	2.20	2.20	1.53	1.53	5.87	5.87	3.69	3.69	(ft)
HD Capacity:	1873	1873	1873	1873	1873	1873	1873	1873	(lbf)
HD Defl:	0.088	0.088	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
0.021	0.042	0.336	0.006	0.027	0.139
	Sum	0.398		Sum	0.172
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.010	0.035	0.258	0.010	0.035	0.258
	Sum	0.303		Sum	0.303
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.002	0.022	0.043	0.002	0.022	0.043
	Sum	0.067		Sum	0.067
Pier 4 (left)			Pier 4 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.002	0.014	0.045	0.007	0.022	0.108
	Sum	0.061		Sum	0.137

Total Defl.	
0.189	(in.)
0.0070	%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

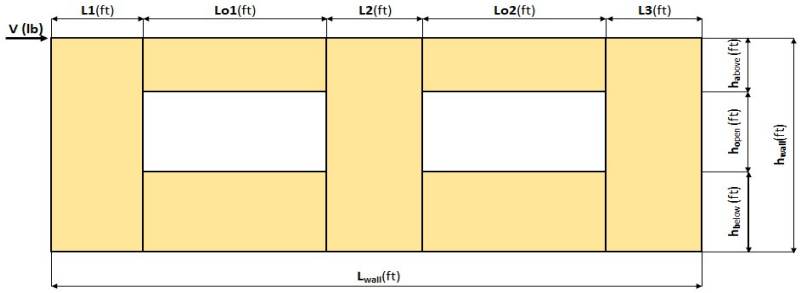
TWO OPENINGS

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
V	3255 lbf				
L1	3.18 ft	h_a1	1.00 ft	h_a2	1.00 ft
L2	7.14 ft	h_o1	5.00 ft	h_o2	5.00 ft
L3	3.18 ft	h_b1	3.20 ft	h_b2	3.20 ft
h_{wall}	9.20 ft	Lo1	6.00 ft	Lo2	6.00 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: $H = Vh_{wall}/L_{wall}$ 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

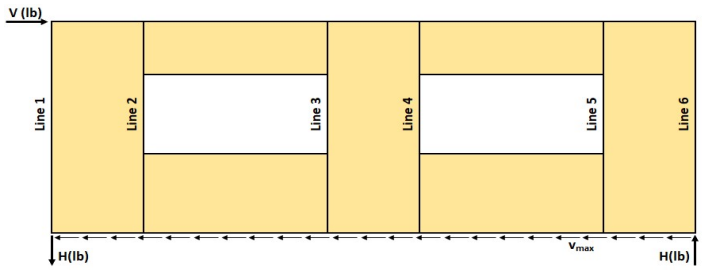
R1 = v1*L1 =	642 lbf
R2 = v2*L2 =	1971 lbf
R3 = v3*L3 =	642 lbf

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

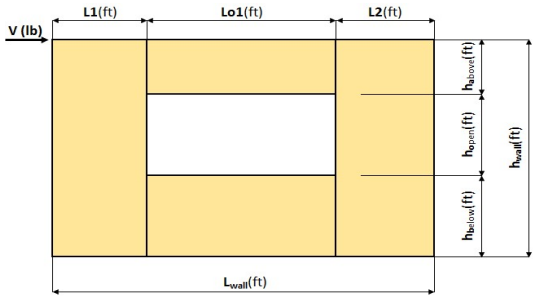
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (23'-10" Section) - (Level 3 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	2390 lbf	Opening 1	
L1	3.31 ft	h_a	1.00 ft
L2	14.52 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	23.83 ft	Lo1	6.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.51	N/A
P2=h_o/L2=	0.34	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 903 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 226 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1354 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 251 lbf

F2 = O1(L2)/(L1+L2) = 1103 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.11 ft

T2 = (L2*Lo1)/(L1+L2) = 4.89 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 134 plf

v2 = (V/L)(T2+L2)/L2 = 134 plf

Check v1*L1+v2*L2=V? 2390 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 444 lbf

R2 = v2*L2 = 1946 lbf

8. Difference corner force + resistance

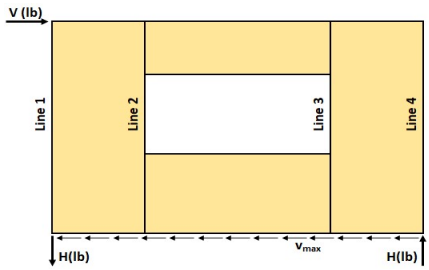
R1-F1 = 192 lbf

R2-F2 = 844 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 58 plf

vc2 = (R2-F2)/L2 = 58 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		232	670	903 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	903	232	670	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	903	232	670	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		232	670	903 lbf

Design Summary*

Req. Sheathing Capacity	226 plf	**4-Term Deflection**	0.100 in.	**3-Term Deflection**	0.146 in.
Req. Strap Force	1103 lbf	**4-Term Story Drift %**	0.004 %	**3-Term Story Drift %**	0.005 %
Req. HD Force (H)	903 lbf				
Req. Shear Wall Anchorage Force (v_{max})	100 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (23'-10" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2390 (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:	2140	2140	(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	
$v_{unfactored}$:	134	134	134	134	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	67	67	67	67	(plf)
e_n:	0.0015	0.0015	0.0015	0.0015	(in.)
b:	3.31	3.31	14.52	14.52	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.011	0.014	0.010	0.169	0.003	0.010	0.007	0.075
		Sum	0.204			Sum	0.095
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
0.001	0.010	0.007	0.017	0.003	0.014	0.010	0.038
		Sum	0.034			Sum	0.065

Total Defl.	
0.100	(in.)
0.0037	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (23'-10" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2390 (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:	2140	2140	(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	
$v_{unfactored}$:	134	134	134	134	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	3.31	3.31	14.52	14.52	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.011	0.080	0.169	0.003	0.054	0.075
	Sum	0.260		Sum	0.132
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.001	0.054	0.017	0.003	0.080	0.038
	Sum	0.071		Sum	0.121

Total Defl.	
0.146	(in.)
0.0054	%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

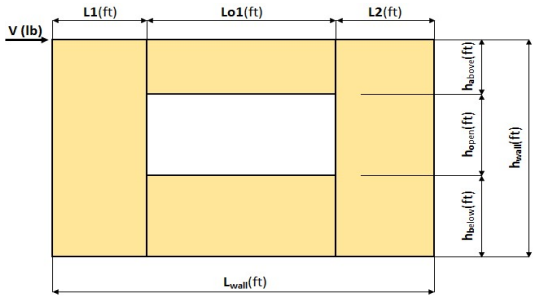
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (23'-10" Section) - (Level 2 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	4430 lbf	Opening 1	
L1	3.31 ft	h_a	1.00 ft
L2	14.52 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	23.83 ft	Lo1	6.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.51	N/A
P2=h_o/L2=	0.34	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1673 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 418 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2510 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 466 lbf

F2 = O1(L2)/(L1+L2) = 2044 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.11 ft

T2 = (L2*Lo1)/(L1+L2) = 4.89 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 248 plf

v2 = (V/L)(T2+L2)/L2 = 248 plf

Check v1*L1+v2*L2=V? 4430 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 822 lbf

R2 = v2*L2 = 3608 lbf

8. Difference corner force + resistance

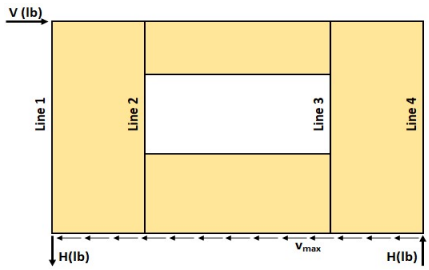
R1-F1 = 356 lbf

R2-F2 = 1564 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?		431	1242	1673 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1673	431	1242	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1673	431	1242	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		431	1242	1673 lbf

Design Summary*

Req. Sheathing Capacity	418 plf	**4-Term Deflection**	0.176 in.	**3-Term Deflection**	0.213 in.
Req. Strap Force	2044 lbf	**4-Term Story Drift %**	0.007 %	**3-Term Story Drift %**	0.008 %
Req. HD Force (H)	1673 lbf				
Req. Shear Wall Anchorage Force (v_{max})	186 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (23'-10" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4430 (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:	2140	2140	(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	
$v_{unfactored}$:	248	248	248	248	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	62	62	62	62	(plf)
e_n:	0.0012	0.0012	0.0012	0.0012	(in.)
b:	3.31	3.31	14.52	14.52	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.020	0.027	0.008	0.313	0.006	0.018	0.005	0.139
		Sum	0.368			Sum	0.168
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
0.001	0.018	0.005	0.032	0.005	0.027	0.008	0.071
		Sum	0.056			Sum	0.111

Total Defl.	
0.176	(in.)
0.0065	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (23'-10" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4430 (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 2	
Nail Spacing:	3	3	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	248	248	248	248	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	3.31	3.31	14.52	14.52	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.020	0.080	0.313	0.006	0.053	0.139
	Sum	0.413		Sum	0.198
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.001	0.053	0.032	0.005	0.080	0.071
	Sum	0.086		Sum	0.156

Total Defl.	
0.213	(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

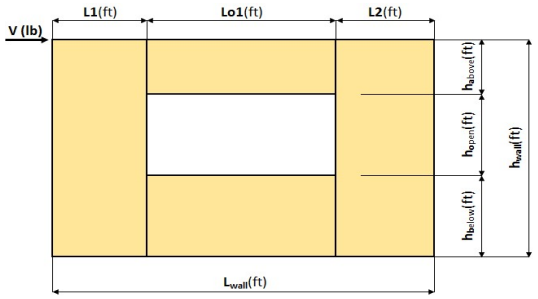
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (23'-10" Section) - (Level 1 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	5940 lbf	Opening 1		Adj. Factor Method =	2bs/h
L1	3.31 ft	h_a	1.00 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	14.52 ft	h_o	5.00 ft	P1=h_o/L1= 1.51	N/A
h_{wall}	9.00 ft	h_b	3.00 ft	P2=h_o/L2= 0.34	N/A
L_{wall}	23.83 ft	Lo1	6.00 ft		

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2243 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 561 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 3365 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 625 lbf

F2 = O1(L2)/(L1+L2) = 2740 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.11 ft

T2 = (L2*Lo1)/(L1+L2) = 4.89 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 333 plf

v2 = (V/L)(T2+L2)/L2 = 333 plf

Check v1*L1+v2*L2=V? 5940 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1103 lbf

R2 = v2*L2 = 4837 lbf

8. Difference corner force + resistance

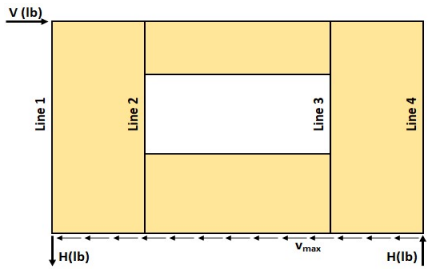
R1-F1 = 478 lbf

R2-F2 = 2097 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 144 plf

vc2 = (R2-F2)/L2 = 144 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		578	1666	2243 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2243	578	1666	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2243	578	1666	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		578	1666	2243 lbf

Design Summary*

Req. Sheathing Capacity	561 plf	**4-Term Deflection**	0.231 in.	**3-Term Deflection**	0.256 in.
Req. Strap Force	2740 lbf	**4-Term Story Drift %**	0.009 %	**3-Term Story Drift %**	0.009 %
Req. HD Force (H)	2243 lbf				
Req. Shear Wall Anchorage Force (v_{max})	249 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (23'-10" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5940 (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:	2140	2140	(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	
$v_{unfactored}$:	333	333	333	333	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	56	56	56	56	(plf)
e_n:	0.0008	0.0008	0.0008	0.0008	(in.)
b:	3.31	3.31	14.52	14.52	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.027	0.036	0.006	0.419	0.008	0.024	0.004	0.186
		Sum	0.488			Sum	0.222
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	0.024	0.004	0.042	0.006	0.036	0.006	0.096
		Sum	0.072			Sum	0.143

Total Defl.	
0.231	(in.)
0.0086	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (23'-10" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5940 (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 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	333	333	333	333	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	3.31	3.31	14.52	14.52	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.027	0.071	0.419	0.008	0.048	0.186
	Sum	0.518		Sum	0.242
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	0.048	0.042	0.006	0.071	0.096
	Sum	0.092		Sum	0.173

Total Defl.	
0.256	(in.)
0.0095	%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

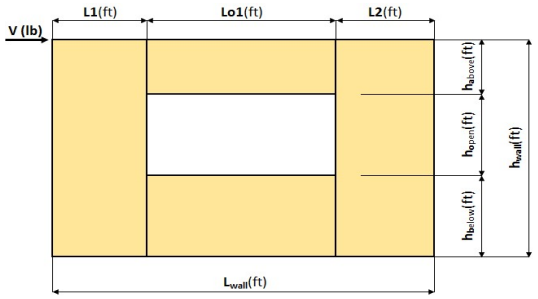
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (12'-6" Section) - (Level 3 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	1254 lbf	Opening 1	
L1	4.23 ft	h_a	2.25 ft
L2	5.77 ft	h_o	3.00 ft
h_{wall}	9.00 ft	h_b	3.75 ft
L_{wall}	12.50 ft	Lo1	2.50 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	0.71	N/A
P2=h_o/L2=	0.52	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 903 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 150 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 376 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 159 lbf

F2 = O1(L2)/(L1+L2) = 217 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.06 ft

T2 = (L2*Lo1)/(L1+L2) = 1.44 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 125 plf

v2 = (V/L)(T2+L2)/L2 = 125 plf

Check v1*L1+v2*L2=V? 1254 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 530 lbf

R2 = v2*L2 = 724 lbf

8. Difference corner force + resistance

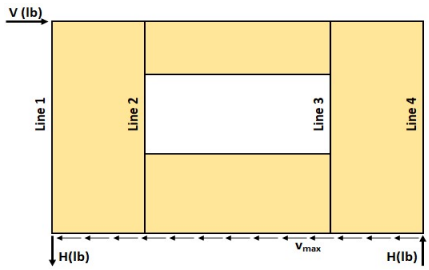
R1-F1 = 371 lbf

R2-F2 = 506 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?		527	376	903 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	903	527	376	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	903	527	376	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		527	376	903 lbf

Design Summary*

Req. Sheathing Capacity	150 plf	**4-Term Deflection**	0.093 in.	**3-Term Deflection**	0.135 in.
Req. Strap Force	217 lbf	**4-Term Story Drift %**	0.003 %	**3-Term Story Drift %**	0.005 %
Req. HD Force (H)	903 lbf				
Req. Shear Wall Anchorage Force (v_{max})	100 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (12'-6" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1254 (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:	2140	2140	(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	
$v_{unfactored}$:	125	125	125	125	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	63	63	63	63	(plf)
e_n:	0.0012	0.0012	0.0012	0.0012	(in.)
b:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.008	0.014	0.008	0.123	0.002	0.008	0.005	0.042
		Sum	0.153			Sum	0.056
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
0.001	0.008	0.005	0.031	0.006	0.014	0.008	0.090
		Sum	0.045			Sum	0.118

Total Defl.	
0.093	(in.)
0.0034	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (12'-6" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1254 (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 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	125	125	125	125	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.008	0.075	0.123	0.002	0.044	0.042
	Sum	0.207		Sum	0.087
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.001	0.044	0.031	0.006	0.075	0.090
	Sum	0.076		Sum	0.172

Total Defl.	
0.135	(in.)
0.0050	%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

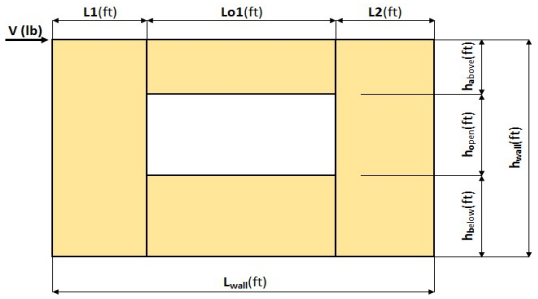
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (12'-6" Section) - (Level 2 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	2324 lbf	Opening 1		Adj. Factor Method =	2bs/h
L1	4.23 ft	h_a	2.25 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	5.77 ft	h_o	3.00 ft	P1=h_o/L1= 0.71	N/A
h_{wall}	9.00 ft	h_b	3.75 ft	P2=h_o/L2= 0.52	N/A
L_{wall}	12.50 ft	Lo1	2.50 ft		

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1673 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 279 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 697 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 295 lbf

F2 = O1(L2)/(L1+L2) = 402 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.06 ft

T2 = (L2*Lo1)/(L1+L2) = 1.44 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 232 plf

v2 = (V/L)(T2+L2)/L2 = 232 plf

Check v1*L1+v2*L2=V? 2324 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 983 lbf

R2 = v2*L2 = 1341 lbf

8. Difference corner force + resistance

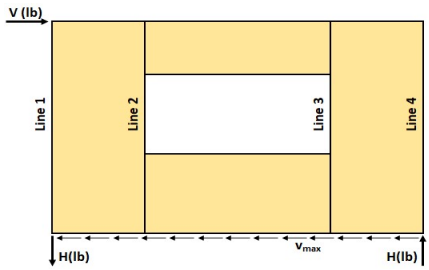
R1-F1 = 688 lbf

R2-F2 = 939 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?		976	697	1673 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1673	976	697	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1673	976	697	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		976	697	1673 lbf

Design Summary*

Req. Sheathing Capacity	279 plf	**4-Term Deflection**	0.173 in.	**3-Term Deflection**	0.216 in.
Req. Strap Force	402 lbf	**4-Term Story Drift %**	0.006 %	**3-Term Story Drift %**	0.008 %
Req. HD Force (H)	1673 lbf				
Req. Shear Wall Anchorage Force (v_{max})	186 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (12'-6" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2324 (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:	4	4	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	232	232	232	232	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	4	4	4	4	(in.)
V_n:	77	77	77	77	(plf)
e_n:	0.0023	0.0023	0.0023	0.0023	(in.)
b:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.015	0.025	0.016	0.229	0.003	0.015	0.009	0.078
		Sum	0.284			Sum	0.104
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	0.009	0.057	0.011	0.025	0.016	0.168
		Sum	0.083			Sum	0.219

Total Defl.	
0.173	(in.)
0.0064	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (12'-6" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2324 (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 2	
Nail Spacing:	4	4	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	232	232	232	232	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	22.0	22.0	22.0	22.0	(kips/in.)
b:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.015	0.095	0.229	0.003	0.055	0.078
	Sum	0.339		Sum	0.136
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	0.055	0.057	0.011	0.095	0.168
	Sum	0.115		Sum	0.274

Total Defl.	
0.216	(in.)
0.0080	%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

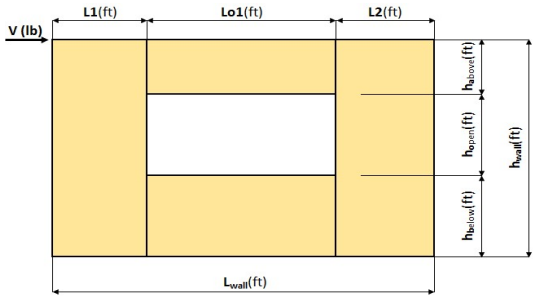
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (12'-6" Section) - (Level 1 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	3116 lbf	Opening 1	
L1	4.23 ft	h_a	2.25 ft
L2	5.77 ft	h_o	3.00 ft
h_{wall}	9.00 ft	h_b	3.75 ft
L_{wall}	12.50 ft	Lo1	2.50 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	0.71	N/A
P2=h_o/L2=	0.52	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2244 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 374 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 935 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 395 lbf

F2 = O1(L2)/(L1+L2) = 539 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.06 ft

T2 = (L2*Lo1)/(L1+L2) = 1.44 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 312 plf

v2 = (V/L)(T2+L2)/L2 = 312 plf

Check v1*L1+v2*L2=V? 3116 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1318 lbf

R2 = v2*L2 = 1798 lbf

8. Difference corner force + resistance

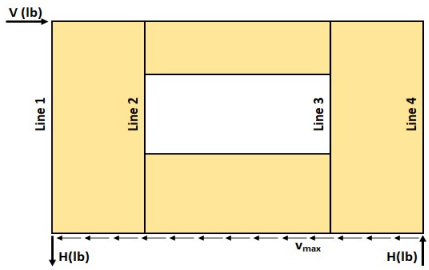
R1-F1 = 923 lbf

R2-F2 = 1259 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?		1309	935	2244 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2244	1309	935	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2244	1309	935	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		1309	935	2244 lbf

Design Summary*

Req. Sheathing Capacity	374 plf	**4-Term Deflection**	0.228 in.	**3-Term Deflection**	0.268 in.
Req. Strap Force	539 lbf	**4-Term Story Drift %**	0.008 %	**3-Term Story Drift %**	0.010 %
Req. HD Force (H)	2244 lbf				
Req. Shear Wall Anchorage Force (v_{max})	249 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (12'-6" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3116 (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:	2140	2140	(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	
$v_{unfactored}$:	312	312	312	312	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	78	78	78	78	(plf)
e_n:	0.0023	0.0023	0.0023	0.0023	(in.)
b:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.020	0.034	0.016	0.307	0.004	0.020	0.009	0.104
		Sum	0.376			Sum	0.137
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	0.009	0.077	0.015	0.034	0.016	0.225
		Sum	0.108			Sum	0.289

Total Defl.	
0.228	(in.)
0.0084	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (12'-6" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3116 (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 2	
Nail Spacing:	3	3	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	312	312	312	312	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.020	0.100	0.307	0.004	0.058	0.104
	Sum	0.427		Sum	0.167
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	0.058	0.077	0.015	0.100	0.225
	Sum	0.138		Sum	0.340

Total Defl.	
0.268	(in.)
0.0099	%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

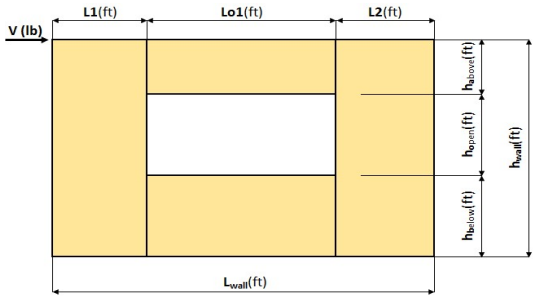
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (15'-9" Section) - (Level 3 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	1579 lbf	Opening 1	
L1	4.87 ft	h_a	1.00 ft
L2	4.88 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	15.75 ft	Lo1	6.00 ft

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 1.03	N/A
P2=h_o/L2= 1.02	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 902 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 226 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1353 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 676 lbf

F2 = O1(L2)/(L1+L2) = 677 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.00 ft

T2 = (L2*Lo1)/(L1+L2) = 3.00 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 162 plf

v2 = (V/L)(T2+L2)/L2 = 162 plf

Check v1*L1+v2*L2=V? 1579 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 789 lbf

R2 = v2*L2 = 790 lbf

8. Difference corner force + resistance

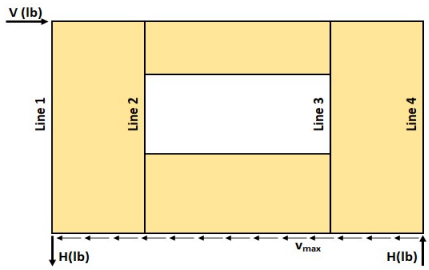
R1-F1 = 113 lbf

R2-F2 = 113 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 23 plf

vc2 = (R2-F2)/L2 = 23 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		93	810	902 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	902	93	810	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	902	93	810	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		93	810	902 lbf

Design Summary*

Req. Sheathing Capacity	226 plf	**4-Term Deflection**	0.135 in.	**3-Term Deflection**	0.187 in.
Req. Strap Force	677 lbf	**4-Term Story Drift %**	0.005 %	**3-Term Story Drift %**	0.007 %
Req. HD Force (H)	902 lbf				
Req. Shear Wall Anchorage Force (v_{max})	100 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (15'-9" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1579 (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:	2140	2140	(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	
$v_{unfactored}$:	162	162	162	162	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	81	81	81	81	(plf)
e_n:	0.0026	0.0026	0.0026	0.0026	(in.)
b:	4.87	4.87	4.88	4.88	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.009	0.017	0.018	0.138	0.003	0.012	0.012	0.062
		Sum	0.183			Sum	0.088
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	0.012	0.012	0.061	0.009	0.017	0.018	0.138
		Sum	0.088			Sum	0.182

Total Defl.	
0.135	(in.)
0.0050	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (15'-9" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1579 (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:	2140	2140	(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	
$v_{unfactored}$:	162	162	162	162	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.87	4.87	4.88	4.88	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.009	0.097	0.138	0.003	0.065	0.062
	Sum	0.245		Sum	0.129
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	0.065	0.061	0.009	0.097	0.138
	Sum	0.129		Sum	0.244

Total Defl.	
0.187	(in.)
0.0069	%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

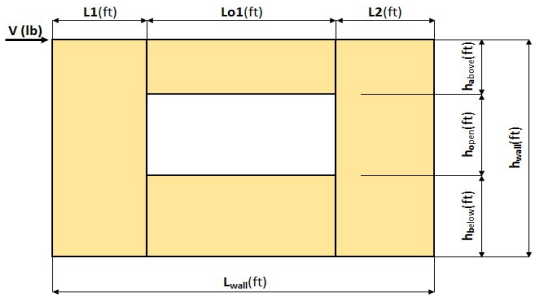
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (15'-9" Section) - (Level 2 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	2928 lbf	Opening 1	
L1	4.87 ft	h_a	1.00 ft
L2	4.88 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	15.75 ft	Lo1	6.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.03	N/A
P2=h_o/L2=	1.02	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1673 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 418 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2510 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1254 lbf

F2 = O1(L2)/(L1+L2) = 1256 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.00 ft

T2 = (L2*Lo1)/(L1+L2) = 3.00 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 300 plf

v2 = (V/L)(T2+L2)/L2 = 300 plf

Check v1*L1+v2*L2=V? 2928 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1462 lbf

R2 = v2*L2 = 1466 lbf

8. Difference corner force + resistance

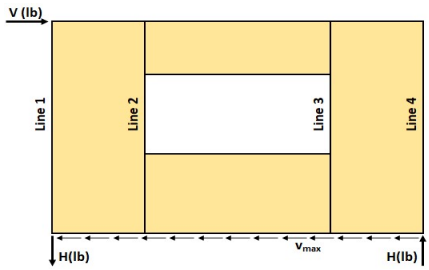
R1-F1 = 209 lbf

R2-F2 = 209 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 43 plf

vc2 = (R2-F2)/L2 = 43 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		172	1502	1673 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1673	172	1502	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1673	172	1502	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		172	1502	1673 lbf

Design Summary*

Req. Sheathing Capacity	418 plf	**4-Term Deflection**	0.235 in.	**3-Term Deflection**	0.277 in.
Req. Strap Force	1256 lbf	**4-Term Story Drift %**	0.009 %	**3-Term Story Drift %**	0.010 %
Req. HD Force (H)	1673 lbf				
Req. Shear Wall Anchorage Force (v_{max})	186 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (15'-9" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2928 (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:	2140	2140	(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	
$v_{unfactored}$:	300	300	300	300	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	75	75	75	75	(plf)
e_n:	0.0021	0.0021	0.0021	0.0021	(in.)
b:	4.87	4.87	4.88	4.88	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.017	0.032	0.014	0.257	0.005	0.022	0.009	0.114
		Sum	0.320			Sum	0.150
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
0.005	0.022	0.009	0.114	0.017	0.032	0.014	0.256
		Sum	0.150			Sum	0.319

Total Defl.	
0.235	(in.)
0.0087	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (15'-9" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2928 (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:	2140	2140	(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	
$v_{unfactored}$:	300	300	300	300	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.87	4.87	4.88	4.88	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.017	0.097	0.257	0.005	0.064	0.114
	Sum	0.370		Sum	0.183
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.005	0.064	0.114	0.017	0.097	0.256
	Sum	0.183		Sum	0.369

Total Defl.	
0.277	(in.)
0.0102	%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

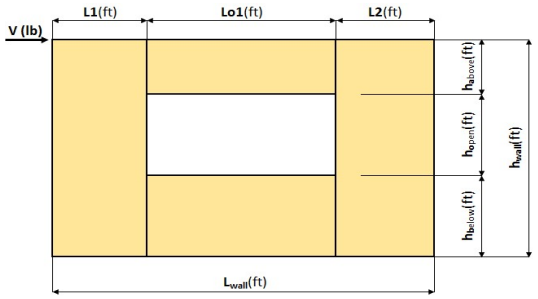
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (15'-9" Section) - (Level 1 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	3926 lbf	Opening 1	
L1	4.87 ft	h_a	1.00 ft
L2	4.88 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	15.75 ft	Lo1	6.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.03	N/A
P2=h_o/L2=	1.02	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2243 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 561 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 3365 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1681 lbf

F2 = O1(L2)/(L1+L2) = 1684 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.00 ft

T2 = (L2*Lo1)/(L1+L2) = 3.00 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 403 plf

v2 = (V/L)(T2+L2)/L2 = 403 plf

Check v1*L1+v2*L2=V? 3926 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1961 lbf

R2 = v2*L2 = 1965 lbf

8. Difference corner force + resistance

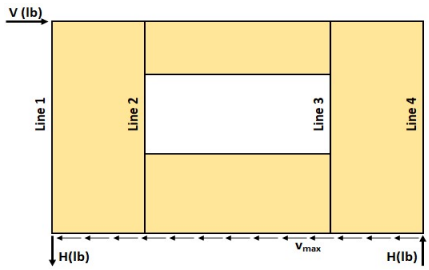
R1-F1 = 280 lbf

R2-F2 = 281 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 58 plf

vc2 = (R2-F2)/L2 = 58 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		230	2013	2243 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2243	230	2013	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2243	230	2013	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		230	2013	2243 lbf

Design Summary*

Req. Sheathing Capacity	561 plf	**4-Term Deflection**	0.307 in.	**3-Term Deflection**	0.335 in.
Req. Strap Force	1684 lbf	**4-Term Story Drift %**	0.011 %	**3-Term Story Drift %**	0.012 %
Req. HD Force (H)	2243 lbf				
Req. Shear Wall Anchorage Force (v_{max})	249 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (15'-9" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3926 (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:	2140	2140	(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	
$v_{unfactored}$:	403	403	403	403	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	67	67	67	67	(plf)
e_n:	0.0015	0.0015	0.0015	0.0015	(in.)
b:	4.87	4.87	4.88	4.88	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.022	0.043	0.010	0.344	0.007	0.029	0.007	0.153
		Sum	0.420			Sum	0.195
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
0.007	0.029	0.007	0.153	0.022	0.043	0.010	0.344
		Sum	0.195			Sum	0.419

Total Defl.	
0.307	(in.)
0.0114	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (15'-9" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3926 (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:	2140	2140	(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	
$v_{unfactored}$:	403	403	403	403	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.87	4.87	4.88	4.88	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.022	0.086	0.344	0.007	0.058	0.153
	Sum	0.453		Sum	0.217
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.007	0.058	0.153	0.022	0.086	0.344
	Sum	0.217		Sum	0.452

Total Defl.	
0.335	(in.)
0.0124	%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

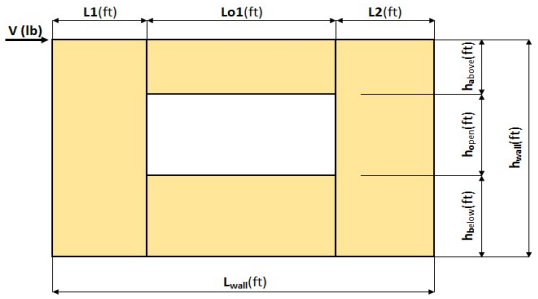
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (14'-7" Section) - (Level 3 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	1462 lbf	Opening 1	
L1	4.54 ft	h_a	1.00 ft
L2	4.04 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	14.58 ft	Lo1	6.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.10	N/A
P2=h_o/L2=	1.24	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 902 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 226 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1354 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 716 lbf

F2 = O1(L2)/(L1+L2) = 637 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.17 ft

T2 = (L2*Lo1)/(L1+L2) = 2.83 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 170 plf

v2 = (V/L)(T2+L2)/L2 = 170 plf

Check v1*L1+v2*L2=V? 1462 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 774 lbf

R2 = v2*L2 = 688 lbf

8. Difference corner force + resistance

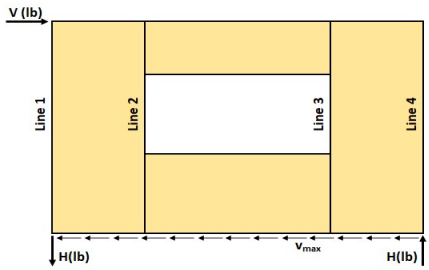
R1-F1 = 57 lbf

R2-F2 = 51 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 13 plf

vc2 = (R2-F2)/L2 = 13 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		50	852	902 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	902	50	852	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	902	50	852	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		50	852	902 lbf

Design Summary*

Req. Sheathing Capacity	226 plf	**4-Term Deflection**	0.159 in.	**3-Term Deflection**	0.212 in.
Req. Strap Force	716 lbf	**4-Term Story Drift %**	0.006 %	**3-Term Story Drift %**	0.008 %
Req. HD Force (H)	902 lbf				
Req. Shear Wall Anchorage Force (v_{max})	100 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (14'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1462 (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:	2140	2140	(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	
$v_{unfactored}$:	170	170	170	170	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	85	85	85	85	(plf)
e_n:	0.0031	0.0031	0.0031	0.0031	(in.)
b:	4.54	4.54	4.04	4.04	(ft)
HD Capacity:	2140	2140	2140	2140	(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	0.021	0.156	0.003	0.012	0.014	0.069
		Sum	0.206			Sum	0.099
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	0.012	0.014	0.078	0.011	0.018	0.021	0.176
		Sum	0.107			Sum	0.226

Total Defl.	
0.159	(in.)
0.0059	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (14'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1462 (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 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	170	170	170	170	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.54	4.54	4.04	4.04	(ft)
HD Capacity:	2140	2140	2140	2140	(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	0.102	0.156	0.003	0.068	0.069
	Sum	0.269		Sum	0.141
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	0.068	0.078	0.011	0.102	0.176
	Sum	0.150		Sum	0.289

Total Defl.	
0.212	(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

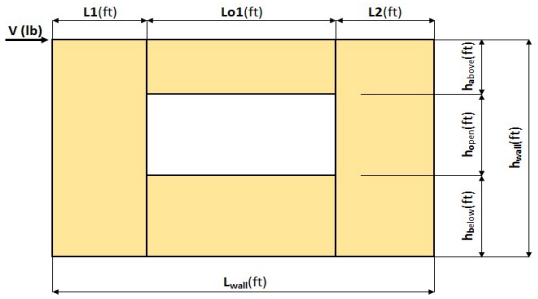
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (14'-7" Section) - (Level 2 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	2710 lbf	Opening 1	
L1	4.54 ft	h_a	1.00 ft
L2	4.04 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	14.58 ft	Lo1	6.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.10	N/A
P2=h_o/L2=	1.24	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1673 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 418 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2509 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1328 lbf

F2 = O1(L2)/(L1+L2) = 1182 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.17 ft

T2 = (L2*Lo1)/(L1+L2) = 2.83 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 316 plf

v2 = (V/L)(T2+L2)/L2 = 316 plf

Check v1*L1+v2*L2=V? 2710 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1434 lbf

R2 = v2*L2 = 1276 lbf

8. Difference corner force + resistance

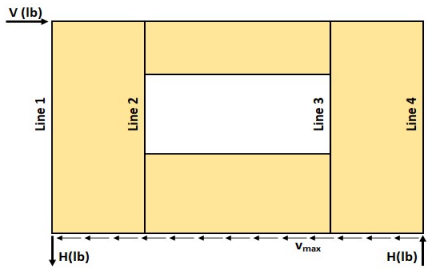
R1-F1 = 106 lbf

R2-F2 = 95 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 23 plf

vc2 = (R2-F2)/L2 = 23 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		94	1579	1673 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1673	94	1579	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1673	94	1579	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		94	1579	1673 lbf

Design Summary*

Req. Sheathing Capacity	418 plf	**4-Term Deflection**	0.277 in.	**3-Term Deflection**	0.320 in.
Req. Strap Force	1328 lbf	**4-Term Story Drift %**	0.010 %	**3-Term Story Drift %**	0.012 %
Req. HD Force (H)	1673 lbf				
Req. Shear Wall Anchorage Force (v_{max})	186 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2710 (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:	2140	2140	(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	
$v_{unfactored}$:	316	316	316	316	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	79	79	79	79	(plf)
e_n:	0.0024	0.0024	0.0024	0.0024	(in.)
b:	4.54	4.54	4.04	4.04	(ft)
HD Capacity:	2140	2140	2140	2140	(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	0.034	0.016	0.290	0.006	0.023	0.011	0.129
		Sum	0.359			Sum	0.168
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	0.023	0.011	0.145	0.021	0.034	0.016	0.326
		Sum	0.185			Sum	0.397

Total Defl.	
0.277	(in.)
0.0103	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2710 (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:	2140	2140	(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	
$v_{unfactored}$:	316	316	316	316	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.54	4.54	4.04	4.04	(ft)
HD Capacity:	2140	2140	2140	2140	(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	0.102	0.290	0.006	0.068	0.129
	Sum	0.410		Sum	0.202
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	0.068	0.145	0.021	0.102	0.326
	Sum	0.219		Sum	0.448

Total Defl.	
0.320	(in.)
0.0118	%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

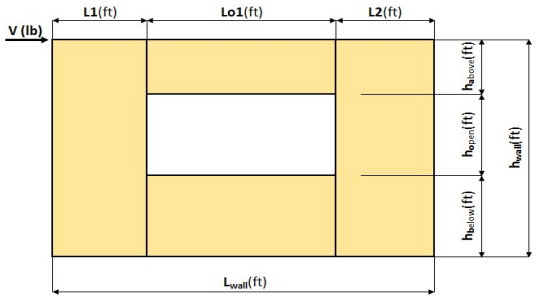
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 1 (14'-7" Section) - (Level 2 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	3634 lbf	Opening 1		Adj. Factor Method =	2bs/h
L1	4.54 ft	h_a	1.00 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	4.04 ft	h_o	5.00 ft	P1=h_o/L1= 1.10	N/A
h_{wall}	9.00 ft	h_b	3.00 ft	P2=h_o/L2= 1.24	N/A
L_{wall}	14.58 ft	Lo1	6.00 ft		

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2243 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 561 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 3365 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1780 lbf

F2 = O1(L2)/(L1+L2) = 1584 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.17 ft

T2 = (L2*Lo1)/(L1+L2) = 2.83 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 424 plf

v2 = (V/L)(T2+L2)/L2 = 424 plf

Check v1*L1+v2*L2=V? 3634 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1923 lbf

R2 = v2*L2 = 1711 lbf

8. Difference corner force + resistance

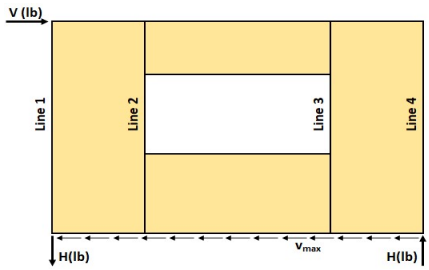
R1-F1 = 142 lbf

R2-F2 = 127 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 31 plf

vc2 = (R2-F2)/L2 = 31 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		125	2118	2243 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2243	125	2118	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2243	125	2118	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		125	2118	2243 lbf

Design Summary*

Req. Sheathing Capacity	561 plf	**4-Term Deflection**	0.363 in.	**3-Term Deflection**	0.391 in.
Req. Strap Force	1780 lbf	**4-Term Story Drift %**	0.013 %	**3-Term Story Drift %**	0.014 %
Req. HD Force (H)	2243 lbf				
Req. Shear Wall Anchorage Force (v_{max})	249 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3634 (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:	2140	2140	(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	
$v_{unfactored}$:	424	424	424	424	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	71	71	71	71	(plf)
e_n:	0.0017	0.0017	0.0017	0.0017	(in.)
b:	4.54	4.54	4.04	4.04	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.025	0.046	0.012	0.388	0.008	0.030	0.008	0.173
		Sum	0.471			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
0.008	0.030	0.008	0.194	0.029	0.046	0.012	0.436
		Sum	0.241			Sum	0.522

Total Defl.	
0.363	(in.)
0.0135	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 1 (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3634 (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:	2140	2140	(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	
$v_{unfactored}$:	424	424	424	424	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.54	4.54	4.04	4.04	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.025	0.091	0.388	0.008	0.061	0.173
	Sum	0.505		Sum	0.241
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	0.061	0.194	0.029	0.091	0.436
	Sum	0.263		Sum	0.556

Total Defl.	
0.391	(in.)
0.0145	%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

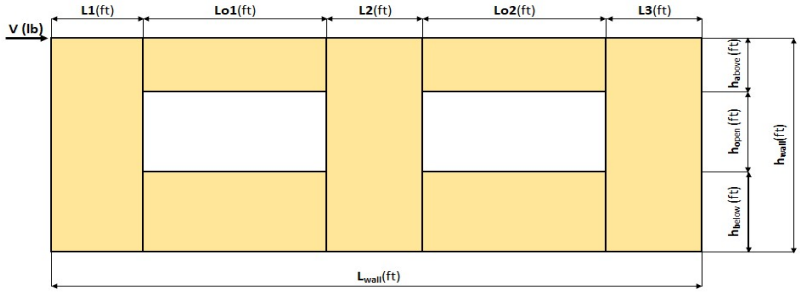
TWO OPENINGS

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 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 13 (21'-10" Section) - (Level 3 Seismic)

Date: 10/13/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	2475 lbf				
L1	2.42 ft	h_a1	1.00 ft	h_a2	1.00 ft
L2	4.57 ft	h_o1	5.00 ft	h_o2	5.00 ft
L3	2.84 ft	h_b1	3.00 ft	h_b2	3.00 ft
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft
L_{wall}	21.83 ft				

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 2.07	0.968
P2=h_o/L2= 1.09	N/A
P3=h_o/L3= 1.76	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1020 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	255 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	255 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	1531 lbf
Second opening: O2 = va2 x (Lo2) =	1531 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	530 lbf
F2 = O1(L2)/(L1+L2) =	1001 lbf
F3 = O2(L2)/(L2+L3) =	944 lbf
F4 = O2(L3)/(L2+L3) =	587 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	2.08 ft
T2 = (L2*Lo1)/(L1+L2) =	3.92 ft
T3 = (L2*Lo2)/(L2+L3) =	3.70 ft
T4 = (L3*Lo2)/(L2+L3) =	2.30 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	211 plf
v2 = (V/L)(T2+L2+T3)/L2 =	302 plf
v3 = (V/L)(T4+L3)/L3 =	205 plf
Check v1*L1+v2*L2+v3*L3=V?	2475 lbf **OK**

7. Resistance to corner forces

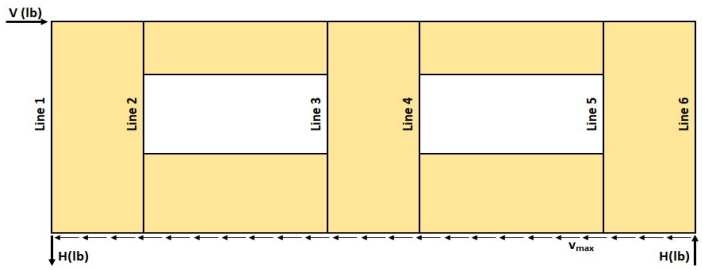
R1 = v1*L1 =	510 lbf
R2 = v2*L2 =	1382 lbf
R3 = v3*L3 =	583 lbf

8. Difference corner force + resistance

R1-F1 =	-20 lbf
R2-F2-F3 =	-562 lbf
R3-F4 =	-4 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	-8 plf
vc2 = (R2-F2-F3)/L2 =	-123 plf
vc3 = (R3-F4)/L3 =	-1 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		-33	1053	1020 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	1020	-33	1053	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-492	1512	1020	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	1020	1512	-492	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	1020	-6	1026	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		-6	1026	1020 lbf

Design Summary*

Req. Sheathing Capacity	302 plf	**4-Term Deflection**	0.222 in.	**3-Term Deflection**	0.263 in.
Req. Strap Force	1001 lbf	**4-Term Story Drift %**	0.008 %	**3-Term Story Drift %**	0.010 %
Req. HD Force	1020 lbf				
Req. Shear Wall Anchorage Force	113 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/13/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (21'-10" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2475 (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	
$v_{unfactored}$:	211	211	302	302	205	205	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	70	70	101	101	68	68	(plf)
e_n:	0.0017	0.0017	0.0051	0.0051	0.0016	0.0016	(in.)
b:	2.42	2.42	4.57	4.57	2.84	2.84	(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
0.024	0.023	0.012	0.320	0.007	0.015	0.008	0.142
		Sum	0.378			Sum	0.172
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
0.005	0.022	0.023	0.108	0.005	0.022	0.023	0.108
		Sum	0.158			Sum	0.158
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
0.006	0.015	0.007	0.118	0.020	0.022	0.011	0.266
		Sum	0.146			Sum	0.318

Total Defl.	
0.222	(in.)
0.0082	%drift

Project Information

Code:	IBC 2018	**Date:**	10/13/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (21'-10" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2475 (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	
$v_{unfactored}$:	211	211	302	302	205	205	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	2.42	2.42	4.57	4.57	2.84	2.84	(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
0.024	0.086	0.320	0.007	0.057	0.142
	Sum	0.430		Sum	0.207
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.005	0.082	0.108	0.005	0.082	0.108
	Sum	0.196		Sum	0.196
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.006	0.056	0.118	0.020	0.084	0.266
	Sum	0.180		Sum	0.369

Total Defl.	
0.263	(in.)
0.0097	%drift

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

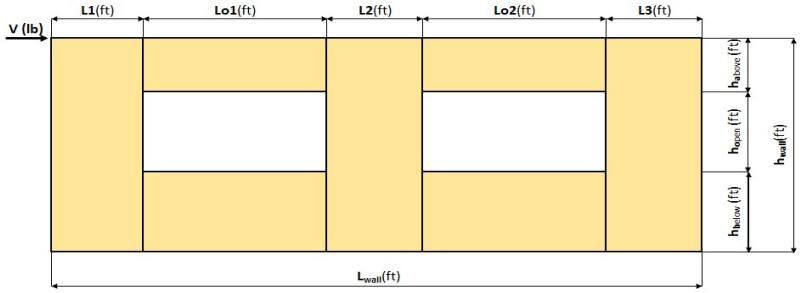
Force Transfer Around Openings Calculator

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 2018	**Date:**	10/13/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (21'-10" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	4580 lbf		Opening 1		Opening 2	Adj. Factor Method =	2bs/h
L1	2.42 ft	h_a1	1.00 ft	h_a2	1.00 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	4.57 ft	h_o1	5.00 ft	h_o2	5.00 ft	P1=h_o/L1= 2.07	0.968
L3	2.84 ft	h_b1	3.00 ft	h_b2	3.00 ft	P2=h_o/L2= 1.09	N/A
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft	P3=h_o/L3= 1.76	N/A
L_{wall}	21.83 ft						

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1888 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	472 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	472 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	2832 lbf
Second opening: O2 = va2 x (Lo2) =	2832 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	981 lbf
F2 = O1(L2)/(L1+L2) =	1852 lbf
F3 = O2(L2)/(L2+L3) =	1747 lbf
F4 = O2(L3)/(L2+L3) =	1086 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	2.08 ft
T2 = (L2*Lo1)/(L1+L2) =	3.92 ft
T3 = (L2*Lo2)/(L2+L3) =	3.70 ft
T4 = (L3*Lo2)/(L2+L3) =	2.30 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	390 plf
v2 = (V/L)(T2+L2+T3)/L2 =	560 plf
v3 = (V/L)(T4+L3)/L3 =	380 plf
Check v1*L1+v2*L2+v3*L3=V?	4580 lbf **OK**

7. Resistance to corner forces

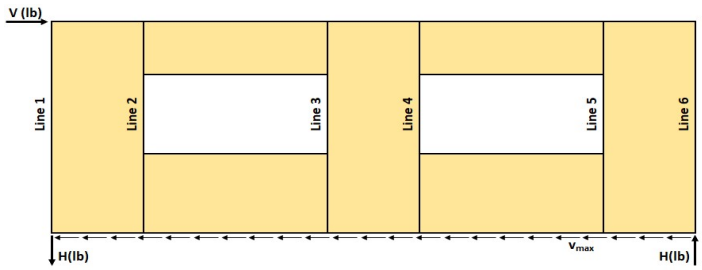
R1 = v1*L1 =	944 lbf
R2 = v2*L2 =	2558 lbf
R3 = v3*L3 =	1078 lbf

8. Difference corner force + resistance

R1-F1 =	-37 lbf
R2-F2-F3 =	-1040 lbf
R3-F4 =	-7 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	-15 plf
vc2 = (R2-F2-F3)/L2 =	-228 plf
vc3 = (R3-F4)/L3 =	-3 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		-61	1949	1888 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	1888	-61	1949	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-911	2799	1888	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	1888	2799	-911	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	1888	-10	1898	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		-10	1898	1888 lbf

Design Summary*

Req. Sheathing Capacity	560 plf	**4-Term Deflection**	0.396 in.	**3-Term Deflection**	0.421 in.
Req. Strap Force	1852 lbf	**4-Term Story Drift %**	0.015 %	**3-Term Story Drift %**	0.016 %
Req. HD Force	1888 lbf				
Req. Shear Wall Anchorage Force	210 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/13/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (21'-10" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4580 (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	
$v_{unfactored}$:	390	390	560	560	380	380	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	65	65	93	93	63	63	(plf)
e_n:	0.0014	0.0014	0.0040	0.0040	0.0012	0.0012	(in.)
b:	2.42	2.42	4.57	4.57	2.84	2.84	(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
0.044	0.042	0.009	0.593	0.013	0.028	0.006	0.263
		Sum	0.688			Sum	0.310
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
0.010	0.040	0.018	0.200	0.010	0.040	0.018	0.200
		Sum	0.268			Sum	0.268
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
0.011	0.027	0.006	0.219	0.036	0.041	0.008	0.492
		Sum	0.262			Sum	0.577

Total Defl.	
0.396	(in.)
0.0147	%drift

Project Information

Code:	IBC 2018	**Date:**	10/13/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (21'-10" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4580 (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:	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	
$v_{unfactored}$:	390	390	560	560	380	380	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	2.42	2.42	4.57	4.57	2.84	2.84	(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
0.044	0.084	0.593	0.013	0.056	0.263
	Sum	0.720		Sum	0.332
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.010	0.080	0.200	0.010	0.080	0.200
	Sum	0.290		Sum	0.290
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.011	0.054	0.219	0.036	0.081	0.492
	Sum	0.284		Sum	0.609

Total Defl.	
0.421	(in.)
0.0156	%drift

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

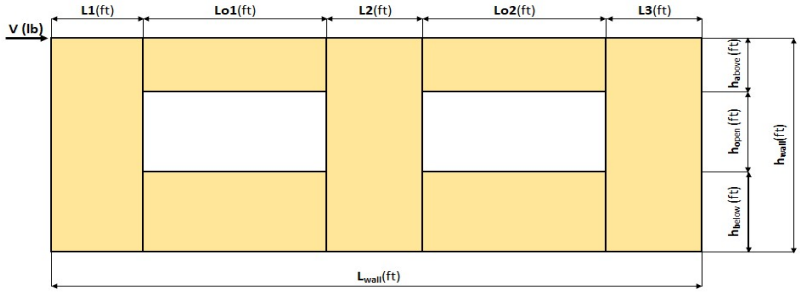
Force Transfer Around Openings Calculator

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 2018	**Date:**	10/13/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (21'-10" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	6131 lbf	h_a	1.00 ft	h_a	1.00 ft
L1	2.42 ft	h_o	5.00 ft	h_o	5.00 ft
L2	4.57 ft	h_b	3.00 ft	h_b	3.00 ft
L3	2.84 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.00 ft				
L_{wall}	21.83 ft				

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	2.07	0.968
P2=h_o/L2=	1.09	N/A
P3=h_o/L3=	1.76	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2528 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	632 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	632 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	3792 lbf
Second opening: O2 = va2 x (Lo2) =	3792 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	1313 lbf
F2 = O1(L2)/(L1+L2) =	2479 lbf
F3 = O2(L2)/(L2+L3) =	2338 lbf
F4 = O2(L3)/(L2+L3) =	1453 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	2.08 ft
T2 = (L2*Lo1)/(L1+L2) =	3.92 ft
T3 = (L2*Lo2)/(L2+L3) =	3.70 ft
T4 = (L3*Lo2)/(L2+L3) =	2.30 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	522 plf
v2 = (V/L)(T2+L2+T3)/L2 =	749 plf
v3 = (V/L)(T4+L3)/L3 =	508 plf
Check v1*L1+v2*L2+v3*L3=V?	6131 lbf **OK**

7. Resistance to corner forces

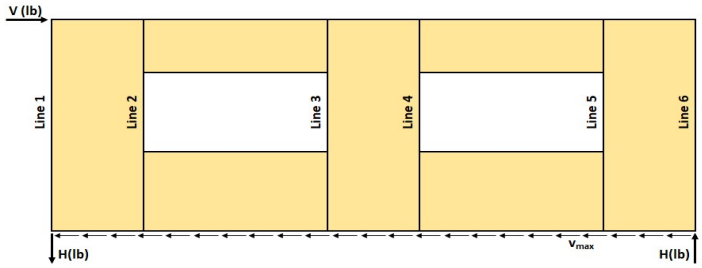
R1 = v1*L1 =	1263 lbf
R2 = v2*L2 =	3424 lbf
R3 = v3*L3 =	1443 lbf

8. Difference corner force + resistance

R1-F1 =	-50 lbf
R2-F2-F3 =	-1393 lbf
R3-F4 =	-10 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	-20 plf
vc2 = (R2-F2-F3)/L2 =	-305 plf
vc3 = (R3-F4)/L3 =	-3 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		-82	2610	2528 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	2528	-82	2610	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-1219	3747	2528	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	2528	3747	-1219	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	2528	-14	2541	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		-14	2541	2528 lbf

Design Summary*

Req. Sheathing Capacity	749 plf	**4-Term Deflection**	0.518 in.	**3-Term Deflection**	0.540 in.
Req. Strap Force	2479 lbf	**4-Term Story Drift %**	0.019 %	**3-Term Story Drift %**	0.020 %
Req. HD Force	2528 lbf				
Req. Shear Wall Anchorage Force	281 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/13/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (21'-10" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6131 (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	
$v_{unfactored}$:	522	522	749	749	508	508	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	87	87	125	125	85	85	(plf)
e_n:	0.0010	0.0010	0.0031	0.0031	0.0009	0.0009	(in.)
b:	2.42	2.42	4.57	4.57	2.84	2.84	(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
0.048	0.056	0.006	0.793	0.014	0.038	0.004	0.353
		Sum	0.904			Sum	0.408
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	0.054	0.014	0.268	0.011	0.054	0.014	0.268
		Sum	0.347			Sum	0.347
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	0.037	0.004	0.293	0.040	0.055	0.006	0.658
		Sum	0.345			Sum	0.758

Total Defl.	
0.518	(in.)
0.0192	%drift

Project Information

Code:	IBC 2018	**Date:**	10/13/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (21'-10" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6131 (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: — 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	
$v_{unfactored}$:	522	522	749	749	508	508	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	2.42	2.42	4.57	4.57	2.84	2.84	(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
0.048	0.090	0.793	0.014	0.060	0.353
	Sum	0.931		Sum	0.427
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	0.268	0.011	0.086	0.268
	Sum	0.365		Sum	0.365
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	0.059	0.293	0.040	0.088	0.658
	Sum	0.363		Sum	0.786

Total Defl.	
0.540	(in.)
0.0200	%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

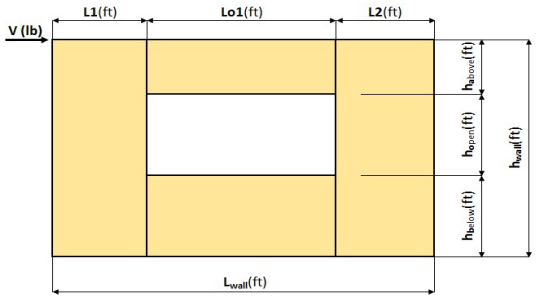
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 13 (12'-6" Section) - (Level 3 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	1417 lbf	Opening 1	
L1	4.23 ft	h_a	2.25 ft
L2	5.77 ft	h_o	3.00 ft
h_{wall}	9.00 ft	h_b	3.75 ft
L_{wall}	12.50 ft	Lo1	2.50 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	0.71	N/A
P2=h_o/L2=	0.52	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1020 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 170 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 425 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 180 lbf

F2 = O1(L2)/(L1+L2) = 245 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.06 ft

T2 = (L2*Lo1)/(L1+L2) = 1.44 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 142 plf

v2 = (V/L)(T2+L2)/L2 = 142 plf

Check v1*L1+v2*L2=V? 1417 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 599 lbf

R2 = v2*L2 = 818 lbf

8. Difference corner force + resistance

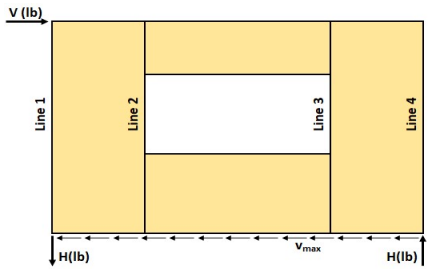
R1-F1 = 420 lbf

R2-F2 = 572 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 99 plf

vc2 = (R2-F2)/L2 = 99 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		595	425	1020 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1020	595	425	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1020	595	425	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		595	425	1020 lbf

Design Summary*

Req. Sheathing Capacity	170 plf	**4-Term Deflection**	0.107 in.	**3-Term Deflection**	0.153 in.
Req. Strap Force	245 lbf	**4-Term Story Drift %**	0.004 %	**3-Term Story Drift %**	0.006 %
Req. HD Force (H)	1020 lbf				
Req. Shear Wall Anchorage Force (v_{max})	113 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (12'-6" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1417 (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:	2140	2140	(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	
$v_{unfactored}$:	142	142	142	142	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	71	71	71	71	(plf)
e_n:	0.0018	0.0018	0.0018	0.0018	(in.)
b:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.009	0.015	0.012	0.139	0.002	0.009	0.007	0.047
		Sum	0.176			Sum	0.065
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
0.001	0.009	0.007	0.035	0.007	0.015	0.012	0.102
		Sum	0.052			Sum	0.136

Total Defl.	
0.107	(in.)
0.0040	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (12'-6" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1417 (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:	2140	2140	(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	
$v_{unfactored}$:	142	142	142	142	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.009	0.085	0.139	0.002	0.050	0.047
	Sum	0.234		Sum	0.099
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.001	0.050	0.035	0.007	0.085	0.102
	Sum	0.086		Sum	0.194

Total Defl.	
0.153	(in.)
0.0057	%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

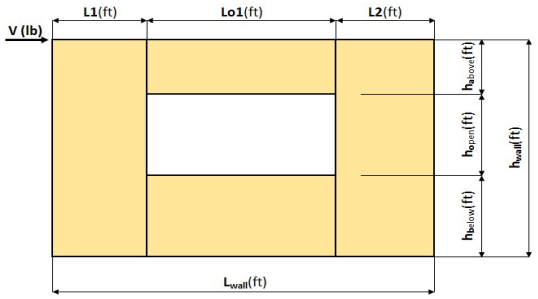
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 13 (12'-6" Section) - (Level 2 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	2588 lbf	Opening 1		Adj. Factor Method =	2bs/h
L1	4.23 ft	h_a	2.25 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	5.77 ft	h_o	3.00 ft	P1=h_o/L1= 0.71	N/A
h_{wall}	9.00 ft	h_b	3.75 ft	P2=h_o/L2= 0.52	N/A
L_{wall}	12.50 ft	Lo1	2.50 ft		

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1863 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 311 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 776 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 328 lbf

F2 = O1(L2)/(L1+L2) = 448 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.06 ft

T2 = (L2*Lo1)/(L1+L2) = 1.44 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 259 plf

v2 = (V/L)(T2+L2)/L2 = 259 plf

Check v1*L1+v2*L2=V? 2588 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1095 lbf

R2 = v2*L2 = 1493 lbf

8. Difference corner force + resistance

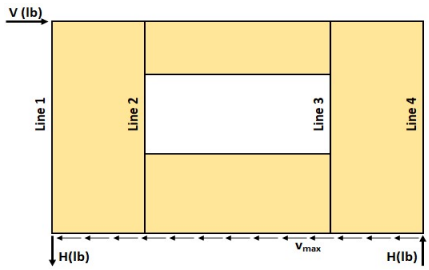
R1-F1 = 766 lbf

R2-F2 = 1045 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 181 plf

vc2 = (R2-F2)/L2 = 181 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		1087	776	1863 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1863	1087	776	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1863	1087	776	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		1087	776	1863 lbf

Design Summary*

Req. Sheathing Capacity	311 plf	**4-Term Deflection**	0.196 in.	**3-Term Deflection**	0.240 in.
Req. Strap Force	448 lbf	**4-Term Story Drift %**	0.007 %	**3-Term Story Drift %**	0.009 %
Req. HD Force (H)	1863 lbf				
Req. Shear Wall Anchorage Force (v_{max})	207 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (12'-6" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2588 (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:	4	4	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	259	259	259	259	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	4	4	4	4	(in.)
V_n:	86	86	86	86	(plf)
e_n:	0.0032	0.0032	0.0032	0.0032	(in.)
b:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.017	0.028	0.021	0.255	0.003	0.016	0.013	0.087
		Sum	0.321			Sum	0.119
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	0.016	0.013	0.064	0.012	0.028	0.021	0.187
		Sum	0.095			Sum	0.248

Total Defl.	
0.196	(in.)
0.0072	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (12'-6" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2588 (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:	4	4	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	259	259	259	259	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	22.0	22.0	22.0	22.0	(kips/in.)
b:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.017	0.106	0.255	0.003	0.062	0.087
	Sum	0.377		Sum	0.152
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	0.062	0.064	0.012	0.106	0.187
	Sum	0.128		Sum	0.305

Total Defl.	
0.240	(in.)
0.0089	%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

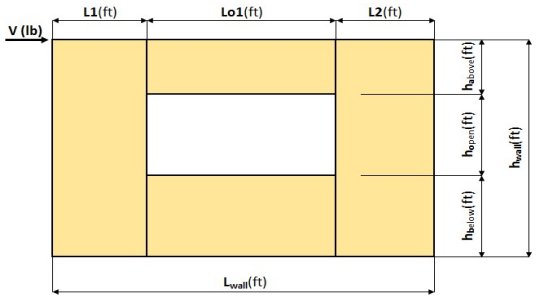
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 13 (12'-6" Section) - (Level 1 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	3511 lbf	Opening 1		Adj. Factor Method =	2bs/h
L1	4.23 ft	h_a	2.25 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	5.77 ft	h_o	3.00 ft	P1=h_o/L1= 0.71	N/A
h_{wall}	9.00 ft	h_b	3.75 ft	P2=h_o/L2= 0.52	N/A
L_{wall}	12.50 ft	Lo1	2.50 ft		

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2528 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 421 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1053 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 446 lbf

F2 = O1(L2)/(L1+L2) = 608 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.06 ft

T2 = (L2*Lo1)/(L1+L2) = 1.44 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 351 plf

v2 = (V/L)(T2+L2)/L2 = 351 plf

Check v1*L1+v2*L2=V? 3511 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1485 lbf

R2 = v2*L2 = 2026 lbf

8. Difference corner force + resistance

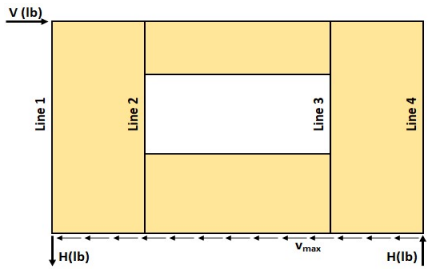
R1-F1 = 1040 lbf

R2-F2 = 1418 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 246 plf

vc2 = (R2-F2)/L2 = 246 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		1475	1053	2528 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2528	1475	1053	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2528	1475	1053	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		1475	1053	2528 lbf

Design Summary*

Req. Sheathing Capacity	421 plf	**4-Term Deflection**	0.260 in.	**3-Term Deflection**	0.302 in.
Req. Strap Force	608 lbf	**4-Term Story Drift %**	0.010 %	**3-Term Story Drift %**	0.011 %
Req. HD Force (H)	2528 lbf				
Req. Shear Wall Anchorage Force (v_{max})	281 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (12'-6" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3511 (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:	2140	2140	(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	
$v_{unfactored}$:	351	351	351	351	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	88	88	88	88	(plf)
e_n:	0.0034	0.0034	0.0034	0.0034	(in.)
b:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.023	0.038	0.023	0.346	0.004	0.022	0.013	0.118
		Sum	0.429			Sum	0.157
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	0.022	0.013	0.086	0.017	0.038	0.023	0.253
		Sum	0.125			Sum	0.330

Total Defl.	
0.260	(in.)
0.0096	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (12'-6" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3511 (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:	2140	2140	(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	
$v_{unfactored}$:	351	351	351	351	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(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:	4.23	4.23	5.77	5.77	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.023	0.113	0.346	0.004	0.066	0.118
	Sum	0.481		Sum	0.188
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	0.066	0.086	0.017	0.113	0.253
	Sum	0.155		Sum	0.383

Total Defl.	
0.302	(in.)
0.0112	%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

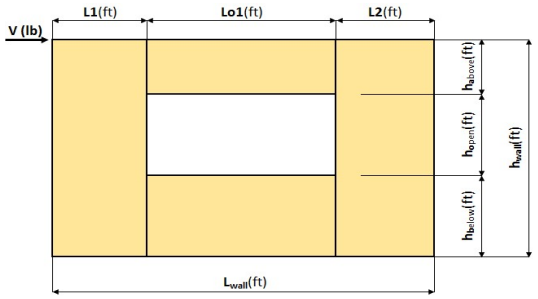
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 13 (18'-9" Section) - (Level 3 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	2126 lbf	Opening 1	
L1	3.02 ft	h_a	1.00 ft
L2	9.73 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	18.75 ft	Lo1	6.00 ft

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 1.66	N/A
P2=h_o/L2= 0.51	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1020 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 255 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1531 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 363 lbf

F2 = O1(L2)/(L1+L2) = 1168 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.42 ft

T2 = (L2*Lo1)/(L1+L2) = 4.58 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 167 plf

v2 = (V/L)(T2+L2)/L2 = 167 plf

Check v1*L1+v2*L2=V? 2126 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 504 lbf

R2 = v2*L2 = 1622 lbf

8. Difference corner force + resistance

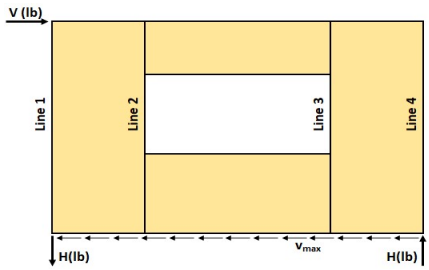
R1-F1 = 141 lbf

R2-F2 = 454 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 47 plf

vc2 = (R2-F2)/L2 = 47 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		187	834	1020 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1020	187	834	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1020	187	834	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		187	834	1020 lbf

Design Summary*

Req. Sheathing Capacity	255 plf	**4-Term Deflection**	0.135 in.	**3-Term Deflection**	0.172 in.
Req. Strap Force	1168 lbf	**4-Term Story Drift %**	0.005 %	**3-Term Story Drift %**	0.006 %
Req. HD Force (H)	1020 lbf				
Req. Shear Wall Anchorage Force (v_{max})	113 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (18'-9" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2126 (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:	4	4	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	167	167	167	167	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4	4	4	4	(in.)
V_n:	56	56	56	56	(plf)
e_n:	0.0008	0.0008	0.0008	0.0008	(in.)
b:	3.02	3.02	9.73	9.73	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.015	0.018	0.006	0.230	0.004	0.012	0.004	0.102
		Sum	0.269			Sum	0.122
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
0.001	0.012	0.004	0.032	0.005	0.018	0.006	0.071
		Sum	0.049			Sum	0.100

Total Defl.	
0.135	(in.)
0.0050	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (18'-9" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2126 (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:	4	4	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	167	167	167	167	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	22.0	22.0	22.0	22.0	(kips/in.)
b:	3.02	3.02	9.73	9.73	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.015	0.068	0.230	0.004	0.045	0.102
	Sum	0.313		Sum	0.152
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.001	0.045	0.032	0.005	0.068	0.071
	Sum	0.079		Sum	0.144

Total Defl.	
0.172	(in.)
0.0064	%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

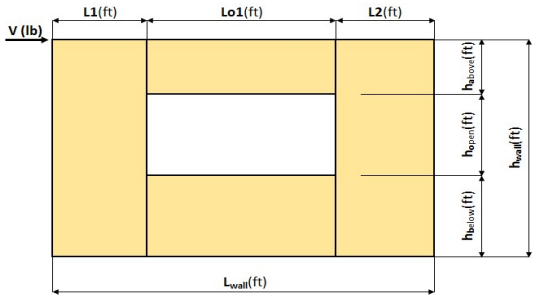
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 13 (18'-9" Section) - (Level 2 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	3934 lbf	Opening 1	
L1	3.02 ft	h_a	1.00 ft
L2	9.73 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	18.75 ft	Lo1	6.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.66	N/A
P2=h_o/L2=	0.51	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1888 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 472 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2832 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 671 lbf

F2 = O1(L2)/(L1+L2) = 2162 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.42 ft

T2 = (L2*Lo1)/(L1+L2) = 4.58 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 309 plf

v2 = (V/L)(T2+L2)/L2 = 309 plf

Check v1*L1+v2*L2=V? 3934 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 932 lbf

R2 = v2*L2 = 3002 lbf

8. Difference corner force + resistance

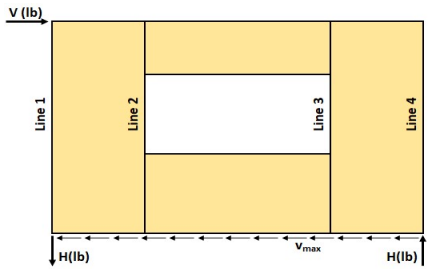
R1-F1 = 261 lbf

R2-F2 = 841 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 86 plf

vc2 = (R2-F2)/L2 = 86 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		346	1543	1888 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1888	346	1543	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1888	346	1543	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		346	1543	1888 lbf

Design Summary*

Req. Sheathing Capacity	472 plf	**4-Term Deflection**	0.245 in.	**3-Term Deflection**	0.268 in.
Req. Strap Force	2162 lbf	**4-Term Story Drift %**	0.009 %	**3-Term Story Drift %**	0.010 %
Req. HD Force (H)	1888 lbf				
Req. Shear Wall Anchorage Force (v_{max})	210 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (18'-9" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3934 (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:	2140	2140	(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	
$v_{unfactored}$:	309	309	309	309	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	51	51	51	51	(plf)
e_n:	0.0007	0.0007	0.0007	0.0007	(in.)
b:	3.02	3.02	9.73	9.73	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.028	0.033	0.005	0.425	0.008	0.022	0.003	0.189
		Sum	0.491			Sum	0.222
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	0.022	0.003	0.059	0.009	0.033	0.005	0.132
		Sum	0.086			Sum	0.178

Total Defl.	
0.245	(in.)
0.0091	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (18'-9" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3934 (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 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	309	309	309	309	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	3.02	3.02	9.73	9.73	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.028	0.066	0.425	0.008	0.044	0.189
	Sum	0.519		Sum	0.241
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	0.044	0.059	0.009	0.066	0.132
	Sum	0.105		Sum	0.207

Total Defl.	
0.268	(in.)
0.0099	%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

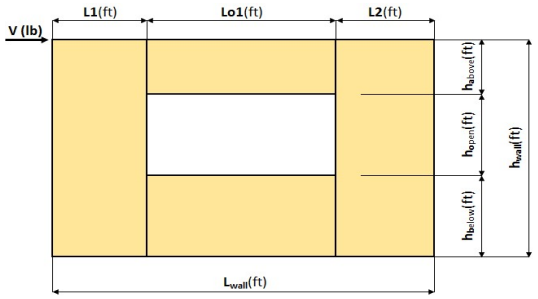
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid 13 (18'-9" Section) - (Level 1 Seismic)

Date: 10/12/2024



Shear Wall Calculation Variables

V	5267 lbf	Opening 1		Adj. Factor Method =	2bs/h
L1	3.02 ft	h_a	1.00 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	9.73 ft	h_o	5.00 ft	P1=h_o/L1= 1.66	N/A
h_{wall}	9.00 ft	h_b	3.00 ft	P2=h_o/L2= 0.51	N/A
L_{wall}	18.75 ft	Lo1	6.00 ft		

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2528 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 632 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 3792 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 898 lbf

F2 = O1(L2)/(L1+L2) = 2894 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.42 ft

T2 = (L2*Lo1)/(L1+L2) = 4.58 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 413 plf

v2 = (V/L)(T2+L2)/L2 = 413 plf

Check v1*L1+v2*L2=V? 5267 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1248 lbf

R2 = v2*L2 = 4019 lbf

8. Difference corner force + resistance

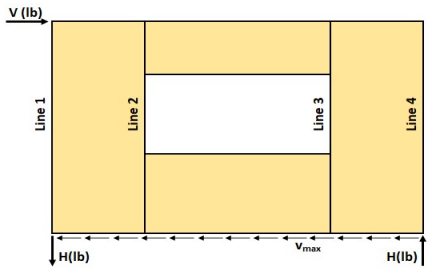
R1-F1 = 349 lbf

R2-F2 = 1125 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 116 plf

vc2 = (R2-F2)/L2 = 116 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		463	2065	2528 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2528	463	2065	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2528	463	2065	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		463	2065	2528 lbf

Design Summary*

Req. Sheathing Capacity	632 plf	**4-Term Deflection**	0.322 in.	**3-Term Deflection**	0.342 in.
Req. Strap Force	2894 lbf	**4-Term Story Drift %**	0.012 %	**3-Term Story Drift %**	0.013 %
Req. HD Force (H)	2528 lbf				
Req. Shear Wall Anchorage Force (v_{max})	281 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (18'-9" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5267 (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:	2140	2140	(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	
$v_{unfactored}$:	413	413	413	413	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	69	69	69	69	(plf)
e_n:	0.0004	0.0004	0.0004	0.0004	(in.)
b:	3.02	3.02	9.73	9.73	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.030	0.045	0.003	0.570	0.009	0.030	0.002	0.253
		Sum	0.647			Sum	0.294
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	0.030	0.002	0.079	0.009	0.045	0.003	0.177
		Sum	0.113			Sum	0.234

Total Defl.	
0.322	(in.)
0.0119	%drift

Project Information

Code:	2018 IBC	**Date:**	10/12/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid 13 (18'-9" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5267 (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: | G_a Override: | C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	413	413	413	413	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	3.02	3.02	9.73	9.73	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.030	0.071	0.570	0.009	0.048	0.253
	Sum	0.671		Sum	0.310
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	0.048	0.079	0.009	0.071	0.177
	Sum	0.129		Sum	0.258

Total Defl.	
0.342	(in.)
0.0127	%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

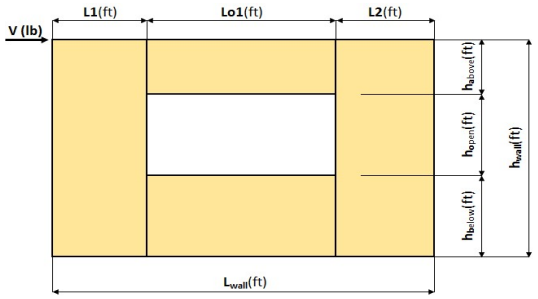
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid A (2-3) (14'-7" Section) - (Level 3 Seismic)

Date: 10/14/2024



Shear Wall Calculation Variables

V	1599 lbf	Opening 1	
L1	4.29 ft	h_a	1.00 ft
L2	4.29 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	14.58 ft	Lo1	6.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.17	N/A
P2=h_o/L2=	1.17	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 987 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 247 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1481 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 740 lbf

F2 = O1(L2)/(L1+L2) = 740 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.00 ft

T2 = (L2*Lo1)/(L1+L2) = 3.00 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 186 plf

v2 = (V/L)(T2+L2)/L2 = 186 plf

Check v1*L1+v2*L2=V? 1599 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 800 lbf

R2 = v2*L2 = 800 lbf

8. Difference corner force + resistance

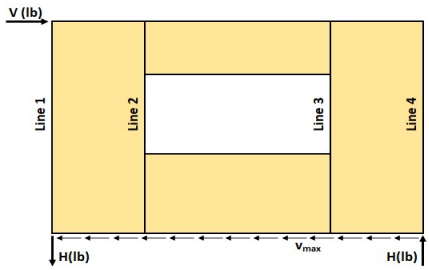
R1-F1 = 59 lbf

R2-F2 = 59 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 14 plf

vc2 = (R2-F2)/L2 = 14 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		55	932	987 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	987	55	932	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	987	55	932	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		55	932	987 lbf

Design Summary*

Req. Sheathing Capacity	247 plf	**4-Term Deflection**	0.162 in.	**3-Term Deflection**	0.202 in.
Req. Strap Force	740 lbf	**4-Term Story Drift %**	0.006 %	**3-Term Story Drift %**	0.007 %
Req. HD Force (H)	987 lbf				
Req. Shear Wall Anchorage Force (v_{max})	110 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (2-3) (14'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1599 (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:	4	4	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	186	186	186	186	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4	4	4	4	(in.)
V_n:	62	62	62	62	(plf)
e_n:	0.0012	0.0012	0.0012	0.0012	(in.)
b:	4.29	4.29	4.29	4.29	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.012	0.020	0.008	0.181	0.003	0.013	0.005	0.080
		Sum	0.221			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
0.003	0.013	0.005	0.080	0.012	0.020	0.008	0.181
		Sum	0.103			Sum	0.221

Total Defl.	
0.162	(in.)
0.0060	%drift

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (2-3) (14'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1599 (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:	4	4	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	186	186	186	186	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	22.0	22.0	22.0	22.0	(kips/in.)
b:	4.29	4.29	4.29	4.29	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.012	0.076	0.181	0.003	0.051	0.080
	Sum	0.269		Sum	0.135
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	0.051	0.080	0.012	0.076	0.181
	Sum	0.135		Sum	0.269

Total Defl.	
0.202	(in.)
0.0075	%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

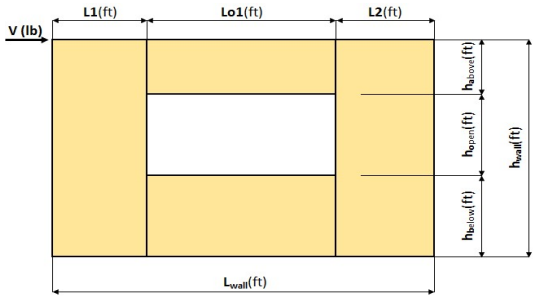
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid A (2-3) (14'-7" Section) - (Level 2 Seismic)

Date: 10/14/2024



Shear Wall Calculation Variables

V	2956 lbf	Opening 1	
L1	4.29 ft	h_a	1.00 ft
L2	4.29 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	14.58 ft	Lo1	6.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.17	N/A
P2=h_o/L2=	1.17	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1825 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 456 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2737 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1369 lbf

F2 = O1(L2)/(L1+L2) = 1369 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.00 ft

T2 = (L2*Lo1)/(L1+L2) = 3.00 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 345 plf

v2 = (V/L)(T2+L2)/L2 = 345 plf

Check v1*L1+v2*L2=V? 2956 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1478 lbf

R2 = v2*L2 = 1478 lbf

8. Difference corner force + resistance

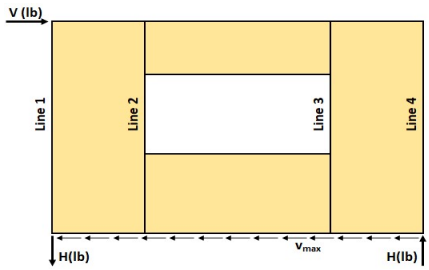
R1-F1 = 109 lbf

R2-F2 = 109 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 26 plf

vc2 = (R2-F2)/L2 = 26 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		102	1723	1825 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1825	102	1723	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1825	102	1723	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		102	1723	1825 lbf

Design Summary*

Req. Sheathing Capacity	456 plf	**4-Term Deflection**	0.292 in.	**3-Term Deflection**	0.317 in.
Req. Strap Force	1369 lbf	**4-Term Story Drift %**	0.011 %	**3-Term Story Drift %**	0.012 %
Req. HD Force (H)	1825 lbf				
Req. Shear Wall Anchorage Force (v_{max})	203 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (2-3) (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2956 (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:	2140	2140	(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	
$v_{unfactored}$:	345	345	345	345	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	57	57	57	57	(plf)
e_n:	0.0009	0.0009	0.0009	0.0009	(in.)
b:	4.29	4.29	4.29	4.29	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.022	0.037	0.006	0.334	0.006	0.025	0.004	0.149
		Sum	0.400			Sum	0.184
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	0.025	0.004	0.149	0.022	0.037	0.006	0.334
		Sum	0.184			Sum	0.400

Total Defl.	
0.292	(in.)
0.0108	%drift

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (2-3) (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2956 (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:	2140	2140	(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	
$v_{unfactored}$:	345	345	345	345	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.29	4.29	4.29	4.29	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.022	0.074	0.334	0.006	0.049	0.149
	Sum	0.430		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
0.006	0.049	0.149	0.022	0.074	0.334
	Sum	0.204		Sum	0.430

Total Defl.	
0.317	(in.)
0.0117	%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

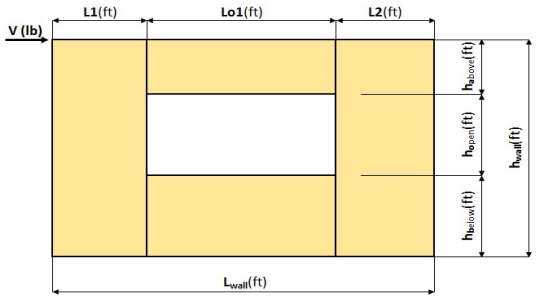
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid A (2-3) (14'-7" Section) - (Level 1 Seismic)

Date: 10/14/2024



Shear Wall Calculation Variables

V	3959 lbf	Opening 1	
L1	4.29 ft	h_a	1.00 ft
L2	4.29 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 ft
L_{wall}	14.58 ft	Lo1	6.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.17	N/A
P2=h_o/L2=	1.17	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2444 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 611 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 3666 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1833 lbf

F2 = O1(L2)/(L1+L2) = 1833 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.00 ft

T2 = (L2*Lo1)/(L1+L2) = 3.00 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 461 plf

v2 = (V/L)(T2+L2)/L2 = 461 plf

Check v1*L1+v2*L2=V? 3959 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1980 lbf

R2 = v2*L2 = 1980 lbf

8. Difference corner force + resistance

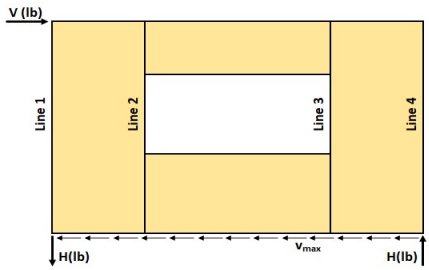
R1-F1 = 147 lbf

R2-F2 = 147 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 34 plf

vc2 = (R2-F2)/L2 = 34 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		137	2307	2444 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2444	137	2307	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2444	137	2307	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		137	2307	2444 lbf

Design Summary*

Req. Sheathing Capacity	611 plf	**4-Term Deflection**	0.384 in.	**3-Term Deflection**	0.405 in.
Req. Strap Force	1833 lbf	**4-Term Story Drift %**	0.014 %	**3-Term Story Drift %**	0.015 %
Req. HD Force (H)	2444 lbf				
Req. Shear Wall Anchorage Force (v_{max})	272 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (2-3) (14'-7" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3959 (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:	2140	2140	(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	
$v_{unfactored}$:	461	461	461	461	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	77	77	77	77	(plf)
e_n:	0.0006	0.0006	0.0006	0.0006	(in.)
b:	4.29	4.29	4.29	4.29	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.024	0.050	0.004	0.448	0.007	0.033	0.003	0.199
		Sum	0.526			Sum	0.242
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
0.007	0.033	0.003	0.199	0.024	0.050	0.004	0.448
		Sum	0.242			Sum	0.526

Total Defl.	
0.384	(in.)
0.0142	%drift

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (2-3) (14'-7" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3959 (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:

G_a Override:

C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	461	461	461	461	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.29	4.29	4.29	4.29	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.024	0.080	0.448	0.007	0.053	0.199
	Sum	0.551		Sum	0.259
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.007	0.053	0.199	0.024	0.080	0.448
	Sum	0.259		Sum	0.551

Total Defl.	
0.405	(in.)
0.0150	%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

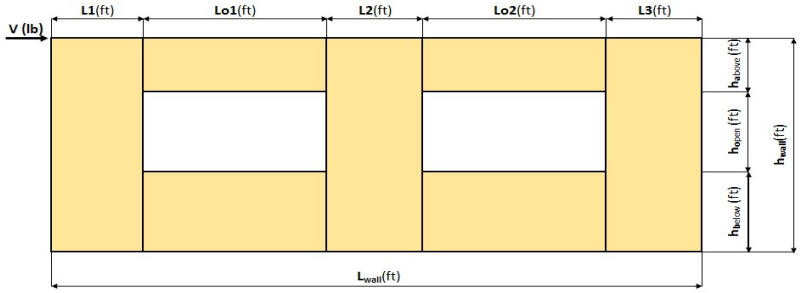
TWO OPENINGS

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 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid A (25'-6") - (Level 3)

Date: 10/14/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	2797 lbf				
L1	3.21 ft	h_a1	1.00 ft	h_a2	1.00 ft
L2	7.08 ft	h_o1	5.00 ft	h_o2	5.00 ft
L3	3.21 ft	h_b1	3.00 ft	h_b2	3.00 ft
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft
L_{wall}	25.50 ft				

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.56	N/A
P2=h_o/L2=	0.71	N/A
P3=h_o/L3=	1.56	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 987 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	247 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	247 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	1481 lbf
Second opening: O2 = va2 x (Lo2) =	1481 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	462 lbf
F2 = O1(L2)/(L1+L2) =	1019 lbf
F3 = O2(L2)/(L2+L3) =	1019 lbf
F4 = O2(L3)/(L2+L3) =	462 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.87 ft
T2 = (L2*Lo1)/(L1+L2) =	4.13 ft
T3 = (L2*Lo2)/(L2+L3) =	4.13 ft
T4 = (L3*Lo2)/(L2+L3) =	1.87 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	174 plf
v2 = (V/L)(T2+L2+T3)/L2 =	238 plf
v3 = (V/L)(T4+L3)/L3 =	174 plf
Check v1*L1+v2*L2+v3*L3=V?	2797 lbf **OK**

7. Resistance to corner forces

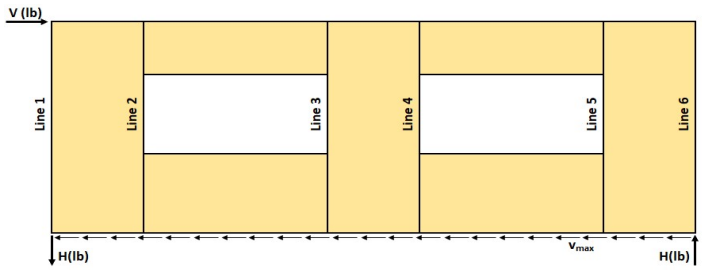
R1 = v1*L1 =	557 lbf
R2 = v2*L2 =	1682 lbf
R3 = v3*L3 =	557 lbf

8. Difference corner force + resistance

R1-F1 =	95 lbf
R2-F2-F3 =	-355 lbf
R3-F4 =	95 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	30 plf
vc2 = (R2-F2-F3)/L2 =	-50 plf
vc3 = (R3-F4)/L3 =	30 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		119	868	987 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	987	119	868	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-201	1188	987	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	987	1188	-201	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	987	119	868	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		119	868	987 lbf

Design Summary*

Req. Sheathing Capacity	247 plf	**4-Term Deflection**	0.145 in.	**3-Term Deflection**	0.182 in.
Req. Strap Force	1019 lbf	**4-Term Story Drift %**	0.005 %	**3-Term Story Drift %**	0.007 %
Req. HD Force	987 lbf				
Req. Shear Wall Anchorage Force	110 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (25'-6") - (Level 3)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2797 (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	
$v_{unfactored}$:	174	174	238	238	174	174	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	58	58	79	79	58	58	(plf)
e_n:	0.0010	0.0010	0.0025	0.0025	0.0010	0.0010	(in.)
b:	3.21	3.21	7.08	7.08	3.21	3.21	(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
0.015	0.019	0.006	0.199	0.004	0.012	0.004	0.088
		Sum	0.239			Sum	0.110
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	0.017	0.011	0.055	0.003	0.017	0.011	0.055
		Sum	0.086			Sum	0.086
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
0.004	0.012	0.004	0.088	0.015	0.019	0.006	0.199
		Sum	0.110			Sum	0.239

Total Defl.	
0.145	(in.)
0.0054	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (25'-6") - (Level 3)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2797 (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	
$v_{unfactored}$:	174	174	238	238	174	174	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	3.21	3.21	7.08	7.08	3.21	3.21	(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
0.015	0.071	0.199	0.004	0.047	0.088
	Sum	0.285		Sum	0.140
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	0.065	0.055	0.003	0.065	0.055
	Sum	0.122		Sum	0.122
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.004	0.047	0.088	0.015	0.071	0.199
	Sum	0.140		Sum	0.285

Total Defl.	
0.182	(in.)
0.0068	%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

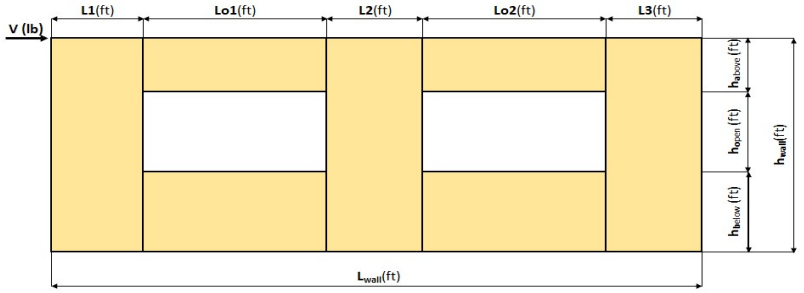
TWO OPENINGS

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 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid A (25'-6") - (Level 2)

Date: 10/14/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	5170 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	3.21 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	7.08 ft	h_b1	3.00 ft	h_b2	3.00 ft
L3	3.21 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.00 ft				
L_{wall}	25.50 ft				

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.56	N/A
P2=h_o/L2=	0.71	N/A
P3=h_o/L3=	1.56	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1825 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	456 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	456 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	2737 lbf
Second opening: O2 = va2 x (Lo2) =	2737 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	854 lbf
F2 = O1(L2)/(L1+L2) =	1883 lbf
F3 = O2(L2)/(L2+L3) =	1883 lbf
F4 = O2(L3)/(L2+L3) =	854 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.87 ft
T2 = (L2*Lo1)/(L1+L2) =	4.13 ft
T3 = (L2*Lo2)/(L2+L3) =	4.13 ft
T4 = (L3*Lo2)/(L2+L3) =	1.87 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	321 plf
v2 = (V/L)(T2+L2+T3)/L2 =	439 plf
v3 = (V/L)(T4+L3)/L3 =	321 plf
Check v1*L1+v2*L2+v3*L3=V?	5170 lbf **OK**

7. Resistance to corner forces

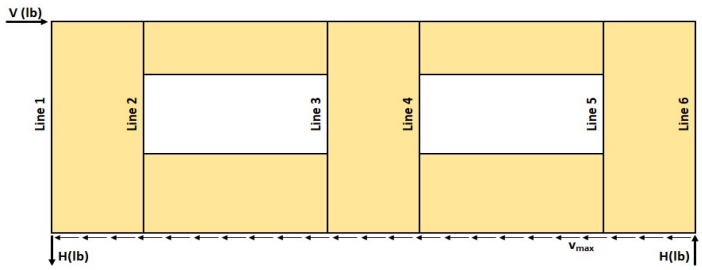
R1 = v1*L1 =	1030 lbf
R2 = v2*L2 =	3109 lbf
R3 = v3*L3 =	1030 lbf

8. Difference corner force + resistance

R1-F1 =	176 lbf
R2-F2-F3 =	-657 lbf
R3-F4 =	176 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	55 plf
vc2 = (R2-F2-F3)/L2 =	-93 plf
vc3 = (R3-F4)/L3 =	55 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		220	1605	1825 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	1825	220	1605	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-371	2196	1825	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	1825	2196	-371	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	1825	220	1605	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		220	1605	1825 lbf

Design Summary*

Req. Sheathing Capacity	456 plf	**4-Term Deflection**	0.260 in.	**3-Term Deflection**	0.283 in.
Req. Strap Force	1883 lbf	**4-Term Story Drift %**	0.010 %	**3-Term Story Drift %**	0.010 %
Req. HD Force	1825 lbf				
Req. Shear Wall Anchorage Force	203 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (25'-6") - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5170 (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	
$v_{unfactored}$:	321	321	439	439	321	321	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	53	53	73	73	53	53	(plf)
e_n:	0.0008	0.0008	0.0019	0.0019	0.0008	0.0008	(in.)
b:	3.21	3.21	7.08	7.08	3.21	3.21	(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
0.027	0.035	0.005	0.368	0.008	0.023	0.003	0.163
		Sum	0.435			Sum	0.198
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
0.005	0.032	0.009	0.101	0.005	0.032	0.009	0.101
		Sum	0.147			Sum	0.147
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
0.008	0.023	0.003	0.163	0.027	0.035	0.005	0.368
		Sum	0.198			Sum	0.435

Total Defl.	
0.260	(in.)
0.0096	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (25'-6") - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5170 (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:	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	
$v_{unfactored}$:	321	321	439	439	321	321	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	3.21	3.21	7.08	7.08	3.21	3.21	(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
0.027	0.069	0.368	0.008	0.046	0.163
	Sum	0.464		Sum	0.217
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.005	0.063	0.101	0.005	0.063	0.101
	Sum	0.169		Sum	0.169
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.008	0.046	0.163	0.027	0.069	0.368
	Sum	0.217		Sum	0.464

Total Defl.	
0.283	(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

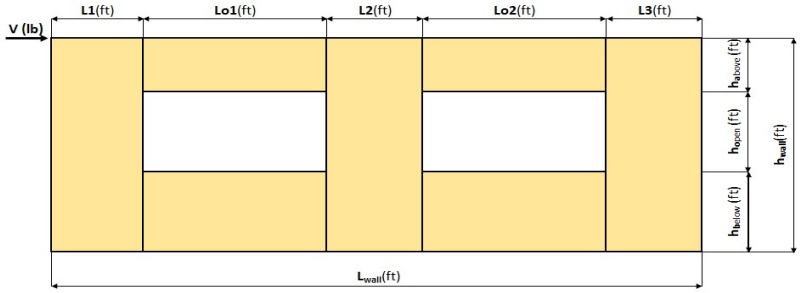
TWO OPENINGS

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 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid A (25'-6") - (Level 2)

Date: 10/14/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	6924 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	3.21 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	7.08 ft	h_b1	3.00 ft	h_b2	3.00 ft
L3	3.21 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.00 ft				
L_{wall}	25.50 ft				

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.56	N/A
P2=h_o/L2=	0.71	N/A
P3=h_o/L3=	1.56	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2444 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	611 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	611 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	3666 lbf
Second opening: O2 = va2 x (Lo2) =	3666 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	1144 lbf
F2 = O1(L2)/(L1+L2) =	2522 lbf
F3 = O2(L2)/(L2+L3) =	2522 lbf
F4 = O2(L3)/(L2+L3) =	1144 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.87 ft
T2 = (L2*Lo1)/(L1+L2) =	4.13 ft
T3 = (L2*Lo2)/(L2+L3) =	4.13 ft
T4 = (L3*Lo2)/(L2+L3) =	1.87 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	430 plf
v2 = (V/L)(T2+L2+T3)/L2 =	588 plf
v3 = (V/L)(T4+L3)/L3 =	430 plf
Check v1*L1+v2*L2+v3*L3=V?	6924 lbf **OK**

7. Resistance to corner forces

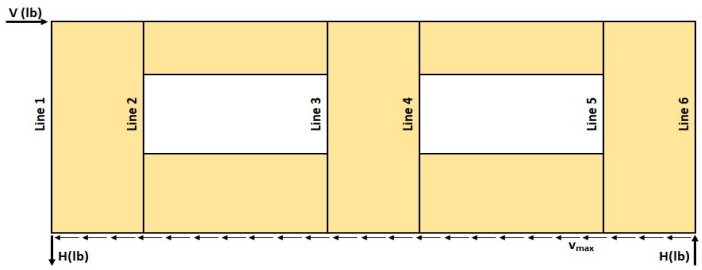
R1 = v1*L1 =	1380 lbf
R2 = v2*L2 =	4164 lbf
R3 = v3*L3 =	1380 lbf

8. Difference corner force + resistance

R1-F1 =	236 lbf
R2-F2-F3 =	-880 lbf
R3-F4 =	236 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	74 plf
vc2 = (R2-F2-F3)/L2 =	-124 plf
vc3 = (R3-F4)/L3 =	74 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		294	2149	2444 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	2444	294	2149	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-497	2941	2444	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	2444	2941	-497	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	2444	294	2149	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		294	2149	2444 lbf

Design Summary*

Req. Sheathing Capacity	611 plf	**4-Term Deflection**	0.341 in.	**3-Term Deflection**	0.361 in.
Req. Strap Force	2522 lbf	**4-Term Story Drift %**	0.013 %	**3-Term Story Drift %**	0.013 %
Req. HD Force	2444 lbf				
Req. Shear Wall Anchorage Force	272 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (25'-6") - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6924 (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	
$v_{unfactored}$:	430	430	588	588	430	430	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	72	72	98	98	72	72	(plf)
e_n:	0.0005	0.0005	0.0014	0.0014	0.0005	0.0005	(in.)
b:	3.21	3.21	7.08	7.08	3.21	3.21	(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
0.030	0.046	0.003	0.493	0.009	0.031	0.002	0.219
		Sum	0.572			Sum	0.261
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
0.005	0.042	0.006	0.136	0.005	0.042	0.006	0.136
		Sum	0.190			Sum	0.190
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	0.031	0.002	0.219	0.030	0.046	0.003	0.493
		Sum	0.261			Sum	0.572

Total Defl.	
0.341	(in.)
0.0126	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (25'-6") - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6924 (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: | 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	
$v_{unfactored}$:	430	430	588	588	430	430	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	3.21	3.21	7.08	7.08	3.21	3.21	(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
0.030	0.074	0.493	0.009	0.050	0.219
	Sum	0.597		Sum	0.277
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.005	0.068	0.136	0.005	0.068	0.136
	Sum	0.209		Sum	0.209
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	0.050	0.219	0.030	0.074	0.493
	Sum	0.277		Sum	0.597

Total Defl.	
0.361	(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

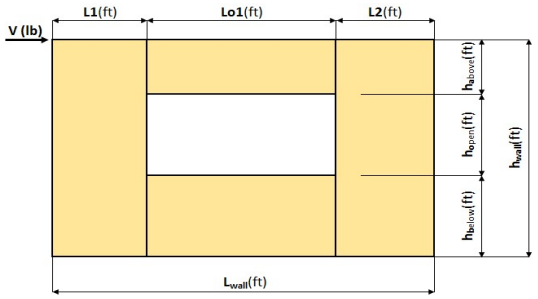
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid A (11-12) (14'-7" Section) - (Level 3 Seismic)

Date: 10/14/2024



Shear Wall Calculation Variables

V	1599 lbf	Opening 1	
L1	4.33 ft	h_a	1.00 ft
L2	7.25 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 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=	1.15	N/A
P2=h_o/L2=	0.69	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 987 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 247 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 740 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 277 lbf

F2 = O1(L2)/(L1+L2) = 463 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.12 ft

T2 = (L2*Lo1)/(L1+L2) = 1.88 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 138 plf

v2 = (V/L)(T2+L2)/L2 = 138 plf

Check v1*L1+v2*L2=V? 1599 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 598 lbf

R2 = v2*L2 = 1001 lbf

8. Difference corner force + resistance

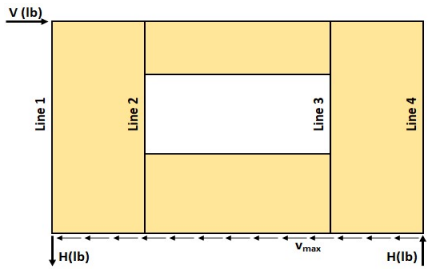
R1-F1 = 321 lbf

R2-F2 = 538 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 74 plf

vc2 = (R2-F2)/L2 = 74 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		297	690	987 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	987	297	690	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	987	297	690	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		297	690	987 lbf

Design Summary*

Req. Sheathing Capacity	247 plf	**4-Term Deflection**	0.096 in.	**3-Term Deflection**	0.128 in.
Req. Strap Force	463 lbf	**4-Term Story Drift %**	0.004 %	**3-Term Story Drift %**	0.005 %
Req. HD Force (H)	987 lbf				
Req. Shear Wall Anchorage Force (v_{max})	110 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (11-12) (14'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1599 (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:	4	4	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	138	138	138	138	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4	4	4	4	(in.)
V_n:	46	46	46	46	(plf)
e_n:	0.0005	0.0005	0.0005	0.0005	(in.)
b:	4.33	4.33	7.25	7.25	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.009	0.015	0.003	0.133	0.003	0.010	0.002	0.059
		Sum	0.160			Sum	0.074
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	0.010	0.002	0.035	0.005	0.015	0.003	0.079
		Sum	0.049			Sum	0.103

Total Defl.	
0.096	(in.)
0.0036	%drift

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (11-12) (14'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1599 (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:	4	4	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	138	138	138	138	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	22.0	22.0	22.0	22.0	(kips/in.)
b:	4.33	4.33	7.25	7.25	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.009	0.056	0.133	0.003	0.038	0.059
	Sum	0.198		Sum	0.099
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	0.038	0.035	0.005	0.056	0.079
	Sum	0.074		Sum	0.141

Total Defl.	
0.128	(in.)
0.0047	%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

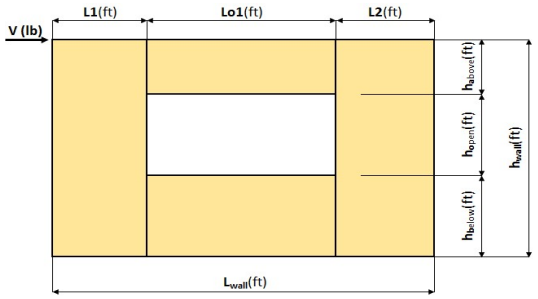
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid A (11-12) (14'-7" Section) - (Level 2 Seismic)

Date: 10/14/2024



Shear Wall Calculation Variables

V	2956 lbf	Opening 1		Adj. Factor Method =	2bs/h
L1	4.33 ft	h_a	1.00 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	7.25 ft	h_o	5.00 ft	P1=h_o/L1= 1.15	N/A
h_{wall}	9.00 ft	h_b	3.00 ft	P2=h_o/L2= 0.69	N/A
L_{wall}	14.58 ft	Lo1	3.00 ft		

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1825 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 456 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1369 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 512 lbf

F2 = O1(L2)/(L1+L2) = 857 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.12 ft

T2 = (L2*Lo1)/(L1+L2) = 1.88 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 255 plf

v2 = (V/L)(T2+L2)/L2 = 255 plf

Check v1*L1+v2*L2=V? 2956 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1105 lbf

R2 = v2*L2 = 1851 lbf

8. Difference corner force + resistance

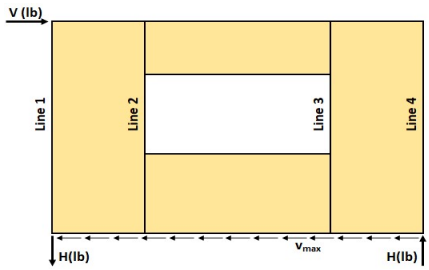
R1-F1 = 594 lbf

R2-F2 = 994 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 137 plf

vc2 = (R2-F2)/L2 = 137 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		548	1276	1825 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1825	548	1276	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1825	548	1276	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		548	1276	1825 lbf

Design Summary*

Req. Sheathing Capacity	456 plf	**4-Term Deflection**	0.175 in.	**3-Term Deflection**	0.195 in.
Req. Strap Force	857 lbf	**4-Term Story Drift %**	0.006 %	**3-Term Story Drift %**	0.007 %
Req. HD Force (H)	1825 lbf				
Req. Shear Wall Anchorage Force (v_{max})	203 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (11-12) (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2956 (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:	2140	2140	(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	
$v_{unfactored}$:	255	255	255	255	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	43	43	43	43	(plf)
e_n:	0.0004	0.0004	0.0004	0.0004	(in.)
b:	4.33	4.33	7.25	7.25	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.016	0.028	0.003	0.245	0.005	0.018	0.002	0.109
		Sum	0.292			Sum	0.134
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	0.018	0.002	0.065	0.010	0.028	0.003	0.147
		Sum	0.088			Sum	0.186

Total Defl.	
0.175	(in.)
0.0065	%drift

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (11-12) (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2956 (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)		

				Pier 1	Pier 2	
G_t Override:			Nail Spacing:	2	2	(in.)
G_a Override:		C_d: 4.00	HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	255	255	255	255	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.33	4.33	7.25	7.25	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.016	0.055	0.245	0.005	0.036	0.109
	Sum	0.316		Sum	0.150
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	0.036	0.065	0.010	0.055	0.147
	Sum	0.104		Sum	0.211

Total Defl.	
0.195	(in.)
0.0072	%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

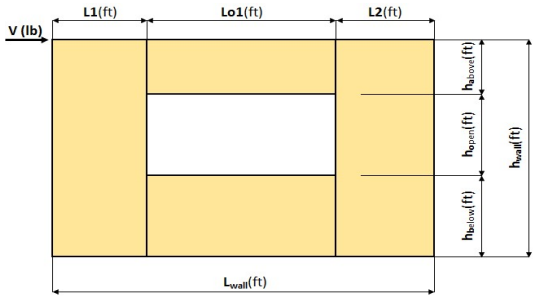
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid A (11-12) (14'-7" Section) - (Level 1 Seismic)

Date: 10/14/2024



Shear Wall Calculation Variables

V	3959 lbf	Opening 1	
L1	4.33 ft	h_a	1.00 ft
L2	7.25 ft	h_o	5.00 ft
h_{wall}	9.00 ft	h_b	3.00 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=	1.15	N/A
P2=h_o/L2=	0.69	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2444 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 611 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1833 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 685 lbf

F2 = O1(L2)/(L1+L2) = 1148 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.12 ft

T2 = (L2*Lo1)/(L1+L2) = 1.88 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 342 plf

v2 = (V/L)(T2+L2)/L2 = 342 plf

Check v1*L1+v2*L2=V? 3959 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1480 lbf

R2 = v2*L2 = 2479 lbf

8. Difference corner force + resistance

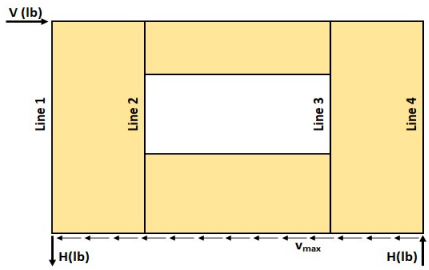
R1-F1 = 795 lbf

R2-F2 = 1331 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 184 plf

vc2 = (R2-F2)/L2 = 184 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		734	1709	2444 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2444	734	1709	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2444	734	1709	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		734	1709	2444 lbf

Design Summary*

Req. Sheathing Capacity	611 plf	**4-Term Deflection**	0.231 in.	**3-Term Deflection**	0.248 in.
Req. Strap Force	1148 lbf	**4-Term Story Drift %**	0.009 %	**3-Term Story Drift %**	0.009 %
Req. HD Force (H)	2444 lbf				
Req. Shear Wall Anchorage Force (v_{max})	272 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (11-12) (14'-7" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3959 (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:	2140	2140	(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	
$v_{unfactored}$:	342	342	342	342	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	57	57	57	57	(plf)
e_n:	0.0002	0.0002	0.0002	0.0002	(in.)
b:	4.33	4.33	7.25	7.25	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.017	0.037	0.002	0.329	0.005	0.025	0.001	0.146
		Sum	0.385			Sum	0.177
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	0.025	0.001	0.087	0.010	0.037	0.002	0.196
		Sum	0.116			Sum	0.245

Total Defl.	
0.231	(in.)
0.0085	%drift

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid A (11-12) (14'-7" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3959 (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: | G_a Override: | C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	342	342	342	342	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.33	4.33	7.25	7.25	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.017	0.059	0.329	0.005	0.039	0.146
	Sum	0.405		Sum	0.191
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	0.039	0.087	0.010	0.059	0.196
	Sum	0.130		Sum	0.266

Total Defl.	
0.248	(in.)
0.0092	%drift

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

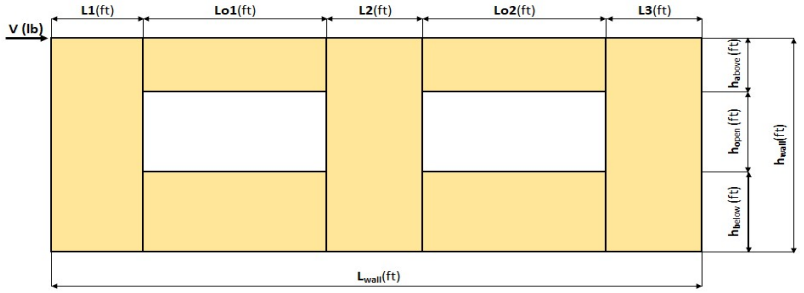
Force Transfer Around Openings Calculator

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 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (25'-2") - (Level 3)		



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	2509 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	2.06 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	8.60 ft	h_b1	3.00 ft	h_b2	3.00 ft
L3	2.50 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.00 ft				
L_{wall}	25.16 ft				

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 2.43	0.824
P2=h_o/L2= 0.58	N/A
P3=h_o/L3= 2.00	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 897 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) = 224 plf

Second opening: va2 = vb2 = H/(h_a2+h_b2) = 224 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1346 lbf

Second opening: O2 = va2 x (Lo2) = 1346 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 260 lbf

F2 = O1(L2)/(L1+L2) = 1086 lbf

F3 = O2(L2)/(L2+L3) = 1043 lbf

F4 = O2(L3)/(L2+L3) = 303 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.16 ft

T2 = (L2*Lo1)/(L1+L2) = 4.84 ft

T3 = (L2*Lo2)/(L2+L3) = 4.65 ft

T4 = (L3*Lo2)/(L2+L3) = 1.35 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 156 plf

v2 = (V/L)(T2+L2+T3)/L2 = 210 plf

v3 = (V/L)(T4+L3)/L3 = 154 plf

Check v1*L1+v2*L2+v3*L3=V? 2509 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 321 lbf

R2 = v2*L2 = 1804 lbf

R3 = v3*L3 = 384 lbf

8. Difference corner force + resistance

R1-F1 = 61 lbf

R2-F2-F3 = -325 lbf

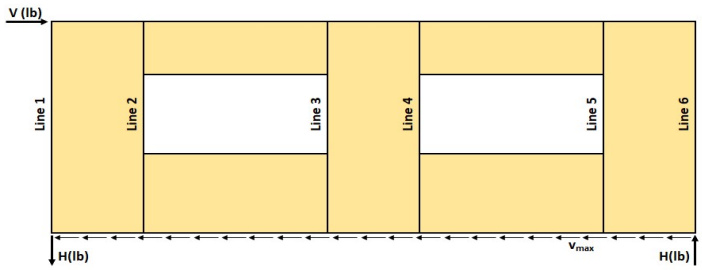
R3-F4 = 81 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 30 plf

vc2 = (R2-F2-F3)/L2 = -38 plf

vc3 = (R3-F4)/L3 = 32 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		118	779	897 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	897	118	779	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-151	1049	897	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	897	1049	-151	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	897	129	768	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		129	768	897 lbf

Design Summary*

Req. Sheathing Capacity	224 plf	**4-Term Deflection**	0.175 in.	**3-Term Deflection**	0.223 in.
Req. Strap Force	1086 lbf	**4-Term Story Drift %**	0.006 %	**3-Term Story Drift %**	0.008 %
Req. HD Force	897 lbf				
Req. Shear Wall Anchorage Force	100 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (25'-2") - (Level 3)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2509 (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	
$v_{unfactored}$:	156	156	210	210	154	154	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	78	78	105	105	77	77	(plf)
e_n:	0.0023	0.0023	0.0057	0.0057	0.0022	0.0022	(in.)
b:	2.06	2.06	8.60	8.60	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
0.021	0.017	0.016	0.278	0.006	0.011	0.011	0.124
		Sum	0.331			Sum	0.151
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	0.026	0.040	0.002	0.015	0.026	0.040
		Sum	0.083			Sum	0.083
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	0.100	0.017	0.017	0.015	0.226
		Sum	0.127			Sum	0.274

Total Defl.	
0.175	(in.)
0.0065	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
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Wall Line:	Grid J-M (25'-2") - (Level 3)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2509 (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:	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	
$v_{unfactored}$:	156	156	210	210	154	154	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	2.06	2.06	8.60	8.60	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
0.021	0.094	0.278	0.006	0.062	0.124
	Sum	0.392		Sum	0.192
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	0.084	0.040	0.002	0.084	0.040
	Sum	0.126		Sum	0.126
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	0.100	0.017	0.092	0.226
	Sum	0.167		Sum	0.335

Total Defl.	
0.223	(in.)
0.0083	%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

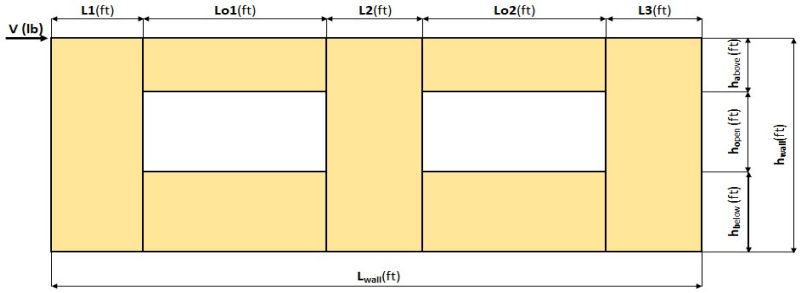
TWO OPENINGS

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 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid J-M (25'-2") - (Level 2)

Date: 10/14/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	4503 lbf				
L1	2.06 ft	h_a1	1.00 ft	h_a2	1.00 ft
L2	8.60 ft	h_o1	5.00 ft	h_o2	5.00 ft
L3	2.50 ft	h_b1	3.00 ft	h_b2	3.00 ft
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft
L_{wall}	25.16 ft				

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 2.43	0.824
P2=h_o/L2= 0.58	N/A
P3=h_o/L3= 2.00	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1611 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) = 403 plf

Second opening: va2 = vb2 = H/(h_a2+h_b2) = 403 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2416 lbf

Second opening: O2 = va2 x (Lo2) = 2416 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 467 lbf

F2 = O1(L2)/(L1+L2) = 1949 lbf

F3 = O2(L2)/(L2+L3) = 1872 lbf

F4 = O2(L3)/(L2+L3) = 544 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.16 ft

T2 = (L2*Lo1)/(L1+L2) = 4.84 ft

T3 = (L2*Lo2)/(L2+L3) = 4.65 ft

T4 = (L3*Lo2)/(L2+L3) = 1.35 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 280 plf

v2 = (V/L)(T2+L2+T3)/L2 = 376 plf

v3 = (V/L)(T4+L3)/L3 = 276 plf

Check v1*L1+v2*L2+v3*L3=V? 4503 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 576 lbf

R2 = v2*L2 = 3238 lbf

R3 = v3*L3 = 689 lbf

8. Difference corner force + resistance

R1-F1 = 109 lbf

R2-F2-F3 = -584 lbf

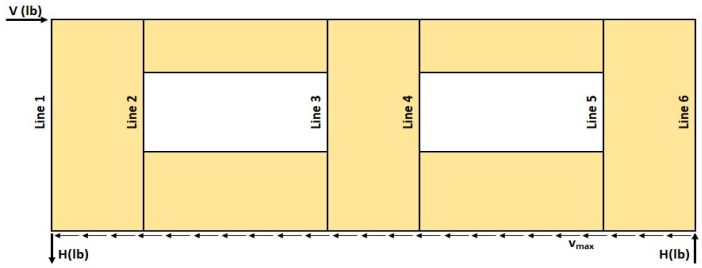
R3-F4 = 145 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 53 plf

vc2 = (R2-F2-F3)/L2 = -68 plf

vc3 = (R3-F4)/L3 = 58 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		212	1399	1611 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	1611	212	1399	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-271	1882	1611	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	1611	1882	-271	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	1611	232	1379	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		232	1379	1611 lbf

Design Summary*

Req. Sheathing Capacity	403 plf	**4-Term Deflection**	0.295 in.	**3-Term Deflection**	0.334 in.
Req. Strap Force	1949 lbf	**4-Term Story Drift %**	0.011 %	**3-Term Story Drift %**	0.012 %
Req. HD Force	1611 lbf				
Req. Shear Wall Anchorage Force	179 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (25'-2") - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4503 (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	
$v_{unfactored}$:	280	280	376	376	276	276	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	70	70	94	94	69	69	(plf)
e_n:	0.0017	0.0017	0.0041	0.0041	0.0016	0.0016	(in.)
b:	2.06	2.06	8.60	8.60	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
0.037	0.030	0.011	0.499	0.011	0.020	0.008	0.222
		Sum	0.578			Sum	0.261
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	0.027	0.019	0.072	0.004	0.027	0.019	0.072
		Sum	0.121			Sum	0.121
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	0.180	0.030	0.030	0.011	0.406
		Sum	0.216			Sum	0.476

Total Defl.	
0.295	(in.)
0.0109	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (25'-2") - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4503 (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:	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	
$v_{unfactored}$:	280	280	376	376	276	276	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	2.06	2.06	8.60	8.60	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
0.037	0.090	0.499	0.011	0.060	0.222
	Sum	0.626		Sum	0.293
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	0.081	0.072	0.004	0.081	0.072
	Sum	0.156		Sum	0.156
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	0.180	0.030	0.089	0.406
	Sum	0.248		Sum	0.524

Total Defl.	
0.334	(in.)
0.0124	%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

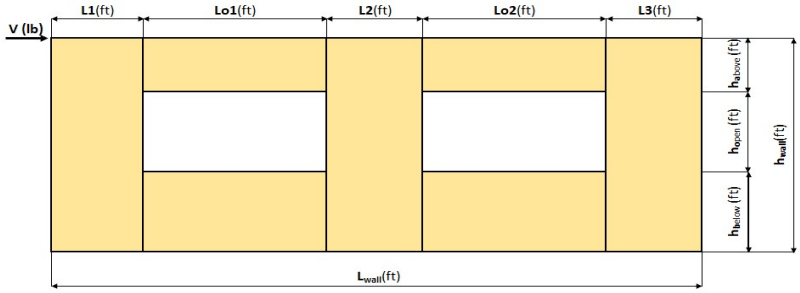
TWO OPENINGS

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 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid J-M (25'-2") - (Level 1)

Date: 10/14/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	6012 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	2.06 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	8.60 ft	h_b1	3.00 ft	h_b2	3.00 ft
L3	2.50 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.00 ft				
L_{wall}	25.16 ft				

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	2.43	0.824
P2=h_o/L2=	0.58	N/A
P3=h_o/L3=	2.00	N/A

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2151 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	538 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	538 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	3226 lbf
Second opening: O2 = va2 x (Lo2) =	3226 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	623 lbf
F2 = O1(L2)/(L1+L2) =	2602 lbf
F3 = O2(L2)/(L2+L3) =	2499 lbf
F4 = O2(L3)/(L2+L3) =	727 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.16 ft
T2 = (L2*Lo1)/(L1+L2) =	4.84 ft
T3 = (L2*Lo2)/(L2+L3) =	4.65 ft
T4 = (L3*Lo2)/(L2+L3) =	1.35 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	373 plf
v2 = (V/L)(T2+L2+T3)/L2 =	503 plf
v3 = (V/L)(T4+L3)/L3 =	368 plf
Check v1*L1+v2*L2+v3*L3=V?	6012 lbf **OK**

7. Resistance to corner forces

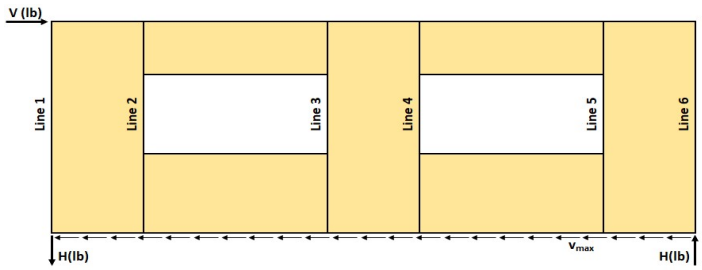
R1 = v1*L1 =	769 lbf
R2 = v2*L2 =	4322 lbf
R3 = v3*L3 =	920 lbf

8. Difference corner force + resistance

R1-F1 =	146 lbf
R2-F2-F3 =	-779 lbf
R3-F4 =	194 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	71 plf
vc2 = (R2-F2-F3)/L2 =	-91 plf
vc3 = (R3-F4)/L3 =	77 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		283	1867	2151 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	2151	283	1867	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-362	2513	2151	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	2151	2513	-362	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	2151	310	1841	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		310	1841	2151 lbf

Design Summary*

Req. Sheathing Capacity	538 plf	**4-Term Deflection**	0.387 in.	**3-Term Deflection**	0.412 in.
Req. Strap Force	2602 lbf	**4-Term Story Drift %**	0.014 %	**3-Term Story Drift %**	0.015 %
Req. HD Force	2151 lbf				
Req. Shear Wall Anchorage Force	239 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (25'-2") - (Level 1)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6012 (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	503	503	368	368	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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	84	84	61	61	(plf)
e_n:	0.0012	0.0012	0.0029	0.0029	0.0011	0.0011	(in.)
b:	2.06	2.06	8.60	8.60	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
0.049	0.040	0.008	0.667	0.015	0.027	0.005	0.296
		Sum	0.764			Sum	0.343
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
0.005	0.036	0.013	0.096	0.005	0.036	0.013	0.096
		Sum	0.149			Sum	0.149
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	0.241	0.040	0.040	0.008	0.542
		Sum	0.284			Sum	0.629

Total Defl.	
0.387	(in.)
0.0143	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (25'-2") - (Level 1)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6012 (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:	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	503	503	368	368	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	2.06	2.06	8.60	8.60	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
0.049	0.080	0.667	0.015	0.053	0.296
	Sum	0.796		Sum	0.364
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.005	0.072	0.096	0.005	0.072	0.096
	Sum	0.172		Sum	0.172
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	0.053	0.241	0.040	0.079	0.542
	Sum	0.305		Sum	0.660

Total Defl.	
0.412	(in.)
0.0152	%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

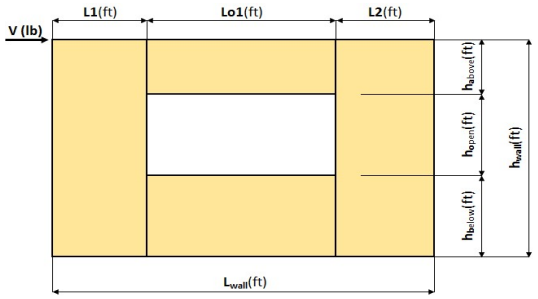
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grids J-M (14'-7" Section) - (Level 3)

Date: 10/14/2024



Shear Wall Calculation Variables

V	1454 lbf	Opening 1		Adj. Factor Method =	2bs/h
L1	4.58 ft	h_a	1.00 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	3.00 ft	h_o	5.00 ft	P1=h_o/L1= 1.09	N/A
h_{wall}	9.00 ft	h_b	3.00 ft	P2=h_o/L2= 1.67	N/A
L_{wall}	14.58 ft	Lo1	7.00 ft		

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} 898 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 224 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1571 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 949 lbf

F2 = O1(L2)/(L1+L2) = 622 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 4.23 ft

T2 = (L2*Lo1)/(L1+L2) = 2.77 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 192 plf

v2 = (V/L)(T2+L2)/L2 = 192 plf

Check v1*L1+v2*L2=V? 1454 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 879 lbf

R2 = v2*L2 = 575 lbf

8. Difference corner force + resistance

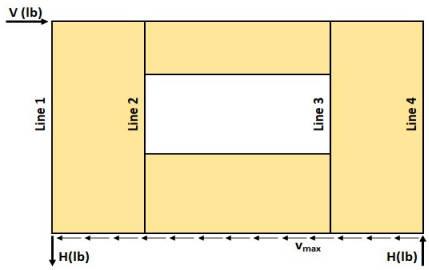
R1-F1 = -70 lbf

R2-F2 = -46 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = -15 plf

vc2 = (R2-F2)/L2 = -15 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		-62	959	898 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	898	-62	959	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	898	-62	959	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		-62	959	898 lbf

Design Summary*

Req. Sheathing Capacity	224 plf	**4-Term Deflection**	0.210 in.	**3-Term Deflection**	0.264 in.
Req. Strap Force	949 lbf	**4-Term Story Drift %**	0.008 %	**3-Term Story Drift %**	0.010 %
Req. HD Force (H)	898 lbf				
Req. Shear Wall Anchorage Force (v_{max})	100 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grids J-M (14'-7" Section) - (Level 3)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1454 (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:	2140	2140	(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	
$v_{unfactored}$:	192	192	192	192	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	96	96	96	96	(plf)
e_n:	0.0044	0.0044	0.0044	0.0044	(in.)
b:	4.58	4.58	3.00	3.00	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.011	0.021	0.030	0.174	0.003	0.014	0.020	0.078
		Sum	0.236			Sum	0.114
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
0.005	0.014	0.020	0.118	0.017	0.021	0.030	0.266
		Sum	0.157			Sum	0.334

Total Defl.	
0.210	(in.)
0.0078	%drift

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grids J-M (14'-7" Section) - (Level 3)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1454 (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 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	192	192	192	192	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.58	4.58	3.00	3.00	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.011	0.115	0.174	0.003	0.077	0.078
	Sum	0.301		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
0.005	0.077	0.118	0.017	0.115	0.266
	Sum	0.200		Sum	0.399

Total Defl.	
0.264	(in.)
0.0098	%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

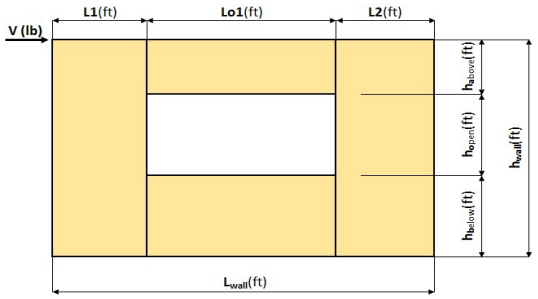
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grids J-M (14'-7" Section) - (Level 2)

Date: 10/14/2024



Shear Wall Calculation Variables

V	2609 lbf	Opening 1		Adj. Factor Method =	2bs/h
L1	4.58 ft	h_a	1.00 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	3.00 ft	h_o	5.00 ft	P1=h_o/L1= 1.09	N/A
h_{wall}	9.00 ft	h_b	3.00 ft	P2=h_o/L2= 1.67	N/A
L_{wall}	14.58 ft	Lo1	7.00 ft		

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} 1610 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 403 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2818 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1703 lbf

F2 = O1(L2)/(L1+L2) = 1115 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 4.23 ft

T2 = (L2*Lo1)/(L1+L2) = 2.77 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 344 plf

v2 = (V/L)(T2+L2)/L2 = 344 plf

Check v1*L1+v2*L2=V? 2609 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1576 lbf

R2 = v2*L2 = 1033 lbf

8. Difference corner force + resistance

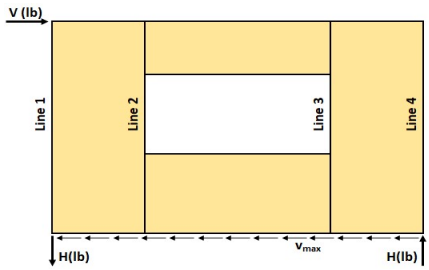
R1-F1 = -127 lbf

R2-F2 = -83 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = -28 plf

vc2 = (R2-F2)/L2 = -28 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		-110	1721	1610 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	1610	-110	1721	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	1610	-110	1721	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		-110	1721	1610 lbf

Design Summary*

Req. Sheathing Capacity	403 plf	**4-Term Deflection**	0.351 in.	**3-Term Deflection**	0.394 in.
Req. Strap Force	1703 lbf	**4-Term Story Drift %**	0.013 %	**3-Term Story Drift %**	0.015 %
Req. HD Force (H)	1610 lbf				
Req. Shear Wall Anchorage Force (v_{max})	179 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grids J-M (14'-7" Section) - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2609 (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:	2140	2140	(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	
$v_{unfactored}$:	344	344	344	344	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	86	86	86	86	(plf)
e_n:	0.0032	0.0032	0.0032	0.0032	(in.)
b:	4.58	4.58	3.00	3.00	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.020	0.037	0.021	0.313	0.006	0.025	0.014	0.139
		Sum	0.392			Sum	0.184
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
0.009	0.025	0.014	0.212	0.031	0.037	0.021	0.478
		Sum	0.260			Sum	0.567

Total Defl.	
0.351	(in.)
0.0130	%drift

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grids J-M (14'-7" Section) - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2609 (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:	2140	2140	(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	
$v_{unfactored}$:	344	344	344	344	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	4.58	4.58	3.00	3.00	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.020	0.111	0.313	0.006	0.074	0.139
	Sum	0.444		Sum	0.219
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.009	0.074	0.212	0.031	0.111	0.478
	Sum	0.295		Sum	0.620

Total Defl.	
0.394	(in.)
0.0146	%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

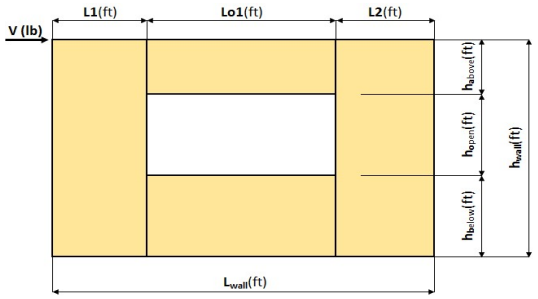
ONE OPENING

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:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grids J-M (14'-7" Section) - (Level 1)

Date: 10/14/2024



Shear Wall Calculation Variables

V	3848 lbf	Opening 1		Adj. Factor Method =	2bs/h
L1	4.58 ft	h_a	1.00 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	3.00 ft	h_o	5.00 ft	P1=h_o/L1= 1.09	N/A
h_{wall}	9.00 ft	h_b	3.00 ft	P2=h_o/L2= 1.67	N/A
L_{wall}	14.58 ft	Lo1	7.00 ft		

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} 2375 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 594 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 4157 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 2512 lbf

F2 = O1(L2)/(L1+L2) = 1645 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 4.23 ft

T2 = (L2*Lo1)/(L1+L2) = 2.77 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 508 plf

v2 = (V/L)(T2+L2)/L2 = 508 plf

Check v1*L1+v2*L2=V? 3848 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 2325 lbf

R2 = v2*L2 = 1523 lbf

8. Difference corner force + resistance

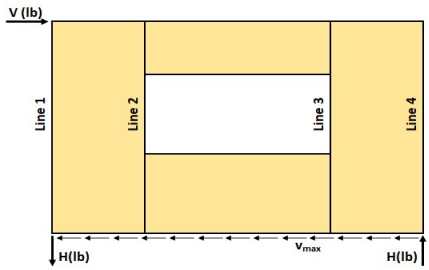
R1-F1 = -187 lbf

R2-F2 = -122 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = -41 plf

vc2 = (R2-F2)/L2 = -41 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		-163	2538	2375 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2375	-163	2538	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2375	-163	2538	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		-163	2538	2375 lbf

Design Summary*

Req. Sheathing Capacity	594 plf	**4-Term Deflection**	0.457 in.	**3-Term Deflection**	0.486 in.
Req. Strap Force	2512 lbf	**4-Term Story Drift %**	0.017 %	**3-Term Story Drift %**	0.018 %
Req. HD Force (H)	2375 lbf				
Req. Shear Wall Anchorage Force (v_{max})	264 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grids J-M (14'-7" Section) - (Level 1)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3484 (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:	2140	2140	(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	
$v_{unfactored}$:	460	460	460	460	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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:	77	77	77	77	(plf)
e_n:	0.0022	0.0022	0.0022	0.0022	(in.)
b:	4.58	4.58	3.00	3.00	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.027	0.050	0.015	0.418	0.008	0.033	0.010	0.186
		Sum	0.510			Sum	0.237
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	0.033	0.010	0.284	0.042	0.050	0.015	0.638
		Sum	0.339			Sum	0.744

Total Defl.	
0.457	(in.)
0.0169	%drift

Project Information

Code:	2018 IBC	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grids J-M (14'-7" Section) - (Level 1)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3484 (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 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	2140	2140	(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	
$v_{unfactored}$:	460	460	460	460	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	9.00	(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	3.00	3.00	(ft)
HD Capacity:	2140	2140	2140	2140	(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
0.027	0.098	0.418	0.008	0.066	0.186
	Sum	0.544		Sum	0.259
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	0.066	0.284	0.042	0.098	0.638
	Sum	0.362		Sum	0.778

Total Defl.	
0.486	(in.)
0.0180	%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

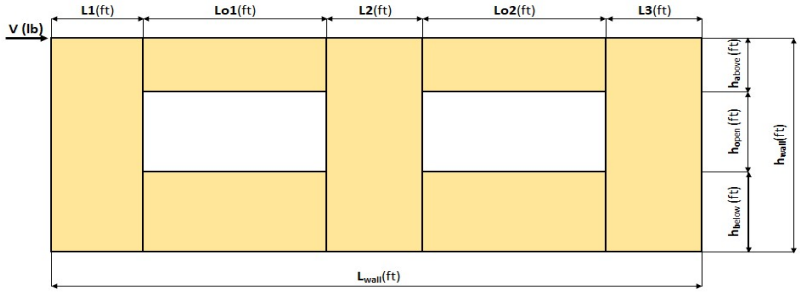
TWO OPENINGS

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 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid J-M (21'-5") - (Level 3)

Date: 10/14/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	2136 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	3.23 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	2.96 ft	h_b1	3.00 ft	h_b2	3.00 ft
L3	3.23 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.00 ft				
L_{wall}	21.42 ft				

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 1.55	N/A
P2=h_o/L2= 1.69	N/A
P3=h_o/L3= 1.55	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 897 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) = 224 plf

Second opening: va2 = vb2 = H/(h_a2+h_b2) = 224 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1346 lbf

Second opening: O2 = va2 x (Lo2) = 1346 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 702 lbf

F2 = O1(L2)/(L1+L2) = 644 lbf

F3 = O2(L2)/(L2+L3) = 644 lbf

F4 = O2(L3)/(L2+L3) = 702 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.13 ft

T2 = (L2*Lo1)/(L1+L2) = 2.87 ft

T3 = (L2*Lo2)/(L2+L3) = 2.87 ft

T4 = (L3*Lo2)/(L2+L3) = 3.13 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 196 plf

v2 = (V/L)(T2+L2+T3)/L2 = 293 plf

v3 = (V/L)(T4+L3)/L3 = 196 plf

Check v1*L1+v2*L2+v3*L3=V? 2136 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 634 lbf

R2 = v2*L2 = 867 lbf

R3 = v3*L3 = 634 lbf

8. Difference corner force + resistance

R1-F1 = -68 lbf

R2-F2-F3 = -420 lbf

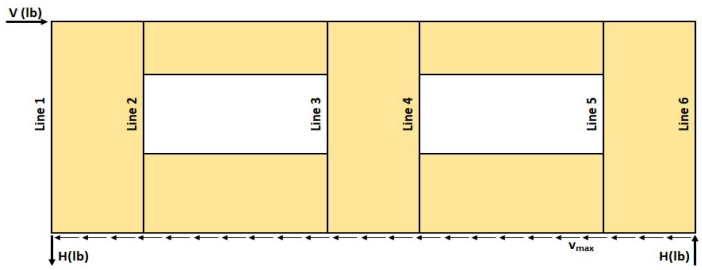
R3-F4 = -68 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = -21 plf

vc2 = (R2-F2-F3)/L2 = -142 plf

vc3 = (R3-F4)/L3 = -21 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		-84	982	897 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	897	-84	982	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-568	1465	897	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	897	1465	-568	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	897	-84	982	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		-84	982	897 lbf

Design Summary*

Req. Sheathing Capacity	293 plf	**4-Term Deflection**	0.202 in.	**3-Term Deflection**	0.243 in.
Req. Strap Force	702 lbf	**4-Term Story Drift %**	0.007 %	**3-Term Story Drift %**	0.009 %
Req. HD Force	897 lbf				
Req. Shear Wall Anchorage Force	100 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (21'-5") - (Level 3)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2136 (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	
$v_{unfactored}$:	196	196	293	293	196	196	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	65	65	98	98	65	65	(plf)
e_n:	0.0014	0.0014	0.0046	0.0046	0.0014	0.0014	(in.)
b:	3.23	3.23	2.96	2.96	3.23	3.23	(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
0.017	0.021	0.009	0.224	0.005	0.014	0.006	0.099
		Sum	0.271			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	0.162	0.008	0.021	0.021	0.162
		Sum	0.212			Sum	0.212
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	0.017	0.021	0.009	0.224
		Sum	0.125			Sum	0.271

Total Defl.	
0.202	(in.)
0.0075	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (21'-5") - (Level 3)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2136 (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	
$v_{unfactored}$:	196	196	293	293	196	196	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	3.23	3.23	2.96	2.96	3.23	3.23	(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
0.017	0.080	0.224	0.005	0.054	0.099
	Sum	0.320		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	0.162	0.008	0.080	0.162
	Sum	0.250		Sum	0.250
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	0.017	0.080	0.224
	Sum	0.158		Sum	0.320

Total Defl.	
0.243	(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

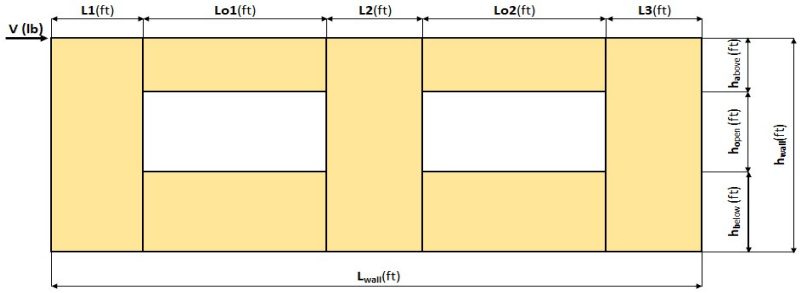
TWO OPENINGS

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 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid J-M (21'-5") - (Level 2)

Date: 10/14/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	3834 lbf				
L1	3.23 ft	h_a1	1.00 ft	h_a2	1.00 ft
L2	2.96 ft	h_o1	5.00 ft	h_o2	5.00 ft
L3	3.23 ft	h_b1	3.00 ft	h_b2	3.00 ft
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft
L_{wall}	21.42 ft				

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
$P1=h_o/L1=$ 1.55	N/A
$P2=h_o/L2=$ 1.69	N/A
$P3=h_o/L3=$ 1.55	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1611 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a1+h_b1)$ = 403 plf

Second opening: $va2 = vb2 = H/(h_a2+h_b2)$ = 403 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2416 lbf

Second opening: O2 = va2 x (Lo2) = 2416 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1261 lbf

F2 = O1(L2)/(L1+L2) = 1155 lbf

F3 = O2(L2)/(L2+L3) = 1155 lbf

F4 = O2(L3)/(L2+L3) = 1261 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.13 ft

T2 = (L2*Lo1)/(L1+L2) = 2.87 ft

T3 = (L2*Lo2)/(L2+L3) = 2.87 ft

T4 = (L3*Lo2)/(L2+L3) = 3.13 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 352 plf

v2 = (V/L)(T2+L2+T3)/L2 = 526 plf

v3 = (V/L)(T4+L3)/L3 = 352 plf

Check v1*L1+v2*L2+v3*L3=V? 3834 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1139 lbf

R2 = v2*L2 = 1557 lbf

R3 = v3*L3 = 1139 lbf

8. Difference corner force + resistance

R1-F1 = -122 lbf

R2-F2-F3 = -754 lbf

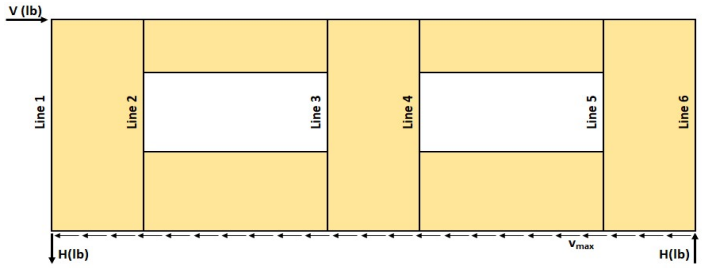
R3-F4 = -122 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = -38 plf

vc2 = (R2-F2-F3)/L2 = -255 plf

vc3 = (R3-F4)/L3 = -38 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H$?		-152	1762	1611 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0$?	1611	-152	1762	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0$?	-1019	2630	1611	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0$?	1611	2630	-1019	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0$?	1611	-152	1762	0
Line 6: $vc3(h_a2+h_b2)+ v3(h_o2) = H$?		-152	1762	1611 lbf

Design Summary*

Req. Sheathing Capacity	526 plf	**4-Term Deflection**	0.350 in.	**3-Term Deflection**	0.375 in.
Req. Strap Force	1261 lbf	**4-Term Story Drift %**	0.013 %	**3-Term Story Drift %**	0.014 %
Req. HD Force	1611 lbf				
Req. Shear Wall Anchorage Force	179 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (21'-5") - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3834 (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	
$v_{unfactored}$:	352	352	526	526	352	352	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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	0.0033	0.0033	0.0010	0.0010	(in.)
b:	3.23	3.23	2.96	2.96	3.23	3.23	(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
0.030	0.038	0.007	0.401	0.009	0.025	0.004	0.178
		Sum	0.476			Sum	0.217
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	0.015	0.290	0.014	0.038	0.015	0.290
		Sum	0.358			Sum	0.358
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	0.025	0.004	0.178	0.030	0.038	0.007	0.401
		Sum	0.217			Sum	0.476

Total Defl.	
0.350	(in.)
0.0130	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (21'-5") - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3834 (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:	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	
$v_{unfactored}$:	352	352	526	526	352	352	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	3.23	3.23	2.96	2.96	3.23	3.23	(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
0.030	0.076	0.401	0.009	0.050	0.178
	Sum	0.507		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
0.014	0.075	0.290	0.014	0.075	0.290
	Sum	0.380		Sum	0.380
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	0.050	0.178	0.030	0.076	0.401
	Sum	0.238		Sum	0.507

Total Defl.	
0.375	(in.)
0.0139	%drift

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

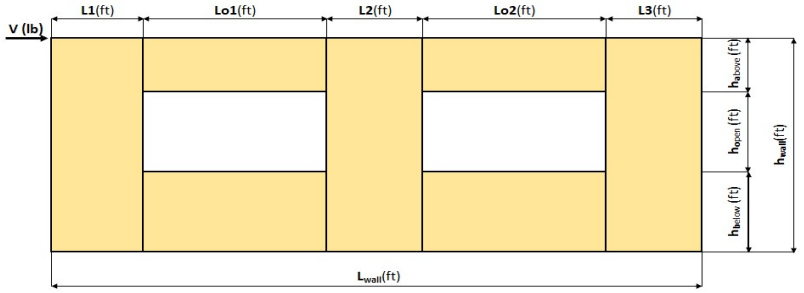
Force Transfer Around Openings Calculator

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 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (21'-5") - (Level 1)		



Shear Wall Calculation Variables

V	5119 lbf		Opening 1		Opening 2	Adj. Factor Method =	2bs/h
L1	3.23 ft	h_a1	1.00 ft	h_a2	1.00 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	2.96 ft	h_o1	5.00 ft	h_o2	5.00 ft	P1=h_o/L1= 1.55	N/A
L3	3.23 ft	h_b1	3.00 ft	h_b2	3.00 ft	P2=h_o/L2= 1.69	N/A
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft	P3=h_o/L3= 1.55	N/A
L_{wall}	21.42 ft						

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2151 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	538 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	538 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	3226 lbf
Second opening: O2 = va2 x (Lo2) =	3226 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	1683 lbf
F2 = O1(L2)/(L1+L2) =	1543 lbf
F3 = O2(L2)/(L2+L3) =	1543 lbf
F4 = O2(L3)/(L2+L3) =	1683 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	3.13 ft
T2 = (L2*Lo1)/(L1+L2) =	2.87 ft
T3 = (L2*Lo2)/(L2+L3) =	2.87 ft
T4 = (L3*Lo2)/(L2+L3) =	3.13 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	471 plf
v2 = (V/L)(T2+L2+T3)/L2 =	702 plf
v3 = (V/L)(T4+L3)/L3 =	471 plf
Check v1*L1+v2*L2+v3*L3=V?	5119 lbf **OK**

7. Resistance to corner forces

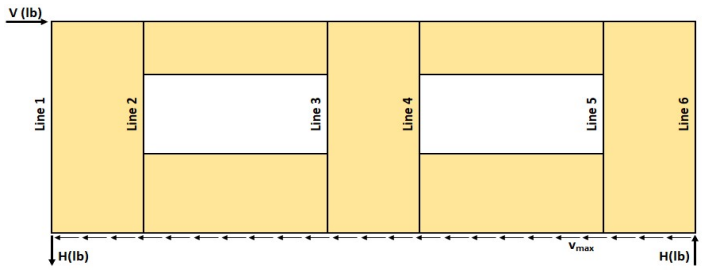
R1 = v1*L1 =	1520 lbf
R2 = v2*L2 =	2079 lbf
R3 = v3*L3 =	1520 lbf

8. Difference corner force + resistance

R1-F1 =	-163 lbf
R2-F2-F3 =	-1007 lbf
R3-F4 =	-163 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	-51 plf
vc2 = (R2-F2-F3)/L2 =	-340 plf
vc3 = (R3-F4)/L3 =	-51 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		-202	2353	2151 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	2151	-202	2353	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-1361	3511	2151	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	2151	3511	-1361	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	2151	-202	2353	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		-202	2353	2151 lbf

Design Summary*

Req. Sheathing Capacity	702 plf	**4-Term Deflection**	0.458 in.	**3-Term Deflection**	0.479 in.
Req. Strap Force	1683 lbf	**4-Term Story Drift %**	0.017 %	**3-Term Story Drift %**	0.018 %
Req. HD Force	2151 lbf				
Req. Shear Wall Anchorage Force	239 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (21'-5") - (Level 1)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5119 (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	
$v_{unfactored}$:	471	471	702	702	471	471	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	78	78	117	117	78	78	(plf)
e_n:	0.0007	0.0007	0.0025	0.0025	0.0007	0.0007	(in.)
b:	3.23	3.23	2.96	2.96	3.23	3.23	(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
0.032	0.051	0.005	0.536	0.010	0.034	0.003	0.238
		Sum	0.623			Sum	0.285
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
0.016	0.050	0.011	0.388	0.016	0.050	0.011	0.388
		Sum	0.465			Sum	0.465
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	0.034	0.003	0.238	0.032	0.051	0.005	0.536
		Sum	0.285			Sum	0.623

Total Defl.	
0.458	(in.)
0.0170	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (21'-5") - (Level 1)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5119 (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: | 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	
$v_{unfactored}$:	471	471	702	702	471	471	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	3.23	3.23	2.96	2.96	3.23	3.23	(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
0.032	0.081	0.536	0.010	0.054	0.238
	Sum	0.650		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
0.016	0.081	0.388	0.016	0.081	0.388
	Sum	0.484		Sum	0.484
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	0.054	0.238	0.032	0.081	0.536
	Sum	0.302		Sum	0.650

Total Defl.	
0.479	(in.)
0.0177	%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

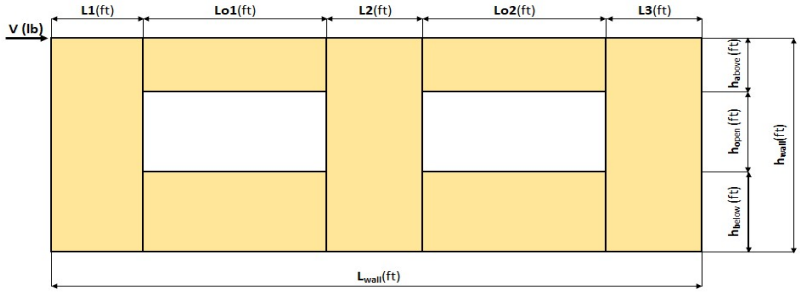
TWO OPENINGS

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 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid J-M (26'-2") - (Level 3)

Date: 10/14/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	2608 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	2.51 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	9.14 ft	h_b1	3.00 ft	h_b2	3.00 ft
L3	2.51 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.00 ft				
L_{wall}	26.16 ft				

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.99	N/A
P2=h_o/L2=	0.55	N/A
P3=h_o/L3=	1.99	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 897 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	224 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	224 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	1346 lbf
Second opening: O2 = va2 x (Lo2) =	1346 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	290 lbf
F2 = O1(L2)/(L1+L2) =	1056 lbf
F3 = O2(L2)/(L2+L3) =	1056 lbf
F4 = O2(L3)/(L2+L3) =	290 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 =	151 plf
v2 = (V/L)(T2+L2+T3)/L2 =	202 plf
v3 = (V/L)(T4+L3)/L3 =	151 plf
Check v1*L1+v2*L2+v3*L3=V?	2608 lbf **OK**

7. Resistance to corner forces

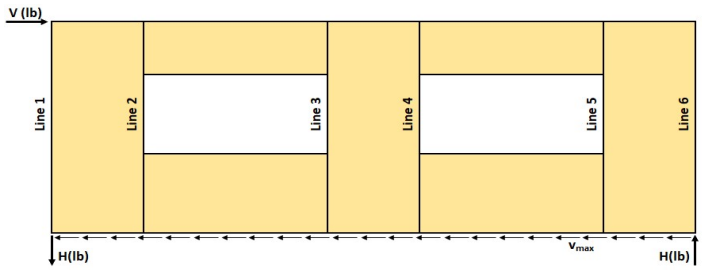
R1 = v1*L1 =	379 lbf
R2 = v2*L2 =	1850 lbf
R3 = v3*L3 =	379 lbf

8. Difference corner force + resistance

R1-F1 =	89 lbf
R2-F2-F3 =	-262 lbf
R3-F4 =	89 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	36 plf
vc2 = (R2-F2-F3)/L2 =	-29 plf
vc3 = (R3-F4)/L3 =	36 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		142	755	897 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	897	142	755	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-115	1012	897	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	897	1012	-115	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	897	142	755	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		142	755	897 lbf

Design Summary*

Req. Sheathing Capacity	224 plf	**4-Term Deflection**	0.156 in.	**3-Term Deflection**	0.204 in.
Req. Strap Force	1056 lbf	**4-Term Story Drift %**	0.006 %	**3-Term Story Drift %**	0.008 %
Req. HD Force	897 lbf				
Req. Shear Wall Anchorage Force	100 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (26'-2") - (Level 3)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2608 (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	
$v_{unfactored}$:	151	151	202	202	151	151	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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	101	101	76	76	(plf)
e_n:	0.0021	0.0021	0.0051	0.0051	0.0021	0.0021	(in.)
b:	2.51	2.51	9.14	9.14	2.51	2.51	(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
0.016	0.016	0.014	0.221	0.005	0.011	0.010	0.098
		Sum	0.268			Sum	0.124
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	0.098	0.016	0.016	0.014	0.221
		Sum	0.124			Sum	0.268

Total Defl.	
0.156	(in.)
0.0058	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (26'-2") - (Level 3)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2608 (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:	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	
$v_{unfactored}$:	151	151	202	202	151	151	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	2.51	2.51	9.14	9.14	2.51	2.51	(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
0.016	0.091	0.221	0.005	0.060	0.098
	Sum	0.328		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
0.002	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	0.060	0.098	0.016	0.091	0.221
	Sum	0.164		Sum	0.328

Total Defl.	
0.204	(in.)
0.0075	%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

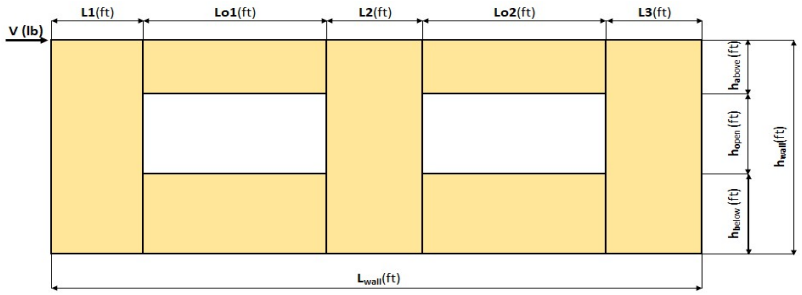
TWO OPENINGS

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 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid J-M (26'-2") - (Level 2)

Date: 10/14/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	4682 lbf				
L1	2.51 ft	h_a1	1.00 ft	h_a2	1.00 ft
L2	9.14 ft	h_o1	5.00 ft	h_o2	5.00 ft
L3	2.51 ft	h_b1	3.00 ft	h_b2	3.00 ft
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft
L_{wall}	26.16 ft				

Adj. Factor Method =	2bs/h
Wall Pier Aspect Ratio	Adj. Factor
P1=h_o/L1= 1.99	N/A
P2=h_o/L2= 0.55	N/A
P3=h_o/L3= 1.99	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1611 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) = 403 plf

Second opening: va2 = vb2 = H/(h_a2+h_b2) = 403 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2416 lbf

Second opening: O2 = va2 x (Lo2) = 2416 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 521 lbf

F2 = O1(L2)/(L1+L2) = 1896 lbf

F3 = O2(L2)/(L2+L3) = 1896 lbf

F4 = O2(L3)/(L2+L3) = 521 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 = 271 plf

v2 = (V/L)(T2+L2+T3)/L2 = 363 plf

v3 = (V/L)(T4+L3)/L3 = 271 plf

Check v1*L1+v2*L2+v3*L3=V? 4682 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 681 lbf

R2 = v2*L2 = 3321 lbf

R3 = v3*L3 = 681 lbf

8. Difference corner force + resistance

R1-F1 = 160 lbf

R2-F2-F3 = -470 lbf

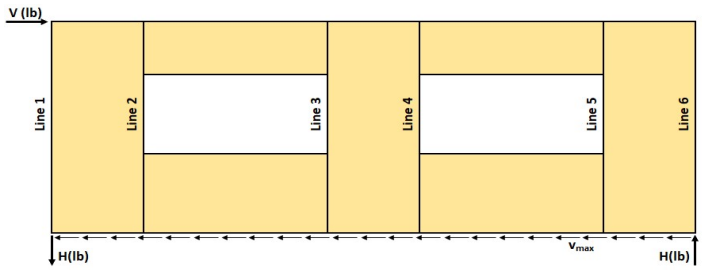
R3-F4 = 160 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 64 plf

vc2 = (R2-F2-F3)/L2 = -51 plf

vc3 = (R3-F4)/L3 = 64 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		255	1356	1611 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	1611	255	1356	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-206	1817	1611	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	1611	1817	-206	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	1611	255	1356	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		255	1356	1611 lbf

Design Summary*

Req. Sheathing Capacity	403 plf	**4-Term Deflection**	0.263 in.	**3-Term Deflection**	0.301 in.
Req. Strap Force	1896 lbf	**4-Term Story Drift %**	0.010 %	**3-Term Story Drift %**	0.011 %
Req. HD Force	1611 lbf				
Req. Shear Wall Anchorage Force	179 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (26'-2") - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4682 (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	
$v_{unfactored}$:	271	271	363	363	271	271	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	0.0015	0.0015	0.0037	0.0037	0.0015	0.0015	(in.)
b:	2.51	2.51	9.14	9.14	2.51	2.51	(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
0.029	0.029	0.010	0.397	0.009	0.019	0.007	0.177
		Sum	0.466			Sum	0.212
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	0.111			Sum	0.111
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	0.019	0.007	0.177	0.029	0.029	0.010	0.397
		Sum	0.212			Sum	0.466

Total Defl.	
0.263	(in.)
0.0097	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (26'-2") - (Level 2)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4682 (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:	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	
$v_{unfactored}$:	271	271	363	363	271	271	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	2.51	2.51	9.14	9.14	2.51	2.51	(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
0.029	0.087	0.397	0.009	0.058	0.177
	Sum	0.514		Sum	0.243
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	0.146		Sum	0.146
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	0.058	0.177	0.029	0.087	0.397
	Sum	0.243		Sum	0.514

Total Defl.	
0.301	(in.)
0.0112	%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

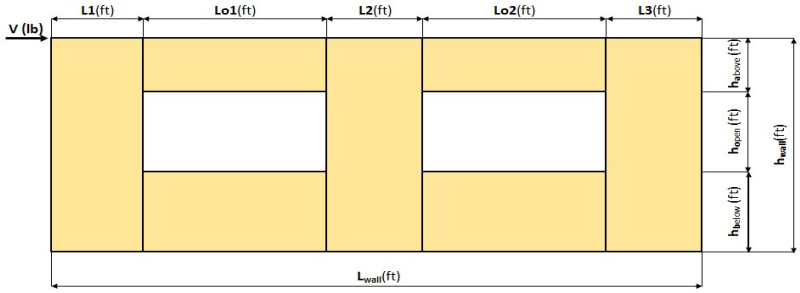
TWO OPENINGS

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 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building E
Wall Line:	Grid J-M (26'-2") - (Level 1)

Date: 10/14/2024



Shear Wall Calculation Variables

			Opening 1		Opening 2
V	6251 lbf	h_a1	1.00 ft	h_a2	1.00 ft
L1	2.51 ft	h_o1	5.00 ft	h_o2	5.00 ft
L2	9.14 ft	h_b1	3.00 ft	h_b2	3.00 ft
L3	2.51 ft	Lo1	6.00 ft	Lo2	6.00 ft
h_{wall}	9.00 ft				
L_{wall}	26.16 ft				

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.99	N/A
P2=h_o/L2=	0.55	N/A
P3=h_o/L3=	1.99	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2151 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	538 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	538 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	3226 lbf
Second opening: O2 = va2 x (Lo2) =	3226 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	695 lbf
F2 = O1(L2)/(L1+L2) =	2531 lbf
F3 = O2(L2)/(L2+L3) =	2531 lbf
F4 = O2(L3)/(L2+L3) =	695 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 =	362 plf
v2 = (V/L)(T2+L2+T3)/L2 =	485 plf
v3 = (V/L)(T4+L3)/L3 =	362 plf
Check v1*L1+v2*L2+v3*L3=V?	6251 lbf **OK**

7. Resistance to corner forces

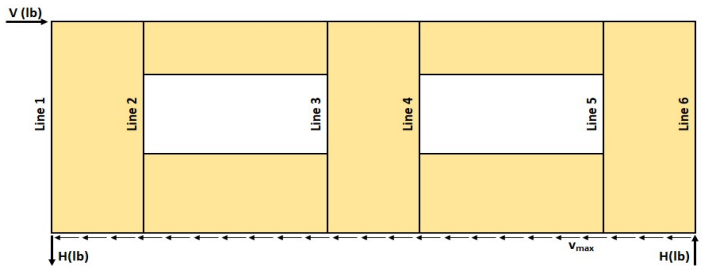
R1 = v1*L1 =	909 lbf
R2 = v2*L2 =	4434 lbf
R3 = v3*L3 =	909 lbf

8. Difference corner force + resistance

R1-F1 =	214 lbf
R2-F2-F3 =	-628 lbf
R3-F4 =	214 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	85 plf
vc2 = (R2-F2-F3)/L2 =	-69 plf
vc3 = (R3-F4)/L3 =	85 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		340	1810	2151 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	2151	340	1810	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-275	2425	2151	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	2151	2425	-275	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	2151	340	1810	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		340	1810	2151 lbf

Design Summary*

Req. Sheathing Capacity	538 plf	**4-Term Deflection**	0.344 in.	**3-Term Deflection**	0.369 in.
Req. Strap Force	2531 lbf	**4-Term Story Drift %**	0.013 %	**3-Term Story Drift %**	0.014 %
Req. HD Force	2151 lbf				
Req. Shear Wall Anchorage Force	239 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (26'-2") - (Level 1)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6251 (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	
$v_{unfactored}$:	362	362	485	485	362	362	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	60	60	81	81	60	60	(plf)
e_n:	0.0011	0.0011	0.0026	0.0026	0.0011	0.0011	(in.)
b:	2.51	2.51	9.14	9.14	2.51	2.51	(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
0.039	0.039	0.007	0.530	0.012	0.026	0.005	0.236
		Sum	0.616			Sum	0.278
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	0.138			Sum	0.138
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	0.236	0.039	0.039	0.007	0.530
		Sum	0.278			Sum	0.616

Total Defl.	
0.344	(in.)
0.0127	%drift

Project Information

Code:	IBC 2018	**Date:**	10/14/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building E		
Wall Line:	Grid J-M (26'-2") - (Level 1)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 6251 (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:	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	
$v_{unfactored}$:	362	362	485	485	362	362	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	6.00	6.00	6.00	6.00	9.00	(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:	2.51	2.51	9.14	9.14	2.51	2.51	(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
0.039	0.078	0.530	0.012	0.052	0.236
	Sum	0.647		Sum	0.299
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	0.069	0.087	0.004	0.069	0.087
	Sum	0.160		Sum	0.160
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	0.236	0.039	0.078	0.530
	Sum	0.299		Sum	0.647

Total Defl.	
0.369	(in.)
0.0137	%drift

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