PRMU20240401

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

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

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$\frac{1}{2}$" 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: 113,036#

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

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

City of Puyallup
Building
REVIEWED FOR COMPLIANCE
BSnowden
05/13/2024
2:41:53 PM

CHON K. PIERUCCIONI
STATE OF WASHINGTON
42816
REGISTERED PROFESSIONAL ENGINEER

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

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

REVISIONS	
01	CITY REVIEW

REVISIONS

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

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

2nd Floor Framing			
Member Name	**Results (Max UTIL %)**	**Current Solution**	**Comments**
Floor Joist 16' and Under	Passed (96% M)	1 piece(s) 11 7/8" TJI® 110 @ 16" OC	
Floor Joist 17'-8"	Passed (98% M)	1 piece(s) 11 7/8" TJI® 210 @ 16" OC	
Floor Joist 19'-4"	Passed (72% M)	1 piece(s) 11 7/8" TJI® 360 @ 16" OC	
Floor Joist 20'-7" (with offset 3rd flr.)	Passed (82% R)	2 piece(s) 11 7/8" TJI® 560 @ 16" OC	
Short Stair Stringers	Passed (68% R)	1 piece(s) 4 x 12 HF No.2	
Long Short Stair Stringers	Passed (98% ΔL)	1 piece(s) 3 1/2" x 12" 24F-V4 DF Glulam	
Top Landing Beam	Passed (98% R)	1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam	
10'-10" Deck Joist	Passed (71% R)	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Deck Cantilever Ledger 2'	Passed (47% R)	2 piece(s) 2 x 12 HF No.2	
Grid 2.6 (F-G.3) Flush Beam	Passed (92% R)	1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.6 (G.9-H.8) Flush Beam	Passed (92% R)	1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.4 (H.8-I.8) Door Header	Passed (46% R)	1 piece(s) 4 x 8 DF No.2	
Grid 2.4 (J.2-K.8) Door Header	Passed (73% M)	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (H-H.8) Door Header	Passed (77% R)	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (G.1-G.3) Flush Beam	Passed (63% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid G.1 (5.2-5.3) Door Header	Passed (53% R)	1 piece(s) 4 x 8 DF No.2	
Grid 6 (G.1-G.3) Flush Beam	Passed (70% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.5 (D.4-D.6) Flush Beam	Passed (86% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 3.3 (D.8-E.1) Flush Beam	Passed (87% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 5.3 (D.5-E.2) Flush Beam	Passed (74% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 6 (D.3-D.6) Flush Beam	Passed (96% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
3rd Floor Framing			
Member Name	**Results (Max UTIL %)**	**Current Solution**	**Comments**
Floor Joist 16' and Under	Passed (96% M)	1 piece(s) 11 7/8" TJI® 110 @ 16" OC	
Floor Joist 17'-8"	Passed (98% M)	1 piece(s) 11 7/8" TJI® 210 @ 16" OC	
Floor Joist 19'-4"	Passed (72% M)	1 piece(s) 11 7/8" TJI® 360 @ 16" OC	
Floor Joist 20'-7"	Passed (59% ΔT)	1 piece(s) 11 7/8" TJI® 560 @ 16" OC	
7'-6" Landing Joists	Passed (100% R)	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Top Landing Beam	Passed (99% ΔL)	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	
Short Stair Stringers	Passed (68% R)	1 piece(s) 4 x 12 HF No.2	
4' Mid Landing Joists	Passed (77% R)	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Mid Landing Beam Inner	Passed (79% ΔL)	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	
Mid Landing Beam Outer	Passed (102% ΔL)	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
10'-10" Deck Joist	Passed (71% R)	1 piece(s) 2 x 12 HF No.2 @ 16" OC	
Deck Cantilever Ledger 2'	Passed (47% R)	2 piece(s) 2 x 12 HF No.2	
6' Window Header	Passed (17% M)	1 piece(s) 4 x 10 DF No.2	
Grid 2.6 (F-G.5) Flush Beam	Passed (92% ΔL)	1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.6 (H-H.8) Flush Beam	Passed (64% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.4 (H.8-I.8) Door Header	Passed (46% R)	1 piece(s) 4 x 8 DF No.2	
Grid 2.4 (J.2-K.8) Door Header	Passed (73% M)	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (H-H.8) Door Header	Passed (34% R)	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (G.4-G.8) Door Header	Passed (89% M)	1 piece(s) 4 x 8 DF No.2	
Grid 5.5 (G.1-G.3) Flush Beam	Passed (32% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid G.1 (5.2-5.3) Door Header	Passed (32% V)	1 piece(s) 4 x 8 DF No.2	
Grid 6 (G.1-G.3) Flush Beam	Passed (35% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 2.5 (D.4-D.6) Flush Beam	Passed (52% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 3.3 (D.8-E.1) Flush Beam	Passed (43% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 5.3 (D.5-E.2) Flush Beam	Passed (67% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
Grid 6 (D.3-D.6) Flush Beam	Passed (48% R)	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	

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

Weyerhaeuser

10/22/2024 1:40:12 AM UTC
ForteWEB v3.8
File Name: East Town Crossing Building D

Roof Framing			
Member Name	**Results (Max UTIL %)**	**Current Solution**	**Comments**
Grid I Entry Roof Beam	Passed (91% R)	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Grid L 10' Deck Roof Beam	Passed (101% R)	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
6' Window Header	Passed (90% R)	1 piece(s) 4 x 10 DF No.2	
Grid B 11' Deck Roof Beam	Passed (100% R)	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Deck Roof Cantilever Beam	~~Failed~~ (61% R) Passed	1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam City of Puyallup Development & Permitting Services ISSUED PERMIT Building Planning Engineering Public Works Fire Traffic	An excessive uplift of -2576 lbs at support located at 4" failed this product.

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

Weyerhaeuser

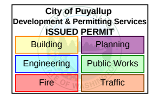
10/22/2024 1:40:12 AM UTC
ForteWEB v3.8
File Name: East Town Crossing Building D

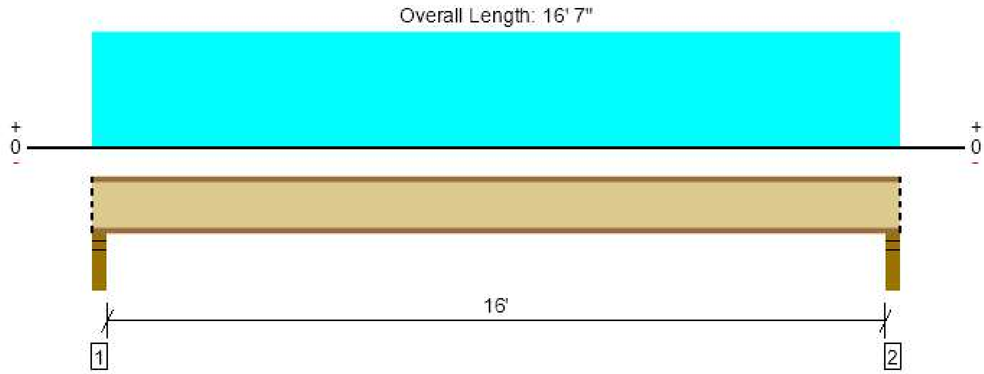
MEMBER REPORT

PASSED

2nd Floor Framing, Floor Joist 16' and Under

1 piece(s) 11 7/8" TJI® 110 @ 16" OC





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

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

Member Length : 16' 7"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.75"	332	442	774	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.75"	332	442	774	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 1" o/c	
Bottom Edge (Lu)	16' 7" o/c	

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

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

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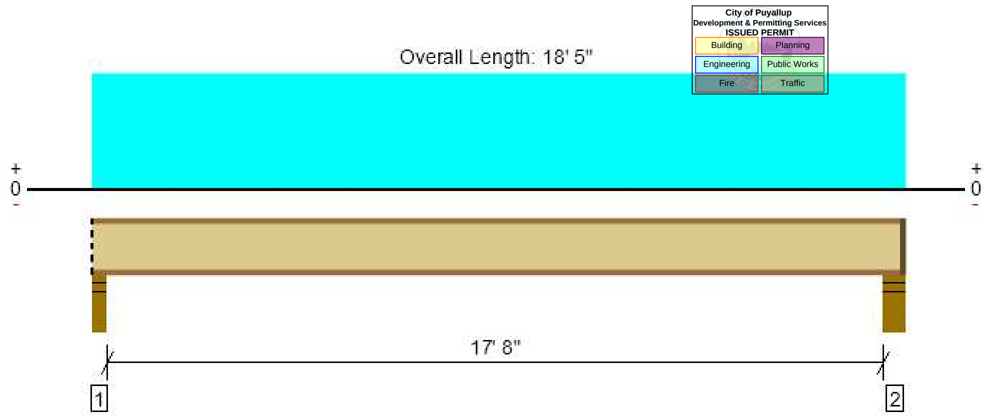
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

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

1 piece(s) 11 7/8" TJI® 210 @ 16" OC



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

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

Member Length : 18' 3 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

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

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 7" o/c	
Bottom Edge (Lu)	18' 4" o/c	

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

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

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

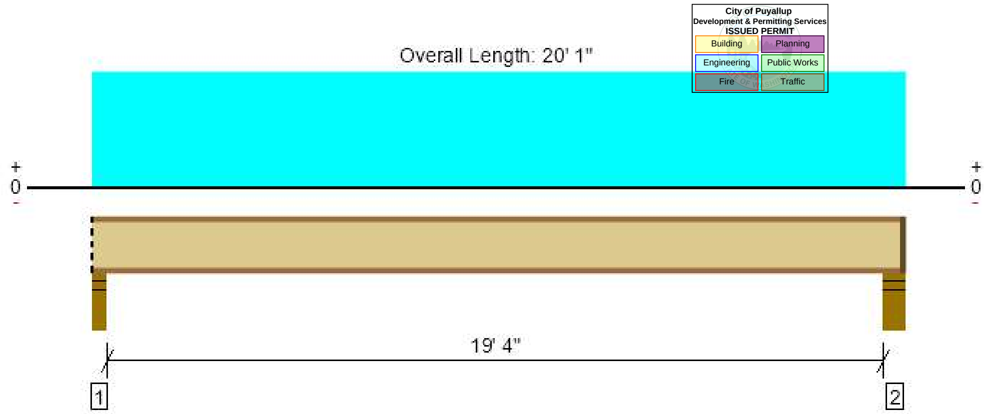
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

MEMBER REPORT

PASSED

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

1 piece(s) 11 7/8" TJI® 360 @ 16" OC



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

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

Member Length : 19' 11 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

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

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 4" o/c	
Bottom Edge (Lu)	20' o/c	

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

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

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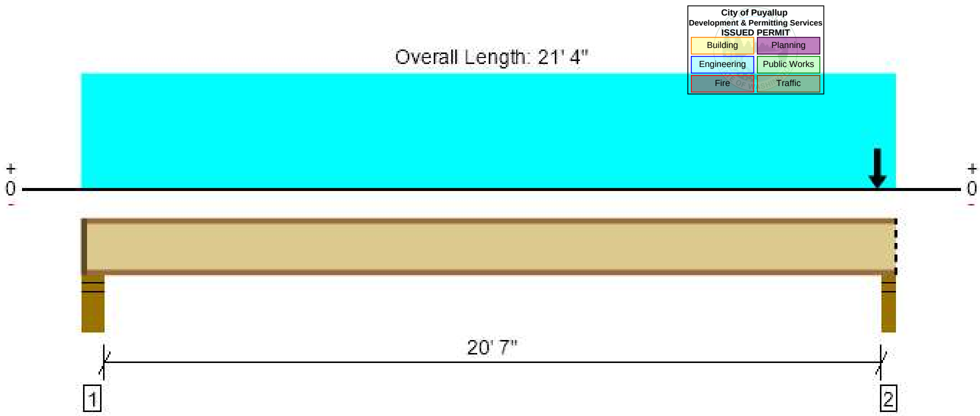
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

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

2 piece(s) 11 7/8" TJI® 560 @ 16" OC



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

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

Member Length : 21' 2 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

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

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' o/c	
Bottom Edge (Lu)	21' 3" o/c	

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

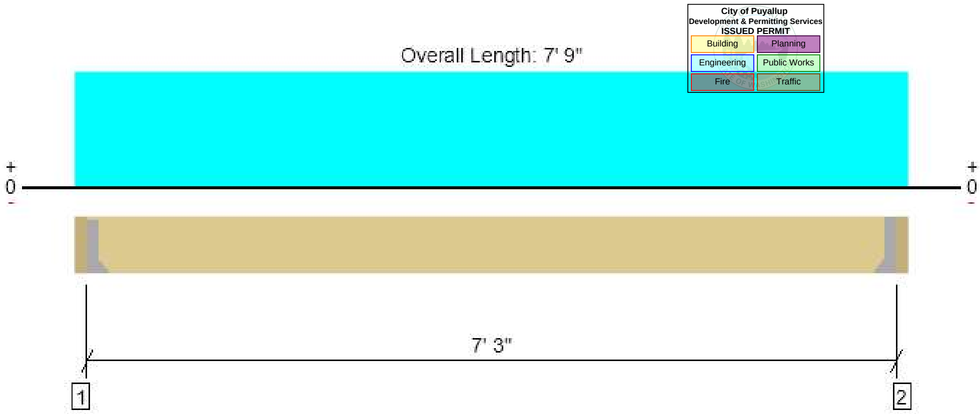
Vertical Loads	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 21' 4"	16"	30.0	40.0	2nd floor load
2 - Point (lb)	20' 10 1/4"	N/A	798	1064	3rd Floor offset wall load

Weyerhaeuser Notes

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

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.

Weyerhaeuser Notes

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

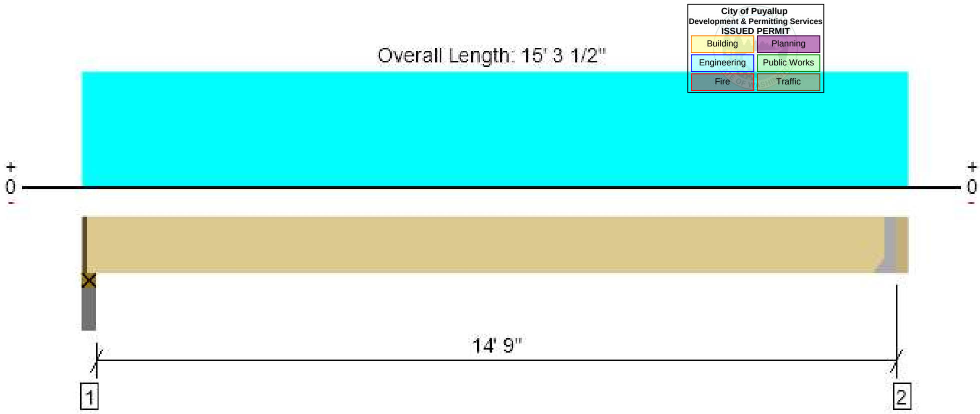
Weyerhaeuser

MEMBER REPORT

PASSED

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.

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

10/22/2024 1:40:12 AM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building D

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

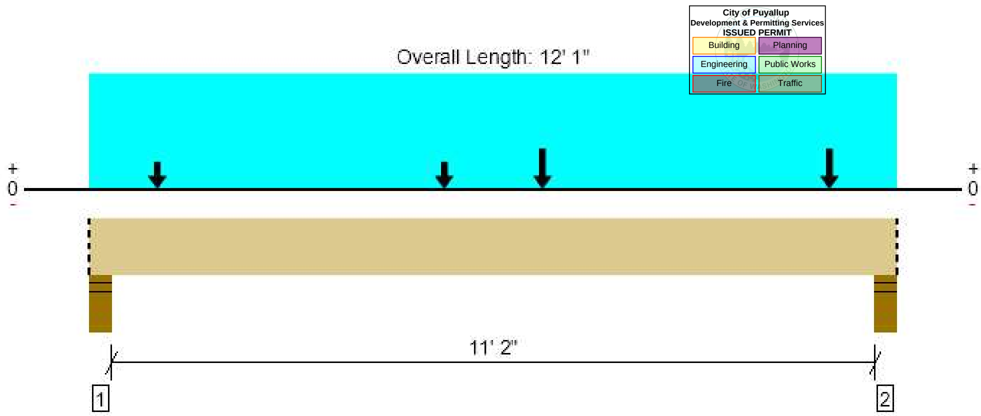
FORTEWEB

MEMBER REPORT

PASSED

2nd Floor Framing, Top Landing Beam

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



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

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

Member Length : 12' 1"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 11' 5".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	4.69"	2563	7873	10437	Blocking
2 - Stud wall - HF	5.50"	5.50"	5.38"	2952	9033	11985	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	12' 1" o/c	
Bottom Edge (Lu)	12' 1" o/c	

- Maximum allowable bracing intervals based on applied load.

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

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

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

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10/22/2024 1:40:12 AM UTC
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File Name: East Town Crossing Building D

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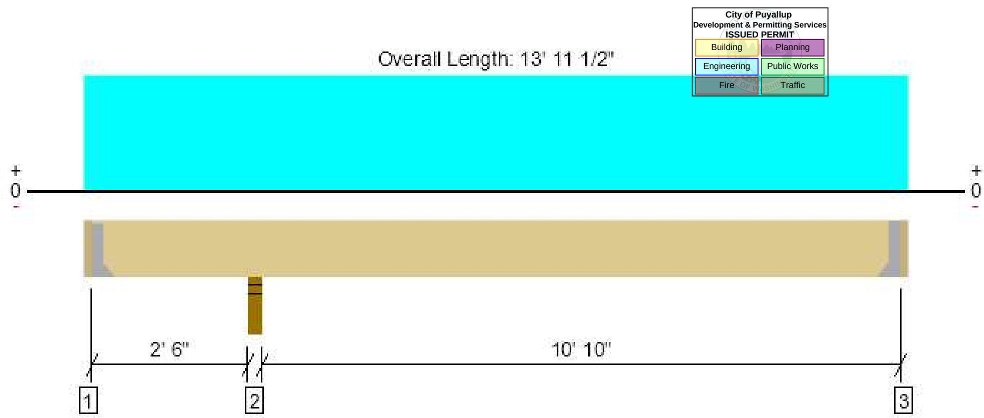
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

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"	Hanger¹	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"	Hanger¹	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

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

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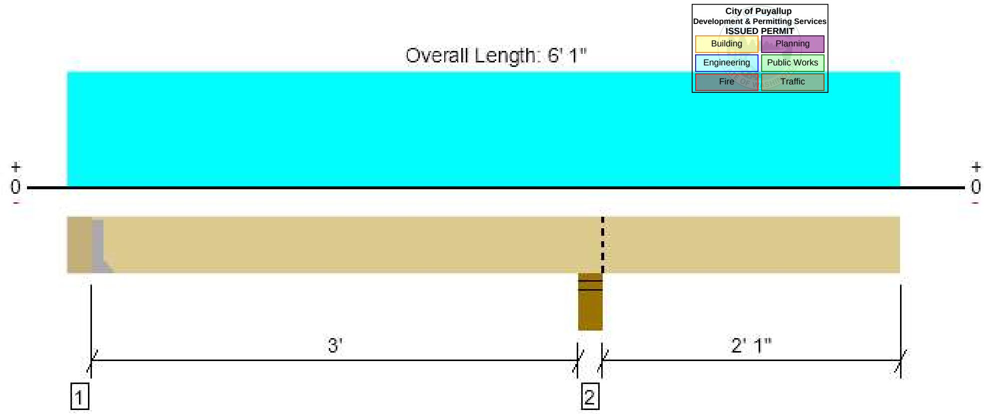
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

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.

Weyerhaeuser Notes

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

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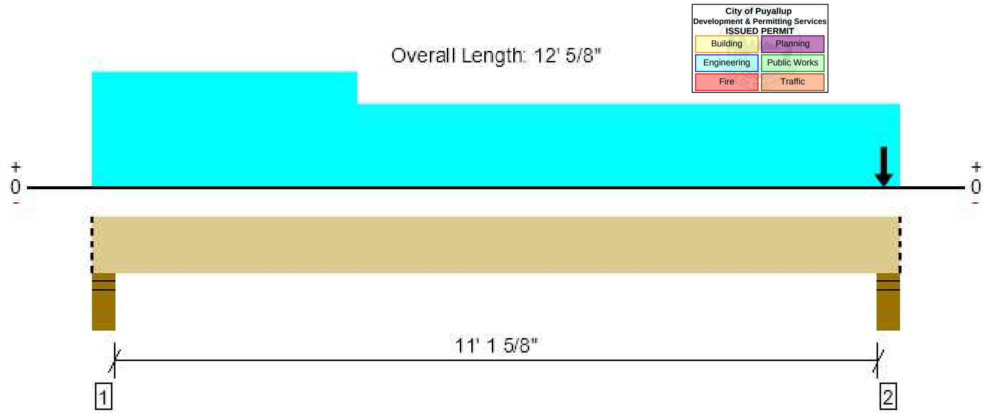
10/22/2024 1:40:12 AM UTC

ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3

File Name: East Town Crossing Building D

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

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



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

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

Member Length : 12' 5/8"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 11' 4 5/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

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

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	12' 1" o/c	
Bottom Edge (Lu)	12' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 12' 5/8"	N/A	15.9	--	
1 - Uniform (PSF)	0 to 3' 11 1/2" (Front)	15' 5 1/2"	30.0	40.0	Default Load
2 - Uniform (PSF)	3' 11 1/2" to 12' 5/8" (Front)	11' 2"	30.0	40.0	Default Load
3 - Point (lb)	11' 9 3/4" (Top)	N/A	2747	3508	Linked from: Grid 2.6 (F-G.5) Flush Beam, Support 2

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

Weyerhaeuser Notes

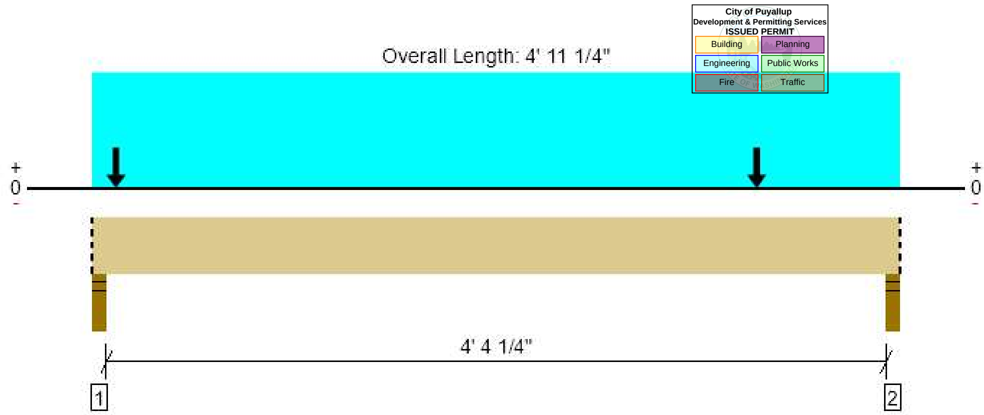
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

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

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



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

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 7 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.21"	3098	4043	7141	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.77"	2677	3491	6167	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 11" o/c	
Bottom Edge (Lu)	4' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

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

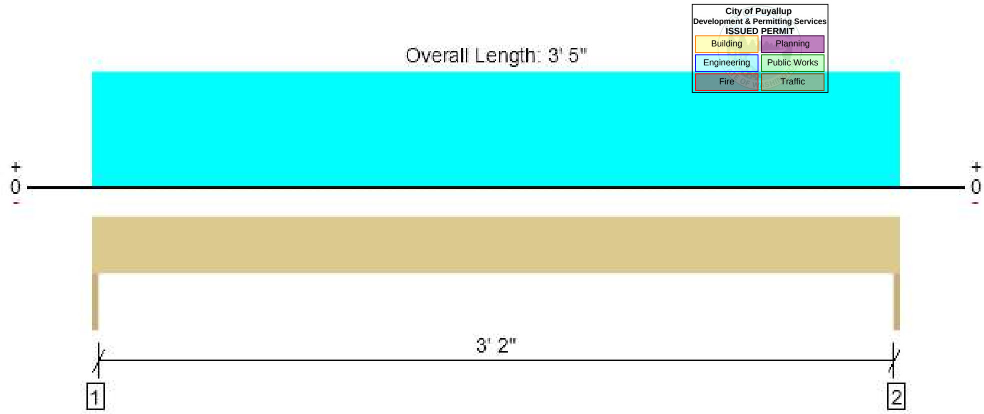
• Side loads are assumed to not induce cross-grain tension.

Weyerhaeuser Notes

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

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

Weyerhaeuser Notes

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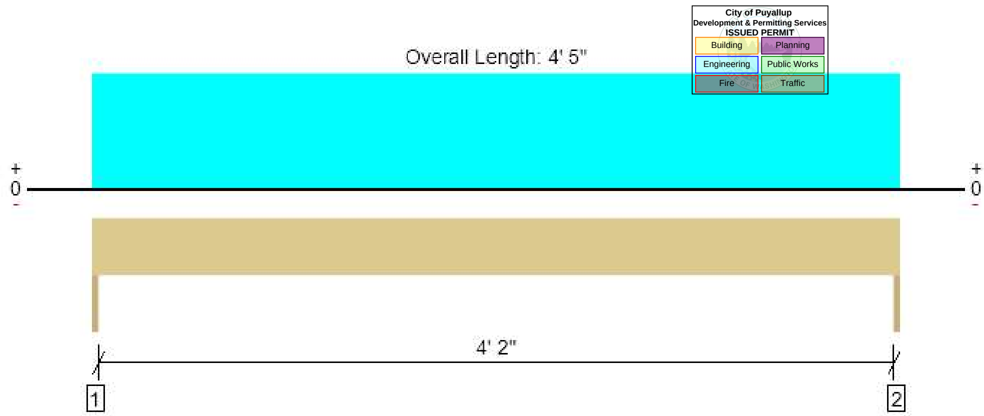
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

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

- 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.

Member Length : 4' 5"
System : Wall
Member Type : Header
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 - 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

Weyerhaeuser Notes

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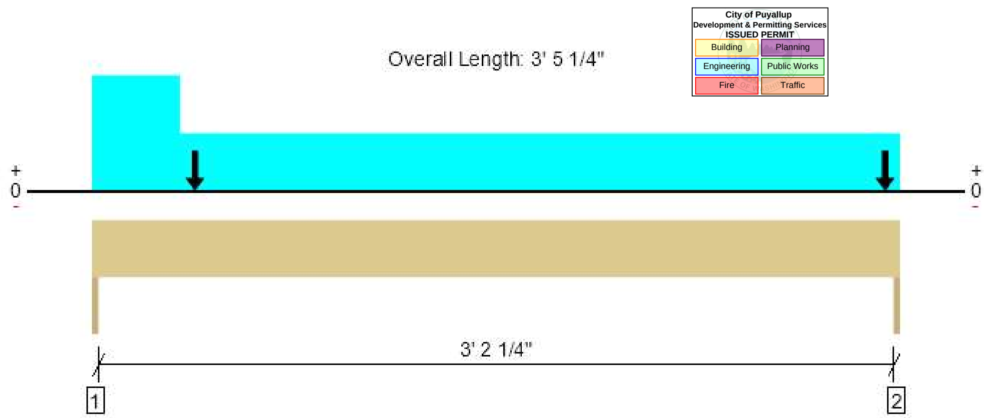
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

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)

- 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.

Member Length : 3' 5 1/4"
System : Wall
Member Type : Header
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 - 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

ForteWEB Software Operator	Job Notes
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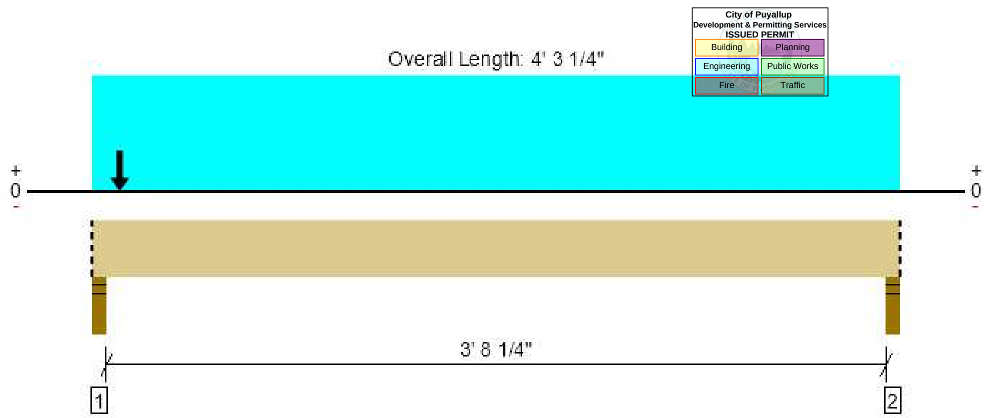
10/22/2024 1:40:12 AM UTC

ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3

File Name: East Town Crossing Building D

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

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



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

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

Member Length : 4' 3 1/4"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 3' 11 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.21"	1366	1764	3130	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	678	876	1554	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 3" o/c	
Bottom Edge (Lu)	4' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 3 1/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 3 1/4" (Front)	10' 3"	30.0	40.0	Default Load
2 - Point (lb)	1 3/4" (Top)	N/A	688	888	Linked from: Grid 5.5 (G.1-G.3) Flush Beam, Support 1

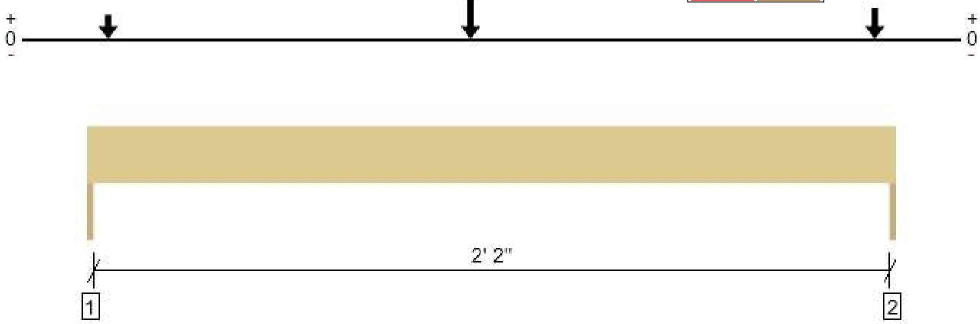
- Side loads are assumed to not induce cross-grain tension.

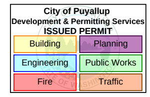
Weyerhaeuser Notes

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

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

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





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

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

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	633	798	1431	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	764	966	1731	None

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

•Maximum allowable bracing intervals based on applied load.

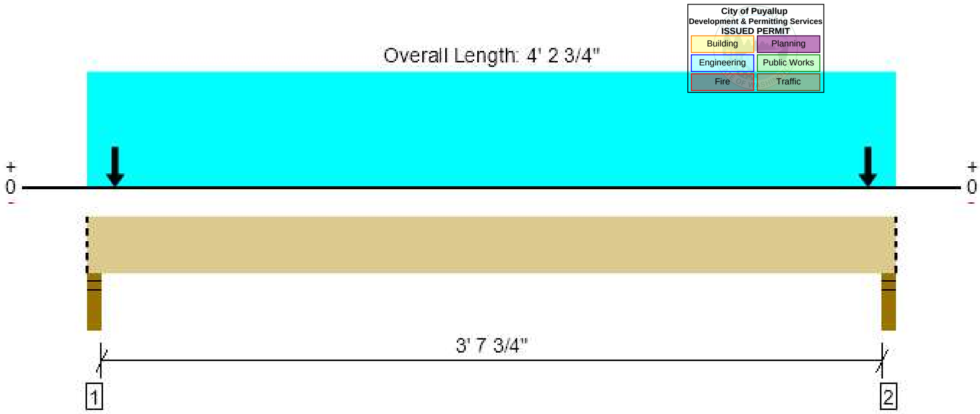
Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 2' 5"	N/A	6.4	--	
1 - Point (lb)	1' 1 3/4"	N/A	678	876	Linked from: Grid 5.5 (G.1-G.3) Flush Beam, Support 2
2 - Point (lb)	3/4"	N/A	269	337	Linked from: Grid G.1 (5.2-5.3) Door Header, Support 1
3 - Point (lb)	2' 4 1/4"	N/A	435	551	Linked from: Grid G.1 (5.2-5.3) Door Header, Support 2

Weyerhaeuser Notes

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

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

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3464 @ 2"	4961 (3.50")	Passed (70%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	674 @ 1' 3 3/8"	7343	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	1535 @ 2' 1 3/8"	16452	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.003 @ 2' 1 3/8"	0.097	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.005 @ 2' 1 3/8"	0.195	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 4' 2 3/4"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 3' 10 3/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.44"	1510	1955	3464	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.44"	1510	1955	3464	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 3" o/c	
Bottom Edge (Lu)	4' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 4' 2 3/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 4' 2 3/4" (Front)	11' 5"	30.0	40.0	Default Load
2 - Point (lb)	1 3/4" (Top)	N/A	764	989	Linked from: Grid 6 (G.1-G.3) Flush Beam, Support 1
3 - Point (lb)	4' 1" (Top)	N/A	764	989	Linked from: Grid 6 (G.1-G.3) Flush Beam, Support 1

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

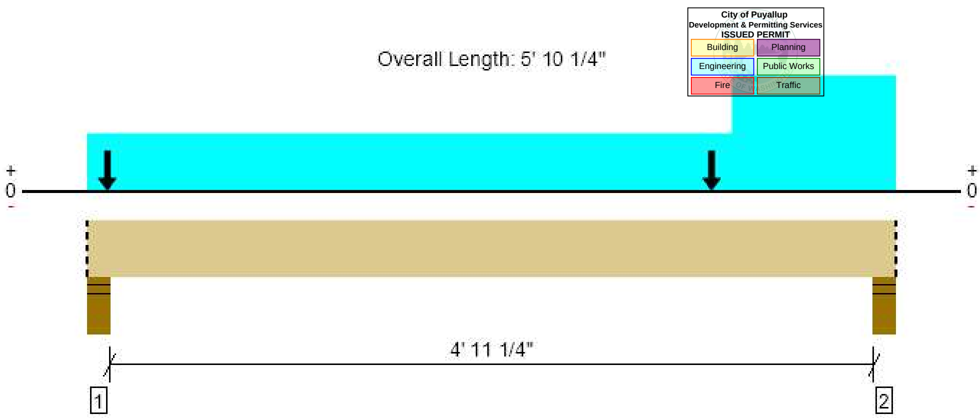
Weyerhaeuser Notes

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

PASSED

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

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



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

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

Member Length : 5' 10 1/4"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 5' 2 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

	Bearing Length			Loads to Supports (lbs)			
Supports	Total	Available	Required	Dead	Floor Live	Factored	Accessories
1 - Stud wall - HF	5.50"	5.50"	4.59"	2818	3682	6500	Blocking
2 - Stud wall - HF	5.50"	5.50"	4.72"	2894	3795	6690	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 10" o/c	
Bottom Edge (Lu)	5' 10" o/c	

•Maximum allowable bracing intervals based on applied load.

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

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

Weyerhaeuser Notes

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

Weyerhaeuser

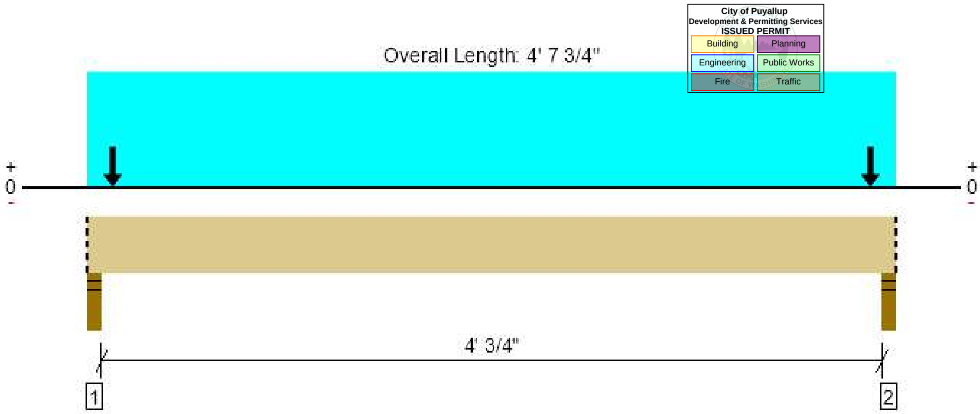
10/22/2024 1:40:12 AM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building D

MEMBER REPORT

PASSED

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

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4302 @ 2"	4961 (3.50")	Passed (87%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	965 @ 1' 3 3/8"	7343	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2153 @ 2' 3 7/8"	16452	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.005 @ 2' 3 7/8"	0.108	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.008 @ 2' 3 7/8"	0.216	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 3 3/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.03"	1870	2432	4302	Blocking
2 - Stud wall - HF	3.50"	3.50"	3.03"	1870	2432	4302	Blocking

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

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

•Maximum allowable bracing intervals based on applied load.

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

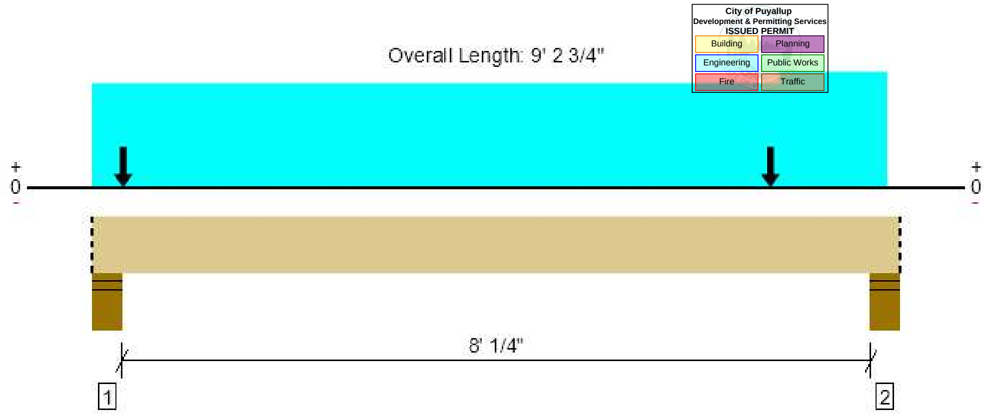
- Side loads are assumed to not induce cross-grain tension.

Weyerhaeuser Notes

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

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

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



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

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

Member Length : 9' 2 3/4"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 3 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	7.25"	7.25"	5.40"	3332	4322	7653	Blocking
2 - Stud wall - HF	7.25"	7.25"	4.82"	2975	3858	6833	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 3" o/c	
Bottom Edge (Lu)	9' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 9' 2 3/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 7' 10 1/4" (Front)	12'	30.0	40.0	Default Load
2 - Uniform (PSF)	7' 10 1/4" to 9' 1" (Front)	13' 4"	30.0	40.0	Default Load
3 - Point (lb)	4 1/4" (Top)	N/A	1447	1877	Linked from: Grid 5.3 (D.5-E.2) Flush Beam, Support 1
4 - Point (lb)	7' 9" (Top)	N/A	1447	1877	Linked from: Grid 5.3 (D.5-E.2) Flush Beam, Support 2

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

Weyerhaeuser Notes

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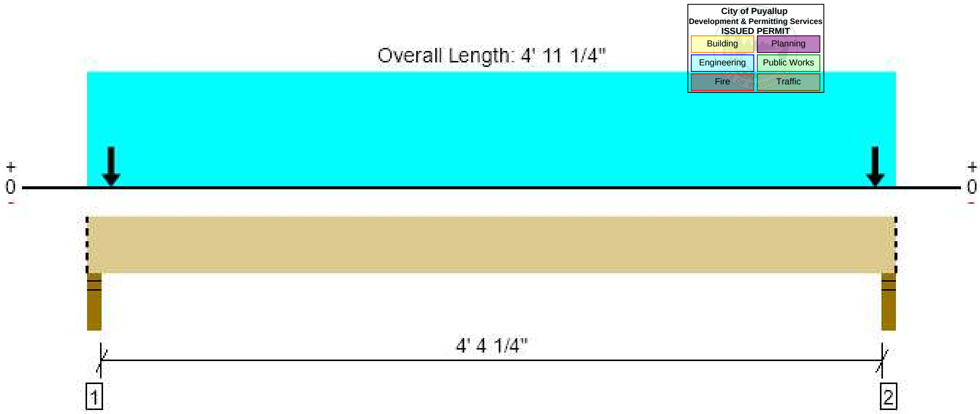
Weyerhaeuser

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

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4744 @ 2"	4961 (3.50")	Passed (96%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1141 @ 1' 3 3/8"	7343	Passed (16%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2546 @ 2' 5 5/8"	16452	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.006 @ 2' 5 5/8"	0.115	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 2' 5 5/8"	0.230	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 7 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.35"	2062	2682	4744	Blocking
2 - Stud wall - HF	3.50"	3.50"	3.35"	2062	2682	4744	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 11" o/c	
Bottom Edge (Lu)	4' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

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

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

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
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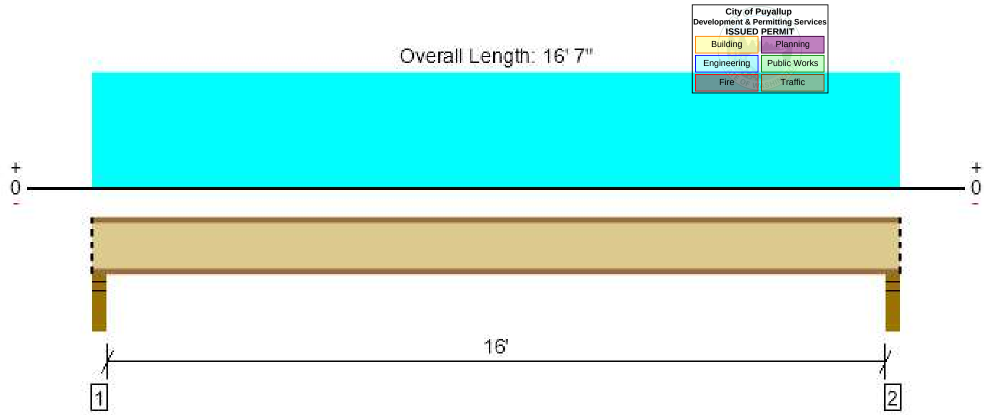
Weyerhaeuser

10/22/2024 1:40:12 AM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building D

3rd Floor Framing, Floor Joist 16' and Under

1 piece(s) 11 7/8" TJI® 110 @ 16" OC



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

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

Member Length : 16' 7"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.75"	332	442	774	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.75"	332	442	774	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 1" o/c	
Bottom Edge (Lu)	16' 7" o/c	

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

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

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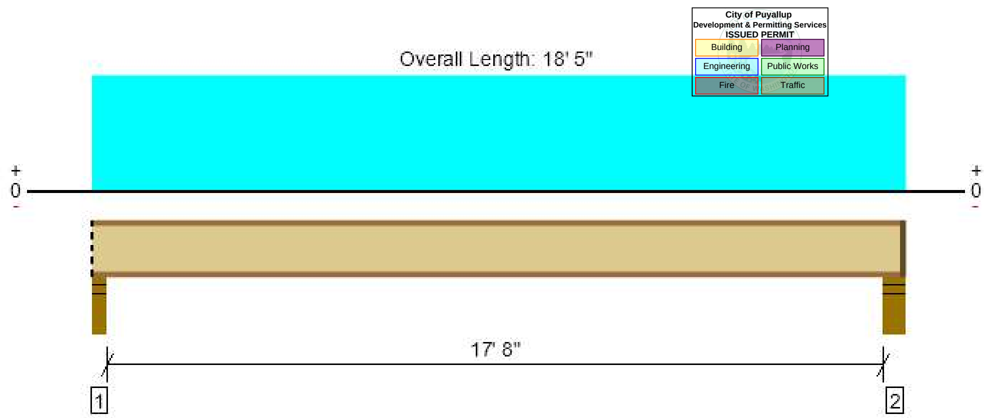
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

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

1 piece(s) 11 7/8" TJI® 210 @ 16" OC



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

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

Member Length : 18' 3 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

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

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 7" o/c	
Bottom Edge (Lu)	18' 4" o/c	

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

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

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

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

Weyerhaeuser

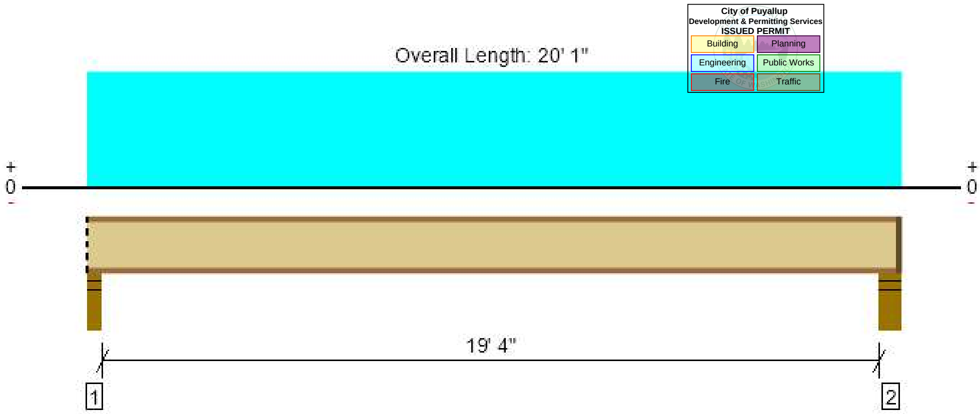
10/22/2024 1:40:12 AM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building D

MEMBER REPORT

PASSED

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

1 piece(s) 11 7/8" TJI® 360 @ 16" OC



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

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

Member Length : 19' 11 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

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

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 4" o/c	
Bottom Edge (Lu)	20' o/c	

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

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

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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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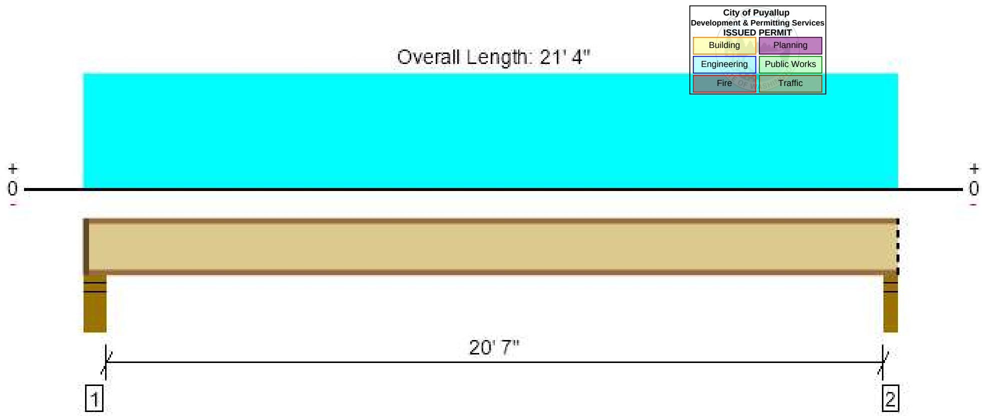
10/22/2024 1:40:12 AM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building D

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

1 piece(s) 11 7/8" TJI® 560 @ 16" OC



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

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

Member Length : 21' 2 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

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

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 10" o/c	
Bottom Edge (Lu)	21' 3" o/c	

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

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

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

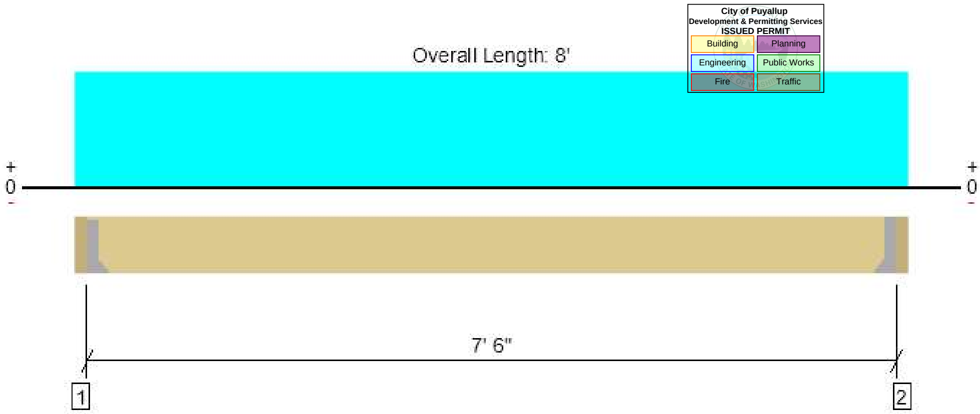
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

10/22/2024 1:40:12 AM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building D

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

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
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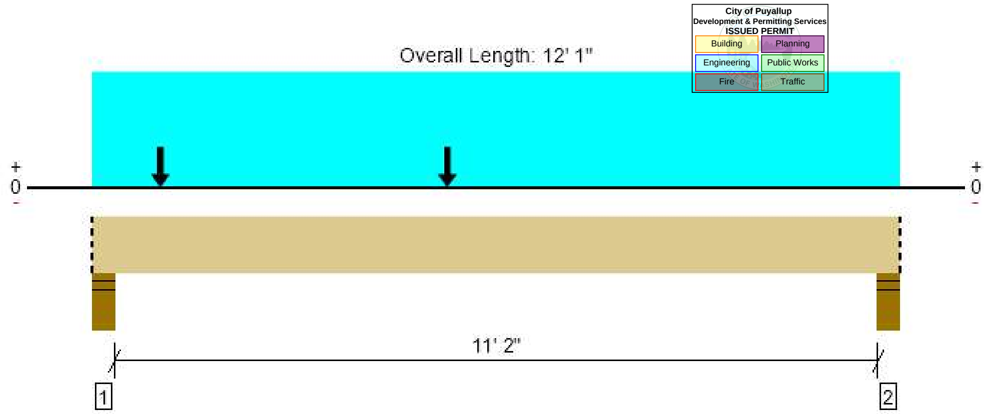
Weyerhaeuser

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.

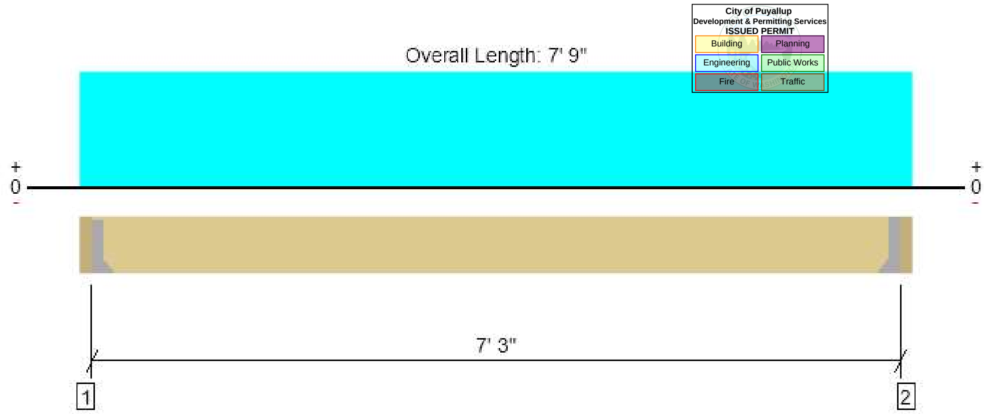
Weyerhaeuser Notes

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

10/22/2024 1:40:12 AM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building D

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)

- 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.

Member Length : 7' 3"
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 - Hanger on 11 1/4" GLB beam	3.00"	Hanger[1]	1.50"	385	1163	1547	See note [1]
2 - Hanger on 11 1/4" GLB beam	3.00"	Hanger[1]	1.50"	385	1163	1547	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 3" o/c	
Bottom Edge (Lu)	7' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LUS410	2.00"	N/A	8-10d	6-10d	
2 - Face Mount Hanger	LUS410	2.00"	N/A	8-10d	6-10d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3" to 7' 6"	N/A	10.0	--	
1 - Uniform (PSF)	0 to 7' 9" (Front)	2'	45.0	150.0	Default Load

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

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

ForteWEB Software Operator	Job Notes
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Weyerhaeuser

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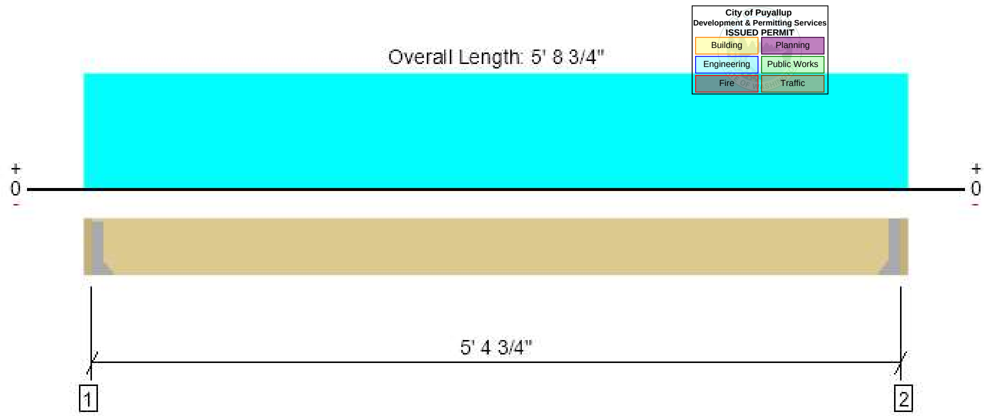
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3

File Name: East Town Crossing Building D

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.

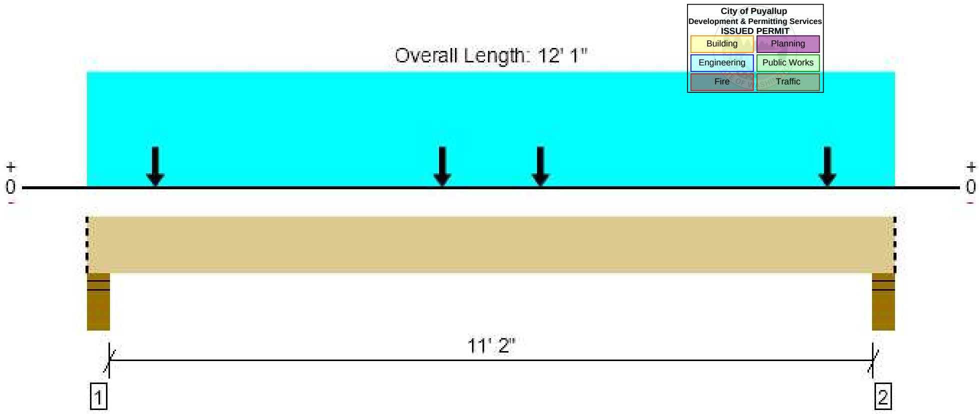
Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 5' 8 3/4"	16"	45.0	150.0	Default Load

Weyerhaeuser Notes

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

3rd Floor Framing, Mid Landing Beam Inner

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



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

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

Member Length : 12' 1"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 11' 5".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	3.06"	1704	5118	6823	Blocking
2 - Stud wall - HF	5.50"	5.50"	3.07"	1706	5122	6828	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	12' 1" o/c	
Bottom Edge (Lu)	12' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 12' 1"	N/A	16.0	--	
1 - Uniform (PSF)	0 to 12' 1" (Front)	3' 1"	45.0	150.0	Default Load
2 - Point (lb)	1' 1/4" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1
3 - Point (lb)	5' 3 3/4" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1
4 - Point (lb)	6' 9 3/8" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1
5 - Point (lb)	11' 7/8" (Front)	N/A	385	1163	Linked from: Short Stair Stringers, Support 1

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

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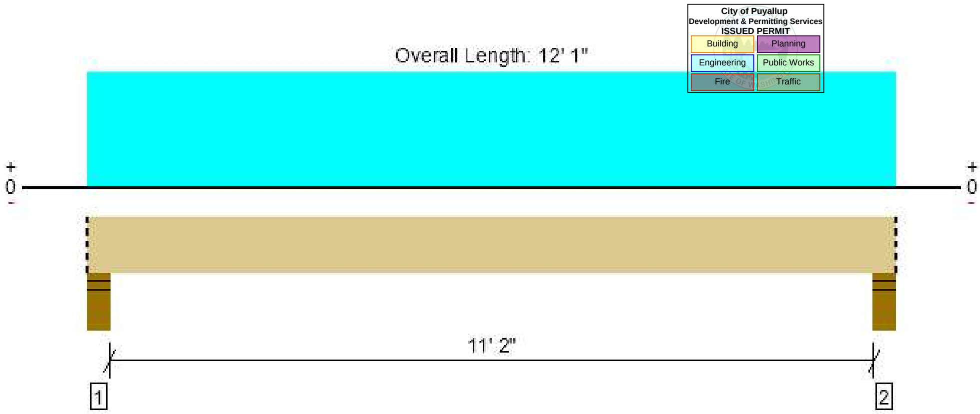
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

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.

Weyerhaeuser Notes

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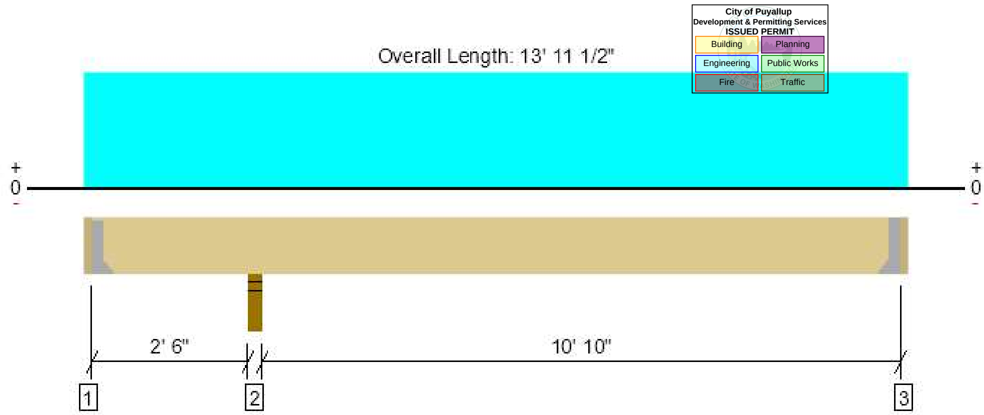
MEMBER REPORT

PASSED

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

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

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10/22/2024 1:40:12 AM UTC

ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3

File Name: East Town Crossing Building D

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

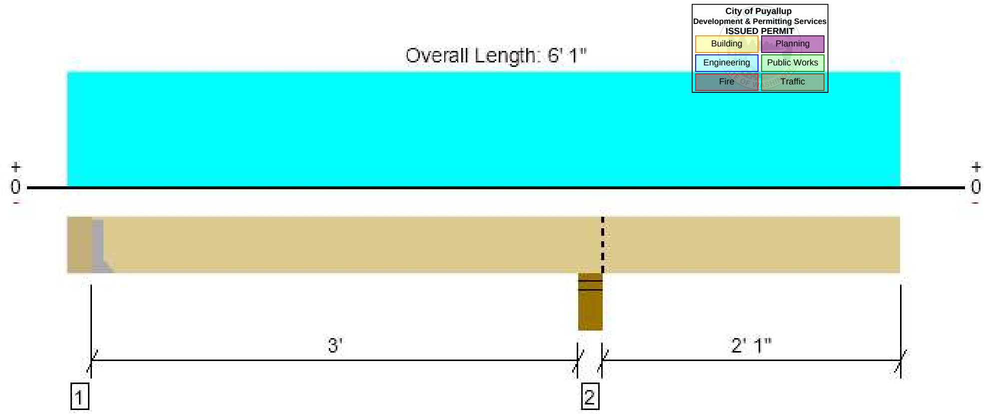
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

MEMBER REPORT

PASSED

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)

- 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.

Member Length : 5' 7"
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 - Hanger on 11 1/4" HF beam	6.00"	Hanger[1]	1.50"	277	893/-142	1170	See note [1]
2 - Stud wall - HF	6.00"	6.00"	2.52"	1048	2014	3062	Blocking

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

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

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LUS28-2	2.00"	N/A	6-10d	3-10d	

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

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

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

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

ForteWEB Software Operator	Job Notes
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File Name: East Town Crossing Building D

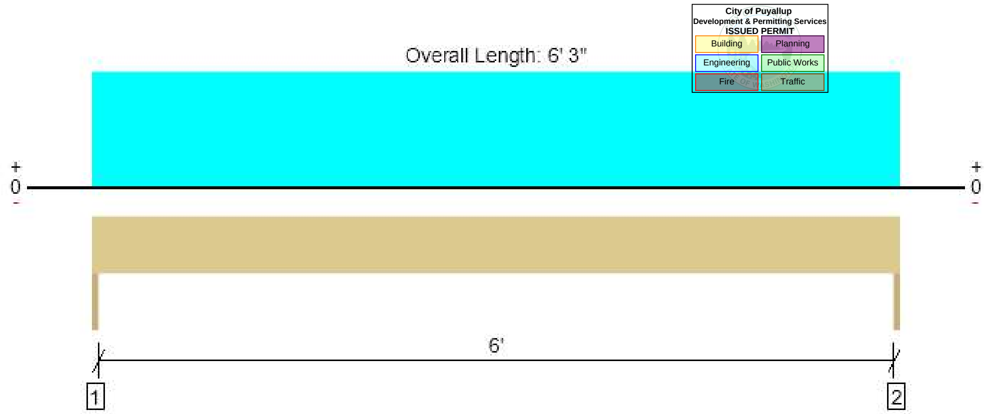
FORTEWEB

MEMBER REPORT

PASSED

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

Weyerhaeuser Notes

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Weyerhaeuser

MEMBER REPORT

PASSED

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

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

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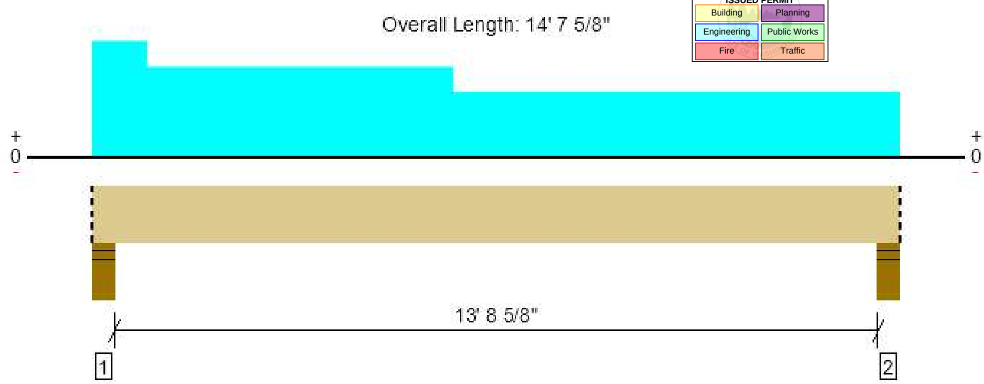
Fire | Traffic



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

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

Member Length : 14' 7 5/8"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 13' 11 5/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

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

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	14' 8" o/c	
Bottom Edge (Lu)	14' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 14' 7 5/8"	N/A	15.9	--	
1 - Uniform (PSF)	0 to 1' (Front)	19' 11 1/2"	30.0	40.0	Default Load
2 - Uniform (PSF)	1' to 6' 6 1/2" (Front)	15' 5 1/2"	30.0	40.0	Default Load
3 - Uniform (PSF)	6' 6 1/2" to 14' 7 5/8" (Front)	11' 2"	30.0	40.0	Default Load

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

Weyerhaeuser Notes

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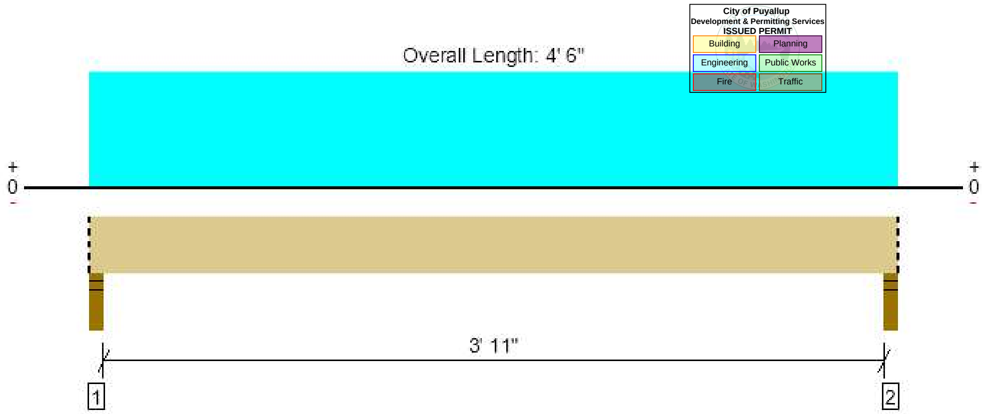
FORTEWEB

MEMBER REPORT

PASSED

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

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3166 @ 2"	4961 (3.50")	Passed (64%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1363 @ 1' 3 3/8"	7343	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	3054 @ 2' 3"	16452	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.006 @ 2' 3"	0.104	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 2' 3"	0.208	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 4' 6"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.23"	1370	1796	3166	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.23"	1370	1796	3166	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 6" o/c	
Bottom Edge (Lu)	4' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

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

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

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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

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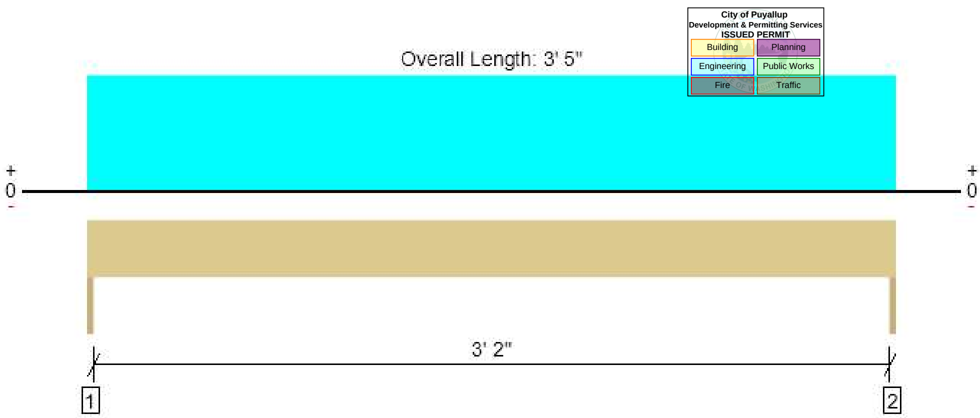
File Name: East Town Crossing Building D

3rd Floor Framing, Grid 2.4 (H.8-I.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)	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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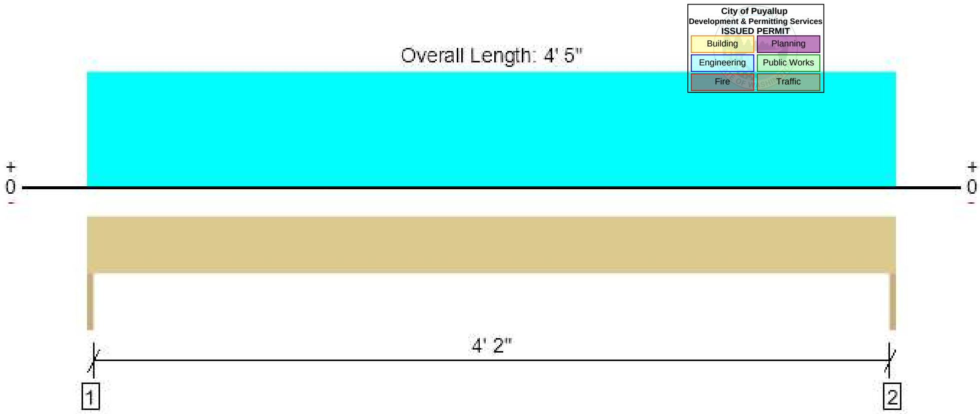
MEMBER REPORT

PASSED

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

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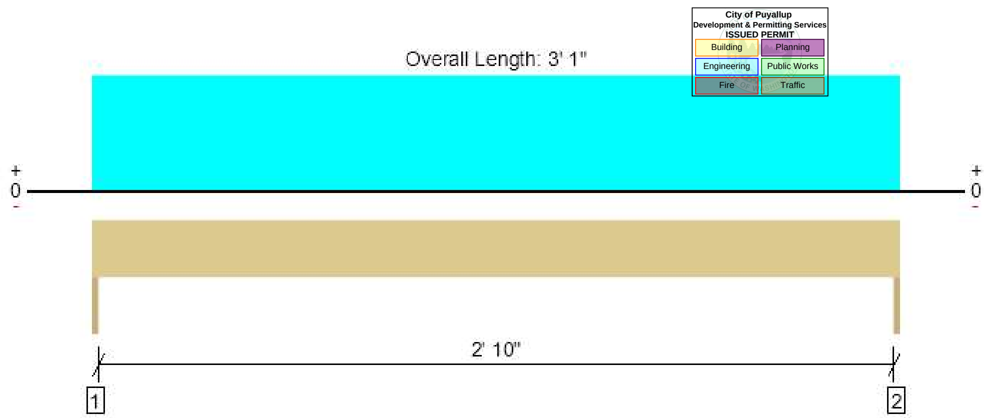
File Name: East Town Crossing Building D

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)

- 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.

Member Length : 3' 1"
System : Wall
Member Type : Header
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 - Trimmer - HF	1.50"	1.50"	1.50"	484	632	1116	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	484	632	1116	None

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

•Maximum allowable bracing intervals based on applied load.

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

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

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

Weyerhaeuser

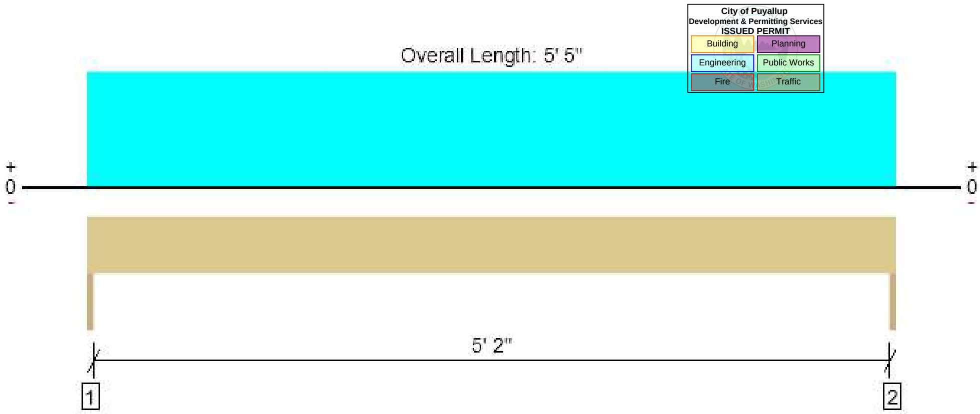
FORTEWEB

MEMBER REPORT

PASSED

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

Weyerhaeuser Notes

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

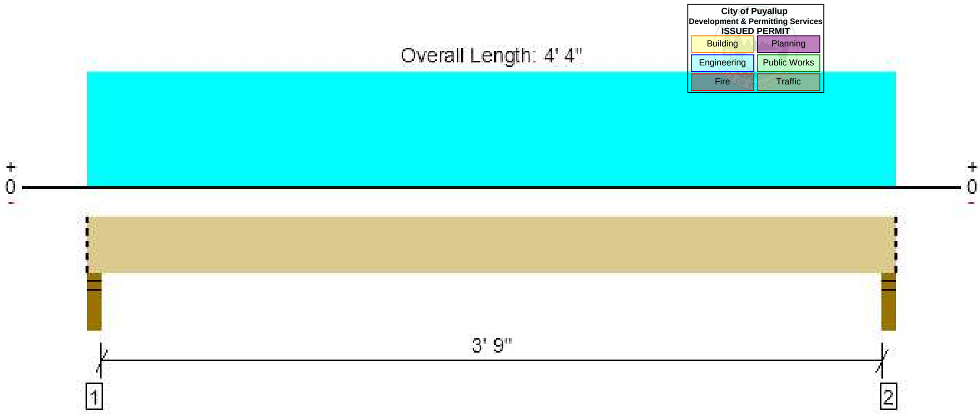
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

Weyerhaeuser

10/22/2024 1:40:12 AM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building D

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

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



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

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

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4'.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.50"	688	888	1576	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	688	888	1576	Blocking

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

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

•Maximum allowable bracing intervals based on applied load.

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

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

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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

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File Name: East Town Crossing Building D

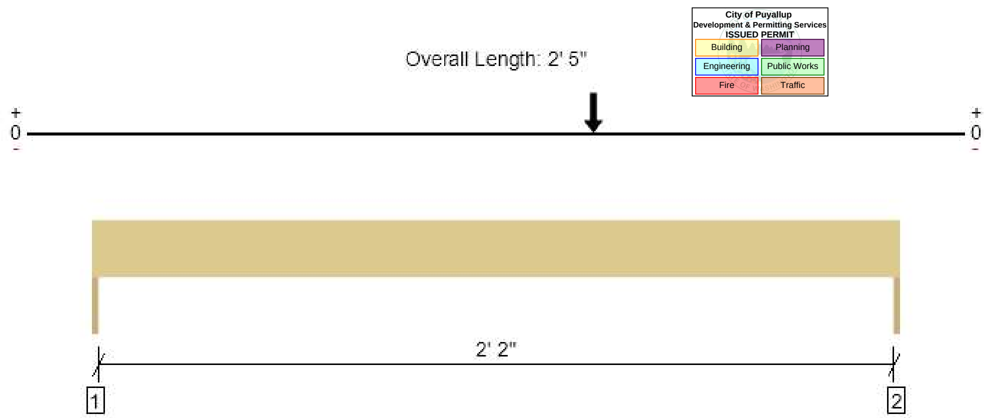
FORTEWEB

MEMBER REPORT

PASSED

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

Weyerhaeuser

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File Name: East Town Crossing Building D

PASSED

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

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

City of Puyallup
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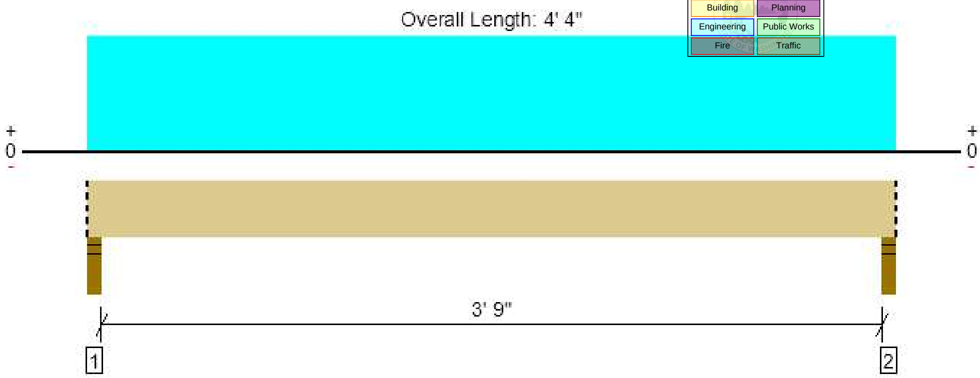

Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

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

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4'.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.50"	764	989	1753	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	764	989	1753	Blocking

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

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

•Maximum allowable bracing intervals based on applied load.

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

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

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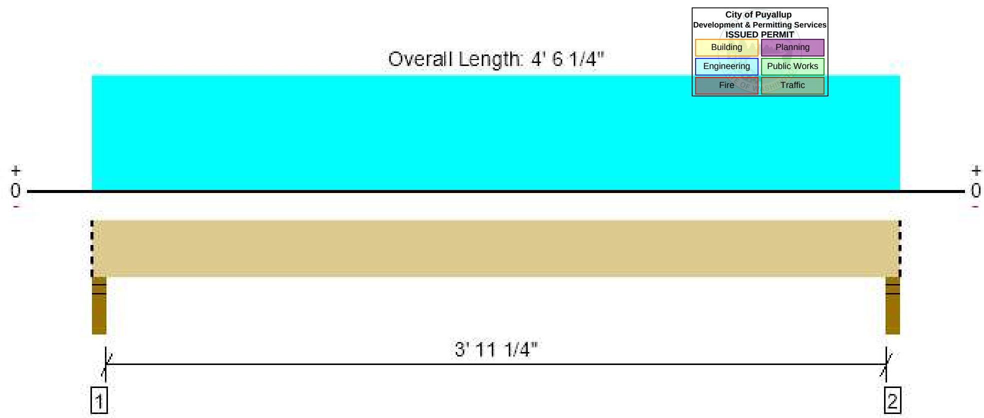
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

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



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

Member Length : 4' 6 1/4"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 2 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.82"	1119	1462	2581	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.82"	1119	1462	2581	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 6" o/c	
Bottom Edge (Lu)	4' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

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

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

Weyerhaeuser Notes

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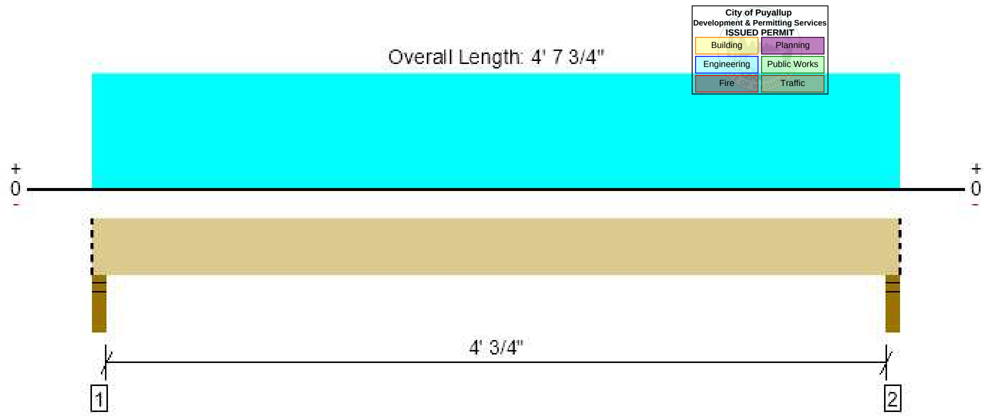
Weyerhaeuser

10/22/2024 1:40:12 AM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building D

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

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2151 @ 2"	4961 (3.50")	Passed (43%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	965 @ 1' 3 3/8"	7343	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2153 @ 2' 3 7/8"	16452	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.005 @ 2' 3 7/8"	0.108	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.008 @ 2' 3 7/8"	0.216	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 3 3/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.52"	935	1216	2151	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.52"	935	1216	2151	Blocking

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

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

•Maximum allowable bracing intervals based on applied load.

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

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

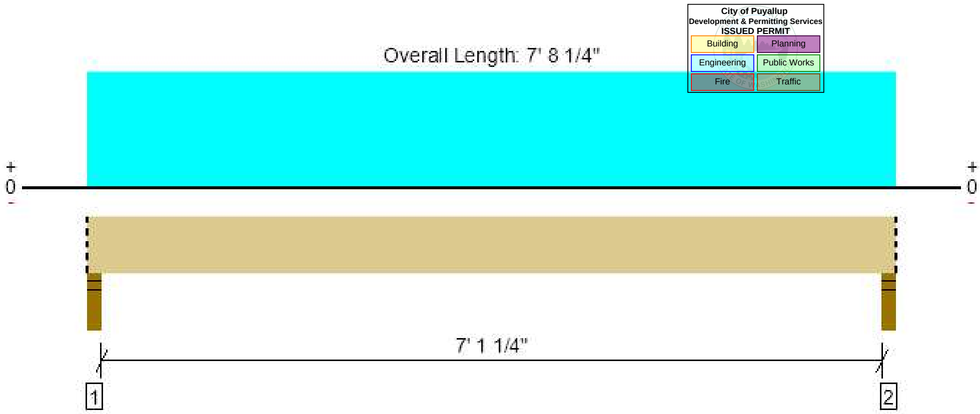
Weyerhaeuser Notes

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

Weyerhaeuser

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

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



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

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

Member Length : 7' 8 1/4"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 7' 4 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.34"	1447	1877	3324	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.34"	1447	1877	3324	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 8" o/c	
Bottom Edge (Lu)	7' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 7' 8 1/4"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 7' 8 1/4" (Front)	12' 2 1/2"	30.0	40.0	Default Load

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

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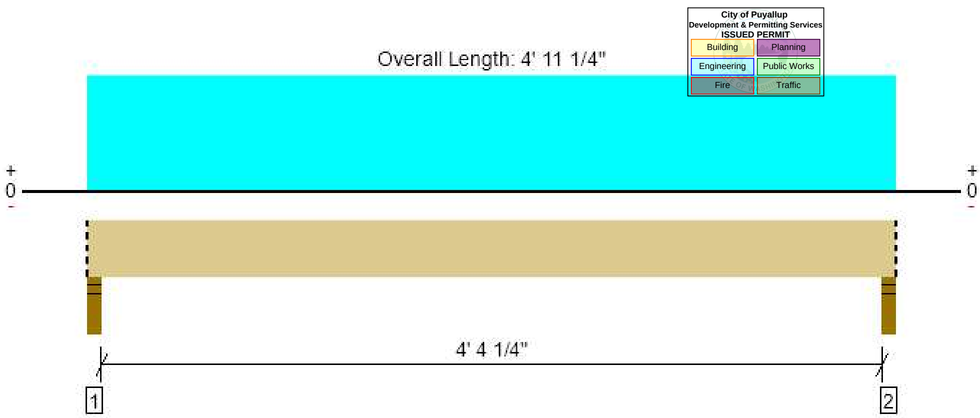
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

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

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2372 @ 2"	4961 (3.50")	Passed (48%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1141 @ 1' 3 3/8"	7343	Passed (16%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2546 @ 2' 5 5/8"	16452	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.006 @ 2' 5 5/8"	0.115	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 2' 5 5/8"	0.230	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 7 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.67"	1031	1341	2372	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.67"	1031	1341	2372	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 11" o/c	
Bottom Edge (Lu)	4' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

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

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

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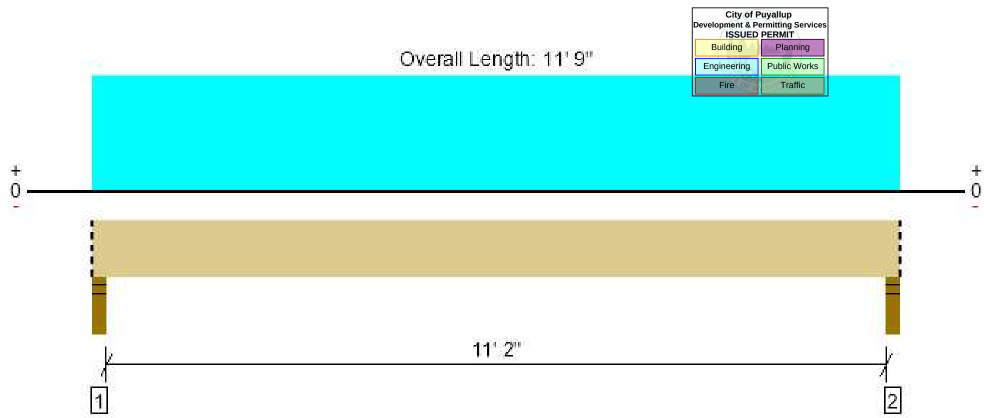
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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

Weyerhaeuser

Roof Framing, Grid I Entry Roof Beam

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



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

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

Member Length : 11' 9"
System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0.25/12

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	3.50"	3.50"	3.20"	2293	2240	4533	Blocking
2 - Stud wall - HF	3.50"	3.50"	3.20"	2293	2240	4533	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 9" o/c	
Bottom Edge (Lu)	11' 9" o/c	

•Maximum allowable bracing intervals based on applied load.

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

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

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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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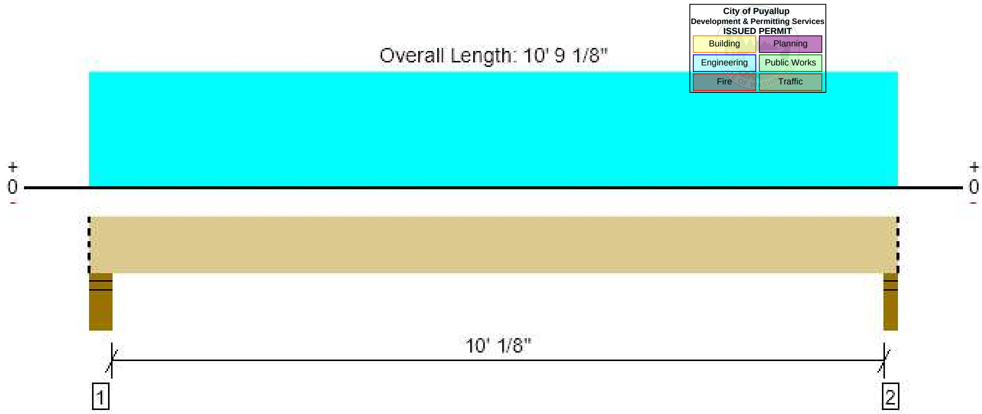
10/22/2024 1:40:12 AM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: East Town Crossing Building D

Roof Framing, Grid L 10' Deck Roof Beam

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



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

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

Member Length : 10' 9 1/8"
System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0.25/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 10' 3 1/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	5.50"	5.50"	3.63"	2600	2550	5149	Blocking
2 - Stud wall - HF	3.50"	3.50"	3.52"	2520	2472	4992	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 9" o/c	
Bottom Edge (Lu)	10' 9" o/c	

•Maximum allowable bracing intervals based on applied load.

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

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

Weyerhaeuser Notes

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

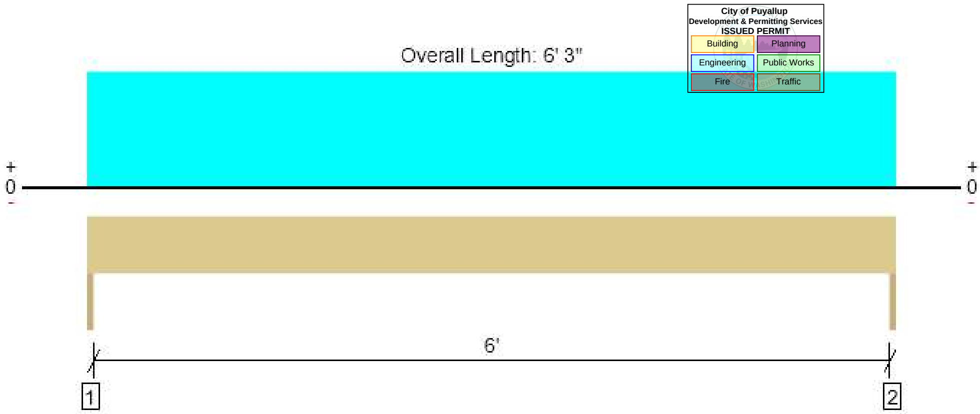
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

MEMBER REPORT

PASSED

Roof Framing, 6' Window Header

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



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

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

Member Length : 6' 3"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

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

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

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

•Maximum allowable bracing intervals based on applied load.

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

Weyerhaeuser Notes

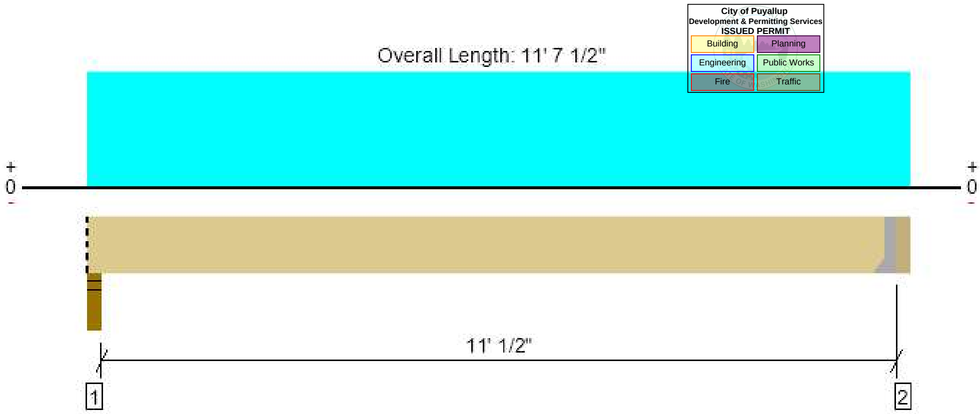
ForteWEB Software Operator	Job Notes
Chon Pieruccioni Pieruccioni Engineering (206) 949-7866 cpieru@hotmail.com	

MEMBER REPORT

PASSED

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
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File Name: East Town Crossing Building D

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

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

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

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File Name: East Town Crossing Building D

FORTEWEB

MEMBER REPORT

~~FAILED~~

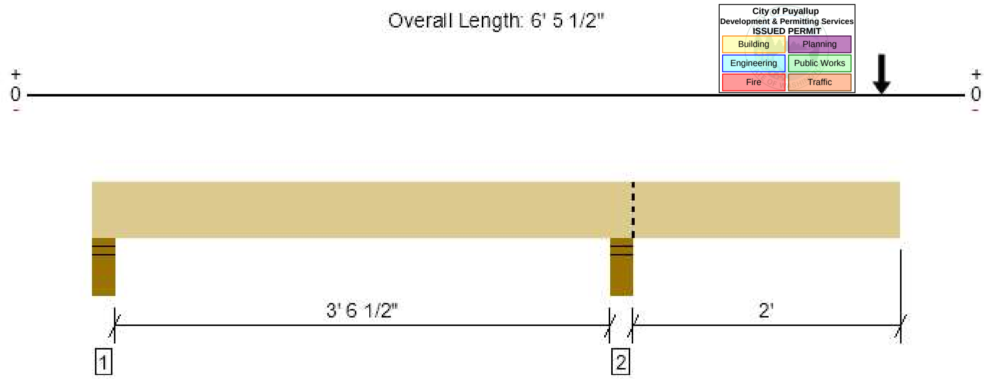
PASSED

Roof Framing, Deck Roof Cantilever Beam

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

An excessive uplift of -2576 lbs at support located at 4" failed this product.

Uplift resisted by (2)ST6215 straps



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.

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
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Weyerhaeuser

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File Name: East Town Crossing Building D

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 = $\dfrac{\textit{Resisting moment}}{\textit{Overturning moment}} = \dfrac{5.4}{0.0}$ = 53.71 > 1.50 OK

SPREAD FOOTING DESIGN

- 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 = $\dfrac{\textit{Resisting moment}}{\textit{Overturning moment}} = \dfrac{5.4}{0.0}$ = 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

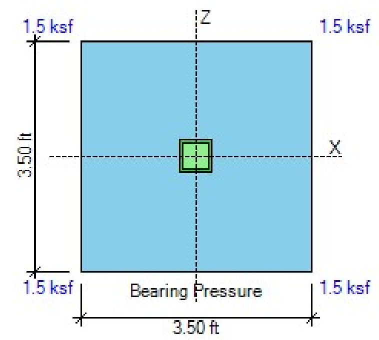
- Footing is in full bearing. Soil pressures are as follows:

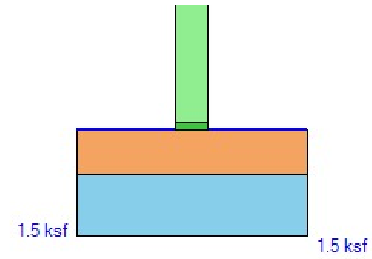
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 18.8 * (1 / 12.3 + 0.00 / 7.1 + 0.00 / 7.1) = 1.54 ksf

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

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

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\dfrac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \dfrac{0.0 + 0.7 + 0.0 - 0.3}{0.0}$ = 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

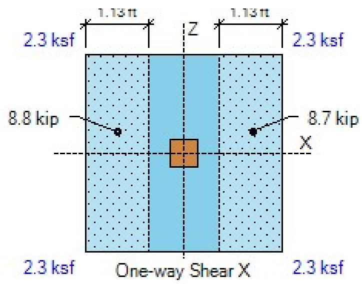
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

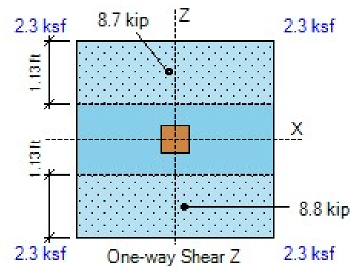
One-way shear Vux (- Side) = 8.8 kip < 15.0 kip OK

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

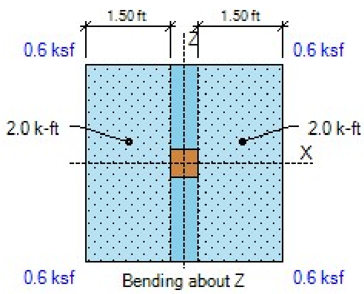
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.73) = 6.0 in

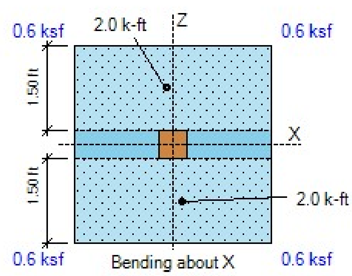
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover =* 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+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 in^2

Sx = *col W * col L² / 6 =* 6.0 * 6.0² / 6 = 36.0 in^3

Sz = *col L * col W² / 6 =* 6.0 * 6.0² / 6 = 36.0 in^3

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 in^2

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

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

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.13) = 6.0 in

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ACI Eq. (8.4.4.2.2)

ACI Eq. (8.4.2.3.2)

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

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

$Jcz = b1 * d^3 / 6 + b1^3 * d / 6 + b1^2 * b2 * d / 2$ ACI R8.4.4.2.3

$Jcz = 10.5 * 4.5^3 / 6 + 10.5^3 * 4.5 / 6 + 10.5^2 * 10.5 * 4.5 / 2 = 3632\ in^4$

$Jcx = b2 * d^3 / 6 + b2^3 * d / 6 + b2^2 * b1 * d / 2$ ACI R8.4.4.2.3

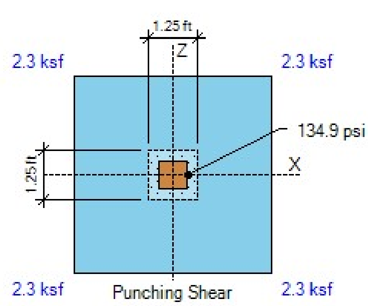
$Jcx = 10.5 * 4.5^3 / 6 + 10.5^3 * 4.5 / 6 + 10.5^2 * 10.5 * 4.5 / 2 = 3632\ in^4$

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

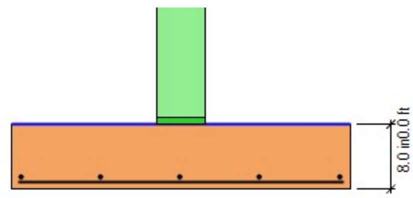
Punching stress = *P-stress + Mx-stress + Mz-stress =* 134.9 + 0.0 + 0.0 = 134.9 psi < 150.0 psi OK



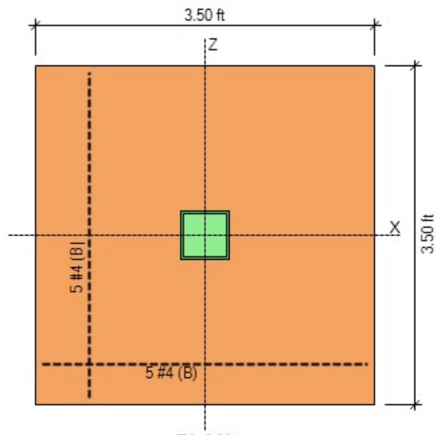
SPREAD FOOTING DESIGN

DESIGN CODES

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



ELEVATION



PLAN

GEOMETRY

Footing Length (X-dir)	3.00	ft	
Footing Width (Z-dir)	3.00	ft	
Footing Thickness	8.0	in	OK
Soil Cover	0.00	ft	
Column Length (X-dir)	6.0	in	
Column Width (Z-dir)	6.0	in	
Offset (X-dir)	0.00	in	OK
Offset (Z-dir)	0.00	in	OK
Base Plate (L x W)	6.0 x 6.0	in	

SOIL PRESSURES (D+L)

Gross Allow. Soil Pressure	2.0	ksf
Soil Pressure at Corner 1	1.5	ksf
Soil Pressure at Corner 2	1.5	ksf
Soil Pressure at Corner 3	1.5	ksf
Soil Pressure at Corner 4	1.5	ksf
Bearing Pressure Ratio	0.76	OK
Ftg. Area in Contact with Soil	100.0	%
X-eccentricity / Ftg. Length	0.00	OK
Z-eccentricity / Ftg. Width	0.00	OK

APPLIED LOADS

	Dead	Live	RLive	Snow	Wind	Seismic	
Axial Force P	8.0	5.2	0.0	0.0	0.0	0.0	kip
Moment about X Mx ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Moment about Z Mz ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Shear Force Vx	0.0	0.0	0.0	0.0	0.0	0.0	kip
Shear Force Vz	0.0	0.0	0.0	0.0	0.0	0.0	kip

OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X

- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft

- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft

- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft

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

- Resisting about X-X

- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 3.00 * 3.00 * 8.0 / 12 * 0.15 = 0.5 kip

Arm = *W / 2 =* 3.00 / 2 = 1.50 ft Moment = 0.5 * 1.50 = 0.8 k-ft

- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip

Arm = *W / 2 - Offset =* 3.00 / 2 - 0.0 / 12 = 1.50 ft Moment = 0.0 * 1.50 = 0.0 k-ft

- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (3.00 * 3.00 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

Arm = *W / 2 =* 3.00 / 2 = 1.50 ft Moment = 0.0 * 1.50 = 0.0 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 3.00 * 3.00 * 62 * (0.67) = -0.2 kip

Arm = *W / 2 =* 3.00 / 2 = 1.50 ft Moment = 0.2 * 1.50 = -0.3 k-ft

- Axial force P = 0.6 * 8.0 + 0.6 * 0.0 = 4.8 kip

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

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

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

SPREAD FOOTING DESIGN

- Overturning about Z-Z

- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft

- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft

- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft

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

- Resisting about Z-Z

- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 3.00 * 3.00 * 8.0 / 12 * 0.15 = 0.5 kip

  Arm = *L / 2 =* 3.00 / 2 = 1.50 ft Moment = 0.5 * 1.50 = 0.8 k-ft

- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip

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

- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (3.00 * 3.00 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *L / 2 =* 3.00 / 2 = 1.50 ft Moment = 0.0 * 1.50 = 0.0 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 3.00 * 3.00 * 62 * (0.67) = -0.2 kip

  Arm = *L / 2 =* 3.00 / 2 = 1.50 ft Moment = 0.2 * 1.50 = -0.3 k-ft

- Axial force P = 0.6 * 8.0 + 0.6 * 0.0 = 4.8 kip

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

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

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

SOIL BEARING PRESSURES (Comb: D+L)

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

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

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

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

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

X-coordinate of resultant from maximum bearing corner:

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

Z-coordinate of resultant from maximum bearing corner:

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

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

Z-ecc = *Width / 2 - Zp =* 3.00 / 2 - 1.50 = 0.00 ft

Area = *Width * Length =* 3.00 * 3.00 = 9.0 ft²

Sx = *Length * Width² / 6 =* 3.00 * 3.00² / 6 = 4.5 ft³

Sz = *Width * Length² / 6 =* 3.00 * 3.00² / 6 = 4.5 ft³

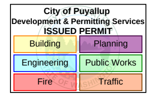
- Footing is in full bearing. Soil pressures are as follows:

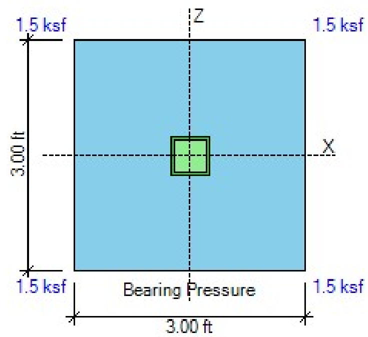
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 13.7 * (1 / 9.0 + 0.00 / 4.5 + 0.00 / 4.5) = 1.53 ksf

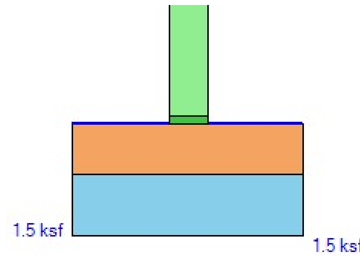
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 13.7 * (1 / 9.0 - 0.00 / 4.5 + 0.00 / 4.5) = 1.53 ksf

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

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







SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33* *(per Coulomb)*

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

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

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

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

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

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

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

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\dfrac{\text{Pedestal + Footing + Cover - Buoyancy}}{\text{Uplift load}} = \dfrac{0.0 + 0.5 + 0.0 - 0.2}{0.0}$ = 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

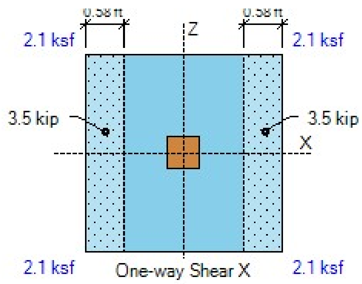
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

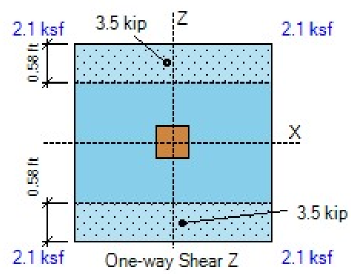
One-way shear Vux (- Side) = 3.5 kip < 11.5 kip OK

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

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

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





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

Plain ϕMnx = *5 * ϕ * $\sqrt{(f'c)}$ * L * Thick² / 6* = 5 * 0.60 * $\sqrt{(2500)}$ * 3.00 * 8.0² / 6 / 1000 = 1.3 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * $\sqrt{(f'c)}$ * W * Thick² / 6* = 5 * 0.60 * $\sqrt{(2500)}$ * 3.00 * 8.0² / 6 / 1000 = 1.3 k-ft

- Top Bars

No Top Reinforcement Provided at the Footing

Use Plain Concrete Flexural Strength at Top

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

Top moment -Mux (- Side) = 0.0 k-ft < 4.8 k-ft OK

Top moment -Mux (+ Side) = 0.0 k-ft < 4.8 k-ft OK

Top moment -Muz (- Side) = 0.0 k-ft < 4.8 k-ft OK

Top moment -Muz (+ Side) = 0.0 k-ft < 4.8 k-ft OK

- Bottom Bars

No Bottom Reinforcement Provided at the Footing

Use Plain Concrete Flexural Strength at Bottom

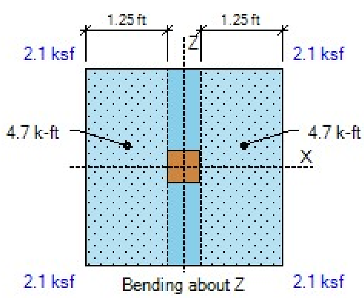
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

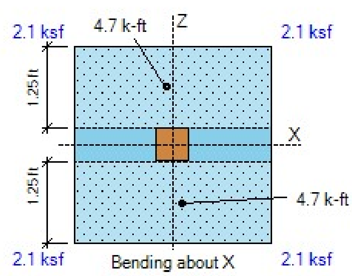
Bottom moment Mux (- Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.97

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

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

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





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

Area $A1 = col\ L * col\ W$ = 6.0 * 6.0 = 36.0 in^2

Sx = $col\ W * col\ L^2 / 6$ = 6.0 * 6.0^2 / 6 = 36.0 in^3

Sz = $col\ L * col\ W^2 / 6$ = 6.0 * 6.0^2 / 6 = 36.0 in^3

Bearing $Pbu = P / A1 + Mz / Sx + Mx / Sz$ = 17.9 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.5 ksi

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

Min edge = Min (3.00 * 12 / 2 - 0.0 - 6.0 / 2, 3.00 * 12 / 2 - 0.0 - 6.0 / 2 = 15.0 in

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

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

Footing $\phi Pnc = \phi * 0.85 * f'c * Min [2, \sqrt{(A2 / A1)}]$ = 0.65 * 0.85 * 2.5 * Min [2, √(1296.0 / 36.0)] = 2.8 ksi

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

Footing bearing $\phi Pn = \phi Pnc + \phi Pns$ = 2.8 + 0.0 = 2.8 ksi > 0.5 psi OK

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

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.09) = 6.0 in

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

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

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

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

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

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

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

bo = 10 / 10 * (6.0 + 8.0 / 2 + 15.0) + 10 / 10 * (6.0 + 8.0 / 2 + 15.0) = 50.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge) =* (6.0 + 8.0 / 2 + 15.0) * (6.0 + 8.0 / 2 + 15.0) = 625.0 in²

Use Plain Concrete Shear Strength

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

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

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

F = 17.9 + 0.07 * 625.0 / 144 - 2.8 = 15.4 kip

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

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

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

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

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

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

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

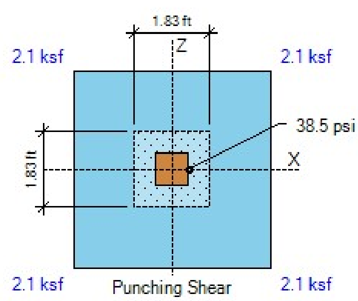
Jcz = 25.0 * 8.0³ / 12 + 25.0³ * 8.0 / 12 + 25.0 * 8.0 * (25.0 / 2 * 6.3)² + 25.0 * 8.0 * 6.3² = 27108 in⁴

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

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

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

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



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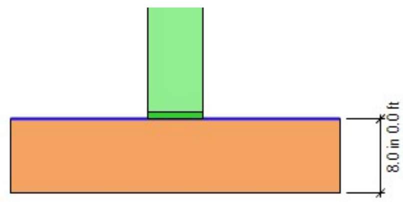
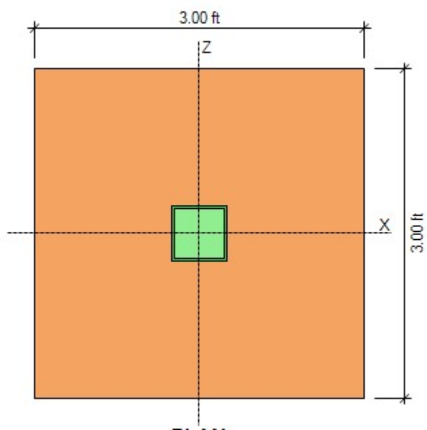
DESIGN CODES

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



ELEVATION



PLAN

SPREAD FOOTING DESIGN

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

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

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 ft^2

Sx = *Length * Width² / 6 =* 3.50 * 3.50^2 / 6 = 7.1 ft^3

Sz = *Width * Length² / 6 =* 3.50 * 3.50^2 / 6 = 7.1 ft^3

- Footing is in full bearing. Soil pressures are as follows:

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

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

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

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

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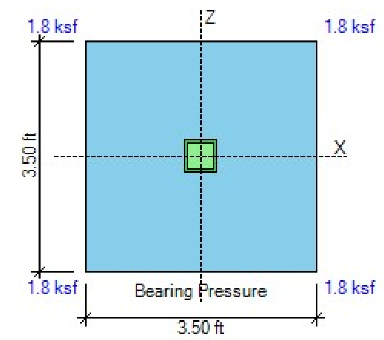
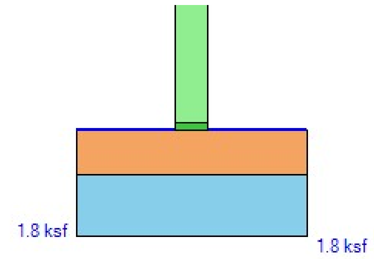




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33* *(per Coulomb)*

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

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

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

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

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

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

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

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\frac{\text{Pedestal + Footing + Cover - Buoyancy}}{\text{Uplift load}} = \frac{0.0 + 0.7 + 0.0 - 0.3}{0.0}$ = 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:

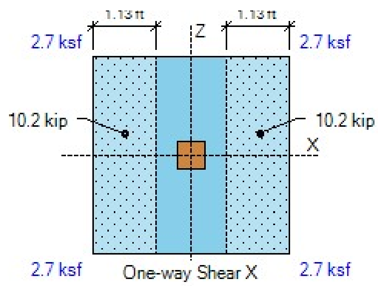
One-way shear Vux (- Side) = 10.2 kip < 15.0 kip OK

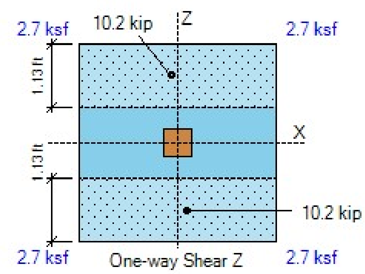
One-way shear Vux (+ Side) = 10.2 kip < 15.0 kip OK

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

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

SPREAD FOOTING DESIGN





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)

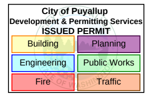
X-Ld = Max (12.0, 3 / 40 * 40.0 * 1000 / (2500)½ * 1.0 * 0.8 * 1.0 / 2.5 * 0.50 * 0.76) = 12.0 in

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

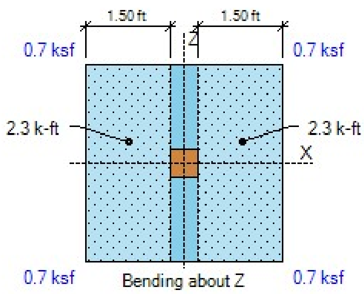
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.85) = 6.0 in

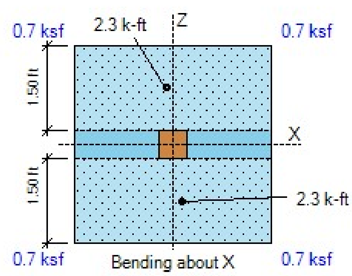
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover =* 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+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 α_{sx} = 20

Z-Edge = *d / 2 =* 4.5 / 2 = 2.3 in α_{sz} = 20

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

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

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

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

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

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

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

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

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

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

ACI Eq. (8.4.4.2.2)

ACI Eq. (8.4.2.3.2)

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

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

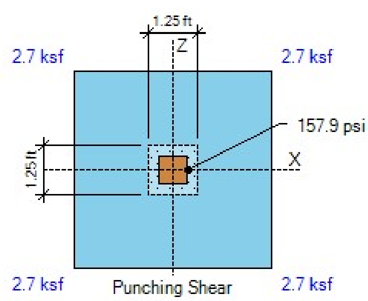
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

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

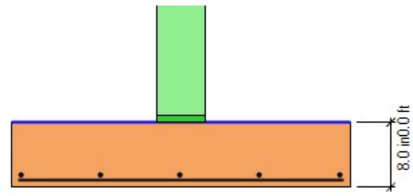
Punching stress = *P-stress + Mx-stress + Mz-stress =* 157.9 + 0.0 + 0.0 = 157.9 psi > 150.0 psi NG



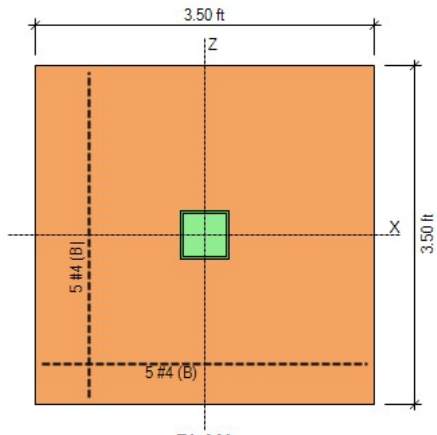
SPREAD FOOTING DESIGN

DESIGN CODES

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



ELEVATION



PLAN

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	1.5	ksf	
Soil Pressure at Corner 2	1.5	ksf	
Soil Pressure at Corner 3	1.5	ksf	
Soil Pressure at Corner 4	1.5	ksf	
Bearing Pressure Ratio	0.76		OK
Ftg. Area in Contact with Soil	100.0	%	
X-eccentricity / Ftg. Length	0.00		OK
Z-eccentricity / Ftg. Width	0.00		OK

APPLIED LOADS

	Dead	Live	RLive	Snow	Wind	Seismic	
Axial Force P	8.0	5.2	0.0	0.0	0.0	0.0	kip
Moment about X Mx ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Moment about Z Mz ..	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
Shear Force Vx	0.0	0.0	0.0	0.0	0.0	0.0	kip
Shear Force Vz	0.0	0.0	0.0	0.0	0.0	0.0	kip

OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

- Overturning about X-X
- Moment Mx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft
- Shear Force Vz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip
  Arm = 0.00 + 8.0 / 12 = 0.67 ft   Moment = 0.0 * 0.67 = 0.0 k-ft
- Passive Force = 0.0 kip   Arm = 0.27 ft   Moment = 0.0 k-ft
- Overturning moment X-X = 0.0 + 0.0 = 0.0 k-ft

- Resisting about X-X
- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 3.00 * 3.00 * 8.0 / 12 * 0.15 = 0.5 kip
  Arm = *W / 2 =* 3.00 / 2 = 1.50 ft   Moment = 0.5 * 1.50 = 0.8 k-ft
- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip
  Arm = *W / 2 - Offset =* 3.00 / 2 - 0.0 / 12 = 1.50 ft   Moment = 0.0 * 1.50 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (3.00 * 3.00 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip
  Arm = *W / 2 =* 3.00 / 2 = 1.50 ft   Moment = 0.0 * 1.50 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 3.00 * 3.00 * 62 * (0.67) = -0.2 kip
  Arm = *W / 2 =* 3.00 / 2 = 1.50 ft   Moment = 0.2 * 1.50 = -0.3 k-ft
- Axial force P = 0.6 * 8.0 + 0.6 * 0.0 = 4.8 kip
  Arm = *W / 2 - Offset =* 3.00 / 2 - 0.0 / 12 = 1.50 ft   Moment = 4.8 * 1.50 = 7.2 k-ft
- Resisting moment X-X = 0.8 + 0.0 + 0.0 + 7.2 + -0.3 = 7.7 k-ft

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

- Overturning about Z-Z

- Moment Mz = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 k-ft

- Shear Force Vx = 0.6 * 0.0 + 0.6 * 0.0 = 0.0 kip

  Arm = 0.00 + 8.0 / 12 = 0.67 ft Moment = 0.0 * 0.67 = 0.0 k-ft

- Passive Force = 0.0 kip Arm = 0.27 ft Moment = 0.0 k-ft

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

- Resisting about Z-Z

- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 3.00 * 3.00 * 8.0 / 12 * 0.15 = 0.5 kip

  Arm = *L / 2 =* 3.00 / 2 = 1.50 ft Moment = 0.5 * 1.50 = 0.8 k-ft

- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip

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

- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (3.00 * 3.00 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip

  Arm = *L / 2 =* 3.00 / 2 = 1.50 ft Moment = 0.0 * 1.50 = 0.0 k-ft

- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 3.00 * 3.00 * 62 * (0.67) = -0.2 kip

  Arm = *L / 2 =* 3.00 / 2 = 1.50 ft Moment = 0.2 * 1.50 = -0.3 k-ft

- Axial force P = 0.6 * 8.0 + 0.6 * 0.0 = 4.8 kip

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

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

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

SOIL BEARING PRESSURES (Comb: D+L)

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

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

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

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

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

X-coordinate of resultant from maximum bearing corner:

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

Z-coordinate of resultant from maximum bearing corner:

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

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

Z-ecc = *Width / 2 - Zp =* 3.00 / 2 - 1.50 = 0.00 ft

Area = *Width * Length =* 3.00 * 3.00 = 9.0 ft^2

Sx = *Length * Width² / 6 =* 3.00 * 3.00^2 / 6 = 4.5 ft^3

Sz = *Width * Length² / 6 =* 3.00 * 3.00^2 / 6 = 4.5 ft^3

- Footing is in full bearing. Soil pressures are as follows:

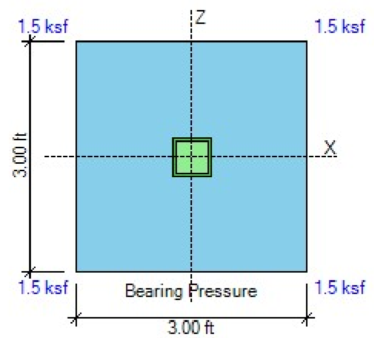
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 13.7 * (1 / 9.0 + 0.00 / 4.5 + 0.00 / 4.5) = 1.53 ksf

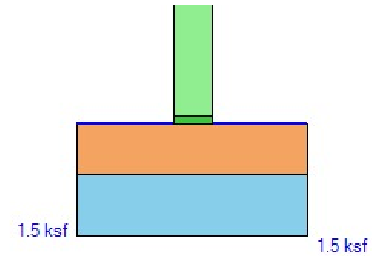
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 13.7 * (1 / 9.0 - 0.00 / 4.5 + 0.00 / 4.5) = 1.53 ksf

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

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

ASDIP Foundation 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 * 3.00 = 0.3 kip

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

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

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

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

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

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\dfrac{\text{Pedestal + Footing + Cover - Buoyancy}}{\text{Uplift load}} = \dfrac{0.0 + 0.5 + 0.0 - 0.2}{0.0}$ = 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:

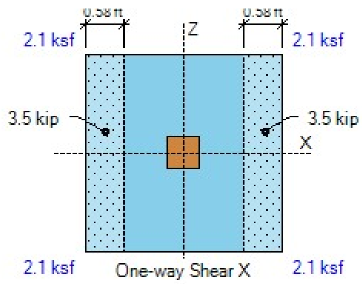
One-way shear Vux (- Side) = 3.5 kip < 11.5 kip OK

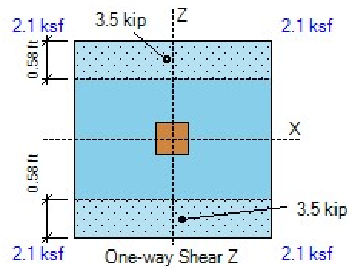
One-way shear Vux (+ Side) = 3.5 kip < 11.5 kip OK

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

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

SPREAD FOOTING DESIGN





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

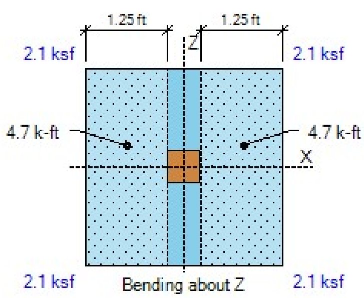
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

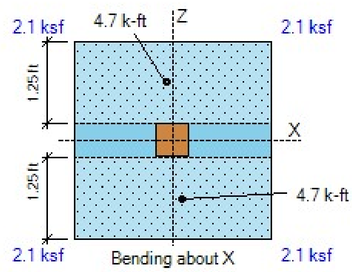
Bottom moment Mux (- Side) = 4.7 k-ft < 4.8 k-ft OK ratio = 0.97

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

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

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





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

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 $Pbu = P / A1 + Mz / Sx + Mx / Sz$ = 17.9 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.5 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 > 0.5 psi OK

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

Ldh = Max (8 db, 6, 0.02 * 60.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.75 * 0.09) = 6.0 in

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

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

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

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

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

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

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

bo = 10 / 10 * (6.0 + 8.0 / 2 + 15.0) + 10 / 10 * (6.0 + 8.0 / 2 + 15.0) = 50.0 in

Area *Abo = (L + d / 2 + X-Edge) * (W + d / 2 + Z-Edge) =* (6.0 + 8.0 / 2 + 15.0) * (6.0 + 8.0 / 2 + 15.0) = 625.0 in²

Use Plain Concrete Shear Strength

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

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

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

F = 17.9 + 0.07 * 625.0 / 144 - 2.8 = 15.4 kip

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

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

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

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

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

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

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

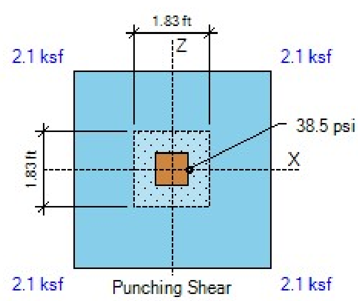
Jcz = 25.0 * 8.0³ / 12 + 25.0³ * 8.0 / 12 + 25.0 * 8.0 * (25.0 / 2 * 6.3)² + 25.0 * 8.0 * 6.3² = 27108 in⁴

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

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

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

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



Punching Shear

ASDIP Foundation 5.3.1.0

SPREAD FOOTING DESIGN

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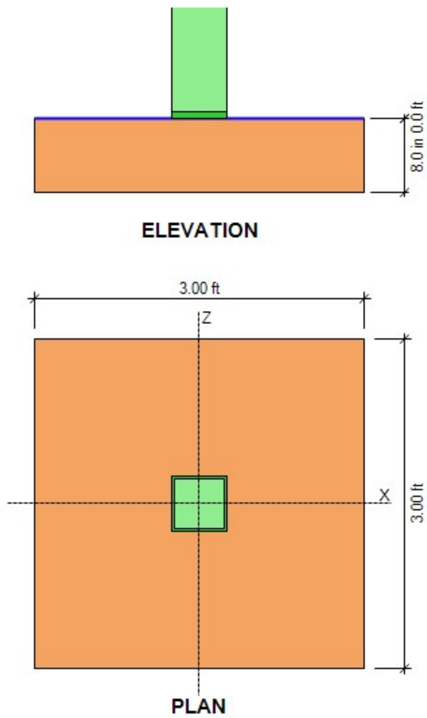
DESIGN CODES

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



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 = $\dfrac{\textit{Resisting moment}}{\textit{Overturning moment}} = \dfrac{6.2}{0.0}$ = 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 = $\dfrac{\text{Resisting moment}}{\text{Overturning moment}} = \dfrac{6.2}{0.0}$ = 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 = $\dfrac{\text{Z-Resisting moment - Z-Overturning moment}}{\text{Resisting force}} = \dfrac{38.4 - 0.0}{21.9}$ = 1.75 ft

Z-coordinate of resultant from maximum bearing corner:

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

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

Z-ecc = *Width / 2 - Zp =* 3.50 / 2 - 1.75 = 0.00 ft

Area = *Width * Length =* 3.50 * 3.50 = 12.3 ft^2

Sx = *Length * Width² / 6 =* 3.50 * 3.50^2 / 6 = 7.1 ft^3

Sz = *Width * Length² / 6 =* 3.50 * 3.50^2 / 6 = 7.1 ft^3

- Footing is in full bearing. Soil pressures are as follows:

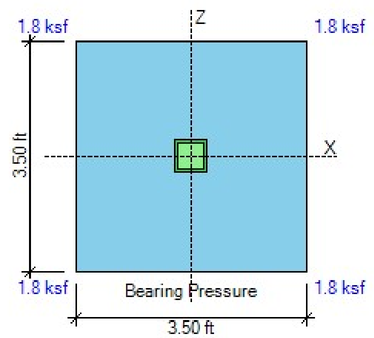
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 21.9 * (1 / 12.3 + 0.00 / 7.1 + 0.00 / 7.1) = 1.79 ksf

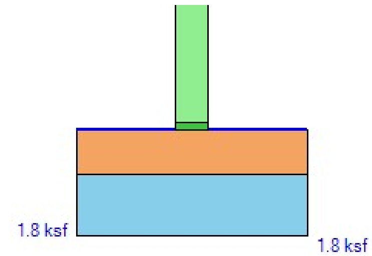
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 21.9 * (1 / 12.3 - 0.00 / 7.1 + 0.00 / 7.1) = 1.79 ksf

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

SPREAD FOOTING DESIGN





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 = $\dfrac{\text{X-Passive force + Friction}}{\text{X-Horizontal load}} = \dfrac{1.00 * 0.4 + 1.00 * 1.2}{0.0}$ = 16.12 > 1.50 OK

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

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\dfrac{\text{Pedestal + Footing + Cover - Buoyancy}}{\text{Uplift load}} = \dfrac{0.0 + 0.7 + 0.0 - 0.3}{0.0}$ = 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

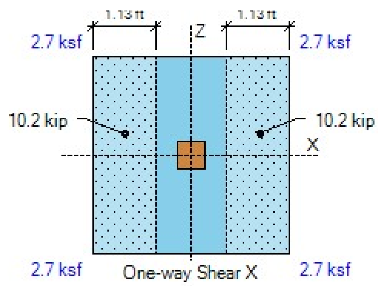
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

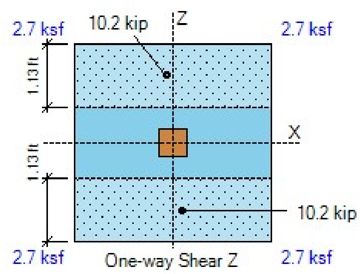
One-way shear Vux (- Side) = 10.2 kip < 15.0 kip OK

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

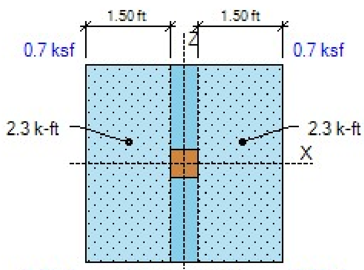
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.85) = 6.0 in

-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

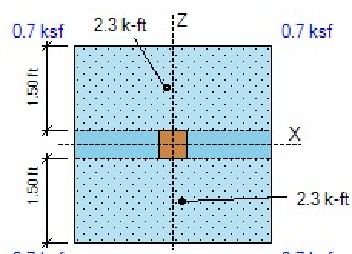
+Z Ld provided =*(Width - Col) / 2 - Offset - Cover =* 3.50 * 12 / 2 - 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

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



Bending about Z



Bending about X

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

Area *A1 = col L * col W =* 6.0 * 6.0 = 36.0 in^2

Sx = *col W * col L² / 6 =* 6.0 * 6.0² / 6 = 36.0 in^3

Sz = *col L * col W² / 6 =* 6.0 * 6.0² / 6 = 36.0 in^3

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 in^2

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

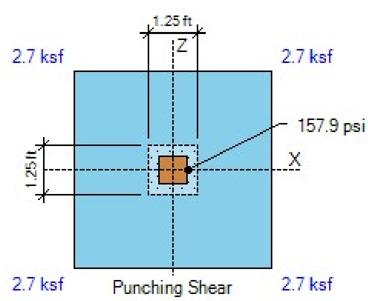
Jcx = 10.5 * 4.5³ / 6 + 10.5³ * 4.5 / 6 + 10.5² * 10.5 * 4.5 / 2 = 3632 in⁴

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

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

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

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



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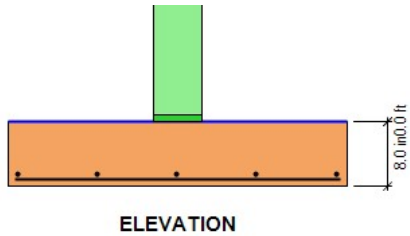
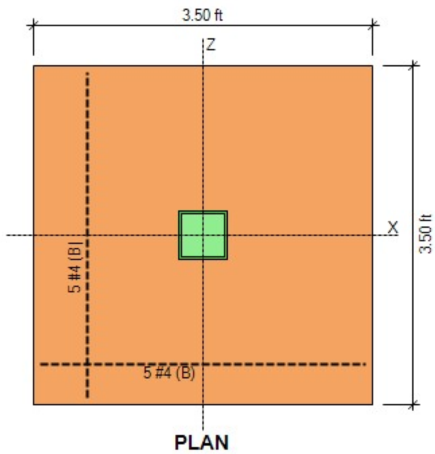
DESIGN CODES

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





SPREAD FOOTING DESIGN

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 = $\dfrac{\text{Resisting moment}}{\text{Overturning moment}} = \dfrac{5.4}{0.0}$ = 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 = $\dfrac{\textit{Resisting moment}}{\textit{Overturning moment}} = \dfrac{5.4}{0.0}$ = 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:

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

Z-coordinate of resultant from maximum bearing corner:

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

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

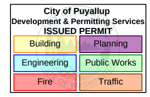
- Footing is in full bearing. Soil pressures are as follows:

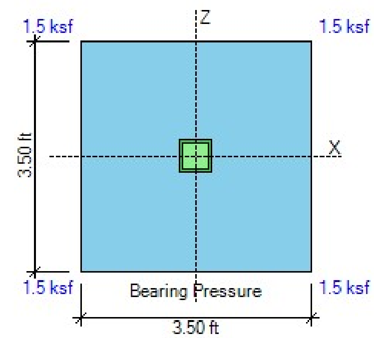
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 18.8 * (1 / 12.3 + 0.00 / 7.1 + 0.00 / 7.1) = 1.54 ksf

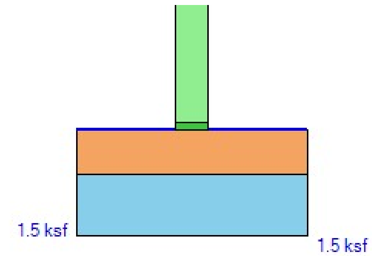
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 18.8 * (1 / 12.3 - 0.00 / 7.1 + 0.00 / 7.1) = 1.54 ksf

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 = $\dfrac{\text{X-Passive force + Friction}}{\text{X-Horizontal load}} = \dfrac{1.00 * 0.4 + 1.00 * 1.1}{0.0}$ = 14.44 > 1.50 OK

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

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\dfrac{\text{Pedestal + Footing + Cover - Buoyancy}}{\text{Uplift load}} = \dfrac{0.0 + 0.7 + 0.0 - 0.3}{0.0}$ = 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

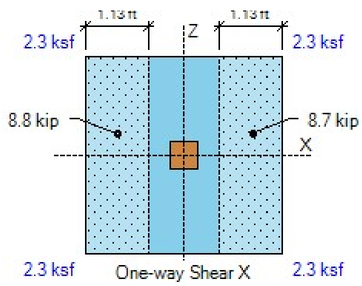
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

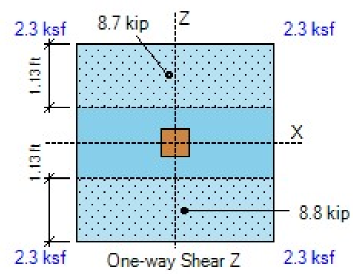
One-way shear Vux (- Side) = 8.8 kip < 15.0 kip OK

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 * Thick^2 / 6* = 5 * 0.60 * √(2500) * 3.50 * 8.0^2 / 6 / 1000 = 1.5 k-ft ACI Eq. (14.5.2.1a)

Plain ϕMnz = *5 * ϕ * √(f'c) * W * Thick^2 / 6* = 5 * 0.60 * √(2500) * 3.50 * 8.0^2 / 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 * d^2 * f'c * q * (1 - 0.59 * q)* ACI 22.2.2

ϕMnx = 0.90 * 3.50 * 12 * 4.3^2 * 2.5 * 0.090 * (1 - 0.59 * 0.090) = 12.1 k-ft

ϕMnz = 0.90 * 3.50 * 12 * 4.8^2 * 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 in^2 < 1.0 in^2 OK ACI 8.6.1.1

Z-As min = *0.0018 * Length * Thick* = 0.0018 * 3.50 * 12 * 8.0 = 0.6 in^2 < 1.0 in^2 OK ACI 8.6.1.1

X-As max for 0.005 tension strain = 3.20 in^2 > 1.00 in^2 OK ACI 21.2.2

Z-As max for 0.005 tension strain = 3.20 in^2 > 1.00 in^2 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

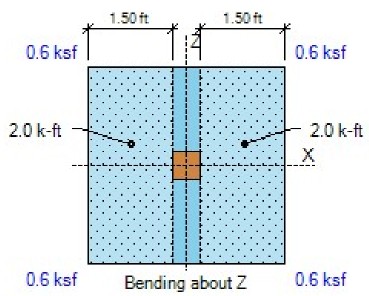
Z-Ldh = Max (8 db, 6, 0.02 * 40.0 * 1000 / (2500)½ * 1.0 * 0.7 * 0.0 * 0.50 * 0.73) = 6.0 in

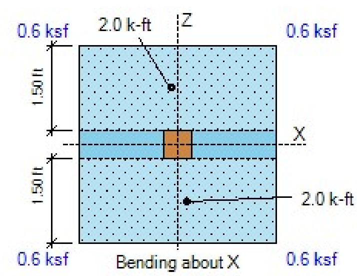
-Z Ld provided = *(Width - Col) / 2 + Offset - Cover =* 3.50 * 12 / 2 + 0.0 - 6.0 / 2 - 2.5 = 15.5 in > 12.0 in OK

+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 in^2

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 = $b1 * d^3 / 6 + b1^3 * d / 6 + b1^2 * b2 * d / 2$ ACI R8.4.4.2.3

Jcz = $10.5 * 4.5^3 / 6 + 10.5^3 * 4.5 / 6 + 10.5^2 * 10.5 * 4.5 / 2 = 3632$ in^4

Jcx = $b2 * d^3 / 6 + b2^3 * d / 6 + b2^2 * b1 * d / 2$ ACI R8.4.4.2.3

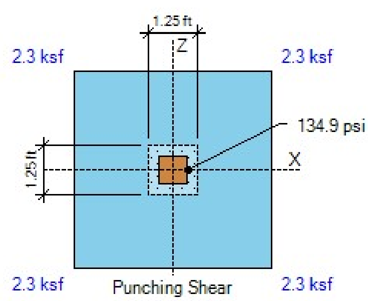
Jcx = $10.5 * 4.5^3 / 6 + 10.5^3 * 4.5 / 6 + 10.5^2 * 10.5 * 4.5 / 2 = 3632$ in^4

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

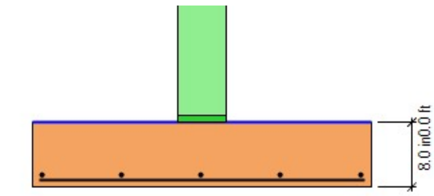
Stress due to Mz = *γvz * Z-OTM * X2z / Jcz =* 0.40 * 0.0 * 12 * 5.3 / 3632 * 1000 = 0.0 psi

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

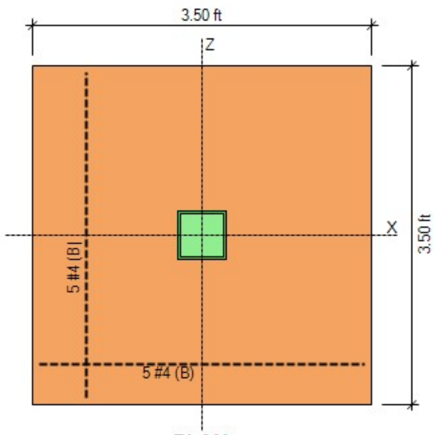


DESIGN CODES

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



ELEVATION



PLAN

Pieruccioni Engineering and Construction, L

Project:

Engineer:

Descrip: Typical exterior Footing 6,000# point load

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

10/21/2024

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 = $\dfrac{\textit{Resisting moment}}{\textit{Overturning moment}} = \dfrac{3.7}{0.0}$ = 37.47 > 1.50 OK

- Overturning about Z-Z

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

- Resisting about Z-Z

- Footing weight = *0.6 * W * L * Thick * Density =* 0.6 * 2.60 * 2.00 * 8.0 / 12 * 0.15 = 0.3 kip
  Arm = *L / 2 =* 2.00 / 2 = 1.00 ft   Moment = 0.3 * 1.00 = 0.3 k-ft
- Pedestal weight = *0.6 * W * L * H * Density =* 0.6 * 6.0 / 12 * 6.0 / 12 * 0.0 * 0.15 = 0.0 kip
  Arm = *L / 2 - Offset =* 2.00 / 2 - 0.0 / 12 = 1.00 ft   Moment = 0.0 * 1.00 = 0.0 k-ft
- Soil cover = *0.6 * W * L * SC * Density =* 0.6 * (2.60 * 2.00 - 6.0 / 12 * 6.0 / 12) * 0.0 * 110 = 0.0 kip
  Arm = *L / 2 =* 2.00 / 2 = 1.00 ft   Moment = 0.0 * 1.00 = 0.0 k-ft
- Buoyancy = *0.6 * W * L * γ * (SC + Thick - WT) =* 0.6 * 2.60 * 2.00 * 62 * (0.67) = -0.1 kip
  Arm = *L / 2 =* 2.00 / 2 = 1.00 ft   Moment = 0.1 * 1.00 = -0.1 k-ft
- Axial force P = 0.6 * 4.5 + 0.6 * 0.0 = 2.7 kip
  Arm = *L / 2 - Offset =* 2.00 / 2 - 0.0 / 12 = 1.00 ft   Moment = 2.7 * 1.00 = 2.7 k-ft
- Resisting moment Z-Z = 0.3 + 0.0 + 0.0 + 2.7 + -0.1 = 2.9 k-ft

- Overturning safety factor Z-Z = $\frac{\textit{Resisting moment}}{\textit{Overturning moment}} = \frac{2.9}{0.0}$ = 28.82 > 1.50 OK

SOIL BEARING PRESSURES (Comb: D+L)

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

Resisting moment X-X = 0.7 + 0.0 + 0.0 + -0.3 + 13.0 = 13.4 k-ft

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

Resisting moment Z-Z = 0.5 + 0.0 + 0.0 + -0.2 + 10.0 = 10.3 k-ft

Resisting force = *Footing + Pedestal + Soil - Buoyancy + P =* 0.5 + 0.0 + 0.0 - 0.2 + 10.0 = 10.3 kip

X-coordinate of resultant from maximum bearing corner:

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

Z-coordinate of resultant from maximum bearing corner:

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

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

Z-ecc = *Width / 2 - Zp =* 2.60 / 2 - 1.30 = 0.00 ft

Area = *Width * Length =* 2.60 * 2.00 = 5.2 ft^2

Sx = *Length * Width² / 6 =* 2.00 * 2.60^2 / 6 = 2.3 ft^3

Sz = *Width * Length² / 6 =* 2.60 * 2.00^2 / 6 = 1.7 ft^3

- Footing is in full bearing. Soil pressures are as follows:

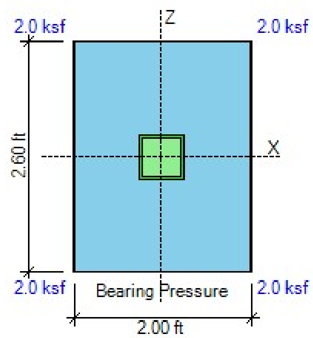
P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 10.3 * (1 / 5.2 + 0.00 / 2.3 + 0.00 / 1.7) = 1.98 ksf

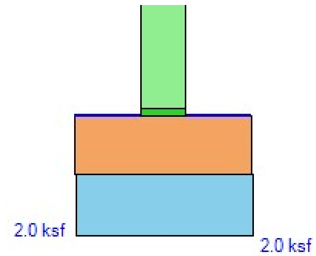
P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 10.3 * (1 / 5.2 - 0.00 / 2.3 + 0.00 / 1.7) = 1.98 ksf

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

SPREAD FOOTING DESIGN





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 = $\dfrac{\textit{X-Passive force + Friction}}{\textit{X-Horizontal load}} = \dfrac{1.00 * 0.3 + 1.00 * 1.0}{0.0}$ = 12.84 > 1.50 OK

- Sliding safety factor Z-Z = $\dfrac{\textit{Z-Passive force + Friction}}{\textit{Z-Horizontal load}} = \dfrac{1.00 * 0.2 + 1.00 * 1.0}{0.0}$ = 12.20 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\dfrac{\textit{Pedestal + Footing + Cover - Buoyancy}}{\textit{Uplift load}} = \dfrac{0.0 + 0.3 + 0.0 - 0.1}{0.0}$ = 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

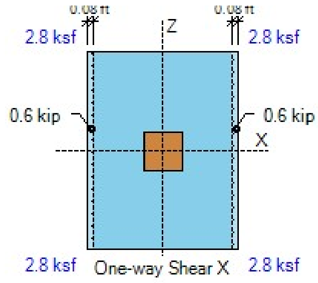
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

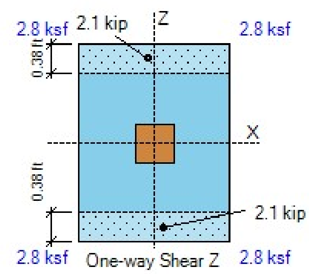
One-way shear Vux (- Side) = 0.6 kip < 10.0 kip OK

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 ϕM_{nx} = *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 ϕM_{nz} = *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

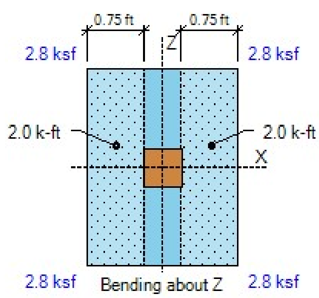
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

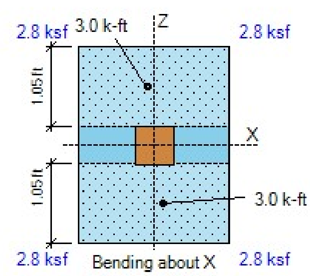
Bottom moment Mux (- Side) = 3.0 k-ft < 3.2 k-ft OK ratio = 0.94

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 L² / 6 =* 6.0 * 6.0² / 6 = 36.0 in³

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

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

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

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

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

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

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)] =* 0.65 * 0.85 * 2.5 * Min [2, √(576.0 / 36.0)] = 2.8 ksi

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

Footing bearing *ϕPn = ϕPnc + ϕPns =* 2.8 + 0.0 = 2.8 ksi > 0.4 psi OK

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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 = $1 - \dfrac{1}{1 + (2/3)\sqrt{b2 / b1}} = 1 - \dfrac{1}{1 + (2/3)\sqrt{22.6 / 19.0}} = 0.42$ ACI Eq. (8.4.4.2.2)

γvz factor = $1 - \dfrac{1}{1 + (2/3)\sqrt{b1 / b2}} = 1 - \dfrac{1}{1 + (2/3)\sqrt{19.0 / 22.6}} = 0.38$ 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

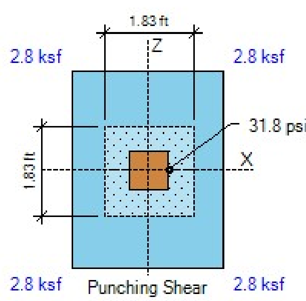
Jcz = 22.6 * 8.0³ / 12 + 22.6³ * 8.0 / 12 + 22.6 * 8.0 * (22.6 / 2 * 6.1)² + 19.0 * 8.0 * 6.1² = 19204 in⁴

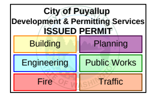
Stress due to P = *F / (bo * d) * 1000 =* 10.6 / (41.6 * 8.0) * 1000 = 31.8 psi

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

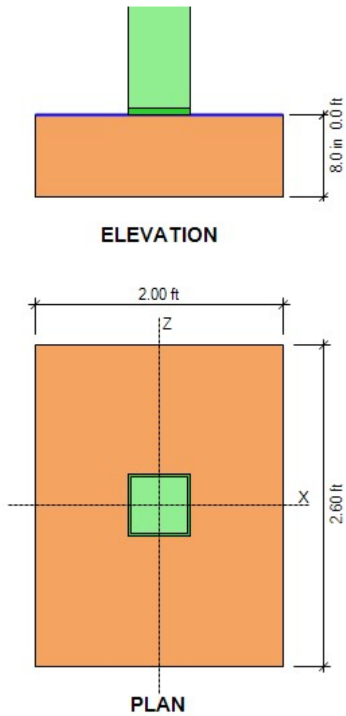




ASDIP Foundation 5.3.1.0 **SPREAD FOOTING DESIGN** *www.asdipsoft.com*

DESIGN CODES

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



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 = $\dfrac{\textit{Resisting moment}}{\textit{Overturning moment}} = \dfrac{2.5}{0.0}$ = 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 = $\frac{\text{Resisting moment}}{\text{Overturning moment}} = \frac{1.5}{0.0}$ = 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:

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

Z-coordinate of resultant from maximum bearing corner:

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

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 ft^2

Sx = *Length * Width² / 6 =* 1.50 * 2.60^2 / 6 = 1.7 ft^3

Sz = *Width * Length² / 6 =* 2.60 * 1.50^2 / 6 = 1.0 ft^3

- Footing is in full bearing. Soil pressures are as follows:

P1 = *P * (1/ A + Z-ecc / Sx + X-ecc / Sz) =* 7.7 * (1 / 3.9 + 0.00 / 1.7 + 0.00 / 1.0) = 1.98 ksf

P2 = *P * (1/ A - Z-ecc / Sx + X-ecc / Sz) =* 7.7 * (1 / 3.9 - 0.00 / 1.7 + 0.00 / 1.0) = 1.98 ksf

P3 = *P * (1/ A - Z-ecc / Sx - X-ecc / Sz) =* 7.7 * (1 / 3.9 - 0.00 / 1.7 - 0.00 / 1.0) = 1.98 ksf

P4 = *P * (1/ A + Z-ecc / Sx - X-ecc / Sz) =* 7.7 * (1 / 3.9 + 0.00 / 1.7 - 0.00 / 1.0) = 1.98 ksf

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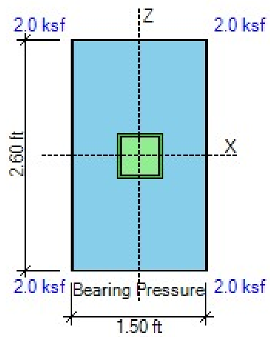
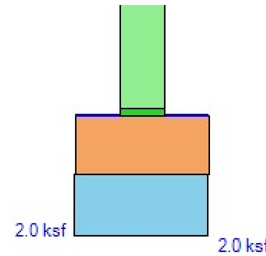




SLIDING CALCULATIONS (Comb: 0.6D+0.6W)

Internal friction angle = 28.0 deg

Passive coefficient *kp = 4.33* *(per Coulomb)*

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

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

Z-Passive force = *Pressure * Thick * Length =* 0.16 * 8.0 / 12 * 1.50 = 0.2 kip

Friction force = *Resisting force * Friction coeff. =* Max (0, 1.9 * 0.35) = 0.7 kip

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

- Sliding safety factor X-X = $\dfrac{\text{X-Passive force + Friction}}{\text{X-Horizontal load}} = \dfrac{1.00 * 0.3 + 1.00 * 0.7}{0.0}$ = 9.53 > 1.50 OK

- Sliding safety factor Z-Z = $\dfrac{\text{Z-Passive force + Friction}}{\text{Z-Horizontal load}} = \dfrac{1.00 * 0.2 + 1.00 * 0.7}{0.0}$ = 8.36 > 1.50 OK

UPLIFT CALCULATIONS (Comb: 0.6D+0.6W)

- Uplift safety factor = $\dfrac{\text{Pedestal + Footing + Cover - Buoyancy}}{\text{Uplift load}} = \dfrac{0.0 + 0.2 + 0.0 - 0.1}{0.0}$ = 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

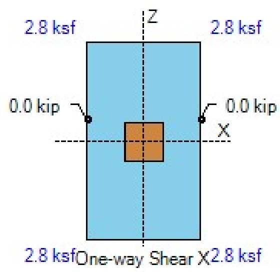
- Shear forces calculated as the volume of the bearing pressures under the effective areas:

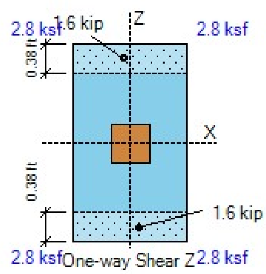
One-way shear Vux (- Side) = 0.0 kip < 10.0 kip OK

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

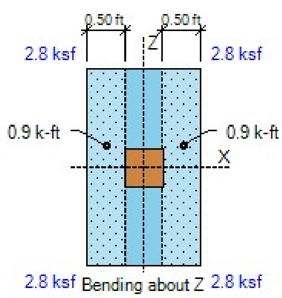
- Bottom moments calculated as the bearing minus the overburden pressures times the lever arm:

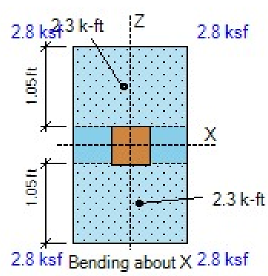
Bottom moment Mux (- Side) = 2.3 k-ft < 2.4 k-ft OK ratio = 0.96

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





SPREAD FOOTING DESIGN

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 =* 10.8 / 36.0 + 0.0 * 12 / 36.0 + 0.0 * 12 / 36.0 = 0.3 ksi

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

Min edge = Min (1.50 * 12 / 2 - 0.0 - 6.0 / 2, 2.60 * 12 / 2 - 0.0 - 6.0 / 2 = 6.0 in

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

A2 = Min [1.50 * 12 * 2.6 * 12, (6.0 + 2 * 6.0) * (6.0 + 2 * 6.0)] = 324.0 in²

Footing *ϕPnc = ϕ * 0.85 * f'c * Min [2, √(A2 / A1)] =* 0.65 * 0.85 * 2.5 * Min [2, √(324.0 / 36.0)] = 2.8 ksi

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

Footing bearing *ϕPn = ϕPnc + ϕPns =* 2.8 + 0.0 = 2.8 ksi > 0.3 psi OK

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

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

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

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

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

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

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

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

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

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

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

Use Plain Concrete Shear Strength

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

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

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

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

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

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

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

X2z = *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

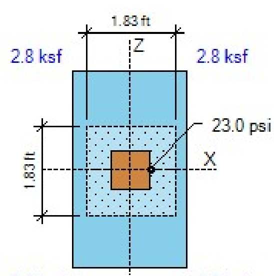
Jcz = 22.6 * 8.0³ / 12 + 22.6³ * 8.0 / 12 + 22.6 * 8.0 * (22.6 / 2 * 6.6)² + 16.0 * 8.0 * 6.6² = 18229 in⁴

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

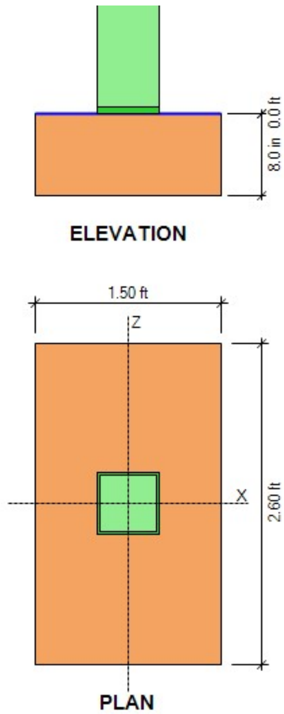


Punching Shear

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

DESIGN CODES

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



WIND V_{ASD} = 85MPH V_{ULT} = 110MPH EXP. B K_{zt} = 1.0 SLOPE = 0°-34°
h = 36' λ = 1.06

ZONE A = 12.9PSF × 1.06 = ~~13.7PSF~~ 16.0PSF MIN

ZONE B = 8.8PSF × 1.06 = 9.3PSF

ZONE C = 10.2PSF × 1.06 = ~~10.8PSF~~ 16.0PSF MIN

ZONE D = 7.0PSF × 1.06 = ~~7.4PSF~~ 8.0PSF MIN

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

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

W_{ROOF} =	(35PSF × 11,490 SF) = 402,150#	h = 9'	h_R = 29'
W_{LEVEL3} =	(40PSF × 10,344 SF) = 413,760#	h = 9'	h_3 = 20'
W_{LEVEL2} =	(40PSF × 10,656 SF) = 426,240#	h = 9'	h_2 = 10'
W_{TOTAL} =	1,242,150#		

V_S = 1,242,150# × 0.091 = 113,036#   24,199,950

$$F_{ROOF} = \left[\frac{(402{,}150\# \times 29')}{(402{,}150\# \times 29') + (413{,}760\# \times 20') + (426{,}240\# \times 10')}\right] \times 113{,}036\# = 54{,}474\#$$

$$F_{LEVEL3} = \left[\frac{(413{,}760\# \times 20')}{(402{,}150\# \times 29') + (413{,}760\# \times 20') + (426{,}240\# \times 10')}\right] \times 113{,}036\# = 38{,}653\#$$

$$F_{LEVEL2} = \left[\frac{(426{,}240\# \times 10')}{(402{,}150\# \times 29') + (413{,}760\# \times 20') + (426{,}240\# \times 10')}\right] \times 113{,}036\# = 19{,}909\#$$

GRIDS 1 & 13

$F_{3W} = (16.0\,PSF \times 302\,SF)$ = 4,832#

$F_{3E} = 54{,}474\# \times (1{,}544\,SF / 11{,}490\,SF)$ = 7,320#

$F_{2W} = 4{,}832\# + (16.0\,PSF \times 240\,SF)$ = 8,672#

$F_{2E} = 7{,}320\# + 38{,}653\# \times (1{,}370\,SF / 10{,}344\,SF)$ = 12,439#

$F_{1W} = 8{,}672\# + (16.0\,PSF \times 238\,SF)$ = 12,480#

$F_{1E} = 12{,}439\# + 19{,}909\# \times (1{,}370\,SF / 10{,}656\,SF)$ = 14,999#

GRIDS 4/5 & 8/9

$F_{3W} = (16.0\,PSF \times 542\,SF)$ = 8,672#

$F_{3E} = 54{,}474\# \times (2{,}813\,SF / 11{,}490\,SF)$ = 13,336#

$F_{2W} = 8{,}672\# + (16.0\,PSF \times 445\,SF)$ = 15,792#

$F_{2E} = 13{,}336\# + 38{,}653\# \times (2{,}476\,SF / 10{,}344\,SF)$ = 22,259#

$F_{1W} = 15{,}792\# + (16.0\,PSF\ 439\,SF)$ = 32,231#

$F_{1E} = 22{,}259\# + 19{,}909\# \times (2{,}633\# / 10{,}656\,SF)$ = 27,508#

GRID 7

$F_{3W} = (16.0\,PSF \times 528\,SF)$ = 8,448#

$F_{3E} = 54{,}474\# \times (2{,}776\,SF / 11{,}490\,SF)$ = 13,161#

$F_{2W} = 8{,}448\# + (16.0\,PSF \times 415\,SF)$ = 15,088#

$F_{2E} = 13{,}161\# + 38{,}653\# \times (2{,}650\,SF / 10{,}344\,SF)$ = 23,063#

$F_{1W} = 15{,}088\# + (16.0\,PSF \times 409\,SF)$ = 21,632#

$F_{1E} = 23{,}063\# + 19{,}909\# \times (2{,}650\,SF / 10{,}656\,SF)$ = 28,014#

GRIDS A-C

$F_{3W} = (16\text{ PSF} \times 181\text{ SF}) + (9.3\text{ PSF} \times 111\text{ SF}) + (8.0\text{ PSF} \times 43\text{ SF}) = 4{,}272\#$

$F_{3E} = 54{,}474\# \times (2{,}447\text{ SF} / 11{,}490\text{ SF}) = 11{,}601\#$

$F_{2W} = 4{,}272\# + (16.0\text{ PSF} \times 203\text{ SF}) = 7{,}520\#$

$F_{2E} = 11{,}601\# + 38{,}653\# \times (2{,}150\text{ SF} / 10{,}344\text{ SF}) = 19{,}635\#$

$F_{1W} = 7{,}520\# + (16.0\text{ PSF} \times 203\text{ SF}) = 10{,}768\#$

$F_{1E} = 19{,}635\# + 19{,}909\# \times (2{,}150\text{ SF} / 10{,}656\text{ SF}) = 23{,}652\#$

GRID F

$F_{3W} = (16.0\text{ PSF} \times 235\text{ SF}) + (8.0\text{ PSF} \times 4\text{ SF}) = 3{,}792\#$

$F_{3E} = 54{,}474\# \times (5{,}897\text{ SF} / 11{,}490\text{ SF}) = 27{,}958\#$

$F_{2W} = 3{,}792\# + (16.0\text{ PSF} \times 321\text{ SF}) = 8{,}928\#$

$F_{2E} = 27{,}958\# + 38{,}653\# \times (5{,}546\text{ SF} / 10{,}344\text{ SF}) = 48{,}682\#$

$F_{1W} = 8{,}928\# + (16.0\text{ PSF} \times 319\text{ SF}) = 14{,}032\#$

$F_{1E} = 48{,}682\# + 19{,}909\# \times (5{,}780\# / 10{,}656\text{ SF}) = 59{,}481\#$

GRIDS J-M

$F_{3W} = (16.0\text{ PSF} \times 180\text{ SF}) + (9.3\text{ PSF} \times 106\text{ SF}) = 3{,}866\#$

$F_{3E} = 54{,}474\# \times (3{,}146\text{ SF} / 11{,}490\text{ SF}) = 14{,}915\#$

$F_{2W} = 3{,}866\# + (16.0\text{ PSF} \times 175\text{ SF}) = 6{,}666\#$

$F_{2E} = 14{,}915\# + 38{,}653\# \times (2{,}648\text{ SF} / 10{,}344\text{ SF}) = 24{,}810\#$

$F_{1W} = 6{,}666\# + (16.0\text{ PSF} \times 175\text{ SF}) = 9{,}466\#$

$F_{1E} = 24{,}810\# + 19{,}909\# \times (2{,}726\text{ SF} / 10{,}656\text{ SF}) = 29{,}903\#$

GRID 1&13 (LEVEL 3) $F_E = 7{,}320^{\#}$ 6 SEGMENTS $L = 4'-7''$ $h = 9'$

$L = 4'-8''$

$V_E = 7{,}320^{\#}/30.33' = 241$ PLF $L = 4'-2''$

$L = 3'-8''$

USE (W2) $V_{E\,ALLOW} = 353\,PLF \times (1.25 - 0.125 \times 9'/2.75') = 296$ PLF $L = 0'-6''$

$L = 2'-9''$

HOLD DOWNS $L_T = 30'-4''$

7-7
3-4

$T_E = 241\,PLF \times 9' \times 1.25 - 1/2(25\,PSF \times 1' \times 1.38') - 1/2(12\,PSF \times 4.5' \times 1.38') = 2{,}660^{\#}$

$\boxed{\text{USE MSTC48 w/ 2 STUDS}}$ $T_{E\,ALLOW} = 3{,}425^{\#} \times 1.4/1.6 = 2{,}997^{\#}$

GRID 1&13 (LEVEL 2) $F_E = 12{,}439^{\#}$ 6 SEGMENTS $L_T = 30'-4''$ $h = 9'$

$V_E = 12{,}439^{\#}/30.33' = 410$ PLF

USE (W4) $V_{E\,ALLOW} = 595\,PLF \times (1.25 - 0.125 \times 9'/2.75') = 500$ PLF

HOLD DOWNS

$T_E = 410\,PLF \times 9' \times 1.25 + 2{,}660^{\#} - 1/2(30\,PSF \times 6' \times 1.38') - 1/2(12\,PSF \times 9' \times 1.38') = 7{,}075^{\#}$

$\boxed{\text{USE CMST12 w/ 2 STUDS}}$ $T_{E\,ALLOW} = 9{,}215^{\#} \times 1.4/1.6 = 8{,}063^{\#}$

GRID 1&13 (LEVEL 1) $F_E = 14{,}999^{\#}$ 6 SEGMENTS $L_T = 30'-4''$ $h = 9'$

$V_E = 14{,}999^{\#}/30.33' = 495$ PLF

USE (W4) $V_{E\,ALLOW} = 595\,PLF \times (1.25 - 0.125 \times 9'/2.75') = 500$ PLF

HOLD DOWNS

$T_E = 495\,PLF \times 9' \times 1.25 + 7{,}075^{\#} - 1/2(30\,PSF \times 6' \times 1.38') - 1/2(12\,PSF \times 9' \times 1.38') = 12{,}440^{\#}$

$\boxed{\text{USE HDU14-SDS2.5 w/ 6x6 DF \#2 POST}}$ $T_{E\,ALLOW} = 14{,}425^{\#} \times 1.4/1.6 = 12{,}639^{\#}$

GRID 4/5 & 8/9 (LEVEL 3), FE = 13,336# 2 SEGMENTS L = 29'-8" h = 9'
L = 29'-8"
LT = 59'-4"

VE = 13,336#/59.33' = 225 plf

USE W1 VE ALLOW = 242 plf

HOLD DOWNS

TE = 225 plf x 9' x 1.25 - 1/2 (25 psf x 2' x 12.83') - 1/2 (12 psf x 4.5' x 12.83') = 1,862#

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

GRID 4/5 & 8/9 (LEVEL 2) FE = 22,259# 2 SEGMENTS LT = 59'-4" h = 9'

VE = 22,259#/59.33' = 375 plf

USE W3 VE ALLOW = 456 plf

HOLD DOWNS

TE = 375 plf x 9' x 1.25 + 1,862# - 1/2 (30 psf x 5.7' x 12.83') - 1/2 (12 psf x 9' x 12.83') = 4,293#

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

GRID 4/5 & 8/9 (LEVEL 1) FE = 27,508# 2 SEGMENTS L = 59'-4" h = 9'

VE = 27,508#/59.33' = 464 plf

USE W4 VE ALLOW = 595 plf

HOLD DOWNS

TE = 464 plf x 9' x 1.25 + 4,293# - 1/2 (30 psf x 5.7' x 12.83') - 1/2 (12 psf x 9' x 12.83') = 7,719#

USE HDU14-SDS w/ 3 STUDS TE ALLOW = 9,260# x 1.4/1.6 = 8,103#

GRID 7 (LEVEL 3) FE = 13,161 # 2 SEGMENTS L = 28'-5" h = 9'
L = 27'-9"
LT = 56'-2"

VE = 13,161 #/56.16' = 234 PLF

USE W1 VE ALLOW = 242 PLF

HOLD DOWNS

TE = 234 PLF x 9' x 1.25 - 1/2(15 PSF x 1' x 13.88') - 1/2(8 PSF x 4.5' x 13.88') = 2,213 #

USE (2) HD04-SDS2.5 w/ 2 STUDS TE ALLOW = 3,395 # x 1.4/1.6 = 2,974 #

GRID 7 (LEVEL 2) FE = 23,063 # 2 SEGMENTS LT = 56'-2" h = 9'

VE = 23,063 #/56.16' = 411 PLF

USE W3 VE ALLOW = 456 PLF

HOLD DOWNS

TE = 411 PLF x 9' x 1.25 + 2,773 # - 1/2(30 PSF x 6.83' x 13.88') - 1/2(8 PSF x 9' x 13.88') = 5,411 #

USE (2) HDU8-SDS2.5 w/ 4 STUDS TE ALLOW = 6,580 # x 1.4/1.6 = 5,758 #

GRID 7 (LEVEL 1) FE = 28,014 # 2 SEGMENTS L = 56'-2" h = 9'

VE = 28,014 #/56.16' = 499 PLF

USE W4 VE ALLOW = 595 PLF

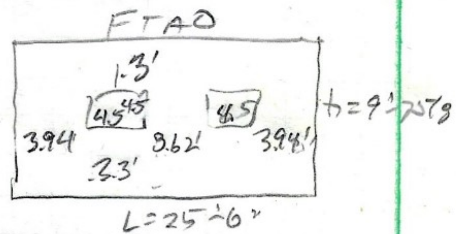
HOLD DOWNS

TE = 499 PLF x 9' x 1.25 + 5,278 # - 1/2(30 PSF x 6.83' x 13.88') - 1/2(8 PSF x 9' x 13.88') = 9,103 #

USE HDU14-SDS2.5 w/ 5 STUDS TE ALLOW = 12,375 # x 1.4/1.6 = 10,828 #

GRID A-C (25'-6" WALLS)

(LEVEL 3) FE = 11,601# x 25.5' / 101.66' = 2,910#



VE = 228 PLF

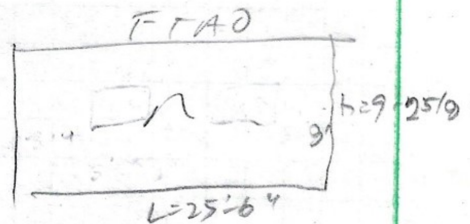
USE W1 VE ALLOW = 242 PLF

HOLD DOWNS

TE = 1,027# x 1.25 - 1/2(25 PSF x 13.5' x 12.75') - 1/2(12 PSF x 4.5' x 12.75') = -1,212#

SO NO HD'S REQ'D

(LEVEL 2) FE = 19,635# x 25.5' / 101.66' = 4,925#



VE = 386 PLF

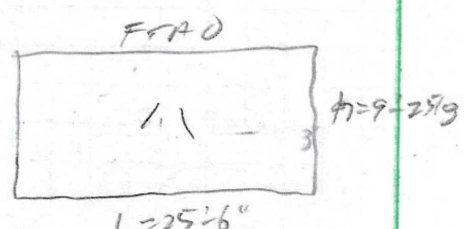
USE W3 VE ALLOW = 456 PLF

HOLD DOWNS

TE = 1,738# x 1.25 - 1,212# - 1/2(12 PSF x 9' x 12.75') = 272#

USE MST37 W/2 STUDS TE ALLOW = 2,140# x 1.41/1.6 = 1,873#

(LEVEL 1) FE = 23,652# x 25.5' / 101.66' = 5,933#



VE = 465 PLF

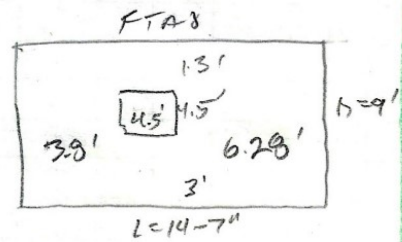
USE W4 VE ALLOW = 595 PLF

HOLD DOWNS

TE = 2,094# x 1.25 + 272# - 1/2(12 PSF x 9' x 12.75') = 2,201#

USE HDU4-SDS2.5 W/2 STUDS TE ALLOW = 3,285# x 1.41/1.6 = 2,874#

GRID A-C (14'-7" WALLS)



(LEVEL 3) FE = 11,601# x 14.58'/101.66' = 1,664#

VE = 228 PLF

USE W1 VE ALLOW = 242 PLF

HOLD DOWNS

TE = 1,027# x 1.25 − 1/2(25PSF x 1.64' x 7.29') − 1/2(12PSF x 4.5' x 7.29') = −408#
SO NO HD'S REQ'D

(LEVEL 2) FE = 19,635# x 14.58'/101.66' = 2,816#

VE = 386 PLF

USE W3 VE ALLOW = 456 PLF

HOLD DOWNS

TE = 1,738# x 1.25 − 408# − 1/2(12PSF x 9' x 7.29') = 1,371#

USE MST37 W/ 2 STUDS TE ALLOW = 2,120# x 1.4/1.6 = 1,855#

(LEVEL 1) FE = 23,652# x 14.58'/101.66' = 3,392#

VE = 465 PLF

USE W4 VE ALLOW = 595 PLF

HOLD DOWNS

TE = 2,094# x 1.25 + 1,371# − 1/2(12PSF x 9' x 7.29') = 3,595#

USE HDU5-SDS2.5 W/ 2 STUDS TE ALLOW = 4,340# x 1.4/1.6 = 3,798#

GRID (A-C) 21'-6" WALL

(LEVEL 3) FE = 11,601# x 21.5'/101.66' = 2,453#

VE = 304 PLF

USE W2 VE ALLOW = 353 PLF

HOLD DOWNS

TE = 1,030# x 1.25 - 1/2 (25PSF x 2.3' x 10.75') - 1/2 (17PSF x 21.5' x 10.75') = 688#

USE MST37 W/2 STUDS

(LEVEL 2) FE = 19,635# x 21.5'/101.66' = 4,153#

VE = 514 PLF

USE W4 VE ALLOW = 595 PLF

HOLD DOWNS

TE = 1,743# x 1.25 + 688# - 1/2 (17PSF x 9' x 10.75') = 2,286#

USE MST48 W/2 STUDS TE ALLOW = 3,475# x 1.4/1.6 = 2,992#

(LEVEL 1) FE = 23,652# x 21.5'/101.66' = 5,002#

VE = 619 PLF

USE W8 VE ALLOW = 770 PLF

HOLD DOWNS

TE = 2,100# x 1.25 + 2,286# - 1/2 (17PSF x 9' x 10.75') = 4,331#

USE HDU5-SDS2.5 W/2 DF#2 STUDS TE ALLOW = 5,645# x 1.4/1.6 = 4,934#

GRID F (LEVEL 3) FE = 27,958# 6 SEGMENTS

L=30'-4" h=9'
L=14'-3"
L=24'-8"
L=24'-9"
L=14'-6"
L=30'-4"
LT=139'-9"

VE = 27,958#/139.75' = 200 PLF

USE W1 VEallow = 242 PLF

HOLD DOWNS

L=30'-4" TE 200 PLF x 9' x 1.25 - ½(25 PSF x 14.75' x 15.16') - ½(8 PSF x 4.5 x 15.16') = -732#
L=24'-9" TE = 200 PLF x 9' x 1.25 - ½(25 PSF x 14.5 x 12.33) - ½(8 PSF x 4.5 x 12.33') = -1,332#
L=14'-3" TE 200 PLF x 9' x 1.25 - ½(25 PSF x 16.75' x 7.13') - ½(12 PSF x 4.5' x 7.13') = 564#

L=30'-4" NO HD'S REQ'D
L=24'-9" NO HD'S REQ'D
L=14'-3" MST37 W/ 2 STUDS

TEallow = 2,140# x 1.4/1.6 = 1,873#

GRID F (LEVEL 2) FE = 48,682# 4 SEGMENTS LT = 139'-9" h=9'

VE = 48,682#/139.75' = 348 PLF

USE W2 VEallow = 353 PLF

HOLD DOWNS

L=30'-4" TE = 348 PLF x 9' x 1.25 - ½(8 PSF x 9' x 15.16') - 732# = 2,637#
L=24'-9" TE = 348 PLF x 9' x 1.25 - ½(8 PSF x 9' x 12.33') - 1,332# = 2,139#
L=14'-3" TE = 348 PLF x 9' x 1.25 - ½(50 PSF x 3.38' x 7.13') - ½(12 PSF x 9' x 7.13') + 564# = 3,402#

L=30'-4" USE (2) HDU4-SDS2.5 W/ 2 STUDS TEallow = 3,285# x 1.4/1.6 = 2,874#
L=24'-9" USE (2) HDU4-SDS2.5 W/ 2 STUDS TEallow = 3,285# x 1.4/1.6 = 2,874#
L=14'-3" USE MST60 W/ 2 STUDS TEallow = 5,405# x 1.4/1.6 = 4,729#

GRID F (LEVEL 1) FE = 59,481# 6 SEGMENTS LT = 139'-9" h=9'

VE = 59,481#/139.75' = 426 PLF

USE W3 VEallow = 456 PLF

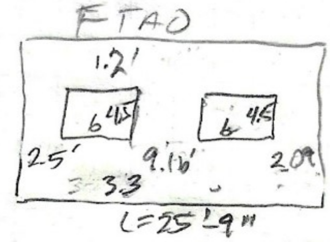
HOLD DOWNS

L=30'-4" TE = 426 PLF x 9' x 1.25 + 2,637# - ½(8 PSF x 9' x 15.16') = 6,884#
L=24'-9" TE = 426 PLF x 9' x 1.25 + 2,139# - ½(8 PSF x 9' x 12.33') = 6,488#
L=14'-3" TE = 426 PLF x 9' x 1.25 + 3,402# - ½(50 PSF x 3.38' x 7.13') - ½(12 PSF x 9' x 7.13') = 7,119#

USE HDU11-SDS2.5 W/ 4 STUDS TEallow = 8,030# x 1.4/1.6 = 7,026#
USE HDU11-SDS2.5 W/ 4 STUDS TEallow = 8,030# x 1.4/1.6 = 7,026#
USE HDU14-SDS2.5 W/ 3 STUDS TEallow = 9,260# x 1.4/1.6 = 8,103#

GRID J-M (25'9" WALLS) 6 FTAO WALLS 1 SEGMENT L = 131'-11" VE = 13,206#/124.83'

FTAO



(LEVEL 3) FE = 14,915# x 25.75'/131.92' = 2,911#

VE = 232 PLF

USE W1 VE ALLOW = 242 PLF

HOLD DOWNS

TE = 1,017# x 1.25 - 1/2(25PSF x 12' x 12.88') - 1/2(12PSF x 4.5' x 12.88') = -1,011#

∴ NO HD'S REQ'D

(LEVEL 2) FE = 24,810# x 25.75'/131.92' = 4,843#

VE = 385 PLF

USE W3 VE ALLOW = 456 PLF

HOLD DOWNS

TE = 1,693# x 1.25 - 1,011# - 1/2(12PSF x 9' x 12.88') = 217#

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

(LEVEL 1) FE = 29,903# x 25.75'/131.92' = 5,837#

VE = 464 PLF

USE W4 VE ALLOW = 595 PLF

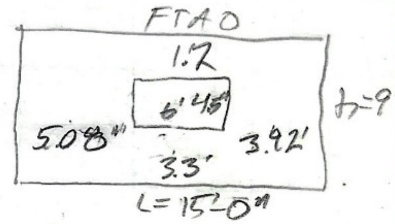
HOLD DOWNS

TE = 2,040# x 1.25 + 217# - 1/2(12PSF x 9' x 12.88') = 2,071#

USE HDU4-SDS2.5 W/ 2 STUDS TE ALLOW = 3,285# x 1.4/1.6 = 2,874#

GRID J-M (11'-7" WALLS)

(LEVEL 3) $F_E = 14{,}915^{\#} \times 15' / 131.92' = 1{,}696^{\#}$



$V_E = 226$ PLF

USE W1 $V_{E\,ALLOW} = 242$ PLF

HOLD DOWNS

$T_E = 1{,}018^{\#} \times 1.25 - \frac{1}{2}(25\,PSF \times 16' \times 7.5') - \frac{1}{2}(12\,PSF \times 4.5' \times 7.5') = -930^{\#}$

SO NO HD'S REQ'D

(LEVEL 2) $F_E = 24{,}810^{\#} \times 15' / 131.92' = 2{,}821^{\#}$

$V_E = 376$ PLF

USE W3 $V_{E\,ALLOW} = 456$ PLF

HOLDDOWNS

$T_E = 1{,}693^{\#} \times 1.25 - 430^{\#} - \frac{1}{2}(12\,PSF \times 9' \times 7.5') = 1{,}281^{\#}$

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

(LEVEL 1) $F_E = 29{,}903^{\#} \times 15' / 131.92' = 3{,}400^{\#}$

$V_E = 453$ PLF

USE W3 $V_{E\,ALLOW} = 456$ PLF

HOLD DOWNS

$T_E = 2{,}040^{\#} \times 1.25 + 1{,}281^{\#} - \frac{1}{2}(12\,PSF \times 9' \times 7.5') = 3{,}426^{\#}$

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

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

(LEVEL 3) FE= 14,915# x 21.42'/131.92' = 2,422#

VE= 333 plf

USE $\boxed{W7}$ VEallow=353 plf

HOLD DOWNS

TE=1,018# x 1.25 − 1/2(25 PSF x 19.75' x 10.7') − 1/2(12 PSF x 4.5' x 10.7') = −1,658#

∴ NO HD'S REQ'D

(LEVEL 2) FE= 24,810# x 21.42'/131.92' = 4,028#

VE= 554 plf

USE $\boxed{W4}$ VEallow=595 plf

HOLD DOWNS

TE= 1,692# x 1.25 − 1,659# − 1/2(12 PSF x 9' x 10.7') = −121# ∴

NO HD'S REQ'D

(LEVEL 1) FE= 29,903# x 21.42'/131.92' = 4,855#

VE= 665 plf

USE $\boxed{W9}$ VEallow= 770 plf

HOLD DOWNS

TE= 2,032# x 1.25 − 121# − 1/2(12 PSF x 9' x 10.7') = 1,841#

$\boxed{\text{USE HDU2-SDS2.5 w/2 STUDS}}$ TEallow= 3,285# x 1.4/1.6 = 2,938#

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

FE = 14,956# x 7.58'/131.92' = 857#

VE = 857#/7.59' = 113 plf

USE W1 VEallow = 242 plf

HOLD DOWNS

TE = 113 plf x 9' x 1.25 - 1/2(12 psf x 4.5' x 3.79') = 1,170#

$\boxed{\text{USE MST37 w/ 2 STUDS}}$ TEallow = 2,140# x 1.4/1.6 = 1,873#

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

FE = 24,310# x 7.59'/131.92' = 1,425#

VE = 1,425#/7.59' = 188 plf

USE W1 VEallow = 242 plf

HOLD DOWNS

TE = 188 plf x 9' x 1.25 + 1,170# - 1/2(12 psf x 9' x 3.79') = 3,081#

$\boxed{\text{USE MST60 w/ 2 STUDS}}$ TEallow = 5405# x 1.4/1.6 = 4,729#

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

FE = 29,903# x 7.59'/131.92' = 1,718#

VE = 1,718#/7.59' = 227 plf

USE W1 VEallow = 242 plf

HOLD DOWNS

TE = 227 plf x 9' x 1.25 + 3,081# - 1/2(12 psf x 9' x 3.79') = 5,426#

$\boxed{\text{USE HDU8-SDS2.5 w/ 3 STUDS}}$ TEallow = 6,580# x 1.4/1.6 = 5,758#

APA

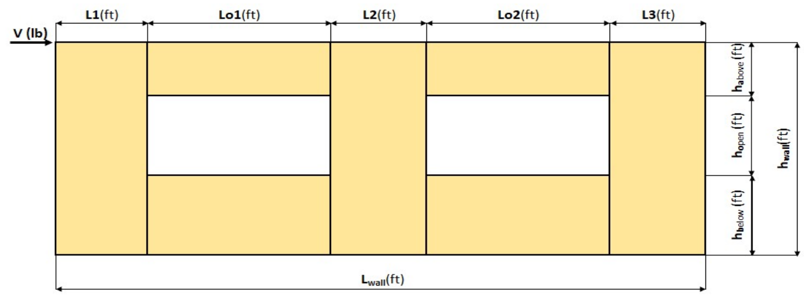
Force Transfer Around Openings Calculator

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:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (25'-6" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	2910 lbf		Opening 1		Opening 2		
L1	3.94 ft	h_a1	1.30 ft	h_a2	1.30 ft		
L2	8.62 ft	h_o1	4.50 ft	h_o2	4.50 ft		
L3	3.94 ft	h_b1	3.20 ft	h_b2	3.20 ft		
h_{wall}	9.00 ft	Lo1	4.50 ft	Lo2	4.50 ft		
L_{wall}	25.50 ft						

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
$P1=h_o/L1=$	1.14	N/A
$P2=h_o/L2=$	0.52	N/A
$P3=h_o/L3=$	1.14	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1027 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a1+h_b1) =$	228 plf
Second opening: $va2 = vb2 = H/(h_a2+h_b2) =$	228 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	1027 lbf
Second opening: O2 = va2 x (Lo2) =	1027 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	322 lbf
F2 = O1(L2)/(L1+L2) =	705 lbf
F3 = O2(L2)/(L2+L3) =	705 lbf
F4 = O2(L3)/(L2+L3) =	322 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.41 ft
T2 = (L2*Lo1)/(L1+L2) =	3.09 ft
T3 = (L2*Lo2)/(L2+L3) =	3.09 ft
T4 = (L3*Lo2)/(L2+L3) =	1.41 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	155 plf	
v2 = (V/L)(T2+L2+T3)/L2 =	196 plf	
v3 = (V/L)(T4+L3)/L3 =	155 plf	
Check v1*L1+v2*L2+v3*L3=V?	2910 lbf	**OK**

7. Resistance to corner forces

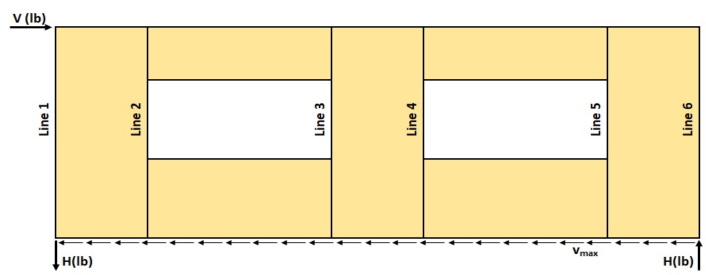
R1 = v1*L1 =	611 lbf
R2 = v2*L2 =	1689 lbf
R3 = v3*L3 =	611 lbf

8. Difference corner force + resistance

R1-F1 =	289 lbf
R2-F2-F3 =	279 lbf
R3-F4 =	289 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	73 plf
vc2 = (R2-F2-F3)/L2 =	32 plf
vc3 = (R3-F4)/L3 =	73 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H?$		330	698	1027 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?$	1027	330	698	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?$	146	882	1027	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?$	1027	882	146	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?$	1027	330	698	0
Line 6: $vc3(h_a2+h_b2)+ v3(h_o2) = H?$		330	698	1027 lbf

Design Summary*

Req. Sheathing Capacity	228 plf	**4-Term Deflection**	0.114 in.	**3-Term Deflection**	0.161 in.
Req. Strap Force	705 lbf	**4-Term Story Drift %**	0.004 %	**3-Term Story Drift %**	0.006 %
Req. HD Force	1027 lbf				
Req. Shear Wall Anchorage Force	114 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (25'-6" Section) - (Level 3 Seismic)		

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2910 (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

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	155	155	196	196	155	155	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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	98	98	78	78	(plf)
e_n:	0.0023	0.0023	0.0047	0.0047	0.0023	0.0023	(in.)
b:	3.94	3.94	8.62	8.62	3.94	3.94	(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.)

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	0.017	0.016	0.145	0.003	0.011	0.010	0.060
		Sum	0.188			Sum	0.084
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	0.014	0.020	0.035	0.002	0.014	0.020	0.035
		Sum	0.070			Sum	0.070
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
0.003	0.011	0.010	0.060	0.011	0.017	0.016	0.145
		Sum	0.084			Sum	0.188

Total Defl.	
0.114	(in.)
0.0042	%drift

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (25'-6" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2910 (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 3
G_t Override:				Nail Spacing:	6	6 (in.)
G_a Override:		C_d:	4.00	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	
$v_{unfactored}$:	155	155	196	196	155	155	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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:	3.94	3.94	8.62	8.62	3.94	3.94	(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
0.011	0.093	0.145	0.003	0.060	0.060
	Sum	0.248		Sum	0.123
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	0.076	0.035	0.002	0.076	0.035
	Sum	0.112		Sum	0.112
Pier 3 (left)			**Pier 3 (right)**		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.003	0.060	0.060	0.011	0.093	0.145
	Sum	0.123		Sum	0.248

Total Defl.	
0.161	(in.)
0.0060	%drift

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

APA

Force Transfer Around Openings Calculator

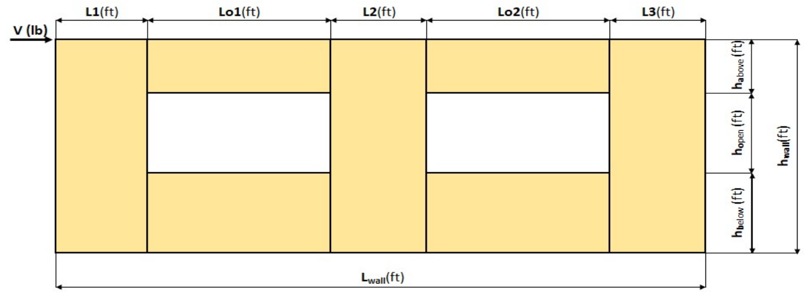
TWO OPENINGS

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.

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

Project Information

Code:	IBC 2018	**Date:**	10/22/20224
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (25'-6" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

			Opening 1		Opening 2	Adj. Factor Method =	2bs/h
V	4925 lbf					Wall Pier Aspect Ratio	Adj. Factor
L1	3.94 ft	h_a1	1.30 ft	h_a2	1.30 ft		
L2	8.62 ft	h_o1	4.50 ft	h_o2	4.50 ft	$P1=h_o/L1=$ 1.14	N/A
L3	3.94 ft	h_b1	3.20 ft	h_b2	3.20 ft	$P2=h_o/L2=$ 0.52	N/A
h_{wall}	9.00 ft	Lo1	4.50 ft	Lo2	4.50 ft	$P3=h_o/L3=$ 1.14	N/A
L_{wall}	25.50 ft						

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1738 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a1+h_b1) =$	386 plf
Second opening: $va2 = vb2 = H/(h_a2+h_b2) =$	386 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	1738 lbf
Second opening: O2 = va2 x (Lo2) =	1738 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	545 lbf
F2 = O1(L2)/(L1+L2) =	1193 lbf
F3 = O2(L2)/(L2+L3) =	1193 lbf
F4 = O2(L3)/(L2+L3) =	545 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.41 ft
T2 = (L2*Lo1)/(L1+L2) =	3.09 ft
T3 = (L2*Lo2)/(L2+L3) =	3.09 ft
T4 = (L3*Lo2)/(L2+L3) =	1.41 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	262 plf
v2 = (V/L)(T2+L2+T3)/L2 =	332 plf
v3 = (V/L)(T4+L3)/L3 =	262 plf
Check v1*L1+v2*L2+v3*L3=V?	4925 lbf **OK**

7. Resistance to corner forces

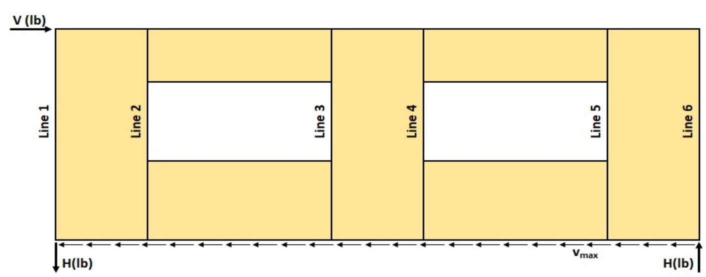
R1 = v1*L1 =	1034 lbf
R2 = v2*L2 =	2858 lbf
R3 = v3*L3 =	1034 lbf

8. Difference corner force + resistance

R1-F1 =	488 lbf
R2-F2-F3 =	472 lbf
R3-F4 =	488 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	124 plf
vc2 = (R2-F2-F3)/L2 =	55 plf
vc3 = (R3-F4)/L3 =	124 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H?$		558	1181	1738 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?$	1738	558	1181	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?$	246	1492	1738	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?$	1738	1492	246	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?$	1738	558	1181	0
Line 6: $vc3(h_a2+h_b2)+ v3(h_o2) = H?$		558	1181	1738 lbf

Design Summary*

Req. Sheathing Capacity	386 plf	**4-Term Deflection**	0.176 in.	**3-Term Deflection**	0.213 in.
Req. Strap Force	1193 lbf	**4-Term Story Drift %**	0.007 %	**3-Term Story Drift %**	0.008 %
Req. HD Force	1738 lbf				
Req. Shear Wall Anchorage Force	193 plf				

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

Project Information

Code:	IBC 2018
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building D
Wall Line:	Grid A-C (25'-6" Section) - (Level 2 Seismic)

Date: 10/22/20224

City of Puyallup
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Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4925 (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

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	262	262	332	332	262	262	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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:	66	66	83	83	66	66	(plf)
e_n:	0.0014	0.0014	0.0028	0.0028	0.0014	0.0014	(in.)
b:	3.94	3.94	8.62	8.62	3.94	3.94	(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.)

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	0.028	0.009	0.245	0.005	0.018	0.006	0.102
		Sum	0.301			Sum	0.131
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	0.023	0.012	0.059	0.003	0.023	0.012	0.059
		Sum	0.097			Sum	0.097
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	0.018	0.006	0.102	0.018	0.028	0.009	0.245
		Sum	0.131			Sum	0.301

Total Defl.	
0.176	(in.)
0.0065	%drift

Project Information

Code:	IBC 2018	**Date:**	10/22/20224
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (25'-6" Section) - (Level 2 Seismic)		

City of Puyallup
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Building	Planning
Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4925 (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 3
G_t Override:				Nail Spacing:	3	3 (in.)
G_a Override:		C_d:	4.00	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	
$v_{unfactored}$:	262	262	332	332	262	262	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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:	3.94	3.94	8.62	8.62	3.94	3.94	(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	0.245	0.005	0.054	0.102
	Sum	0.347		Sum	0.161
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	0.069	0.059	0.003	0.069	0.059
	Sum	0.130		Sum	0.130
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	0.102	0.018	0.084	0.245
	Sum	0.161		Sum	0.347

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

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:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (25'-6" Section) - (Level 1 Seismic)		

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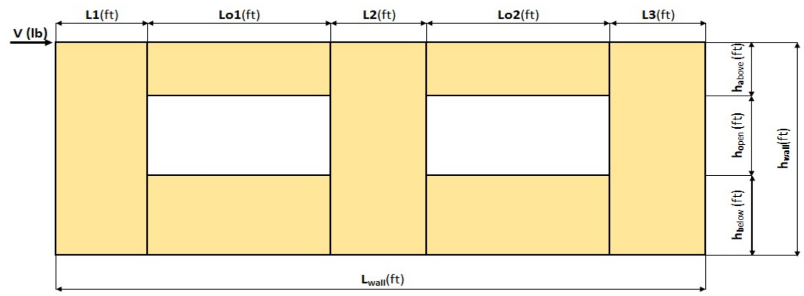


Shear Wall Calculation Variables

V	5933 lbf	Opening 1		Opening 2			
L1	3.94 ft	h_a1	1.30 ft	h_a2	1.30 ft		
L2	8.62 ft	h_o1	4.50 ft	h_o2	4.50 ft		
L3	3.94 ft	h_b1	3.20 ft	h_b2	3.20 ft		
h_{wall}	9.00 ft	Lo1	4.50 ft	Lo2	4.50 ft		
L_{wall}	25.50 ft						

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
$P1=h_o/L1=$	1.14	N/A
$P2=h_o/L2=$	0.52	N/A
$P3=h_o/L3=$	1.14	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2094 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a1+h_b1) =$	465 plf
Second opening: $va2 = vb2 = H/(h_a2+h_b2) =$	465 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	2094 lbf
Second opening: O2 = va2 x (Lo2) =	2094 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	657 lbf
F2 = O1(L2)/(L1+L2) =	1437 lbf
F3 = O2(L2)/(L2+L3) =	1437 lbf
F4 = O2(L3)/(L2+L3) =	657 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.41 ft
T2 = (L2*Lo1)/(L1+L2) =	3.09 ft
T3 = (L2*Lo2)/(L2+L3) =	3.09 ft
T4 = (L3*Lo2)/(L2+L3) =	1.41 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	316 plf	
v2 = (V/L)(T2+L2+T3)/L2 =	399 plf	
v3 = (V/L)(T4+L3)/L3 =	316 plf	
Check v1*L1+v2*L2+v3*L3=V?	5933 lbf	**OK**

7. Resistance to corner forces

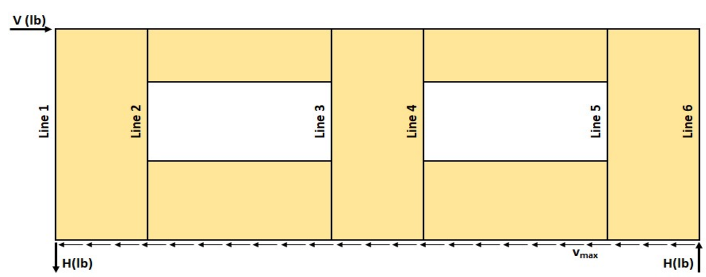
R1 = v1*L1 =	1245 lbf
R2 = v2*L2 =	3443 lbf
R3 = v3*L3 =	1245 lbf

8. Difference corner force + resistance

R1-F1 =	588 lbf
R2-F2-F3 =	568 lbf
R3-F4 =	588 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	149 plf
vc2 = (R2-F2-F3)/L2 =	66 plf
vc3 = (R3-F4)/L3 =	149 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H$?		672	1422	2094 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0$?	2094	672	1422	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0$?	297	1797	2094	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0$?	2094	1797	297	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0$?	2094	672	1422	0
Line 6: $vc3(h_a2+h_b2)+ v3(h_o2) = H$?		672	1422	2094 lbf

Design Summary*

Req. Sheathing Capacity	465 plf	**4-Term Deflection**	0.206 in.	**3-Term Deflection**	0.229 in.
Req. Strap Force	1437 lbf	**4-Term Story Drift %**	0.008 %	**3-Term Story Drift %**	0.008 %
Req. HD Force	2094 lbf				
Req. Shear Wall Anchorage Force	233 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (25'-6" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5933 (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	
$v_{unfactored}$:	316	316	399	399	316	316	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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	67	67	53	53	(plf)
e_n:	0.0007	0.0007	0.0015	0.0015	0.0007	0.0007	(in.)
b:	3.94	3.94	8.62	8.62	3.94	3.94	(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
0.022	0.034	0.005	0.295	0.006	0.022	0.003	0.123
		Sum	0.356			Sum	0.153
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	0.028	0.006	0.071	0.003	0.028	0.006	0.071
		Sum	0.108			Sum	0.108
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	0.022	0.003	0.123	0.022	0.034	0.005	0.295
		Sum	0.153			Sum	0.356

Total Defl.	
0.206	(in.)
0.0076	%drift

Project Information

Code:	IBC 2018	**Date:** 10/22/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building D	
Wall Line:	Grid A-C (25'-6" Section) - (Level 1 Seismic)	

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Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5933 (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 3	
G_t Override:				Nail Spacing:	2	2	(in.)
G_a Override:		C_d:	4.00	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	
$v_{unfactored}$:	316	316	399	399	316	316	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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:	3.94	3.94	8.62	8.62	3.94	3.94	(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
0.022	0.068	0.295	0.006	0.044	0.123
	Sum	0.385		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
0.003	0.055	0.071	0.003	0.055	0.071
	Sum	0.129		Sum	0.129
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	0.044	0.123	0.022	0.068	0.295
	Sum	0.172		Sum	0.385

Total Defl.	
0.229	(in.)
0.0085	%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	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (14'-7" Section) - (Level 3 Seismic)		

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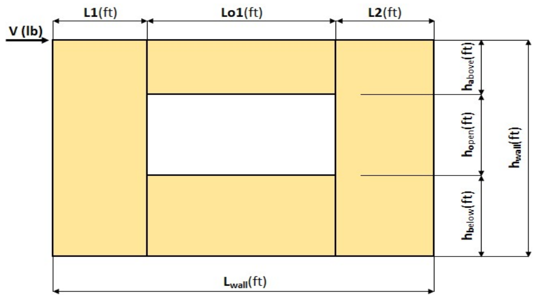


Shear Wall Calculation Variables

V	1664 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	3.80 ft	h_a	1.30 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	6.28 ft	h_o	4.50 ft	$P1=h_o/L1=$	1.18	N/A
h_{wall}	9.00 ft	h_b	3.20 ft	$P2=h_o/L2=$	0.72	N/A
L_{wall}	14.58 ft	Lo1	4.50 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1027 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a+h_b)$ = 228 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1027 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 387 lbf
F2 = O1(L2)/(L1+L2) = 640 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.70 ft
T2 = (L2*Lo1)/(L1+L2) = 2.80 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 165 plf
v2 = (V/L)(T2+L2)/L2 = 165 plf
Check v1*L1+v2*L2=V? 1664 lbf **OK**

7. Resistance to corner forces

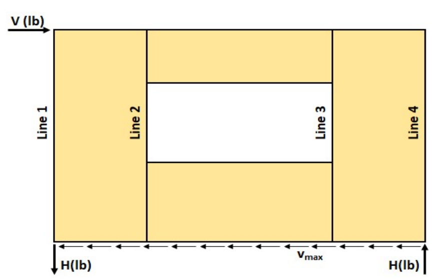
R1 = v1*L1 = 627 lbf
R2 = v2*L2 = 1037 lbf

8. Difference corner force + resistance

R1-F1 = 240 lbf
R2-F2 = 397 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 63 plf
vc2 = (R2-F2)/L2 = 63 plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		284	743	1027 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1027	284	743	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1027	284	743	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		284	743	1027 lbf

Design Summary*

Req. Sheathing Capacity	228 plf	**4-Term Deflection**	0.079 in.	**3-Term Deflection**	0.131 in.
Req. Strap Force	640 lbf	**4-Term Story Drift %**	0.003 %	**3-Term Story Drift %**	0.005 %
Req. HD Force (H)	1027 lbf				
Req. Shear Wall Anchorage Force (v_{max})	114 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (14'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1664 (lbf)

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

G_t Override:
G_a Override:

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

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	165	165	165	165	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	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:	83	83	83	83	(plf)
e_n:	0.0028	0.0028	0.0028	0.0028	(in.)
b:	3.80	3.80	6.28	6.28	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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	0.018	0.019	0.076	0.003	0.011	0.012	0.032
		Sum	0.124			Sum	0.058
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	0.011	0.012	0.019	0.007	0.018	0.019	0.046
		Sum	0.045			Sum	0.090

Total Defl.	
0.079	(in.)
0.0029	%drift

Project Information

Code:	2018 IBC	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (14'-7" Section) - (Level 3 Seismic)		

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Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1664 (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:	6	6	(in.)
G_a Override:		C_d:	4.00	HD Capacity:	5093	5093	(lbf)
				HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	165	165	165	165	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	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:	3.80	3.80	6.28	6.28	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.012	0.099	0.076	0.003	0.064	0.032
	Sum	0.187		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	0.064	0.019	0.007	0.099	0.046
	Sum	0.085		Sum	0.152

Total Defl.	
0.131	(in.)
0.0048	%drift

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

Force Transfer Around Openings Calculator

ONE OPENING

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

Project Information

Code:	2018 IBC
Designer:	Chon Pieruccioni, PE
Client:	
Project:	East Town Crossing - Building D
Wall Line:	Grid A-C (14'-7" Section) - (Level 2 Seismic)

Date: 10/22/2024

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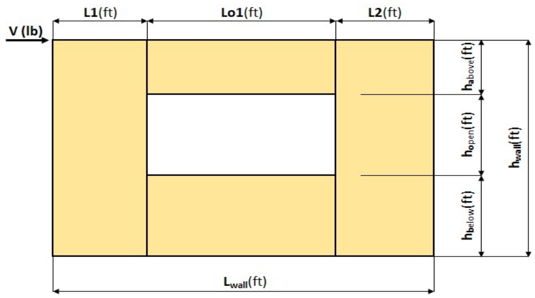


Shear Wall Calculation Variables

					Adj. Factor Method =	2bs/h
V	2816 lbf	Opening 1			Wall Pier Aspect Ratio	Adj. Factor
L1	3.80 ft	h_a	1.30 ft		$P1=h_o/L1=$ 1.18	N/A
L2	6.28 ft	h_o	4.50 ft		$P2=h_o/L2=$ 0.72	N/A
h_{wall}	9.00 ft	h_b	3.20 ft			
L_{wall}	14.58 ft	Lo1	4.50 ft			

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1738 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a+h_b) =$ 386 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1738 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 655 lbf
F2 = O1(L2)/(L1+L2) = 1083 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.70 ft
T2 = (L2*Lo1)/(L1+L2) = 2.80 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 279 plf
v2 = (V/L)(T2+L2)/L2 = 279 plf
Check v1*L1+v2*L2=V? 2816 lbf **OK**

7. Resistance to corner forces

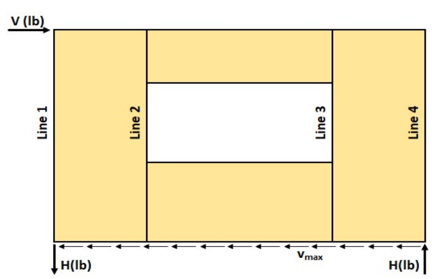
R1 = v1*L1 = 1062 lbf
R2 = v2*L2 = 1754 lbf

8. Difference corner force + resistance

R1-F1 = 406 lbf
R2-F2 = 671 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 107 plf
vc2 = (R2-F2)/L2 = 107 plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H$?		481	1257	1738 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0$?	1738	481	1257	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0$?	1738	481	1257	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H$?		481	1257	1738 lbf

Design Summary*

Req. Sheathing Capacity	386 plf	**4-Term Deflection**	0.117 in.	**3-Term Deflection**	0.157 in.
Req. Strap Force	1083 lbf	**4-Term Story Drift %**	0.004 %	**3-Term Story Drift %**	0.006 %
Req. HD Force (H)	1738 lbf				
Req. Shear Wall Anchorage Force (v_{max})	193 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (14'-7" Section) - (Level 2 Seismic)		

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Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2816 (lbf)

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

G_t Override:
G_a Override:

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

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	3	3	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	279	279	279	279	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	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:	70	70	70	70	(plf)
e_n:	0.0017	0.0017	0.0017	0.0017	(in.)
b:	3.80	3.80	6.28	6.28	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.020	0.030	0.011	0.129	0.005	0.019	0.007	0.053
		Sum	0.190			Sum	0.085
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	0.019	0.007	0.032	0.012	0.030	0.011	0.078
		Sum	0.062			Sum	0.131

Total Defl.	
0.117	(in.)
0.0043	%drift

Project Information

Code:	2018 IBC	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (14'-7" Section) - (Level 2 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2816 (lbf)

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

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

Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:

C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	3	3	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	279	279	279	279	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	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:	3.80	3.80	6.28	6.28	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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	0.090	0.129	0.005	0.058	0.053
	Sum	0.238		Sum	0.117
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	0.032	0.012	0.090	0.078
	Sum	0.093		Sum	0.180

Total Defl.	
0.157	(in.)
0.0058	%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	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (14'-7" Section) - (Level 1 Seismic)		

City of Puyallup
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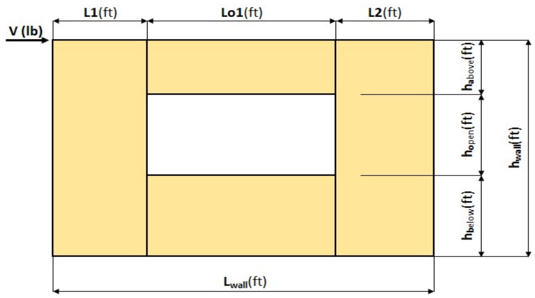


Shear Wall Calculation Variables

V	3392 lbf	Opening 1		Adj. Factor Method =	2bs/h	
L1	3.80 ft	h_a	1.30 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	6.28 ft	h_o	4.50 ft	P1=h_o/L1=	1.18	N/A
h_{wall}	9.00 ft	h_b	3.20 ft	P2=h_o/L2=	0.72	N/A
L_{wall}	14.58 ft	Lo1	4.50 ft			

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2094 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 465 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2094 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 789 lbf

F2 = O1(L2)/(L1+L2) = 1304 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.70 ft

T2 = (L2*Lo1)/(L1+L2) = 2.80 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 337 plf

v2 = (V/L)(T2+L2)/L2 = 337 plf

Check v1*L1+v2*L2=V? 3392 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1279 lbf

R2 = v2*L2 = 2113 lbf

8. Difference corner force + resistance

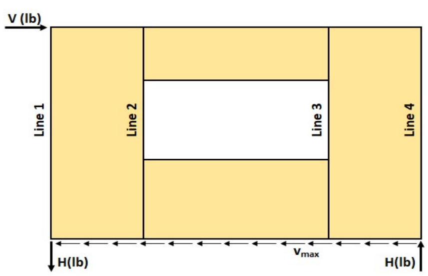
R1-F1 = 489 lbf

R2-F2 = 809 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 129 plf

vc2 = (R2-F2)/L2 = 129 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		580	1514	2094 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2094	580	1514	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2094	580	1514	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		580	1514	2094 lbf

Design Summary*

Req. Sheathing Capacity	465 plf	**4-Term Deflection**	0.135 in.	**3-Term Deflection**	0.160 in.
Req. Strap Force	1304 lbf	**4-Term Story Drift %**	0.005 %	**3-Term Story Drift %**	0.006 %
Req. HD Force (H)	2094 lbf				
Req. Shear Wall Anchorage Force (v_{max})	233 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (14'-7" Section) - (Level 1 Seismic)		

City of Puyallup
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Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3392 (lbf)

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

G_t Override:
G_a Override:

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

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

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

Four-Term Equation Deflection Check

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	337	337	337	337	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	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:	0.0009	0.0009	0.0009	0.0009	(in.)
b:	3.80	3.80	6.28	6.28	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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	0.036	0.006	0.155	0.006	0.023	0.004	0.064
		Sum	0.221			Sum	0.098
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	0.023	0.004	0.039	0.015	0.036	0.006	0.094
		Sum	0.070			Sum	0.150

Total Defl.	
0.135	(in.)
0.0050	%drift

Project Information

Code:	2018 IBC	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (14'-7" Section) - (Level 1 Seismic)		

City of Puyallup Development & Permitting Services ISSUED PERMIT

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Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3392 (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:	5093	5093	(lbf)
			HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

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

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	337	337	337	337	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	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:	3.80	3.80	6.28	6.28	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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	0.072	0.155	0.006	0.046	0.064
	Sum	0.251		Sum	0.117
Pier 2 (left)			**Pier 2 (right)**		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.004	0.046	0.039	0.015	0.072	0.094
	Sum	0.089		Sum	0.180

Total Defl.	
0.160	(in.)
0.0059	%drift

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

Force Transfer Around Openings Calculator
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 D
Wall Line:	Grid A-C (21'-6" Section) - (Level 3 Seismic)

Date: 10/22/2024

City of Puyallup
Development & Permitting Services
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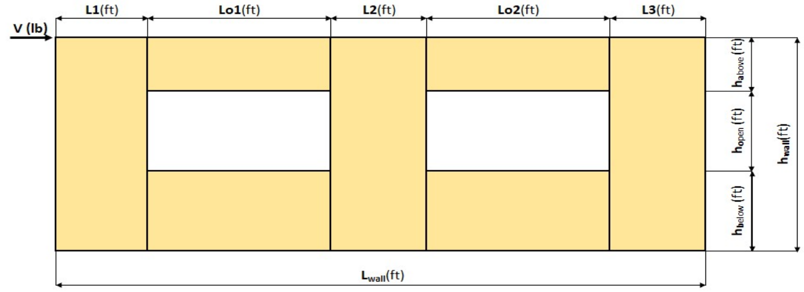
Fire | Traffic



Shear Wall Calculation Variables

V	2453 lbf		Opening 1		Opening 2	Adj. Factor Method =		2bs/h
L1	2.18 ft	h_a1	1.30 ft	h_a2	1.30 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	5.08 ft	h_o1	4.50 ft	h_o2	4.50 ft	$P1=h_o/L1=$	2.06	0.969
L3	2.18 ft	h_b1	3.20 ft	h_b2	3.20 ft	$P2=h_o/L2=$	0.89	N/A
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft	$P3=h_o/L3=$	2.06	0.969
L_{wall}	21.44 ft							

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1030 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a1+h_b1) =$	229 plf
Second opening: $va2 = vb2 = H/(h_a2+h_b2) =$	229 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	1373 lbf
Second opening: O2 = va2 x (Lo2) =	1373 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	412 lbf
F2 = O1(L2)/(L1+L2) =	961 lbf
F3 = O2(L2)/(L2+L3) =	961 lbf
F4 = O2(L3)/(L2+L3) =	412 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.80 ft
T2 = (L2*Lo1)/(L1+L2) =	4.20 ft
T3 = (L2*Lo2)/(L2+L3) =	4.20 ft
T4 = (L3*Lo2)/(L2+L3) =	1.80 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	209 plf	
v2 = (V/L)(T2+L2+T3)/L2 =	304 plf	
v3 = (V/L)(T4+L3)/L3 =	209 plf	
Check v1*L1+v2*L2+v3*L3=V?	2453 lbf	**OK**

7. Resistance to corner forces

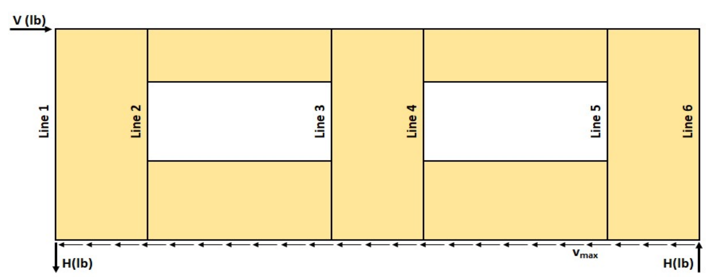
R1 = v1*L1 =	456 lbf
R2 = v2*L2 =	1542 lbf
R3 = v3*L3 =	456 lbf

8. Difference corner force + resistance

R1-F1 =	43 lbf
R2-F2-F3 =	-379 lbf
R3-F4 =	43 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	20 plf
vc2 = (R2-F2-F3)/L2 =	-75 plf
vc3 = (R3-F4)/L3 =	20 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H?$		89	940	1030 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?$	1030	89	940	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?$	-336	1366	1030	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?$	1030	1366	-336	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?$	1030	89	940	0
Line 6: $vc3(h_a2+h_b2)+ v3(h_o2) = H?$		89	940	1030 lbf

Design Summary*

Req. Sheathing Capacity	304 plf	**4-Term Deflection**	0.242 in.	**3-Term Deflection**	0.283 in.
Req. Strap Force	961 lbf	**4-Term Story Drift %**	0.009 %	**3-Term Story Drift %**	0.010 %
Req. HD Force	1030 lbf				
Req. Shear Wall Anchorage Force	114 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (21'-6" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2453 (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

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	209	209	304	304	209	209	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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	70	70	(plf)
e_n:	0.0017	0.0017	0.0051	0.0051	0.0017	0.0017	(in.)
b:	2.18	2.18	5.08	5.08	2.18	2.18	(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.)

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.026	0.023	0.011	0.353	0.007	0.015	0.007	0.146
		Sum	0.412			Sum	0.175
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	0.021	0.022	0.091	0.004	0.021	0.022	0.091
		Sum	0.139			Sum	0.139
Pier 3 (left)				**Pier 3 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.007	0.015	0.007	0.146	0.026	0.023	0.011	0.353
		Sum	0.175			Sum	0.412

Total Defl.	
0.242	(in.)
0.0090	%drift

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (21'-6" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2453 (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 3	
G_t Override:				Nail Spacing:	4	4	(in.)
G_a Override:		C_d:	4.00	HD Capacity:	1938	1938	(lbf)
				HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	209	209	304	304	209	209	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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:	2.18	2.18	5.08	5.08	2.18	2.18	(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.)

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.026	0.085	0.353	0.007	0.055	0.146
	Sum	0.464		Sum	0.208
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	0.080	0.091	0.004	0.080	0.091
	Sum	0.176		Sum	0.176
Pier 3 (left)			**Pier 3 (right)**		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.007	0.055	0.146	0.026	0.085	0.353
	Sum	0.208		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.

APA

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:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (21'-6" Section) - (Level 2 Seismic)		

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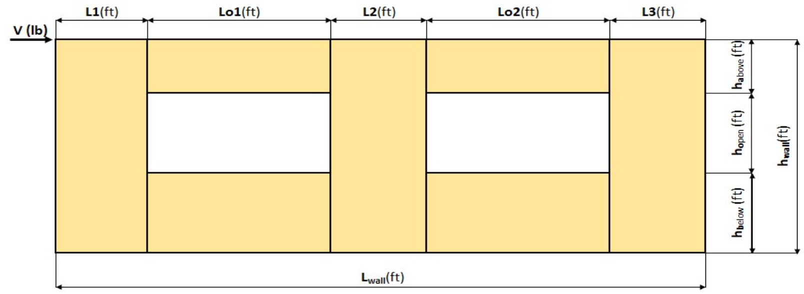
Fire	Traffic



Shear Wall Calculation Variables

V	4153 lbf	Opening 1		Opening 2		Adj. Factor Method =	2bs/h
L1	2.18 ft	h_a1	1.30 ft	h_a2	1.30 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	5.08 ft	h_o1	4.50 ft	h_o2	4.50 ft	$P1=h_o/L1=$ 2.06	0.969
L3	2.18 ft	h_b1	3.20 ft	h_b2	3.20 ft	$P2=h_o/L2=$ 0.89	N/A
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft	$P3=h_o/L3=$ 2.06	0.969
L_{wall}	21.44 ft						

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1743 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a1+h_b1)$ =	387 plf
Second opening: $va2 = vb2 = H/(h_a2+h_b2)$ =	387 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	2324 lbf
Second opening: O2 = va2 x (Lo2) =	2324 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	698 lbf
F2 = O1(L2)/(L1+L2) =	1626 lbf
F3 = O2(L2)/(L2+L3) =	1626 lbf
F4 = O2(L3)/(L2+L3) =	698 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.80 ft
T2 = (L2*Lo1)/(L1+L2) =	4.20 ft
T3 = (L2*Lo2)/(L2+L3) =	4.20 ft
T4 = (L3*Lo2)/(L2+L3) =	1.80 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	354 plf
v2 = (V/L)(T2+L2+T3)/L2 =	514 plf
v3 = (V/L)(T4+L3)/L3 =	354 plf
Check v1*L1+v2*L2+v3*L3=V?	4153 lbf **OK**

7. Resistance to corner forces

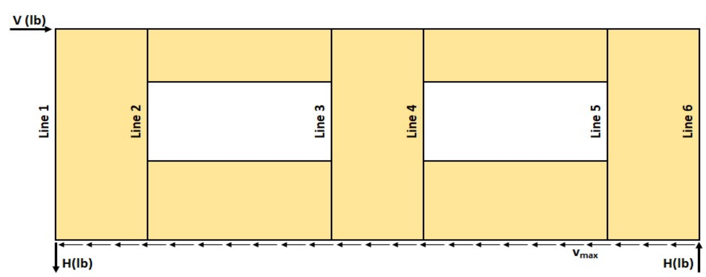
R1 = v1*L1 =	771 lbf
R2 = v2*L2 =	2610 lbf
R3 = v3*L3 =	771 lbf

8. Difference corner force + resistance

R1-F1 =	73 lbf
R2-F2-F3 =	-642 lbf
R3-F4 =	73 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	34 plf
vc2 = (R2-F2-F3)/L2 =	-126 plf
vc3 = (R3-F4)/L3 =	34 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H?$		151	1592	1743 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?$	1743	151	1592	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?$	-569	2312	1743	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?$	1743	2312	-569	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?$	1743	151	1592	0
Line 6: $vc3(h_a2+h_b2)+ v3(h_o2) = H?$		151	1592	1743 lbf

Design Summary*

Req. Sheathing Capacity	514 plf	**4-Term Deflection**	0.395 in.	**3-Term Deflection**	0.419 in.
Req. Strap Force	1626 lbf	**4-Term Story Drift %**	0.015 %	**3-Term Story Drift %**	0.016 %
Req. HD Force	1743 lbf				
Req. Shear Wall Anchorage Force	194 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (21'-6" Section) - (Level 2 Seismic)		

City of Puyallup
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Building	Planning
Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4153 (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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	354	354	514	514	354	354	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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	86	86	59	59	(plf)
e_n:	0.0010	0.0010	0.0031	0.0031	0.0010	0.0010	(in.)
b:	2.18	2.18	5.08	5.08	2.18	2.18	(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
0.044	0.038	0.007	0.597	0.012	0.025	0.004	0.248
		Sum	0.686			Sum	0.289
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	0.036	0.014	0.155	0.007	0.036	0.014	0.155
		Sum	0.211			Sum	0.211
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	0.025	0.004	0.248	0.044	0.038	0.007	0.597
		Sum	0.289			Sum	0.686

Total Defl.	
0.395	(in.)
0.0146	%drift

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (21'-6" Section) - (Level 2 Seismic)		

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4153 (lbf)

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

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

Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:

C_d: 4.00

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

Three-Term Equation Deflection Check

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	354	354	514	514	354	354	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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:	2.18	2.18	5.08	5.08	2.18	2.18	(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.)

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	0.076	0.597	0.012	0.049	0.248
	Sum	0.717		Sum	0.309
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	0.071	0.155	0.007	0.071	0.155
	Sum	0.233		Sum	0.233
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	0.049	0.248	0.044	0.076	0.597
	Sum	0.309		Sum	0.717

Total Defl.	
0.419	(in.)
0.0155	%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:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (21'-6" Section) - (Level 1 Seismic)		

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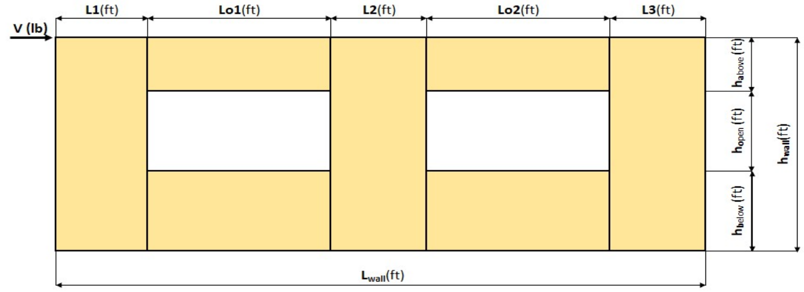
Building | Planning
Engineering | Public Works
Fire | Traffic



Shear Wall Calculation Variables

			Opening 1		Opening 2		
V	5002 lbf					Adj. Factor Method =	2bs/h
L1	2.18 ft	h_a1	1.30 ft	h_a2	1.30 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	5.08 ft	h_o1	4.50 ft	h_o2	4.50 ft	$P1=h_o/L1=$ 2.06	0.969
L3	2.18 ft	h_b1	3.20 ft	h_b2	3.20 ft	$P2=h_o/L2=$ 0.89	N/A
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft	$P3=h_o/L3=$ 2.06	0.969
L_{wall}	21.44 ft						

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2100 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a1+h_b1)$ =	467 plf
Second opening: $va2 = vb2 = H/(h_a2+h_b2)$ =	467 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	2800 lbf
Second opening: O2 = va2 x (Lo2) =	2800 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	841 lbf
F2 = O1(L2)/(L1+L2) =	1959 lbf
F3 = O2(L2)/(L2+L3) =	1959 lbf
F4 = O2(L3)/(L2+L3) =	841 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.80 ft
T2 = (L2*Lo1)/(L1+L2) =	4.20 ft
T3 = (L2*Lo2)/(L2+L3) =	4.20 ft
T4 = (L3*Lo2)/(L2+L3) =	1.80 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	426 plf
v2 = (V/L)(T2+L2+T3)/L2 =	619 plf
v3 = (V/L)(T4+L3)/L3 =	426 plf
Check v1*L1+v2*L2+v3*L3=V?	5002 lbf **OK**

7. Resistance to corner forces

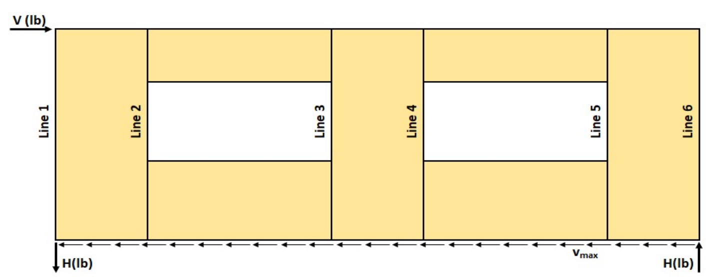
R1 = v1*L1 =	929 lbf
R2 = v2*L2 =	3144 lbf
R3 = v3*L3 =	929 lbf

8. Difference corner force + resistance

R1-F1 =	88 lbf
R2-F2-F3 =	-774 lbf
R3-F4 =	88 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	40 plf
vc2 = (R2-F2-F3)/L2 =	-152 plf
vc3 = (R3-F4)/L3 =	40 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H$?		182	1918	2100 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0$?	2100	182	1918	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0$?	-685	2785	2100	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0$?	2100	2785	-685	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0$?	2100	182	1918	0
Line 6: $vc3(h_a2+h_b2)+ v3(h_o2)$ = H?		182	1918	2100 lbf

Design Summary*

Req. Sheathing Capacity	619 plf	**4-Term Deflection**	0.466 in.	**3-Term Deflection**	0.485 in.
Req. Strap Force	1959 lbf	**4-Term Story Drift %**	0.017 %	**3-Term Story Drift %**	0.018 %
Req. HD Force	2100 lbf				
Req. Shear Wall Anchorage Force	233 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (21'-6" Section) - (Level 1 Seismic)		

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

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5002 (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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	426	426	619	619	426	426	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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:	71	71	103	103	71	71	(plf)
e_n:	0.0005	0.0005	0.0017	0.0017	0.0005	0.0005	(in.)
b:	2.18	2.18	5.08	5.08	2.18	2.18	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.043	0.046	0.003	0.719	0.012	0.030	0.002	0.299
		Sum	0.811			Sum	0.342
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	0.043	0.007	0.186	0.007	0.043	0.007	0.186
		Sum	0.244			Sum	0.244
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	0.030	0.002	0.299	0.043	0.046	0.003	0.719
		Sum	0.342			Sum	0.811

Total Defl.	
0.466	(in.)
0.0172	%drift

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid A-C (21'-6" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5002 (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)		

					Pier 1	Pier 3
G_t Override:				Nail Spacing:	2	2 (in.)
G_a Override:		C_d:	4.00	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	
$v_{unfactored}$:	426	426	619	619	426	426	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	5.80	5.80	5.80	5.80	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:	2.18	2.18	5.08	5.08	2.18	2.18	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Sheathing Type: 15/32 OSB APA Rated Sheathing

Nail Type: 10d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.043	0.074	0.719	0.012	0.048	0.299
	Sum	0.836		Sum	0.358
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	0.069	0.186	0.007	0.069	0.186
	Sum	0.262		Sum	0.262
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	0.048	0.299	0.043	0.074	0.719
	Sum	0.358		Sum	0.836

Total Defl.	
0.485	(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	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (25'-9" Section) - (Level 3 Seismic)		

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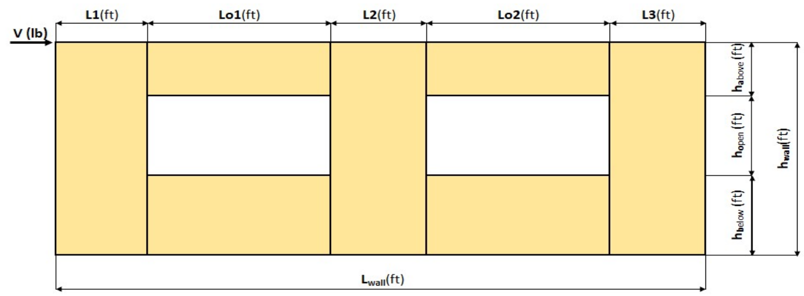
Building	Planning
Engineering	Public Works
Fire	Traffic



Shear Wall Calculation Variables

V	2911 lbf		Opening 1		Opening 2		
L1	2.50 ft	h_a1	1.20 ft	h_a2	1.20 ft		
L2	9.16 ft	h_o1	4.50 ft	h_o2	4.50 ft		
L3	2.09 ft	h_b1	3.30 ft	h_b2	3.30 ft		
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft		
L_{wall}	25.75 ft						

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
$P1=h_o/L1=$	1.80	N/A
$P2=h_o/L2=$	0.49	N/A
$P3=h_o/L3=$	2.15	0.929

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1017 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a1+h_b1) =$	226 plf
Second opening: $va2 = vb2 = H/(h_a2+h_b2) =$	226 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	1357 lbf
Second opening: O2 = va2 x (Lo2) =	1357 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	291 lbf
F2 = O1(L2)/(L1+L2) =	1066 lbf
F3 = O2(L2)/(L2+L3) =	1105 lbf
F4 = O2(L3)/(L2+L3) =	252 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) =	4.89 ft
T4 = (L3*Lo2)/(L2+L3) =	1.11 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	171 plf	
v2 = (V/L)(T2+L2+T3)/L2 =	232 plf	
v3 = (V/L)(T4+L3)/L3 =	173 plf	
Check v1*L1+v2*L2+v3*L3=V?	2911 lbf	**OK**

7. Resistance to corner forces

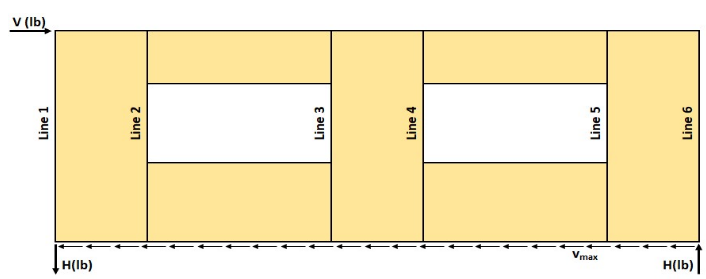
R1 = v1*L1 =	428 lbf
R2 = v2*L2 =	2121 lbf
R3 = v3*L3 =	362 lbf

8. Difference corner force + resistance

R1-F1 =	137 lbf
R2-F2-F3 =	-50 lbf
R3-F4 =	110 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	55 plf
vc2 = (R2-F2-F3)/L2 =	-5 plf
vc3 = (R3-F4)/L3 =	53 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H?$		247	770	1017 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?$	1017	247	770	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?$	-24	1042	1017	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?$	1017	1042	-24	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?$	1017	237	780	0
Line 6: $vc3(h_a2+h_b2)+ v3(h_o2) = H?$		237	780	1017 lbf

Design Summary*

Req. Sheathing Capacity	232 plf	**4-Term Deflection**	0.190 in.	**3-Term Deflection**	0.237 in.
Req. Strap Force	1105 lbf	**4-Term Story Drift %**	0.007 %	**3-Term Story Drift %**	0.009 %
Req. HD Force	1017 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:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (25'-9" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2911 (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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	171	171	232	232	173	173	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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:	86	86	116	116	87	87	(plf)
e_n:	0.0031	0.0031	0.0077	0.0077	0.0032	0.0032	(in.)
b:	2.50	2.50	9.16	9.16	2.09	2.09	(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
0.019	0.018	0.021	0.252	0.005	0.012	0.013	0.101
		Sum	0.310			Sum	0.131
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	0.033	0.037	0.002	0.016	0.033	0.037
		Sum	0.088			Sum	0.088
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	0.012	0.014	0.122	0.023	0.019	0.022	0.305
		Sum	0.154			Sum	0.368

Total Defl.	
0.190	(in.)
0.0070	%drift

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (25'-9" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2911 (lbf)

Wood End Post Values:

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

Species: HF#2
E: 1.30E+06 (psi)

Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:

C_d: 4.00

	Pier 1	Pier 3	
Nail Spacing:	6	6	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	171	171	232	232	173	173	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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:	2.50	2.50	9.16	9.16	2.09	2.09	(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
0.019	0.103	0.252	0.005	0.065	0.101
	Sum	0.373		Sum	0.171
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	0.088	0.037	0.002	0.088	0.037
	Sum	0.127		Sum	0.127
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	0.066	0.122	0.023	0.104	0.305
	Sum	0.194		Sum	0.432

Total Defl.	
0.237	(in.)
0.0088	%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:** 10/22/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building D	
Wall Line:	Grid J-M (25'-9" Section) - (Level 2 Seismic)	

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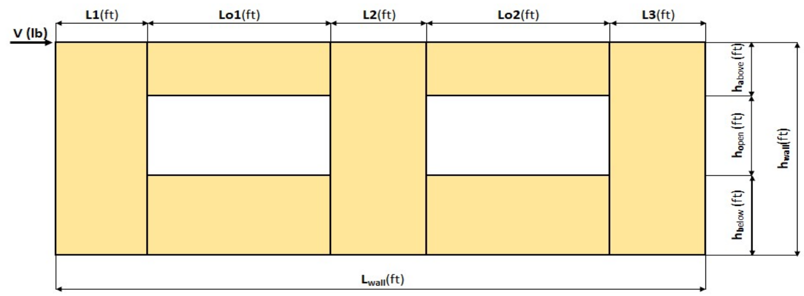


Shear Wall Calculation Variables

V	4843 lbf		Opening 1		Opening 2		
L1	2.50 ft	h_a1	1.20 ft	h_a2	1.20 ft		
L2	9.16 ft	h_o1	4.50 ft	h_o2	4.50 ft		
L3	2.09 ft	h_b1	3.30 ft	h_b2	3.30 ft		
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft		
L_{wall}	25.75 ft						

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.80	N/A
P2=h_o/L2=	0.49	N/A
P3=h_o/L3=	2.15	0.929

1. Hold-down forces: H = Vh_{wall}/L_{wall} 1693 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	376 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	376 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	2257 lbf
Second opening: O2 = va2 x (Lo2) =	2257 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	484 lbf
F2 = O1(L2)/(L1+L2) =	1773 lbf
F3 = O2(L2)/(L2+L3) =	1838 lbf
F4 = O2(L3)/(L2+L3) =	419 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) =	4.89 ft
T4 = (L3*Lo2)/(L2+L3) =	1.11 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	285 plf	
v2 = (V/L)(T2+L2+T3)/L2 =	385 plf	
v3 = (V/L)(T4+L3)/L3 =	288 plf	
Check v1*L1+v2*L2+v3*L3=V?	4843 lbf	**OK**

7. Resistance to corner forces

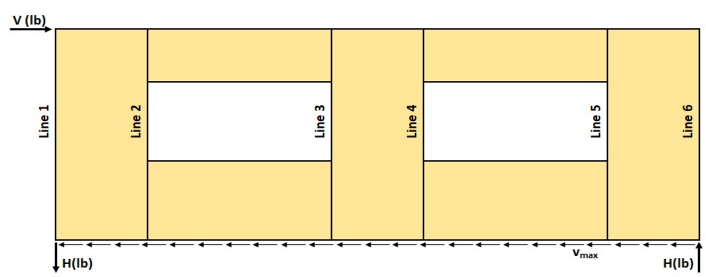
R1 = v1*L1 =	712 lbf
R2 = v2*L2 =	3528 lbf
R3 = v3*L3 =	603 lbf

8. Difference corner force + resistance

R1-F1 =	228 lbf
R2-F2-F3 =	-83 lbf
R3-F4 =	183 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	91 plf
vc2 = (R2-F2-F3)/L2 =	-9 plf
vc3 = (R3-F4)/L3 =	88 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		411	1282	1693 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	1693	411	1282	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-41	1733	1693	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	1693	1733	-41	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	1693	395	1298	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		395	1298	1693 lbf

Design Summary*

Req. Sheathing Capacity	385 plf	**4-Term Deflection**	0.291 in.	**3-Term Deflection**	0.329 in.
Req. Strap Force	1838 lbf	**4-Term Story Drift %**	0.011 %	**3-Term Story Drift %**	0.012 %
Req. HD Force	1693 lbf				
Req. Shear Wall Anchorage Force	188 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (25'-9" Section) - (Level 2 Seismic)		

City of Puyallup
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Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4843 (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

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	285	285	385	385	288	288	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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:	71	71	96	96	72	72	(plf)
e_n:	0.0018	0.0018	0.0044	0.0044	0.0019	0.0019	(in.)
b:	2.50	2.50	9.16	9.16	2.09	2.09	(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.)

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
0.031	0.031	0.012	0.419	0.008	0.019	0.008	0.168
		Sum	0.493			Sum	0.203
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	0.019	0.062	0.003	0.026	0.019	0.062
		Sum	0.110			Sum	0.110
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	0.020	0.008	0.204	0.038	0.031	0.012	0.508
		Sum	0.241			Sum	0.589

Total Defl.	
0.291	(in.)
0.0108	%drift

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (25'-9" Section) - (Level 2 Seismic)		

City of Puyallup
Development & Permitting Services
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Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4843 (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 3	
G_t Override:				Nail Spacing:	3	3	(in.)
G_a Override:		C_d:	4.00	HD Capacity:	1938	1938	(lbf)
				HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	285	285	385	385	288	288	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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:	2.50	2.50	9.16	9.16	2.09	2.09	(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.)

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
0.031	0.092	0.419	0.008	0.058	0.168
	Sum	0.542		Sum	0.234
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	0.062	0.003	0.078	0.062
	Sum	0.143		Sum	0.143
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	0.059	0.204	0.038	0.093	0.508
	Sum	0.272		Sum	0.638

Total Defl.	
0.329	(in.)
0.0122	%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:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (25'-9" Section) - (Level 1 Seismic)		

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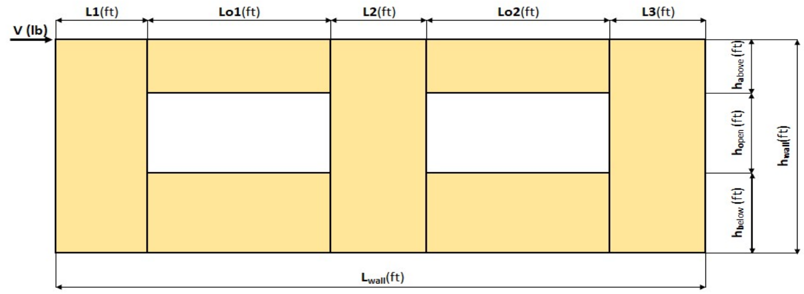


Shear Wall Calculation Variables

V	5837 lbf		Opening 1		Opening 2		
L1	2.50 ft	h_a1	1.20 ft	h_a2	1.20 ft		
L2	9.16 ft	h_o1	4.50 ft	h_o2	4.50 ft		
L3	2.09 ft	h_b1	3.30 ft	h_b2	3.30 ft		
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft		
L_{wall}	25.75 ft						

Adj. Factor Method = 2bs/h

Wall Pier Aspect Ratio		Adj. Factor
P1=h_o/L1=	1.80	N/A
P2=h_o/L2=	0.49	N/A
P3=h_o/L3=	2.15	0.929

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2040 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a1+h_b1) =	453 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =	453 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	2720 lbf
Second opening: O2 = va2 x (Lo2) =	2720 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	583 lbf
F2 = O1(L2)/(L1+L2) =	2137 lbf
F3 = O2(L2)/(L2+L3) =	2215 lbf
F4 = O2(L3)/(L2+L3) =	505 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) =	4.89 ft
T4 = (L3*Lo2)/(L2+L3) =	1.11 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	343 plf
v2 = (V/L)(T2+L2+T3)/L2 =	464 plf
v3 = (V/L)(T4+L3)/L3 =	348 plf
Check v1*L1+v2*L2+v3*L3=V?	5837 lbf **OK**

7. Resistance to corner forces

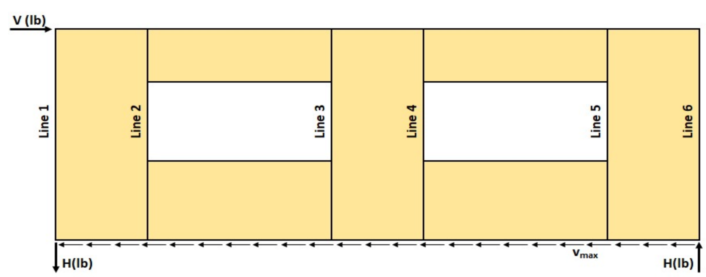
R1 = v1*L1 =	858 lbf
R2 = v2*L2 =	4252 lbf
R3 = v3*L3 =	726 lbf

8. Difference corner force + resistance

R1-F1 =	275 lbf
R2-F2-F3 =	-99 lbf
R3-F4 =	221 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	110 plf
vc2 = (R2-F2-F3)/L2 =	-11 plf
vc3 = (R3-F4)/L3 =	106 plf



Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		495	1545	2040 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	2040	495	1545	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	-49	2089	2040	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	2040	2089	-49	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	2040	476	1564	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		476	1564	2040 lbf

Design Summary*

Req. Sheathing Capacity	464 plf	**4-Term Deflection**	0.342 in.	**3-Term Deflection**	0.365 in.
Req. Strap Force	2215 lbf	**4-Term Story Drift %**	0.013 %	**3-Term Story Drift %**	0.014 %
Req. HD Force	2040 lbf				
Req. Shear Wall Anchorage Force	227 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (25'-9" Section) - (Level 1 Seismic)		

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Development & Permitting Services
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Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5837 (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

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	343	343	464	464	348	348	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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:	57	57	77	77	58	58	(plf)
e_n:	0.0009	0.0009	0.0023	0.0023	0.0010	0.0010	(in.)
b:	2.50	2.50	9.16	9.16	2.09	2.09	(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.)

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	0.037	0.006	0.505	0.009	0.023	0.004	0.203
		Sum	0.586			Sum	0.239
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	0.032	0.010	0.075	0.004	0.032	0.010	0.075
		Sum	0.120			Sum	0.120
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	0.024	0.004	0.245	0.045	0.037	0.006	0.612
		Sum	0.285			Sum	0.701

Total Defl.	
0.342	(in.)
0.0127	%drift

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (25'-9" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 5837 (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 3	
G_t Override:				Nail Spacing:	2	2	(in.)
G_a Override:		C_d:	4.00	HD Capacity:	1938	1938	(lbf)
				HD Deflection:	0.088	0.088	(in.)

Three-Term Equation Deflection Check

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

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	343	343	464	464	348	348	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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:	2.50	2.50	9.16	9.16	2.09	2.09	(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.)

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	0.074	0.505	0.009	0.047	0.203
	Sum	0.616		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
0.004	0.063	0.075	0.004	0.063	0.075
	Sum	0.141		Sum	0.141
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	0.047	0.245	0.045	0.074	0.612
	Sum	0.304		Sum	0.731

Total Defl.	
0.365	(in.)
0.0135	%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 D
Wall Line:	Grid J-M (15'-0" Section) - (Level 3 Seismic)

Date: 10/22/2024

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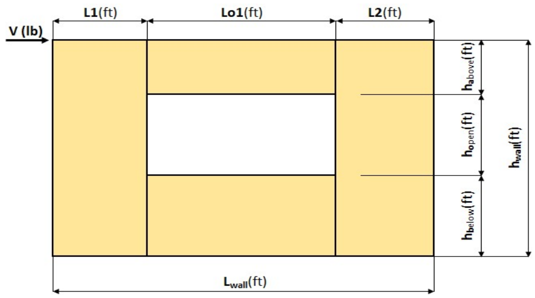


Shear Wall Calculation Variables

V	1696 lbf		Opening 1		Adj. Factor Method =	2bs/h	
L1	5.08 ft	h_a	1.20 ft		Wall Pier Aspect Ratio		Adj. Factor
L2	3.92 ft	h_o	4.50 ft		$P1=h_o/L1=$	0.89	N/A
h_{wall}	9.00 ft	h_b	3.30 ft		$P2=h_o/L2=$	1.15	N/A
L_{wall}	15.00 ft	Lo1	6.00 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1018 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) = 1357 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 766 lbf

F2 = O1(L2)/(L1+L2) = 591 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.39 ft

T2 = (L2*Lo1)/(L1+L2) = 2.61 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 188 plf

v2 = (V/L)(T2+L2)/L2 = 188 plf

Check v1*L1+v2*L2=V? 1696 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 957 lbf

R2 = v2*L2 = 739 lbf

8. Difference corner force + resistance

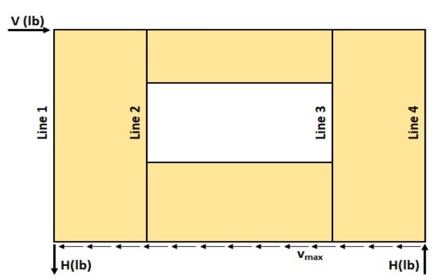
R1-F1 = 191 lbf

R2-F2 = 148 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 38 plf

vc2 = (R2-F2)/L2 = 38 plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H$?		170	848	1018 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0$?	1018	170	848	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0$?	1018	170	848	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H$?		170	848	1018 lbf

Design Summary*

Req. Sheathing Capacity	226 plf	**4-Term Deflection**	0.099 in.	**3-Term Deflection**	0.152 in.
Req. Strap Force	766 lbf	**4-Term Story Drift %**	0.004 %	**3-Term Story Drift %**	0.006 %
Req. HD Force (H)	1018 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:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (15'-0" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1696 (lbf)

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

G_t Override:
G_a Override:

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

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	188	188	188	188	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	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:	94	94	94	94	(plf)
e_n:	0.0042	0.0042	0.0042	0.0042	(in.)
b:	5.08	5.08	3.92	3.92	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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	0.020	0.028	0.065	0.003	0.013	0.018	0.026
		Sum	0.123			Sum	0.059
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	0.018	0.034	0.013	0.020	0.028	0.084
		Sum	0.068			Sum	0.146

Total Defl.	
0.099	(in.)
0.0037	%drift

Project Information

Code:	2018 IBC	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (15'-0" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1696 (lbf)

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

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

Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:

C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	188	188	188	188	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	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:	5.08	5.08	3.92	3.92	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.010	0.113	0.065	0.003	0.072	0.026
	Sum	0.188		Sum	0.100
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	0.072	0.034	0.013	0.113	0.084
	Sum	0.109		Sum	0.210

Total Defl.	
0.152	(in.)
0.0056	%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	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (15'-0" Section) - (Level 2 Seismic)		

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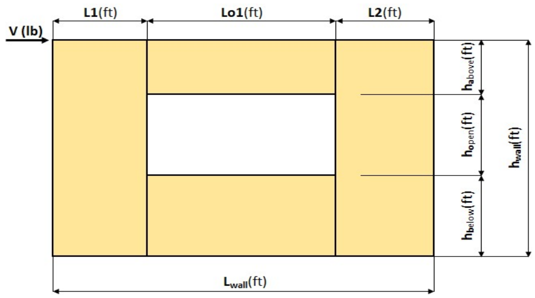


Shear Wall Calculation Variables

V	2821 lbf		Opening 1	Adj. Factor Method =		2bs/h
L1	5.08 ft	h_a	1.20 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	3.92 ft	h_o	4.50 ft	$P1=h_o/L1=$	0.89	N/A
h_{wall}	9.00 ft	h_b	3.30 ft	$P2=h_o/L2=$	1.15	N/A
L_{wall}	15.00 ft	Lo1	6.00 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ — 1693 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a+h_b) =$ 376 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2257 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1274 lbf
F2 = O1(L2)/(L1+L2) = 983 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.39 ft
T2 = (L2*Lo1)/(L1+L2) = 2.61 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 313 plf
v2 = (V/L)(T2+L2)/L2 = 313 plf
Check v1*L1+v2*L2=V? 2821 lbf **OK**

7. Resistance to corner forces

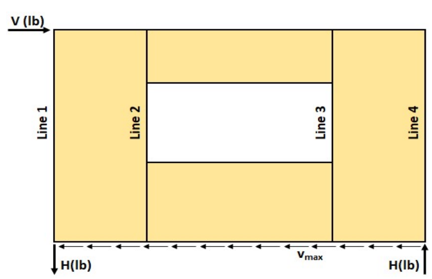
R1 = v1*L1 = 1592 lbf
R2 = v2*L2 = 1229 lbf

8. Difference corner force + resistance

R1-F1 = 318 lbf
R2-F2 = 246 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 63 plf
vc2 = (R2-F2)/L2 = 63 plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		282	1411	1693 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1693	282	1411	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1693	282	1411	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		282	1411	1693 lbf

Design Summary*

Req. Sheathing Capacity	376 plf	**4-Term Deflection**	0.140 in.	**3-Term Deflection**	0.181 in.
Req. Strap Force	1274 lbf	**4-Term Story Drift %**	0.005 %	**3-Term Story Drift %**	0.007 %
Req. HD Force (H)	1693 lbf				
Req. Shear Wall Anchorage Force (v_{max})	188 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (15'-0" Section) - (Level 2 Seismic)		

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Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2821 (lbf)

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

G_t Override:
G_a Override:

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

Enter individual post sizes below.

C_d: 4.00

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	3	3	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	313	313	313	313	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	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:	0.0024	0.0024	0.0024	0.0024	(in.)
b:	5.08	5.08	3.92	3.92	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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	0.034	0.016	0.108	0.004	0.021	0.010	0.043
		Sum	0.175			Sum	0.079
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	0.021	0.010	0.056	0.022	0.034	0.016	0.140
		Sum	0.093			Sum	0.211

Total Defl.	
0.140	(in.)
0.0052	%drift

Project Information

Code:	2018 IBC	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (15'-0" Section) - (Level 2 Seismic)		

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Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2821 (lbf)

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

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

Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:

C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	3	3	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	313	313	313	313	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	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:	5.08	5.08	3.92	3.92	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.017	0.101	0.108	0.004	0.064	0.043
	Sum	0.225		Sum	0.111
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	0.064	0.056	0.022	0.101	0.140
	Sum	0.125		Sum	0.262

Total Defl.	
0.181	(in.)
0.0067	%drift

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

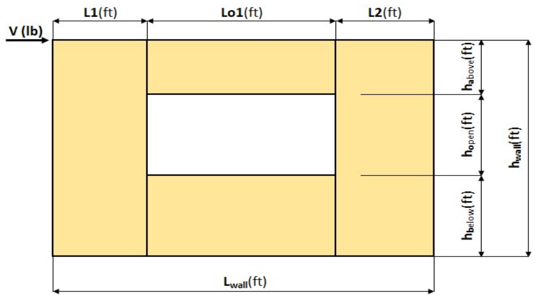
Force Transfer Around Openings Calculator

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	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (15'-0" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	3400 lbf		Opening 1	Adj. Factor Method =		2bs/h
L1	5.08 ft	h_a	1.20 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	3.92 ft	h_o	4.50 ft	P1=h_o/L1=	0.89	N/A
h_{wall}	9.00 ft	h_b	3.30 ft	P2=h_o/L2=	1.15	N/A
L_{wall}	15.00 ft	Lo1	6.00 ft			

1. Hold-down forces: H = Vh_{wall}/L_{wall} 2040 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(h_a+h_b) = 453 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2720 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1535 lbf

F2 = O1(L2)/(L1+L2) = 1185 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.39 ft

T2 = (L2*Lo1)/(L1+L2) = 2.61 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 378 plf

v2 = (V/L)(T2+L2)/L2 = 378 plf

Check v1*L1+v2*L2=V? 3400 lbf **OK**

7. Resistance to corner forces

R1 = v1*L1 = 1919 lbf

R2 = v2*L2 = 1481 lbf

8. Difference corner force + resistance

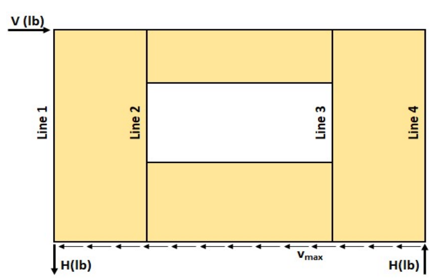
R1-F1 = 384 lbf

R2-F2 = 296 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 76 plf

vc2 = (R2-F2)/L2 = 76 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(h_a+h_b)+v1(h_o)=H?		340	1700	2040 lbf
Line 2: va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?	2040	340	1700	0
Line 3: va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?	2040	340	1700	0
Line 4: vc2(h_a+h_b)+v2(h_o)=H?		340	1700	2040 lbf

Design Summary*

Req. Sheathing Capacity	453 plf	**4-Term Deflection**	0.175 in.	**3-Term Deflection**	0.218 in.
Req. Strap Force	1535 lbf	**4-Term Story Drift %**	0.006 %	**3-Term Story Drift %**	0.008 %
Req. HD Force (H)	2040 lbf				
Req. Shear Wall Anchorage Force (v_{max})	227 plf				

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

Project Information

Code:	2018 IBC	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (15'-0" Section) - (Level 1 Seismic)		

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Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3400 (lbf)

Sheathing Type:	7/16 OSB	Wood End Post Values:		
Grade:	APA Rated Sheathing	Species:	HF#2	
		E:	1.30E+06	(psi)
G_t Override:		Enter individual post sizes below.		
G_a Override:		C_d:	4.00	

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	3	3	(in.)
HD Capacity:	5093	5093	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	378	378	378	378	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	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:	94	94	94	94	(plf)
e_n:	0.0042	0.0042	0.0042	0.0042	(in.)
b:	5.08	5.08	3.92	3.92	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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	0.041	0.028	0.130	0.005	0.026	0.018	0.052
		Sum	0.219			Sum	0.101
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	0.026	0.018	0.068	0.026	0.041	0.028	0.169
		Sum	0.118			Sum	0.264

Total Defl.	
0.175	(in.)
0.0065	%drift

Project Information

Code:	2018 IBC	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (15'-0" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 3400 (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:	3	3	(in.)
G_a Override:		C_d:	4.00	HD Capacity:	5093	5093	(lbf)
				HD Deflection:	0.11	0.11	(in.)

Three-Term Equation Deflection Check

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

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$v_{unfactored}$:	378	378	378	378	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	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:	5.08	5.08	3.92	3.92	(ft)
HD Capacity:	5093	5093	5093	5093	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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	0.121	0.130	0.005	0.077	0.052
	Sum	0.272		Sum	0.134
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	0.077	0.068	0.026	0.121	0.169
	Sum	0.151		Sum	0.316

Total Defl.	
0.218	(in.)
0.0081	%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:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (21'-5" Section) - (Level 3 Seismic)		

City of Puyallup
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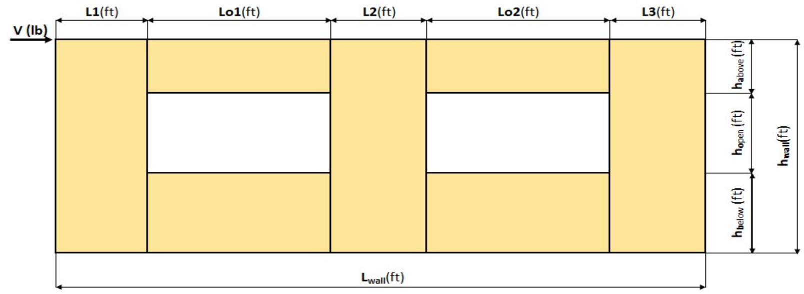
Engineering	Public Works
Fire	Traffic



Shear Wall Calculation Variables

			Opening 1		Opening 2	Adj. Factor Method =	2bs/h
V	2422 lbf					Wall Pier Aspect Ratio	Adj. Factor
L1	3.25 ft	h_a1	1.20 ft	h_a2	1.20 ft	$P1=h_o/L1=$ 1.38	N/A
L2	2.92 ft	h_o1	4.50 ft	h_o2	4.50 ft	$P2=h_o/L2=$ 1.54	N/A
L3	3.25 ft	h_b1	3.30 ft	h_b2	3.30 ft	$P3=h_o/L3=$ 1.38	N/A
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft		
L_{wall}	21.42 ft						

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1018 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a1+h_b1) =$	226 plf
Second opening: $va2 = vb2 = H/(h_a2+h_b2) =$	226 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	1357 lbf
Second opening: O2 = va2 x (Lo2) =	1357 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	715 lbf
F2 = O1(L2)/(L1+L2) =	642 lbf
F3 = O2(L2)/(L2+L3) =	642 lbf
F4 = O2(L3)/(L2+L3) =	715 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	3.16 ft
T2 = (L2*Lo1)/(L1+L2) =	2.84 ft
T3 = (L2*Lo2)/(L2+L3) =	2.84 ft
T4 = (L3*Lo2)/(L2+L3) =	3.16 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	223 plf
v2 = (V/L)(T2+L2+T3)/L2 =	333 plf
v3 = (V/L)(T4+L3)/L3 =	223 plf
Check v1*L1+v2*L2+v3*L3=V?	2422 lbf **OK**

7. Resistance to corner forces

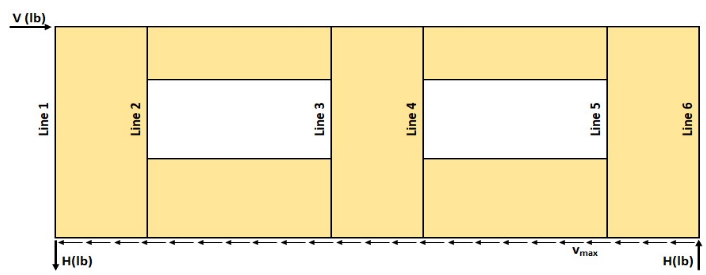
R1 = v1*L1 =	725 lbf
R2 = v2*L2 =	972 lbf
R3 = v3*L3 =	725 lbf

8. Difference corner force + resistance

R1-F1 =	10 lbf
R2-F2-F3 =	-312 lbf
R3-F4 =	10 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	3 plf
vc2 = (R2-F2-F3)/L2 =	-107 plf
vc3 = (R3-F4)/L3 =	3 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H$?		14	1004	1018 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0$?	1018	14	1004	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0$?	-481	1498	1018	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0$?	1018	1498	-481	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0$?	1018	14	1004	0
Line 6: $vc3(h_a2+h_b2)+ v3(h_o2) = H$?		14	1004	1018 lbf

Design Summary*

Req. Sheathing Capacity	333 plf	**4-Term Deflection**	0.222 in.	**3-Term Deflection**	0.263 in.
Req. Strap Force	715 lbf	**4-Term Story Drift %**	0.008 %	**3-Term Story Drift %**	0.010 %
Req. HD Force	1018 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:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (21'-5" Section) - (Level 3 Seismic)		

City of Puyallup
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Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2422 (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

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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	223	223	333	333	223	223	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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:	74	74	111	111	74	74	(plf)
e_n:	0.0020	0.0020	0.0068	0.0068	0.0020	0.0020	(in.)
b:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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	0.024	0.014	0.252	0.005	0.015	0.009	0.101
		Sum	0.309			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
0.008	0.023	0.029	0.168	0.008	0.023	0.029	0.168
		Sum	0.228			Sum	0.228
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	0.009	0.101	0.019	0.024	0.014	0.252
		Sum	0.130			Sum	0.309

Total Defl.	
0.222	(in.)
0.0082	%drift

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (21'-5" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2422 (lbf)

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

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

Nail Type: 8d common (penny weight)

G_t Override:
G_a Override:

C_d: 4.00

	Pier 1	Pier 3	
Nail Spacing:	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	
$v_{unfactored}$:	223	223	333	333	223	223	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.019	0.091	0.252	0.005	0.058	0.101
	Sum	0.362		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
0.008	0.086	0.168	0.008	0.086	0.168
	Sum	0.262		Sum	0.262
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	0.058	0.101	0.019	0.091	0.252
	Sum	0.164		Sum	0.362

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:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (21'-5" Section) - (Level 2 Seismic)		

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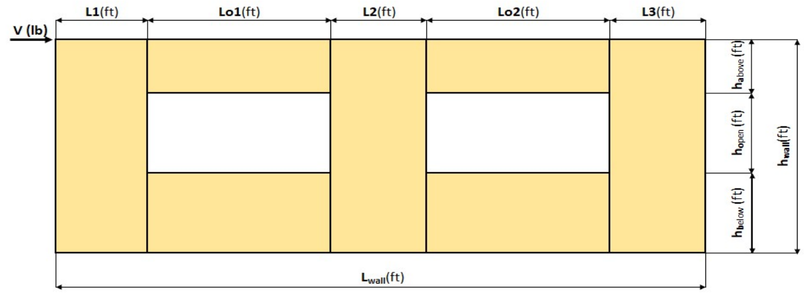


Shear Wall Calculation Variables

V	4028 lbf	Opening 1		Opening 2		Adj. Factor Method =	2bs/h	
L1	3.25 ft	h_a1	1.20 ft	h_a2	1.20 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	2.92 ft	h_o1	4.50 ft	h_o2	4.50 ft	$P1=h_o/L1=$	1.38	N/A
L3	3.25 ft	h_b1	3.30 ft	h_b2	3.30 ft	$P2=h_o/L2=$	1.54	N/A
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft	$P3=h_o/L3=$	1.38	N/A
L_{wall}	21.42 ft							

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1692 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a1+h_b1) =$	376 plf
Second opening: $va2 = vb2 = H/(h_a2+h_b2) =$	376 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	2257 lbf
Second opening: O2 = va2 x (Lo2) =	2257 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	1189 lbf
F2 = O1(L2)/(L1+L2) =	1068 lbf
F3 = O2(L2)/(L2+L3) =	1068 lbf
F4 = O2(L3)/(L2+L3) =	1189 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	3.16 ft
T2 = (L2*Lo1)/(L1+L2) =	2.84 ft
T3 = (L2*Lo2)/(L2+L3) =	2.84 ft
T4 = (L3*Lo2)/(L2+L3) =	3.16 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 =	371 plf	
v2 = (V/L)(T2+L2+T3)/L2 =	554 plf	
v3 = (V/L)(T4+L3)/L3 =	371 plf	
Check v1*L1+v2*L2+v3*L3=V?	4028 lbf	**OK**

7. Resistance to corner forces

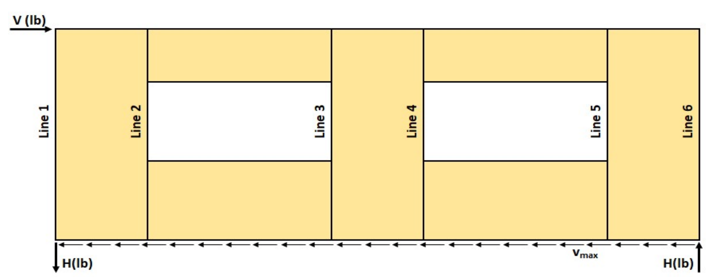
R1 = v1*L1 =	1205 lbf
R2 = v2*L2 =	1617 lbf
R3 = v3*L3 =	1205 lbf

8. Difference corner force + resistance

R1-F1 =	17 lbf
R2-F2-F3 =	-519 lbf
R3-F4 =	17 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	5 plf
vc2 = (R2-F2-F3)/L2 =	-178 plf
vc3 = (R3-F4)/L3 =	5 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H?$		23	1669	1692 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?$	1692	23	1669	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?$	-800	2492	1692	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?$	1692	2492	-800	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?$	1692	23	1669	0
Line 6: $vc3(h_a2+h_b2)+ v3(h_o2) = H?$		23	1669	1692 lbf

Design Summary*

Req. Sheathing Capacity	554 plf	**4-Term Deflection**	0.351 in.	**3-Term Deflection**	0.375 in.
Req. Strap Force	1189 lbf	**4-Term Story Drift %**	0.013 %	**3-Term Story Drift %**	0.014 %
Req. HD Force	1692 lbf				
Req. Shear Wall Anchorage Force	188 plf				

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

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (21'-5" Section) - (Level 2 Seismic)		

City of Puyallup
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Engineering	Public Works
Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4028 (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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	371	371	554	554	371	371	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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	92	92	62	62	(plf)
e_n:	0.0012	0.0012	0.0039	0.0039	0.0012	0.0012	(in.)
b:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.031	0.040	0.008	0.420	0.008	0.025	0.005	0.168
		Sum	0.499			Sum	0.207
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
0.013	0.038	0.017	0.280	0.013	0.038	0.017	0.280
		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
0.008	0.025	0.005	0.168	0.031	0.040	0.008	0.420
		Sum	0.207			Sum	0.499

Total Defl.	
0.351	(in.)
0.0130	%drift

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (21'-5" Section) - (Level 2 Seismic)		

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Fire	Traffic

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4028 (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 3	
G_t Override:			Nail Spacing:	2	2	(in.)
G_a Override:		C_d: 4.00	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	
$v_{unfactored}$:	371	371	554	554	371	371	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.031	0.079	0.420	0.008	0.050	0.168
	Sum	0.530		Sum	0.227
Pier 2 (left)			**Pier 2 (right)**		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.013	0.075	0.280	0.013	0.075	0.280
	Sum	0.368		Sum	0.368
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	0.050	0.168	0.031	0.079	0.420
	Sum	0.227		Sum	0.530

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:**	10/22/2024
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Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (21'-5" Section) - (Level 1 Seismic)		

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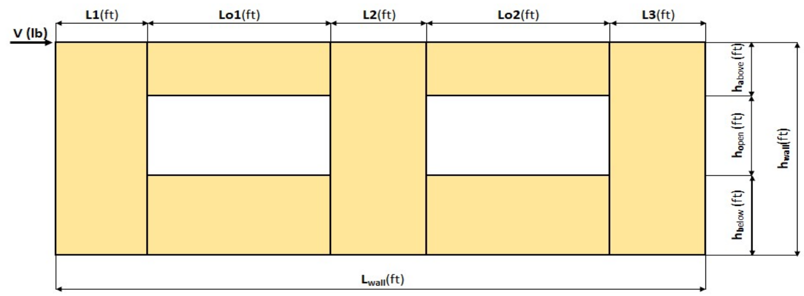


Shear Wall Calculation Variables

V	4835 lbf		Opening 1		Opening 2	Adj. Factor Method =		2bs/h
L1	3.25 ft	h_a1	1.20 ft	h_a2	1.20 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	2.92 ft	h_o1	4.50 ft	h_o2	4.50 ft	$P1=h_o/L1=$	1.38	N/A
L3	3.25 ft	h_b1	3.30 ft	h_b2	3.30 ft	$P2=h_o/L2=$	1.54	N/A
h_{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft	$P3=h_o/L3=$	1.38	N/A
L_{wall}	21.42 ft							

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2032 lbf

2. Unit shear above + below opening

First opening: $va1 = vb1 = H/(h_a1+h_b1) =$ 451 plf
Second opening: $va2 = vb2 = H/(h_a2+h_b2) =$ 451 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2709 lbf
Second opening: O2 = va2 x (Lo2) = 2709 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1427 lbf
F2 = O1(L2)/(L1+L2) = 1282 lbf
F3 = O2(L2)/(L2+L3) = 1282 lbf
F4 = O2(L3)/(L2+L3) = 1427 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 3.16 ft
T2 = (L2*Lo1)/(L1+L2) = 2.84 ft
T3 = (L2*Lo2)/(L2+L3) = 2.84 ft
T4 = (L3*Lo2)/(L2+L3) = 3.16 ft

6. Unit shear beside opening

v1 = (V/L)(L1+T1)/L1 = 445 plf
v2 = (V/L)(T2+L2+T3)/L2 = 665 plf
v3 = (V/L)(T4+L3)/L3 = 445 plf
Check v1*L1+v2*L2+v3*L3=V? 4835 lbf **OK**

7. Resistance to corner forces

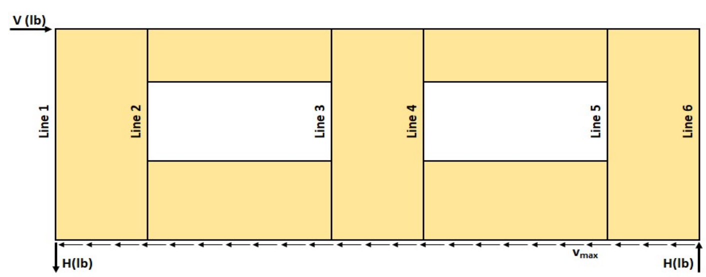
R1 = v1*L1 = 1447 lbf
R2 = v2*L2 = 1941 lbf
R3 = v3*L3 = 1447 lbf

8. Difference corner force + resistance

R1-F1 = 20 lbf
R2-F2-F3 = -623 lbf
R3-F4 = 20 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 6 plf
vc2 = (R2-F2-F3)/L2 = -213 plf
vc3 = (R3-F4)/L3 = 6 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_a1+h_b1)+v1(h_o1)=H?$		28	2004	2032 lbf
Line 2: $va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?$	2032	28	2004	0
Line 3: $vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?$	-960	2991	2032	0
Line 4: $va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?$	2032	2991	-960	0
Line 5: $va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?$	2032	28	2004	0
Line 6: $vc3(h_a2+h_b2)+v3(h_o2) = H?$		28	2004	2032 lbf

Design Summary*

Req. Sheathing Capacity	665 plf	**4-Term Deflection**	0.411 in.	**3-Term Deflection**	0.430 in.
Req. Strap Force	1427 lbf	**4-Term Story Drift %**	0.015 %	**3-Term Story Drift %**	0.016 %
Req. HD Force	2032 lbf				
Req. Shear Wall Anchorage Force	226 plf				

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

Project Information

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Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4835 (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

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	445	445	665	665	445	445	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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:	74	74	111	111	74	74	(plf)
e_n:	0.0006	0.0006	0.0021	0.0021	0.0006	0.0006	(in.)
b:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.030	0.048	0.004	0.504	0.008	0.030	0.002	0.202
		Sum	0.586			Sum	0.243
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
0.013	0.045	0.009	0.336	0.013	0.045	0.009	0.336
		Sum	0.403			Sum	0.403
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	0.030	0.002	0.202	0.030	0.048	0.004	0.504
		Sum	0.243			Sum	0.586

Total Defl.	
0.411	(in.)
0.0152	%drift

Project Information

Code:	IBC 2018	**Date:**	10/22/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building D		
Wall Line:	Grid J-M (21'-5" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4835 (lbf)

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

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

Nail Type: 10d common (penny weight)

G_t Override:
G_a Override:

C_d: 4.00

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

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$v_{unfactored}$:	445	445	665	665	445	445	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	5.70	5.70	5.70	5.70	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:	3.25	3.25	2.92	2.92	3.25	3.25	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.030	0.077	0.504	0.008	0.049	0.202
	Sum	0.611		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
0.013	0.073	0.336	0.013	0.073	0.336
	Sum	0.421		Sum	0.421
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	0.049	0.202	0.030	0.077	0.504
	Sum	0.259		Sum	0.611

Total Defl.	
0.430	(in.)
0.0159	%drift

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