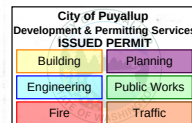


GRID F (LEVEL 2) FE = 41,895#

6 SEGMENTS LT = 117'-3" 7-9'

$$VE = 41,895\# / 117.75' = 357\text{PIF}$$

USE W3 VEALLOW = 450PIFHOLD DOWNS

$$L = 30'-4" \quad TE = 357\text{PIF} \times 9' \times 1.25 + 358\# - 1/2(8\text{PIF} \times 9' \times 15.16') = 3,828\#$$

$$(2) \text{ HD08-S0S2.5 w/2 STUQS} \quad TEALLOW = 5,920\# \times 1.4/1.6 = 5,093\#$$

$$L = 14'-3" \quad TE = 357\text{PIF} \times 9' \times 1.25 - 409\# - 1/2(45\text{PIF} \times 4.1' \times 7.13') - 1/2(12\text{PIF} \times 9' \times 7.13') = 2,564\#$$

$$(1) \text{ ST48 w/2 STUQS} \quad TEALLOW = 3,425\# \times 1.4/1.6 = 2,997\#$$

$$L = 24'-8" \quad TE = 357\text{PIF} \times 9' \times 1.25 - 956\# - 1/2(8\text{PIF} \times 9' \times 12.33') = 2,616\#$$

$$(2) \text{ HD04-S0S2.5 w/2 STUQS} \quad TEALLOW = 3,285\# \times 1.4/1.6 = 2,874\#$$

$$L = 13'-10" \quad TE = 357\text{PIF} \times 9' \times 1.25 + 870\# - 1/2(8\text{PIF} \times 9' \times 16.92') = 4,277\#$$

$$(2) \text{ HD08-S0S2.5 w/2 STUQS} \quad TEALLOW = 5,920\# \times 1.4/1.6 = 5,093\#$$

$$L = 15'-7" \quad TE = 357\text{PIF} \times 9' \times 1.25 - 623\# - 1/2(45\text{PIF} \times 4.1' \times 7.81') - 1/2(12\text{PIF} \times 9' \times 7.81') = 2,253\#$$

$$(1) \text{ ST48 w/2 STUQS} \quad TEALLOW = 3,425\# \times 1.4/1.6 = 2,997\#$$

$$L = 13'-7" \quad TE = 357\text{PIF} \times 9' \times 1.25 + 130\# - 1/2(8\text{PIF} \times 9' \times 9.29') = 3,812\#$$

$$(2) \text{ HD08-S0S2.5 w/2 STUQS}$$

GRID F (LEVEL) $FE = 51,137\#$ 6 SECTIONS $L_T = 117.25' \quad b = 9'$

$$VE = 51,137\# / 117.25' = 436\text{PIF}$$

USE W3 $VE_{allow} = 456\text{PIF}$

HOLD DOWNS

$$L = 30.41' \quad TE = 463\text{PIF} \times 9' \times 1.25 + 3828\# - \frac{1}{2}(8\text{PIF} \times 9' \times 15.16') = 8,491\#$$

$$\boxed{\text{USE HDU14-SDS25 w/ 5 STUOS}} \quad TE_{allow} = 12,375\# \times 1.4 / 1.6 = 10,928\#$$

$$L = 14.43' \quad TE = 463\text{PIF} \times 9' \times 1.25 + 2,564\# - \frac{1}{2}(4\text{PIF} \times 9' \times 7.13') = \frac{1}{2}(12\text{PIF} \times 9' \times 7.13') = 6,730\#$$

$$\boxed{\text{USE HDU11-SDS25 w/ 3 STUOS}} \quad TE_{allow} = 8,030\# \times 1.4 / 1.6 = 7,026\#$$

$$L = 24.19' \quad TE = 463\text{PIF} \times 9' \times 1.25 + 2,616\# - \frac{1}{2}(8\text{PIF} \times 9' \times 12.33') = 7,381\#$$

$$\boxed{\text{USE HDU14-SDS25 w/ 4 STUOS}} \quad TE_{allow} = 9,260\# \times 1.4 / 1.6 = 8,103\#$$

$$L = 13.10' \quad TE = 463\text{PIF} \times 9' \times 1.25 + 4,277\# - \frac{1}{2}(8\text{PIF} \times 9' \times 6.92') = 9,237\#$$

$$\boxed{\text{USE HDU14-SDS25 w/ 5 STUOS}} \quad TE_{allow} = 12,375\# \times 1.4 / 1.6 = 10,928\#$$

$$L = 15.17' \quad TE = 463\text{PIF} \times 9' \times 1.25 + 2,253\# - \frac{1}{2}(4\text{PIF} \times 9' \times 7.8') = \frac{1}{2}(12\text{PIF} \times 9' \times 7.8') = 6,321\#$$

$$\boxed{\text{HDU11-SDS25 w/ 3 STUOS}} \quad TE_{allow} = 8,030\# \times 1.4 / 1.6 = 7,026\#$$

$$L = 19.17' \quad TE = 463\text{PIF} \times 9' \times 1.25 + 3,812\# - \frac{1}{2}(8\text{PIF} \times 9' \times 9.29') = 8,686\#$$

$$\boxed{\text{USE HDU14-SDS25 w/ 5 STUOS}} \quad TE_{allow} = 12,375\# \times 1.4 / 1.6 = 10,928\#$$

GRID L (26'-2" FTAO)

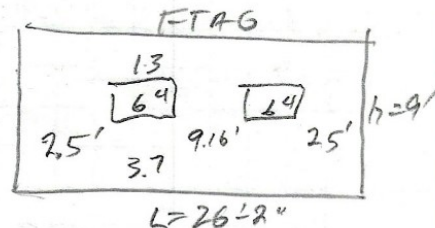
(LEVEL 3) $FE = 12,376\# \times (26.16' / 109.25') = 2,963\#$

$VE = 230\text{PIF}$

USE W11 $VE_{ALLOW} = 242\text{PIF}$

HOLD DOWNS

$TE = 1919\# \times 1.25 - 1/2(25\text{PIF} \times 12' \times 13.00') - 1/2(12\text{PIF} \times 4.5' \times 13.00') = -1,041\#$
 SO NO HD'S REQ'D



(LEVEL 2) $FE = 20,207\# \times (26.16' / 109.25') = 4,839\#$

$VE = 375\text{PIF}$

USE W3 $VE_{ALLOW} = 456\text{PIF}$

HOLD DOWNS

$TE = 1,665\# \times 1.25 - 1,041\# - 1/2(12\text{PIF} \times 9' \times 13.00') = 334\#$

USE MST37 w/ 2 STOPS $TE_{ALLOW} = 2,140\# \times 1.4 / 1.6 = 1,928\#$

(LEVEL 1) $FE = 24,207\# \times (26.16' / 109.25') = 5,796\#$

$VE = 450\text{PIF}$

USE W3 $VE_{ALLOW} = 456\text{PIF}$

HOLD DOWNS

$TE = 1,994\# \times 1.25 + 334\# - 1/2(12\text{PIF} \times 9' \times 13.00') = 2,120\#$

USE HD04-S0S2.5 w/ 2 STOPS $TE_{ALLOW} = 3,285\# \times 1.4 / 1.6 = 2,874\#$

GRID K (14L7" FTAO)

$$(LEVEL 3) FE = 12,376\# \times (14.59' / 109.25') = 1,652\#$$

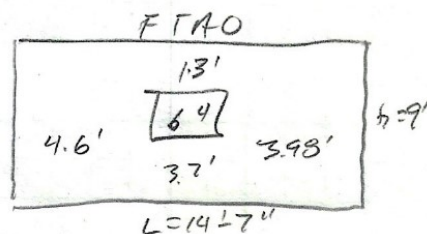
$$VE = 209\text{ PIF}$$

$$\text{USE } \triangle W1 \quad V_{EALLOW} = 242\text{ PIF}$$

HOLD DOWNS

$$TE = 1,020\# \times 1.25 - \frac{1}{2}(25\text{PSF} \times 18.2' \times 7.29') - \frac{1}{2}(12\text{PSF} \times 4.5' \times 7.29') = -580\#$$

SO NO HD'S REQ'D



$$(LEVEL 2) FE = 20,207\# \times (14.59' / 109.25') = 2,927\#$$

$$VE = 361\text{ PIF}$$

$$\text{USE } \triangle W3 \quad V_{EALLOW} = 456\text{ PIF}$$

HOLD DOWNS

$$TE = 1,807\# \times 1.25 - 580\# - \frac{1}{2}(12\text{PSF} \times 9' \times 7.29') = 1,285\#$$

$$\text{USE } \triangle W3 \text{ w/ 2 STUDS} \quad T_{EALLOW} = 2,140\# \times 1.4 / 1.6 = 1,873\#$$

$$(LEVEL 1) FE = 24,207\# \times (14.59' / 109.25') = 3,231\#$$

$$VE = 399\text{ PIF}$$

$$\text{USE } \triangle W3 \quad V_{EALLOW} = 456\text{ PIF}$$

HOLD DOWNS

$$TE = 1,794\# \times 1.25 + 1,285\# - \frac{1}{2}(12\text{PSF} \times 9' \times 7.29') = 3,384\#$$

$$\text{USE } \triangle D U5-SDS2 \text{ w/ 2 STUDS} \quad T_{EALLOW} = 4,340\# \times 1.2 / 1.6 = 3,298\#$$

GRID M (1'-5" FTAO)

$$(LEVEL 3) \quad FE = 12,376\# \times (21.42' / 109.75') = 2,426\#$$

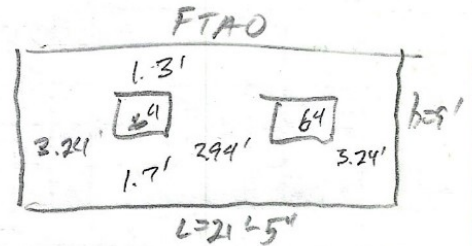
$$VE = 333\text{PIF}$$

$$USE \triangle W2 \quad VEA_{allow} = 353\text{PIF}$$

HOLD DOWNS

$$TE = 1,019\# \times 1.25 - 1/2(25\text{PSF} \times 16' \times 10.71') - 1/2(12\text{PSF} \times 4.5' \times 10.71') = -1,157\#$$

SO NO HDL REQ'D



$$(LEVEL 2) \quad FE = 20,207\# \times (21.42' / 109.75') = 3,962\#$$

$$VE = 544\text{PIF}$$

$$USE \triangle W4 \quad VEA_{allow} = 595\text{PIF}$$

HOLD DOWNS

$$TE = 1,665\# \times 1.25 - 1,157\# - 1/2(12\text{PSF} \times 9' \times 10.71') = 346\#$$

$$USE \triangle MST37 \quad W/2 STUFS \quad VEA_{allow} = 2,140\# \times 1.1 / 1.6 = 1,873\#$$

$$(LEVEL 1) \quad FE = 24,207\# \times (21.42' / 109.75') = 4,746\#$$

$$VE = 652\text{PIF}$$

$$USE \triangle W8 \quad VEA_{allow} = 770\text{PIF}$$

HOLD DOWNS

$$TE = 11,779\# \times 1.25 + 346\# - 1/2(25\text{PSF} \times 9' \times 10.71') = 2,260\#$$

$$USE HDU4-SDS25 \quad W/2 STUFS \quad VEA_{allow} = 3,285\# \times 1.1 / 1.6 = 2,874\#$$

GRID J (17' SEGMENT) $h=9'$

(LEVEL 3) $FE = 12,376\# \times (7.58' / 109.25') = 859\#$

$VE = 859\# / 7.58' = 113\text{PIF}$

USE  $VE_{allow} = 242\text{PIF}$

HOLD DOWNS

$TE = 113\text{PIF} \times 9' \times 1.25 - \frac{1}{2} (2513\text{F} \times 17.2' \times 3.79') - \frac{1}{2} (1215\text{F} \times 4.5' \times 3.79') = 354\#$

USE MST37 w/2 STOPS $TE_{allow} = 2,140\# \times 1.4 / 1.6 = 1,873\#$

(LEVEL 2) $FE = 20,207\# \times (7.58' / 109.25') = 1,402\#$

$VE = 1,402\# / 7.58' = 185\text{PIF}$

USE  $VE_{allow} = 242\text{PIF}$

HOLD DOWNS

$TE = 185\text{PIF} \times 9' \times 1.25 + 354\# - \frac{1}{2} (1215\text{F} \times 9' \times 3.79') = 2,230\#$

USE MST48 w/2 STOPS $TE_{allow} = 3,425\# \times 1.4 / 1.6 = 2,997\#$

(LEVEL 1) $FE = 24,207\# \times (7.58' / 109.25') = 1,680\#$

$VE = 1,680\# / 7.58' = 222\text{PIF}$

USE  $VE_{allow} = 242\text{PIF}$

HOLD DOWNS

$TE = 222\# \times 9' \times 1.25 + 2,230\# - \frac{1}{2} (1215\text{F} \times 9' \times 3.79') = 4,518\#$

USE H108-SDS2.5 w/2 STOPS $TE_{allow} = 5,820\# \times 1.4 / 1.6 = 5,093\#$

GRID L (11.4' FTAD)

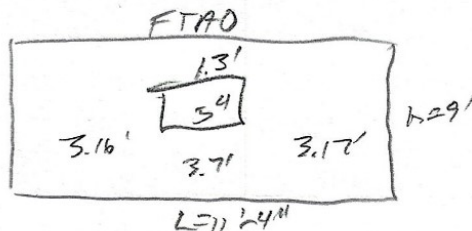
(LEVEL 3) $FE = 12,376^{\#} \times (11.33' / 109.75') = 1,283^{\#}$

$VE = 204 PIF$

USE  $VE_{allow} = 242 PIF$

HOLD DOWNS

$TE = 1,019^{\#} \times 1.25 - \frac{1}{2}(2592^{\#} \times 16.7' \times 5.67') - \frac{1}{2}(1215^{\#} \times 4.5' \times 5.67') = -63^{\#}$
30 NO HD'S REQ'D



(LEVEL 2) $FE = 20,207^{\#} \times (11.33' / 109.75') = 2,096^{\#}$

$VE = 333 PIF$

USE  $VE_{allow} = 353 PIF$

HOLD DOWNS

$TE = 1,665^{\#} \times 1.25 - 63^{\#} - \frac{1}{2}(1215^{\#} \times 9' \times 5.67') = 1,712^{\#}$

USE 11 ST37 W/2 STUDS $TE_{allow} = 2,140^{\#} \times 1.4 / 1.6 = 1,873^{\#}$

(LEVEL 1) $FE = 24,207^{\#} \times (11.33' / 109.75') = 2,510^{\#}$

$VE = 399 PIF$

USE  $VE_{allow} = 456 PIF$

HOLD DOWNS

$TE = 1,194^{\#} \times 1.25 + 1,712^{\#} - \frac{1}{2}(1215^{\#} \times 9' \times 5.67') = 3,898^{\#}$

USE 11 DUG-SDS2.5 W/2 STUDS $TE_{allow} = 5,820^{\#} \times 1.4 / 1.6 = 5,093^{\#}$

GRID L (14'-10" FTAD)

(LEVEL 3) $FE = 12,376 \# \times (14.83' / 109.75') = 1,680 \#$

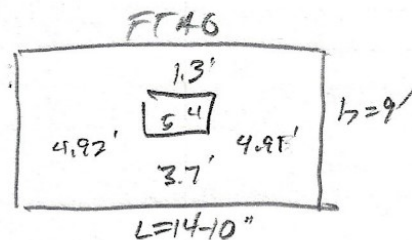
$VE = 204 \text{ PIF}$

USE  $VE_{ALLOW} = 242 \text{ PIF}$

HOLD DOWN

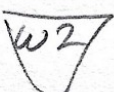
$TE = 1,020 \# \times 1.75 - 1/2 (25 \text{ PSF} \times 16.3' \times 7.42') - 1/2 (12 \text{ PSF} \times 4.5' \times 7.42') = -437 \#$

80 WD HD'S REQ'D



(LEVEL 2) $FE = 20,207 \# \times (14.83' / 109.75') = 2,743 \#$

$VE = 333 \text{ PIF}$

USE  $VE_{ALLOW} = 353 \text{ PIF}$

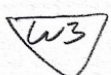
HOLD DOWN

$TE = 1,665 \# \times 1.75 - 437 \# - 1/2 (12 \text{ PSF} \times 9' \times 7.42') = 1,244 \#$

USE MST37 W/2 8 FUDS $TE_{ALLOW} = 2,140 \# \times 1.4 / 1.6 = 1,873 \#$

(LEVEL 1) $FE = 24,207 \# \times (14.83' / 109.75') = 3,286 \#$

$VE = 399 \text{ PIF}$

USE  $VE_{ALLOW} = 456 \text{ PIF}$

HOLD DOWN

$TE = 1,994 \# + 1,244 \# - 1/2 (12 \text{ PSF} \times 9' \times 7.42') = 3,336 \#$

USE H1005-5057.5 W/2 8 FUDS $TE_{ALLOW} = 4,340 \# \times 1.4 / 1.6 = 3,798 \#$

GRID K (13'-4" FTAD)

(LEVEL 3) $FEE = 12,376\# \times (13.33' / 109.25') = 1,510\#$

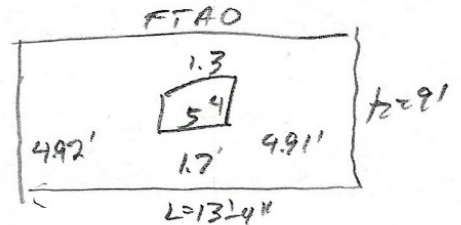
$VE = 183\text{PIF}$

USE  $VE_{ALLOW} = 242\text{PIF}$

HOLD DOWNS

$TE = 916\# \times 1.25 - 1/2(125\text{PIF} \times 6.9' \times 6.67') - 1/2(125\text{PIF} \times 4.5' \times 6.67') = 390\#$

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



(LEVEL 2) $FEE = 20,207\# \times (13.33' / 109.25') = 2,466\#$

$VE = 289\text{PIF}$

USE  $VE_{ALLOW} = 353\text{PIF}$

HOLD DOWNS

$TE = 1,497\# \times 1.25 + 390\# - 1/2(125\text{PIF} \times 9' \times 6.67') = 1,901\#$

USE MST48 w/ 2 STOPS $TE_{ALLOW} = 3,425\# \times 1.4 / 1.6 = 2,997\#$

(LEVEL 1) $FEE = 24,207\# \times (13.33' / 109.25') = 2,954\#$

$VE = 359\text{PIF}$

USE  $VE_{ALLOW} = 456\text{PIF}$

HOLD DOWNS

$TE = 1,793\# \times 1.25 + 1,901\# - 1/2(125\text{PIF} \times 9' \times 6.67') = 3,782\#$

USE HOUS-SDS 2.5 w/ 2 STOPS $TE_{ALLOW} = 4,340\# \times 1.4 / 1.6 = 3,798\#$



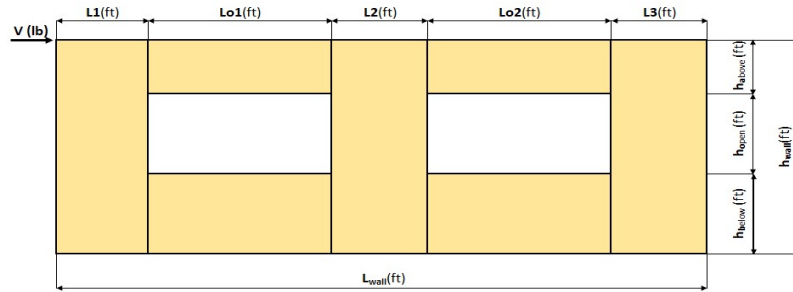
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 1 (21'-10" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	2497 lbf	Opening 1		Opening 2		Adj. Factor Method =		2bs/h
L1	2.00 ft	h _a 1	1.20 ft	h _a 2	1.20 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	4.12 ft	h _o 1	6.00 ft	h _o 2	6.00 ft	P1=h _o /L1=	3.00	0.667
L3	2.80 ft	h _b 1	1.80 ft	h _b 2	1.80 ft	P2=h _o /L2=	1.46	N/A
h _{wall}	9.00 ft	Lo1	6.00 ft	Lo2	7.00 ft	P3=h _o /L3=	2.14	0.933
L _{wall}	21.92 ft							

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1025 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 342 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 342 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2050 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 2392 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 670 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1380 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 1424 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 968 \text{ lbf}$

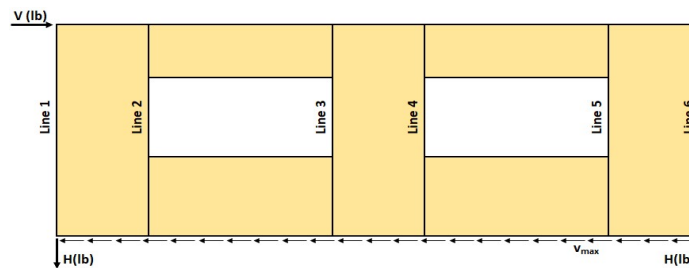
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 1.96 \text{ ft}$
 $T2 = (L2*Lo1)/(L1+L2) = 4.04 \text{ ft}$
 $T3 = (L2*Lo2)/(L2+L3) = 4.17 \text{ ft}$
 $T4 = (L3*Lo2)/(L2+L3) = 2.83 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 226 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 341 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 229 \text{ plf}$
Check $v1*L1+v2*L2+v3*L3=V?$ 2497 lbf OK

7. Resistance to corner forces
 $R1 = v1*L1 = 451 \text{ lbf}$
 $R2 = v2*L2 = 1404 \text{ lbf}$
 $R3 = v3*L3 = 642 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = -219 \text{ lbf}$
 $R2-F2-F3 = -1400 \text{ lbf}$
 $R3-F4 = -326 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = -109 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = -340 \text{ plf}$
 $vc3 = (R3-F4)/L3 = -117 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H?$	-328	1354	1025 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0?$	1025	-328	0
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0?$	-1020	2045	0
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0?$	1025	2045	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0?$	1025	-350	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H?$	-350	1375	1025 lbf

Design Summary*

Req. Sheathing Capacity	342 plf	4-Term Deflection	0.324 in.	3-Term Deflection	0.371 in.
Req. Strap Force	1424 lbf	4-Term Story Drift %	0.012 %	3-Term Story Drift %	0.014 %
Req. HD Force	1025 lbf				
Req. Shear Wall Anchorage Force	114 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 1 (21'-10" Section) - (Level 3 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	2497	(lbf)
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C_d :	4.00
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Total	
Defl.	
0.324	(in.)
0.0120	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
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Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2497	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	4 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	226	226	341	341	229	229	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	7.20	7.20	7.20	7.20	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:	2.00	2.00	4.12	4.12	2.80	2.80	(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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.031	0.092	0.415	0.016	0.074	0.266
Sum		0.538	Sum		0.355
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.012	0.112	0.195	0.012	0.112	0.195
Sum		0.318	Sum		0.318
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.011	0.075	0.193	0.022	0.094	0.301
Sum		0.279	Sum		0.417

Total	
Defl.	(in.)
0.371	
0.0137	%drift

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



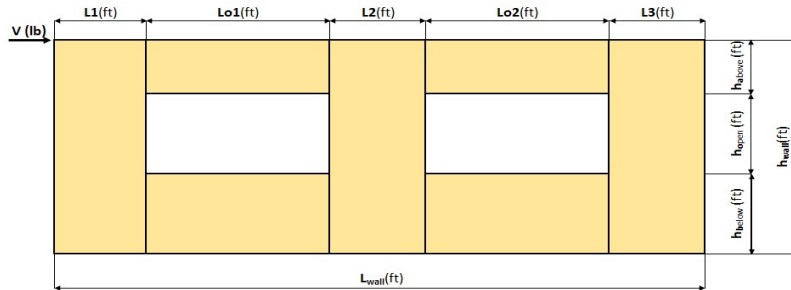
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 1 (21'-10" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	4248 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.00 ft	h _{a1}	h _{a2}	Wall Pier Aspect Ratio	Adj. Factor
L2	4.12 ft	h _{o1}	h _{o2}	P1=h _{o1} /L1=	0.667
L3	2.80 ft	h _{b1}	h _{b2}	P2=h _{o2} /L2=	1.46
h _{wall}	9.00 ft	Lo1	Lo2	P3=h _{o2} /L3=	2.14
L _{wall}	21.92 ft				N/A
					0.933

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1744 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 581 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 581 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 3488 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 4070 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1140 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 2348 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 2423 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 1647 \text{ lbf}$

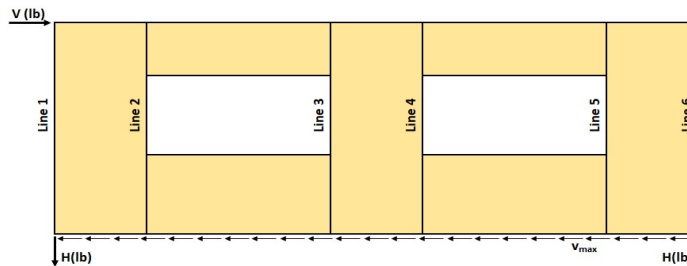
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.96 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 4.04 \text{ ft}$
 $T3 = (L2 \times Lo2)/(L2+L3) = 4.17 \text{ ft}$
 $T4 = (L3 \times Lo2)/(L2+L3) = 2.83 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 384 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 580 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 390 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 + v3 \times L3 = V$ 4248 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 768 \text{ lbf}$
 $R2 = v2 \times L2 = 2389 \text{ lbf}$
 $R3 = v3 \times L3 = 1092 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = -372 \text{ lbf}$
 $R2-F2-F3 = -2382 \text{ lbf}$
 $R3-F4 = -555 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = -186 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = -578 \text{ plf}$
 $vc3 = (R3-F4)/L3 = -198 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H$?	-559	2303	1744 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0$?	1744	-559	2303
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0$?	-1735	3479	1744
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0$?	1744	3479	-1735
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0$?	1744	-595	2339
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H$?	-595	2339	1744 lbf

Design Summary*

Req. Sheathing Capacity	581 plf	4-Term Deflection	0.305 in.	3-Term Deflection	0.326 in.
Req. Strap Force	2423 lbf	4-Term Story Drift %	0.011 %	3-Term Story Drift %	0.012 %
Req. HD Force	1744 lbf				
Req. Shear Wall Anchorage Force	194 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 1 (21'-10" Section) - (Level 2 Seismic)		

Unfactored Shear Load $V_{unfactored}$:	2497	(lbf)
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Unfactored Shear Load $V_{unfactored}$:	2497	(lbf)
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Nail Type: 8d common (penny weight)

Enter individual post sizes below.

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.)

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

[illegible]

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	0.024	0.002	0.415	0.016	0.019	0.001	0.266
Sum			0.472	Sum			0.302
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.012	0.029	0.005	0.195	0.012	0.029	0.005	0.195
Sum			0.241	Sum			0.241
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	0.020	0.001	0.193	0.022	0.025	0.002	0.301
Sum			0.225	Sum			0.350

Total	
Defl.	
0.305	(in.)
0.0113	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 1 (21'-10" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2497	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	2 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	226	226	341	341	229	229	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	7.20	7.20	7.20	7.20	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:	2.00	2.00	4.12	4.12	2.80	2.80	(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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.031	0.048	0.415	0.016	0.039	0.266
Sum		0.494	Sum		0.320
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.012	0.058	0.195	0.012	0.058	0.195
Sum		0.265	Sum		0.265
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.011	0.039	0.193	0.022	0.049	0.301
Sum		0.243	Sum		0.372

Total	
Defl.	(in.)
0.326	
0.0121	%drift

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



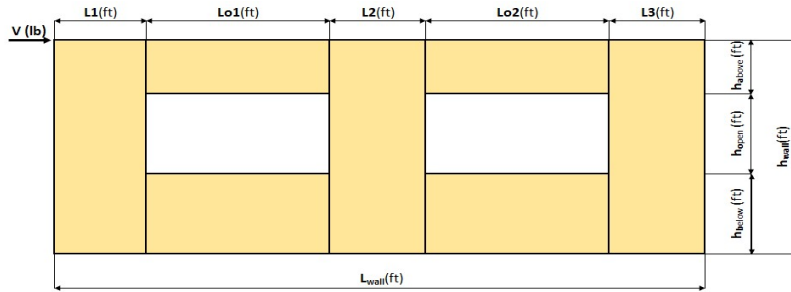
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 1 (21'-10" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	5116 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.00 ft	h _{a1}	h _{a2}	Wall Pier Aspect Ratio	Adj. Factor
L2	4.12 ft	h _{o1}	h _{o2}	P1=h _{o1} /L1=	0.667
L3	2.80 ft	h _{b1}	h _{b2}	P2=h _{o2} /L2=	1.46
h _{wall}	9.00 ft	Lo1	Lo2	P3=h _{o2} /L3=	2.14
L _{wall}	21.92 ft				0.933

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2101 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 700$ plf
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 700$ plf

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 4201$ lbf
Second opening: $O2 = va2 \times (Lo2) = 4901$ lbf

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1373$ lbf
 $F2 = O1(L2)/(L1+L2) = 2828$ lbf
 $F3 = O2(L2)/(L2+L3) = 2918$ lbf
 $F4 = O2(L3)/(L2+L3) = 1983$ lbf

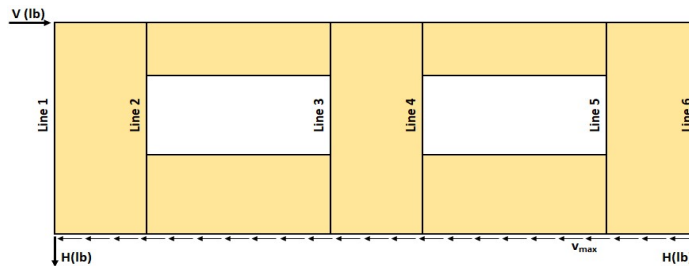
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.96$ ft
 $T2 = (L2 \times Lo1)/(L1+L2) = 4.04$ ft
 $T3 = (L2 \times Lo2)/(L2+L3) = 4.17$ ft
 $T4 = (L3 \times Lo2)/(L2+L3) = 2.83$ ft

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 462$ plf
 $v2 = (V/L)(T2+L2+T3)/L2 = 698$ plf
 $v3 = (V/L)(T4+L3)/L3 = 469$ plf
Check $v1 \times L1 + v2 \times L2 + v3 \times L3 = V$ 5116 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 924$ lbf
 $R2 = v2 \times L2 = 2877$ lbf
 $R3 = v3 \times L3 = 1315$ lbf

8. Difference corner force + resistance
 $R1-F1 = -448$ lbf
 $R2-F2-F3 = -2869$ lbf
 $R3-F4 = -669$ lbf

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = -224$ plf
 $vc2 = (R2-F2-F3)/L2 = -696$ plf
 $vc3 = (R3-F4)/L3 = -239$ plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H$?	-673	2773	2101 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0$?	2101	-673	2773
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0$?	-2089	4190	2101
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0$?	2101	4190	-2089
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0$?	2101	-716	2817
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H$?	-716	2817	2101 lbf

Design Summary*

Req. Sheathing Capacity	700 plf	4-Term Deflection	0.620 in.	3-Term Deflection	0.643 in.
Req. Strap Force	2918 lbf	4-Term Story Drift %	0.023 %	3-Term Story Drift %	0.024 %
Req. HD Force	2101 lbf				
Req. Shear Wall Anchorage Force	233 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 1 (21'-10" Section) - (Level 1 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	5116	(lbf)
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G _t Override:	
G _a Override:	

C_d :	4.00
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Nail Type: 10d common

Sheathing Type: 15/32 OSB APA Rated Sheathing

Total	
Defl.	
0.620	(in.)
0.0230	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 1 (21'-10" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	5116	(lbf)

Sheathing Type: 15/32 OSB		Wood End Post Values:		Nail Type: 10d common (penny weight)	
Grade: APA Rated Sheathing		Species: DF#2			
		E: 1.60E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	2 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	462	462	698	698	469	469	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	7.20	7.20	7.20	7.20	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:	2.00	2.00	4.12	4.12	2.80	2.80	(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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.051	0.080	0.850	0.026	0.064	0.544
Sum		0.981	Sum		0.634
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.019	0.097	0.399	0.019	0.097	0.399
Sum		0.515	Sum		0.515
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.019	0.065	0.395	0.037	0.081	0.617
Sum		0.479	Sum		0.735

Total	
Defl.	(in.)
0.643	
0.0238	%drift

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



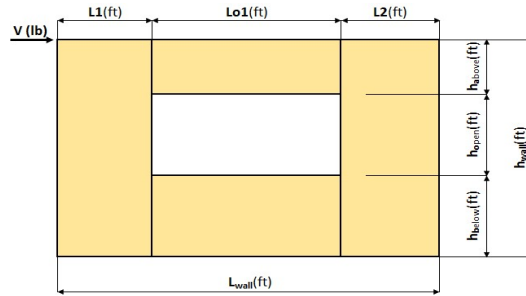
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 2 (12'-6" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1430 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	4.27 ft	h _a	1.33 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	5.73 ft	h _o	3.00 ft	P1=h _a /L1=	0.70	N/A
h _{wall}	9.00 ft	h _b	4.67 ft	P2=h _o /L2=	0.52	N/A
L _{wall}	12.50 ft	Lo1	2.50 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1030 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 172 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 429 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 183 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 246 \text{ lbf}$

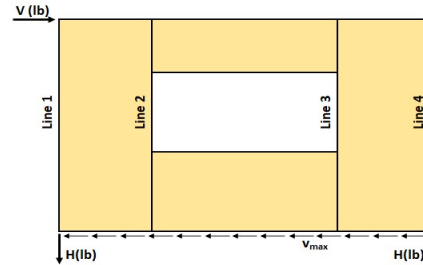
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 1.07 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 1.43 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 143 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 143 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 1430 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 611 \text{ lbf}$
 $R2 = v2 \cdot L2 = 819 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 427 \text{ lbf}$
 $R2 - F2 = 574 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 100 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 100 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		601	429	1030 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1030	601	429	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1030	601	429	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		601	429	1030 lbf

Design Summary*

Req. Sheathing Capacity	172 plf	4-Term Deflection	0.100 in.	3-Term Deflection	0.143 in.
Req. Strap Force	246 lbf	4-Term Story Drift %	0.004 %	3-Term Story Drift %	0.005 %
Req. HD Force (H)	1030 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: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 2 (12'-6" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1430 (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_i Override:

G_a Override:

Enter individual post sizes below.
C_d: 4.00

Nail Spacing: 6
HD Capacity: 2140
HD Deflection: 0.11

Pier 1
6
2140
0.11

Pier 2
6
2140
0.11

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	143	143	143	143	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.33	4.33	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 :	72	72	72	72	(plf)
e_n :	0.0018	0.0018	0.0018	0.0018	(in.)
b:	4.27	4.27	5.73	5.73	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.009	0.015	0.012	0.139	0.001	0.007	0.006	0.032
Sum			0.176	Sum			0.047
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.001	0.007	0.006	0.024	0.007	0.015	0.012	0.104
Sum			0.038	Sum			0.138

Total Defl.	
0.100	(in.)
0.0037	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 2 (12'-6" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		1430	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:		Pier 1	Pier 2
G_a Override:		Nail Spacing:	6 (in.)
		HD Capacity:	2140 (lbf)
		HD Deflection:	0.11 (in.)
		C_d :	4.00

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	143	143	143	143 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	4.33	4.33	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G_a :	15.0	15.0	15.0	15.0 (kips/in.)
b:	4.27	4.27	5.73	5.73 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.009	0.086	0.139	0.001	0.041	0.032
Sum		0.234	Sum		0.075
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.001	0.041	0.024	0.007	0.086	0.104
Sum		0.066	Sum		0.196

Total Defl.	
0.143	(in.)
0.0053	%drift

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



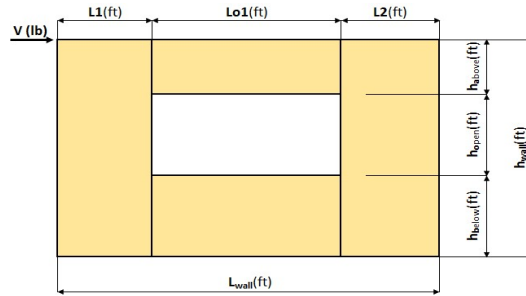
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 2 (12'-6" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2432 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	4.27 ft	h _a	1.33 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	5.73 ft	h _o	3.00 ft	P1=h _o /L1=	0.70	N/A
h _{wall}	9.00 ft	h _b	4.67 ft	P2=h _o /L2=	0.52	N/A
L _{wall}	12.50 ft	Lo1	2.50 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1751 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 292 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 730 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 312 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 418 \text{ lbf}$

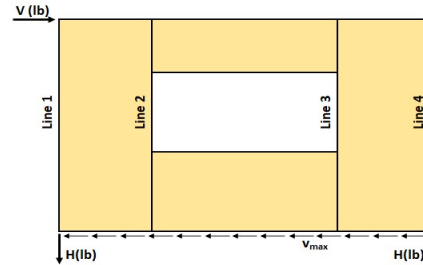
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 1.07 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 1.43 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 243 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 243 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 2432 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 1038 \text{ lbf}$
 $R2 = v2 \cdot L2 = 1394 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 727 \text{ lbf}$
 $R2 - F2 = 975 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 170 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 170 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	1021	730	1751 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1751	1021	730
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1751	1021	730
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	1021	730	1751 lbf

Design Summary*

Req. Sheathing Capacity	292 plf	4-Term Deflection	0.168 in.	3-Term Deflection	0.209 in.
Req. Strap Force	418 lbf	4-Term Story Drift %	0.006 %	3-Term Story Drift %	0.008 %
Req. HD Force (H)	1751 lbf				
Req. Shear Wall Anchorage Force (v_{max})	195 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 2 (12'-6" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2432 (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_i Override:
G_a Override:

Enter individual post sizes below.
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	4	4	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	243	243	243	243	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.33	4.33	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	(in.)
V _n :	81	81	81	81	(plf)
e _n :	0.0026	0.0026	0.0026	0.0026	(in.)
b:	4.27	4.27	5.73	5.73	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.015	0.026	0.018	0.237	0.002	0.013	0.009	0.055
Sum			0.297	Sum			0.078
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.001	0.013	0.009	0.041	0.012	0.026	0.018	0.177
Sum			0.063	Sum			0.232

Total Defl.	
0.168	(in.)
0.0062	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 2 (12'-6" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2432	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _i Override:		C _d : 4.00		Nail Spacing:	Pier 1 4 (in.)
G _a Override:				HD Capacity:	Pier 2 2140 (lbf)
				HD Deflection:	0.11 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	243	243	243	243	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.33	4.33	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G _a :	22.0	22.0	22.0	22.0	(kips/in.)
b:	4.27	4.27	5.73	5.73	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.015	0.099	0.237	0.002	0.048	0.055
Sum		0.352	Sum		0.104
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.001	0.048	0.041	0.012	0.099	0.177
Sum		0.090	Sum		0.288

Total Defl.	
0.209	(in.)
0.0077	%drift

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



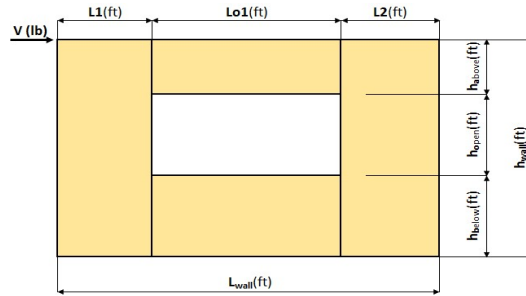
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 2 (12'-6" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	2930 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	4.27 ft	h _a	1.33 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	5.73 ft	h _o	3.00 ft	P1=h _a /L1=	0.70	N/A
h _{wall}	9.00 ft	h _b	4.67 ft	P2=h _o /L2=	0.52	N/A
L _{wall}	12.50 ft	Lo1	2.50 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2110 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 352 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 879 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 375 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 504 \text{ lbf}$

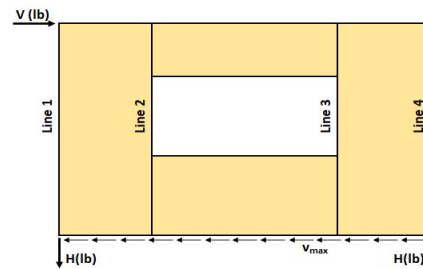
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 1.07 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 1.43 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 293 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 293 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 2930 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 1251 \text{ lbf}$
 $R2 = v2 \cdot L2 = 1679 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 876 \text{ lbf}$
 $R2 - F2 = 1175 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 205 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 205 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		1231	879	2110 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	2110	1231	879	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	2110	1231	879	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		1231	879	2110 lbf

Design Summary*

Req. Sheathing Capacity	352 plf	4-Term Deflection	0.209 in.	3-Term Deflection	0.251 in.
Req. Strap Force	504 lbf	4-Term Story Drift %	0.008 %	3-Term Story Drift %	0.009 %
Req. HD Force (H)	2110 lbf				
Req. Shear Wall Anchorage Force (v_{max})	234 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 2 (12'-6" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2930 (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_i Override:
G_a Override:

Enter individual post sizes below.
C_d: 4.00

Pier 1

Pier 2

Nail Spacing: 4 4 (in.)
HD Capacity: 2140 2140 (lbf)
HD Deflection: 0.11 0.11 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	293	293	293	293	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.33	4.33	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	(in.)
V_n :	98	98	98	98	(plf)
e_n :	0.0046	0.0046	0.0046	0.0046	(in.)
b:	4.27	4.27	5.73	5.73	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.019	0.032	0.031	0.286	0.002	0.015	0.015	0.066
Sum			0.367	Sum			0.098
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.002	0.015	0.015	0.049	0.014	0.032	0.031	0.213
Sum			0.081	Sum			0.290

Total Defl.	
0.209	(in.)
0.0077	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 2 (12'-6" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:			2930	(lbf)
Wood End Post Values:				
Sheathing Type:	7/16 OSB	Species:	HF#2	
Grade:	APA Rated Sheathing	E:	1.30E+06	(psi)
Nail Type:		8d common (penny weight)		
G_i Override:				
G_a Override:		C_d :	4.00	
		Nail Spacing:	Pier 1 4	Pier 2 4 (in.)
		HD Capacity:	2140	2140 (lbf)
		HD Deflection:	0.11	0.11 (in.)

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	293	293	293	293 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	4.33	4.33	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G_a :	22.0	22.0	22.0	22.0 (kips/in.)
b:	4.27	4.27	5.73	5.73 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.019	0.120	0.286	0.002	0.058	0.066
Sum		0.424	Sum		0.126
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.002	0.058	0.049	0.014	0.120	0.213
Sum		0.108	Sum		0.347

Total Defl.
0.251
0.0093

(in.)
%drift

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



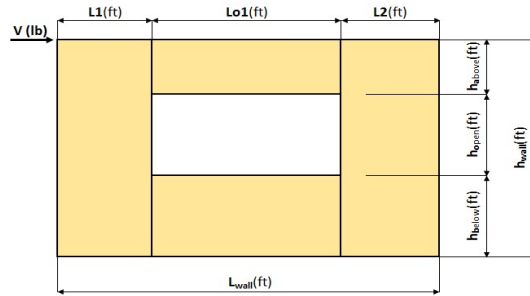
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 1 (18'-9" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	2145 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	10.52 ft	h _a	1.25 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	3.73 ft	h _o	3.50 ft	P1=h _o /L1=	0.33	N/A
h _{wall}	9.00 ft	h _b	4.25 ft	P2=h _o /L2=	0.94	N/A
L _{wall}	18.75 ft	Lo1	4.50 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1030 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 187 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 842 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 622 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 221 \text{ lbf}$

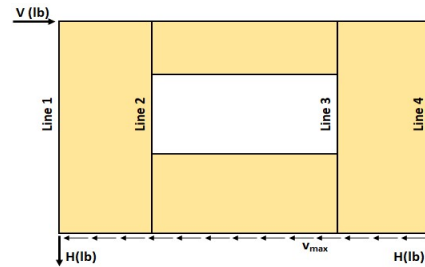
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.32 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 1.18 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 151 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 151 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2145 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1584 \text{ lbf}$
 $R2 = v2 \times L2 = 561 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 962 \text{ lbf}$
 $R2 - F2 = 341 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 91 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 91 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	503	527	1030 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1030	503	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1030	503	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	503	527	1030 lbf

Design Summary*

Req. Sheathing Capacity	187 plf	4-Term Deflection	0.100 in.	3-Term Deflection	0.146 in.
Req. Strap Force	622 lbf	4-Term Story Drift %	0.004 %	3-Term Story Drift %	0.005 %
Req. HD Force (H)	1030 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: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 1 (18'-9" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2145 (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_i Override:
G_a Override:

Enter individual post sizes below.
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	151	151	151	151	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.75	4.75	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	6	6	6	6	(in.)
V_n :	75	75	75	75	(plf)
e_n :	0.0021	0.0021	0.0021	0.0021	(in.)
b:	10.52	10.52	3.73	3.73	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.004	0.016	0.014	0.060	0.001	0.009	0.008	0.017
Sum			0.094	Sum			0.033
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.002	0.009	0.008	0.047	0.011	0.016	0.014	0.168
Sum			0.064	Sum			0.209

Total Defl.	
0.100	(in.)
0.0037	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 1 (18'-9" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2145	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _i Override:					
G _a Override:		C _d : 4.00			
				Pier 1	Pier 2
				Nail Spacing: 6	6 (in.)
				HD Capacity: 2140	2140 (lbf)
				HD Deflection: 0.11	0.11 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	151	151	151	151	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.75	4.75	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:	10.52	10.52	3.73	3.73	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.004	0.090	0.060	0.001	0.048	0.017
Sum		0.154	Sum		0.065
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.002	0.048	0.047	0.011	0.090	0.168
Sum		0.096	Sum		0.269

Total Defl.	
0.146	(in.)
0.0054	%drift

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



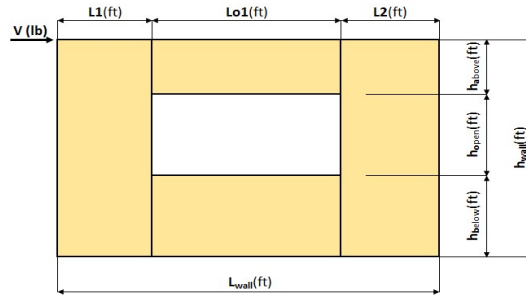
Force Transfer Around Openings Calculator

ONE OPENING

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

Project Information

Code:	2018 IBC	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 1 (18'-9" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	3649 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	10.52 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	3.73 ft	ho	P1=ha/L1=	0.33
hwall	9.00 ft	hb	P2=ho/L2=	0.94
Lwall	18.75 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1752 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) =$ 318 plf

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) =$ 1433 lbf

4. Corner forces
 $F1 = O1(L1)/(L1+L2) =$ 1058 lbf
 $F2 = O1(L2)/(L1+L2) =$ 375 lbf

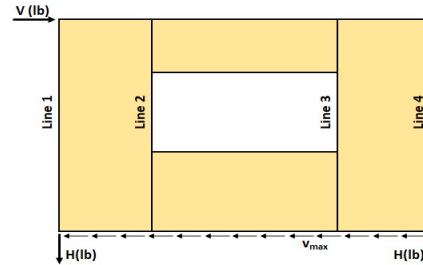
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) =$ 3.32 ft
 $T2 = (L2 \times Lo1)/(L1+L2) =$ 1.18 ft

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 =$ 256 plf
 $v2 = (V/L)(T2+L2)/L2 =$ 256 plf
Check $v1 \times L1 + v2 \times L2 = V?$ 3649 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 =$ 2694 lbf
 $R2 = v2 \times L2 =$ 955 lbf

8. Difference corner force + resistance
 $R1 - F1 =$ 1636 lbf
 $R2 - F2 =$ 580 lbf

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 =$ 156 plf
 $vc2 = (R2 - F2)/L2 =$ 156 plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	855	896	1752 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1752	855	896
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1752	855	896
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	855	896	1752 lbf

Design Summary*

Req. Sheathing Capacity	318 plf	4-Term Deflection	0.168 in.	3-Term Deflection	0.211 in.
Req. Strap Force	1058 lbf	4-Term Story Drift %	0.006 %	3-Term Story Drift %	0.008 %
Req. HD Force (H)	1752 lbf				
Req. Shear Wall Anchorage Force (v_{max})	195 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 1 (18'-9" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:			3649	(lbf)
Sheathing Type:			7/16 OSB	
Grade:			APA Rated Sheathing	
G _i 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)
Nail Spacing:				
			Pier 1	Pier 2
			4	4
			(in.)	
HD Capacity:			2140	2140
			(lbf)	
HD Deflection:			0.11	0.11
			(in.)	

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	256	256	256	256	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.75	4.75	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	(in.)
V_n :	85	85	85	85	(plf)
e_n :	0.0031	0.0031	0.0031	0.0031	(in.)
b:	10.52	10.52	3.73	3.73	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.007	0.028	0.021	0.101	0.001	0.015	0.011	0.028
Sum			0.156	Sum			0.055
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.003	0.015	0.011	0.080	0.019	0.028	0.021	0.286
Sum			0.108	Sum			0.353

Total	
Defl.	
0.168	(in.)
0.0062	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 1 (18'-9" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	3649	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G_i Override:		C_d : 4.00		Nail Spacing:	Pier 1 4 (in.)
G_a Override:				HD Capacity:	Pier 2 2140 (lbf)
				HD Deflection:	0.11 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	256	256	256	256	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.75	4.75	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G_a :	22.0	22.0	22.0	22.0	(kips/in.)
b:	10.52	10.52	3.73	3.73	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.007	0.105	0.101	0.001	0.055	0.028
Sum		0.213	Sum		0.084
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.055	0.080	0.019	0.105	0.286
Sum		0.138	Sum		0.409

Total Defl.	
0.211	(in.)
0.0078	%drift

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



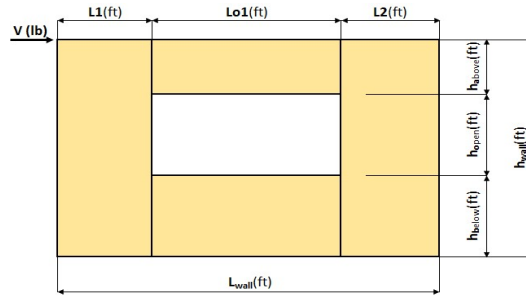
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 1 (18'-9" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	4395 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	10.52 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	3.73 ft	ho	P1=ho/L1=	0.33
hwall	9.00 ft	hb	P2=ho/L2=	0.94
Lwall	18.75 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2110 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 384 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1726 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1274 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 452 \text{ lbf}$

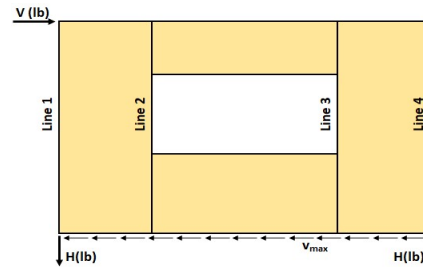
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.32 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 1.18 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 308 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 308 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 4395 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 3245 \text{ lbf}$
 $R2 = v2 \times L2 = 1150 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 1970 \text{ lbf}$
 $R2 - F2 = 699 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 187 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 187 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	1030	1079	2110 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	2110	1030	1079
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	2110	1030	1079
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	1030	1079	2110 lbf

Design Summary*

Req. Sheathing Capacity	384 plf	4-Term Deflection	0.195 in.	3-Term Deflection	0.234 in.
Req. Strap Force	1274 lbf	4-Term Story Drift %	0.007 %	3-Term Story Drift %	0.009 %
Req. HD Force (H)	2110 lbf				
Req. Shear Wall Anchorage Force (v_{max})	234 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 1 (18'-9" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 4395 (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_i Override:

G_a Override:

Enter individual post sizes below.

C_d: 4.00

Pier 1

Pier 2

Nail Spacing: 3 (in.)

HD Capacity: 2140 (lbf)

HD Deflection: 0.11 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	308	308	308	308	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.75	4.75	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 :	77	77	77	77	(plf)
e_n :	0.0023	0.0023	0.0023	0.0023	(in.)
b:	10.52	10.52	3.73	3.73	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.008	0.033	0.015	0.122	0.001	0.018	0.008	0.034
Sum			0.179	Sum			0.061
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.003	0.018	0.008	0.096	0.022	0.033	0.015	0.344
Sum			0.125	Sum			0.415

Total Defl.	
0.195	(in.)
0.0072	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 1 (18'-9" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		4395	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:		Pier 1	Pier 2
G_a Override:		Nail Spacing:	3 3 (in.)
		HD Capacity:	2140 2140 (lbf)
		HD Deflection:	0.11 0.11 (in.)
		C_d :	4.00

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	308	308	308	308 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	4.75	4.75	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:	10.52	10.52	3.73	3.73 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.008	0.099	0.122	0.001	0.052	0.034
Sum		0.229	Sum		0.087
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.052	0.096	0.022	0.099	0.344
Sum		0.152	Sum		0.466

Total Defl.	
0.234	(in.)
0.0086	%drift

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



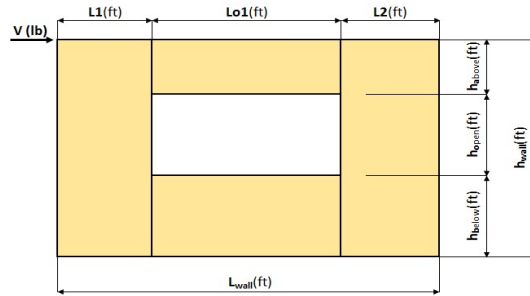
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 2 (10'-7" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1210 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	2.54 ft	h _a	1.25 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	2.04 ft	h _o	4.00 ft	P1=h _a /L1=	1.57	N/A
h _{wall}	9.00 ft	h _b	3.75 ft	P2=h _o /L2=	1.96	N/A
L _{wall}	10.58 ft	Lo1	6.00 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1029 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 206 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1235 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 685 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 550 \text{ lbf}$

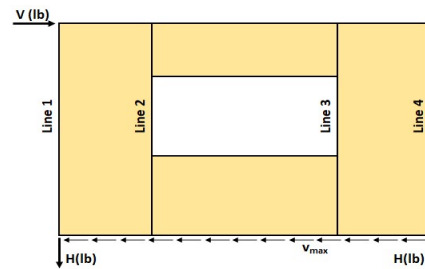
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 3.33 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 2.67 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 264 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 264 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 1210 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 671 \text{ lbf}$
 $R2 = v2 \cdot L2 = 539 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = -14 \text{ lbf}$
 $R2 - F2 = -11 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = -5 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = -5 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	-27	1057	1029 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1029	-27	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1029	-27	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	-27	1057	1029 lbf

Design Summary*

Req. Sheathing Capacity	264 plf	4-Term Deflection	0.385 in.	3-Term Deflection	0.430 in.
Req. Strap Force	685 lbf	4-Term Story Drift %	0.014 %	3-Term Story Drift %	0.016 %
Req. HD Force (H)	1029 lbf				
Req. Shear Wall Anchorage Force (v_{max})	114 plf				

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

Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 2 (10'-7" Section) - (Level 3 Seismic)	

Unfactored Shear Load $V_{\text{unfactored}}$:	1210	(lbf)
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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	
V _{unfactored} :	264	264	264	264	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G _i :	83,500	83,500	83,500	83,500	(lb/ft.in.)
Nail Spacing:	4	4	4	4	(in.)
V _n :	88	88	88	88	(plf)
e _n :	0.0034	0.0034	0.0034	0.0034	(in.)
b:	2.54	2.54	2.04	2.04	(ft)
HD Capacity:	2140	2140	2140	2140	(lb/ft)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.028	0.028	0.023	0.433	0.006	0.017	0.013	0.147
Sum			0.513	Sum			0.183
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	0.017	0.013	0.183	0.035	0.028	0.023	0.539
Sum			0.220	Sum			0.626

Total	
Defl.	
0.385	(in.)
0.0143	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 2 (10'-7" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	1210	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G_i Override:		C_d :	4.00	Nail Spacing:	Pier 1 4 (in.)
G_a Override:				HD Capacity:	Pier 2 2140 (lbf)
				HD Deflection:	0.11 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	264	264	264	264	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G_a :	22.0	22.0	22.0	22.0	(kips/in.)
b:	2.54	2.54	2.04	2.04	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.028	0.108	0.433	0.006	0.063	0.147
Sum		0.569	Sum		0.216
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.007	0.063	0.183	0.035	0.108	0.539
Sum		0.254	Sum		0.682

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.



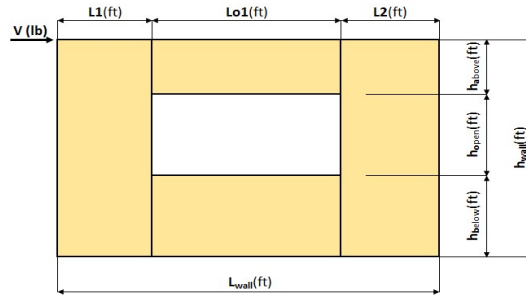
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 2 (10'-7" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2059 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	2.54 ft	h _a	1.25 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	2.04 ft	h _o	4.00 ft	P1=h _o /L1=	1.57	N/A
h _{wall}	9.00 ft	h _b	3.75 ft	P2=h _o /L2=	1.96	N/A
L _{wall}	10.58 ft	Lo1	6.00 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1752 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 350 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2102 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1166 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 936 \text{ lbf}$

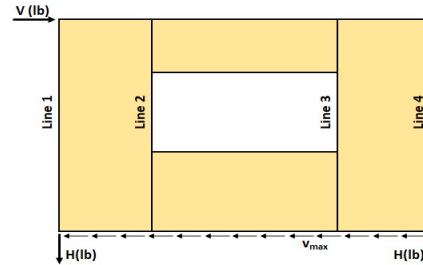
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.33 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.67 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 450 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 450 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2059 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1142 \text{ lbf}$
 $R2 = v2 \times L2 = 917 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = -24 \text{ lbf}$
 $R2 - F2 = -19 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = -9 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = -9 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		-47	1798	1752 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1752	-47	1798	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1752	-47	1798	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		-47	1798	1752 lbf

Design Summary*

Req. Sheathing Capacity	450 plf	4-Term Deflection	0.663 in.	3-Term Deflection	0.701 in.
Req. Strap Force	1166 lbf	4-Term Story Drift %	0.025 %	3-Term Story Drift %	0.026 %
Req. HD Force (H)	1752 lbf				
Req. Shear Wall Anchorage Force (v_{max})	195 plf				

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

Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 2 (10'-7" Section) - (Level 2 Seismic)	

Unfactored Shear Load $V_{unfactored}$:	2059	(lbf)
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Sheathing Type:	7/16 OSB	Wood End Post Values:		Nail Type:	8d common	(penny weight)
Grade:	APA Rated Sheathing	Species:	HF#2			
		E:	1.30E+06	(psi)		
G _r Override:		Enter individual post sizes below.		Pier 1	Pier 2	
G _s Override:		C _d :	4.00	Nail Spacing:	3	3 (in.)
				HD Capacity:	2140	2140 (lbf)
				HD Deflection:	0.11	0.11 (in.)

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
V _{unfactored} :	450	450	450	450	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G _i :	83,500	83,500	83,500	83,500	(lb/ft.in.)
Nail Spacing:	3	3	3	3	(in.)
V _n :	112	112	112	112	(plf)
e _n :	0.0071	0.0071	0.0071	0.0071	(in.)
b:	2.54	2.54	2.04	2.04	(ft)
HD Capacity:	2140	2140	2140	2140	(lb/ft)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.048	0.048	0.048	0.737	0.010	0.028	0.028	0.251
Sum			0.881	Sum			0.316
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.012	0.028	0.028	0.312	0.060	0.048	0.048	0.918
Sum			0.380	Sum			1.074

Total	
Defl.	
0.663	(in.)
0.0246	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 2 (10'-7" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2059	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common	(penny weight)
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G_i Override:					
G_a Override:		C_d : 4.00			
				Pier 1	Pier 2
				Nail Spacing: 3	3 (in.)
				HD Capacity: 2140	2140 (lbf)
				HD Deflection: 0.11	0.11 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	450	450	450	450	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.25	5.25	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G_a :	28.0	28.0	28.0	28.0	(kips/in.)
b:	2.54	2.54	2.04	2.04	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.048	0.145	0.737	0.010	0.084	0.251
Sum		0.930	Sum		0.345
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.012	0.084	0.312	0.060	0.145	0.918
Sum		0.408	Sum		1.122

Total Defl.	
0.701	(in.)
0.0260	%drift

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



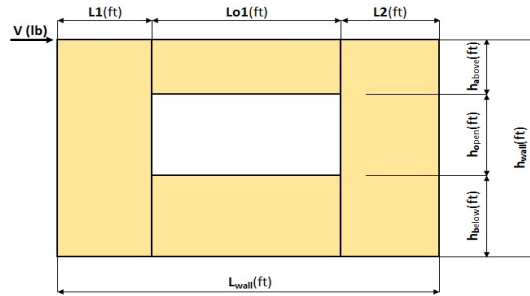
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 2 (10'-7" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	2480 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	2.54 ft	h _a	1.25 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	2.04 ft	h _o	4.00 ft	P1=h _a /L1=	1.57	N/A
h _{wall}	9.00 ft	h _b	3.75 ft	P2=h _o /L2=	1.96	N/A
L _{wall}	10.58 ft	Lo1	6.00 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2110 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 422 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2532 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1404 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1128 \text{ lbf}$

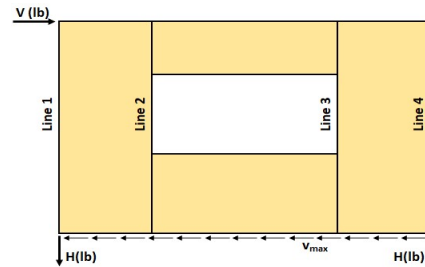
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.33 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.67 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 541 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 541 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2480 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1375 \text{ lbf}$
 $R2 = v2 \times L2 = 1105 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = -29 \text{ lbf}$
 $R2 - F2 = -23 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = -11 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = -11 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	-56	2166	2110 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	2110	-56	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	2110	-56	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	-56	2166	2110 lbf

Design Summary*

Req. Sheathing Capacity	541 plf	4-Term Deflection	0.772 in.	3-Term Deflection	0.799 in.
Req. Strap Force	1404 lbf	4-Term Story Drift %	0.029 %	3-Term Story Drift %	0.030 %
Req. HD Force (H)	2110 lbf				
Req. Shear Wall Anchorage Force (v_{max})	234 plf				

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

Code:	2018 IBC	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 2 (10'-7" Section) - (Level 1 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	2480	(lbf)
---	------	-------

Sheathing Type:	7/16 OSB	Wood End Post Values:		Nail Type:	8d common	(penny weight)
Grade:	APA Rated Sheathing	Species:	HF#2			
		E:	1.30E+06	(psi)		
G _x Override:		Enter individual post sizes below.		Pier 1	Pier 2	
G _y Override:		C _d :	4.00	Nail Spacing:	2	2 (in.)
				HD Capacity:	2140	2140 (lbf)
				HD Deflection:	0.11	0.11 (in.)

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R		Sheathing Type: 7/16 OSB APA Rated Sheathing
V _{unfactored} :	541	541	541	541	(plf)	Nail Type: 8d common
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)	
h:	9.00	5.25	5.25	9.00	(ft)	
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00		
Stud Size:	2x6	2x6	2x6	2x6		
A Override:					(in. ²)	
A:	16.5	16.5	16.5	16.5	(in. ²)	
G _i :	83,500	83,500	83,500	83,500	(lbf/in.)	
Nail Spacing:	2	2	2	2	(in.)	
V _n :	90	90	90	90	(plf)	
e _n :	0.0036	0.0036	0.0036	0.0036	(in.)	
b:	2.54	2.54	2.04	2.04	(ft)	
HD Capacity:	2140	2140	2140	2140	(lbf)	
HD Defl:	0.11	0.11	0.11	0.11	(in.)	

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
0.058	0.058	0.025	0.888	0.012	0.034	0.014	0.302
Sum			1.029	Sum			0.362
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.014	0.034	0.014	0.376	0.072	0.058	0.025	1.105
Sum			0.439	Sum			1.260

Total	
Defl.	
0.772	(in.)
0.0286	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 2 (10'-7" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2480	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G _i Override:			
G _a Override:			
C _d :		4.00	
		Pier 1	Pier 2
Nail Spacing:		2	2 (in.)
HD Capacity:		2140	2140 (lbf)
HD Deflection:		0.11	0.11 (in.)

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	541	541	541	541 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	5.25	5.25	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G _a :	42.0	42.0	42.0	42.0 (kips/in.)
b:	2.54	2.54	2.04	2.04 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.058	0.116	0.888	0.012	0.068	0.302
Sum		1.062	Sum		0.381
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.014	0.068	0.376	0.072	0.116	1.105
Sum		0.458	Sum		1.293

Total Defl.

0.799 (in.)

0.0296 %drift

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



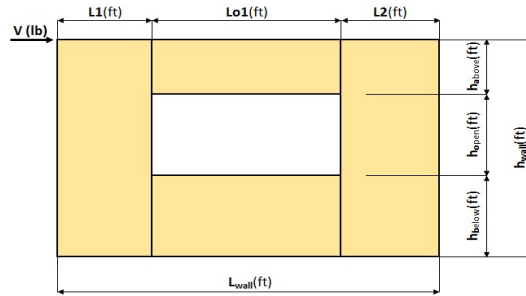
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (11'-9" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1384 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	2.88 ft	h _a	1.40 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	2.87 ft	h _o	6.00 ft	P1=h _a /L1=	2.08	0.960
h _{wall}	9.00 ft	h _b	1.60 ft	P2=h _o /L2=	2.09	0.957
L _{wall}	11.75 ft	Lo1	6.00 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1060 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 353 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2120 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1062 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1058 \text{ lbf}$

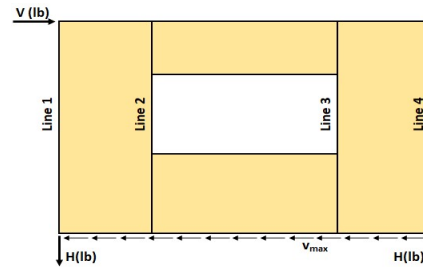
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 3.01 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 2.99 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 241 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 241 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 1384 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 693 \text{ lbf}$
 $R2 = v2 \cdot L2 = 691 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = -369 \text{ lbf}$
 $R2 - F2 = -367 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = -128 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = -128 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		-384	1444	1060 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1060	-384	1444	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1060	-384	1444	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		-384	1444	1060 lbf

Design Summary*

Req. Sheathing Capacity	353 plf	4-Term Deflection	0.340 in.	3-Term Deflection	0.380 in.
Req. Strap Force	1062 lbf	4-Term Story Drift %	0.013 %	3-Term Story Drift %	0.014 %
Req. HD Force (H)	1060 lbf				
Req. Shear Wall Anchorage Force (v_{max})	118 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (11'-9" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1384 (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_i Override:
G_a Override:

Enter individual post sizes below.
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	3	3	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	241	241	241	241	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	7.40	7.40	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 :	60	60	60	60	(plf)
e_n :	0.0011	0.0011	0.0011	0.0011	(in.)
b:	2.88	2.88	2.87	2.87	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.023	0.026	0.007	0.348	0.013	0.021	0.006	0.235
Sum			0.404	Sum			0.275
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.013	0.021	0.006	0.236	0.023	0.026	0.007	0.349
Sum			0.276	Sum			0.405

Total Defl.	
0.340	(in.)
0.0126	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (11'-9" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		1384	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:		Pier 1	Pier 2
G_a Override:		Nail Spacing:	3 3 (in.)
		HD Capacity:	2140 2140 (lbf)
		HD Deflection:	0.11 0.11 (in.)
		C_d :	4.00

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	241	241	241	241 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	7.40	7.40	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:	2.88	2.88	2.87	2.87 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.023	0.077	0.348	0.013	0.064	0.235
Sum		0.448	Sum		0.311
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.013	0.064	0.236	0.023	0.077	0.349
Sum		0.312	Sum		0.449

Total Defl.	
0.380	(in.)
0.0141	%drift

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



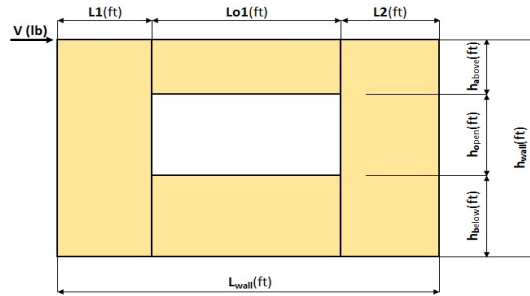
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (11'-9" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2365 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	2.88 ft	h _a	1.40 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	2.87 ft	h _o	6.00 ft	P1=h _a /L1=	2.08	0.960
h _{wall}	9.00 ft	h _b	1.60 ft	P2=h _o /L2=	2.09	0.957
L _{wall}	11.75 ft	Lo1	6.00 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1811 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 604 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 3623 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1815 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1808 \text{ lbf}$

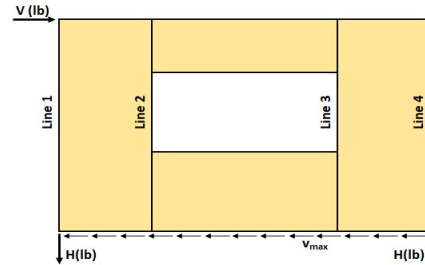
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 3.01 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 2.99 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 411 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 411 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 2365 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 1185 \text{ lbf}$
 $R2 = v2 \cdot L2 = 1180 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = -630 \text{ lbf}$
 $R2 - F2 = -628 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = -219 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = -219 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		-656	2468	1811 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1811	-656	2468	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1811	-656	2468	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		-656	2468	1811 lbf

Design Summary*

Req. Sheathing Capacity	604 plf	4-Term Deflection	0.567 in.	3-Term Deflection	0.589 in.
Req. Strap Force	1815 lbf	4-Term Story Drift %	0.021 %	3-Term Story Drift %	0.022 %
Req. HD Force (H)	1811 lbf				
Req. Shear Wall Anchorage Force (v_{max})	201 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (11'-9" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:			2365	(lbf)
Wood End Post Values:				
Sheathing Type:	15/32 OSB	Species:	DF#2	
Grade:	APA Rated Sheathing	E:	1.60E+06	(psi)
Enter individual post sizes below.				
G_i Override:		C_d :	4.00	
G_a Override:		Nail Type: 10d common (penny weight)		
		Nail Spacing:	Pier 1: 2	Pier 2: 2 (in.)
		HD Capacity:	2140	2140 (lbf)
		HD Deflection:	0.11	0.11 (in.)

Four-Term Equation Deflection Check

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

Sheathing Type: 15/32 OSB APA Rated Sheathing				
Nail Type: 10d common				
$V_{unfactored}$:	Pier 1-L: 411	Pier 1-R: 411	Pier 2-L: 411	Pier 2-R: 411 (plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06 (psi)
h:	9.00	7.40	7.40	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_i :	83,500	83,500	83,500	83,500 (lbf/in.)
Nail Spacing:	2	2	2	2 (in.)
V_n :	69	69	69	69 (plf)
e_n :	0.0004	0.0004	0.0004	0.0004 (in.)
b:	2.88	2.88	2.87	2.87 (ft)
HD Capacity:	2140	2140	2140	2140 (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
0.032	0.044	0.003	0.595	0.018	0.036	0.002	0.402
Sum			0.673	Sum			0.458
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
0.018	0.036	0.002	0.403	0.032	0.044	0.003	0.597
Sum			0.460	Sum			0.676

Total Defl.	
0.567	(in.)
0.0210	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (11'-9" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2365	(lbf)
Wood End Post Values:			
Sheathing Type:	15/32 OSB	Species:	DF#2
Grade:	APA Rated Sheathing	E:	1.60E+06 (psi)
Nail Type:		10d common (penny weight)	
G _i Override:			
G _a Override:			
C _d :		4.00	
		Pier 1	Pier 2
Nail Spacing:		2	2 (in.)
HD Capacity:		2140	2140 (lbf)
HD Deflection:		0.11	0.11 (in.)

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	411	411	411	411 (plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06 (psi)
h:	9.00	7.40	7.40	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G _a :	52.0	52.0	52.0	52.0 (kips/in.)
b:	2.88	2.88	2.87	2.87 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

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

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.032	0.071	0.595	0.018	0.059	0.402
Sum		0.697	Sum		0.478
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.018	0.059	0.403	0.032	0.071	0.597
Sum		0.480	Sum		0.700

Total Defl.	
0.589	(in.)
0.0218	%drift

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



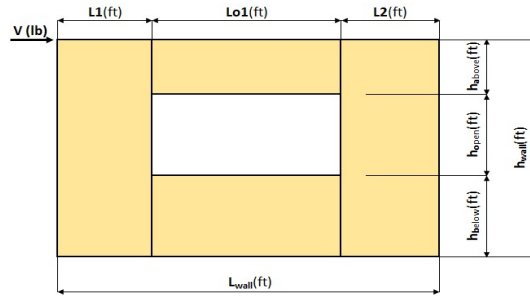
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (11'-9" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	2852 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	2.88 ft	h _a	1.40 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	2.87 ft	h _o	6.00 ft	P1=h _a /L1=	2.08	0.960
h _{wall}	9.00 ft	h _b	1.60 ft	P2=h _o /L2=	2.09	0.957
L _{wall}	11.75 ft	Lo1	6.00 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2185 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 728 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 4369 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 2188 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 2181 \text{ lbf}$

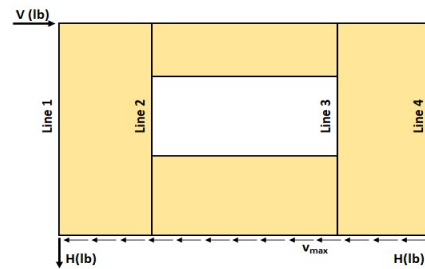
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.01 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.99 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 496 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 496 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2852 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1428 \text{ lbf}$
 $R2 = v2 \times L2 = 1424 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = -760 \text{ lbf}$
 $R2 - F2 = -757 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = -264 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = -264 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		-791	2976	2185 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	2185	-791	2976	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	2185	-791	2976	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		-791	2976	2185 lbf

Design Summary*

Req. Sheathing Capacity	728 plf	4-Term Deflection	0.685 in.	3-Term Deflection	0.710 in.
Req. Strap Force	2188 lbf	4-Term Story Drift %	0.025 %	3-Term Story Drift %	0.026 %
Req. HD Force (H)	2185 lbf				
Req. Shear Wall Anchorage Force (v_{max})	243 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (11'-9" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:			2852	(lbf)
Wood End Post Values:				
Sheathing Type:		15/32 OSB	Species:	DF#2
Grade:		APA Rated Sheathing	E:	1.60E+06 (psi)
Enter individual post sizes below.				
G_i Override:				
G_a Override:				
		C_d :	4.00	
Nail Type:			10d common	(penny weight)
Nail Spacing:			Pier 1: 2	Pier 2: 2 (in.)
HD Capacity:			2140	2140 (lbf)
HD Deflection:			0.11	0.11 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	496	496	496	496	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	7.40	7.40	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_i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	(in.)
V_n :	83	83	83	83	(plf)
e_n :	0.0008	0.0008	0.0008	0.0008	(in.)
b:	2.88	2.88	2.87	2.87	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.038	0.053	0.005	0.717	0.021	0.044	0.004	0.485
Sum			0.814	Sum			0.554
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.021	0.044	0.004	0.486	0.038	0.053	0.005	0.720
Sum			0.556	Sum			0.817

Total Defl.	
0.685	(in.)
0.0254	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (11'-9" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2852	(lbf)

Sheathing Type: 15/32 OSB		Wood End Post Values:		Nail Type: 10d common (penny weight)	
Grade: APA Rated Sheathing		Species: DF#2			
		E: 1.60E+06	(psi)		
G_i Override:					
G_a Override:		C_d : 4.00			
				Pier 1	Pier 2
				Nail Spacing: 2	2 (in.)
				HD Capacity: 2140	2140 (lbf)
				HD Deflection: 0.11	0.11 (in.)

Three-Term Equation Deflection Check				
$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	496	496	496	496 (plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06 (psi)
h:	9.00	7.40	7.40	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G_a :	52.0	52.0	52.0	52.0 (kips/in.)
b:	2.88	2.88	2.87	2.87 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 15/32 OSB APA Rated Sheathing				
Nail Type: 10d common				

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.038	0.086	0.717	0.021	0.071	0.485
Sum		0.841	Sum		0.576
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.021	0.071	0.486	0.038	0.086	0.720
Sum		0.578	Sum		0.844

Total Defl.	
0.710	(in.)
0.0263	%drift

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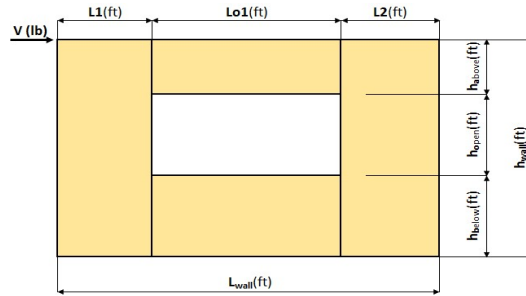
Force Transfer Around Openings Calculator

ONE OPENING

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

Project Information

Code:	2018 IBC	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (11'-7" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1364 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	4.84 ft	h _a	1.85 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	4.24 ft	h _o	3.00 ft	P1=h _o /L1=	0.62	N/A
h _{wall}	9.00 ft	h _b	4.15 ft	P2=h _o /L2=	0.71	N/A
L _{wall}	11.58 ft	Lo1	2.50 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1060 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 177 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 442 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 235 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 206 \text{ lbf}$

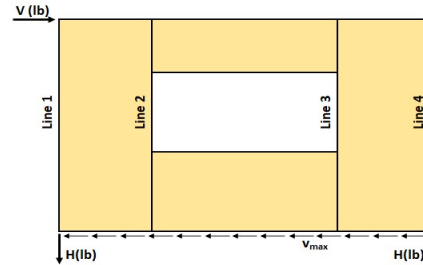
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.33 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 1.17 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 150 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 150 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 1364 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 727 \text{ lbf}$
 $R2 = v2 \times L2 = 637 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 492 \text{ lbf}$
 $R2 - F2 = 431 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 102 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 102 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		609	451	1060 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1060	609	451	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1060	609	451	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		609	451	1060 lbf

Design Summary*

Req. Sheathing Capacity	177 plf	4-Term Deflection	0.118 in.	3-Term Deflection	0.164 in.
Req. Strap Force	235 lbf	4-Term Story Drift %	0.004 %	3-Term Story Drift %	0.006 %
Req. HD Force (H)	1060 lbf				
Req. Shear Wall Anchorage Force (v_{max})	118 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (11'-7" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		1364		(lbf)	
Wood End Post Values:					
Species:		HF#2			
E:		1.30E+06 (psi)			
Enter individual post sizes below.					
G _i Override:					
G _a Override:					
C _d :		4.00			
Nail Type:		8d common (penny weight)			
Sheathing Type:		7/16 OSB			
Grade:		APA Rated Sheathing			
Nail Spacing:		Pier 1	Pier 2	(in.)	
HD Capacity:		6	6	(lbf)	
HD Deflection:		2140	2140	(in.)	
		0.11	0.11	(in.)	

Four-Term Equation Deflection Check

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

Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				
$V_{unfactored}$:	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
E:	150	150	150	150
h:	1.30E+06	1.30E+06	1.30E+06	1.30E+06
Qty:	9.00	4.85	4.85	9.00
Stud Size:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
A Override:	2x6	2x6	2x6	2x6
A:				
G _i :				
Nail Spacing:	16.5	16.5	16.5	16.5
V _n :	83,500	83,500	83,500	83,500
e _n :	6	6	6	6
b:	75	75	75	75
HD Capacity:	0.0021	0.0021	0.0021	0.0021
HD Defl:	4.84	4.84	4.24	4.24
	2140	2140	2140	2140
	0.11	0.11	0.11	0.11

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.008	0.016	0.014	0.129	0.001	0.009	0.008	0.038
Sum			0.168	Sum			0.055
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.002	0.009	0.008	0.043	0.010	0.016	0.014	0.148
Sum			0.061	Sum			0.187

Total	
Defl.	
0.118	(in.)
0.0044	%drift

Code:	2018 IBC	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (11'-7" Section) - (Level 3 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	1364	(lbf)
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Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
V _{unfactored} :	150	150	150	150	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.85	4.85	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G _a :	15.0	15.0	15.0	15.0	(kips/in.)
b:	4.84	4.84	4.24	4.24	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.008	0.090	0.129	0.001	0.049	0.038
Sum		0.228	Sum		0.087
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.002	0.049	0.043	0.010	0.090	0.148
Sum		0.093	Sum		0.247

Total	
Defl.	
0.164	(in.)
0.0061	%drift

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



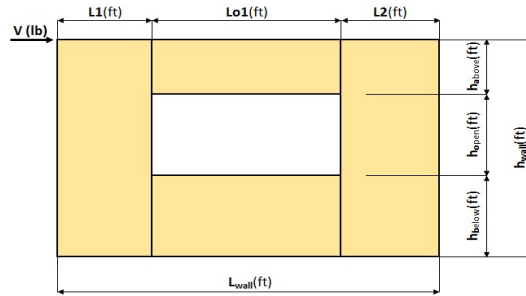
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (11'-7" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2331 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	4.84 ft	h _a	1.85 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	4.24 ft	h _o	3.00 ft	P1=h _a /L1=	0.62	N/A
h _{wall}	9.00 ft	h _b	4.15 ft	P2=h _o /L2=	0.71	N/A
L _{wall}	11.58 ft	Lo1	2.50 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1812 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 302 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 755 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 402 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 352 \text{ lbf}$

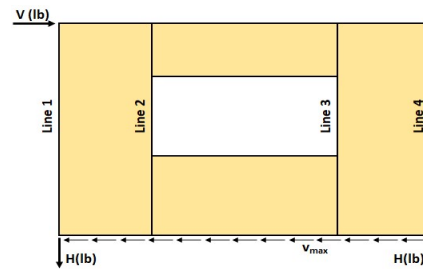
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.33 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 1.17 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 257 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 257 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2331 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1243 \text{ lbf}$
 $R2 = v2 \times L2 = 1088 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 840 \text{ lbf}$
 $R2 - F2 = 736 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 174 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 174 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		1042	770	1812 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1812	1042	770	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1812	1042	770	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		1042	770	1812 lbf

Design Summary*

Req. Sheathing Capacity	302 plf	4-Term Deflection	0.199 in.	3-Term Deflection	0.242 in.
Req. Strap Force	402 lbf	4-Term Story Drift %	0.007 %	3-Term Story Drift %	0.009 %
Req. HD Force (H)	1812 lbf				
Req. Shear Wall Anchorage Force (v_{max})	201 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (11'-7" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2331 (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_i Override:
G_a Override:

Enter individual post sizes below.
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	4	4	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	257	257	257	257	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.85	4.85	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	(in.)
V_n :	86	86	86	86	(plf)
e_n :	0.0031	0.0031	0.0031	0.0031	(in.)
b:	4.84	4.84	4.24	4.24	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.014	0.028	0.021	0.221	0.002	0.015	0.011	0.064
Sum			0.284	Sum			0.093
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.003	0.015	0.011	0.073	0.016	0.028	0.021	0.252
Sum			0.102	Sum			0.317

Total Defl.	
0.199	(in.)
0.0074	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (11'-7" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2331	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G _i Override:			
G _a Override:			
C _d :		4.00	
		Pier 1	Pier 2
Nail Spacing:		4	4 (in.)
HD Capacity:		2140	2140 (lbf)
HD Deflection:		0.11	0.11 (in.)

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	257	257	257	257 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	4.85	4.85	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G _a :	22.0	22.0	22.0	22.0 (kips/in.)
b:	4.84	4.84	4.24	4.24 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

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

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.014	0.105	0.221	0.002	0.057	0.064
Sum		0.340	Sum		0.123
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.057	0.073	0.016	0.105	0.252
Sum		0.132	Sum		0.374

Total Defl.	
0.242	(in.)
0.0090	%drift

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



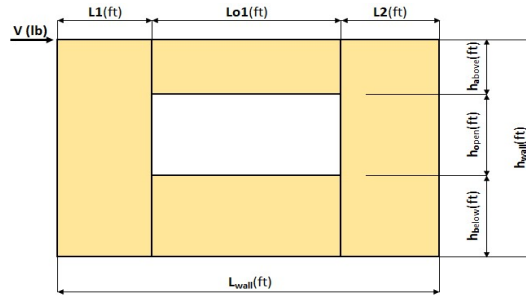
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (11'-7" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	2811 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	4.84 ft	h _a	1.85 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	4.24 ft	h _o	3.00 ft	P1=h _a /L1=	0.62	N/A
h _{wall}	9.00 ft	h _b	4.15 ft	P2=h _o /L2=	0.71	N/A
L _{wall}	11.58 ft	Lo1	2.50 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2185 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 364 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 910 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 485 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 425 \text{ lbf}$

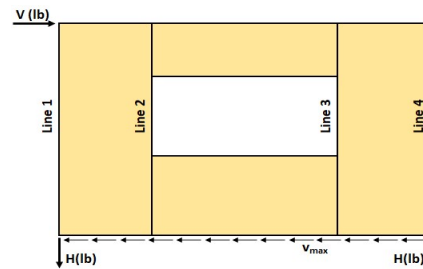
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.33 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 1.17 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 310 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 310 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2811 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1498 \text{ lbf}$
 $R2 = v2 \times L2 = 1313 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 1013 \text{ lbf}$
 $R2 - F2 = 888 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 209 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 209 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		1256	929	2185 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	2185	1256	929	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	2185	1256	929	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		1256	929	2185 lbf

Design Summary*

Req. Sheathing Capacity	364 plf	4-Term Deflection	0.232 in.	3-Term Deflection	0.271 in.
Req. Strap Force	485 lbf	4-Term Story Drift %	0.009 %	3-Term Story Drift %	0.010 %
Req. HD Force (H)	2185 lbf				
Req. Shear Wall Anchorage Force (v_{max})	243 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (11'-7" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2811 (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_i Override:
G_a Override:

Enter individual post sizes below.
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	3	3	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	310	310	310	310	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.85	4.85	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	3	3	3	3	(in.)
V_n :	77	77	77	77	(plf)
e_n :	0.0023	0.0023	0.0023	0.0023	(in.)
b:	4.84	4.84	4.24	4.24	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.017	0.033	0.015	0.266	0.003	0.018	0.008	0.077
Sum			0.333	Sum			0.106
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.003	0.018	0.008	0.088	0.020	0.033	0.015	0.304
Sum			0.118	Sum			0.373

Total Defl.	
0.232	(in.)
0.0086	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (11'-7" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2811	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:		Pier 1	Pier 2
G_a Override:		Nail Spacing:	3 (in.)
		HD Capacity:	2140 (lbf)
		HD Deflection:	0.11 (in.)
		C_d :	4.00

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	310	310	310	310 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	4.85	4.85	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G_a :	28.0	28.0	28.0	28.0 (kips/in.)
b:	4.84	4.84	4.24	4.24 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.017	0.100	0.266	0.003	0.054	0.077
Sum		0.383	Sum		0.134
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.054	0.088	0.020	0.100	0.304
Sum		0.145	Sum		0.423

Total Defl.	
0.271	(in.)
0.0100	%drift

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



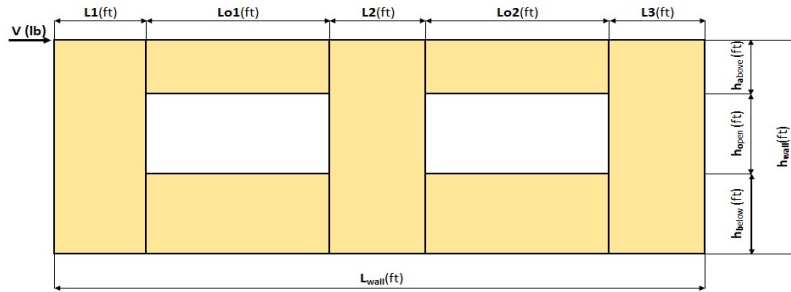
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (22'-1" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	2600 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.93 ft	ha1	ha2	Wall Pier Aspect Ratio	Adj. Factor
L2	8.28 ft	ho1	ho2	P1=ho/L1=	1.37
L3	3.87 ft	hb1	hb2	P2=ho/L2=	0.48
hwall	9.00 ft	Lo1	Lo2	P3=ho/L3=	1.03
Lwall	22.08 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1060 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 212 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 212 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1060 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 424 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 277 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 783 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 289 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 135 \text{ lbf}$

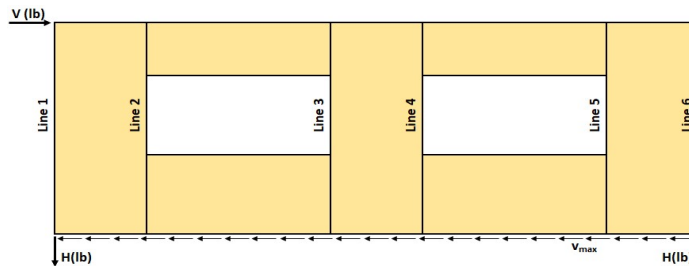
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 1.31 \text{ ft}$
 $T2 = (L2*Lo1)/(L1+L2) = 3.69 \text{ ft}$
 $T3 = (L2*Lo2)/(L2+L3) = 1.36 \text{ ft}$
 $T4 = (L3*Lo2)/(L2+L3) = 0.64 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 170 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 190 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 137 \text{ plf}$
Check $v1*L1+v2*L2+v3*L3=V$ 2600 lbf OK

7. Resistance to corner forces
 $R1 = v1*L1 = 499 \text{ lbf}$
 $R2 = v2*L2 = 1570 \text{ lbf}$
 $R3 = v3*L3 = 531 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 222 \text{ lbf}$
 $R2-F2-F3 = 499 \text{ lbf}$
 $R3-F4 = 396 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 76 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = 60 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 102 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{c1})=H$?	379	681	1060 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{c1})=0$?	1060	379	0
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{c2})-va1(h_{a1}+h_{b1})=0$?	301	759	0
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{c2})-vc2(h_{a2}+h_{b2})=0$?	1060	759	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{c2})=0$?	1060	511	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{c2})=H$?	511	549	1060 lbf

Design Summary*

Req. Sheathing Capacity	212 plf	4-Term Deflection	0.124 in.	3-Term Deflection	0.170 in.
Req. Strap Force	783 lbf	4-Term Story Drift %	0.005 %	3-Term Story Drift %	0.006 %
Req. HD Force	1060 lbf				
Req. Shear Wall Anchorage Force	118 plf				

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

Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (22'-1" Section) - (Level 3 Seismic)	

Unfactored Shear Load $V_{\text{unfactored}}$:	2600	(lbf)
---	------	-------

G _t Override:	
G _a Override:	

C_d :	4.00
---------	------

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
V _{unfactored} :	170	170	190	190	137	137	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.60	5.60	5.60	5.60	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:	83,500	83,500	83,500	83,500	83,500	83,500	(lb/ft.in.)
Nail Spacing:	6	6	6	6	6	6	(in.)
V _n :	85	85	95	95	69	69	(plf)
e _n :	0.0031	0.0031	0.0042	0.0042	0.0016	0.0016	(in.)
b:	2.93	2.93	8.28	8.28	3.87	3.87	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lb/ft)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.016	0.018	0.021	0.214	0.004	0.011	0.013	0.083
Sum			0.269	Sum			0.111
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	0.013	0.018	0.033	0.002	0.013	0.018	0.033
Sum			0.065	Sum			0.065
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.002	0.009	0.007	0.050	0.010	0.015	0.011	0.130
Sum			0.069	Sum			0.165

Total	
Defl.	
0.124	(in.)
0.0046	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (22'-1" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2600	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	6 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	170	170	190	190	137	137	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.60	5.60	5.60	5.60	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:	2.93	2.93	8.28	8.28	3.87	3.87	(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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.016	0.102	0.214	0.004	0.064	0.083
Sum		0.332	Sum		0.150
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.002	0.071	0.033	0.002	0.071	0.033
Sum		0.105	Sum		0.105
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.002	0.051	0.050	0.010	0.082	0.130
Sum		0.104	Sum		0.222

Total	
Defl.	0.170 (in.)
	0.0063 %drift

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



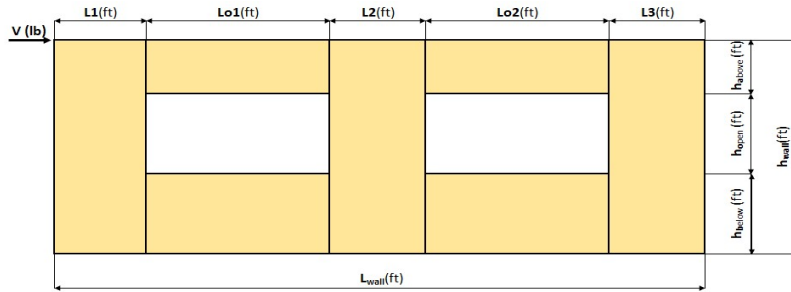
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (22'-1" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	4444 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.93 ft	h _{a1}	h _{a2}	Wall Pier Aspect Ratio	Adj. Factor
L2	8.28 ft	h _{o1}	h _{o2}	P1=h _o /L1=	N/A
L3	3.87 ft	h _{b1}	h _{b2}	P2=h _o /L2=	N/A
h _{wall}	9.00 ft	Lo1	Lo2	P3=h _o /L3=	N/A
L _{wall}	22.08 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1811 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 362$ plf
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 362$ plf

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1811$ lbf
Second opening: $O2 = va2 \times (Lo2) = 725$ lbf

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 473$ lbf
 $F2 = O1(L2)/(L1+L2) = 1338$ lbf
 $F3 = O2(L2)/(L2+L3) = 494$ lbf
 $F4 = O2(L3)/(L2+L3) = 231$ lbf

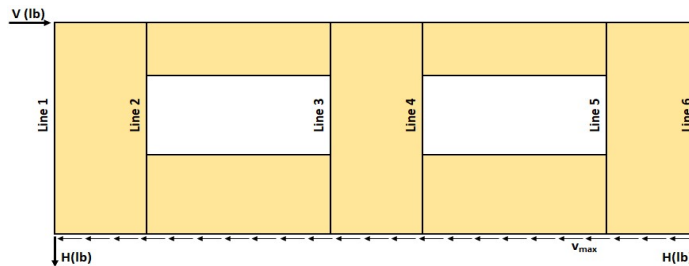
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 1.31$ ft
 $T2 = (L2*Lo1)/(L1+L2) = 3.69$ ft
 $T3 = (L2*Lo2)/(L2+L3) = 1.36$ ft
 $T4 = (L3*Lo2)/(L2+L3) = 0.64$ ft

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 291$ plf
 $v2 = (V/L)(T2+L2+T3)/L2 = 324$ plf
 $v3 = (V/L)(T4+L3)/L3 = 234$ plf
Check $v1*L1+v2*L2+v3*L3=V?$ 4444 lbf OK

7. Resistance to corner forces
 $R1 = v1*L1 = 853$ lbf
 $R2 = v2*L2 = 2684$ lbf
 $R3 = v3*L3 = 907$ lbf

8. Difference corner force + resistance
 $R1-F1 = 379$ lbf
 $R2-F2-F3 = 852$ lbf
 $R3-F4 = 676$ lbf

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 129$ plf
 $vc2 = (R2-F2-F3)/L2 = 103$ plf
 $vc3 = (R3-F4)/L3 = 175$ plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H?$	647	1164	1811 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0?$	1811	647	0
Line 3: $vc2(h_{a1}+h_{b1})+v2(h_{o1})-va1(h_{a1}+h_{b1})=0?$	515	1297	0
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0?$	1811	1297	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0?$	1811	874	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H?$	874	938	1811 lbf

Design Summary*

Req. Sheathing Capacity	362 plf	4-Term Deflection	0.196 in.	3-Term Deflection	0.232 in.
Req. Strap Force	1338 lbf	4-Term Story Drift %	0.007 %	3-Term Story Drift %	0.009 %
Req. HD Force	1811 lbf				
Req. Shear Wall Anchorage Force	201 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (22'-1" Section) - (Level 2 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	4444	(lbf)
---	------	-------

G _t Override:	
G _a Override:	

C_d :	4.00
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Nail Type: 8d common

Sheathing Type: 7/16 OSB APA Rated Sheathing

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.027	0.031	0.013	0.365	0.007	0.020	0.008	0.141
Sum			0.437	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
0.003	0.022	0.011	0.056	0.003	0.022	0.011	0.056
Sum			0.091	Sum			0.091
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.004	0.016	0.004	0.086	0.016	0.025	0.007	0.223
Sum			0.110	Sum			0.271

Total	(in.) %drift
Defl.	
0.196	
0.0073	

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (22'-1" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	4444	(lbf)

Sheathing Type:		7/16 OSB	Wood End Post Values:			Nail Type:		8d common	(penny weight)
Grade:		APA Rated Sheathing	Species:		HF#2	E:		1.30E+06	(psi)
G _t Override:			C _d :		4.00	Nail Spacing:		Pier 1 3	Pier 3 3
G _a Override:						HD Capacity:		1938	1938
						HD Deflection:		0.088	0.088
									(in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	291	291	324	324	234	234	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.60	5.60	5.60	5.60	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:	2.93	2.93	8.28	8.28	3.87	3.87	(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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.027	0.094	0.365	0.007	0.058	0.141
Sum		0.486	Sum		0.206
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.065	0.056	0.003	0.065	0.056
Sum		0.123	Sum		0.123
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.004	0.047	0.086	0.016	0.075	0.223
Sum		0.137	Sum		0.315

Total	
Defl.	
0.232	(in.)
0.0086	%drift

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



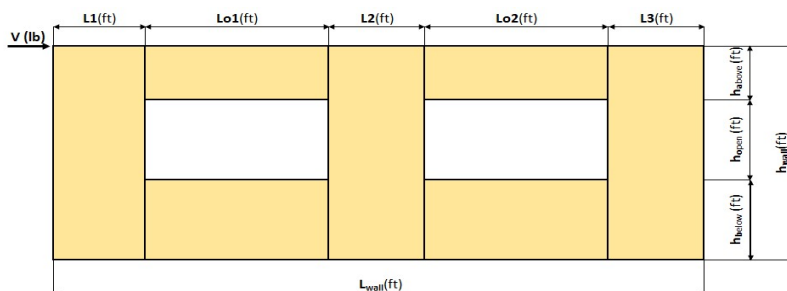
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (22'-1" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	5360 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.93 ft	h _{a1}	h _{a2}	Wall Pier Aspect Ratio	Adj. Factor
L2	8.28 ft	h _{o1}	h _{o2}	P1=h _o /L1=	N/A
L3	3.87 ft	h _{b1}	h _{b2}	P2=h _o /L2=	N/A
h _{wall}	9.00 ft	Lo1	Lo2	P3=h _o /L3=	N/A
L _{wall}	22.08 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2185 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 437 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 437 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2185 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 874 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 571 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1614 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 596 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 278 \text{ lbf}$

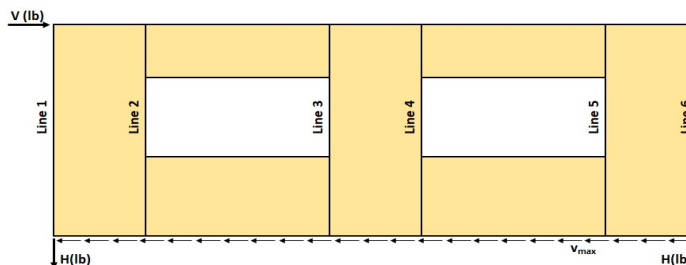
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.31 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 3.69 \text{ ft}$
 $T3 = (L2 \times Lo2)/(L2+L3) = 1.36 \text{ ft}$
 $T4 = (L3 \times Lo2)/(L2+L3) = 0.64 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 351 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 391 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 283 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 + v3 \times L3 = V$ 5360 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1029 \text{ lbf}$
 $R2 = v2 \times L2 = 3237 \text{ lbf}$
 $R3 = v3 \times L3 = 1094 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 457 \text{ lbf}$
 $R2-F2-F3 = 1028 \text{ lbf}$
 $R3-F4 = 816 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 156 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = 124 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 211 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H$?	781	1404	2185 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0$?	2185	781	1404
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0$?	621	1564	2185
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0$?	2185	1564	621
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0$?	2185	1054	1131
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H$?	1054	1131	2185 lbf

Design Summary*

Req. Sheathing Capacity	437 plf	4-Term Deflection	0.241 in.	3-Term Deflection	0.279 in.
Req. Strap Force	1614 lbf	4-Term Story Drift %	0.009 %	3-Term Story Drift %	0.010 %
Req. HD Force	2185 lbf				
Req. Shear Wall Anchorage Force	243 plf				

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

Project Information

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (22'-1" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		5360	(lbf)
Sheathing Type:	7/16 OSB	Wood End Post Values:	Nail Type: 8d common (penny weight)
Grade:	APA Rated Sheathing	Species:	HF#2
		E:	1.30E+06 (psi)
G_L Override:		Enter individual post sizes below.	
G_A Override:		C_d :	4.00

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	351	351	391	391	283	283	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.60	5.60	5.60	5.60	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 :	88	88	98	98	71	71	(plf)
e_n :	0.0034	0.0034	0.0046	0.0046	0.0017	0.0017	(in.)
b:	2.93	2.93	8.28	8.28	3.87	3.87	(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	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.033	0.038	0.023	0.441	0.008	0.024	0.014	0.171
Sum			0.534	Sum			0.216
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.003	0.026	0.019	0.067	0.003	0.026	0.019	0.067
Sum			0.116	Sum			0.116
Pier 3 (left)				Pier 3 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.005	0.019	0.007	0.104	0.020	0.030	0.012	0.269
Sum			0.135	Sum			0.331

Total	
Defl.	0.241
	0.0089

(in.)
%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (22'-1" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	5360	(lbf)

Sheathing Type:		7/16 OSB	Wood End Post Values:			Nail Type:		8d common	(penny weight)
Grade:		APA Rated Sheathing	Species:		HF#2	E:		1.30E+06	(psi)
G _t Override:			C _d :		4.00	Nail Spacing:		Pier 1 3	Pier 3 3
G _a Override:						HD Capacity:		1938	1938
						HD Deflection:		0.088	0.088
									(in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	351	351	391	391	283	283	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.60	5.60	5.60	5.60	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:	2.93	2.93	8.28	8.28	3.87	3.87	(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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.033	0.113	0.441	0.008	0.070	0.171
Sum		0.586	Sum		0.249
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.078	0.067	0.003	0.078	0.067
Sum		0.149	Sum		0.149
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.005	0.057	0.104	0.020	0.091	0.269
Sum		0.165	Sum		0.379

Total	
Defl.	(in.)
0.279	
0.0103	%drift

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



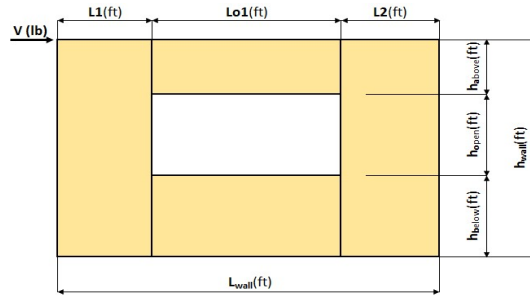
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (18'-2" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	2138 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	6.08 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	6.08 ft	ho	P1=ha/L1=	0.99
hwall	9.00 ft	hb	P2=ho/L2=	0.99
Lwall	18.16 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1060 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 353 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2119 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1060 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1060 \text{ lbf}$

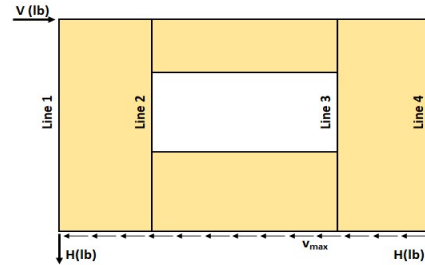
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 3.00 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 3.00 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 176 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 176 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 2138 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 1069 \text{ lbf}$
 $R2 = v2 \cdot L2 = 1069 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 9 \text{ lbf}$
 $R2 - F2 = 9 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 2 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 2 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	5	1055	1060 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1060	5	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1060	5	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	5	1055	1060 lbf

Design Summary*

Req. Sheathing Capacity	353 plf	4-Term Deflection	0.126 in.	3-Term Deflection	0.157 in.
Req. Strap Force	1060 lbf	4-Term Story Drift %	0.005 %	3-Term Story Drift %	0.006 %
Req. HD Force (H)	1060 lbf				
Req. Shear Wall Anchorage Force (v_{max})	118 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (18'-2" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2138	(lbf)				
Wood End Post Values:							
Sheathing Type:	7/16 OSB	Species:	HF#2				
Grade:	APA Rated Sheathing	E:	1.30E+06	(psi)			
Enter individual post sizes below.							
G_i Override:		C_d :	4.00				
G_a Override:		Nail Type: 8d common (penny weight)					
Nail Spacing:							
HD Capacity:							
HD Deflection:							

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	176	176	176	176	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	7.33	7.33	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_i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	3	3	3	3	(in.)
V_n :	44	44	44	44	(plf)
e_n :	0.0004	0.0004	0.0004	0.0004	(in.)
b:	6.08	6.08	6.08	6.08	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.008	0.019	0.003	0.120	0.004	0.015	0.002	0.080
Sum			0.150	Sum			0.102
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.004	0.015	0.002	0.080	0.008	0.019	0.003	0.120
Sum			0.102	Sum			0.150

Total	
Defl.	
0.126	(in.)
0.0047	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (18'-2" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2138	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:			
G_a Override:		C_d :	4.00
		Pier 1	Pier 2
Nail Spacing:		3	3 (in.)
HD Capacity:		2140	2140 (lbf)
HD Deflection:		0.11	0.11 (in.)

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	176	176	176	176 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	7.33	7.33	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:	6.08	6.08	6.08	6.08 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

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

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.008	0.057	0.120	0.004	0.046	0.080
Sum		0.185	Sum		0.130
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.004	0.046	0.080	0.008	0.057	0.120
Sum		0.130	Sum		0.185

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.



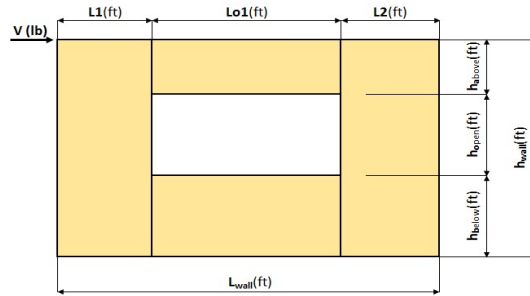
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid 13 (18'-2" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	3655 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	6.08 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	6.08 ft	ho	P1=ha/L1=	0.99
hwall	9.00 ft	hb	P2=ho/L2=	0.99
Lwall	18.16 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1811 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 604 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 3623 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1811 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1811 \text{ lbf}$

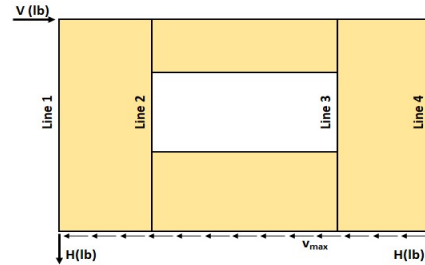
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 3.00 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 3.00 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 301 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 301 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 3655 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 1828 \text{ lbf}$
 $R2 = v2 \cdot L2 = 1828 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 16 \text{ lbf}$
 $R2 - F2 = 16 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 3 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 3 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	8	1803	1811 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1811	1803	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1811	1803	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	8	1803	1811 lbf

Design Summary*

Req. Sheathing Capacity	604 plf	4-Term Deflection	0.210 in.	3-Term Deflection	0.227 in.
Req. Strap Force	1811 lbf	4-Term Story Drift %	0.008 %	3-Term Story Drift %	0.008 %
Req. HD Force (H)	1811 lbf				
Req. Shear Wall Anchorage Force (v_{max})	201 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (18'-2" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:			3655	(lbf)
Sheathing Type:			15/32 OSB	
Grade:			APA Rated Sheathing	
G _i 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)
Nail Spacing:				
HD Capacity:				
HD Deflection:				
			Pier 1	Pier 2
			2	2
			2140	2140
			0.11	0.11

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	301	301	301	301	(plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06	(psi)
h:	9.00	7.33	7.33	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	2	2	2	2	(in.)
V_n :	50	50	50	50	(plf)
e_n :	0.0002	0.0002	0.0002	0.0002	(in.)
b:	6.08	6.08	6.08	6.08	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.011	0.032	0.001	0.206	0.006	0.026	0.001	0.137
Sum			0.250	Sum			0.170
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.006	0.026	0.001	0.137	0.011	0.032	0.001	0.206
Sum			0.170	Sum			0.250

Total	
Defl.	
0.210	(in.)
0.0078	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid 13 (18'-2" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		3655	(lbf)
Wood End Post Values:			
Sheathing Type:	15/32 OSB	Species:	DF#2
Grade:	APA Rated Sheathing	E:	1.60E+06 (psi)
Nail Type:		10d common (penny weight)	
G _i Override:			
G _a Override:			
C _d :		4.00	
		Pier 1	Pier 2
Nail Spacing:		2	2 (in.)
HD Capacity:		2140	2140 (lbf)
HD Deflection:		0.11	0.11 (in.)

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	301	301	301	301 (plf)
E:	1.60E+06	1.60E+06	1.60E+06	1.60E+06 (psi)
h:	9.00	7.33	7.33	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G _a :	52.0	52.0	52.0	52.0 (kips/in.)
b:	6.08	6.08	6.08	6.08 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

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

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.011	0.052	0.206	0.006	0.042	0.137
Sum		0.269	Sum		0.185
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.006	0.042	0.137	0.011	0.052	0.206
Sum		0.185	Sum		0.269

Total Defl.	
0.227	(in.)
0.0084	%drift

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



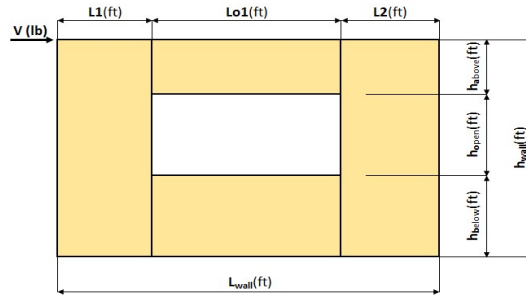
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid B (14'-7" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1771 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	3.85 ft	h _a	1.40 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	6.23 ft	h _o	3.50 ft	P1=h _a /L1=	0.91	N/A
h _{wall}	9.00 ft	h _b	4.10 ft	P2=h _o /L2=	0.56	N/A
L _{wall}	14.58 ft	Lo1	4.50 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1093 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 199 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 894 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 342 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 553 \text{ lbf}$

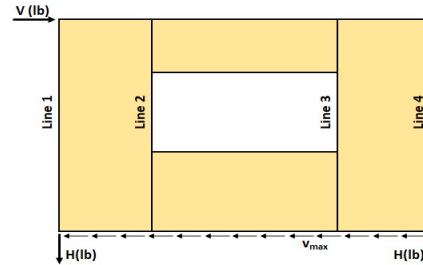
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.72 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.78 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 176 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 176 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 1771 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 676 \text{ lbf}$
 $R2 = v2 \times L2 = 1095 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 335 \text{ lbf}$
 $R2 - F2 = 542 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 87 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 87 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		478	615	1093 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1093	478	615	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1093	478	615	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		478	615	1093 lbf

Design Summary*

Req. Sheathing Capacity	199 plf	4-Term Deflection	0.138 in.	3-Term Deflection	0.187 in.
Req. Strap Force	553 lbf	4-Term Story Drift %	0.005 %	3-Term Story Drift %	0.007 %
Req. HD Force (H)	1093 lbf				
Req. Shear Wall Anchorage Force (v_{max})	121 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid B (14'-7" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1771 (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_i Override:
G_a Override:

Enter individual post sizes below.
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	176	176	176	176	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	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 :	88	88	88	88	(plf)
e_n :	0.0034	0.0034	0.0034	0.0034	(in.)
b:	3.85	3.85	6.23	6.23	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.012	0.019	0.023	0.190	0.002	0.010	0.012	0.056
Sum			0.244	Sum			0.081
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.001	0.010	0.012	0.035	0.008	0.019	0.023	0.117
Sum			0.059	Sum			0.167

Total Defl.	
0.138	(in.)
0.0051	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid B (14'-7" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		1771	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:			
G_a Override:		C_d :	4.00
		Pier 1	Pier 2
Nail Spacing:		6	6 (in.)
HD Capacity:		2140	2140 (lbf)
HD Deflection:		0.11	0.11 (in.)

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{Eab} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	176	176	176	176 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	4.90	4.90	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:	3.85	3.85	6.23	6.23 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.012	0.105	0.190	0.002	0.057	0.056
Sum		0.308	Sum		0.116
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.001	0.057	0.035	0.008	0.105	0.117
Sum		0.093	Sum		0.231

Total Defl.	
0.187	(in.)
0.0069	%drift

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



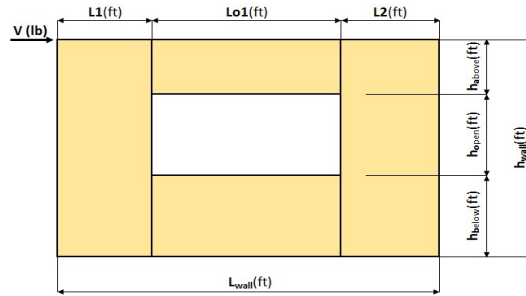
Force Transfer Around Openings Calculator

ONE OPENING

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

Project Information

Code:	2018 IBC	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid B (14'-7" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2959 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	3.85 ft	h _a	1.40 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	6.23 ft	h _o	3.50 ft	P1=h _o /L1=	0.91	N/A
h _{wall}	9.00 ft	h _b	4.10 ft	P2=h _o /L2=	0.56	N/A
L _{wall}	14.58 ft	Lo1	4.50 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1827 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) =$ 332 plf

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) =$ 1494 lbf

4. Corner forces
 $F1 = O1(L1)/(L1+L2) =$ 571 lbf
 $F2 = O1(L2)/(L1+L2) =$ 924 lbf

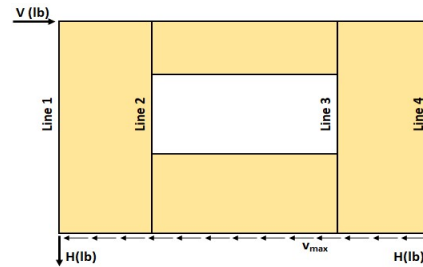
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) =$ 1.72 ft
 $T2 = (L2 \times Lo1)/(L1+L2) =$ 2.78 ft

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 =$ 294 plf
 $v2 = (V/L)(T2+L2)/L2 =$ 294 plf
Check $v1 \times L1 + v2 \times L2 = V?$ 2959 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 =$ 1130 lbf
 $R2 = v2 \times L2 =$ 1829 lbf

8. Difference corner force + resistance
 $R1 - F1 =$ 559 lbf
 $R2 - F2 =$ 905 lbf

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 =$ 145 plf
 $vc2 = (R2 - F2)/L2 =$ 145 plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		799	1027	1827 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1827	799	1027	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1827	799	1027	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		799	1027	1827 lbf

Design Summary*

Req. Sheathing Capacity	332 plf	4-Term Deflection	0.225 in.	3-Term Deflection	0.269 in.
Req. Strap Force	924 lbf	4-Term Story Drift %	0.008 %	3-Term Story Drift %	0.010 %
Req. HD Force (H)	1827 lbf				
Req. Shear Wall Anchorage Force (v_{max})	203 plf				

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

Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid B (14'-7" Section) - (Level 2 Seismic)	

Unfactored Shear Load $V_{\text{unfactored}}$:	2959	(lbf)
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Sheathing Type:	7/16 OSB	Wood End Post Values:		Nail Type:	8d common	(penny weight)
Grade:	APA Rated Sheathing	Species:	HF#2			
		E:	1.30E+06	(psi)		
G _x Override:		Enter individual post sizes below.		Pier 1	Pier 2	
G _y Override:		C _d :	4.00	Nail Spacing:	4	4 (in.)
				HD Capacity:	2140	2140 (lbf)
				HD Deflection:	0.11	0.11 (in.)

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
V _{unfactored} :	294	294	294	294	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	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 _i :	83,500	83,500	83,500	83,500	(lb/ft.in.)
Nail Spacing:	4	4	4	4	(in.)
V _n :	98	98	98	98	(plf)
e _n :	0.0047	0.0047	0.0047	0.0047	(in.)
b:	3.85	3.85	6.23	6.23	(ft)
HD Capacity:	2140	2140	2140	2140	(lb/ft)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.021	0.032	0.031	0.317	0.003	0.017	0.017	0.094
Sum			0.401	Sum			0.132
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	0.017	0.017	0.058	0.013	0.032	0.031	0.196
Sum			0.095	Sum			0.272

Total	
Defl.	
0.225	(in.)
0.0083	%drift

Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid B (14'-7" Section) - (Level 2 Seismic)	

Unfactored Shear Load $V_{\text{unfactored}}$:	2959	(lbf)
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Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
V _{unfactored} :	294	294	294	294	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G _a :	22.0	22.0	22.0	22.0	(kips/in.)
b:	3.85	3.85	6.23	6.23	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

	Pier 1	Pier 2	
Nail Spacing:	4	4	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.021	0.120	0.317	0.003	0.065	0.094
Sum		0.458	Sum		0.163
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	0.065	0.058	0.013	0.120	0.196
Sum		0.126	Sum		0.329

Total	
Defl.	
0.269	(in.)
0.0100	%drift

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



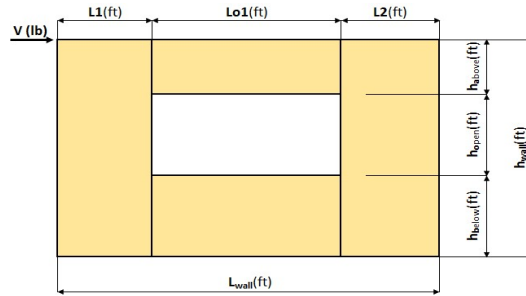
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid B (14'-7" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	3548 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	3.85 ft	h _a	1.40 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	6.23 ft	h _o	3.50 ft	P1=h _a /L1=	0.91	N/A
h _{wall}	9.00 ft	h _b	4.10 ft	P2=h _o /L2=	0.56	N/A
L _{wall}	14.58 ft	Lo1	4.50 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2190 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 398 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1792 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 684 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1108 \text{ lbf}$

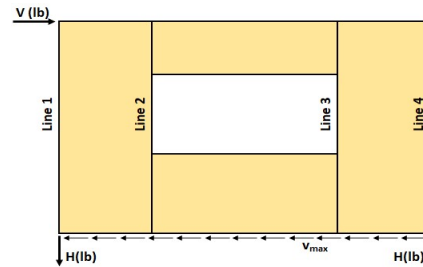
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.72 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.78 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 352 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 352 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 3548 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1355 \text{ lbf}$
 $R2 = v2 \times L2 = 2193 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 671 \text{ lbf}$
 $R2 - F2 = 1085 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 174 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 174 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		958	1232	2190 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	2190	958	1232	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	2190	958	1232	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		958	1232	2190 lbf

Design Summary*

Req. Sheathing Capacity	398 plf	4-Term Deflection	0.258 in.	3-Term Deflection	0.299 in.
Req. Strap Force	1108 lbf	4-Term Story Drift %	0.010 %	3-Term Story Drift %	0.011 %
Req. HD Force (H)	2190 lbf				
Req. Shear Wall Anchorage Force (v_{max})	243 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid B (14'-7" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		3548	(lbf)
Sheathing Type:		7/16 OSB	
Grade:		APA Rated Sheathing	
G _i 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)
Nail Spacing:		Pier 1: 3	Pier 2: 3 (in.)
HD Capacity:		Pier 1: 2140	Pier 2: 2140 (lbf)
HD Deflection:		Pier 1: 0.11	Pier 2: 0.11 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	352	352	352	352	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	3	3	3	3	(in.)
V_n :	88	88	88	88	(plf)
e_n :	0.0034	0.0034	0.0034	0.0034	(in.)
b:	3.85	3.85	6.23	6.23	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.025	0.038	0.023	0.381	0.004	0.021	0.012	0.113
Sum			0.466	Sum			0.150
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.002	0.021	0.012	0.070	0.015	0.038	0.023	0.235
Sum			0.105	Sum			0.311

Total Defl.	
0.258	(in.)
0.0096	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid B (14'-7" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	3548	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G_i Override:		C_d : 4.00		Nail Spacing:	Pier 1 3 (in.)
G_a Override:				HD Capacity:	Pier 2 2140 (lbf)
				HD Deflection:	0.11 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	352	352	352	352	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	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:	3.85	3.85	6.23	6.23	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.025	0.113	0.381	0.004	0.062	0.113
Sum		0.519	Sum		0.178
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.002	0.062	0.070	0.015	0.113	0.235
Sum		0.134	Sum		0.364

Total Defl.	
0.299	(in.)
0.0111	%drift

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



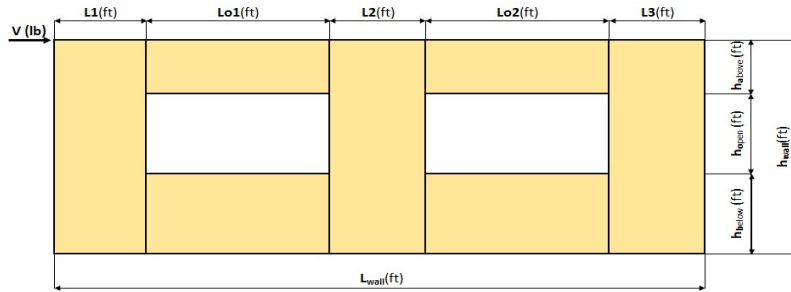
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid C (25'-6" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	3096 lbf	Opening 1		Opening 2		Adj. Factor Method =		2bs/h	
L1	3.96 ft	h _a 1	1.40 ft	h _a 2	1.40 ft	Wall Pier Aspect Ratio		Adj. Factor	
L2	8.60 ft	h _o 1	3.50 ft	h _o 2	3.50 ft	P1=h _o /L1=	0.88	N/A	
L3	3.94 ft	h _b 1	4.10 ft	h _b 2	4.10 ft	P2=h _o /L2=	0.41	N/A	
h _{wall}	9.00 ft	Lo1	4.50 ft	Lo2	4.50 ft	P3=h _o /L3=	0.89	N/A	
L _{wall}	25.50 ft								

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1093 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 199 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 199 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 894 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 894 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 282 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 612 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 613 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 281 \text{ lbf}$

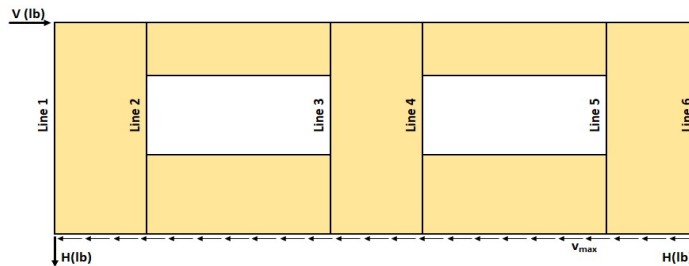
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 1.42 \text{ ft}$
 $T2 = (L2*Lo1)/(L1+L2) = 3.08 \text{ ft}$
 $T3 = (L2*Lo2)/(L2+L3) = 3.09 \text{ ft}$
 $T4 = (L3*Lo2)/(L2+L3) = 1.41 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 165 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 208 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 165 \text{ plf}$
Check $v1*L1+v2*L2+v3*L3=V?$ 3096 lbf OK

7. Resistance to corner forces
 $R1 = v1*L1 = 653 \text{ lbf}$
 $R2 = v2*L2 = 1793 \text{ lbf}$
 $R3 = v3*L3 = 650 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 371 \text{ lbf}$
 $R2-F2-F3 = 568 \text{ lbf}$
 $R3-F4 = 369 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 94 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = 66 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 94 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H?$	516	577	1093 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0?$	1093	516	0
Line 3: $vc2(h_{a1}+h_{b1})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0?$	363	730	1093
Line 4: $va2(h_{a2}+h_{b2})-vc2(h_{a2}+h_{b2})-v2(h_{o2})=0?$	1093	730	363
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0?$	1093	515	577
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H?$	515	577	1093 lbf

Design Summary*

Req. Sheathing Capacity	208 plf	4-Term Deflection	0.110 in.	3-Term Deflection	0.154 in.
Req. Strap Force	613 lbf	4-Term Story Drift %	0.004 %	3-Term Story Drift %	0.006 %
Req. HD Force	1093 lbf				
Req. Shear Wall Anchorage Force	121 plf				

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

Project Information

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid C (25'-6" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		3096	(lbf)
Sheathing Type:	7/16 OSB	Wood End Post Values:	Nail Type: 8d common (penny weight)
Grade:	APA Rated Sheathing	Species:	HF#2
		E:	1.30E+06 (psi)
G_L Override:		Enter individual post sizes below.	
G_A Override:		C_d :	4.00

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	165	165	208	208	165	165	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	4.90	4.90	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 :	82	82	104	104	82	82	(plf)
e_n :	0.0028	0.0028	0.0056	0.0056	0.0028	0.0028	(in.)
b:	3.96	3.96	8.60	8.60	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	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.011	0.018	0.019	0.153	0.002	0.010	0.010	0.045
Sum			0.201	Sum			0.067
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.001	0.012	0.021	0.026	0.001	0.012	0.021	0.026
Sum			0.060	Sum			0.060
Pier 3 (left)				Pier 3 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.002	0.010	0.010	0.046	0.011	0.018	0.019	0.154
Sum			0.067	Sum			0.202

Total	
Defl.	0.110
	0.0041

(in.)
%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid C (25'-6" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	3096	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	6 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	165	165	208	208	165	165	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	4.90	4.90	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:	3.96	3.96	8.60	8.60	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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.011	0.099	0.153	0.002	0.054	0.045
Sum		0.263	Sum		0.101
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.001	0.068	0.026	0.001	0.068	0.026
Sum		0.096	Sum		0.096
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.002	0.054	0.046	0.011	0.099	0.154
Sum		0.101	Sum		0.264

Total	
Defl.	(in.)
0.154	
0.0057	%drift

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



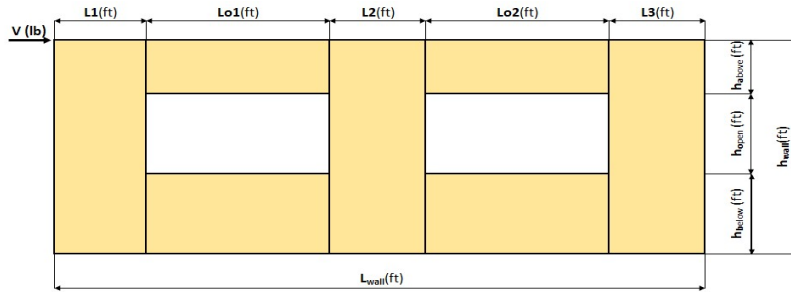
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid C (25'-6" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	5175 lbf	Opening 1		Opening 2		Adj. Factor Method =		2bs/h	
L1	3.96 ft	h _a 1	1.40 ft	h _a 2	1.40 ft	Wall Pier Aspect Ratio		Adj. Factor	
L2	8.60 ft	h _o 1	3.50 ft	h _o 2	3.50 ft	P1=h _o /L1=		0.88	
L3	3.94 ft	h _b 1	4.10 ft	h _b 2	4.10 ft	P2=h _o /L2=		0.41	
h _{wall}	9.00 ft	Lo1	4.50 ft	Lo2	4.50 ft	P3=h _o /L3=		0.89	
L _{wall}	25.50 ft							N/A	

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1826 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 332 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 332 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1494 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 1494 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 471 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1023 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 1025 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 470 \text{ lbf}$

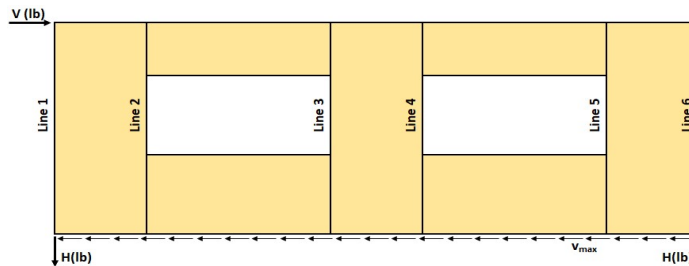
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 1.42 \text{ ft}$
 $T2 = (L2*Lo1)/(L1+L2) = 3.08 \text{ ft}$
 $T3 = (L2*Lo2)/(L2+L3) = 3.09 \text{ ft}$
 $T4 = (L3*Lo2)/(L2+L3) = 1.41 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 276 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 348 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 276 \text{ plf}$
Check $v1*L1+v2*L2+v3*L3=V$ 5175 lbf OK

7. Resistance to corner forces
 $R1 = v1*L1 = 1092 \text{ lbf}$
 $R2 = v2*L2 = 2997 \text{ lbf}$
 $R3 = v3*L3 = 1087 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 620 \text{ lbf}$
 $R2-F2-F3 = 949 \text{ lbf}$
 $R3-F4 = 617 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 157 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = 110 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 157 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H$?	862	965	1826 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0$?	1826	862	0
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0$?	607	1220	0
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0$?	1826	1220	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0$?	1826	861	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H$?	861	965	1826 lbf

Design Summary*

Req. Sheathing Capacity	348 plf	4-Term Deflection	0.179 in.	3-Term Deflection	0.218 in.
Req. Strap Force	1025 lbf	4-Term Story Drift %	0.007 %	3-Term Story Drift %	0.008 %
Req. HD Force	1826 lbf				
Req. Shear Wall Anchorage Force	203 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid C (25'-6" Section) - (Level 2 Seismic)		

Unfactored Shear Load $V_{unfactored}$:	5175	(lbf)
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Unfactored Shear Load $V_{unfactored}$:	5175	(lbf)
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Nail Type: 8d common (penny weight)

Enter individual post sizes below.

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.)

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

[illegible]

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

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	0.030	0.026	0.256	0.003	0.016	0.014	0.076
Sum			0.331	Sum			0.109
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	0.020	0.029	0.044	0.002	0.020	0.029	0.044
Sum			0.095	Sum			0.095
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	0.016	0.014	0.076	0.019	0.030	0.026	0.257
Sum			0.110	Sum			0.332

Total	
Defl.	
0.179	(in.)
0.0066	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid C (25'-6" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	5175	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Nail Spacing:	
G _a Override:				HD Capacity:	
				HD Deflection:	
				Pier 1	Pier 3
				4	4
				1938	1938
				0.088	0.088

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	276	276	348	348	276	276	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	4.90	4.90	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:	3.96	3.96	8.60	8.60	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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.019	0.113	0.256	0.003	0.061	0.076
Sum		0.388	Sum		0.140
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.002	0.078	0.044	0.002	0.078	0.044
Sum		0.124	Sum		0.124
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.061	0.076	0.019	0.113	0.257
Sum		0.141	Sum		0.389

Total	
Defl.	(in.)
0.218	
0.0081	%drift

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



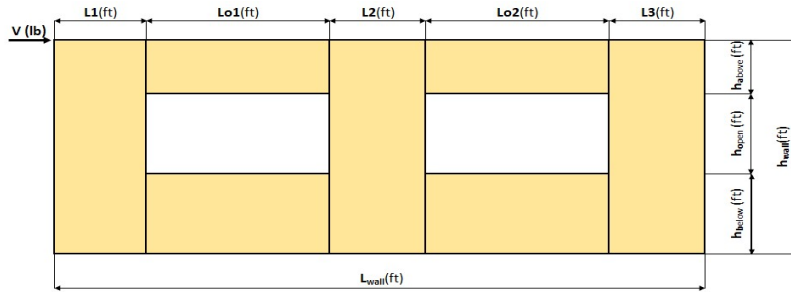
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid C (25'-6" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	6206 lbf	Opening 1		Opening 2		Adj. Factor Method =		2bs/h	
L1	3.96 ft	h _a 1	1.40 ft	h _a 2	1.40 ft	Wall Pier Aspect Ratio		Adj. Factor	
L2	8.60 ft	h _o 1	3.50 ft	h _o 2	3.50 ft	P1=h _o /L1=	0.88	N/A	
L3	3.94 ft	h _b 1	4.10 ft	h _b 2	4.10 ft	P2=h _o /L2=	0.41	N/A	
h _{wall}	9.00 ft	Lo1	4.50 ft	Lo2	4.50 ft	P3=h _o /L3=	0.89	N/A	
L _{wall}	25.50 ft								

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2190 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 398 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 398 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1792 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 1792 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 565 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1227 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 1229 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 563 \text{ lbf}$

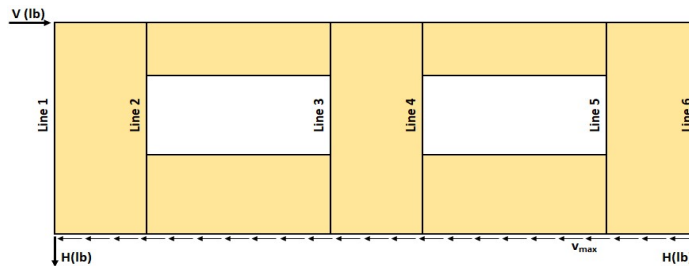
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 1.42 \text{ ft}$
 $T2 = (L2*Lo1)/(L1+L2) = 3.08 \text{ ft}$
 $T3 = (L2*Lo2)/(L2+L3) = 3.09 \text{ ft}$
 $T4 = (L3*Lo2)/(L2+L3) = 1.41 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 331 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 418 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 331 \text{ plf}$
Check $v1*L1+v2*L2+v3*L3=V?$ 6206 lbf OK

7. Resistance to corner forces
 $R1 = v1*L1 = 1309 \text{ lbf}$
 $R2 = v2*L2 = 3594 \text{ lbf}$
 $R3 = v3*L3 = 1303 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 744 \text{ lbf}$
 $R2-F2-F3 = 1138 \text{ lbf}$
 $R3-F4 = 740 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 188 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = 132 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 188 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H?$	1033	1157	2190 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0?$	2190	1033	0
Line 3: $vc2(h_{a1}+h_{b1})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0?$	728	1463	0
Line 4: $va2(h_{a2}+h_{b2})-vc2(h_{a2})-vc2(h_{a2}+h_{b2})=0?$	2190	1463	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0?$	2190	1033	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H?$	1033	1157	2190 lbf

Design Summary*

Req. Sheathing Capacity	418 plf	4-Term Deflection	0.203 in.	3-Term Deflection	0.239 in.
Req. Strap Force	1229 lbf	4-Term Story Drift %	0.008 %	3-Term Story Drift %	0.009 %
Req. HD Force	2190 lbf				
Req. Shear Wall Anchorage Force	243 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid C (25'-6" Section) - (Level 1 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	6206	(lbf)
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Unfactored Shear Load $V_{\text{unfactored}}$:	6206	(lbf)
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Nail Type: 8d common (penny weight)

Enter individual post sizes below.

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

C_d :	4.00
---------	------

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

[illegible]

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.023	0.036	0.019	0.307	0.004	0.019	0.010	0.091
Sum			0.384	Sum			0.124
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.002	0.025	0.021	0.053	0.002	0.025	0.021	0.053
Sum			0.100	Sum			0.100
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.004	0.019	0.010	0.092	0.023	0.036	0.019	0.309
Sum			0.125	Sum			0.386

Total	(in.) %drift
Defl.	
0.203	
0.0075	

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid C (25'-6" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	6206	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	3 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	331	331	418	418	331	331	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	4.90	4.90	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:	3.96	3.96	8.60	8.60	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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.023	0.106	0.307	0.004	0.058	0.091
Sum		0.436	Sum		0.153
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.002	0.073	0.053	0.002	0.073	0.053
Sum		0.128	Sum		0.128
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.004	0.058	0.092	0.023	0.106	0.309
Sum		0.153	Sum		0.438

Total	
Defl.	
0.239	(in.)
0.0089	%drift

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



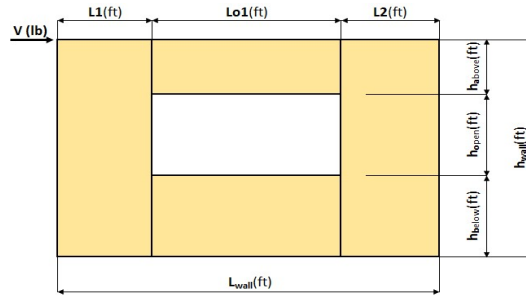
Force Transfer Around Openings Calculator

ONE OPENING

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

Project Information

Code:	2018 IBC	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid A (10'-7" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1285 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	2.17 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	2.41 ft	ho	P1=ha/L1=	N/A
hwall	9.00 ft	hb	P2=ho/L2=	N/A
Lwall	10.58 ft	Lo1		

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1093 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 199 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1192 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 565 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 627 \text{ lbf}$

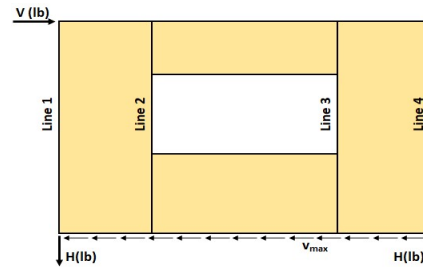
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 2.84 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 3.16 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 281 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 281 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 1285 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 609 \text{ lbf}$
 $R2 = v2 \times L2 = 676 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 44 \text{ lbf}$
 $R2 - F2 = 49 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 20 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 20 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	111	982	1093 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1093	111	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1093	111	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	111	982	1093 lbf

Design Summary*

Req. Sheathing Capacity	281 plf	4-Term Deflection	0.395 in.	3-Term Deflection	0.440 in.
Req. Strap Force	627 lbf	4-Term Story Drift %	0.015 %	3-Term Story Drift %	0.016 %
Req. HD Force (H)	1093 lbf				
Req. Shear Wall Anchorage Force (v_{max})	121 plf				

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

Project Information

Code:	2018 IBC	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid A (10'-7" Section) - (Level 3 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		1285	(lbf)
Sheathing Type:		7/16 OSB	
Grade:		APA Rated Sheathing	
G _i 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)
Nail Spacing:		Pier 1: 4	Pier 2: 4 (in.)
HD Capacity:		Pier 1: 2140	Pier 2: 2140 (lbf)
HD Deflection:		Pier 1: 0.11	Pier 2: 0.11 (in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a \frac{h}{b}$$

(Equation 23-2)

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	281	281	281	281	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	(in.)
V_n :	94	94	94	94	(plf)
e_n :	0.0041	0.0041	0.0041	0.0041	(in.)
b:	2.17	2.17	2.41	2.41	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.035	0.030	0.027	0.538	0.006	0.016	0.015	0.160
Sum			0.631	Sum			0.197
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.005	0.016	0.015	0.144	0.032	0.030	0.027	0.485
Sum			0.180	Sum			0.574

Total Defl.	
0.395	(in.)
0.0146	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (10'-7" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	1285	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G_i Override:		C_d :	4.00		
G_a Override:					
				Pier 1	Pier 2
				Nail Spacing: 4	4 (in.)
				HD Capacity: 2140	2140 (lbf)
				HD Deflection: 0.11	0.11 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	281	281	281	281	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G_a :	22.0	22.0	22.0	22.0	(kips/in.)
b:	2.17	2.17	2.41	2.41	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.035	0.115	0.538	0.006	0.062	0.160
Sum		0.688	Sum		0.228
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.005	0.062	0.144	0.032	0.115	0.485
Sum		0.211	Sum		0.631

Total Defl.	
0.440	(in.)
0.0163	%drift

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



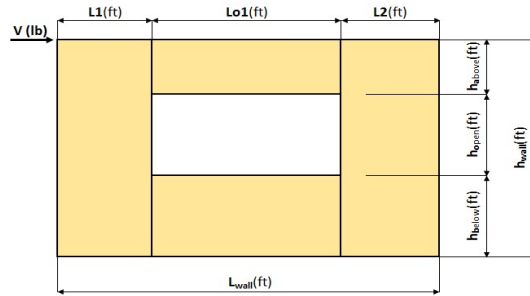
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid A (10'-7" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2147 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	2.17 ft	h _a	1.40 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	2.41 ft	h _o	3.50 ft	P1=h _o /L1=	1.61	N/A
h _{wall}	9.00 ft	h _b	4.10 ft	P2=h _o /L2=	1.45	N/A
L _{wall}	10.58 ft	Lo1	6.00 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1826 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 332 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1992 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 944 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1048 \text{ lbf}$

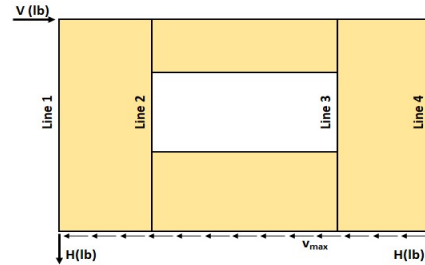
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 2.84 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 3.16 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 469 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 469 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2147 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1017 \text{ lbf}$
 $R2 = v2 \times L2 = 1130 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 73 \text{ lbf}$
 $R2 - F2 = 81 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 34 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 34 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		186	1641	1826 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1826	186	1641	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1826	186	1641	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		186	1641	1826 lbf

Design Summary*

Req. Sheathing Capacity	469 plf	4-Term Deflection	0.638 in.	3-Term Deflection	0.664 in.
Req. Strap Force	1048 lbf	4-Term Story Drift %	0.024 %	3-Term Story Drift %	0.025 %
Req. HD Force (H)	1826 lbf				
Req. Shear Wall Anchorage Force (v_{max})	203 plf				

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

Project Information

Code:2018 IBC

Date:10/28/2024

Designer:Chon Pieruccioni, PE

Client:

Project:East Town Crossing - Building F

Wall Line:Grid A (10'-7" Section) - (Level 2 Seismic)

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:2147(lbf)

Sheathing Type:7/16 OSB

Grade:APA Rated Sheathing

G_i 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:22

HD Capacity:21402140

HD Deflection:0.110.11

(in.)

(lbf)

(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a \frac{h}{b}$$

(Equation 23-2)

Pier 1-L

Pier 1-R

Pier 2-L

Pier 2-R

$V_{unfactored}$:469469469469

E :1.30E+061.30E+061.30E+061.30E+06

h :9.004.904.909.00

Qty :2.00E+002.00E+002.00E+002.00E+00

$Stud Size$:2x62x62x62x6

A Override:

A :16.516.516.516.5

G_i :83,50083,50083,50083,500

Nail Spacing:22

V_n :78787878

e_n :0.00240.00240.00240.0024

b :2.172.172.412.41

HD Capacity:2140214021402140

HD Defl:0.110.110.110.11

(plf)

(psi)

(ft)

(in.²)

(in.²)

(lbf/in.)

(in.)

(plf)

(in.)

(ft)

(lbf)

(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	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.059	0.051	0.016	0.899	0.009	0.028	0.009	0.267
Sum			1.025	Sum			0.312
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.009	0.028	0.009	0.240	0.053	0.051	0.016	0.810
Sum			0.285	Sum			0.929

Total Defl.	(in.) %drift
0.638 0.0236	

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (10'-7" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2147	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:		Pier 1	Pier 2
G_a Override:		Nail Spacing:	2 2 (in.)
		HD Capacity:	2140 2140 (lbf)
		HD Deflection:	0.11 0.11 (in.)
		C_d :	4.00

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{Eab} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	469	469	469	469 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	4.90	4.90	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:	2.17	2.17	2.41	2.41 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.059	0.100	0.899	0.009	0.055	0.267
Sum		1.059	Sum		0.331
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.009	0.055	0.240	0.053	0.100	0.810
Sum		0.303	Sum		0.963

Total Defl.	
0.664	(in.)
0.0246	%drift

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



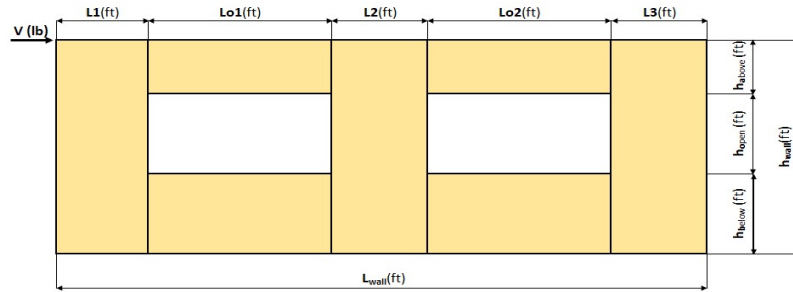
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid A (21'-1" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	5130 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.17 ft	h _{a1}	h _{a2}	Wall Pier Aspect Ratio	Adj. Factor
L2	5.42 ft	h _{o1}	h _{o2}	P1=h _o /L1=	N/A
L3	2.51 ft	h _{b1}	h _{b2}	P2=h _o /L2=	N/A
h _{wall}	9.00 ft	Lo1	Lo2	P3=h _o /L3=	N/A
L _{wall}	21.10 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2188 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 398 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 398 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2387 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 1989 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 682 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1705 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 1360 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 630 \text{ lbf}$

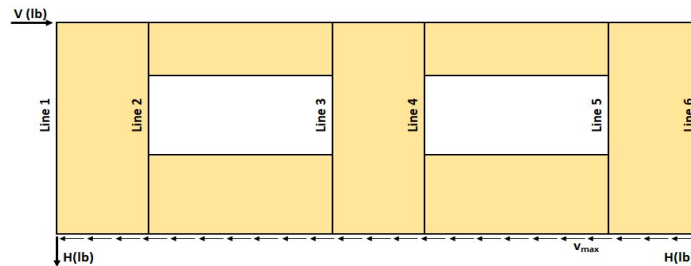
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 1.72 \text{ ft}$
 $T2 = (L2*Lo1)/(L1+L2) = 4.28 \text{ ft}$
 $T3 = (L2*Lo2)/(L2+L3) = 3.42 \text{ ft}$
 $T4 = (L3*Lo2)/(L2+L3) = 1.58 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 435 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 589 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 396 \text{ plf}$
Check $v1*L1+v2*L2+v3*L3=V?$ 5130 lbf OK

7. Resistance to corner forces
 $R1 = v1*L1 = 945 \text{ lbf}$
 $R2 = v2*L2 = 3190 \text{ lbf}$
 $R3 = v3*L3 = 995 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 262 \text{ lbf}$
 $R2-F2-F3 = 126 \text{ lbf}$
 $R3-F4 = 365 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 121 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = 23 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 146 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H?$	665	1524	2188 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0?$	2188	665	0
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0?$	128	2060	0
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0?$	2188	2060	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0?$	2188	801	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H?$	801	1387	2188 lbf

Design Summary*

Req. Sheathing Capacity	589 plf	4-Term Deflection	0.391 in.	3-Term Deflection	0.414 in.
Req. Strap Force	1705 lbf	4-Term Story Drift %	0.014 %	3-Term Story Drift %	0.015 %
Req. HD Force	2188 lbf				
Req. Shear Wall Anchorage Force	243 plf				

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

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (21'-1" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	5130	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:	Nail Type: 8d common (penny weight)
Grade: APA Rated Sheathing		Species: HF#2	
		E: 1.30E+06 (psi)	
G _l Override:		Enter individual post sizes below.	
G _a Override:		C _d : 4.00	
		Nail Spacing:	Pier 1 2 (in.)
		HD Capacity:	Pier 3 1938 (lbf)
		HD Deflection:	0.088 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	435	435	589	589	396	396	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	4.90	4.90	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 :	73	73	98	98	66	66	(plf)
e_n :	0.0019	0.0019	0.0047	0.0047	0.0014	0.0014	(in.)
b:	2.17	2.17	5.42	5.42	2.51	2.51	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.055	0.047	0.013	0.738	0.009	0.026	0.007	0.219
Sum			0.852	Sum			0.260
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.005	0.035	0.017	0.118	0.005	0.035	0.017	0.118
Sum			0.175	Sum			0.175
Pier 3 (left)				Pier 3 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.007	0.023	0.005	0.172	0.043	0.043	0.010	0.581
Sum			0.208	Sum			0.676

Total	
Defl.	0.391 (in.)
	0.0145 %drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (21'-1" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	5130	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1 Pier 3	
G _a Override:				Nail Spacing: 2 HD Capacity: 1938 HD Deflection: 0.088	
				2 1938 0.088	
				(in.) (lbf) (in.)	

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	435	435	589	589	396	396	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	4.90	4.90	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:	2.17	2.17	5.42	5.42	2.51	2.51	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.055	0.093	0.738	0.009	0.051	0.219
Sum		0.886	Sum		0.278
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.005	0.069	0.118	0.005	0.069	0.118
Sum		0.192	Sum		0.192
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.007	0.046	0.172	0.043	0.085	0.581
Sum		0.225	Sum		0.709

Total	
Defl.	(in.)
0.414	
0.0153	%drift

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



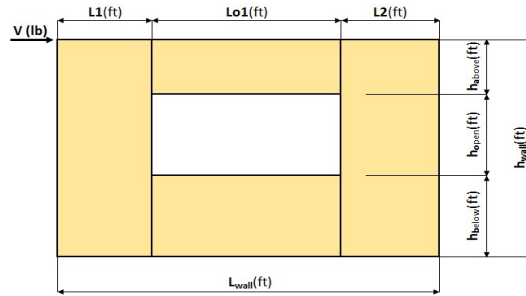
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid A (10'-6" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1275 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	2.50 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	2.00 ft	ho	P1=ha/L1=	N/A
hwall	9.00 ft	hb	P2=ho/L2=	N/A
Lwall	10.50 ft	Lo1		

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1093 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) =$ 199 plf

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) =$ 1192 lbf

4. Corner forces
 $F1 = O1(L1)/(L1+L2) =$ 662 lbf
 $F2 = O1(L2)/(L1+L2) =$ 530 lbf

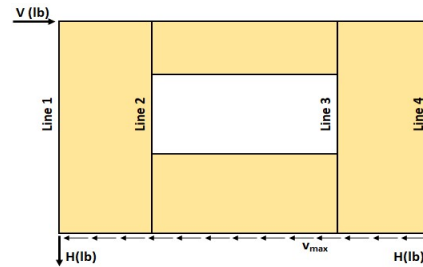
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) =$ 3.33 ft
 $T2 = (L2 \times Lo1)/(L1+L2) =$ 2.67 ft

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 =$ 283 plf
 $v2 = (V/L)(T2+L2)/L2 =$ 283 plf
Check $v1 \times L1 + v2 \times L2 = V?$ 1275 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 =$ 708 lbf
 $R2 = v2 \times L2 =$ 567 lbf

8. Difference corner force + resistance
 $R1 - F1 =$ 46 lbf
 $R2 - F2 =$ 37 lbf

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 =$ 18 plf
 $vc2 = (R2 - F2)/L2 =$ 18 plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	101	992	1093 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1093	101	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1093	101	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	101	992	1093 lbf

Design Summary*

Req. Sheathing Capacity	283 plf	4-Term Deflection	0.410 in.	3-Term Deflection	0.454 in.
Req. Strap Force	662 lbf	4-Term Story Drift %	0.015 %	3-Term Story Drift %	0.017 %
Req. HD Force (H)	1093 lbf				
Req. Shear Wall Anchorage Force (v_{max})	121 plf				

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

Project Information

Code:2018 IBC

Date:10/28/2024

Designer:Chon Pieruccioni, PE

Client:

Project:East Town Crossing - Building F

Wall Line:Grid A (10'-6" Section) - (Level 3 Seismic)

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:1275(lbf)

Sheathing Type:7/16 OSB

Grade:APA Rated Sheathing

G_i 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:44(in.)

HD Capacity:21402140(lbf)

HD Deflection:0.110.11(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a \frac{h}{b}$$

(Equation 23-2)

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	283	283	283	283	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	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_i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	(in.)
V_n :	94	94	94	94	(plf)
e_n :	0.0042	0.0042	0.0042	0.0042	(in.)
b:	2.50	2.50	2.00	2.00	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.031	0.031	0.028	0.472	0.005	0.017	0.015	0.140
Sum			0.561	Sum			0.177
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.006	0.017	0.015	0.175	0.039	0.031	0.028	0.590
Sum			0.213	Sum			0.687

Total Defl.	
0.410	(in.)
0.0152	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (10'-6" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		1275	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:		Pier 1	Pier 2
G_a Override:		Nail Spacing:	4 4 (in.)
		HD Capacity:	2140 2140 (lbf)
		HD Deflection:	0.11 0.11 (in.)
		C_d :	4.00

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	283	283	283	283 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	4.90	4.90	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G_a :	22.0	22.0	22.0	22.0 (kips/in.)
b:	2.50	2.50	2.00	2.00 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.031	0.116	0.472	0.005	0.063	0.140
Sum		0.619	Sum		0.208
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.006	0.063	0.175	0.039	0.116	0.590
Sum		0.244	Sum		0.744

Total Defl.	
0.454	(in.)
0.0168	%drift

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



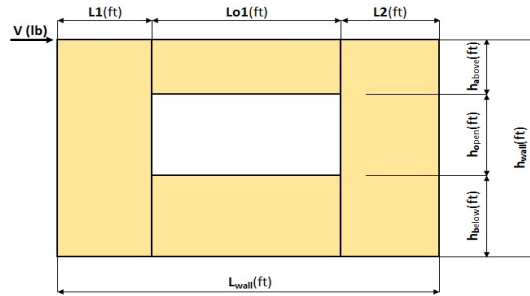
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid A (10'-6" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2131 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	2.50 ft	ha	1.40	
L2	2.00 ft	ho	3.50 ft	
hwall	9.00 ft	hb	4.10 ft	
Lwall	10.50 ft	Lo1	6.00 ft	
			Wall Pier Aspect Ratio	Adj. Factor
			P1=ha/L1=	N/A
			P2=ho/L2=	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1827 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 332 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1993 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1107 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 886 \text{ lbf}$

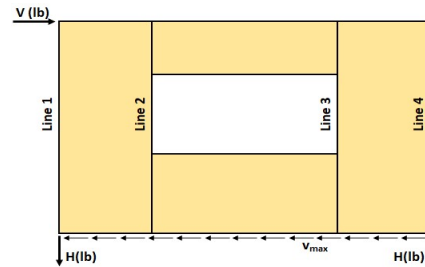
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.33 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.67 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 474 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 474 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2131 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1184 \text{ lbf}$
 $R2 = v2 \times L2 = 947 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 77 \text{ lbf}$
 $R2 - F2 = 62 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 31 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 31 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	169	1657	1827 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1827	169	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1827	169	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	169	1657	1827 lbf

Design Summary*

Req. Sheathing Capacity	474 plf	4-Term Deflection	0.661 in.	3-Term Deflection	0.687 in.
Req. Strap Force	1107 lbf	4-Term Story Drift %	0.024 %	3-Term Story Drift %	0.025 %
Req. HD Force (H)	1827 lbf				
Req. Shear Wall Anchorage Force (v_{max})	203 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (10'-6" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2131 (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_i Override:
G_a Override:

Enter individual post sizes below.
C_d: 4.00

Pier 1

Pier 2

Nail Spacing: 2 2 (in.)
HD Capacity: 2140 2140 (lbf)
HD Deflection: 0.11 0.11 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	474	474	474	474	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	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 :	79	79	79	79	(plf)
e_n :	0.0024	0.0024	0.0024	0.0024	(in.)
b:	2.50	2.50	2.00	2.00	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.052	0.051	0.016	0.789	0.008	0.028	0.009	0.234
Sum			0.908	Sum			0.279
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.010	0.028	0.009	0.292	0.064	0.051	0.016	0.986
Sum			0.339	Sum			1.118

Total Defl.	
0.661	(in.)
0.0245	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (10'-6" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2131	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:		Pier 1	Pier 2
G_a Override:		Nail Spacing:	2 2 (in.)
		HD Capacity:	2140 2140 (lbf)
		HD Deflection:	0.11 0.11 (in.)
		C_d :	4.00

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	474	474	474	474 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	4.90	4.90	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:	2.50	2.50	2.00	2.00 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.052	0.101	0.789	0.008	0.055	0.234
Sum		0.942	Sum		0.297
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.010	0.055	0.292	0.064	0.101	0.986
Sum		0.358	Sum		1.152

Total Defl.	
0.687	(in.)
0.0254	%drift

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



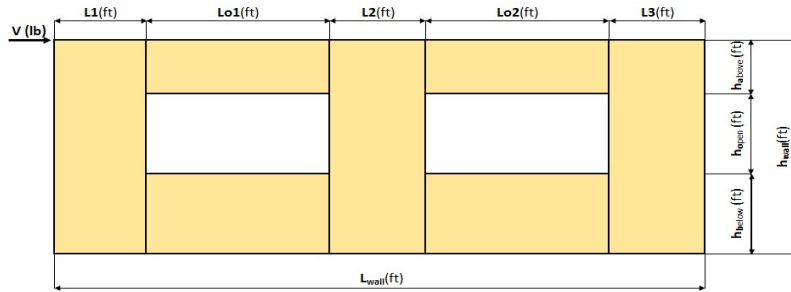
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid B (20'-9" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	2520 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.00 ft	ha1	ha2	Wall Pier Aspect Ratio	Adj. Factor
L2	4.75 ft	ho1	ho2	P1=ho/L1=	N/A
L3	2.00 ft	hb1	hb2	P2=ho/L2=	N/A
hwall	9.00 ft	Lo1	Lo2	P3=ho/L3=	N/A
Lwall	20.75 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1093 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 199 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 199 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1192 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 1192 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 353 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 839 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 839 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 353 \text{ lbf}$

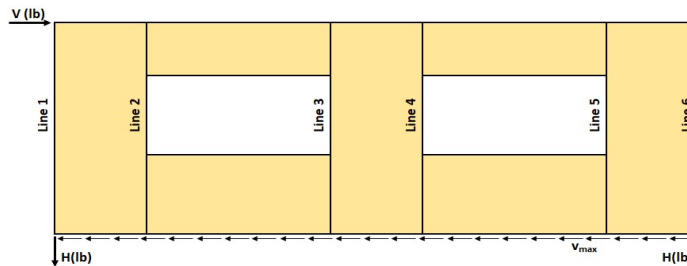
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 1.78 \text{ ft}$
 $T2 = (L2*Lo1)/(L1+L2) = 4.22 \text{ ft}$
 $T3 = (L2*Lo2)/(L2+L3) = 4.22 \text{ ft}$
 $T4 = (L3*Lo2)/(L2+L3) = 1.78 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 229 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 337 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 229 \text{ plf}$
Check $v1*L1+v2*L2+v3*L3=V?$ 2520 lbf OK

7. Resistance to corner forces
 $R1 = v1*L1 = 459 \text{ lbf}$
 $R2 = v2*L2 = 1602 \text{ lbf}$
 $R3 = v3*L3 = 459 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 105 \text{ lbf}$
 $R2-F2-F3 = -76 \text{ lbf}$
 $R3-F4 = 105 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 53 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = -16 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 53 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H?$	290	803	1093 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0?$	1093	290	0
Line 3: $vc2(h_{a1}+h_{b1})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0?$	-88	1181	1093
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0?$	1093	1181	-88
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0?$	1093	290	803
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H?$	290	803	1093 lbf

Design Summary*

Req. Sheathing Capacity	337 plf	4-Term Deflection	0.257 in.	3-Term Deflection	0.295 in.
Req. Strap Force	839 lbf	4-Term Story Drift %	0.010 %	3-Term Story Drift %	0.011 %
Req. HD Force	1093 lbf				
Req. Shear Wall Anchorage Force	121 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid B (20'-9" Section) - (Level 3 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	2520	(lbf)
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G _t Override:	
G _a Override:	

C_d :	4.00
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Nail Type: 8d common

Sheathing Type: 7/16 OSB APA Rated Sheathing

Total	(in.) %drift
Defl.	
0.257	
0.0095	

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid B (20'-9" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2520	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	4 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	229	229	337	337	229	229	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	4.90	4.90	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:	2.00	2.00	4.75	4.75	2.00	2.00	(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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.031	0.094	0.422	0.005	0.051	0.125
Sum		0.547	Sum		0.181
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.075	0.077	0.003	0.075	0.077
Sum		0.156	Sum		0.156
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.005	0.051	0.125	0.031	0.094	0.422
Sum		0.181	Sum		0.547

Total	
Defl.	(in.)
0.295	
0.0109	%drift

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



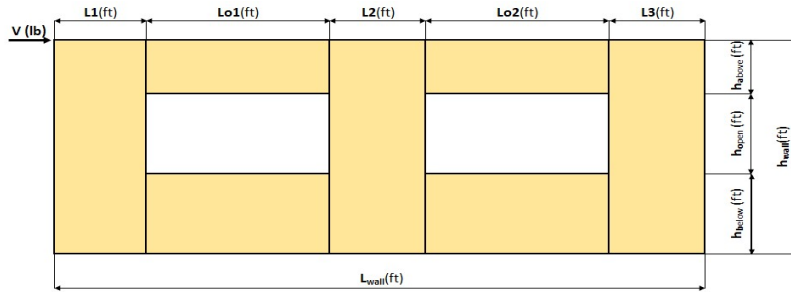
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid B (20'-9" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	4211 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.00 ft	h _{a1}	h _{a2}	Wall Pier Aspect Ratio	Adj. Factor
L2	4.75 ft	h _{o1}	h _{o2}	P1=h _o /L1=	N/A
L3	2.00 ft	h _{b1}	h _{b2}	P2=h _o /L2=	N/A
h _{wall}	9.00 ft	Lo1	Lo2	P3=h _o /L3=	N/A
L _{wall}	20.75 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1826 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 332 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 332 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1992 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 1992 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 590 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1402 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 1402 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 590 \text{ lbf}$

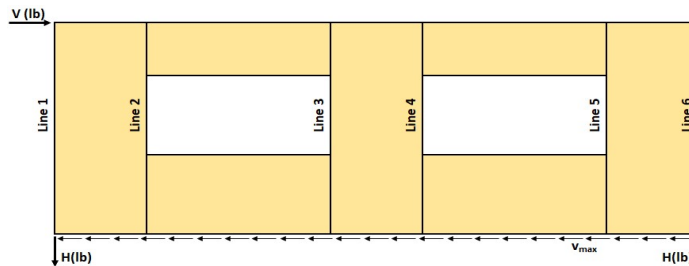
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 1.78 \text{ ft}$
 $T2 = (L2*Lo1)/(L1+L2) = 4.22 \text{ ft}$
 $T3 = (L2*Lo2)/(L2+L3) = 4.22 \text{ ft}$
 $T4 = (L3*Lo2)/(L2+L3) = 1.78 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 383 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 564 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 383 \text{ plf}$
Check $v1*L1+v2*L2+v3*L3=V?$ 4211 lbf OK

7. Resistance to corner forces
 $R1 = v1*L1 = 767 \text{ lbf}$
 $R2 = v2*L2 = 2678 \text{ lbf}$
 $R3 = v3*L3 = 767 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 176 \text{ lbf}$
 $R2-F2-F3 = -127 \text{ lbf}$
 $R3-F4 = 176 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 88 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = -27 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 88 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H?$	485	1342	1826 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0?$	1826	485	0
Line 3: $vc2(h_{a1}+h_{b1})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0?$	-147	1973	0
Line 4: $va2(h_{a2}+h_{b2})-vc2(h_{a2}+h_{b2})-vc2(h_{o2})=0?$	1826	1973	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0?$	1826	485	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H?$	485	1342	1826 lbf

Design Summary*

Req. Sheathing Capacity	564 plf	4-Term Deflection	0.411 in.	3-Term Deflection	0.434 in.
Req. Strap Force	1402 lbf	4-Term Story Drift %	0.015 %	3-Term Story Drift %	0.016 %
Req. HD Force	1826 lbf				
Req. Shear Wall Anchorage Force	203 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid B (20'-9" Section) - (Level 2 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	4211	(lbf)
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C_d :	4.00
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[illegible]

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
0.052	0.041	0.009	0.705	0.008	0.022	0.005	0.209
Sum			0.807	Sum			0.245
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.005	0.033	0.015	0.129	0.005	0.033	0.015	0.129
Sum			0.183	Sum			0.183
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	0.022	0.005	0.209	0.052	0.041	0.009	0.705
Sum			0.245	Sum			0.807

Total	
Defl.	
0.411	(in.)
0.0152	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid B (20'-9" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	4211	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	2 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check						
$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$						
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R
$V_{unfactored}$:	383	383	564	564	383	383
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06
h:	9.00	4.90	4.90	4.90	4.90	9.00
Qty:	2	2	2	2	2	2
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6
A Override:						
A:	16.5	16.5	16.5	16.5	16.5	16.5
G _a :	42.0	42.0	42.0	42.0	42.0	42.0
b:	2.00	2.00	4.75	4.75	2.00	2.00
HD Capacity:	1938	1938	1938	1938	1938	1938
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088

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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.052	0.082	0.705	0.008	0.045	0.209
Sum		0.839	Sum		0.262
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.005	0.066	0.129	0.005	0.066	0.129
Sum		0.200	Sum		0.200
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.008	0.045	0.209	0.052	0.082	0.705
Sum		0.262	Sum		0.839

Total
Defl.
0.434
0.0161

(in.)

%drift

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



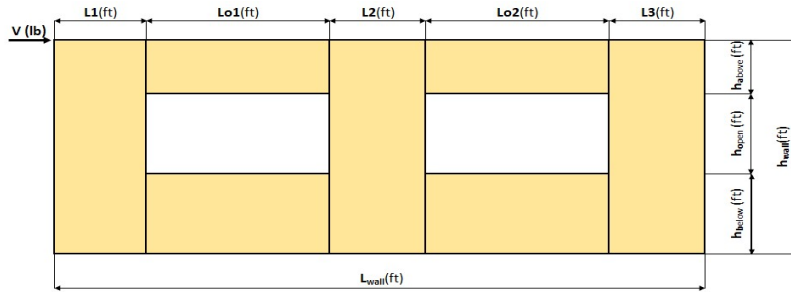
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid B (20'-9" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	5050 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.50 ft	ha1	ha2	Wall Pier Aspect Ratio	Adj. Factor
L2	5.75 ft	ho1	ho2	P1=ho/L1=	N/A
L3	2.50 ft	hb1	hb2	P2=ho/L2=	N/A
hwall	9.00 ft	Lo1	Lo2	P3=ho/L3=	N/A
Lwall	20.75 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2190 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 398 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 398 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1991 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 1991 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 603 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1388 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 1388 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 603 \text{ lbf}$

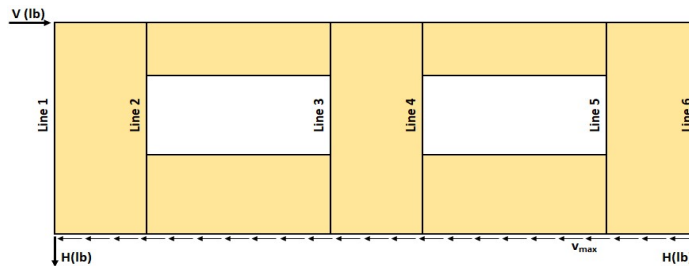
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.52 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 3.48 \text{ ft}$
 $T3 = (L2 \times Lo2)/(L2+L3) = 3.48 \text{ ft}$
 $T4 = (L3 \times Lo2)/(L2+L3) = 1.52 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 391 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 538 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 391 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 + v3 \times L3 = V$ 5050 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 977 \text{ lbf}$
 $R2 = v2 \times L2 = 3096 \text{ lbf}$
 $R3 = v3 \times L3 = 977 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 374 \text{ lbf}$
 $R2-F2-F3 = 320 \text{ lbf}$
 $R3-F4 = 374 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 150 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = 56 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 150 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H$?	822	1368	2190 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0$?	2190	822	0
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0$?	306	1884	0
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0$?	2190	1884	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0$?	2190	822	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H$?	822	1368	2190 lbf

Design Summary*

Req. Sheathing Capacity	538 plf	4-Term Deflection	0.342 in.	3-Term Deflection	0.364 in.
Req. Strap Force	1388 lbf	4-Term Story Drift %	0.013 %	3-Term Story Drift %	0.013 %
Req. HD Force	2190 lbf				
Req. Shear Wall Anchorage Force	243 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid B (20'-9" Section) - (Level 2 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	5050	(lbf)
---	------	-------

Unfactored Shear Load $V_{unfactored}$:	5050	(lbf)
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Nail Type: 8d common (penny weight)

Enter individual post sizes below.

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.)

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

[illegible]

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

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	0.042	0.009	0.575	0.007	0.023	0.005	0.170
Sum			0.669	Sum			0.205
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	0.013	0.102	0.004	0.032	0.013	0.102
Sum			0.151	Sum			0.151
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	0.023	0.005	0.170	0.043	0.042	0.009	0.575
Sum			0.205	Sum			0.669

Total	
Defl.	
0.342	(in.)
0.0127	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid B (20'-9" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	5050	(lbf)

Sheathing Type:		7/16 OSB	Wood End Post Values:			Nail Type:		8d common	(penny weight)
Grade:		APA Rated Sheathing	Species:		HF#2	E:		1.30E+06	(psi)
G _t Override:			C _d :		4.00	Nail Spacing:		Pier 1 2	Pier 3 2
G _a Override:						HD Capacity:		1938	1938
						HD Deflection:		0.088	0.088

Three-Term Equation Deflection Check							Sheathing Type: 7/16 OSB APA Rated Sheathing	
$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$							Nail Type: 8d common	
$V_{unfactored}$:	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	(plf)	
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)	
h:	9.00	4.90	4.90	4.90	4.90	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	5.75	5.75	2.50	2.50	(ft)	
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)	
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)	

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.043	0.084	0.575	0.007	0.046	0.170
Sum		0.701	Sum		0.223
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.004	0.063	0.102	0.004	0.063	0.102
Sum		0.169	Sum		0.169
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.007	0.046	0.170	0.043	0.084	0.575
Sum		0.223	Sum		0.701

Total	
Defl.	(in.)
0.364	
0.0135	%drift

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



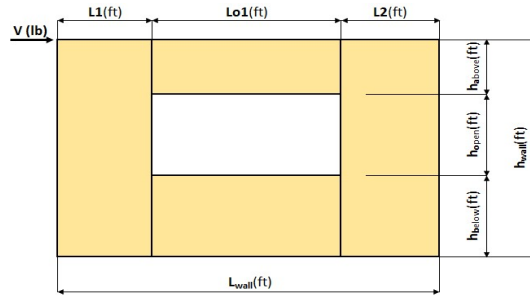
Force Transfer Around Openings Calculator

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	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid A (11'-9" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1427 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	2.85 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	2.85 ft	ho	P1=ha/L1=	N/A
hwall	9.00 ft	hb	P2=ho/L2=	N/A
Lwall	11.70 ft	Lo1		

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1098 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 200 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1197 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 599 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 599 \text{ lbf}$

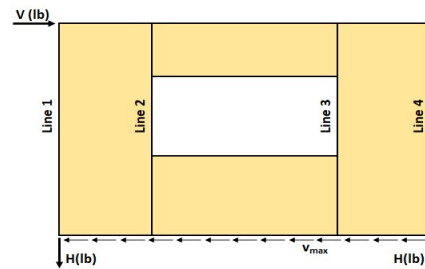
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.00 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 3.00 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 250 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 250 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 1427 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 714 \text{ lbf}$
 $R2 = v2 \times L2 = 714 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 115 \text{ lbf}$
 $R2 - F2 = 115 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 40 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 40 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	221	876	1098 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1098	221	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1098	221	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	221	876	1098 lbf

Design Summary*

Req. Sheathing Capacity	250 plf	4-Term Deflection	0.287 in.	3-Term Deflection	0.330 in.
Req. Strap Force	599 lbf	4-Term Story Drift %	0.011 %	3-Term Story Drift %	0.012 %
Req. HD Force (H)	1098 lbf				
Req. Shear Wall Anchorage Force (v_{max})	122 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (11'-9" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1427 (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_i Override:
G_a Override:

Enter individual post sizes below.
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	4	4	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	250	250	250	250	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	(in.)
V_n :	83	83	83	83	(plf)
e_n :	0.0029	0.0029	0.0029	0.0029	(in.)
b:	2.85	2.85	2.85	2.85	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.024	0.027	0.019	0.366	0.004	0.015	0.011	0.108
Sum			0.436	Sum			0.138
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.004	0.015	0.011	0.108	0.024	0.027	0.019	0.366
Sum			0.138	Sum			0.436

Total Defl.	
0.287	(in.)
0.0106	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (11'-9" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	1427	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G_i Override:		C_d :	4.00		
G_a Override:					
				Pier 1	Pier 2
				Nail Spacing: 4	4 (in.)
				HD Capacity: 2140	2140 (lbf)
				HD Deflection: 0.11	0.11 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	250	250	250	250	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G_a :	22.0	22.0	22.0	22.0	(kips/in.)
b:	2.85	2.85	2.85	2.85	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.024	0.102	0.366	0.004	0.056	0.108
Sum		0.492	Sum		0.168
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.004	0.056	0.108	0.024	0.102	0.366
Sum		0.168	Sum		0.492

Total Defl.	
0.330	(in.)
0.0122	%drift

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



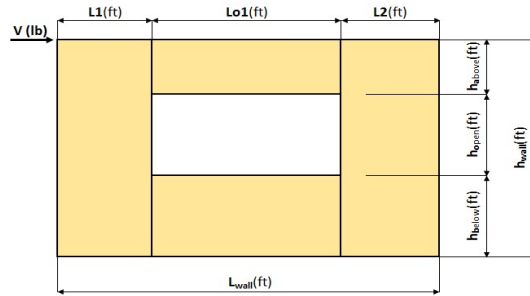
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid A (11'-9" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2384 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	2.85 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	2.85 ft	ho	P1=ha/L1=	1.23
hwall	9.00 ft	hb	P2=ho/L2=	1.23
Lwall	11.70 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1834 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 333 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2001 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1000 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1000 \text{ lbf}$

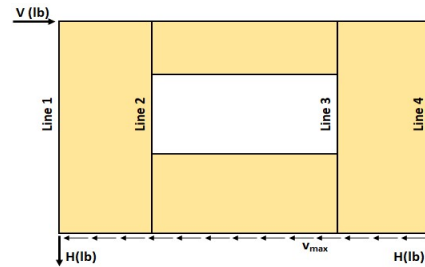
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 3.00 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 3.00 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 418 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 418 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 2384 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 1192 \text{ lbf}$
 $R2 = v2 \cdot L2 = 1192 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 192 \text{ lbf}$
 $R2 - F2 = 192 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 67 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 67 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	370	1464	1834 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1834	370	1464
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1834	370	1464
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	370	1464	1834 lbf

Design Summary*

Req. Sheathing Capacity	418 plf	4-Term Deflection	0.484 in.	3-Term Deflection	0.523 in.
Req. Strap Force	1000 lbf	4-Term Story Drift %	0.018 %	3-Term Story Drift %	0.019 %
Req. HD Force (H)	1834 lbf				
Req. Shear Wall Anchorage Force (v_{max})	204 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (11'-9" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2384	(lbf)
Sheathing Type:		7/16 OSB	
Grade:		APA Rated Sheathing	
G _i 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)
Nail Spacing:		Pier 1: 3	Pier 2: 3 (in.)
HD Capacity:		Pier 1: 2140	Pier 2: 2140 (lbf)
HD Deflection:		Pier 1: 0.11	Pier 2: 0.11 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	418	418	418	418	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	3	3	3	3	(in.)
V_n :	105	105	105	105	(plf)
e_n :	0.0057	0.0057	0.0057	0.0057	(in.)
b:	2.85	2.85	2.85	2.85	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.040	0.045	0.038	0.611	0.006	0.025	0.021	0.181
Sum			0.734	Sum			0.233
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.006	0.025	0.021	0.181	0.040	0.045	0.038	0.611
Sum			0.233	Sum			0.734

Total Defl.	
0.484	(in.)
0.0179	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (11'-9" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2384	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:		Pier 1	Pier 2
G_a Override:		Nail Spacing:	3 3 (in.)
		HD Capacity:	2140 2140 (lbf)
		HD Deflection:	0.11 0.11 (in.)
		C_d :	4.00

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	418	418	418	418 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	4.90	4.90	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:	2.85	2.85	2.85	2.85 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

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

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.040	0.134	0.611	0.006	0.073	0.181
Sum		0.785	Sum		0.261
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.006	0.073	0.181	0.040	0.134	0.611
Sum		0.261	Sum		0.785

Total Defl.	
0.523	(in.)
0.0194	%drift

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



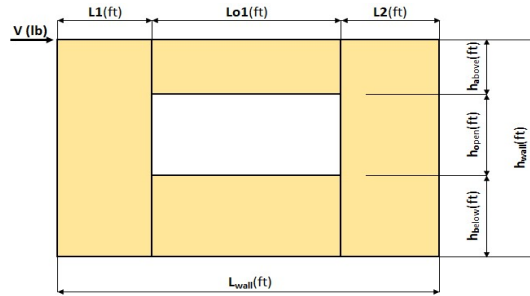
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid A (11'-9" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	2860 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	2.85 ft	h _a	1.40 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	2.85 ft	h _o	3.50 ft	P1=h _o /L1=	1.23	N/A
h _{wall}	9.00 ft	h _b	4.10 ft	P2=h _o /L2=	1.23	N/A
L _{wall}	11.70 ft	Lo1	6.00 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2200 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 400 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2400 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1200 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1200 \text{ lbf}$

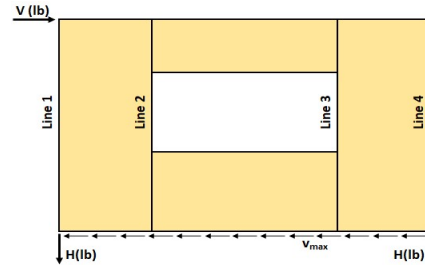
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.00 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 3.00 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 502 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 502 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2860 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1430 \text{ lbf}$
 $R2 = v2 \times L2 = 1430 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 230 \text{ lbf}$
 $R2 - F2 = 230 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 81 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 81 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		444	1756	2200 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	2200	444	1756	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	2200	444	1756	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		444	1756	2200 lbf

Design Summary*

Req. Sheathing Capacity	502 plf	4-Term Deflection	0.667 in.	3-Term Deflection	0.661 in.
Req. Strap Force	1200 lbf	4-Term Story Drift %	0.025 %	3-Term Story Drift %	0.024 %
Req. HD Force (H)	2200 lbf				
Req. Shear Wall Anchorage Force (v_{max})	244 plf				

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

Project Information

Code:2018 IBC

Date:10/28/2024

Designer:Chon Pieruccioni, PE

Client:

Project:East Town Crossing - Building F

Wall Line:Grid A (11'-9" Section) - (Level 1 Seismic)

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:2860(lbf)

Sheathing Type:7/16 OSB

Grade:APA Rated Sheathing

G_i 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:44(in.)

HD Capacity:21402140(lbf)

HD Deflection:0.110.11(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a \frac{h}{b}$$

(Equation 23-2)

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	502	502	502	502	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	4.90	4.90	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G_t :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	(in.)
V_n :	167	167	167	167	(plf)
e_n :	0.0235	0.0235	0.0235	0.0235	(in.)
b:	2.85	2.85	2.85	2.85	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.048	0.054	0.158	0.733	0.008	0.029	0.086	0.217
Sum			0.993	Sum			0.341
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.008	0.029	0.086	0.217	0.048	0.054	0.158	0.733
Sum			0.341	Sum			0.993

Total Defl.	
0.667	(in.)
0.0247	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid A (11'-9" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2860	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:		Pier 1	Pier 2
G_a Override:		Nail Spacing:	4 4 (in.)
		HD Capacity:	2140 2140 (lbf)
		HD Deflection:	0.11 0.11 (in.)
		C_d :	4.00

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	502	502	502	502 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	4.90	4.90	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G_a :	22.0	22.0	22.0	22.0 (kips/in.)
b:	2.85	2.85	2.85	2.85 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.048	0.205	0.733	0.008	0.112	0.217
Sum		0.986	Sum		0.337
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.008	0.112	0.217	0.048	0.205	0.733
Sum		0.337	Sum		0.986

Total Defl.	
0.661	(in.)
0.0245	%drift

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



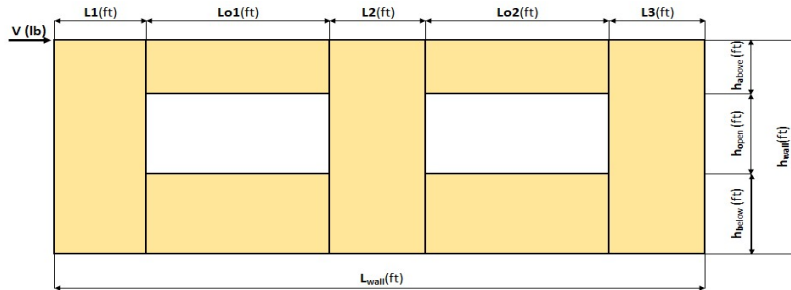
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (26'-2" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	2963 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.50 ft	ha1	ha2	Wall Pier Aspect Ratio	Adj. Factor
L2	9.16 ft	ho1	ho2	P1=ho/L1=	N/A
L3	2.50 ft	hb1	hb2	P2=ho/L2=	N/A
hwall	9.00 ft	Lo1	Lo2	P3=ho/L3=	N/A
Lwall	26.16 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1019 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 204 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 204 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1223 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 1223 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 262 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 961 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 961 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 262 \text{ lbf}$

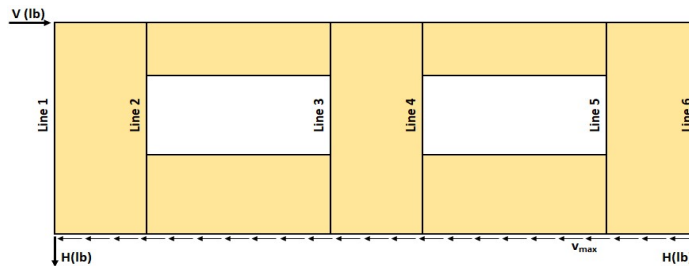
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 1.29 \text{ ft}$
 $T2 = (L2*Lo1)/(L1+L2) = 4.71 \text{ ft}$
 $T3 = (L2*Lo2)/(L2+L3) = 4.71 \text{ ft}$
 $T4 = (L3*Lo2)/(L2+L3) = 1.29 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 172 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 230 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 172 \text{ plf}$
Check $v1*L1+v2*L2+v3*L3=V$ 2963 lbf OK

7. Resistance to corner forces
 $R1 = v1*L1 = 429 \text{ lbf}$
 $R2 = v2*L2 = 2105 \text{ lbf}$
 $R3 = v3*L3 = 429 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 167 \text{ lbf}$
 $R2-F2-F3 = 183 \text{ lbf}$
 $R3-F4 = 167 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 67 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = 20 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 67 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{c1})=H$?	333	686	1019 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{c1})=0$?	1019	333	686
Line 3: $vc2(h_{a1}+h_{b1})+v2(h_{c2})-va1(h_{a1}+h_{b1})=0$?	100	919	1019
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{c2})-vc2(h_{a2}+h_{b2})=0$?	1019	919	100
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{c2})=0$?	1019	333	686
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{c2})=H$?	333	686	1019 lbf

Design Summary*

Req. Sheathing Capacity	230 plf	4-Term Deflection	0.168 in.	3-Term Deflection	0.214 in.
Req. Strap Force	961 lbf	4-Term Story Drift %	0.006 %	3-Term Story Drift %	0.008 %
Req. HD Force	1019 lbf				
Req. Shear Wall Anchorage Force	113 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (26'-2" Section) - (Level 3 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	2963	(lbf)
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G _t Override:	
G _a Override:	

C_d :	4.00
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Nail Type: 8d common

Sheathing Type: 7/16 OSB APA Rated Sheathing

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	0.004	0.011	0.012	0.088
Sum			0.311	Sum			0.115
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.001	0.015	0.030	0.032	0.001	0.015	0.030	0.032
Sum			0.078	Sum			0.078
Pier 3 (left)				Pier 3 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.004	0.011	0.012	0.088	0.019	0.018	0.021	0.252
Sum			0.115	Sum			0.311

Total	
Defl.	
0.168	(in.)
0.0062	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (26'-2" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2963	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	6 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	172	172	230	230	172	172	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	5.30	5.30	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	2.50	2.50	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.019	0.103	0.252	0.004	0.061	0.088
Sum		0.374	Sum		0.152
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.001	0.081	0.032	0.001	0.081	0.032
Sum		0.115	Sum		0.115
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.004	0.061	0.088	0.019	0.103	0.252
Sum		0.152	Sum		0.374

Total	
Defl.	(in.)
0.214	
0.0079	%drift

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



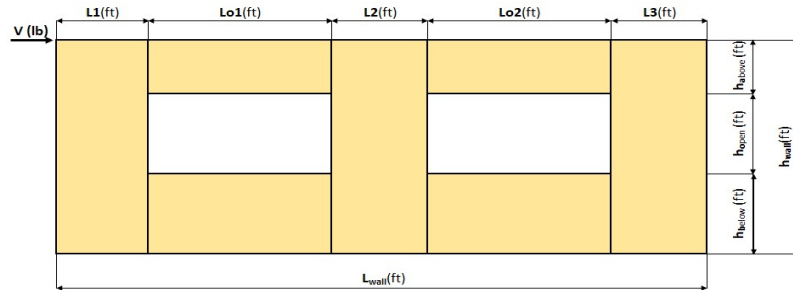
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (26'-2" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	4839 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.50 ft	h _{a1}	h _{a2}	Wall Pier Aspect Ratio	Adj. Factor
L2	9.16 ft	h _{b1}	h _{b2}	P1=h _{a1} /L1=	N/A
L3	2.50 ft	h _{b1}	h _{b2}	P2=h _{b1} /L2=	N/A
h _{wall}	9.00 ft	Lo1	Lo2	P3=h _{a1} /L3=	N/A
L _{wall}	26.16 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1665 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 333 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 333 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1998 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 1998 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 428 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1569 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 1569 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 428 \text{ lbf}$

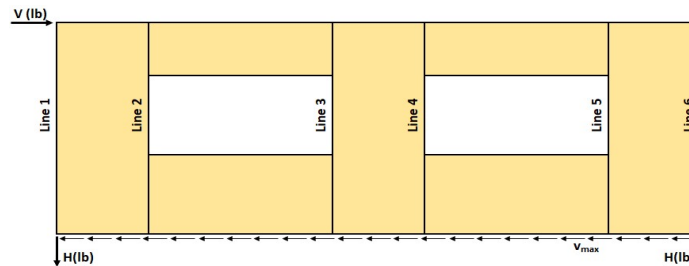
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.29 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 4.71 \text{ ft}$
 $T3 = (L2 \times Lo2)/(L2+L3) = 4.71 \text{ ft}$
 $T4 = (L3 \times Lo2)/(L2+L3) = 1.29 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 280 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 375 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 280 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 + v3 \times L3 = V$ 4839 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 700 \text{ lbf}$
 $R2 = v2 \times L2 = 3438 \text{ lbf}$
 $R3 = v3 \times L3 = 700 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 272 \text{ lbf}$
 $R2-F2-F3 = 299 \text{ lbf}$
 $R3-F4 = 272 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 109 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = 33 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 109 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{c1})=H$?	544	1121	1665 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{c1})=0$?	1665	544	0
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{c2})-va1(h_{a1}+h_{b1})=0$?	163	1501	0
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{c2})-vc2(h_{a2}+h_{b2})=0$?	1665	1501	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{c2})=0$?	1665	544	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{c2})=H$?	544	1121	1665 lbf

Design Summary*

Req. Sheathing Capacity	375 plf	4-Term Deflection	0.251 in.	3-Term Deflection	0.287 in.
Req. Strap Force	1569 lbf	4-Term Story Drift %	0.009 %	3-Term Story Drift %	0.011 %
Req. HD Force	1665 lbf				
Req. Shear Wall Anchorage Force	185 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (26'-2" Section) - (Level 2 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	4839	(lbf)
---	------	-------

G _t Override:	
G _a Override:	

C_d :	4.00
---------	------

Nail Type: 8d common

Sheathing Type: 7/16 OSB APA Rated Sheathing

Total	
Defl.	
0.251	(in.)
0.0093	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (26'-2" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	4839	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	3 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	280	280	375	375	280	280	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	5.30	5.30	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	2.50	2.50	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.030	0.090	0.412	0.006	0.053	0.143
Sum		0.533	Sum		0.202
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.002	0.071	0.052	0.002	0.071	0.052
Sum		0.126	Sum		0.126
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.006	0.053	0.143	0.030	0.090	0.412
Sum		0.202	Sum		0.533

Total	
Defl.	(in.)
0.287	
0.0106	%drift

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



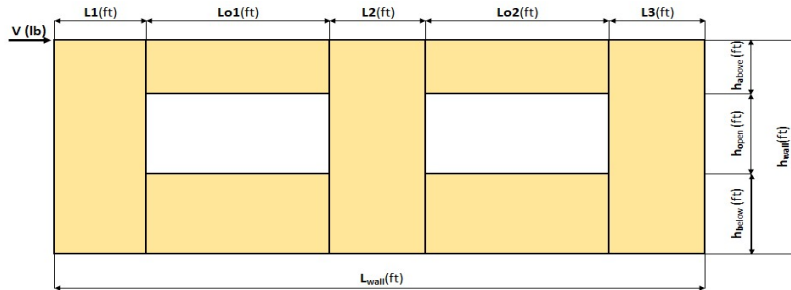
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (26'-2" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	5796 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	2.50 ft	h _{a1}	h _{a2}	Wall Pier Aspect Ratio	Adj. Factor
L2	9.16 ft	h _{o1}	h _{o2}	P1=h _o /L1=	N/A
L3	2.50 ft	h _{b1}	h _{b2}	P2=h _o /L2=	N/A
h _{wall}	9.00 ft	Lo1	Lo2	P3=h _o /L3=	N/A
L _{wall}	26.16 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1994 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 399 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 399 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2393 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 2393 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 513 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1880 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 1880 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 513 \text{ lbf}$

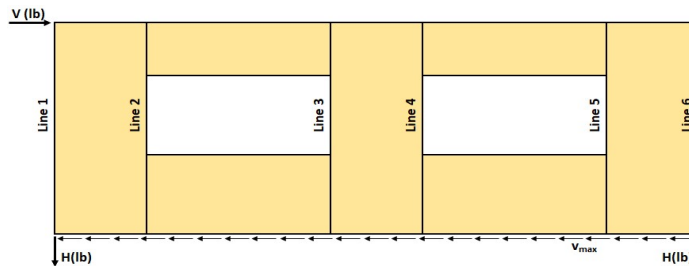
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 1.29 \text{ ft}$
 $T2 = (L2*Lo1)/(L1+L2) = 4.71 \text{ ft}$
 $T3 = (L2*Lo2)/(L2+L3) = 4.71 \text{ ft}$
 $T4 = (L3*Lo2)/(L2+L3) = 1.29 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 336 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 450 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 336 \text{ plf}$
Check $v1*L1+v2*L2+v3*L3=V?$ 5796 lbf OK

7. Resistance to corner forces
 $R1 = v1*L1 = 839 \text{ lbf}$
 $R2 = v2*L2 = 4118 \text{ lbf}$
 $R3 = v3*L3 = 839 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 326 \text{ lbf}$
 $R2-F2-F3 = 359 \text{ lbf}$
 $R3-F4 = 326 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 130 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = 39 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 130 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H?$	652	1342	1994 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0?$	1994	652	0
Line 3: $vc2(h_{a1}+h_{b1})+v2(h_{o1})-va1(h_{a1}+h_{b1})=0?$	196	1798	0
Line 4: $va2(h_{a2}+h_{b2})-vc2(h_{a2})-vc2(h_{a2}+h_{b2})=0?$	1994	1798	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0?$	1994	652	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H?$	652	1342	1994 lbf

Design Summary*

Req. Sheathing Capacity	450 plf	4-Term Deflection	0.307 in.	3-Term Deflection	0.344 in.
Req. Strap Force	1880 lbf	4-Term Story Drift %	0.011 %	3-Term Story Drift %	0.013 %
Req. HD Force	1994 lbf				
Req. Shear Wall Anchorage Force	222 plf				

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

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (26'-2" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	5796	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _l Override:		Enter individual post sizes below.		Pier 1	Pier 3
G _a Override:		C _d : 4.00		Nail Spacing: 3	3 (in.)
				HD Capacity: 1938	1938 (lbf)
				HD Deflection: 0.088	0.088 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	336	336	450	450	336	336	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	5.30	5.30	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 :	84	84	112	112	84	84	(plf)
e_n :	0.0029	0.0029	0.0071	0.0071	0.0029	0.0029	(in.)
b:	2.50	2.50	9.16	9.16	2.50	2.50	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.036	0.036	0.020	0.494	0.007	0.021	0.012	0.171
Sum			0.586	Sum			0.212
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.003	0.029	0.028	0.063	0.003	0.029	0.028	0.063
Sum			0.122	Sum			0.122
Pier 3 (left)				Pier 3 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.007	0.021	0.012	0.171	0.036	0.036	0.020	0.494
Sum			0.212	Sum			0.586

Total	
Defl.	
0.307	(in.)
0.0114	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (26'-2" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	5796	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	3 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	336	336	450	450	336	336	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	5.30	5.30	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	2.50	2.50	(ft)
HD Capacity:	1938	1938	1938	1938	1938	1938	(lbf)
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.036	0.108	0.494	0.007	0.064	0.171
Sum		0.638	Sum		0.242
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.085	0.063	0.003	0.085	0.063
Sum		0.150	Sum		0.150
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.007	0.064	0.171	0.036	0.108	0.494
Sum		0.242	Sum		0.638

Total	
Defl.	(in.)
0.344	
0.0127	%drift

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



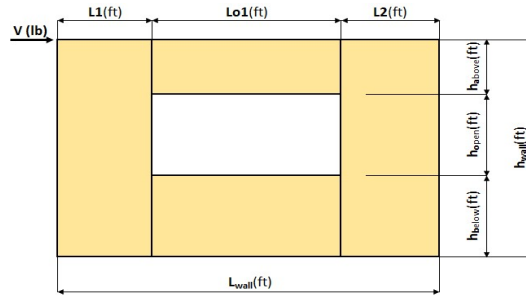
Force Transfer Around Openings Calculator

ONE OPENING

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

Project Information

Code:	2018 IBC	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid K (14'-7" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1652 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	4.60 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	3.98 ft	ho	P1=ho/L1=	0.87
hwall	9.00 ft	hb	P2=ho/L2=	1.01
Lwall	14.58 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1020 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 204 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1224 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 656 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 568 \text{ lbf}$

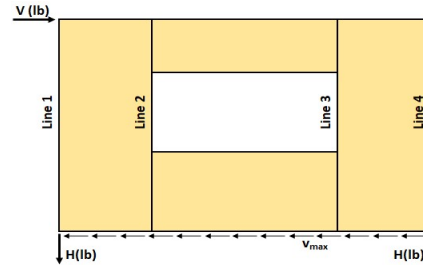
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.22 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.78 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 193 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 193 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 1652 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 886 \text{ lbf}$
 $R2 = v2 \times L2 = 766 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 230 \text{ lbf}$
 $R2 - F2 = 199 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 50 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 50 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	250	770	1020 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1020	250	770
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1020	250	770
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	250	770	1020 lbf

Design Summary*

Req. Sheathing Capacity	204 plf	4-Term Deflection	0.174 in.	3-Term Deflection	0.226 in.
Req. Strap Force	656 lbf	4-Term Story Drift %	0.006 %	3-Term Story Drift %	0.008 %
Req. HD Force (H)	1020 lbf				
Req. Shear Wall Anchorage Force (v_{max})	113 plf				

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

Project Information

Code:2018 IBC

Date:10/28/2024

Designer:Chon Pieruccioni, PE

Client:

Project:East Town Crossing - Building F

Wall Line:Grid K (14'-7" Section) - (Level 3 Seismic)

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:1652(lbf)

Sheathing Type:7/16 OSB

Grade:APA Rated Sheathing

G_i 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:66(in.)

HD Capacity:21402140(lbf)

HD Deflection:0.110.11(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a \frac{h}{b}$$

(Equation 23-2)

Pier 1-L

Pier 1-R

Pier 2-L

Pier 2-R

$V_{unfactored}$

E

h

Qty

Stud Size

A Override

A

G_i

Nail Spacing

V_n

e_n

b

HD Capacity

HD Defl

193

193

193

193

(plf)

(psi)

(ft)

(in.²)

(in.²)

(lbf/in.)

(in.)

(plf)

(in.)

(ft)

(lbf)

(in.)

2.00E+00

2.00E+00

2.00E+00

2.00E+00

2x6

2x6

2x6

2x6

16.5

16.5

16.5

16.5

83,500

83,500

83,500

83,500

6

6

6

6

96

96

96

96

0.0044

0.0044

0.0044

0.0044

4.60

4.60

3.98

3.98

2140

2140

2140

2140

0.11

0.11

0.11

0.11

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	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.011	0.021	0.030	0.174	0.002	0.012	0.018	0.060
Sum			0.236	Sum			0.093
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.003	0.012	0.018	0.070	0.013	0.021	0.030	0.201
Sum			0.102	Sum			0.265

Total Defl.

0.1740.0064(in.) %drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid K (14'-7" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		1652	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:		Pier 1	Pier 2
G_a Override:		Nail Spacing:	6 (in.)
		HD Capacity:	2140 (lbf)
		HD Deflection:	0.11 (in.)
		C_d :	4.00

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	193	193	193	193 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	5.30	5.30	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G_a :	15.0	15.0	15.0	15.0 (kips/in.)
b:	4.60	4.60	3.98	3.98 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.011	0.116	0.174	0.002	0.068	0.060
Sum		0.301	Sum		0.131
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.068	0.070	0.013	0.116	0.201
Sum		0.141	Sum		0.330

Total Defl.	
0.226	(in.)
0.0084	%drift

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



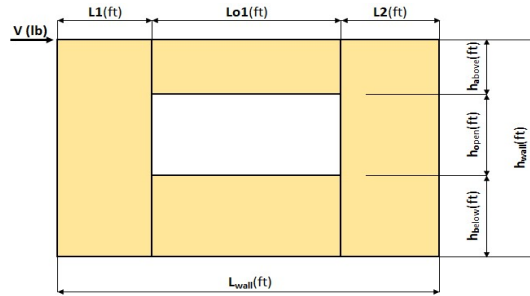
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid K (14'-7" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2927 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	4.60 ft	h _a	1.30 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	3.98 ft	h _o	4.00 ft	P1=h _o /L1=	0.87	N/A
h _{wall}	9.00 ft	h _b	3.70 ft	P2=h _o /L2=	1.01	N/A
L _{wall}	14.58 ft	Lo1	6.00 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1807 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 361 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2168 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1162 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1006 \text{ lbf}$

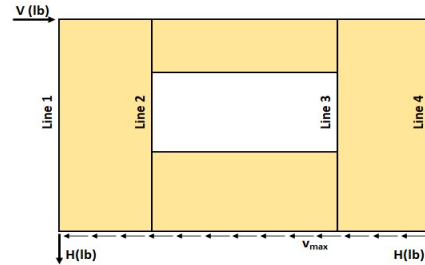
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.22 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.78 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 341 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 341 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2927 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1569 \text{ lbf}$
 $R2 = v2 \times L2 = 1358 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 407 \text{ lbf}$
 $R2 - F2 = 352 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 88 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 88 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		442	1365	1807 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1807	442	1365	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1807	442	1365	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		442	1365	1807 lbf

Design Summary*

Req. Sheathing Capacity	361 plf	4-Term Deflection	0.400 in.	3-Term Deflection	0.400 in.
Req. Strap Force	1162 lbf	4-Term Story Drift %	0.015 %	3-Term Story Drift %	0.015 %
Req. HD Force (H)	1807 lbf				
Req. Shear Wall Anchorage Force (v_{max})	201 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid K (14'-7" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2927 (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_i Override:
G_a Override:

Enter individual post sizes below.
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	341	341	341	341	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	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 :	171	171	171	171	(plf)
e_n :	0.0249	0.0249	0.0249	0.0249	(in.)
b:	4.60	4.60	3.98	3.98	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.020	0.037	0.168	0.309	0.004	0.022	0.099	0.107
Sum			0.534	Sum			0.232
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.005	0.022	0.099	0.124	0.023	0.037	0.168	0.357
Sum			0.249	Sum			0.585

Total Defl.	
0.400	(in.)
0.0148	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid K (14'-7" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2927	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:			
G_a Override:		C_d :	4.00
		Pier 1	Pier 2
Nail Spacing:		6	6 (in.)
HD Capacity:		2140	2140 (lbf)
HD Deflection:		0.11	0.11 (in.)

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	341	341	341	341 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	5.30	5.30	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G_a :	15.0	15.0	15.0	15.0 (kips/in.)
b:	4.60	4.60	3.98	3.98 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.020	0.205	0.309	0.004	0.121	0.107
Sum		0.534	Sum		0.232
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.005	0.121	0.124	0.023	0.205	0.357
Sum		0.249	Sum		0.585

Total Defl.	
0.400	(in.)
0.0148	%drift

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



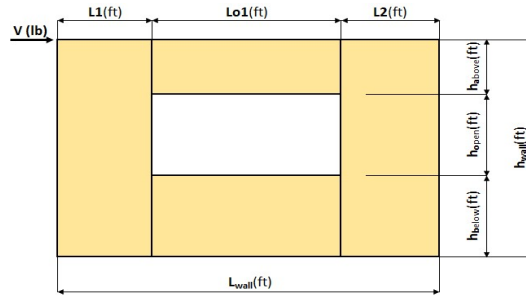
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid K (14'-7" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	3231 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	4.60 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	3.98 ft	ho	P1=ha/L1=	0.87
hwall	9.00 ft	hb	P2=ho/L2=	1.01
Lwall	14.58 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{\text{wall}}/L_{\text{wall}}$ 1994 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 399 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2393 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1283 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1110 \text{ lbf}$

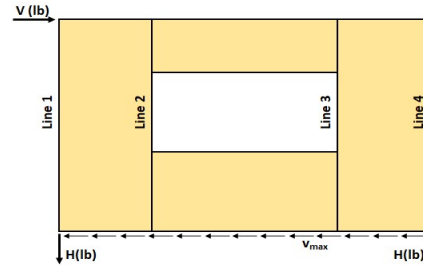
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.22 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.78 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 377 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 377 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 3231 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1732 \text{ lbf}$
 $R2 = v2 \times L2 = 1499 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 449 \text{ lbf}$
 $R2 - F2 = 389 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 98 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 98 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	488	1506	1994 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1994	488	1506
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1994	488	1506
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	488	1506	1994 lbf

Design Summary*

Req. Sheathing Capacity	399 plf	4-Term Deflection	0.474 in.	3-Term Deflection	0.441 in.
Req. Strap Force	1283 lbf	4-Term Story Drift %	0.018 %	3-Term Story Drift %	0.016 %
Req. HD Force (H)	1994 lbf				
Req. Shear Wall Anchorage Force (v_{max})	222 plf				

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

Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid K (14'-7" Section) - (Level 1 Seismic)	

Unfactored Shear Load $V_{unfactored}$:	3231	(lbf)
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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	
V _{unfactored} :	377	377	377	377	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	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 _i :	83,500	83,500	83,500	83,500	(lb/ft.in.)
Nail Spacing:	6	6	6	6	(in.)
V _n :	188	188	188	188	(plf)
e _n :	0.0335	0.0335	0.0335	0.0335	(in.)
b:	4.60	4.60	3.98	3.98	(ft)
HD Capacity:	2140	2140	2140	2140	(lb/ft)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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	0.041	0.226	0.341	0.005	0.024	0.133	0.118
Sum			0.630	Sum			0.280
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.005	0.024	0.133	0.137	0.026	0.041	0.226	0.394
Sum			0.299	Sum			0.687

Total	
Defl.	
0.474	(in.)
0.0176	%drift

Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid K (14'-7" Section) - (Level 1 Seismic)	

Unfactored Shear Load $V_{\text{unfactored}}$:	3231	(lbf)
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Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
V _{unfactored} :	377	377	377	377	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G _a :	15.0	15.0	15.0	15.0	(kips/in.)
b:	4.60	4.60	3.98	3.98	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

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	0.226	0.341	0.005	0.133	0.118
Sum		0.589	Sum		0.256
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.005	0.133	0.137	0.026	0.226	0.394
Sum		0.275	Sum		0.646

Total	
Defl.	
0.441	(in.)
0.0163	%drift

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



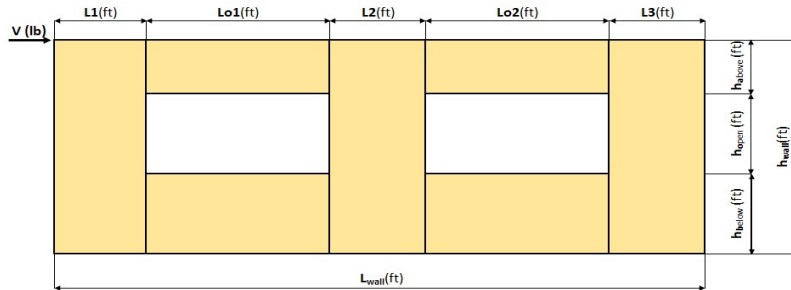
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid M (21'-5" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	2426 lbf	Opening 1	Opening 2	Adj. Factor Method =	2bs/h
L1	3.24 ft	ha1	ha2	Wall Pier Aspect Ratio	Adj. Factor
L2	2.94 ft	ho1	ho2	P1=ho/L1=	N/A
L3	3.24 ft	hb1	hb2	P2=ho/L2=	N/A
hwall	9.00 ft	Lo1	Lo2	P3=ho/L3=	N/A
Lwall	21.42 ft				

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1019 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a1+h_b1) = 204 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_a2+h_b2) = 204 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1223 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 1223 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 641 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 582 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 582 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 641 \text{ lbf}$

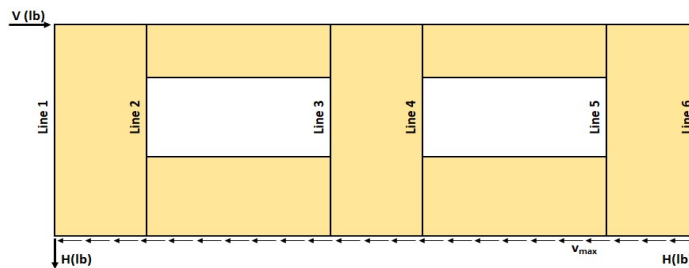
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.15 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.85 \text{ ft}$
 $T3 = (L2 \times Lo2)/(L2+L3) = 2.85 \text{ ft}$
 $T4 = (L3 \times Lo2)/(L2+L3) = 3.15 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 223 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 333 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 223 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 + v3 \times L3 = V$ 2426 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 723 \text{ lbf}$
 $R2 = v2 \times L2 = 980 \text{ lbf}$
 $R3 = v3 \times L3 = 723 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 82 \text{ lbf}$
 $R2-F2-F3 = -184 \text{ lbf}$
 $R3-F4 = 82 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 25 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = -63 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 25 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H$?	126	893	1019 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0$?	1019	126	0
Line 3: $vc2(h_{a1}+h_{b1})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0$?	-313	1333	0
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0$?	1019	1333	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0$?	1019	126	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H$?	126	893	1019 lbf

Design Summary*

Req. Sheathing Capacity	333 plf	4-Term Deflection	0.208 in.	3-Term Deflection	0.247 in.
Req. Strap Force	641 lbf	4-Term Story Drift %	0.008 %	3-Term Story Drift %	0.009 %
Req. HD Force	1019 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: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid M (21'-5" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2426	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _l Override:		Enter individual post sizes below.			
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.)

Four-Term Equation Deflection Check

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

	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	5.30	5.30	5.30	5.30	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:	3.24	3.24	2.94	2.94	3.24	3.24	(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	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.019	0.024	0.014	0.253	0.004	0.014	0.008	0.088
Sum			0.310	Sum			0.114
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.006	0.021	0.027	0.145	0.006	0.021	0.027	0.145
Sum			0.199	Sum			0.199
Pier 3 (left)				Pier 3 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.004	0.014	0.008	0.088	0.019	0.024	0.014	0.253
Sum			0.114	Sum			0.310

Total	
Defl.	
0.208	(in.)
0.0077	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid M (21'-5" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2426	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Nail Spacing:	
G _a Override:				HD Capacity:	
				HD Deflection:	
				Pier 1	Pier 3
				4	4
				1938	1938
				0.088	0.088

Three-Term Equation Deflection Check						
$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$						
	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
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06
h:	9.00	5.30	5.30	5.30	5.30	9.00
Qty:	2	2	2	2	2	2
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6
A Override:						
A:	16.5	16.5	16.5	16.5	16.5	16.5
G _a :	22.0	22.0	22.0	22.0	22.0	22.0
b:	3.24	3.24	2.94	2.94	3.24	3.24
HD Capacity:	1938	1938	1938	1938	1938	1938
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088

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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.019	0.091	0.253	0.004	0.054	0.088
Sum		0.363	Sum		0.145
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.006	0.080	0.145	0.006	0.080	0.145
Sum		0.231	Sum		0.231
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.004	0.054	0.088	0.019	0.091	0.253
Sum		0.145	Sum		0.363

Total	
Defl.	
0.247	(in.)
0.0091	%drift

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



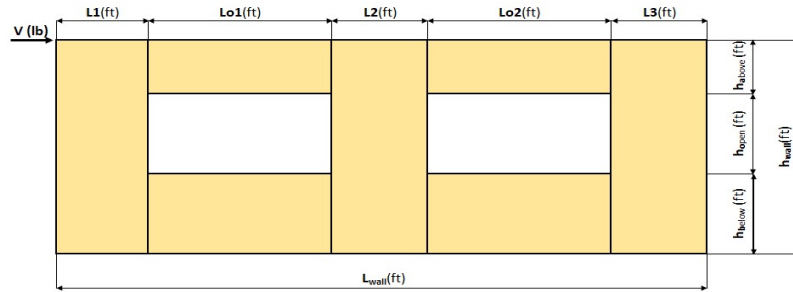
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid M (21'-5" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	3962 lbf	Opening 1		Opening 2		Adj. Factor Method =		2bs/h	
L1	3.24 ft	h _{a1}	1.30 ft	h _{a2}	1.30 ft	Wall Pier Aspect Ratio		Adj. Factor	
L2	2.94 ft	h _{a1}	4.00 ft	h _{a2}	4.00 ft	P1=h _a /L1=		1.23	
L3	3.24 ft	h _{b1}	3.70 ft	h _{b2}	3.70 ft	P2=h _a /L2=		1.36	
h _{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft	P3=h _a /L3=		1.23	
L _{wall}	21.42 ft								

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1665 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 333 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 333 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1998 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 1998 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1047 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 950 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 950 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 1047 \text{ lbf}$

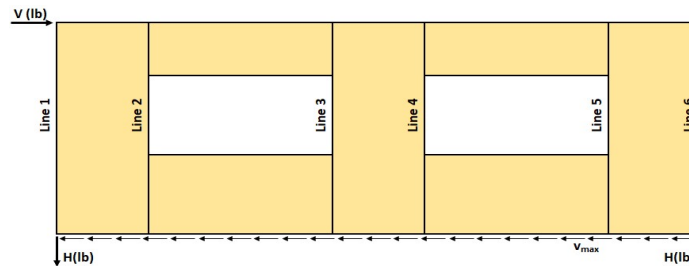
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.15 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.85 \text{ ft}$
 $T3 = (L2 \times Lo2)/(L2+L3) = 2.85 \text{ ft}$
 $T4 = (L3 \times Lo2)/(L2+L3) = 3.15 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 365 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 544 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 365 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 + v3 \times L3 = V$ 3962 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1181 \text{ lbf}$
 $R2 = v2 \times L2 = 1600 \text{ lbf}$
 $R3 = v3 \times L3 = 1181 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 134 \text{ lbf}$
 $R2-F2-F3 = -301 \text{ lbf}$
 $R3-F4 = 134 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 41 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = -102 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 41 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H?$		207	1458	1665 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0?$	1665	207	1458	0
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0?$	-512	2177	1665	0
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0?$	1665	2177	-512	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0?$	1665	207	1458	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H?$		207	1458	1665 lbf

Design Summary*

Req. Sheathing Capacity	544 plf	4-Term Deflection	0.321 in.	3-Term Deflection	0.344 in.
Req. Strap Force	1047 lbf	4-Term Story Drift %	0.012 %	3-Term Story Drift %	0.013 %
Req. HD Force	1665 lbf				
Req. Shear Wall Anchorage Force	185 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid M (21'-5" Section) - (Level 2 Seismic)		

Unfactored Shear Load $V_{unfactored}$:	3962	(lbf)
--	------	-------

Unfactored Shear Load $V_{unfactored}$:	3962	(lbf)
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Nail Type: 8d common (penny weight)

Enter individual post sizes below.

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.)

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

[illegible]

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

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	0.039	0.007	0.414	0.006	0.023	0.004	0.144
Sum			0.491	Sum			0.177
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.010	0.035	0.015	0.236	0.010	0.035	0.015	0.236
Sum			0.296	Sum			0.296
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	0.023	0.004	0.144	0.031	0.039	0.007	0.414
Sum			0.177	Sum			0.491

Total	
Defl.	
0.321	(in.)
0.0119	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid M (21'-5" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	3962	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Pier 1	
G _a Override:				Pier 3	
				Nail Spacing:	2 (in.)
				HD Capacity:	1938 (lbf)
				HD Deflection:	0.088 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	
$V_{unfactored}$:	365	365	544	544	365	365	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	5.30	5.30	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:	3.24	3.24	2.94	2.94	3.24	3.24	(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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.031	0.078	0.414	0.006	0.046	0.144
Sum		0.523	Sum		0.196
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.010	0.069	0.236	0.010	0.069	0.236
Sum		0.315	Sum		0.315
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.006	0.046	0.144	0.031	0.078	0.414
Sum		0.196	Sum		0.523

Total	
Defl.	(in.)
0.344	
0.0128	%drift

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



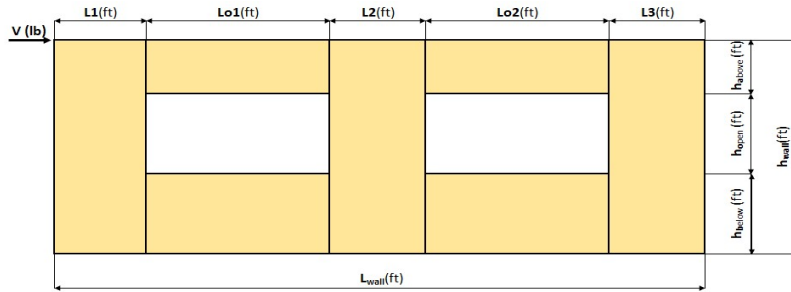
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid M (21'-5" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	4746 lbf	Opening 1		Opening 2		Adj. Factor Method =		2bs/h	
L1	3.24 ft	h _a 1	1.30 ft	h _a 2	1.30 ft	Wall Pier Aspect Ratio		Adj. Factor	
L2	2.94 ft	h _o 1	4.00 ft	h _o 2	4.00 ft	P1=h _o /L1=	1.23	N/A	
L3	3.24 ft	h _b 1	3.70 ft	h _b 2	3.70 ft	P2=h _o /L2=	1.36	N/A	
h _{wall}	9.00 ft	Lo1	6.00 ft	Lo2	6.00 ft	P3=h _o /L3=	1.23	N/A	
L _{wall}	21.42 ft								

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1994 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 399 \text{ plf}$
Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 399 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 2393 \text{ lbf}$
Second opening: $O2 = va2 \times (Lo2) = 2393 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 1255 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 1138 \text{ lbf}$
 $F3 = O2(L2)/(L2+L3) = 1138 \text{ lbf}$
 $F4 = O2(L3)/(L2+L3) = 1255 \text{ lbf}$

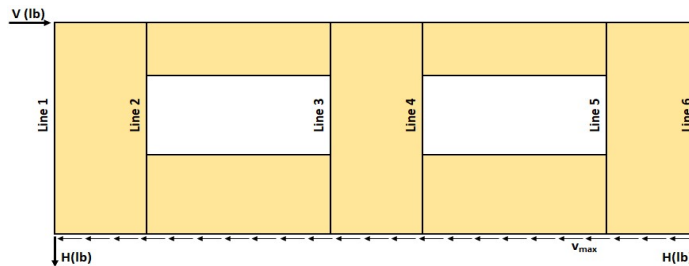
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 3.15 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.85 \text{ ft}$
 $T3 = (L2 \times Lo2)/(L2+L3) = 2.85 \text{ ft}$
 $T4 = (L3 \times Lo2)/(L2+L3) = 3.15 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 437 \text{ plf}$
 $v2 = (V/L)(T2+L2+T3)/L2 = 652 \text{ plf}$
 $v3 = (V/L)(T4+L3)/L3 = 437 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 + v3 \times L3 = V$ 4746 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1415 \text{ lbf}$
 $R2 = v2 \times L2 = 1916 \text{ lbf}$
 $R3 = v3 \times L3 = 1415 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = 160 \text{ lbf}$
 $R2-F2-F3 = -360 \text{ lbf}$
 $R3-F4 = 160 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = 49 \text{ plf}$
 $vc2 = (R2-F2-F3)/L2 = -123 \text{ plf}$
 $vc3 = (R3-F4)/L3 = 49 \text{ plf}$



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H$?	247	1747	1994 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0$?	1994	247	0
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0$?	-613	2607	0
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0$?	1994	2607	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0$?	1994	247	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H$?	247	1747	1994 lbf

Design Summary*

Req. Sheathing Capacity	652 plf	4-Term Deflection	0.390 in.	3-Term Deflection	0.413 in.
Req. Strap Force	1255 lbf	4-Term Story Drift %	0.014 %	3-Term Story Drift %	0.015 %
Req. HD Force	1994 lbf				
Req. Shear Wall Anchorage Force	222 plf				

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

Code:	IBC 2018	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid M (21'-5" Section) - (Level 1 Seismic)		

Unfactored Shear Load $V_{unfactored}$:	4746	(lbf)
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Unfactored Shear Load $V_{unfactored}$:	4746	(lbf)
--	------	-------

Nail Type: 8d common (penny weight)

Enter individual post sizes below.

G _a Override:	
--------------------------	--

C_d :	4.00
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	Pier 1	Pier 3	
Nail Spacing:	2	2	(in.)
HD Capacity:	1938	1938	(lbf)
HD Deflection:	0.088	0.088	(in.)

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

[illegible]

Sheathing Type: 7/16 OSB APA Rated Sheathing

Nail Type: 8d common

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	0.047	0.013	0.496	0.007	0.028	0.008	0.172
Sum			0.592	Sum			0.215
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.012	0.041	0.025	0.283	0.012	0.041	0.025	0.283
Sum			0.362	Sum			0.362
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	0.028	0.008	0.172	0.037	0.047	0.013	0.496
Sum			0.215	Sum			0.592

Total	
Defl.	
0.390	(in.)
0.0144	%drift

Project Information		
Code:	IBC 2018	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid M (21'-5" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	4746	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G _t Override:		C _d : 4.00		Nail Spacing:	
G _a Override:				HD Capacity:	
				HD Deflection:	
				Pier 1	Pier 3
				2	2
				1938	1938
				0.088	0.088

Three-Term Equation Deflection Check						
$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$						
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R
$V_{unfactored}$:	437	437	652	652	437	437
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06
h:	9.00	5.30	5.30	5.30	5.30	9.00
Qty:	2	2	2	2	2	2
Stud Size:	2x6	2x6	2x6	2x6	2x6	2x6
A Override:						
A:	16.5	16.5	16.5	16.5	16.5	16.5
G _a :	42.0	42.0	42.0	42.0	42.0	42.0
b:	3.24	3.24	2.94	2.94	3.24	3.24
HD Capacity:	1938	1938	1938	1938	1938	1938
HD Defl:	0.088	0.088	0.088	0.088	0.088	0.088

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	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.037	0.094	0.496	0.007	0.055	0.172
Sum		0.626	Sum		0.234
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.012	0.082	0.283	0.012	0.082	0.283
Sum		0.377	Sum		0.377
Pier 3 (left)			Pier 3 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.007	0.055	0.172	0.037	0.094	0.496
Sum		0.234	Sum		0.626

Total	
Defl.	
0.413	(in.)
0.0153	%drift

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



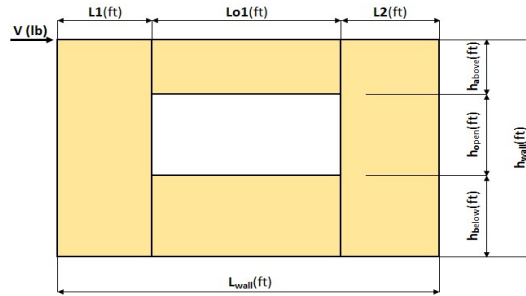
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (11'-4" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1283 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	3.16 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	3.17 ft	ho	P1=ho/L1=	N/A
hwall	9.00 ft	hb	P2=ho/L2=	N/A
Lwall	11.33 ft	Lo1		

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1019 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 204 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1019 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 509 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 510 \text{ lbf}$

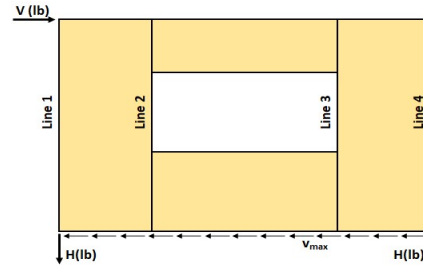
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 2.50 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 2.50 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 203 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 203 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 1283 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 640 \text{ lbf}$
 $R2 = v2 \cdot L2 = 643 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 132 \text{ lbf}$
 $R2 - F2 = 132 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 42 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 42 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$		208	811	1019 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1019	208	811	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1019	208	811	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$		208	811	1019 lbf

Design Summary*

Req. Sheathing Capacity	204 plf	4-Term Deflection	0.235 in.	3-Term Deflection	0.287 in.
Req. Strap Force	510 lbf	4-Term Story Drift %	0.009 %	3-Term Story Drift %	0.011 %
Req. HD Force (H)	1019 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: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (11'-4" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		1283	(lbf)
Sheathing Type:		7/16 OSB	
Grade:		APA Rated Sheathing	
G _i 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)
Nail Spacing:		Pier 1: 6	Pier 2: 6 (in.)
HD Capacity:		Pier 1: 2140	Pier 2: 2140 (lbf)
HD Deflection:		Pier 1: 0.11	Pier 2: 0.11 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	203	203	203	203	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	6	6	6	6	(in.)
V_n :	101	101	101	101	(plf)
e_n :	0.0052	0.0052	0.0052	0.0052	(in.)
b:	3.16	3.16	3.17	3.17	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.017	0.022	0.035	0.267	0.004	0.013	0.021	0.093
Sum			0.341	Sum			0.130
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.004	0.013	0.021	0.092	0.017	0.022	0.035	0.266
Sum			0.129	Sum			0.340

Total Defl.	
0.235	(in.)
0.0087	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (11'-4" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	1283	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G_i Override:		C_d : 4.00		Nail Spacing:	Pier 1 6 (in.)
G_a Override:				HD Capacity:	Pier 2 2140 (lbf)
				HD Deflection:	0.11 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	203	203	203	203	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	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:	3.16	3.16	3.17	3.17	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.017	0.122	0.267	0.004	0.072	0.093
Sum		0.406	Sum		0.168
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.004	0.072	0.092	0.017	0.122	0.266
Sum		0.167	Sum		0.405

Total Defl.	
0.287	(in.)
0.0106	%drift

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



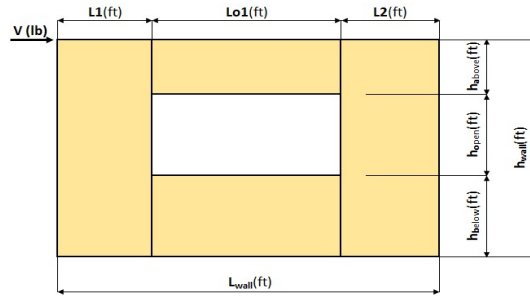
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (11'-4" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2096 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	3.16 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	3.17 ft	ho	P1=ha/L1=	N/A
hwall	9.00 ft	hb	P2=ho/L2=	N/A
Lwall	11.33 ft	Lo1		

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1665 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 333 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1665 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 831 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 834 \text{ lbf}$

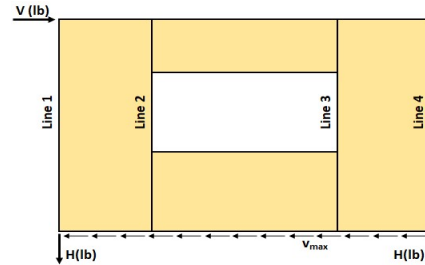
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 2.50 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 2.50 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 331 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 331 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 2096 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 1046 \text{ lbf}$
 $R2 = v2 \cdot L2 = 1050 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 215 \text{ lbf}$
 $R2 - F2 = 216 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 68 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 68 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	340	1324	1665 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1665	340	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1665	340	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	340	1324	1665 lbf

Design Summary*

Req. Sheathing Capacity	333 plf	4-Term Deflection	0.375 in.	3-Term Deflection	0.418 in.
Req. Strap Force	834 lbf	4-Term Story Drift %	0.014 %	3-Term Story Drift %	0.015 %
Req. HD Force (H)	1665 lbf				
Req. Shear Wall Anchorage Force (v_{max})	185 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (11'-4" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 2096 (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_i Override:

G_a Override:

Enter individual post sizes below.

C_d: 4.00

Pier 1

Pier 2

Nail Spacing: 4 4 (in.)

HD Capacity: 2140 2140 (lbf)

HD Deflection: 0.11 0.11 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	331	331	331	331	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G _t :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	(in.)
V _n :	110	110	110	110	(plf)
e _n :	0.0067	0.0067	0.0067	0.0067	(in.)
b:	3.16	3.16	3.17	3.17	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.028	0.036	0.045	0.436	0.006	0.021	0.027	0.151
Sum			0.546	Sum			0.205
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.006	0.021	0.027	0.151	0.028	0.036	0.045	0.435
Sum			0.204	Sum			0.544

Total Defl.	
0.375	(in.)
0.0139	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (11'-4" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2096	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G_i Override:		C_d :	4.00		
G_a Override:					
				Pier 1	Pier 2
				Nail Spacing: 4	4 (in.)
				HD Capacity: 2140	2140 (lbf)
				HD Deflection: 0.11	0.11 (in.)

Three-Term Equation Deflection Check				
$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	331	331	331	331 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	5.30	5.30	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G_a :	22.0	22.0	22.0	22.0 (kips/in.)
b:	3.16	3.16	3.17	3.17 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.028	0.135	0.436	0.006	0.080	0.151
Sum		0.600	Sum		0.237
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.006	0.080	0.151	0.028	0.135	0.435
Sum		0.236	Sum		0.599

Total Defl.	
0.418	(in.)
0.0155	%drift

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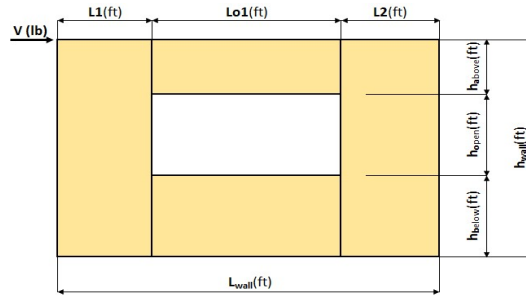
Force Transfer Around Openings Calculator

ONE OPENING

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

Project Information

Code:	2018 IBC	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (11'-4" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	2510 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	3.16 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	3.17 ft	ho	P1=ha/L1=	N/A
hwall	9.00 ft	hb	P2=ho/L2=	N/A
Lwall	11.33 ft	Lo1		

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1994 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 399 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1994 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 995 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 998 \text{ lbf}$

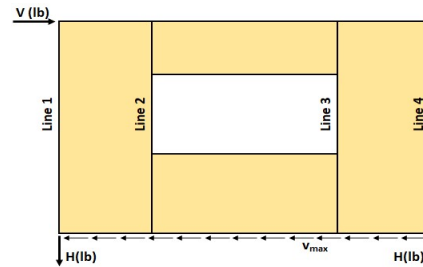
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 2.50 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.50 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 397 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 397 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2510 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1253 \text{ lbf}$
 $R2 = v2 \times L2 = 1257 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 258 \text{ lbf}$
 $R2 - F2 = 258 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 82 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 82 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$		408	1586	1994 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1994	408	1586	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1994	408	1586	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$		408	1586	1994 lbf

Design Summary*

Req. Sheathing Capacity	399 plf	4-Term Deflection	0.468 in.	3-Term Deflection	0.501 in.
Req. Strap Force	998 lbf	4-Term Story Drift %	0.017 %	3-Term Story Drift %	0.019 %
Req. HD Force (H)	1994 lbf				
Req. Shear Wall Anchorage Force (v_{max})	222 plf				

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

Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (11'-4" Section) - (Level 1 Seismic)	

Unfactored Shear Load $V_{\text{unfactored}}$:	2510	(lbf)
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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	
V _{unfactored} :	397	397	397	397	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	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 _i :	83,500	83,500	83,500	83,500	(lb/ft.in.)
Nail Spacing:	4	4	4	4	(in.)
V _n :	132	132	132	132	(plf)
e _n :	0.0115	0.0115	0.0115	0.0115	(in.)
b:	3.16	3.16	3.17	3.17	(ft)
HD Capacity:	2140	2140	2140	2140	(lb/ft)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.034	0.043	0.078	0.522	0.007	0.025	0.046	0.181
Sum			0.677	Sum			0.259
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	0.025	0.046	0.181	0.034	0.043	0.078	0.521
Sum			0.259	Sum			0.675

Total	
Defl.	
0.468	(in.)
0.0173	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (11'-4" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2510	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_i Override:		Pier 1	Pier 2
G_a Override:		Nail Spacing:	4 4 (in.)
		HD Capacity:	2140 2140 (lbf)
		HD Deflection:	0.11 0.11 (in.)
		C_d :	4.00

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	397	397	397	397 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	5.30	5.30	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G_a :	22.0	22.0	22.0	22.0 (kips/in.)
b:	3.16	3.16	3.17	3.17 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)
Sheathing Type: 7/16 OSB APA Rated Sheathing				
Nail Type: 8d common				

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.034	0.162	0.522	0.007	0.096	0.181
Sum		0.719	Sum		0.284
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.007	0.096	0.181	0.034	0.162	0.521
Sum		0.283	Sum		0.717

Total Defl.	
0.501	(in.)
0.0185	%drift

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



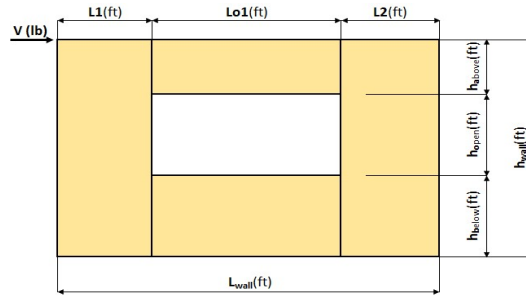
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (14'-10" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1680 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	4.92 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	4.91 ft	ho	P1=ha/L1=	0.81
hwall	9.00 ft	hb	P2=ho/L2=	0.81
Lwall	14.83 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1020 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 204 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1020 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 510 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 509 \text{ lbf}$

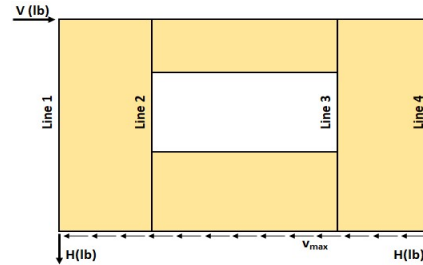
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 2.50 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.50 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 171 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 171 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 1680 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 841 \text{ lbf}$
 $R2 = v2 \times L2 = 839 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 331 \text{ lbf}$
 $R2 - F2 = 330 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 67 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 67 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$		336	684	1020 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1020	336	684	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1020	336	684	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$		336	684	1020 lbf

Design Summary*

Req. Sheathing Capacity	204 plf	4-Term Deflection	0.134 in.	3-Term Deflection	0.185 in.
Req. Strap Force	510 lbf	4-Term Story Drift %	0.005 %	3-Term Story Drift %	0.007 %
Req. HD Force (H)	1020 lbf				
Req. Shear Wall Anchorage Force (v_{max})	113 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (14'-10" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$: 1680 (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_i Override:
G_a Override:

Enter individual post sizes below.
C_d: 4.00

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	171	171	171	171	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G _t :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	6	6	6	6	(in.)
V_n :	85	85	85	85	(plf)
e_n :	0.0031	0.0031	0.0031	0.0031	(in.)
b:	4.92	4.92	4.91	4.91	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.009	0.018	0.021	0.145	0.002	0.011	0.012	0.050
Sum			0.193	Sum			0.075
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	0.050	0.009	0.018	0.021	0.145
Sum			0.075	Sum			0.194

Total Defl.	
0.134	(in.)
0.0050	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (14'-10" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		1680	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G _i Override:			
G _a Override:			
C _d :		4.00	
		Pier 1	Pier 2
Nail Spacing:		6	6 (in.)
HD Capacity:		2140	2140 (lbf)
HD Deflection:		0.11	0.11 (in.)

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	171	171	171	171 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	5.30	5.30	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G _a :	15.0	15.0	15.0	15.0 (kips/in.)
b:	4.92	4.92	4.91	4.91 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

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

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.009	0.103	0.145	0.002	0.060	0.050
Sum		0.257	Sum		0.112
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.002	0.060	0.050	0.009	0.103	0.145
Sum		0.113	Sum		0.257

Total Defl.	
0.185	(in.)
0.0068	%drift

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



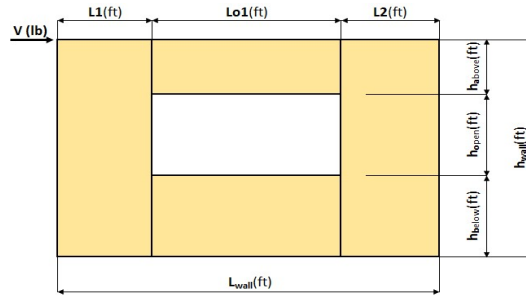
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (14'-10" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2743 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	4.92 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	4.91 ft	ho	P1=ha/L1=	0.81
hwall	9.00 ft	hb	P2=ho/L2=	0.81
Lwall	14.83 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1665 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 333 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1665 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 833 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 831 \text{ lbf}$

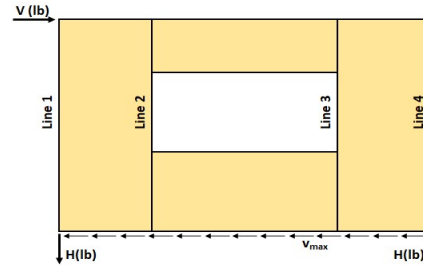
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 2.50 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.50 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 279 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 279 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 2743 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 1373 \text{ lbf}$
 $R2 = v2 \times L2 = 1370 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 540 \text{ lbf}$
 $R2 - F2 = 539 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 110 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 110 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	548	1116	1665 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1665	548	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1665	548	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	548	1116	1665 lbf

Design Summary*

Req. Sheathing Capacity	333 plf	4-Term Deflection	0.214 in.	3-Term Deflection	0.259 in.
Req. Strap Force	833 lbf	4-Term Story Drift %	0.008 %	3-Term Story Drift %	0.010 %
Req. HD Force (H)	1665 lbf				
Req. Shear Wall Anchorage Force (v_{max})	185 plf				

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

Code:	2018 IBC	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (14'-10" Section) - (Level 2 Seismic)		

Unfactored Shear Load $V_{\text{unfactored}}$:	2743	(lbf)
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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	
V _{unfactored} :	279	279	279	279	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	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 _i :	83,500	83,500	83,500	83,500	(lb/ft.in.)
Nail Spacing:	4	4	4	4	(in.)
V _n :	93	93	93	93	(plf)
e _n :	0.0040	0.0040	0.0040	0.0040	(in.)
b:	4.92	4.92	4.91	4.91	(ft)
HD Capacity:	2140	2140	2140	2140	(lb/ft)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.015	0.030	0.027	0.236	0.003	0.018	0.016	0.082
Sum			0.309	Sum			0.119
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.003	0.018	0.016	0.082	0.015	0.030	0.027	0.237
Sum			0.119	Sum			0.309

Total	
Defl.	
0.214	(in.)
0.0079	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (14'-10" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2743	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G_i Override:		C_d : 4.00		Nail Spacing:	Pier 1 4 (in.)
G_a Override:				HD Capacity:	Pier 2 2140 (lbf)
				HD Deflection:	0.11 (in.)

Three-Term Equation Deflection Check

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

	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	5.30	5.30	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G_a :	22.0	22.0	22.0	22.0	(kips/in.)
b:	4.92	4.92	4.91	4.91	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.015	0.114	0.236	0.003	0.067	0.082
Sum		0.366	Sum		0.152
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.067	0.082	0.015	0.114	0.237
Sum		0.152	Sum		0.366

Total Defl.	
0.259	(in.)
0.0096	%drift

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



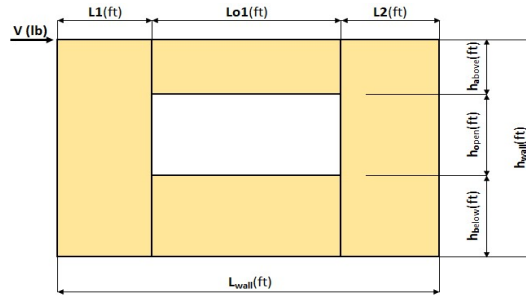
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (14'-10" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	3286 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	4.92 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	4.91 ft	ho	P1=ho/L1=	0.81
hwall	9.00 ft	hb	P2=ho/L2=	0.81
Lwall	14.83 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1994 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 399 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1994 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 998 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 996 \text{ lbf}$

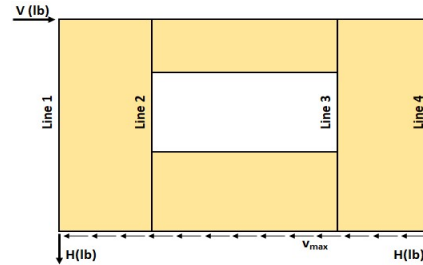
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 2.50 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 2.50 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 334 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 334 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 3286 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 1645 \text{ lbf}$
 $R2 = v2 \cdot L2 = 1641 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 647 \text{ lbf}$
 $R2 - F2 = 645 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 131 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 131 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	657	1337	1994 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1994	657	1337
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1994	657	1337
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	657	1337	1994 lbf

Design Summary*

Req. Sheathing Capacity	399 plf	4-Term Deflection	0.267 in.	3-Term Deflection	0.310 in.
Req. Strap Force	998 lbf	4-Term Story Drift %	0.010 %	3-Term Story Drift %	0.011 %
Req. HD Force (H)	1994 lbf				
Req. Shear Wall Anchorage Force (v_{max})	222 plf				

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

Project Information

Code:	2018 IBC	Date:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid L (14'-10" Section) - (Level 1 Seismic)		

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:	3286	(lbf)
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Sheathing Type:	7/16 OSB	Wood End Post Values:	Species:	HF#2	Nail Type:	8d common	(penny weight)
Grade:	APA Rated Sheathing		E:	1.30E+06			
				(psi)			
G_i Override:		Enter individual post sizes below.					
G_a Override:			C_d :	4.00			

	Pier 1	Pier 2	
Nail Spacing:	4	4	(in.)
HD Capacity:	2140	2140	(lbf)
HD Deflection:	0.11	0.11	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a \frac{h}{b}$$

(Equation 23-2)

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R		Sheathing Type: 7/16 OSB APA Rated Sheathing
$V_{unfactored}$:	334	334	334	334	(plf)	Nail Type: 8d common
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)	
h:	9.00	5.30	5.30	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_i :	83,500	83,500	83,500	83,500	(lbf/in.)	
Nail Spacing:	4	4	4	4	(in.)	
V_n :	111	111	111	111	(plf)	
e_n :	0.0069	0.0069	0.0069	0.0069	(in.)	
b:	4.92	4.92	4.91	4.91	(ft)	
HD Capacity:	2140	2140	2140	2140	(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	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.018	0.036	0.046	0.283	0.004	0.021	0.027	0.098
Sum			0.384	Sum			0.150
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.004	0.021	0.027	0.098	0.019	0.036	0.046	0.283
Sum			0.151	Sum			0.384

Total Defl.	
0.267	(in.)
0.0099	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid L (14'-10" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	3286	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G_i Override:		C_d :	4.00	Nail Spacing:	Pier 1 4 (in.)
G_a Override:				HD Capacity:	Pier 2 2140 (lbf)
				HD Deflection:	0.11 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	334	334	334	334	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G_a :	22.0	22.0	22.0	22.0	(kips/in.)
b:	4.92	4.92	4.91	4.91	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.018	0.137	0.283	0.004	0.081	0.098
Sum		0.438	Sum		0.182
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.004	0.081	0.098	0.019	0.137	0.283
Sum		0.183	Sum		0.439

Total Defl.	
0.310	(in.)
0.0115	%drift

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



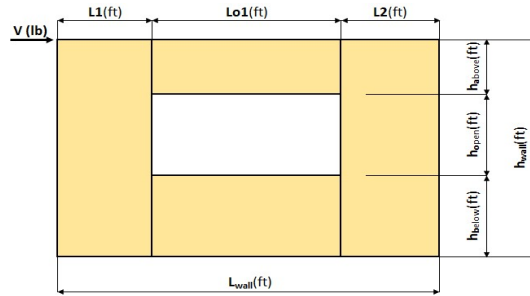
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid K (13'-4" Section) - (Level 3 Seismic)		



Shear Wall Calculation Variables

V	1510 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	4.92 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	4.91 ft	ho	P1=ha/L1=	0.81
hwall	9.00 ft	hb	P2=ho/L2=	0.81
Lwall	14.83 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 916 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 183 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 916 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 459 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 458 \text{ lbf}$

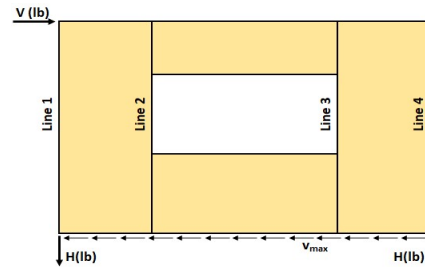
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 2.50 \text{ ft}$
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.50 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 154 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 154 \text{ plf}$
Check $v1 \times L1 + v2 \times L2 = V?$ 1510 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 756 \text{ lbf}$
 $R2 = v2 \times L2 = 754 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 297 \text{ lbf}$
 $R2 - F2 = 297 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 60 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 60 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	302	614	916 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	916	302	0
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	916	302	0
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	302	614	916 lbf

Design Summary*

Req. Sheathing Capacity	183 plf	4-Term Deflection	0.118 in.	3-Term Deflection	0.166 in.
Req. Strap Force	459 lbf	4-Term Story Drift %	0.004 %	3-Term Story Drift %	0.006 %
Req. HD Force (H)	916 lbf				
Req. Shear Wall Anchorage Force (v_{max})	102 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid K (13'-4" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		1510	(lbf)
Sheathing Type:		7/16 OSB	
Grade:		APA Rated Sheathing	
G _i 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)
Nail Spacing:		Pier 1: 6	Pier 2: 6 (in.)
HD Capacity:		Pier 1: 2140	Pier 2: 2140 (lbf)
HD Deflection:		Pier 1: 0.11	Pier 2: 0.11 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	154	154	154	154	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	6	6	6	6	(in.)
V_n :	77	77	77	77	(plf)
e_n :	0.0022	0.0022	0.0022	0.0022	(in.)
b:	4.92	4.92	4.91	4.91	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.008	0.017	0.015	0.130	0.002	0.010	0.009	0.045
Sum			0.170	Sum			0.065
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.002	0.010	0.009	0.045	0.009	0.017	0.015	0.130
Sum			0.066	Sum			0.170

Total Defl.	
0.118	(in.)
0.0044	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid K (13'-4" Section) - (Level 3 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		1510	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G _i Override:			
G _a Override:			
C _d :		4.00	
		Pier 1	Pier 2
Nail Spacing:		6	6 (in.)
HD Capacity:		2140	2140 (lbf)
HD Deflection:		0.11	0.11 (in.)

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{Eab} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	154	154	154	154 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	5.30	5.30	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G _a :	15.0	15.0	15.0	15.0 (kips/in.)
b:	4.92	4.92	4.91	4.91 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.008	0.092	0.130	0.002	0.054	0.045
Sum		0.231	Sum		0.101
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.002	0.054	0.045	0.009	0.092	0.130
Sum		0.101	Sum		0.231

Total Defl. 0.166 (in.)
0.0061 %drift

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



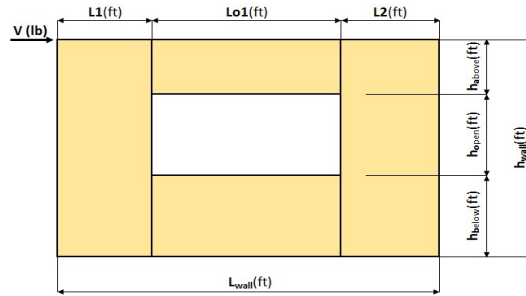
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid K (13'-4" Section) - (Level 2 Seismic)		



Shear Wall Calculation Variables

V	2466 lbf	Opening 1	Adj. Factor Method =	2bs/h
L1	4.92 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	4.91 ft	ho	P1=ha/L1=	0.81
hwall	9.00 ft	hb	P2=ho/L2=	0.81
Lwall	14.83 ft	Lo1		N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1497 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) =$ 299 plf

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) =$ 1497 lbf

4. Corner forces
 $F1 = O1(L1)/(L1+L2) =$ 749 lbf
 $F2 = O1(L2)/(L1+L2) =$ 748 lbf

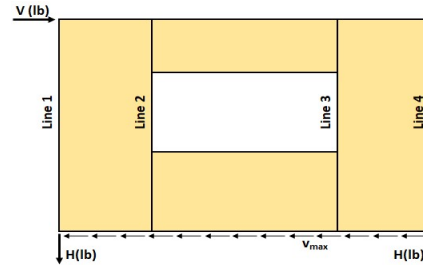
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) =$ 2.50 ft
 $T2 = (L2 \times Lo1)/(L1+L2) =$ 2.50 ft

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 =$ 251 plf
 $v2 = (V/L)(T2+L2)/L2 =$ 251 plf
Check $v1 \times L1 + v2 \times L2 = V?$ 2466 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 =$ 1234 lbf
 $R2 = v2 \times L2 =$ 1232 lbf

8. Difference corner force + resistance
 $R1 - F1 =$ 485 lbf
 $R2 - F2 =$ 484 lbf

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 =$ 99 plf
 $vc2 = (R2 - F2)/L2 =$ 99 plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a + h_b) + v1(h_o) = H?$	493	1003	1497 lbf
Line 2: $va1(h_a + h_b) - vc1(h_a + h_b) - v1(h_o) = 0?$	1497	493	1003
Line 3: $va1(h_a + h_b) - vc2(h_a + h_b) - v1(h_o) = 0?$	1497	493	1003
Line 4: $vc2(h_a + h_b) + v2(h_o) = H?$	493	1003	1497 lbf

Design Summary*

Req. Sheathing Capacity	299 plf	4-Term Deflection	0.188 in.	3-Term Deflection	0.233 in.
Req. Strap Force	749 lbf	4-Term Story Drift %	0.007 %	3-Term Story Drift %	0.009 %
Req. HD Force (H)	1497 lbf				
Req. Shear Wall Anchorage Force (v_{max})	166 plf				

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

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid K (13'-4" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2466	(lbf)
Sheathing Type:		7/16 OSB	
Grade:		APA Rated Sheathing	
G _i 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)
Nail Spacing:		Pier 1: 4	Pier 2: 4 (in.)
HD Capacity:		Pier 1: 2140	Pier 2: 2140 (lbf)
HD Deflection:		Pier 1: 0.11	Pier 2: 0.11 (in.)

Four-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	251	251	251	251	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)
Nail Spacing:	4	4	4	4	(in.)
V_n :	84	84	84	84	(plf)
e_n :	0.0029	0.0029	0.0029	0.0029	(in.)
b:	4.92	4.92	4.91	4.91	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System							
Pier 1 (left)				Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.014	0.027	0.020	0.212	0.003	0.016	0.012	0.074
Sum			0.273	Sum			0.104
Pier 2 (left)				Pier 2 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.003	0.016	0.012	0.074	0.014	0.027	0.020	0.213
Sum			0.104	Sum			0.273

Total Defl.	
0.188	(in.)
0.0070	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid K (13'-4" Section) - (Level 2 Seismic)	

Shear Wall Deflection Calculation Variables		
Unfactored Shear Load $V_{unfactored}$:	2466	(lbf)

Sheathing Type: 7/16 OSB		Wood End Post Values:		Nail Type: 8d common (penny weight)	
Grade: APA Rated Sheathing		Species: HF#2			
		E: 1.30E+06	(psi)		
G_i Override:		C_d :	4.00	Nail Spacing:	Pier 1 4 (in.)
G_a Override:				HD Capacity:	Pier 2 2140 (lbf)
				HD Deflection:	0.11 (in.)

Three-Term Equation Deflection Check

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
$V_{unfactored}$:	251	251	251	251	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.00	5.30	5.30	9.00	(ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00	
Stud Size:	2x6	2x6	2x6	2x6	
A Override:					(in. ²)
A:	16.5	16.5	16.5	16.5	(in. ²)
G_a :	22.0	22.0	22.0	22.0	(kips/in.)
b:	4.92	4.92	4.91	4.91	(ft)
HD Capacity:	2140	2140	2140	2140	(lbf)
HD Defl:	0.11	0.11	0.11	0.11	(in.)

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

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.014	0.103	0.212	0.003	0.060	0.074
Sum		0.329	Sum		0.137
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.060	0.074	0.014	0.103	0.213
Sum		0.137	Sum		0.329

Total Defl.	
0.233	(in.)
0.0086	%drift

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



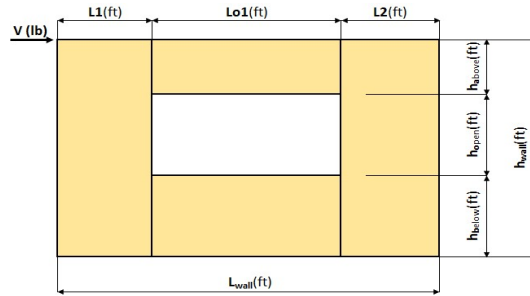
Force Transfer Around Openings Calculator

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:	10/28/2024
Designer:	Chon Pieruccioni, PE		
Client:			
Project:	East Town Crossing - Building F		
Wall Line:	Grid K (13'-4" Section) - (Level 1 Seismic)		



Shear Wall Calculation Variables

V	2954 lbf	Opening 1		Adj. Factor Method =		2bs/h
L1	4.92 ft	h _a	1.30 ft	Wall Pier Aspect Ratio		Adj. Factor
L2	4.91 ft	h _o	4.00 ft	P1=h _o /L1=	0.81	N/A
h _{wall}	9.00 ft	h _b	3.70 ft	P2=h _o /L2=	0.81	N/A
L _{wall}	14.83 ft	Lo1	5.00 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1793 lbf

2. Unit shear above + below opening
First opening: $va1 = vb1 = H/(h_a + h_b) = 359 \text{ plf}$

3. Total boundary force above + below openings
First opening: $O1 = va1 \times (Lo1) = 1793 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 897 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 895 \text{ lbf}$

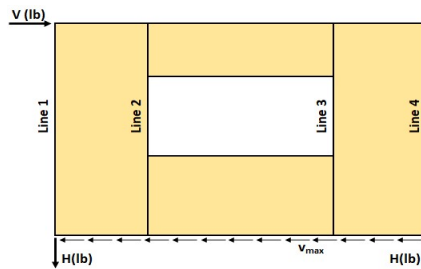
5. Tributary length of openings
 $T1 = (L1 \cdot Lo1)/(L1+L2) = 2.50 \text{ ft}$
 $T2 = (L2 \cdot Lo1)/(L1+L2) = 2.50 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 301 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 301 \text{ plf}$
Check $v1 \cdot L1 + v2 \cdot L2 = V?$ 2954 lbf OK

7. Resistance to corner forces
 $R1 = v1 \cdot L1 = 1479 \text{ lbf}$
 $R2 = v2 \cdot L2 = 1475 \text{ lbf}$

8. Difference corner force + resistance
 $R1 - F1 = 581 \text{ lbf}$
 $R2 - F2 = 580 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1 = 118 \text{ plf}$
 $vc2 = (R2 - F2)/L2 = 118 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		591	1202	1793 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1793	591	1202	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1793	591	1202	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		591	1202	1793 lbf

Design Summary*

Req. Sheathing Capacity	359 plf	4-Term Deflection	0.218 in.	3-Term Deflection	0.258 in.
Req. Strap Force	897 lbf	4-Term Story Drift %	0.008 %	3-Term Story Drift %	0.010 %
Req. HD Force (H)	1793 lbf				
Req. Shear Wall Anchorage Force (v_{max})	199 plf				

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

Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid K (13'-4" Section) - (Level 1 Seismic)	

Unfactored Shear Load $V_{\text{unfactored}}$:	2954	(lbf)
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Sheathing Type:	7/16 OSB	Wood End Post Values:		Nail Type:	8d common	(penny weight)
Grade:	APA Rated Sheathing	Species:	HF#2			
		E:	1.30E+06 (psi)			
G _x Override:		Enter individual post sizes below.		Pier 1	Pier 2	
G _y Override:		C _d :	4.00	Nail Spacing:	3	3 (in.)
				HD Capacity:	2140	2140 (lbf)
				HD Deflection:	0.11	0.11 (in.)

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

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R		Sheathing Type: 7/16 OSB APA Rated Sheathing
V _{unfactored} :	301	301	301	301	(plf)	Nail Type: 8d common
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)	
h:	9.00	5.30	5.30	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 _i :	83,500	83,500	83,500	83,500	(lbf/in.)	
Nail Spacing:	3	3	3	3	(in.)	
V _n :	75	75	75	75	(plf)	
e _n :	0.0021	0.0021	0.0021	0.0021	(in.)	
b:	4.92	4.92	4.91	4.91	(ft)	
HD Capacity:	2140	2140	2140	2140	(lbf)	
HD Defl:	0.11	0.11	0.11	0.11	(in.)	

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.017	0.032	0.014	0.254	0.003	0.019	0.008	0.088
Sum			0.317	Sum			0.119
Pier 2 (left)				Pier 2 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.003	0.019	0.008	0.088	0.017	0.032	0.014	0.255
Sum			0.119	Sum			0.318

Total	
Defl.	
0.218	(in.)
0.0081	%drift

Project Information		
Code:	2018 IBC	Date: 10/28/2024
Designer:	Chon Pieruccioni, PE	
Client:		
Project:	East Town Crossing - Building F	
Wall Line:	Grid K (13'-4" Section) - (Level 1 Seismic)	

Shear Wall Deflection Calculation Variables

Unfactored Shear Load $V_{unfactored}$:		2954	(lbf)
Wood End Post Values:			
Sheathing Type:	7/16 OSB	Species:	HF#2
Grade:	APA Rated Sheathing	E:	1.30E+06 (psi)
Nail Type:		8d common (penny weight)	
G_t Override:		C_d :	4.00
G_a Override:			
		Pier 1	Pier 2
Nail Spacing:		3	3 (in.)
HD Capacity:		2140	2140 (lbf)
HD Deflection:		0.11	0.11 (in.)

Three-Term Equation Deflection Check

$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \quad (4.3-1)$				
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R
$V_{unfactored}$:	301	301	301	301 (plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06 (psi)
h:	9.00	5.30	5.30	9.00 (ft)
Qty:	2.00E+00	2.00E+00	2.00E+00	2.00E+00
Stud Size:	2x6	2x6	2x6	2x6
A Override:				(in. ²)
A:	16.5	16.5	16.5	16.5 (in. ²)
G_a :	28.0	28.0	28.0	28.0 (kips/in.)
b:	4.92	4.92	4.91	4.91 (ft)
HD Capacity:	2140	2140	2140	2140 (lbf)
HD Defl:	0.11	0.11	0.11	0.11 (in.)

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

Check Total Deflection of Wall System					
Pier 1 (left)			Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.017	0.097	0.254	0.003	0.057	0.088
Sum		0.368	Sum		0.148
Pier 2 (left)			Pier 2 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003	0.057	0.088	0.017	0.097	0.255
Sum		0.149	Sum		0.368

Total Defl.	
0.258	(in.)
0.0096	%drift

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