Architecture 544 Wood Structures

Diaphragms and Shear Walls



Load Paths

Vertical Loads gravity D, L, Lr, S,

Lateral Loads wind seismic



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Force is more evenly resisted with centroid of walls in the kern of slab









supported by (and nailed to) framing member.

edge is supported by framing member.

This is the most common situation.

Drag Strut – at the edge of the diaphragm.

diaphragm to shear wall.

It distributes the shear force from one diaphragm to another - e.g. from floor



Figure 9.5b. Blocked diaphragm. Unblocked Diaphragm - only the short, 4 ft

DIAPHRAGM THIS PANEL JOINT NOT CONTINUOUS BOUNDARY CONTINUOUS PANEL JOINT 4' X 8' WOOD STRUCTURAL PANEL -NAILING TO INTERMEDIATE FRAMING MAX. NAIL SPACING AT DIAPH BOUNDARY AND SUPPORTED EDGES IS 6" O.C. FRAMING MEMBERS IS ALSO KNOWN AS "FIELD" NAILING. SPACING IS 12" O.C. FOR ROOFS AND FLOORS (6" O.C. WHEN (UPPOPTS THIS PANEL EDGE WHEN SUPPORTS IS NOT SUPPORTED ARE SPACED 48 BY BLOCKING AND IS KNOWN AS THE OR GREATER) UNBLOCKED EDGE FLOOR OR ROOF - OTHER TYPE OF EDGE SUPPORT MAY BE REQUIRED FOR SHEATHING LOADS JOISTS PARTIAL ROOF OR FLOOR PLAN

Breyer Figure 9.5a. Unblocked diaphragm.

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Example 1: residential roof diaphragm trussed roof (2x dim. lumber) unblocked any case capacity 180 plf - any direction





bace nails maximum 12 in. o.c. along interr o.c. when supports are spaced 48 in. o.c.). nediate fram ning at adjoining panel edges shall be 3-in. nominal or wider, and all be stacaered where nails are spaced 2 inches o.c. or

2-1/2 inches o.c. Case 2 Blocking.

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(e) 8d is recommended minimum for roofs due to negative pressures of high winds.

Notes: Design for diaphragm stresses depends on direction of continuou panel joints with reference to load, not on direction of long dimension of sheet. Continuous framing may be in either direction for blocked diaphra



Diaphragm SelectionTABLE 1For Shear ForceDiaphragmsroof and floor diaphragms

Example 2: commercial roof diaphragm trussed roof (2x dim. lumber) capacity 350 plf - Case 1 blocked



						Blo	cked D	iaphrag	ms	Unblocked I	Diaphragms
					(Na diap (all c par to la edg	il Spac hragm ases), o nel edg bad (C and at es (Ca	ting (in.) bound at contin ges para ases 3 8 all pana ses 5 &	Nails Spaced 6" max. at Supported Edges ^(b)		
		Minimum	Minimum	Minimu	um	6	4	2-1/2(c)	2 (c)	Case 1 (No	
Panel Grade	Common Nail Sizo	Nail Penetration in Framing (inches)	Nominal Panel Thickness (inch)	Width of Framing Member (inches)	of ng er s)	Na ot (C	iil Spac her pa ases 1	ing (in.) nel edg , 2, 3 &	edges or continuous joints parallel to load)	All other configurations (Cases 2, 3, 4, 5 & 6)	
				••••••	· -	6	6	4	3	- •	
	6d	1-1/4	5/16	2 3	12	185 210	250 280	375 420	420 475	165 185	125 140
STRUCTURAL I grades	8d	1-3/8	3/8	2 3	23	270 300	360 400	530 600	600 675	240 265	180 200
	10d ^(d)	1-1/2	15/32	2 3	999	320 360	425 480	640 720	730 820	285 320	215 240
	(1(0)	1.1/4	5/16	2 3	ł	170 190	225 250	335 380	380 430	150 170	110 125
	80(0)	1-1/4	3/8	2 3	12	185 210	250 280	375 420	420 475	165 185	125 140
APA RATED SHEATHING, APA RATED			3/8	2 3	222	240 270	320 360	480 540	545 610	215 240	160 180
STURD-I- FLOOR and other	8d	1-3/8	7/16	2 3	22	255 285	340 380	505 570	575 645	230 255	170 190
APA grades except Species Group 5			15/32	2 3	243	270 300	360 400	530 600	600 675	240 265	180 200
	10d(d)	1.1/2	15/32	2 3	23	290 325	385 430	575 650	655 735	255 290	190 215
	100(0)	1-1/2	19/32	2 3	6363	320 360	425 480	640 720	730 820	285 320	215 240
(a) For framing of in the AFPA Nation above for nail size ment factor: Specif = specific gravity of	other species: (1 al Design Speci for actual grade ic Gravity Adjus of the framing. T) Find specific grav fication. (2) Find sh e. (3) Multiply value tment Factor = [1 - 'his adjustment sha	ity for species of ear value from ta by the following - (0.5 – SG)], whe Il not be greater t	lumber (ible r adjust- r ere SG than 1.	(d) Framir nails shal more thar (e) 8d is r high wind	ng at e Il be st n 1-5/ recom	adjoining aggered '8 inches mended	g panel ec l where 10 s are spac minimum	lges sha Id nails l ed 3 incl for roof	II be 3-in. nominal having penetration hes o.c. 's due to negative p	or wider, and into framing of rressures of
(b) Space nails ma (6 in. o.c. when su (c) Framing at adjo nails shall be stage	ximum 12 in. o. pports are space pining panel edg pered where nai	c. along intermedia ed 48 in. o.c.). ges shall be 3-in. na ls are spaced 2 incl	ate framing meml	bers and s	Notes: D panel joir sheet. Co	Design nts with ontinuc	for diap h referer ous fram	hragm str ice to load ing may b	esses de l, not on e in eith	pends on direction direction of long d er direction for blog	of continuous limension of cked diaphragms

Three Shear Wall Types

Design considerations:

- · Sheathing type and thickness
- Sheathing nailing size and spacing
- · Chord design tension and compression

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- Collector design tension and comp.
- Anchorage hold-downs, shear ties
- Shear panel proportions h:w (see SDPWS)
- Deflection





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Shear Wall Types – 1. Segmented

Acts like a vertical cantilever beam

Let-in Wall Bracing – 45° - limited to single or top story

Wall Board - requires 8 ft length

Wood Structural Panel - requires 4 ft length -3 times stronger by length

Table 4.3.4 **Maximum Shear Wall Aspect** Ratios

Shear Wall	Maximum
Sheathing Type	h/b _s Ratio
Wood structural panels, unblocked	2:1
Wood structural panels, blocked	3.5:1
Particleboard, blocked	2:1
Diagonal sheathing, conventional	2:1
Gypsum wallboard	$2:1^{1}$
Portland cement plaster	$2:1^{1}$
Structural Fiberboard	3.5:1
Walls having concet ratios exceeding 1 5.1 shall 1	a blocked about wells

1 Walls having aspect ratios exceeding 1.5:1 shall be blocked shear walls.

AWC SDPWS 2015 (in 2021 Tab. 4.3.3)



Heavier sheathing and nailing is generally required.



29 plf

467 plf

Ε

в

29 plf

С

З

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BLOCKING ON LINES

MEMBERS. PROVIDE EDGE NAILING FOR

THE FULL LENGTH OF

THESE LINES.

2, 3, 6 & 7 ACT AS BOUNDARY

Shear Wall Types – 3. Perforated shearwall

- Semi-empirical method based on testing.
- Similar to the force transfer method, but with simplified details.
- Generally lower capacity and lower stiffness.
- Follows maximum L/W ratios see limitations of use.
- Capacity of the "weak direction" (lacking tension tie-down) is reduce by C_o factor (IBC).



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Shear Wall Design Elements

- Panel Thickness
- Panel Grade •
- Nail spacing •

A Shear Wall...

Is vertical

Is designed

cantilevered

Table has only

wall is always

blocked*

blocked values,

because a shear

*A code requirement.

like a

beam

- Base shear anchors •
- Hold down anchors (at ends of each wall)

beam

values

- Placement for lateral stability
- Fastening at edges (chords)



FIGURE 11

SHEAR WALL SEGMENT

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Drag Struts

Double Top Plate





Double top plate acts like a drag strut in these locations (over openings).

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Anchors and Tie-downs



Shear Wall Selection Table

SHEAR WALLS: RECOMMENDED SHEAR	(POUNDS PER FOOT) FOR APA PANEL SHEAR	WALLS WITH FRAMING OF
DOUGLAS-FIR, LARCH, OR SOUTHERN	PINE ^(a) FOR WIND OR SEISMIC LOADING ^(b)	
		Panels Applied Over
	Panels Applied Direct to Framing	1/2" or 5/8" Gypsum Sheathing

special case diaphragm	P
Example: Commercial building shear wall w/ 5/8" gypsum sheathing for 1 hr. fire rating. required capacity = 437 plf	AP, STI gro AP, SHI RAI and gro spe SIE and spe

Den al Canada	Nominal Panel	Nail Penetration	Nail Size (common or	N Po	Nail Spa anel Ed	icing at ges (in.)	Nail Size (common or	I P	Nail Sp anel Ec	acing a Iges (in	t)
Panel Grade	(in.)	in Framing (in.)	box)	6	4	3	2(e)	box)	6	4	3	2(e)
	5/16	1-1/4	6d	200	300	390	510	8d	200	300	390	510
APA	3/8			230 ^(d)	360(d)	460 ^(d)	610 ^(d)					
STRUCTURAL I	7/16	1-3/8	8d	255(d)	395(d)	505(d)	670 ^(d)	10d ^(f)	280	430	550	730
grades	15/32			280	430	550	730					
	15/32	1-1/2	10d ^(f)	340	510	665	870	-	-	-	-	-
	5/16 or 1/4(c)			180	270	350	450		180	270	350	450
APA RATED	3/8	1-1/4	6d	200	300	390	510	8d	200	300	390	510
SHEATHING; APA	3/8			220 ^(d)	320 ^(d)	410 ^(d)	530(d)					
and other APA	7/16	1-3/8	8d	240 ^(d)	350(d)	450 ^(d)	585(d)	10d ^(f)	260	380	490	640
grades except	15/32			260	380	490	640					
species Group 5	15/32			310	460	600	770	_	-	_	_	_
	19/32	1-1/2	10d(†)	340	510	665	870	_	—	_	_	—
APA RATED SIDING 303 ^(g)			Nail Size (galvanized casing)					Nail Size (galvanized casing)				

DING 303 ^(g) id other APA			(galvanized casing)					(galvanized casing)				
ades except	5/16 ^(c)	1-1/4	6d	140	210	275	360	8d	140	210	275	360
ecies Group 5	3/8	1-3/8	8d	160	240	310	410	10d ^(f)	160	240	310	410

(a) For framing of other species: (1) Find specific gravity for species of lumber in the AFPA National Design Specification; (2) For common or galvanized box nails, find shear value from table above for nail size for actual grade; (3) Multi-ply value by the following adjustment factor: Specific Gravity Adjustment Factor = [1 - (0.3 - 3C)], where SC = specific gravity of the framing. This adjustment shall not be greater than 1.
 (b) All panel edges backed with 2-inch nominal or wider framing. Install panel els either horizontally or vertically. Space nails maximum 6 inches o.c. along intermediate framing members for 3/8-inch and 7/16-inch panels installed on studs spaced 24 inches o.c. For other conditions and panel thicknesses, space nails maximum 12 inches o.c. on intermediate supports.
 (c) 3/8-inch ard APA RATES DIDING 16 oci simplinum recommended when

(c) 3/8-inch or APA RATED SIDING 16 oc is minimum recommended when applied direct to framing as exterior siding.

Typical Layout for Shear Walls



TABLE 2



(d) Shears may be increased to values shown for 15/32-inch sheathing with same nailing provided (1) studs are spaced a maximum of 16 inches o.c., or (2) if panels are applied with long dimension across studs.

(c) Framing at adjoining panel edges shall be 3-inch nominal or wider, and nails shall be staggered where nails are spaced 2 inches o.c. (f) Framing at adjoining panel edges shall be 3-inch nominal or wider, and nails shall be staggered where 104 nails having penetration into framing of more than 1-5/8 inches are spaced 3 inches o.c.

(g) Values apply to all-veneer plywood APA RATED SIDING panels only. Other APA RATED SIDING panels may also qualify on a proprietary basis. APA RATED SIDING 16 oc plywood may be 11/32 inch, 3/8 inch or thicker. Thickness at point of nailing on panel edges governs shear values.



OF

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APA X305







28

60

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Force VA

$$\frac{\omega f}{2} = \frac{240 (60)'}{2} = 7200^{\frac{1}{2}}$$
Subtraction of the point.

JHEAK 257 PLF



66

$$\frac{\omega - l^2}{2} = \frac{240 (60)^2}{8} = 108000' - 4$$

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108000'-1

240 PLF IT LLL

Roof Diaphragm Panel

Try first the lesser quality:

APA rated sheathing

unblocked, case 1, 19/32"

blocked, any case, 15/32"

unblocked

2" rafters

•

•

Try:

or

TABLE 1

DIAPHRAGMS: RECOMMENDED SHEAR (POUNDS PER FOOT) FOR HORIZONTAL APA PANEL DIAPHRAGMS WITH FRAMING OF DOUGLAS-FIR, LARCH OR SOUTHERN PINE^(a) FOR WIND OR SEISMIC LOADING **Blocked Diaphragms** Unblocked Diaphragms Nail Spacing (in.) at diaphragm boundaries (all cases), at continuous panel edges parallel to load (Cases 3 & 4), and at all panel edges (Cases 5 & 6)^(b) Nails Spaced 6" max. at Supported Edges^(b) Choose Panel from APA chart 4 2-1/2(c) 2(c) Case 1 (No unblocked edges or continuous 6 Nominal Width of Framing Member edges or All other continuous configuration joints parallel (Cases 2, 3, to load) 4, 5 & 6) Nail enetration Framir (inches) Nail Spacing (in.) at other panel edges (Cases 1, 2, 3 & 4) Commo. Nail Size **Panel Grade** 3 6 6 4 1-1/4 5/16 23 185 250 375 420 210 280 420 475 165 185 125 140 6d ADA STRUCTURAL I 23 530 600 270 300 360 400 600 675 240 265 180 200 8d 1-3/8 3/8 grades edge shear force = 257 plf 23 320 360 425 480 640 720 730 820 285 320 215 240 10d(d) 1-1/2 15/32 23 170 190 225 335 250 380 380 430 150 170 110 125 5/16 6d(e) 1-1/4 23 185 250 375 210 280 420 420 165 185 125 140 3/8 APA RATED SHEATHING, APA RATED STURD-I-23 3/8 240 320 270 360 480 540 545 610 215 240 160 180 23 FLOOR 255 285 340 380 505 570 575 645 230 255 170 190 8d 1-3/8 7/16 and other APA grades 10d nails at 6" edge 12" inter. o.c. 23 270 300 360 400 530 600 240 265 180 200 600 675 15/32 except Species Group 5 23 290 325 385 430 575 650 655 735 255 290 190 215 15/32 10d(d) 1-1/2 23 320 425 640 360 480 720 730 820 285 320 215 240 19/32 8d nails at 6" edge 12" inter. o.c. (d) Framing at adjoining panel edges shall be 3-in. nominal or wider, and nails shall be staggered where 10d nails having penetration into framing more than 1-5/8 inches are spaced 3 inches o.c. (a) For framing of other species: (1) Find specific gravity for species of lumber in the AFPA National Design Specification, (2) Find shear value from table above for nail size for actual grade. (3) Multiply value by the following adjust-ment factor: Specific Gravity Adjustment Factor = (1 – (0.5 – SC)), where SG = specific gravity of the framing. This adjustment hall not be greater than 1. specific gravity of the framing. This adjustment shall not be grader than (b) Space nails maximum 12 in. o.c. along intermediate framing members (b) in. o.c. when supports are specified and specific the specific transmission of tr (e) 8d is recommended minimum for roofs due to negative high winds. res of

Notes: Design for diaphragm stresses depends on direction of continuous panel joints with reference to load, not on direction of long dimension of sheet. Continuous framing may be in either direction for blocked diaphragm:

Case 1 Framing	Case 2 Blocking, if unde if unde Disphragm boundary	Case 3 Framing	Continuous panel joints	Case 5 Blocking.	Cas Load

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Roof Diaphragm Chord

For the diaphragm, the chords carry the moment couple and the panels carry the web shear

Tension generally controls.

Chords are usually the double top plates of the walls, but for simple but jointed members only 1 member is acting at the joint. Therefore Area is for 1 2x4

CHORD FORCE ON DIAPHRACH 240 PLF

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Shear Wall

Check minimum shear wall width:

by AWC SDPWS

https://awc.org/publications/2021-sdpws/

w = h/2 (unblocked)	w = h/3.5 (blocked)
w = 16'/2 = 8'	w = 16'/3.5 = 4.57'

Table 4.3.4	Maximum Shear Wall Aspect Ratios						
Shear Wall Sheathing Ty	ре	Maximum h/b _s Ratio					
Wood structura	l panels, unblocked	2:1					
Wood structura	l panels, blocked	3.5:1					
Particleboard, b	olocked	2:1					
Diagonal sheath	ning, conventional	2:1					
Gypsum wallbo	bard	$2:1^{1}$					
Portland cemen	t plaster	$2:1^{1}$					
Structural Fiber	board	3.5:1					

Calculate the shear carried in plf by walls Total force / sum of width = PLF



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Shear Wall Panel

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2015

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TABLE 2

SHEAR WALLS: RECOMMENDED SHEAR (POUNDS PER FOOT) FOR APA PANEL SHEAR WALLS WITH FRAMING OF DOUGLAS-FIR, LARCH, OR SOUTHERN PINE($^{\circ}$) FOR WIND OR SEISMIC LOADING($^{\circ}$) Panels Applied Over

				Panels A	pplied D	Direct to	Framir	ng	1/2" or 5	/8" Gy	psum S	Sheathi	ng
Choose panel from APA		Nominal Panel	Minimum Nail Penetration	Panels Applied Direct to Framing 1/2" or 5/8" Gypsum Sheathing m Nail Size (common or galvanized box) Nail Spacing at Panel Edges (in.) Nail Size (common or galvanized box) Nail Size (common or galvanized box) Nail Size (common or galvanized box) Nail Size (common or galvanized box) Nail Spacing at Panel Edges (in.) 6d 200 300 390 510 8d 200 300 390 510 8d 255(d) 350(d) 60(d) 10d(f) 280 430 550 730 10d(f) 340 510 665 870 —									
shear wall shart	Panel Grade	Thickness (in.)	in Framing (in.)	galvanized box)	6	4	3	2(e)	galvanized box)	6	4	3	2(e)
snear wall chart	$ \begin{array}{c} \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	510											
	APA	3/8			230 ^(d)	360 ^(d)	460 ^(d)	610(d					
	STRUCTURAL I	7/16	1-3/8	8d	255 ^(d)	395(d)	505 ^(d)	670(d	10d ^(f)	280	430	550	730
for 360 plf	grades	15/32			280	430	550	730				um Sheathing iil Spacing at rel Edges (in.) 4 3 2(e) 300 390 510 430 550 730	
		15/32	Panels Applied Direct to Framing 1/2" or 5/8" Gypsum Sheathing Mail Penetration in Framing galvanized (in.) Nail Size (common or box) Nail Spacing at Panel Edges (in.) Nail Size (common or galvanized box) Nail Spacing at Panel Edges (in.) 1-1/4 6d 200 300 390 510 8d 200 300 390 510 1-1/4 6d 200 300 390 510 8d 200 300 390 510 1-3/8 8d 250/d 350/d 66 8d 200 300 390 510 1-1/2 10d/fl 340 510 665 870 - - - - 201/4 1-1/4 6d 180 270 350 450 8d 200 300 390 510 201/4 1-1/4 6d 10/d 350/d 450 8d 200 300 390 510 201/4 201/4 30/d 450/d 58/d 10d										
		5/16 or 1/4(c)	1.1/4	64	180	270	350	450	84	180	270	350	450
Tw/ ADA wated also athing	APA RATED	3/8	1-1/4	00	200	300	390	510	ou	200	300	390	510
Try APA rated sheathing	RATED SIDING ^(g)	3/8			220(d)	320(d)	410 ^(d)	530(d					
15/32" 8d. at //" o.c	and other APA	7/16	1-3/8	8d	240 ^(d)	350(d)	450 ^(d)	585(d	10d ^(f)	260	380	490	640
15/52 OU at 4 0.0.	grades except	15/32			260	380	490	640					
380 > 360 plf ok	species Group 5	15/32	1-1/2	10d(f)	310	460	600	770	—	-	-	-	-
		19/32	, 2		340	510	665	870					
	APA RATED SIDING 303 ^(g) and other APA			Nail Size (galvanized casing)					Nail Size (galvanized casing)				
	grades except	5/16 ^(c)	1-1/4	6d	140	210	275	360	8d	140	210	275	360
	species Group 5	3/8	1-3/8	8d	160	240	310	410	10d ^(f)	160	240	310	410
	 (a) For framing of oth in the AFPA National nails, find shear value ply value by the follow = [1 - (0.5 - SG)], w shall not be greater th (b) All panel edges b 	er species: (1) Fin Design Specification in table above ving adjustment fa where SG = specifi- nan 1.	d specific gravity on. (2) For comm e for nail size for actor: Specific Gr c gravity of the fi nominal or wide	for species of lum non or galvanized actual grade. (3) avity Adjustment F raming. This adjust er framing. Install	nber box Multi- actor stment	(d) Shear same na (2) if par (e) Frami nails sha (f) Frami	rs may be iling prov nels are a ing at adj Il be stag ng at adjo	increase ided (1) pplied w oining p gered w pining po	ed to values show studs are spaced ith long dimensic anel edges shall here nails are spa anel edges shall b	n for 15 a maxin n across be 3-incl aced 2 in be 3-incl	i/32-inch num of 1 s studs. h nomin nches o.c h nomine	i sheathir 16 inches al or wide al or wide	ng with o.c., or er, and er, and
	els either horizontally intermediate framing on studs spaced 24 i space nails maximum (c) 3/8-inch or APA R	or vertically. Space members for 3/8 nches o.c. For othe 12 inches o.c. or ATED SIDING 16	e nails maximum -inch and 7/16- er conditions and n intermediate so oc is minimum r	m 6 inches o.c. al inch panels instal d panel thicknesse upports. ecommended wh	ong led es,	nails sha more tha (g) Value APA RATI RATED S Thicknes	II be stag in 1-5/8 i s apply to ED SIDING IDING 16 s at point	gered wi inches a o all-ven G panels oc plyw of nailir	here 10d nails ha re spaced 3 inche eer plywood APA s may also qualify rood may be 11/3 ig on panel edge	RATED S on a pr 32 inch, s govern	Netration SIDING p roprietan 3/8 inch ns shear	into fran vanels on y basis. A i or thicke values.	ning of ly. Other ∖PA ≱r.

when RESILI



$$\frac{7200}{20} = 360 \, \text{pLF}$$

UNIT SHEAR



Typical Layout for Shear Walls









Foundation resistance

Shear Panel Top Cord

(Collector Strut)

Find the greatest net tension force:

- 1. Find the net PLF force in the top chord by taking the difference between the force applied by the diaphragm and the resisting force of the shear wall.
- 2. Convert the PLF force to total force on the wall segment by multiplying PLF x w
- 3. Graph the change in force along the chord starting at one end. The free ends should both be zero.
- 4. Choose the highest tensile force and find the actual stress in one member (2x4)
- 5. Check against the factored allowable for the wood species and grade.

MAX TENSION FORCE = 617 4 $f_{t} = \frac{617}{5.25} = 118 \, psi$ F= 1030 7118 (oK (AS ABOVE FOR SP.F H°2)





Shear Wall Base Anchors

Peter von Buelow

Find the force in each fastener and select them from manufacturer's literature.



Shear Wall End Holdown Anchor



PSON Simpson Strong-Tie Holdown Selector (USA Version)

Post Installed Input Information

Demand Load Ibs 5760 Ibs

Wood Species DF/SP

T=5760 lbs



Holdown Application	Holdown Model	Holdown Capacity	Deflection at Demand Load	Minimum Post Thickness	Anchor Bolt Diameter	Required Fasteners	Installed Cost Index*
Screwed	HDU8- SDS2.5	5980 lbs	0.081 in.	3.0 in.	7/8 in.	20-SDS 1/4"X2 1/2"	Lowest
Screwed	HDQ8- SDS3	9230 lbs	0.059 in.	4.5 in.	7/8 in.	20-SDS 1/4"X3"	10%
Screwed	HDU11- SDS2.5	9535 lbs	0.083 in.	5.5 in.	1 in.	30-SDS 1/4"X2 1/2"	20%
Screwed	HDU14- SDS2.5	14375 lbs	0.071 in.	7.25 in.	1 in.	36-SDS 1/4"X2 1/2"	48%
Bolted	HD7B	6645 lbs	0.123 in.	3.0 in.	7/8 in.	3-3/4"x4" M.B.	26%
Bolted	HD9B	7740 lbs	0.118 in.	3.5 in.	7/8 in.	3-7/8"x5" M.B.	127%
Bolted	HD12	11350 lbs	0.087 in.	3.5 in.	1 in.	4-1"x5" M.B.	267%
Bolted	HD19	16775 lbs	0.069 in.	5.5 in. (1)	1 1/8 in.	5-1"x7" M.B.	544%

Note:

Holdown and Tension Tie allowable loads are based on installation with an anchor rod length of 6" from the concrete to the top of the holdown seat. The products may be raised to any height with consideration of the increased deflection due to additional bolt elongation.

HDU8-SDS2.5HDG

*The Installed Cost Index is used to compare the relative installed costs of similar connectors in order to identify which are the least expensive to install. The values are determined by combining the estimated cost of the connector, fasteners and labor for each installation and then presenting them in order from "lowest" cost to highest, showing the percentage of cost increase for each option.

Shear Wall – base plate anchor for A307 bolts Fy = 36 ksi Fv = 10 ksi (threads included) root area for 3/8" bolt = 0.0742 in² shear capacity = 10000 x 0.0742 = 742 lbs. > 720lbs ok

Steel L Hook Anchor Bolts



Multiple product options available

Brands

CALDWELL, FABORY and GRAINGER APPROVED

1 Anchor Dia.	Anchor Length	Thread Length	Anchor Hook Length	Brand	Item #
Hot Dipped Galvaniz	ed Fastener Finish				
3/8"	6"	1-3/4*	1*	GAV	21Y486
3/8"	8"	1-3/4"	1"	GAV	21Y487
1/2*	6"	1-3/4*	1-1/2*	GAV	21Y488
1/2"	8"	1-3/4"	1-1/2"	GAV	21Y463
1/2"	10"	1-3/4"	1-1/2"	GAV	21Y464