Chen Residence

3869 80th Avenue SE
Mercer Island, Washington 98040

Structural Engineering Calculations

By

Dihong Shao, SE

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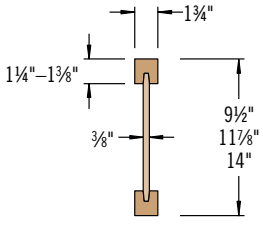
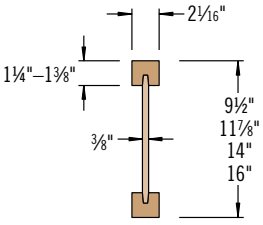
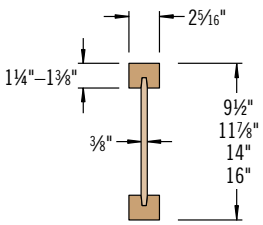
DESIGN PROPERTIES



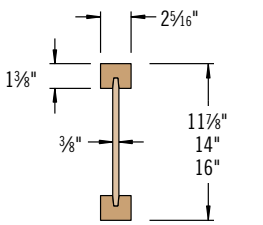
TJI® 110 Joists



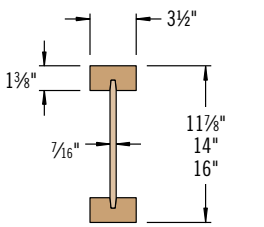
TJI® 210 Joists



TJI® 230 Joists



TJI® 360 Joists



TJI® 560 Joists

Some TJI® joist series may not be available in your region.
Contact your iLevel representative for information.

Design Properties (100% Load Duration)

Depth	TJI®	Basic Properties				Reaction Properties					
		Joist Weight (lbs/ft)	Maximum Resistive Moment(1) (ft-lbs)	Joist Only EI x 10^6 (in.^{2}-lbs)	Maximum Vertical Shear (lbs)	1¾" End Reaction (lbs)	3½" End Reaction (lbs)	3½" Intermediate Reaction (lbs)		5¼" Intermediate Reaction (lbs)	
								No Web Stiffeners	With Web Stiffeners	No Web Stiffeners	With Web Stiffeners
9½"	110	2.3	2,500	157	1,220	910	1,220	1,935	N.A.	2,350	N.A.
	210	2.6	3,000	186	1,330	1,005	1,330	2,145	N.A.	2,565	N.A.
	230	2.7	3,330	206	1,330	1,060	1,330	2,410	N.A.	2,790	N.A.
11⅞"	110	2.5	3,160	267	1,560	910	1,375	1,935	2,295	2,350	2,705
	210	2.8	3,795	315	1,655	1,005	1,460	2,145	2,505	2,565	2,925
	230	3.0	4,215	347	1,655	1,060	1,485	2,410	2,765	2,790	3,150
	360	3.0	6,180	419	1,705	1,080	1,505	2,460	2,815	3,000	3,360
	560	4.0	9,500	636	2,050	1,265	1,725	3,000	3,475	3,455	3,930
14"	110	2.8	3,740	392	1,860	910	1,375	1,935	2,295	2,350	2,705
	210	3.1	4,490	462	1,945	1,005	1,460	2,145	2,505	2,565	2,925
	230	3.3	4,990	509	1,945	1,060	1,485	2,410	2,765	2,790	3,150
	360	3.3	7,335	612	1,955	1,080	1,505	2,460	2,815	3,000	3,360
	560	4.2	11,275	926	2,390	1,265	1,725	3,000	3,475	3,455	3,930
16"	210	3.3	5,140	629	2,190	1,005	1,460	2,145	2,505	2,565	2,925
	230	3.5	5,710	691	2,190	1,060	1,485	2,410	2,765	2,790	3,150
	360	3.5	8,405	830	2,190	1,080	1,505	2,460	2,815	3,000	3,360
	560	4.5	12,925	1,252	2,710	1,265	1,725	3,000	3,475	3,455	3,930

(1) **Caution: Do not** increase joist moment design properties by a repetitive member use factor.

General Notes

- Design reaction includes all loads on the joist. Design shear is computed at the inside face of supports and includes all loads on the span(s). Allowable shear may sometimes be increased at interior supports in accordance with ICC ES ESR-1153, and these increases are reflected in span tables.
- The following formulas approximate the uniform load deflection of Δ (inches):

For TJI® 110, 210, 230, and 360 Joists

$$\Delta = \frac{22.5\ wL^4}{EI} + \frac{2.67\ wL^2}{d \times 10^5}$$

For TJI® 560 Joists

$$\Delta = \frac{22.5\ wL^4}{EI} + \frac{2.29\ wL^2}{d \times 10^5}$$

w = uniform load in pounds per linear foot
L = span in feet
d = out-to-out depth of the joist in inches
EI = value from table above

PRODUCT STORAGE

Protect products from sun and water

CAUTION: Wrap is slippery when wet or icy

Use support blocks at 10' on-center to keep products out of mud and water

TJI® joists are intended for dry-use applications

FLOOR SPAN TABLES AND MATERIAL WEIGHTS

L/480 Live Load Deflection

Depth	TJI®	40 PSF Live Load / 10 PSF Dead Load				40 PSF Live Load / 20 PSF Dead Load			
		12" o.c.	16" o.c.	19.2" o.c.	24" o.c.	12" o.c.	16" o.c.	19.2" o.c.	24" o.c.
9½"	110	16'-11"	15'-6"	14'-7"	13'-7"	16'-11"	15'-6"	14'-3"	12'-9"
	210	17'-9"	16'-3"	15'-4"	14'-3"	17'-9"	16'-3"	15'-4"	14'-0"
	230	18'-3"	16'-8"	15'-9"	14'-8"	18'-3"	16'-8"	15'-9"	14'-8"
11⅞"	110	20'-2"	18'-5"	17'-4"	15'-9"(1)	20'-2"	17'-8"	16'-1"(1)	14'-4"(1)
	210	21'-1"	19'-3"	18'-2"	16'-11"	21'-1"	19'-3"	17'-8"	15'-9"(1)
	230	21'-8"	19'-10"	18'-8"	17'-5"	21'-8"	19'-10"	18'-7"	16'-7"(1)
	360	22'-11"	20'-11"	19'-8"	18'-4"	22'-11"	20'-11"	19'-8"	17'-10"(1)
	560	26'-1"	23'-8"	22'-4"	20'-9"	26'-1"	23'-8"	22'-4"	20'-9"(1)
14"	110	22'-10"	20'-11"	19'-2"	17'-2"(1)	22'-2"	19'-2"	17'-6"(1)	15'-0"(1)
	210	23'-11"	21'-10"	20'-8"	18'-10"(1)	23'-11"	21'-1"	19'-2"(1)	16'-7"(1)
	230	24'-8"	22'-6"	21'-2"	19'-9"(1)	24'-8"	22'-2"	20'-3"(1)	17'-6"(1)
	360	26'-0"	23'-8"	22'-4"	20'-9"(1)	26'-0"	23'-8"	22'-4"(1)	17'-10"(1)
	560	29'-6"	26'-10"	25'-4"	23'-6"	***29'-6"***	***26'-10"***	25'-4"(1)	20'-11"(1)
16"	210	26'-6"	24'-3"	22'-6"(1)	19'-11"(1)	26'-0"	22'-6"(1)	20'-7"(1)	16'-7"(1)
	230	27'-3"	24'-10"	23'-6"	21'-1"(1)	***27'-3"***	23'-9"	21'-8"(1)	17'-6"(1)
	360	28'-9"	26'-3"	24'-8"(1)	21'-5"(1)	***28'-9"***	26'-3"(1)	22'-4"(1)	17'-10"(1)
	560	32'-8"	29'-8"	28'-0"	25'-2"(1)	***32'-8"***	***29'-8"***	26'-3"(1)	20'-11"(1)

L/360 Live Load Deflection (Minimum Criteria per Code)

Depth	TJI®	40 PSF Live Load / 10 PSF Dead Load				40 PSF Live Load / 20 PSF Dead Load			
		12" o.c.	16" o.c.	19.2" o.c.	24" o.c.	12" o.c.	16" o.c.	19.2" o.c.	24" o.c.
9½"	110	18'-9"	17'-2"	15'-8"	14'-0"	18'-1"	15'-8"	14'-3"	12'-9"
	210	19'-8"	18'-0"	17'-0"	15'-4"	19'-8"	17'-2"	15'-8"	14'-0"
	230	20'-3"	18'-6"	17'-5"	16'-2"	***20'-3"***	18'-1"	16'-6"	14'-9"
11⅞"	110	22'-3"	19'-4"	17'-8"	15'-9"(1)	20'-5"	17'-8"	16'-1"(1)	14'-4"(1)
	210	23'-4"	21'-2"	19'-4"	17'-3"(1)	***22'-4"***	19'-4"	17'-8"	15'-9"(1)
	230	24'-0"	21'-11"	20'-5"	18'-3"	***23'-7"***	20'-5"	18'-7"	16'-7"(1)
	360	25'-4"	23'-2"	21'-10"	20'-4"(1)	***25'-4"***	***23'-2"***	***21'-10"***(1)	17'-10"(1)
	560	28'-10"	26'-3"	24'-9"	23'-0"	***28'-10"***	***26'-3"***	***24'-9"***	20'-11"(1)
14"	110	24'-4"	21'-0"	19'-2"	17'-2"(1)	22'-2"	19'-2"	17'-6"(1)	15'-0"(1)
	210	26'-6"	23'-1"	21'-1"	18'-10"(1)	24'-4"	21'-1"	19'-2"(1)	16'-7"(1)
	230	27'-3"	24'-4"	22'-2"	19'-10"(1)	***25'-8"***	22'-2"	20'-3"(1)	17'-6"(1)
	360	28'-9"	26'-3"	24'-9"(1)	21'-5"(1)	***28'-9"***	***26'-3"***(1)	22'-4"(1)	17'-10"(1)
	560	32'-8"	29'-9"	28'-0"	25'-2"(1)	***32'-8"***	***29'-9"***	***26'-3"***(1)	20'-11"(1)
16"	210	28'-6"	24'-8"	22'-6"(1)	19'-11"(1)	26'-0"	22'-6"(1)	20'-7"(1)	16'-7"(1)
	230	30'-1"	26'-0"	23'-9"	21'-1"(1)	***27'-5"***	23'-9"	21'-8"(1)	17'-6"(1)
	360	31'-10"	29'-0"	26'-10"(1)	21'-5"(1)	***31'-10"***	***26'-10"***(1)	22'-4"(1)	17'-10"(1)
	560	36'-1"	32'-11"	31'-0"(1)	25'-2"(1)	***36'-1"***	***31'-6"***(1)	26'-3"(1)	20'-11"(1)

(1) Web stiffeners are required at intermediate supports of continuous-span joists when the intermediate bearing length is ***less*** than 5¼" and the span on either side of the intermediate bearing is greater than the following spans:

TJI®	40 PSF Live Load / 10 PSF Dead Load				40 PSF Live Load / 20 PSF Dead Load			
	12" o.c.	16" o.c.	19.2" o.c.	24" o.c.	12" o.c.	16" o.c.	19.2" o.c.	24" o.c.
110	N.A.	N.A.	N.A.	15'-4"	N.A.	N.A.	16'-0"	12'-9"
210	N.A.	N.A.	21'-4"	17'-0"	N.A.	21'-4"	17'-9"	14'-2"
230	N.A.	N.A.	N.A.	19'-2"	N.A.	N.A.	19'-11"	15'-11"
360	N.A.	N.A.	24'-5"	19'-6"	N.A.	24'-5"	20'-4"	16'-3"
560	N.A.	N.A.	29'-10"	23'-10"	N.A.	29'-10"	24'-10"	19'-10"

- Long-term deflection under dead load, which includes the effect of creep, has not been considered. ***Bold italic*** spans reflect initial dead load deflection exceeding 0.33".

Material Weights

(Include TJI® weights in dead load calculations— see **Design Properties** table on page 3 for joist weights)

Floor Panels

Southern Pine

½" plywood . . . . . 1.7 psf
⅝" plywood . . . . . 2.0 psf
¾" plywood . . . . . 2.5 psf
1⅛" plywood . . . . . 3.8 psf
½" OSB . . . . . 1.8 psf
⅝" OSB . . . . . 2.2 psf
¾" OSB . . . . . 2.7 psf
⅞" OSB . . . . . 3.1 psf
1⅛" OSB . . . . . 4.1 psf

Based on: Southern pine – 40 pcf for plywood, 44 pcf for OSB

Roofing

Asphalt shingles . . . . . 2.5 psf
Wood shingles . . . . . 2.0 psf
Clay tile . . . . . 9.0 to 14.0 psf
Slate (⅜" thick) . . . . . 15.0 psf

Roll or Batt Insulation (1" thick):

Rock wool . . . . . 0.2 psf
Glass wool . . . . . 0.1 psf

Floor Finishes

Hardwood (nominal 1") . . . . . 4.0 psf
Sheet vinyl . . . . . 0.5 psf
Carpet and pad . . . . . 1.0 psf
¾" ceramic or quarry tile . . . . . 10.0 psf

Concrete:

Regular (1") . . . . . 12.0 psf
Lightweight (1") . . . . . 8.0 to 10.0 psf
Gypsum concrete (¾") . . . . . 6.5 psf

Ceilings

Acoustical fiber tile . . . . . 1.0 psf
½" gypsum board . . . . . 2.2 psf
⅝" gypsum board . . . . . 2.8 psf
Plaster (1" thick) . . . . . 8.0 psf

How to Use These Tables

1. Determine the appropriate live load deflection criteria.
2. Identify the live and dead load condition.
3. Select on-center spacing.
4. Scan down the column until you meet or exceed the span of your application.
5. Select TJI® joist and depth.

Live load deflection is not the only factor that affects how a floor will perform. To more accurately predict floor performance, use our TJ-Pro™ Ratings.

General Notes

- Tables are based on:
  - Uniform loads.
  - More restrictive of simple or continuous span.
  - Clear distance between supports (1¾" minimum end bearing).
- Assumed composite action with a single layer of 24" on-center span-rated, glue-nailed floor panels for deflection only. **Spans shall be reduced 6" when floor panels are nailed only.**
- Spans generated from iLevel® software may exceed the spans shown in these tables because software reflects actual design conditions.
- For multi-family applications and other loading conditions not shown, refer to iLevel® software or to the load table on page 5.

FLOOR LOAD TABLE

Floor—100% (PLF)

Depth	TJI®	Joist Clear Span																	
		8'		10'		12'		14'		16'		18'		20'		22'		24'	
		Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load
9½"	110	*	190	140	152	85	127	56	99	38	76								
	210	*	210	161	169	99	141	65	119	45	90								
	230	*	236	175	190	108	158	71	133	49	99								
11⅞"	110	*	190	*	152	*	127	92	109	63	95	45	76						
	210	*	210	*	169	*	141	106	121	74	106	53	92						
	230	*	236	*	190	*	158	116	136	80	119	58	102	43	83				
	360	*	241	*	193	*	162	136	139	95	121	69	108	51	97	39	78		
	560	*	294	*	236	*	197	*	169	138	148	101	132	76	119	58	108	45	91
14"	110	*	190	*	152	*	127	*	109	91	95	66	85						
	210	*	210	*	169	*	141	*	121	*	106	76	94	57	85				
	230	*	236	*	190	*	158	*	136	115	119	83	106	62	95	47	81		
	360	*	241	*	193	*	162	*	139	*	121	98	108	73	97	56	88	44	81
	560	*	294	*	236	*	197	*	169	*	148	*	132	107	119	83	108	65	99
16"	210	*	210	*	169	*	141	*	121	*	106	*	94	76	85	58	77		
	230	*	236	*	190	*	158	*	136	*	119	*	106	83	95	64	87	50	78
	360	*	241	*	193	*	162	*	139	*	121	*	108	*	97	75	88	59	81
	560	*	294	*	236	*	197	*	169	*	148	*	132	*	119	*	108	86	99

* Indicates that **Total Load** value controls.

How to Use This Table

1. Calculate actual total and live load in pounds per linear foot (plf).
2. Select appropriate **Joist Clear Span**.
3. Scan down the column to find a TJI® joist that meets or exceeds actual total and live loads.

General Notes

- Table is based on:
  - Uniform loads.
  - No composite action provided by sheathing.
  - More restrictive of simple or continuous span.
- **Total Load** limits joist deflection to L/240.
- **Live Load** is based on joist deflection of L/480.
- If a live load deflection limit of L/360 is desired, multiply value in **Live Load** column by 1.33. The resulting live load shall not exceed the **Total Load** shown.
- Table does not account for safe loading. Use iLevel software when this condition applies.

PSF to PLF Conversions

O.C. Spacing	Load in Pounds Per Square Foot (PSF)								
	20	25	30	35	40	45	50	55	60
	Load in Pounds Per Linear Foot (PLF)								
12"	20	25	30	35	40	45	50	55	60
16"	27	34	40	47	54	60	67	74	80
19.2"	32	40	48	56	64	72	80	88	96
24"	40	50	60	70	80	90	100	110	120

DO NOT walk on joists until braced. INJURY MAY RESULT.

DO NOT stack building materials on unsheathed joists. Stack only over beams or walls.

DO NOT walk on joists that are lying flat.

WARNING

Joists are unstable until braced laterally

Bracing Includes:

- Blocking
- Hangers
- Rim Board
- Sheathing
- Rim Joist
- Strut Lines

WARNING NOTES: *Lack of proper bracing during construction can result in serious accidents. Observe the following guidelines:*

1. All blocking, hangers, rim boards, and rim joists at the end supports of the TJI® joists must be completely installed and properly nailed.
2. Lateral strength, like a braced end wall or an existing deck, must be established at the ends of the bay. This can also be accomplished by a temporary or permanent deck (sheathing) fastened to the first 4 feet of joists at the end of the bay.
3. Safety bracing of 1x4 (minimum) must be nailed to a braced end wall or sheathed area (as in note 2) and to each joist. Without this bracing, buckling sideways or rollover is highly probable under light construction loads—such as a worker or one layer of unnailed sheathing.
4. Sheathing must be completely attached to each TJI® joist before additional loads can be placed on the system.
5. Ends of cantilevers require safety bracing on both the top and bottom flanges.
6. The flanges must remain straight within a tolerance of ½" from true alignment.

Project Name				Page No.
Bm/Jst Location/Description:	**R1**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**14.50**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**0.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**0.00**			
Beam Span (ft)	**6.00**			
load duration/repetitive factor	**1.15**		**1.00**	
Beam Data Base Number	**9**		**2.0E PSL**	
tributary load (plf)	580.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	2.61		Provided M	#N/A
shear/reaction (kips)	1.74		Provided V	#N/A
			Provided I	#N/A

	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	21.79	30.66	11.35	#N/A
Required I (in^4)	36.22	111.15	36.22	#N/A
Required A (in^2)	23.89	25.38	11.55	#N/A
Size	**4x8**	**Beam No.1-20**	**#N/A**	**Beam No.20-60**

Bm/Jst Location/Description:	**R2**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**7.00**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**0.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**0.00**			
Beam Span (ft)	**11.00**			
load duration/repetitive factor	**1.15**		**1.00**	
Beam Data Base Number	**10**		**2.0E PSL**	
tributary load (plf)	280.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	4.24		Provided M	#N/A
shear/reaction (kips)	1.54		Provided V	#N/A
			Provided I	#N/A

	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	35.35	49.91	18.41	#N/A
Required I (in^4)	107.74	230.84	107.74	#N/A
Required A (in^2)	21.14	32.38	9.47	#N/A
Size	**4x10**	**Beam No.1-20**	**#N/A**	**Beam No.20-60**

Project Name				Page No.
Bm/Jst Location/Description:	**R3**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**8.00**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**0.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**0.00**			
Beam Span (ft)	**8.00**			
load duration/repetitive factor	**1.15**		**1.00**	
Beam Data Base Number	**9**		**2.0E PSL**	
tributary load (plf)	320.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	2.56		Provided M	#N/A
shear/reaction (kips)	1.28		Provided V	#N/A
			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	21.37	30.66	11.13	#N/A
Required I (in^4)	47.36	111.15	47.36	#N/A
Required A (in^2)	17.57	25.38	10.12	#N/A
Size	**4x8**	**Beam No.1-20**	**#N/A**	**Beam No.20-60**

Bm/Jst Location/Description:	**R4**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**5.00**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**0.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**0.00**			
Beam Span (ft)	**12.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**10**		**2.0E PSL**	
tributary load (plf)	200.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	3.60		Provided M	#N/A
shear/reaction (kips)	1.20		Provided V	#N/A
3x3x1.5=13.5 kips			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	34.56	49.91	18.00	#N/A
Required I (in^4)	99.91	230.84	99.91	#N/A
Required A (in^2)	18.95	32.38	10.91	#N/A
Size	**4x10**	**Beam No.1-20**	**#N/A**	**Beam No.20-60**

Project Name				Page No.
Bm/Jst Location/Description:	**R5**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		9.52
tributary width (ft)	**6.00**	point load location to farthest support (ft)		6.50
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**0.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**0.00**			
Beam Span (ft)	**9.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**47**		**2.0E PSL**	
tributary load (plf)	240.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	19.62		Provided M	#N/A
shear/reaction (kips)	7.96		Provided V	#N/A
footing 2x4x1.5=12kips			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	188.34	280.73	98.09	162.00
Required I (in^4)	408.36	2456.38	408.36	972.00
Required A (in^2)	125.62	96.25	72.32	81.00
Size	**6x18**	**Beam No.1-20**	**6-3/4x12**	**Beam No.20-60**

Bm/Jst Location/Description:	U1			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**4.00**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**7.50**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**9.00**			
Beam Span (ft)	**9.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**9**		**2.0E PSL**	
tributary load (plf)	662.50		**#N/A**	**Beam No.61-88**
moment (kip-ft)	6.71		Provided M	#N/A
shear/reaction (kips)	2.98		Provided V	#N/A
U3+U4 Footing 3x3x1.5=13.5 kips			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	64.40	30.66	33.54	#N/A
Required I (in^4)	139.62	111.15	139.62	#N/A
Required A (in^2)	35.31	25.38	27.10	#N/A
Size	**4x8**	**Beam No.1-20**	**#N/A**	**Beam No.20-60**

Project Name				Page No.
Bm/Jst Location/Description:	**U2**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**0.00**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**11.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**9.00**			
Beam Span (ft)	**9.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**24**		**2.0E PSL**	
tributary load (plf)	695.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	7.04		Provided M	#N/A
shear/reaction (kips)	3.13		Provided V	#N/A
			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	67.55	280.73	35.18	57.42
Required I (in^4)	146.47	2456.38	146.47	301.46
Required A (in^2)	41.15	96.25	28.43	32.81
Size	**6x18**	**Beam No.1-20**	**3-1/8x10-1/2**	**Beam No.20-60**

Bm/Jst Location/Description:	**U3**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**6.00**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**0.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**0.00**			
Beam Span (ft)	**16.50**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**16**		**2.0E PSL**	
tributary load (plf)	240.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	8.17		Provided M	#N/A
shear/reaction (kips)	1.98		Provided V	#N/A
			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	78.41	82.73	40.84	#N/A
Required I (in^4)	311.67	392.96	311.67	#N/A
Required A (in^2)	31.26	52.25	9.00	#N/A
Size	**6x10**	**Beam No.1-20**	**#N/A**	**Beam No.20-60**

Project Name				Page No.
Bm/Jst Location/Description:	**U4**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**4.50**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**0.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**0.00**			
Beam Span (ft)	**12.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**10**		**2.0E PSL**	
tributary load (plf)	180.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	3.24		Provided M	#N/A
shear/reaction (kips)	1.08		Provided V	#N/A
footing 2x4x1.5=12kips			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	31.10	49.91	16.20	#N/A
Required I (in^4)	89.92	230.84	89.92	#N/A
Required A (in^2)	14.21	32.38	9.82	#N/A
Size	**4x10**	**Beam No.1-20**	**#N/A**	**Beam No.20-60**

Bm/Jst Location/Description:	**U5**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		1.08
tributary width (ft)	**4.00**	point load location to farthest support (ft)		4.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**0.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**0.00**			
Beam Span (ft)	**8.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**10**		**2.0E PSL**	
tributary load (plf)	160.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	3.44		Provided M	#N/A
shear/reaction (kips)	1.18		Provided V	#N/A
			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	33.02	49.91	17.20	#N/A
Required I (in^4)	63.65	230.84	63.65	#N/A
Required A (in^2)	13.97	32.38	10.73	#N/A
Size	**4x10**	**Beam No.1-20**	**#N/A**	**Beam No.20-60**

Project Name				Page No.
Bm/Jst Location/Description:	**U6**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**19.00**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**8.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**9.00**			
Beam Span (ft)	**4.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**10**		**2.0E PSL**	
tributary load (plf)	1290.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	2.58		Provided M	#N/A
shear/reaction (kips)	2.58		Provided V	#N/A
			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	24.77	49.91	12.90	#N/A
Required I (in^4)	23.87	230.84	23.87	#N/A
Required A (in^2)	30.55	32.38	15.63	#N/A
Size	**4x10**	**Beam No.1-20**	**#N/A**	**Beam No.20-60**

Bm/Jst Location/Description:	**U7**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**11.50**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**1.33**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**9.00**			
Beam Span (ft)	**14.50**	**I RATIO**	1.12	<2.0/1.7=1.18 OK
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**71**		**2.0E PSL**	
tributary load (plf)	623.15		**3-1/2x11-7/8**	**Beam No.61-88**
moment (kip-ft)	16.38		Provided M	19.90
shear/reaction (kips)	4.52		Provided V	8.04
			Provided I	490.00
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	157.22	280.73	81.89	1200.45
Required I (in^4)	549.20	2456.38	549.20	26244.00
Required A (in^2)	53.50	96.25	41.07	243.00
Size	**6x18**	**Beam No.1-20**	**6-3/4x36**	**Beam No.20-60**

Project Name				Page No.
Bm/Jst Location/Description:	**U8**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**0.00**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**13.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**9.00**			
Beam Span (ft)	**6.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**10**		**2.0E PSL**	
tributary load (plf)	805.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	3.62		Provided M	#N/A
shear/reaction (kips)	2.42		Provided V	#N/A
footing 3x3x1.5=13.5kips			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	34.78	49.91	18.11	#N/A
Required I (in^4)	50.27	230.84	50.27	#N/A
Required A (in^2)	31.78	32.38	21.95	#N/A
Size	**4x10**	**Beam No.1-20**	**#N/A**	**Beam No.20-60**

Bm/Jst Location/Description:	**U9**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**8.00**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	60.00	additional total point load (kips)		0.00
tributary width (ft)	**5.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**9.00**			
Beam Span (ft)	**9.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**71**		**2.0E PSL**	
tributary load (plf)	785.00		**3-1/2x11-7/8**	**Beam No.61-88**
moment (kip-ft)	7.95		Provided M	19.90
shear/reaction (kips)	3.53		Provided V	8.04
			Provided I	490.00
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	76.30	280.73	39.74	1200.45
Required I (in^4)	181.98	2456.38	181.98	26244.00
Required A (in^2)	44.62	96.25	16.06	243.00
Size	**6x18**	**Beam No.1-20**	**6-3/4x36**	**Beam No.20-60**

Project Name				Page No.
Bm/Jst Location/Description:	**U10**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		3.00
tributary width (ft)	**0.00**	point load location to farthest support (ft)		10.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**2.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**9.00**			
Beam Span (ft)	**13.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**71**		**2.0E PSL**	
tributary load (plf)	200.00		**3-1/2x11-7/8**	**Beam No.61-88**
moment (kip-ft)	11.15		Provided M	19.90
shear/reaction (kips)	3.61		Provided V	8.04
			Provided I	490.00
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	107.02	280.73	55.74	1200.45
Required I (in^4)	335.17	2456.38	335.17	26244.00
Required A (in^2)	47.47	96.25	32.79	243.00
Size	**6x18**	**Beam No.1-20**	**6-3/4x36**	**Beam No.20-60**

Bm/Jst Location/Description:	**U11**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		0.00
tributary width (ft)	**17.50**	point load location to farthest support (ft)		0.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**2.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**9.00**			
Beam Span (ft)	**14.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**78**		**2.0E PSL**	
tributary load (plf)	900.00		**5-1/4x11-7/8**	**Beam No.61-88**
moment (kip-ft)	22.05		Provided M	29.86
shear/reaction (kips)	6.30		Provided V	12.06
			Provided I	735.00
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	211.68	280.73	110.25	1200.45
Required I (in^4)	713.94	2456.38	713.94	26244.00
Required A (in^2)	79.58	96.25	28.63	243.00
Size	**6x18**	**Beam No.1-20**	**6-3/4x36**	**Beam No.20-60**

Project Name				Page No.
Bm/Jst Location/Description:	**U12**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		9.91
tributary width (ft)	**0.00**	point load location to farthest support (ft)		16.50
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**14.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**0.00**			
Beam Span (ft)	**23.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**54**		**2.0E PSL**	
tributary load (plf)	770.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	97.12		Provided M	#N/A
shear/reaction (kips)	15.96		Provided V	#N/A
footing 3x3x1.5=13.5kips			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	932.32	280.73	485.58	531.11
Required I (in^4)	5165.88	2456.38	5165.88	6407.23
Required A (in^2)	210.04	96.25	145.10	151.88
Size	**6x18**	**Beam No.1-20**	**6-3/4x22-1/2**	**Beam No.20-60**

Bm/Jst Location/Description:	**U13**			
Roof				
dead load (psf)	15.00			
live load (psf)	25.00	additional total point load (kips)		15.96
tributary width (ft)	**0.00**	point load location to farthest support (ft)		3.00
Floor				
dead load (psf)	15.00			
live load (psf)	40.00	additional total point load (kips)		0.00
tributary width (ft)	**2.00**	point load location to farthest support (ft)		0.00
Wall				
wall weight (psf)	10.00			
height (ft)	**0.00**			
Beam Span (ft)	**6.00**			
load duration/repetitive factor	**1.00**		**1.00**	
Beam Data Base Number	**30**		**2.0E PSL**	
tributary load (plf)	110.00		**#N/A**	**Beam No.61-88**
moment (kip-ft)	24.44		Provided M	#N/A
shear/reaction (kips)	8.31		Provided V	#N/A
			Provided I	#N/A
	DF#2	Provided	**24F-V4 or 24F-V8 DF GL**	Provided
Required S (in^3)	234.61	280.73	122.20	187.65
Required I (in^4)	339.12	2456.38	339.12	1930.96
Required A (in^2)	104.99	96.25	37.78	60.94
Size	**6x18**	**Beam No.1-20**	**3-1/8x19-1/2**	**Beam No.20-60**

Seismic Mass Calculation

Floor areas (sqft)

2nd	3320
roof	1820

Roof Framing Seismic Mass (psf)

roof framing		14.00
roofing (4.00 psf future PV panels)		6.00
wall framing to diaphragm		5.00
	total	**25.00** psf

Floor Framing Seismic Mass (psf)

floor framing		15.00
wall framing to diaphragm		10.00
	total	**25.00** psf

2nd

seismic mass (area x floor framing seismic mass) **83.00 kips**

roof

seismic mass (area x roof framing seismic mass) **45.50 kips**

Seismic Forces

(per attached spreadsheet calculations)

roof		9.80 kips
2nd		9.70
	total	19.50 kips

	NS	*EW*
ASD = Seismic Force/1.4	Cumulative	Cumulative
roof	7.00 kips	7.00 kips
2nd	13.93 kips	13.93 kips

	total	13.93 kips

Wind Forces

(per attached spreadsheet calculations)

NS	21.49 kips	0.96
EW	20.68 kips	

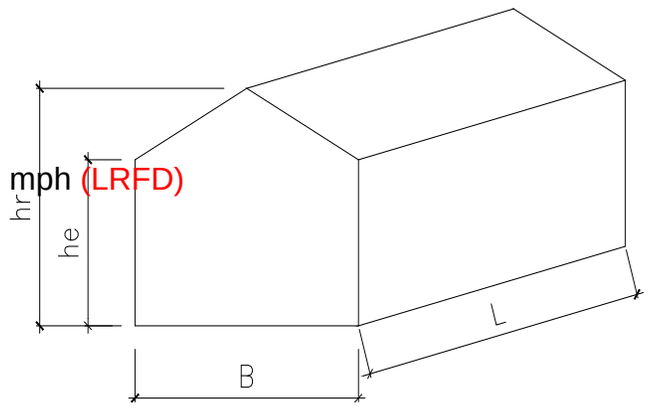
		NS	*EW*
NS		Cumulative	
roof = ((8'+9'/2)/28') x 21.49 kips	9.59	**9.59 kips**	
2nd = (((9'+11')/2)/28') x 21.49 kips	7.68	**17.27 kips**	
	total 17.27 kips		
EW			Cumulative
roof = ((8'+9'/2)/28') x 20.68 kips	9.23		**9.23 kips**
2nd = (((9'+11')/2)/28') x 20.68 kips	7.39		**16.62 kips**
	total 16.62 kips		

Lateral Force Summary (ASD)

	NS	*EW*
	Cumulative	Cumulative
WIND/WIND	**9.59 kips**	**9.23 kips**
WIND/WIND	**17.27 kips**	**16.62 kips**

INPUT DATA

Exposure category (B, C or D)			B	
Importance factor, pg 77, (0.87, 1.0 or 1.15)	I	=	1.00	Category II
Basic wind speed (IBC Tab 1609.3.1 V_{3S})	V	=	85	mph (ASD); 110 mph (LRFD)
Topographic factor (Sec.6.5.7.2, pg 26 & 45)	K_{zt}	=	2	
Building height to eave	h_e	=	20	ft
Building height to ridge	h_r	=	28	ft
Building length	L	=	55	ft
Building width	B	=	52	ft
Effective area of components	A	=	10	ft^2



DESIGN SUMMARY

Max horizontal force normal to building length, L, face	=	21.49	kips
Max horizontal force normal to building length, B, face	=	20.68	kips
Max total horizontal torsional load	=	156.85	ft-kips
Max total upward force	=	50.94	kips

ANALYSIS

Velocity pressure

$q_h = 0.00256\, K_h\, K_{zt}\, K_d\, V^2\, I$ = **22.01** psf

where: q_h = velocity pressure at mean roof height, h. (Eq. 6-15, page 27)

K_h = velocity pressure exposure coefficient evaluated at height, h, (Tab. 6-3, Case 1,pg 79) = **0.70**

K_d = wind directionality factor. (Tab. 6-4, for building, page 80) = **0.85**

h = mean roof height = **24.00** ft

< 60 ft, [Satisfactory]

Design pressures for MWFRS

$p = q_h\, [(G\, C_{pf}) - (G\, C_{pi})]$

where: p = pressure in appropriate zone. (Eq. 6-18, page 28).

$G\, C_{pf}$ = product of gust effect factor and external pressure coefficient, see table below. (Fig. 6-10, page 53 & 54)

$G\, C_{pi}$ = product of gust effect factor and internal pressure coefficient.(Fig. 6-5, Enclosed Building, page 47)

= **0.18** or **-0.18**

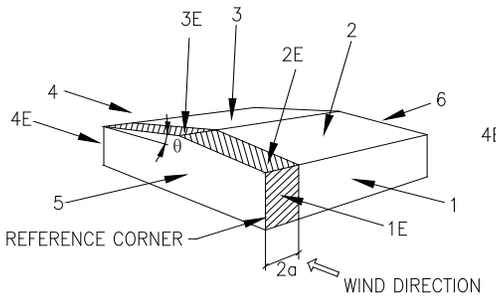
a = width of edge strips, Fig 6-10, note 9, page 54, MAX[MIN(0.1B, 0.4h), 0.04B,3] = **5.20 ft**

Net Pressures (psf), Basic Load Cases

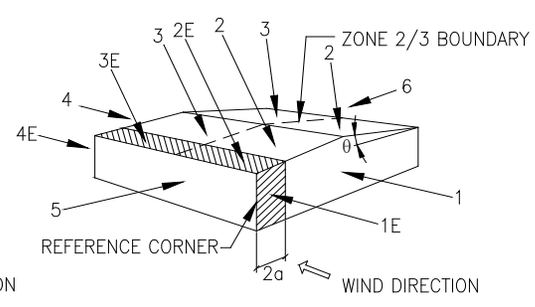
Surface	Roof angle θ = 17.10			Roof angle θ = 0.00		
	$G\, C_{pf}$	Net Pressure with		$G\, C_{pf}$	Net Pressure with	
		$(+GC_{pi})$	$(-GC_{pi})$		$(+GC_{pi})$	$(-GC_{pi})$
1	0.50	7.15	15.07	0.40	4.84	12.77
2	-0.69	-19.15	-11.23	-0.69	-19.15	-11.23
3	-0.46	-14.06	-6.14	-0.37	-12.11	-4.18
4	-0.40	-12.83	-4.91	-0.29	-10.34	-2.42
1E	0.76	12.84	20.76	0.61	9.46	17.39
2E	-1.07	-27.51	-19.59	-1.07	-27.51	-19.59
3E	-0.66	-18.47	-10.55	-0.53	-15.63	-7.70
4E	-0.60	-17.16	-9.23	-0.43	-13.43	-5.50
5	-0.45	-13.87	-5.94	-0.45	-13.87	-5.94
6	-0.45	-13.87	-5.94	-0.45	-13.87	-5.94

Net Pressures (psf), Torsional Load Cases

Surface	Roof angle θ = 17.10		
	$G\, C_{pf}$	Net Pressure with	
		$(+GC_{pi})$	$(-GC_{pi})$
1T	0.50	1.79	3.77
2T	-0.69	-4.79	-2.81
3T	-0.46	-3.51	-1.53
4T	-0.40	-3.21	-1.23
Surface	Roof angle θ = 0.00		
	$G\, C_{pf}$	Net Pressure with	
		$(+GC_{pi})$	$(-GC_{pi})$
1T	0.40	1.21	3.19
2T	-0.69	-4.79	-2.81
3T	-0.37	-3.03	-1.05
4T	-0.29	-2.59	-0.61

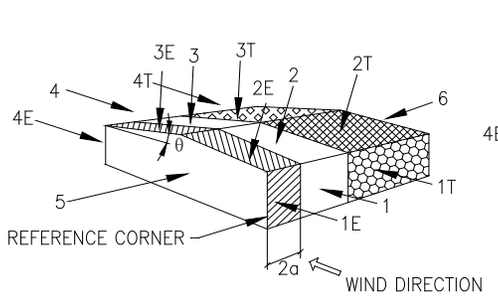


Transverse Direction

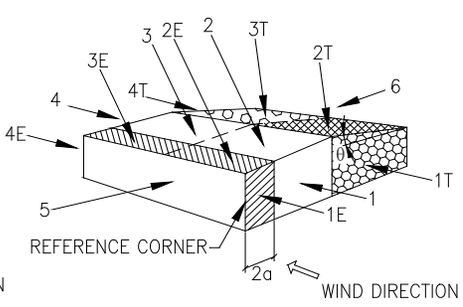


Longitudinal Direction

Basic Load Cases



Transverse Direction



Longitudinal Direction

Torsional Load Cases

Basic Load Cases in Transverse Direction

Surface	Area (ft^2)	Pressure (k) with $(+GC_{pi})$	Pressure (k) with $(-GC_{pi})$
1	892	6.38	13.45
2	1213	-23.23	-13.62
3	1213	-17.06	-7.44
4	892	-11.45	-4.38
1E	208	2.67	4.32
2E	283	-7.78	-5.54
3E	283	-5.22	-2.98
4E	208	-3.57	-1.92
Σ	Horiz.	21.49	21.49
	Vert.	-50.94	-28.28
10 psf min.	Horiz.	15.40	15.40
Sec. 6.1.4.1	Vert.	-28.60	-28.60

Basic Load Cases in Longitudinal Direction

Surface	Area (ft^2)	Pressure (k) with $(+GC_{pi})$	Pressure (k) with $(-GC_{pi})$
1	1023	4.96	13.06
2	1197	-22.92	-13.44
3	1197	-14.49	-5.01
4	1023	-10.59	-2.48
1E	225	2.13	3.91
2E	299	-8.23	-5.86
3E	299	-4.68	-2.31
4E	225	-3.02	-1.24
Σ	Horiz.	20.68	20.68
	Vert.	-48.09	-25.43
10 psf min.	Horiz.	12.48	12.48
Sec. 6.1.4.1	Vert.	-28.60	-28.60

Torsional Load Cases in Transverse Direction

Surface	Area (ft^2)	Pressure (k) with $(+GC_{pi})$	Pressure (k) with $(-GC_{pi})$	Torsion (ft-k) $(+GC_{pi})$	Torsion (ft-k) $(-GC_{pi})$
1	342	2.45	5.16	27	57
2	465	-8.91	-5.22	-29	-17
3	465	-6.54	-2.85	21	9
4	342	-4.39	-1.68	49	19
1E	208	2.67	4.32	60	96
2E	283	-7.78	-5.54	-51	-36
3E	283	-5.22	-2.98	34	20
4E	208	-3.57	-1.92	80	43
1T	550	0.98	2.07	-14	-29
2T	748	-3.58	-2.10	14	8
3T	748	-2.63	-1.15	-11	-5
4T	550	-1.76	-0.67	-24	-9
Total Horiz. Torsional Load, M_T				157	157

Torsional Load Cases in Longitudinal Direction

Surface	Area (ft^2)	Pressure (k) with $(+GC_{pi})$	Pressure (k) with $(-GC_{pi})$	Torsion (ft-k) $(+GC_{pi})$	Torsion (ft-k) $(-GC_{pi})$
1	399	1.93	5.10	15	39
2	898	-17.19	-10.08	70	41
3	898	-10.87	-3.75	-44	-15
4	399	-4.13	-0.97	31	7
1E	225	2.13	3.91	44	81
2E	299	-8.23	-5.86	33	24
3E	299	-4.68	-2.31	-19	-9
4E	225	-3.02	-1.24	62	26
1T	624	0.76	1.99	-9	-24
2T	1197	-5.73	-3.36	-46	-27
3T	1197	-3.62	-1.25	29	10
4T	624	-1.61	-0.38	-20	-5
Total Horiz. Torsional Load, M_T				145.9	145.9

Design pressures for components and cladding

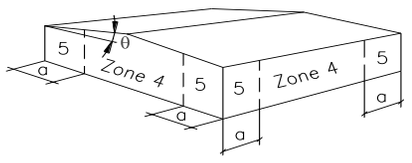
$p = q_h[(G C_p) - (G C_{pi})]$

where: p = pressure on component. (Eq. 6-22, pg 28)

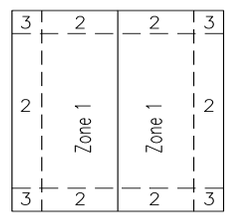
p_{min} = 10 psf (Sec. 6.1.4.2, pg 21)

G C_p = external pressure coefficient.

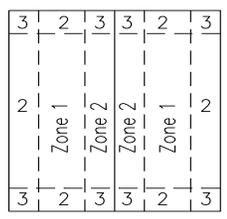
see table below. (Fig. 6-11, page 55~58)



Walls



Roof $\theta \leq 7°$



Roof $\theta > 7°$

	Effective Area (ft^2)	Zone 1 GC_P	Zone 1 $-GC_P$	Zone 2 GC_P	Zone 2 $-GC_P$	Zone 3 GC_P	Zone 3 $-GC_P$	Zone 4 GC_P	Zone 4 $-GC_P$	Zone 5 GC_P	Zone 5 $-GC_P$
Comp.	10	0.50	-0.90	0.50	-1.70	0.50	-2.60	1.00	-1.10	1.00	-1.40

Comp. & Cladding Pressure (psf)	Zone 1		Zone 2		Zone 3		Zone 4		Zone 5	
	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
	14.97	-23.77	14.97	-41.38	14.97	-61.19	25.97	-28.17	25.97	-34.78

INPUT DATA

Typical floor height	h =	**11.0**	ft
Typical floor weight	w_x =	**46**	k
Number of floors	n =	**2**	
Importance factor (ASCE 11.5.1)	I =	**1.00**	(IBC Tab.1604.5)
Building location	Zip Code	**98040**	
Site class (A, B, C, D, E, F)		**D**	(If no soil report, use D)
The coefficient (ASCE Tab 12.8-2)	C_t =	**0.02**	
The coefficient(ASCE Tab. 12.2.1)	R =	**6.50**	

DESIGN SUMMARY

Total base shear

V = 0.15 W, (SD) = **20** k, (SD)

= 0.11 W, (ASD) = **14** k, (ASD)

Seismic design category = **D**

Latitude: 47.562605

Longitude: -122.2254

S_S = 147.595 %g , S_{ms} = 1.476 g , F_a = 1.000

S_1 = 50.091 %g , S_{m1} = 0.751 g , F_v = 1.500

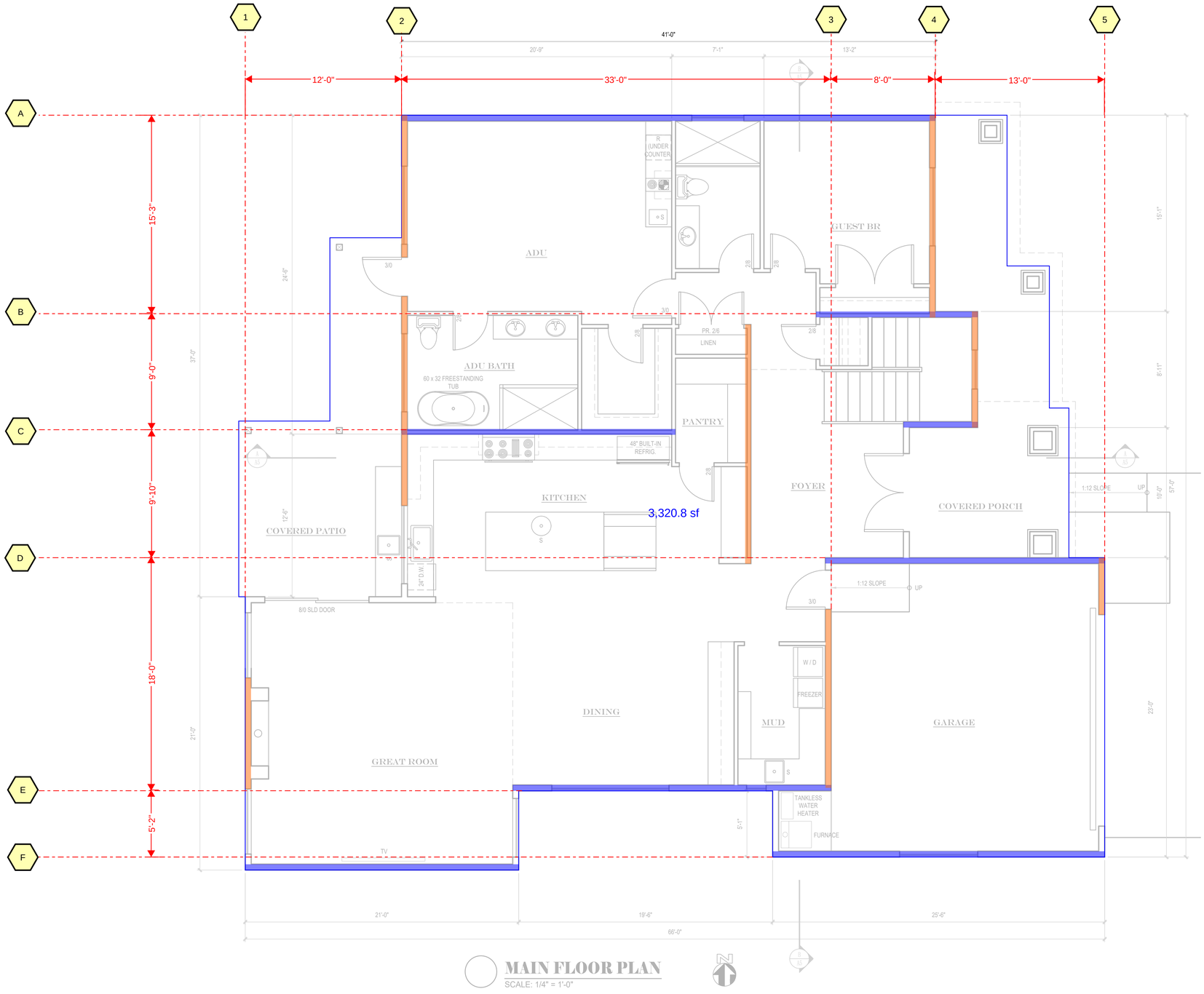
S_{DS} = **0.984** g , S_{D1} = **0.501** g

h_n = 20.0 ft k = 1.00 , (ASCE 12.8.3, pg 130) x = 0.75 , (ASCE Tab 12.8-2)

W = 129 k $\Sigma w_x h^k$ = 1,833 $T_a = C_t (h_n)^x$ = 0.19 Sec, (ASCE 12.8.2.1)

VERTICAL DISTRIBUTION OF LATERAL FORCES

Level No.	Level Name	Floor to floor Height ft	Height h_x ft	Weight w_x k	$w_x h_x^k$	C_{vx}	Lateral force @ each level F_x k	V_x k	O. M. k-ft	Diaphragm force ΣF_i k	ΣW_i k	F_{px} k
2	Roof		20.0	46	920	0.502	9.8			9.8	46	10
		9.00						9.8				
1	2nd		11.0	83	913	0.498	9.7		88	19.5	129	16
		11.00						19.5				
	Ground		0.0						303			



MAIN FLOOR PLAN

SCALE: 1/4" = 1'-0"

CHC ARCHITECTS
13301 SE 79th PL Unit A205
NEWCASTLE WA 98059
(M) 425.785.3992
(O) 425.988.3618
chcarch@gmail.com

8666 REGISTERED ARCHITECT
CHAOHUA CHANG
STATE OF WASHINGTON

CHEN RESIDENCE

3869 80TH AVE SE MERCER ISLAND WA 98040

NUMBER	DATE	DESCRIPTION OF REVISIONS
	09-05-2017	PERMIT PLANS

SHEET TITLE

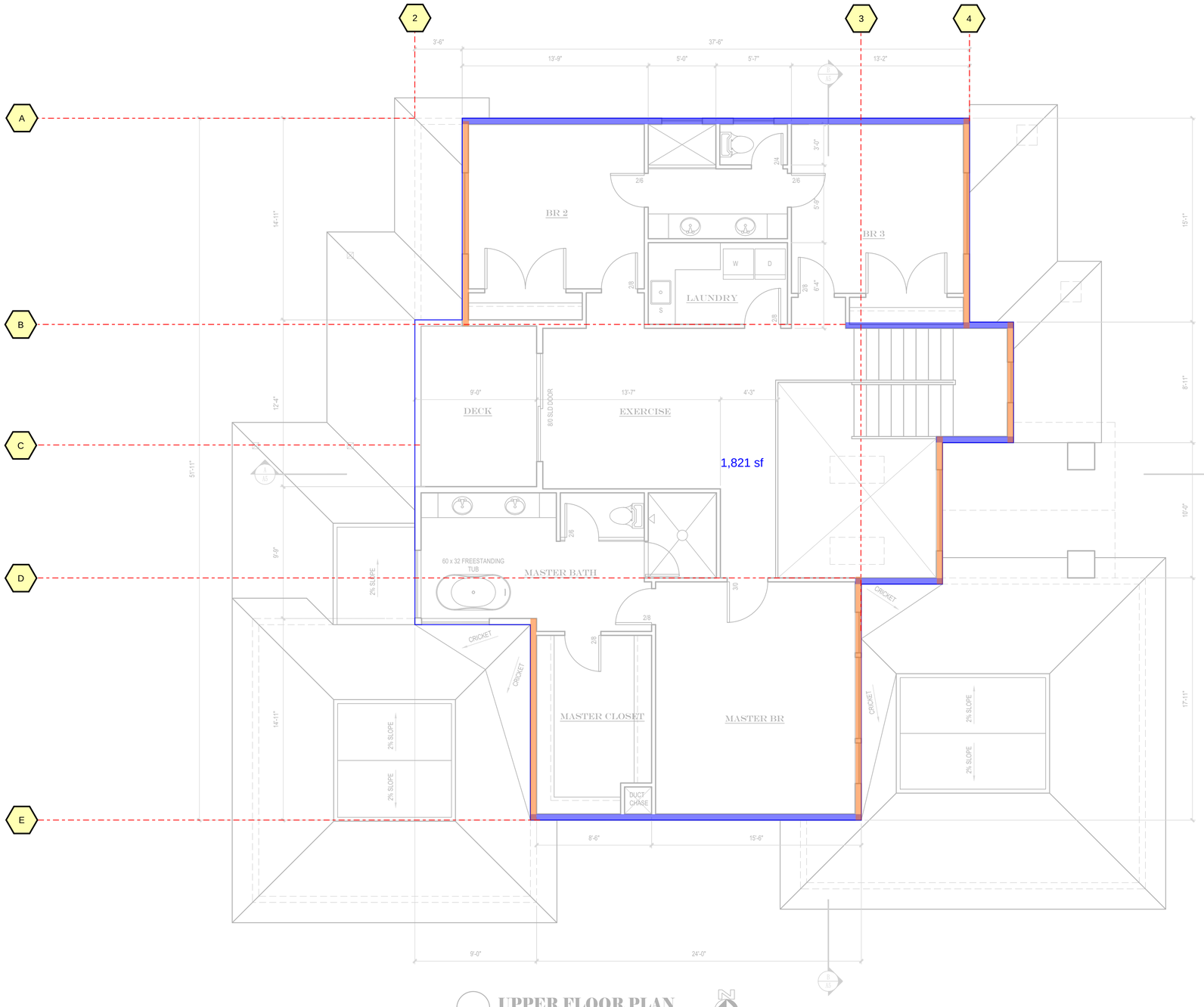
MAIN FLOOR PLAN

JOB NUMBER

SHEET NUMBER

A1

CITY STAMP



UPPER FLOOR PLAN

SCALE: 1/4" = 1'-0"

CHC ARCHITECTS
13301 SE 79th PL Unit A205
NEWCASTLE WA 98059
(M) 425.785.3992
(O) 425.988.3618
chcarch@gmail.com

8666 REGISTERED ARCHITECT
CHAOHUA CHANG
STATE OF WASHINGTON

CHEN RESIDENCE

3869 80TH AVE SE MERCER ISLAND WA 98040

NUMBER	DATE	DESCRIPTION OF REVISIONS
	09-05-2017	PERMIT PLANS

SHEET TITLE

UPPER FLOOR PLAN

JOB NUMBER

SHEET NUMBER

A2

CITY STAMP

NS Shear Wall Design

shear wall location:	LINE-1	roof diaphragm	2nd flr diaphragm
shear force (kips)		0.00	0.70
floor height (ft)		9.00	11.00
wall length without opening (ft)		31.00	8.00
wall length with opening (ft)		52.00	8.00
wall segment length (ft)		52.00	8.00
shear flow (plf)		0.00	87.50
shear wall type per schedule on GN		NA	6
dead loads from floor/roof framing (plf)		330.00	75.00
wall weight (plf)		90.00	110.00
hold down force (kips) with 0.6DL		NA	0.52
hold down type per schedule on GN		NO HD	2
shear wall location:	LINE-2	roof diaphragm	2nd flr diaphragm
shear force (kips)		3.86	6.48
floor height (ft)		9.00	11.00
wall length without opening (ft)		44.00	27.00
wall length with opening (ft)		38.00	14.00
wall segment length (ft)		14.00	11.00
shear flow (plf)		87.73	240.00
shear wall type per schedule on GN		6	4
dead loads from floor/roof framing (plf)		135.00	60.00
wall weight (plf)		90.00	110.00
hold down force (kips) with 0.6DL		-0.16	2.08
hold down type per schedule on GN		NO HD	2
shear wall location:	LINE-3	roof diaphragm	2nd flr diaphragm
shear force (kips)		1.43	3.82
floor height (ft)		9.00	11.00
wall length without opening (ft)		8.00	31.00
wall length with opening (ft)		8.00	31.00
wall segment length (ft)		5.00	13.00
shear flow (plf)		178.75	123.23
shear wall type per schedule on GN		4	6
dead loads from floor/roof framing (plf)		210.00	30.00
wall weight (plf)		90.00	110.00
hold down force (kips) with 0.6DL		1.16	1.97
hold down type per schedule on GN		A	2
shear wall location:	LINE-4	roof diaphragm	2nd flr diaphragm
shear force (kips)		4.30	5.52
floor height (ft)		9.00	11.00
wall length without opening (ft)		34.00	24.00
wall length with opening (ft)		17.00	12.00
wall segment length (ft)		9.00	9.00
shear flow (plf)		126.47	230.00
shear wall type per schedule on GN		4	4
dead loads from floor/roof framing (plf)		60.00	90.00
wall weight (plf)		90.00	110.00
hold down force (kips) with 0.6DL		0.73	2.72
hold down type per schedule on GN		A	4

shear wall location:	LINE-5	roof diaphragm	2nd flr diaphragm
shear force (kips)		0.00	0.76
floor height (ft)		9.00	11.00
wall length without opening (ft)		23.00	4.00
wall length with opening (ft)		40.00	4.00
wall segment length (ft)		40.00	4.00
shear flow (plf)		0.00	190.00
shear wall type per schedule on GN		6	6
dead loads from floor/roof framing (plf)		330.00	60.00
wall weight (plf)		90.00	110.00
hold down force (kips) with 0.6DL		-5.04	1.89
hold down type per schedule on GN		NO HD	2

EW Shear Wall Design

shear wall location:	LINE-A	roof diaphragm	2nd flr diaphragm
shear force (kips)		1.36	2.34
floor height (ft)		9.00	11.00
wall length without opening (ft)		37.00	42.00
wall length with opening (ft)		31.00	38.00
wall segment length (ft)		37.00	42.00
shear flow (plf)		36.76	55.71
shear wall type per schedule on GN		6	6
dead loads from floor/roof framing (plf)		255.00	112.50
wall weight (plf)		90.00	110.00
hold down force (kips) with 0.6DL		-3.55	-2.25
hold down type per schedule on GN		NO HD	NO HD
shear wall location:	LINE-B	roof diaphragm	2nd flr diaphragm
shear force (kips)		2.15	3.71
floor height (ft)		9.00	11.00
wall length without opening (ft)		12.00	12.00
wall length with opening (ft)		12.00	12.00
wall segment length (ft)		12.00	12.00
shear flow (plf)		179.17	309.17
shear wall type per schedule on GN		6	4
dead loads from floor/roof framing (plf)		90.00	30.00
wall weight (plf)		90.00	110.00
hold down force (kips) with 0.6DL		0.96	2.90
hold down type per schedule on GN		A	4

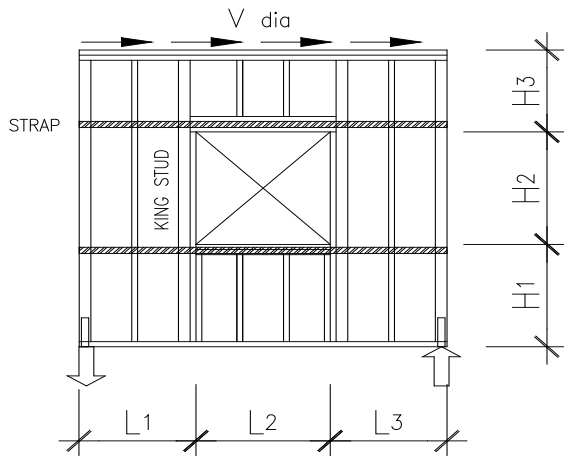
shear wall location:	LINE-C	roof diaphragm	2nd flr diaphragm
shear force (kips)		1.67	2.88
floor height (ft)		9.00	11.00
wall length without opening (ft)		5.00	25.00
wall length with opening (ft)		5.00	25.00
wall segment length (ft)		5.00	5.00
shear flow (plf)		334.00	115.20
shear wall type per schedule on GN		4	3
dead loads from floor/roof framing (plf)		90.00	90.00
wall weight (plf)		90.00	110.00
hold down force (kips) with 0.6DL		2.74	3.70
hold down type per schedule on GN		B	4
shear wall location:	LINE-D	roof diaphragm	2nd flr diaphragm
shear force (kips)		2.46	4.26
floor height (ft)		9.00	11.00
wall length without opening (ft)		6.00	21.00
wall length with opening (ft)		6.00	21.00
wall segment length (ft)		6.00	21.00
shear flow (plf)		410.00	202.86
shear wall type per schedule on GN		4	6
dead loads from floor/roof framing (plf)		255.00	180.00
wall weight (plf)		90.00	110.00
hold down force (kips) with 0.6DL		3.07	3.47
hold down type per schedule on GN		B	4
shear wall location:	LINE-E	roof diaphragm	2nd flr diaphragm
shear force (kips)		1.59	3.09
floor height (ft)		9.00	11.00
wall length without opening (ft)		24.00	24.00
wall length with opening (ft)		24.00	12.00
wall segment length (ft)		24.00	24.00
shear flow (plf)		66.25	128.75
shear wall type per schedule on GN		6	6
dead loads from floor/roof framing (plf)		60.00	105.00
wall weight (plf)		90.00	110.00
hold down force (kips) with 0.6DL		-0.48	-0.13
hold down type per schedule on GN		NO HD	NO HD
shear wall location:	LINE-F	roof diaphragm	2nd flr diaphragm
shear force (kips)		0.00	0.34
floor height (ft)		9.00	11.00
wall length without opening (ft)		40.00	46.00
wall length with opening (ft)		30.00	40.00
wall segment length (ft)		40.00	21.00
shear flow (plf)		0.00	8.50
shear wall type per schedule on GN		6	6
dead loads from floor/roof framing (plf)		120.00	180.00
wall weight (plf)		90.00	110.00
hold down force (kips) with 0.6DL		-2.52	-1.73
hold down type per schedule on GN		NO HD	NO HD

Wood Shear Wall with an Opening Based on NDS

window width = total wall pier length = 340/2=170 plf

INPUT DATA

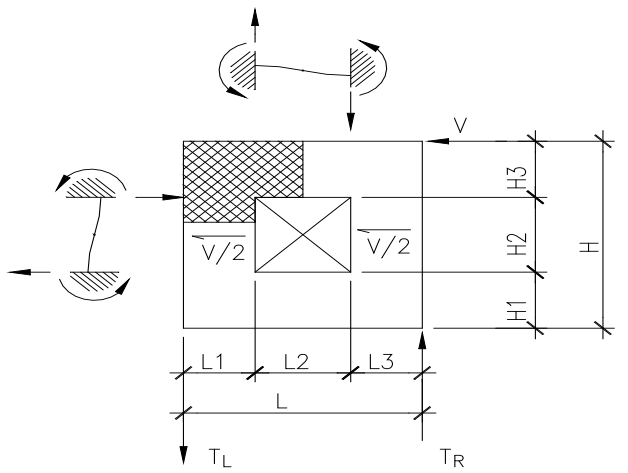
LATERAL FORCE ON DIAPHRAGM:	$v_{dia,\ WIND}$ =	170	plf,for wind						
(SERVICE LOADS)	$v_{dia,\ SEISMIC}$ =	170	plf,for seismic						
DIMENSIONS:	L_1 =	3	ft ,	L_2 =	6	ft ,	L_3 =	3	ft
	H_1 =	2	ft ,	H_2 =	5	ft ,	H_3 =	2	ft
KING STUD SECTION		1	pcs, b =		2	in ,	h =	6	in
EDGE STUD SECTION		2	pcs, b =		2	in ,	h =	6	in
PANEL GRADE (0 or 1) =		1	<= Sheathing and Single-Floor						
MINIMUM NOMINAL PANEL THICKNESS =		15/32	in						
COMMON NAIL SIZE (0=6d, 1=8d, 2=10d)		2	10d						
SPECIFIC GRAVITY OF FRAMING MEMBERS		0.5							
STORY OPTION (1=ground level, 2=upper level)		2	upper level shear wall						

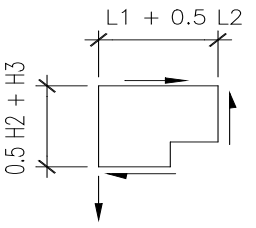


DESIGN SUMMARY

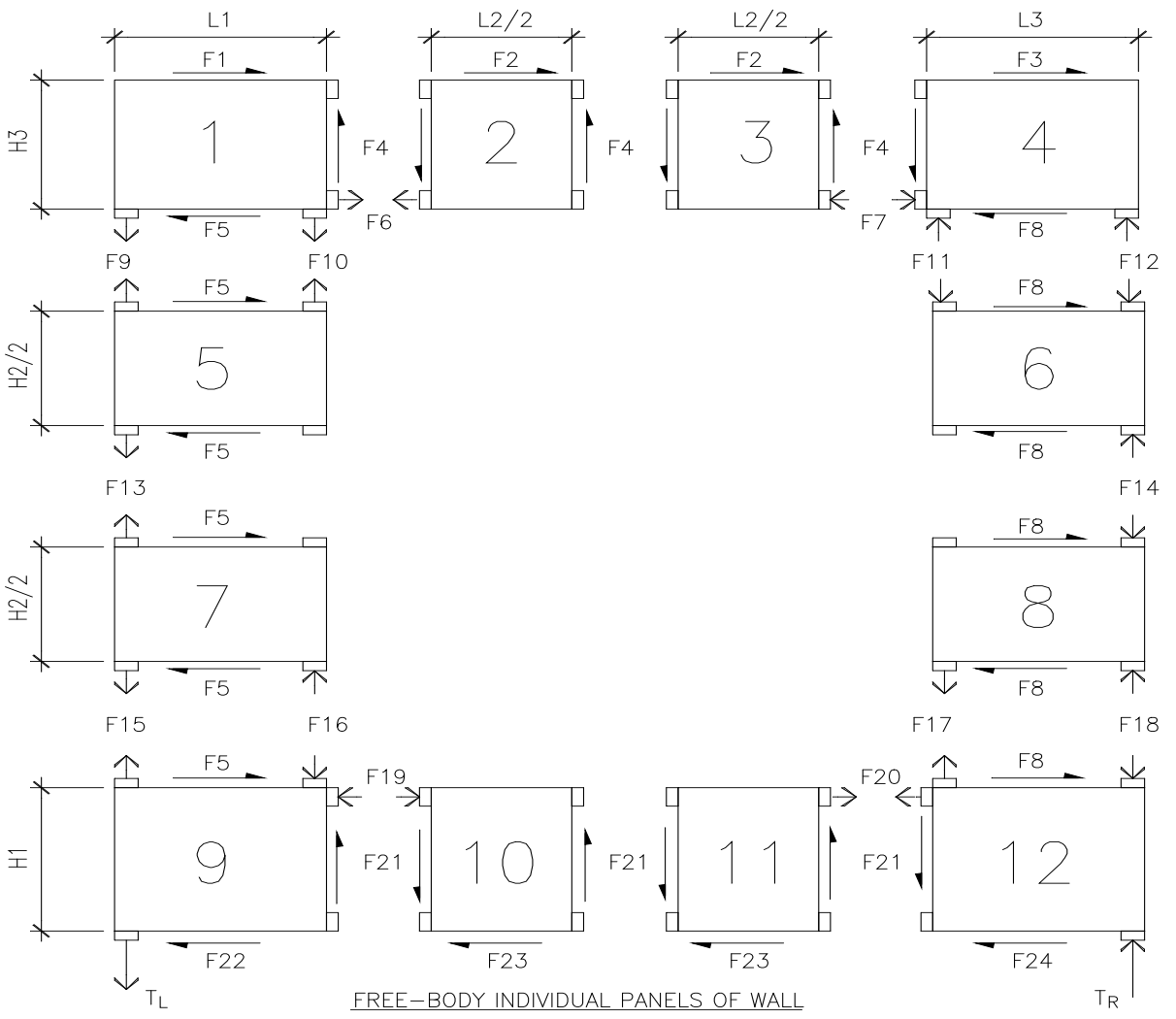
BLOCKED 15/32 SHEATHING WITH 10d COMMON NAILS
@ 4 in O.C. BOUNDARY & ALL EDGES / 12 in O.C. FIELD,
SILL PLATE ATTACHMENT 16d AT 6" O.C.

HOLD-DOWN FORCES: T_L = 1.59 k , T_R = 1.59 k (USE CS16 SIMPSON HOLD-DOWN)
MAX STRAP FORCE: F = 1.15 k (USE SIMPSON CS18 OVER WALL SHEATHING WITH FLAT BLOCKING)
KING STUD: 1 - 2" x 6" DOUGLAS FIR-LARCH No. 1, CONTINUOUS FULL HEIGHT.
EDGE STUD: 2 - 2" x 6" DOUGLAS FIR-LARCH No. 1, CONTINUOUS FULL HEIGHT.
SHEAR WALL DEFLECTION: Δ = 0.63 in





ASSUME INFLECTION POINT AT MIDDLE OF WINDOW



FREE–BODY INDIVIDUAL PANELS OF WALL

ANALYSIS

CHECK MAX SHEAR WALL DIMENSION RATIO h / w = 1.7 **<** 2 **[Satisfactory]**

DETERMINE FORCES & SHEAR STRESS OF FREE-BODY INDIVIDUAL PANELS OF WALL

INDIVIDUAL PANEL	W (ft)	H (ft)	MAX SHEAR STRESS (plf)	NO.	FORCE (lbf)	NO.	FORCE (lbf)
1	3.00	2.00	-43	F1	-128	F13	765
2	3.00	2.00	383	F2	1148	F14	765
3	3.00	2.00	383	F3	-128	F15	1615
4	3.00	2.00	-43	F4	765	F16	850
5	3.00	2.50	340	F5	1020	F17	850
6	3.00	2.50	340	F6	1148	F18	1615
7	3.00	2.50	340	F7	1148	F19	1050
8	3.00	2.50	340	F8	1020	F20	1050
9	3.00	2.00	-10	F9	-85	F21	830
10	3.00	2.00	415	F10	850	F22	-30
11	3.00	2.00	415	F11	850	F23	1050
12	3.00	2.00	-10	F12	-85	F24	-30

DETERMINE REQUIRED CAPACITY v_b = 415 plf, (1 Side Panel Required, the Max. Nail Spacing = 4 in)

THE SHEAR CAPACITIES PER IBC Table 2306.4.1 / UBCTable 23-II-I-1 :

Panel Grade	Common Nail	Min. Penetration (in)	Min. Thickness (in)	Blocked Nail Spacing Boundary & All Edges			
				6	4	3	2
Sheathing and Single-Floor	10d	1 5/8	15/32	310	460	600	770

Note: The indicated shear numbers have reduced by specific gravity factor per IBC note a / UBC note1 of the table.

DETERMINE FLOOR SILL PLATE ATTACHMENT (NDS 2005, Table 11Q & Table 11L)

SILL PLATE ATTACHMENT 16d AT 6" O.C.

THE HOLD-DOWN FORCES:

	v_{dia} (plf)	Wall Seismic at mid-story (lbs)	Overturning Moments (ft-lbs)		Resisting Moments (ft-lbs)	Safety Factors	Net Uplift (lbs)		Holddown SIMPSON
SEISMIC	170	173	19138	Left	0	0.9	T_L =	1595	CS16
				Right	0	0.9	T_R =	1595	
WIND	170		18360	Left	0	2/3	T_L =	1530	
				Right	0	2/3	T_R =	1530	

(T_L & T_R values should include upper level UPLIFT forces if applicable)

DETERMINE MAXIMUM SHEAR WALL DEFLECTION: (IBC Section 2305.3.2)

$$\Delta = \Delta_{Bending} + \Delta_{Shear} + \Delta_{Nail\ slip} + \Delta_{Chord\ splice\ slip} = \frac{8 v_b h^3}{E A L_w} + \frac{v_b h}{G t} + 0.75 h e_n + \frac{h d_a}{L_w} = 0.628 \text{ in}$$

Where:

v_b =	415	plf	L_w =	6	ft	E =	1.7E+06	psi
A =	16.50	in^2	h =	9	ft	G =	9.0E+04	psi
t =	0.298	in	e_n =	0.037	in	d_a =	0.15	in

CHECK KING STUD CAPACITY

P_{max} = 0.85 kips

F_c =	1500	psi	C_D =	1.60	C_P =	0.43		A =	8.25	in^2	
E =	1700	ksi	C_F =	1.10	F_c' =	1146	psi	>	f_c =	103	psi

[Satisfactory]

CHECK EDGE STUD CAPACITY

P_{max} = 1.59 kips, (this value should include upper level DOWNWARD loads if applicable)

F_c =	1500	psi	C_D =	1.60	C_P =	0.43		A =	16.50	in^2	
E =	1700	ksi	C_F =	1.10	F_c' =	1146	psi	>	f_c =	97	psi

[Satisfactory]

Technical References:

1. "National Design Specification, NDS", 2005 Edition, AF & PA, AWC, 2005.

SB *Anchor Bolt*

This product is preferable to similar connectors because of a) easier installation, b) higher loads, c) lower installed cost, or a combination of these features.

The SB⅝x24 anchor bolt offers a load-tested anchorage solution that exceeds the capacity of all of our holdowns that call for a ⅝" dia. anchor. Similarly, the SB1x30 covers holdowns utilizing a 1" diameter anchor that exceed the capacity of our SSTB bolts. The SB⅞x24 is designed to maximize performance with minimum embedment for holdowns utilizing a ⅞" dia. anchor.

SB anchor bolts are code listed by ICC-ES under the 2009 and 2012 IBC and IRC to meet the requirements of ICC-ES acceptance criteria – AC 399. ICC-ES ESR-2611 is the industry's first code report issued for proprietary anchor bolts evaluated to the criteria of AC 399.

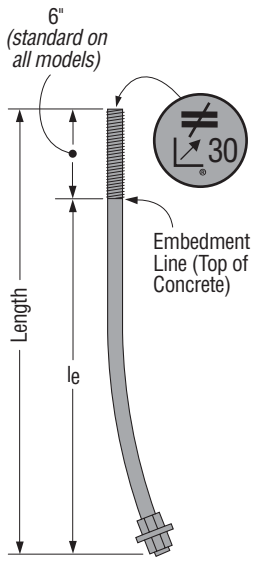
Special Features:

- Indentification on the bolt head showing embedment angle and model
- Sweep geometry to optimize position in form
- Rolled thread for higher tensile capacity
- Hex nuts and plate washer fixed in position
- Available in HDG for additional corrosion resistance

MATERIAL: ASTM F-1554, Grade 36
FINISH: None. May be ordered HDG. Contact Simpson Strong-Tie.
INSTALLATION:

- SB is only for concrete applications poured monolithically except where noted.
- Top nuts and washers for holdown attachment are not supplied with the SB; install standard nuts, couplers and/or washers as required.
- On HDG SB anchors, chase the threads to use standard nuts or couplers or use overtapped products in accordance with ASTM A563, for example Simpson Strong-Tie® NUT5/8-OST, NUT7/8-OST and NUT1-OST, CNW⅝-OST, CNW⅞-OST and CNW1-OST.
- Install SB before the concrete pour using AnchorMates®. Install the SB per the plan view detail.
- Minimum concrete compressive strength is 2500 psi.
- When rebar is required it does not need to be tied to the SB.

CODES: See page 12 for Code Reference Key Chart.



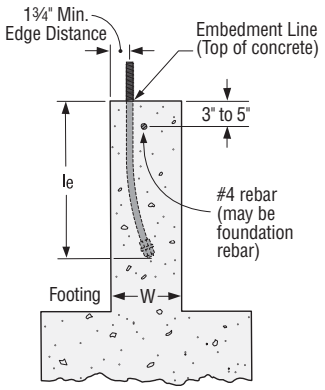
SB1x30
(Other models similar)

These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

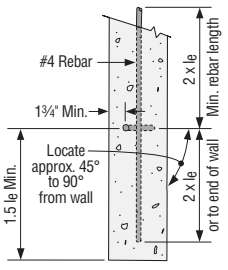
SB Bolts at Stemwall

Model No.	Dimensions (in.)				Allowable Tension Loads						Code Ref.
	Stemwall Width	Dia.	Length	Min. Embed. (l_e)	Wind & SDC A&B			SDC C-F			
					Midwall	Corner	End Wall	Midwall	Corner	End Wall	
SB⅝x24	6	⅝	24	18	6675	6675	6675	6675	5730	5730	I23, F30, L20
SB⅞x24	8	⅞	24	18	10470	9355	6820	8795	7855	5730	
SB1x30	8	1	30	24	13665	9905	7220	11470	8315	6065	

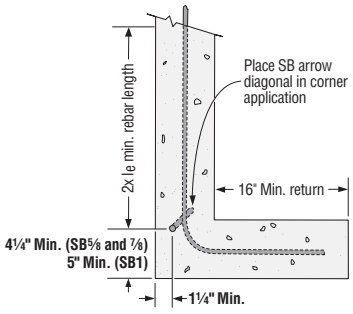
1. See page 34 for notes to the Designer.



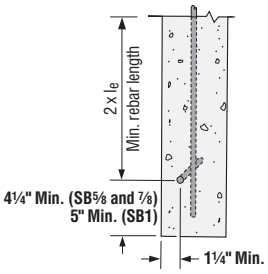
Typical SB Installation



Midwall

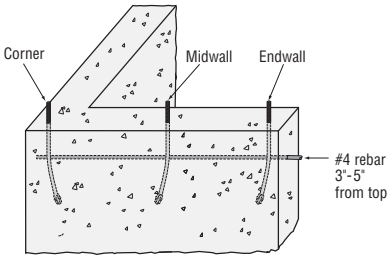


Corner

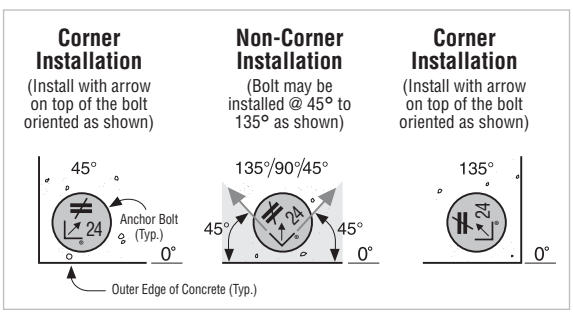


End Wall

STEMWALL PLAN VIEWS



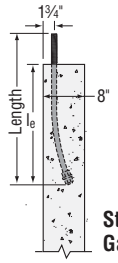
Perspective View



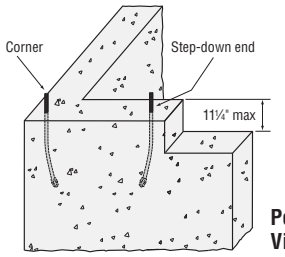
Plan View of SB Placement in Concrete

SB Bolts at Stemwall: Garage Front

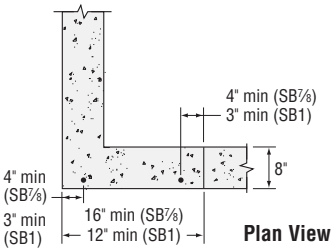
Model No.	Dimensions (in.)				Allowable Tension Loads				Code Ref.
	Stemwall Width	Dia.	Length	Min. Embed. (l_e)	Wind & SDC A&B		SDC C-F		
					Step-Down End	Corner	Step-Down End	Corner	
SB⅞x24	8	⅞	24	18	7225	7660	6070	6435	I23
SB1x30	8	1	30	24	11305	9635	9495	8030	



Stemwall Garage Front



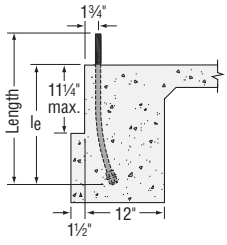
Perspective View



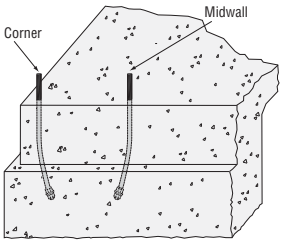
Plan View

SB Bolts at Slab on Grade: Edge

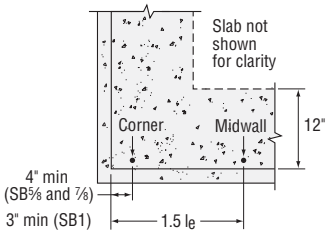
Model No.	Dimensions (in.)				Allowable Tension Loads				Code Ref.
	Footing Width	Dia.	Length	Min. Embed. (l_e)	Wind & SDC A&B		SDC C-F		
					Midwall	Corner	Midwall	Corner	
SB⅝x24	12	⅝	24	18	6675	6675	6675	5730	I23
SB⅞x24	12	⅞	24	18	13080	12135	12320	10190	
SB1x30	12	1	30	24	17080	15580	16300	13090	



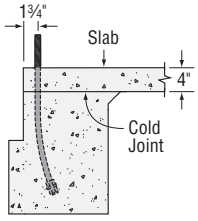
Slab Edge



Perspective View



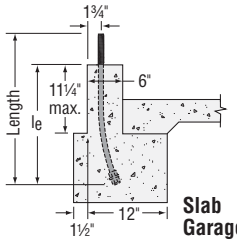
Plan View



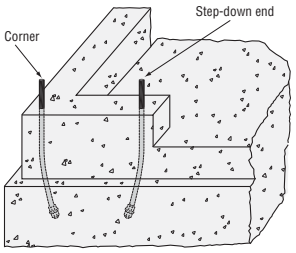
Two-Pour Installation

SB Bolts at Slab on Grade: Garage Curb

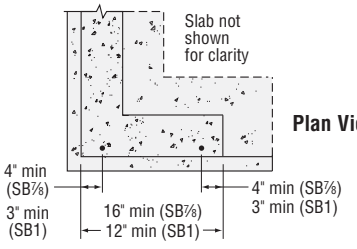
Model No.	Dimensions (in.)				Allowable Tension Loads				Code Ref.
	Curb Width	Dia.	Length	Min. Embed. (l_e)	Wind & SDC A&B		SDC C-F		
					Step-down End	Corner	Step-down End	Corner	
SB⅞x24	6	⅞	24	18	9175	11075	7705	9305	I23
SB1x30	6	1	30	24	15580	15580	13090	13090	



Slab Garage Curb



Perspective View



Plan View

Notes to the Designer:

1. Rebar is required at top of stemwall foundations but is not required for Slab-on-Grade Edge and Garage Curb, or Stemwall Garage Front installations.
2. Minimum end distances for SB bolts are as shown in graphics.
3. Multiply the tabulated ASD wind or seismic loads by 1.6 or 1.4, respectively, to obtain LRFD capacities.
4. Per Section 1613 of the IBC, detached one- and two-story dwellings in SDC C may use "Wind and SDC A&B" allowable loads.
5. See ESR-2611 for additional information.
6. Midwall loads apply when anchor is 1.5 l_e or greater from the end. For bolts acting in tension simultaneously, the minimum bolt center-to-center spacing is 3 l_e.
7. Full catalog loads apply for two-pour installation for slab-on-grade: edge.

HDU/DTT *Holdowns*

SIMPSON Strong-Tie®

This product is preferable to similar connectors because of a) easier installation, b) higher loads, c) lower installed cost, or a combination of these features.

HDU holdowns are pre-deflected during the manufacturing process, virtually eliminating deflection under load due to material stretch. They use Simpson Strong-Tie® Strong-Drive® SDS Heavy-Duty Connector screws which install easily, reduce fastener slip and provide a greater net section when compared to bolts.

The HDU series of holdowns are designed to replace previous versions of the product such as PHDs as well as bolted holdowns. The HDU2, 4 and 5 are direct replacements for the PHD2, 5 and 6, respectively.

The DTT tension ties are designed for lighter-duty holdown applications on single or 2x posts. The new DTT1Z is installed with nails or Simpson Strong-Tie Strong-Drive SD Connector screws and the DTT2Z installs easily with the Strong-Drive SDS Heavy-Duty Connector screws *(included)*. The DTT1Z holdowns have been tested for use in designed shearwalls and prescriptive braced wall panels as well as prescriptive wood-deck applications *(see page 209 for deck applications)*.

For more information on holdown options, contact Simpson Strong-Tie.

HDU SPECIAL FEATURES:

- Holdown designs virtually eliminate deflection due to material stretch.
- Uses Strong-Drive SDS Heavy-Duty Connector screws which install easily, reduce fastener slip, and provide a greater net section area of the post compared to bolts.
- Strong-Drive SDS Heavy-Duty Connector screws are supplied with the holdowns to ensure proper fasteners are used.
- No stud bolts to countersink at openings.

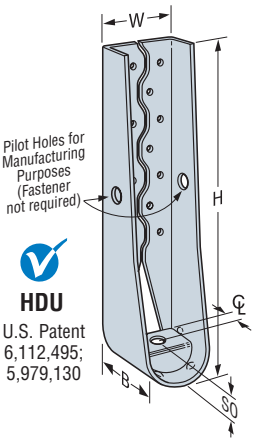
MATERIAL: See table

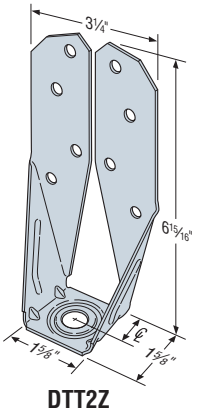
FINISH: HDU – Galvanized; DTT1Z and DTT2Z – ZMAX® coating; DTT2SS – stainless steel

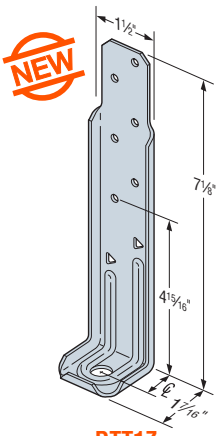
INSTALLATION: • See General Notes on page 45.

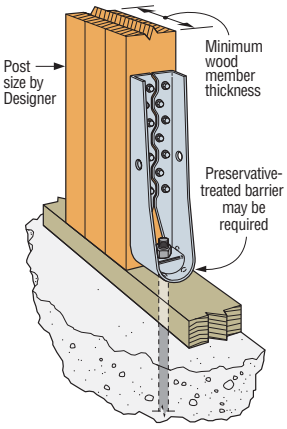
- The HDU requires no additional washer, the DTT requires a standard cut washer *(included with DTT2Z)* be installed between the nut and the seat.
- Strong-Drive SDS Heavy-Duty Connector screws install best with a low speed high torque drill with a ⅜" hex head driver.

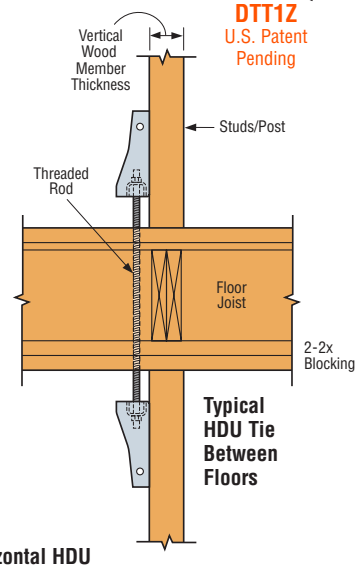
CODES: See page 12 for Code Reference Key Chart.

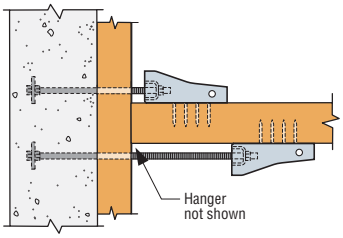












See Holdown and Tension Tie General Notes on page 45.

These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

Model No.	Ga	Dimensions (in.) W	H	B	℄	SO	Fasteners Anchor Bolt Dia. (in.)	Post Fasteners	Minimum Wood Member Thickness[4] (in.)	Allowable Tension Loads (160)[1] DF/SP	SPF/HF	Deflection at Allowable Load (in.)	Code Ref.
NEW DTT1Z	14	1½	7⅛	1⁷⁄₁₆	¾	⅜	⅜	6-SD #9x1½	1½	840	840	0.170	160
								6-10dx1½		910	640	0.167	
								8-10dx1½		910	850	0.167	
DTT2Z	14	3¼	6¹⁵⁄₁₆	1⅝	1³⁄₁₆	⅜	½	8-SDS ¼"x1½"	1½	1825	1800	0.105	I6, L8, F5
								8-SDS ¼"x1½"	3	2145	1835	0.128	
DTT2Z-SDS2.5								8-SDS ¼"x2½"	3	2145	2105	0.128	
HDU2-SDS2.5	14	3	8¹¹⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	6-SDS ¼"x2½"	3	3075	2215	0.088	
HDU4-SDS2.5	14	3	10¹⁵⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	10-SDS ¼"x2½"	3	4565	3285	0.114	
HDU5-SDS2.5	14	3	13³⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	14-SDS ¼"x2½"	3	5645	4065	0.115	
HDU8-SDS2.5	10	3	16⅝	3½	1⅜	1½	⅞	20-SDS ¼"x2½"	3	6765	4870	0.084	
									3½	6970	5020	0.116	
									4½	7870	5665	0.113	
HDU11-SDS2.5	10	3	22¼	3½	1⅜	1½	1	30-SDS ¼"x2½"	5½	9535	6865	0.137	
									7¼	11175	8045	0.137	
HDU14-SDS2.5	7	3	25¹¹⁄₁₆	3½	1⁹⁄₁₆	1⁹⁄₁₆	1	36-SDS ¼"x2½"	4x6[3,4]	10770	7755	0.122	170
									7¼[3]	14390	10435	0.177	I6, L8, F5
									5½[2,3]	14445	10350	0.177	

1. See page 45 for Holdown and Tension Tie General Notes.
2. Noted HDU14 allowable loads are based on a 5½" wide post *(6x6 min.)*.
3. HDU14 requires heavy hex anchor nut to achieve tabulated loads *(supplied with holdown)*.
4. Loads are applicable to installation on either narrow or wide face of post.

HRS/ST/PS/HST/HTP/LSTA/LSTI/MST/MSTA/MSTC/MSTI *Strap Ties*

Straps are designed to transfer tension loads in a wide variety of applications.

HRS—A 12 gauge strap with a nailing pattern designed for installation on the edge of 2x members. The HRS416Z installs with Simpson Strong-Tie® Strong-Drive® SDS Heavy-Duty Connector screws.

LSTA and MSTA—Designed for use on the edge of 2x members, with a nailing pattern that reduces the potential for splitting.

LSTI—Light straps that are suitable where pneumatic-nailing is necessary through diaphragm decking and wood chord open web trusses.

MST—Splitting may be a problem with installations on lumber smaller than 3½"; either fill every nail hole with 10dx1½" nails or fill every-other hole with 16d common nails. Reduce the allowable load based upon the size and quantity of fasteners used.

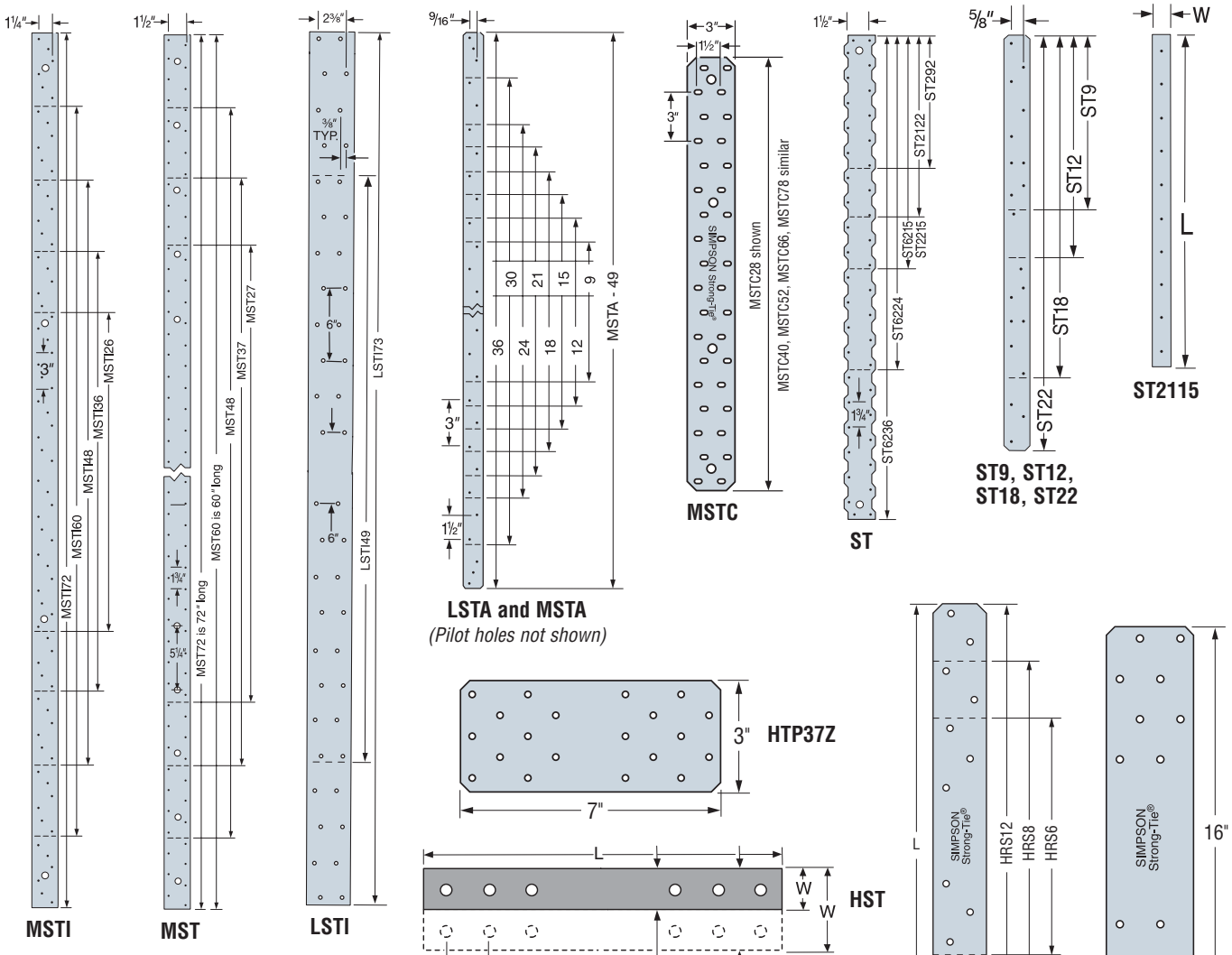
MSTC—High Capacity strap which utilizes a staggered nail pattern to help minimize wood splitting. Nail slots have been countersunk to provide a lower nail head profile.

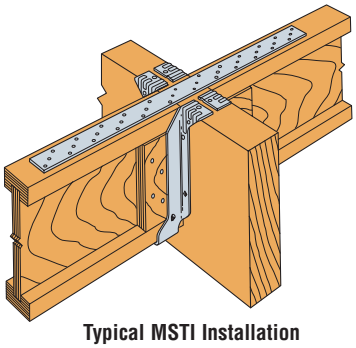
FINISH: PS–HDG; HST3 and HST6–Simpson Strong-Tie® gray paint; all others–galvanized. Some products are available in stainless steel or ZMAX® coating; see Corrosion Information, pages 13-15.

INSTALLATION: Use all specified fasteners. See General Notes.

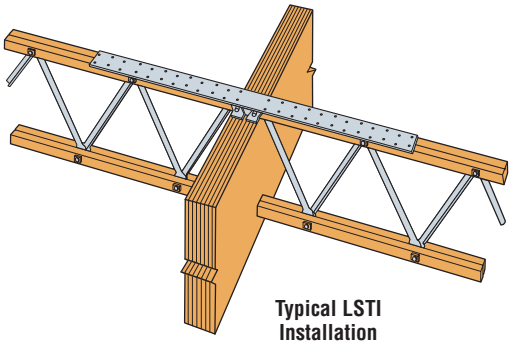
OPTIONS: Special sizes can be made to order. Contact Simpson Strong-Tie.

CODES: See page 12 for Code Reference Key Chart.
MSTC and RPS meet code requirements for reinforcing cut members (16 gauge) at top plate and RPS at sill plate.
International Residential Code®– 2000/2006 R602.6.1
International Building Code®– 2000/2006 2308.9.8
(For RPS, refer to page 223.)

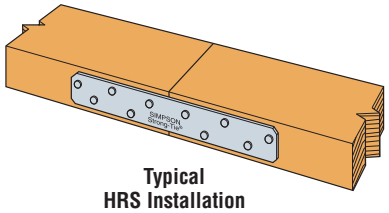




Typical MSTI Installation
(MIT hanger shown)
LSTI similar



Typical LSTI Installation



Typical HRS Installation

HRS/ST/PS/HST/HTP/LSTA/LSTI/MST/MSTA/MSTC/MSTI *Strap Ties*

SIMPSON Strong-Tie®

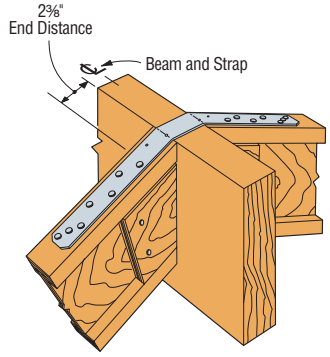
CODES: See page 12 for Code Reference Key Chart.

These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

These products are approved for installation with the Strong-Drive® SD Connector screw. See page 27 for more information.

Model No.	Ga	Dimensions W	Dimensions L	Fasteners (Total)	Allowable Tension Loads (DF/SP) (160)	Allowable Tension Loads (SPF/HF) (160)	Code Ref.
LSTA9	20	1¼	9	8-10d	740	635	I4, L3, L5, F2
LSTA12		1¼	12	10-10d	925	795	
LSTA15		1¼	15	12-10d	1110	950	
LSTA18		1¼	18	14-10d	1235	1110	
LSTA21		1¼	21	16-10d	1235	1235	
LSTA24		1¼	24	18-10d	1235	1235	
ST292		2⅛6	9⅝6	12-16d	1265	1120	
ST2122		2⅛6	12⅜6	16-16d	1530	1505	
ST2115		¾	16⅝6	10-16d	660	660	
ST2215		2⅛6	16⅝6	20-16d	1875	1875	
LSTA30	18	1¼	30	22-10d	1640	1640	
LSTA36		1¼	36	24-10d	1640	1640	
LSTI49		3¾	49	32-10dx1½	2975	2555	
LSTI73		3¾	73	48-10dx1½	4205	3830	
MSTA9		1¼	9	8-10d	750	645	
MSTA12		1¼	12	10-10d	940	810	
MSTA15		1¼	15	12-10d	1130	970	
MSTA18		1¼	18	14-10d	1315	1130	
MSTA21		1¼	21	16-10d	1505	1290	
MSTA24		1¼	24	18-10d	1640	1455	
MSTA30	16	1¼	30	22-10d	2050	1820	
MSTA36		1¼	36	26-10d	2050	2050	
MSTA49		1¼	49	26-10d	2020	2020	F2, L3, L5
ST6215		2⅛6	16⅝6	20-16d	2095	1900	I4, IL14, L3, L5, F2
ST6224		2⅛6	23⅝6	28-16d	2540	2540	I4, L3, L5, F2
ST9		1¼	9	8-16d	885	760	
ST12		1¼	11⅜	10-16d	1105	950	
ST18		1¼	17¾	14-16d	1420	1330	
ST22		1¼	21⅜	18-16d	1420	1420	I4, L3, L5, F2
MSTC28		3	28¼	36-16d sinkers	3455	2980	
MSTC40		3	40¼	52-16d sinkers	4745	4305	
MSTC52		3	52¼	62-16d sinkers	4745	4745	
HTP37Z		3	7	20-10dx1½	1850	1600	L5
MSTC66	14	3	65¾	76-16d sinkers	5860	5860	I4, L3, L5, F2
MSTC78		3	77¾	76-16d sinkers	5860	5860	
ST6236		2⅛6	33⅜6	40-16d	3845	3845	
HRS6	12	1⅜	6	6-10d	605	525	L5, F26
HRS8		1⅜	8	10-10d	1010	880	
HRS12		1⅜	12	14-10d	1415	1230	
MSTI26		2⅛6	26	26-10dx1½	2745	2325	I4, L3, L5, F2
MSTI36		2⅛6	36	36-10dx1½	3800	3220	
MSTI48		2⅛6	48	48-10dx1½	5065	4290	
MSTI60		2⅛6	60	60-10dx1½	5080	5080	
MSTI72		2⅛6	72	72-10dx1½	5080	5080	
HRS416Z		3¼	16	16-SDS ¼"x1½"	2835	2305	170

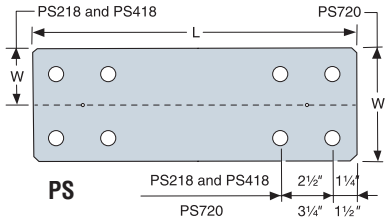
1. Loads include a 60% load duration increase on the fasteners for wind or earthquake loading.
2. 10dx1½" nails may be substituted where 16d sinkers or 10d are specified at 100% of the table loads except where straps are installed over sheathing.
3. 10d commons may be substituted where 16d sinkers are specified at 100% of table loads.
4. 16d sinkers (0.148" dia. x 3¼" long) or 10d commons may be substituted where 16d commons are specified at 0.84 of the table loads.
5. Use half of the nails in each member being connected to achieve the listed loads.
6. Tension loads apply for uplift when installed vertically.
7. **NAILS:** 16d = 0.162" dia. x 3½" long, 16d Sinker = 0.148" dia. x 3¼" long, 10d = 0.148" dia. x 3" long. 10dx1½ = 0.148" dia. x 1½" long. See pages 22-23 for other nail sizes and information.

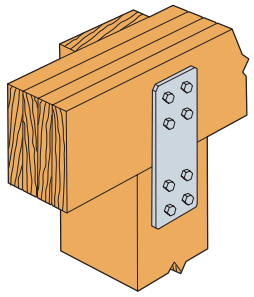


Typical LSTA Installation
(Hanger not shown)
Bend strap one time only,
max 12/12 joist pitch.

Model No.	Material Thickness Gauge	Dim. W	Dim. L	Bolts Qty	Bolts Dia	Code Ref.
PS218	7 ga	2	18	4	¾	180
PS418		4	18	4	¾	
PS720		6¾	20	8	½	

1. PS strap design loads must be determined by the Designer for each installation. Bolts are installed both perpendicular and parallel-to-grain. Hole diameter in the part may be oversized to accommodate the HDG. Designer must determine if the oversize creates an unacceptable installation.
2. For allowable tension loads, see page 230.





Typical PS720 Installation

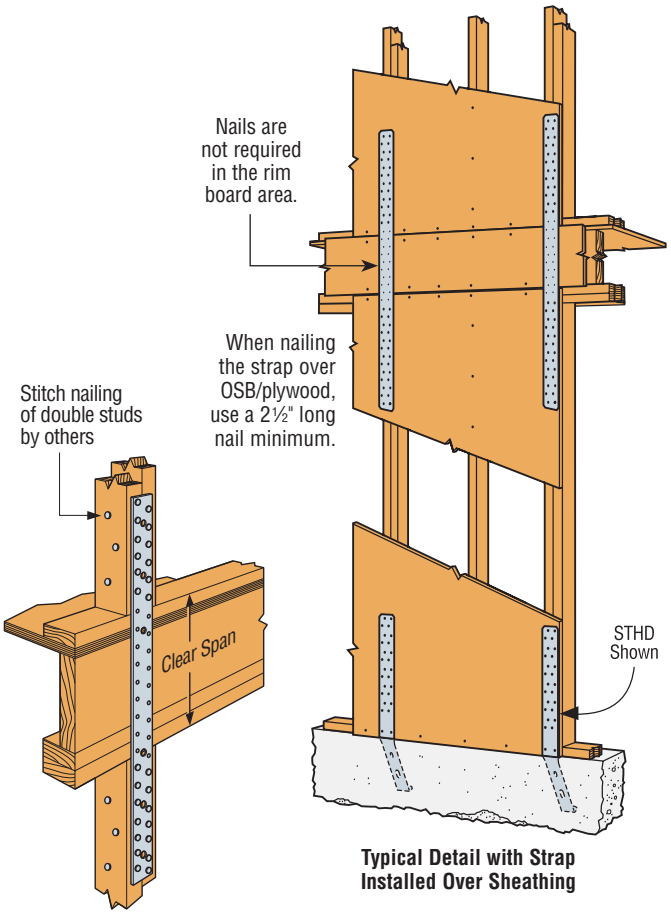
HST/MST/MSTC/MSTA *Strap Ties*

CODES: See page 12 for Code Reference Key Chart.

These products are approved for installation with the Strong-Drive® SD Connector screw. See page 27 for more information.

Floor-to-Floor Clear Span Table

Model No.	Clear Span	Fasteners (Total)	Allowable Tension Loads (DF/SP) (160)	Allowable Tension Loads (SPF/HF) (160)
MSTA49	18	26-10d	2020	2020
	16	26-10d	2020	2020
MSTC28	18	12-16d sinkers	1155	995
	16	16-16d sinkers	1540	1325
MSTC40	24	20-16d sinkers	2310	1985
	18	28-16d sinkers	2695	2320
	16	32-16d sinkers	3080	2650
MSTC52	24	36-16d sinkers	3465	2980
	18	44-16d sinkers	4235	3645
	16	48-16d sinkers	4620	3975
MSTC66	30	48-16d sinkers	4780	4120
	24	54-16d sinkers	5380	4640
	18	64-16d sinkers	5860	5495
	16	68-16d sinkers	5860	5840
MSTC78	30	64-16d sinkers	5860	5495
	24	72-16d sinkers	5860	5860
	18	76-16d sinkers	5860	5860
MST37	24	14-16d	1725	1495
	18	20-16d	2465	2135
	16	22-16d	2710	2345
MST48	24	26-16d	3215	2780
	18	32-16d	3960	3425
	16	34-16d	4205	3640
MST60	30	34-16d	4605	3995
	24	40-16d	5240	4700
	18	46-16d	6235	5405
MST72	30	48-16d	6505	5640
	24	54-16d	6730	6345
	18	62-16d	6730	6475



Floor-to-Floor Tie Installation showing a Clear Span

Typical Detail with Strap Installed Over Sheathing

These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

Model No.	Ga	Dimensions W	Dimensions L	Fasteners (Total) Nails	Fasteners (Total) Bolts Qty	Fasteners (Total) Bolts Dia	Allowable Tension Loads (DF/SP) Nails (160)	Allowable Tension Loads (DF/SP) Bolts (160)	Allowable Tension Loads (SPF/HF) Nails (160)	Allowable Tension Loads (SPF/HF) Bolts (160)	Code Ref.
MST27	12	2⅛	27	30-16d	4	½	3700	2165	3200	2000	I4, L3, F2
MST37		2⅛	37½	42-16d	6	½	5080	3025	4480	2805	
MST48		2⅛	48	50-16d	8	½	5310	3675	5190	3410	
MST60	10	2⅛	60	68-16d	10	½	6730	4485	6475	4175	
MST72		2⅛	72	68-16d	10	½	6730	4485	6475	4175	
HST2	7	2½	21¼	—	6	⅝	—	5220	—	4835	
HST5		5	21¼	—	12	⅝	—	10650	—	9870	
HST3	3	3	25½	—	6	¾	—	7680	—	6660	
HST6		6	25½	—	12	¾	—	15470	—	13320	

1. Loads include a 60% load duration increase on the fasteners for wind or earthquake loading.
2. Install bolts or nails as specified by Designer. Bolt and nail values may not be combined.
3. Allowable bolt loads are based on parallel-to-grain loading and these minimum member thicknesses: MST–2½"; HST2 and HST5–4"; HST3 and HST6–4½".
4. Use half of the required nails in each member being connected to achieve the listed loads.
5. When installing strap over wood structural panel sheathing, use 2½" long nail minimum.
6. Tension loads apply for uplift as well when installed vertically.
7. **NAILS:** 16d = 0.162" dia. x 3½" long, 16d Sinker = 0.148" dia. x 3¼" long, 10dx1½ = 0.148" dia. x 1½" long. See pages 22-23 for other nail sizes and information.

CS/CMST/CMSTC

Coiled Straps

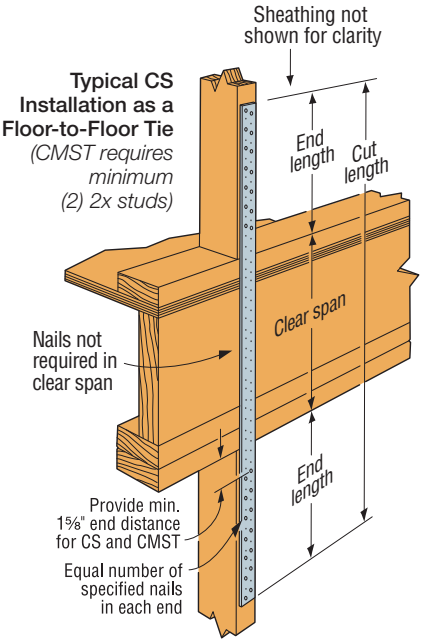
CMSTC provides coined nail slots for lower profile when installed with 0.148" x 3¼" sinkers; it can be cut to length. CS are continuous utility straps which can be cut to length on the jobsite. Packaged in lightweight (about 40 lb.) cartons.

Finish: Galvanized. Some products available in ZMAX® coating; see Corrosion Information, pp. 13–15.

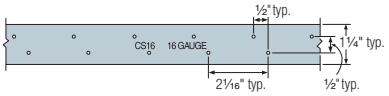
Installation: • Use all specified fasteners; see General Notes.

- Wood shrinkage after strap installation across horizontal wood members may cause strap to buckle outward.
- Refer to the applicable code for minimum nail penetration and minimum wood edge and end distances.
- The table shows the maximum allowable loads and the nails required to obtain them. Fewer nails may be used; reduce the allowable load as shown in the Straps and Ties General Notes on pp. 260–261.
- For lap slice and alternate nailing information, refer to p. 268.
- The cut length of the strap shall be equal to twice the "End Length" noted in the table plus the clear span dimension.
- CMST only — Use every other round hole if the wood tends to split. Use round and triangle holes for comparable MST loads, providing wood does not tend to split.
- CS straps are available in 25' lengths; order CS14-R, CS16-R or CS20-R.
- For stainless steel, order CS16SS-R.

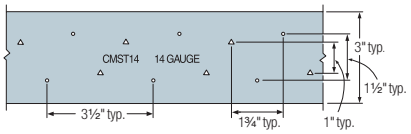
Codes: See p. 12 for Code Reference Key Chart



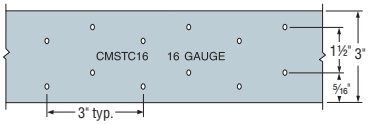
Typical CS Installation as a Floor-to-Floor Tie *(CMST requires minimum (2) 2x studs)*



CS16 Hole Pattern
(all other CS straps similar)

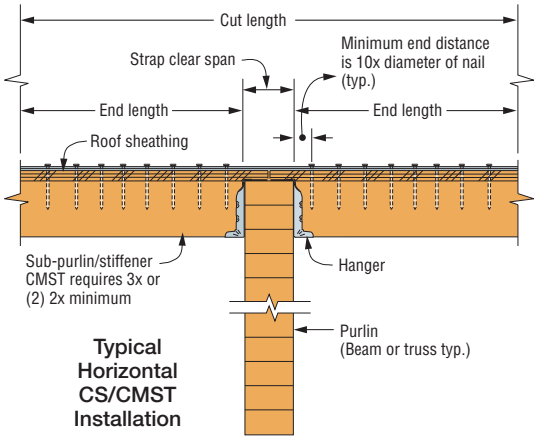


CMST14 Hole Pattern
(CMST12 similar)



CMSTC16 Hole Pattern

Gauge stamped on part for easy identification



Typical Horizontal CS/CMST Installation

These products are available with additional corrosion protection. For more information, see p. 15.

SS For stainless-steel fasteners, see p. 21.

SD Many of these products are approved for installation with Strong-Drive® SD Connector screws. See pp. 335–337 for more information.

Model No.	Total L	Ga.	DF/SP		SPF/HF		Allowable Tension Loads (160)	Code Ref.
			Fasteners (in.)	End Length	Fasteners (in.)	End Length		
CMST12	40'	12	(74) 0.162 x 2½	33"	(84) 0.162 x 2½	38"	9,215	IBC, FL, LA
			(86) 0.148 x 2½	39"	(98) 0.148 x 2½	44"	9,215	
CMST14	52½'	14	(56) 0.162 x 2½	26"	(66) 0.162 x 2½	30"	6,475	
			(66) 0.148 x 2½	30"	(76) 0.148 x 2½	34"	6,475	
CMSTC16	54'	16	(50) 0.148 x 3¼	20"	(58) 0.148 x 3¼	25"	4,690	
CS14	100'	14	(26) 0.148 x 2½	15"	(30) 0.148 x 2½	16"	2,490	
			(30) 0.131 x 2½	16"	(36) 0.131 x 2½	19"	2,490	
SS CS16	150'	16	(20) 0.148 x 2½	11"	(22) 0.148 x 2½	13"	1,705	
			(22) 0.131 x 2½	13"	(26) 0.131 x 2½	14"	1,705	
CS20	250'	20	(12) 0.148 x 2½	6"	(14) 0.148 x 2½	9"	1,030	
			(14) 0.131 x 2½	9"	(16) 0.131 x 2½	9"	1,030	

1. See pp. 260–261 for Straps and Ties General Notes.
2. Calculate the connector value for a reduced number of nails as follows:

$$\text{Allowable Load} = \frac{\text{No. of Nails Used}}{\text{No. of Nails in Table}} \times \text{Table Load}$$

Example: CMSTC16 in DF/SP with 40 nails total.
(Half of the nails in each member being connected)

$$\text{Allowable Load} = \frac{\text{40 Nails (Used)}}{\text{50 Nails (Table)}} \times \text{4,690 lb.} = \text{3,752 lb.}$$

3. See page 268 for alternate nailing and lap splice information.
4. **Fasteners:** Nail dimensions in the table are listed diameter by length. See pp. 21–22 for fastener information.

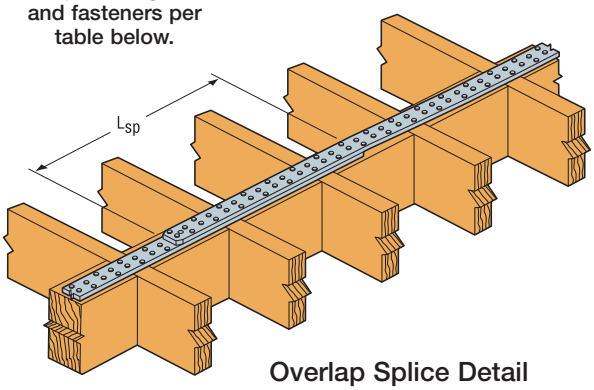
Coiled Straps (cont.)

Lap splicing of coiled straps can be used to extend standard CMST12, CMST14 and CMSTC16 strap lengths longer than 40', 52½' and 54' respectively, for designing continuous drag elements and diaphragm chord members. The Strap Lap Splices table provides the minimum splice length (L_{sp}) and fasteners, within the splice length, to achieve the highest allowable capacity of the strap.

The allowable loads table provides allowable loads for coiled straps when installed with different nailing schedules. The highest allowable load given for each model is limited by the steel capacity.

The Engineer/Designer of Record must evaluate and determine the adequacy of the coiled strap's lap splice and alternative nailing applications to meet their design loads.

Splice length and fasteners per table below.



Overlap Splice Detail

Strap Lap Splices

Model No.	Ga.	Strap Lap Splice	
		Minimum Fasteners per Splice	Min. Splice Length, L_{sp} (in.)
CMST12	12	(18) 0.162 x 2½	18
		(22) 0.148 x 2½	21
CMST14	14	(13) 0.162 x 2½	14
		(15) 0.148 x 2½	15
CMSTC16	16	(11) 0.162 x 2½	10
		(11) 0.148 x 2½	10
CS14	14	(6) 0.148 x 2½	9
		(7) 0.131 x 2½	10
CS16	16	(5) 0.148 x 2½	8
		(6) 0.131 x 2½	9
CS20	20	(5) 0.148 x 2½	8
		(5) 0.131 x 2½	8
CSHP18	18	(7) 0.148 x 2½	9
		(7) 0.131 x 2½	9
CSHP20	20	(6) 0.148 x 2½	8
		(7) 0.131 x 2½	9

1. See pp. 260–261 for Straps and Ties General Notes
2. 0.148" x 2½" nails can be replaced by 0.148" x 3¼" nails. No other nail substitution is allowed for lap splices.
3. Refer to the applicable code for minimum edge distance and minimum end distance.
4. No strap modification is allowed and the splice must meet both the minimum number of fasteners and the minimum splice length.

Allowable Loads for Alternative Nailing

Model No.	Ga.	Total Coil Length (ft.)	Fasteners (in.)	DF/SP Allowable Tension Loads	End Length (in.)	
				(160)	Nail Spacing Every Hole	Nail Spacing Every Other Hole
CMST12	12	40	(66) 0.162 x 2½	8,415	30	58
			(58) 0.162 x 2½	7,395	27	51
			(50) 0.162 x 2½	6,375	23	44
			(76) 0.148 x 2½	8,320	35	66
			(68) 0.148 x 2½	7,445	31	59
			(60) 0.148 x 2½	6,570	28	52
CMST14	14	52.5	(48) 0.162 x 2½	5,615	22	42
			(40) 0.162 x 2½	4,680	19	35
			(32) 0.162 x 2½	3,745	15	28
			(58) 0.148 x 2½	5,770	27	51
			(50) 0.148 x 2½	4,975	23	44
			(42) 0.148 x 2½	4,180	20	37
CMSTC16	16	54	(42) 0.162 x 2½	4,690	17	32
			(34) 0.162 x 2½	3,875	14	26
			(26) 0.162 x 2½	2,965	11	20
			(18) 0.162 x 2½	2,050	8	14
			(48) 0.148 x 2½	4,610	19	35
			(40) 0.148 x 2½	3,840	16	29
			(32) 0.148 x 2½	3,070	13	23
			(24) 0.148 x 2½	2,305	10	17
			(16) 0.148 x 2½	1,535	7	11
CS14	14	100	(24) 0.148 x 2½	2,390	13	23
			(22) 0.148 x 2½	2,190	13	22
			(28) 0.131 x 2½	2,340	15	27
			(26) 0.131 x 2½	2,170	15	27
CS16	16	150	(18) 0.148 x 2½	1,700	11	18
			(16) 0.148 x 2½	1,510	9	15
			(20) 0.131 x 2½	1,570	11	19
			(18) 0.131 x 2½	1,415	11	18
CS20	20	250	(10) 0.148 x 2½	915	6	10
			(12) 0.131 x 2½	910	7	11
CSHP18	18	75	(12) 0.148 x 2½	1,440	8	14
			(10) 0.148 x 2½	1,200	8	12
			(14) 0.131 x 2½	1,445	9	16
			(12) 0.131 x 2½	1,240	8	14
CSHP20	20	75	(10) 0.148 x 2½	1,150	8	12
			(8) 0.148 x 2½	920	6	10
			(10) 0.131 x 2½	985	8	12
			(8) 0.131 x 2½	790	6	10

1. See pp. 260–261 for Straps and Ties General Notes.
2. **Fasteners:** Nail dimensions in the table are listed diameter x length. See pp. 21–22 for fastener information.