Specifying iLevel® Shear Brace Garage Portals Using the Wood Frame Construction Manual – 2001 Edition

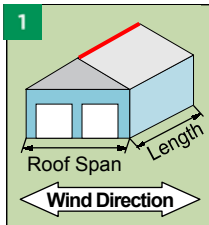
In structures where prescriptive lateral bracing cannot be used for garage fronts, such as areas with wind speeds of 100 mph or greater in hurricane prone regions or wind speeds exceeding 110 mph elsewhere, it is necessary to design the lateral force resisting system. The International Residential Code (IRC) section R301.2.1.1 states that one permitted method is to use the American Forest & Paper Association (AF&PA) *Wood Frame Construction Manual for One- and Two-Family Dwellings* (WFCM). This Technical Bulletin provides a subset of WFCM Tables 2.5A (wind perpendicular to the ridge) and 2.5B (wind parallel to the ridge) along with an example illustrating how to specify iLevel Shear Brace portal frames to resist those loads.

How to Use This Technical Bulletin

1. Determine the unit lateral load for your condition using the tables below.
2. Calculate the total shear load by multiplying the unit lateral load by the building length perpendicular to the wind direction. Then, divide this number by two (each parallel wall is resisting half the load) to determine the required shear load the iLevel Shear Brace portal frame must resist.
3. Select an iLevel Shear Brace portal frame, or combination of portal frames, that meets or exceeds the required shear load using the table on page 2.
4. Select a header for each portal frame based on the roof loading condition using the tables on page 3.
5. Refer to the *iLevel Shear Brace Specifier's Guide* (TJ-8620) to determine the anchorage requirements.
6. Ensure a complete lateral load path exists.

Unit Lateral Loads – Wind Perpendicular to Ridge (plf)

1

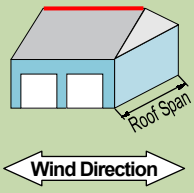


Multiply table value by *Length* to determine total shear load

Wind Speed (mph)	Roof Pitch																
	≤ 4:12	6:12				8:12				10:12				12:12			
	Roof Span (ft.)																
	24-36	24	28	32	36	24	28	32	36	24	28	32	36	24	28	32	36
90	54	79	83	88	92	119	130	141	152	137	151	164	178	154	170	187	203
100	66	98	103	108	113	147	161	174	188	169	186	202	219	190	210	231	251
110	80	118	124	131	137	178	194	211	227	204	224	245	265	230	254	279	303
120	95	141	148	156	163	212	231	251	270	243	267	292	316	273	302	332	361
130	112	165	174	183	192	249	272	294	317	285	313	342	370	321	355	390	424
140	130	192	202	212	222	289	315	342	368	330	363	397	430	372	412	452	492
150	149	220	232	243	255	331	361	392	422	379	417	455	493	427	473	518	564

Unit Lateral Loads – Wind Parallel to Ridge (plf)

2



Multiply table value by *Roof Span* to determine total shear load

Wind Speed (mph)	Roof Pitch																
	≤ 4:12	6:12				8:12				10:12				12:12			
	Roof Span (ft.)																
	24-36	24	28	32	36	24	28	32	36	24	28	32	36	24	28	32	36
90	64	65	69	74	78	74	80	86	92	84	91	99	106	93	102	111	120
100	80	80	86	91	97	92	99	107	114	103	112	122	131	115	126	137	148
110	96	97	104	110	117	111	120	128	137	125	136	147	158	139	152	166	179
120	114	116	124	131	139	132	143	153	164	149	162	175	188	166	182	197	213
130	134	136	145	154	163	155	167	180	192	175	190	206	221	194	213	231	250
140	156	158	168	179	189	180	194	209	223	203	221	238	256	225	246	268	289
150	179	181	193	205	217	207	223	240	256	233	253	274	294	259	283	308	332

General Notes

- Tabulated values are based on 8' wall heights. For other wall heights, H, multiply the unit lateral load by H/8.
- Tabulated values assume a building located in Exposure B with a mean roof height of 33' or less. For buildings located in Exposure C, multiply the tabulated unit lateral loads by 1.39.
- Hip roof systems shall be designed using condition 1, wind perpendicular to ridge, for both orthogonal directions.
- See the WFCM for additional roof pitch options and information on the limitations for use of these tables.

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iLevel Shear Brace Allowable Design Loads(1) - Portal Systems

iSB Portal		Width	Height	Total Vertical loads (lbs)	Wind Load		
					Allowable Shear(2) (lbs)	Drift at Allowable Load (in.)	Hold-Down Uplift at Allowable Shear(2)(3)(4) (lbs)
Double	iSB 12x7	12"	78"	8,000	3,000	0.31	9,370
	iSB 12x7.5	12"	85½"	8,000	2,770	0.35	9,480
	iSB 12x8	12"	93¼"	8,000	2,540	0.39	9,480
	iSB 18x7	18"	78"	8,000	6,160	0.33	13,515
	iSB 18x7.5	18"	85½"	8,000	5,910	0.37	14,220
	iSB 18x8	18"	93¼"	8,000	5,665	0.40	14,860
Single	iSB 12x7	12"	78"	8,000	1,430	0.33	8,925
	iSB 12x7.5	12"	85½"	8,000	1,320	0.38	9,040
	iSB 12x8	12"	93¼"	8,000	1,210	0.42	9,030
	iSB 18x7	18"	78"	8,000	3,080	0.36	13,515
	iSB 18x7.5	18"	85½"	8,000	2,885	0.40	13,890
	iSB 18x8	18"	93¼"	8,000	2,695	0.43	14,140

(1) Based on 160% load duration. No further increases for duration of load are permitted.
(2) Allowable Shear must be considered in the hold-down anchor design.
(3) Hold-down anchors are ⅞" diameter ASTM A449 (minimum grade) or ASTM A193-B7 threaded rod.
(4) Hold-Down Uplift at Allowable Shear is based on an assumed moment-arm equal to the brace width minus 2".

General Notes

- Values shown are for the complete portal frame assembly.
- Portal braces are not for use in raised-floor applications.
- For shimming requirements, see TJ-8620.
- Portal header clear span must be 8' minimum and 18'-6" maximum.
- Portal braces may be used in 2x4 or 2x6 wall framing. Center brace under header.

Allowable Out-of-Plane Lateral Loads(1)(2) (PSF)

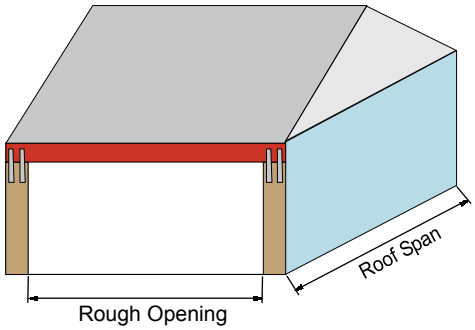
iSB Width	Portal Brace Height		
	7'	7.5'	8'
12"	275	255	230
18"	185	170	155

(1) Based on 160% load duration. No further increases for duration of load are permitted.
(2) Multiply by 0.88 for portals with a 16" deep header and 0.78 for portals with an 18" deep header.

Minimum Header Size Required – Roof Only

Roof Load (PSF)		Roof Span	Rough Opening 9'-3"				16'-3"				18'-3"			
Non-Snow Area 125%	20LL+ 15DL	24	3½" x 9¼"	T	M	P	3½" x 14"	T	M	P	3½" x 14"	T	M	P
		30	3½" x 9¼"	T	M	P	3½" x 14"	T	M	P	3½" x 14"		M	P
		36	3½" x 9¼"	T	M	P	3½" x 14"	T	M	P	3½" x 16"	T	M	P
	20LL+ 20DL	24	3½" x 9¼"	T	M	P	3½" x 14"	T	M	P	3½" x 14"		M	P
		30	3½" x 9¼"	T	M	P	3½" x 14"	T	M	P	3½" x 16"	T	M	P
		36	3½" x 9¼"	T	M	P	3½" x 14"		M	P	3½" x 16"		M	P
Snow Area 115%	25LL+ 15DL	24	3½" x 9¼"	T	M	P	3½" x 14"	T	M	P	3½" x 14"		M	P
		30	3½" x 9¼"	T	M	P	3½" x 14"	T	M	P	3½" x 16"	T	M	P
		36	3½" x 9¼"	T	M	P	3½" x 14"		M	P	3½" x 16"		M	P
	30LL+ 15DL	24	3½" x 9¼"	T	M	P	3½" x 14"	T	M	P	3½" x 14"		M	P
		30	3½" x 9¼"	T	M	P	3½" x 14"		M	P	3½" x 16"		M	P
		36	3½" x 9¼"	T	M	P	3½" x 16"	T	M	P	5¼" x 14"		M	P
	40LL+ 15DL	24	3½" x 9¼"	T	M	P	3½" x 14"		M	P	3½" x 16"		M	P
		30	3½" x 9¼"	T	M	P	3½" x 16"		M	P	5¼" x 14"		M	P
		36	3½" x 9¼"		M	P	5¼" x 14"		M	P	5¼" x 16"	T	M	P

T 1.55E TimberStrand® LSL M 1.9E Microllam® LVL P 2.0E Parallam® PSL



How to Use This Table

1. Determine appropriate **Roof Load** and **Roof Span**
2. Locate **Rough Opening**
3. Select header size and material

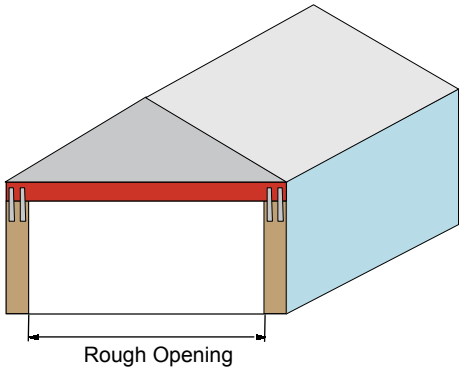
General Notes

- Table is based on:
  - Uniform loads.
  - Roof tributary width of ½ of the roof span.
  - Deflection criteria of L/240 live load and L/180 total load.
- For other conditions use iLevel software or contact your iLevel representative.

Minimum Header Size Required- Gable End Supporting Roof and Floor

Roof Load (PSF)		Rough Opening 9'-3"				16'-3"				18'-3"			
Non-Snow Area 125%	20LL+ 15DL	3½" x 9¼"	T	M	P	3½" x 9½"		M	P	3½" x 11¼"	T	M	P
						3½" x 11¼"	T						
	20LL+ 20DL	3½" x 9¼"	T	M	P	3½" x 9½"		M	P	3½" x 11¼"		M	P
						3½" x 11¼"	T			3½" x 11⅞"	T		
Snow Area 115%	25LL+ 15DL	3½" x 9¼"	T	M	P	3½" x 9½"		M	P	3½" x 11¼"		M	P
						3½" x 11¼"	T			3½" x 11⅞"	T		
	30LL+ 15DL	3½" x 9¼"	T	M	P	3½" x 9½"			P	3½" x 11¼"		M	P
						3½" x 11¼"	T	M		3½" x 11⅞"	T		
	40LL+ 15DL	3½" x 9¼"	T	M	P	3½" x 11¼"	T	M	P	3½" x 11¼"		M	P
										3½" x 14"	T		

T 1.55E TimberStrand® LSL M 1.9E Microllam® LVL P 2.0E Parallam® PSL



How to Use This Table

1. Determine appropriate **Roof Load**
2. Locate **Rough Opening**
3. Select header size and material

General Notes:

- Table is based on:
  - Uniform loads.
  - Floor loads of 40 psf Live and 12 psf Dead.
  - Roof tributary width of 2 feet and floor tributary area of 1 foot.
  - 80 plf exterior wall weight.
  - Deflection criteria of L/360 live load and L/240 total load.
- For other conditions use iLevel software or contact your iLevel representative.

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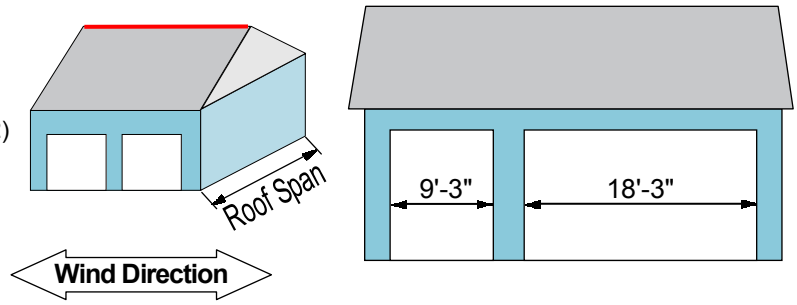
Design Example

- 130 mph wind speed, Exposure B
- Non-snow area, roof load of 20LL + 15DL
- Garage front, wind parallel to ridge (condition 2)
- Roof span of 28'
- Roof pitch of 10:12
- Mean roof height < 33'
- 9' wall height



Step 1: Determine unit lateral load

From the Wind Parallel to Ridge table on page 1, a structure in a 130 mph wind speed with a 10:12 roof pitch and 28' roof span has a unit lateral load of 190 plf. The wall height is 9′, so per the first table General Note, we must multiply by 9/8 to determine the correct unit lateral load: (190 plf)(9/8) = 214 plf

Step 2: Calculate required shear load

Required shear load = unit lateral load * building length perpendicular to wind * 0.5: (214 plf)(28')(0.5) = 2996 lbs.

Step 3: Select iLevel Shear Brace portal frames that meet or exceed the required shear load

A double (one iSB on each side of the opening) iSB 12x7 portal and all three heights of the double iSB 18x_ portals have a capacity greater than the required 2996 lbs, thus only one portal frame is required. Select the height based on local foundation, garage curb, and header height preferences. Specify the double iSB portal frame in the 18'-3" opening and stick framing for the 9'-3" opening. Alternatively, a single (iSB on one side of the opening and a column on the other) iSB 18x_ portal could be specified in each opening since the sum of any two single iSB 18x_ portals exceeds the required 2996 lbs.

Step 4: Select a header for each iLevel Shear Brace portal frame

Locate the non-snow areas (125%) section of the Minimum Header Size Required table on page 3. For a roof load of 20LL + 15DL and a roof span of 30' (since 28' is not tabulated, the next higher roof span of 30' is used), the following options are determined:

- 9'-3" opening: the minimum size required is a 3½" x 9¼" 1.55E TimberStrand® LSL, 1.9E Microllam® LVL, or 2.0E Parallam® PSL header
- 18'-3" opening: the minimum size required is a 3½" x 14" 1.9E Microllam® LVL or 2.0E Parallam® PSL header

Step 5: Determine concrete anchorage and footing requirements using the *iLevel Shear Brace Specifier's Guide* (TJ-8620)

Turn to the Anchorage Details pages of TJ-8620 and determine embedment length, l_e, and footing dimensions C_1, C_2, and C_3 using the "Portal Brace" sections of the tables.

Step 6: Ensure a complete lateral load path

The garage portals are only effective if a complete lateral load path exists to transfer the load from the surrounding structure. The American Wood Council's *WFCM Guide to Wood Construction in High Wind Areas for One- and Two-Family Dwellings* are available for free download at www.awc.org and are an excellent resource for identifying the components necessary to create a complete load path. Individual guides are provided for 90 mph, 100 mph, 110 mph, 120 mph, and 130 mph wind speeds.

Note that design of foundation systems and a complete lateral load path are the responsibility of the designer of record.

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