Product Specifications and Design Values - Limit States Design (LSD)

August 2023
2023-101

PWT LVL - SPECIFIED STRENGTH AND STIFFNESS (PSI)

Grade	Beam Orientation				Plank Orientation				Axial	
	Modulus of Elasticity (MOE) ($x10^6$ psi)	Bending (f_b)	Shear (f_v)	Compression perpendicular to the grain (f_{cp})	Modulus of Elasticity (MOE) ($x10^6$ psi)	Bending (f_b)	Shear (f_v)	Compression perpendicular to the grain (f_{cp})	Tension (f_t)	Compression (f_c)
1.5E 2250F$_b$	1.5	4158	427	1365	1.4	4066	255	1001	2021	3112
2.0E 2900F$_b$	2.0	5359	530	1365	2.0	5452	255	1001	2694	5107
2.1E 3100F$_b$	2.1	5729	530	1365	2.0	5729	255	1001	2694	4389

Notes:

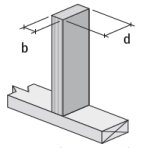
1. PWT LVL shall be designed for dry-use conditions only. Dry-use applies to products installed in dry, covered and well ventilated interior conditions in which the equivalent moisture content in lumber will not exceed 15% nor a maximum of 19%.
2. The specified strengths and stiffness are for standard load duration. Bending, shear and axial tension and both compression parallel-to-grain and perpendicular-to-grain shall be adjusted according to code. Modulus of elasticity shall not be adjusted for load duration.
3. The specified bending, fb, for PWT LVL in the Beam orientation is tabulated for a standard 12" depth. For depths less than 12", multiply fb by $(12/depth)^{0.111}$. For depths greater than 12", multiply fb by $(12/depth)^{0.200}$.
4. The specified Bending, fb, in the Plank orientation shall not be adjusted for depth (thickness).
5. The specified edgewise bending shall also be multiplied by the system factor, KH = 1.04, when 3 or more pieces are properly connected in direct contact or are used as wall studs spaced no more than 24" oc and properly connected together by an adequate wall sheathing.
6. The specified tension strength, ft, for PWT LVL is assigned for a standard length of 20 feet. For lengths other than 20 feet, multiply ft by $(20/length)^{0.111}$. For lengths less than 3 feet, use the value adjusted for 3 feet.
7. Deflection calculations for PWT LVL shall include both bending and shear deformations.

Deflection for wall framing, uniform load: $\Delta = \frac{270wL^4}{Ebd^3} + \frac{28.8wL^2}{Ebd}$

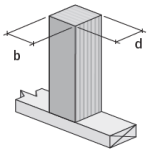
Where: Δ = deflection (in); w = uniform load (plf); L = design span (ft); E = modulus of elasticity (from table); b = width (in); d = depth (in direction of bending) (in)

Equations for other conditions can be found in engineering references.

PRODUCT ORIENTATION



Beam (Edgewise)



Plank (Flatwise)

FACTORED BEARING RESISTANCE

Stud or Column Size	Column Bearing (lbs)			Stud Bearing (lbs)			
	1.5E 2250Fb (820 psi)	2.0E 2900Fb (1001 psi)	2.1E 3100Fb (1001 psi)	1.5E 2250Fb (820 psi) 12" oc	16" oc	2.0E 2900Fb (1001 psi) 12" oc	16" oc
1-1/2" x 3-1/2"	3444	4204		3444	2583	4204	3153
1-1/2" x 5-1/2"	5412	6606		5412	4059	6606	4954
1-1/2" x 7-1/4"	7134	8708		7134	5350	8708	6531
1-3/4" x 5-1/2"	6314	7707		6314	4735	7707	5780
1-3/4" x 7-1/4"	8323	10160		8323	6242	10160	7620
3-1/2" x 3-1/2"	8036	9809	9809				
3-1/2" x 5-1/2"	12628	15415	15415				
3-1/2" x 7-1/4"	16646	20320	20320				
5-1/4" x 5-1/4"	18081	22072	22072				
5-1/4" x 5-1/2"	18942	23123	23123				
5-1/4" x 7-1/4"	24969	30480	30480				
7" x 7"	32144	39239	39239				

Notes:

1. The resistance for wood bearing is based on the compression strength, perpendicular to grain, of the bearing plate based on standard term load duration and dry service conditions in accordance with CSA O86.
2. To determine the bearing resistance of a multiple-ply member (such as a double 2x4 stud), multiply the bearing resistance from the table by the number of plies. The resistance is additive and may be increased for wood bearing on wood plates as per note 3.
3. When a stud or column is located at least 3" from the end of a wall plate, the bearing resistance above are permitted to be increased by the length of bearing factor KB per Clause 6.5.7.5 of CSA Standard O86-14.

Code Provisions for Wind Loads

Using Static Procedure excluding any adjustments for speed-up over hills and escarpments, all wind loads for walls in this guide are calculated based on the following:

$$p = I_w * q_{1/50} * C_e * (C_pC_g - C_{pi} * C_{gi})$$

Where:
p = Design wind pressure (kPa)
Iw = Importance factor for wind loads
q1/50 = Hourly wind pressure (kPa) based on Table C-2 of Appendix C of the NBC
Ce = Exposure factor based on Exposure categories below
CpCg = External peak composite pressure-gust coefficient based on the NBC User's Guide
Cpi = Internal pressure coefficient
Cgi = Internal gust effect factor

DEFINITIONS

Mean roof height - is the mean height of the roof or 6 m [19.7 ft], whichever is greater. The height of the eaves may be substituted for the mean height if the slope of the roof is less than 7° (NBC User's Guide Commentary).

Exposure Categories:

Open terrain - is level terrain with only scattered buildings, trees and other obstructions, open water or shorelines (NBC Section 4.1.7).

Rough terrain - is suburban, urban or wooded terrain extending upwind from the building uninterrupted for at least 1 km [0.62 mi] or 20 times the building height, whichever is greater (NBC Section 4.1.7).

For more relevant code provisions refer to:

1. Section 4.1.7 (Wind Load) of the NBC, and
2. Commentary I (Wind Loads and Effects) of the NBC User's Guide.

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Table date: August, 2023
Valid until: August, 2024

Factored Wall Stud Resistance (plf)

$q_{1/50}$*C_e=0.45 kPa (9.4 psf)

June 2023
2023-101

HOURLY WIND PRESSURE: ≤0.45 KPA (9.4 PSF) FOR OPEN TERRAIN; ≤0.64 KPA (13.4 PSF) FOR ROUGH TERRAIN

1.5E 2250Fb PWT LVL

Stud Height	Spacing	2x4 (1-1/2"x 3-1/2")	2x6 (1-1/2"x 5-1/2")	2x8 (1-1/2"x 7-1/4")
8'	12''	3428 L/293	5388 L/958	7102 L/999
	16''	2571 L/228	4041 L/780	5327 L/999
9'	12''	3427 L/207	5385 L/720	7098 L/999
	16''	2570 L/161	4039 L/581	5324 L/999
10'	12''	3425 L/149	5382 L/550	7095 L/999
	16''	-	4036 L/442	5321 L/895
11'	12''	-	5379 L/427	7091 L/868
	16''	-	4034 L/341	5318 L/712
12'	12''	-	5376 L/336	7087 L/704
	16''	-	4032 L/267	5315 L/572
13'	12''	-	5373 L/268	7083 L/576
	16''	-	4030 L/212	5312 L/464
14'	12''	-	5370 L/216	7079 L/475
	16''	-	4028 L/170	5309 L/381
15'	12''	-	5367 L/176	7075 L/395
	16''	-	4025 L/138	5306 L/315
16'	12''	-	5364 L/144	7071 L/330
	16''	-	-	5303 L/262
18'	12''	-	-	7063 L/236
	16''	-	-	5297 L/186
20'	12''	-	-	7056 L/172
	16''	-	-	5292 L/135
22'	12''	-	-	7048 L/128
	16''	-	-	-
24'	12''	-	-	-
	16''	-	-	-

TO USE:

1. Determine the height (or next tallest height) of the wall stud.
2. Select the row for the desired spacing.
3. Calculate factored vertical load applied to the top of the wall using the procedure at the bottom of this page.
4. Select the grade and size where the factored vertical resistance that meets or exceeds the # in step 3.
5. Verify the plate bearing capacity for the selected stud. See Design Assumption 8 below.

DESIGN ASSUMPTIONS:

1. The tables are limited to structures with a mean roof height of 39'-4" (12 m) for rough terrain, and 32'-9" (10 m) for open terrain.
2. The factored resistance has been reduced to allow for one hole up to 25% of the stud depth located in the upper or lower 1/3 of the stud height or 3 feet, whichever is less. The hole shall not be placed within 6" of either end of the stud. Exacte by PWT (isDesign) assumes the hole can be anywhere and therefore is more conservative.
3. The vertical resistance assumes an eccentricity of 1/6 of the stud depth.
4. The following assumptions have been used in the calculation of design wind pressure:
   - Iw = 1.0 for ULS; Iw = 0.75 for SLS
   - Ce = 0.7 for rough terrain; Ce = 1.0 for open terrain. Refer to the NBC for terrain definitions and note 1 for building height restrictions
   - Cpi is based on Category 2
   - Cgi = 2.0
5. A duration of load adjustment, KD = 1.15 has been applied for wind.
6. A system factor of 1.04 has been applied for bending resistance for three or more studs spaced no more than 24" o.c, properly connected by a suitable exterior sheathing. No increase in stiffness has been assumed for the wall sheathing.
7. Gypsum wall board is assumed attached to the interior side of the studs.
8. The tabulated values assume the plates are the same material and grade as the stud. For other plate material or grade, the designer shall check the factored load against the factored compressive resistance for the plate and adjust the stud size and/or the spacing accordingly. No increase is allowed without a complete analysis of the vertical resistance of the wall stud.

2.0E 2900Fb PWT LVL

Stud Height	Spacing	2x4 (1-1/2"x 3-1/2")	2x6 (1-1/2"x 5-1/2")	2x8 (1-1/2"x 7-1/4")	1-3/4"x 5-1/2"	1-3/4"x 7-1/4"
8'	12''	4189 L/428	6582 L/999	8677 L/999	7680 L/999	10123 L/999
	16''	3141 L/336	4937 L/999	6508 L/999	5760 L/999	7592 L/999
9'	12''	4187 L/306	6580 L/999	8673 L/999	7676 L/999	10119 L/999
	16''	3140 L/240	4935 L/830	6505 L/999	5757 L/930	7589 L/999
10'	12''	4185 L/224	6577 L/786	8669 L/999	7673 L/878	10114 L/999
	16''	3139 L/175	4932 L/637	6502 L/999	5754 L/718	7586 L/999
11'	12''	4183 L/167	6574 L/616	8665 L/999	7669 L/692	10110 L/999
	16''	3055 L/131	4930 L/496	6499 L/999	5752 L/562	7582 L/999
12'	12''	3587 L/132	6571 L/489	8662 L/995	7666 L/553	10105 L/999
	16''	-	4928 L/392	6496 L/817	5749 L/445	7579 L/916
13'	12''	-	6568 L/394	8658 L/821	7662 L/446	10101 L/916
	16''	-	4926 L/313	6493 L/669	5747 L/357	7575 L/753
14'	12''	-	6565 L/320	8654 L/682	7659 L/364	10096 L/765
	16''	-	4923 L/253	6490 L/552	5744 L/289	7572 L/623
15'	12''	-	6562 L/262	8650 L/571	7656 L/299	10092 L/643
	16''	-	4921 L/206	6487 L/459	5742 L/236	7569 L/520
16'	12''	-	6559 L/216	8646 L/481	7652 L/247	10087 L/543
	16''	-	4919 L/170	6484 L/385	5739 L/195	7565 L/438
18'	12''	-	6246 L/153	8638 L/348	7356 L/175	10078 L/395
	16''	-	4420 L/121	6479 L/276	5379 L/138	7558 L/315
20'	12''	-	-	8630 L/257	5783 L/134	10069 L/293
	16''	-	-	6473 L/202	-	7552 L/232
22'	12''	-	-	8623 L/193	-	10060 L/221
	16''	-	-	6467 L/151	-	7545 L/174
24'	12''	-	-	7983 L/151	-	9449 L/172
	16''	-	-	5518 L/120	-	6872 L/136

ADDITIONAL NOTES:

1. Height is the clear height of the wall stud between the bottom plate and the lower top plate.
2. The first value in each cell represents the factored vertical resistance of the studs in pounds per lineal foot (plf) of wall length. These factored vertical resistances are the resistances of the stud based on Load Combinations cases 1 to 4 of Table 4.1.3.2.A of the NBC or horizontal wind pressure acting alone (no gravity loads except Dead Load), whichever control.
3. The second value in each cell represents the deflection ratio (L/x). The designer shall verify the correct deflection ratio limit for the intended application. For brick or stone veneer, a maximum deflection of L/360 is required in accordance with CSA O86 and the Canadian Wood Council's Wood Frame Construction Guide.
4. Install full-width blocking per local code requirements, normally not more than every 8' along the height of the stud.

Calculate factored vertical load

The factored vertical load is the greater of:
1.25D+1.5L+1.0S or 1.25D+1.5S+1.0L.
Note that the tables are valid only for
(L + 0.5S) / 4 ≤ D ≤ L + 0.5S or
(S + 0.5L) / 4 ≤ D ≤ S + 0.5L
where D = unfactored Dead Load,
L = unfactored Live Load (use & occupancy),
S = unfactored Snow Load

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Table date: June, 2023
Valid until: June, 2024

Factored Wall Stud Resistance (plf)

$q_{1/50}$*C_e=0.60 kPa (12.5 psf)

June 2023
2023-101

HOURLY WIND PRESSURE: ≤0.60 KPA (12.5 PSF) FOR OPEN TERRAIN; ≤0.85 KPA (17.8 PSF) FOR ROUGH TERRAIN

1.5E 2250Fb PWT LVL

Stud Height	Spacing	2x4 (1-1/2"x 3-1/2")	2x6 (1-1/2"x 5-1/2")	2x8 (1-1/2"x 7-1/4")
8'	12''	3428 L/258	5388 L/872	7102 L/999
	16''	2571 L/199	4041 L/698	5327 L/999
9'	12''	3427 L/182	5385 L/648	7098 L/999
	16''	2200 L/144	4039 L/516	5324 L/999
10'	12''	3086 L/134	5382 L/491	7095 L/991
	16''	-	4036 L/389	5321 L/807
11'	12''	-	5379 L/378	7091 L/786
	16''	-	4034 L/299	5318 L/636
12'	12''	-	5376 L/297	7087 L/632
	16''	-	4032 L/234	5315 L/507
13'	12''	-	5373 L/236	7083 L/514
	16''	-	4030 L/185	5312 L/410
14'	12''	-	5370 L/190	7079 L/422
	16''	-	3945 L/149	5309 L/335
15'	12''	-	5367 L/154	7075 L/349
	16''	-	3245 L/125	5306 L/276
16'	12''	-	5110 L/128	7071 L/292
	16''	-	-	5303 L/229
18'	12''	-	-	7063 L/208
	16''	-	-	5297 L/162
20'	12''	-	-	7056 L/151
	16''	-	-	4613 L/121
22'	12''	-	-	-
	16''	-	-	-
24'	12''	-	-	-
	16''	-	-	-

TO USE:

1. Determine the height (or next tallest height) of the wall stud.
2. Select the row for the desired spacing.
3. Calculate factored vertical load applied to the top of the wall using the procedure at the bottom of this page.
4. Select the grade and size where the factored vertical resistance that meets or exceeds the # in step 3.
5. Verify the plate bearing capacity for the selected stud. See Design Assumption 8 below.

DESIGN ASSUMPTIONS:

1. The tables are limited to structures with a mean roof height of 39'-4" (12 m) for rough terrain, and 32'-9" (10 m) for open terrain.
2. The factored resistance has been reduced to allow for one hole up to 25% of the stud depth located in the upper or lower 1/3 of the stud height or 3 feet, whichever is less. The hole shall not be placed within 6" of either end of the stud. Exacte by PWT (isDesign) assumes the hole can be anywhere and therefore is more conservative.
3. The vertical resistance assumes an eccentricity of 1/6 of the stud depth.
4. The following assumptions have been used in the calculation of design wind pressure:
   - Iw = 1.0 for ULS; Iw = 0.75 for SLS
   - Ce = 0.7 for rough terrain; Ce = 1.0 for open terrain. Refer to the NBC for terrain definitions and note 1 for building height restrictions
   - Cpi is based on Category 2
   - Cgi = 2.0
5. A duration of load adjustment, KD = 1.15 has been applied for wind.
6. A system factor of 1.04 has been applied for bending resistance for three or more studs spaced no more than 24" o.c, properly connected by a suitable exterior sheathing. No increase in stiffness has been assumed for the wall sheathing.
7. Gypsum wall board is assumed attached to the interior side of the studs.
8. The tabulated values assume the plates are the same material and grade as the stud. For other plate material or grade, the designer shall check the factored load against the factored compressive resistance for the plate and adjust the stud size and/or the spacing accordingly. No increase is allowed without a complete analysis of the vertical resistance of the wall stud.

2.0E 2900Fb PWT LVL

Stud Height	Spacing	2x4 (1-1/2"x 3-1/2")	2x6 (1-1/2"x 5-1/2")	2x8 (1-1/2"x 7-1/4")	1-3/4"x 5-1/2"	1-3/4"x 7-1/4"
8'	12''	4189 L/336	6582 L/999	8677 L/999	7680 L/999	10123 L/999
	16''	3141 L/262	4937 L/892	6508 L/999	5760 L/999	7592 L/999
9'	12''	4187 L/238	6580 L/827	8673 L/999	7676 L/926	10119 L/999
	16''	3140 L/185	4935 L/664	6505 L/999	5757 L/750	7589 L/999
10'	12''	4185 L/173	6577 L/631	8669 L/999	7673 L/711	10114 L/999
	16''	2913 L/137	4932 L/504	6502 L/999	5754 L/573	7586 L/999
11'	12''	4013 L/130	6574 L/489	8665 L/997	7669 L/554	10110 L/999
	16''	-	4930 L/390	6499 L/814	5752 L/444	7582 L/915
12'	12''	-	6571 L/386	8662 L/807	7666 L/439	10105 L/905
	16''	-	4928 L/306	6496 L/654	5749 L/350	7579 L/738
13'	12''	-	6568 L/309	8658 L/660	7662 L/352	10101 L/743
	16''	-	4926 L/243	6493 L/531	5747 L/279	7575 L/602
14'	12''	-	6565 L/249	8654 L/544	7659 L/285	10096 L/615
	16''	-	4923 L/196	6490 L/435	5744 L/225	7572 L/495
15'	12''	-	6562 L/203	8650 L/453	7656 L/233	10092 L/513
	16''	-	4921 L/159	6487 L/360	5742 L/183	7569 L/411
16'	12''	-	6559 L/167	8646 L/379	7652 L/192	10087 L/431
	16''	-	4848 L/131	6484 L/300	5739 L/150	7565 L/343
18'	12''	-	-	8638 L/272	7154 L/136	10078 L/311
	16''	-	-	6479 L/214	-	7558 L/245
20'	12''	-	-	8630 L/199	-	10069 L/229
	16''	-	-	6473 L/156	-	7552 L/179
22'	12''	-	-	8623 L/149	-	10060 L/171
	16''	-	-	-	-	7545 L/134
24'	12''	-	-	-	-	9139 L/134
	16''	-	-	-	-	-

ADDITIONAL NOTES:

1. Height is the clear height of the wall stud between the bottom plate and the lower top plate.
2. The first value in each cell represents the factored vertical resistance of the studs in pounds per lineal foot (plf) of wall length. These factored vertical resistances are the resistances of the stud based on Load Combinations cases 1 to 4 of Table 4.1.3.2.A of the NBC or horizontal wind pressure acting alone (no gravity loads except Dead Load), whichever control.
3. The second value in each cell represents the deflection ratio (L/x). The designer shall verify the correct deflection ratio limit for the intended application. For brick or stone veneer, a maximum deflection of L/360 is required in accordance with CSA O86 and the Canadian Wood Council's Wood Frame Construction Guide.
4. Install full-width blocking per local code requirements, normally not more than every 8' along the height of the stud.

Calculate factored vertical load

The factored vertical load is the greater of:
1.25D+1.5L+1.0S or 1.25D+1.5S+1.0L.
Note that the tables are valid only for
(L + 0.5S) / 4 ≤ D ≤ L + 0.5S or
(S + 0.5L) / 4 ≤ D ≤ S + 0.5L
where D = unfactored Dead Load,
L = unfactored Live Load (use & occupancy),
S = unfactored Snow Load

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Table date: June, 2023
Valid until: June, 2024

Factored Free-Standing Interior Column Resistance (lbs)

January 2024
2024-2512a

This Tech Note must be used in conjunction with the appropriate PWT Technical and Installation Guides.

Canadian (LSD) Interior Free Standing Column Factored Vertical Load Resistance Table (lbs)

Solid Sections

Height	2.1E 3100Fb								
	3-1/2" Thick				5-1/4" Thick			7" Thick	
	x 3-1/2"	x 5-1/2"	x 7-1/4"	x 9-1/4"	x 5-1/2"	x 7-1/4"	x 9-1/4"	x 7-1/4"	x 9-1/4"
6'	17,437	27,390	36,122	46,090	46,138	60,818	77,595	81,091	103,461
7'	14,802	23,267	30,664	39,123	46,127	60,804	77,578	81,072	103,437
8'	12,482	19,614	25,850	32,989	43,375	57,170	72,949	81,054	103,414
9'	10,496	16,494	21,742	27,739	39,287	51,781	66,068	81,036	103,310
10'	8,823	13,864	18,278	23,323	35,378	46,633	59,473	76,848	98,038
12'	6,255	9,828	12,955	16,529	28,396	37,448	47,762	66,703	85,123
14'	4,471	7,023	9,261	11,818	22,677	29,874	38,125	57,125	72,903
16'	-	-	-	-	18,086	23,842	30,404	48,584	61,985
18'	-	-	-	-	14,453	19,055	24,309	41,176	52,534
20'	-	-	-	-	11,590	15,272	19,490	34,863	44,495
22'	-	-	-	-	-	-	-	29,514	37,673
24'	-	-	-	-	-	-	-	25,020	31,921

TO USE:

1. Determine the height of the column. If not listed, select the next tallest height in the table.
2. Select the PWT LVL grade and size where the factored axial resistance meets or exceeds the applied factored vertical load.
3. Verify the bearing resistance of the support for the selected column. See Design Assumption 6 below.

DESIGN ASSUMPTIONS:

1. Height is the clear height of the column between the top and bottom supports.
2. The axial resistance is the total factored vertical load applied to the column, including all dead loads. No lateral loads have been applied.
3. The factored axial resistance is for a full cross-section only. Notching and drilling are not allowed without further analysis by a design professional except as required for the proper installation of column caps, bases and other holddowns. Bolts, lag screws and self-tapping screws shall only be inserted through the face of the column, perpendicular to the face of the veneers in PWT LVL.
4. The factored axial resistance assumes an eccentricity of 1/6 of the column width or depth, whichever controls.
5. Columns are assumed to be braced in both directions at the top and bottom supports.
6. For bearing on a wood plate, concrete, or any material other than steel the designer shall check the factored vertical load against the factored bearing resistance of the plate material and increase the column size accordingly.
7. The factored axial resistance in these tables are valid only for when $(L + 0.5S) / 4 \le D \le L + 0.5S$ or $(S + 0.5L) / 4 \le D \le S + 0.5L$ where D = unfactored Dead Load, L = unfactored Live Load due to use and occupancy, and S = unfactored Snow Load.

Our literature is updated frequently, so please visit www.pwtewp.com for the most current version of our specifications.

Table date: January, 2024
Valid until: January, 2025