

PROPERTIES OF STRUCTURAL LUMBER — Sectional Properties of Standard Dressed (S4S) Lumber Sizes										
NOMINAL SIZE b(inches)d	STANDARD DRESSED SIZE (S4S) b(inches)d	AREA OF SECTION A	MOMENT OF INERTIA I	SECTION MODULUS S	Weight in pounds per linear foot of piece when weight of wood per cubic foot equals:					
					25 lb.	30 lb.	35 lb.	40 lb.	45 lb.	50 lb.
1 x 3	3/4 x 2 1/2	1.875	0.977	0.781	0.326	0.391	0.456	0.521	0.586	0.651
1 x 4	3/4 x 3 1/2	2.625	2.680	1.531	0.456	0.547	0.638	0.729	0.820	0.911
1 x 6	3/4 x 5 1/2	4.125	10.398	3.781	0.716	0.859	1.003	1.146	1.289	1.432
1 x 8	3/4 x 7 1/4	5.438	23.817	6.570	0.944	1.133	1.322	1.510	1.699	1.888
1 x 10	3/4 x 9 1/4	6.938	49.466	10.695	1.204	1.445	1.686	1.927	2.168	2.409
1 x 12	3/4 x 11 1/4	8.438	88.989	15.820	1.465	1.758	2.051	2.344	2.637	2.930
2 x 3	1 1/2 x 2 1/2	3.750	1.953	1.563	0.651	0.781	0.911	1.042	1.172	1.302
2 x 4	1 1/2 x 3 1/2	5.250	5.359	3.063	0.911	1.094	1.276	1.458	1.641	1.823
2 x 6	1 1/2 x 5 1/2	8.250	20.797	7.563	1.432	1.719	2.005	2.292	2.578	2.865
2 x 8	1 1/2 x 7 1/4	10.875	47.635	13.141	1.888	2.266	2.643	3.021	3.398	3.776
2 x 10	1 1/2 x 9 1/4	13.875	98.932	21.391	2.409	2.891	3.372	3.854	4.336	4.818
2 x 12	1 1/2 x 11 1/4	16.875	177.979	31.641	2.930	3.516	4.102	4.688	5.273	5.859
2 x 14	1 1/2 x 13 1/4	19.875	290.775	43.891	3.451	4.141	4.831	5.521	6.211	6.901
3 x 1	2 1/2 x 3/4	1.875	0.088	0.234	0.326	0.391	0.456	0.521	0.586	0.651
3 x 2	2 1/2 x 1 1/2	3.750	0.703	0.938	0.651	0.781	0.911	1.042	1.172	1.302
3 x 4	2 1/2 x 3 1/2	8.750	8.932	5.104	1.519	1.823	2.127	2.431	2.734	3.038
3 x 6	2 1/2 x 5 1/2	13.750	34.661	12.604	2.387	2.865	3.342	3.819	4.297	4.774
3 x 8	2 1/2 x 7 1/4	18.125	79.391	21.901	3.147	3.776	4.405	5.035	5.664	6.293
3 x 10	2 1/2 x 9 1/4	23.125	164.886	35.651	4.015	4.818	5.621	6.424	7.227	8.030
3 x 12	2 1/2 x 11 1/4	28.125	296.631	52.734	4.883	5.859	6.836	7.813	8.789	9.766
3 x 14	2 1/2 x 13 1/4	33.125	484.625	73.151	5.751	6.901	8.051	9.201	10.352	11.502
3 x 16	2 1/2 x 15 1/4	38.125	738.870	96.901	6.619	7.943	9.266	10.590	11.914	13.238
4 x 1	3 1/2 x 3/4	2.625	0.123	0.328	0.456	0.547	0.638	0.729	0.820	0.911
4 x 2	3 1/2 x 1 1/2	5.250	0.984	1.313	0.911	1.094	1.276	1.458	1.641	1.823
4 x 3	3 1/2 x 2 1/2	8.750	4.557	3.646	1.519	1.823	2.127	2.431	2.734	3.038
4 x 4	3 1/2 x 3 1/2	12.250	12.505	7.146	2.127	2.552	2.977	3.403	3.828	4.253
4 x 6	3 1/2 x 5 1/2	19.250	48.526	17.646	3.342	4.010	4.679	5.347	6.016	6.684
4 x 8	3 1/2 x 7 1/4	25.375	111.148	30.661	4.405	5.286	6.168	7.049	7.930	8.811
4 x 10	3 1/2 x 9 1/4	32.375	230.840	49.911	5.621	6.745	7.869	8.993	10.117	11.241
4 x 12	3 1/2 x 11 1/4	39.375	415.283	73.828	6.836	8.203	9.570	10.938	12.305	13.672
4 x 14	3 1/2 x 13 1/4	46.38	678.5	102.4	8.051	9.661	11.27	12.88	14.49	16.10
4 x 16	3 1/2 x 15 1/4	53.38	1034	135.7	9.266	11.12	12.97	14.83	16.68	18.53
6 x 1	5 1/2 x 3/4	4.125	0.193	0.516	0.716	0.859	1.003	1.146	1.289	1.432
6 x 2	5 1/2 x 1 1/2	8.250	1.547	2.063	1.432	1.719	2.005	2.292	2.578	2.865
6 x 3	5 1/2 x 2 1/2	13.750	7.161	5.729	2.387	2.865	3.342	3.819	4.297	4.774
6 x 4	5 1/2 x 3 1/2	19.250	19.651	11.229	3.342	4.010	4.679	5.347	6.016	6.684
6 x 6	5 1/2 x 5 1/2	30.250	76.255	27.729	5.252	6.302	7.352	8.403	9.453	10.503
6 x 8	5 1/2 x 7 1/2	41.250	193.359	51.563	7.161	8.594	10.026	11.458	12.891	14.323
6 x 10	5 1/2 x 9 1/2	52.250	392.963	82.729	9.071	10.885	12.700	14.514	16.328	18.142
6 x 12	5 1/2 x 11 1/2	63.250	697.068	121.229	10.981	13.177	15.373	17.569	19.766	21.962
6 x 14	5 1/2 x 13 1/2	74.250	1127.672	167.063	12.891	15.469	18.047	20.625	23.203	25.781
6 x 16	5 1/2 x 15 1/2	85.250	1706.776	220.229	14.800	17.760	20.720	23.681	26.641	29.601
6 x 18	5 1/2 x 17 1/2	96.250	2456.380	280.729	16.710	20.052	23.394	26.736	30.078	33.420
6 x 20	5 1/2 x 19 1/2	107.250	3398.484	348.563	18.620	22.344	26.068	29.792	33.516	37.240
6 x 22	5 1/2 x 21 1/2	118.250	4555.086	423.729	20.530	24.635	28.741	32.847	36.953	41.059
6 x 24	5 1/2 x 23 1/2	129.250	5948.191	506.229	22.439	26.927	31.415	35.903	40.391	44.878
8 x 1	7 1/4 x 3/4	5.438	0.255	0.680	0.944	1.133	1.322	1.510	1.699	1.888
8 x 2	7 1/4 x 1 1/2	10.875	2.039	2.719	1.888	2.266	2.643	3.021	3.398	3.776
8 x 3	7 1/4 x 2 1/2	18.125	9.440	7.552	3.147	3.776	4.405	5.035	5.664	6.293
8 x 4	7 1/4 x 3 1/2	25.375	25.904	14.802	4.405	5.286	6.168	7.049	7.930	8.811
8 x 6	7 1/2 x 5 1/2	41.250	103.984	37.813	7.161	8.594	10.026	11.458	12.891	14.323
8 x 8	7 1/2 x 7 1/2	56.250	263.672	70.313	9.766	11.719	13.672	15.625	17.578	19.531
8 x 10	7 1/2 x 9 1/2	71.250	535.859	112.813	12.370	14.844	17.318	19.792	22.266	24.740
8 x 12	7 1/2 x 11 1/2	86.250	950.547	165.313	14.974	17.969	20.964	23.958	26.953	29.948
8 x 14	7 1/2 x 13 1/2	101.250	1537.734	227.813	17.578	21.094	24.609	28.125	31.641	35.156
8 x 16	7 1/2 x 15 1/2	116.250	2327.422	300.313	20.182	24.219	28.255	32.292	36.328	40.365
8 x 18	7 1/2 x 17 1/2	131.250	3349.609	382.813	22.786	27.344	31.901	36.458	41.016	45.573
8 x 20	7 1/2 x 19 1/2	146.250	4634.297	475.313	25.391	30.469	35.547	40.625	45.703	50.781
8 x 22	7 1/2 x 21 1/2	161.250	6211.484	577.813	27.995	33.594	39.193	44.792	50.391	55.990
8 x 24	7 1/2 x 23 1/2	176.250	8111.172	690.313	30.599	36.719	42.839	48.958	55.078	61.198

WOOD COLUMNS

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Use of Tabular Column Data

The tabular data included herein for unit axial stresses provides a simplified and accurate method for calculating design loads on columns of any size and length. The load is determined by multiplying the appropriate tabular unit stress by the cross-sectional area of the member, based on net dimensions. Where the degree of refinement so indicates, the weight of the column should be deducted to determine the design load which may be applied.

Unit axial stresses are provided for simple solid columns, spaced columns with end condition "a" and spaced columns with end condition "b".

Ratio of ℓ/d

The ℓ/d ratio is calculated in the manner previously described in the text on wood columns. Values of F_c' for ℓ/d ratios intermediate to those given may be determined by straight line interpolation. For example, a simple, solid column having an F_c of 1,200 psi and E of 1,600,000 psi, the F_c' for an ℓ/d of 28 is 529 psi and the F_c' for an ℓ/d of 29 is 500 psi. For an ℓ/d of 28.4, the F_c' is $500 + 0.6(529-500) = 517.4$ psi.

Design Values of E and F_c

Modulus of elasticity, E, and compression parallel to grain, F_c , design values for the species and grade of wood to be used may be obtained from the National Design Specification for Wood Construction. If appropriate, E and F_c should be adjusted as previously described for the conditions under which the column will be used.

Tabular values of F_c' are provided for a range of E values from 2,100,000 to 900,000 psi, for F_c values between 200 and 3,600 psi as appropriate for each E. Values of F_c' for F_c values intermediate to those tabulated may be determined by straight line interpolation. For example, for an ℓ/d of 25 and E of 1,400,000 psi, the F_c' for an F_c of 1000 psi is 543 psi and the F_c' for an F_c of 800 psi is 502 psi. For an F_c of 875 psi, the interpolated F_c' is $502 + 75/200 (543-502) = 517.4$ psi.

Use of Tabular Data for Round Columns

Unit axial loads for simple solid columns of square cross section may be converted to unit loads for round columns. First, multiply the column diameter by 0.886 to determine the dimension, d, and then calculate the ℓ/d ratio. From the tabular data obtain the applicable F_c' for that ℓ/d ratio and multiply this by the cross sectional area of the round column to determine the design load for the column.

Conversely, to determine the diameter of a round column required to carry the same total load as a square column, multiply the dimension d of the square column by 1.128.