CONSTRUCCIONES DE MADERA

(del Código de Construcciones Sismo Resistentes para la Provincia de Mendoza – 1987)

Para las construcciones de madera rigen las normas DIN 1052 y complementarias.

CLASIFICACION DE LAS MADERAS

Las maderas para estructuras se clasifican en:

Grupo	designación	peso específico en N/dm^3 (agua: 10 N/dm^3)
Grupo 1:	Maderas duras	mayor de 8 N/dm^3
Grupo 2:	Maderas semiduras	de 8 a 6,50 N/dm^3
Grupo 3:	Maderas blandas	de 6,50 a 4,5 N/dm^3
Grupo 4:	maderas muy blandas	menor de 4,5 N/dm^3

En todo lo referente a tensiones y cargas admisibles, el grupo 2 se corresponde con el grupo "Roble" y"Haya" y el grupo 3 con "Coníferas" de la DIN 1052.
La clasificación por grupos de calidad de la DIN 1052 (DIN 4074) se extiende a los grupos 1 y 4 con los mismos criterios de clasificación.
Para los grupos 1 y 2 sólo se considerará calidad II y para el grupo 4 sólo se considerarán calidades II y III.
Los pesos específicos corresponden a madera con 12% de humedad (madera seca).

Para orientación se indican algunas maderas posibles de conseguir en la zona y por grupos:

Grupo 1: andiroba; Gonzalo Alves; itín; guayacán; lapacho amarillo, negro y rosado; quebracho; urunday.
Grupo 2: acacia blanca; cebil blanco; curupay; coihue; eucalipto globulus; ibirá-pitá; incienso; ñandubay; guatambú; palo rosa; palo santo; palo amarillo; pino Paraná; pino spruce; quebracho blanco; raulí; reroba do campo; roble pellín; virapitá; viraró.
Grupo 3: algarrobo; guaica; laurel; lenga; peteribí; pino blanco americano; pino eliotis; pino insigne; roble salteño o boliviano; sota caballo.
Grupo 4: cedro misionero; ciprés; timbó colorado; álamo.

TENSIONES DE CALCULO PARA ESTRUCTURAS DE MADERA

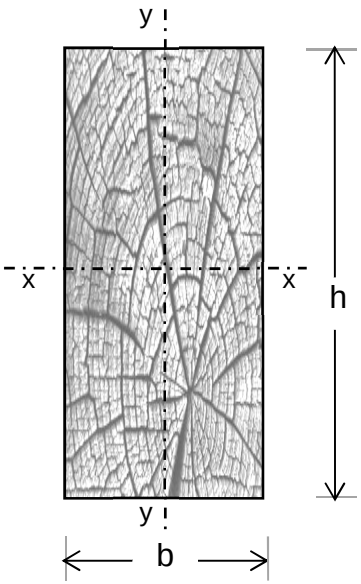
CONDICIONES DE SERVICIO NORMAL

Piezas prismáticas (tensiones admisibles en $kg/cm^2 = daN/cm^2$)

Solicitación	grupo 4 maciza o laminada		grupo 3 maciza			grupo 3 laminada		grupo 2 mac./lam.	grupo 1 maciza
	III	II	III	II	I	II	I	II	II
1 - flexión	50	30	70	100	130	110	140	110	150
2 - tracción	0	70	0	85	105	85	105	100	120
3 - compresión paralela	45	70	60	85	110	85	110	100	120
4 - compresión normal	15	15	20	20	20	20	20	30	60
compresión normal (1)	20	20	25	25	25	25	25	40	80
5 - hendimiento	7	7	9	9	9	9	9	10	15
6 - tangencial paralela	7	7	9	9	9	12	12	10	15
7 - módulo E /1000	70	70	100	100	100	100	100	125	150

(1) Siempre que las deformaciones por aplastamiento sean admisibles para el conjunto de la construcción

b	h	b	h	Área	Wx	Ix	rx	Wy	Iy	ry
nominales [pulgadas]		reales [cm]		[cm²]	[cm³]	[cm⁴]	[cm]	[cm³]	[cm⁴]	[cm]
1.0	1.0	2.3	2.3	5.29	2.03	2.33	0.66	2.03	2.33	0.66
1.0	1.5	2.3	3.5	7.94	4.56	7.87	1.00	3.04	3.50	0.66
1.0	2.0	2.3	4.6	10.58	8.11	18.66	1.33	4.06	4.66	0.66
1.0	2.5	2.3	5.8	13.23	12.67	36.44	1.66	5.07	5.83	0.66
1.0	3.0	2.3	6.9	15.87	18.25	62.96	1.99	6.08	7.00	0.66
1.5	1.5	3.5	3.5	11.90	6.84	11.81	1.00	6.84	11.81	1.00
1.5	2.0	3.5	4.6	15.87	12.17	27.98	1.33	9.13	15.74	1.00
1.5	2.5	3.5	5.8	19.84	19.01	54.66	1.66	11.41	19.68	1.00
1.5	3.0	3.5	6.9	23.81	27.38	94.45	1.99	13.69	23.61	1.00
1.5	4.0	3.5	9.2	31.74	48.67	223.87	2.66	18.25	31.48	1.00
1.5	5.0	3.5	11.5	39.68	76.04	437.25	3.32	22.81	39.35	1.00
1.5	6.0	3.5	13.8	47.61	109.50	755.57	3.98	27.38	47.22	1.00
1.5	7.0	3.5	16.1	55.55	149.05	1199.82	4.65	31.94	55.09	1.00
1.5	8.0	3.5	18.4	63.48	194.67	1790.98	5.31	36.50	62.96	1.00
2.0	2.0	4.6	4.6	21.16	16.22	37.31	1.33	16.22	37.31	1.33
2.0	2.5	4.6	5.8	26.45	25.35	72.88	1.66	20.28	46.64	1.33
2.0	3.0	4.6	6.9	31.74	36.50	125.93	1.99	24.33	55.97	1.33
2.0	4.0	4.6	9.2	42.32	64.89	298.50	2.66	32.45	74.62	1.33
2.0	5.0	4.6	11.5	52.90	101.39	583.00	3.32	40.56	93.28	1.33
2.0	6.0	4.6	13.8	63.48	146.00	1007.43	3.98	48.67	111.94	1.33
2.0	7.0	4.6	16.1	74.06	198.73	1599.76	4.65	56.78	130.59	1.33
2.0	8.0	4.6	18.4	84.64	259.56	2387.98	5.31	64.89	149.25	1.33
2.5	2.5	5.8	5.8	33.06	31.68	91.09	1.66	31.68	91.09	1.66
2.5	3.0	5.8	6.9	39.68	45.63	157.41	1.99	38.02	109.31	1.66
2.5	4.0	5.8	9.2	52.90	81.11	373.12	2.66	50.70	145.75	1.66
2.5	5.0	5.8	11.5	66.13	126.74	728.75	3.32	63.37	182.19	1.66
2.5	6.0	5.8	13.8	79.35	182.51	1259.28	3.98	76.04	218.63	1.66
2.5	7.0	5.8	16.1	92.58	248.41	1999.70	4.65	88.72	255.06	1.66
2.5	8.0	5.8	18.4	105.80	324.45	2984.97	5.31	101.39	291.50	1.66



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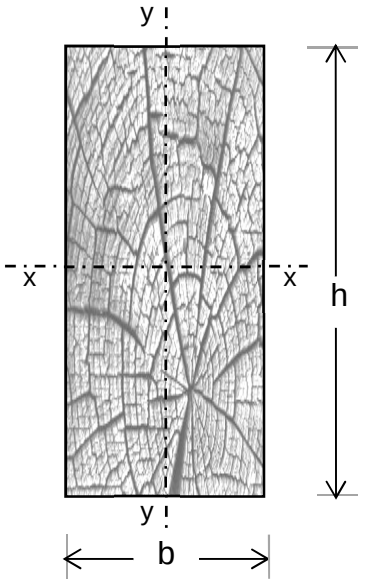
b	h	b	h	Área	Wx	Ix	rx	Wy	Iy	ry
nominales [pulgadas]		reales [cm]		[cm²]	[cm³]	[cm⁴]	[cm]	[cm³]	[cm⁴]	[cm]
3.0	3.0	6.9	6.9	47.61	54.75	188.89	1.99	54.75	188.89	1.99
3.0	4.0	6.9	9.2	63.48	97.34	447.75	2.66	73.00	251.86	1.99
3.0	5.0	6.9	11.5	79.35	152.09	874.50	3.32	91.25	314.82	1.99
3.0	6.0	6.9	13.8	95.22	219.01	1511.14	3.98	109.50	377.79	1.99
3.0	7.0	6.9	16.1	111.09	298.09	2399.64	4.65	127.75	440.75	1.99
3.0	8.0	6.9	18.4	126.96	389.34	3581.96	5.31	146.00	503.71	1.99
4.0	4.0	9.2	9.2	84.64	129.78	596.99	2.66	129.78	596.99	2.66
4.0	5.0	9.2	11.5	105.80	202.78	1166.00	3.32	162.23	746.24	2.66
4.0	6.0	9.2	13.8	126.96	292.01	2014.86	3.98	194.67	895.49	2.66
4.0	7.0	9.2	16.1	148.12	397.46	3199.52	4.65	227.12	1044.74	2.66
4.0	8.0	9.2	18.4	169.28	519.13	4775.95	5.31	259.56	1193.99	2.66
5.0	5.0	11.5	11.5	132.25	253.48	1457.51	3.32	253.48	1457.51	3.32
5.0	6.0	11.5	13.8	158.70	365.01	2518.57	3.98	304.18	1749.01	3.32
5.0	7.0	11.5	16.1	185.15	496.82	3999.39	4.65	354.87	2040.51	3.32
5.0	8.0	11.5	18.4	211.60	648.91	5969.94	5.31	405.57	2332.01	3.32
6.0	6.0	13.8	13.8	190.44	438.01	3022.28	3.98	438.01	3022.28	3.98
6.0	7.0	13.8	16.1	222.18	596.18	4799.27	4.65	511.01	3526.00	3.98
6.0	8.0	13.8	18.4	253.92	778.69	7163.93	5.31	584.02	4029.71	3.98
7.0	7.0	16.1	16.1	259.21	695.55	5599.15	4.65	695.55	5599.15	4.65
7.0	8.0	16.1	18.4	296.24	908.47	8357.92	5.31	794.91	6399.03	4.65
8.0	8.0	18.4	18.4	338.56	1038.25	9551.91	5.31	1038.25	9551.91	5.31



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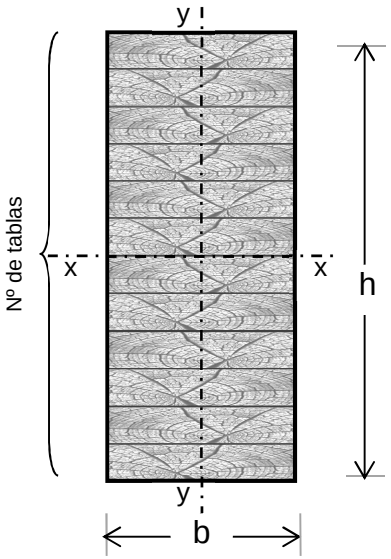
H | **2** | **DIMENSIONAMIENTO EN MADERA** | **SECCIONES COMERCIALES: LAMINADAS**

Ancho	Nº	b	h	b	h	Área	Wx	Ix	rx	Wy	Iy	ry
[pulg.]	TABLAS	nominales [pulgadas]		reales [cm]		[cm²]	[cm³]	[cm⁴]	[cm]	[cm³]	[cm⁴]	[cm]
2	3	2.0	3.0	4.1	6.3	25.83	27.12	85.43	1.82	17.65	36.18	1.18
2	4	2.0	4.0	4.1	8.4	34.44	48.22	202.51	2.42	23.53	48.24	1.18
2	5	2.0	5.0	4.1	10.5	43.05	75.34	395.52	3.03	29.42	60.31	1.18
2	6	2.0	6.0	4.1	12.6	51.66	108.49	683.46	3.64	35.30	72.37	1.18
2	7	2.0	7.0	4.1	14.7	60.27	147.66	1085.31	4.24	41.18	84.43	1.18
2	8	2.0	8.0	4.1	16.8	68.88	192.86	1620.06	4.85	47.07	96.49	1.18
2	9	2.0	9.0	4.1	18.9	77.49	244.09	2306.68	5.46	52.95	108.55	1.18
2	10	2.0	10.0	4.1	21.0	86.10	301.35	3164.18	6.06	58.84	120.61	1.18
2.5	3	2.5	3.0	5.1	6.3	32.29	33.90	106.79	1.82	27.58	70.67	1.48
2.5	4	2.5	4.0	5.1	8.4	43.05	60.27	253.13	2.42	36.77	94.23	1.48
2.5	5	2.5	5.0	5.1	10.5	53.81	94.17	494.40	3.03	45.96	117.78	1.48
2.5	6	2.5	6.0	5.1	12.6	64.58	135.61	854.33	3.64	55.16	141.34	1.48
2.5	7	2.5	7.0	5.1	14.7	75.34	184.58	1356.64	4.24	64.35	164.90	1.48
2.5	8	2.5	8.0	5.1	16.8	86.10	241.08	2025.07	4.85	73.54	188.46	1.48
2.5	9	2.5	9.0	5.1	18.9	96.86	305.12	2883.35	5.46	82.74	212.01	1.48
2.5	10	2.5	10.0	5.1	21.0	107.63	376.69	3955.22	6.06	91.93	235.57	1.48
3	3	3.0	3.0	6.2	6.3	38.75	40.68	128.15	1.82	39.71	122.12	1.78
3	4	3.0	4.0	6.2	8.4	51.66	72.32	303.76	2.42	52.95	162.83	1.78
3	5	3.0	5.0	6.2	10.5	64.58	113.01	593.28	3.03	66.19	203.53	1.78
3	6	3.0	6.0	6.2	12.6	77.49	162.73	1025.19	3.64	79.43	244.24	1.78
3	7	3.0	7.0	6.2	14.7	90.41	221.49	1627.97	4.24	92.67	284.95	1.78
3	8	3.0	8.0	6.2	16.8	103.32	289.30	2430.09	4.85	105.90	325.65	1.78
3	9	3.0	9.0	6.2	18.9	116.24	366.14	3460.03	5.46	119.14	366.36	1.78
3	10	3.0	10.0	6.2	21.0	129.15	452.03	4746.26	6.06	132.38	407.06	1.78
3	11	3.0	11.0	6.2	23.1	142.07	546.95	6317.28	6.67	145.62	447.77	1.78
3	12	3.0	12.0	6.2	25.2	154.98	650.92	8201.54	7.27	158.85	488.48	1.78



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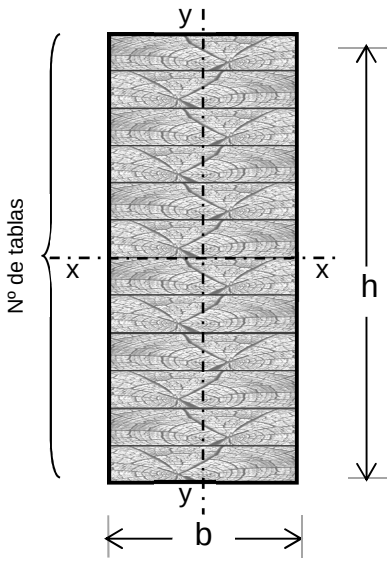
Ancho	Nº	b	h	b	h	Área	Wx	Ix	rx	Wy	Iy	ry
[pulg.]	TABLAS	nominales [pulgadas]		reales [cm]		[cm²]	[cm³]	[cm⁴]	[cm]	[cm³]	[cm⁴]	[cm]
4	4	4.0	4.0	8.2	8.4	68.88	96.43	405.01	2.42	94.14	385.96	2.37
4	5	4.0	5.0	8.2	10.5	86.10	150.68	791.04	3.03	117.67	482.45	2.37
4	6	4.0	6.0	8.2	12.6	103.32	216.97	1366.92	3.64	141.20	578.94	2.37
4	7	4.0	7.0	8.2	14.7	120.54	295.32	2170.62	4.24	164.74	675.43	2.37
4	8	4.0	8.0	8.2	16.8	137.76	385.73	3240.12	4.85	188.27	771.92	2.37
4	9	4.0	9.0	8.2	18.9	154.98	488.19	4613.37	5.46	211.81	868.40	2.37
4	10	4.0	10.0	8.2	21.0	172.20	602.70	6328.35	6.06	235.34	964.89	2.37
4	11	4.0	11.0	8.2	23.1	189.42	729.27	8423.03	6.67	258.87	1061.38	2.37
4	12	4.0	12.0	8.2	25.2	206.64	867.89	10935.39	7.27	282.41	1157.87	2.37
5	5	5.0	5.0	10.3	10.5	107.63	188.34	988.80	3.03	183.86	942.28	2.96
5	6	5.0	6.0	10.3	12.6	129.15	271.22	1708.65	3.64	220.63	1130.74	2.96
5	7	5.0	7.0	10.3	14.7	150.68	369.15	2713.28	4.24	257.40	1319.19	2.96
5	8	5.0	8.0	10.3	16.8	172.20	482.16	4050.14	4.85	294.18	1507.65	2.96
5	9	5.0	9.0	10.3	18.9	193.73	610.23	5766.71	5.46	330.95	1696.10	2.96
5	10	5.0	10.0	10.3	21.0	215.25	753.38	7910.44	6.06	367.72	1884.56	2.96
5	11	5.0	11.0	10.3	23.1	236.78	911.58	10528.79	6.67	404.49	2073.01	2.96
5	12	5.0	12.0	10.3	25.2	258.30	1084.86	13669.24	7.27	441.26	2261.47	2.96
5	13	5.0	13.0	10.3	27.3	279.83	1273.20	17379.23	7.88	478.03	2449.93	2.96
5	14	5.0	14.0	10.3	29.4	301.35	1476.62	21706.24	8.49	514.81	2638.38	2.96
5	15	5.0	15.0	10.3	31.5	322.88	1695.09	26697.73	9.09	551.58	2826.84	2.96
6	6	6.0	6.0	12.3	12.6	154.98	325.46	2050.39	3.64	317.71	1953.91	3.55
6	7	6.0	7.0	12.3	14.7	180.81	442.98	3255.94	4.24	370.66	2279.56	3.55
6	8	6.0	8.0	12.3	16.8	206.64	578.59	4860.17	4.85	423.61	2605.21	3.55
6	9	6.0	9.0	12.3	18.9	232.47	732.28	6920.05	5.46	476.56	2930.87	3.55
6	10	6.0	10.0	12.3	21.0	258.30	904.05	9492.53	6.06	529.52	3256.52	3.55
6	11	6.0	11.0	12.3	23.1	284.13	1093.90	12634.55	6.67	582.47	3582.17	3.55
6	12	6.0	12.0	12.3	25.2	309.96	1301.83	16403.08	7.27	635.42	3907.82	3.55
6	13	6.0	13.0	12.3	27.3	335.79	1527.84	20855.08	7.88	688.37	4233.47	3.55
6	14	6.0	14.0	12.3	29.4	361.62	1771.94	26047.49	8.49	741.32	4559.12	3.55
6	15	6.0	15.0	12.3	31.5	387.45	2034.11	32037.27	9.09	794.27	4884.78	3.55



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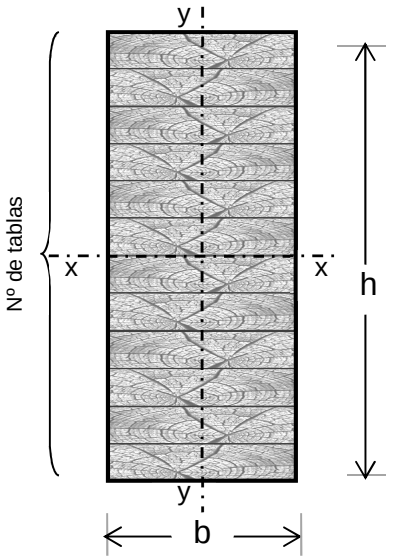
Ancho	Nº	b	h	b	h	Área	Wx	Ix	rx	Wy	Iy	ry
[pulg.]	TABLAS	nominales [pulgadas]		reales [cm]		[cm²]	[cm³]	[cm⁴]	[cm]	[cm³]	[cm⁴]	[cm]
7	7	7.0	7.0	14.4	14.7	210.95	516.82	3798.59	4.24	504.51	3619.86	4.14
7	8	7.0	8.0	14.4	16.8	241.08	675.02	5670.20	4.85	576.58	4136.98	4.14
7	9	7.0	9.0	14.4	18.9	271.22	854.33	8073.39	5.46	648.66	4654.11	4.14
7	10	7.0	10.0	14.4	21.0	301.35	1054.73	11074.61	6.06	720.73	5171.23	4.14
7	11	7.0	11.0	14.4	23.1	331.49	1276.22	14740.31	6.67	792.80	5688.35	4.14
7	12	7.0	12.0	14.4	25.2	361.62	1518.80	19136.93	7.27	864.87	6205.47	4.14
7	13	7.0	13.0	14.4	27.3	391.76	1782.49	24330.92	7.88	936.95	6722.60	4.14
7	14	7.0	14.0	14.4	29.4	421.89	2067.26	30388.74	8.49	1009.02	7239.72	4.14
7	15	7.0	15.0	14.4	31.5	452.03	2373.13	37376.82	9.09	1081.09	7756.84	4.14
8	8	8.0	8.0	16.4	16.8	275.52	771.46	6480.23	4.85	753.09	6175.32	4.73
8	9	8.0	9.0	16.4	18.9	309.96	976.37	9226.73	5.46	847.22	6947.24	4.73
8	10	8.0	10.0	16.4	21.0	344.40	1205.40	12656.70	6.06	941.36	7719.15	4.73
8	11	8.0	11.0	16.4	23.1	378.84	1458.53	16846.07	6.67	1035.50	8491.07	4.73
8	12	8.0	12.0	16.4	25.2	413.28	1735.78	21870.78	7.27	1129.63	9262.98	4.73
8	13	8.0	13.0	16.4	27.3	447.72	2037.13	27806.77	7.88	1223.77	10034.90	4.73
8	14	8.0	14.0	16.4	29.4	482.16	2362.58	34729.98	8.49	1317.90	10806.81	4.73
8	15	8.0	15.0	16.4	31.5	516.60	2712.15	42716.36	9.09	1412.04	11578.73	4.73
9	9	9.0	9.0	18.5	18.9	348.71	1098.42	10380.08	5.46	1072.27	9891.67	5.33
9	10	9.0	10.0	18.5	21.0	387.45	1356.08	14238.79	6.06	1191.41	10990.75	5.33
9	11	9.0	11.0	18.5	23.1	426.20	1640.85	18951.83	6.67	1310.55	12089.82	5.33
9	12	9.0	12.0	18.5	25.2	464.94	1952.75	24604.62	7.27	1429.69	13188.89	5.33
9	13	9.0	13.0	18.5	27.3	503.69	2291.77	31282.62	7.88	1548.83	14287.97	5.33
9	14	9.0	14.0	18.5	29.4	542.43	2657.91	39071.23	8.49	1667.97	15387.04	5.33
9	15	9.0	15.0	18.5	31.5	581.18	3051.17	48055.91	9.09	1787.11	16486.12	5.33
10	10	10.0	10.0	20.5	21.0	430.50	1506.75	15820.88	6.06	1470.88	15076.47	5.92
10	11	10.0	11.0	20.5	23.1	473.55	1823.17	21057.58	6.67	1617.96	16584.12	5.92
10	12	10.0	12.0	20.5	25.2	516.60	2169.72	27338.47	7.27	1765.05	18091.76	5.92
10	13	10.0	13.0	20.5	27.3	559.65	2546.41	34758.46	7.88	1912.14	19599.41	5.92
10	14	10.0	14.0	20.5	29.4	602.70	2953.23	43412.48	8.49	2059.23	21107.06	5.92
10	15	10.0	15.0	20.5	31.5	645.75	3390.19	53395.45	9.09	2206.31	22614.70	5.92



$A = b \cdot h$

$Wx = b \cdot h^2/6$

$Ix = b \cdot h^3/12$

$rx = 0{,}289 \cdot h$

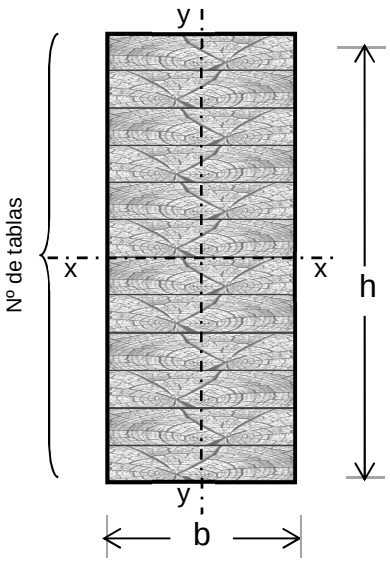
$Wy = h \cdot b^2/6$

$Iy = h \cdot b^3/12$

$ry = 0{,}289 \cdot b$

H	2	DIMENSIONAMIENTO EN MADERA	SECCIONES COMERCIALES: LAMINADAS

Ancho	Nº	b	h	b	h	Área	Wx	Ix	rx	Wy	Iy	ry
[pulg.]	TABLAS	nominales [pulgadas]		reales [cm]		[cm²]	[cm³]	[cm⁴]	[cm]	[cm³]	[cm⁴]	[cm]
11	11	11.0	11.0	22.6	23.1	520.91	2005.48	23163.34	6.67	1957.73	22073.46	6.51
11	12	11.0	12.0	22.6	25.2	568.26	2386.69	30072.32	7.27	2135.71	24080.14	6.51
11	13	11.0	13.0	22.6	27.3	615.62	2801.05	38234.31	7.88	2313.69	26086.81	6.51
11	14	11.0	14.0	22.6	29.4	662.97	3248.55	47753.73	8.49	2491.66	28093.49	6.51
11	15	11.0	15.0	22.6	31.5	710.33	3729.21	58735.00	9.09	2669.64	30100.17	6.51
12	12	12.0	12.0	24.6	25.2	619.92	2603.66	32806.17	7.27	2541.67	31262.57	7.10
12	13	12.0	13.0	24.6	27.3	671.58	3055.69	41710.15	7.88	2753.48	33867.78	7.10
12	14	12.0	14.0	24.6	29.4	723.24	3543.88	52094.98	8.49	2965.28	36472.99	7.10
12	15	12.0	15.0	24.6	31.5	774.90	4068.23	64074.54	9.09	3177.09	39078.21	7.10
13	13	13.0	13.0	26.7	27.3	727.55	3310.33	45186.00	7.88	3231.51	43059.90	7.69
13	14	13.0	14.0	26.7	29.4	783.51	3839.20	56436.23	8.49	3480.09	46372.20	7.69
13	15	13.0	15.0	26.7	31.5	839.48	4407.24	69414.09	9.09	3728.67	49684.50	7.69
14	14	14.0	14.0	28.7	29.4	843.78	4134.52	60777.47	8.49	4036.08	57917.76	8.28
14	15	14.0	15.0	28.7	31.5	904.05	4746.26	74753.63	9.09	4324.37	62054.75	8.28
15	15	15.0	15.0	30.8	31.5	968.63	5085.28	80093.18	9.09	4964.20	76324.62	8.88



$A = b \cdot h$

$Wx = b \cdot h^2/6$

$Ix = b \cdot h^3/12$

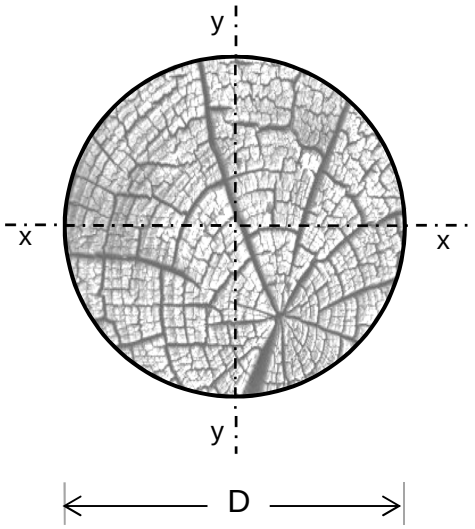
$rx = 0{,}289 \cdot h$

$Wy = h \cdot b^2/6$

$Iy = h \cdot b^3/12$

$ry = 0{,}289 \cdot b$

D [cm]	Área [cm²]	Wx = Wy [cm³]	Ix = Iy [cm⁴]	rx = ry [cm]
8	50,27	50,27	201,06	2,00
9	63,62	71,57	322,06	2,25
10	78,54	98,17	490,87	2,50
11	95,03	130,67	718,69	2,75
12	113,10	169,65	1017,88	3,00
13	132,73	215,69	1401,98	3,25
14	153,94	269,39	1885,74	3,50
15	176,71	331,34	2485,05	3,75
16	201,06	402,12	3216,99	4,00
17	226,98	482,33	4099,83	4,25
18	254,47	572,56	5153,00	4,50
19	283,53	673,38	6397,12	4,75
20	314,16	785,40	7853,98	5,00
21	346,36	909,20	9546,56	5,25
22	380,13	1045,36	11499,01	5,50
23	415,48	1194,49	13736,66	5,75
24	452,39	1357,17	16286,02	6,00
25	490,87	1533,98	19174,76	6,25
26	530,93	1725,52	22431,76	6,50
27	572,56	1932,37	26087,05	6,75
28	615,75	2155,13	30171,86	7,00
29	660,52	2394,38	34718,57	7,25
30	706,86	2650,72	39760,78	7,50
32	804,25	3216,99	51471,85	8,00
35	962,11	4209,24	73661,76	8,75
40	1256,64	6283,19	125663,71	10,00
45	1590,43	8946,18	201288,96	11,25
50	1963,50	12271,85	306796,16	12,50

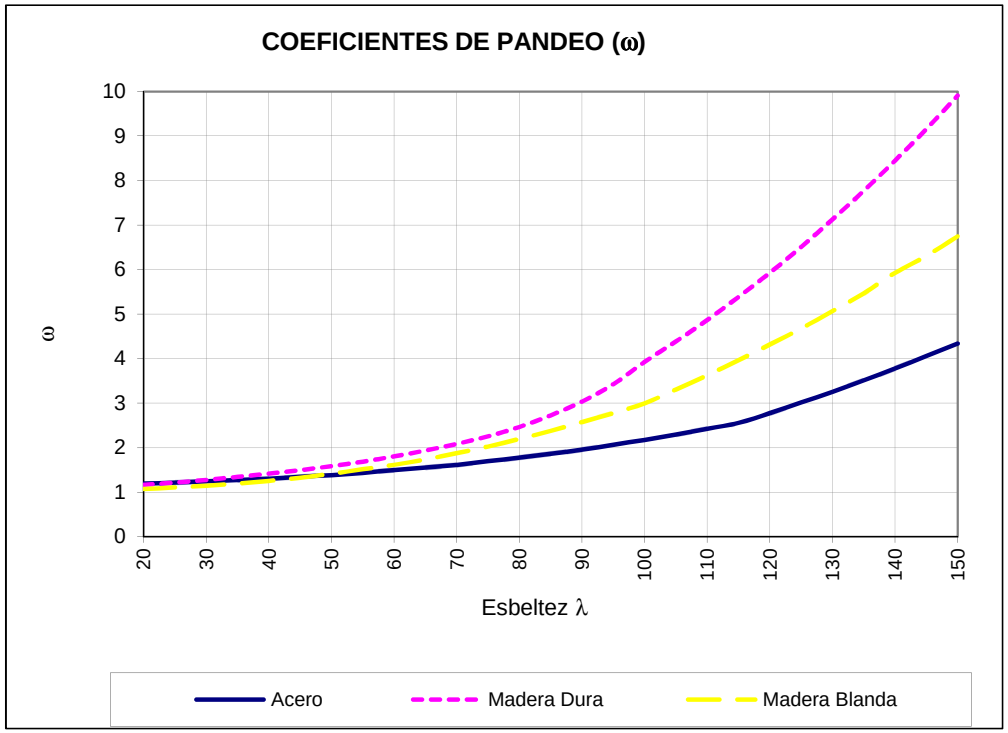


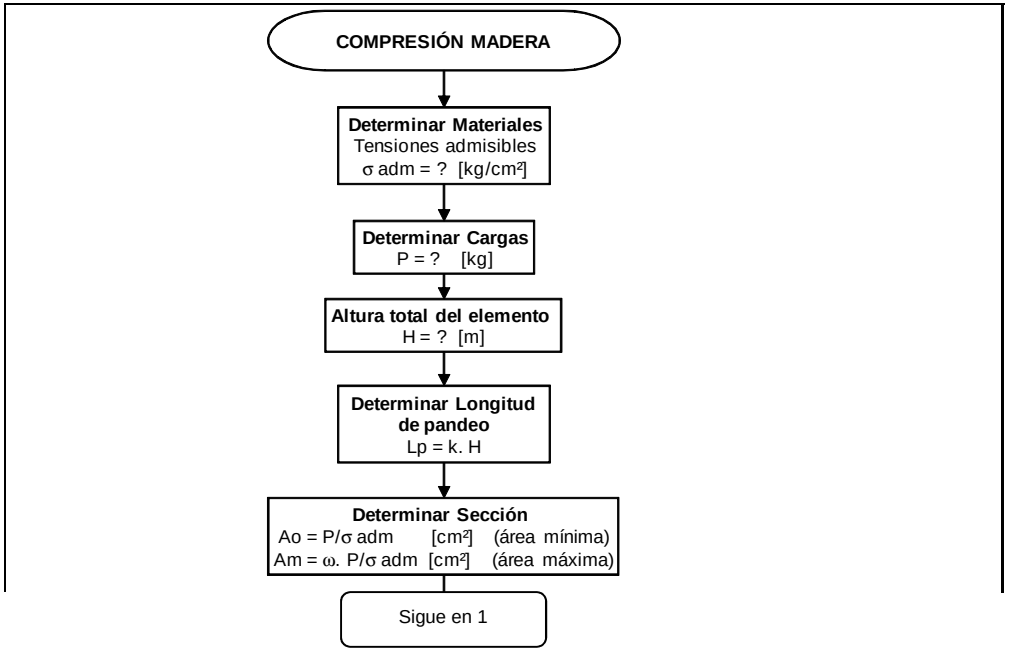
$A = PI. D^2/4$

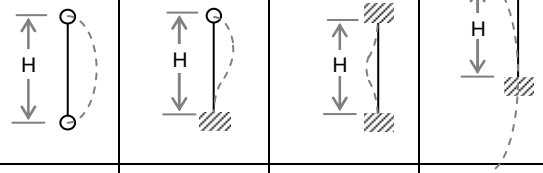
$Wx = PI . D^3/32$

$Ix = PI . D^4/64$

λ	Madera Dura	Madera Blanda
20	1.17	1.08
25	1.22	1.11
30	1.28	1.15
35	1.35	1.20
40	1.42	1.26
45	1.50	1.33
50	1.59	1.42
55	1.69	1.52
60	1.81	1.62
65	1.94	1.74
70	2.09	1.88
75	2.26	2.03
80	2.47	2.20
85	2.73	2.38
90	3.04	2.58
95	3.43	2.78
100	3.93	3.00
105	4.39	3.31
110	4.87	3.63
115	5.39	3.97
120	5.93	4.32
125	6.51	4.68
130	7.13	5.07
135	7.77	5.47
140	8.45	5.93
145	9.16	6.31
150	9.91	6.75





Coeficiente “k” para determinar (Lp)			
articulada articulada	articulada empotrada	empotrada empotrada	empotrada libre
			
1.00	0.80	0.65	2.10