

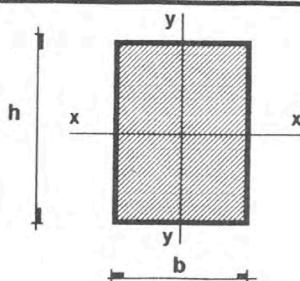
# ESTRUCTURAS I

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Tablas

Facultad de Arquitectura, Diseño y Urbanismo  
Universidad de la República

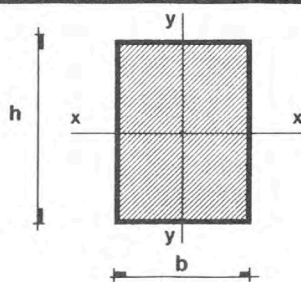
Características geométricas de elementos estructurales  
ESCUADRIAS DE MADERA



b,h,nominal pulgadas  
b,h,bruto mm  
b,h,neto mm  
A cm<sup>2</sup>  
I<sub>x</sub>,I<sub>y</sub> cm<sup>4</sup>  
W<sub>x</sub>,W<sub>y</sub> cm<sup>3</sup>  
i<sub>x</sub>,i<sub>y</sub> cm

b x h nominal	b x h bruto	b neto	h neto	A	I <sub>x</sub>	W <sub>x</sub>	i <sub>x</sub>	I <sub>y</sub>	W <sub>y</sub>	i <sub>y</sub>
1 x 1	25.4x25.4	21.40	21.40	4.58	1.75	1.63	0.618	1.75	1.63	0.618
1 x 1 1/2	25.4x38.1	21.40	34.10	7.30	7.07	4.15	0.984	2.78	2.60	0.618
1 x 2	25.4x50.8	21.40	46.80	10.02	18.28	7.81	1.351	3.82	3.57	0.618
1 x 2 1/2	25.4x63.5	21.40	59.50	12.73	37.57	12.63	1.718	4.86	4.54	0.618
1 x 3	25.4x76.2	21.40	72.20	15.45	67.12	18.59	2.084	5.90	5.51	0.618
1 x 3 1/2	25.4x88.9	21.40	84.90	18.17	109.13	25.71	2.451	6.93	6.48	0.618
1 x 4	25.4x101.6	21.40	97.60	20.89	165.80	33.98	2.817	7.97	7.45	0.618
1 x 4 1/2	25.4x114.3	21.40	110.30	23.60	239.31	43.39	3.184	9.01	8.42	0.618
1 x 5	25.4x127.0	21.40	119.00	25.47	300.52	50.51	3.435	9.72	9.08	0.618
1 x 5 1/2	25.4x139.7	21.40	131.70	28.18	407.37	61.86	3.802	10.76	10.05	0.618
1 x 6	25.4x152.4	21.40	144.40	30.90	536.95	74.37	4.168	11.79	11.02	0.618
1 x 6 1/2	25.4x165.1	21.40	157.10	33.62	691.45	88.03	4.535	12.83	11.99	0.618
1 x 7	25.4x177.8	21.40	169.80	36.34	873.06	102.83	4.902	13.87	12.96	0.618
1 x 7 1/2	25.4x190.5	21.40	182.50	39.06	1083.98	118.79	5.268	14.90	13.93	0.618
1 x 8	25.4x203.2	21.40	195.20	41.77	1326.39	135.90	5.635	15.94	14.90	0.618
1 x 8 1/2	25.4x215.9	21.40	207.90	44.49	1602.49	154.16	6.002	16.98	15.87	0.618
1 x 9	25.4x228.6	21.40	220.60	47.21	1914.47	173.57	6.368	18.02	16.84	0.618
1 x 9 1/2	25.4x241.3	21.40	233.30	49.93	2264.52	194.13	6.735	19.05	17.81	0.618
1 x 10	25.4x254.0	21.40	246.00	52.64	2654.84	215.84	7.101	20.09	18.78	0.618
1 x 10 1/2	25.4x266.7	21.40	258.70	55.36	3087.61	238.70	7.468	21.13	19.75	0.618
1 x 11	25.4x279.4	21.40	271.40	58.08	3565.02	262.71	7.835	22.17	20.72	0.618
1 x 11 1/2	25.4x292.1	21.40	284.10	60.80	4089.27	287.88	8.201	23.20	21.68	0.618
1 x 12	25.4x304.8	21.40	296.80	63.52	4662.56	314.19	8.568	24.24	22.65	0.618
1 1/2 x 1 1/2	38.1x38.1	34.10	34.10	11.63	11.27	6.61	0.984	11.27	6.61	0.984
1 1/2 x 2 1/2	38.1x50.8	34.10	46.80	15.96	29.13	12.45	1.351	15.46	9.07	0.984
1 1/2 x 2 1/2	38.1x63.5	34.10	59.50	20.29	59.86	20.12	1.718	19.66	11.53	0.984
1 1/2 x 3 1/2	38.1x76.2	34.10	72.20	24.62	106.95	29.63	2.084	23.86	13.99	0.984
1 1/2 x 3 1/2	38.1x88.9	34.10	84.90	28.95	173.90	40.97	2.451	28.05	16.45	0.984
1 1/2 x 4	38.1x101.6	34.10	97.60	33.28	264.19	54.14	2.817	32.25	18.92	0.984
1 1/2 x 4 1/2	38.1x114.3	34.10	110.30	37.61	381.33	69.14	3.184	36.45	21.38	0.984
1 1/2 x 5	38.1x127.0	34.10	119.00	40.58	478.87	80.48	3.435	39.32	23.06	0.984
1 1/2 x 5 1/2	38.1x139.7	34.10	131.70	44.91	649.13	98.58	3.802	43.52	25.52	0.984

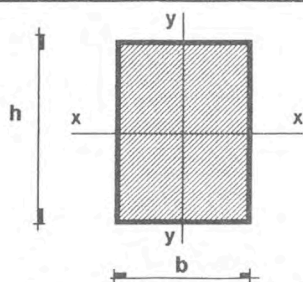
Características geométricas de elementos estructurales  
**ESCUADRIAS DE MADERA**



**b,h,nominal** pulgadas  
**b,h,bruto** mm  
**b,h,neto** mm  
**A** cm<sup>2</sup>  
**I<sub>x</sub>,I<sub>y</sub>** cm<sup>4</sup>  
**W<sub>x</sub>,W<sub>y</sub>** cm<sup>3</sup>  
**i<sub>x</sub>,i<sub>y</sub>** cm

b x h nominal	b x h bruto	b neto	h neto	A	I <sub>x</sub>	W <sub>x</sub>	i <sub>x</sub>	I <sub>y</sub>	W <sub>y</sub>	i <sub>y</sub>
1 1/2 x 6	38.1x152.4	34.1	144.4	49.24	855.61	118.51	4.168	47.71	27.98	0.984
1 1/2 x 6 1/2	38.1x165.1	34.1	157.1	53.57	1101.80	140.27	4.535	51.91	30.45	0.984
1 1/2 x 7	38.1x177.8	34.1	169.8	57.90	1391.19	163.86	4.902	56.11	32.91	0.984
1 1/2 x 7 1/2	38.1x190.5	34.1	182.5	62.23	1727.28	189.29	5.268	60.30	35.37	0.984
1 1/2 x 8	38.1x203.2	34.1	195.2	66.56	2113.55	216.55	5.635	64.50	37.83	0.984
1 1/2 x 8 1/2	38.1x215.9	34.1	207.9	70.89	2553.50	245.65	6.002	68.70	40.29	0.984
1 1/2 x 9	38.1x228.6	34.1	220.6	75.22	3050.63	276.58	6.368	72.89	42.75	0.984
1 1/2 x 9 1/2	38.1x241.3	34.1	233.3	79.56	3608.42	309.34	6.735	77.09	45.21	0.984
1 1/2 x 10	38.1x254.0	34.1	246.0	83.89	4230.37	343.93	7.101	81.29	47.68	0.984
1 1/2 x 10 1/2	38.1x266.7	34.1	258.7	88.22	4919.97	380.36	7.468	85.48	50.14	0.984
1 1/2 x 11	38.1x279.4	34.1	271.4	92.55	5680.71	418.62	7.835	89.68	52.60	0.984
1 1/2 x 11 1/2	38.1x292.1	34.1	284.1	96.88	6516.09	458.72	8.201	93.88	55.06	0.984
1 1/2 x 12	38.1x304.8	34.1	296.8	101.21	7429.59	500.65	8.568	98.07	57.52	0.984
2 x 2	50.8x50.8	46.8	46.8	21.90	39.98	17.08	1.351	39.98	17.08	1.351
2 x 2 1/2	50.8x63.5	46.8	59.5	27.85	82.15	27.61	1.718	50.82	21.72	1.351
2 x 3	50.8x76.2	46.8	72.2	33.79	146.78	40.66	2.084	61.67	26.36	1.351
2 x 3 1/2	50.8x88.9	46.8	84.9	39.73	238.66	56.22	2.451	72.52	30.99	1.351
2 x 4	50.8x101.6	46.8	97.6	45.68	362.59	74.30	2.817	83.37	35.63	1.351
2 x 4 1/2	50.8x114.3	46.8	110.3	51.62	523.35	94.90	3.184	94.22	40.26	1.351
2 x 5	50.8x127.0	46.8	119.0	55.69	657.21	110.46	3.435	101.65	43.44	1.351
2 x 5 1/2	50.8x139.7	46.8	131.7	61.64	890.89	135.29	3.802	112.50	48.08	1.351
2 x 6	50.8x152.4	46.8	144.4	67.58	1174.27	162.64	4.168	123.35	52.71	1.351
2 x 6 1/2	50.8x165.1	46.8	157.1	73.52	1512.14	192.51	4.535	134.19	57.35	1.351
2 x 7	50.8x177.8	46.8	169.8	79.47	1909.32	224.89	4.902	145.04	61.98	1.351
2 x 7 1/2	50.8x190.5	46.8	182.5	85.41	2370.57	259.79	5.268	155.89	66.62	1.351
2 x 8	50.8x203.2	46.8	195.2	91.35	2900.71	297.20	5.635	166.74	71.26	1.351
2 x 8 1/2	50.8x215.9	46.8	207.9	97.30	3504.52	337.13	6.002	177.59	75.89	1.351
2 x 9	50.8x228.6	46.8	220.6	103.24	4186.79	379.58	6.368	188.44	80.53	1.351
2 x 9 1/2	50.8x241.3	46.8	233.3	109.18	4952.32	424.55	6.735	199.28	85.16	1.351
2 x 10	50.8x254.0	46.8	246.0	115.13	5805.91	472.02	7.101	210.13	89.80	1.351
2 x 10 1/2	50.8x266.7	46.8	258.7	121.07	6752.33	522.02	7.468	220.98	94.44	1.351
2 x 11	50.8x279.4	46.8	271.4	127.02	7796.40	574.53	7.835	231.83	99.07	1.351
2 x 11 1/2	50.8x292.1	46.8	284.1	132.96	8942.90	629.56	8.201	242.68	103.71	1.351
2 x 12	50.8x304.8	46.8	296.8	138.90	10196.62	687.10	8.568	253.52	108.34	1.351

Características geométricas de elementos estructurales  
**ESCUADRIAS DE MADERA**



**b,h,nominal** pulgadas  
**b,h,bruto** mm  
**b,h,neto** mm  
**A** cm<sup>2</sup>  
**I<sub>x</sub>,I<sub>y</sub>** cm<sup>4</sup>  
**W<sub>x</sub>,W<sub>y</sub>** cm<sup>3</sup>  
**i<sub>x</sub>,i<sub>y</sub>** cm

b x h nominal	b x h bruto	b neto	h neto	A	I <sub>x</sub>	W <sub>x</sub>	i <sub>x</sub>	I <sub>y</sub>	W <sub>y</sub>	i <sub>y</sub>
3 x 2 1/2	76.2x63.5	72.2	59.5	42.96	126.74	42.60	1.718	186.62	51.69	2.084
3 x 3	76.2x76.2	72.2	72.2	52.13	226.45	62.73	2.084	226.45	62.73	2.084
3 x 3 1/2	76.2x88.9	72.2	84.9	61.30	368.20	86.74	2.451	266.28	73.76	2.084
3 x 4	76.2x101.6	72.2	97.6	70.47	559.38	114.63	2.817	306.11	84.80	2.084
3 x 4 1/2	76.2x114.3	72.2	110.3	79.64	807.39	146.40	3.184	345.94	95.83	2.084
3 x 5	76.2x127.0	72.2	119.0	85.92	1013.90	170.40	3.435	373.23	103.39	2.084
3 x 5 1/2	76.2x139.7	72.2	131.7	95.09	1374.40	208.72	3.802	413.06	114.42	2.084
3 x 6	76.2x152.4	72.2	144.4	104.26	1811.58	250.91	4.168	452.90	125.46	2.084
3 x 6 1/2	76.2x165.1	72.2	157.1	113.43	2332.84	296.99	4.535	492.73	136.49	2.084
3 x 7	76.2x177.8	72.2	169.8	122.60	2945.57	346.95	4.902	532.56	147.52	2.084
3 x 7 1/2	76.2x190.5	72.2	182.5	131.77	3657.17	400.79	5.268	572.39	158.56	2.084
3 x 8	76.2x203.2	72.2	195.2	140.93	4475.02	458.51	5.635	612.22	169.59	2.084
3 x 8 1/2	76.2x215.9	72.2	207.9	150.10	5406.54	520.11	6.002	652.06	180.62	2.084
3 x 9	76.2x228.6	72.2	220.6	159.27	6459.11	585.59	6.368	691.89	191.66	2.084
3 x 9 1/2	76.2x241.3	72.2	233.3	168.44	7640.12	654.96	6.735	731.72	202.69	2.084
3 x 10	76.2x254.0	72.2	246.0	177.61	8956.97	728.21	7.101	771.55	213.73	2.084
3 x 10 1/2	76.2x266.7	72.2	258.7	186.78	10417.06	805.34	7.468	811.38	224.76	2.084
3 x 11	76.2x279.4	72.2	271.4	195.95	12027.78	886.35	7.835	851.22	235.79	2.084
3 x 11 1/2	76.2x292.1	72.2	284.1	205.12	13796.52	971.24	8.201	891.05	246.83	2.084
3 x 12	76.2x304.8	72.2	296.8	214.29	15730.69	1060.02	8.568	930.88	257.86	2.084
4 x 2 1/2	101.6x63.5	97.6	59.5	58.07	171.32	57.59	1.718	460.98	94.46	2.817
4 x 3	101.6x76.2	97.6	72.2	70.47	306.11	84.80	2.084	559.38	114.63	2.817
4 x 3 1/2	101.6x88.9	97.6	84.9	82.86	497.73	117.25	2.451	657.77	134.79	2.817
4 x 4	101.6x101.6	97.6	97.6	95.26	756.17	154.95	2.817	756.17	154.95	2.817
4 x 4 1/2	101.6x114.3	97.6	110.3	107.65	1091.43	197.90	3.184	854.56	175.12	2.817
4 x 5	101.6x127.0	97.6	119.0	116.14	1370.60	230.35	3.435	921.97	188.93	2.817
4 x 5 1/2	101.6x139.7	97.6	131.7	128.54	1857.92	282.14	3.802	1020.36	209.09	2.817
4 x 6	101.6x152.4	97.6	144.4	140.93	2448.89	339.18	4.168	1118.76	229.25	2.817
4 x 6 1/2	101.6x165.1	97.6	157.1	153.33	3153.53	401.47	4.535	1217.15	249.42	2.817
4 x 7	101.6x177.8	97.6	169.8	165.72	3981.82	469.00	4.902	1315.55	269.58	2.817
4 x 7 1/2	101.6x190.5	97.6	182.5	178.12	4943.76	541.78	5.268	1413.94	289.74	2.817
4 x 8	101.6x203.2	97.6	195.2	190.52	6049.34	619.81	5.635	1512.34	309.90	2.817
4 x 8 1/2	101.6x215.9	97.6	207.9	202.91	7308.56	703.08	6.002	1610.73	330.07	2.817
4 x 9	101.6x228.6	97.6	220.6	215.31	8731.42	791.61	6.368	1709.12	350.23	2.817
4 x 9 1/2	101.6x241.3	97.6	233.3	227.70	10327.92	885.38	6.735	1807.52	370.39	2.817
4 x 10	101.6x254.0	97.6	246.0	240.10	12108.04	984.39	7.101	1905.91	390.56	2.817
4 x 10 1/2	101.6x266.7	97.6	258.7	252.49	14081.79	1088.66	7.468	2004.31	410.72	2.817
4 x 11	101.6x279.4	97.6	271.4	264.89	16259.16	1198.17	7.835	2102.70	430.88	2.817
4 x 11 1/2	101.6x292.1	97.6	284.1	277.28	18650.15	1312.93	8.201	2201.10	451.04	2.817
4 x 12	101.6x304.8	97.6	296.8	289.68	21264.75	1432.93	8.568	2299.49	471.21	2.817

**Características geométricas de elementos estructurales  
PERFILES DE ACERO I**

segun DIN 1025

largos normales: 4 a 15 m

**h,bo,b,r,r1,d**    mms

**A**                    cms2

**g**                     daN/m

**ly,lx**                cms4

**Wx,Wy**              cms3

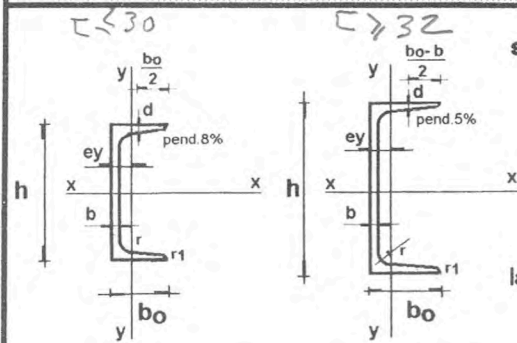
**ix,iy**                cms

**SLn**                 cms3

I	h	bo	b=r	d	r1	A	g	lx	Wx	ix	ly	Wy	iy	SLN
8	80	42	3.9	5.9	2.3	7.54	5.94	77.8	19.5	3.20	6.3	3.00	0.91	11.4
10	100	50	4.5	6.8	2.7	10.6	8.34	171	34.2	4.01	12.2	4.88	1.07	19.9
12	120	58	5.1	7.7	3.1	14.2	11.1	328	54.7	4.81	21.5	7.41	1.23	31.8
14	140	66	5.7	8.6	3.4	18.2	14.3	573	81.09	5.61	35.2	10.70	1.40	47.7
16	160	74	6.3	9.5	3.8	22.8	17.9	935	117	6.40	54.7	14.80	1.55	68.0
18	180	82	6.9	10.4	4.1	27.9	21.9	1450	161	7.20	81.3	19.80	1.71	93.4
20	200	90	7.5	11.3	4.5	33.4	26.2	2140	214	8.00	117	26.00	1.87	125
22	220	98	8.1	12.2	4.9	39.5	31.1	3060	278	8.80	162	33.10	2.02	162
24	240	106	8.7	13.1	5.2	46.1	36.2	4250	354	9.59	221	41.70	2.20	206
26	260	113	9.4	14.1	5.6	53.3	41.9	5740	442	10.4	288	51.00	2.32	257
28	280	119	10.1	15.2	6.1	61.0	47.9	7590	542	11.1	364	61.20	2.45	316
30	300	125	10.8	16.2	6.5	69.0	54.2	9800	653	11.9	451	72.20	2.56	381
32	320	131	11.5	17.3	6.9	77.7	61.0	12510	782	12.7	555	84.70	2.67	457
34	340	137	12.2	18.3	7.3	86.7	68.0	15700	923	13.5	674	98.40	2.80	540
36	360	143	13.0	19.5	7.8	97.0	76.1	19610	1090	14.2	818	114	2.90	638
38	380	149	13.7	20.5	8.2	107	84.0	24010	1260	15.0	975	131	3.02	741
40	400	155	14.4	21.6	8.6	118	92.4	29210	1460	15.70	1160	149	3.13	857
42 1/2	425	163	15.3	23.0	9.2	132	104	36970	1740	16.70	1440	176	3.30	1020
45	450	170	16.2	24.3	9.7	147	115	45850	2040	17.70	1730	203	3.43	1200
47 1/2	475	178	17.1	25.6	10.3	163	128	56480	2380	18.60	2090	235	3.60	1400
50	500	185	18.0	27.0	10.8	179	141	68740	2750	19.60	2480	268	3.72	1620
55	550	200	19.0	30.0	11.9	212	166	99180	3610	21.60	3490	349	4.02	2120
60	600	215	21.6	32.4	13.0	254	199	139000	4630	23.40	4670	434	4.30	2730

NOTA: LOS PERFILES DENTRO DEL RECUADRO SON LOS QUE USUALMENTE SE ENCUENTRAN DISPONIBLES EN PLAZA.

### Características geométricas de elementos estructurales PERFILES [ DE ACERO



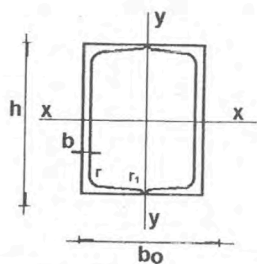
segun DIN 1026

largos normales 4 a 15 m para perfiles [ > 8  
3 a 12 m para perfiles [ ≤ 8

<b>h,bo,b,r,r1,d</b>	mms
<b>A</b>	cms2
<b>g</b>	daN/m
<b>ly,lx</b>	cms4
<b>Wx,Wy</b>	cms3
<b>ey,ix,iy</b>	cms
<b>SLN</b>	cms3

	h	bo	b	d=r	r1	A	g	ey	lx	Wx	ix	ly	Wy	iy	SLN
3	30	33	5	7	3.5	5.44	4.27	1.31	6.39	4.26	1.08	5.33	2.68	0.99	-
4	40	35	5	7	3.5	6.21	4.87	1.33	14.1	7.05	1.50	6.68	3.08	1.04	-
5	50	38	5	7	3.5	7.12	5.59	1.37	26.4	10.6	1.92	9.12	3.75	1.13	-
6 1/2	65	42	5.5	7.5	4	9.03	7.09	1.42	57.5	17.7	2.52	14.1	5.07	1.25	-
8	80	45	6	8	4	11.0	8.64	1.45	106	26.5	3.10	19.4	6.36	1.33	15.9
10	100	50	6	8.5	4.5	13.5	10.6	1.55	206	41.2	3.91	29.3	8.49	1.47	24.5
12	120	55	7	9	4.5	17.0	13.4	1.60	364	60.7	4.62	43.2	11.1	1.59	36.3
14	140	60	7	10	5	20.4	16.0	1.75	605	86.4	5.45	62.7	14.8	1.75	51.4
16	160	65	7.5	10.5	5.5	24.0	18.8	1.84	925	116	6.21	85.3	18.3	1.89	68.8
18	180	70	8	11	5.5	28.0	22.0	1.92	1350	150	6.95	114	22.4	2.02	89.6
20	200	75	8.5	11.5	6	32.2	25.3	2.01	1910	191	7.7	148	27.0	2.14	114
22	220	80	9	12.5	6.5	37.4	29.4	2.14	2690	245	8.48	197	33.6	2.30	146
24	240	85	9.5	13	6.5	42.3	33.2	2.23	3600	300	9.22	248	39.6	2.42	179
26	260	90	10	14	7	48.3	37.9	2.36	4820	371	9.99	317	47.7	2.56	221
28	280	95	10	15	7.5	53.3	41.8	2.53	6280	448	10.9	399	57.2	2.74	266
30	300	100	10	16	8	58.8	46.2	2.70	8030	535	11.7	495	67.8	2.90	316
32	320	100	14	17.5	8.75	75.8	59.5	2.60	10870	679	12.1	597	80.6	2.81	413
35	350	100	14	16	8	77.3	60.6	2.40	12840	734	12.9	570	75.0	2.72	459
38	380	102	13.5	16	8	80.4	63.1	2.38	15760	829	14.0	615	78.7	2.77	507
40	400	110	14	18	9	91.5	71.8	2.65	20350	1020	14.9	846	102	3.04	618

Características geométricas de elementos estructurales  
**COMBINACION DE PERFILES [ DE ACERO**

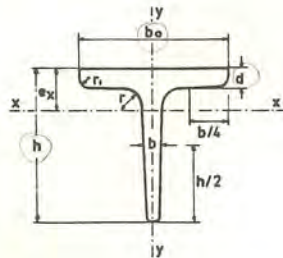


h,bo,b,d,r,r1 mm  
 A cms2  
 g daN/m  
 Iy,Ix cms4  
 Wx,Wy cms3  
 ix,Iy cms

	h	bo	b	d=r	r1	A	g	Ix	Wx	ix	Iy	Wy	Iy
3	30	66.00	5.00	7.0	3.50	10.88	8.54	12.78	8.52	1.08	53.55	16.3	2.22
4	40	70.00	5.00	7.0	3.50	12.42	9.74	28.20	14.10	1.50	71.84	20.5	2.41
5	50	76.00	5.00	7.0	3.50	14.24	11.18	52.80	21.12	1.92	102.33	26.9	2.68
6 1/2	65	84.00	5.50	7.5	4.00	18.06	14.18	115.00	35.38	2.52	167.77	39.9	3.05
8	80	90.00	6.00	8.0	4.00	22.00	17.28	212.00	53.00	3.10	243.46	54.1	3.33
10	100	100.00	6.00	8.5	4.50	27.00	21.20	412.00	82.40	3.91	379.97	76.0	3.75
12	120	110.00	7.00	9.0	4.50	34.00	26.80	728.00	121.33	4.62	603.54	109.7	4.21
14	140	120.00	7.00	10.0	5.00	40.80	32.00	1210.00	172.86	5.45	862.35	143.7	4.60
16	160	130.00	7.50	10.5	5.50	48.00	37.60	1850.00	231.25	6.21	1212.95	186.6	5.03
18	180	140.00	8.00	11.0	5.50	56.00	44.00	2700.00	300.00	6.95	1673.16	239.0	5.47
20	200	150.00	8.50	11.5	6.00	64.40	50.60	3820.00	382.00	7.7	2237.02	298.3	5.89
22	220	160.00	9.00	12.5	6.50	74.80	58.80	5380.00	489.09	8.48	2962.60	370.3	6.29
24	240	170.00	9.50	13.0	6.50	84.60	66.40	7200.00	600.00	9.22	3821.87	449.6	6.72
26	260	180.00	10.00	14.0	7.00	96.60	75.80	9640.00	741.54	9.99	4893.06	543.7	7.12
28	280	190.00	10.00	15.0	7.50	106.60	83.60	12560.00	897.14	10.9	5976.72	629.1	7.49
30	300	200.00	10.00	16.0	8.00	117.60	92.40	16060.00	1070.67	11.7	7256.90	725.7	7.86
32	320	200.00	14.00	17.5	8.75	151.60	119.00	21740.00	1358.75	12.1	9495.62	949.6	7.91
35	350	200.00	14.00	16.0	8.00	154.60	121.20	25680.00	1467.43	12.9	10069.70	1007.0	8.07
38	380	204.00	13.34	16.0	8.00	160.80	126.20	31520.00	1658.95	14.10	11063.31	1084.6	8.33
40	400	220.00	14.00	18.0	9.00	183.00	143.60	40700.00	2035.00	14.9	14451.20	1313.7	8.89

NOTA: LOS PERFILES DENTRO DEL RECUADRO SON LOS QUE USUALMENTE SE ENCUENTRAN DISPONIBLES EN PLAZA.

Características geométricas de elementos estructurales  
ACEROS T DE ALMA ALTA



UNIT 646 - 81

$b = h$

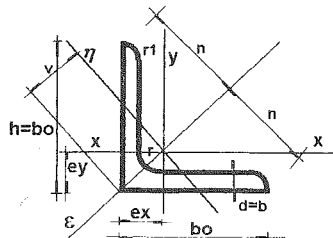
largos normales 6.50m  
7.00m  
7.50m

DENOMINACION pulgadas  
bo,h,d,r1,r2,r3 cm  
A cm<sup>2</sup>  
g daN/m  
ex, ix, iy cm  
bx, ly cm<sup>4</sup>  
Wx, Wy cm<sup>3</sup>

DENOMINACION	bo	h	d	r1	r2	r3	A	g	ex	bx	Wx	ix	ly	Wy	iy
5/8 x 1/8	1.59	1.59	0.32	0.30	0.15	0.10	0.93	0.73	0.50	0.19	0.18	0.45	0.11	0.13	0.34
3/4 x 1/8	1.91	1.91	0.32	0.30	0.15	0.10	1.13	0.89	0.57	0.34	0.26	0.55	0.18	0.19	0.40
7/8 x 1/8	2.22	2.22	0.32	0.30	0.15	0.10	1.33	1.04	0.64	0.55	0.35	0.65	0.28	0.25	0.46
1 x 1/8	2.54	2.54	0.32	0.35	0.20	0.10	1.54	1.21	0.71	0.84	0.46	0.74	0.41	0.32	0.52
1 x 3/16	2.54	2.54	0.48	0.35	0.20	0.10	2.21	1.74	0.79	1.20	0.69	0.74	0.64	0.51	0.54
1 x 1/4	2.54	2.54	0.64	0.35	0.20	0.10	2.84	2.23	0.85	1.50	0.89	0.73	0.89	0.70	0.56
1 1/8 x 1/8	2.86	2.86	0.32	0.35	0.20	0.10	1.74	1.36	0.78	1.22	0.59	0.84	0.59	0.41	0.58
1 1/8 x 3/16	2.86	2.86	0.48	0.35	0.20	0.10	2.52	1.98	0.86	1.75	0.88	0.83	0.92	0.64	0.60
1 1/8 x 1/4	2.86	2.86	0.64	0.35	0.20	0.10	3.25	2.55	0.93	2.21	1.14	0.82	1.26	0.88	0.62
1 1/4 x 1/8	3.18	3.18	0.32	0.40	0.25	0.15	1.94	1.52	0.85	1.66	0.71	0.92	0.79	0.49	0.64
1 1/4 x 3/16	3.18	3.18	0.48	0.40	0.25	0.15	2.82	2.22	0.93	2.43	1.08	0.93	1.23	0.78	0.66
1 1/4 x 1/4	3.18	3.18	0.64	0.40	0.25	0.15	3.65	2.87	1.00	3.09	1.42	0.92	1.70	1.07	0.68
1 1/2 x 1/8	3.81	3.81	0.32	0.45	0.25	0.15	2.36	1.85	0.98	2.87	1.02	1.10	1.36	0.71	0.76
1 1/2 x 3/16	3.81	3.81	0.48	0.45	0.25	0.15	3.44	2.70	1.07	4.26	1.56	1.11	2.12	1.11	0.78
1 1/2 x 1/4	3.81	3.81	0.64	0.45	0.25	0.15	4.47	3.51	1.15	5.50	2.06	1.11	2.90	1.52	0.81
1 3/4 x 1/8	4.45	4.45	0.32	0.55	0.30	0.15	2.79	2.19	1.11	4.58	1.37	1.28	2.11	0.95	0.87
1 3/4 x 3/16	4.45	4.45	0.48	0.55	0.30	0.15	4.08	3.20	1.21	6.90	2.13	1.30	3.32	1.49	0.90
1 3/4 x 1/4	4.45	4.45	0.64	0.55	0.30	0.15	5.31	4.17	1.29	8.98	2.84	1.30	4.55	2.04	0.93
2 x 1/8	5.08	5.08	0.32	0.60	0.30	0.15	3.22	2.53	1.23	6.79	1.76	1.45	3.15	1.24	0.99
2 x 3/16	5.08	5.08	0.48	0.60	0.30	0.15	4.70	3.69	1.34	10.34	2.77	1.48	4.94	1.94	1.03
2 x 1/4	5.08	5.08	0.64	0.60	0.30	0.15	6.13	4.81	1.43	13.56	3.72	1.49	6.75	2.66	1.05
2 x 5/16	5.08	5.08	0.79	0.60	0.30	0.15	7.42	5.83	1.50	16.33	4.56	1.48	8.47	3.34	1.07
2 x 3/8	5.08	5.08	0.95	0.60	0.30	0.15	8.76	6.87	1.57	19.05	5.43	1.47	10.35	4.07	1.09
2 1/4 x 3/16	5.72	5.72	0.48	0.60	0.30	0.15	5.30	4.16	1.48	14.79	3.49	1.67	7.04	2.46	1.15
2 1/4 x 1/4	5.72	5.72	0.64	0.60	0.30	0.15	6.94	5.45	1.57	19.55	4.72	1.68	9.60	3.36	1.18
2 1/4 x 5/16	5.72	5.72	0.79	0.60	0.30	0.15	8.42	6.61	1.65	23.68	5.81	1.68	12.04	4.21	1.20
2 1/4 x 3/8	5.72	5.72	0.95	0.60	0.30	0.15	9.96	7.82	1.72	27.75	6.94	1.67	14.68	5.13	1.21
2 1/2 x 3/16	6.35	6.35	0.48	0.70	0.35	0.20	5.94	4.66	1.60	20.08	4.23	1.84	9.50	2.99	1.26
2 1/2 x 1/4	6.35	6.35	0.64	0.70	0.35	0.20	7.77	6.10	1.70	26.80	5.77	1.86	12.99	4.09	1.29
2 1/2 x 5/16	6.35	6.35	0.79	0.70	0.35	0.20	9.44	7.41	1.78	32.66	7.15	1.86	16.31	5.14	1.31
2 1/2 x 3/8	6.35	6.35	0.95	0.70	0.35	0.20	11.17	8.77	1.86	38.49	8.57	1.86	19.89	6.26	1.33
2 3/4 x 1/4	6.99	6.99	0.64	0.80	0.40	0.20	8.62	6.77	1.84	35.94	6.98	2.04	17.14	4.91	1.41
2 3/4 x 5/16	6.99	6.99	0.79	0.80	0.40	0.20	10.49	8.23	1.92	44.00	8.69	2.05	21.54	6.16	1.43
2 3/4 x 3/8	6.99	6.99	0.95	0.80	0.40	0.20	12.42	9.75	2.00	52.05	10.44	2.05	26.29	7.52	1.45
3 x 1/4	7.62	7.62	0.64	0.80	0.40	0.20	9.42	7.40	1.97	46.62	8.26	2.22	22.18	5.82	1.53
3 x 5/16	7.62	7.62	0.79	0.80	0.40	0.20	11.47	9.00	2.06	57.30	10.31	2.24	27.86	7.31	1.56
3 x 3/8	7.62	7.62	0.95	0.80	0.40	0.20	13.61	10.68	2.15	68.03	12.43	2.24	33.97	8.92	1.58
3 x 1/2	7.62	7.62	1.27	0.80	0.40	0.20	17.73	13.92	2.29	87.66	16.45	2.22	46.40	12.18	1.62



Características geométricas de elementos estructurales  
ACEROS 'L' DE ALAS IGUALES



UNIT 645 - 81

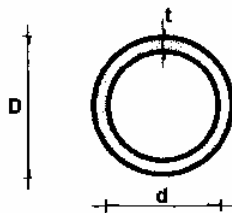
largos normales : 6.50m  
7.00m  
7.50m

DENOMINACION pulgadas  
bo,b,r1,r2 cm  
A cm<sup>2</sup>  
g daN/m  
ei,ix,iy,iε,iη cm  
lx,ly,lε,lη cm<sup>4</sup>  
Wx,Wy cm<sup>3</sup>

DENOMINACION	bo	b	r1	r2	A	g	ex=ey	lx=ly	ix=iy	l <sub>ε</sub>	i <sub>ε</sub>	l <sub>η</sub>	i <sub>η</sub>
5/8 x 1/8	1.59	0.32	0.20	0.35	0.92	0.73	0.50	0.19	0.46	0.30	0.57	0.08	0.29
3/4 x 1/8	1.91	0.32	0.20	0.35	1.13	0.89	0.58	0.35	0.56	0.56	0.70	0.14	0.36
7/8 x 1/8	2.22	0.32	0.20	0.35	1.33	1.04	0.66	0.57	0.66	0.91	0.83	0.23	0.42
1 x 1/8	2.54	0.32	0.25	0.50	1.55	1.22	0.73	0.87	0.75	1.40	0.95	0.35	0.47
1 x 3/16	2.54	0.48	0.25	0.50	2.23	1.75	0.80	1.22	0.74	1.91	0.92	0.51	0.48
1 x 1/4	2.54	0.64	0.25	0.50	2.87	2.25	0.86	1.51	0.73	2.28	0.89	0.67	0.48
1 1/8 x 1/8	2.86	0.32	0.25	0.50	1.75	1.38	0.81	1.28	0.85	2.05	1.08	0.51	0.54
1 1/8 x 3/16	2.86	0.48	0.25	0.50	2.54	2.00	0.88	1.79	0.84	2.83	1.06	0.74	0.54
1 1/8 x 1/4	2.86	0.64	0.25	0.50	3.28	2.57	0.94	2.24	0.83	3.44	1.02	0.97	0.54
1 1/4 x 1/8	3.18	0.32	0.25	0.50	1.96	1.54	0.89	1.79	0.96	2.88	1.21	0.72	0.61
1 1/4 x 3/16	3.18	0.48	0.25	0.50	2.85	2.24	0.96	2.53	0.94	4.01	1.19	1.04	0.60
1 1/4 x 1/4	3.18	0.64	0.25	0.50	3.69	2.89	1.02	3.17	0.93	4.92	1.16	1.36	0.61
1 1/2 x 1/8	3.81	0.32	0.30	0.65	2.39	1.87	1.03	3.14	1.15	5.05	1.45	1.26	0.73
1 1/2 x 3/16	3.81	0.48	0.30	0.65	3.48	2.73	1.10	4.49	1.14	7.16	1.43	1.83	0.72
1 1/2 x 1/4	3.81	0.64	0.30	0.65	4.52	3.55	1.17	5.68	1.12	8.95	1.41	2.37	0.72
1 3/4 x 1/8	4.45	0.32	0.30	0.65	2.80	2.20	1.19	5.13	1.35	8.23	1.72	2.06	0.86
1 3/4 x 3/16	4.45	0.48	0.30	0.65	4.09	3.21	1.26	7.37	1.34	11.77	1.70	2.99	0.85
1 3/4 x 1/4	4.45	0.64	0.30	0.65	5.34	4.19	1.33	9.39	1.33	14.87	1.67	3.88	0.85
2 x 1/8	5.08	0.32	0.30	0.65	3.20	2.51	1.35	7.76	1.56	12.45	1.97	3.13	0.99
2 x 3/16	5.08	0.48	0.30	0.65	4.70	3.69	1.42	11.21	1.54	17.92	1.95	4.54	0.98
2 x 1/4	5.08	0.64	0.30	0.65	6.14	4.82	1.49	14.35	1.53	22.80	1.93	5.89	0.98
2 x 5/16	5.08	0.79	0.30	0.65	7.45	5.85	1.54	17.05	1.51	26.88	1.90	7.11	0.98
2 x 3/8	5.08	0.95	0.30	0.65	8.80	6.91	1.60	19.69	1.50	30.69	1.87	8.39	0.98
2 1/4 x 3/16	5.72	0.48	0.40	0.80	5.33	4.18	1.56	16.06	1.74	25.79	2.20	6.43	1.10
2 1/4 x 1/4	5.72	0.64	0.40	0.80	6.98	5.48	1.63	20.71	1.72	33.10	2.18	8.38	1.10
2 1/4 x 5/16	5.72	0.79	0.40	0.80	8.48	6.66	1.70	24.75	1.71	39.29	2.15	10.15	1.09
2 1/4 x 3/8	5.72	0.95	0.40	0.80	10.03	7.88	1.76	28.73	1.69	45.22	2.12	11.99	1.09
2 1/2 x 3/16	6.35	0.48	0.40	0.85	5.95	4.67	1.72	22.33	1.94	35.83	2.45	8.99	1.23
2 1/2 x 1/4	6.35	0.64	0.40	0.85	7.80	6.13	1.79	28.88	1.92	46.15	2.43	11.70	1.22
2 1/2 x 5/16	6.35	0.79	0.40	0.85	9.50	7.45	1.85	34.60	1.91	55.03	2.41	14.15	1.22
2 1/2 x 3/8	6.35	0.95	0.40	0.85	11.25	8.83	1.91	40.28	1.89	63.65	2.38	16.70	1.22
2 3/4 x 1/4	6.99	0.64	0.45	0.90	8.62	6.77	1.94	38.90	2.12	62.32	2.69	15.66	1.35
2 3/4 x 5/16	6.99	0.79	0.45	0.90	10.51	8.25	2.01	46.77	2.11	74.61	2.66	18.98	1.34
2 3/4 x 3/8	6.99	0.95	0.45	0.90	12.47	9.79	2.07	54.63	2.09	86.69	2.64	22.42	1.34
3 x 1/4	7.62	0.64	0.50	1.00	9.45	7.42	2.09	50.79	2.32	81.51	2.94	20.39	1.47
3 x 5/16	7.62	0.79	0.50	1.00	11.52	9.05	2.16	61.24	2.31	97.92	2.92	24.75	1.47
3 x 3/8	7.62	0.95	0.50	1.00	13.68	10.74	2.22	71.74	2.29	114.19	2.89	29.26	1.46
3 x 1/2	7.62	1.27	0.50	1.00	17.85	14.01	2.34	90.92	2.26	142.96	2.83	38.03	1.46

BARRAS DE SECCION CIRCULAR													
DIAMETRO (mm)	6	8	10	12	14	16	20	25	32	40			
PERIMETRO (cm)	1.885	2.513	3.142	3.770	4.398	5.026	6.283	7.854	10,053	12,566			
PESO (daN/ml)	0.222	0.395	0.617	0.888	1,208	1,578	2,466	3.853	6,313	9.865			
SECCION (cm <sup>2</sup> )	0.283	0.503	0.785	1.131	1,539	2,011	3,141	4.909	8,042	12,566			
COMBINACION DE BARRAS													
2 $\phi$		3 $\phi$		4 $\phi$		5 $\phi$				6 $\phi$			
Area	Barras	Area	Barras	Area	Barras	Area	Barras	Area	Barras	Area	Barras	Area	Barras
0.57	2 $\phi$ 6	0.85	3 $\phi$ 6	1.13	4 $\phi$ 6	1.41	5 $\phi$ 6	30,81	3 $\phi$ 25+2 $\phi$ 32	1.70	6 $\phi$ 6	20,61	5 $\phi$ 20+1 $\phi$ 25
0.79	1 $\phi$ 6+1 $\phi$ 8	1.07	2 $\phi$ 6+1 $\phi$ 8	1.35	3 $\phi$ 6+1 $\phi$ 8	1.63	4 $\phi$ 6+1 $\phi$ 8	33,95	2 $\phi$ 25+3 $\phi$ 32	1.92	5 $\phi$ 6+1 $\phi$ 8	22,38	4 $\phi$ 20+2 $\phi$ 25
1.01	2 $\phi$ 8	1.29	1 $\phi$ 6+2 $\phi$ 8	1.57	2 $\phi$ 6+2 $\phi$ 8	1.85	3 $\phi$ 6+2 $\phi$ 8	37,08	1 $\phi$ 25+4 $\phi$ 32	2.14	4 $\phi$ 6+2 $\phi$ 8	24,15	3 $\phi$ 20+3 $\phi$ 25
1.29	1 $\phi$ 8+1 $\phi$ 10	1.51	3 $\phi$ 8	1.79	1 $\phi$ 6+3 $\phi$ 8	2.07	2 $\phi$ 6+3 $\phi$ 8	40,21	5 $\phi$ 32	2.36	3 $\phi$ 6+3 $\phi$ 8	25,92	2 $\phi$ 20+4 $\phi$ 25
1.57	2 $\phi$ 10	1.79	2 $\phi$ 8+1 $\phi$ 10	2.01	4 $\phi$ 8	2.29	1 $\phi$ 6+4 $\phi$ 8	44,74	4 $\phi$ 32+1 $\phi$ 40	2.58	2 $\phi$ 6+4 $\phi$ 8	27,68	1 $\phi$ 20+5 $\phi$ 25
1.92	1 $\phi$ 10+1 $\phi$ 12	2.07	1 $\phi$ 8+2 $\phi$ 10	2.29	3 $\phi$ 8+1 $\phi$ 10	2.51	5 $\phi$ 8	49,26	3 $\phi$ 32+2 $\phi$ 40	2.80	1 $\phi$ 6+5 $\phi$ 8	29,45	6 $\phi$ 25
2.26	2 $\phi$ 12	2.35	3 $\phi$ 10	2.58	2 $\phi$ 8+2 $\phi$ 10	2.80	4 $\phi$ 8+1 $\phi$ 10	53,78	2 $\phi$ 32+3 $\phi$ 40	3.02	6 $\phi$ 8	32,58	5 $\phi$ 25+1 $\phi$ 32
2,67	1 $\phi$ 12+1 $\phi$ 14	2.70	2 $\phi$ 10+1 $\phi$ 12	2.86	1 $\phi$ 8+3 $\phi$ 10	3.08	3 $\phi$ 8+2 $\phi$ 10	58,3	1 $\phi$ 32+4 $\phi$ 40	3.30	5 $\phi$ 8+1 $\phi$ 10	35,72	4 $\phi$ 25+2 $\phi$ 32
3,08	2 $\phi$ 14	3.05	1 $\phi$ 10+2 $\phi$ 12	3.14	4 $\phi$ 10	3.36	2 $\phi$ 8+3 $\phi$ 10	62,83	5 $\phi$ 40	3.58	4 $\phi$ 8+2 $\phi$ 10	38,86	3 $\phi$ 25+3 $\phi$ 32
3,55	1 $\phi$ 14+1 $\phi$ 16	3.39	3 $\phi$ 12	3.49	3 $\phi$ 10+1 $\phi$ 12	3.64	1 $\phi$ 8+4 $\phi$ 10			3.86	3 $\phi$ 8+3 $\phi$ 10	41,99	2 $\phi$ 25+4 $\phi$ 32
4,02	2 $\phi$ 16	3.80	2 $\phi$ 12+1 $\phi$ 14	3.83	2 $\phi$ 10+2 $\phi$ 12	3.92	5 $\phi$ 10			4.15	2 $\phi$ 8+4 $\phi$ 10	45,12	1 $\phi$ 25+5 $\phi$ 32
5,15	1 $\phi$ 16+1 $\phi$ 20	4,21	1 $\phi$ 12+2 $\phi$ 14	4.18	1 $\phi$ 10+3 $\phi$ 12	4.27	4 $\phi$ 10+1 $\phi$ 12			4.43	1 $\phi$ 8+5 $\phi$ 10	48,25	6 $\phi$ 32
6,28	2 $\phi$ 20	4,62	3 $\phi$ 14	4.52	4 $\phi$ 12	4.62	3 $\phi$ 10+2 $\phi$ 12			4.71	6 $\phi$ 10	52,78	5 $\phi$ 32+1 $\phi$ 40
8,05	1 $\phi$ 20+1 $\phi$ 25	5,09	2 $\phi$ 14+1 $\phi$ 16	4,93	3 $\phi$ 12+1 $\phi$ 14	4.96	2 $\phi$ 10+3 $\phi$ 12			5.06	5 $\phi$ 10+1 $\phi$ 12	57.30	4 $\phi$ 32+2 $\phi$ 40
9,82	2 $\phi$ 25	5,56	1 $\phi$ 14+2 $\phi$ 16	5,34	2 $\phi$ 12+2 $\phi$ 14	5.31	1 $\phi$ 10+4 $\phi$ 12			5.40	4 $\phi$ 10+2 $\phi$ 12	61,83	3 $\phi$ 32+3 $\phi$ 40
12,95	1 $\phi$ 25+1 $\phi$ 32	6,03	3 $\phi$ 16	5,75	1 $\phi$ 12+3 $\phi$ 14	5.65	5 $\phi$ 12			5.75	3 $\phi$ 10+3 $\phi$ 12	66,34	2 $\phi$ 32+4 $\phi$ 40
16,08	2 $\phi$ 32	7,16	2 $\phi$ 16+1 $\phi$ 20	6,16	4 $\phi$ 14	6.06	4 $\phi$ 12+1 $\phi$ 14			6.09	2 $\phi$ 10+4 $\phi$ 12	70,87	1 $\phi$ 32+5 $\phi$ 40
20,61	1 $\phi$ 32+1 $\phi$ 40	8,29	1 $\phi$ 16+2 $\phi$ 20	6,63	3 $\phi$ 14+1 $\phi$ 16	6,47	3 $\phi$ 12+2 $\phi$ 14			6.44	1 $\phi$ 10+5 $\phi$ 12	75.40	6 $\phi$ 40
25,13	2 $\phi$ 40	9,42	3 $\phi$ 20	7.10	2 $\phi$ 14+2 $\phi$ 16	6,88	2 $\phi$ 12+3 $\phi$ 14			6.79	6 $\phi$ 12		
		11.19	2 $\phi$ 20+1 $\phi$ 25	7,57	1 $\phi$ 14+3 $\phi$ 16	7,29	1 $\phi$ 12+4 $\phi$ 14			7.19	5 $\phi$ 12+1 $\phi$ 14		
		12.96	1 $\phi$ 20+2 $\phi$ 25	8,04	4 $\phi$ 16	7,69	5 $\phi$ 14			7.60	4 $\phi$ 12+2 $\phi$ 14		
		14.73	3 $\phi$ 25	9,17	3 $\phi$ 16+1 $\phi$ 20	8,17	4 $\phi$ 14+1 $\phi$ 16			8,01	3 $\phi$ 12+3 $\phi$ 14		
		17.86	2 $\phi$ 25+1 $\phi$ 32	10,30	2 $\phi$ 16+2 $\phi$ 20	8,64	3 $\phi$ 14+2 $\phi$ 16			8,42	2 $\phi$ 12+4 $\phi$ 14		
		20.99	1 $\phi$ 25+2 $\phi$ 32	11.43	1 $\phi$ 16+3 $\phi$ 20	9,11	2 $\phi$ 14+3 $\phi$ 16			8,82	1 $\phi$ 12+5 $\phi$ 14		
		24.13	3 $\phi$ 32	12.56	4 $\phi$ 20	9,58	1 $\phi$ 14+4 $\phi$ 16			9,23	6 $\phi$ 14		
		28.65	2 $\phi$ 32+1 $\phi$ 40	14.33	3 $\phi$ 20+1 $\phi$ 25	10,05	5 $\phi$ 16			9.70	5 $\phi$ 14+1 $\phi$ 16		
		33.17	1 $\phi$ 32+2 $\phi$ 40	16.10	2 $\phi$ 20+2 $\phi$ 25	11,18	4 $\phi$ 16+1 $\phi$ 20			10,18	4 $\phi$ 14+2 $\phi$ 16		
		37.70	3 $\phi$ 40	17.87	1 $\phi$ 20+3 $\phi$ 25	12,31	3 $\phi$ 16+2 $\phi$ 20			10,65	3 $\phi$ 14+3 $\phi$ 16		
				19.64	4 $\phi$ 25	13,44	2 $\phi$ 16+3 $\phi$ 20			11,12	2 $\phi$ 14+4 $\phi$ 16		
				22.77	3 $\phi$ 25+1 $\phi$ 32	14,57	1 $\phi$ 16+4 $\phi$ 20			11,59	1 $\phi$ 14+5 $\phi$ 16		
				25.90	2 $\phi$ 25+2 $\phi$ 32	15.70	5 $\phi$ 20			12,07	6 $\phi$ 16		
				29.04	1 $\phi$ 25+3 $\phi$ 32	17,47	4 $\phi$ 20+1 $\phi$ 25			13,19	5 $\phi$ 16+1 $\phi$ 20		
				32.17	4 $\phi$ 32	19,24	3 $\phi$ 20+2 $\phi$ 25			14,32	4 $\phi$ 16+2 $\phi$ 20		
				36.70	3 $\phi$ 32+1 $\phi$ 40	21,01	2 $\phi$ 20+3 $\phi$ 25			15,45	3 $\phi$ 16+3 $\phi$ 20		
				41.21	2 $\phi$ 32+2 $\phi$ 40	22,78	1 $\phi$ 20+4 $\phi$ 25			16,58	2 $\phi$ 16+4 $\phi$ 20		
				45.74	1 $\phi$ 32+3 $\phi$ 40	24,54	5 $\phi$ 25			17,71	1 $\phi$ 16+5 $\phi$ 20		
				50.26	4 $\phi$ 40	27,68	4 $\phi$ 25+1 $\phi$ 32			18,85	6 $\phi$ 20		

**Características geométricas de elementos estructurales  
CANOS DE ACERO SIN COSTURA DE SECCION CIRCULAR**

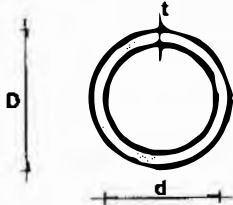


UNIT 134 - 59  
COPANT 13:5 - 032

DENOMINACION	pulgadas
D, d, t	cm
A	cm <sup>2</sup>
g	daN/m
I	cm <sup>4</sup>
W	cm <sup>3</sup>
i	cm

DENOMINACION	D	d	t	A	g	I	W	i
1	33.40	26.64	3.38	3.19	2.50	3.64	2.18	1.07
1	33.40	24.30	4.55	4.12	3.23	4.40	2.63	1.03
1	33.40	20.70	6.35	5.40	4.23	5.21	3.12	0.98
1	33.40	15.20	9.10	6.95	5.45	5.85	3.50	0.92
1	33.50	27.70	2.90	2.79	2.19	3.29	1.97	1.09
1	33.70	27.90	2.90	2.81	2.21	3.36	1.99	1.09
1	33.70	27.20	3.25	3.11	2.44	3.64	2.16	1.08
1	33.70	25.60	4.05	3.77	2.97	4.22	2.51	1.06
1 1/4	42.16	35.04	3.56	4.32	3.38	8.11	3.85	1.37
1 1/4	42.16	32.46	4.85	5.68	4.46	10.06	4.77	1.33
1 1/4	42.16	29.46	6.35	7.14	5.60	11.81	5.60	1.29
1 1/4	42.16	22.76	9.70	9.89	7.75	14.19	6.73	1.20
1 1/4	42.25	36.05	3.10	3.81	2.99	7.35	3.48	1.39
1 1/4	42.40	36.60	2.90	3.60	2.84	7.06	3.33	1.40
1 1/4	42.40	35.90	3.25	4.00	3.14	7.71	3.64	1.39
1 1/4	42.40	34.30	4.05	4.88	3.84	9.07	4.28	1.36
1 1/2	48.25	42.05	3.10	4.40	3.45	11.26	4.67	1.60
1 1/2	48.26	40.90	3.68	5.15	4.05	12.89	5.34	1.58
1 1/2	48.26	38.10	5.08	6.89	5.40	16.28	6.75	1.5
1 1/2	48.26	33.98	7.14	9.22	7.23	20.08	8.32	1.48
1 1/2	48.26	27.94	10.16	12.16	9.54	23.64	9.80	1.39
1 1/2	48.30	42.54	2.90	4.14	3.26	10.70	4.43	1.61
1 1/2	48.30	41.80	3.25	4.60	3.61	11.73	4.86	1.60
1 1/2	48.30	40.20	4.05	5.63	4.43	13.90	5.75	1.57
2	60.00	53.40	3.30	5.88	4.61	23.70	7.90	2.01
2	60.30	53.80	3.25	5.82	4.56	23.77	7.89	2.02
2	60.30	53.00	3.65	6.50	5.10	26.17	8.68	2.01
2	60.30	51.30	4.50	7.89	6.17	30.90	10.25	1.98
2	60.32	52.50	3.91	6.93	5.43	27.69	9.18	2.00
2	60.32	49.24	5.54	9.53	7.47	36.13	11.98	1.95
2	60.32	42.84	8.74	14.16	11.10	48.45	16.06	1.85
2	60.32	38.16	11.08	17.14	13.44	54.58	18.10	1.78

Características geométricas de elementos estructurales  
**CAÑOS DE ACERO SIN COSTURA DE SECCION CIRCULAR**



UNIT 134 - 59  
 COPANT 13:5 - 032

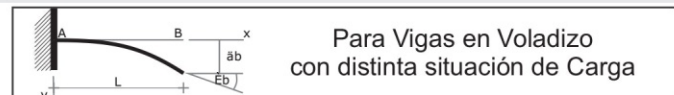
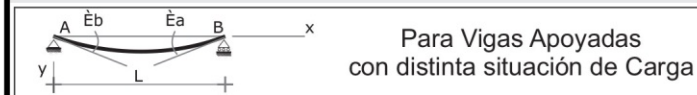
<b>DENOMINACION</b>	<b>pulgadas</b>
D, d, t	cm
A	cm <sup>2</sup>
g	daN/m
I	cm <sup>4</sup>
W	cm <sup>3</sup>
i	cm

DENOMINACION	D	d	t	A	g	I	W	i
2 1/2	73.03	62.71	5.16	11.00	8.62	63.72	17.45	2.41
2 1/2	73.03	59.01	7.01	14.54	11.40	80.11	21.94	2.35
2 1/2	73.03	53.97	9.53	19.01	14.90	97.98	26.83	2.27
2 1/2	73.03	44.99	14.02	25.99	20.39	119.52	32.73	2.14
2 1/2	75.50	68.00	3.75	8.45	6.64	54.54	14.45	2.54
2 1/2	76.10	69.60	3.25	7.48	5.81	49.44	12.99	2.58
2 1/2	76.10	68.60	3.65	8.31	6.51	54.65	14.36	2.56
2 1/2	76.10	67.10	4.50	10.12	7.90	65.12	17.11	2.54
3	88.25	80.25	4.00	10.59	8.31	94.15	21.34	2.98
3	88.90	81.60	3.65	9.78	7.65	88.97	20.02	3.02
3	88.90	80.80	4.05	10.80	8.47	97.38	21.91	3.00
3	88.90	79.20	4.85	12.81	10.10	113.46	25.53	2.98
3	88.90	77.92	5.49	14.39	11.28	125.65	28.27	2.96
3	88.90	73.66	7.62	19.46	15.25	162.09	36.47	2.89
3	88.90	66.64	11.13	27.19	21.30	209.80	47.20	2.78
3	88.90	58.42	15.24	35.27	27.65	249.43	56.11	2.66
3 1/2	101.00	92.50	4.25	12.92	10.10	151.44	29.99	3.42
3 1/2	101.60	94.30	3.65	11.23	8.77	134.89	26.55	3.47
3 1/2	101.60	93.50	4.05	12.41	9.72	147.89	29.11	3.45
3 1/2	101.60	91.90	4.85	36.85	11.60	172.92	34.04	3.42
3 1/2	101.60	90.12	5.74	36.22	13.56	199.27	39.23	3.40
3 1/2	101.60	85.44	8.08	34.60	18.62	261.47	51.47	3.32
4	113.50	105.00	4.25	46.94	11.50	217.96	38.41	3.87
4	114.30	106.20	4.05	47.80	11.00	213.42	37.34	3.90
4	114.30	105.30	4.50	47.43	12.10	234.32	41.00	3.89
4	114.30	103.50	5.40	46.69	14.40	274.54	48.04	3.85
4	114.30	102.26	6.02	46.18	16.06	301.05	52.68	3.83
4	114.30	97.18	8.56	44.20	22.29	400.03	70.00	3.75
4	114.30	87.32	13.49	40.62	33.51	562.45	96.67	3.60
4	114.30	80.06	17.12	38.24	40.98	636.16	111.31	3.49





# MATERIAL PARA EL ESTUDIO DE FLECHAS MÁXIMAS PARA VIGAS DE E.I CONSTANTE



$$Z_{(max)} = \frac{Pb(L^2 - b^2)^{3/2}}{9LEI\sqrt{3}}$$

$$Z_{(max)} = \frac{Pa^2(3L - a)}{6EI}$$

$$Z_{(max)} = \frac{PL^3}{48EI}$$

$$Z_{(max)} = \frac{PL^3}{3EI}$$

$$Z_{(max)} = \frac{P \cdot a(3L^2 - 4a^2)}{24EI}$$

$$Z_{(max)} = \frac{7PL^3}{16EI}$$

$$Z_{(max)} = \frac{(P_2)L^3 + 5(P_1)L^3}{3EI + 48EI}$$

$$Z_{(max)} = \frac{PL^3 n}{8EI\alpha}$$

n = n° de espacios

n	2	3	4	5	6	7
α	12	9.39	10.11	9.52	9.81	9.56

$$Z_{(max)} = \frac{PL^3 \cdot n^2 - 1}{8EI\alpha n}$$

$$Z_{(max)} = \frac{PL^3 n}{8EI\alpha}$$

n = n° de espacios

n	2	3	4	5	6	7
α	8.72	10.19	9.52	9.82	9.49	9.72

$$Z_{(max)} = \frac{PL^3 \cdot n^2 + 1}{8EI\alpha n}$$

$$Z_{(max)} = \frac{5pL^4}{384EI}$$

$$Z_{(max)} = \frac{pL^4}{8EI}$$

$$Z_{(max)} = \frac{pL^4}{10^3EI} (13.57 \frac{a}{L} - 0.55)$$

$$Z_{(max)} = \frac{p \cdot a^3(4L - a)}{24EI}$$

$$Z_{(max)} = \frac{5pL^4}{768EI}$$

$$Z_{(max)} = \frac{p(3L^4 - 4a^3 \cdot L + a^4)}{24EI}$$

$$Z_{(max)} = \frac{p c L^3}{24EI} \left[ 1 - \frac{c^2(2 - c)}{L^2} \right]$$

# MATERIAL PARA EL ESTUDIO DE CONTRAFLECHAS PARA VIGAS DE E.I CONSTANTE

$$Z_{(L/2)} = -\frac{1}{16} \cdot \frac{MoL^2}{EI}$$

$$Z_{(L/2)} = -\frac{1}{16} \cdot \frac{L^2}{EI} (MA + MB)$$

Tabla 5.1.1.

**REACCIONES Y MOMENTOS DE EMPOTRAMIENTO PARA TRAMOS DE INERCIA CONSTANTE**

CARGAS	Diagrama 1: Empotramiento en A, articulación en B		Diagrama 2: Empotramiento en B, articulación en A		Diagrama 3: Empotramiento en A y B	
	Ra	Rb	Ma	Mb	Ma	Mb
	$\frac{Pb}{l}$	$\frac{Pa}{l}$	$\frac{Pab}{2l^2} (l+b)$	$\frac{Pab}{2l^2} (l+a)$	$\frac{Pab}{l^2} b$	$\frac{Pab}{l^2} a$
	$\frac{P}{2}$	$\frac{P}{2}$	$\frac{3}{16} Pl$	$\frac{3}{16} Pl$	$\frac{1}{8} Pl$	$\frac{1}{8} Pl$
	P	P	$\frac{3}{2} Pa (1 - \frac{a}{l})$	$\frac{3}{2} Pa (1 - \frac{a}{l})$	$Pa (1 - \frac{a}{l})$	$Pa (1 - \frac{a}{l})$
	P	P	$\frac{1}{3} Pl$	$\frac{1}{3} Pl$	$\frac{2}{9} Pl$	$\frac{2}{9} Pl$
	1.5 P	1.5 P	$\frac{15}{32} Pl$	$\frac{15}{32} Pl$	$\frac{5}{16} Pl$	$\frac{5}{16} Pl$
	$\frac{pl}{2}$	$\frac{pl}{2}$	$\frac{1}{8} pl^2$	$\frac{1}{8} pl^2$	$\frac{1}{12} pl^2$	$\frac{1}{12} pl^2$
	$\frac{pa}{l} (b + \frac{a}{2})$	$\frac{pa^2}{2l}$	$\frac{pa^2}{8} (2 - \frac{a}{l})^2$	$\frac{pa^2}{8} (2 - \frac{a}{l})^2$	$\frac{pa^2}{12} (6 - 8\frac{a}{l} + 3\frac{a^2}{l^2})$	$\frac{pa^2}{12} (4\frac{a}{l} - 3\frac{a^2}{l^2})$
	$\frac{3}{8} pl$	$\frac{1}{8} pl$	$\frac{9}{128} pl^2$	$\frac{7}{128} pl^2$	$\frac{11}{192} pl^2$	$\frac{5}{192} pl^2$
	pa	pa	$\frac{pa^2}{4} (3 - 2\frac{a}{l})$	$\frac{pa^2}{4} (3 - 2\frac{a}{l})$	$\frac{pa^2}{6} (3 - 2\frac{a}{l})$	$\frac{pa^2}{6} (3 - 2\frac{a}{l})$
	$\frac{pcb}{l}$	$\frac{pca}{l}$	$\frac{pabc}{2l^2} (l + b - \frac{c^2}{4a})$	$\frac{pabc}{2l^2} (l + a - \frac{c^2}{4b})$	$\frac{pc}{l^2} [ab^2 + \frac{c^2}{12} (l-3b)]$	$\frac{pc}{l^2} [a^2b + \frac{c^2}{12} (l-3a)]$
	$\frac{pa}{2}$	$\frac{pa}{2}$	$\frac{pla}{16} (3 - \frac{a^2}{l^2})$	$\frac{pla}{16} (3 - \frac{a^2}{l^2})$	$\frac{pla}{24} (3 - \frac{a^2}{l^2})$	$\frac{pla}{24} (3 - \frac{a^2}{l^2})$
	$\frac{pa}{2} (1 - \frac{2a}{3l})$	$\frac{pa^2}{3l}$	$\frac{pa^2}{120} (40 - 45\frac{a}{l} + 12\frac{a^2}{l^2})$	$\frac{pa^2}{60} (10 - 6\frac{a^2}{l^2})$	$\frac{pa^2}{30} (10 - 15\frac{a}{l} + 6\frac{a^2}{l^2})$	$\frac{pa^2}{20} (5\frac{a}{l} - 4\frac{a^2}{l^2})$
	$\frac{pl}{6}$	$\frac{pl}{3}$	$\frac{7}{120} pl^2$	$\frac{1}{15} pl^2$	$\frac{1}{30} pl^2$	$\frac{1}{20} pl^2$
	$\frac{pl}{4}$	$\frac{pl}{4}$	$\frac{5}{64} pl^2$	$\frac{5}{64} pl^2$	$\frac{5}{96} pl^2$	$\frac{5}{96} pl^2$
	$\frac{pa}{2} (1 - \frac{a}{6l})$	$\frac{pa^2}{6l}$	$\frac{pa^2}{120} (20 - 15\frac{a}{l} + 3\frac{a^2}{l^2})$	$\frac{pa^2}{120} (10 - 3\frac{a^2}{l^2})$	$\frac{pa^2}{60} (10 - 10\frac{a}{l} + 3\frac{a^2}{l^2})$	$\frac{pa^2}{60} (5\frac{a}{l} - 3\frac{a^2}{l^2})$
	$\frac{pl}{3}$	$\frac{pl}{3}$	$\frac{1}{10} pl^2$	$\frac{1}{10} pl^2$	$\frac{1}{15} pl^2$	$\frac{1}{15} pl^2$
	$\frac{pl-a}{2}$	$\frac{pl-a}{2}$	$\frac{pl}{64} (l+b)(5 - \frac{b^2}{l^2})$	$\frac{pl}{64} (l+b)(5 - \frac{b^2}{l^2})$	$\frac{pl}{64} (l+b)(5 - \frac{b^2}{l^2})$	$\frac{pl}{64} (l+b)(5 - \frac{b^2}{l^2})$
	$\frac{m}{l}$	$\frac{m}{l}$	$\frac{m}{2} (1 - 3\frac{b^2}{l^2})$	$\frac{m}{2} (1 - 3\frac{a^2}{l^2})$	$\frac{mb}{l} (2 - 3\frac{b}{l})$	$\frac{ma}{l} (2 - 3\frac{a}{l})$

FUENTE: Tablas y Abacos para Proyecto de Estructura / Instituto de la Construcción de Edificios / Depto. de Estabilidad



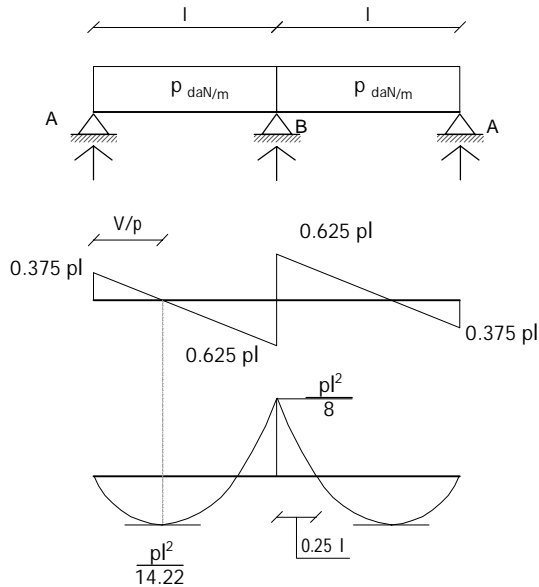
# TABLA SIMPLIFICADA DE VIGAS CONTINUAS

PARA MATERIALES HOMOGÉNEOS, TRAMOS DE INERCIA CONSTANTE, DE LUCES IGUALES, E IGUAL VALOR DE CARGA UNIFORMEMENTE DISTRIBUIDA

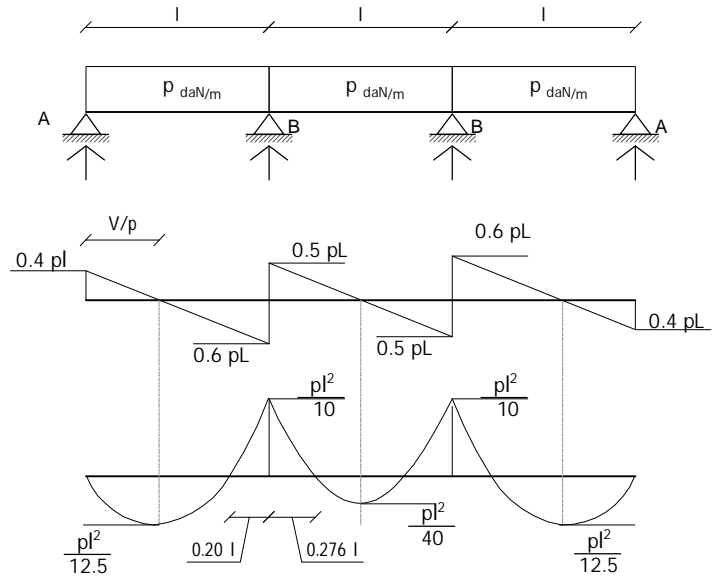
Solicitaciones de momentos en tramo y apoyo, de abscisas y cortantes

\* Se admite una variación de carga o de luces de hasta un 20%.

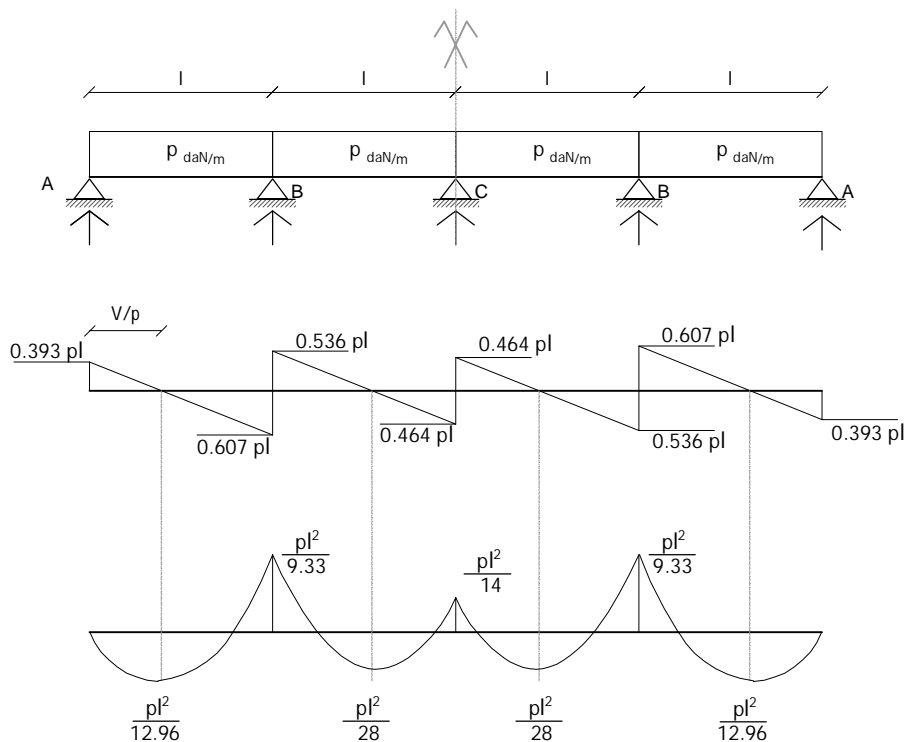
## VIGA DE DOS TRAMOS



## VIGA DE TRES TRAMOS



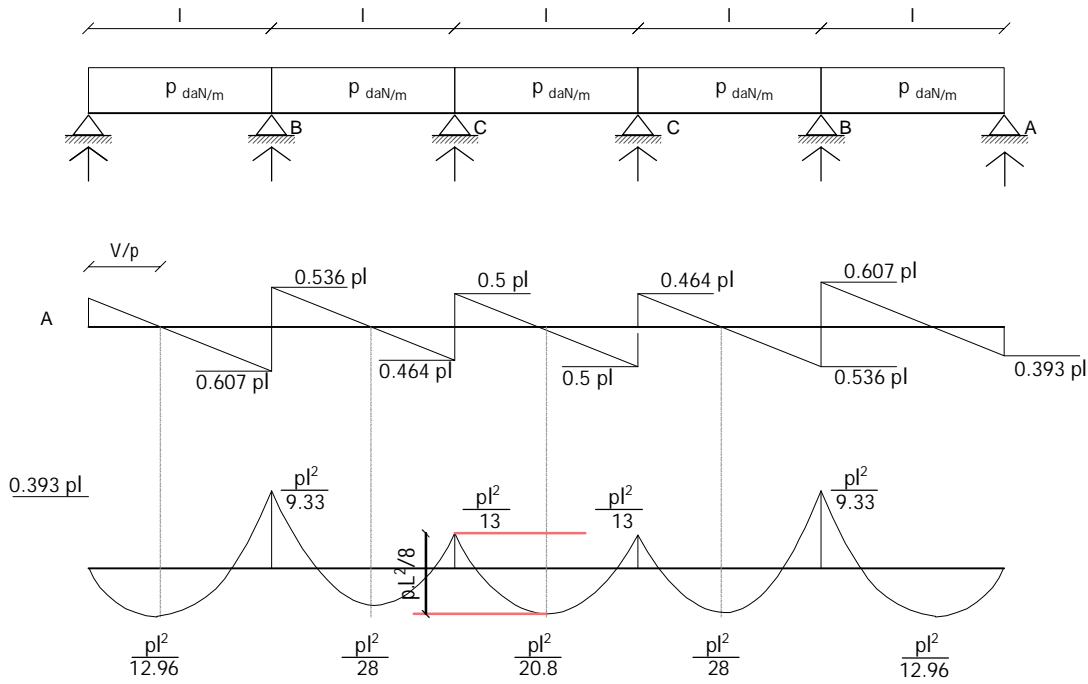
## VIGA DE CUATRO TRAMOS



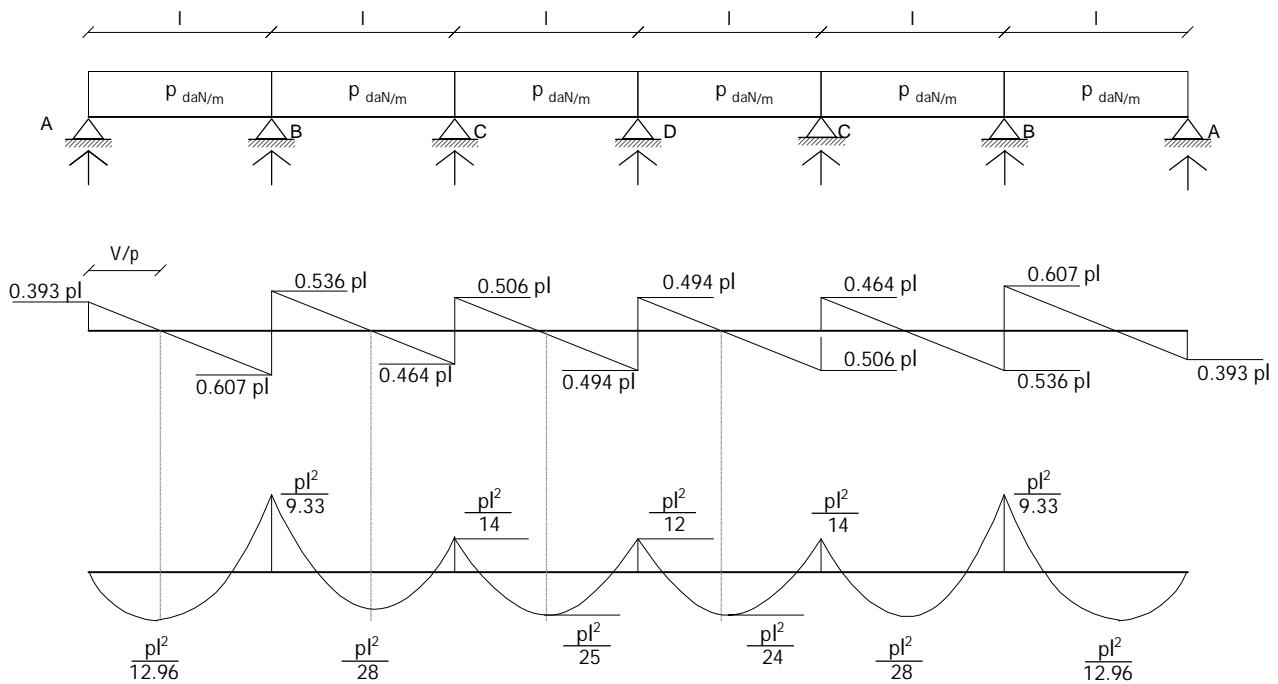
**ESTRUCTURAS I**

Facultad de Arquitectura, Diseño y Urbanismo  
UNIVERSIDAD DE LA REPÚBLICA

## VIGA DE CINCO TRAMOS



## VIGA DE SEIS TRAMOS



## VIGA DE MAS DE SEIS TRAMOS

El primer, segundo y tercer tramo se calculan como en el caso de seis tramos.  
Para los tramos internos:

