

TABLAS

QUE DAN LAS ÁREAS DE LAS SECCIONES TRASVERSALES

PARA LA CUBICACION DEL MOVIMIENTO DE TIERRAS

Por creerlas de utilidad para nuestros colegas de la ingeniería de ferrocarriles, damos a continuación cuatro tablas, que habíamos calculado para nuestro uso particular, que dan las áreas de los perfiles transversales — tipos de la Dirección Jeneral de Obras Públicas, para trochas de 1.00 y 1.68 — i en las cuales se ha hecho variar de centímetro en centímetro i desde 0 a 10 metros la altura de corte i terraplen.

Como lo veremos mas adelante, pueden aplicarse, alijerando sobremanera las operaciones de cubicacion, en casos de terrenos horizontales o uniformemente inclinados.

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Sean S , S' , S'' , y S''' las superficies de diversas secciones transversales tomadas en estacas sucesivas del trazado de un ferrocarril i a distancias l , l' i l'' unas de las otras.

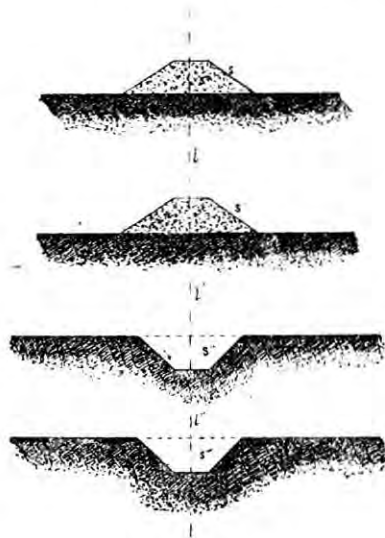


Fig. 1.

El cubo del movimiento de tierras seria dado por las fómulas siguientes:

Para las tierras puestas en terraplen:

$$C_t = \left(\frac{S + S'}{2} \right) l + \left(\frac{S'^2}{S' + S''} \right) l'$$

Para las tierras de corte:

$$C_c = \left(\frac{S'' + S'''}{2} \right) l' + \left(\frac{S'' + S'''}{2} \right) l''$$

En casos de terrenos muy accidentados o de pendientes fuertes estas áreas S , S' , S'' , i S''' es necesario deducirlas de los perfiles transversales tomados directamente en el campo; pero si son horizontales o ligera i uniformemente inclinados bastan las alturas de cortes i terraplen del perfil longitudinal para calcularlas.

Efectivamente, si el terreno es horizontal i si se trata de un terraplen, tendríamos como valor de la superficie

$$S_t = h (a + 1.5 h) \dots \dots \dots (1)$$

en la que

- a es el ancho de la plataforma,
- h la altura del terraplen, i
- 1: 1.5 es la inclinacion de los taludes

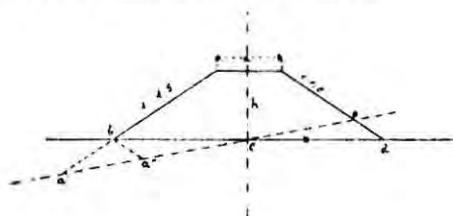


Fig. 2.

Esta fórmula tambien es aplicable para terrenos ligera i uniformemente inclinados, con pendientes que no pasen de 1 a 1.5%, porque entónces, prácticamente hablando, hai compensacion entre los triángulos $a' b c$ i $c d e$. Pero si la inclinacion es mayor habrá que agregarle la superficie del pequeño triángulo $a' b a''$, que se forma trazando la línea $a'' b$ paralela a $d e$.

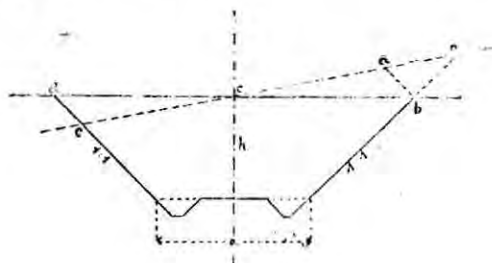


Fig. 3.

Procederíamos en un todo semejante si se tratase de cortes en terrenos horizontales o uniformemente inclinados.

Siendo:

a el ancho de la plataforma,

h la altura de corte,

I : I la inclinacion de los taludes i

s_z la superficie de las dos zanjias laterales,

la superficie S_c de la seccion transversal nos seria dada por la fórmula

$$S_c = h(a + h) + S_z \dots \dots \dots (2)$$

En caso de terrenos de inclinacion superior a 1 o 1.5% habrá que agregarle la superficie del pequeño triángulo $a' b a''$, formado de igual manera que en el caso anterior.

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Apliquemos estas fórmulas (1) i (2) a los perfiles tipos de la Direccion de Obras Públicas para trochas de 1.00 i 1.68 i tendremos

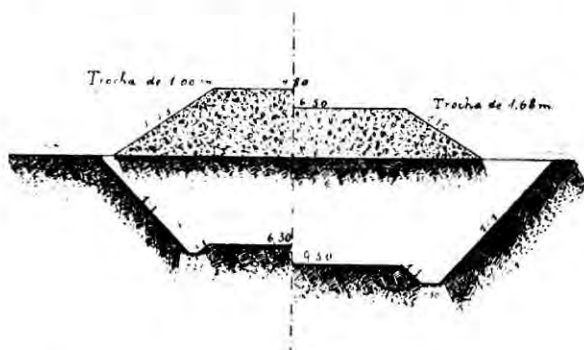


Fig. 4

Para trocha de 1.00

$$S_t = h(4.80 + 1.5 h) \dots \dots \dots (3)$$

$$S_c = h(6.30 + h + 0.25) \dots \dots \dots (4)$$

puesto que a es igual 4.80 i 6.30 respectivamente i la superficie S_z de las dos zanjias laterales es

$$S_z = 2 \left(\frac{0.25 + 0.75}{2} \times 0.25 \right) = 0.25$$

Para trocha de 1.68:

$$S_t = h(6.50 + 1.5 h) \dots \dots \dots (5)$$

$$S_c = h(9.50 + h) + 1.00 \dots \dots \dots (6)$$

siendo

$$S_z = 2 \left(\frac{0.50 + 1.50}{2} \times 0.50 \right) = 1.00$$

Con estas cuatro fórmulas (3), (4), (5) i (6), hemos calculado las tablas de mas adelante, haciendo variar a h de centímetro en centímetro i desde 0 hasta 10 metros.

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Para el cálculo de estas fórmulas, ya que habría sido sumamente largo desarrollarlas en cada caso particular, nos hemos valido del *método de las diferencias constantes*, cuya aplicacion es tan fácil como espedita.

Tomemos por ejemplo la fórmula (3) i desarrollémosla haciendo variar a h de 0.10 en 0.10:

	<u>S</u>	<u>Δ</u>	<u>Δ'</u>
0.10 (4.80 + 0.15) =	0.495		
0.20 (4.80 + 0.30) =	1.020	0.525	0.030
0.30 (4.80 + 0.45) =	1.575	0.555	0.030
0.40 (4.80 + 0.60) =	2.160	0.585	0.030
0.50 (4.80 + 0.75) =	2.775	0.615	

Vemos que la segunda diferencia Δ' es constante, luego para calcular la fórmula (3) procederíamos de la manera siguiente: conocida la primera diferencia 0.495, las demas las tendríamos agregándole sucesivamente la constante 0.03 i estas primeras diferencias Δ , sumadas de igual modo al primer producto 0.495 de la fórmula (3) nos daría los valores sucesivos de S_i , en que h varia de 0.10 en 0.10.

<u>h</u>	<u>Δ</u>	<u>S_i</u>
0.00		0.000
0.10	0.495	
0.20	0.525	0.495
0.30	0.555	1.020
0.40	0.585	1.575
0.50	0.615	2.160
0.60	0.645	2.775
0.70	0.675	3.420
0.80	0.705	4.095
0.90	0.735	4.800
1.00	0.765	5.535
		6.300

Esas mismas primeras diferencias Δ , solo dividiéndolas por 10, nos dan las constantes para interpolar de centímetro en centímetro.

Hé aquí, por lo demas, las tablas a que hemos hecho referencia.

Trocha de 1.00

SUPERFICIE DE LAS SECCIONES TRASVERSALES PARA TERRAPLENES DE 0 A 10
METROS DE ALTURA.

$$S = h (4.80 + 1.5 h) \text{ siendo } a = 4.80$$

<i>h</i>	^m 0.00	^m 1.00	^m 2.00	^m 3.00	^m 4.00	^m 5.00	^m 6.00	^m 7.00	^m 8.00	^m 9.00
^m 0.00	0.00	6.30	15.60	27.90	43.20	61.50	82.80	107.10	134.40	164.70
01	0.05	6.38	15.71	28.04	43.37	61.70	83.03	107.36	134.69	165.02
02	0.10	6.46	15.82	28.18	43.54	61.90	83.26	107.62	134.98	165.34
03	0.14	6.53	15.92	28.31	43.70	62.10	83.49	107.88	135.27	165.66
04	0.19	6.61	16.03	28.45	43.87	62.30	83.72	108.14	135.56	165.98
05	0.24	6.69	16.14	28.59	44.04	62.49	83.94	108.39	135.84	166.29
06	0.29	6.77	16.25	28.73	44.21	62.69	84.17	108.65	136.13	166.61
07	0.34	6.85	16.36	28.87	44.38	62.89	84.40	108.91	136.42	166.93
08	0.39	6.93	16.47	29.01	44.55	63.09	84.63	109.17	136.71	167.25
09	0.44	7.01	16.58	29.15	44.72	63.29	84.86	109.43	137.00	167.57
0.10	0.49	7.09	16.69	29.29	44.89	63.49	85.09	109.69	137.29	167.89
0.11	0.55	7.18	16.81	29.44	47.07	63.69	85.33	109.96	137.59	168.22
12	0.60	7.26	16.92	29.58	45.24	63.90	85.56	110.22	137.88	168.54
13	0.65	7.34	17.03	29.72	45.41	64.10	85.79	110.48	138.17	168.86
14	0.70	7.42	17.14	29.86	45.58	64.30	86.02	110.74	138.46	169.18
15	0.75	7.50	17.25	30.00	45.75	64.50	86.25	111.00	138.75	169.50
16	0.81	7.59	17.37	30.14	45.93	64.71	86.49	111.27	139.05	169.83
17	0.86	7.67	17.48	30.29	46.10	64.91	86.72	111.53	139.34	170.15
18	0.91	7.75	17.59	30.43	46.27	65.11	86.95	111.79	139.63	170.47
19	0.97	7.84	17.71	30.57	46.45	65.31	87.18	112.05	139.92	170.79
0.20	1.02	7.92	17.82	30.72	46.62	65.52	87.42	112.32	140.22	171.12
0.21	1.07	8.00	17.93	30.86	46.79	65.73	87.65	112.58	140.51	171.44
22	1.13	8.09	18.05	31.01	46.97	65.93	87.89	112.85	140.81	171.77
23	1.18	8.17	18.16	31.15	47.14	66.14	88.12	113.11	141.10	172.09
24	1.24	8.26	18.28	31.30	47.32	66.34	88.36	113.38	141.40	172.42
25	1.29	8.34	18.39	31.44	47.49	66.55	88.59	113.64	141.69	172.74
26	1.35	8.43	18.51	31.59	47.67	66.75	88.83	113.91	141.99	173.07
27	1.40	8.51	18.62	31.73	47.84	66.96	89.06	114.17	142.28	173.39
28	1.46	8.60	18.74	31.88	48.12	67.16	89.30	114.44	142.58	173.72
29	1.52	8.69	18.86	32.03	48.20	67.37	89.53	114.70	142.87	174.04
0.30	1.57	8.77	18.97	32.17	48.37	67.57	89.77	114.97	143.17	174.37
0.31	1.63	8.86	19.09	32.32	48.55	67.78	90.01	115.24	143.47	174.70
32	1.69	8.95	19.21	32.47	48.73	67.99	90.25	115.51	143.77	175.03

<i>h</i>	m 0.00	m 1.00	m 2.00	m 3.00	m 4.00	m 5.00	m 6.00	m 7.00	m 8.00	m 9.00
m 0.33	1.75	9.04	19.33	32.62	48.91	68.20	90.49	115.78	144.07	175.36
34	1.80	9.12	19.45	32.76	49.08	68.41	90.73	116.05	144.37	175.69
35	1.86	9.21	19.57	32.91	49.26	68.61	90.96	116.31	144.67	176.02
36	1.92	9.30	19.69	33.06	49.44	68.82	91.20	116.58	144.96	176.34
37	1.98	9.39	19.80	33.21	49.62	69.03	91.44	116.85	145.26	176.67
38	2.04	9.48	19.92	33.36	49.80	69.24	91.68	117.12	145.56	177.00
39	2.10	9.57	20.04	33.51	49.98	69.45	91.92	117.38	145.86	177.33
0.40	2.16	9.66	20.16	33.66	50.16	69.66	92.16	117.66	146.16	177.66
0.41	2.22	9.75	20.28	33.81	50.34	69.87	92.40	117.93	146.46	177.99
42	2.28	9.84	20.40	33.96	50.52	70.08	92.64	118.20	146.76	178.32
43	2.34	9.93	20.52	34.11	50.70	70.29	92.88	118.47	147.06	178.65
44	2.40	10.02	20.64	34.26	50.88	70.50	93.12	118.74	147.36	178.98
45	2.46	10.11	20.76	34.41	51.06	70.71	93.36	119.01	147.66	179.31
46	2.52	10.20	20.88	34.56	51.24	70.93	93.61	119.29	147.97	179.65
47	2.59	10.30	21.01	34.72	51.43	71.14	93.85	119.56	148.27	179.98
48	2.65	10.39	21.13	34.87	51.61	71.35	94.09	119.83	148.57	180.31
49	2.71	10.48	21.25	35.02	51.79	71.56	94.33	120.10	148.87	180.64
0.50	2.77	10.57	21.37	35.17	51.97	71.77	94.57	120.37	149.17	180.97
0.51	2.84	10.67	21.50	35.33	52.16	71.99	94.82	120.65	149.48	181.31
52	2.90	10.76	21.62	35.48	52.34	72.20	95.06	120.92	149.78	181.64
53	2.96	10.85	21.74	35.64	52.53	72.42	95.31	121.20	150.09	181.98
54	3.03	10.95	21.87	35.79	52.71	72.63	95.55	121.47	150.39	182.31
55	3.09	11.04	21.99	35.94	52.89	72.84	95.80	121.74	150.69	182.64
56	3.16	11.14	22.12	36.10	53.08	73.06	96.04	122.02	151.00	182.98
57	3.22	11.23	22.24	36.25	53.26	73.27	96.28	122.29	151.30	183.31
58	3.29	11.33	22.37	36.41	53.45	73.49	96.53	122.57	151.61	183.65
59	3.35	11.42	22.49	36.56	53.63	73.70	96.77	122.84	151.91	183.98
0.60	3.42	11.52	22.62	36.72	53.82	73.92	97.02	123.12	152.22	184.32
0.61	3.49	11.62	22.75	36.88	54.01	74.14	97.27	123.40	152.53	184.66
62	3.55	11.71	22.87	37.03	54.19	74.35	97.51	123.67	152.83	184.99
63	3.62	11.81	23.00	37.19	54.38	74.57	97.76	123.95	153.14	185.33
64	3.69	11.91	23.13	37.35	54.57	74.79	98.01	124.23	153.45	185.67
65	3.75	12.00	23.25	37.50	54.75	75.00	98.25	124.50	153.75	186.00
66	3.82	12.10	23.38	37.66	54.94	75.22	98.50	124.78	154.06	186.34
67	3.89	12.20	23.51	37.82	55.13	75.44	98.75	125.06	154.37	186.68
68	3.96	12.30	23.64	37.98	55.32	75.66	99.00	125.34	154.68	187.02
69	4.03	12.40	23.77	38.13	55.50	75.87	99.24	125.61	154.98	187.35
0.70	4.09	12.50	23.89	38.29	55.69	76.09	99.49	125.89	155.29	187.69
0.71	4.16	12.59	24.02	38.45	55.88	76.31	99.74	126.17	155.60	188.03
72	4.23	12.69	24.15	38.61	56.07	76.53	99.99	126.45	155.91	188.37
73	4.30	12.79	24.28	38.77	56.26	76.75	100.24	126.73	156.22	188.71
74	4.37	12.89	24.41	38.93	56.45	76.97	100.49	127.01	156.53	189.05

<i>h</i>	^m 0.00	^m 1.00	^m 2.00	^m 3.00	^m 4.00	^m 5.00	^m 6.00	^m 7.00	^m 8.00	^m 9.00
^m 0.75	4.44	12.99	24.54	39.09	56.64	77.19	100.74	127.29	156.84	189.39
76	4.51	13.09	24.67	39.25	56.83	77.41	101.00	127.57	157.15	189.73
77	4.58	13.19	24.80	39.41	57.02	77.63	101.24	127.85	157.46	190.07
78	4.66	13.30	24.93	39.57	57.21	77.85	101.49	128.13	157.77	190.41
79	4.73	13.40	25.06	39.73	57.40	78.07	101.74	128.41	158.08	190.75
0.80	4.80	13.50	25.20	39.90	57.60	78.30	102.00	128.70	158.40	191.10
0.81	4.87	13.60	25.33	40.06	57.79	78.52	102.25	128.98	158.71	191.44
82	4.94	13.70	25.47	40.23	57.99	78.75	102.51	129.27	159.03	191.79
83	5.02	13.81	25.60	40.39	58.18	78.97	102.76	129.55	159.34	192.13
84	5.09	13.91	25.73	40.55	58.37	79.19	103.01	129.83	159.65	192.47
85	5.16	14.01	25.86	40.71	58.56	79.42	103.26	130.11	159.96	192.81
86	5.24	14.12	26.00	40.88	58.76	79.64	103.52	130.40	160.28	193.16
87	5.31	14.22	26.13	41.04	58.95	79.86	103.77	130.68	160.59	193.50
88	5.39	14.33	26.26	41.20	59.14	80.08	104.02	130.96	160.90	193.84
89	5.46	14.43	26.40	41.37	59.34	80.31	104.28	131.25	161.22	193.19
0.90	5.53	14.53	26.53	41.53	59.53	80.53	104.53	131.53	161.53	194.53
0.91	5.61	14.64	26.67	41.70	59.73	80.76	104.79	131.82	161.85	194.88
92	5.69	14.75	26.81	41.87	59.93	80.99	105.05	132.11	162.17	195.23
93	5.76	14.85	26.94	42.03	60.12	81.21	105.30	132.39	162.48	195.57
94	5.84	14.96	27.08	42.20	60.32	81.44	105.56	132.68	162.80	195.92
95	5.91	15.06	27.21	42.36	60.51	81.66	105.81	132.96	163.11	196.26
96	5.98	15.17	27.35	42.53	60.71	81.89	106.07	133.25	163.43	196.61
97	6.06	15.28	27.49	42.70	60.91	82.12	106.33	133.54	163.75	196.96
98	6.13	15.38	27.62	42.86	61.10	82.34	106.58	133.82	164.06	197.30
99	6.21	15.49	27.76	43.03	61.30	82.57	106.84	134.11	164.38	197.65
1.00	6.30	15.60	27.90	43.20	61.50	82.80	107.10	134.40	164.70	198.00

Trocha de 1.00

SUPERFICIE DE LAS SECCIONES TRASVERSALES PARA CORTES DE 0 A 10 METROS DE ALTURA.

$$S = h(6.30 + h) + 0.25 \text{ siendo } a = 6.30 \text{ i } S_c = 0.25$$

<i>h</i>	^m 0.00	^m 1.00	^m 2.00	^m 3.00	^m 4.00	^m 5.00	^m 6.00	^m 7.00	^m 8.00	^m 9.00
^m 0.00	0.25	7.55	16.85	28.15	41.45	56.75	74.05	93.35	114.65	137.95
01	0.31	7.63	16.95	28.27	41.59	56.91	74.23	93.55	114.87	138.19
02	0.38	7.72	17.06	28.40	41.74	57.08	74.42	93.76	115.10	138.44
03	0.44	7.80	17.16	28.52	41.82	57.24	74.60	93.96	115.32	138.68
04	0.51	7.89	17.27	28.65	42.03	57.41	74.79	94.17	115.55	138.93
05	0.57	7.97	17.37	28.77	42.17	57.57	74.97	94.37	115.77	139.17
06	0.63	8.05	17.47	28.89	42.31	57.73	75.15	94.57	115.99	139.41
07	0.70	8.14	17.58	29.02	42.46	57.90	75.34	94.78	116.22	139.66
08	0.76	8.22	17.68	29.14	42.60	58.06	75.52	94.98	116.44	139.90
09	0.83	8.31	17.79	29.27	42.75	58.23	75.71	95.19	116.67	140.15
0.10	0.89	8.39	17.89	29.39	42.89	58.39	75.89	95.39	116.89	140.39
0.11	0.96	8.48	18.00	29.52	43.04	58.56	76.08	95.60	117.12	140.64
12	1.02	8.56	18.10	29.64	43.18	58.72	76.26	95.80	117.34	140.88
13	1.09	8.65	18.21	29.77	43.33	58.89	76.45	96.01	117.57	141.13
14	1.15	8.73	18.31	29.89	43.47	59.05	76.63	96.21	117.79	141.37
15	1.22	8.82	18.42	30.02	43.62	59.22	76.82	96.42	118.02	141.62
16	1.29	8.91	18.53	30.15	43.77	59.39	77.01	96.63	118.25	141.87
17	1.35	8.99	18.63	30.27	43.91	59.55	77.19	96.83	118.47	142.11
18	1.41	9.08	18.74	30.40	44.06	59.72	77.38	97.04	118.70	142.36
19	1.49	9.16	18.84	30.52	44.20	59.88	77.56	97.24	118.92	142.60
0.20	1.55	9.25	18.95	30.65	44.35	60.05	77.75	97.45	119.15	142.85
0.21	1.62	9.34	19.06	30.78	44.50	60.22	77.94	97.66	119.38	143.10
22	1.69	9.43	19.17	30.91	44.65	60.39	78.13	97.87	119.61	143.35
23	1.75	9.51	19.27	31.03	44.79	60.55	78.31	98.07	119.83	143.59
24	1.82	9.60	19.38	31.16	44.94	60.72	78.50	98.28	120.06	143.84
25	1.89	9.69	19.49	31.29	45.09	60.89	78.69	98.49	120.29	144.09
26	1.96	9.78	19.60	31.42	45.24	61.05	78.89	98.70	120.52	144.34
27	2.03	9.87	19.71	31.55	45.39	61.23	79.07	98.91	120.75	144.59
28	2.09	9.94	19.81	31.67	45.53	61.39	79.25	99.11	120.97	144.83
29	2.16	10.04	19.92	31.80	45.68	61.56	79.44	99.32	121.20	145.08
0.30	2.23	10.13	20.03	31.93	45.83	61.73	79.63	99.53	121.43	145.33
0.31	2.30	10.22	20.14	32.06	45.98	61.90	79.82	99.74	121.66	145.58
32	2.37	10.31	20.25	32.19	46.13	62.07	80.01	99.95	121.89	145.83

h	m 0.00	m 1.00	m 2.00	m 3.00	m 4.00	m 5.00	m 6.00	m 7.00	m 8.00	m 9.00
m 0.33	2.44	10.40	20.36	32.32	46.28	62.24	80.20	100.16	122.12	146.08
34	2.51	10.49	20.47	32.45	46.43	62.41	80.39	100.37	122.35	146.33
35	2.58	10.58	20.58	32.58	46.58	62.58	80.58	100.58	122.58	146.58
36	2.65	10.67	20.69	32.71	46.73	62.75	80.77	100.79	122.81	146.83
37	2.72	10.76	20.80	32.84	46.88	62.92	80.96	101.00	123.04	147.08
38	2.79	10.85	20.91	32.97	47.03	63.09	81.15	101.21	123.27	147.33
39	2.86	10.94	21.02	33.10	47.18	63.26	81.34	101.42	123.50	147.58
0.40	2.93	11.03	21.13	33.23	47.33	63.43	81.53	101.63	123.73	147.83
0.41	3.00	11.12	21.24	33.36	47.48	63.60	81.72	101.84	123.96	148.08
42	3.07	11.21	21.35	33.49	47.63	63.77	81.91	102.05	124.19	148.33
43	3.15	11.31	21.47	33.63	47.79	63.95	82.11	102.27	124.43	148.59
44	3.22	11.40	21.58	33.76	47.94	64.12	82.30	102.48	124.66	148.84
45	3.29	11.49	21.69	33.89	48.09	64.29	82.49	102.69	124.89	149.09
46	3.36	11.58	21.80	34.02	48.24	64.46	82.68	102.90	125.12	149.34
47	3.43	11.67	21.91	34.15	48.39	64.63	82.87	103.11	125.35	149.59
48	3.51	11.77	22.03	34.29	48.55	64.81	83.07	103.33	125.59	149.85
49	3.58	11.86	22.14	34.42	48.70	64.99	83.26	103.54	125.82	150.10
0.50	3.65	11.95	22.25	34.55	48.85	65.15	83.45	103.75	126.05	150.35
0.51	3.72	12.04	22.36	34.68	49.00	65.32	83.64	103.96	126.28	150.60
52	3.80	12.14	22.48	34.82	49.16	65.50	83.84	104.18	126.52	150.86
53	3.87	12.23	22.59	34.95	49.31	65.67	84.03	104.39	126.75	151.11
54	3.95	12.33	22.71	35.09	49.47	65.85	84.23	104.61	126.99	151.37
55	4.02	12.42	22.82	35.22	49.63	66.02	84.42	104.82	127.22	151.62
56	4.09	12.51	22.93	35.35	49.77	66.19	84.61	105.03	127.45	151.87
57	4.17	12.61	23.05	35.49	49.93	66.37	84.81	105.25	127.69	152.13
58	4.24	12.70	23.16	35.62	50.08	66.54	85.00	105.46	127.92	152.38
59	4.31	12.80	23.28	35.76	50.24	66.72	85.20	105.68	128.16	152.64
0.60	4.39	12.89	23.39	35.89	50.39	66.89	85.39	105.89	128.39	152.89
0.61	4.47	12.99	23.51	36.02	50.55	67.07	85.59	106.10	128.63	153.15
62	4.54	13.08	23.62	36.16	50.70	67.24	85.78	106.32	128.86	153.40
63	4.62	13.18	23.74	36.30	50.86	67.42	85.98	106.54	129.10	153.66
64	4.69	13.27	23.85	36.43	51.01	67.59	86.17	106.75	129.33	153.91
65	4.77	13.37	23.97	36.57	51.17	67.77	86.37	106.97	129.57	154.17
66	4.85	13.47	24.08	36.71	51.33	67.95	86.57	107.19	129.81	154.43
67	4.92	13.56	24.20	36.84	51.48	68.12	86.76	107.40	130.04	154.68
68	5.00	13.66	24.32	36.99	51.64	68.30	86.96	107.62	130.28	154.94
69	5.07	13.75	24.43	37.11	51.79	68.47	87.15	107.83	130.51	155.19
0.70	5.15	13.85	24.55	37.25	51.95	68.65	87.35	108.05	130.75	155.45
0.71	5.23	13.95	24.67	37.39	52.11	68.83	87.55	108.27	130.99	155.71
72	5.31	14.05	24.79	37.53	52.27	69.01	87.75	108.49	131.23	155.97
73	5.38	14.14	24.90	37.66	52.42	69.18	87.94	108.70	131.46	156.22
74	5.46	14.24	25.02	37.80	52.58	69.36	88.14	108.92	131.70	156.48

<i>h</i>	m 0.00	m 1.00	m 2.00	m 3.00	m 4.00	m 5.00	m 6.00	m 7.00	m 8.00	m 9.00
m										
0.75	5.54	14.34	25.14	37.94	52.74	69.54	88.34	109.14	131.94	156.74
76	5.62	14.44	25.26	38.01	52.90	69.72	88.54	109.36	132.18	157.00
77	5.70	14.54	25.38	38.22	53.06	69.90	88.74	109.58	132.42	157.26
78	5.77	14.63	25.49	38.35	53.21	70.07	88.93	109.79	132.65	157.51
79	5.85	14.73	25.61	38.49	53.37	70.25	89.13	110.01	132.89	157.77
0.80	5.93	14.83	25.73	38.63	53.53	70.43	89.33	110.23	133.13	158.03
0.81	6.01	14.93	25.85	38.77	53.69	70.61	89.53	110.45	133.37	158.29
82	6.09	15.03	25.97	38.91	53.85	70.79	89.73	110.67	133.61	158.55
83	6.17	15.13	26.09	39.05	54.01	70.97	89.93	110.89	133.85	158.81
84	6.25	15.23	26.21	39.19	54.17	71.15	90.13	111.11	134.09	159.07
85	6.33	15.33	26.33	39.33	54.33	71.33	90.33	111.33	134.33	159.33
86	6.41	15.43	26.45	39.47	54.49	71.51	90.53	111.55	134.57	159.59
87	6.49	15.53	26.57	39.61	54.65	71.69	90.73	111.77	134.81	159.85
88	6.57	15.63	26.69	39.75	54.81	71.87	90.93	111.99	135.05	160.11
89	6.65	15.73	26.81	39.89	54.97	72.05	91.13	112.21	135.29	160.37
0.90	6.73	15.83	26.93	40.03	55.13	72.23	91.33	112.43	135.53	160.63
0.91	6.81	15.93	27.05	40.17	55.29	72.41	91.53	112.65	135.77	160.89
92	6.89	16.03	27.17	40.31	55.45	72.59	91.74	112.87	136.01	161.15
93	6.98	16.14	27.30	40.46	55.62	72.78	91.94	113.10	136.26	161.42
94	7.06	16.24	27.42	40.60	55.78	72.96	92.14	113.32	136.50	161.68
95	7.14	16.34	27.54	40.74	55.94	73.14	92.34	113.54	136.74	161.94
96	7.22	16.44	27.66	40.88	56.10	73.32	92.54	113.76	136.98	162.20
97	7.31	16.54	27.78	41.02	56.26	73.50	92.74	113.98	137.22	162.46
98	7.40	16.65	27.91	41.16	56.43	73.69	92.95	114.21	137.47	162.73
99	7.48	16.75	28.02	41.31	56.59	73.87	93.15	114.43	137.71	162.99
1.00	7.55	16.85	28.15	41.45	56.75	74.05	93.35	114.65	137.95	163.25

Trocha de 1.68

SUPERFICIE DE LAS SECCIONES TRASVERSALES PARA TERRAPLENES DE 0 A 10
METROS DE ALTURA.

$$S = h (6.50 + 1.5 h) \text{ siendo } \alpha = 6.50$$

h	m 0.00	m 1.00	m 2.00	m 3.00	m 4.00	m 5.00	m 6.00	m 7.00	m 8.00	m 9.00
m 0.00	0.00	8.00	19.00	33.00	50.00	70.00	93.00	119.00	148.00	180.00
01	0.06	8.10	19.12	33.15	50.19	70.22	93.25	119.28	148.31	180.34
02	0.13	8.19	19.25	33.31	50.37	70.43	93.49	119.55	148.61	180.67
03	0.20	8.29	19.37	33.46	50.56	70.65	93.74	119.83	148.92	181.01
04	0.26	8.38	19.50	33.61	50.74	70.86	93.98	120.16	149.22	181.34
05	0.33	8.47	19.62	33.77	50.93	71.08	94.23	120.38	149.53	181.68
06	0.39	8.57	19.75	33.92	51.11	71.30	94.48	120.66	149.84	182.03
07	0.46	8.66	19.87	34.08	51.30	71.51	94.72	120.93	150.14	182.36
08	0.53	8.76	20.00	34.24	51.48	71.73	94.97	121.21	150.45	182.70
09	0.60	8.86	20.13	34.40	51.67	71.94	95.21	121.49	150.75	183.03
0.10	0.66	8.96	20.26	34.56	51.86	72.16	95.46	121.76	151.06	183.36
0.11	0.73	9.06	20.39	34.72	52.05	72.38	95.71	122.04	151.37	183.70
12	0.80	9.16	20.52	34.88	52.24	72.60	95.96	122.32	151.68	184.04
13	0.87	9.26	20.65	35.04	52.43	72.82	96.21	122.60	151.99	184.38
14	0.94	9.36	20.78	35.20	52.62	73.04	96.46	122.88	152.30	184.72
15	1.01	9.46	20.91	35.36	52.81	73.26	96.71	123.16	152.61	185.06
16	1.08	9.56	21.04	35.52	53.00	73.48	96.96	123.44	152.92	185.40
17	1.15	9.66	21.17	35.68	53.19	73.70	97.21	123.72	153.23	185.74
18	1.22	9.76	21.30	35.84	53.38	73.92	97.46	124.00	153.54	186.08
19	1.29	9.86	21.43	36.00	53.57	74.14	97.71	124.28	153.85	186.42
0.20	1.36	9.96	21.56	36.16	53.76	74.36	97.96	124.56	154.16	186.76
0.21	1.43	10.06	21.69	36.32	53.95	74.58	98.21	124.84	154.47	187.10
22	1.50	10.16	21.82	36.48	54.14	74.80	98.46	125.12	154.78	187.44
23	1.57	10.26	21.95	36.64	54.33	75.03	98.72	125.41	155.10	187.79
24	1.64	10.36	22.08	36.80	54.52	75.25	98.97	125.69	155.41	188.13
25	1.72	10.46	32.21	36.97	54.71	75.47	99.22	125.97	155.72	188.47
26	1.79	10.57	22.34	37.13	54.90	75.69	99.47	126.25	156.03	188.81
27	1.86	10.67	22.47	37.29	55.09	75.91	99.72	126.53	156.34	189.15
28	1.93	10.77	22.61	37.45	55.28	76.14	99.98	126.82	156.66	189.51
29	2.00	10.87	22.75	37.61	55.48	76.36	100.23	127.10	156.97	189.84
0.30	2.08	10.98	22.88	37.78	55.68	76.51	100.48	127.38	157.28	190.18
0.31	2.15	11.08	23.01	37.94	55.87	76.81	100.74	127.67	157.60	190.53
32	2.23	11.19	23.15	38.11	56.07	77.03	100.99	127.95	157.91	190.87

<i>h</i>	m 0.00	m 1.00	m 2.00	m 3.00	m 4.00	m 5.00	m 6.00	m 7.00	m 8.00	m 9.00
m										
0.33	2.30	11.30	23.28	38.27	56.26	77.26	101.25	128.24	158.23	191.22
34	2.38	11.40	23.42	38.44	56.46	77.48	101.50	128.52	158.54	191.56
35	2.45	11.51	23.55	38.60	56.65	77.71	101.76	128.81	158.86	191.91
36	2.53	11.61	23.69	38.77	56.85	77.94	102.02	129.09	159.17	192.25
37	2.60	11.72	23.82	38.94	57.04	78.16	102.27	129.38	159.49	192.60
38	2.68	11.82	23.96	39.10	57.24	78.39	102.53	129.66	159.80	192.94
39	2.76	11.93	24.10	39.27	57.44	78.61	102.78	129.95	160.12	193.29
0.40	2.84	12.04	24.24	39.44	57.64	78.84	103.04	130.24	160.44	193.64
0.41	2.91	12.15	24.37	39.60	57.83	79.07	103.30	130.53	160.76	193.99
42	2.99	12.25	24.51	39.77	58.03	79.30	103.56	130.82	161.08	194.34
43	3.07	12.36	24.65	39.94	58.22	79.52	103.81	131.10	161.39	194.68
44	3.15	12.47	24.79	40.11	58.42	79.75	104.07	131.39	161.71	195.03
45	3.23	12.58	24.92	40.28	58.62	79.98	104.33	131.68	162.03	195.38
46	3.30	12.68	25.06	40.44	58.82	80.21	104.59	131.97	162.35	195.73
47	3.38	12.79	25.20	40.61	59.02	80.44	104.85	132.26	162.67	196.08
48	3.46	12.90	25.34	40.78	59.22	80.66	105.10	132.54	162.98	196.42
49	3.54	13.01	25.48	40.95	59.42	80.89	105.36	132.83	163.30	196.77
0.50	3.62	13.12	25.62	41.12	59.62	81.12	105.68	133.12	163.62	197.12
0.51	3.70	13.23	25.76	41.29	59.82	81.35	105.88	133.42	163.95	197.48
52	3.78	13.34	25.90	41.46	60.02	81.58	106.14	133.71	164.27	197.83
53	3.86	13.45	26.04	41.63	60.22	81.82	106.41	134.00	164.59	198.18
54	3.94	13.56	26.18	41.80	60.43	82.05	106.67	134.29	164.91	198.53
55	4.02	13.67	26.33	41.98	60.63	82.28	106.93	134.58	165.23	198.88
56	4.11	13.78	26.47	42.15	60.83	82.51	107.19	134.89	165.55	199.23
57	4.19	13.89	26.61	42.32	61.03	82.74	107.45	135.18	165.87	199.58
58	4.27	14.00	26.75	42.49	61.23	82.98	107.72	135.47	166.19	199.93
59	4.35	14.12	26.87	42.66	61.43	83.21	107.98	135.76	166.51	200.28
0.60	4.44	14.24	27.04	42.84	61.64	83.44	108.24	136.04	166.84	200.64
0.61	4.52	14.35	27.18	43.01	61.85	83.67	108.50	136.33	167.16	200.99
62	4.60	14.47	27.33	43.18	62.05	83.91	108.77	136.63	167.49	201.35
63	4.69	14.58	27.47	43.35	62.25	84.14	109.03	136.92	167.81	201.70
64	4.77	14.70	27.61	43.52	62.40	84.38	109.30	137.22	168.14	202.06
65	4.86	14.81	27.76	43.71	62.66	84.61	109.56	137.51	168.46	202.41
66	4.94	14.92	27.90	43.88	62.86	84.84	109.82	137.80	168.78	202.76
67	5.03	15.04	28.04	44.05	63.06	85.08	110.09	138.10	169.11	203.12
68	5.11	15.15	28.19	44.23	63.26	85.31	110.35	138.39	169.43	203.47
69	5.19	15.26	28.33	44.40	63.46	85.55	110.62	138.69	169.76	203.83
0.70	5.28	15.38	28.48	44.58	63.68	85.78	110.88	138.98	170.08	204.18
0.71	5.36	15.49	28.62	44.75	63.88	86.02	111.15	139.28	170.41	204.54
72	5.45	15.60	28.76	44.93	64.08	86.26	111.42	139.58	170.74	204.90
73	5.54	15.72	28.91	45.10	64.29	86.49	111.68	139.88	171.07	205.26
74	5.63	15.84	29.06	45.28	64.50	86.73	111.95	140.17	171.39	205.61

<i>h</i>	^m 0.00	^m 1.00	^m 2.00	^m 3.00	^m 4.00	^m 5.00	^m 6.00	^m 7.00	^m 8.00	^m 9.00
^m 0.75	5.72	15.96	29.21	45.46	64.71	86.97	112.22	140.47	171.72	205.97
76	5.80	16.08	29.36	45.64	64.92	87.21	112.49	140.77	172.05	206.33
77	5.89	16.20	29.51	45.82	65.13	87.45	112.76	141.06	172.37	206.68
78	5.98	16.32	29.66	46.00	65.34	87.68	113.02	141.36	172.70	207.04
79	6.07	16.44	29.81	46.18	65.55	87.92	113.29	141.66	173.03	207.40
0.80	6.16	16.56	29.96	46.36	65.76	88.16	113.56	141.96	173.36	207.76
0.81	6.25	16.68	30.11	46.54	65.97	88.40	113.83	142.26	173.69	208.12
82	6.34	16.80	30.26	46.72	66.18	88.64	114.10	142.56	174.02	208.48
83	6.43	16.92	30.41	46.90	66.39	88.88	114.37	142.86	174.35	208.84
84	6.52	17.04	30.56	47.08	66.60	89.12	114.64	143.16	174.68	209.20
85	6.61	17.16	30.71	47.26	66.81	89.36	114.91	143.46	175.01	209.56
86	6.70	17.28	30.86	47.44	67.02	89.60	115.18	143.76	175.34	209.92
87	6.79	17.40	31.01	47.62	67.23	89.84	115.45	144.06	175.67	210.28
88	6.88	17.52	31.16	47.80	67.41	90.08	115.72	144.36	176.00	210.64
89	6.97	17.64	31.31	47.98	67.25	90.32	115.99	144.66	176.33	211.00
0.90	7.06	17.76	31.46	48.16	67.86	90.56	116.26	144.96	176.66	211.36
0.91	7.15	17.88	31.61	48.34	68.08	90.80	116.53	145.27	177.00	211.73
92	7.25	18.00	31.77	48.53	68.29	91.05	116.81	145.57	177.33	212.09
93	7.34	18.13	31.92	48.71	68.51	91.29	117.08	145.87	177.66	212.45
94	7.44	18.25	32.08	48.89	68.72	91.54	117.36	146.18	178.00	212.82
95	7.53	18.38	32.23	49.08	68.93	91.78	117.63	146.48	178.33	213.18
96	7.63	18.50	32.39	49.26	69.15	92.02	117.90	146.78	178.66	213.54
97	7.72	18.62	32.54	49.45	69.36	92.27	118.18	147.09	179.00	213.91
98	7.82	18.75	32.69	49.63	69.57	92.51	118.45	147.39	179.33	214.27
99	7.91	18.87	32.84	49.81	69.78	92.76	118.73	147.69	179.66	214.63
1.00	8.00	19.00	33.00	50.00	70.00	93.00	119.00	148.00	180.00	215.00

Trocha de 1.68

SUPERFICIE DE LAS SECCIONES TRASVERSALES PARA CORTES DE 0 A 10 METROS
DE ALTURA.

$$S = h(9.50 + h) + 1.00 \text{ siendo } a = 9.50 \text{ i } S_z = 1.00$$

<i>h</i>	^m 0.00	^m 1.00	^m 2.00	^m 3.00	^m 4.00	^m 5.00	^m 6.00	^m 7.00	^m 8.00	^m 9.00
^m 0.00	1.00	11.50	24.00	38.50	55.00	73.50	94.00	116.50	141.00	167.50
01	1.09	11.62	24.14	38.66	55.18	73.70	94.22	116.74	141.26	167.78
02	1.19	11.73	24.27	38.81	55.35	73.89	94.43	116.97	141.51	168.05
03	1.29	11.85	24.41	38.97	55.53	74.09	94.65	117.21	141.77	168.33
04	1.38	11.96	24.54	39.12	55.70	74.28	94.86	117.44	142.02	168.60
05	1.48	12.08	24.68	39.28	55.88	74.48	95.08	117.68	142.28	168.88
06	1.58	12.20	24.82	39.44	56.06	74.68	95.30	117.92	142.54	169.16
07	1.67	12.31	24.95	39.59	56.23	74.87	95.51	118.15	142.79	169.43
08	1.77	12.43	25.09	39.75	56.41	75.07	95.73	118.39	143.05	169.71
09	1.86	12.54	25.22	39.90	56.58	75.26	95.94	118.62	143.30	169.98
0.10	1.96	12.66	25.36	40.06	56.76	75.46	96.16	118.86	143.56	170.26
0.11	2.06	12.78	25.50	40.22	56.94	75.66	96.38	119.10	143.82	170.54
12	2.15	12.90	25.64	40.38	57.12	75.86	96.60	119.34	144.08	170.82
13	2.25	13.01	25.77	40.53	57.29	76.05	96.81	119.57	144.33	171.09
14	2.35	13.13	25.91	40.69	57.47	76.25	97.03	119.81	144.59	171.37
15	2.45	13.25	26.05	40.85	57.65	76.45	97.25	120.05	144.85	171.65
16	2.55	13.37	26.19	41.01	57.83	76.65	97.47	120.29	145.11	171.93
17	2.65	13.49	26.33	41.17	58.01	76.85	97.69	120.53	145.37	172.21
18	2.74	13.60	26.46	41.32	58.18	77.04	97.90	120.76	145.62	172.48
19	2.84	13.72	26.60	41.48	58.36	77.24	98.12	121.00	145.88	172.76
0.20	2.94	13.84	26.74	41.64	58.54	77.44	98.34	121.24	146.14	173.04
0.21	3.04	13.96	26.88	41.80	58.72	77.64	98.56	121.48	146.40	173.32
22	3.14	14.08	27.02	41.96	58.90	77.84	98.78	121.72	146.66	173.60
23	3.24	14.20	27.16	42.12	59.08	78.04	99.00	121.96	146.92	173.88
24	3.34	14.32	27.30	42.28	59.26	78.24	99.22	122.20	147.18	174.16
25	3.44	14.44	27.44	42.44	59.44	78.44	99.44	122.44	147.44	174.44
26	3.54	14.56	27.58	42.60	59.62	78.64	99.66	122.68	147.70	174.72
27	3.64	14.68	27.72	42.76	59.80	78.84	99.88	122.92	147.96	175.00
28	3.74	14.80	27.86	42.92	59.98	79.04	100.10	123.16	148.22	175.28
29	3.84	14.92	28.00	43.08	60.16	79.24	100.32	123.40	148.48	175.56
0.30	3.94	15.04	28.14	43.24	60.34	79.44	100.54	123.64	148.74	175.84
0.31	4.04	15.16	28.28	43.40	60.52	79.64	100.76	123.88	149.00	176.12
32	4.14	15.28	28.42	43.56	60.70	79.84	100.98	124.12	149.26	176.40

h	m 0.00	m 1.00	m 2.00	m 3.00	m 4.00	m 5.00	m 6.00	m 7.00	m 8.00	m 9.00
$\frac{m}{0.33}$	4.25	15.41	28.57	43.73	60.89	80.05	101.21	124.37	149.53	176.69
34	4.35	15.53	28.71	43.89	61.07	80.25	101.43	124.61	149.78	176.97
35	4.45	15.65	28.85	44.05	61.25	80.45	101.65	124.85	150.05	177.25
36	4.55	15.77	28.99	44.21	61.43	80.65	101.87	125.09	150.31	177.53
37	4.65	15.89	29.13	44.37	61.61	80.85	102.09	125.33	150.57	177.81
38	4.76	16.02	29.28	44.54	61.80	81.06	102.32	125.58	150.84	178.10
39	4.86	16.14	29.42	44.70	61.98	81.26	102.54	125.82	151.10	178.38
0.40	4.96	16.26	29.56	44.86	62.16	81.46	102.76	126.06	151.36	178.66
0.41	5.06	16.38	29.70	45.02	62.34	81.66	102.98	126.30	151.62	178.94
42	5.17	16.51	29.85	45.19	62.53	81.87	103.20	126.55	151.89	179.23
43	5.27	16.63	29.99	45.35	62.71	82.07	103.43	126.79	152.15	179.51
44	5.38	16.76	30.14	45.52	62.90	82.28	103.65	127.04	152.42	179.80
45	5.48	16.88	30.28	45.68	63.08	82.48	103.88	127.28	152.68	180.08
46	5.58	17.00	30.42	45.84	63.26	82.68	104.10	127.52	152.94	180.36
47	5.69	17.13	30.57	46.01	63.45	82.89	104.32	127.77	153.21	180.65
48	5.79	17.25	30.71	46.17	63.63	83.09	104.55	128.01	153.47	180.93
49	5.90	17.38	30.86	46.34	63.82	83.30	104.77	128.26	153.74	181.22
0.50	6.00	17.50	31.00	46.50	64.00	83.50	105.00	128.50	154.00	181.50
0.51	6.11	17.63	31.15	46.67	64.19	83.71	105.23	128.75	154.27	181.79
52	6.21	17.75	31.29	46.83	64.37	83.91	105.46	128.99	154.53	182.07
53	6.32	17.88	31.44	47.00	64.56	84.12	105.68	129.24	154.80	182.36
54	6.42	18.00	31.58	47.16	64.74	84.32	105.91	129.48	155.06	182.64
55	6.53	18.13	31.73	47.33	64.93	84.53	106.14	129.73	155.33	182.93
56	6.63	18.26	31.88	47.50	65.12	84.74	106.32	129.98	155.60	183.22
57	6.74	18.38	32.02	47.66	65.30	84.94	106.59	130.22	155.86	183.50
58	6.85	18.51	32.17	47.83	65.49	85.15	106.81	130.47	156.13	183.79
59	6.95	18.63	32.31	48.00	65.67	85.35	107.04	130.71	156.39	184.07
0.60	7.06	18.76	32.46	48.16	65.86	85.56	107.26	130.96	156.66	184.36
0.61	7.17	18.89	32.61	48.33	66.05	85.77	107.49	131.21	156.93	184.65
62	7.28	19.02	32.76	48.50	66.24	85.98	107.72	131.46	157.20	184.94
63	7.38	19.14	32.90	48.66	66.42	86.18	107.94	131.70	157.46	185.22
64	7.49	19.27	33.05	48.83	66.61	86.39	108.17	131.95	157.73	185.51
65	7.60	19.40	33.20	49.00	66.80	86.60	108.40	132.20	158.00	185.80
66	7.71	19.53	33.35	49.17	66.99	86.81	108.63	132.45	158.27	186.09
67	7.82	19.66	33.50	49.34	67.18	87.02	108.86	132.70	158.54	186.38
68	7.92	19.78	33.64	49.50	67.36	87.22	109.08	132.94	158.80	186.66
69	8.03	19.91	33.79	49.67	67.55	87.43	109.31	133.19	159.07	186.95
0.70	8.14	20.04	33.94	49.84	67.74	87.64	109.54	133.44	159.34	187.24
0.71	8.25	20.17	34.09	50.01	67.93	87.85	109.77	133.69	159.61	187.53
72	8.36	20.30	34.24	50.18	68.12	88.06	110.00	133.94	159.88	187.82
73	8.47	20.43	34.39	50.35	68.31	88.27	110.23	134.19	160.15	188.11
74	8.58	20.56	34.54	50.52	68.50	88.48	110.46	134.44	160.42	188.40

h	m 0.00	m 1.00	m 2.00	m 3.00	m 4.00	m 5.00	m 6.00	m 7.00	m 8.00	m 9.00
^m 0.75	8.69	20.69	34.69	50.69	68.69	88.69	110.69	134.69	160.69	188.69
76	8.80	20.82	34.84	50.86	68.88	88.90	110.92	134.94	160.96	188.98
77	8.91	20.95	34.99	51.03	69.07	89.11	111.15	135.19	161.23	189.27
78	9.02	21.08	35.14	51.20	69.26	89.32	111.38	135.44	161.50	189.56
79	9.13	21.21	35.29	51.37	69.45	89.53	111.61	135.69	161.77	189.85
0.80	9.24	21.34	35.44	51.54	69.64	89.74	111.84	135.94	162.04	190.14
81	9.35	21.47	35.59	51.71	69.83	89.95	112.07	136.19	162.31	190.43
82	9.46	21.60	35.74	51.88	70.02	90.16	112.30	136.44	162.58	190.92
83	9.57	21.74	35.90	52.06	70.22	90.38	112.54	136.70	162.86	191.02
84	9.68	21.87	36.05	52.23	70.41	90.59	112.77	136.95	163.13	191.31
85	9.80	22.00	36.20	52.40	70.60	90.80	113.00	137.20	163.40	191.60
86	9.91	22.13	36.35	52.57	70.79	91.01	113.23	137.45	163.67	191.89
87	10.02	22.26	36.50	52.74	70.98	91.22	113.46	137.70	163.94	192.18
88	10.13	22.40	36.66	52.92	71.18	91.44	113.70	137.96	164.22	192.48
89	10.25	22.53	36.81	53.09	71.37	91.65	113.93	138.21	164.49	192.77
0.90	10.36	22.66	36.96	53.26	71.56	91.86	114.16	138.46	164.76	193.06
91	10.47	22.79	37.11	53.43	71.75	92.07	114.39	138.71	165.03	193.35
92	10.59	22.93	37.27	53.61	71.95	92.29	114.63	138.97	165.31	193.65
93	10.70	23.06	37.42	53.78	72.14	92.50	114.86	139.22	165.58	193.94
94	10.82	23.20	37.57	53.96	72.33	92.72	115.10	139.48	165.86	194.24
95	10.93	23.33	37.73	54.13	72.53	92.93	115.33	139.73	166.13	194.53
96	11.04	23.46	37.88	54.30	72.72	93.14	115.56	139.98	166.40	194.82
97	11.16	23.60	38.04	54.48	72.92	93.36	115.80	140.24	166.68	195.12
98	11.27	23.73	38.19	54.65	73.11	93.57	116.03	140.49	166.95	195.41
99	11.39	23.87	38.24	54.83	73.31	93.79	116.27	140.75	167.23	195.71
1.00	11.50	24.00	38.50	55.00	73.50	94.00	116.50	141.00	167.50	196.00

Hubiéramos deseado completar estas tablas, calculándolas para la trocha de 0. m. 76; pero la Direccion de Obras Públicas no ha fijado aun el perfil tipo para ella, porque el Estado no ha proyectado todavia ningun ferrocarril con esa trocha.

Sin embargo, dejaremos constancia de que el señor Omer Huet, ex-Director de Obras Públicas i actual Consultor Técnico del Ministerio de Industria i Obras Públicas, la ha aconsejado para ferrocarriles secundarios en diversos informes (1).

Recuérdese tambien que de los 2317 kilómetros de ferrocarriles particulares que existen en Chile hai 674 kilómetros de trocha de 2'. 6" = 0. m. 76 o sea el 29.1% i que entre esos ferrocarriles se encuentra el de *Antofagasta a Bolivia, de servicio internacional*, que tiene 924 kilómetros de desarrollo, de los cuales corresponden a la seccion chilena 442 kilómetros, i en el cual existen gradientes hasta de 2.5%.

Quitratué, 20 de Mayo de 1901.

SANTIAGO MARIN VICUÑA

(Ingeniero jefe de Sección
del ferrocarril de Pitrufquen a Loncoche)

(1) Véase mi libro «*Estudio de los Ferrocarriles Chilenos*» por Santiago Marin Vicuña (Imprenta Cervantes—1901)

