

General Information & Terms

RAIL ACCESSORIES REQUIRED PER TRACK MILE (5280')

Tie Spacing	24"	22"	21"	20"	19"
Number of ties per mile	2,640	2,880	3,017	3,168	3,335
Number of tie plates per mile	5,280	5,760	6,034	6,336	6,670
Number of spikes per mile					
2 per plate	10,560	11,520	12,068	12,672	13,340
3 per plate	15,840	17,280	18,102	19,008	20,101
4 per plate	21,120	23,040	24,136	25,344	26,680
Number of anchors per mile					
every other tie boxed	5,280	5,760	6,034	6,336	6,670
every 3rd tie boxed	3,520	3,840	4,024	4,224	4,448
	39' rails		36' rails		33' rails
Number of rails per mile	270		294		320
pairs of bars per mile	270		294		320
Number of bolts per mile					
6-hole bars	1620		1764		1920
4-hole bars	1080		1176		1280

DATA FOR CALCULATING RAIL TONNAGES

Nominal Weight and Section	Theoretical Weight/Yard	Feet/Ton of Rail	Tons/Foot of Rail	Tons/Mile of Track
140RE	140.6 lb.	42.67	.023436	247.48
136RE	136.2	44.05	.022701	239.72
133RE	133.4	44.98	.022232	234.77
132RE	132.1	45.42	.022017	232.50
131RE	130.8	45.87	.021801	230.22
130RE	129.6	46.30	.021598	228.07
119RE	118.8	50.51	.019798	209.07
115RE	114.7	52.31	.019117	201.88
112RE	112.3	53.43	.018716	197.64
110RE	110.4	54.35	.018399	194.29
100RE	101.5	59.11	.016918	178.65
100RA-A	100.4	59.76	.016734	176.71
90RA-A	90.0	66.67	.014999	158.39
100RA-B	100.5	59.70	.016750	176.88
90RA-B	90.5	66.30	.015083	159.28
90ASCE	90.1	66.59	.015017	158.58
85ASCE	85.0	70.59	.014166	149.59
80ASCE	80.2	74.51	.013367	141.16
75ASCE	75.4	79.58	.012566	132.70
70ASCE	70.4	85.23	.011733	123.90
65ASCE	65.4	91.74	.010900	115.10
60ASCE	60.4	99.34	.010066	106.30



Decimal & Metric Equivalents of Common Fractions of an Inch

64 ths	32 nds	16 ths	8 ths	Decimal	Mm
1/64	1/32	1/16		0.01562	0.397
3/64				0.03125	0.794
5/64	3/32			0.04688	1.191
7/64				0.06250	1.588
9/64	5/32	3/16	1/8	0.07812	1.984
11/64				0.09375	2.381
13/64	7/32			0.10938	2.778
15/64				0.12500	3.175
17/64	9/32	5/16	1/4	0.14062	3.572
19/64				0.15625	3.969
21/64	11/32			0.17188	4.366
23/64				0.18750	4.763
25/64	13/32	7/16	3/8	0.20312	5.159
27/64				0.21875	5.556
29/64	15/32			0.23438	5.953
31/64				0.25000	6.350
33/64	17/32	9/16	1/2	0.26562	6.747
35/64				0.28125	7.144
37/64	19/32			0.29688	7.541
39/64				0.31250	7.938
41/64	21/32	11/16	5/8	0.32812	8.334
43/64				0.34375	8.731
45/64	23/32			0.35938	9.128
47/64				0.37500	9.525
49/64	25/32	13/16	3/4	0.39062	9.922
51/64				0.40625	10.319
53/64	27/32			0.42188	10.716
55/64				0.43750	11.113
57/64	29/32	15/16	7/8	0.45312	11.509
59/64				0.46875	11.906
61/64	31/32			0.48438	12.303
63/64				0.50000	12.700
			1	0.51562	13.097
				0.53125	13.494
				0.54688	13.891
				0.56250	14.288
				0.57812	14.684
				0.59375	15.081
				0.60938	15.478
				0.62500	15.875
				0.64062	16.272
				0.65625	16.669
				0.67188	17.066
				0.68750	17.463
				0.70312	17.859
				0.71875	18.256
				0.73438	18.653
				0.75000	19.050
				0.76562	19.447
				0.78125	19.844
				0.79688	20.241
				0.81250	20.638
				0.82812	21.034
				0.84375	21.431
				0.85938	21.828
				0.87500	22.225
				0.89062	22.622
				0.90625	23.019
				0.92188	23.416
				0.93750	23.813
				0.95312	24.209
				0.96875	24.606
				0.98438	25.003
				1.00000	25.400

CONVERSIONS

From English to Metric Units

Pressure
 1 PSI = 0.06897 bar
 1 bar = 14.5 PSI

Measurements
 1 inch = 2.54 cm.
 1 cm. = .3937 in.

Volume
 1 CFM = 28.03 liters/min.
 1 liter/min. = .0356 CFM



Metric & English Conversion Table

Linear Measure

1 kilometer = 0.6214 mile	1 mile = 1.609 kilometer.
1 meter = $\begin{cases} 39.37 \text{ inches} \\ 3.2808 \text{ feet.} \\ 1.0936 \text{ yard.} \end{cases}$	1 yard = 0.9144 meter. 1 foot = 0.3048 meter. 1 foot = 304.8 millimeters .
1 centimeter = 0.3937 inch	1 inch = 2.54 centimeters.
1 millimeter = 0.03937 inch	1 inch = 25.4 millimeters

Square Measure

1 square kilometer = 0.3861 square mile = 247.1 acres.
1 hectare = 2.471 acres = 107,640 square feet.
1 are = 0.0247 acre = 1076.4 square feet.
1 square meter = 10.764 square feet = 1.196 square yard.
1 square centimeter = 0.155 square inch.
1 square millimeter = 0.00155 square inch.
1 square mile = 2.5899 square kilometers.
1 acre = 0.4047 hectare = 40.47 ares.
1 square yard = 0.836 square meter.
1 square foot = 0.0929 square meter = 929 square centimeters.
1 square inch = 6.452 square centimeters = 645.2 square millimeters.

Cubic Measure

1 cubic meter = 35.314 cubic feet = 1.308 cubic yard.
1 cubic meter = 264.2 U. S. gallons.
1 cubic centimeter = 0.061 cubic inch.
1 liter (cubic decimeter) = 0.0353 cubic foot = 61.023 cubic inches.
1 liter = 0.2642 U.S. gallon = 1.0567 U.S. quart.
1 cubic yard = 0.7645 cubic meter.
1 cubic foot = 0.02832 cubic meter = 28.317 liters.
1 cubic inch = 16.38716 cubic centimeters.
1 U.S. gallon = 3.785 liters .
1 U.S. quart = 0.946 liter.

Weight

1 metric ton = 0.9842 gross ton (2240 pounds) = 1.1023 net ton (of 2000 pounds) .
1 kilogram = 2.2046 pounds = 35.274 ounces avoirdupois.
1 gram = 0.03215 ounce troy = 0.03527 ounce avoirdupois.
1 gram = 15,432 grains.
1 net ton (of 2000 pounds) = .9072 metric ton = 907.2 kilograms.
1 gross ton (of 2240 pounds) = 1.016 metric ton = 1016 kilograms.
1 pound = 0.4536 kilogram = 453.6 grams.
1 ounce avoirdupois = 28.35 grams.
1 ounce troy = 31.103 grams.
1 grain = 0.0648 gram.



Middle Ordinates in Inches

For Railroad Curves

Degree of Curve 100' Chord	Radius in Feet	LENGTH OF RAILS IN FEET								
		39	33	30	28	26	24	22	20	10
0°-30'	11460	3/16	5/32	1/8	3/32	5/64	1/16	3/64	3/64	—
1°-00'	5730	13/32	9/32	15/64	3/16	5/32	1/8	7/64	3/32	1/64
1°-30'	3820	19/32	7/16	11/32	5/16	1/4	7/32	3/16	5/32	1/32
2°-00'	2865	25/32	9/16	29/64	13/32	11/32	19/64	1/4	13/64	3/64
2°-30'	2292	1	23/32	37/64	33/64	7/16	3/8	21/64	17/64	1/16
3°-00'	1910	1 3/16	7/8	11/16	39/64	17/32	7/16	3/8	5/16	5/64
3°-30'	1637	1 13/32	1	27/32	47/64	5/8	33/64	7/16	3/8	3/32
4°-00'	1433	1 19/32	1 1/8	61/64	53/64	23/32	19/32	1/2	27/64	7/64
4°-30'	1274	1 25/32	1 9/32	1 1/16	59/64	13/16	43/64	9/16	15/32	1/8
5°-00'	1146	2	1 7/16	1 3/16	1 1/32	57/64	3/4	5/8	17/32	9/64
5°-30'	1042	2 3/16	1 9/16	1 19/64	1 1/8	63/64	27/32	45/64	37/64	5/32
6°-00'	955.4	2 3/8	1 23/32	1 13/32	1 7/32	1 1/16	29/32	49/64	5/8	5/32
6°-30'	882	2 19/32	1 27/32	1 17/32	1 11/32	1 11/64	63/64	53/64	11/16	11/64
7°-00'	819	2 25/32	2	1 21/32	1 7/16	1 1/4	1 1/16	57/64	47/64	3/16
7°-30'	764.5	3	2 1/8	1 3/4	1 33/64	1 21/64	1 1/8	61/64	25/32	3/16
8°-00'	716.8	3 3/16	2 9/32	1 7/8	1 41/64	1 27/64	1 13/64	1 1/64	27/32	13/64
8°-30'	674.6	3 3/8	2 7/16	2	1 47/64	1 33/64	1 17/64	1 5/64	57/64	7/32
9°-00'	637.3	3 19/32	2 9/16	2 3/32	1 53/64	1 19/32	1 11/32	1 9/64	15/16	15/64
9°-30'	603.8	3 25/32	2 23/32	2 15/64	1 61/64	1 11/16	1 27/64	1 7/32	1	1/4
10°-00'	573.7	4	2 27/32	2 11/32	2 3/64	1 25/32	1 1/2	1 17/64	1 3/64	17/64
11°-00'	524.7	4 3/8	3 1/8	2 19/32	2 1/4	1 61/64	1 43/64	1 13/32	1 5/32	9/32
12°-00'	478.3	4 25/32	3 7/16	2 13/16	2 15/32	2 9/64	1 13/16	1 17/32	1 17/64	5/16
13°-00'	441.7	5 3/16	3 11/16	3 3/64	2 21/32	2 9/32	1 61/64	1 21/32	1 23/64	21/64
14°-00'	410.3	5 9/16	4	3 5/16	2 55/64	2 31/64	2 3/32	1 25/32	1 15/32	23/64
15°-00'	383.1	5 31/32	4 1/4	3 35/64	3 5/64	2 43/64	2 1/4	1 29/32	1 37/64	25/64
16°-00'	359.3	6 11/32	4 9/16	3 3/4	3 9/32	2 53/64	2 13/32	2 3/64	1 43/64	27/64
17°-00'	338.3	6 3/4	4 27/32	4	3 31/64	3 1/32	2 9/16	2 5/32	1 25/32	7/16
18°-00'	319.6	7 5/32	5 1/8	4 7/32	3 43/64	3 3/16	2 45/64	2 9/32	1 7/8	15/32
19°-00'	302.9	7 17/32	5 13/32	4 29/64	3 57/64	3 23/64	2 55/64	2 13/32	1 63/64	31/64
20°-00'	287.9	7 15/16	5 11/16	4 45/64	4 3/32	3 35/64	3	2 35/64	2 3/32	17/32
21°-00'	274.37	8 5/16	5 31/32	4 59/64	4 9/32	3 45/64	3 5/32	2 21/32	2 3/16	35/64
22°-00'	262.04	8 23/32	6 1/4	5 5/32	4 31/64	3 7/8	3 19/64	2 49/64	2 19/64	37/64
23°-00'	250.79	9 3/32	6 1/2	5 25/64	4 11/16	4 3/64	3 29/64	2 57/64	2 25/64	19/32
24°-00'	240.49	9 1/2	6 13/16	5 5/8	4 57/64	4 7/32	3 19/32	3 1/64	2 1/2	5/8
25°-00'	231.01	9 7/8	7 1/16	5 27/32	5 3/32	4 25/64	3 3/4	3 9/64	2 19/32	21/32
26°-00'	222.27	10 1/4	7 3/8	6 5/64	5 19/64	4 9/16	3 57/64	3 17/64	2 45/64	43/64
27°-00'	214.18	10 11/16	7 5/8	6 5/16	5 1/2	4 47/64	4 1/32	3 25/64	2 51/64	45/64
28°-00'	207.67	11 1/16	7 15/16	6 35/64	5 45/64	4 29/32	4 3/16	3 33/64	2 29/32	23/32
29°-00'	199.7	11 7/16	8 3/16	6 49/64	5 57/64	5 5/64	4 21/64	3 41/64	3	3/4
30°-00'	193.2	11 13/16	8 1/2	6 63/64	6 3/32	5 1/4	4 31/64	3 49/64	3 7/64	25/32



Middle Ordinates of Curves in 10' Chord & 30' Rail

FORMULA FOR CALCULATING MIDDLE ORDINATES

R = Radius of curvature in feet.

C = Length of chord in feet.

L = Length of arc (or rail) in feet.

M.O. = Middle ordinate in inches.

a = Included angle in degrees, minutes and seconds of chord C or arc L.

$$\text{M.O.} = 12 R (1 - \cos \frac{a}{2}) \text{ Theoretical.}$$

$$\text{M.O.} = 12 (R - \sqrt{R^2 - \frac{C^2}{4}}) \text{ Theoretical.}$$

$$\text{M.O.} = \frac{L^2}{R} (1.5 - \frac{L^2}{32R^2}) \text{ approximate.}$$

Formula gives results within practical limits for radii longer than the arc length.

For standard rail lengths, second term ($\frac{L^2}{32R^2}$) may be omitted for radii longer than 100 feet.

$$\text{M.O.} = \frac{1.5C^2}{R} \text{ approximate.}$$

Formula gives results within practical limits for chords shorter than 20' and radii longer than 60'.

Radius	10' Ch.	30' Rail	Radius	10' Ch.	30' Rail	Radius	10' Ch.	30' Rail
25'	6 1/16"	4'- 4 7/16"	45'	3 11/32"	2'- 5 3/4"	80'	1 7/8"	1'- 4 13/16"
26'	5 13/16"	4'- 2 1/2"	46'	3 9/32"	2'- 5 1/8"	82'	1 27/32"	1'- 4 3/8"
27'	5 5/8"	4'- 0 3/4"	47'	3 7/32"	2'- 4 1/2"	84'	1 13/16"	1'- 4"
28'	5 13/32"	3'- 11 1/32"	48'	3 5/32"	2'- 3 7/8"	86'	1 3/4"	1'- 3 5/8"
29'	5 7/32"	3'- 9 1/2"	49'	3 1/16"	2'- 3 5/16"	88'	1 11/16"	1'- 3 5/16"
30'	5 1/32"	3'- 8 1/16"	50'	3"	2'- 2 3/4"	90'	1 21/32"	1'- 3"
31'	4 27/32"	3'- 6 3/4"	52'	2 7/8"	2'- 1 13/16"	95'	1 19/32"	1'- 2 3/16"
32'	4 23/32"	3'- 5 7/16"	54'	2 25/32"	2'- 0 7/8"	100'	1 1/2"	1'- 1 1/2"
33'	4 9/16"	3'- 4 3/16"	56'	2 11/16"	2'- 0"	110'	1 3/8"	1'- 0 1/4"
34'	4 7/16"	3'- 3 1/16"	58'	2 9/16"	1'- 11 1/8"	120'	1 1/4"	0'- 11 1/4"
35'	4 5/16"	3'- 2"	60'	2 1/2"	1'- 10 3/8"	130'	1 1/8"	0'- 10 3/8"
36'	4 3/16"	3'- 0 15/16"	62'	2 7/16"	1'- 9 5/8"	140'	1 1/16"	0'- 9 5/8"
37'	4 1/16"	3'- 0"	64'	2 11/32"	1'- 9"	150'	1"	0'- 9"
38'	3 15/16"	2'- 11 1/16"	66'	2 9/32"	1'- 8 1/4"	160'	0 15/16"	0'- 8 7/16"
39'	3 27/32"	2'- 10 3/16"	68'	2 7/32"	1'- 7 3/4"	170'	0 29/32"	0'- 7 7/8"
40'	3 3/4"	2'- 9 3/8"	70'	2 5/32"	1'- 7 1/4"	180'	0 13/16"	0'- 7 9/16"
41'	3 21/32"	2'- 8 9/16"	72'	2 3/32"	1'- 6 11/16"	190'	0 25/32"	0'- 7 1/8"
42'	3 19/32"	2'- 7 13/16"	74'	2 1/32"	1'- 6 3/16"	200'	0 3/4"	0'- 6 3/4"
43'	3 1/2"	2'- 7 1/16"	76'	1 31/32"	1'- 5 3/4"			
44'	3 13/32"	2'- 6 3/8"	78'	1 15/16"	1'- 5 1/4"			

