

## ***Continental Cartographics***

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### Some useful information about the **Map** or **Natural Scale Indicator**

**Principal Uses of the Four Scales.** The map scale indicator may be used: **1.** To ascertain the natural scale of any map on which parallels of **latitude**, or one or more graphic scales of linear distances, are shown; **2.** To lay out a graphic linear scale, either in **kilometers**, **statute miles**, or **feet**, for any map of known natural scale.

**The Natural Scale of a Map.** The simplest and the most widely accepted method of stating the scale of a map is to indicate it in terms of the "Natural Scale" or "Representative Fraction ("R.F."). Regardless of difference of language, and units of measure, the natural scale is equally intelligible to all who read the same numerals as, for instance, the Arabic numerals. To state that the scale of a map is 1:100,000 (also written  $1/100,000$  or  $\frac{1}{100,000}$ ) is to say that one unit of

measure on the map (as 1 inch, or 1 centimeter, or other unit) is equal to 100,000 of the same units of linear measure on the surface of the earth.

**How to Use the Scales.** Each scale is constructed for use directly on the interval at the top ( $1^\circ$  latitude, 1 statute mile, etc.). If that interval may not be read conveniently on the map, note instead the reading at any convenient *multiple* of that interval, and **MULTIPLY THE READING** by the number of units on which it is read. (It is necessary to *multiply*, not to divide, because the scales are reciprocal scales, the significant number being the denominator of a fraction whose numerator is 1.) Thus, if on the latitude scale the reading on  $10^\circ$  of latitude is 2,500,000, the natural scale of the map is 1:250,000, because the reading at  $1^\circ$  would be 10 times the reading at  $10^\circ$  latitude. Similarly, if the reading on one-half statute mile on the statute mile scale is 40,000, the natural scale of the map is 1:20,000, because the reading at 1 mile would be only one-half as much as the reading at one-half mile.

**Special Note on the Use of the Latitude Scale.** To ascertain the natural scale of a map from an interval of *latitude*, it should be taken from the *average* reading of  $1^\circ$  of latitude on the map. The reading should be made on a *straight meridian*; on many maps the only straight meridian is to be found in the center of the map. The reading should not be made along the borders of the map. Due allowance must be made, in some instances, for the *map projection*. In determining the scale of any map of the entire globe, or of a major part such as a hemisphere or a continent, it is necessary to take into account the mathematical properties of the particular projection which is used. Thus, to find the approximate *equatorial* scale of a map on the *Mercator* projection, read  $1^\circ$  of *longitude*. To find the approximate scale of a map on *Gall's stereographic* projection, on the  $45^\circ$  *parallel*, multiply the reading of  $1^\circ$  of longitude by 0.71. To find the approximate scale of a map on *Mollweide's homolographic* projection, multiply by 10 the reading of the interval between  $35^\circ$  and  $45^\circ$  (either north or south), or multiply the  $0^\circ$ - $10^\circ$  latitude by 11.1.

**Laying Out Graphic Linear Scales.** The use of the scales for making a graphic linear scale may be most readily explained by illustration.

**Example 1.** Suppose it is desired to make a graphic linear scale of statute miles for a map on the natural scale of  $1/50,000$ . Use the *statute mile* scale which is made for use on 1 statute mile. The interval from the top line down to 50,000 is the exact length of 1 statute mile, and may therefore be laid out direct on the desired linear scale; that distance may, of course, be spaced off for any

number of miles. To check a long linear scale of miles at 1:50,000, it should be noted that the linear scale for 2 miles equals the reading at 25,000; that the linear scale for 5 miles equals the reading at 10,000; etc.

**Example 2.** Suppose it is necessary to make a graphic linear scale of kilometers for a map which is on the natural scale of 1:5,000,000. Use the *kilometer* scale which is made to use on 1 kilometer. It will be noted that 5,000,000 does not appear on the scale, therefore a convenient decimal fraction should be used. Thus the interval at 500,000 equals 100 kilometers on the 1:5,000,000 scale, the interval at 50,000 equals 10 kilometers, the interval at 25,000 equals 200 kilometers, etc. If it is desired to make a graphic linear scale (e.g., in kilometers) for a map having some other graphic scale (e.g., in miles or feet), it is necessary simply to ascertain the natural scale of the map (if not indicated); and at that natural scale to lay out the required second graphic linear scale.

**Scale in Miles per Inch.** The scale of a map in statute miles per inch may readily be computed from the natural scale by use of the following table:

<i>Natural scale</i>	<i>Miles per inch</i>	<i>Natural scale</i>	<i>Miles per inch</i>
1:1,000,000	15.787878	1:6,000,000	94.696969
1:2,000,000	31.565656	1:7,000,000	110.479797
1:3,000,000	47.348484	1:8,000,000	126.262626
1:4,000,000	63.131313	1:9,000,000	142.045454
1:5,000,000	78.914141		

Example: Suppose it is desired to determine the scale in statute miles per inch of a map on the natural scale of 1:3,750,000. Simply add the factors taken from the above table, using the proper decimals thereof, as follows:

<i>Natural Scale</i>	<i>Miles per inch</i>
1:3,000,000	= 47.34848
1: 700,000	= 11.04798
1: 50,000	= .78914
1:3,750,000	= 59.18560

Similarly, the natural scale may be computed from a known scale of statute miles per inch, by using the following table:

<i>Miles per inch</i>	<i>Natural scale</i>	<i>Miles per inch</i>	<i>Natural scale</i>
1	63,360	6	380,160
2	126,720	7	443,520
3	190,080	8	506,880
4	253,440	9	570,240
5	316,800		

Example: Suppose it is desired to determine the natural scale of a map which is on the scale of 48 statute miles per inch. The factors from the above table, using proper decimals or multiples thereof, should be added as follows:

<i>Miles per inch</i>	<i>Natural scale</i>
40	2,534,400
8	506,880
48	3,041,280