

Research Note

Number 183

Portland, Oregon

March 1960

A PARALLAX-FACTOR ALIGNMENT CHART

by

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Photo-mensuration techniques are often used in obtaining elevation differences in areas where topographic maps are unavailable. These differences can be obtained with simple instruments such as the parallax wedge or the parallax bar. Although the accuracy of measurements with this equipment is not as high as that obtained with the complicated plotting instruments used in topographic mapping, past experience has shown that elevation differences can be measured within ± 10 percent two out of three times.

Measurements on photos are made in terms of parallax difference. This is the difference in instrument readings between the upper and lower points being measured. Parallax differences are translated into elevation differences by means of a parallax formula. When many measurements are to be made, solution of this formula is facilitated by use of the alignment chart presented here.

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The parallax formula can be written as follows:

$$h = \text{PSR} \frac{f(dp)}{P+dp}$$

Where h = elevation difference in feet

PSR = Photo scale reciprocal (denominator of representative fraction denoting scale)

f = focal length of camera lens in feet

P = Photo base in inches or millimeters

dp = parallax difference in same unit of measure as photo base

The chart solves for the $\frac{f(dp)}{P+dp}$ part of the formula. When this parallax factor is multiplied by the number of thousands in the photo scale reciprocal (PSR), the result is elevation difference in feet. Parallax difference (dp) may be measured in either inches or millimeters, depending on the instrument used. Parallax wedges and some parallax bars are graduated in thousandths of an inch; other parallax bars (including the Abrams height finder) are read in hundredths of a millimeter. Photo base (P) is usually measured in inches. The chart is designed for the two most commonly used focal lengths--8-1/4 inches and 12 inches.

By formula, the problem accompanying the chart would be solved in the following manner:

$$f = 0.6875 \text{ feet (8-1/4 inches)}$$

$$P = 81.28 \text{ mm. (3.2 inches)}$$

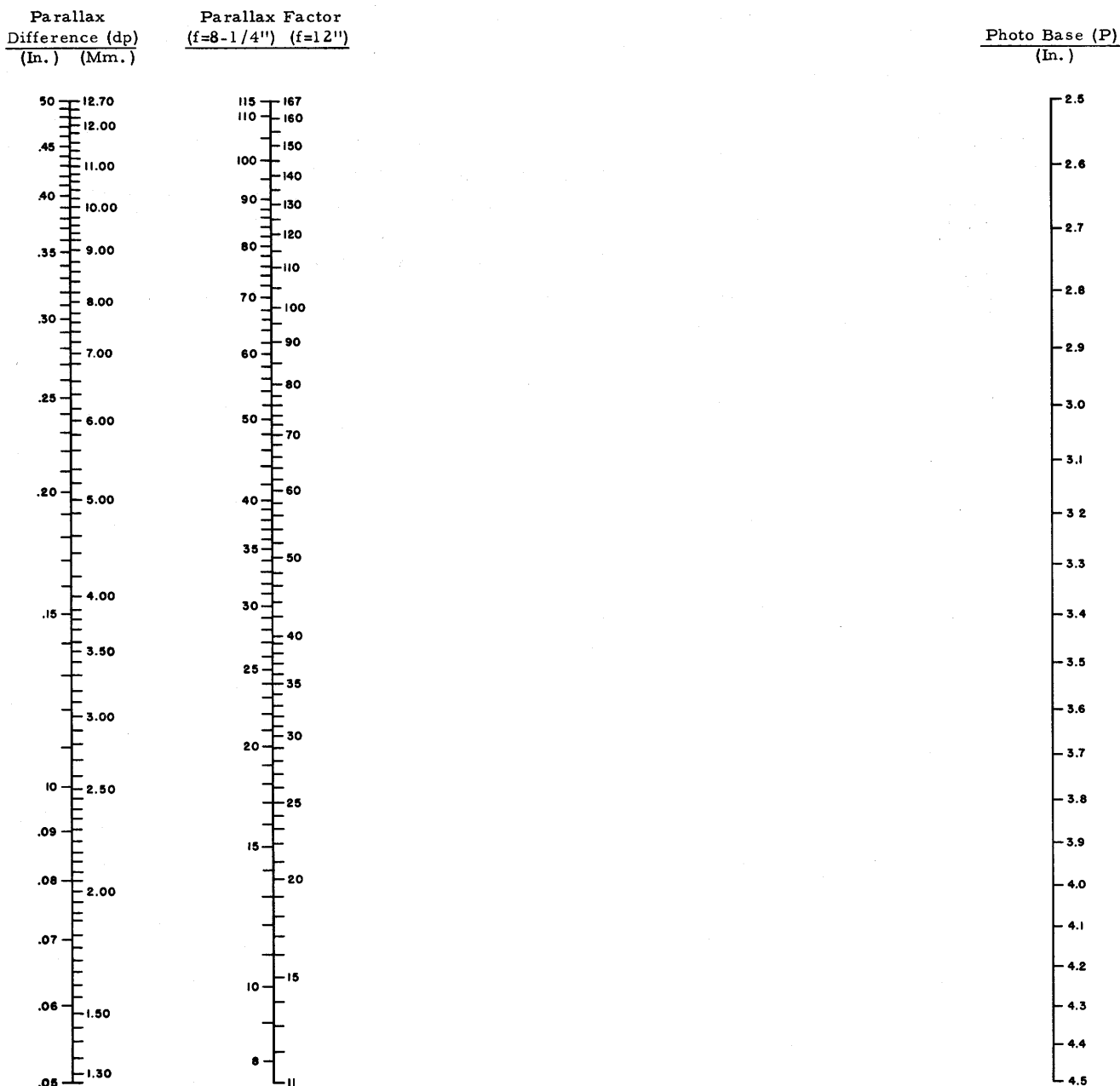
$$dp = 10.00 \text{ mm.}$$

$$\text{PSR} = 20,000$$

$$h = 20,000 \frac{0.6875(10)}{81.28+10} = 20,000(0.0753) = 1,506 \text{ feet}$$

The chart solution is 1,500 feet, which differs by only 0.4 percent from the formula solution.

PARALLAX-FACTOR ALIGNMENT CHART



USE OF CHART

Given: a focal length (f) of 8-1/4 inches, a photo base (P) of 3.2 inches, a parallax difference (dp) of 10.00 millimeters, and a representative fraction of 1:20,000. Place a straightedge so that it passes through the 10.00-millimeter mark on the Parallax Difference scale and the 3.2-inch mark on the Photo Base scale. Read the left-hand side of the center scale where the straightedge intersects it. A factor of 75 is read. To adjust this factor for scale of photography, multiply it by the number of thousands in the denominator of the representative fraction of the photography.

$$\text{Elevation difference} = 75(20) = 1,500 \text{ feet}$$

In measuring the parallax difference of two different locations on a photo, special care must be used to assure that the photos are correctly aligned and securely fastened down. Another source of potential error is the determination of photo base by measuring the distance between principal and conjugate points. Obtaining photo base in this manner is acceptable on fairly level terrain; but when it is being determined for mountainous terrain, it must be obtained at the elevation of the lower of the two points being measured. Techniques for aligning photos and measuring the photo base are described in detail in "Parallax Wedge Procedures in Forest Surveys," by Karl E. Moessner and Earl J. Rogers (U.S. Forest Serv., Inter-mountain Forest and Range Expt. Sta. Misc. Pub. 15, 22 pp., illus. 1957).