Solutions and Comments to “Test Yourself: Proportioning (May/June 2004)

Solution to No. 1:
This problem requires a double proportion solution. To accomplish the solution, the 1973 BLM “Manual” offers the following procedure: “In order to restore a lost corner…a retracement will first be made between the nearest known corners on the meridional line, north and south of the missing corner, and upon that line a temporary stake will be placed at the proper proportionate distance; this will determine the latitude of the lost corners. Next, the nearest corners on the latitudinal line will be connected, and a second point will be marked for the proportionate measurement east and west; this point will determine the position of the lost corner in departure (or longitude). Then, through the first temporary stake run a line east or west, and through the second temporary stake a line north or south, as relative situations may determine; the intersection of these two lines will fix the position for the restored corner.”

This passage or definition is widely quoted, but how does one apply it to the real-world (or test) situation when the measured coordinates of the existent corners are known? Here’s the numerical solution by proportioning coordinates.

According to the GLO measurements, the day the original surveyors left the field, the north-south position of the now lost section corner was exactly two-thirds of the distance from the southwest corner of Section 16 toward the quarter corner between Sections 8 and 9. So, where should the north-south position of the corner be restored today? Like the GLO, it should be two-thirds of the distance between the existent corners. Using the coordinates, here’s an expression to compute the north coordinate to reestablish the lost corner:

$$\text{North Coordinate to reestablish the lost corner position} = 1000.00 + \frac{80}{120}(9072.62 - 1000.00)$$

North Coordinate = 6381.75 feet

Now for the east coordinate: According to the GLO measurements, the day the original surveyors left the field, the east-west position of the now lost section corner was exactly 81.37/161.46 of the distance from the southwest corner of Section 8 toward the southeast corner of Section 9. So, where should the east-west position of the corner be restored today? Same as GLO; 81.37/161.36 of the distance between the existent corners. Using the coordinates, here’s an expression to compute the east coordinate to reestablish the lost corner:

$$\text{East Coordinate to reestablish the lost corner position} = 2680.56 + \frac{81.37}{161.46}(13{,}649.13 - 2680.56)$$

East Coordinate = 8208.32 feet

There is an alternate solution which involves inversing between the coordinates given (east-west and north-south), and then single proportioning along those lines and then using the north coordinate of the north-south proportioned line and the east coordinate of the east-west proportioned line. This method requires more work than merely proportioning coordinates which was the method applied above.

Solution to No. 2:
This is a simple, straight forward single proportion solution. We will simply single proportion to compute the coordinate to reestablish the lost lot corner (4, 5, 8, 9). This solution applies proportioning coordinates. The corner to Lots 1 and 12 has no influence on the solution.

$$\text{North Coordinate} = 100.26 + \frac{150}{265}(100.17 - 100.26) = 100.21 \text{ feet}$$

$$\text{East Coordinate} = 150.08 + \frac{150}{265}(415.79 - 150.08) = 300.48 \text{ feet}$$

Solution to No. 3:
In this problem, we must decide if we are going to proportion the excess or deficiency through the streets, or, are we going to hold (or fix) the street widths at their platted record widths and place all the excess or deficiency in the blocks. Which legal principle has been adopted for your jurisdiction? What are the arguments for each?

If the original surveyor used a tape which was too long or too short, the excess or deficiency would be throughout the entire measurement, including the street(s), between the existent corners. This uniform excess or deficiency is sometimes called a measurement index. There are applications for a measurement index where a uniform, consistent excess or deficiency can be identified between existent monumentation. This may be in a subdivision or on the U.S. Public Land Survey System. If one believes in a measurement index, and a uniform excess or deficiency throughout the measurement, then it would follow that this excess or deficiency should be applied between existent corners and the intervening record street widths would be proportioned. This will make the streets slightly wider or more narrow than their record widths. Here is the solution by proportioning coordinates. Although not asked in the problem statement, by proportioning through the streets, Rolla Road becomes 39.54 feet wide.

$$\text{North Coordinate} = 805.62 + \frac{140}{310}(800.00 - 805.62) = 803.08 \text{ feet}$$

$$\text{East Coordinate} = 293.65 + \frac{140}{310}(600.00 - 293.65) = 432.00 \text{ feet}$$

An alternative solution is to hold (or fix) the street widths at their record widths. The legal principle is that the street widths are specified by some governmental unit or requirement, and that through the platting and approval process have been accepted on behalf of the public and therefore are fixed (at their record widths) and cannot be proportioned. Most courts have adopted this legal principle. Here's the solution for holding Rolla Road and Alley Way at their platted, record widths:

Inversing between the found, existent block corners yields a distance and direction of: 306.40 feet. 91°03'04" azimuth.

We are going to place all the excess (in this case) in the block lengths and none in the street or alley. Thus, the proportioning distances are:

Record = 310' – 60' = 250'
Measured = 306.40' – 60' = 246.40'

The distance to reestablish the northwest corner of Block 2 from the northwest corner of Block 1 is the proportioned part of the 100-foot record block length plus 40.00 feet:

$$\frac{\text{Proportioned Distance}}{100.00} = \frac{246.40}{250.00}$$

Proportioned Distance = 98.56

Distance to reestablish the northwest corner of Block 2 from the northwest corner of Block 1 = 98.56 + 40.00 = 138.56'

Therefore coordinates of the corner are:

803.08 feet north
432.19 feet east