



ALTA/ACSM Land Title Survey corner

by Gary Kent

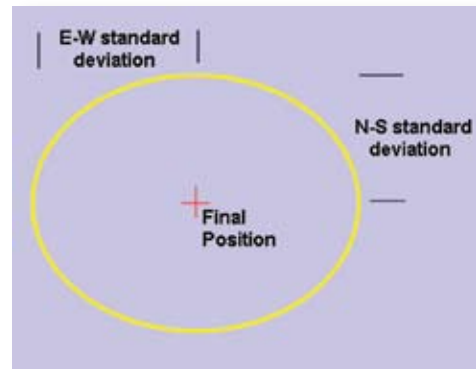
Q Can the standard error ellipse obtained from a least squares adjustment be used to estimate the Relative Positional Accuracy for points located as part of an ALTA survey? In other words, if the ellipses are smaller than 0.07 ft + 50 ppm does the survey meet the standard?

A According to the standards, “Relative Positional Accuracy may be tested by... the results of a minimally constrained, correctly weighted least square adjustment of the survey.”

Assuming the least squares adjustment takes into account the primary sources of random, accidental error (which, for an angle are instrument centering, target centering, pointing and reading (DIN), and which, for an EDM distance are instrument centering, target centering and reading), the adjustment will hopefully be “corrected weighted,” and will result in valid error ellipses for each point on the survey.

The definition of RPA is “... the value expressed in feet or meters that represents the uncertainty due to random errors in measurements in the location of any point on a survey relative to any other point on the same survey at the 95 percent confidence level.”

So, it is not the error ellipse of an *individual point*, but rather the relative error ellipse between any two specified points that defines RPA (keeping in mind this is at two standard deviations, not one). This means, among other things, that there is not a single Relative Positional Accuracy for the overall survey, but rather an RPA (and a respective “allowable” RPA) for every two-point combination on the survey. Of course, on a large survey, it would be time-consuming and unnecessary to check every single combination of points, so looking for the potential worst cases would be a logical approach. In a normal survey, this might be the two most distant points on the survey, although depending on if, where and how redundant measurements were made, those points might *not* result in the worst case. Those points separated by some combination of the most observations with the lowest con-



fidence in those observations will probably result in the highest RPA's.

Recently, we have been asked how to make RPA more meaningful to the layperson (0.07 feet plus 50 ppm does not communicate anything comprehensible to most people). Perhaps determining the worst case RPA (e.g. as suggested above) in feet, assuring that it does not exceed the allowable 0.07 feet plus 50 ppm, and then stating that the RPA does not exceed that amount on the survey (with 95% confidence) might not be a bad way to express it (understanding that the result will be the worst case and that in most cases, the RPA will likely be significantly less than the worst case).

Expressing RPA in such a way is not a requirement of the ALTA/ACSM standards; the standards merely require that it be addressed in the certificate. But it is a requirement in some states, and some surveyors are being asked by attorneys and title people for some simplified explanation of what 0.07 feet and 50 ppm means on a given survey.

Incidentally, the development of a relative error ellipse is a mathematical exercise that will require a software program for most persons to execute.