

## 18. GPS Error Sources



A thought experiment (Wormley, 2004): Attach your GPS receiver to a tripod. Turn it on, and record its position every ten minutes for 24 hours. Next day, plot the 144 coordinates your receiver calculated. What do you suppose the plot would look like?

Do you imagine a cloud of points scattered around the actual location? That's a reasonable expectation. Now, imagine drawing a circle or ellipse that encompasses about 95 percent of the points. What would the radius of that circle or ellipse be? (In other words, what is your receiver's positioning error?)

The answer depends in part on your receiver. If you used a hundred-dollar receiver, the radius of the circle you drew might be as much as ten meters to capture 95 percent of the points. If you used a WAAS-enabled, single frequency receiver that cost a few hundred dollars, your error ellipse might shrink to one to three meters or so. But if you had spent a few thousand dollars on a dual frequency, survey-grade receiver, your error circle radius might be as small as a centimeter or less. In general, GPS users get what they pay for.

As the market for GPS positioning grows, receivers are becoming cheaper. Still, there are lots of mapping applications for which it's not practical to use a survey-grade unit. For example, if your assignment was to GPS 1,000 manholes for your municipality, you probably wouldn't want to set up and calibrate a survey-grade receiver 1,000 times. How, then, can you minimize errors associated with mapping-grade receivers? A sensible start is to understand the sources of GPS error.

In this section you will learn to:

1. state the kinds and magnitude of error and uncertainty associated with uncorrected GPS positioning; and
2. use a PDOP chart to determine the optimal times for GPS positioning at a given location and date.

Note: My primary source for the material in this section is Jan Van Sickle's text *GPS for Land Surveyors, 2nd Ed.* If you want a readable and much more detailed treatment of this material, I recommend Jan's book. See the bibliography at the end of this chapter for more information about this and other resources.

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