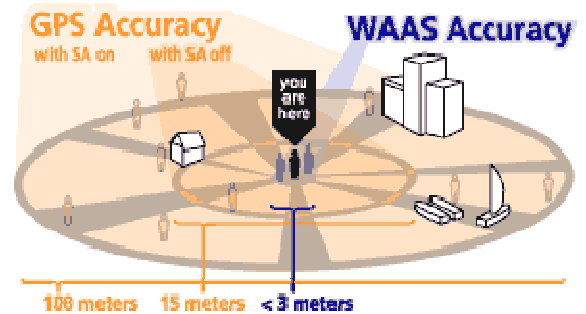


From the SmuttyNose Hampton Half Marathon and Rockfest website, you can check out their website here: <http://www.locoraces.com/>

GPS Accuracy Fact, Fiction and Common Sense.

How does a GPS compare when measuring race courses.:

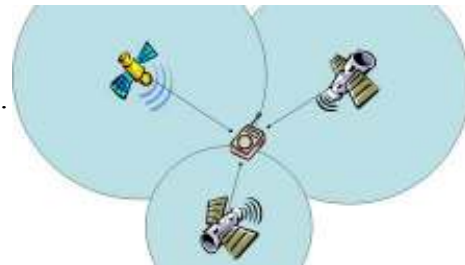
The short answer is: A GPS measurement is often not nearly as accurate as a wheel measured course. The normal wrist-held or recreational devices are accurate to anywhere from 3 meters to 10 meters 95% of the time causing them to often report longer distances on an accurate measured course. There are many other issues that prevent a GPS measurement to be as accurate.



There is a tremendous amount of information on the web related to GPS accuracy and very long descriptive accuracy statements made by different manufacturers.

One would think that with all the technology of satellites and computers and software algorithms that the GPS is far more accurate than the old fashioned bike measurement method. Think again.

A little background: To determine an object's location, the GPS system must receive a radio signal from at least three satellites, preferably four.. Since each satellite emits a unique signal, the receiver can then match the signal to the satellite and its orbital position. This is called triangulation. Distance from the receiver is then calculated (for each satellite), and from that data, the receiver accurately calculates its geographic position.



What affects the accuracy of a GPS?

A comprehensive comparison of all commercially available GPS devices is beyond the scope of this article. However, many runners use a leading brand, Garmin and the stated current specification using the latest WAAS is 3-5 meters. However that is only for 95% of the time, the other 5% of the time, your GPS may be off as much as 10 meters or more.

10 Meters off, that doesn't seem like a lot.

(Check again - That's as much as 30 FEET PER READING)

There is a general misunderstanding of what a GPS device is. People have a picture in their mind that it follows your path like a traditional wheel. The image being of a consistent and continuous line being drawn along the path that you run.

FICTION: Your GPS measures the same path you are running.

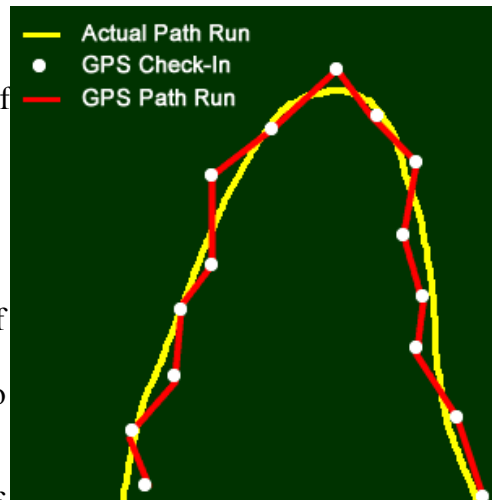
Not so. Instead your GPS records a series of reading that can be plotted on a chart. So instead of a constant line it is a reading every 1 to 20 seconds. These dots are to the left or right of you or front or back. See chart below. According to the MANUFACTURERS Spec... 95% of the time that dot is within 10 feet or 3 meters. (not that close really when you think about it.)



To better illustrate, let's just say your GPS is very special Border Collie that will run with you anytime, anywhere. Like any well trained dog they run right next to you, or within 10 feet 95% of the time, but 5% of the time, they see a squirrel and chase it just for a short time. Or they run through a large puddle up to 30 feet away. But like a good dog they start and finish right with you.

GPS - Connect the Dots if you can

The reality is that your GPS plots all those points of the Collie's path. This series of dots are connected make lines. To measure distance it simply plays connect-the-dots and adds up the total difference between those points.



The second (and bigger) problem is the accuracy of those dots. Garmin's web site itself states the following: "Garmin® GPS receivers are accurate to within 10 meters on average."

The image to the right shows what happens 95% of the time. So the result is that your GPS can read your path as weaving 10 meters in either direction, when you are actually moving in a straight line.

More Issues with Accuracy: Skip this part if you are already convinced!

GPS accuracy is affected by a number of factors, including satellite positions, noise in the radio signal, atmospheric conditions, and natural barriers to the signal. Noise can create an error between 1 to 10 meters and results from static or interference from something near the receiver or something on the same frequency. Objects such a mountains or buildings between the satellite and the receiver can also produce error, sometimes up to 30 meters. The most accurate determination of position occurs when the satellite and receiver have a clear view of each other and no other objects interfere.

Obviously, mountains and clouds cannot be controlled or moved, nor can interference and blockage from buildings always be prevented. These factors then, will affect GPS accuracy. To overcome or get around these factors, other technology, AGPS, DGPS, and WAAS, has been developed to aid in determining an accurate location. The net result can be best described by a study by Michael D. Londe PHD summary below.

"It could be conservatively stated that at best these types of receivers are accurate to 8m to 10 m at 95% confidence. This set of tests has concentrated on Garmin recreational receivers. Tests that have been run on other brands of recreational receivers have yielded similar results." (1)

Runners just run....race and have fun.. stop checking your GPS every tenth of a mile! !!

What other factors affect measurements using a GPS

Not only is the GPS not accurate enough for a true reading but runners on a course are not able to run the exact shortest distance due to a number of factors including:

1. Courses with lots of turns often create longer GPS readings. Runners in a race can try to run the tangent or the shortest possible line on a corner, but often other runners are in the way, or traffic prohibits them from doing this safely.
2. Water stops and other excursions from the course will make your GPS report a longer difference
3. Not starting the GPS at the start line, often the runner starts the GPS before the start in the corral
4. Inexperience with the course. If you are running a course for the very first time, you are not able to pick the best tangent or shortest line since you have limited knowledge of the course
5. Runners often choose to run on the softer side of the road, or on the cant of the road that feels best.
6. Runners almost never run in a straight line, they make hundreds of small adjustments in a race left and right. Try this test, run 10 miles hard on the roads, now go to a track and try to run following exactly on the white line for 3 miles. You will find yourself wandering ever so slightly.
7. Runners are more focused on "running the race" and over time become tired and more focused on finishing. Professional certifiers ride smoothly along on a bike with little of no discomfort to distract them.

So, I just bought this \$200 GPS and you are saying it's not accurate??

Your GPS is a great tool for workouts, for figuring out approximately where you are in a race and for elevation and pacing charts. The object of this site is to contrast the two measuring means, a wheel measured certified course and a recreational GPS device.

"So, whereas the phenomenon of GPS technology has added some unique, valuable and fun aspects to running, and races, **they are not as accurate** at measuring a course as the standard wheel measuring method, especially when the course has lots of turns." Dave McGillivray (Ask the Race Director, BAA Boston Marathon RD)

Here's a standard of proof anyone can try.

Find a good track at a University. Set your GPS and go for a 5K run. Remember to run precisely next to the white line in the first lane. The actual measurement of 400 meter track That would be a boring 12 and a half laps. (Start at the 200 meter mark and run to the start line, now do 12 more laps)

You have just run the most accurate 5K course you can find. Now go to your computer and pull down the results. Check your results. Now plot your points on a chart. This is a 5K course with 25 corners, your chart will not show a perfect oval. It will show an oval with points going way inside the track and way up in the bleachers.

Common Sense:

If it were just so easy to certify a course by running or biking on it using a GPS, race directors worldwide would be adopting this method. Alas, it is not that easy or accurate. Some certifiers in the UK are actually trying to do this. but so far no luck. Certified professions whose sole job is to measure and certify a course using stringent calculated methods developed over tens of years have a much better chance at getting extremely close to the actual race course distance required.

Math being my strong point, lets look at a final ingredient, That 1:44 marathoner ran for about 6,240 seconds. Over that period if his GPS sampled every 5 seconds that will provide 1,248 samples over a half marathon course. The certifier will record 211,290 points or clicks on the counter over the same course - or almost 200 times as many.

Courses measuring short: Note from our great course measurer Ron "I've used a GPS while measuring and found that tree cover will affect the distance measured. When running a path with several turns in a heavily wooded area, the GPS loses satellite information, and when out from under the trees, and satellite info is again available, the GPS assumes that you traveled a straight line from where satellites were lost and regained-- hence a shorter route."