

Global Positioning Systems

GPS Systems

By Michael Bassett, CET

By now, most people are quite familiar with GPS (Global Positioning Systems). GPS are turning up in more places every day, from rental cars to emergency vehicles, from ocean liners to the weekend hiker. Not only have they become more economical, but also the accuracy has improved. These changes have opened up even more possibilities for the systems.

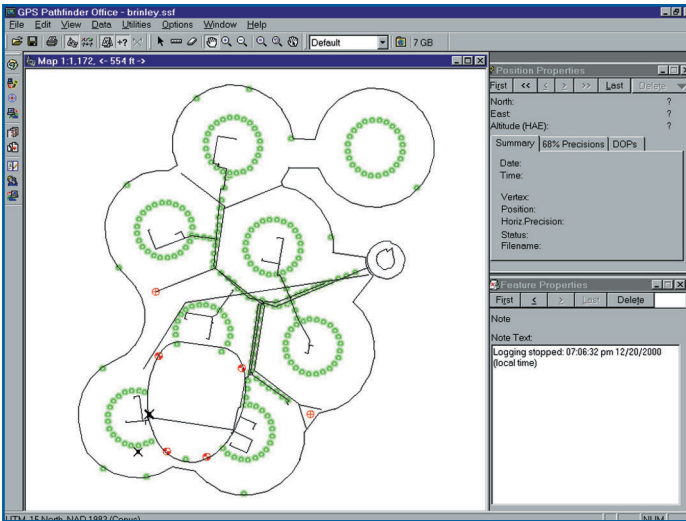
My company's first experience with the systems was quite a few years ago. A large, complex facility established a need



Above: GPS unit collecting data to generate a roof plan.



Left: Two GPS units entering utility line data. Multiple GPS files can be joined seamlessly to create a single drawing.



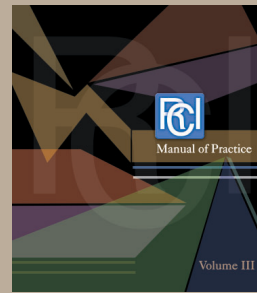
Raw data retrieved from a GPS showing a building ideally suited for GPS survey.

for a better way to generate roof and site plans. At that time, GPS systems were expensive and the accuracy was not suitable for most applications. Developed by the Department of Defense, civilian usage was not a major priority and was in ways discouraged through the scrambling of signals, reducing accuracy. Economically, they were not what was required for generating an accurate roof or site plan. Our definition of “accurate” was less than twelve inches off for a given length. For some, this may not seem very precise. The alternative would be to measure utilizing a nylon tape. Granted, on small, simple buildings, pulling a 300-foot nylon tape and measuring to the nearest inch will probably be more accurate. However, on larger facilities with multiple levels or complex shapes, during inclement weather, and with penetration obstruction, errors can add up. Even on calm days under perfect conditions, the stretch in the tape will vary by inches. Methods are available to achieve more precise readings, but most require a larger investment in equipment, more time to collect the data, or both.

As with every new venture, the time comes when payback outweighs the investment. Our first GPS system drew some speculation even within our own organization. Was this a tool or a toy? Being reasonably priced did not mean that we were running out to buy each consultant his or her own GPS system. It meant that the company could venture into the idea with a single unit and see where it took us.

Two grades of systems are available, mapping and surveying. Mapping – being less accurate and much more economical – seemed the best fit for the company’s needs. There were no hard data to prove that the system would work effectively. The manufacturer of the system the company purchased had never sold one for measuring roofs and was of minimal help. We were pretty much on our own.

After a few initial projects, some distinct advantages and disadvantages were obvious. Most projects showed great potential. Others taught us a valuable lesson, and one showed that return trips to re-measure a building could be quite expensive.



YES! Send me my copy of the

RCI Manual of Practice
Volume III

\$235 per copy
(plus \$10 shipping and handling)
nonmembers pay \$275 (plus \$10 s&h)

Name:
Company Name:
Address:
City/State/Zip:
Phone: _____ Fax: _____
E-mail:
RCI Member No.:

Payment Method

- Check (payable to RCI - US funds)
- American Express
- Visa
- MasterCard

Card Number:
Exp. Date:
Name on Card:
Signature:

No. of Copies: _____ @ \$ _____ each

Order Subtotal: \$ _____
Shipping and Handling: \$ _____
Total Submitted: \$ _____

Order online! www.rci-online.org/order.htm

Roof Consultants Institute

1500 Sunday Drive, Suite 204
 Raleigh, NC 27607
 800-828-1902 (p)
 919-859-1328 (f)
www.rci-online.org





Numerous pipes would present a problem to either tape or GPS. Capabilities were added to collect pipe features by recording the centerline and adding the number of pipes.

Advantages:

We discovered the accuracy was not only within our desired parameters, but was exceeding our expectations. Periodically, we would tape roof sections taking readings to the nearest inch to compare to the GPS data. Typical readings were different by less than 6 inches from the taped dimensions.

The time to measure a building was cut by half in some cases. The more unusual the building shape or the more scattered the penetrations, the more time was saved.

While a building simple in size or shape does not necessarily merit using a GPS, the advantage in doing so is that we now have it located on the world. The readings can now generate other useful information as to the distance between particular buildings, which is essential information in forming a site plan.

Since the data are stored digitally, extracting a plan is generally quite easy. Normally, within minutes of collecting data, a rough plan can be printed. A final plan requires drafting time to clean up intersections and corners and to check alignment and placement of penetrations.

Accumulated errors are limited. In measuring a multiple level or a long building that requires moving a tape multiple times, errors are going to accumulate. In using the GPS, each corner or junction is located with the same accuracy.

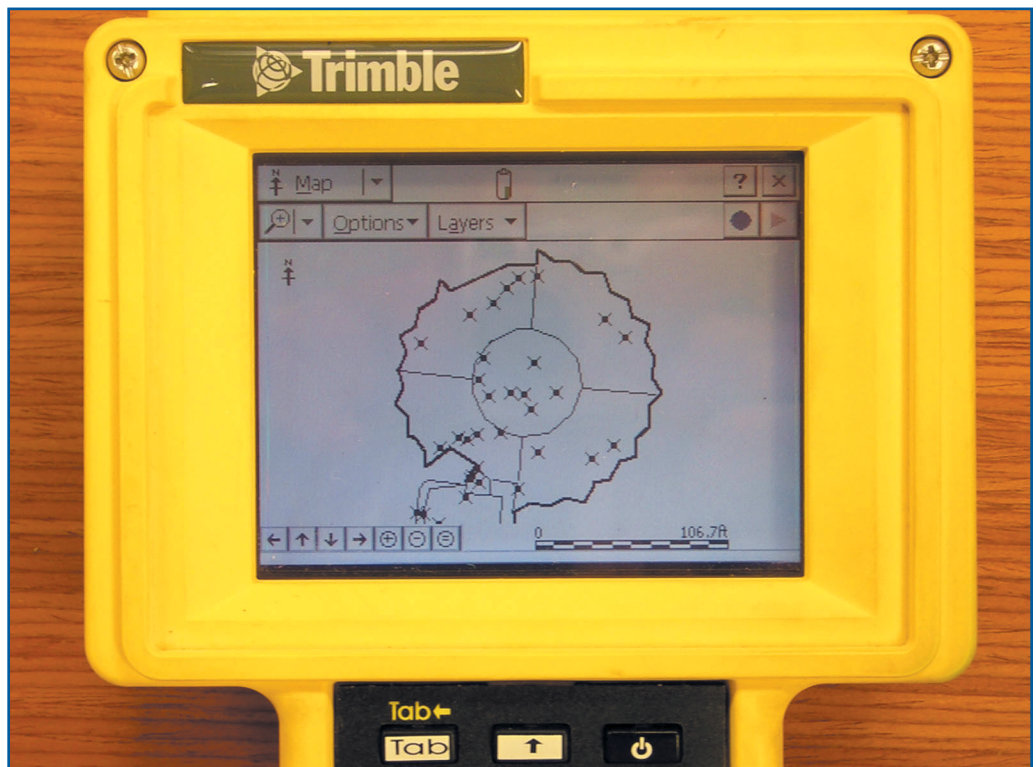
Inclement weather can slow or stop a normal survey. The GPS does not care if the sun is shining or it is the middle of a downpour. There is only minor degradation of the signal sent by the satellites through poor atmospheric conditions. Of course, this could also be seen as a disadvantage if you are the person operating the system.

Disadvantages:

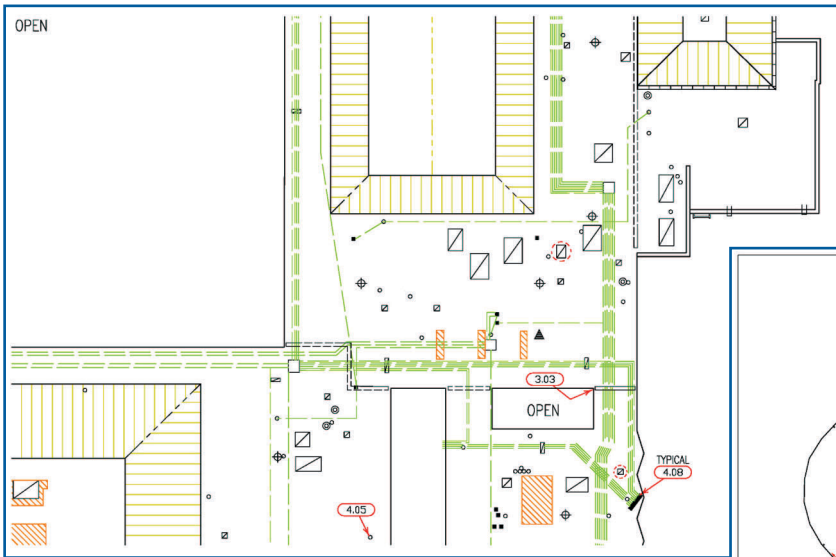
Although one of our goals was to have a system that was simple enough for almost anyone to operate, certain characteristics complicated data collection. A good knowledge of the systems is not required but is very helpful in avoiding data collection problems.

One of the hardest traits of the system to get used to is the lack of

a physical drawing. There are certain features that tend to be more difficult to enter into the system. Understanding these problems helps but can be more time consuming. The mapping feature



Data collector screen in map view showing portion of a facility ideal for GPS use.

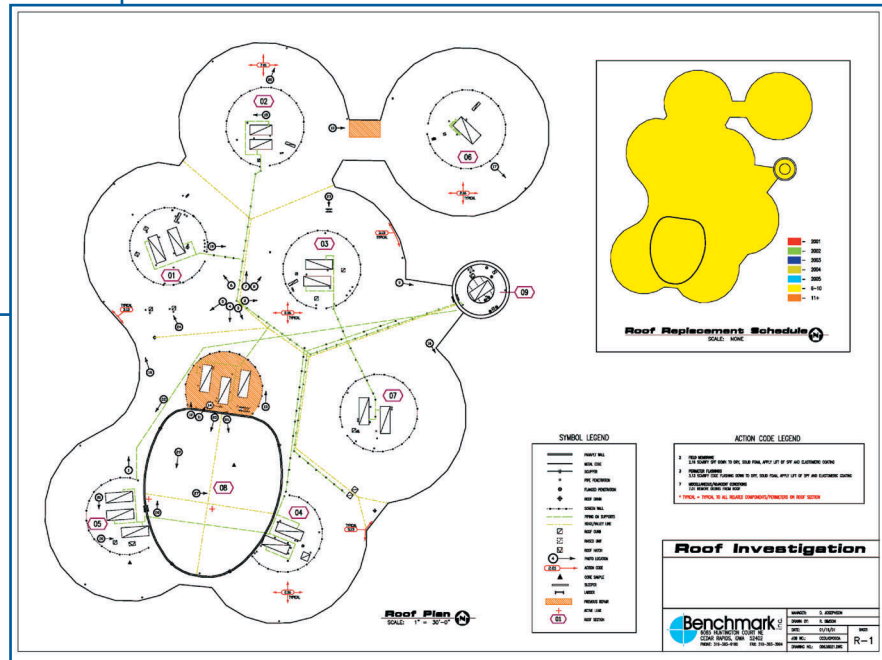


ing what are known as multipath errors, rendering the GPS almost useless. There are ways to work around these problems by using offsets or collecting the feature from a higher location where the signal is stronger. There are times when it is just more efficient to measure the feature with a tape.

Partially finished AutoCAD file showing completed pipe network.

of the data collector provides the user with a graphic image of the data. It must be utilized and trusted. Potential problems must be corrected before leaving the project.

Since the system requires a signal from above, areas with high walls, overhangs, adjacent trees, or other objects could block the signal or reflect the signal, creat-



Finished AutoCAD drawing file.



Subscribe

Welcome to RCI-Mercury
The Reliable Resource for Roofing and Waterproofing Information

RCI-Mercury is a free information service provided by the [Roof Consultants Institute](#) as a means to promote professionalism, education and research in the roofing industry.

RCI-Mercury is your online roofing and waterproofing document resource. Check below for categories and news:

E-Mail Service
New! Get weekly email updates from RCI-Mercury:
[Click Here](#)

Articles
Journal publications from the early 1980s and onward including industry and scientific publications. This is the place to go if you are looking for from-the-field reports on materials performance, weather-related issues, or installation advice.
[Browse Subcategories](#)

Sign up to receive FREE e-mail notification

of new documents as they are added to the
RCI-Mercury database

Thousands of Roofing and Waterproofing Technical Documents Online

www.RCI-Mercury.com

Conclusion:

Individual applications determines whether a GPS is beneficial. Although the systems can generate very accurate readings – in the 2-centimeter range – a lengthy time is required to collect sufficient data to do so. If extremely accurate readings are required in a timely manner or in crowded locations, GPS may not be a feasible tool. For those in need of very accurate data, look to the surveying grade, but keep in mind that disadvantages still apply. From our experience, the mapping grade systems, under ideal circumstances, will provide readings less than 6 inches different from actual.

Benchmark, Inc. has been utilizing GPS for over three years and currently owns three GPS systems used not only to create roof plans, but also paving and site plans. ■

ABOUT THE AUTHOR

Michael Bassett, CET, is the general manager for Benchmark, Inc., a national roof and paving consulting firm, where he has been employed for the past 15 years. Bassett's varied duties include maintenance and development of the GPS. He has an associate of applied science degree in civil engineering technology and has attained certification from NICET.



MICHAEL BASSETT, CET

SPECIAL OFFER

**Business Card Ads
\$125 per month!**

Your business card size ad will appear in ten issues of *Interface* for just \$125 per issue.

For more information, call:
800-828-1902

CRRC BEGINS AGED TESTING PROGRAM

The Cool Roof Rating Council (CRRC) announces the initiation of the aged testing component of its product rating program. The completed aged testing protocol complements the initial testing protocol implemented in Fall 2002. It provides third party verification of weathered performance claims to aid in the selection of cool roofs that save energy and reduce a building's impact on the local environment.

The CRRC was established in 1998 to focus on implementing a fair, accurate, and credible radiative energy performance rating system for roof surfaces and to disseminate the information to all interested parties. The Product Rating program, the core element of CRRC, was launched in September 2002 with the purpose of reporting initial and three-year aged values for solar reflectance and thermal emittance. The CRRC board of directors pledged to launch this final element of the rating program by January 2004, and in fact, weathering of products for CRRC rated products for aged testing has already begun, according to CRRC Chairman Peter Turnbull.

The performance of a cool roof over time is greatly influenced by environmental exposure. Several variables, such as different climates and slopes of roofs, contribute to the amount of dirt, staining, and fungal growth that accumulate on roofs over time. This weathering can impact the reflectance and emittance of a roof, pointing to the importance of aged testing in evaluating cool roof performance.

Over 130 roofing products are currently listed with their initial ratings in the CRRC Rated Products Directory (found at www.coolroofs.org). Both initial and aged performance ratings (as they become available) are displayed on product labels and the online directory.

As the multiple benefits of cool roofs are increasingly being recognized, code bodies are starting to require increased roof radiative performance. In many locations, cool roofs not only save energy and money by reducing air-conditioning needs for individual buildings; their implementation on a broader scale also promises to reduce the urban heat island phenomenon by lowering a community's ambient temperatures by several degrees.

Current revisions (adopted in November 2003) to California's energy efficiency code, Title 24, require a cool roof, defined by the state as having an initial solar reflectance of 0.70 and thermal emittance of 0.75 for low-sloped roofs of commercial buildings, as rated and documented under the CRRC system.

CRRC's Rating Program complements other programs, such as EPA's EnergyStar® program, that set minimum performance thresholds. The growing cool roofing market relies on clear and accurate information about product performance. The CRRC hopes that the development of the aged testing procedure will provide up-to-date information for the industry. All roofing materials manufacturers and sellers are encouraged to participate in the CRRC Product Rating Program.

For more information on the CRRC, the new aged testing protocol, program participation, and membership, visit www.cool-roofs.org, or contact the CRRC directly at (866) 465-2523.