

GIFFELS-WEBSTER ENGINEERS

WHEN FOREVER REALLY MEANS FOREVER: AN ABSOLUTE SOLUTION FOR GEO-POSITIONING

—by John N. Redash, PS
Giffels-Webster Engineers



John Redash is a vice president and principal of Giffels-Webster Engineers in Rochester Hills, Michigan. He directs the firm's

survey department, and is the program administrator and coordinator of the Wayne County Plat Office's Surveying and Remonumentation Program.



CORS stations such as this one are the backbone of the Michigan Spatial Reference Network (MSRN)

Within the last 10 years, the greatest technological breakthroughs for the geospatial industry have been the development of GPS hardware and software, establishment of continuously operating reference stations, and advancements in wireless communication. Together, these new technologies have resulted in an absolute solution for the actual, physical geo-positioning of three-dimensional ground information.

The most outstanding feature of this combination of technologies is the fact that once a position has been occupied for one second, the position is fixed in time and space. It can be recovered by anyone, at any time with a high-precision GPS receiver. This solution is absolute because the reference stations established are true datum control points for the survey, not a local point established for temporary or site-specific purposes. This breakthrough technology has given rise to networks of continuously operating reference stations known for short as CORS.

Positive Impact on Land Development

In Michigan, these breakthrough technologies have been implemented through a cooperative effort between the Michigan Department of Transportation Design Survey Unit and County Remonumentation Program

Partners. The result is the Michigan Spatial Reference Network (MSRN). The MSRN gives all agencies, public and private, free access to corrected GPS signals, which enables them to produce centimeter-level GPS results with a single, roving unit.

In land development, geospatial information acquired with CORS impacts projects in numerous ways, through real-time coordinate data acquisition, data recoverability, and electronic data management.

The processes directly impacted by CORS include:

- Project base mapping;
- Design/construction management; and
- As-built record data management.

Project Base Mapping

Boundary and legal surveys

—with CORS, surveyors now use property-controlling information collected in real time and the horizontal datum (which is defined early in the project on one contiguous datum) that can be recovered at any time, regardless of loss of onsite ground control.

Topographical surveys—three-dimensional coordinates are collected in real time and the vertical datum is defined and maintained throughout the development process.

Wetland/woodland inventories—the real-time location data defining wetlands and

woodlands create a permanent record of these resources.

Design/Construction Management

Site management for construction staking control—here, CORS makes it possible to establish project improvements in real time and then reproduce the alignment, control points, and topographic data without having to reconstruct the original survey and without completely reproducing the original ground control.

As-built Record Data Management

Construction management and project finalization—real-time inventories of project improvements enable construction managers to more effectively monitor site activities for quality and production issues. In addition, CORS makes it possible to inventory final as-built locations as one contiguous base file.

Before Michigan implemented the MSRN with real-time broadcasting, local base stations had to be set up and positioned for all survey-grade GPS observations.

In other words, one GPS receiver had to be set out and exposed (and subject to theft or vandalism) for the entire time the rover was operating on the survey. Then, to make sure that the broadcasting position of the local GPS base was correct and true, surveyors had to conduct time-consuming checks before field operations with the rover could begin. With CORS, the need for this task has been eliminated. And last but not the least, a single GPS base station can cost upwards of \$25,000—money better spent on highly efficient rover units that can work independently with MSRN stations.



A surveyor with portable GPS, CORS, and up-to-date wireless can deliver accurate geospatial information in real time

CORS and Giffels-Webster

Giffels-Webster Engineers was among the first private firms in Wayne County, Michigan, to establish five continuously operating reference stations and encourage county-wide involvement in CORS through the remonumentation program. These reference stations are the backbone of the MSRN; they allow our firm to collect data more accurately and more time and cost effectively.

Giffels-Webster Engineers have implemented the use of the MSRN on public as well as private projects. A typical public application would be the use of real-time data to enhance the GIS systems in place for Governing Municipalities.

For example, a township can encompass 36 square miles of land and infrastructure inventories. Within this vast area of space, a seamless special data file can be created and enhanced with the use of a one-man (or one-rover) GPS receiver. All locations of the infrastructure are inventoried in

real time, including addresses, buildings, roads, traffic signals, utility poles, manholes, and fire hydrants, together with descriptions as to their condition, dates of data collection, and nature and materials of the structures collected.

And what did Michigan achieve by implementing MSRN? Quite a lot:

- All surveyed data collected in the municipality are on the same coordinate system as the neighboring townships/municipalities.
- Surveyors can repeat any and all coordinated points to 1 cm and 2 ppm.
- All points surveyed from the MSRN are fixed in time and space forever.
- Survey base stations are no longer needed.
- Surveyors can validate section and quarter corners and property controlling coordinates based on data with 24/7 complete redundancy.
- Never again will an important physical mark be lost once it has been observed from an MSRN station.

Conclusion

Without the cutting-edge GPS technology surveyors are now using, the acquisition of the all-important positioning data would be limited to methods developed in the 1990s. As counties install a spatial reference network such as that used in Michigan, they will realize an immediate benefit of improved tactical surveying operations, and a long-term benefit of having all geo-spatial data on a contiguous coordinate system, fixed forever in time and space.