

A

WINNING Partnership



Total Tech Surveying uses SmartNet to lay out the utility poles for overhead electrical lines to connect to wind generators—*photo courtesy Total Tech Surveying.*

Left: GNSS reference station in Bracebridge, Ontario

A fast-growing reference station network covers almost all of southern Ontario.

By Daniel C. Brown

In recent years the cellular telephone network in southern Ontario, Canada, has improved greatly. Cell phone towers have densified, and the network is more powerful in its ability to carry data. Data can be streamed at a half-second or better through a cellular connection.

That means cellular networks can support the latency of data much better, so they have given surveyors the opportunity to take advantage of cell phone technology to further use the capabilities of the GPS receiver. And because no governmental agency has stepped in to build a reference station network in Ontario, that job has been left to private industry.

In a manner similar to reference station networks developing in the United States, Leica Geosystems has set up SmartNet Southern Ontario, a network that now covers nearly all the southern portion of the province. “We knew it was just a matter of time for us,” says Amar Kalsi, Leica’s SmartNet administrator for southern Ontario. “As the cellular network developed, lo and behold, we were ready to go.”

Growing Network

Since 2006, this RTK GPS network has grown from 5 base stations to 51, with an additional 10 to 12 more stations planned for deployment this year. Coverage extends from Windsor in the southwest for a distance of some 800 kilometers north-east to Ottawa, and from the Niagara Falls area in the south to Bracebridge in the north.

Leica Geosystems manages and maintains the network and provides corrections to users. The network is a joint venture between users and Leica. For somewhat more than half the stations, the cost of the receiver, the cabling, the antenna, the high-speed internet line, and the antenna masts have been covered by Leica Geosystems. For the remaining stations, private companies within the industry have purchased similar hardware and the high-speed internet connections.

SmartNet provides real-time corrections for a variety of users and applications in southern Ontario. Users employ the network for cadastral surveying, construction layout, topographic work, and more. This application flexibility, along with our expected network expansion, promises rapid growth in the coming months.

“As soon as you get out of your vehicle, you are off and surveying within about five minutes,” says Bloss J. Sutherland,

OLS, treasurer of Total Tech Survey Inc., Essex, Ontario. "With the old system, you had to set up a base station and radio transmitter and then use your GPS unit as a rover. Just to set up this base station then set up your rover and start the survey would add anywhere from a half hour to an hour to the job."

Adds Kalsi, "Using radio transmitters to communicate between a field rover and a fixed base station, customers could typically achieve 3 to 10 kilometer range at best. But now we have been able to take advantage of the cellular link to further push the range of how far our customers can go. Users can now work up to 15, 20, 40, or even 50 kilometers because of the cellular network."

With a cellular modem, users can connect to a specific IP address on the internet that correlates to Leica's SmartNet server in Toronto. "Once they hit that IP address, we authenticate them with a user name and password," says Kalsi. "Based on this, and the coarse position of the rover unit in the field, we can supply the most appropriate RTK correction for that specific user."

An Open-World Format

Leica has designed the system so that most receivers on the market that are designed for RTK applications will work within SmartNet. Leica has adopted the industry-standard RTCM3 format that provides interoperability among the various manufacturers in the GPS/GNSS rover market.

"To make sure we can support the widest array of equipment and applications, Leica has adopted the RTCM3 message type throughout SmartNet," says Kalsi. "That being said, we can broadcast correction in a variety of ways depending on the customer and the application."

Kalsi says by using the RTCM3, message-type issues affecting older network messages are avoided. The RTCM3 message allows for a complete network message to be used at the rover, ensuring optimal performance and accuracies. The use of an open message format also ensures that non-Leica rover users are capable of using the benefits of the network today and into the future.

At a coarse range of about 10 kilometers or better, using single baseline corrections, GPS accuracy is approximately 1.0 to 1.5 centimeters horizontally and 1.0 to 2.5 centimeters vertically. "The accuracy associated to GPS measurements decrease as your working area increases," says Kalsi. "But with the network technology we have in place, many of our users are pushing the measurement distances past 30 kilometers while maintaining excellent results well within standard RTK tolerances."

SmartNet is seeing a high rate of use, weekends included. It is available 24/7. Highway construction users especially use the system on weekends because in some cases it is the only time they have access to roads.

Leica has upgraded nearly all the stations in SmartNet Southern Ontario to full GNSS capability, which includes GPS satellites, Russian GLONASS, and other constellations that will become available in the future. Users in the SmartNet partnership must agree to update and optimize their reference stations. "We made it clear to our partners that within two years, or a reasonable amount of time, that their hardware

must be upgraded to full GNSS," says Kalsi. "At this stage of the game, probably 90 percent of our stations have been upgraded to full GNSS, and we have made the commitment to upgrade all of our Leica-owned stations as well. It goes hand in hand."

Excellent Repeatability

When asked what sets SmartNet apart from others, Kalsi said it is the network's ability to repeat points in the field. "You can go out today, work a specific area, set your coordinates, and have full confidence knowing that those coordinates will be the same tomorrow, a week or a year from now—well within typical GPS tolerances. Our ability to repeat measurements within SmartNet is unsurpassed."

The proof of this repeatability was evident on a customer's recent project. P.A. Miller Surveying Ltd. in Stirling, Ontario, primarily does cadastral surveying but also handles topographic work and engineering-type surveys. Recently the Miller firm sent a crew to a fairly isolated spot in southeast Ontario that has SmartNet coverage. It was a cadastral project to separate Crown land from private land. "They were able to retrace five

"Our ability to repeat measurements within SmartNet is unsurpassed."

miles of very thick bush up and down rocky land in about four days," says principal Paul Miller. "By using normal terrestrial methods, that would have taken three weeks of work."

He says the crew was looking for nearly 200-year-old evidence of a boundary between two ascertainable points. No evidence was found, but the crew did locate one river near the north end of the project. As a result of the survey, Miller could draw a straight line between the two known points.

Miller says he has been testing GPS systems for almost 20 years. Just two years ago he bought Leica equipment and says their algorithms seemed to provide good canopy penetration through leaf cover and the like. "As soon as you get into a thickly wooded area, GPS is not very helpful," says Miller. "But with this equipment, we found that if you go into a clearing, get a good signal, then walk slowly into a wooded area, the receiver seems to be able to distinguish between the good signals and those that are the result of a multi-path, like a bounce off a leaf."

Surveying for Wind Turbines

Total Tech Surveying Inc. mainly does construction layouts with some legal surveying and pre-engineering surveys added in. They host a reference station within SmartNet, and the firm recently used SmartNet to lay out the sites for 24 wind turbines located in southwest Ontario.

"All we had to start with was the UTM coordinates," says Sutherland, referring to Universal Transverse Mercator. "There were no dimensions of any boundaries or anything. You do not

have to tie into any control. That is the advantage of the system. You turn your rover on when you go into your job. The coordinate system that we attached to the job was the NAD83 UTM Zone 17 (CSRS—an updated coordinate system).

Sutherland said the wind turbine survey took just four weeks and would have taken eight weeks if the firm had to set up a temporary base station for every turbine. The surveying included doing a topographic map of a main three-mile road, staking access roads for each turbine, and establishing the centerline of each of the 24 turbines.

Sutherland says SmartNet saves a great deal of time because it eliminates having to check two or three benchmarks to get a correct vertical orthometric value. “Before you would have to go out with your GPS unit connected to your base station by radio, and you would have to go and find at least two known benchmarks with their published values. Almost without fail you never find two intact, you have to go and find three.

“Out in the rural country, I would be on jobs where you would spend three or four hours driving around trying to locate these control benchmarks,” says Sutherland. “And then once you find them, you have to measure them and transfer their values back to your subject property.”

Instead, by using SmartNet the customer now has access to a standard spatial frame by simply using his rover. “The GPS gives you an ellipsoidal height,” says Sutherland. “So, by using the corrections generated by SmartNet, my rover is able to produce an extremely accurate ellipsoidal measurement. By taking this and attaching a geoid to my measurements, I am able to easily produce an orthometric value, which is typically what vertical values are stated in.”

Landfill Density

Jeff Armstrong is the director of solid waste management for Genivar, a multidisciplined civil engineering firm with several offices in Canada. Genivar owns one SmartNet base station and hosts a second in their Owen Sound and Ha-

nover offices respectively.

One of Genivar's clients is Waste Management, the solid waste disposal company that has a large landfill in Ottawa. Genivar has been retained to survey the landfill periodically so that Waste Management can calculate the trash density. Trash is constantly being dumped, compacted, and covered with soil. By measuring the height of the cover and comparing it to previous elevations, Waste Management can tell if they're reaching the goal of about 1,000 kilograms per cubic meter of waste and daily cover.

Armstrong says SmartNet saves Genivar a half hour to an hour per project surveyed because there's no need to set up a base station and remove it. “So if you do two projects in a day, you save up to two hours and that is great,” says Armstrong. †

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