Utility Uses Trimble Technology to Develop Accurate GIS Database of Medium-Voltage (MV) Network

PROJECT: Serbia’s largest utility relies on Trimble GPS and GIS technology to collect data and create geospatial database of medium-voltage utility network for more efficient maintenance and intelligent network planning

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Home to more than 1.5 million people, Belgrade is the third largest and one of the oldest cities in Southeastern Europe. It is the capital of Serbia and an important focal point for traffic and transport, connecting important points in Eastern and Western Europe. The city relies on Elektrodistribucija Beograd, or Electric Power Distribution Company of Belgrade (EDB), for its electric power distribution needs.

EDB’s network is comprised of 6,500 km (4,000 miles) of underground power lines and spans 9,500 (5,900 miles) km of overhead transmission lines. Despite a sophisticated power grid, the organization had an out-of-date graphical mapping system that was used to track, monitor, and maintain its equipment, including utility poles. The organization’s middle-voltage mapping system included a mix of paper-based survey and cable plans, CAD files that were somewhat incomplete, and an array of aerial photos. This somewhat haphazard collection of geographic data documenting distribution equipment and facilities, including middle and low voltage poles, made it extremely difficult for EDB’s 1,700 employees to effectively service and repair equipment efficiently.

“In order to provide the best service possible, our team determined that we needed a comprehensive, enterprise-wide Geographic Information System (GIS) of our power network comprised of one database and one data entry process,” said Vladimir Stojicic, lead engineer for the GPS project at Electric Power Distribution Belgrade. “We also wanted to ensure that that system could be accessed through the web so all of our employees, and those in related public departments, could benefit.”

As the basis for any operational system with these requirements, EDB realized they needed a very accurate GIS database of their network. To meet this need, the organization selected Trimble® GeoXT™ high performance submeter GPS handholds equipped with the Windows Mobile® operating system loaded with Trimble® TerraSync™ Professional software designed for fast and efficient data collection and maintenance efforts. In addition, EDB selected Trimble GPS Pathfinder® Office software to differentially correct data collected about the location and condition of utility poles and other equipment.

“We selected Trimble because the equipment met our requirements in terms of providing submeter accuracy, Windows Mobile compatibility, the ability to load raster and vector maps, and superior technical support,” said Stojicic. “We were also impressed by the long battery life and durability of the GeoXT handhels.”

Using GPS Pathfinder Office software, EDB created a data dictionary describing the attributes of the utility poles to be collected, which provided a consistent interface with all of the critical fields to be populated during the field data collection process. Stojicic believes that ability to track and record consistent information about each utility pole was a tremendous benefit and a critical success factor for the project. Specifically, the data dictionary created using GPS Pathfinder Office software helped ensure a high level of data integrity and compatibility with EDB’s AED-SICAD ArcFM UT GIS database.

Once the data dictionary was complete and transferred to the GeoXT handhels loaded with TerraSync, 20 teams of two traveled throughout the region to complete the data collection project. Feature data collected by the field team included pole number in the section, section number, type of pole, earthing, type of foundation, substation number, line disconnectors, and recloser numbers. Field crews also took a digital photograph of each pole to help monitor the condition and aid in maintenance and repair processes.

At the end of each data collection day, team members uploaded the uncorrected middle-voltage network data to a local server. Given the scope, complex attribute requirements, and sometimes challenging environmental conditions, Stojicic said his team decided to differentially correct field data through postprocessing rather than using real-time VRS corrections. As a result, the field data was differentially corrected in GPS Pathfinder Office using base data from AGROS, the official Serbian VRS network based on Trimble GPS hardware and software. The corrected files were then exported to Microsoft® Excel® or Microsoft Office Access® where queries could be made and the data could be analyzed further to check the validity and accuracy of collected attributes and calculated coordinates.

Once the data passed the verification process, it was sent to a test environment and eventually migrated into EDB’s AED-SICAD ArcFM UT enterprise GIS system using
Safe Software’s FME application. First, GPS Pathfinder Office software was used to export the GPS data in ESRI® shapefile format. Then FME was used to import the pole data into the AED-SICAD GIS and automatically create power lines and other equipment located on the pole, based on the pole attribute data. The end result was an updated enterprise GIS geodatabase with highly accurate network information available to everyone in the organization via AED-SICAD UT web application (GIS Portal).

Stojicic believes another significant benefit of the Trimble GPS solution is that TerraSync software has Serbian language support. “While we generally use English in our postprocessing environment, I think the language support helped to increase the productivity of our field personnel because they could interface with the data dictionary in their preferred language”.

Over the course of approximately 1,300 total field hours, EDB successfully collected accurate position and attribute data for 31,000 utility poles. With more traditional, pen-and-paper data collection methods, EDB project leaders estimate this collection process would have taken several months if not years longer.

The team was extremely happy with the overall efficiency of using Trimble GPS handhelds and Stojicic estimates the equipment generated a substantial return on investment. He asserts it gives his team extreme confidence in the accuracy of the data gathered. A trusted GIS database saves time and supports more sound decision making in day-to-day operations.

With accurate pole location data and condition information now at EDB’s fingertips, Stojicic believes both preventative and emergency maintenance operations will be managed more proficiently by the company. For example, if a utility pole is damaged during a storm, crews will have access to a highly accurate location for the pole as well as data on critical attributes that will ensure the correct part numbers are identified prior to visiting the site. Replacement equipment brought to the field will be correct the first time, which minimizes equipment downtime and speeds the repair process. Overall, these efficiency gains will help to minimize the impact felt by customers affected by outages on the network. In addition, since more accurate information results in fewer man hours required to maintain and repair the network, EDB will be able to keep operational costs low while raising the quality of services delivered.

"With help from Trimble and our data integration team, we now have an accurate digital representation of our medium-voltage network—a comprehensive GIS that we are confident is accurate and up-to-date," said Stojicic. "It includes geographically accurate records, attribute data, data sets, and digital photos that we can use to better service our customers and strategically plan and grow our network as needed."

Stojicic also points out that the team at Livona d.o.o. of Belgrade, the exclusive Trimble Distributor for Serbia, provided strategic planning efforts, project support and management, and technical expertise. Looking ahead EDB plans to continue its pole mapping initiative, focusing next on the organization’s low-voltage (LV) network, which includes approximately 160,000 poles and supports more than 200,000 customers in more rural areas. The organization also plans to make the GIS available securely on the web to the entire organization including IT staff, GIS specialists, maintenance crews, planners, and strategic officers, as well as collaborators in neighboring public departments. Outside the company, there is also the opportunity to provide web access to regional cable companies to provide utility pole location and condition information for joint use applications.

Overall, the field collection of high accuracy network data and sharing the information through web-based GIS will help all departments within EDB increase productivity and save time and resources while raising the bar for services delivered.