



PROJECT: Edgecombe County Inventories Entire Water/Wastewater Structure

PROJECT DATE: 2005

Trimble's GPS Analyst Streamlines Workflow

Charm, hospitality and environmental stewardship are the three qualities for which Edgecombe County, North Carolina, likes to be known. Located between the city of Raleigh and the famous N.C. beaches in the southeastern United States, the county's brick-paved sidewalks and town commons preserve its charm, while the natural friendliness of the 56,000 residents makes Edgecombe a hospitable tourist destination. And, the county government is doing its part to carry on the tradition of preserving the natural resources.

"Environmental stewardship is a lifestyle here," said County Manager Lorenzo Carmon. "The state informed us a few years ago that the aquifer is drying up, which motivated us to better safeguard the water supply."

Concern over the county's water supply led to a \$40 million engineering and construction project with the entire water and wastewater system in the 505-square-mile county eventually being replaced. In early 2005, about midway through the project, Edgecombe decided to initiate a parallel project that would map and inventory the entire water/wastewater infrastructure, both old and new. This database would reside inside the county's existing Geographic Information System (GIS).

This project would require mapping more than two dozen feature types and collecting up to 15 attributes per feature along 400 linear miles of water and sewer transmission mains. Field mapping crews would have to accurately locate and collect attribute information for every manhole cover, control valve, blow-off, fire hydrant, master meter, and pump station. The database would drill down to level of individual pump stations, including their storage tanks, pressurized lines, and gravity lines.

Edgecombe turned to The Wooten Company, a Raleigh-based engineering, planning and architectural design firm to perform the mapping. The county chose Wooten because the firm already was performing the pre-construction engineering work for the water/wastewater upgrade project and was therefore familiar with the components to be mapped. With just a two-month deadline to

collect thousands of features, the firm decided to utilize GPS technology for GIS field mapping. For the hardware, Wooten selected Trimble's® GeoExplorer® series because it combines a submeter GPS receiver and a handheld GIS data collection computer into a single ruggedized unit for the rapid collection of attribute and location data.

But before making the purchase, Wooten wanted to ensure there would be direct compatibility between the new GPS equipment and the firm's existing suite of ESRI GIS software. It planned to build the Edgecombe geodatabase in ArcInfo 9.0.

"We knew from experience that to get maximum benefits from two technologies that are meant to work together, the integration between them must be fast, seamless, and easy," said Alex Fuller, Wooten GIS Coordinator.

The engineering firm obtained a bundled hardware-software package including a Trimble GeoXT™ handheld equipped with ESRI's ArcPad mobile GIS software and the Trimble GPScorrect™ extension for ESRI ArcPad postprocessing software. In addition, Wooten acquired Trimble GPS Analyst™ extension, an ArcGIS software extension that creates a seamless workflow between GPS data collected in the field and the enterprise geodatabase in the office.

Edgecombe County's only existing water/sewer system schematic resided in a CAD format and was not drawn in such a way that they could be readily referenced into the geodatabase. Wooten printed these diagrams as workbooks to assist in locating system features in the field. With guidance from the county, the firm's GIS specialists generated data models, or classification structures, of the attributes that would be collected in the field for each type of infrastructure asset and created a geodatabase based upon the data model that had been created. Attribute and location data would be gathered simultaneously during the field mapping.

At the beginning of each day's field work, which mostly takes place on the dusty shoulders of roads and highways running aside the water pipe rights-of-way, Wooten technicians

PROJECT HIGHLIGHTS

- Aimed at safeguarding its water supply, Edgecombe County conducted a detailed inventory of 400 linear miles of water and sewer transmission mains.
- Water/wastewater system data collected is added to County's enterprise database and used by crews to track and analyze the system's condition, monitor its security and assign work orders for repair and routine maintenance.
- The Trimble GPS Analyst extension for ESRI ArcGIS software allowed GIS technicians to differentially postprocess GPS data directly inside of ArcGIS. The result is location data that is accurate to less than one meter and the convenience of not having to export data to an external program.

THE EQUIPMENT USED ON THIS PROJECT INCLUDES

- GeoXT handhelds
- ESRI ArcPad software
- Trimble GPSCorrect extension for ESRI ArcPad software
- Trimble GPS Analyst extension for ESRI ArcGIS software

NORTH & SOUTH AMERICA

Trimble Navigation Limited
7401 Church Ranch Blvd
Westminster, CO 80021
USA
+1-720-887-4374 Phone
+1-720-887-8019 Fax

EUROPE, AFRICA & MIDDLE EAST

Trimble GmbH
Am Prime Parc 11
65479 Raunheim
GERMANY
+49-6142-2100-0 Phone
+49-6142-2100-550 Fax

ASIA-PACIFIC

Trimble Navigation Australia
PTY Limited
Level 1/120 Wickham Street
Fortitude Valley, QLD 4006
AUSTRALIA
+61-7-3216-0044 Phone
+61-7-3216-0088 Fax

open the GPS Analyst extension running inside ArcGIS on a laptop computer to “check out” the data sets to be mapped. This means that the geodatabase files relating to those infrastructure features that will be mapped or updated are selected and uploaded by USB cable link from the laptop into the GeoXT handheld.

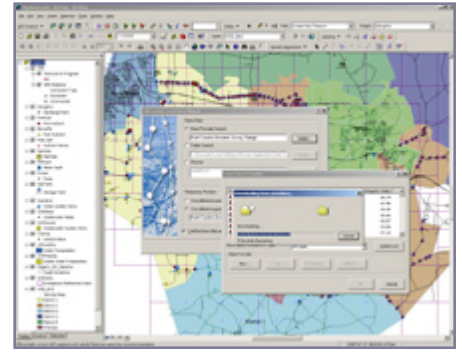
In the field, ArcPad displays a schematic of the water system assets that will be mapped. As the field crew finds each feature, an onscreen point-and-click menu generated from the data file assists the user in collecting the desired attribute information. As the crew member enters the descriptive data into ArcPad, the GPS receiver records 20 location points for each feature in less than a minute. This location data is stored with the other attribute data in the mobile geodatabase inside the GeoXT handheld.

“Usually the schematic gives us a pretty good idea of where the pipes run so we know where to look for valves and manhole covers, but sometimes we find a fire hydrant where there is no record of one existing,” said Fuller. “We simply add it to the database. This is where the value of field mapping will really pay off for the county.”

Completely transparent to the Wooten field technician, Trimble GPSCorrect extension is also running inside ArcPad, collecting additional data from the GPS satellites that will be required later to postprocess the location data recorded by the receiver. Differential postprocessing allows the crew to enhance the accuracy of the location data to less than one meter after it is collected.

“This mobile GIS solution has more than doubled the number of small features like valves, manhole covers and fire hydrants that we can collect in a day,” said Fuller.

Once the field work has been completed for the day, the crew reconnects the GPS receiver with the laptop computer to download field data back into the ArcGIS geodatabase. Working in ArcGIS, the GIS specialist then accesses GPS Analyst to differentially correct and edit the GPS points collected in the field. Differential postprocessing of mobile GIS data previously involved exporting the GPS data to an external software package, but now Wooten technicians perform the task without ever removing data from the geodatabase.



Technicians click on the postprocessing command and select from a list of local reference station sources. GPS Analyst extension determines which source provides the best coverage for that day's points and then logs onto the Internet to access the appropriate correction data. The software then completes the postprocessing automatically inside ArcGIS within minutes—compared to the hour or so it once took to export data and correct it externally.

The GPS Analyst extension also allows the Wooten field crews to validate GPS points by visualizing each of the 20 location values collected for every fire hydrant or manhole cover shown onscreen. By looking at the data cluster, they can determine which points are not consistent with the others. With the click of the mouse, these errant points can be deleted to improve the average value of the remaining points and thus, the overall accuracy of the feature map.

Once the field data has been collected, Wooten overlays the new layer of water and wastewater features on a digital orthophotograph of Edgecombe County. Many of the larger assets, such as pump stations, water storage tanks and meter vaults, are readily visible on the orthophoto. GIS specialists compare the location of the features mapped in the field with those visible on the ortho. They have now determined the accuracy of the data collection is well within the one meter mandated by the Edgecombe County.

“The data transfer and editing workflow is so simple that you forget you are working in another software package inside the GIS,” said Fuller.

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