

Edgecombe County

Cut Field-Mapping Time in Half Using Mobile GIS

Problem

Edgecombe County needed to map and inventory its entire water/wastewater infrastructure inside its existing GIS.

Goals

- Compile a detailed database of the entire system, old and new, in two months.
- Manage and maintain updates to the system more efficiently.
- Create a seamless work flow between the GPS data collected in the field and the enterprise geodatabase in the office.

Results

- Gathered location and attribute data simultaneously during field mapping
- Collected data accurate within one meter with the use of automatic differential postprocessing
- Recorded double the features available with traditional surveying techniques
- Transferred data from mobile device to in-office computer effortlessly
- Completed mapping of system within set time frame

Edgecombe County, North Carolina, likes to be known for its charm, hospitality, and environmental stewardship. A few years ago, the state informed the county that the freshwater aquifer was drying up. To better safeguard the water supply, Edgecombe economic developers set their sights on attracting environmentally friendly companies that would not pollute the freshwater aquifer. That motivation led to a \$40 million engineering and construction project that will eventually replace the entire water and wastewater system in the 505-square-mile county. Using mobile GIS, the county decided to map the entire water/wastewater infrastructure, both old and new, and have this database reside inside the county's existing GIS.

The Challenge

This project would require field 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.

Mapping crews would have to accurately locate and collect attribute information for every pressurized line, gravity line, manhole, control valve, storage tank, fire hydrant, meter vault, and pump station. Mapping would drill down to the level of individual pump stations and meter vaults including their method of treatment and the types of pumps and meters they contain.

The decision to map the water/wastewater infrastructure was driven by three factors.

- As the new system ages, an accurate database of component locations and conditions will be required for efficient management and maintenance.
- A GIS database would enable the county to more easily meet the reporting requirements of the U.S. Government Accounting Standards Board directive known as GASB 34, which mandates that all local governments maintain detailed inventories of their infrastructure assets for accounting purposes.
- County residents and businesses may qualify for reduced fire insurance rates if certain water access standards are met including the availability of detailed fire hydrant location maps.

The Solution

Without the staff to perform the mapping, Edgecombe turned to The Wooten Company, a Raleigh-based engineering, planning, and architectural design firm. The county chose Wooten because the firm was already performing the preconstruction engineering work for the water/wastewater upgrade project and was, therefore, familiar with the components to be mapped. The county also knew that Wooten maintained survey crews for site-mapping projects. Known for its willingness to adopt new technologies to accommodate the diverse and changing needs of its clients, the firm saw both a challenge and an opportunity in the mapping contract.



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ESRI Software Used

ArcPad

ArcInfo

Other Software Used

Trimble GPS Analyst for ArcGIS

Trimble GPScorrect for ArcPad

Hardware Used

Trimble GeoExplorer GeoXT

For previous asset mapping projects, Wooten had exclusively used traditional survey technology in the field; however, with a two-month deadline and thousands of features to collect, the firm knew it could not use survey equipment to complete the project. The time was right for its planned switch to GPS technology for field mapping. Wooten decided to use the Trimble® GeoExplorer® series of handheld mobile devices. This product line had been selected because it combines a submeter GPS receiver and a handheld GIS data collection computer in a single ruggedized unit for rapid collection of attribute and location data.

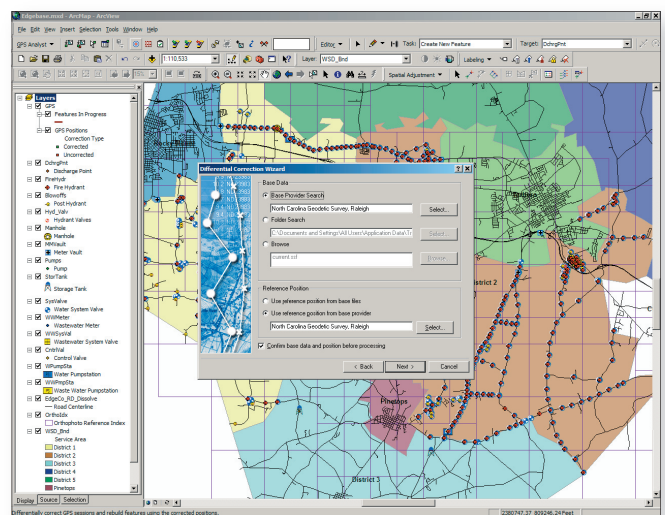
Before making the purchase, Wooten wanted to ensure there would be direct compatibility between the new GPS equipment and the firm's existing suite of ESRI® ArcGIS® software. It planned to build the Edgecombe geodatabase with ArcInfo®. Alex Fuller, Wooten GIS coordinator, says, "We knew from experience that to get maximum benefits from two technologies, the integration between them must be fast, seamless, and easy." The engineering firm obtained a bundled hardware-software package, which included a Trimble GeoExplorer GeoXT™ equipped with ESRI's ArcPad® mobile GIS software and the Trimble GPScorrect postprocessing extension. In addition, Wooten acquired Trimble's GPS Analyst™, a new ArcGIS extension that creates a seamless work flow between GPS data collected in the field and the enterprise geodatabase in the office.

Wooten printed schematic diagrams of the water/wastewater system map books 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 on the data model that had been created. Attribute and location data would be gathered simultaneously during the field mapping with ArcPad.

At the beginning of each day's fieldwork, which mostly takes place on the dusty shoulders of roads and highways running alongside the water pipe rights-of-way, Wooten technicians open the GPS Analyst program operating inside ArcGIS on a laptop computer to "check out" the datasets to be mapped. This means 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 to ArcPad running on the GeoXT handheld.

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Alex Fuller
GIS Coordinator, The Wooten Company



GPS Analyst provides postprocessing of GPS data collected with ArcPad.

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A GPS cursor shows the user's current position while collecting data.

"The data transfer and editing work flow are so simple that you forget you are working in another software package inside of ArcGIS."

Alex Fuller
GIS Coordinator, The Wooten Company

In the field, ArcPad displays a schematic of the water system assets that will be mapped. As the field crew locates each feature, an on-screen 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 one minute. This location data is stored with the other attribute data in the mobile geodatabase inside the GeoXT. "Usually the record drawing gives us a pretty good idea of where the pipes run," says Fuller, "so we know where to look for valves and other features, but sometimes we find a fire hydrant where there is no record of one existing. We simply add it to the database. This is where field mapping will really pay off for the county."

Completely transparent to the Wooten field technician, the Trimble GPSCorrect extension is also running inside ArcPad, collecting additional data from GPS satellites that will be required later to postprocess the 20 locations recorded by the receiver. Differential postprocessing allows the crew to enhance the accuracy of the location data to less than one meter. In the end, the crews collect more than double the features available with traditional surveying techniques.

Once the fieldwork has been completed for the day, the crew reconnects the GPS receiver with the laptop computer to download field data 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 correction of GPS data previously involved first exporting the GPS data to an external software package, but now Wooten technicians perform the task of postprocessing data within the geodatabase. They click on the differential correction tool and select from a list of local reference station sources. The differential correction wizard within GPS Analyst assists in determining which source provides the best coverage for that day's points, then connects with the base data provider to access the appropriate correction data. The software completes the postprocessing automatically inside ArcGIS within minutes compared with the hour or more 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 and manhole shown on-screen. By looking at the data cluster, they can determine which points are not consistent with the others. With a mouse click, these errant points can be deleted to improve the average value of the remaining points and, thus, the accuracy of the overall 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 orthophoto. Wooten GIS analysts have determined the accuracy of the data collection is well within the one meter mandated by Edgecombe County.

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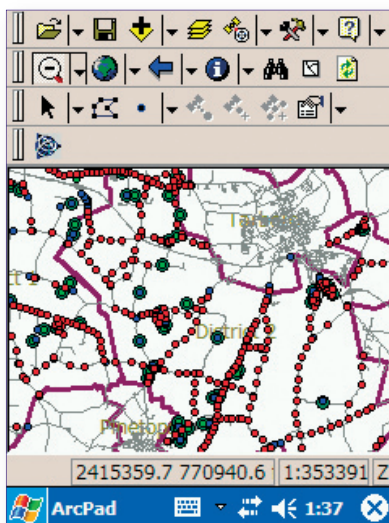
"This mobile GIS solution has more than doubled the number of small features, such as valves, manholes, and fire hydrants, that we can collect in a day compared to traditional survey techniques."

Alex Fuller
GIS Coordinator, The Wooten Company

Results

The Wooten Company was familiar with the benefits of mobile data collection prior to adopting it for use on the Edgecombe project. However, ArcPad and GPS Analyst surpassed the company's expectations: "The data transfer and editing work flow are so simple that you forget you are working in another software package inside of ArcGIS," says Fuller.

As Fuller notes, "This mobile GIS solution has more than doubled the number of small features, such as valves, manholes, and fire hydrants, that we can collect in a day compared to traditional survey techniques." The technology has proven to be cost-effective, time saving, and extremely accurate for The Wooten Company. In the end, it permitted Edgecombe County to get an accurate and complete spatial representation of its water/wastewater system within its strict time frame.



ArcPad is used to collect water and sewer infrastructure information, represented as colored points and lines.

Information is input into ArcPad data collection forms while in the field.

For More Information



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