

Get More from Your GIS: Improve Data Quality

By Power System Engineering, Inc. (PSE)

Migrating to GIS provides
opportunities for improved
integration and better accessibility
to system information.

I. Introduction

Many utilities have now implemented geographic information systems (GIS) to improve the operations and management of electric, water, and gas systems. Migrating to GIS provides opportunities for improved integration to other enterprise applications, better accessibility of system information for both office and field workers, and new visualization and analysis tools.

However, the background images typically included in a GIS often highlight issues with data quality that were not apparent with prior one-line CAD-based mapping systems. Utility lines and service point locations may be shown 500 feet or more from their actual locations (Figure 1). For example, with a road center-lines layer, users will see electric, gas, or water lines/mains that are clearly in the wrong location. Entire subdivisions may appear to be in the middle of a body of water. Lack of trust in the system's accuracy may limit use and adoption of the GIS by field crews.



Figure 1: Example import of data from CAD into GIS with an aerial photo background.

Accuracy of spatial data
allows smooth integration
of enterprise GIS.



Correction Methods

Field Asset Inventory

Asset Inspection with GPS

On-screen Spatial Corrections

II. Spatial Correction Benefits

The growing use of automatic vehicle location (AVL) systems, often in conjunction with mobile workforce management (MWM) suites, requires more accurate utility data. Use of GIS for analysis and modeling also requires improved spatial accuracy. More and more utilities are making data available to customers via web portals; in the case of outage maps, for example, utility data must be mapped accurately to correlate to landbase features with aerial photography.

Accuracy of spatial data allows enterprise GIS to smoothly integrate with these systems.

III. Spatial Correction Methods

Prior to starting a spatial corrections project, the utility should consider the following questions:

- **What is the desired end product; i.e. what is driving the need? For example, spatial corrections for asset inventory/inspection?**
- **How much accuracy is needed?**
- **What are the available utility and external resources?**
- **How soon is the corrected data needed?**
- **What are the limits of the financial budget?**

Methods used to improve spatial accuracy of GIS data include:

- A.** Conducting a field inventory of utility assets, either manually or by using drive-by or fly-by techniques with high-resolution image capture, light detection and ranging (LiDAR), and post-processing of the captured asset coordinates and images in GIS.
- B.** This includes capture of utility asset GPS coordinates during standard inspection cycles; for example, as part of utility pole inspections.
- C.** Using high-resolution aerial photography, county parcel data, and other data sources to correct pole and line locations without going to the field.

Field asset inventory method provides the most thorough inventory but is also the most costly and time-consuming.

A. Field Asset Inventory

A field asset inventory captures field asset locations using GPS hardware. While the technician is in the field, he could typically capture additional data, including clearance, sag, right of way, vegetation, devices, attachments, and images of the poles or other assets. The GIS is updated once the field data is captured. This option provides the most thorough inventory of field assets but is also the most costly and time-consuming as the technician must physically visit each utility asset and take the time to capture the asset and location data. Costs can range from \$6 - \$8 per pole or more (depending on the skills of the technician and data captured) plus the cost of moving the existing data after loading the new GPS data into the GIS. A periodic quality assurance check of the data being captured is important, particularly if using lower-cost providers or temporary utility workers.

Drive-by and fly-by methods using video and/or LiDAR can also be used to capture and digitize utility assets and populate GIS with location and device attributes, including images. Fly-by methods are most commonly used to capture transmission line asset status, including

sag, due to the difficulty of reaching the asset locations on the ground and the speed with which the fly-by survey can be performed. Drive-by methods have gained in popularity, speeding the utility asset inventory process, but assets that are not visible from roads will still need to be manually captured.

B. Asset Inspection with GPS

Most utilities have an established asset inspection cycle—for example, inspecting utility poles once every seven years—so another option is to capture asset the GPS location at the same time as the inspection data is gathered. This method saves cost because it eliminates a second visit for GPS location purposes only. The additional cost may be about \$2 and still requires bringing the data back to the office to update and correct the GIS. While this method provides very accurate location data, the disadvantage is that the asset spatial corrections will not be complete until the inspection cycle is finished—and in the case of the utility sample provided above, it would take seven years.

C. On-screen Spatial Corrections

The availability of high-resolution aerial photography allows visual confirmation of actual poles, pole shadows, and lines. Accuracy and speed may be significantly improved in service areas for which aerial photographs exist because assets can be simply moved on-screen to locations indicated in the images. Spatial correction of lines, poles, and service points to within five to 10 feet may be achieved in a fraction of the time of a field asset inventory. Costs are less than \$1 per pole, and the GIS is updated and corrected as part of the process.

While this method corrects the spatial data accuracy, it does not provide the additional device and line data or imagery obtained during a field asset inventory. It does, however, offer a rapid spatial correction of field assets, which can then be augmented as part of the normal asset inspection cycle.

IV. Comparison of Data Correction Methods

Method	Accuracy	Cost/Service Points – 10,000	Time
Field Asset Inventory	2' – 3'	\$60,000 – \$80,000 + cost of adjusting existing data	Months
Asset Inspection with GPS	2' – 3'	GPS point capture + cost of existing data – ~ \$2/pole	Years
On-screen Spatial Correction	5' – 10'	< \$10,000	Weeks

Accurate GIS data
is critical.

V. Summary/Next Steps

Accurate GIS data is critical for supporting short- and long-cycle work management efficiency, asset management and accounting, customer web map interfaces, and mutual assistance during disaster response. Field assets represent a very large investment for utilities, and having an accurate inventory of those assets—including accurate locations—protects that investment, improves utility operation efficiency, and ensures enterprise adoption of GIS.

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