Utilizing GIS in Inspection Management

A Logical and Cost-effective Solution to a Utility Priority

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Introduction

More and more utilities are increasingly being held accountable for their inspection and maintenance management practices. With the increased publicity regarding energy reliability, these utility activities are being more heavily scrutinized by various regulatory agencies. The old standards of hand-written notes and spreadsheet data are increasingly not meeting the latest standards, while more and more regulations loom on the horizon. Environmental regulations, whether habitat based or hazardous material tracking, are lingering in the distance. Current inspection systems, including ERP-based applications are good at tracking inspections based on relationships but cannot account for spatial activities that should be noted during inspections. In addition, a spatial component to both inspection and maintenance activities can lead to better allocation of resources in both performing inspections and resolving maintenance activities in the field.

GIS’s Historical Involvement in Inspection Management

GIS has traditionally been referenced as a backdrop for performing field inspections. The inspections are performed against a utility’s mapping data and then stored in a separate set of database tables. Often an Enterprise Resource Planning System generates a list of those assets which are due to be inspected. Referencing a selected asset, the field user would perform the inspection and then store the findings as red-lined notes or possibly using a spreadsheet. Upon returning to the office, these results would then be either manually re-entered or a complex synchronization process would be performed to upload the data to the ERP system. Although this process was an improvement over keeping up with manually writing notes on a map, the newer processes are also expensive to maintain and labor intensive and remain prone to errors and omissions.

Recently, improvements to GIS technology have increased available options for field work to be uploaded back to a central GIS data store, yet challenges remain. Among the issues faced in effectively utilizing GIS in the field are the following:

- Complex GIS software requires computing power which is often limited on field computing devices.
- Getting map changes from the central GIS to each field unit’s map repository can be time-consuming and unreliable.
- Major IT resources are often needed to effectively manage field GIS.
- Inflexible GIS software is unable to adapt to a utility’s business needs without expensive customizations.

Benefits of New GIS Technology
Utilizing GIS in Inspection Management

A Logical and Cost-effective Solution to a Utility Priority

Among the latest advancements in GIS technology are server based applications. These server GIS software toolsets provide a base set of functionality to serve up maps and related data to users through websites or streamlined field applications. Although more traditional GIS users can continue to access the same data through more complex GIS editing environments, server-based applications provide a utility the following benefits:

- Software releases are maintained on the server, IT resources are not burdened with client installations and upgrades.
- Streamlined web and field applications can be tailored to a user’s needs – minimizing training.
- A wealth of free online map data, including streets, satellite imagery, and weather data can be overlaid on the utility’s data.
- Simpler interfaces to the GIS data increase the likelihood of the technology being adopted.

Benefits of New Technology

In addition to the web-based GIS interfaces, the new server technologies include mobile components as well. Esri’s ArcGIS Server application has an integrated ArcGIS Mobile component that can be used to quickly get GIS asset data into the field. In addition, ArcGIS Mobile technology can communicate with ArcGIS Server to upload data edits back to the central GIS repository. A product built around ArcGIS Mobile, such as 3-GIS’s Field Express, can then be deployed to a number of Windows devices, including tablets, laptops and handhelds. The entire installation can be accomplished in under ten minutes. Using ArcGIS Mobile, asset data edits are stored in a local map cache. When the user is connected to the utility’s network, these data edits are pushed back to ArcGIS Server.

These processes enable a simplified communication between the field and the server, reducing data interfaces and synchronization which was problematic in the past.

An Integrated GIS & Inspection Management System

This evolution of GIS technology makes new uses at a utility possible. An obvious extension of GIS at a utility is in the inspection and maintenance management arena. In the past these systems have generally been performed against a database application, either an Access database or spreadsheet. By performing inspection management in a spatial environment, additional benefits can be realized.

- A user can visualize a utility’s asset information, retrieving critical information regarding the utility’s equipment.
- Non-asset information relevant to accessing assets for inspection, including paths, gates, and environmental constraints may be seen and documented.
- In addition to performing asset inspections, a field worker can record other types of problems in the field, for example vegetation issues or third-party damage.
- A utility’s existing GIS repository can be improved by noting data issues and omissions while performing inspections.
Utilizing GIS in Inspection Management

A Logical and Cost-effective Solution to a Utility Priority

Once inspections have been performed, a spatial environment helps a supervisor logically group and schedule maintenance activities to resolve reported issues. Being able to visualize these issues is instrumental in optimizing the grouping and routing of these problems.

3-GIS’s Express Solution

3-GIS is at the forefront of developing innovative GIS products specifically geared towards the utility and telecommunications industries. With its web-based GIS product, Network Express, and its adaptable mobile product Field Express, 3-GIS has extended the capabilities of the base ArcGIS Server technology to perform true inspection and maintenance management. Through using Network Express, a supervisor can perform queries against GIS asset data to determine those assets which are due inspection. From this list, the supervisor can create work orders, and add either inspection or maintenance activities to the work order and then assign the work to a particular crew. All of this is done through a web mapping interface that is simple to learn and easy to administer.

3-GIS’s Field Express is an ArcGIS Server based application that can run either connected or disconnected in the field and runs on any laptop, tablet, or Windows Mobile handheld device. Using Field Express, a user can download work orders and associated activities to the field unit, then go out in the field to perform the inspection and maintenance activities. In addition to these activity types, field express can be configured to perform other operations, including adding access roads and barriers as well as environmental activities. When the user comes back into the office, any inspection or data edits are seamlessly transferred back to the central GIS repository. The supervisor may then review the progress of the work order activities and analyze any issues that were reported.

The 3-GIS Network Express application also has a built in query and reporting tools that allow an supervisor or clerk to create progress reports on inspections being performed as well as identify areas that are due inspections. The reporting tool is a huge time saving application for the office personnel because all of the inspection data is maintained in the geodatabase and accessible by a single poke of a button. Reports that have traditionally taken weeks to gather information and compile can now be produced in a matter of minutes without the introduction of human error.

Another important benefit of 3-GIS’s Network Express and Field Express products is the ease in which they are implemented and configured. They work with a utility’s existing ArcGIS geodatabase with a minimal amount of effort and can be configured through configuration wizards and applications. This configuration process effectively minimizes any costly customizations. In addition, once the initial implementation is performed, these configuration tools can extend Network Express and Field Express to meet new business requirements as they come up.

Case Study

A number of utilities have begun to see the benefits of this new technology. Tri-State Generation and Transmission, based in Westminster, Colorado is a wholesale electric power supplier owned by the 44
Utilizing GIS in Inspection Management

A Logical and Cost-effective Solution to a Utility Priority

electric cooperatives that it serves. Tri-State generates and transports electricity to its member systems throughout a 250,000 square-mile service territory across Colorado, Nebraska, New Mexico and Wyoming. Tri-State owns or has maintenance responsibilities for more than 5,200 miles of transmission line across Colorado, Nebraska, New Mexico and Wyoming. Line crews and substation technicians work to ensure power delivery is safe and reliable. As part of their reliability process, Tri-State performs regular inspections of its transmission infrastructure in order to satisfy federal regulations.

To fulfill Tri-State’s requirements, 3-GIS configured Field Express to enable line crews to perform structure and switch inspections as well as record right of way condition locations, such as encroachments or required tree trimming. When the structure inspections are saved back to the GIS database, 3-GIS creates a Condition object for every issue reported in the field. For instance, if a structure had a damaged insulator and cross-arm, each of these inspection results would result in a condition record being created in the GIS. Once these are posted to the GIS Database, a Tri-State manager may assign these conditions to a work order, and then assign the work order to a particular user. When the field user logs in, the user can download the active work orders and conditions to his local Field Express device and then take them to the field to resolve.

By leveraging the capabilities of 3-GIS’s Express Solution, Tri-State G&T has succeeded in deploying a GIS that meets the inspection and maintenance needs of both its office and field users.

Conclusion

Inspection and Maintenance Management is becoming a larger priority for utilities, with growing regulatory requirements and system quality demands. The newest generation of server based GIS tools makes integrating GIS data into the inspection workflow a logical fit. 3-GIS’s Express Solution extends the new GIS technology to make a GIS-based Inspection and Maintenance Management Solution a viable option for utility companies.

Information

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