Utilization of ArcPad and Mobile Technology to Update Street Signs in Local Government

Martin County, Florida

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Abstract:

The Engineering Department in Martin County, Florida currently maintains more than 15,000 street signs within its Asset Management System (Hansen). County Staff desired to expand the initial sign inventory database to include a number of new attributes that could only be obtained by a field inspection of each sign. Utilizing ArcPad 6.0.2 and ArcPad Studio 6.0.1 with Trimble's GeoXT GPS receiver, a custom application was created for the Engineering Department to facilitate and integrate new field collected data with the County's existing Asset

Management System (Hansen). The application was developed specifically for use by County Staff in the field data collection process and was designed for seamless integration into the existing Hansen database. This paper describes the project strategies, the customized application, and the integration process with the Hansen Asset Management System.

Paper Body:

Project Background – An inventory of signs (regulatory and non-regulatory) is a critical element for effective governmental transportation management practices. The investment in signs is significant when considering all the assets of a government agency. An ideal inventory system tracks signs from initial installation, through inspections and maintenance, up until removal from the system occurs.
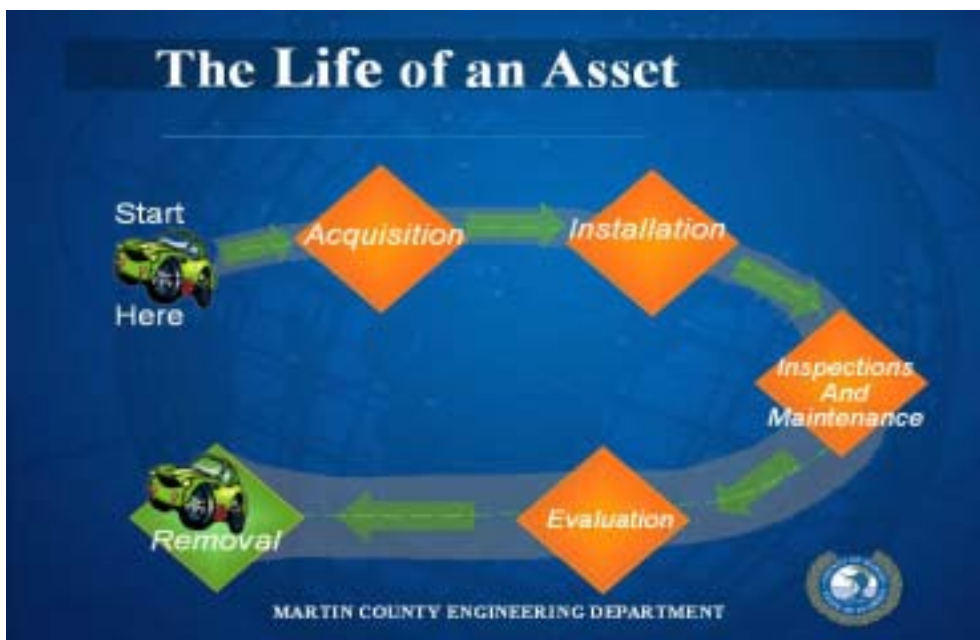
A traffic control device inventory can be a valuable asset in tort liability cases. This inventory can provide documentation of the condition of specific signs in place for any given period of time. In addition, pertinent inspection and maintenance activities can be noted in the inventory and available for use by the County.

An inventory system can be used for many activities. It can identify signs for replacement based on criteria such as age or condition. Recording and evaluating maintenance and replacement history can help the County to identify

high-vandalism areas or sign locations with visibility or operations deficiencies. In addition, planning and budgeting for sign replacement or expansion of new development areas is much easier to accomplish with inventory records identifying existing signs and required maintenance activities. A sign inventory can be used to manage personnel and maximize production by combining workorders and scheduling routine maintenance activities. The system can track responses to customer service requests and complaints, resulting in an improved level of service (LOS) to the residents.

Realizing the importance of such a program, Martin County embarked upon the implementation of a comprehensive asset management system in 2001. The effort began with obtaining the services of a company who specializes in the collection of roadway attributes via mobile mapping technology. The data was quickly collected using stereoscopic imagery, a GPS receiver, and an inertial navigation system. Over 1,123 roadway centerline miles were driven in both directions in less than 45 days. Snapshots of roadway attributes were taken every 35 ft. to provide 360-degree coverage. Over 19,000 signs were extracted from these images and populated into the County's asset management (Hansen) and GIS (ESRI) systems.

Growth Beyond Initial Database Development - Since completing the initial database development project in Spring 2002, engineering staff determined it was necessary to obtain additional attribute information on the existing signage. Several key factors prompted this decision.

State and Federal mandates, such as the Elder Ready Program, requires sign lettering to be enlarged based on the type of sign being installed and/or replaced. Letter size information combined with an accurate inventory allows staff to prepare a sign replacement program that will ensure compliance requirements are met within established deadlines.

Reflectivity ratings are also a requirement of the Elder Ready Program. A reflectivity meter is utilized in obtaining this information directly from the sign material. Knowledge of these ratings has proven to be useful in matters dealing with legal issues and fiscal planning activities.

Another reason for obtaining a comprehensive sign inventory is due to the adoption of GASB 34 (Government Accounting Standards Bureau). GASB 34 mandates that governments report all capital assets, including infrastructure assets, in their financial statements. Martin County chose to implement an asset management system and demonstrate these assets are being maintained at a certain functional level.

Determining Attributes of the Inventory - The additional sign attributes desired by the County are divided into three primary categories: Core, Critical and Desirable.

Core Attributes: Core data indicates primarily the location (GPS coordinate), type, condition, inspection and maintenance history.   This information assists in the development of a replacement program, provides documentation on liability issues, and furnishes benefits in management and budgeting. More specifically they are identified as follows:

Unit ID (unique to ea. sign)
Sign Category
Location
Sign Orientation (direction)
Sign Type (MUTCD designation)
Ownership
Installation Date
Maintenance / Inspection information

Critical Attributes: Critical attributes provide more specific information about the asset itself. This information is valuable in keeping proper inventories in stock and can provide additional information that supports the County in liability issues. With this data "in hand", the County can document that signage is in compliance with established standards and guidelines.

Reflectivity
Dimensions
Height
Shape
Sheeting Material
Text Size
Support Materials

Desirable Attributes: Desirable attributes provide additional information about the sign that can assist with maintenance and replacement activities. They include the following:

Text Color
Images of Signs
Offset
Inspector Name
Additional Comments

***Data Collection and Processing*:**

Because of the diversity of the sign inventory project, multiple software applications and hardware platforms were used during the data collection and processing stages. As stated earlier, the County has implemented a successful asset management program using Hansen. Hansen is the core component in relation to asset work orders, maintenance, and inventory relating to street signs in Martin County. It was essential that applications and databases be compatible and fully integrate with information currently maintained within the Hansen system. The preliminary efforts to determine the sign attributes to be collected before the initial data collection were critical in streamlining the data collection and processing functions. This exercise provided the framework for development of specific applications and database designs to facilitate the street sign inventory.

Data Collection

Collecting street sign attribute data consisted of four key components: GPS, Hardware, Software, and People.

GPS

Positional accuracy of a street sign is an important component when creating and/or maintaining a street sign inventory. Fortunately, Martin County acquired a substantial amount of street sign data from previous collection efforts and new measurements would only need to be taken for signs that have been added since that time. However, as the County wished to inventory and update all existing

signs, the use of GPS allowed staff to navigate to the existing signs, confirm the horizontal position of that sign, then add the desired attributes. It was determined that sub-meter horizontal accuracy was sufficient for the sign inventory project.
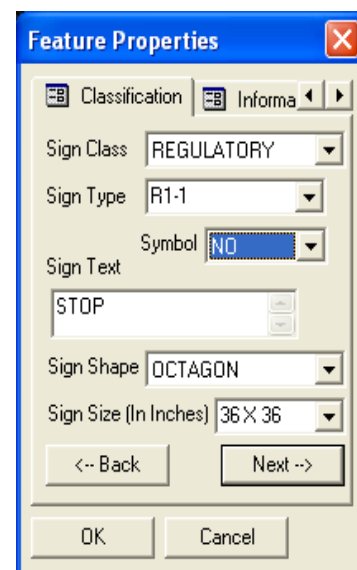
<u>Hardware</u>

The sign inventory project team evaluated various hardware options for the data collection project including PDA's and hand held GPS devices. The nature of the field work required a data collector and GPS receiver that was suitable for daily field work in a variety of conditions. The device also was required to operate ESRI ArcPad software. NorthStar Geomatics had previous successful experience with the Trimble GeoXT in field data collection and recommended its use for the project. Trimble's GeoXT provides a lightweight, durable, and sub-meter accurate product for data collection, while providing the necessary technology to facilitate the processing of data. It allowed the County to maintain and utilize a single device to measure and capture all street sign information within the County. The sign inventory team selected the Trimble GeoXT and purchased the unit for use by County sign inventory staff.

<u>Software</u>

The Trimble GeoXT not only provided the necessary physical characteristics, the Windows CE operating system provided the County with an opportunity to utilize advanced data collection software such as Trimble's Pathfinder and ESRI's ArcPad software. Due to the customization capabilities provided by ESRI's ArcPad software, it was chosen as the software utilized for this project; in addition, Trimble's GPSCorrect, an extension to ESRI's ArcPad, provided the County with the ability to obtain real-time corrections to eliminate all post processing of GPS data. ArcPad provides the County the opportunity to create custom applications specific to its needs by providing a user-friendly interface to facilitate data collection in the field.

Forms and fields were built, using ESRI's ArcPad Application Builder that were project specific to the attributes determined in previous exercises. VBScript functions were created for data validation and error reduction to expedite the street sign collection. Code definition, or lookup, tables were created in the ArcPad application to provide compatibility and integration with the County's Asset Management software, Hansen. With each of these key factors in position; forms, functions, and compatibility, the application was ready to be tested in the field.

People

Having the above components in place, GPS technology, hardware, and software, provided the County with the majority of the elements necessary to successfully complete a street sign inventory. The most crucial element to any data collection project is the people. Specific business processes and functions must be relayed to these individuals and feedback from them is essential to the success of any project. Field crews provide the knowledge and experience required to accurately capture street sign information in the most timely fashion.

The first stage in the field collection process is training the individuals on not only core ArcPad functions, but also the custom applications built specifically for street sign data collection. This training was performed both in and out of the office by NorthStar Geomatics staff.

The next stage is actual data collection. Once the crews were comfortable enough with the hardware and software in the field, commencement of sign collection began in the pilot area.

Processing

Processing data collected in the field proved to be one of the more complicated aspects of the project. This is due to the fact that a variety of applications would be required to successfully perform this process.

Hansen is the chosen solution for asset management in Martin County. All assets in Martin County, including street signs, are maintained within this application.

ArcGIS is the software utilized for the County's GIS program. One of the reasons Hansen was chosen as the asset management software was its ability to coordinate with ESRI's ArcGIS software. GeoAdminstrator, an ArcGIS extension provided by Hansen, provides the ability for Hansen and the County's GIS to communicate and coordinate assets stored within each system.

ArcGIS provides the user with the ability to store information within a Geodatabase. This is the current format chosen for storage of the County's GIS street sign inventory. ArcGIS provides the user with the ArcPad toolbar which enables users to check out data from the Geodatabase and then check in data that has had any modifications made to it out in the field. We are able to track which street signs have been added, moved, or have simply had their attributes updated utilizing this toolbar.

The current process implemented in Martin County consists of each of these software packages including the ArcPad application. Currently, Hansen's

GeoAdminstrator allows for communication between assets stored in Hansen and assets stored in the GIS. Quality Control and Assurance measures provide the confirmation that information within each of these systems is identical. ArcGIS and the ArcPad toolbar is utilized to check out a specified area or selection set of signs to be inventoried in the field. Microsoft ActiveSync is then used to move the data from the desktop to the Trimble GeoXT. The ArcPad software and custom applications allow the field crew to manipulate the street sign inventory to provide an accurate account of information about each sign. This information is then processed back to the desktop, again using MicroSoft ActiveSync. ArcGIS and the ArcPad toolbar is then used to check street sign data back into the Geodatabase. Again quality control and assurance is applied to the information collected in the field. Once this information has been accepted Hansen's GeoAdminstrator is used to push the information collected in the field into Hansen.
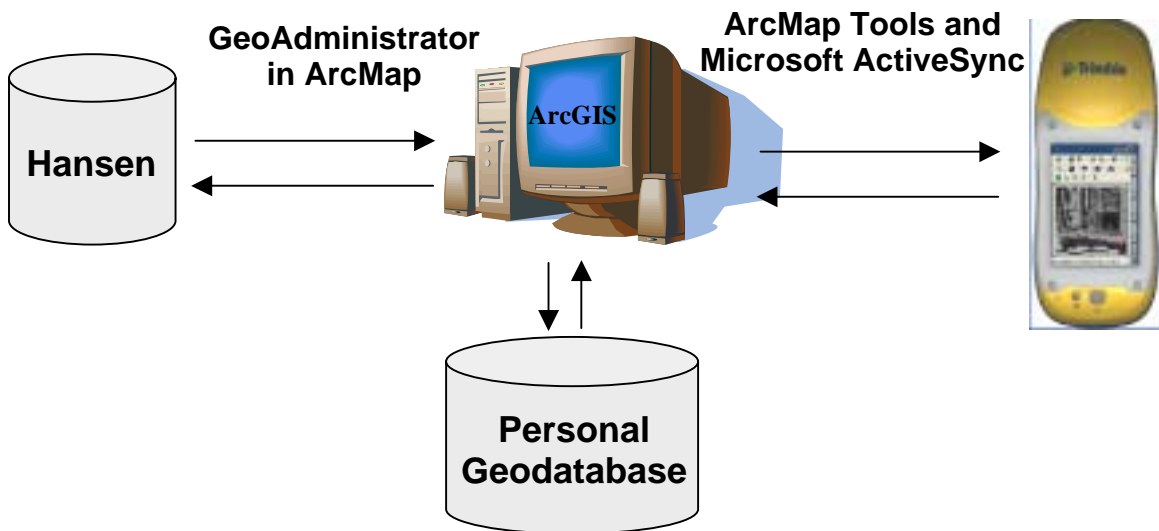
GIS Interface to Hansen Asset Management System:

One of the key benefits Hansen provides to its customers is the ability to allow seamless integration with Hansen's asset management system and an organization's GIS. The GeoAdminstrator extension provides the user with the ability to display and query Hansen data in ArcGIS and also provides the ability to find and repair inaccuracies between the two systems. In addition, new signs that are added to the GIS can be created as new asset records in Hansen. This tool provided the County with a convenient and simplified approach to maintaining their street sign inventory in both GIS and Hansen.

Conclusion:

This application clearly illustrates how the use of ArcPad, GPS and mobile technology can be customized for an asset management project or other projects that require field data collection activity and GIS integration.   With accurate attribute information on traffic control devices, County Staff will be better equipped to provide policy makers the necessary tools to make cost effective decisions.

Acknowledgements:

Martin County Board of County Commissioners
Governing body, policy makers

Martin County Engineering Department
Project management role

NorthStar Geomatics, Inc.
GIS consulting firm, data collection and GIS integration

Hansen
Hansen's suite of Transportation modules (e.g. Roadway, Streets, Pavement Management) and GIS tools (GeoAdministrator and GeoAssistant)

Transmap Corporation
Data collection firm specializing in mobile mapping technology.

Appendixes:

None.

End Notes:

None.

References:

None.

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Biography

Kimberly Maynard Roden

Kim Roden, Operations Manager of the Engineering Department in Martin County, Florida, provides support in the daily operations of a department with an operating budget of $10.7 mil. and a capital improvement budget of $20.5 mil. Kim has been with Martin County since 1987 providing long range planning assistance on budget and finance issues and project management support on transportation related projects.   During calendar year '01 Kim was made responsible for the implementation of Martin County's Asset Management System with primary focus being database development, data collection and GIS integration.   Kim received her BA from the University of Florida in '81 and is currently working on her master's degree in public administration.

Gregory S. Fleming, NorthStar Geomatics

Greg Fleming is President and Co-owner of NorthStar Geomatics Inc, a GIS firm located in Stuart, Florida. NorthStar Geomatics, Inc. was founded for the specific purpose of providing Geographic Information Systems (GIS) services to government clients. The firm provides complete GIS services including data collection project design and implementation. Greg received his bachelor of land surveying degree from the University of Florida in 1986, and is a registered surveyor and mapper in the State of Florida. Greg has been involved in GIS and surveying/mapping in both public and private sector organizations since 1991.

Jason Drost, NorthStar Geomatics

Jason Drost is a GIS programmer/analyst for NorthStar Geomatics. Jason is responsible for GIS production, project management and application development. Jason has created customized applications for GIS users using ArcPad, ArcObjects, VBA, ArcIMS, PHP, MySQL, and Javascript. Jason received his bachelor of science in management information systems from the University of Central Florida.