City of Gainesville Florida Application
for the
2007
J. Robert Havlick Award for
Innovation in Local Government

Using GIS in Emergency Response and Recovery Activities

Submitted by:
Teresa Scott, P.E., Director
City of Gainesville Public Works Department
M.S. 58, P.O. Box 490
Gainesville, FL 32602-0490
352.334.5070 Fax 352.334.2093
scottta@cityofgainesville.org

DESCRIPTION OF THE INNOVATION

The Storm Impact Assessment Tool provides a reliable and inexpensive method for quickly collecting field data following a storm event. The tool requires little input from field personnel, comes equipped with error handling routines that minimize input error, and has a time feature that allows the coordinator to verify mitigation delays.

HISTORY AND IMPORTANCE

Immediately following Hurricane Frances in September 2004, it became clear that the City of Gainesville needed a more efficient way to manage incoming incident reports from the public and city departments. With duplication of reports coming in we had to quickly develop a method to minimize repetition of effort in our response and recovery efforts.

IMPLEMENTATION

The damage assessment idea originated from a traffic infrastructure inventory tool, first learned about online from the ESRI Online Support Center website. This site provides developers and others in the GIS community with the ability to share knowledge, code samples and other tips and tricks that enable those within the community to become more efficient and creative in sometimes limited fiscal environments. What has now been termed the Storm Impact Assessment Tool works within ESRI's ArcMap application, requiring very little input from the user. Instead, users rely on accurate base-map layers and native ArcMap functionality to correctly site impact locations in the field. The assessment tool is similar to many windows applications, where information is entered via dropdown lists and text input boxes.

Our talented staff, and in some cases spouses and friends, came in to establish a makeshift database through our Geographic Information System (GIS) so the information could be used by our unified command staff in making decisions for response activities as well as to share with other agencies and jurisdictions. Less than 30 days later we were given an opportunity to refine these efforts following Hurricane Jeanne's arrival. During our after-incident discussions we decided that the idea of developing a GIS utility capable of monitoring and/or recording damage assessment(s) would be a useful tool for us to deal with a major emergency management incident.

Our Principal Engineer, Alice Rankeillor, P.E. and her staff were tasked with finding a reliable and inexpensive method to assess impact to city infrastructure following major storm events. Ideally, the method would include a tool or utility that would enable staff members to quickly locate and survey storm impact to city maintained infrastructure. Further, it was hoped that the tool or utility could be developed in house, thereby eliminating the cost of a consultant. Lastly, it needed to work utilizing current hardware and software configurations. Finally, the tool or utility had to be able to collect data from the field without using GPS technology, as the city has a limited number of GPS receivers.

After staff talked through the issues and conducted some research, they were able to create a way for field crews assigned to impact assessment to simultaneously mark field locations and record the data in a database through GIS. The field data will be used to generate route-impact information for emergency vehicles and maps for operations crews assigned to clear storm debris.

How the Storm Assessment Tool Works

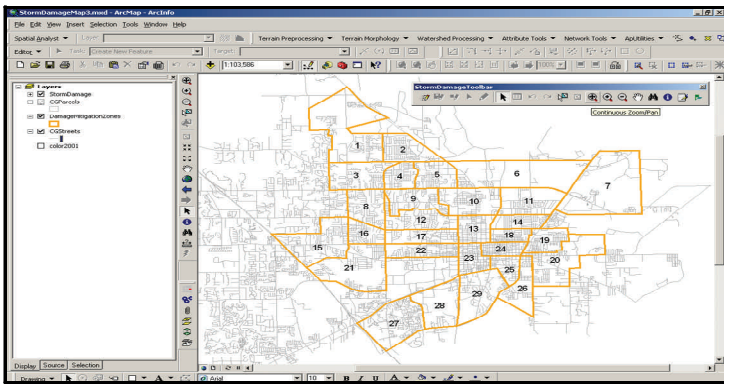

Figure 1
Data frame layout showing impact assessment zones and city streets.

The damage assessment idea originated from a traffic infrastructure inventory tool, first learned about online from the ESRI Online Support Center website. This site provides developers and others in the GIS community with the ability to share knowledge, code samples and other tips and tricks that enable those within the community to become more efficient and creative in sometimes limited fiscal environments. What has now been termed the Storm Impact Assessment Tool works within ESRI's ArcMap application, requiring very little input from the user. Instead, users rely on accurate base-map layers and native ArcMap functionality to correctly site impact locations in the field. The assessment tool is similar to many windows applications, where information is entered via dropdown lists and text input boxes. The following text provides a brief description on how the application works along with some screen shots for visualization.

Field Methods

Upon opening the Arc Map document, the field assessor is greeted with an opening data frame layout showing City of Gainesville streets and impact zones (figure 1).

Although ArcMap has plenty of toolbars, menus and commands, it cannot possibly account for the needs of all users. As such, ArcMap and the ArcGIS environment is highly customizable. With a little skill and research, users can quickly create custom toolbars and menus from existing commands within ArcMap, as shown in figure 2. Here, nearly every command icon on the toolbar was pulled together from existing commands, with two exceptions. The notepad icon accesses code that opens a help file, while the green flag icon accesses the Storm Impact Assessment Tool.

Figure 2. The Storm Impact Assessment Toolbar.

Once the user has correctly zoomed to the impact zone where they will be working, 1ft2 resolution aerials, city parcels and street name labels become visible, enabling the user to locate their field position. Once the field assessor clicks the green flag, the mouse arrow turns into a crosshair. The user then simply places the crosshair over the impact location, and with a left-click of the mouse, places a point on the map that simultaneously brings up the Storm Impact Dialog form (figure 3).

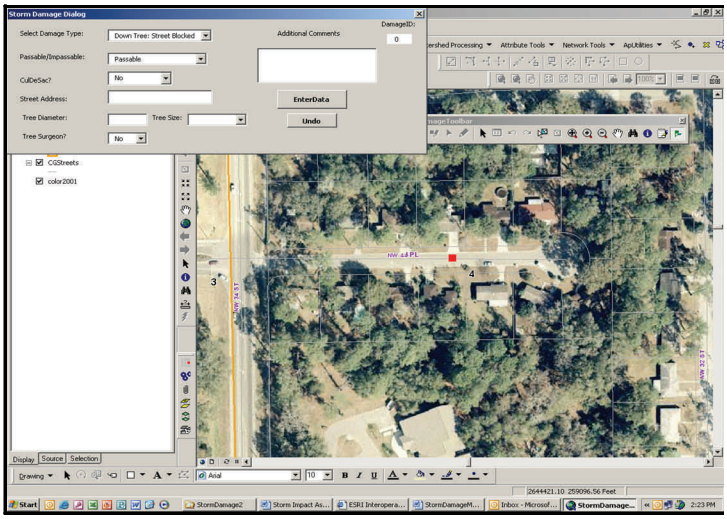

Figure 3. Storm Impact Assessment Form within ArcMap.

The user then records the following information for each site (figure 4):

- The impact type (e.g. down tree, down tree involving powerlines, street flooding, manhole cover popped, etc).
- Whether the street is passable or impassable.
- Whether the street is a cul-de-sac (dead end.)
- A street address selected with aid of the parcels data layer. The field assessor simply uses the identify tool and clicks on the nearest parcel, bringing up the street address, which is then copy-pasted into the address field. Future versions will automatically record the address or street block.
- If the impact involves a tree or any tree-related impact, the user will record its diameter (in inches), and will indicate if a tree surgeon is needed.
- When the user indicates a diameter, a nominal tree size list is automatically populated with small, medium and large sizes.
- If any additional comments are needed, the user can enter those via the text input box.
- If the user has entered everything correctly, they then hit the EnterData button, which stores the information both spatially and in the database. If the user has made a mistake, information boxes coded into the application pop-up and inform the user to make corrections.
- If the user has made a mistake, they can simply click the Undo button and the point and any information entered will be deleted.
- Date and time of day are recorded automatically behind the scene. No input is required.

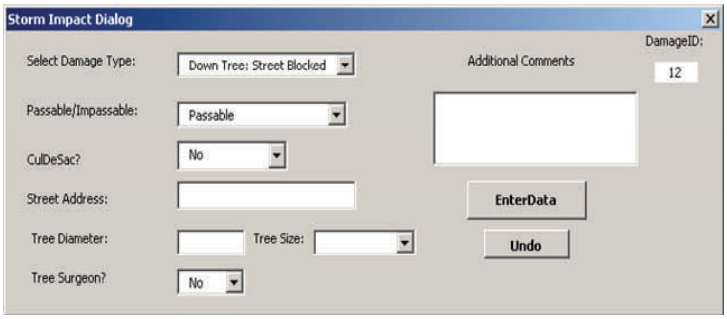

Figure 4. Storm Impact Dialog form.

Other error handling code was also written to ensure that the user enters a correct street address, only numeric values into the tree diameter input field, and if they are sure a tree surgeon is really required on site.

Data Compilation and Map Generation

Once the field teams have returned, they are instructed to insert a flash memory card into the USB port on the laptop, and to start ArcCatalog. When they are in the ArcCatalog environment, they can quickly copy and paste their data from the local hard drive to the flash card. The data from each field team is then compiled into a single database and maps are generated for field crews. Once major transportation routes are opened, the highest priority will be given to streets that are impassable cul-de-sacs, as people would be trapped. Upon data compilation from all field crews, the data will be queried for these two attributes and maps printed for the operations crews (figure 5).

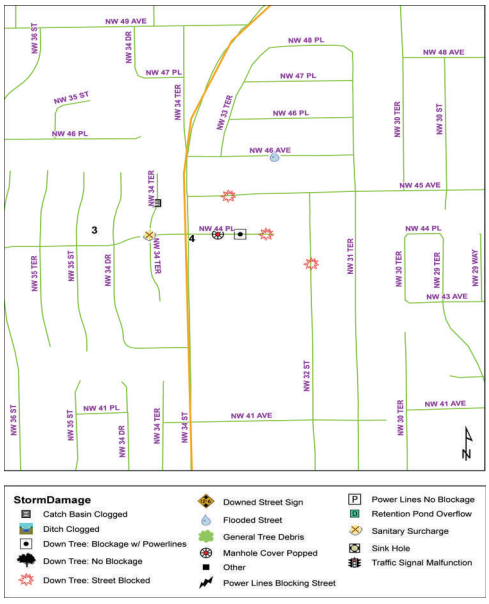

Figure 5. Example of map generated for operations crews.

In figure 5, a map is generated showing all impact types within zones 3 and 4. These non-specific impact maps will provide an overview of impact types to be corrected. However, operations crews will also need high-priority maps, and those will be generated by data query (figure 6).

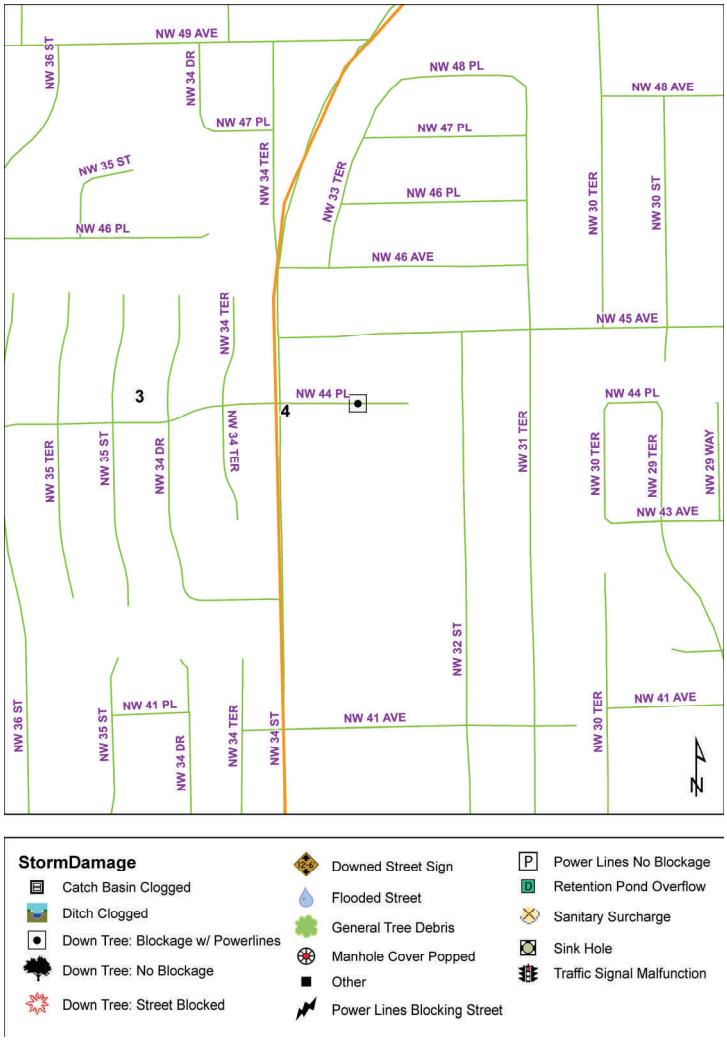

Figure 6. Map showing location of a cul-de-sac that is currently impassable. The impact type involves a tree that has also taken down powerlines.

COMMUNITY BENEFITS

The Storm Impact Assessment Tool provides a reliable and inexpensive method for quickly collecting field data following a storm event. The tool requires little input from field personnel, comes equipped with error handling routines that minimize input error, and has a time feature that allows the coordinator to verify mitigation delays. Future versions of the tool will include enhanced address handling routines, and will be compiled into a DLL. Perhaps most importantly, the collected data can be quickly compiled, enabling the coordinator to upload route information to emergency services via an ftp site or directly through an ArcSDE-Geodatabase connection. This will allow emergency services to alert their drivers about important route impacts caused by storm debris. Finally, as the operations crews clear obstructions, they will alert dispatch that the site has been cleared and mark off each location on hard copy maps. This information will be available in real time to the 911 Call Center as well as other first responder agencies to assist them in routing their response efforts and to help calm an anxious public during the stressful recovery period.