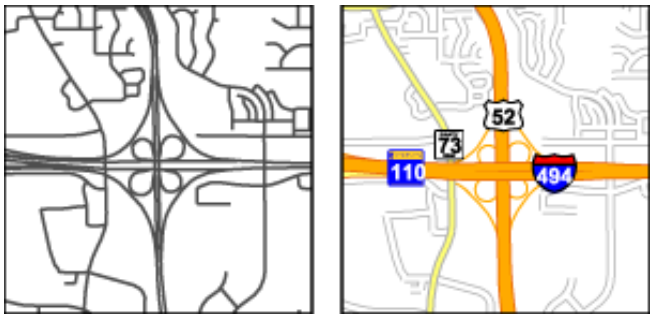
Winter 2010 - Tech Talk: New Streets

By Joe Sapletal, GISP

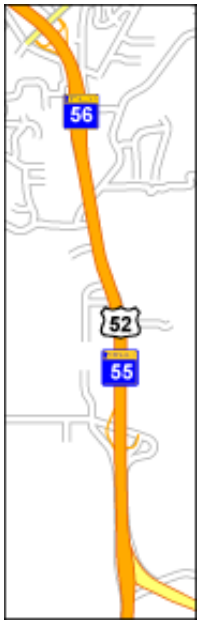
Occasionally we will all create a dataset, derived from another dataset, that we use only once for one map or map series. When the project is done, the data gets filed away, or maybe even deleted after a while. And, sometimes, others see that data and have a need to use it, too. Now you must maintain the data. But what if you don't, and then, later, decide to use it again? You have data (and a map) that is out of date. Recently, a dataset that was derived from our addressing centerline was created to better depict interstates and U.S. and state highways on some maps. Well, the data kept getting used more and more, but it was not getting the local street updates that the addressing dataset was. So it was time to combine the two.

Those who have used the addressing centerline dataset called **lmdak70** know that it is great for geocoding and labeling street names, but it lacked the ability to easily depict road types and to label certain roads with road shields. In some cases **lmdak70** was used in conjunction with a shields point dataset, but that was useful only at certain scales. Dakota County GIS staff evaluated which fields in **lmdak70** were being maintained and what was missing. After deciding on which fields would be eliminated from the dataset, which fields could be renamed to be less cryptic, and what new fields could be added to increase the usability of the dataset , the new dataset **Streets** was born.

Streets will continue to be a source for geocoding like **lmdak70** has been for years, but it will now be a source for road type symbolization and road shield labeling as well. In the future, additional fields will be added to aid in analysis and to increase the cartographic usage of the dataset. Examples of additions would be fields to help depict overpasses and underpasses, number of lanes, surface types and road closures or road construction.



The first enhancement that needed to be addressed was road types for symbolization and labeling. As you can see in the samples above, in **lmdak70** (on the left), you were stuck with one line type for your roads, and if you wanted to label with road shields you were stuck using the point dataset that was designed at a specific scale for the official county map, or using map graphics and annotation. But now, with the new **Streets** dataset (on the right), the line dataset has all the information built in so you can symbolize everything just as you want, and label it, too.



To accomplish this, **Streets** has six new fields to aid in road type symbolization and shield labeling. The new fields are *ROADNUM1*, *ROADNUM2*, *ROADNUM3*, *ROADTYPE1*, *ROADTYPE2*, and *ROADTYPE3*. The "ROADTYPE" fields are used for symbolizing the different road types (Interstate, U.S. Highway, County Road, etc.) appropriately on maps and placing the appropriate shield type on those roads. The three "ROADNUM" fields are used to place the appropriate number on the road shield for that road type. There are three "ROADTYPE" and "ROADNUM" fields because some roads have three overlapping road designations, and you may want to show that on your map. We recommend using the *ROADTYPE1* field to symbolize your roads, as it is the highest level jurisdiction for the road. Then, use *ROADNUM1* and, if needed, *ROADNUM2* and *ROADNUM3* for their respective shield types and labels.

As you can see in this example, US Highway 52 and Minnesota State Highways 55 and 56 have overlapping jurisdictions. The first road number and road type fields represent US Highway 52, the second fields represent State Highway 55, and the third fields represent State Highway 56.

ROADNUM1	ROADNUM2	ROADNUM3	ROADTYPE1	ROADTYPE2	ROADTYPE3
52	55	56	US Highway	State Highway	State Highway
52	55	56	US Highway	State Highway	State Highway
52	55	56	US Highway	State Highway	State Highway
52	56	0	US Highway	State Highway	None
52	56	0	US Highway	State Highway	None

This new layer is being used to symbolize and label the streets on the basemap for all new web maps being created in ArcGIS Server. It will be directly available to ArcMap users through the **Transportation** group layer and will be available to the cities on the FTP site with their usual data downloads. The dataset **lmdak70** will continue to be updated from **Streets** (as it is a subset of the information available in **Streets**) until we are sure that users have made the switch to the new dataset.

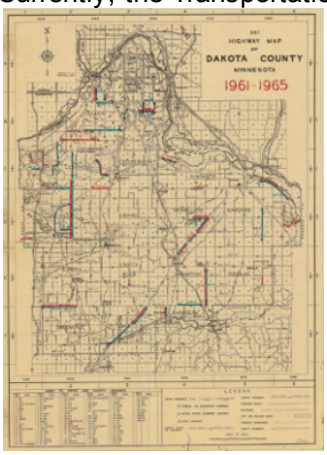
Winter 2010 - Desktop GIS: From Paper to Electronic - Improving Access to Transportation Plans and Easements

By Dan Castaneda and Kent Tupper

One of the Dakota County Transportation Department's goals for 2009 was to increase their use of GIS in their everyday work. One of the best ways to accomplish that goal was to take record-keeping tasks that had previously been done on paper and stored in filing cabinets and convert them into jobs that could be maintained and accessed electronically. Two of the tasks that are currently going through the conversion process are the Transportation Plans and the Transportation Easements databases.

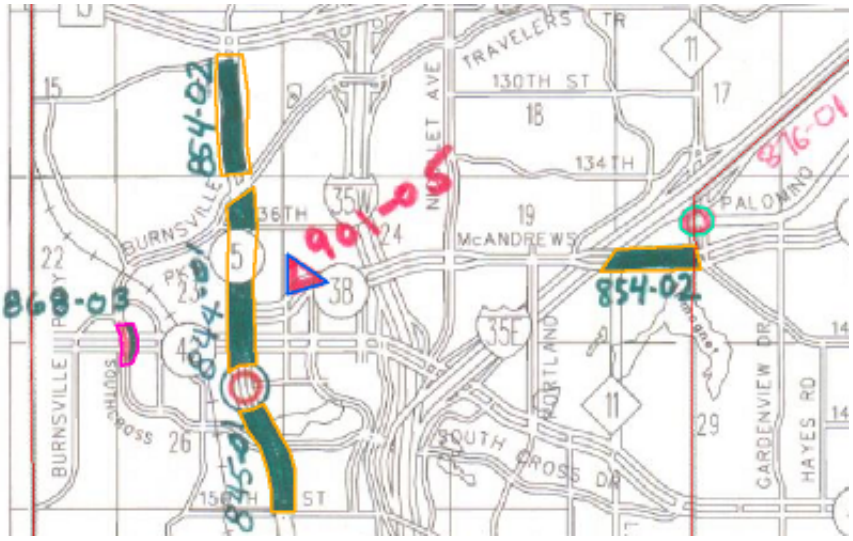
Transportation Plans

The Dakota County Transportation Department completes many road construction projects every year, investing several million dollars in order to maintain a safe, accessible county road network. For each of these projects, one or more plan sets is created in order to plan and track what type of work is being done.



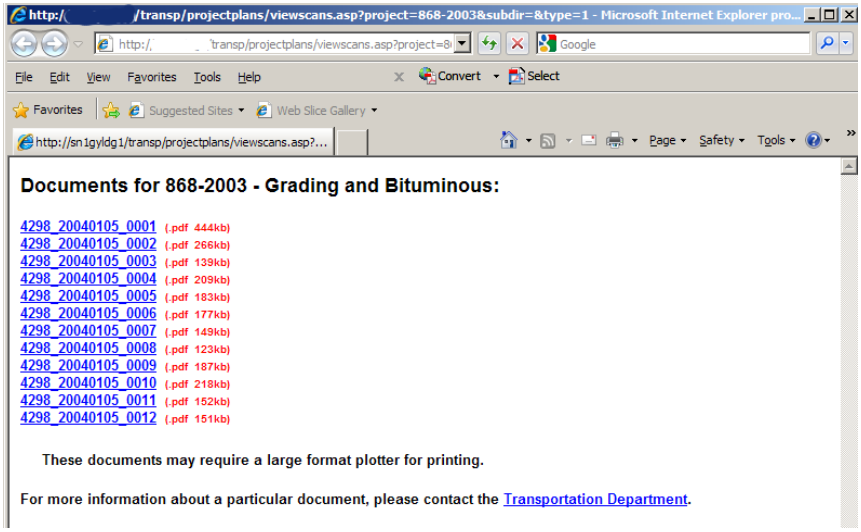
Currently, the Transportation Department maintains a spreadsheet of all of the projects, along with several paper index maps, which show where and when the projects were completed. The index maps are split into varying ranges of years. For example, certain maps will show projects that were completed from 1901 to 1920, while a different map will show which projects were completed from 1971 to 1975. Typically, when someone is looking for a set of plans from a specific project, they will either start by looking at the spreadsheet, or by looking at one of the paper index maps. After finding the project, they will then need to browse a directory looking for the plan sheets. This can become a long process when looking for several projects that occur in the same area. The user may have to look through several different index maps, or continue to refer back to the spreadsheet multiple times, which lengthens the time spent looking for information.

In order to help improve this process, the Office of GIS began digitizing the information found on the index maps. This was done by first geo-referencing all fifteen of the index maps. Then, each project was digitized as a simple polygon feature.



A database was created to store the information, which includes the project type, the year it was completed, a

directory ID, and a three-digit project ID which was created by the Transportation Department. The information is displayed based on project type, and the user can use the Identify tool to find out which projects occurred on a segment of roadway, or at an intersection.



Using the attribute information stored in the table, a URL is created for each project, and it links the user to a webpage with a list of all of the applicable plan sheets in PDF format. Also included in the webpage is a short description as to what type of project is being viewed.

The user is instantly able to see all of the projects in a particular area, dating back to 1901, and no longer has to spend time looking at individual paper maps or at a spreadsheet to find a particular project. All of this data is integrated into DCGIS as well, which allows everyone in the Transportation Department to search for past project plans quickly and easily.

Transportation Easements

Another database under development in the County GIS system to facilitate the conversion of paper maps and documents to electronic format is Transportation Easements. These easements are obtained in large part for county road purposes. They define the County's interest and rights along our county road corridors.

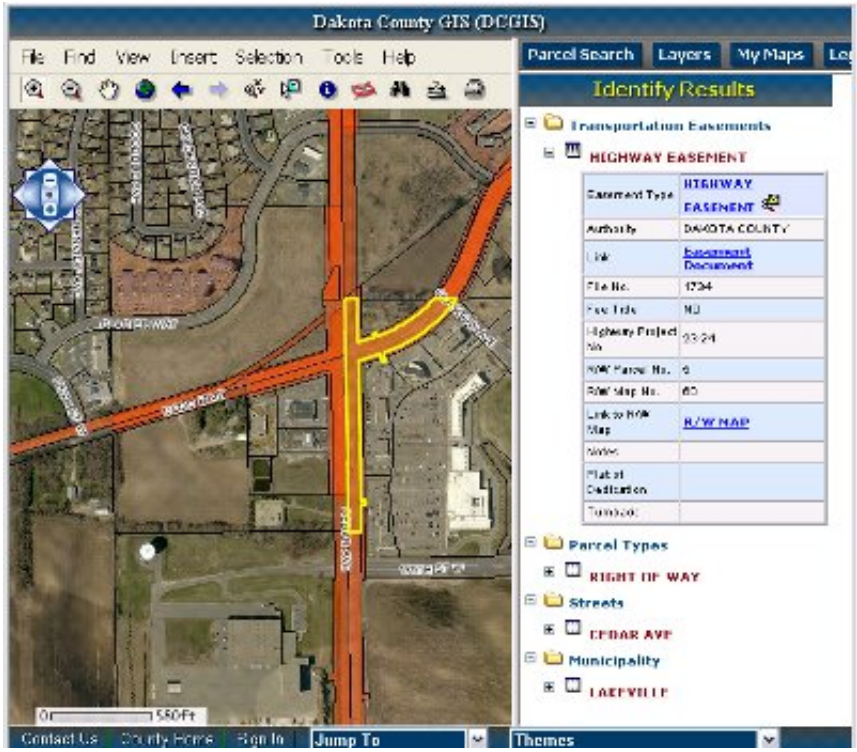
The way it was:

In the past, when road easements were obtained, they were recorded at the County Recorder's Office. The originals would be sent to the Transportation Department where they were filed in a filing cabinet using a unique ID created by the Transportation Department. This unique ID would be entered in a ledger with additional information, for example, the date recorded, the document number, road and project numbers, etc. The third step was to go to a series of printed section maps (some being more than 20 years old) and draw by hand the approximate extents of each easement, and then to number it with the unique ID.

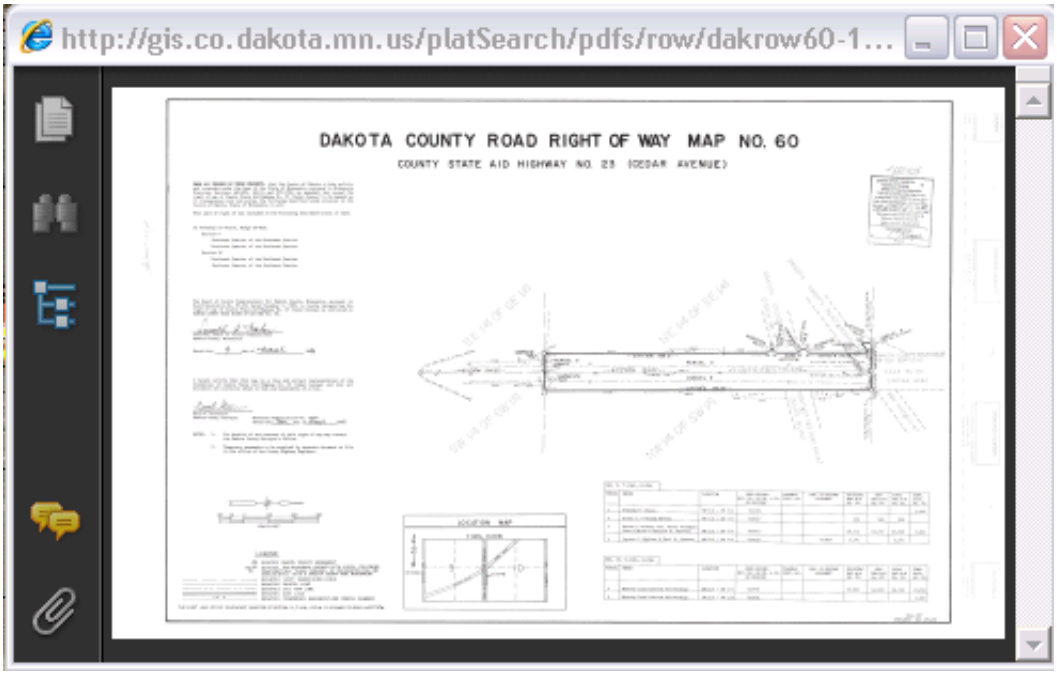
When a question would arise about the specifics of a county road easement, Transportation staff would have to go through a long series of steps to find the answer. First, determine the section, township and range of the location. Then, go to the appropriate paper section map. Determine where on the map the area of interest was. Take the index number from the map and go to the filing cabinet. Look up the document, then read the document to verify that the easement was indeed for the area in question, and in some cases go to the ledger book to get additional information to help make the determination. Sometimes it was very difficult to relate a particular easement to current ownership. The whole process could be very time consuming.

The way it will be:

The Surveyor's Office is defining GIS areas for each record easement utilizing the existing GIS tax parcel database at the County. These areas are tagged with the unique ID used by the Transportation Department. The paper ledger was converted some years back to an Excel spreadsheet, so that information has easily been associated with the new easement areas in the GIS. The other phase of the project is to scan the existing transportation documents into the County's Electronic Database Management System, OnBase. These documents are then indexed with the same unique ID as the corresponding road easement.



The end result is a GIS layer that can be displayed with other GIS information, for example, tax parcels. When identified, these easement areas contain information about easement type, county road project information, county road right-of-way map or the record plat of road dedication information. Hyperlinks open PDF files of the record easement document, right-of-way map or record plat, if applicable. All this can be done through a web application so no special software need be installed.



Now, when a question arises, County staff can query against a name, an address or a street intersection, zoom to that location to see easement areas in the neighborhood, and then click on them to retrieve information about the easement, record documents, current tax ownership information, or information from other various underlying GIS layers including aerial orthophotography and obliques from the County Pictometry system. This can all be done in less than a minute from any computer located in County offices.

The database is more than half completed and is anticipated to be county-wide by the second quarter of 2010.

Winter 2010 - Department Spotlight: Spotlight on Transportation

By Randy Knippel

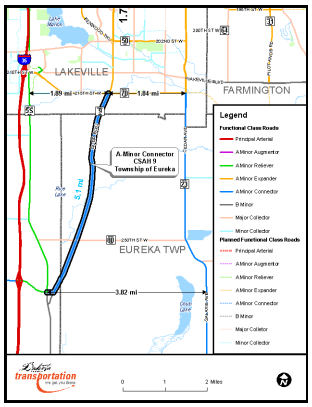
Normally, the Department Spotlight article focuses on a single GIS application in a department. However, a number of GIS projects were started in the Transportation Department this year, representing a special emphasis by the Department to employ GIS to improve work processes. Therefore, this spotlight article will give an overview of several of their projects. This focus on the large projects shouldn't overshadow the fact that there are several individuals in the Transportation Department that make regular, even daily, use of GIS for analysis and decision support.

The marked increase in 2009 is due to a special initiative taken by several Transportation Department managers and staff, with encouragement by their leadership. In some cases, the bulk of the work was already done, and GIS simply created an added level of functionality. In other cases, the project has just begun as a pilot, with more work to follow. The following is a brief overview of some of the projects. You'll find more in-depth articles elsewhere in this newsletter.

Sign Inventory

The coordinates for all signs on County roads are being located using GPS. A GPS-integrated camera is being used to take a digital photograph of the front of the sign and to record the coordinates. Each day, all pictures and coordinates are downloaded from the camera. Each picture is used to attach additional information to each sign record in a GIS database. The signs can be viewed in DCGIS, with hyperlinks to the photos. The GIS sign database can be queried for the type, installation date, and facing direction for further analysis.

SAFETEA-LU maps



Over 70 maps were created as supplements to six applications for grants totaling over $23M. The maps were done efficiently and consistently using standardized map templates and data. Once a set of maps were created for the first location, the layouts were then re-used for the rest of the locations, leading to significant time savings. Plus, since the same series of maps were created for each location, they also showed the same map scales, content, and symbolization. As refinements were requested or new areas added, the entire series of maps for all locations could be updated and re-created easily.

Crash Analysis

Each year, Transportation Department staff members analyze crash data from the state DOT. Although the state provides specialized software for viewing and querying crashes at specific locations or on specific road segments, it doesn't have the flexibility to easily perform spatial queries to find all crashes within a certain distance of an intersection or broad analysis across the entire road system. By creating a GIS database of these crashes, tedious data manipulation is avoided, allowing transportation engineers to focus more on a comprehensive analysis of the transportation system. (See the GIS 101 article, "Here a Buffer, There a Buffer, Everywhere a Buffer..." for more information on on this project.)

Historical Project Plans

All construction project plans are saved for future reference. Now, thanks to a new GIS web application, any area of interest can be used to generate a list of any type of construction project from any combination of years. See the Tech Talk article, "From Paper to Electronic - Improving Access to Transportation Plans and Easements", to find out how.

Roadway Easements

Easements define specific uses along or across County roads. Paper records of easements stretch back for many years, and accessing them has been a tortuous ordeal. Now, however, the Transportation Department and the Office of GIS are setting up a process that is easier and much quicker. See the Tech Talk article, "From Paper to Electronic - Improving Access to Transportation Plans and Easements", to learn how it's being done.

These are just a few examples of the ways in which the Transportation Department is integrating GIS into their everyday work.

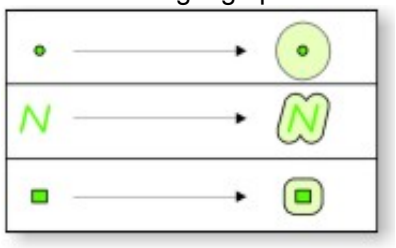
Winter 2010 - GIS 101: Here a Buffer, There a Buffer, Everywhere a Buffer...

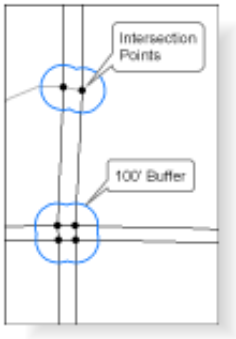
By Todd Lusk

Tell a GIS professional that you “want to buffer something,” and their eyes will light up like a kid in a candy store.

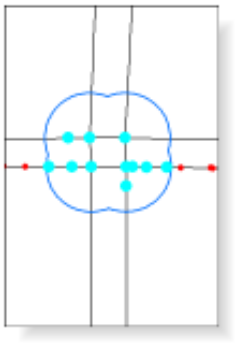
“Why?” you may ask.

"Buffering", or "proximity analysis", is a way of analyzing geographic features in relation to other geographic features. It is one of the most basic concepts of GIS, yet it is also one of the most powerful tools. It is basic in the sense that the concepts are applied visually when looking at a map. It is powerful because GIS allows the concepts to be performed automatically, to analyze large areas and relationships among multiple geographic features and related data. This power may often be taken for granted by GIS professionals and be poorly understood by others.





A recent application of a buffer analysis was put to use by the Office of GIS for the Transportation Department. Each year the Transportation Department analyzes the number of crashes at intersections on County roads to try to determine if further safety enhancements are needed. The task of analyzing the data was very laborious because it involved identifying all of the intersections, then determining how many crashes occurred with 100 feet of each intersection. Just identifying the number of crashes within the 100 feet required two people and a couple of hundred hours of time to complete. Looking for ways to make the process more efficient, staff from the Transportation Department approached the Office of GIS to see if GIS could somehow be used in the analysis. The process was a perfect candidate for using a buffer analysis because it involved determining how many crashes (point locations) fell within a certain distance of the intersections (a “buffer,” or a polygon).



The first step of the process was identifying all of the intersections that the Transportation Department was interested in. That process involved creating a point location at the intersection of each direction of travel for all County roads and the roads they intersect. A point location was created for each direction of travel because the crash data from MnDOT used for the analysis is delineated in such a manner. Once that task was complete, 100-foot buffers around each intersection were created using GIS software. The buffers were then used to select all of the crashes that fell within 100 feet of each intersection.

The process was further refined by setting up the software to automatically loop through all of the intersections. The entire analysis process was then completed in a matter of minutes, rather than several hundred hours. It also made it easier to run more “what-if” scenarios. For example, what would happen if the buffers were 150 feet instead of 100?

The critical pieces of information for this project were the intersections and the crash locations. However, the most important things were the buffers. Without the buffers it would be virtually impossible to identify the crashes that fell within 100 feet of the intersections. Having the buffers made the process very fast, efficient and easy.