GIS SOLUTIONS FOR SURVEYING
(How GIS is or can be used in my workplace)

By NM Mpiti (June 2016), Survey technician at Surveying & Land Information Department

INTRODUCTION
GIS is being used as a tool to support our everyday work routines. It supplies us with information that helps in our decision making, database storage, efficient use of past projects, all with easy access and accuracy.

GIS is proving to be a very important tool to our firm that is divided into so many engineering departments such as the land survey, civil engineering, architecture and many others which are not even engineering related. GIS is a visualization tool for improved identification an environment of paperless interaction between departments.

Our survey department uses the ESRI ArcGIS which improves our productivity and efficiency. Using GIS in our organisation allows all our departments to easily access and share geographic data. Layers of data from all departments can be setup and view by all on the GIS making it easier for everyone in the organisation to access any type of information that they may require, all found within a single system.

The Surveying and Land Information Department is divided into three branches, which are Land Survey Branch, Map Production and Land Information & Records. All these branches use GIS for different purposes as they deal with different aspects of survey work but they all have the same information on the GIS which is updated every week.

Land Information & Records Branch
Deal with record keeping of cadastral information of the eThekwini Municipality which include General Plans and Survey Diagrams. Their main function is to assist the internal departments, the general public, the private companies and the ordinary person with geographic information. The information is stored in GIS under different layers which makes it easy to view and analyse. A person would come looking for cadastral data with the wrong cadastral description but because of the information on the GIS they are able to identify exactly the site that they are looking for with the help of the image as can be seen below.
Map production
Deals with the production of Maps and Hand Plans. The Hand Plans are used for subdivision purposes, allocation & acquisition of land. The branch uses the GIS to identify the buildings, services and other structures which could have an impact in the process of subdivision or acquisition.
Land Survey branch

Project Planning
Land Survey Branch deals with all the issues relating to survey which includes field and office work. Surveyors use GIS to manage the entire planning aspect of a surveying project. GIS provides the tools necessary to research, develop, implement, and monitor the progress of a project and manage site location. The planning aspect of a survey project has a number of unique requirements depending on its area, purpose, and overall goal.

We make use of aerial photographs as our source of topographical data. Land boundaries and parcels can be viewed in high accuracy and quality as they are provided by survey. Planning of civil engineering works is easy with data for water pipes, sewer, electric services all integrated in the GIS system. Roads and other transportation routes are easier to manage and improve upon. As an additional tag to features on the system, GIS allows us to have records on properties, past jobs done on site, power stations, etc. we are able to store such useful information on the GIS and this is very important for any organisation. As surveyors, we can store parcel data, manhole data, control points coordinates, and boundary coordinates, etc.

The example below illustrates a piece of land and how we have added data on it show the extent of a future survey. From the picture we are able to view roads, land parcels, control points, buildings, previous surveyed areas, and a whole lot more. These in turn enables us to pre plan and tackle every survey with more knowledge of what’s going on site.

Data Collection
ArcGIS is used for many purposes as we serve the community and internal departments for issues relating to survey. GIS helps us to capture, manage, analyse and display all forms of geographically referenced information. It also allows us to view, understand, question, interpret and visualize our world in ways that reveal relationships, patterns and trends in the form of maps. It also helps us answer questions and solve problems by looking at the data in a way that is quickly understood. Surveyors enter raw data, measurements, and field sketches directly into the GIS, enabling them to efficiently manage data in a central repository with other spatial information, streamlining workflows and improving productivity.
Cadastral boundaries shown in our GIS are obtained from General plans like this one. Cadastral boundaries can also be obtained from survey diagrams all of which are surveyed by land surveyors, so are very accurate.

**Using ArcGIS for data collection enables surveyors to**
- View, edit, and analyse survey data.
- Store data in a centralized environment.
- Use project-collected data to build an information system.
- Collect and transfer/transmit feature data directly from the field into the geodatabase.
- Customize workflows and/or data collection processes to suit individual needs and requirements.

**Field Measurement**
Surveyors rely on a range of data collection devices in the field, from total station angle measurements to high-resolution of scanners. With ArcGIS software, surveyors not only bring data straight from the field into a geodatabase in a seamless workflow, but they also take GIS data back into the field via a data collector, or laptop computer.
Construction
GIS technology improves the mechanics and management for building new infrastructure by combining design and site data and providing the framework for as built data collection. All parties involved in a project such as surveyors, engineer’s contractors and the public rely on GIS to communicate their data.

Land Development
Land development involves several areas to consider including topographic and terrain features, roadways, drainage systems, utilities, property boundaries, and building sites. Surveyors work alongside other engineers and land developers to define legal land boundaries and provide essential engineering support for development. GPS and laser scanning are used create complex layers of interconnected geographic information

Land Analysis
ArcGIS software products greatly enhance the optimum use of land, functional efficiency of a proposed design and its marketability, and overall cost-effectiveness of a project. ArcGIS software, coupled with specialized applications designed specifically for land developers, is used to perform, Cadastral mapping ,Surveying ,Contouring, Traverse adjustments ,Stakeout, Site design, Drafting.

Looking at the picture above contours are generally developed from aerial photograph but can also be obtained from field survey.
Survey Data Management

GIS is special because it allows us to bring together information from many different sources using geography as the common framework to link them together. This has been possible using paper maps for many years, but with GIS we can displace paper maps and explore the data in real time without having to spend months redrafting it. We can combine information we hold in whatever way we want, producing customised visualisation of different combination of data quickly and effective. Instead of storing surveys in isolated, individual files, GIS allows surveyors to store all survey data in one database, providing easy access to past work that can be efficiently reused and overlaid with new data.

With datasets in our GIS, there is attribute data that is stored in tables. For example when viewing the land parcel dataset, we can view all relevant information related to a particular land parcel by selecting the required parcel.

CONCLUSION

In our company, the survey department has been able to start and manage a survey information system that has seen growth and has built up over the years. This system is proving to be very powerful and helpful to not only us but other surveyors who come in every now and then for such data. Control points coordinates and previous surveys that can be linked to stored files are an everyday request from surveyors doing work in areas that we have already covered.

GIS is an important everyday tool to our organisation. Be it professionals trying to get data from it for a project they are tackling or the public using it for clarity on an issue regarding their property, GIS has proved very helpful and full of resources in one system. From a simple use of finding a route to site, to obtaining coordinates of parcel beacons, as well as coordinates of nearby survey control points, to finally tackling a job on site, GIS has proved to be a useful tool in our organisation.