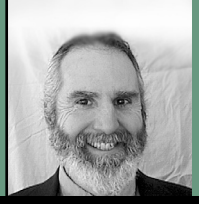
GIS**Matters**



By Rj Zimmer, LS

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The Surveyor's Roles in a GIS Framework

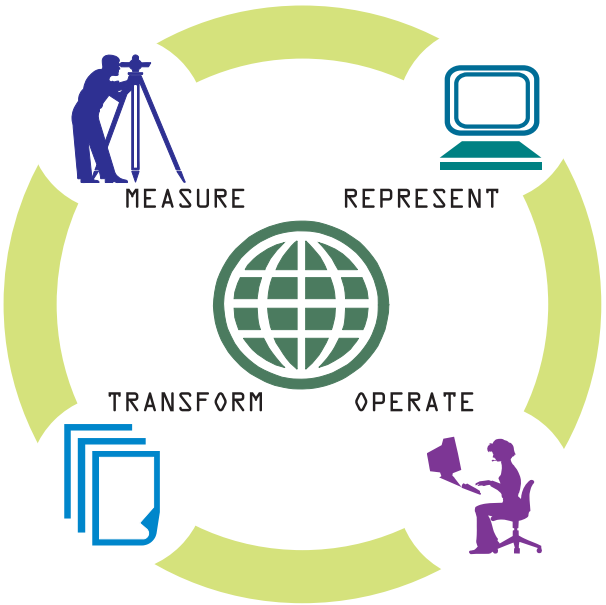
I have been asked by non-surveyors in the GIS profession, what will become of surveyors when the tools to map and measure data become so easy to use that anyone can map data to centimeter accuracy? I also see fear within the surveying profession as surveyors themselves ask this very question. But fear not, there is more to surveying than just making measurements, and there are many roles for the surveyor even within the GIS framework.

The nature of the surveying profession has changed in recent years as technological innovations put measurement tools into the hands of many, thereby enabling those with lesser skills to measure and map things that only trained surveyors used to do. Those (within and outside of our profession) who think that measurement is the essence of surveying may see this trend as the beginning of the end of the surveying profession, but it is not. Instead of spending most of our time measuring the mundane and the trivial, we surveyors will refocus our attention to activities that are more professional in nature, such as analysis of measurement data and spatial relationships, and, of course, the ever important land boundary work. As measurement and mapping activities become more accessible to everyone, the need for a surveyor to perform many kinds of measurements decreases, while the need increases for a learned and trained professional to evaluate and certify measurement data, and to provide context and meaning to those spatial relationships that measurements reveal. Geographic Information Systems and the new measurement technologies do not make the surveyor obsolete. On the contrary, these technologies reemphasize the need for expert survey analysis and evaluation of measurement data. Within the GIS framework, there are many different types of activities, of which measuring is one. The land surveyor performs all these activities to varying degrees.

In his book *Exploring Geographic Information Systems*, Nicholas Chrisman, a professor of geography at the University of Washington in Seattle, describes a GIS as *an organized activity by which people:*

- ***Measure** aspects of geographic phenomena and processes;*
- ***Represent** these measurements, usually in the form of a computer database, to emphasize spatial themes, entities, and relationships;*
- ***Operate** upon these representations to produce more measurements and to discover new relationships by integrating disparate sources; and*
- ***Transform** these representations to conform to other frameworks of entities and relationships.*

GIS Cycle of Activities



Although typically viewed from outside our profession as working only in the area of measurement, the surveyor works increasingly in all the activities in GIS. These activities may not be identified as GIS activities, especially when performed outside a GIS environment. However, as GIS technology advances, more of the surveyor's activities can be performed directly within and in concert with the GIS environment. Additionally, Chrisman alludes to *Data Quality: Verify against World activities*, that is the ground truthing of measurements, and the quality assessment (including the spatial accuracy

assessment) of measurement data. He also states that the measurements should support the goals of the project, and that the project should support the expectations of the institutions and cultures that demand the information. Admittedly, the vast majority are not some of these goals and expectations that are within the purview of the land surveying profession. Nevertheless, the land surveyor does have the experience, training, and knowledge to make the kinds of assessments necessary to determine the spatial quality of measurement data, and, the context and suitability of certain types of information (such as boundaries).

Measure

We measure phenomena in order to communicate their location to others. Measurement is a means to an end–that end being the communication of location of some thing or things. Whether the data is tied to the National Spatial Reference System, property corners, or other context, the measurements are always relative to other phenomena, and in this way, the measurer provides context for the locations. Depending on the nature of the phenomena, the measurements may be performed on the complete data set (such as control points) or on portions or representative samples of the data, such as elevation point measurement for topography, or point measurements that are connected by lines to represent a roadway or curb line.

In addition to measuring the location of phenomena, we may also observe and record other characteristics of the phenomena. For instance, we might perform a GPS control survey of a survey monument. When we perform that survey, we may also record characteristics of our control monument such as its material, markings, location, stability, etc. Or we may perform a weed survey, where the location of weeds is measured and the types of weeds are observed and recorded.

Typically, in a GIS, these observations are more important than the location measurements. That is to say, that often within a GIS, the *what* takes higher precedence than the *where.* These observations may be recorded in the GIS as attributes to the data, and can be used to symbolize the data, and as the basis for analysis of the data.

Represent

Representation of measurements has become increasingly, though not yet exclusively, digital. In fact for the surveyor, the data is digital from field to finish for many projects, although hard copy output, such as plats and survey records continue to be important representations of survey measurements and analysis.

In the GIS realm, we are beginning to see survey measurements represented in their raw form, in addition to the derivative products (such as parcel polygons). This trend is an important advancement for the integration of true survey data.

Operate

As Chrisman defines *operate*, more measurements may be made and new relationships between disparate information may be discovered, once data is brought together within a GIS. Surveys perform important analysis of spatial data, like boundary resolution, but other types of analysis can be done using GIS, such as site analysis and planning, based on the integration of a topographic survey, geology overlay, zoning and regulatory overlays and other relevant GIS data. Surveyors can also analyze the success and geographic distribution of their own projects in order to maximize profitability and allocation of staff and equipment.

Chrisman contends that we measure in order to meet certain goals, and those goals predicate the choices we make about what to measure and how to represent the phenomena, and in turn, the *availability of information shapes social expectations and the cultural expectations of professions and disciplines shape the choices of measurement and representation.* The land surveyor, through experience and training, knows how to plan a project to make the correct choices about what to measure. On the other hand, there is no way to predict what new expectations may be derived from the availability of new data. The misuse of data is one of the surveyors' greater fears with regard to GIS, but this is an area that no one has control over. The only caution that surveyors or anyone else can provide is to clearly state in the metadata, the intended and appropriate uses for the data. What happens after the data becomes available is hard to predict and nearly impossible to control.

The expectations of engineers and surveyors are different in many cases from the expectations of other professions and disciplines. Those expectations derive from the types of usage of the data, after all, we do not measure merely for measurement's sake. We measure for a stated purpose, in order to fulfill a goal. However, others who have access to the survey or engineering data may view the data in a different way and may see opportunities for other uses of the data. The classic example of this is the use of cadastral data. In recent decades land surveyors came to feel proprietary about cadastral data (indeed, some surveyors felt that surveyors where the only ones who could rightfully use the word). Those who felt that surveyors were the only ones who could do cadastral work, failed to understand that the cadastral survey activities were not the entirety of a cadastre, but only a piece of the cadastre. A cadastre is more than mere boundary lines. A cadastre originally was a registry of land and real estate ownership, and the land boundaries are *one* aspect of that registry. The origin of a cadastre was for the purpose of taxation, but a cadastre has innumerable uses and applications today, due to the wealth of information contained in a modern cadastre. That is, social expectations changed over time as data became available. The surveyor continues to have a role in cadastres (digital and otherwise), and performs many types of operations, including analysis of measurement data that fall within the GIS framework.

Transform

Transforming data representations to other frameworks (spatial and non-spatial) and into other types of relationships is also an activity performed by surveyors. Surveyors often transform legal descriptions contained in a deed or other record, into maps and into various digital forms. Surveyors also transform data sets from one coordinate system or datum to another. These types of transformations may seem trivial to the surveyor, but they are important activities in a GIS.

The surveying profession is evolving. While many people within and outside the profession see us as a profession of measurers, measurement is only one aspect of the profession; surveyors also *represent*, *operate* and *transform* information. So, surveyors perform all the activities within the spectrum of the GIS framework. In doing so, we surveyors are transforming as well.

Author's note: Excerpts from Dr. Chrisman's book, *Exploring Geographic Information Systems*, Second Edition, are available online.