INTERSECT

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GIS uses coordinates. Surveyors use measurements. Same thing or miles apart?

GIS JANET says …

I'm unique. Randy, you're unique. And every hydrant on the planet is unique—at least to a GIS! OK, maybe hydrants aren't quite as unique as Randy and I are, but their location on the planet is definitely unique. To map those hydrants, a GIS must know exact coordinates, not measurements, of each individual hydrant. So I say the difference between coordinates and measurements is miles apart, or at the very least, thousands of individual coordinates apart.

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One of the most important distinctions about a GIS is that each and every point or feature is unique, and it needs to be for the computer to spatially locate it correctly! The underlying assembly of GIS requires coordinates of every feature so each can be placed, or spatially located, on top of an imaginary x/y GRID or projection system. The projection system can be different for each state, and some states even have more than one projection system.

ESRI's online dictionary defines x/y coordinates as "a pair of values that represents the distance from an origin (0,0) along two axes, a horizontal axis (x), and a vertical axis (y). On a map, x/y coordinates are used to represent features at the location they are found on the earth's spherical surface." For example, to place a hydrant feature at the corner of Columbia and Franklin Streets in Chapel Hill, North Carolina, the GIS needs to read an exact and unique set of x/y coordinates, not measurements.

Surveyors commonly record a bearing measurement and distance of something like north 87 degrees, 35 minutes, 07 seconds east, and 574 feet. To a GIS, this means nothing because it is unable to map or place an X on the geographical spot that represents this string of numbers. To be useful for GIS,

SURVEYOR RANDY says …

I agree that many people and objects are unique, and that the location on the planet of any object is unique, but I don't agree that measurements and coordinate are miles apart in most cases. In fact, the ACSM publication *Definitions of Surveying and Associated Terms* defines coordinates as "linear or angular quantities, or both, which designate the position of a point in relation to a given reference frame."

Maybe 40 or 50 years ago a case could be made for measurements and coordinates being miles apart, but that is not true today. When I began my career in the early 1970s, it was common to use a magnetic bearing as a north reference and angles and distances to survey to a known point or a calculated location. Assumed elevations were also routinely used if a benchmark set by a governmental agency on a known geodetic datum was not available.

Measurements and coordinates may have been miles apart a few decades ago, but today they are headed on a collision course to share the same space.

Early in my career, I observed my boss closing survey traverses using a large book containing trigonometric tables for sines, cosines, tangents, and cotangents to eight decimal places to the nearest second and a Marchant mechanical calculator. Even at that time, x and y coordinates were calculated, although they might be on a local datum and not tied to State Plane Coordinates. One of my first surveying texts, *Elementary Surveying, 5th Edition* by Russell C. Brinker and printed in 1969, discusses State Plane Coordinate Systems and the computations necessary to place a survey on a State Coordinate Grid System.

Fast forwarding to the present, I surmise that most surveys are tied to a State Plane Coordinate System, and the points shown on those surveys have unique x, y, and possibly z coordinates. Tying our surveys to State Plane Coordinates has been facilitated by local and state regulations and

Janet *continued*

survey measurements need to be processed through coordinate geometry software that converts the measurements to a set of coordinates relative to the situation and regional location.

Measurements are helpful, but first you have to know where you are in the context of what you are looking for. Coordinates provide the unique spot within the context of a huge area—even within the context of the whole planet. So while Surveyor Randy may say the hydrant is located 4.3 feet from the back of a curb, GIS Janet will say the same hydrant is located at x=2405472.78 and y=717098.85.

Again, the x/y set of coordinates is used to spatially adjust individual or groups of points or identify each object as a singular entity. In addition, the coordinate set becomes the object's name tag. One perfect application for using the coordinate name tag is when you need to field-locate a feature, like a manhole or meter box buried by dirt or foliage. By putting the feature's x/y coordinates into the mobile computer and viewing the X-marks-the-spot on top of the base mapping information, you should be able to walk or drive directly to the manhole or meter box.

Uniqueness is a good thing. It's what keeps us different but moving toward a common goal. The surveyor and the GIS person are both interested in mapping features with accuracy and completeness, whether we use coordinates or measurements. However, the GIS software can only use the x/y coordinates to spatially locate each and every feature. Let's be glad we have choices and know when to use coordinates or measurements. Neither of us is wrong; we're simply celebrating our uniqueness!

Janet Jackson, *GISP is certified as a GIS Professional and heads McKim & Creed's GIS activities in North Carolina and Virginia.*

Randy *continued*

requirements, the availability of control monuments with established State Plane Coordinates, and the increased use of GPS equipment by a large percentage of surveyors.

Many local governments are also requiring as-builts of new utility projects to be tied to State Plane Coordinates. Also, requirements call for the elevations be based on a Mean Sea Level datum so the as-built data can be imported into a GIS to facilitate the maintenance and repair of those systems. Even if a small survey is not tied to a State Plane Coordinate System, it can almost be guaranteed the points within that survey will have coordinates, and those points and coordinates can be tied to the State Plane System. They can then be translated and inserted into that system and any GIS based on the same State Plane System.

These surveys provide accurate data that can be imported into a multitude of GIS to greatly enhance their quality and broaden the range of their usefulness. With survey measurements being recorded and mapped on "exact coordinates," it is only proper that the "survey grade" data make its way into GIS and benefit everyone using that information.

I believe the vast improvement in data quality and its insertion into the multitude of GIS is an important key to the "intersection" of the surveying and GIS communities. Measurements and coordinates may have been miles apart a few decades ago, but today they are headed on a collision course to share the same space.

Randy Rambeau, PLS, *manages the surveying operations in McKim & Creed's Cary, North Carolina office, overseeing land surveying, photogrammetry, GPS, SUE, and laser scanning activities.*

While Janet and Randy may not see eye-to-eye on all surveying and GIS issues, they do work together on a daily basis, respect each other's perspective and point of view, and attempt to "intersect" their professions whenever possible. Randy and Janet invite you to submit your questions to "Intersect." Contact them via email at *intersect@mckimcreed.com* or at 919-233-8091.