

# Pin-pointing the lot lines

## Art of surveying crucial element of construction

Photographs and text by Walter Horylev

Most people wouldn't even notice those little marks on the pavement or sidewalk but it didn't take Rich Mitchell and Curt Adams very long to find a couple of them, in spite of the fact that the street and most of the sidewalk had been recently replaced. Curt, a technician, and Rich, an Alfred University student and surveyor intern, are employees of Schultz Associates, Engineers and Land Surveyors, P.C. located in Spencerport and their task on this day was to lay out the proper location for a garage, replacing a smaller one which would soon be torn down.

After locating a pin, a concrete nail was driven into the sidewalk, Curt set up a prism pole to serve as a target for Rich, who looked through a Total Station instrument to use this location as a reference. "The Total Station instrument is such a help compared to the old way of using a chain and pins and a range pole in the old days," Curt said.

Surveyors work from a known reference and a map



A close-up view head-on into the prism pole reveals the prism divided into six segments.

and work their way onto a property by using the correct angles and measured distances to determine a new reference point. In this case they were able to cross the street to a new reference and from there arrive

at a spot which defined the front corner of the lot. This spot was marked by a concrete nail driven into the sidewalk. Curt worked his way down the east side of the property line guided by directions from Rich looking through the lens of the Total Station using the theodolite mechanism, which measures angles. Curt established one identifying mark, driving a concrete nail plus a folded blue ribbon underneath it. The duo repeated this process several times so that there was a series of nails, like dots in a row, which gave an outline of the lot's northern border going back into the lot. Then it was a simple matter to make measurements using a tape measure to proceed back into the yard next to the old garage to define the corner of the new garage, one which would be bigger but no closer to the lot line.

Once the back corner was defined, the next step was to define the other corners of the foundation of the new garage using the Total Station and a tape measure. Then, using the level capability of the Total Station, the height of the garage floor was determined to obtain proper drainage measurements. An elevation was read and indicated by a mark on the nearby house foundation.



One of the concrete nails used to mark reference points in surveying.



Curt places the Prism Pole into the indentation of the masonry nail.



Rich operates the Total Station, which consists of a level, a theodolite (which gives angular measurements), and an EDM, which provides an electronic distance measurement.



Curt is looking down to observe a bubble level, making sure that he is holding the prism pole exactly vertical while a reading is being made from the Total Station.



Curt hammers a special masonry nail with a folded yellow tab underneath into the sidewalk along the street, to establish the location where the corner of the lot was found. (He was directed to the proper location via directions received from readings made by Rich.) The nail has an indentation in the center, which provides an easy location to place and hold the point of the prism pole.

## Land surveying requires precision and accuracy

Compiled by Helen Nguyen

*Before they were U.S. presidents, George Washington, Abraham Lincoln and Thomas Jefferson were all practicing land surveyors.*

It was Jefferson who commissioned Meriwether Lewis and William Clark to explore and survey the territories the United States had acquired through the Louisiana Purchase. It was also Jefferson who proposed the Public Land Survey System. The system was created through the Land Ordinance of 1785, and forms the foundation of the way the country identifies, surveys and divides its land.

Land surveys are vitally important since they are the starting point for the construction of the roads and bridges we drive over, the stores and malls at which we shop and the giant skyscrapers that dominate the skyline. On a smaller and more personal level, land surveys define the boundaries of the property of our homes. Those who conduct the surveys are also the ones who write the descriptions of our property for deeds, leases and other legal documents.

### Surveying as a profession

Land surveying requires great precision and accuracy because fractions of inches matter when it comes to taking proper measurements.

Those who choose to pursue a career as a professional land surveyor are typically proficient in mathematics, geometry, trigonometry, engineering, computer science, physics and algebra.

There are two and four-year degree college or vocational programs for land surveying; sometimes referred to as geomatics engineering. According to the National Society of Professional Surveyors (NSPS), in order to work as a land surveyor, individuals must take a Fundamentals of Land Surveying exam. They then are allowed to work under an experienced and licensed surveyor. The last step of the licensing process involves the surveyor taking a second exam known as the Principles and Practice of Land Surveying, as well as possibly a state-specific exam if it is required by the state in which the surveyor wants to work.

One of the biggest employers of land surveyors is the federal and state government. A surveyor can find jobs with the U.S. Geological Survey, Bureau of Land Management, the Army Corps of Engineers and state highway departments. Public utilities and construction companies also employ surveyors.

### Surveying tools

The profession of land surveying has dramatically changed throughout the years. Years ago, surveyors used compasses to measure angles and alimeters to measure height. It also used to take days and sometimes weeks to create a single map.

Technology and computers have changed that significantly. According to the NSPS, surveyors have an array of cutting-edge technology to use that includes laser scanning systems and GPS equipment. By using a Global Positioning System (GPS), a surveyor can precisely locate points on the earth by using radio signals transmitted via satellites. A surveyor can also use Geographic Information Systems (GIS) hardware which contains computerized banks of spatial data that can digitally capture measurements of a piece of land using 3D scanning technology. And instead of creating a map by hand, computers can help a surveyor create one within hours.

There will inevitably be more changes when it comes to the field of surveying but there's one thing for certain — where there is land, there will always be a need for land surveying.



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This placed a reference mark in an easily accessible location and would allow the contractor to set up concrete forms for the concrete floor at the appropriate elevation.

The job took about two hours on site. "It was a straightforward job but much preparation had to be done beforehand, in the office, to establish the property lines," Curt said.

The last remark explains what a surveyor's life is like, lots of indoor preparations and study and lots of exposure to the elements when outside making the final measurements; you have to love the outdoors and be able to move heavy equipment around.

To get to that point, a person who wants to be a licensed surveyor must spend considerable time and effort in training, as I learned in a round table discussion with three Schultz Associates members, Kris Schultz, president of Shultz Associates and a licensed surveyor in New York state, Bob Hatch, surveyor manager and licensed surveyor in New Hampshire, and Darryl Moser, licensed surveyor in New York state.

"To be a licensed surveyor in New York state a person needs a four-year bachelor's degree in land surveying, with heavy emphasis on mathematics, English and history, plus four years of experience in a responsible position with a firm, equivalent to a crew chief, and then pass a three part exam," Bob explained. "The first two parts of the exam have a national basis consisting of an eight-hour test in the fundamentals of surveying along with a six-hour test concerning the principles and practice of surveying; the third part, in New York state, is a two-hour state-specific exam, other states have different time-rated exams."

"If a student's four-year degree is in another subject then he or she must have eight years in the field," Kris said. "The biggest problem for candidates is that the experience must be well-rounded and broad; basically the person must be able to open a surveyor's office to qualify." This is somewhat akin to being a real-estate agent, but having to have a real estate broker's license to qualify for the job of selling real estate. In addition, a licensed land surveyor must have 24 hours of continuing education during every three-year period in his career. Alfred University is one institution in New York state that offers a four-year program in land surveying; Penn State offers one in Pennsylvania.

According to Kris: "Nationally, surveyors are in demand; locally the job opportunities are good. Monroe County is unusual in having a large number of surveyors. A lot depends on the economy and building construction, which is interest-rate sensitive. Salaries for surveyors in the Northeast run anywhere from \$40,000 to the mid \$50,000 range."

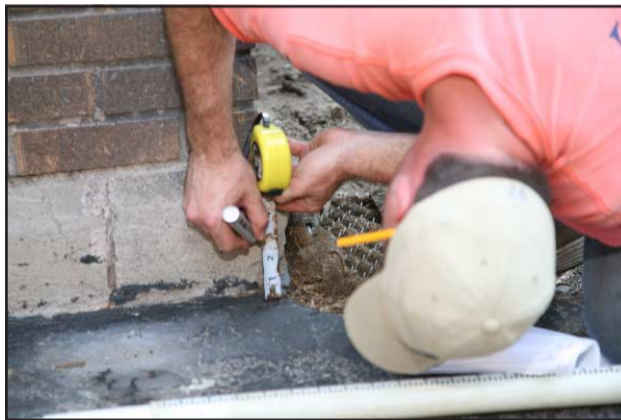
Bob adds statistics: Over the past five years, about 1,035 professional engineers have been licensed per year in New York state; when it comes to land surveyors, a branch of engineering, an average of about 40 have been



Rich switches to level mode on the Total Station to determine the height of the garage sill. The aim was to set the floor of the garage at an elevation which promoted positive drainage.

licensed per year. Darryl Moser, a licensed land surveyor who has been involved in surveying for almost 30 years said, "One of the joys of surveying is solving problems

you find out in the field." He added, "No one really notices the surveying that enables a project to happen; it's very important that it's done right but it's just not visible."



Curt takes a measurement from another reference point out on the ground and provides a visual indicator of the proper height of the garage floor by making a mark on the side of the house foundation. Later, when the forms for the garage floor were laid out, a sighting could be made to this mark to insure that the height is appropriate.



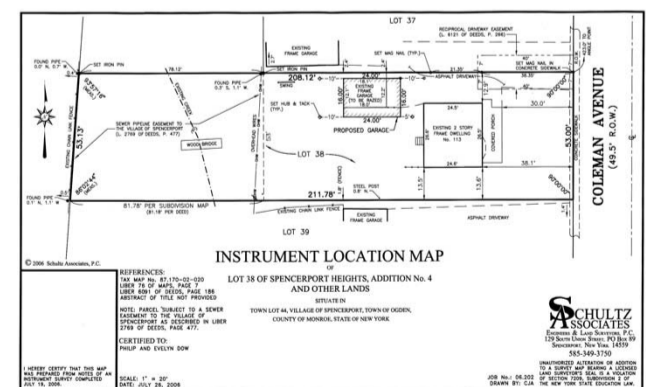
Curt establishes the rear corner of the garage. Since this is the side of the garage closest to the lot line it is important to ascertain that the construction conforms to the zoning requirements.



Curt takes a distance reading from the reference point out on the sidewalk. The readings are taken to an accuracy of one hundredth of an inch.



A stake is placed in the ground to define a reference distance to the back corner of the garage. The circle with an "x" in it indicates an offset.



The finished product -- a greatly reduced copy of the new instrument location map which shows the placement of the new garage on the site.

**A note from Westside News Editor Evelyn Dow:** In December 2005, my husband and I decided it was time to replace the garage on our property with a larger structure. The need had been long discussed and the time seemed right. As it existed, we could fit all of our "garage stuff" into the space, or a car -- not both. We began the process with calls to contractor Mark Warren and architect David Strabel to toss ideas around. We visited the Ogden town offices to talk with building inspector Jack Crooks. Research of existing lot maps

showed the then-existing garage was built only 2.2 feet from the north lot line. One way to enlarge the structure would pull the new building forward toward the street and into the interior of the lot. The project would need a variance from the village planning board to accommodate the non-conforming side setback. The surveying process defined the footprint for the new building and inspired this photo essay.

The past holiday season, the new garage sported its first balsam wreath. Both the "stuff" and the car fit!