[DC-05-001] Professional Land Surveying

Abstract

Professional Land Surveyors are the only profession that create the legal description of land parcels, which are then officially recorded to show ownership and rights pertaining to each and every land parcel within a jurisdiction. The Surveyor is skilled at undertaking the physical measurements that are needed to locate accurately land parcels on the ground and to write the unambiguous legal description of the land to create legal title in real estate. These land ownership records are critical for the transfer of ownership in the real estate market. The legal land description provided by Surveyors forms the foundation, and the real estate market provides the mechanism, for real estate to become the largest store of tangible wealth in any free market economy.

Keywords: land measurement, land ownership, land partitioning systems, real estate, surveyor

Author & citation

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Explanation

1. Definitions

The geospatial experts who oversee the extent of human land ownership and jurisdiction are **Professional Land Surveyors**, whose skills in measurement, mapping, and legally describing portions of the land surface, form the basis of large databases which record ownership information and interests in real estate. Without surveyors, lands cannot be quantified, legally described, or purchased and sold in the real estate market.

The **real estate market** is also very important to any vibrant and free market economy. Land is a fundamental input to any economic activity, even in the digital world the computer device for the storage of data must be located somewhere on Earth.

The biggest tangible asset in any free market economy is **real estate**, which represents the largest store of wealth in any economy. The real estate market exists because buyers,

sellers, and financial lenders (think mortgages) rely on the legally described and accurately located descriptions of land parcels and condominium space provided by the Professional Land Surveyor. The Professional Land Surveyor is the only licensed person who can legally describe a land parcel or locate the legal description of a land parcel upon the ground in its correct location. The most important and usually the largest investment most of us will ever make is in real estate.

Professional land surveyors have been using **Geographic Information Systems** since their inception. GIS is a very useful tool for surveyors to track their job locations and to attach the required records research to each land parcel surveyed. The dimensions of each land parcel created by surveyors make their way into maps (nowadays GIS managed geospatial databases) depicting all property boundaries used for valuation or appraisal for land taxation purposes. These appraisal systems are often referred to as the **Fiscal Cadastre**, which governments (mostly local government) use for tax assessment to create an income stream to provide services to maintain infrastructure for individual land parcels (roads, water, sanitation, local parks and recreation, etc.)

Professional Land Surveyors are often also referred to as **Cadastral Surveyors**. The **Cadastre** (also called Cadaster in some jurisdictions) is the comprehensive system a jurisdiction has set up to store records of the ownership of all real estate holdings, which include land parcels or the space within buildings, which comprises offices, condominiums, etc. The Cadastre can also hold the records of mortgages, liens, easements, leases, covenants, and any other recognized legal right in land or real estate.

A **land surveyor** must know the history of land development within the jurisdiction or state they are licensed to practice and the laws that govern the practice of Professional Land Surveying. The jurisdiction is usually at the national or state level. The practice of surveying is governed by a licensing body in accordance with statute law and legal precedence emanating from court cases, which have decided numerous interpretations of evidence from legal conflicts over disputed boundaries or ownership. These conflicts have arisen by adjoining land owners entering disputes about common boundary or over the location of lost land boundaries or conflicting ownership records or ambiguous legal descriptions, to name a few.

2. History of Land and Surveying

Land surveyors are skilled at measurement as the original granting of land to past generations of the first settlers was allocated by area. For example, many original land grants in the USA were for 640 acres, which if staked as a square would measure one mile by one mile on the ground. Quite often the final shape of a 640-acre grant was not square and may have been laid out on the ground with one boundary running along the banks of a river or a stream, which would require the land surveyor to accurately locate the meanders of the river bank and then compute the remaining land boundary dimensions so the grantee (new land owner) received a minimum of 640 acres.

When surveying these land grants, the surveyor marks the corner with a stake, or iron rod, or some other convenient marker. Usually, the land owner would then remove the corner mark and replace the mark with a corner fence post and build a fence along the boundary line marked by the surveyor. Knowing that the owner would remove the corner mark, the

land surveyor would set a reference mark (maybe an iron rod, a bottle buried in the ground, or an X marked in a nearby tree) just a short distance from the corner, so future land Surveyors can retrace the records and accurately relocate the corner in the future.

Lands in the United States are controlled at the state level. Each state has its own history of human settlement ranging from the displaced native Indians to the European settlers who started the formal occupation by settlers earning or purchasing the right to accept original land grants. These grants were earned for military service, service to the state, purchased, or even given away in a “land rush” to encourage primary production, commerce, and improvement of the land. Each state has a series of statute laws which govern the issue of land grants, licensing of surveyors, and the recording of land records at the local County Courthouse.

As time goes by and new generations inherited the land that the original land owners passed onto their families, fences deteriorated and were rebuilt, or the land was subdivided into smaller lots. There have been many generations since the original settlement of the land within each state in the US. As each family grows they may decide to subdivide portions of the original property, which requires a registered land surveyor to define accurately the location of the new boundaries and then describe these boundaries in a legal description, which is eventually described on a deed to transfer ownership to the new parcel owner. Once the deed is executed (signed by all parties), it is recorded at the Land Records office of the County Courthouse. This recording in the deed at the Courthouse is an important step as it puts “notice to all the world” that the property, as described in the deed, was transferred from the original owner to the new owner. Registered land surveyors are the only professionals who can legally define boundaries, which form the foundations of land title. Each time a property is sold and ownership changes, it is this legal description provided by the land surveyor, which describes what is being transferred because of the sale or inheritance.

3. Surveying Equipment and Methods

So how does a professional land surveyor define property boundaries in today’s modern world? Surveyors, today, have an array of digital measuring equipment that is usually attached to a data logger, which turns out to be a small hand held computer with many programs to help the surveyor record the measurements and accurately map the locations of points of interest (corner marks for example) located on the ground. These instruments include a Total Station, which sits on a tripod and can be accurately located over a point on the ground. The Total Station has a telescope with precisely located cross-hairs within the optics to allow accurate pointing to distant objects where a precisely manufactured glass prism can reflect back to the Total Station a beam of infra-red light (sometimes lasers) shot through the telescope. The Total Station can accurately measure horizontal and vertical angles to the nearest second of arc and the sloped distance to the glass prism to an accuracy of +/- 5 millimeters (about 1/100 of a foot). The Total Station or the data logger records all these measurements and can compute horizontal distances knowing the slope distance and the vertical angle from the Total Station to the glass prism. These measurements from known points to unknown points can then be represented as straight lines on a digital map and eventually describe all the evidence found on the ground to represent the original survey of the boundaries of the property being surveyed.

Figure 1. Surveyor using a Total Station. Source: author.

Another instrument used by land surveyors is a very precise Global Positioning System (GPS) geodetic quality satellite receiver (recent versions of these satellite receivers can observe other satellite navigation systems, such as the Russian GLONAS system, European Galileo System, Chinese Beidou system, etc.). These receivers have their very precisely manufactured antennae attached to a hand-held pole (or tripod), which can be held vertically on a found or set mark on the ground and record a very accurate three-dimensional coordinate for each point observed. These point coordinates can then be manipulated within the data logger, or a computer, to then describe boundary lines from points observed during the field or on the ground survey.

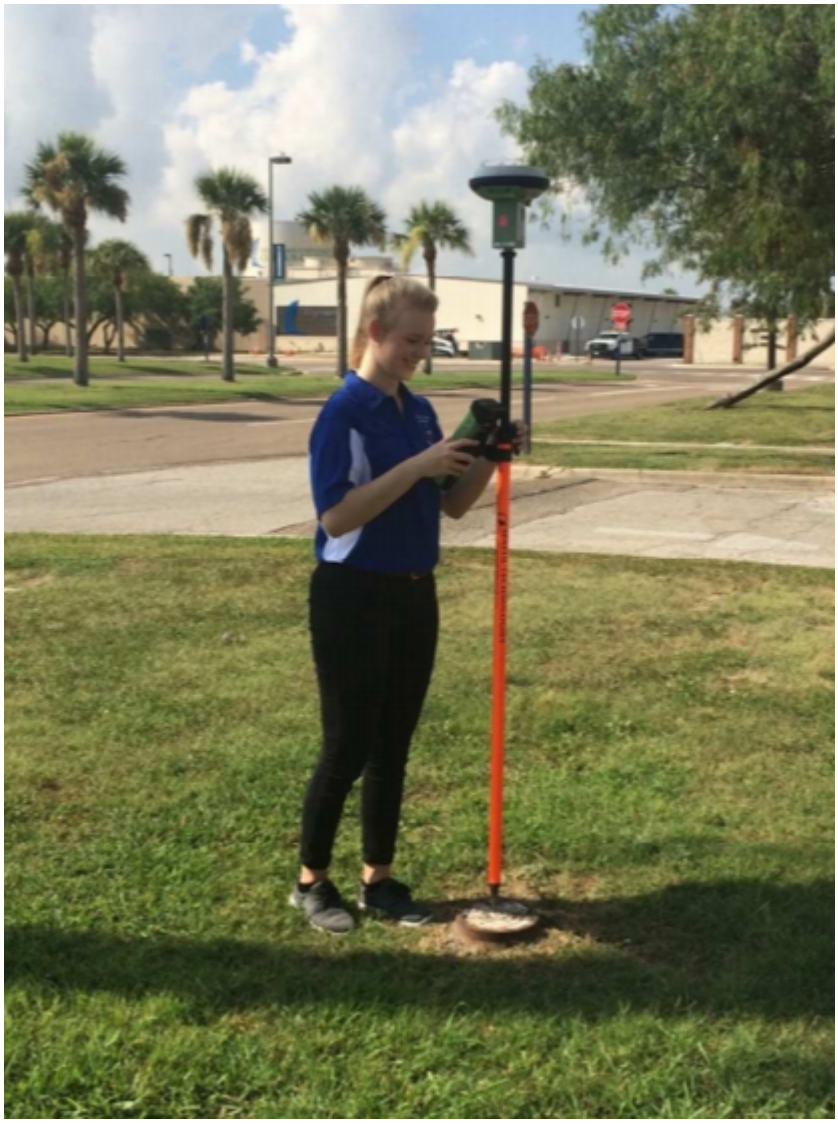

Figure 2. Surveyor using a Geodetic GPS Receiver and Data Logger

Before a land surveyor sets foot in the field to locate original property boundaries, the surveyor must research the existing records of past surveys (being original surveys, recent subdivisions, and adjoining property surveys, or adjoining road surveys). Much of this information can be digitally plotted to a known scale and stored in the data logger used to capture field measurements. This allows the surveyor to find quickly marks left on the ground by previous surveyors and to check measurements and dimensions observed in the field. During the field data collection process, the surveyor collects many more points of interest from along the road frontage where the property is located, the adjoining properties corners, and often the location of the corners of the nearest cross streets to check that the subject area of the survey, as well as adjoining properties, have correct dimensions and areas.

The collection of all these data points and corners pertaining to the boundaries of the land being surveyed, and the adjoining properties, is an important function of the registered land surveyor. The professional land surveyor has not only a duty to the client purchasing or subdividing the land in question, but also to the public. When defining a client’s land boundaries, the surveyor is also defining the boundaries of all the adjoining land owners and the public, who owns the street or road which the property fronts. It is very important

for the land surveyor to “do no harm” in defining the boundaries of his client and, importantly, to the public who own adjoining lands and the public right-of-way in the roads or streets adjoining the property.

Before the surveyor presents the client with the results of the survey measurements, many computations and checks must be performed on the measurements to compare results found using the very accurate modern digital measurements to the original survey measurements, which were inaccurate and sometimes incorrect. This process also can include the conversion of old units of measurement (such examples as chains, rods, links, Spanish varas) into feet (or the US survey feet), all which could be shown in some of the old original survey records.

Also, very important in the final location of defining the client’s property boundaries is the resolving of conflicting evidence collected during the discovery of survey marks found on the ground, then compared to the evidence in the original records. The surveyor must have knowledge of which evidence takes priority when a conflict arises. This knowledge comes from the surveyor’s education (usually a four-year degree) and experience received with training under the supervision of very experienced land surveyors (usually two years). Much of the weight of evidence has been ascertained from court cases where boundary disputes have resulted in litigation. Judges and juries have given land surveyors the legal interpretation of many different cases that have ruled on hundreds if not thousands of legal disputes over the location of property boundaries. For example, natural boundaries (such as a bank of a river, center of a stream, mean high water along the coast) are the highest evidence of boundaries because they are always evident on the ground (even if they move gradually, imperceptibly, and naturally). Next in priority is artificial monuments set by surveyors in the past (such as iron rods, iron pipes, wooden stakes, concrete markers, brass markers to name a few). Next comes directions from records, then distances from records, and, lastly, area from records. Note that the first two priorities are physical monuments and the last three are the results of measurements. Hence the surveyor’s creed “monuments take precedence over measurements”.

Professional land surveyors are the quiet achievers that have helped settlers stake out the beginnings of civilization and enabled their future generations to benefit from the wealth that is now tied up in real estate. Every form of physical development attached to the land surface must be located within the bounds of the legal description which defines its legal location and boundaries on paper and on the ground. Professional Land Surveyors continue to assist their clients build wealth and prevent risk in real estate.