

Chapter 2

Getting Started

2.1 Land Surveying Types

A broad definition of land surveying is that surveyors make measurements on or near the surface of the earth. These measurements have traditionally consisted of angles and distances made using optical surveying instruments. Global Navigation Satellite Systems (GNSS or GPS), which use signals emitted by satellites to fix locations on the earth, are supplementing, or in some cases even replacing, traditional techniques and equipment.

Land Surveying can be grouped into several general classifications, such as boundary surveying, topographic surveying, construction surveying, and control surveying. Topographic surveys deal with physical features found at a site and the elevation of the earth's surface. A topographic plan will commonly show buildings, fences, shorelines, sewers and utilities. Topographic plans show contour lines which depict the ground elevations at the site (Fig. 2.1). These plans are often used by developers, engineers and architects for the design and siting of roads, buildings and other structures.

Construction surveys establish control and layout for road and highway layouts, bridges, buildings, sewers and other man-made improvements. Hydrographic surveys are made to acquire data on water depths, locations of rocks, sandbars, coastline erosion and other features associated with oceans, bays, harbors, lakes or rivers.

Control surveying is used to establish precise networks of control points for fixing horizontal and vertical positions. After the control points are established, they can be used for other types of survey projects such as topographic, boundary, route layout and mapping surveys. Control surveys were originally performed using



Fig. 2.1 Topographic map

conventional surveying techniques and instruments but modern techniques rely heavily on global positioning because of its high accuracy over long distances.

Cadastral surveying is the determination of the legal boundaries of a parcel of land. It is sometimes called Boundary Surveying or even simply Land Surveying. It encompasses original and retracement surveys of both private and public lands. It is the branch of surveying which will be discussed in this book.

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Boundary surveys often include a plan, prepared by the surveyor, showing the results of the survey. A properly prepared plan will show the boundaries of the parcel, and the evidence used to locate those boundaries. The plan will also show the type and location of monuments that were set to fix the boundaries on the ground, and the location of buildings, natural features and improvements on or adjacent to the property. The plan should also show any encroachments and evidence of occupation. The plan is essentially a record of the survey.

Boundary surveys have the potential to affect the legal rights of the property owner and the abutters. Because of this, land surveyors have an obligation not only to their client, but to the public to insure that their survey work is performed with adequate precision and accuracy and that the legal rules governing boundary location have been carefully considered and properly applied.

Land surveying is an ancient profession dating back thousands of years at least to the Egyptians and the great pyramids. The importance of land surveying is not a recent development. Three of the four presidents carved into Mount Rushmore were land surveyors: George Washington, Thomas Jefferson and Abraham Lincoln. History has shown that these presidents were among the greatest presidents to serve our country.

2.2 Land Surveyors Must Be Licensed

Land Surveyors must be licensed by the state in which they practice before they can perform surveying activities. In many jurisdictions, Professional Engineers, such as Civil Engineers, may not establish property lines unless they are also licensed as Land Surveyors.

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Many states will grant a surveyor who is not licensed in the state but is licensed in another state, permission on a limited basis to perform surveying activities in that state. For example, a surveyor licensed in Rhode Island but not Massachusetts can apply to the Massachusetts Board of Registration of Land Surveyors and Professional Engineers for permission to perform a survey in Massachusetts. If permission is given, it may be limited to performing specific work or work under specific conditions.

States have web sites that list the surveyors that are licensed in the state. If you are in need of a surveyor, you may want to check the state web site to ensure that the surveyor under consideration is properly licensed and is on active status as a land surveyor.

Sometimes a licensed surveyor will send a crew into the field to perform work. On other occasions, a licensed surveyor may have others participate in calculations or research. Under most licensing statutes, the licensed person may delegate some of the work to employees providing that he or she remains in Responsible Charge. Responsible charge means that the unlicensed person is under the direct control and personal supervision of the licensed person. The licensed person is required to supervise the work, review all final documents and take responsibility for the work. One test of whether responsible charge exists is that the client would be able to reasonably presume that the licensed person was the provider of the services. In many if not most cases, the licensed surveyor will sign and stamp plans and other documents with his seal, thereby attesting to the information shown on the documents. Because of the substantial value of real property, licensed surveyors must be very careful not to allow errors or omissions to occur which may have financial consequences for the client, and possibly the surveyor or the survey firm.

2.3 A Land Surveyor's Ethical Obligations

A surveyor has certain obligations to his client and to the public. It is a surveyor's duty to locate boundaries at their true location. Even though a surveyor is paid by his client he has a duty to the **Adjoiner** (abutting property owner) to locate the boundary line in its true location and not in a location that will favor his client's interests. That is not to say that a boundary surveyor shouldn't listen to what a client has to say about boundary locations. For example, a client may recall the exact location of a monument that was destroyed many years ago. The final decision about where to locate the boundary must be based on the legal principles of boundary establishment in the jurisdiction in which the property is located. If the property is in a state in which the public land survey system exists, the rules governing corner reestablishment must be understood and followed.

When re-establishing property lines from a previous survey, a surveyor has a duty to find the original monuments. A surveyor has a duty to inform the client of encroachments on the client's property that come to the attention of the surveyor during the process of surveying the property. A surveyor also has a duty to set sufficient permanent markers so that the client and future owners of the property will be able to locate the property lines.

2.4 What Does a Surveyor Need to Know?

Boundary Surveying requires knowledge of the mathematics and physics necessary to make accurate measurements and to analyze and adjust survey data. It also requires an intimate knowledge of the recording system where property records and road layouts are kept. It requires knowledge of the legal aspects of evidence and procedures for boundary location. It requires diligence in searching for and finding all of the record and real evidence which has the potential to affect ownership and the location of boundaries. It requires an understanding of the surveyor's ethical responsibility and duty to the client and the public. When working in the Public Land Survey System the surveyor must understand the appropriate rules for boundary location and reestablishment as set out by the Government in the *Manual of Instructions for the Survey of the Public Lands of the United States*. The surveyor must be familiar with and understand statutes and case law which have the potential to affect the outcome of a survey. For some surveys, the surveyor must be acquainted with subdivision control laws and zoning.

It cannot be stressed enough that, in many cases, precise measurements, by themselves, will not establish a property line in the correct location if the legal rules concerning evidence and procedures for boundary location are not understood and followed. This is the element that sets boundary surveying apart from a merely technical discipline. This is what makes it a substantially more complex, interesting and challenging endeavor.

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2.5 What a Surveyor Can and Cannot Do

A surveyor can locate a written description on the ground. In some cases the client may provide the surveyor with a written description of the property. In other cases the surveyor will need to search the public recording system for the deed. The property description is found in the deed that the client received when the property was purchased. In most cases the deed will be recorded in the public recording system at the local, county or state level. The boundaries described in a deed are often called **Record Boundaries**. Where property has been inherited, the client may not have a deed in their name and, in such cases, probate records may need to be searched. The deed may make reference to a plan. If so the surveyor will consider both the plan and the deed as providing a description of the property to be surveyed.

Although it was stated earlier that surveyors establish property lines, surveyors cannot always determine the actual extent of ownership with finality. In some situations the client's deed description accurately describes the extent of ownership, but in many cases it does not. A property owner can always claim to own all of the property described in their deed. However, there are many factors that can modify the record boundaries of ownership. For example, unwritten title, such as adverse possession can change the location of record boundaries. Prior conveyances by a common grantor can change the record boundaries. Mistakes in the survey that created a series of subdivision lots can effectively change the record boundaries of the subdivision lots.

When it becomes apparent to a surveyor that the record boundary locations conflict with other evidence of ownership, or there are conflicting deed elements, all the surveyor can do is to establish the boundaries on the ground in accordance with the legal rules governing boundary establishment and advise the client to seek advice from an attorney on how to proceed in order to resolve the issues. It is important to recognize that boundary locations are based on the surveyor's opinion of the available evidence and application of the appropriate legal rules. In such cases, unless the parties can come to an agreement over the boundary location, litigation may be the only solution. Each client must recognize that, even though they may have paid their surveyor a substantial fee for locating a boundary, the location is really just an opinion. It does not have the force of law. This will be discussed in more detail when we look at the surveyor's authority.

2.6 The Surveyor's Authority

Many original boundary surveys are imperfect in one sense or another. Original monuments become disturbed over time, errors may be discovered in measurements, plans or deed descriptions. Perhaps the original surveyor was unable to find all the evidence, made incorrect decisions or interpreted evidence incorrectly. Sometimes these errors or problems are small and will have very little practical effect on the survey. It is not uncommon, however, for the effects to be substantial and the results unacceptable under the circumstances. Because even the most precise surveying techniques always involve some degree of error it can be safely said that all retracement surveys (resurveys of property originally surveyed) will result in some disagreement between the original survey and the new survey.

Theoretically, if all surveyors were successful in discovering all the evidence, had equipment of similar precision, made measurements and adjustments using proper techniques and correctly applied the legal rules and procedures for boundary location, there should be little or no disagreement between the resulting boundary locations. In the real world this may not actually happen, and three surveyors may come up with three different locations for the same property corner. With the precision and accuracy available with modern measuring equipment, most surveyors shouldn't have much disagreement over their measurements. Interpreting the evidence for boundary establishment, however, can result in substantially different opinions, which can lead to large differences in boundary locations.

There is no law requiring each surveyor to arrive at identical boundary locations. Each surveyor is entitled to his or her opinion regarding where they believe the true boundary should be located. To be sure, theirs is an educated opinion and one based on experience, but it is an opinion nonetheless. It might be argued that a surveyor working in the public land survey system will have an easier time with troublesome boundaries than a surveyor in the eastern colonial states because the rules for boundary relocation have been more clearly stated by the government. However, surveys of the public lands present their own unique set of challenges.

Unless the surveyor is working under the authority of the judicial system and is performing a survey for or under the direction of a court of competent jurisdiction, the boundaries established by the surveyor do not have the force of law and are subject to relocation. In most circumstances, the only way to fix boundaries permanently is by court order or by agreement between abutters. So, while a surveyor can locate a boundary on the ground, the location is really the surveyor's opinion of the true boundary location.

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2.7 Trespass by Surveyors and Adjoining Property Owners

Can a surveyor go onto abutting property without permission of the land owner? **Trespass** is the intentional intrusion or invasion of the land of another person. Any knowing entry is a trespass. It has been said that the essence of private property is the right to exclude others. Because private property is so highly regarded in our legal system the courts have been reluctant to diminish the right of an individual to keep unwanted persons from entering their property. Liability is incurred by the trespasser merely by knowingly entering the land of another. It is not necessary that the trespasser actually damage the owner's property. Just being there is enough (Fig. 2.2).

A person can commit a trespass not only by their presence on the land of another, but also by causing some object to enter upon the land of another. Setting a concrete bound on the abutting property without permission of the landowner is a trespass. Erecting a building or putting a driveway on abutting property, without permission, is a trespass. When a surveyor cuts brush on an abutter's property without consent of the owner, the surveyor can be held liable for trespass and for damaging the owner's property. A machete which is commonly used by surveyors for cutting brush to clear survey lines can be seen in Fig. 2.3.

Trespass can also be a criminal offense. This commonly occurs when the trespasser knows they are not allowed on the property or when the trespasser remains on the property when told to leave. Entering upon posted property or upon property after being told by the property owner not to trespass may subject



Fig. 2.2 Surveyors must understand the laws against trespass prior to entering upon abutting property



Fig. 2.3 A machete is used for cutting brush when surveying in the woods. Surveyors must be careful not to cut on abutting property without consent of the owner

the trespasser to criminal charges. Criminal trespass is considered a crime against the community and as such can be punishable by fine or imprisonment or both.

Some jurisdictions have enacted statutes allowing surveyors to enter upon lands adjoining the land being surveyed in order to conduct surveying activities. Usually the surveyor is required to give reasonable notice to the adjoining land owner. Once proper notice is given the entry becomes privileged and the surveyor may not be held liable for trespass. Unless a jurisdiction has such a statute a surveyor has no more privilege than anyone else; the surveyor cannot enter upon land without permission of the owner and doing so will subject the surveyor to liability for trespass. Even where there is privilege to enter upon adjoining lands the surveyor has no right to cut brush or otherwise damage the land owner's property.

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2.8 Why Become a Land Surveyor?

Boundary surveying is a great profession, and most surveyors remain in their profession because they love their work. There is a great deal of variety in the work because every boundary survey is different. Boundary surveyors are always visiting new places. They are constantly meeting new people and solving new problems. When the surveyor is not doing research, he or she may be performing field work. When the field work is done, the surveyor may be in the office performing calculations or meeting with clients. Surveyors often attend public meetings in order to have their plans approved. They will often meet with local building inspectors, engineering departments, health boards and conservation agencies regarding surveys and plans.

Boundary surveyors must be adept at making very precise measurements in difficult environments and under difficult working conditions. Surveyors spend a lot of their time in the field. Much of the work is physically demanding so surveyors must remain physically fit. Setting lot corners on their client's property can be hard work. Setting a concrete or stone marker means digging holes three feet deep. If these markers are far in the woods, the survey crew must carry in the heavy markers and the equipment used to set them. There is also equipment to maintain. Working outdoors presents many challenges. Surveyors are sometimes working in the woods where they have the opportunity to observe wildlife and be observed by wildlife. Sometimes in remote areas, particularly where there are bears, mountain lions or poisonous snakes, wildlife encounters can be potentially dangerous and surveyors must take appropriate precautions. In some remote areas, where wildlife is known or likely to present a danger, it is prudent for the surveyor and the crew to carry firearms or pepper spray. There are also lots of bees, ticks, mosquitos and gnats to contend with. When working on farms and ranches, there are usually domestic animals. Some are naturally curious and insistent on visiting the survey crew—whether they are welcome or not.

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Getting equipment in and out of remote locations can require the use of all-terrain-vehicles (ATV), snowmobiles or horses. An ATV set up to carry surveying equipment can be seen in Fig. 2.4. In very remote places, equipment and people must be flown in by aircraft or float plane. Measuring across streams is easy with electronic measurement equipment but the survey crew will still need to cross the streams to bring equipment across. If the water is deep, a boat may be the only way to cross. Sometimes the boundary marker that has to be located is in the middle of a swamp and one or more of the crew has to cut line through the brush to get to it. There is often poison ivy or poison oak, so surveyors need to be skillful in plant species identification. In inaccessible mountainous terrain packing equipment in by foot or horseback may be the only practical and economical alternative.



Fig. 2.4 All terrain vehicle (four-wheeler) set up to carry surveying equipment in remote areas or in large acreages. Notice the instrument tripods mounted in a special fixture

Many surveys are on a budget, so hiring a helicopter at several hundred dollars per hour might be out of the question.

Surveying in urban and suburban locations also presents challenges. In these areas, most properties are bounded by streets and highways so it is necessary to run survey lines in places with vehicular traffic—often fast moving traffic. Surveyors working in these locations soon come to realize that the inattention of some drivers poses a substantial hazard to those working on or near a traveled roadway. Even with proper precautions such as traffic cones and signs, constant vigilance is required. Working on the relatively benign area of a sidewalk can also subject a surveyor to hazards. Ask the surveyor whose ten thousand dollar total station was tipped over onto the concrete when the training wheel of a little boy's bicycle happened to catch the tripod leg.

The weather can also be challenging. Working in hot sunny climates, surveyors have to deal with heat shimmer which refracts light and makes accurate sighting of points through the instrument a real challenge, particularly when sighting over long stretches of pavement. In cold climates, snow covers physical evidence making boundary markers challenging to find. Frozen ground makes it difficult or impossible to dig in order to find buried points. Snowmobiles, skis or snowshoes may be required in order to get from one point to another. Rainy climates pose their own challenges in keeping equipment dry and serviceable, not to mention keeping the crew dry. Sometimes, the survey crew doesn't have a great deal of choice other than to accept the weather and get on with the work.

There are also hostile abutters. Some of the work performed by boundary surveyors is the result of disputes over one or more boundary lines. By the time a surveyor is retained, relations between the parties may have deteriorated to the level where the only way of performing the survey is by having the local police on hand to keep the peace. Because a surveyor is working for an adversarial party, abutters sometimes view the surveyor in a less than favorable light. It is not always well understood that the surveyor's job is to locate a boundary in its true location. A surveyor cannot favor a client's interests; he must remain neutral. Nevertheless, the fact that the surveyor is "working for" the adverse party is often enough to tip the scales against him. This can make the performance of the survey difficult, particularly if the surveyor needs to go onto the abutting property to look for or measure to physical evidence. In many cases, the surveyor's application of a bit of "finessing" can ease what would otherwise be an awkward or even dangerous situation. In addition to understanding how to perform a survey, a surveyor sometimes needs to understand and employ a bit of psychology.

Because surveyors work in public places, they are often asked questions by passers-by. Some of the most common questions to the author are: "Are they going to fix the road?" (This may be more of a wish than a question.). "What are you taking pictures of?" (Total stations and theodolites must look like cameras to some people). "I live in that house down the street. What would it cost to put my markers in?" (This is often impossible for the surveyor to answer without first doing some research). The author recalls one survey where an abutter walked over and asked "What are you doing?" When I answered that we were surveying her neighbor's land, she responded that in her experience there were two kinds of people that she feared most: "surveyors and lawyers". I didn't have the heart to tell her I was both.

Every survey presents new challenges. Even after years of surveying, when you may think that you have experienced every situation, a new challenge will present itself. The reader may ask, with all of these potential difficulties and hazards, why would anyone want to become a boundary surveyor? The best answer is: That is precisely what makes the work so interesting and worth doing.

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