

Types of Surveys

Boundary Surveys

For the purposes of a property deed, boundary surveys are conducted to determine a land parcel's property lines as well as any easements, encroachments, state or locally imposed restrictions. Conducting boundary surveys before purchasing a piece of property mitigates the risk of subsequent boundary disputes that could result in costly lawsuits or having to move or redesign a building.

Boundary surveys include:

Monumented Land Survey –

Sometimes called a pin survey, a monumented land survey involves finding or setting monuments to mark a specified parcel of land. To perform a monumented land survey, surveyors first look for evidence, such as existing property corner monuments, block corners, subdivision corners, section corners, fences and other lines of occupation. Next, a series of measurements is taken and compared to the legal descriptions for the subject and adjoining parcels. Considering the accuracy of found monuments, seniority of the subject parcel, and any other evidence discovered, a property boundary is determined and property monuments are placed at each angle point or change of direction, such as the beginning or end of a curve. Monuments usually consist of steel pins driven flush with or beneath the surface of the ground with caps identifying the surveyor's registration number placed atop the steel pin. When practical, offset monuments may be placed on an extension of a line, usually alongside sidewalks or curb heads.

Land Survey Plat –

This document is a map of the monumented land survey designed to provide survey data for subsequent land surveys. Typically registered in a public office, the land survey plat also makes the results of the monumented land survey a matter of public record, further protecting the property owner's interests.

Improvement Survey Plat –

An improvement survey plat augments the information provided by a land survey plat with the location of structures (improvements), easements, visible encroachments, fences, hedges, or walls on or within five feet of both sides of all parcel boundaries, visible utilities, and underground utilities for which there is either visible surface or record evidence. Some improvement survey plats also include topographic contours.

ALTA Survey –

This type of boundary survey reflects preparation to a set of minimum standards (and optional elements) that have been jointly prepared and adopted by the American Land Title Association/American Congress on Surveying and Mapping (ALTA/ACSM). ALTA survey graphically shows those elements impacting land ownership, such as: improvements, easements, encumbrances, encroachments, rights-of-way, and other elements impacting the ownership of land. It is typically prepared for commercial properties to meet the title insurance and improvement needs usually required for commercial development. ALTA surveys require close coordination between surveyor and the title company to ensure a comprehensive "picture" of issues affecting the land ownership and improvements.

Subdivision Plats –

This type of plat provides the means for creating several parcels of land simultaneously, usually under the jurisdiction of a local agency. Based on a boundary survey of the overall parcel to be divided (and perhaps a topographic survey, improvement survey plat, and ALTA survey), the subdivision plat will typically be completed in cooperation with civil engineers (for balancing design with boundary issues) if a larger subdivision. For dividing a smaller lot or replatting, the surveyor typically works directly with the landowner.

Types of Surveys

Right-of-way (ROW) Acquisition –

Projects involving roadways or pipelines typically require negotiating purchase of land for right of way or an easement. ROW survey work involves obtaining ownership information from public records or a title company and then preparing a map showing current ownerships and relationship of the proposed right of way to the existing ownership. Legal descriptions may also be part of the documentation required.

Condominium Maps --

Surveyors prepare condominium maps in order to divide buildings into General Common Elements (e.g., halls and staircases) and Limited Common Elements (e.g., units and parking spaces) – individual units that can be bought and sold. The surveyor prepares a map that graphically illustrates areas and volumes (air-space) of both elements.

Engineering Surveys

While boundary surveys tend to be geared more toward identifying property ownerships and rights, engineering surveys focus more on the land's characteristics in order to design and build structures given the “lay of the land.” Oftentimes, combinations of survey methods can be used to increase both accuracy and precision. For example, to overcome some of the challenges of aerial mapping, many surveyors also perform GPS mapping for horizontal control and traditional methods for vertical control.

Engineering surveys include:

Topographic Maps –

Using contour lines, a topographic map illustrates such land features as drainage patterns, rock outcropping locations, hills and other natural features, and artificial features (e.g., buildings, utility locations, detention ponds, and other features affecting site design). Topographic contours can be shown at different intervals; however, accuracy is only one-half the distance between contour lines. The “topo” map is based on XYZ coordinates determined from horizontal and vertical information gathered and is typically requested by engineers, architects or building contractors who need to know information about overall site grade and elevations to place site improvements, estimate the volume of dirt to be moved, or for other construction and development purposes.

Digital Terrain Modeling –

This electronic process gives a three-dimensional model of the Earth's surface, provided in digital format, and includes information relating to factors such as surface texture as well as elevation. The model's digital data file includes a set of three-dimensional (x,y,z) coordinates and produces an image that may be displayed on a computer monitor or portrayed on a topographic map. This method of transforming elevation data into a contoured surface or a three-dimensional display allows information gathered to be converted to information represented without loss of data integrity.

Aerial Mapping –

Used primarily to efficiently map horizontal and vertical features of large land areas, aerial mapping creates a stereoscopic image of the ground from a series of aerial photographs. Each photograph must have several points of known XYZ coordinates for creating an accurate photographic model or digital terrain model and for obtaining accurate horizontal and vertical information.

This method can be accurate yet not as precise as traditional survey methods depending on the potential for features to be obscured or unidentifiable due to foliage present.

Types of Surveys

Surveyors provide horizontal and vertical control for the mapping as well as supplemental information by placing aerial targets on the ground at positions that ensure adequate visual coverage and supplying the person creating the map with coordinates and elevations for each aerial target. These coordinates become control points for the site's photographic model. Surveyors supply supplemental information, such as locations of manholes, fire hydrants, or other items not visible in the photo.

Global Positioning System (GPS) --

Surveys utilizing GPS can indicate an exact position (longitude, latitude, and altitude) on Earth anytime, anywhere, in any weather to a sub-centimeter level of accuracy. The GPS system consists of some 24 satellites that orbit 11,000 nautical miles above Earth's surface and continuously send signals to ground stations that monitor and control GPS operations. GPS receivers calculate locations anywhere on Earth within less than a meter by determining distances from at least three GPS satellites. Each satellite features an atomic clock that keeps time to within three nanoseconds —0.000000003 or three-billionths of a second — broadcasting signals synchronized with those from other satellites. This system allows surveyors worldwide to produce maps with a common reference frame for latitude and longitude.

Construction Surveying (Staking)

In performing construction surveying (or staking), the surveyor translates the construction plans into physical points on the ground as a basis for determining the horizontal location of new improvements as well as the vertical information needed for required drain or pipe flow. Virtually any roadway, building, or other man-made improvement involves some construction surveying.

Stakes and points set during construction surveying typically are not at the actual construction point, but usually on some sort of offset so as not to disturb markers during excavation or other activities. Stakes are marked with an "offset" and a "grade," signaling construction crewmembers what the spatial relationship of the construction stake is to the actual point of construction.

Key considerations for establishing an offset include:

- Typically using three feet for curb and gutter and 10 feet for underground pipes
- Working with the contractor to coordinate offset distances with existing field conditions or special equipment needs
- Clearly marking offsets on the survey stake (usually by a number enclosed in a circle)

A "grade" indicates elevation change from the reference point to the actual construction point and is expressed as a "cut" (lower in elevation) or a "fill" (higher in elevation). Grade also indicates the vertical feature being referenced, usually a flow line or finished floor elevation.