

## Professional Surveying

### Definition of Profession:

A profession can be defined as:

An occupation, the practice of which directly influences human well-being and requires mastery of a complex body of knowledge and specialized skills, requiring both formal education and practical experience..

**A true profession** is said to have four basic elements:

1- organization: membership and participation in a professional organization. In America there is the American Congress of Surveying and Mapping for the surveying engineers. 2- education: for surveying engineers the completion of as many surveying courses as possible. 3- experience: it is obtained over the years and is a gradual transformation obtained by undertaking specific tasks. 4- exclusion: of those who are unfit or unworthy. It can be accomplished by a code of ethics or code of professional conduct or licensing requirements.

**A Professional** is a person who has acquired some special knowledge that he uses to instruct, help, advise, or guide others.

The primary objective of a professional is to provide service to humanity without regard to financial reward. **Examples of Professionals:** doctors, instructors, lawyers and engineers.

### **Who is the successful professional?**

A professional who can be depended on and who will work hard and continuously learn as much as he can about his profession is going to be successful in his profession.

**Ethics:** can be defined as the duties that a professional owes to the public and to his fellow professionals.

**Code of Ethics:** is a few general statements of noble motives expressing concern for the welfare of others and the standing of the profession as a whole.

Many groups of surveying engineers have published codes of ethics. In general these codes are similar to each other and to the codes of the various engineering societies.

The purpose of the code of ethics may be summarized as:

'The surveying engineer must, faithfully and impartially perform his work with fidelity to his clients, his employer and the public. He must be

actively interested in the welfare of the public and should always be ready to apply his knowledge for the benefit of mankind."

### **Competencies and Standards for Licensing Cadastral Surveyors**

The Competencies and Standards detailed below were adopted by the **Cadastral Surveyors Licensing Board of New Zealand** on 3 Sept. 2004.

The Board requires cadastral surveyors to be competent in:

#### 1- Survey Measurement:

- \* An understanding of the principles of plane surveying, geodetic surveying, remote sensing and photogrammetry.
- \* An ability to apply suitable measuring methods and techniques, eliminate measurement errors and correct and adjust measurements.
- \* An ability to apply statistical and mathematical analysis and adjustment to: geodetic and plane surveying networks, map projections and GPS observations.
- \* An ability to apply coordinate transformations and relate measurements to geodetic reference systems and datums.
- \* An ability to interpret and determine topographic and hydrographic features relevant to the definition or location of boundaries.

- \* An ability to use and calibrate survey equipment correctly.
- \* An ability to record and document measurements and other survey observations accurately.

## 2- Land Tenure Systems

Land tenure describes the kind of right or title by which land is held and land tenure systems provide for creation or transfer of interests in land.

Competency requires:

- Understanding the law and administrative systems relating to lands, principles and administrative practices of land registration, land tenure systems.
- Understanding the different types of surveys and their purpose in relation to land tenure and subdivision of land.
- Understanding legislation affecting interests and rights in land.

## 3- Land Boundary Definition

Accurate land boundary location and correct definition is fundamental to cadastral surveying and requires a sound knowledge of, and ability to apply correctly the hierarchy of evidence applicable to the definition of cadastral boundaries.

It requires the ability to resolve discrepancies and gaps in this evidence. Knowledge of topographic, marine and hydrographic surveying is required to relate water, marine and other natural features to boundaries and interests in land.

#### 4- Information Systems

Information technology and spatial information systems facilitate recording, interrogating and enhancing cadastral survey datasets.

Competency in information systems requires

- Understanding the application of survey information technology to cadastral surveying and subdivision of land.
- Understanding of the basic principles, concepts and methods, for using digital spatial and attribute data for visual presentation.
- Understanding of the basic principles of geographic information systems management and operations, their development process and the application of these concepts to intelligent information systems.

#### 5- Planning Process

This requires competencies in:

- Understanding and ability to interpret the district and regional plans related to the subdivision of land.

- Ability to understand engineering principles that affect land subdivision: soil properties, earthworks, roading, wastewater and stormwater drainage, water supply systems and the provision of utility services, etc.

## **Cadastral (Property) Surveying**

**Property Surveying** is concerned with the location or relocation on the ground of the perimeter or division line boundaries as well as the determination of the area of the lot, parcel or tract of real estate being surveyed and preparation of maps which show these boundaries. In addition, it involves the writing and interpretation of land descriptions involved in legal documents for land sales or leases. Land surveys which are executed for the purpose of recording land rights and inventory of land areas, land uses or for determining tax assessments are called Cadastral Surveys.

In accordance with the above definition, cadastral surveying can be classified as follows:

- a) Original Surveys: to measure the unknown lengths and directions of boundaries, for the first time. Such surveys are usually carried out on rural lands. As an example, when somebody purchase from another a certain parcel of land bounded or defined by features or objects such as fences, roads or trees. In order that the deed may contain a definite description of the tract, a survey is necessary.
- b) Resurveys: to reestablish the boundaries of a tract for which a survey has previously been made . In this case, the surveyor is guided by a description of the property based

upon the original survey, and by evidence on the ground.

The description may be in the form of the original survey notes, an old deed, or a map or plat on which are recorded the measured lengths and bearings of sides and other important data. When land is transferred by deed from one party to another, often a resurvey is made.

- c) Subdivision Survey: to subdivide land into more or less regular tracts in accordance with a prearranged plan.

Subdivision surveys are usually original surveys.

The location of property lines began before recorded history and for all of subsequent ages it has been necessary for the surveyor to reestablish obliterated land boundaries, establish new boundaries, and prepare boundary description. The need for people to locate, divide and measure land caused the development of the surveying profession. Today, the expanding population, the demand for shelter and the formation of new industries are creating a demand for more property surveys. In general, land prices have been shooting up rapidly and the accurate location of property lines is becoming increasingly important. A few decades ago the compass and chain were satisfactory for making property surveys, but this is no longer the case. These were then replaced by steel tapes, optical distance measurement techniques and theodolites, but the situation is still rapidly changing. Recent technical advancements, such as electronic



distance measuring devices and electronic total stations are now commonly applied. Photogrammetric methods and global positioning systems are used to establish the control points from which property corners are located.

### **Standards for Cadastral Surveying**

These standards provide a means by which surveyor and client can effectively assess professional performance and enable the surveying profession as a whole to better protect the safety, health and welfare of the public.

#### **Classification of Surveys**

Surveying can be classified as far as the degree of precision which should be attained. These classifications are based upon both the purposes for which the property is being used and any proposed developments which are disclosed by the client.

- 1- **Class A Surveys:** Surveys of extensively developed and valuable properties which require maximum surveying accuracy. This includes, but is not limited to, surveys of urban business district properties and highly developed commercial properties.

2- **Class B Surveys:** Surveys of properties which are subject to costly improvements and justify a high degree of accuracy. This includes, but is not limited to, surveys of commercial properties and higher priced residential properties located outside urban business districts and highly developed commercial areas.

3- **Class C Surveys:** Surveys of residential and surrounding areas which are apt to increase rapidly in value. This includes, but is not limited to, surveys of residential areas which can't be classified as Class A or Class B.

4- **Class D Surveys:** Surveys of all remaining properties including farm lands and rural areas.

All Field measurements shall satisfy the closures and tolerances expressed in the following table:

class	A	B	C	D	Remarks
	Business	Urban	Suburban	Rural	
Unadjusted Closure	1:15000	1:10000	1:7500	1:5000	Between control monuments
Min Angular	10" $\sqrt{N}$	15" $\sqrt{N}$	20" $\sqrt{N}$	30" $\sqrt{N}$	N=no. of angles in

Closure					traverse
Linear dist acc.	1:20000	1:10000	1:7000	1:5000	
Positional Error	d/15000	d/10000	d/7500	d/5000	D=length of course
Area Acc. To 1 acre	0.0001	0.0001	0.001	0.001	
Map scale	1:2500	1:5000	1:10000	1:25000	

**Products of Boundary Surveying:** A property survey results in:

- 1) The establishment of monumented corners, points of curvature and tangency and reference points.
- 2) A certified map or plat depicting the survey as made on the ground.
- 3) A signed and sealed written description depicting the surveyed boundary.
- 4) A signed and sealed written report of the surveyor's findings and determinations.

**Information Required :** A surveyor shall consider and evaluate the necessity to obtain the following data based on the specific purpose of the survey:

- 1) The most recent legal descriptions and plats describing the property to be surveyed.
- 2) The most recent legal descriptions and plats of tracts adjoining or in proximity to the property to be surveyed.
- 3) Legal

descriptions of adjoining servitudes including highways roadways, pipelines, waterways used for drainage or flood control. 4) Relevant data regarding special circumstances such as unrecorded servitudes or court decrees that may influence the location of the boundary lines. 5) Claims against the property that may influence the location of the boundary lines such as encroachments, or adverse possession by third parties. 6) Any grant, patent, subdivision plat, historical data, or other recorded data that will influence the position of boundary lines.

**Monuments:**

Monuments are marks placed for the purpose of establishing boundary lines. Monumented property survey is a land survey in which monuments are either found or set to mark the boundaries of a specified parcel of land. The first step in performing a monumented survey is a search for evidence such as existing property corner monuments (both on the subject property and on adjacent properties), block corners, subdivision corners and section corners. Once a sufficient amount of monumentation and other evidence (fences and other lines of occupation) are located, a series of measurements are performed. These measurements are then compared to the legal descriptions for the subject parcel and adjoining parcels. A determination of the property boundary is made, giving consideration to the accuracy of found monuments, seniority of the subject parcel, and any other evidence discovered.

After the determination of the boundary location, property monuments are placed at each corner (angle point), or change of direction such as the beginning or end of a curve.

Artificial monuments must retain a stable and distinctive location and be of sufficient size and composition to withstand the deteriorating forces of nature. The following points should be considered when setting up monument:

- \* Monuments of ferrous material (steel) must have at least 1.5cm outside diameter, and must be at least 45cm in length (it can be longer for soft or unstable soil). Concrete monuments shall be at least 10cm in diameter by 60cm length, reinforced with an iron rod at least 5mm diameter. Wooden stakes should not be used as monuments.

- \* Monuments must be set vertically whenever possible and the top should be reasonably flush with the ground.

- \* Monuments subject to damage from earth-work, construction or traffic should be buried at a sufficient depth to offer protection.

- \* Marks on existing concrete, stone, or steel surfaces will consist of drill holes, chisel marks or punch marks and must be of sufficient size, diameter or depth to be definitive, stable and readily identifiable as a survey monument.

- \* All monuments must be made easily locatable and identifiable by guard stakes flagged with surveyor's ribbon or by other suitable means

such as die stamps, paints or marked adhesive tape. A cap identifying the registration number of the surveyor responsible for setting the monument should be placed atop the steel or concrete monument.

\* Monuments should be referred to nearby prominent objects (bearing and distance to the center of the object). These references must be included in the survey plat.

\* When it is physically impossible to set a monument at the corner, witness monuments (also called offsets) shall be set, preferably on each converging line at measured distances from the corner and identified as such in the description and on the property plat. Offset monuments are easier to find and protect from damage, but should not be mistaken as the actual property corner.

### **Cadastral Systems**

The word *cadastral* is a Latin term that refers to the registry of lands. It has something to do with determining and defining land ownership and boundaries. The cadastral system should be systematic, sustainable and sensitive to local requirements, culture and needs. The key to success of the cadastral system lies in how it protects the land rights and permits those rights to be traded.

Countries such as Australia, New Zealand, Singapore, Japan and Korea rely on a well-established cadastral system, supporting an efficient land

market. All lands are included in the system with the result that they can be bought, sold, leased or mortgaged with security and relative ease. This is not to say that the cadastral systems in these developed countries are efficient or ideal.

The countries in Eastern and Central Europe, and some African countries are primarily concerned with establishing complete cadastral systems in a short time. Such countries often wish to develop cadastral and land information systems modeled on their Western European neighbors.

Unfortunately there is a lack of recognition that the countries in Western Europe are building on well-established "complete" systems, which are over 100 years old and are now applying technologies from a highly sophisticated industrial and educational base.