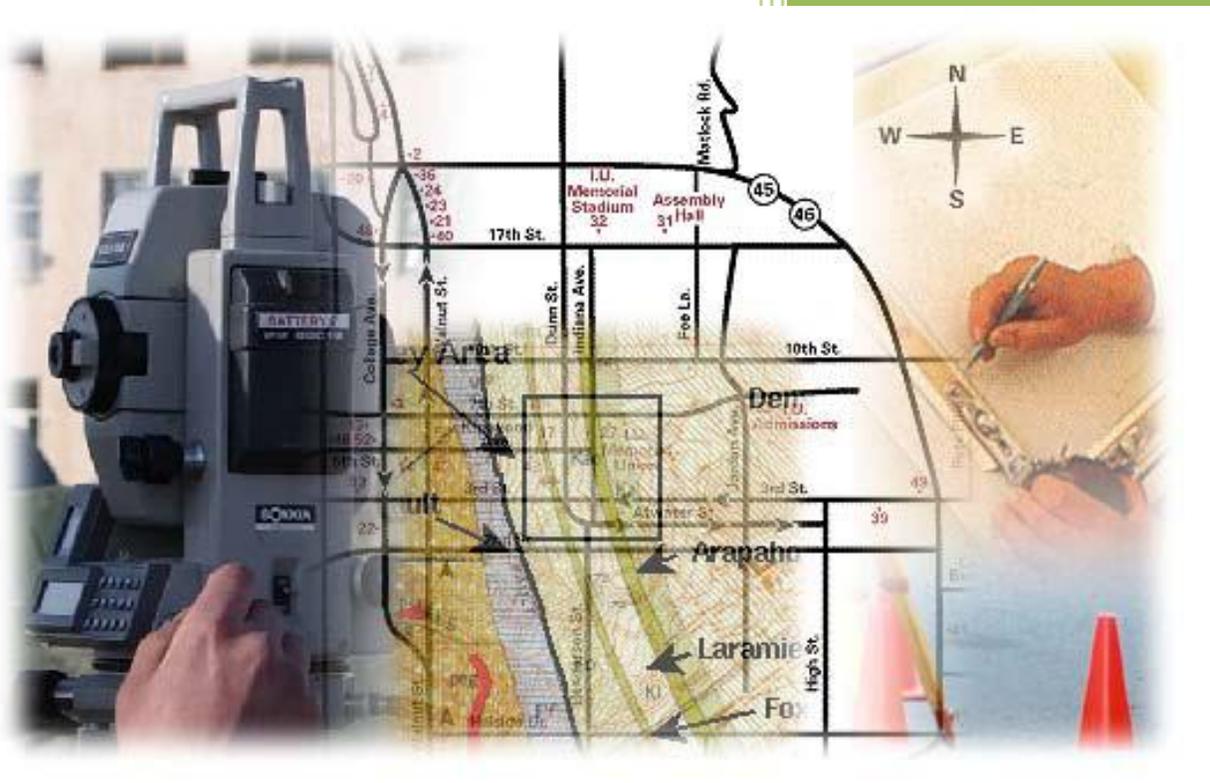


CE 370

Surveying I



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Chapter 1

Introduction

1-1 Surveying

The purpose of surveying is to **locate the positions** of points on or near the surface of the earth.

Some surveys involve the measurement of **distances** and **angles** for the following reasons:

- 1- To determine horizontal positions of arbitrary points on the earth's surface;
- 2- To determine elevations of arbitrary points above or below a reference surface, such as mean sea level;
- 3- To determine the configuration of the ground;
- 4- To determine the directions of lines;
- 5- To determine the lengths of lines;
- 6- To determine the positions of boundary lines;
- 7- To determine the areas of tracts bounded by given lines.

Such measurements are *data-gathering* measurements.

In other surveys it is required to lay off distances and angles to locate construction lines for buildings, bridges, highways, and other engineering works, and to establish the positions of boundary lines on the ground. These distances and angles constitute *layout* measurements.

What is a surveyor?

A surveyor is more than one of those guys you see out in the road. **Surveying is a vital part of the design and construction process.** Surveys are used to perform

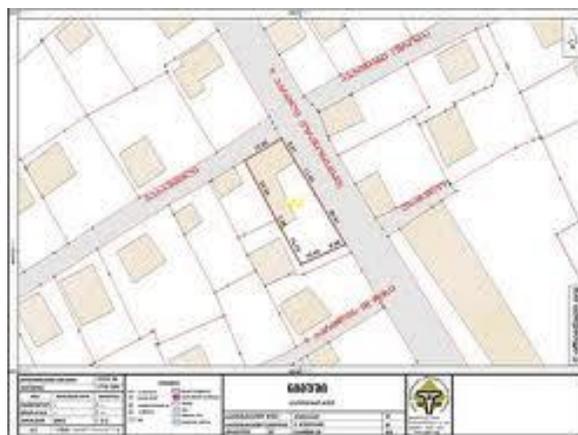
boundary to tell people where their property is, map the topography of land for engineering design, establish elevations of home sites for flood insurance, perform title surveys for real estate transactions, certify that structures are built according to design, lay out buildings, subdivisions and other construction projects so the construction companies can relate the engineering plans to the real world, and build control networks that all land parcels can relate to in a given area. Surveys are also used to map slopes and areas for pay volumes or quantities, map river bottoms for dredging, lay out photo control for aerial photography and photogrammetry, write legal descriptions that are used to describe pieces of property, map and layout tunnels, roads, airports, pipelines, and railroads, and split up properties into new lots, such as subdivisions.

1-2 Types of Surveys

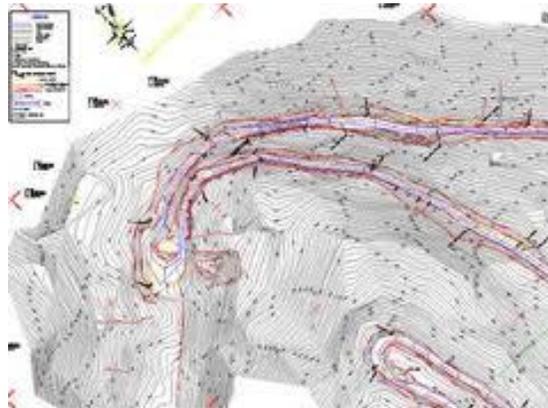
- 1) **Control survey:** a survey made to establish the horizontal or vertical positions of arbitrary points.



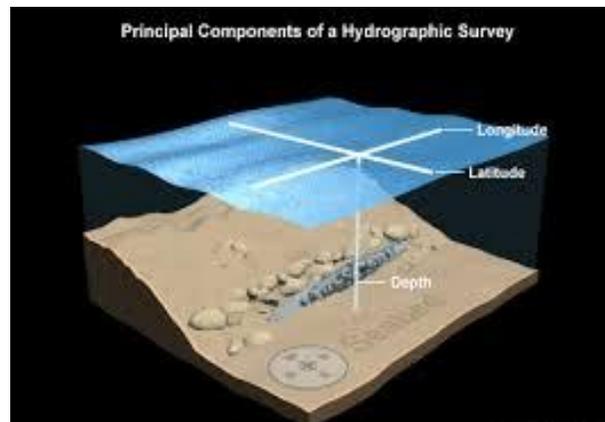
- 2) **Cadastral, land, boundary, or property survey:** a survey made to establish the positions of boundary lines on the ground.



- 3) **Topographic survey:** a survey conducted to determine the configuration of the ground.



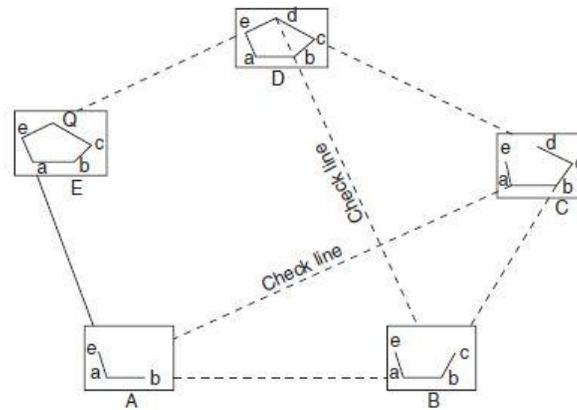
- 4) **Hydrographic survey:** it is the determination of the configuration of the bottom of a body of water.



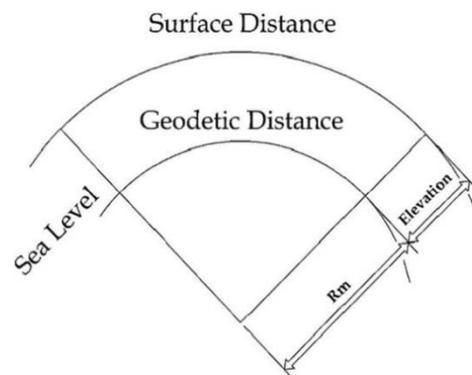
- 5) **Construction survey:** surveys executed to locate or lay out engineering works.



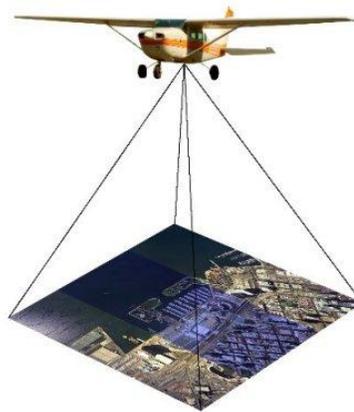
- 6) **Plane surveying:** is that branch of surveying wherein all distances and horizontal angles are assumed to be projected onto one horizontal plane.



- 7) **Geodetic surveying:** is that branch of surveying wherein all distances and horizontal angles are projected onto the surface of the spheroid that represents mean sea level on the earth.



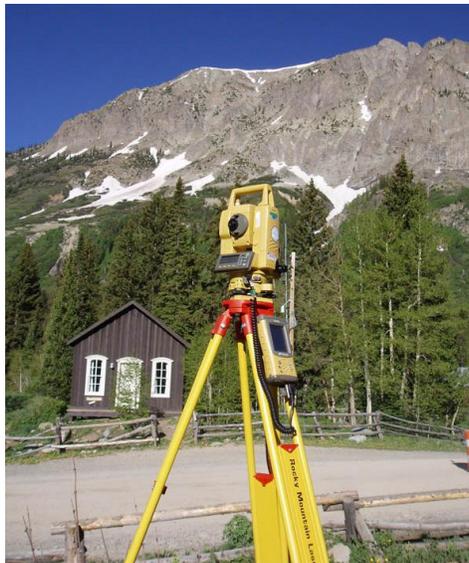
- 8) **Aerial or photogrammetric survey:** a survey performed by means of aerial photography.



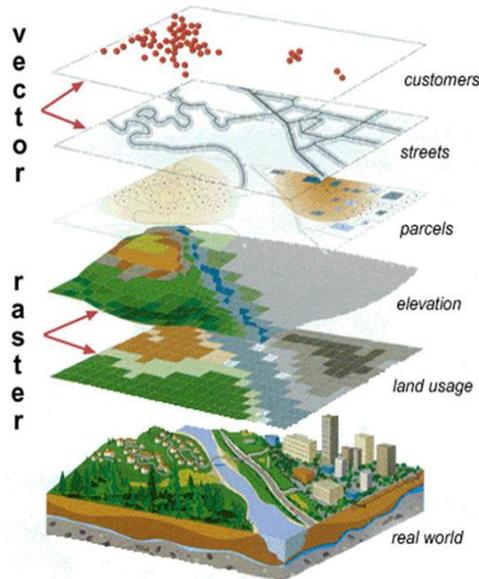
- 9) **Global Positioning System (GPS):** GPS is a tool used for precise positioning of points. It operates through satellites which send out signals to a receiver. The receiver then transmits those signals to a data collector, which stores the data. Then at the office, the data are downloaded into the computer, and the computer software resolves from the data the exact position of our point within a few millimeters.



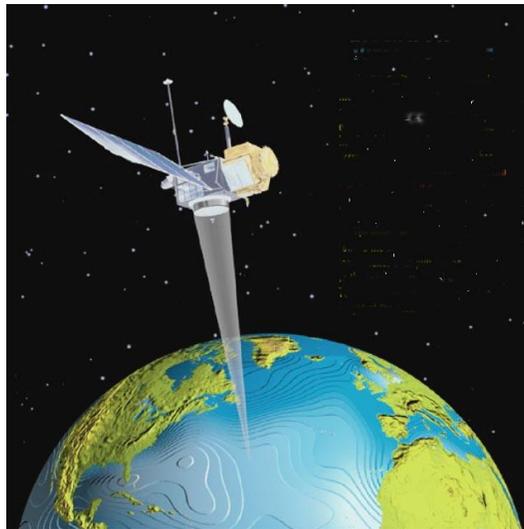
- 10) **Total Station Surveying:** The total station measures by sending a beam of infrared light toward a prism, usually supported either by a tripod or a pole. The light reflects off the prism directly back to the total station. By measuring the time it takes for the light to return, the total station calculates the distance away that the prism is.



11) Geographic Information Systems (GIS): are used to display, manipulate, and analysis spatial (map) data. Spatial data are data that contain a reference to a place.



12) Remote Sensing: it is the subject and art of getting information about an object or target without being in touch with it. It is common knowing by extracting information from satellite images.



1-3 Basic Definitions

Oblate spheroid: also called *ellipsoid of revolution*, is a solid obtained by rotating an ellipse on its shorter axis.

A vertical line: at any point on the earth's surface is the line that follows the direction of gravity at that point.

A horizontal line: at any point is any line that is perpendicular to the vertical line at the point. At any point there are an unlimited number of horizontal lines.

A horizontal Plane: at a point is the plane that is perpendicular to the vertical line at the point. There is only one horizontal plane through a given point.

A vertical Plane: at a point is any plane that contains the vertical line at the point. There are unlimited numbers of vertical planes at a given point.

A level surface: is a continuous surface that is at all points perpendicular to the direction of gravity. It is exemplified by the surface of a large body of water at complete rest.

A horizontal distance: between two given points is the distance between the points projected onto a horizontal plane. The horizontal plane, however, can be defined at only one point.

A horizontal angle: is an angle measured in a horizontal plane between two vertical planes.

A vertical angle: is an angle measured in a vertical plane.

The elevation of a point is its vertical distance above or below a given reference level surface.

The difference in elevation between two points is the vertical distance between two level surfaces containing the two points.