

CVEN303 ENGINEERING MEASUREMENT

Lecture 1– Basics of Surveying (Ch. 1) 2013

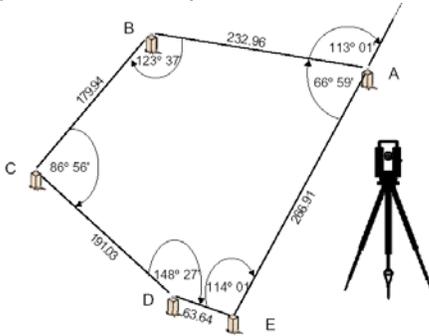
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Surveying

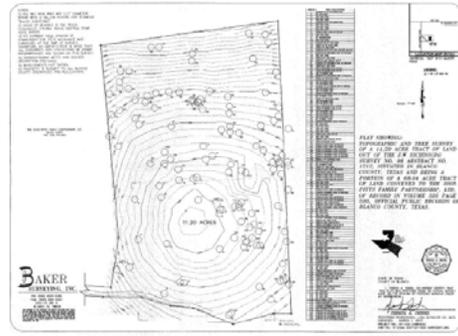
Surveying for civil engineers deals with the measurement of angles, distances, and positions, on or near the surface of the earth.

- Horizontal
- Vertical
- Horizontal
- Slope
- Vertical
- 2-D Position
 - Plane grid (x, y)
 - Geographic (longitude, latitude)
- Elevation

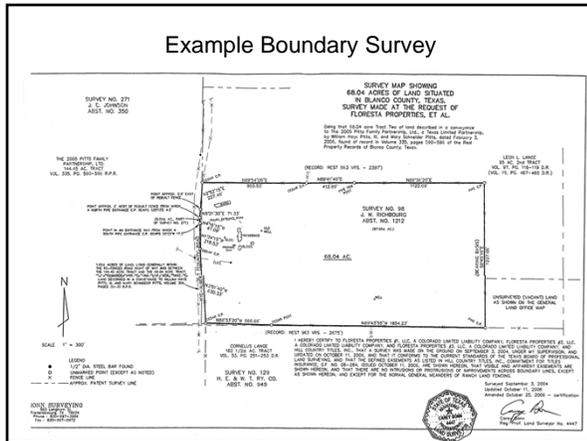
Angles & distances tell us the shape, but not the position of an object on the earth's surface



Example Topographic Survey



Example Boundary Survey

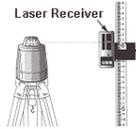


Classes of Survey (by application)

- Construction surveys
- Land surveys
- Topographic surveys
- Route surveys
- Other survey types: Hydrographic, Marine, Mine, Geological, Photogrammetric, as built (performed after construction is completed), and others.

Common Leveling Instruments

- Automatic level
- Laser levels
- Total station
- GPS



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GPS Receivers

- Base station and rover
- Hand-held



Geomatics

Encompasses modern technologies that deal with gathering and managing spatial data, including traditional surveying, Geographic Information Systems (GIS), Global Positioning System (GPS), and Remote Sensing.

9

Types of Survey

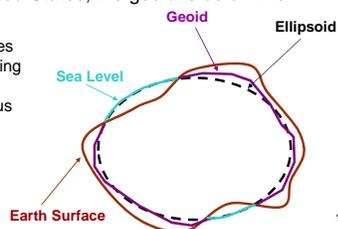
- Plane:
 - Earth surface is considered plane in the X & Y dimensions (flat)
 - Used for small-scale surveys in limited areas (e.g., 1 mile or less)
- Geodetic:
 - Earth surface is considered an ellipsoid
 - Used for very accurate and large-scale surveys (e.g., state & national boundaries, control networks)

10

Earth Models

- Ellipsoid: such as the Geodetic Reference System of 1980 (GRS80) and the World Geodetic System of 1984 (WGS84)
- Geoid: ideal Mean Sea Level (MSL)
- In the continental United States, the geoid is below the ellipsoid.

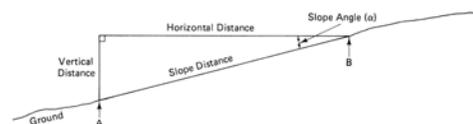
Understanding earth surfaces is necessary for understanding vertical and horizontal referencing systems and thus the position of objects on earth.



11

Measurement of Horizontal Distances

- Maps and drawings are plotted on a flat plane and distances are horizontal projections.
- Land area is computed based on horizontal measurements.



12

Stationing

- Stations represent distance along a baseline relative to a reference point.
- The beginning point is described as 0+00.
- A point 100 ft(m) after the beginning is 1+00.
- A point 100 ft(m) before the beginning is -1+00.

Measurement Errors

- Any measurement contains some error.
- Sources of measurement error:
 - Human: imperfect senses of sight and touch
 - Instrument: imperfect manufacturing
 - Nature: temperature, wind, etc.
- Pay attention to measurement units (e.g., conversions between decimal degrees and D-M-S).

14

Error Types

- Systematic
- Random

Surveying Licensing

- Especially important for land surveying
- Registration requirements:
 - College degree (most states)
 - Two years of surveying experience
 - Pass written exams (one 6-hour national exam and one 2-hour state exam)
- Most states require a certain number of continuing education units each year to main their licenses

16