

Basic Surveying

BUTE PreEngineering Course

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Course details

- ▶ Consultation/questions: in Teams or via email. More info at geod.bme.hu - staff.
- ▶ Topics covered in the course: basic mathematics and physics required to understand measurements and surveying calculations, basics of surveying calculations, usage of the engineer's level, measurements with the level, drafting of measurements, basics of mapping and map reading.
- ▶ Online study material: edu.epito.bme.hu - current semester - Department of Geodesy and Surveying - Basic Surveying

Requirements

- ▶ 2 control tests, 1 homework: each for 20 points, covers the topics previously examined in class
- ▶ 60 points can be achieved from the tests and homework, at least half of this (30 points) have to be achieved to pass the subject.

What is surveying?

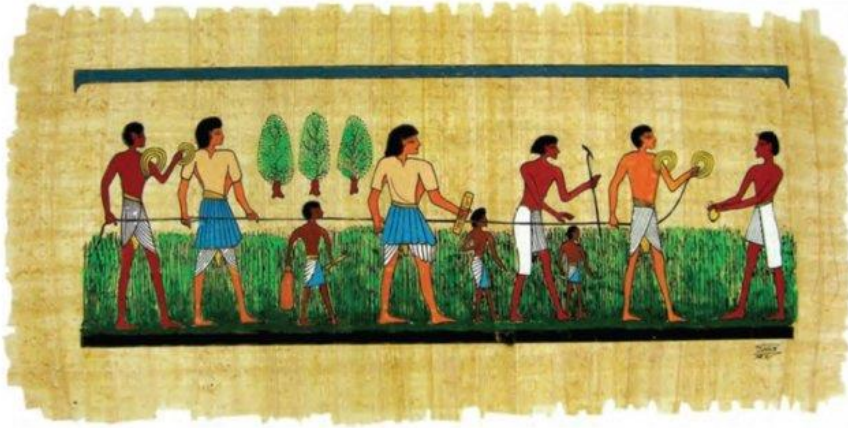
The art of making measurements of the relative positions of natural and man-made features on the Earth's surface, and the presentation of this information either graphically or numerically.

Since when?

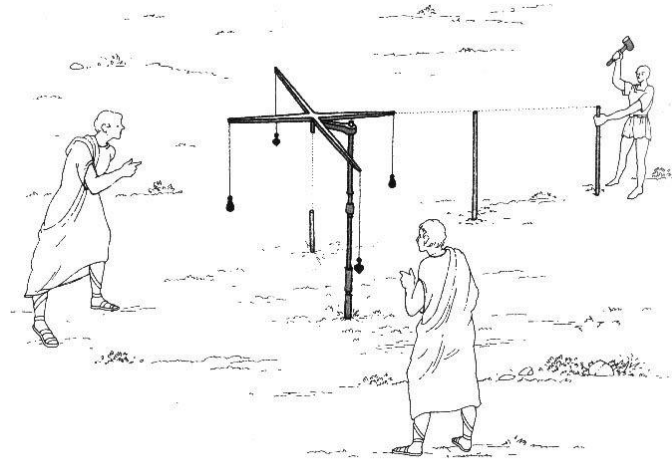
The first surveying works date back to the antiquity, the Greek provided the first account of surveying techniques.

Euclid founded the theoretical background for surveying by the development of his geometry.

Historical Surveying



Ancient Egyptians' survey



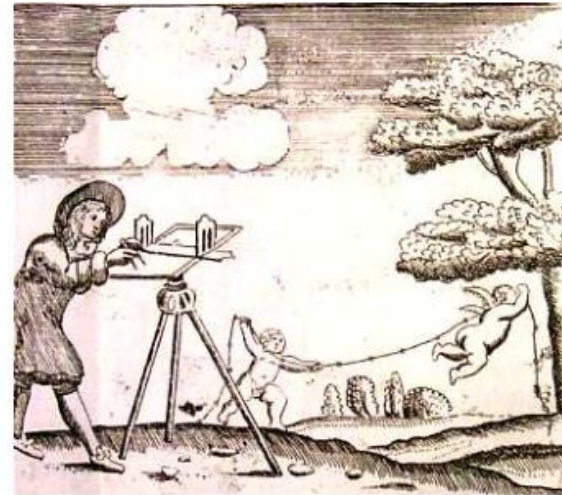
Roman surveyors at work with their groma



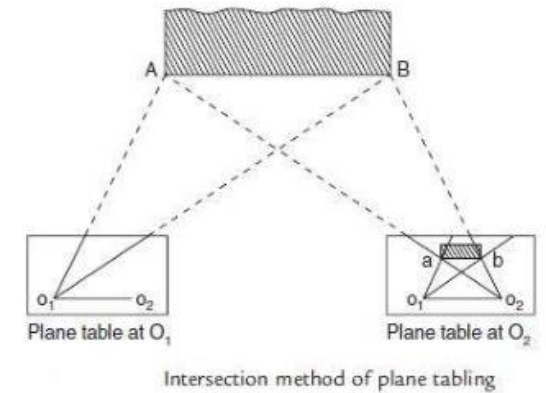
Dioptra



Theodolite in its most basic form



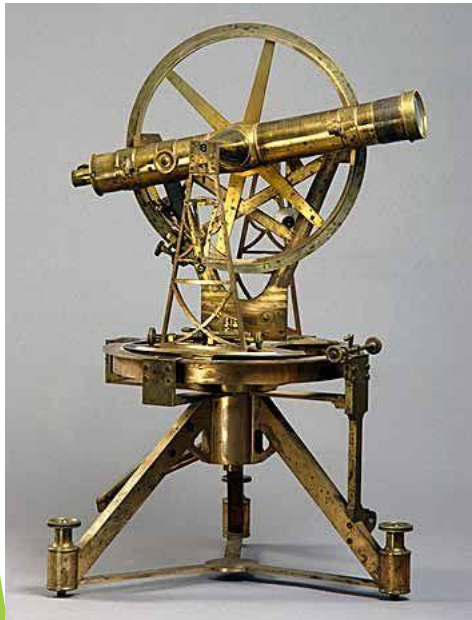
Example of the use of the plain table



Some surveying instruments



Level instruments



Theodolites



Total Station



RTK GPS

Surveying vs. Geodesy

- ▶ In most languages there are no distinctions between the terms
- ▶ in English (according to Vanicek - Krakiwsky):
 - Surveying: the practice of positioning
 - Geodesy: the theoretical foundation of surveying
- ▶ Geodesy is the scientific background of Surveying as a profession.

Surveying vs. Geodesy

▶ Surveying:

The art of making measurements of the relative positions of natural and man-made features on the Earth's surface, and the presentation of this information either graphically or numerically.

- ▶ Plane surveying: relatively small areas, surface of earth can supposed to be flat, measurements plotted represent a horizontal projection of the actual field measurements

▶ Geodesy:

Geodesy is the discipline that deals with the measurements and representation of the Earth, including its gravity field, in a three-dimensional time varying space.

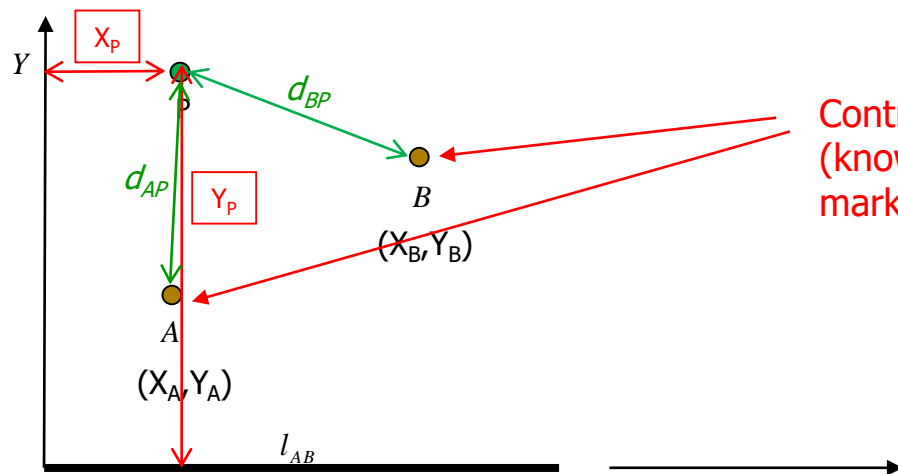
- ▶ Geodetic surveying: large areas, surface of the Earth can not supposed to be flat, the curvature of the Earth is taken into account
- ▶ *Geodesy focus on the Earth and neglect any man-made features on it (e.g. buildings, public utilities, etc.), while surveying use the results of geodesy for positioning and mapping of these features.*

Basic principles of Surveying

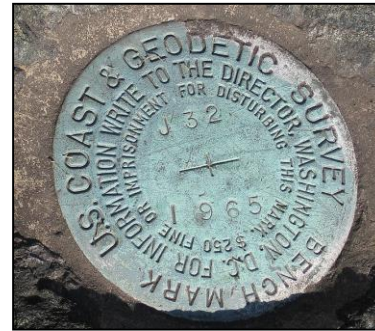
- ▶ Applied geometry
- ▶ Making measurements of the positions of objects, and the presentation of this information.
- ▶ How to achieve this?

Let's determine the position (X_p, Y_p) of point P!

Absolute vs **Relative** positioning



Control points
(known coords;
marked on the field)



Material by Szabolcs Rózsa

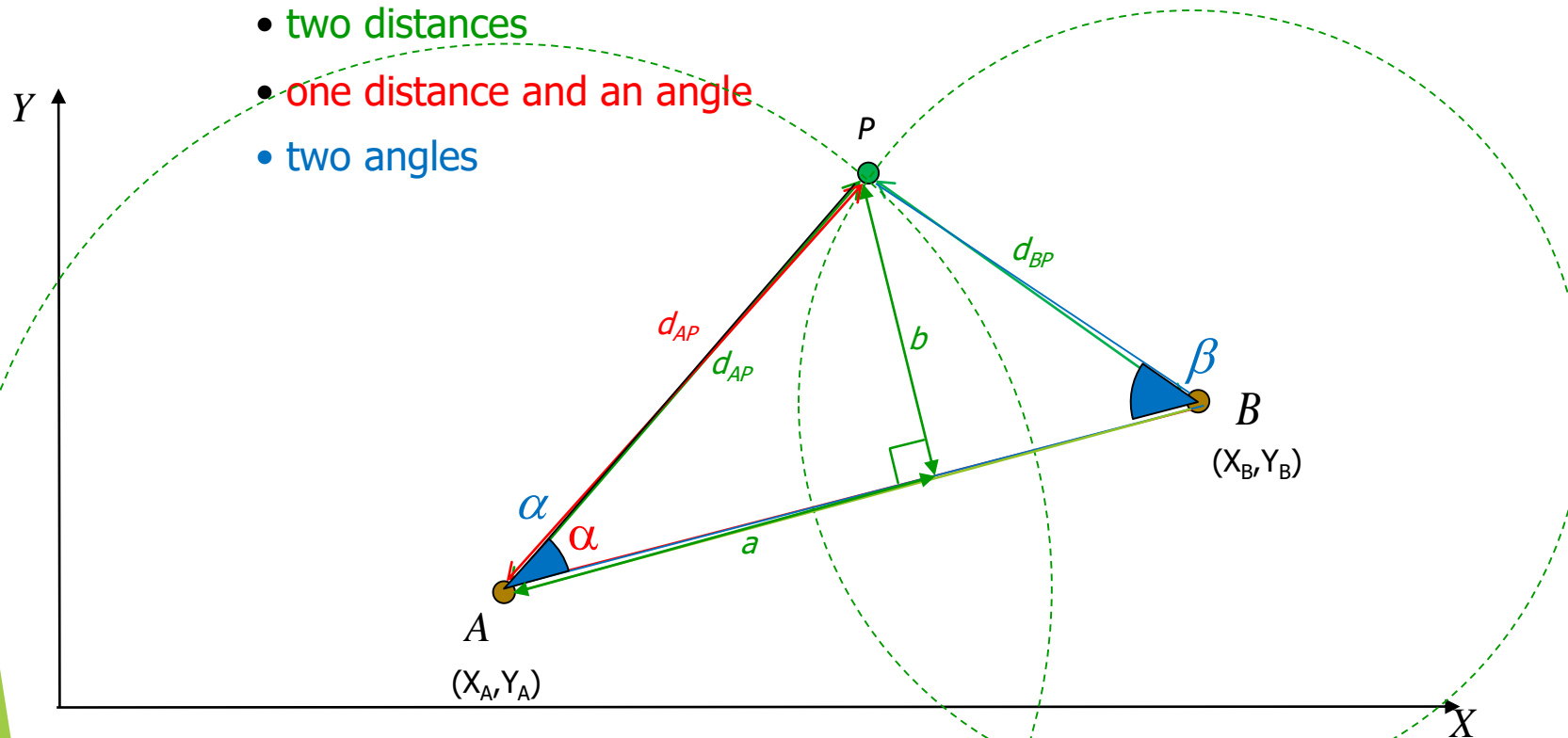
Basic principles of Surveying

Let's determine the position of a third, unknown point (C).

We have two unknowns: X_P , Y_P

We need two measurements:

- two distances
- one distance and an angle
- two angles



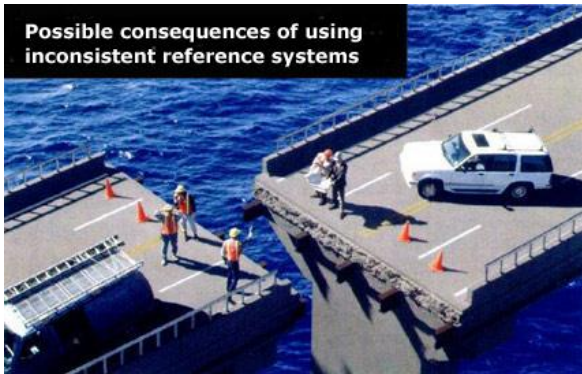
Material by Szabolcs Rózsa

The role of Surveying in Civil Engineering Practice

Surveyors are needed:

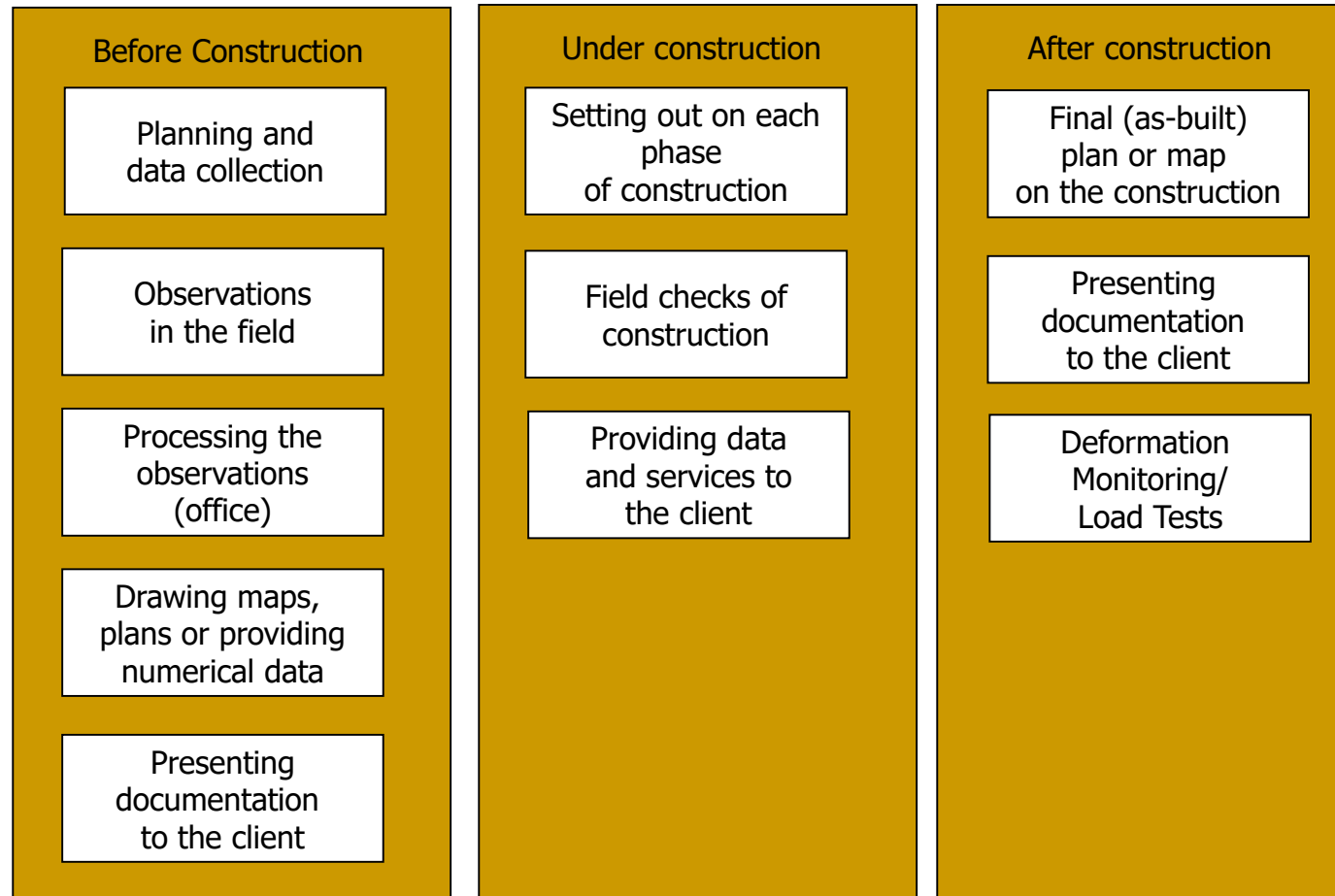
- ▶ to maintain the geometric order during the construction process
- ▶ to provide fundamental data for the design and planning process
- ▶ to provide quantity control during the construction process (for example: earthwork quantities)
- ▶ to monitor the structure after the construction (subsidence, deformations, etc.)

Possible consequences of construction without proper Surveying:



Material by Szabolcs Rózsa

Surveying activities during the construction process



Topics covered in the course

- ▶ basic mathematics (especially geometry!) and physics required to understand measurements and surveying calculations,
- ▶ basics of surveying calculations,
- ▶ usage of the engineer's level (only in theory)
- ▶ drafting of measurements