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SURVEY PLANIMETRY USING DIFFERENT INSTRUMENTS

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Abstract

In our contemporary context world is more and more necessary to have a better accuracy in everything we do. So that, in scientific field, there is an explosion of smart devices, which are better and betterevery new year, and whose advantages are obvious for our daily work. Our paper presents the differences between two surveying measurements, the first made with an theodolite Leica Builder 100, and the second one with a total station, Leica TC 407. The measurements were done in UASVM campus, Bucharest.

***Key words**: planimetry, total station, theodolite, survey.*

INTRODUCTION

Planimetry is the study of plane measurements, including angles, distances, and areas.
To measure planimetry, a planimeter is used. This rather advanced analogue technology is being taken over by simple Image Measurement software tools like, ImageJ, Adobe Acrobat, Google Pro Earth, Gimp, Photoshop and KLONK Image Measurement which can help do this kind of work from digitalized images.
Planimetric elements in geography are those features that are independent of elevation, such as roads, building footprints, and rivers and lakes. They are represented on two-dimensional maps as they are seen from the air, or in aerial photography. These features are often digitized from orthorectifiedaerialphotography into data layers that can be used in analysis and cartographic outputs.
A planimetric map is one that does not include relief data.

Our theme work was making a traverse inside the campus of the University of Agronomic Sciences and Veterinary Medicine, Bucharest, with points by known coordinates as GPS 1 and GPS 2, in orderto determine the coordinates of a set of new, unknown points(Figure 1).

Figure 1. Satellite view of station points

MATERIALS AND METHODS

Working with the task of accurately determining the coordinates of some certain points clearly defined into a measurement, depending on the points with known coordinates of our route and those who have to determine, we can follow one of the Traverse methods listed below.
Traverse is a method of thickening geodetic network to determine coordinates of the detail points in the pitch.
Planimetric Traverse is a polygonal broken lineand the mutual points position is determined by measuring distances between points of breaking and measuring angles in the break points of the route polygonal.
Depending on the number of points with known coordinates identified in the field and the type of work to be performed on the ground, traverses may be classified as:

■ **the traverse at the ends to points with known coordinates** - field identifies four points with known coordinates, arranged two on one end (A, B) and two at the other end of the traverse (C, D) - (Figure 2)

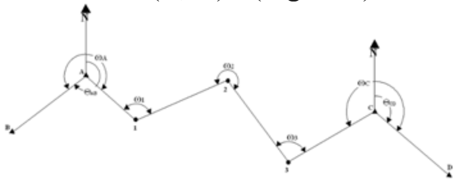

Figure 2.Graphical representation: traverse supported at the ends on points with known coordinates and orientations

■**traverses closed circuit** - identifies land at least 2 points with known coordinates (A, B - Figure 3) of which start and stop measurements:

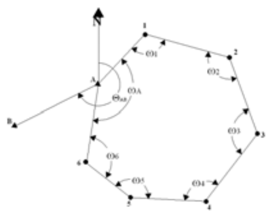

Figure 3. Graphical representation:closed circuit traverse

■ **traverse the hub** - is made up of a minimum of 3 traverses that start from some 2 points with known coordinates (A, B, C, D, E, F) and meet all three in - a common point (N) called hub with visa for a foothold (S) which is not necessary to know the coordinates (Figure 4):

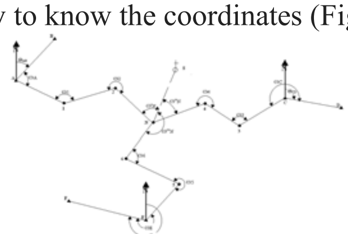

Figure 4. Graphical representation: traverse with hub point

Traverse supported at the ends, closed circuit traverse and traverse the hub (as described above) are the methods by which we can determine the coordinates of new pointsreading, knowing other key points of our measurement.

Work appliances needed are either classic theodolite or total station – a modern and improved version of the theodolite.

About theodolite

Surveying theodolite is an instrument used to measure angular field of horizontal and vertical directions. With theodolite can measure longer distances using staff and through an indirect method of measurement.

Figure 5. Theodolite Otto Fennel Sohne Kassel – 1920

Classical theodolites, which were built in the early eighteenth century (Figure 5), **modern theodolites (optical)**, which have almost the same principle constructive, but contain internal optics that enable readings in two circles through a microscope reading whose eye is next to the telescope eyepieceare the first precise measuring devices, before the occurof**electronic theodolites** (Figure 6).

Figure 6. Teodolit electronic LEICA Builder T100

The **electronic theodolites**,occurred in seventh decade of the XX century, have been rapidly improvedand are the most used and precise instrumentation of surveying. The electronic theodolite contain a microprocessor which serves to put up on a display similar to that seen in microcomputers (consisting of liquid crystals) of the measurement results, as well as a number of elements automatically calculated (the length of the inclined, the difference in height, the horizontal distance, direction, coordinates , etc.)

Rangefinder electro complete with functions of a theodolite led to the Electronic Total Station, equipped with digital display automatic meter readings, with the possibility of automatic recording in external memories and by "tracking", which offers the advantage of displaying horizontal directions every second and a new distance value every 3 seconds, with the opportunity to move without interrupting targeting mobile reflector. Making electronic book field allows connection to PC and plotter.

A **total station** or TST (total station theodolite) is an electronic/optical instrument used in modern surveying and building construction (figure 7). The total station is an electronic theodolite (transit) integrated with an electronic distance meter (EDM) to read slope distances from the instrument to a particular point.

Figure 7. Total station Leica TC 407

Some models include internal electronic data storage to record distance, horizontal angle, and vertical angle measured, while other models are equipped to write these measurements to an external data collector, such as a hand-held computer.

A total station is superior to a theodolite because it can directly process data in the device. When data is downloaded from a total station on computer, application software can be used to compute results and generate a map of the surveyed area. The newest generation of total stations can also show the map on the touch-screen of the instrument immediately after measuring the points.

Figure 8. The measurement principle with reflector

The measurement principle (Figure 8) is the same of the theodolite: the operator targetsthe reflector from the station pointand records data using ***All*** command (to register distances and angles, too – figure 9). All data are being recorded in device memory, on a ***Job***, and then the field bookwill be developed on PC, where from is easy to reconstruct thesite plan and delimitation, on correct coordinates, of the area we hadto identify and account for drawing.

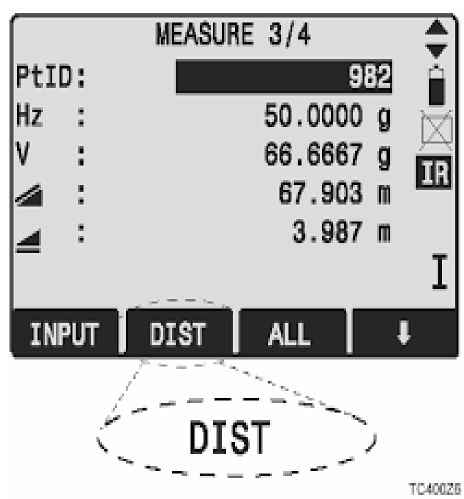

Figure 9. Display of a total station

In our work, we used both devices - Leica Builder TC 100 and Leica TC 407, in order to identify, in the field, enhanced effectiveness of a device in front of the other.

RESULTS AND DISCUSSIONS

Technical differences between the two instruments have repercussion in the results.If the electronic theodolite Builder T100, precision machine is 9"equivalent of 28cc, the 407 TC precision is 7 ", equivalent of 20cc.
This fact is noticeable on measuring results:
The measurement performed with the theodolite , we had an angleserror(-0.035) , being smaller than the tolerance (4.47) and the distance errors were 0.07 (X)and -0.06 (Y).
The measurement performed with the total station , the angle error was -0.025 , which is lower than the tolerance (2.26) . The total station distance errors were 0.04 for X and -0.03 for Y.

CONCLUSIONS

Using different surveying instruments we obtained planimetric coordinates for the points measuredin the U.A.S.V.M Bucharest campus.
The paper hashighlightedthe capabilities and the importance of the accuracy of two different surveying instruments.

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