TOPOGRAPHIC AND LAND SURVEY MEASUREMENTS AT THE DIDACTIC EXPERIMENTAL STATION FARM No 5 TIMISOARA

A. ŞMULEAC, C. POPESCU, Valeria CIOLAC, M. HERBEI

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Agricultural Sciences, Timisoara, Aradului Street, no. 119, RO-300645, Romania,
Corresponding author: adrian_smuleac@yahoo.com

Abstract: *The topographic operations for this paper were performed at Farm No 5 of the Didactic Station of the University of Agricultural Sciences and Veterinary Medicine Timisoara. The Leica TPC 805 Total Station was used for the topographic and land survey measurements, and the data were downloaded with LEICA Geo Office Tools special software. Class V points within the university were used for the measurements. The total station is an optical device used for topographic measurements. It is a combination of the classic theodolite and an electronic instrument for measuring distances. The total station can include a small computer that provides storage capacity and makes precise calculations. The following plans were executed after the measurements were taken: dimension site plan - 1:500; plot plan - 1:1000; development site plan - 1:10000. Generally, a geodesic network has at least two old (already coordinated) points that in the first stage help determine the coordinates of the "new" points with the help of a certain method. A direct link is created between the older points through horizontal angular observations. Distances and orientation must also be determined between these points. These elements will be used in the compensation calculations. For this reason, their determination must be very precise. The calculations of the geo-topographic support networks were done with the TOTAL 2.0 software. The (temporary) coordinates of the points to be determined are done automatically. The compensation of the support network is done with the least squares method, the indirect measurement method. The software creates a DFX file that can be used with the AutoCAD package at a later time. TOTAL 2.0 calculates and, where necessary, compensates any combination of direction and distance measurements, from the easiest (cancellation of registration, multiple intersection, multiple resection) to the most complex ones (various traverses, polygonometric networks, triangulation).*

Key words**:** *topographic operation, Farm No 5, retrospection, total station*

INTRODUCTION

Total stations are part of the new generation of topographic instruments. Basically, they function like a classic tachymeter. They have been improved continuously since they were created and are now used almost exclusively. They are precise, easy to use and very efficient and have become the symbol of the modern land surveyor.

In planimetric traverses, angles and distances or orientations and distances are measured.

In principle, the problem is to find the coordinates of a new point, P(X,Y) using sights exclusively from this new point P to three older points $A(X_A,Y_A)$, $B(X_B,Y_B)$ and $C(X_C,Y_C)$ – given by their coordinates. The solution to this problem was found by Snellius in 1624 and improved by Pothénot in 1692. This is also called the "Pothénot problem" or the "map problem".

For field control, an additional sight is required (four coordinated points). It is recommended that the older points should be divided in four sectors

Unlike the intersection, which required the equipment to stand in at least two known coordinated points, from which older points and the point to be determined are observed, the

resection method requires standing in the point under location exclusively and measuring the lengths to at least three older points (of known coordinates).

The method is called resection because it reverses the intersection process using crossed back bearings.

In the field, data collection is much easier if the equipment stands in one point only instead of being moved to two or more points, as required when the intersection method is applied.

This method is necessary when the region provides visibility only to older inaccessible points (church crosses, signals, chimneys) and when control measurements for traversing are taken.

It should be mentioned that the coordinates of the new point are only temporary. Several measurements should be taken which will be entered in a processing software application at a later time.

MATERIAL AND METHODS

The topographic operations for this paper were performed at Farm No 5 of the Didactic Station of the University of Agricultural Sciences and Veterinary Medicine Timisoara. The Leica TPC 805 Total Station was used for the topographic and land survey measurements, and the data were downloaded with LEICA Geo Office Tools special software.

The total station is an optical device used for topographic measurements. It is a combination of the classic theodolite and an electronic instrument for measuring distances. The total station can include a small computer that provides storage capacity and makes precise calculations.

The calculations of the geo-topographic support networks were done with the TOTAL 2.0 software.

The (temporary) coordinates of the points to be determined are done automatically. The compensation of the support network is done with the least squares method, the indirect measurement method.

The software creates a DFX file that can be used with the AutoCAD package at a later time.

TOTAL 2.0 calculates and, where necessary, compensates any combination of direction and distance measurements, from the easiest (cancellation of registration, multiple intersection, multiple resection) to the most complex ones (various traverses, polygonometric networks, triangulation).

The following plans were executed after the measurements were taken: dimension site plan 1:500; plot plan 1:1000; development site plan 1:10000.

RESULTS AND DISCUSSIONS

The measurements carried out at Farm no 5 of the Didactic Experimental Station of the University started in station point A1 of unknown coordinates, which is located near the access area. From there the instrument was oriented to points of known coordinates 712 and 722. A traverse was started from point A1 through points A2, A3 and A4 for planimetric elevations.

Used in a large number of operations, traversing is a central method in plan elevations. It is the most common method in *elevation networks* and *detail positioning*, but it is also applied in dense support networks.

Data processing and plan drawing followed the topographic measurements. Table 1 gives the coordinates of the known points used for orientation purposes, of the station points

and of the radiate points. Figure 1 shows the development 1:10000 site plan and the location of Farm no 5 and figure 2 is the 1:1000dimension site plan.

Table 1

Coordinates of radiate points - Farm no 5, Didactic Station USAMVB Timisoara
STEREO'70

No of point	X [m]	Y [m]	No of point	X [m]	Y [m]
712	***482915.514***	***205943.585***	20	*482750.814*	*205710.807*
722	***482924.045***	***205995.037***	21	*482805.844*	*205774.888*
A1	***482895.258***	***205756.735***	22	*482745.275*	*205699.570*
A2	***482850.600***	***205782.461***	23	*482748.528*	*205703.803*
A3	***482831.345***	***205709.607***	24	*482798.886*	*205656.370*
A4	***482798.074***	***205633.386***	25	*482802.157*	*205660.359*
1	*482894.600*	*205749.014*	26	*482807.298*	*205657.217*
2	*482895.639*	*205745.031*	27	*482803.080*	*205660.609*
3	*482846.236*	*205684.160*	28	*482828.257*	*205691.670*
4	*482835.531*	*205692.267*	29	*482832.375*	*205688.349*
5	*482891.430*	*205751.554*	30	*482802.648*	*205660.956*
6	*482885.188*	*205756.555*	31	*482843.970*	*205701.552*
7	*482879.492*	*205761.119*	32	*482840.007*	*205704.846*
8	*482872.664*	*205766.590*	33	*482837.249*	*205701.541*
9	*482860.267*	*205751.249*	34	*482836.444*	*205702.202*
10	*482857.097*	*205753.818*	35	*482834.635*	*205699.992*
11	*482854.332*	*205750.341*	36	*482839.485*	*205695.891*
12	*482857.465*	*205747.797*	37	*482834.751*	*205699.894*
13	*482864.296*	*205742.269*	38	*482838.813*	*205696.440*
14	*482849.250*	*205747.027*	39	*482746.782*	*205706.250*
15	*482809.477*	*205779.108*	40	*482854.382*	*205750.402*
16	*482845.853*	*205742.876*	41	*482851.587*	*205752.591*
17	*482797.024*	*205773.718*	42	*482847.999*	*205748.040*
18	*482799.753*	*205771.384*	43	*482800.858*	*205778.235*
19	***482748.028***	***205712.834***			

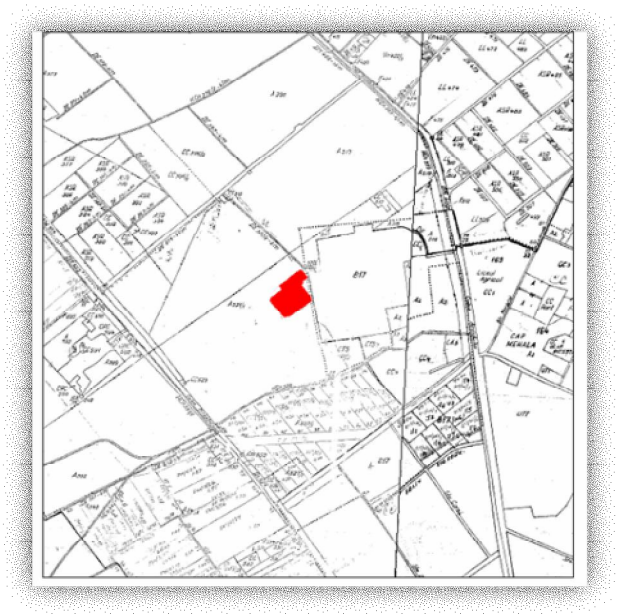

Figure 1: Development site plan

In order to check the measurements, the result of the processing was laid over the orthophotoplan no 205_482 corresponding to the area (figure 3). Two 1:1000 mapping plans were made with the help of a Leica Disto A5 laser distance meter (figures 4 and 5).

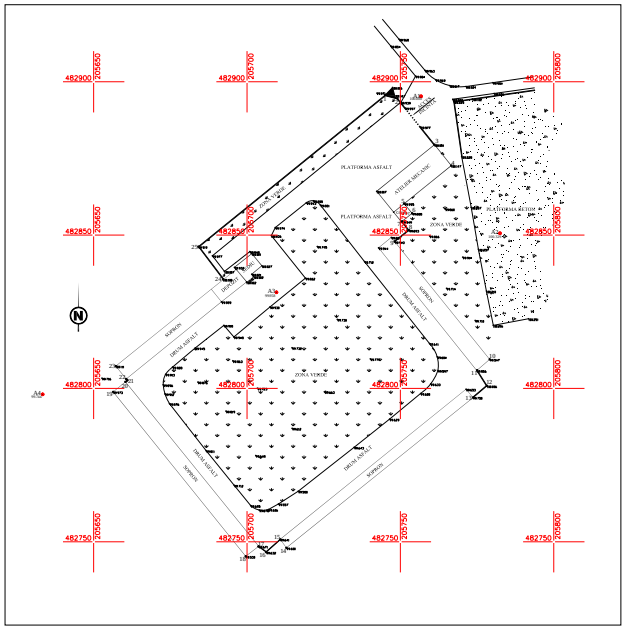

Figure 2: Dimension site plan – Didactic Station Timisoara, Farm no 5

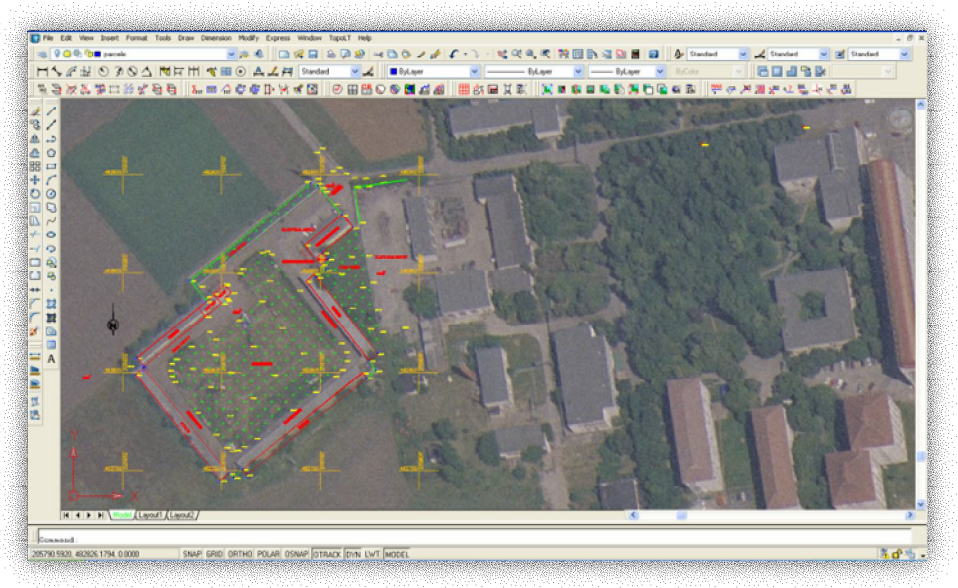

Figure 3: Dimension site plan overlapping the orthophotoplan – Didactic Station Timisoara, Farm no 5,

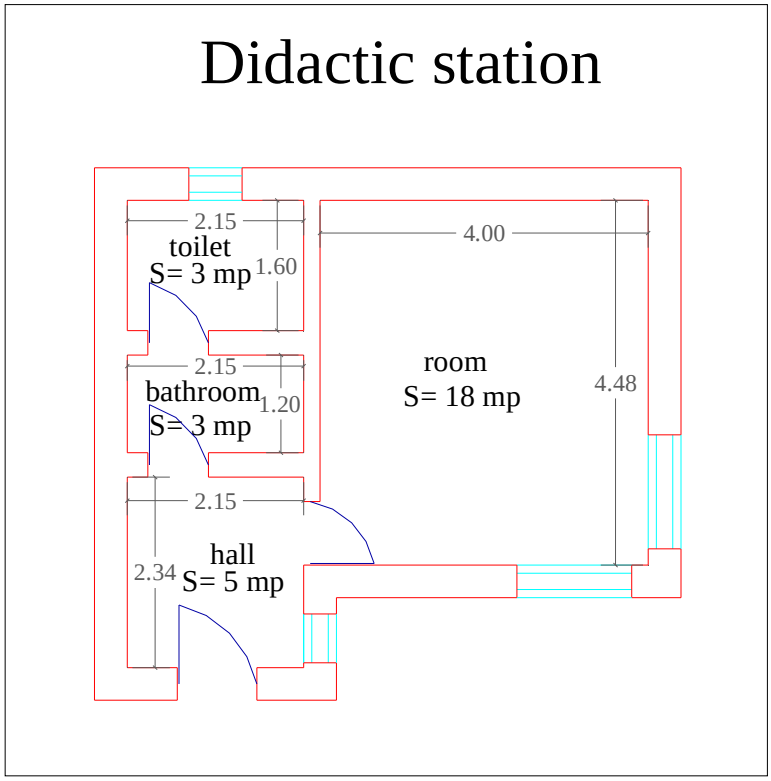

Figure 4: Mapping of Didactic Station, Farm no 5

CONCLUSIONS

The topographic operations for this paper were performed at Farm No 5 of the Didactic Station of the University of Agricultural Sciences and Veterinary Medicine Timisoara. The Leica TPC 805 Total Station was used for the topographic and land survey measurements, and the data were downloaded with LEICA Geo Office Tools special software.

The measurements carried out at Farm no 5 of the Didactic Experimental Station of the University started in station point A1 of unknown coordinates, which is located near the access area. From there the instrument was oriented to points of known coordinates 712 and 722. A traverse was started from point A1 through points A2, A3 and A4 for planimetric elevations.

Data processing and plan drawing followed the topographic measurements.

BIBLIOGRAPHY

1. CIOLAC VALERIA, RITT C., POPESCU C., SMULEAC A., Lucrari practice de topografie agricola, Ed. Eurobit, Timisoara, 2007;
2. DOANDES V., Topografie speciala, Ed. Politehnica Timisoara, 2006;
3. KIRALY A., Grafica pe calculator, Ed. U.T.Press, Cluj-Napoca, 2002;
4. BOS N., IACOBESCU O., Topografie moderna, Ed. C.H. Beck, Bucuresti, 2007.

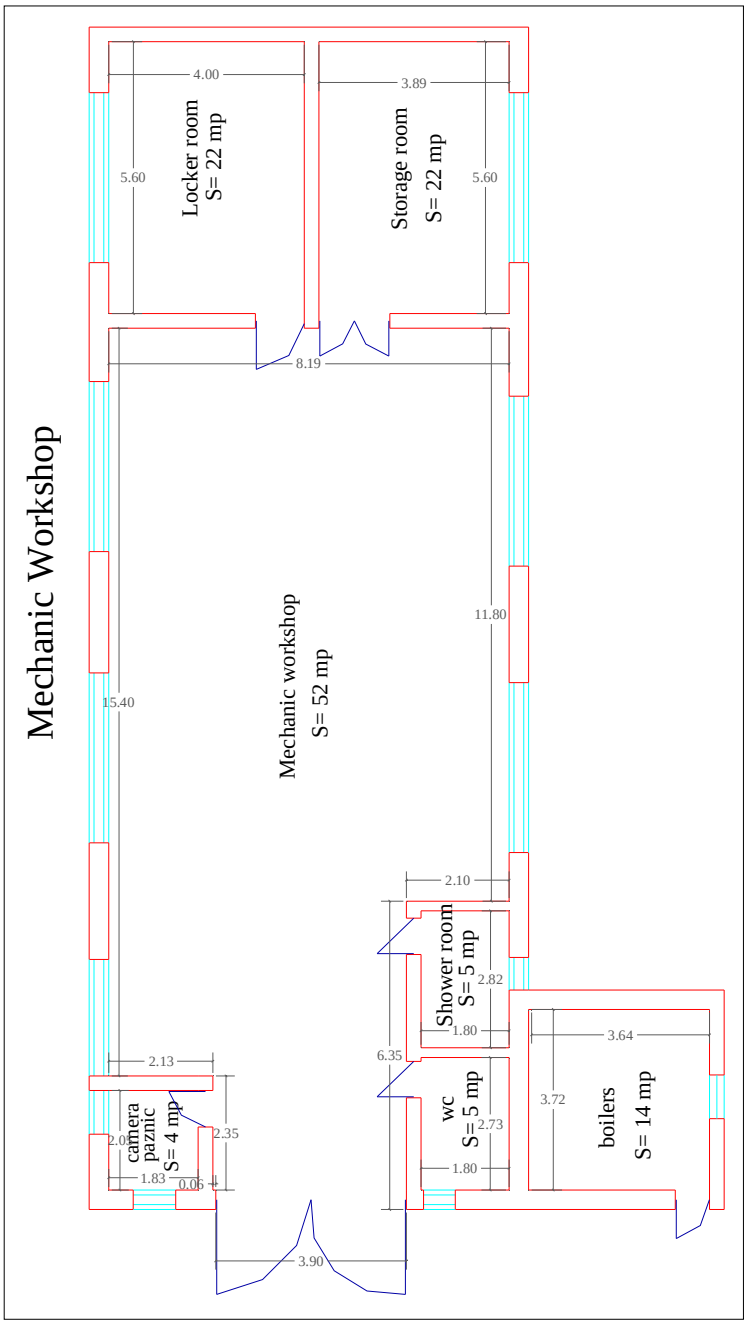

Figure 5: Mapping for the mechanic workshop in the Didactic Station, Farm no 5