

## USE OF MODERN TOPOGRAPHIC TECHNOLOGIES TO CREATE A BICYCLE TRACK

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**Abstract:** *The cadastre has meant over time the human activity of inventorying the land resources, for the establishment of taxes. In the contemporary era, the cadastre has expanded its scope so that it represents the technical, economic and legal evidence of all goods. Topography is a branch of terrestrial measurement science. It deals with the measurement of land surfaces, cadastral units, the study of the measurement methods as well as the analysis of the instrument and the equipment required to carry out activities. The values measured in the topography are of the type of horizontal nails and the vertical angles formed by the sides of two alignments obtained between neighboring points and the distances between points, that is to say the sides of the nails. In the process of establishing the position of the topographic points, it starts from the measured values of points belonging to the geodetic networks. The total station also called the smart station is an optical instrument used in topographic measurements. They represent a new generation of devices that include cutting-edge achievements of fine mechanics, electronics and optics. The present work was performed on Cetatii Street in the city of Caransebes, Caras Severin county. The street was measured in order to create a track for cyclists. In order to take measurements, we needed to ensure the execution documents, checking the special conditions, training the personnel in executing the works and equipping them with tools and devices necessary to perform the work. The documents required for carrying out the drawing procedure are: the execution project, the drawing plan, the specifications. For the measurement of the street the total station was used, which has its own memory center and an external memory, as well as a series of calculation programs specific to the topo-geodesic measurements. The measured data and calculations are measured and then transferred to the memory of the computer, where by means of processing programs the graphic components are determined, which are drawn in the automated system with plots attached to the computer. After performing the measurements obtained from the field it was started to download the total station and to process the data on the computer. The AutoCAD program was used to process the obtained data. AutoCad is a program that is used in designing two-dimensional (2D) and less three-dimensional (3D) construction plans developed by the American company Autodesk. The first version called MicroCad appeared in 1982, reaching the version of AutoCAD 2014. AutoCad is the most widespread computer-aided design and graphics environment, successfully used in fields such as architecture, geography, medicine, astronomy, etc.*

**Keywords:** ROMPOS, RTK, GNSS, LAND BOOK, LEICA, GPS, DWG, DXF, GSM.

### INTRODUCTION

Electronic tachometers are the most commonly used geodetic instruments in terrestrial measurements (ȘMULEAC, A. ET ALL., 2017). Their evolution, from an electronic point of view, has led to the designation of a total station which involves both a measurement of the characteristic elements for a classic tachometer, as well as a series of direct controls and calculations on the ground, such as: automatic data storage, calculations through specific programs of orientation, coordinates, plot elements, etc. The main components of a total station are: theodolite, telemetry, keyboard and display and microprocessor (HERBEI, M. V. ET ALL., 2010, 2016).

Constructively, electronic theodolites have the form, component elements and axes similar to classical theodolites, the most important differences appearing in the construction of graded circles and in the devices for reading. The reading devices generate pulses that are transformed by a microprocessor into encoded signals that are transmitted to peripheral equipment. The values of the measured directions or angles will appear on the display. Any reading (including zero) can be entered in the direction of origin. The recording of the readings is done on magnetic media, either on a diskette inserted in the device. The errors that affect the measurements have, in general, the same character (systematic or random), the same sources of provenance and the same methods of determination and elimination as in the classical theodolites. The difference lies in the fact that the microprocessor can automatically mediate the readings corresponding to both positions of the rear window and can signal possible punctuation errors.

The rangefinder is of electro-optic type and is incorporated into the theodolite. All corrections that are made to the measured distances and which can be evaluated using mathematical relations are applied automatically. The keyboard and display ensure operator-instrument communication in the measurement and control. The keyboard is more and more simplified, avoiding the multifunctional keys, applying the menu technique. The display screen is liquid crystal, in alphanumeric system, with magnification tendencies to allow simultaneous display of all information (measured data, executed orders, corrections applied, etc.).

The microprocessor is the most important component of the total station, having multiple functions. Through existing programs in its memory acting on peripherals and in data memory. There is the possibility of coupling with electronic field notebooks to facilitate the storage of data and the use in processing of older data as well as of calculation programs specific to topographic measurements (ŞMULEAC, A. ET ALL., 2012, 2017). Leica, Topcon, Pentax that have prevailed on the market due to their characteristics.

The total TPS400 station from Leica Geosystems is produced by the Leica company in Switzerland and is a high quality device intended for topography, geodesy, cadastral, construction. The advanced technology used allows the measurement work to be easier, without problems in a short time. The total station TPS 400 is provided with a fast distance measuring device, which works both on the prism (0.8 sec.) For the Together with the quality offered by Leica, you can be sure that you will get the desired level of accuracy for each measurement. The download of the measured data in the field is realized with the help of the download cable of the total station to the computer (ŞMULEAC, A. ET ALL., 2015, 2016).

The total Leica TPS 400 station is equipped with a software package that allows most topography tasks to be performed easily, quickly and elegantly (ŞMULEAC, L. ET ALL., 2016; 3). The Leica TPS 400 station is used where it is necessary to determine the position of the points or the height. This station has the following features: interactive keys, large and clear LCD screen, additional trigger key on the side of the instrument, continuous movements for horizontal and vertical angles, battery support, laser centering, measurement without EDM reflector, lightweight construction, software and built-in data memory.

## **MATERIALS AND METHODS**

The present work was carried out in the city of Caransebes. Caransebes city is a municipality in Caraş-Severin county, Banat, Romania, formed by the component locality Caransebeş (residence), and from the village of Jupa. In the Middle Ages until the 16th century Caransebeşul was the political center of a Romanian district enjoying autonomy and its own history. [4] It is located at the confluence of the Timiş and Sebeş rivers, the last one flowing from the Sarcu Mountains. In the west, it is in direct contact with the Banat Mountains. It is an

important railway hub, being located about 40 km away from Reșița, 21 km from Oțelu Roșu, 70 km from Hațeg and around 25 km away from the Muntele Mic ski resort, located in the Tarcu Mountains (ȘMULEAC, L., ȘTEFANCA, L. ET ALL., 2017; MILOŠRUSNÁK ET ALL., 2017).

In 1385, the Franciscan monastery from Caransebeș is attested, probably built during the reign of Ludovic de Anjou (1342-1382). The monastery was built of stone and brick, with the incorporation of Roman ruins. The ruins of the old Franciscan monastery were accidentally brought to light in 1988, on the occasion of urban planning. They are visible today in the city center.

In 1738 Caransebeș was burnt down entirely by the "Vlahi", during the Romanian uprising against the Austrian Empire, as the Franciscan chronicle mentions. The Romans rebelled against the taxation imposed by the imperial administration and against the reform measures imposed by the imperial ones. The restoration of the city has been accomplished quickly. In 1788 the city was burned during an Ottoman incursion. The new Franciscan church, built in the eighteenth century, now functions as a Roman Catholic parish church, west of the old archaeological site, next to which the new Orthodox cathedral was built, under the leadership of Bishop Laurențiu Streza.

After the railways began to appear, the role of Caransebeș increased steadily. At the end of the 19th century the Romanians from the city elected Traian Doda, Hungarian general in the Austrian army and a great fighter for the few political rights that the Romanians had at that time in the Austro-Hungarian dualism. Following the unification of Transylvania with Romania in 1918, Caransebeș became part of Greater Romania. During the communist regime Caransebeș Airport was built and an air base near the city (figure 1).



Figure. 1 Caras-Severin county

Following the exact determination of the objective to be measured in the first stage, the land was recognized and the working method established. The present work was carried out in the city of Caransebes on the fortress street for a distance of 2 km in order to create a bicycle track.

The total Leica station from the TPS400 range was used, which has a data memory of at least 10,000 measurements, offering the advantage of executing large-scale works in a relatively short time. Field handling is fast and accurate with the laser centering system and digital display of the toric level. Horizontal micrometric motion screws have the possibility of infinite rotation, providing speed and precision when measuring (ŞMULEAC, A. ET ALL., 2017).

The angle measurement is made with a standard deviation between 3 "and 7". the maximum distance measured with a prism is 3500m in a time of less than 1 second. The data transfer software offers the possibility of simultaneous display on the computer monitor of both the data taken from the total station and the computer's hard disk for fast operation. on files in both directions.

The way of working on the field was as follows:

Install the level on the tripod;

▶ The spherical level of the mounting screws is adjusted;

▶ The target installed on the target point is targeted and it is aimed so that the vertical reticular wire coincides with the vertical axis of the target;

▶ Toric level is reached through the coincidence of the bubble ends;

▶ The readings are made on the target at all three horizontal reticular yarns: at the upper stage, at the middle and at the bottom;

▶ Check the readings on the target with the relationship:

$$c_m = \frac{c_s + c_j}{2} \pm (1...2)mm;$$

For field measurements or performed the following steps:

- To measure angles, through a microprocessor + reading system, appropriate to the circle grading mode

- To memorize the measured data, the programs from the work menu, or data loaded operator (known points coordinates, codes),

- To communicate with the operator, through i through a display et and a keyboard, go ahead the state of the measured values, of the commands in the available programs, of the problems arising according to them Driven.

All these functions are supported by the energy from the batteries or accumulators, which provides function operation components electronic, specific to total stations.

Electronic tachometers allow to solve very different ranges of topographic applications. Into the in the case of tracking and measuring in time the behavior of a construction, the total stations solve with precision raised the problems related to the periodic creation and verification of vertical variation and displacement; and horizontal of the stationary points that define the support network of the subject objective observation.

### **Office stage**

The processing of the field data represents the last and perhaps the most important phase of the work, it requires a great deal of attention especially when entering the raw data from different working sessions and their correct correlation.

Although current software automatically processes data, special attention will be paid to post-processing, and the results of post-processing are good when the precision of the determination of points is millimetric.

### Post-processing of data:

In this stage, all the data files downloaded from the receivers into the software are loaded, the files in the field are carefully monitored.

After performing the field measurements, the device was downloaded and the data obtained were processed. Data processing was done with the AutoCAD software.

AutoCad is a CAD program used to design two-dimensional (2D), less three-dimensional (3D) construction plans, developed and marketed by the American company Autodesk. The system-specific files ("native") are those of the dwg type, as well as the widely distributed dxf (Drawing eXchange Format). Although it was originally designed to run on platforms such as Unix and Macintosh, it was discontinued in favor of the Windows operating system (SIMON M. ET ALL., 2017, 2018).

AutoCAD - computer aided design (computer-aided design) - is the most widespread medium of computer-aided graphics and design, successfully used in fields such as architecture, geography, medicine, astronomy, technique, etc. The first version, called MicroCAD, appeared in 1982, up to the version of AutoCAD 2014. Autodesk has also developed a variety of AutoCAD softwares customized in certain areas: AutoCAD Architecture, AutoCAD Electrical, AutoCAD Mechanical, AutoCAD Overlay, AutoCAD Land Desktop, AutoCAD Map, AutoCAD Civil 3D (figure 2).

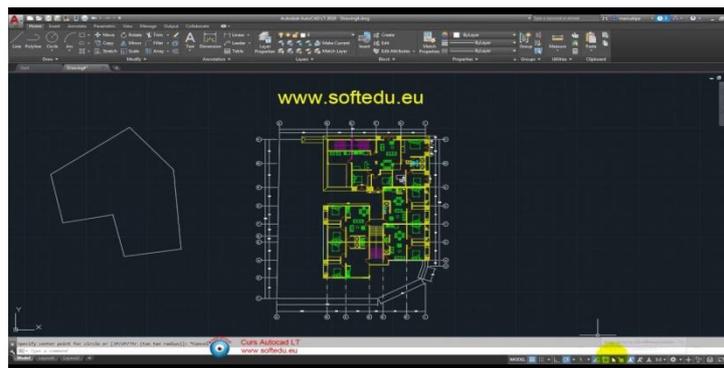


Figure. 2 AutoCAD Civil 3D

After the data processing, the 3D model was developed using TopoLT

The TopoLT application is an indispensable tool in the field of topography and cadastre, fulfilling all the requirements required for field work - office. It works in several languages and can be translated by the user in any language, and the configuration of the functions has been designed in such a way as to cover a wider range of situations. TopoLT runs under AutoCAD, BricsCAD or ZWCAD, using the drawing functions of these programs, in addition to the specific program functions required for topographic and cadastral plans in digital format.

The facilities offered by this program are:

-Reports directly in the drawing the coordinates file, reports directly the coordinates of the total station or sends coordinates from the drawing to the total station;

-you can create the 3D model of the terrain and the level curves, you can calculate volumes without any restriction (the volume obtained by the intersection of a 3D surface with a plane or the volume between two 3D surfaces of any grid shape or triangles);

-you can view the three-dimensional entities of a drawing with real-time rendering, you can save AVI movies with the three-dimensional moving bodies, you can save images, you can view 3ds files, you can attach textures to 3D bodies including attaching some images in coordinated for a photorealistic visualization of the 3D models, the visualization is also valid for the functions of creating the 3D model and calculating volumes;

-raster images can be transformed to make them correlate with the coordinate system of the plane, also raster images can be both cut and framed once the transformation is performed, raster images can be saved in different formats, the color format can be changed;

-draw polygons, paths, or points in Google Earth using the TransLT library, another 3D Space product.

### CONCLUSIONS

Considering the accuracy of the measurements obtained on each point following the network compensation, and comparing the data we can specify the following:

In order to carry out the bending work of the geodetic network, the following measurements were made in the field.

The static method offers the highest precision of determination on coordinates.

The method is practical but requires compliance with the conditions regarding the correct and efficient planning of the points.

From a technical point of view the work ensures the accuracy required by the specifications and the technical norms in force.

The results obtained after the verification highlight the good quality of the total station.

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