

LAND SURVEYS IN ORDER TO CALCULATE THE VOLUME OF A DECONTAMINATED LAND

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Abstract. *This work is achieved in the town Viseu de Sus, Maramures County, D.N. 18. Following discussions we had with a view to this land survey of calculus of an excavated volume, we proceeded to verify the land and choose the best solution from practical and economical point of view. After consulting the National Mapping Center site and seeing the VISE_2.3 permanent GPS station from Viseu de Sus in functional state, we chose the measurements alternative using of a GPS, module RTK. The land surveys for volume calculation were made with the GPS equipment, Hi-Target V30 model, a top brand in China and the rest of the Asian countries. The ratio between price and quality is very good. This GPS model is used for RTK module measurements or in static mode. It is very resistant to water, dust and shocks caused by blows. The material used to construct the GPS antenna carcass is made of a very durable material, however the manufacturer recommends prudence, this being about a precise measuring device. The elevation angle recommended by the manufacturer is at least 15 degrees to reduce errors caused by satellites at the horizon line. At the same time high buildings, water basins, TV antennas, mobile telephones or high voltage power lines can affect the functionality of the device. The land survey is considering settlement of related amounts, following the excavation and decontamination works of the land which hosted a fuel station. The measurements were made with the Hi-Target V30 GPS in RTK mode, after which they were exported and processed with TopoLT version 11.2 and AutoCad Map 2012. Coordinates exported following the measurements were in STEREO'70 because this GPS has installed the TRANSDATRO software. In this way, the coordinates are obtained directly in the stereographic projection system in a secant plane. With the two programs you can work much faster to report points and model them. In order to create the 3D model we used reporting from the TopoLT introduction software of the coordinates obtained.*

Keywords: *GPS, TopoLT, Autocad Map, RTK, TransDatRo.*

INTRODUCTION

To achieve modern measurements, we always need advanced technology. Modern technology has fascinated the engineers and has revolutionized the way of working in certain areas.

In the field of topography and in particular of cadastral rules imposed at the moment, I consider it imperative to use these technologies. Among the most important aspects which technology brings, is particularly noteworthy reducing of the working times. The working time or the period during which a topographic work can be done represents an important factor in determining of the costs. With RTK technology, we shorten the working time, reduce costs with human resources and obtain real-time information.

Thanks to Global Navigation Satellite System (GNSS), we can observe any moving object at any time of the day, regardless of the position on the globe, which the receiver has. This system of satellites includes NAVSTAR (NAVigation System with Timing And Ranging) developed by the US. Being known as the Global Navigation System (GPS), being the most important navigation system currently in use, having a number of 24 active satellites and 4 stationaries. The next major satellite system is developed by the Russian Federation and is known as GLONASS (GLOBAL Navigation Satellite System). The European Commission in

partnership with the European Space Agency has developed the Galileo EGNOS satellite system (European Geostationary Navigation Overlay Service). We can also mention BeiDou 1 and BeiDou 2 (BeiDou Navigation Satellite System), developed by China, which planned several satellites for the next period. The latest satellite system is owned by India and is called the Indian Regional Navigation Satellite System (IRNSS). With the help of satellites and permanent stations provided by A.N.C.P.I. National Authority for Cadastre and Real Estate Advertising in partnership with the National Cartography Center we have a developed network of stations. At present, Romania has a total of 77 Permanent GNSS Stations. The National Mapping Center was established for the achievement of maps, compensation of the levelling network in Black Sea reference plan, development of the number of GNSS permanent stations and aerial mapping of the country.

MATERIAL AND METHODS

Land surveys were made with RTK HI-Target V30 GPS with 220-channel. This is one of the latest generation products from HI-Target range.. This GPS has Trimble BD 970 motherboard. Works with GPS satellites simultaneous L1 C/A, L2 E, L2 C, L5, SBAS simultaneous L1 C/A, L1 P, L2 C/A, L2 P, Giove-A simultaneous L1 BOC, E5A, E5B, E5AltBOC1, Giove-B simultaneous L1 CBOC, E5A, E5B, E5AltBOC1. The initialization time is only 60 seconds. Its initialization in RTK mode is done in about 10 seconds. Bluetooth has a range of up to 50 meters. Internal radio that allows accurate base and rover measurements. The GSM / GPRS modem of the V30 receiver is internal. Its data formats are: CMR+, CMRx, RTCM 2.3, RTCM 3.0, RTCM 3.1. In static mode, recordings can be made at one second. Static measurements are downloaded directly from the GPS antenna. Horizontal accuracy in static mode is +/-2,5 mm + 1 ppm. Vertically in static mode we have +/-5 mm + 1 ppm. In RTK mode, the accuracy is lower. At RTK measurements on horizontal we have +/- 1 cm + 1 ppm and vertically +/- 2 cm + 1 ppm. The device is very resistant to shocks and dust. According to the manufacturer it resists in water at a depth of one meter. Resistant to falls from a height of 1.5 meters. The controller has a processor of 806MHz with Windows Mobile 6.5 operating system.

The battery is 3.7 V, 3100 mAh lithium allowing functioning lasting. The working software installed in controller is RTK-Road (with Stereo 70 projection in RTK mode implemented). The device's RAM is of 256 MB and the storage space is of 8 GB.

This allows storing several thousand projects with measurements on the device. Color Display Led of 3,7 inch with touch screen and communication with other devices can be done via USB, Bluetooth and WIFI. Resistant to working temperatures from -20 to + 70 degrees Celsius. Also the controller is very resistant to falls, so it can withstand to a fall of 1.5 meters. Water and dust resistance is given by IP 65 class. It holds the certifications FCC class B, CE Mark, EN60950, RoHS, FM Class I, Div 2.

The advantages of the Hi-Target V30 GPS are that you can insert saved measurements in dxf and it can be very easy to work on plottings. Automatic connection to ROMPOS service is confirmed by a voice command located in the GPS antenna. The way of working can be adapted depending on the conditions under which measurements are made. This device can perform measurements where the GSM signal is low, while other models can not do so. As a way of working we mention Rover, Base, Static as well communication mode Internal UHF. The UHF internal mode allows base and rover measurements up to 2 km, depending on the area where the measurements take place. With an external radio, base and rover measurements

can be made over a distance of 20-30 km in areas where there is no GSM coverage or where the permanent GNSS station is not functional.

Following the topographic measurements, a total of 310 points were collected in the Stereo format 70. For point processing we used Autocad Map 2012 and TopoLT version 11.2. TopoLT is a program especially used for cadastre and topography adapted for processing data from GPS and total stations. This software allows you to report points in 3D to view the elevation marks of the points. In Autocad Map, the TopoLT software loads using the command "_appload". Using the "rapact" command, we insert the points measured in Autocad. When reporting points, we'll enable the "3D Plan" option.



Figure 1. Reporting of the points in 3D and visualization in Autocad Map 2012

RESULTS AND DISCUSSIONS

For 3 D model development we use the command "M3D" from TopoLT and we obtain a model very well defined on colors and lines for viewing and rotation of the topographic works. Following modeling, we observe the shape of the studied pit. After a closer analysis, it is noticed that the model obtained does not have an identical reference elevation that we can use as a reference elevation. The pit does not have an elevation mark that we can use as a reference plan as the software requires. We have been building a 3D model as a reference. By building of a 3D polyline on the contour of the pit we have built a cap, which can be used as a reference plane on the upper part for the volume calculation.

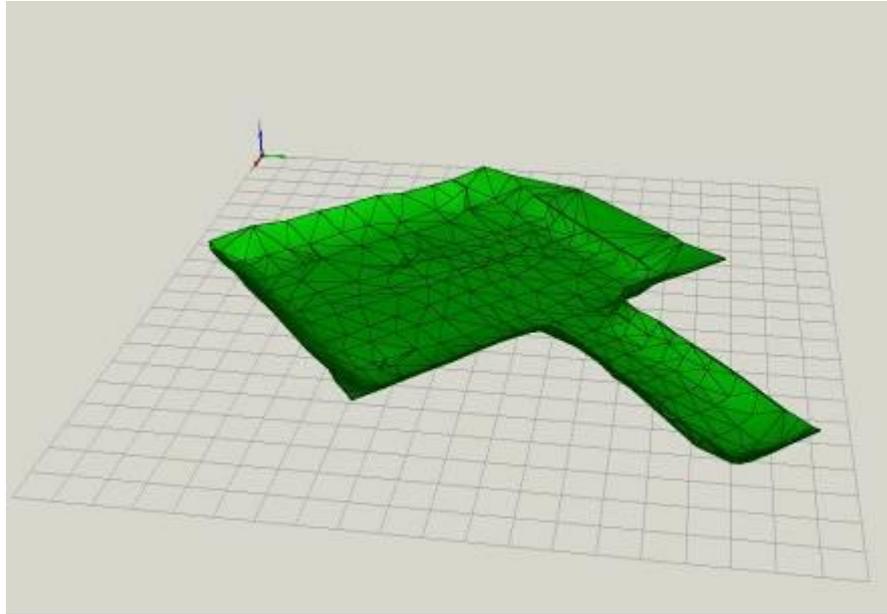


Figure 2. 3D modeling and viewing with TopoLT version 11.2

In figure 3 we can notice the shape of the cap obtained by 3D modeling achieved on the contour of the excavated area. The cap will be used as a reference model for obtaining a quantity of excavated earth as accurate as possible.

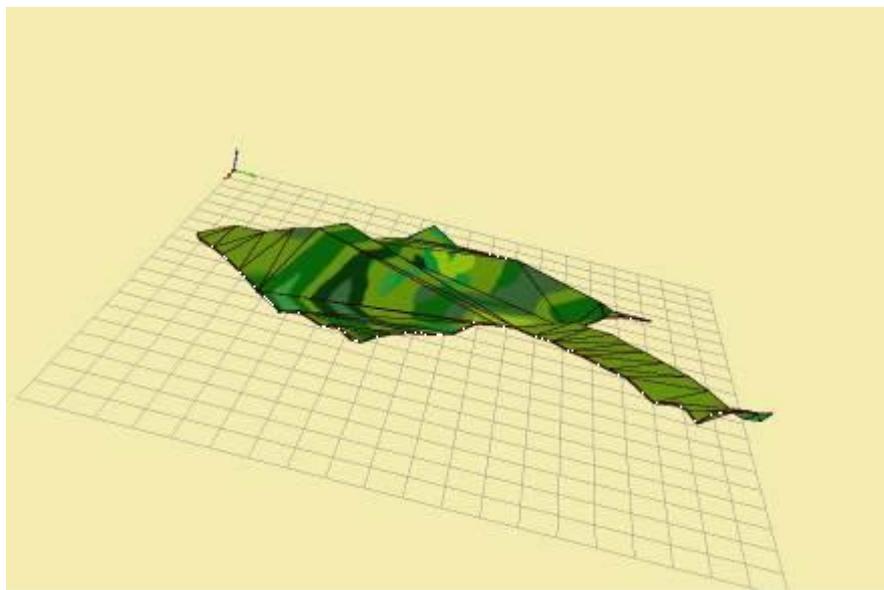


Figure 3. 3D Model of the Pit's Cap viewed in TopoLT Version 11.2

Using the "vol" command, we will calculate the volume between the two superimposed 3D models as a reference. The model in Figure 1 will be superimposed on the model in Figure 2 and we will obtain the excavated volume.

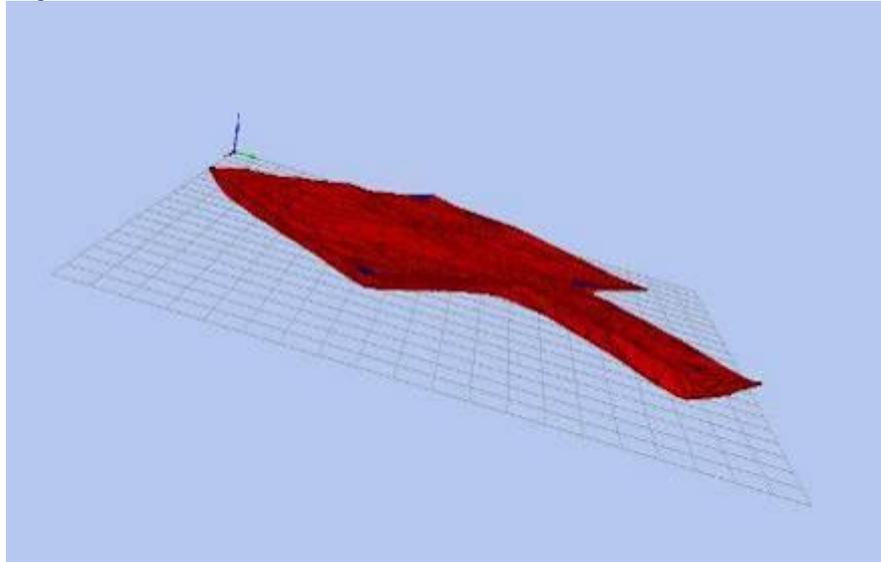


Figure 4. 3D model with volume viewed in TopoLT version 11.2

Finally, we have obtained a volume of 3,449.5 m³ of excavated earth. The data was handed over to the company that carried out the excavation and decontamination of the polluted land. In addition, we made a plan, on which we replayed the excavated quantity and the level curves for the respectively pit.

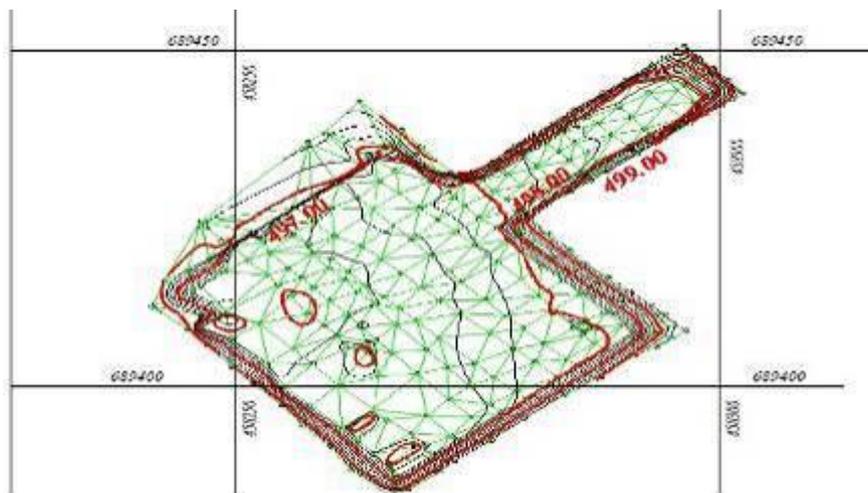


Figure 5. Table at scale 1:500 level curves

For level curves, we used a frequency of 1 meter per elevation mark for the main line (red) and 0.25 meters per elevation mark for the secondary line (black). On figure 5 we can notice that there are pits in five places where the smallest elevation mark is of 495.40 meters.

The maximum elevation mark is of 500.57 and is located in the north part. The plan is fronted to the north according to the legislation in force and has grid lines with frequent of 50 meters specific for the 1: 500 scale. With the help of the grid, the competent institutions in approving building permits for certain sites, where lay-out plans have been made, can easily locate real estates. The main authority directly interested is the Environmental Agency and then the ones specified in the urban planning certificate.

CONCLUSIONS

The land surveys can be accomplished much faster with GPS equipment, which are working in RTK mode. Costs are lower due to the fact that one person alone can perform the land survey. The connection mode in RTK was achieved by connecting to VISE_2.3 GNSS permanent station.

The measurements being achieved in the town Viseu de Sus and the permanent station being very close, the accuracy of the elevation mark was between 1 and 2 cm. RTK technology competes with total stations thanks to its fast way of collecting data and processing of them. Certainly, this technology does not apply to topography domain when it comes to plotting buildings, roads, bridges, and other specialized works that requires a high precision. In the domain of cadaster and works for volumes calculation is the ideal technology.

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