TOPOGRAPHIC WORKS FOR VOLUME CALCULATION AND TECHNICAL-TOPOGRAPHIC DESIGN AT GREENING OF LANDFILLS

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Abstract: *This paper aims at calculating volumes at landfills and designing the volume of waste on a topographic site, with a view to the greening of the respective deposits. The work was carried out at the landfills in Bocşa and Herculane localities from Caraş Severin County, Alba Iulia from Alba County and Viseu de Jos from Maramureş County. The measurements were made using a Trimble 4800 GPS, using the Rompos permanent stations. Rompos is based on global navigation systems via GNSS satellites (GPS / Glonas / Galileo), providing data for positioning purposes. At present, the positioning system provides coverage of the entire Earth's surface, being in the same time a unitary reference system, so called global positioning system (GPS) with satellites. Global Navigation Satellite System (GNSS) uses the positioning technique of objects in moving and / or static at any hour from day and night, 24 hours a day, anywhere on Earth, with real-time information delivery The reason for using multiple reference stations in a GPS correction network is to model and correct the errors dependent of distance, that reduce the precision of the RTK position in proportion to the distance between the Rover and the nearest reference station. Monitoring and control of the permanent GPS station is made through a simple internet connection of the computer serving this station. The Trimble 4800 GPS software allows this connection through the functions it holds. Static and cinematic measurements (RTK) were made within the frame of this paper, static measurements were made for determination of the building site markers and the kinematic ones for the calculation of the waste volumes being in the respective locations. The volumetric calculation was processed by using a SurvCe software, version 2.3 and by using of AUTOCAD MAPS 2012, TOPOLT 11.2 program.*

Key words**:** *GPS Trimble 4800, RTK, Rompos, AutoCad Maps 2012, TopoLT*

INTRODUCTION

The emergence of GPS technology is a step forward in obtaining precision measurements with increased work speed. Each satellite transmits an electromagnetic signal that transmits information to a device (GPS receivers) that can receive the signal. The satellite has a precision oscillator with a fundamental frequency of 10.23 Mhz, from which derives the other two frequencies L1 = 1575.42 Mhz and L2 = 1227.60 Mhz.

The GPS receivers must receive a signal from at least 4 satellites and have the following components: antenna, connector cable, computer, battery, surveying rod.

Interceptions of multiple satellites simultaneously, allows the cancellation of major sources of errors in satellite observations, result which, in case of GPS technology is reflected by obtaining of a relative positioning accuracy of 1ppm (parts per million).

A superior advantage of using GPS equipment is that it does not require the measurements of angular and and distances in field, thus eliminating many of the inconveniences of the intelligent total stations, thus leading also to reducing the costs for performing topo-cadastral works of materialization of the geodetic points.

The system adopted for GPS is a system according to WGS 84 (World Geodetic System 1884). The GPS receiver measures the time it takes for a signal to propagate from the

satellite to receiver. The position of the points on the terrestrial surface is given by the orthogonal coordinates x, y, z reported to the origin of the system according to WGS 84.

Based on ROMPOS services, the coordinates of the points can be determined. Using this service, they can retrieve data from the GNSS (Global Navigation Satellite System) reference stations and can fit their land survey network into the ETRS89 Reference and Coordinates system.

MATERIAL AND METHODS

The topographic quotas for this work were made with the Trimble 4800 GPS used as a rover for static and kinematic measurements (RTK) . The device has the following features:

- in the static mode precision of: ±5 mm + 0,5 ppm Horizontal
  ±5 mm + 1 ppm Vertical

-in the kinematic mode precision of: ±1 cm + 1 ppm Horizontal
±2 cm + 1 ppm Vertical

General Performance:

Start-up: <30 seconds from power-on to start survey with recent ephemeris

Measurements: L1 C/A code, L1/L2 full cycle carrier. Fully operational during P-code Encryption

Number of channels: 18

Data logging: In internal memory; in TSC1 data collector; or on TSC1 optional removable PC card

Receiver data storage: 50 hour internal memory of L1/L2 data, 6 satellites, 15 second interval. Unlimited data storage using optional TSC1 and PC data card.

The devices can operate at an ambient temperature of -400 C to +550 C, resist at dropping shocks from 2 m high.

For the correction of the measurement, multiple permanent reference stations RO_VRS 2.3 GPS (VRS-Virtual Reference Stations) have been used The way of working VRS represents for Rover the entire network, as a single reference station.

The coordinates of registered points by receiver from the satellites are converted to the STEREO 70 system with the TransData 4.1 application. The coordinates recording is done in files type ASCII 11. By using of the SurvCe software version 2.3 the volume calculation is done.

It is identified the surface on which the landfill greening designing is made, after which the surface resulting from the difference between the initial surface of waste and the designed surface is calculated. Knowing this surface, with the TopoLT program, the volume of waste that have to be dislocated is calculated.

After finding out the dislocated volume, it will be carried out the design of the geometric shape on which it will have the final, ecological form of the landfill on a given surface.

ASCII files are copied to TopoLT where, based on the information we hold, we design the geometric form of the landfill greening .

RESULTS AND DISCUSSIONS

As a result of the measurements, the coordinates of the points were obtained. Using the ROPOS satellites, the TRIMBLE 4800 GPS and the TRANS DATA program, the

coordinates of the points were obtained in the STEREO 70 system. The density of the measured points is of 4 points per 100 square meters.

The land survey is done over the entire surface occupied by waste. It is calculated the volume of waste on the measured surface, knowing the coordinates of the points and using the SurvCe program, version 2.3. Having knowledge about the volume of waste it follows the technical-topographic design part of the landfill. We have a surface of land on which we have to execute the project. We download the coordinates of the points from the TRIMBLE 4800 GPS in the TOPOLT program, in "Receiving coordinates", we choose "from file" (file ASCII 11 in GPS TRIMBLE) and "ok". Having the points on the drawing it is drewn the surface occupied by the waste. It is introduced the surface on which it is made the designing waste greening.

Having this information, it is calculated the surface of waste that have to be dislocated (the difference between the initial surface and the design surface) With TOPOLT program, the following steps are taken: "3D Model" → "Create 3D Model" → "Volume Calculus" it is found out the amount of waste to be dislocated. Knowing the volume of dislocated waste it follows the "3D modeling" designing using the TOPOLT program on the given surface for greening of the landfill.

The volumes calculated at the landfills are presented below:

A. At the landfill from Bocsa, Caraş Severin County:

- The total volume of waste is 30872 cubic meters on an area of 30049 square meters;
- The volume of waste that has to be dislocated is of 10328 cubic meters;
- Designing the greening is done on an area of 14,850 square meters.

The presentation of the original land survey is shown in the figure 1:

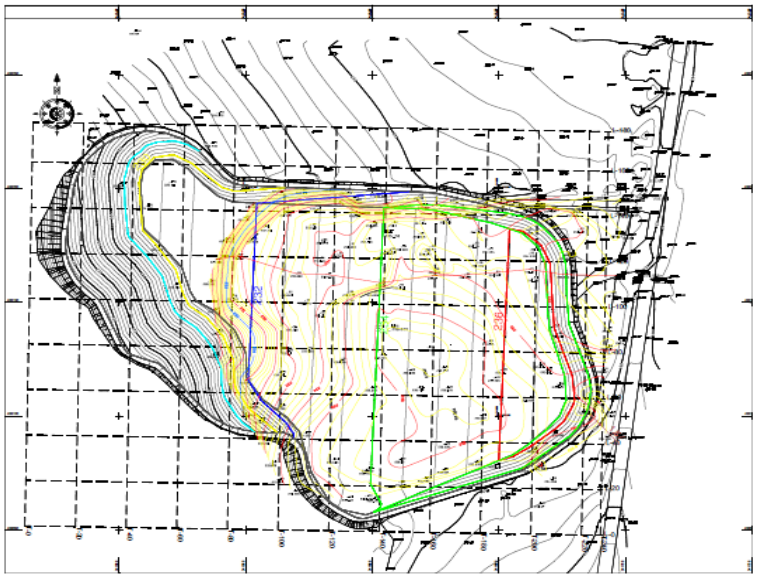


Figure 1. The presentation of the land survey at the landfill from Bocsa, Caras Severin County.

The presentation in 3D of the volume of the landfill is shown in Figure 2 and in Figure 3 is presented in 3D the final design of the volume of the ecological deposit:

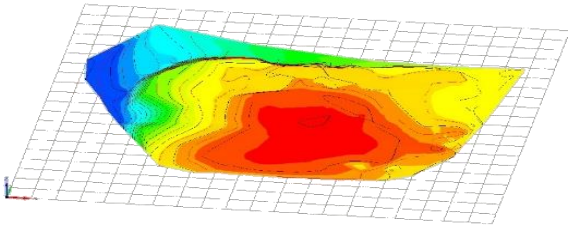


Figure 2. The presentation in 3D of the volume of the landfill

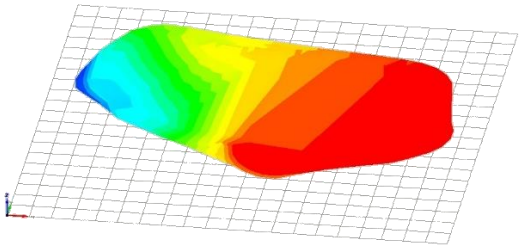


Figure 3. The final design in 3D of the volume of the ecological deposit

B. At the landfill from Herculane, Caraş Severin County:

- The total volume of waste is of 25321 cube meters on an area of 15 268 square meters;
- The volume of waste that has to be dislocated is of 10076 cube meters;
- Designing the greening is done on an area of 10 321 square meters.

The presentation of the original land survey is shown in the figure 4:

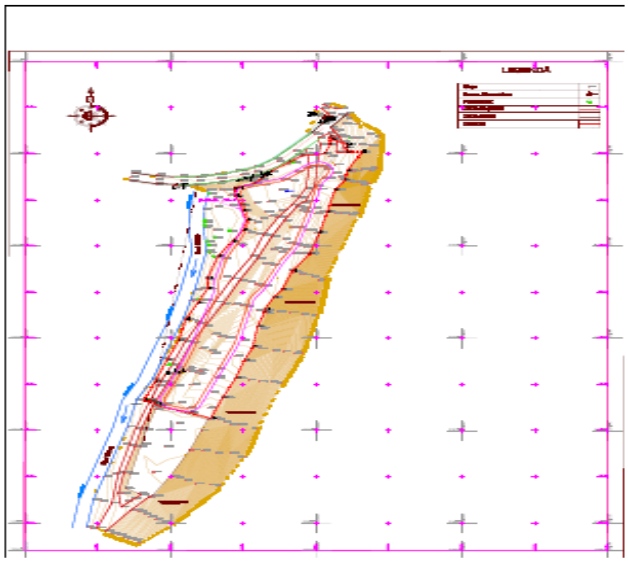


Figure 4. The presentation of the land survey at the landfill from Herculane, Caras Severin County.

The presentation in 3D of the volume of the landfill is shown in Figure 5 and in Figure 6 is presented in 3D the final design of the volume of the ecological deposit:

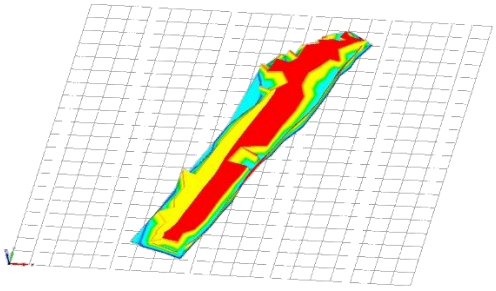


Figure 5. The presentation in 3D of the volume of the landfill

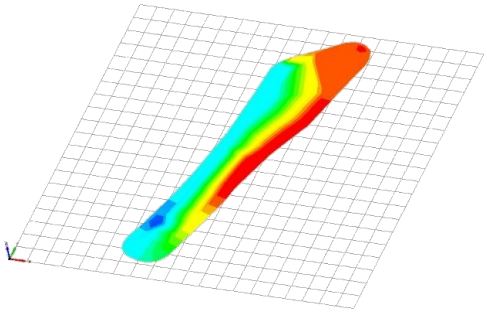


Figure 6. The final design in 3D of the volume of the ecological deposit

C. At the landfill from Alba Iulia, Alba County:

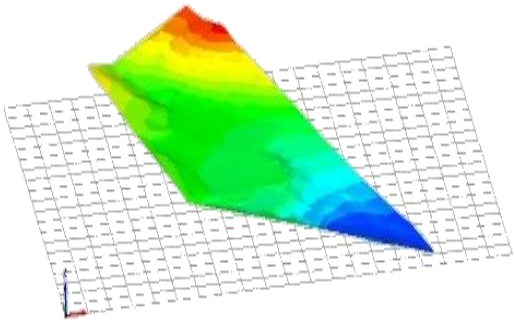
Figure 7. The presentation of the land survey at the landfill from Alba Iulia, Alba County

- The total volume of waste is of 250893 cube meters on an area of 54667 square metres;

- The volume of waste that has to be dislocated is of 50321 cube meters;
- Designing the greening is done on an area of 33 706 square metres .

The presentation of the original land survey is shown in the figure 7:

The presentation in 3D of the volume of the landfill is shown in Figure 8 and in Figure 9 is presented in 3D the final design of the volume of the ecological deposit:



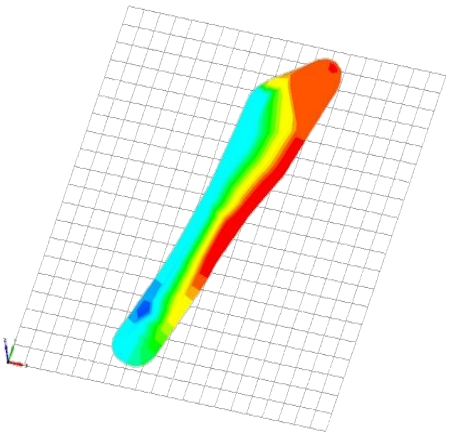


Figure 8. The presentation in 3D of the volume of the landfill

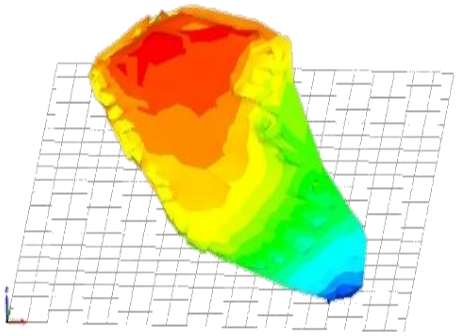


Figure 9 The final design in 3D of the volume of the ecological deposit

D. At the landfill from Vişeu de Jos, Maramureş County:

- The total volume of waste is of 35021cube meters on an area of 15798 square meters;
- The volume of waste that has to be dislocated is of 22408 cube meters;
- Designing the greening is done on an area of 10664 square meters

The presentation of the original land survey is shown in the figure 10:

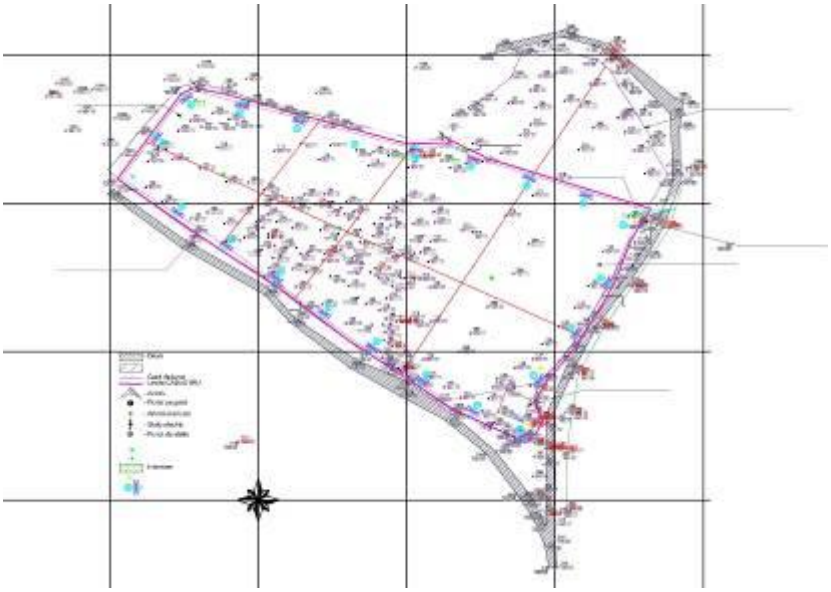


Figure 10. The presentation of the land survey at the landfill from Viseu de Jos, Maramures County

The presentation in 3D of the volume of the landfill is shown in Figure 11 and in Figure 12 is presented in 3D the final design of the volume of the ecological deposit:

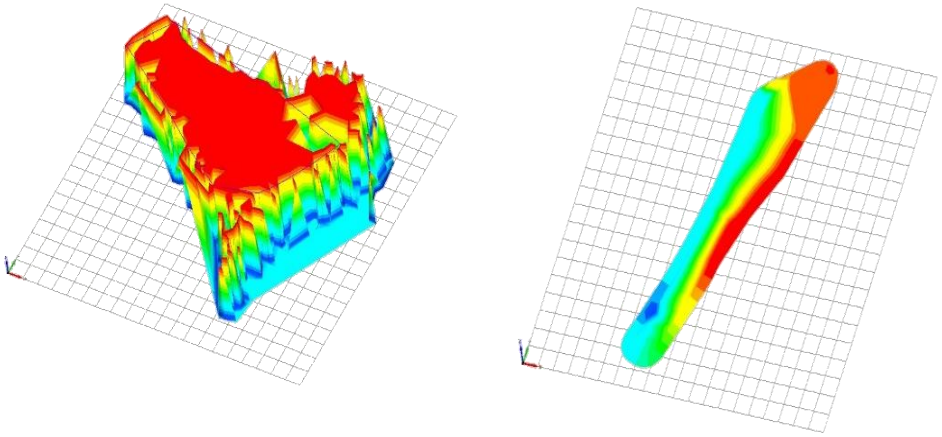


Figure 11. The presentation in 3D of the volume of the landfill

CONCLUSIONS

The calculation of the volumes and the designing of the landfills greening form was done in Bocşa, Herculane (Caraş Severin County), Alba Iulia (Alba County), Vişeu de Jos

(Maramureş County). The TRIMBLE 4800 GPS was used, the point determination method was static and kinematic. It was used as permanent station RO_VRS 2.3 GPS.

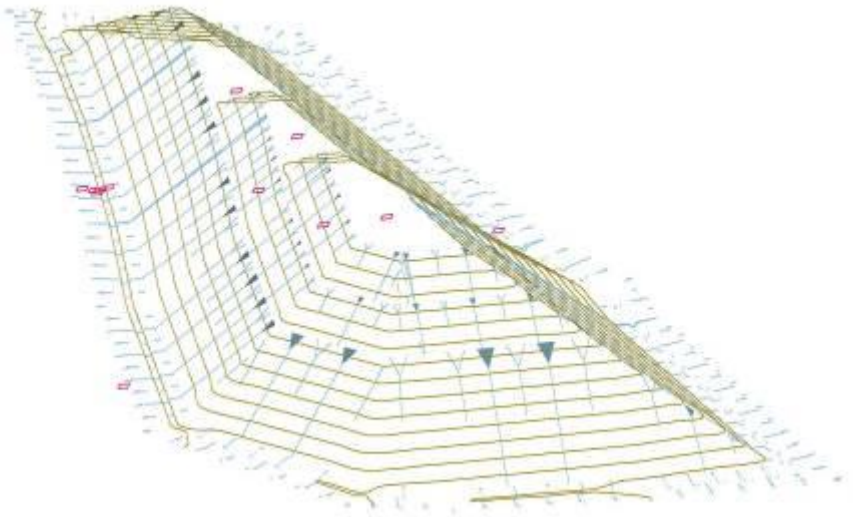


Figure 12 The final design in 3D of the volume of the ecological deposit

Topographic measurements were made to calculate volumes in order to determine the amount of waste that has to be dislocated for being able to design the form of greening of the landfill. The coordinates were obtained in the STEREO 70 system and the calculation of volumes and designing of the final form of the deposit was made with the AUTOCAD MAPS 2012, TOPOLT 11.2.

BIBLIOGRAFY

CRISTA FL.,2014, Conservarea Fertilitatii Solului Si Managementul Nutrientilor, Agroprint,Isbn 978-606-8037-72-1

IMBREA FL, 2011, Proiectele de cercetare în domeniul agriculturii în parteneriat public-privat–provocări privind managementul și finanțarea, Agrobuletin Agir An III

IMBREA FL, 2011, Cercetarea agricola mai aproape de ferma, Agrobuletin Agir An III

SMULEAC A., I. NEMES 2017 , Măsurători geodezice prin unde, Timisoara, Ed. Mirton

ȘMULEAC L.I., S. NITA, A. IENCIU, A. ȘMULEAC, D. DICU, 2016, Topographic survey for the monitoring of the impact of the BRUA/ROHUAT pipe on water flow in the irrigation system at Fantanele, Arad county, Romania, GeoConference SGEM 2016, SGEM Vienna GREEN Extended Scientific Sessions, SGEM2016 Conference Proceedings, ISBN 978-619-7105-81-0 / ISSN 1314-2704, , Book 3 Vol. 3, p. 333-340

ȘMULEAC A., C. POPESCU, F. IMBREA, G. POPESCU, L.I. ȘMULEAC, 2016, Topographic and cadastre works for the establishment of an animal farm with NPRD funds, measure 121, Varadia, Caras-Severin county, Romania, GeoConference SGEM 2016, SGEM Vienna GREEN Extended Scientific Sessions, SGEM2016 Conference Proceedings, ISBN 978-619-7105-79-7 / ISSN 1314-2704, Book 6 Vol. 3, 685-692pp;

ŞMULEAC A, I NEMEŞ, IA CREŢAN, NS NEMEŞ, L ŞMULEAC, 2017, Comparative Study of the Volumetric Methods Calculation Using GNSS Measurements, IOP Conference Series: Materials Science and Engineering 245 (5), 052020

ŞMULEAC A, C POPESCU, L ŞMULEAC, 2014, 3D land modelling using gps technology in Bencecu de Sus, Timis County, Romania, Research Journal of Agricultural Science 46 (2), 344-353

A ŞMULEAC, S ONCIA, C POPESCU, M HERBEI, L ŞMULEAC, 2013, Topographic Surveys For The Updating Of Soil Improvement Works In A Teaching Experimental Station, Research Journal of Agricultural Science 45 (2), 279-286

WWW.ANCPI.RO

HTTP://WWW.CNGCFT.RO

HTTP://WWW.EPNCB.OMA.BE

HI-TARGET V30 GNSS RTK SYSTEM OPERATION MANUAL

HI-TARGET HI-RTK ROAD SOFTWARE MANUAL