

ASPECTS REGARDING THE EVALUATION OF EXCAVATED VOLUMES FROM CORBII MARI, DÂMBOVIȚA

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Abstract

Through studies and research in this paper was intended to carry out the calculations of volumes of clay excavated from Corbii Mari quarry, Dâmbovița county, in order to locate and quantify the amount of material excavated from an excavation in case of embankments.

Topographic surveys were made by specialized teams strictly following the steps of obtaining the topographic plan: enriching the support network, obtaining the levelling network and obtaining the topographic plans.

The measurements followed by office calculations performed by automated methods and through dedicated software will determine the volumes of the amount of sterile soil respectively the amount of extracted clay.

Key words: evaluation, excavated, quarry

INTRODUCTION

„In mining and excavation works, volume calculation is extremely important both in terms of geodesic and economically. First, excavation has more variables and unknowns — you don't know what's down there until you start digging; second, you have to rely on information from many sources — some of which may not be accurate” (Fodor D., 1980). The aim of this paper is to highlight the differences between working methods and the differences that we have achieved and also to calculate excavated volumes of earth, sand, ballast and refusal sieve. „Depending on the construction and the location of excavation is necessary to establish the technical solutions that protect neighborhoods, reducing the risks associated with deep excavations to a minimum acceptable” (Ortelecan M., 2006). The works were held in Dâmbovița County, at Corbii Mari quarry (Figure 1).



Figure 1. Orthophotomap of the quarry

The acceptable limit is, however, difficult to estimate, requiring complex investigations of the site and then modeling of the overall support structure to estimate its behavior and impact on neighborhoods.

Geotechnical investigations were carried out in several stages. In the first phase there have been completed three drillings: two drillings of 45 m depth and one of a 60 m depth. From these drillings there were taken samples for laboratory tests carried out with simultaneous

penetration of SPT type (Small Precision Tools). The drillings of 45 m were additionally equipped with piezometers for hydrogeological analysis of the site.

Calculation methods have been developed along with technology, especially as the calculation of the excavated materia is an operation too difficult or has inaccurate results by classical methods. One of the classical methods of calculating volumes is truncated pyramid method. This method consists of construction of fixed transversal profiles on the embankments.

It is calculated the area of the simple geometrical figures formed by the profile before and after the excavation and measuring the depth of excavation and the distance between two or more profiles, reaching the volume of excavated material. It is a laborious work that has to be treated with attention and a lot of working time. But nowadays the technology explosion and informatics which made daily advances help us perform these calculations with higher precision and much faster by many software and specialized programs.

MATERIALS AND METHODS

To facilitate the measurements around the quarry area there were built a network of 6 points whose coordinates were determined with high precision and were materialized in the ground by concrete terminals. The orientation point was Cioaba point. Surveying was done by traverse combined with radiation method and with the help of state geodetic network with points determined with high precision we were able to verify all measurements and to reduce errors. Drilling points were made by the method of radiation.

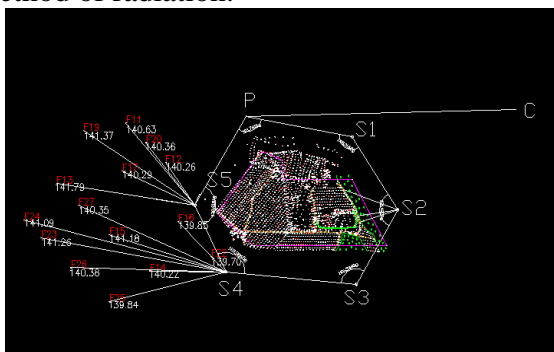


Figure 2. Traverse method combined with radiation

The equipment that was used to make the measurements was the Sokkia 630-R total station (Figure 2).

Table 1. Coordinates of the network points around the quarry

Point	X	Y
C	339405,33	544411,66
P	339357,299	542439,434
101	339209,05	543212,83
102	338682,14	543546,72
103	338143,68	543243,84
104	338235,28	542287,95
105	338715,45	542062,88

Regarding the office stage, the data were downloaded from the total station and using them we made a topographical plans. Using specialized software, 3D terrain model was made which showed us the real situation of land during the time which we analyzed the amount of excavated material.

The software we used for the analysis of volume calculations are:

- AutoCAD 2007- TopoLT
- Surfer v 9.8

RESULTS AND DISCUSSIONS

By creating 3D models in the two softwares we wanted to track the most accurate software in assessing and quantifying the volume of excavated material. Measurements were performed in two phases: 2008 and 2009 on the two lakes. After the representation of the points in the two softwares was performed the longitudinal profile, transversal profile and topographic plan at 1:2000 scale. The 3D models were made in both ages in AutoCAD-TopoLT and Surfer 9 (Figure 3, Figure 4), with the aim to follow differences between the two softwares in the way that they shows the terrain after excavations.

With these two softwares we obtained the following 3D models:

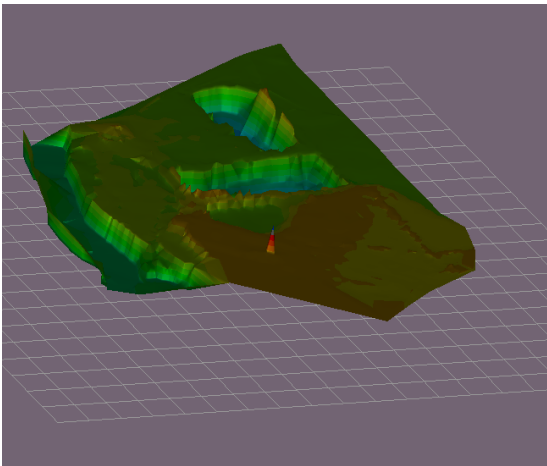


Figure 3. The AutoCAD-TopoLT 3D Model

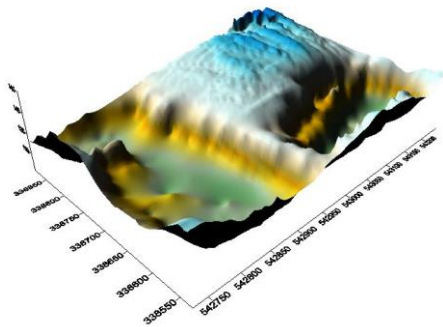


Figure 4. The Surfer 9 3D Model

In TopoLT for the volume calculation, the program automatically overlap the chosen 3D Model and calculates the cut & fill volumes (Figure 5, Figure 6.)

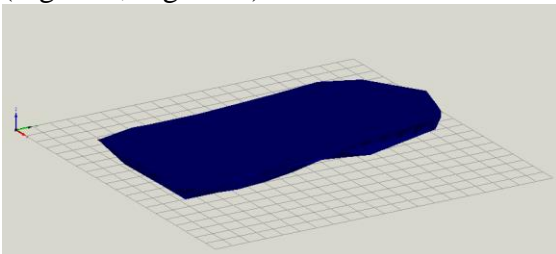


Figure 5. AutoCAD-TopoLT, Lake 1

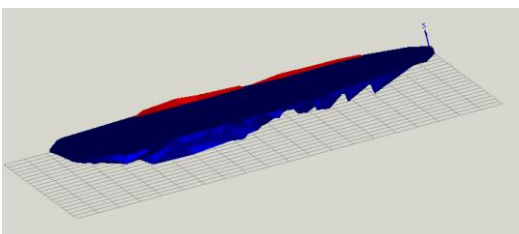


Figure 6. AutoCAD-TopoLT, Lake 2

In Surfer 9 the volumes were calculated by two rules: the trapezoidal rule and the Simson`s rule (Figure 7, Figure 8). With the Surfer version 9 we created a grid file which one we could create the 3D Model and then we calculated the volumes (Table 2).

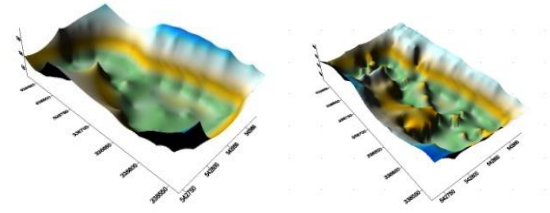


Figure 7. Surfer 9, Comparison of the Lake 1 in two ages

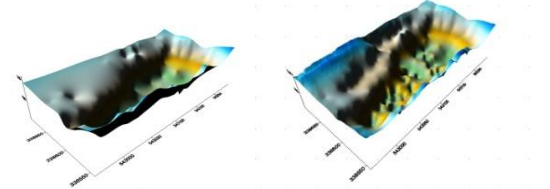


Figure 8. Surfer 9, Comparison of the Lake 2 in two ages

Table 2. Results of the volume calculation

Software	Cut	Fill	Cut+Fill
AutoCAD-TopoLT	214414.8 8 mc	76247.26 mc	290662.1 4 mc
Surfer 9	218445.7 8 mc	76850.52 1 mc	295296.7 1 mc

CONCLUSIONS

Between these two softwares the most precise is the AutoCAD TopoLT because it makes the 3D Model using a triangulated network. The volume calculation result that we have obtained using Surfer program are not very accurate as the results from TopoLT.

Surfer allows the evaluation of data using the 3D model, the vectorial model and level curves. It is easy to use because it has the Excel worksheet. Instead TopoLT AutoCAD has many tools for processing data and allows to overlap the 3D Models.

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