Scientific Bulletin of Politehnica University of Timişoara

Transactions on HYDROTECHNICS

Volume 60(74), Issue 2, 2015

RESEARCH ON THE ACHIEVEMENT DIGITAL TERRAIN MODEL TO BIRTZ QUARRY, AGHIREŞ VILLAGE, CLUJ COUNTY

Ioan Voina[1] **Bala Alina Corina[2]**
Brebu Floarea Maria[3]

Abstract:
This paper aims to present the achievement of digital terrain model on rock quarry of gypsum mining Birtz located in the municipality Aghireş, Cluj County, Romania. The methods and techniques used is nationally and internationally innovation of the last decade, so the terrain engineering method used in this paper bring an important contribution to research and studies in achieving digital terrain model. The presented technology and results achieved and materialized by achieving a digital terrain model on rock quarry of gypsum exploitation remembered, describes the importance and applicability topography engineering in identifying optimal solutions.
Keywords: Digital Terrain Model (DTM), Exploitation, Real Time Kinematic (RTK), Surveying.

1. INTRODUCERE

With the development of the specialized software applications was realized possibility of approaching and solving complex problems concerning automation and process optimization are used field data. Computer representation of the shape and size of the earth requires a detailed mathematical modelling, known as the "digital terrain model". Modelling consists of a set of mathematical equations defining in detail the shape of the Earth's surface and has an approximate surface rigorously mathematical actual land area. Therefore, the digital terrain model is meant digital representation of the earth's surface through a mathematical model that approximates land surface terrain modelling that can be used in various applications civil, industrial and land-based data.

The product obtained is known as digital terrain model (DTM). It can display following a process called rendering three-dimensional or use computer simulation of physical phenomena. Technology used is an advanced package designed to generate contours and three dimensional digital plans of various kinds. This innovation, transform the data obtained from measurements topographic editable results, high quality, with multiple themes, such as: contour, surface, network spacious terrain model, and plan cyberspace vector image. Exporting graphics in many formats, objects and elements of detail can be viewed permanently using a carefully structured forms, with the possibility of selective display product elements that make up the final result.

A full three-dimensional digital model has carefully underlined a form as shown in Figure 1.

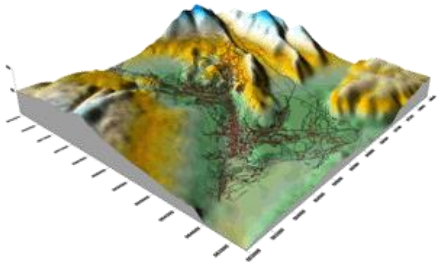

Figure 1. Digital Terrain Model

The case study in this paper aims at delivering digital model of the rock quarry of gypsum mining,, Birtz "Aghireşu is located within the village, east of Valley Leghiei on the left side of the creek Batoş, in Cluj County, Romania . The method of mining of gypsum rock is one stepped righteous descendants. In the extractive sector career, it was conducted a joint anti dust system, consisting in stone wetting of gypsum by spraying water into the fine crusher and

[1] Technical University of Construction Bucharest, Faculty of Geodesy, Department of Topography and Cadastre, nutu_rc@yahoo.com.
[2,3]Politehnica University Timisoara, Faculty of Construction, Department of Overland Communication Ways, Foundation and Cadastral Survey, alina.bala@upt.ro , floarea.brebu@upt.ro

mechanical powder-guided aspiration into a cyclone fitted with bagging.

Figure 2. Birtz mining perimeter, Aghireşu village, Cluj County, Romania

The basic principle of digital terrain modeling is to define an area using rectangular coordinates x, y, z of the points that define the shape and dimensions of the field, points determined and recorded in a data file.

In order to achieve an automatic interpolation of the interpolation program is required to be able to permit automatic finding points neighboring planimetric point given by coordinates x, y and z interpolate the share point. Digital terrain modelling requires the fulfillment of certain conditions such as:

- data necessary for carrying digital terrain model must be obtained in a simple and effective way;
- digital model made with sufficient precision to approximate the terrain;
- calculations automatic interpolation share digital model does not require a very long time to achieve efficiency. Depending on the source and method of achieving data, digital terrain model can be classified as:
- digital model based on the classic surveying, are used points and feature lines of the land;
- digital model based on the quota of points taken at a certain time or distance;
- based on the digital model of the terrain equidistant profiles or contours of a certain equidistance;
- digital model based on the randomly chosen points and the characteristic points of the land.

2. METHODS USED IN CARRYING DIGITAL TERRAIN MODEL

In the last decade it was developed a number of means and methods to determine the spatial points, from traditional methods to picking up all the points by photogrammetry and laser scanning methods. One of the most frequently used means in order to determine of magnitudes topography is total station.

The measuring instrument is actually a complex electronic tachometer that performs processing station measured values, displaying measured values directly. A Total Station allows a number of operations such as (Figure 3):

- calculating the angle of orientation based on measured directions to points with known coordinates;
- calculating the coordinates of a point based on measured data and stored in the memory these coordinates;
- calculating distances, differences in level and orientation between two points;
- polar element calculation (position and height) of an existing in memory and point station;
- calculating coordinates of of station by resection method, the old points with coordinates saved in memory or being placed manually on the keyboard.

Figure 3. Total station

A second means of determining the quantities needed to elaborate a digital terrain model is GPS system equipment (Global Positioning System), which is a global positioning system based on artificial satellites and radio waves (figure 4).

Figure 4. GPS system

Among the methods for determining the horizontal and vertical position necessary for carrying digital terrain model are: the static method, the method of Real Time Kinematic (RTK) and Post Processed Kinematic method (PPK). The development of this equipment has brought to the evolution of electronic instruments for surveying and was thus created an integrated and constructive, namely Smart Station system which consists of a total station to which they attached coaxially with the main axis module ATX1230. This instrument is nothing but a dual-frequency RTK GPS receiver L1 and L2, each with 12 channels, strong signal and directly related to the total station.

Figure 5. Integrated Smart Station

Another means revolutionary and topical means are laser scanning equipment. Laser scanning technology is part of the latest methods of collecting geo-data. This method is applicable especially in

areas that use 3D data with high accuracy. The main product of laser scanning is a set of 3D coordinates of the points reflected called cloud points. The final result of the processing of laser scanned data can be, for example, a very detailed model of the surface of the terrain or a pattern of triangulation or general 3D vector model.

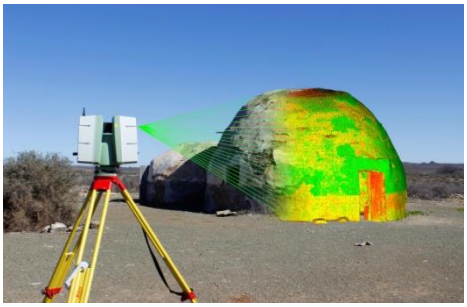

Figure 6. Terrestrial Laser Scanning System

To achieve digital terrain model of data recorded using linear and nonlinear interpolation method based on the support points that highlights the physical surface area studied.

The mathematical model of making digital terrain model is chosen according to way of electing the planimetric and elevation details.

In achieving digital terrain model can be used several methods such as method of using surfaces for interpolation consumables, interpolation method with surfaces phones interpolation method using a network of triangles and method of using profiles, the latter being the most commonly used practice.

3. ACHIEVEMENT DIGITAL TERRAIN MODEL TO BIRTZ QUARRY, AGHIREŞ VILLAGE, CLUJ COUNTY

Given the complexity of this work is absolutely necessary detailed knowledge of all topographic elements in the work area, without which the actions to be undertaken to design and workmanship would not be possible. It's such a study and identity density geodetic points from the higher order, marked or not, reaching the lower order of previous work and existing and marks leveling. Following these identifications, to conduct a careful analysis of the coverage of land with various details, whether natural components, whether they are diversified namely: construction, utility networks or networks of roads, etc. The main objective of this project is of realization and representation of the digital terrain model concerning rock quarry of gypsum mining Birtz, Aghireş village, Cluj County, Romania. In order to be realized digital terrain model, measurements must have a three-dimensional character, this was possible thanks to technology (Global Navigation Satellite System) Real Time Kinematic using the GNSS (RTK). This measurement method is a method cinematic menus in real time. In Figure 7, the GNSS system used to perform this case study.

Figure 7. GNSS equipment

As a reference system was used observations Romanian position determination system called ROMPOS (Romanian Position Determination System), specialized measurements carried into national Stereographic Projection System 1970 respectively reference system altimetry Black Sea in 1975. Following topographic measurements performed resulted in a data file with rectangular coordinates (X, Y, Z) of all points on the surface careers. This file is shown in Figure number 4, figure they can observe the values of data points obtained both legally planimetric (rectangular coordinate values of X and Y-column A, column B) and data from the point of view of altitude (values coordinate).

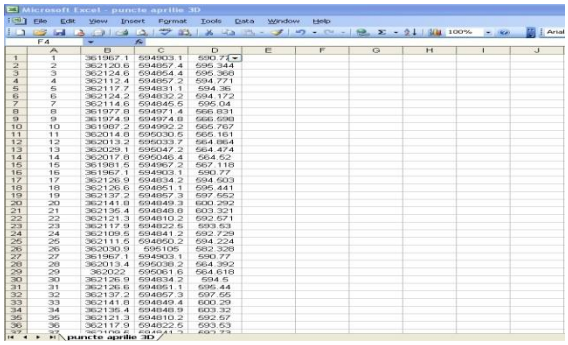

Figure 8. Coordinates file

To achieve digital terrain model, within a specialized software were set appropriate parameters needed to achieve this case study. Having done this step, uterior import data obtained from measurements in the specialized software passed the realization of a data file type,,. Grid.

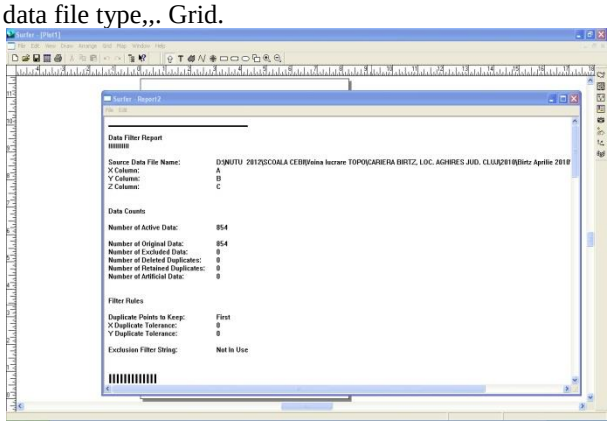

Figure 9. Achieving .grid File Type

Using data obtained previously, made the switch to digital terrain model in order Map- New 3D Surface of specialized software.

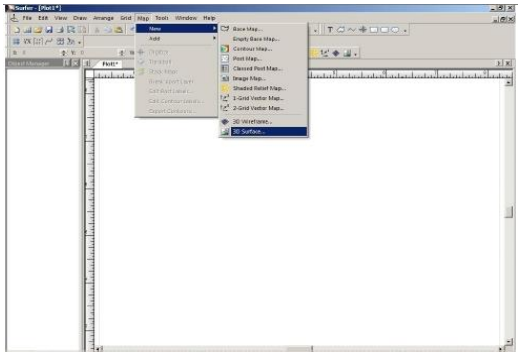

Figure 10. The command used to enable digital terrain model (3D)

The final result obtained shall digital terrain model of the rock quarry of gypsum mining Birtz, Aghireş village, Cluj County, Romania.

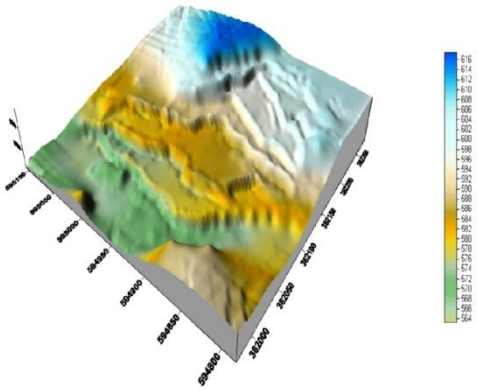

Figure 11. Digital terrain model Birtz of the quarry, Aghireşu village, Cluj County, Romania

5. CONCLUSIONS

Digital terrain model is the product of complex who holds characteristics that are equivalent to specialists using satellite images and information stored in a digital model is easier to use. Among the areas where digital terrain model can have an immediate application shall include: analysis of telecommunication systems, design in pipeline networks, command and control various systems, military, video games and in all other areas it is necessary to know altitude information at various points of a surface. Digital terrain model and related technology is a basic tool of a Geographical Information System (GIS) to provide a more real and more complex the world around enabling the management of large volumes of data and better management of human activities to maintain the vitality global economy and environmental quality.

REFERENCES

[1] **** The teaching staff specialization and Cadastre Land Measurements - Faculty of Engineering - Politehnica University Timisoara "Complement of terrestrial measurements Vol. I-II, revised and enlarged edition "Publisher Politehnica Timisoara 2009*

[2] *Ienciu I., Rişteiu M., - „Database in surveying and cadastre '', „ 1 December 1918 , University'', Alba Iulia, 2001*

[3] *Ienciu I., Rişteiu M., -„ Support informatic for digitizing data from surveying and cadastre" Publisher Aeternitas, 2003*

[4] *Ienciu I., -„ Exploiting topographic programs " University Publishing „ 1 December 1918", Alba Iulia, 2006*

[5] *Novac Ghe., - „Cadastre "Mirton Publishing, Timişoara, 2009*

[6] *Tămâioagă Ghe., Tămâioagă D., -„ The automation of cadastral works " Matrix Rom Publishing, Bucureşti, 2007*

[7] ****www.goldensoftwere.com*

[8] ****www.geotop.ro*

[9] ****www.ssg-surfer.com*