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COMPLEX STUDY OF ZANOAGA-BRAN ZONE FROM ROMANIA

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Abstract

The main purpose of the study is to effectuate a complete GIS analysis to design a fun park located within the Bucegi Natural Park. The objectives that achieve this goal are given by the complex study of the area of interest and include: topographic measurements that take into account the surface proposed for the planning and topographical measurements on the torrential hydrographic network for realizing the natural flood risk maps. The study will include the way of realizing the support network based on which was made the land measurement, both planimetric and altimetric for the elaboration of the topographic plan and the three-dimensional model of the terrain. The closed-loop method on the starting point was used, combined with the radius method. The study of the torrential hydrographic network of the area of interest envisages the elaboration of some calculations based on topographicalmeasurements made on the river valley, and its elements. This will result in the situation of the network in case of natural disasters and the management of the risk situations by estimating and quantifying the possible damages. All the steps listed above are based on the preparation of the GIS surface analysis project, which in turn will represent the basics of designing a fun park.

Key words*: topographical measurements,torrents study,GIS analyses, fun park.*

INTRODUCTION

Terrestrial surveys have an important and while-ranging role throughout the globe. They represent the basic support for designing and constructing any study of the Earth's surface. The main purpose of the study is to prepare a complete GIS analyze for the setting up of a theme park located in the Bucegi Natural Park. The objectives that lead to the achievement of this goal are given by the complex study of the area of interest and include: topographic measurements that take into account the surface proposed for the planning and topographical measurements on the torrential hydrographic network for drawing natural flood risk maps. The study area is located in the protected and management area of the Bucegi Natural Park, which is also located on the administrative territory of Brasov County, more precisely in Bran Valley. The land area concerned show the western limit of the park, which is structural-tectonic and morpho-hydrographic, comprising a rich hydrographic network made up of streams as well as different eypes of roks. By identifying the cartographic basis of the land it was found that it lies on the surface of the trapezes L-35-87-D-b-1-I and L-35-87-D-b-1-II (Figure 1).

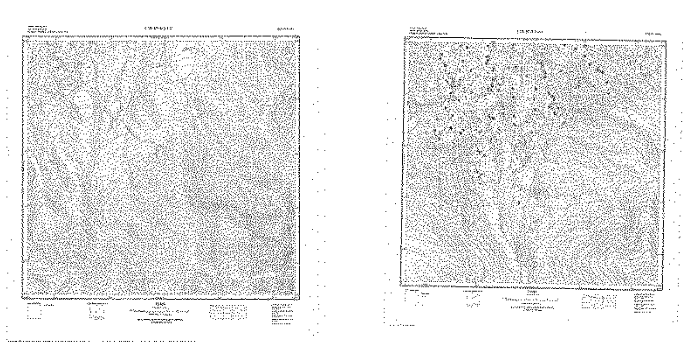

Figure 1. Trapeze L-35-87-D-b-1-I and trapeze L-35-87-D-b-1-II

The total area of land in the Bucegi Natural Park under study is approximately 38.000 sqm which covers a 1,4 km perimeter, out of which

14.000 sq m have been granted to meet the proposed objectives in view of carrying out topographical measurements for the purpose of setting up a park of entertainment. The remaining area of 24.000 square meters of land was allocated to the hydrographic network study of the area, covering both the riverbeds and the water of the river and its slopes.

MATERIALS AND METHODS

The chosen methods of work were influenced mostly by relief forms in the area, the land being at the entrance to the park and on it there are different types of rocks, trees with an average height of 30 meters and a stream.
For the start of the field works, the first stage was to raise the land level where the entertainment park is to be designed.
For designing the support network, the points were chosen to meet the following conditions:
• Points are accessible
• Location of points near construction and forest vegetation has been avoided to reduce the multi-path effect
• Points were not located under high-voltage lines, nor near electromagnetic wave emitters
• For a cut of angle of more than 15°, there are no obstacles that could block the signal
• For the kinematic method PDOP, it must not exceed a value of 5
After selecting the location of these points, they were materialized on the ground and signaled in advance, and then, with the aid of the GPS device, namely the ComNav T300, measurements were made to establish the position of these points in the National Stereographic System 1970 (for X, Y) and the Black Sea 1975 (for Z).
The next step will be to design the levels collection network, which must be located so that all the details of the land can be collected from the points of the network. Thus, the method of turning closed on the starting point, combined with the radius method, was chosen. As with the support network, the points are judiciously chosen taking into account the conditions:
• Visibility between station points, but to the points of the lifting network at least two points of the lift network.
• Location of the station points has been made so that there is visibility to all interested details.
• "Discarded stations" were also carried out, which were determined by double erasure, allowing the detailing of the details if they cannot be targeted at the main stations.
• For the density of the network, the configuration and the location of the site were taken into account, using a number of stations that comply with the technical norms: 1 pct / km^2 at lowland, 1 pct / 2 km^2in the hill area and 1 pct / 5 km^2 in the mountain.
• The points have been placed so that they are free from traffic, they are not destroyed and the protection of the device and the operator has been ensured.
Once selected, these points were marked and signalled (Figure 2). The measurements were started and consideration was given to raising every detail that consisted of trees, rocks, forest roads, vestibules, stream and its elements and as well as other elements that helped to replicate the geometry of the terrain.
In order to raise the river valley (Figure 3), stations were thrown along it and the ridge of water, the riverbeds, the slopes between which is included and other details that help to obtain its 3D model.
The equipment used for the measurements was the Leica TCMR 1103+ total station with a 3-second angular accuracy.

Figure 2. Location point station;

Figure 3. Raising the river valley

RESULTS AND DISCUSSIONS

After completing the above-mentioned stages of the field, we passed to the office stages. These stages consist of processing the data collected from the field with which it will draw up its location plan.
The measurements were exported from the GPS and the total station with help programs and transferred to the computer, after which the semi rigid reading compensation was performed. Compensated points were reported using the AutoCAD 2013 program, at a 1: 500 scale, from which both the 3D surface model and its location plan, which includes all the details found in the field.
The basin level curves were also drawn (Figure 4). The second stage includes the study of the torrential hydrographic network of the area of interest (Munteanu et al., 1979; Munteanu et al., 1993). The study envisages the elaboration of some calculations based on the topographical measurements performed on the river valley, as well as its elements, measurements presented in the field stage. This will result in the situation of the network in case of natural disasters and the management of the risk situations by estimating and quantifying the possible damages. Natural flood risk maps are documents on the basis of which the state or local government bodies manage crisis situations caused by actual or potential floods (Ionescu, 2006; ***, 2003;***2005).
From a geological point of view, the territory was formed in the lower to middle cretacic and consists of conglomerates and limestones arranged on a foil crystalline support, as well as depressions formed by crystalline nuclei, foil limestone blocks and embedded in conglomerates, sandstone and marl , constituting themselves in the geological substrate on which the soils were formed(***, 1960; ***, 1983).
By presenting a medium and even low erosion resistance, such rocks favour beginning of erosion and amplify torrential transport.

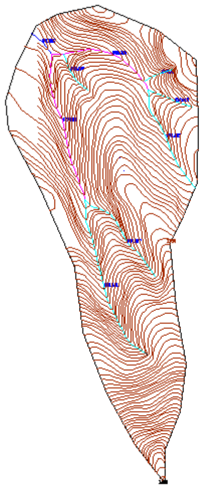

Figure 4. The underground river basin studied

With the measurements made with the total station but also with the use of the basic plans L-35-87-Db-1-I and L-35-87-Db-1-II and the ortofotoplan 530-442 were determined the elements representing basin morphometry. The basic morphometric parameters of the basin were determined with AutoCAD:

- The surface, which shows the dimensions of the basin and therefore it is found that we have to deal with a small hydrographic basin, ie with a hydrographic basin with a pronounced predisposition to the torrentiality, knowing that there is a chance of its uniform covering by a rain;
- The perimeter is presented in tandem with the surface;
- The average length of the basin;
- The shape of the basin, which is determined by means of three coefficients:
  - The coefficient of Gravelius;
  - Circularity report;
  - Extension ratio;
- Minimum, maximum and average altitude;
- The height of the basin;

- Basin slope;
- Length of slopes in the basin;

The following hydrographic morphometry elements were determined: the hydrographic order, which according to the Strahler system, the studied hydrographic basin contains segments of order I, II and III, the length of the bed and the mean slope of the main bed.

Also, the maximum liquid flow rate was calculated by indirect methods, i.e. by methods that take into account the rain that is at the origin of the flood and the characteristics of the basin that are involved in the formation and propagation of the flood (Clinciu and Lazăr, 1999). Maximum flow was calculated by two methods, namely:

- Rational formula: the flow is calculated taking into account the average rainfall intensity, the average drainage coefficient on the basin and the surface of the basin;
- Hourly rain formulas: for the calculation of the flow we refer to: the surface of the basin, the average drainage coefficient, the maximum hourly precipitations, the districts on Romania Territory and a sub unitary exponent on the territory of Romania;

In order to determine the water level at any point on the hydrographic network, the topographical measurements were checked in the cross sections at three points per each bed area. The GIS program, HEC-RAS, has been used, which, based on the spatial development of the hydrographic network (Figure 6) and the cross-sections (Figure 5), has made an overall view of this network (Tereşneu, 2005; Tereşneu et al., 2006). For each section, two or three points were taken on the bed and three points on each bank. Further, the following steps were taken:

- Digitization of the hydrographic network;
- Entering data specific to each cross-section taken from the field by the total station;
- The introduction of the liquid flow values calculated for each river bed area;
- Define the corresponding junctions (the points of confluence) and the lengths of the arcs intersecting at the respective points;
- Specification of the normal depth condition in the calculation section;
- Triggering the water level simulation across the hydrographic network;
- Analysis of each riverbed sector ;

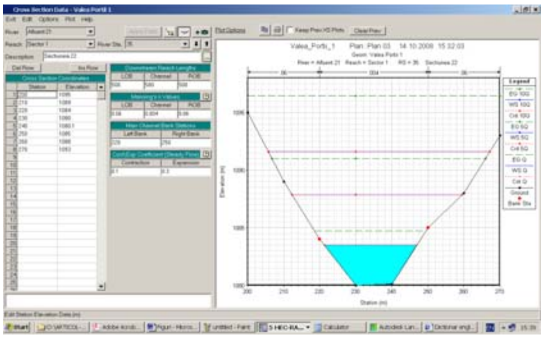

Figure 5. Water level figured in a cross section

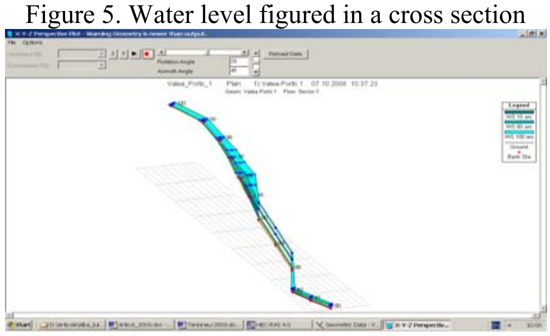

Figure 6. Space development of the runway of the river;

Therefore, the determination of the morphometric parameters of a river basin and the maximum flow rate forecast within it is accomplished in AutoCAD with a much lower effort than the classical one, and in addition it ensures a higher accuracy and a good quality of results.

Knowing the value of the maximum liquid flow rate and having certain metric measurements on the downstream hydrographic network (at least three cross-sections), using the HEC-RAS program, the water level can be obtained at each point of the bed, and it is possible to draw up the map of natural flood risk for the respective area, a document on the basis of which the state or local government bodies can manage the crisis situations caused by actual or potential floods.

In conclusion, all the above-mentioned stages, both the field and the office ones, are based on the elaboration of the GIS project related to the surface in question. This complex study will represent the basics of designing a fun park within the Bucegi Natural Park.

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