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Topographyc Survey for Achieving a Recreation Sport Fishing Basin

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Abstract – The paper show a topographic survey carried out for the realization of a recreational pool for sport fishing, in order to be registered in the land book of Pecica city. The land is located at the exit of Pecica. The water basin was made by greening and expanding an old existing water basin. The water basin is populated with carp and caras. The fish population in the basin has a mixed composition, with dimensions according to age.

The basin has a rectangular shape and is located 2m from the outer foot of the dam, so 7m more than the width of the protection zone, 5m imposed by the legislation in force, thus fulfilling the conditions of placement.

The recreational basin for sport fishing is populated with an amount of 600kg / year, in accordance with the provisions of the aquaculture production unit, ensuring a feed quantity of 30kg feed / day.

This recreational pool for sport fishing is a simple semi-systematic arrangement, meaning that the entire production process is carried out in a single basin. For this reason, it is designed so that the depth of the water both ensures the growth, reproduction and wintering of the fish population, without needing any human intervention.

Keywords: topographic survey, recreational basin.

1. INTRODUCTION

The topographic and geodetic works precede, accompany and complete any construction process, contributing to the good development of the construction process both by shortening the term of design and execution, as well as by a better organization of the work place. The importance of the topographic works contribution increases as the construction process is mechanized as well as the use of modern techniques and technologies. The content and importance of the topographic and geodetic works in the process of studies, design and execution are influenced by a complex of factors, such as: the extension and relief of the land use for construction; the dimensions of the component elements of the construction, the accuracy of the topographic works for the design and execution of the edifice, the nature and volume of the earthworks, the nature of the materials used, the execution methods, the deadlines for use, etc. The design of any construction cannot be carried out without updated topographic plans and topographic profiles, drawn up at the highest scales and the field application of the construction project as well as the construction execution works call for topographic methods and instruments. At the same time, the process of construction exploitation, starting with the reception of the construction works and ending with the observations on the behavior of the executed construction, requires topographic and geodetic measurements. Engineering topography comprises the following main categories of works:

- topographic technical studies;
- engineering surveyor design;
- topographic mapping;
- ensuring the engineering surveyor of the technological process of construction-assemblement;
- photogrammetric observations of the deformations and displacements of the foundations of constructions and of the lands with a high degree from the point of view of the risk of landslides.

Each of these categories is related to certain phases of the construction process, differing in the problems to be solved and the accuracy of the measurements. The technical-topographic studies serve as a basis for designing the constructions and carrying out other types of studies and research (for example, hydrological studies, geotechnical and geophysical surveys), having the following content:

- development of the support network and topographic-engineering the survey of the surface intended for construction; topographic survey is performed for medium and large surfaces, by photogrammetric methods; as a result, construction site plans and profiles for different directions are obtained;
- stakeing out the access communication ways (rads, railways, energy transport lines, water supply and drainage routes etc.), all having a linear form;
- topographic linking of geological and geophysical points and profiles and hydrological alignments, etc.

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The topographic-engineering design is included in the elaboration phase of the construction project and includes:
- elaboration of the topographic documentation on large and very large scale for designing the construction in detail;
- topographic preparation of the project for field application and detailed design of the stake out works; solving the problems of horizontal and vertical systematization, the calculation of the surfaces and volumes of earthworks as well as the flood volumes of the accumulation lakes, etc.
The topographic stake out includes the topographic works when applying the project on the ground. These works usually require topographic bases and stake out methods more accurately than at topographic surveying.
The basic materiel necessary for topographic purpose is various, being conditioned by the project type and by the landscape futures; the most available material consist in the followings;
The general plan of the construction is the topographic plan with level contours for the construction site (general situation plan) where the communication railway roads, houses neighborhood, main instalations, including the vertical sistematization are projected.
The general plan of the construction can take various types:
a) general plan, with permanent construction sites;
b) general plan, with temporarry and auxiliarry construction sites of the construction site;
c) the general general plan with permanent and provisional constructions, including auxiliary ones;
d) the general plan of the housing district, when it is at a great distance from the main projected construction (eg industrial enterprise, port, etc.).
It is mentioned that each of these plans contains both horizontal and vertical systematization of the territory, either together on the same plane or separately on different planes.

2. MATERIAL AND METHOD

The RTK method (Real Time Kinematic)

Modern topographic measurements have evolved from precise measurement of angles vertically and horizontally with the help of theodolites, to establishing the precise global position of points using receivers of signals emitted by satellites integrated into the global positioning systems.
The first satellite system, the American one, called GPS (Global Positioning System) has become the generic name for the topographic measurements that use the satellite signal for positioning and for this type of devices. The first generations of such GPS devices used single frequency (L1) receivers, which could receive only modulated signals on a single frequency from the American GPS system.
If single-frequency (L1) GPS systems can be used only for static, or kinematic measurements, and later the results being obtain after post-processing of the recorded data in the field, GNSS-RTK systems can be used for both static and kinematic measurements, as well as for real-time measurements, the so-called RTK (Real Time Kinematic) measurements. In order to determine in real time with centimeter precision the coordinates of the points, it is necessary that the GPS-GNSS RTK devices receive corrections from fixed terrestrial stations. This is possible either via UHF radio from its own base (in this way requiring 2 devices - base and rover), or using GSM modems to connect to the internet for receiving RTK corrections from permanent fixed stations existing in many countries (ROMPOS for Romania). GSM modules work with GSM internet cards from local mobile operators. The condition of the GPS-RTK measurements is that the controller software has implemented the WGS84 coordinate system transcalculation algorithm in the national coordinate system of each country. (in the case of Romania - Transdat - for transcalculation and Stereographic projection 1970 as a national projection system).
Kinematic measurement method: The main purpose of position determination in kinematic GPS observations is the calculation of the satellite receiver coordinates. The determined coordinates can be absolute coordinates or relative coordinates. As a rule, it is preferred to make a relative kinematic positioning, which ensures accuracy even in the centimeter order. Depending on the time elapsed between the moment of observations and the moment when the coordinates are determined, kinematic GPS positioning can be done in real time or post-processing.
Traverse method with total station: The traverse method occupies a central position in all the topographic survey in the plane considering the volume and frequency of the works in which it is requested. The main importance consist in determining the topographic network and positioning the details, but it can also be used for the thickening the geodesic network.
The total station, through the structure and the possibilities offered, has become the representative instrument, used today exclusively for the traverse measurement, being, at the same time, the only serious competitor of the GPS system. The main arguments in support of this option are:
- allows the automatic measurement, on request, of the geometric elements, their display and recording in memory, the partial processing according to the built-in program menu and their transfer to the computer;
- the field work software is differentiated from a simple (basic) one, which targets only these elements, to other complex ones, which processes and displays the results they hold. Regardless of the program, the measured data are recorded and stored in memory;
- the program "*polar coordinates*" or with a similar name, allows to determine on the spot the spatial position of a point, radiated from a known station, based on a reference sight, possibility also used in many topographic applications.
Genneraly, in the case of a traverse, the path can be considered as a succession of successive deletions: depending on the known coordinates of the station point, an bearing sight and the data obtained from measurements, the coordinates values (x, y) are displayed and also the hight of the target point (z).
The working steps for the achieving a traverse with a total station through the program that provides the

coordinates of the hike directly on the ground are, in general, the following:
- installing the device at the known coordinates point, starting, initializing and passing the coordinate program;
- station bearing by intrtoducing the own coordinates and the reference coordinates into the memory;
- sighting the bearing signal, accesing the polar coordinates programm, inputing the station point height, the station height and prism height;
- sihting the prism from point 1, starting the measurements, obtaining the x, y, z coordinates and saving them into the station memory. The operation is repeated for the following (1, 2, ...n) traverse points considering the following:
- the station bearing for each station point is made by backsighting;
- the control of the bearing operation is made by making measurements for the backsight point where the coordinates difference must be on 1-2 mm limit.

The final verification is made on *the last sight of determination* toward B point*:* on the station display we must have its coordinates *in the tolerance limits* compared to the known ones, taken from the inventory of the support network.

Some mistakes in the execution of the traverse with total stations are to be expected, as in any measure operaion their occurrence is substantially reduced compared to the classical equipment, because the measurement and recording of the geometric elements (angles and distances} is done automatically, without the operator's intervention, after targeting the prism and triggering the command.

Surveying with total stations

Topographic survey is the operation by which the position of the characteristic detail points is determined by using the surveying network, the relative position of the detail. Through detail we mean points from the earth surface whether they are natural or artificial proviency. All together, the detail make up the plan. Topographic survey consist in the following steps:
- decomposing the details in characteristic points,
- determining the position of the characteristic points from those of the lifting network.

Mainly, the topographic survey is done in any situation, whenever you can measure the distance and the horizontal angle to a detail point. Within the method, the position of a detail point is defined in relation to a station known point and a reference direction (usually the sight to the last station point).

The height position of the point (Figure 1) resulte by determining the level difference between the station point and the detail point.

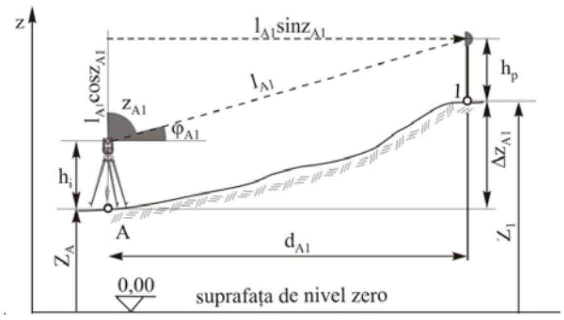

Figure 1. Determining the height of a point

Topographic survey with total stations by far, it occupies the most important place in the method of traverse combined with survey.

The measurements are made by using only the 1[st] telescope position and differes according to the instruments that we use:
- the horizontal angle α_1 having as reference the sight to B point;
- the slope distance l_{A1} displayed directly on the station display;
- the vertical angle z_{A1} or ϕ_{A-1}, displayed also on the station display;

3. REZULTS AND DISCUSSION

In the topographic work of surveying and identifying a recreational pool for sport fishing, the basin was made by greening and extending an old water basin already existing and populated with carp and crucian crap. It is rectangular in shape, it is located at 12m from the outside foot of the dam, so by 7m more than the width of the protection area of 5m, imposed by the legislation in force, thus fulfilling the conditions of placement. In addition to this basin, there are three secondary basins, which are not populated and are significantly smaller than the basin. The basin is located at the exit of the village of Pecica, on a non-agricultural land in the outskirts. (Figure 2)

Figure 2. Recreational pool for sport fishing

This recreational pool for sport fishing is a simple semi-systematic arrangement, meaning that the entire production process is carried out in a single basin. For this reason, it is designed so that the depth of the water both ensures the growth, reproduction and wintering of the fish population, without the need for human intervention.

THE RECOGNITION AND FIELD STAGE

The site is at the exit of the village of Pecica, at a distance of about 2km from the living spaces (Figure 3).

Figure 3. The limit of the site on an orthophotoplan
Source: Google Earth

The land in the Nordic direction is delimited by the channel no.top. 629/10, and in the East direction is the channel no.top. 626. In the southern direction, the dam no.top 2227 is located, and in the western direction it is delimited by the channel identified with no. 623 (Figure 4).

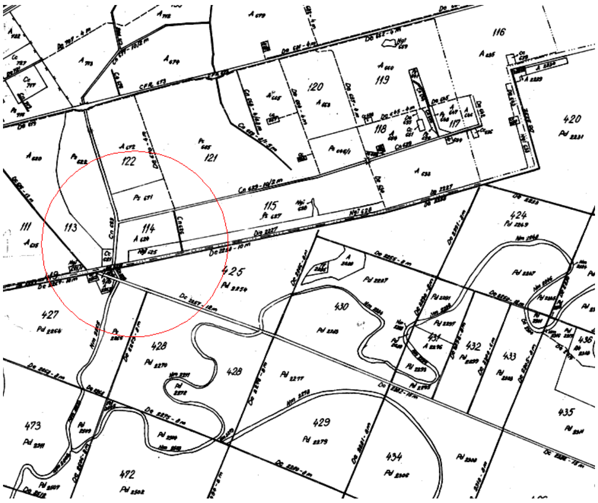

Figure 4. Framing plan in the area

Taking into account the presence of the dam, we can have an increased visibility above the ground, so we can make the sketch and the measurement plan easier.

The Recreational basin for sport fishing, from U.A.T. Pecica comprises the following:

- main bazin;
- three secondary small basins;
- two wells drilled;
- an annex built with a reception role;
- a terrace;
- mini terraces around the pool for resting

In the recognition of the land, the details present on the surface of the site were taken into account, as well as the conditions of visibility and the signs of the state geodetic support network. There were no previously determined points in the field, which will mean that these points will be determined by satellite methods. Therefore, in order to carry out the topographic survey, in our case, we need to determine at least two station points, in order to have full visibility on all the details. To determine these points, the Stonex S8 + GPS will be used by the RTK method, and to determine the outline of the site, we will use the closed-loop traverse method using the Leica TCR705 total station. As a final step, we will perform, by surveying the planimetric details.

The last phase of the field recognition is the realization of the sketch of the hand, comprising all the details that will be measured, it has the role of helping during the processing of the measurements. (Figure 5).

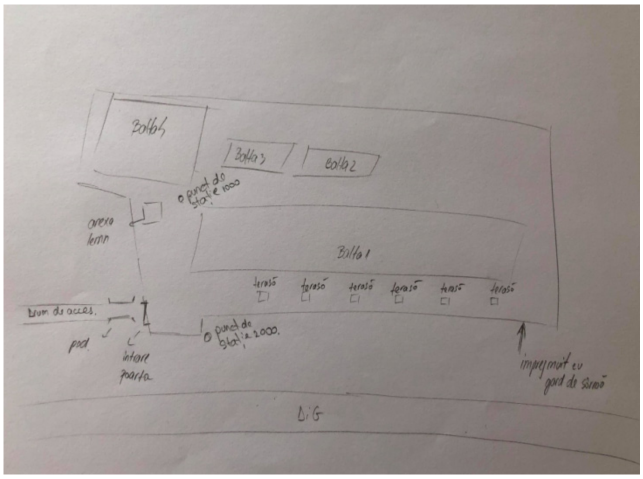

Figure 5. Hand sketch

In order to realize the identification and verification of the property limit, we took as starting point the 1000 station point whose coordinates we previously determined with the Stonex S8 + GPS, and then I carried out the bearing sight on the 2000 station point.

The topographic survey was performed using the closed-loop traverse method, with the Leica TRC705 total station. The topographic survey required the reading of 21 points in the perimeter of the site, followed by the closing at the starting point, more precisely at the station point 1000 (Figure 6).

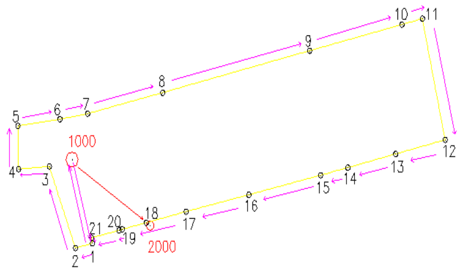

Figure 6. Sketch of closed traverse

The survey of the planimetric details was achieved by using the total station, using the method of topographic survey with two station points, with the determined

coordinates. In the phase of topographic survey the planimetric details with respect to the network of support points (1000 - 2000), the positions of the characteristic points of the details are determined.
After the topographic survey, the shape, size and positioning of the details were obtained.
The operations start by setting the total station in the station point. In the first phase, the tripod was set, raised up to the level of the chest, which is usually the desired level and fixed it with the help of the screws on the legs of the tripod.
The tripod was installed in a position as central as possible above the initially established station point.
The topographic survey started from station point 1000, and from this point I gave the bearing sight to point 2000.
Further, the total station was installed at the next station point, at station point 2000, after setting the station the station point 1000 was sight for setting up the bearing.
After completing the field stage, the office stage was followed, which was represented by a lot of operations necessary to prepare the final documentation. The office stage more precisely included the download of the devices, followed by the processing of the primary data in a software, in our case in AutoCAD, after which, as a final step, we elaborated the plans and the desired maps.
The detail points were survey from 2 station points: station point 1000 and station point 2000. The coordinates of both points were determined with the StonexS8 + GNSS GPS receiver.
The data in the instrument was transferred to the computer using a cable and a transfer program. The data were downloaded in two formats: file with the extension *.idx that contains the rectangular coordinates and polar coordinates and extension LeicaGeoSistem*.gsi.
For data processing from AutoCad 2013, the file having the *.gsi extension was transformed in a file with *.dxf extension by using DXFGenerate software.
After downloaded the data from GPS, the points coordinate of station point 1000 și 2000 were obtained (Table 1).

Station points coordinates Table 1

Punct	X[m]	Y[m]	Z[m]
1000	200410.526	525472.469	101.571
2000	200477.158	525427.204	101.977

By using the Leica TCR 705 total station the survey of the topographic details in the 1970 Stereographic coordinate system, with the Black Sea level 1975 system. 57 detail points were topographically survey to make the situation plan as accurate as possible. Next is the download of the Leica TCR705 total station, which requires its connection to the computer using a data transfer cable, in order to transmit the raw data to the computer. Downloading is done using Leica GeoOffice Tools software for faster download. The data is imported into the AutoCAD program using TopoLT software for proper data processing.
The calculation of the surfaces and the drawing up of the coordinate inventory was carried out using the TopoLT program (Figure 7).

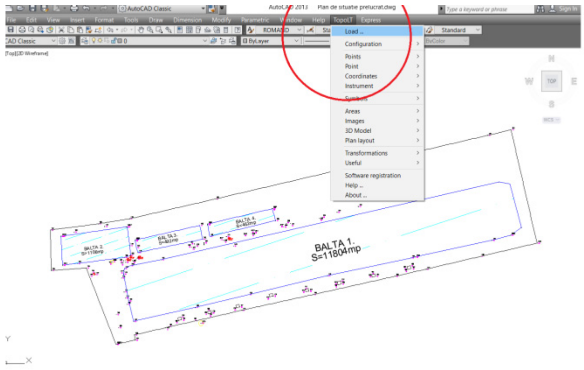

Figure 7. TopoLT Software

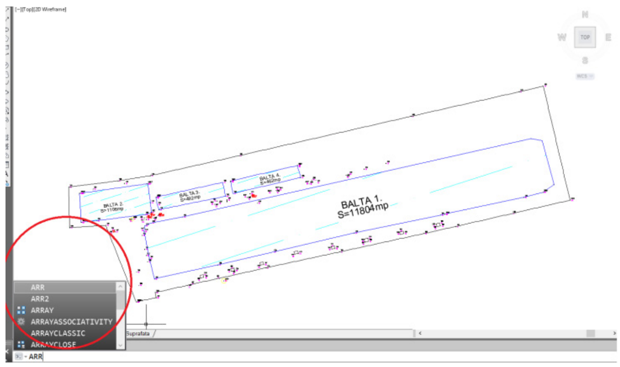

Figure 8. The coordinates inventory

Using the [ARR] shortcut (Figure 8.), we performed the total surface determination, and the surfaces for each pond.
The filling of the ponds is accomplished by pumping from the three wells, with a depth of 9 m each. A pumping well is equipped with a wind turbine pump, with a nominal flow rate of 56 l / minute and an average flow of about 40 l / minute.
From the other two wells, the water is pumped using a fuel pump (petrol) with a nominal flow rate of 50 l / minute. Thus, if all three wells are used one can continuously pump 56 + 50 + 50 = 156 l / minute = 244.64 mc / day, which causes the pond to be filled with the required water in 46 days.
Finally, to find out the exact volume of water needed to fill the main basin (Basin 1.) using the TopoLT program, we created a three-dimensional model using the measurements made previously. After creating this model, we can have a real vision about the shape of the basin and obtain the volume of water in real time.
To obtain the three-dimensional model, select from the top bar the command creates 3D model, mark the points with the highest and deepest odds, to obtain the network between points (Fig. 9).

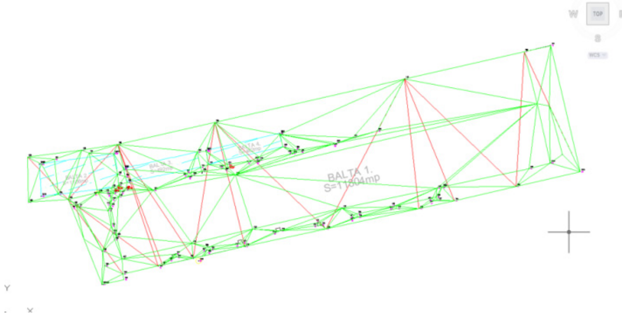

Figure 9. The network between points

The next step is to calculate the volume using the TopoLT program (Figure 10).

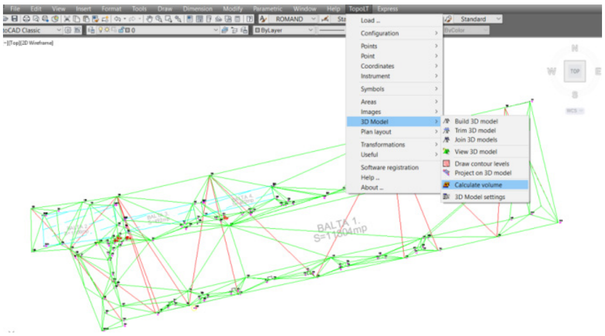

Figure 10. Calculating the water volume

Following the above steps results in a Model3D, from which we can obtain the following data: the deepest points, the highest points and the volume of water needed to fill the basin (Fig. 11-12).

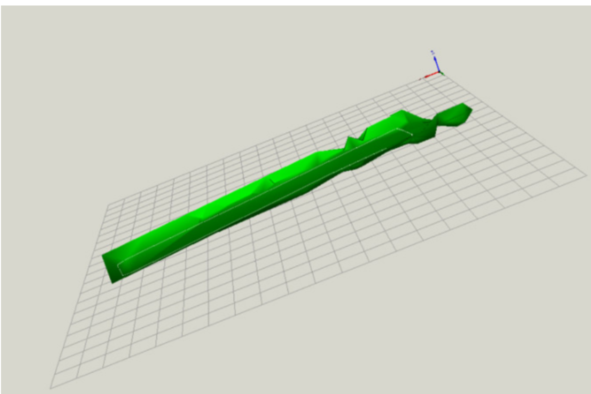

Figure 11 Gross 3D model

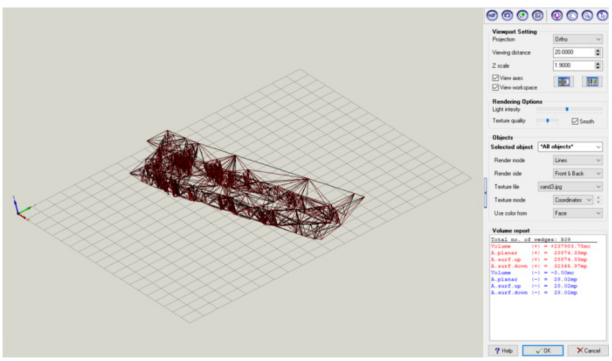

Figure 12. 3D model processed

4. CONCLUSIONS

For the elaboration of this work it was necessary first of all basic knowledge, knowledge related to the tools used, both regarding their structure and their use and also knowledge about certain methods used.
In the accomplishment of the work, I had the help of GPS RTK, which made my work easier because, in the area I had no previously determined points, so I determined two points with the help of this tool.
The space where the pool is located, was used for other purposes but at present it is a perfect space for sport fishing. Making measurements and documentation was important from several points of view: firstly it allowed the owner to see where the building is exactly and secondly, it provided important information about the share of the land, the surface of the land and the volume of water needed to fill the basin.
In order to do this, it was necessary to involve at least two people and of course, owning and using high-performance tools. If these sources were out of the reach of the workers, the old methods required 3-4 people and obviously, and the time for the final documentation was increased.
In addition to acquiring the basic knowledge related to the tools and methods used, it was also necessary to know about the use of digital technology, because after recording the data on the field it was processed in the office stage, the stage when using a Cad type program (AutoCad) was essential. Without using this program we could not find some very important information. After the realization of this recreational pool for sport fishing, the city of Pecica has become rich in terms of tourism, as this area has become more frequented by tourists and fishermen.

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