

EXECUTION OF THE TOPOGRAPHIC WORKS AND STAKING OUT OF AN INDUSTRIAL CONSTRUCTION IN GHIRODA, TIMIȘ COUNTY

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Abstract: The paper aimed to present a model for the elaboration and development of a follow-up work for surface constructions, in order to build a construction with a height regime on the ground floor. This project was approved by the Ghiroda Commune City Hall. Due to the small tolerances allowed by the builder in tracing the axles and bolts, it was absolutely necessary to contract a surveying company to perform the land identification, and then to place the future construction according to the distances approved by the Urbanism Certificate and Construction Authorization.

This type of work requires a large volume of work both in the preliminary phase and in the execution phase which requires the measurement of large areas of land. In order to identify and delimit the properties, stake out the construction elements and follow the execution, it is imperative that the surveyor is well informed about the data and plans already existing in the OCPI archives, which must coincide with those resulting from field measurements.

Keywords: GPS, staking.

1. INTRODUCTION

In the conditions of accentuated urbanization, constructions of all types are the biggest consumers of land. The efficient and correct management of all the problems related to the cities is conditioned by ensuring, first of all, the balance of the existing interests in the society, which can be achieved only by highlighting the functioning of the complex individuality of the respective territory. Concerns in the field of urban space configuration have crystallized into a new, complex activity, which is a direction of studies and theoretical and practical approaches of great importance, relevance and scope, all over the world. The stake out accuracy is an important component of the geometric qualities of construction objectives and must be correlated with their execution accuracy.

The geometric qualities of a target to be achieved must be viewed in two ways:

- the objective needs to be located in space in relation to other existing objectives and in relation to the points of the staking network;

- compliance with the shape and dimensions of the target to be drawn.

From these two criteria result two aspects of the tracing works:

1. staking (placing) objects in space;
2. staking the object in detail.

The objectives to be staking can be divided into three categories:

- volume objectives at which the staking accuracy on the three dimensions is the same (constructions developed vertically.);

- surface targets at which the vertical staking accuracy is lower than the plane staking accuracy (eg airports);

- linear objectives to which it is applied in the field through the main breaking points (eg dams, roads).

The axes can be transmitted to the pilasters with forced centering, in the case of special importance constructions, where the precision requirements are very high.

Conditions to be met by fencing:

1. The fences must be parallel to the basic axes of the constructions. The non-parallelism error depends on the accuracy of the distance measurement;
2. The fences must be rectilinear, not zig-zag;
3. The tracing of the upper part of the fences must be done by geometric leveling, with a precision that does not affect the tracing accuracy of the construction.

2. MATERIAL AND METHOD

The equipment used to carry out the task consisted of a total **Leica TS02** station and a GNSS GPS Hi-Target V30 system.

Leica TS02 Total Station is a topographic equipment with a very good value for money, high precision, being, from my point of view ranked first in the world, with the most complex menu, including all the necessary needs in a topographic perfect survey performed. The tool is very reliable, flexible, helping to acquire a great dexterity in a very short time. It is specially designed for medium to low level accuracy

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applications. It comes with a set of standard software applications.

Hi-Target V30 GPS equipped with a Hi-Target Controller iHand20 is equipped with Android system, iHand 20 has Dual Sim technology that allows, with the help of Dual Sim - Dual Standby technology, its endowment with two SIM cards belonging to different telephone operators. This allows the selection of the operator with the highest coverage in the area of interest, and therefore a more efficient measurement session and higher measurement accuracies.



Figure 1. Controller Hi-Target iHand20

With built-in measurement technology and rode inclined electronic rod, the new controller iHand 20 cooperates perfectly with the new V90 plus.

Advantages of HI-TARGET V30 GPS:

- The voice mode that notifies you at the start of the receiver if in that area you can measure, you only turn on the receiver and it connects itself to Rompos;
- It connects to the internet and in areas where the GSM signal is very low there are 2 lines, while other GPSs do not work in those areas;
- In static measurement mode, the recording rate of 1/5/10 seconds and the elevation angle can be changed;
- Rinex files can be named via software that is installed on the controller, they can be deleted from the controller. The recording rate and elevation angle can be changed directly from the controller via bluetooth;
- 3G working mode;
- The rover variant - without corrections from Rompos (if the Rompos is non-functional) has an error of 25-35 cm / x, y while for other GPSs autonomously they have 0.8 - 1 m;
- Works well in wooded areas.

In order to carry out the staking, it is necessary for the project to undergo a topographic processing, an operation generally called topographic preparation of the project.

It comprises the following phases:

1. Choosing the topographic staking network, made up of points marked on the field by stakes or terminals, of known X, Y, H coordinates (determined);

The following types of topographic staking networks can be found in practice:

- basic networks, previously used for the topographic survey of the area, which correspond, from the point of view of the precision of determining the positions of the points, to the precision criteria for staking;
- special staking networks, designed, measured and calculated especially for the respective work, if the precision necessary for the execution, requested by the beneficiary of the work or the general designer, is high

(the precision of a point of the special tracing network is, as a rule, $< \pm 1$ cm.);

2. Choosing the methods for staking the points in the project;

3. Staking on the field the main axes and the characteristic points of the constructions and technological equipments that can be executed by various methods;

Choosing of the stacking method is made according to the existing measurement conditions:

- field relief;
- built area;
- underground measurements;
- industrial buildings;
- dimensions and shape in terms of constructions;
- requires the precision of land application;
- how to make the tracing network;
- endowment with equipment, etc.

3. Choosing the topographic instruments and accessories for staking and measuring technologies, depending on the precisions imposed by the beneficiary and on the performances of the equipment;

4. Calculation of the plan elements of the project points;

5. Calculation of the necessary precision for planimetric staking of the points from the project.

Staking the foundation can be define as an operation of great importance, therefore, ensures the success of the work required for subsequent installation work. Errors in the execution of foundations can influence the stability of the building and can make it difficult to install its other elements.

- The topographic works for the installation of the prefabricated poles are executed with high precision, starting from the main axes or their basic axes and tracing the auxiliary axes necessary for the assembly.

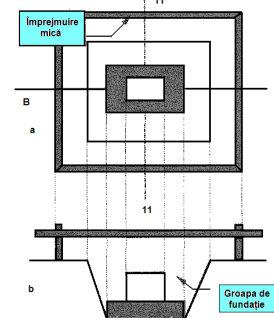


Figure 2. Detailed stake of isolated foundation for poles (a-plan; b-section)

The determination of the topographic elements of the project consists in the transformation of the geometric elements given in the project, in topographic elements (coordinates, elevations, distances, angles, level differences, slopes, etc.) by numerical calculation procedures.

3. RESULTS AND DISCUSSION

The purpose of developing the survey project is for building a hall as industrial construction on one storey (ground floor), for industrial storage, a production facility and offices for employees. For achieving the

project we identified the area and we executed the basic survey operations, and later on, after after the architect provided us with the plan, we stake out the axis of the construction.

At the end of the staking out process, the industrial construction is registered as being CIE (Industrial and Urban Construction) in the Land Book Register as 403216-C1 (where C1 means the construction registered).

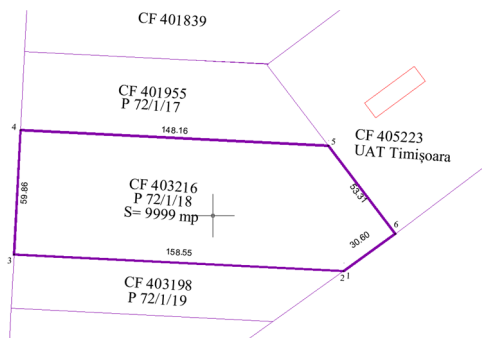


Figure 3. The identification of the project - CF 403216

Ghiroda commune is a commune located near the city of Timișoara and is notable for the fact that it is in a continuous development both from an industrial point of view, but also in terms of development of residential areas, by building buildings within the Ghiroda Territorial Administrative Unit, but also the development of extra-urban areas through the realization of Zonal Urban Plans (P.U.Z.).

The study area is located in the northern part of Ghiroda Commune, being located in the area of Traian Vuia International Airport, Timișoara.



Figure 4. The CF 403216 estate – Framing plan, Ghiroda

Recognition of the area

The area recognition is realized with the Land Registry number of the Territorial Administrative Unit, CF 403216. After the reception of the Land Registry it was necessary to identify the cadastral data where the land is situated, and based on the stereographic coordinates and having the GPS equipment we proceed to identify on the field the position of the terrain. The terrain contour was materialized by 1.20m high wooden stakes. After the setting out of the area the survey

methods in order to proceed with surveying operations were established.

Execution of topographic survey with GNSS system GPS Hi-Target V30

Before starting the topographic survey with the help of the Hi-Target V30 GPS, first of all the optimal position for the location of the two station points was identified. (S1 and S2).

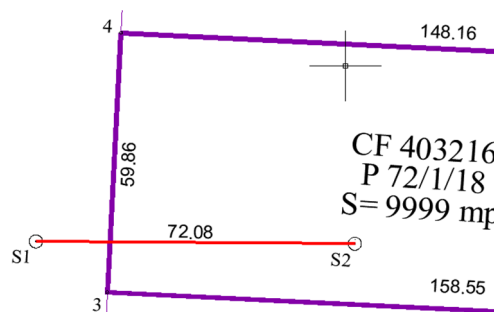


Figure 5. Location of station points S1 and S2

Due to the opening of the area, the building is located in an area where there is no vegetation, buildings, awnings or any other factor that complicates the situation of the signal, this makes the topographic survey to be performed using GPS, because there is RTK signal, with minimal errors, accepted by the Cadastre Office, but also technically correct.

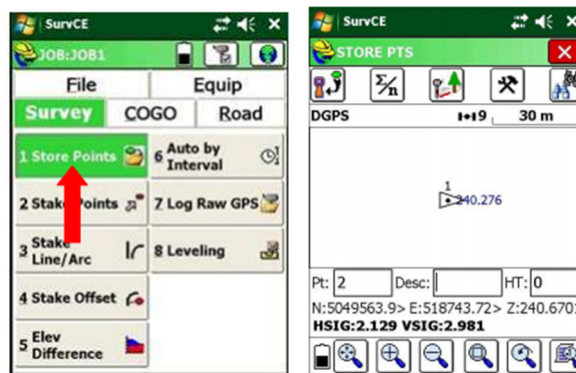


Figure 6. Recording the points coordinates – GPS Hi-Target V30

Marking and signaling of topographic points (S1, S2)

The marking of the 2 topographic points (S1 and S2) was made with concrete terminals, and with fenotype terminals, they ensure resistance and durability over time, which is very important for this project, taking into account that the construction has a deadline of about 10 -12 months. Ensuring that the position of fixed topographic points does not change is very important, because when we return to this project, we want there to be no problems of stereographic orientation and affect the stereographic X and Y coordinates of points of interest.



Figure 7. Marking and signaling of topographic points (S1, S2) concrete landmark

Downloading and processing data of GPS Hi-Target V30

The data download was done by connecting the GPS to the computer, and with the help of the controller the data was transferred from the GPS to the PC (our computer), in .xyz (ASCII file) and .dxf file.

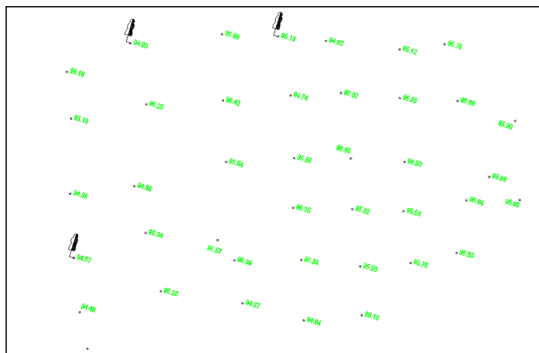


Figure 8. Reporting raw data

The above topographic coordinates are extracted from the GPS, without processing this data. The transfer and reporting of those coordinates in AutoCAD are done with the help of the auxiliary program TopoLT, a program that is installed and visible in the AutoCAD toolbar.

Drawing topographical plan

After downloading the data in AutoCAD, the data from the cadastre Office was overlapped. That is why it can be seen in the figure below the position of the topographic points in relation to the position of the boundaries of neighboring buildings, but also our building.

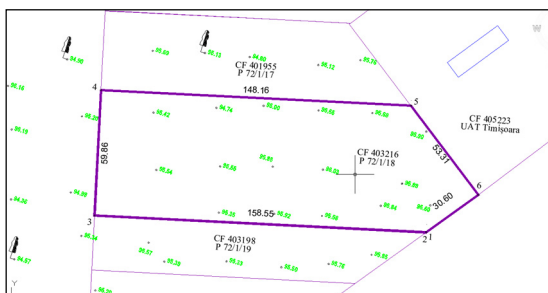


Figure 9. Preparation of topographic plan - AutoCAD

Drawing up the plan

Before extracting the stereographic coordinates, the position of the industrial construction was received from the architect, regarding the location, the withdrawals from the limits of the buildings.

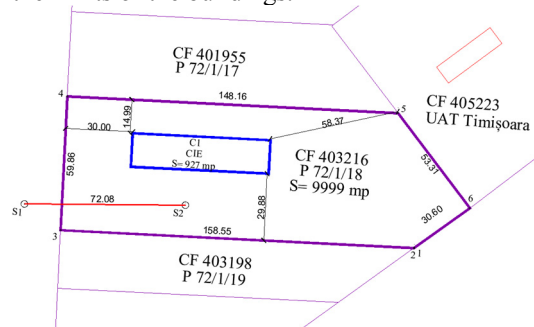


Figure 10. Industrial construction site

Based on these data, a tracing plan was drawn up by polar coordinates, respectively a tracing verification plan by the same method, insisting especially on the corners of the future construction, taking into account the distance and orientation angle.

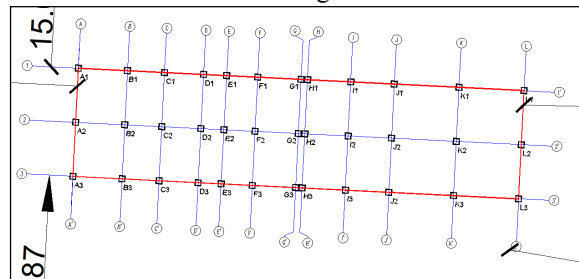


Figure 11. Drawing up the stake out plan

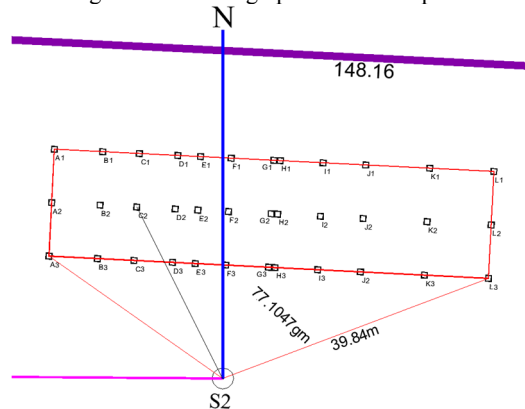


Figure 12. Preparation of the verification plan for the stake out
Setting up of the Leica TS02 Total Station.

The stake out of the construction was made from coordinates, angles, and subsequently they were verified by measuring the diagonals of the construction, so that their equality confirms the correctness of the stake out.

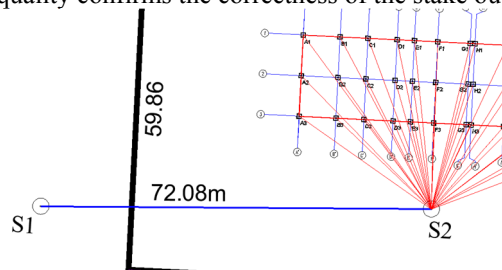


Figure 13. Total Station Placement

The point S2 was used as station point, and the orientation was made at station point S1.

After setting up the total station in the S2 station point the stake out was made.

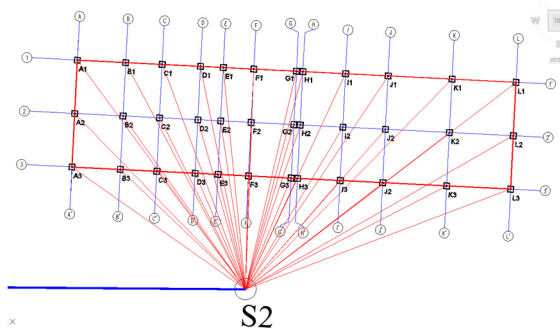


Figure 14. Polar coordinate method - total station

Using the S2 station point the stake out was made from the West to the East, starting with axis A (1,2,3) and ending with axis L (1,2,3).

The stereographic coordinates of each point were entered into the total station before reaching the field. In order to be able to stake out a point, it was necessary to have a mini-prism of the device, this being used by the field operator, being guided by the total station operator. The total station indicates the distance and location angle to each point.

Checking the stake out: distances and diagonals.

After the tracing of the axes was finished with the help of the total station, the correctness of the tracing was verified, thus the diagonals of the drawn points were measured, these being equal.

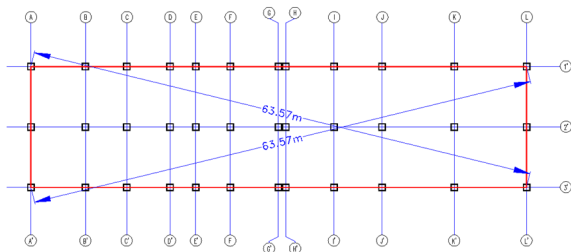


Figure 15. Checking the diagonals

4. CONCLUSIONS

Ghiroda commune is one of the most developed localities in Timiș County, this being almost included in the city of Timișoara, the limit of the 2 localities being made right in the houses area (the edge of the Ghiroda Commune urban area).

The studied area is located on Calea Aeroportului, being an area in a continuous development from an industrial point of view. The development of the area is of major impact for the local budget of Ghiroda Commune, but especially facilitates the access of employees to the jobs created. In that area there are many companies withdrawn from inside the city, because there is access to points of interest such as the highway, the ring road, the airport. The studied plot has an area of 9999 sqm and it is desired to make a P.U.Z. in order to be able to build an industrial production and storage hall with a ground floor height regime. The

development and construction on the edge of Ghiroda commune brings a benefit both to the commune citizens, because new jobs are being formed, but it is also a financial benefit for Ghiroda Commune City Hall. The development of this project also benefits the City of Timișoara, because industrial companies no longer pollute the city, they develop industrial areas on the outskirts of Ghiroda, being easily accessible to citizens of Timișoara and nearby communes, but especially the citizens of Ghiroda. In conclusion, the development of this project brings a benefit both for the State and for the citizens of these communes located very close to a big city of Romania, respectively Timișoara. When performing on the field the topographic works for picking up the details, it was necessary to take into account the following aspects:

All appliances must be checked and rectified; Before starting the topographic survey of the details, the planimetric and level position of the points in the support network to which the tracing is made was checked; Measures have been taken to preserve and protect the points determined by GPS, against which all the details have been collected. The marking of the points was done with increased precision by using bolts, studs with nails and other precision elements; Currently, topographic measuring instruments are new instruments of high precision, thus reducing the execution time and the accuracy with which the contour points were determined.

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