Scientific Bulletin of Politechnica University of Timișoara

Transactions on HIDROTECHNICS

Volume 66(80), Issue 1, 2021

TOPOGRAPHIC SURVEY AND STAKE OUT FOR THE COLLECTIVE DWELLING LOCATED IN U.A.T. TIMIȘOARA

Luminița Livia BÂRLIBA[1], Gabriel ELEȘ[2], Florin Cristian BÂRLIBA[1], Costel BÂRLIBA[1]

Abstract. The main purpose for which this work was prepared was to make a construction up to the finishing stage of the works. The location of the studied area is beneficial for the future inhabitants of the proposed construction being in the southern part of the city, Calea Urseni, belonging to the Municipality of Timișoara and near the Giroc Territorial Administrative Unit. The development of such constructions, especially being collective construction, helps to develop the city, but also to offer on the real estate market, especially for young people, alternatives for starting an independent life. The topographic contribution was on the one hand the field by using specific equipment, and on the office side, by using graphic processing software such as AutoCad and TopoLT, in order to achieve the situation plan (location and delimitation plans of the building, trace). The finality of the topographic works consisted in the transposition on the field of the proposed project, by performing constant plotting and checking for the foundation and each level, so that each is according to the location plan proposed by the architect and approved by the City Hall of Timișoara.
Keywords: topographic survey, foundation stake out, situation plan.

1. INTRODUCTION

The theme of the paper aims to present a model for drawing up and carrying out a drawing work for collective constructions, in order to build a Construction with a height regime GROUND FLOOR + FLOOR 1 + ATTIC.

This project is approved by the Timișoara City Hall. Due to the small tolerances allowed by the builder in drawing the axles and bolts, it was absolutely necessary to contract a surveying company to identify the land and then place the future construction according to the distances approved by the Town Planning Certificate and Building Permit.

This type of work requires a large volume of work both in the preliminary phase and in the execution phase because it requires the measurement of large areas of land.

In order to identify and delimit the properties, trace the construction elements and follow the execution, it is imperative that the surveyor be well informed about the data and plans already existing in the Office of Cadastre and Real Estate Publicity archives, which must coincide with those resulting from field measurements [1].

Drawing 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 executed must be considered in two respects: compliance with the shape and size of the target to be drawn on one side and the target which needs to be placed in space in relation to other existing targets and in relation to the points of the tracing network.

From these two criteria result two aspects of the tracing works: the tracing of the object in detail and the tracing (location) of the objects in space.

The axes can be transmitted to the pilasters with forced centering, in the case of constructions of special importance, 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 enclosures must be done by geometric leveling, with an accuracy that does not affect the tracing accuracy of the construction.

2. MATERIAL AND METHOD

Depending on the number of receivers used in the GPS system, there are two basic concepts:

- absolute positioning, of a single receiver, based on the measurement of the phase of the codes and of the pseudo-distances, which ensures an accuracy of order of meters, of some moving vehicles, also called the navigation solution;
- relative or differential positioning, using at least two receivers, one installed at a known point and another at new points to be determined, based on code and phase measurements of the carrier wave [6].

The RTK method was used to carry out this project using a GNSS RTK receiver as a device.

STONEX S9 GNSS is a precision built-in GNSS RTK receiver. This device receives GPS signals but also signals from GLONASS and GALILEO satellites. The main unit of the S9 receiver has integrated GNSS interface, radio interface, GSM / GPRS modem and Bluetooth for more convenient use.

[1] Banat University of Agricultural Sciences and Veterinary Medicine, "Regele Mihai I al României", Timisoara, Calea Aradului 119, 300645, Romania, barlibacostel@yahoo.com
[2] Politehnica University of Timisoara, Spiru Haret Street, no. 1/A, 300022, Romania, eles.gabriel@yahoo.com

The receiver is light and stable. The housing is designed to prevent water and dust from entering, the material used can withstand a long use in the field.

The main body of the receiver

The main body of the receiver consists of three parts: the housing, a rubber ring for protection and the main structure. The housing protects the GNSS antenna inside. The protective ring inside has the function of protecting the antenna from dust and water. The LED display and control buttons are integrated in front of the main structure. At the bottom is a place where you can insert radio receivers and GSM module, a battery compartment and SIM card. The rest of the receiver components are inside the main receiver structure (Figure 1).

Figure 1. S9 main unit

Data processing with GPS

The processing of GPS data involves a set of works aimed at processing them until obtaining the spatial coordinates of the points of the compression network in the national geodetic data. The operations are carried out automatically with the help of software only that the operator is the one who decides from the choice of the working method, the selection of the input elements until the establishment of the necessary constraints.

There are two options for choosing the working mode: by post-processing, in the case of using classic GPS technology, or in real time.

The real-time process consists in transmitting data via UHF radio when field coordinates are obtained directly in stereographic 70 using a complex program based on 7 Helmet transformation parameters for the region in question, deduced on the basis of common points both in international data and in the national one.

Real-time processing is based on the calculation of the coordinates of the fixed receiver installed in a known point and new points, starting from the signals received from at least four common satellites. By comparing the values with the old known ones of the reference station, a position correction is calculated which the fixed receiver transmits by radio to the mobile receivers. They must be equipped with radio links and a program for recalculating the provisional coordinates in order to turn them into definitive values.

Real-time differential GPS

The RTD GPS (Real-Time Differential GPS) method, also called real-time kinematics, RTK (Real Time Kinematic), eliminates the main drawback of kinematic and static methods and procedures. RTK allows the determination and immediate knowledge of the coordinates of the mobile receiver, including checking the quality of measurements and remedying it as needed.

The differential GPS technique allows the observation of pseudo-distance measurement errors, towards the four satellites, in a reference point precisely known in the WGS 84 system. On a permanent GPS station with a receiver module with 12-16 parallel channels, it establishes each mobile station the difference between the measured and the theoretical distance obtained from the ephemeris and the known position of the reference station. The corrections are transmitted via UHF waves permanently to all mobile receivers located at least 40 km away.

For the application of this modern technique, the condition that the receivers see simultaneously the same at least four satellites is taken into account. In addition, all receivers have the appropriate equipment: radio equipment for transmissions and receivers and differential processing software.

RTK technology has an advantage, namely: the correlation and correction of distance errors with the transmission of data through radio waves and the provision in real time, in the field, of the coordinates of new points, including information about their quality.

After performing the measurements, the radio links and the application of the corrections, the GPS coordinates in the international WGS 84 system are displayed in real time, directly in the field.

Total station Leica TS02, is a topographic device with a very good quality-price ratio, of high precision, being ranked first in the world, with the most complex menu, including all the desired needs in a perfectly executed topographic survey. 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 applications. It comes with a set of standard software applications that guide you through your daily work. If it is more convenient, use Bluetooth® wireless technology to connect any data collector and use the Software that best suits your activity and level of knowledge. With a TS02 - FlexLine Total Station, measurement activities can be completed faster and more safely than ever before (Figure 2).

Figure 2. Total station Leica TS02

Whether measured with a prism, or by direct measurement of objects, the choice is available to the user. A selection of EDM options has provided you with exactly what you need.

The Total Station is specifically designed for medium to low level accuracy applications. It comes with a set of standard software applications that guide you through your daily work. If it is more convenient, Bluetooth® wireless technology can be used to connect any data collector and the Software that best suits the activity and complexity of the type of topographic survey or tracing is used [3].

3. RESULTS AND DISCUSSION

3.1. REAL ESTATE LOCATION

The studied building is located in the southern part of Timişoara, Timiş County;

The studied area is located on an artery in continuous development, being close to the Buziaş area, of the city of Timişoara. The distance from the building in CF 441649 to the city center is about 4.5 km;

The studied building comes from the dismantling of the plot CF 438684, through the Zonal Urbanistic Plan 188/07.04.15 (Figure 3).

Figure 3. Location of the property

PROPERTY IDENTIFICATION

The building CF 441649 was identified in the bases of the Office of Cadastre and Real Estate Advertising according to the request for information and the inventory of coordinates in the Stereographic system 1970 (Figure 4).

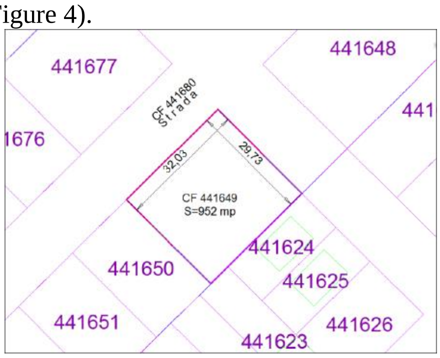

Figure 4. Property identification from CF 441649

After the requested information was resolved, we followed the process of physical identification and marking of the property boundary. (Figure 5).

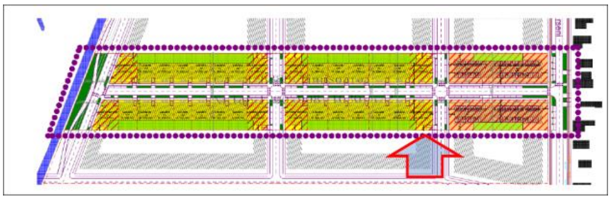

Figure 5. Construction structure plan

3.2. FIELD WORKS

Execution of topo-geodetic determination works:

USING GPS STONEX S9 GNSS:

- Property identification;
- Drawing the property limit;
- Determining the coordinate system

Stereographically 1970 identified by S1 and S2 (Figure 6).

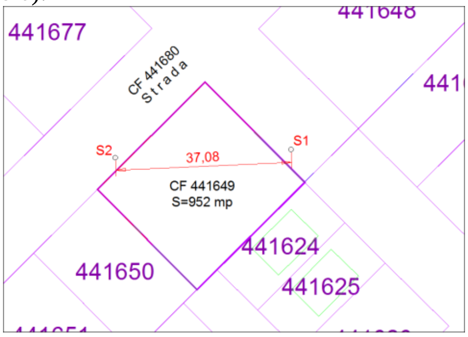

Figure 6. Determination of station points in the field - GPS Stonex S9 GNSS

USING THE LEICA TS02 TOTAL STATION:

- Orientation, reading and execution of the erasure of the points in the field from the station points S1 and S2;
- Determining the points of detail necessary to draw up the situation plan according to the topographic survey in the field (Figure 7);
- Staking out the collective construction according to the Plans drawn up by the architect.

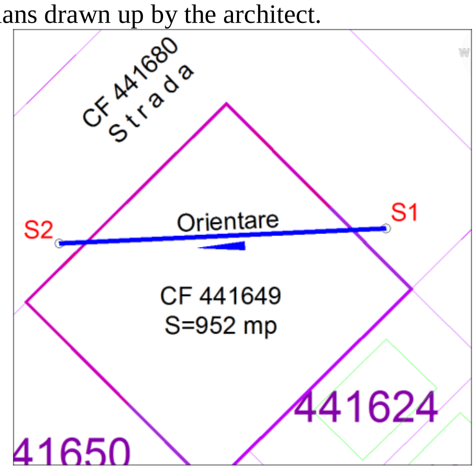

Figure 7. Stationing, orientation and verification performed with Leica TS02

Orientation to the previous station point (in case of a trip) or orientation to any point determined by random stereographic coordinates is very important, by orientation we can check if our position is correct, for example in this case there were 3mm (X) errors, 2 mm (Y), 2 mm (Z) [2].

3.3. OFFICE WORKS

Download and process measurements from used devices

The download can be said to be only of the total station, the GPS was used only to determine the stereographic coordinate system, more precisely S1 and

S2 determining the stereographic coordinates 1970 (X, Y) and Z as height (Figure 8 and Table 1).

To download the total station, I used the specialized program from Leica, called Leica Geo Office:

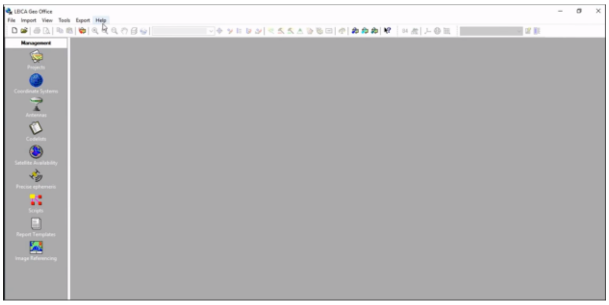

Figure 8. Total station software - Leica Geo Office

Table 1. Inventory of coordinates S1 și S2

Nr.pct.	X [m]	Y [m]	Z [m]
S1	475898.592	209159.309	88.751
S2	475896.890	209122.272	88.829

Subsequently, after the coordinates have been extracted from the total station in the form accepted by the AutoCad program, more precisely TopoLT, with the extension “.asc” they will be introduced on the graphic platform with the extension “.dwg” (Figure 9, Figure 10). The coordinates of the total station that were deleted from the field were reported using the TopoLT program.

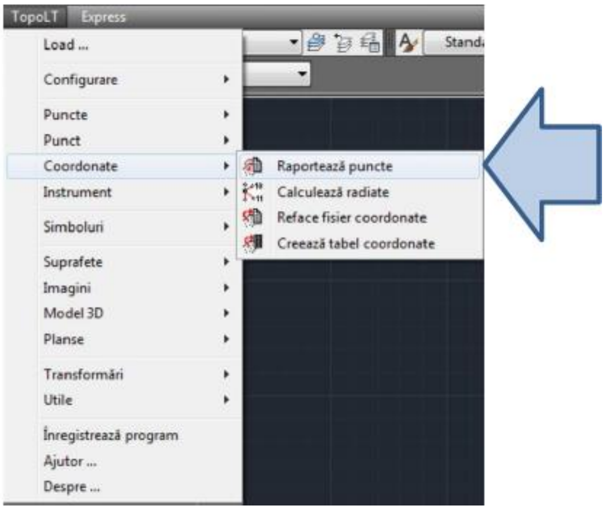

Figure 9. Coordinate reporting - TopoLT

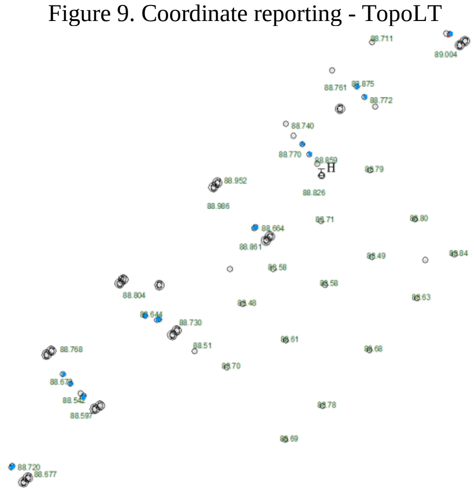

Figure 10. Raw data from the field

Preparation of the situation plan

After processing the raw data, overlapping the legal buildings and drawing the shape of the land (2D), the situation plan is drawn up, it is sent to the architect, who will design the construction according to the elevations and topographic survey of the land (Figure 11) [1].

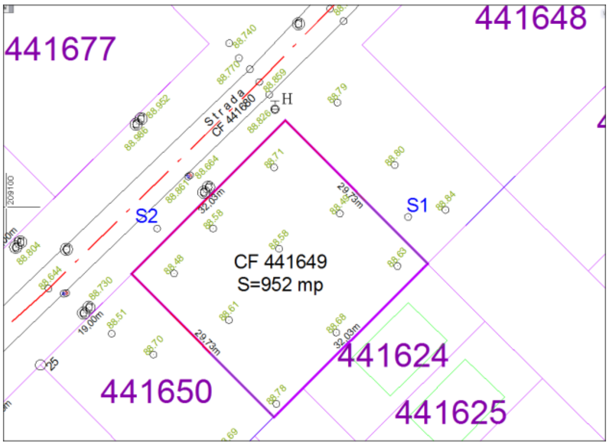

Figure 11. Situation plan – CF 441649

Following the situation plan sent to the architect, he will send the construction site according to the urban requirements [7] (Fig.12, 13).

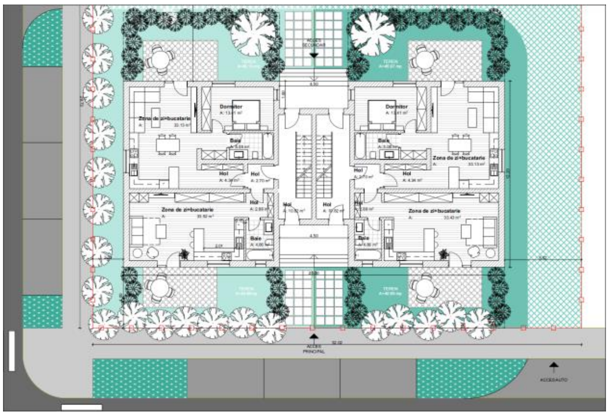

Figure 12. Architectural plan received - ground floor and systematization

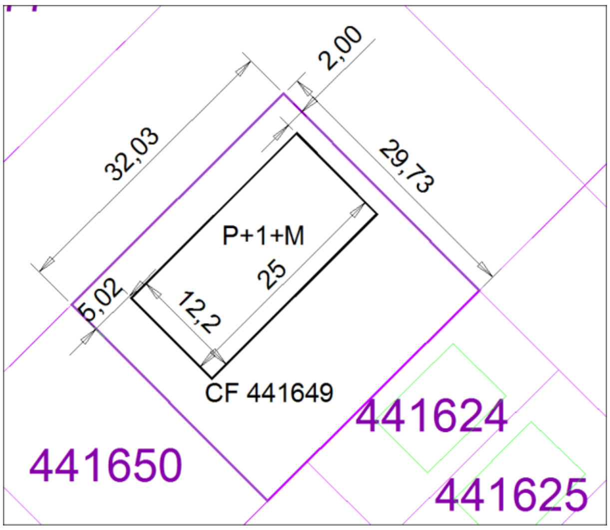

Figure 13. Situation plan - construction site P+1E+M

Drawing up the levels plan

Following the plans received from the architect in digital form, we electronically executed the excavation plan of the foundation, the blue color being represented by the excavation / ditch of the foundation, and the red color by the axis of the foundation / wall (Figure 14) [5].

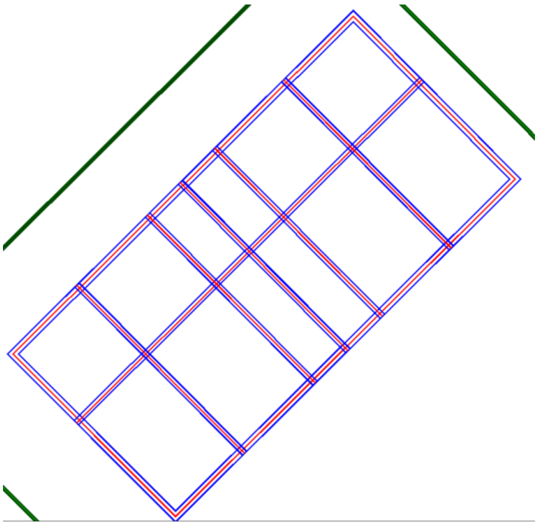

Figure 14. Excavation plan - foundations

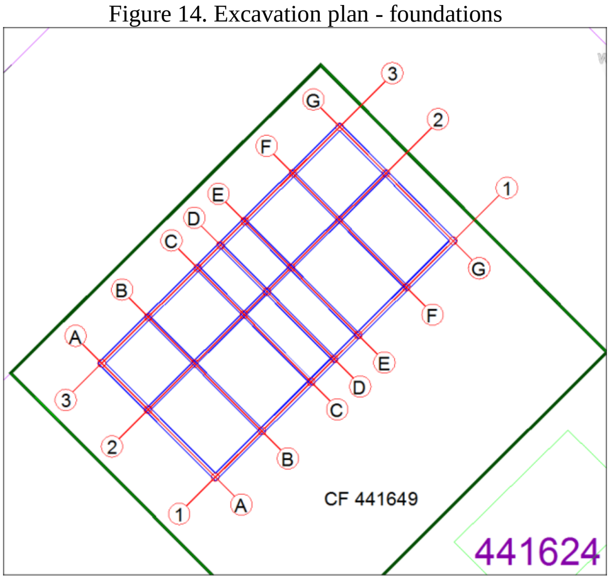

Figure 15. Axis drawing plan - construction

Table 2. Inventory of coordinates – Stake out ground floor + first floor + attic

No. Crt.	X [m	Y [m]	Z_1 [m]	Z_2 [m]	Z_3[m]
A1	475882.542	209133.505	88.60	91.60	94.60
A2	475887.498	209128.571	88.60	91.60	94.60
A3	475890.905	209125.180	88.60	91.60	94.60
B1	475885.933	209136.911	88.60	91.60	94.60
B2	475890.889	209131.977	88.60	91.60	94.60
B3	475894.296	209128.586	88.60	91.60	94.60
C1	475889.537	209140.532	88.60	91.60	94.60
C2	475894.493	209135.598	88.60	91.60	94.60
C3	475897.900	209132.207	88.60	91.60	94.60
D1	475891.210	209142.212	88.60	91.60	94.60
D2	475896.166	209137.278	88.60	91.60	94.60
D3	475899.572	209133.887	88.60	91.60	94.60
E1	475892.971	209143.981	88.60	91.60	94.60
E2	475897.927	209139.047	88.60	91.60	94.60
E3	475901.334	209135.656	88.60	91.60	94.60
F1	475896.487	209147.512	88.60	91.60	94.60
F2	475901.443	209142.579	88.60	91.60	94.60
F3	475904.849	209139.187	88.60	91.60	94.60
G1	475899.898	209150.939	88.60	91.60	94.60
G2	475904.854	209146.005	88.60	91.60	94.60
G3	475908.260	209142.614	88.60	91.60	94.60

The construction of the X and Y coordinates keeps the same coordinates because the position is the same, but the coordinates of the Z point [elevation] differ from level to level, for example the ground floor has elevation 0, being elevation 88.60, but the floor has + 3.00m, the attic has +6.00 from the ground floor (quota 0) (Figure 15 and Table 2.).

Preparation of the verification plan

The construction check was done by the method of angles, so each point, for example the axis G3 was drawn from the station point S2, using the angle formed by the north direction and the intersection of the axes G and 3, resulting in G3, an angle of 67.5507g, thus being made at each axis intersection.

3.4. STAKING OUT STAGE IN THE FIELD

Staking out by the method of rectangular coordinates

In order to stake out from rectangular coordinates, the same procedure is done as at the beginning of a road / erasure with the total station: the total station is calibrated, in this case it is calibrated above the metal bolt of point S1, orienting towards point S2 [8].

After orientation to S2, enter the Stake Out menu of the total station, where, after entering the above coordinates in the form of a table, the operator of the prism / milestone is guided by the operator of the total station to the points drawn (Figure 16).

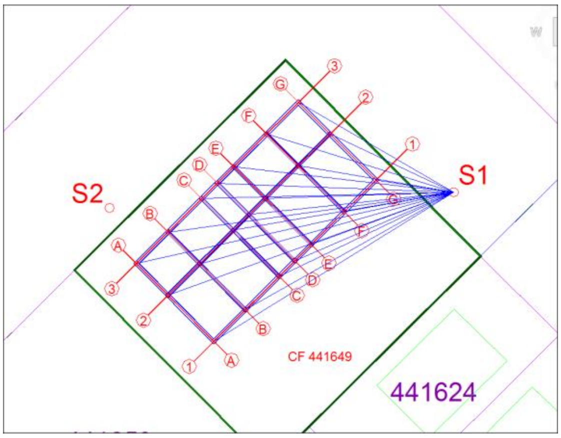

Figure 16. Staking out using rectangular coordinates

The staking out steps were performed from the excavation face of the foundation, the introduction of iron in the excavation, the pouring of the tiles for each level, ground floor-attic-attic [4].

Checking the stake out by the method of angles and distances

This check is a precise and the most approached method, it was done randomly, at 3-4 points between the axes, respecting the angle and the distance from the extracted plane.

This time the ride was made above the station point S2, with orientation towards S1, entering the desired angle and distance, the total station display allows us a more accurate view until the plot is executed correctly. (Figure 17) [9].

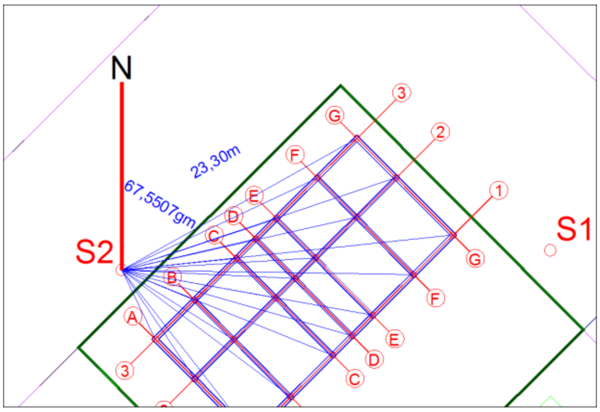

Figure 17. Checking the stake out through angles and distances

4. CONCLUSIONS

Timisoara is the largest city in Western Romania and one of the largest cities in Romania in many ways, its development being continuous. The studied area is Calea Urseni, an area in full ascent, development, there are dozens of Zonal Urbanistic Plans of residential and collective housing with complementary functions in the area because it is the area adjacent to the city of Timisoara, belonging to the Buziaş area. Calea Urseni comes from the road leading to the village of Urseni, belonging to the Moşnița Nouă Territorial Administrative Unit.

The plot where the P + 1E + M construction is targeted is a plot that resulted from a Zonal Urbanistic Plan, the plot being created especially for such collective type constructions.

The development and construction on the outskirts of the city has a major benefit for localities such as those mentioned above: Moşnița Nouă, Dumbrăvița, Săcălaz, Ghiroda, even Şag, in the future will form a suburb of the city, in the immediate vicinity of only a few kilometers.

Today's young people approach these types of collective housing very much. Regarding the indirect development of the surrounding localities, we can say that it facilitates the maintenance of youth in rural areas, access to the city being more accessible and efficient, for example the northern area has access on the belt or national / European roads such as Sânandrei, Giarmata Mare, Remetea Great even, and the rest of the localities such as Giroc, Şag, are in continuous development, forming even 2 lanes per direction, which does not make it difficult for citizens to commute.

We recommend and support the development of Zonal Urbanistic Plans for duplex, triplex, terraced or collective housing type of this project, because we believe that it stimulates young people to purchase through government programs that are in support of them, housing only 5% in advance.

In conclusion, the development of the above-mentioned project, that of collective housing, brings a benefit to society, leading to the maintenance of youth in the country, as well as the use of land that is often without plantations on them.

REFERENCES

[1] *Bârliba C.*, 2006, Desen tehnic și cartografie, Editura Solness, Timișoara;

[2] *Bârliba C., 2018,* Ridicări topografice speciale, Editura Agroprint, Timișoara*;*

[3] *Bârliba L. și colab.,* 2005, Topografie, Editura Solness, Timișoara;

[4] *Cosarca C.,* 2003, Topografie inginerească, Editura MatrixROM, București;

[5] *Dima N., Herbei O.,* 2005, Topografie generală și elemente de topografie minieră, Ed. Universitas, Petrosani;

[6] *Eleş G.,* 2006, Topografie specială, Editura Politehnică, Timișoara;

[7] *Moldoveanu C.*, 2005, Topografie Modernă, Editura All Beck, București;

[8] *Smuleac A., Nemes I.,* 2014, Măsurători electronice de distanțe, Editura Mirton, Timișoara*;*

[9] ***, https://www.ct.upt.ro/users/Tehnologii_ Geodezice_Spatiale.pdf