THE DEVELOPMENT OF THE STREET NETWORK WITHIN LUGOJ CITY ON THE CITY BELT SECTION USING GPS TECHNOLOGY

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Abstract. *The work aims at developing a road connection as city belt of Lugoj city on the section DN6 Caransebes-Timisoara situated outside the built-up area of Lugos city. Currently, the land is classified as SERVICE ROAD, according to the Real Estate Register excerpt no. 425620 issued by O.C.L.R. Timiș. The proposal consists of subdividing the land into two real estates to develop a road connection as city belt of Lugos city (DN6 Caransebes-Timisoara). This work was carried out for absorbing efficiently the traffic, the balanced regional development considering the building of the highway as an efficient network for traffic flow decongestion. Once the two areas of 2798 m² are subdivided, the land survey of the road section is going to be conducted, in order to develop the connection and subsequently the highway. In the first phase feasibility studies are carried out and depending on the road characteristics, is conducted the actual land survey. For overcoming the unevenness of the land, earthworks (digging, respective land filling) and defence, reinforcement and protection works have been carried out. The MN vertical which passes through the middle of the roadway has 4 metres and generates a flat surface. The projection of the axis of the respective road of the layout on two plans, a horizontal one on which the projections of the two lines coincide and a vertical one on which both the axis of the road and the layout are projected distinctly. The horizontal projection represented in this work the site plan and the longitudinal profile of the road is represented by the vertical projection. The width of the road is 4 metres and the distance between the lanes is 2 metres, the last quota of the asphalt and the inclination of the road are considered. The pouring of the asphalt is carried out in two phases considering the highest quota provided by the axis of the road. The connection of the alignment is performed through internal curve C1, C2 and C3. On a length of 5 metres are used external curves also named serpentine as the intersection angle of the alignments is 43º. The next phase consists of digging the ditches for rain water drainage from the roadway. The works are going to be performed in three phases: Phase 1 -feasibility works, Phase 2 - infrastructure (digging, foundation, compacting degree works), Phase 3- superstructure (the final construction of the road). The land surveys have been carried out in the field with the GPS equipment from Leica, serial number 1200, the download being performed with the help of Leica Geo Office Combined software, the conversion of WGS 1984 coordinates into Stereographic 1970 coordinates being performed with the software TransDatRo and data processing with TopoLT and AutoCAD 2016 software.*

Keywords**:** *Subdivision, Exploitation, OCPI, GPS, TransDatRO, WGS 1984, Stereographic 1970, TopoLT, AutoCad,Real Estate Register*

INTRODUCTION

Any road is a complex structure of constructions and facilities for the vehicle traffic and its servicing These constructions and facilities are made on a strip of land called the road area and are necessary for overcoming the landforms difficulties of the land in its natural form, and to ensure for the upper part of the road a driving surface as smooth as possible.

If a cross section through a road is taken into consideration, being represented schematically in Figure 1.1, the central part of the road surface is meant for the circulation of vehicles and is called carriageway or path, being bordered by two lateral strips called shoulders of the road.

To ensure a more resistant surface for the traffic demands and the weather conditions, the carriageway is reinforced by a road system which consists of one or more road layers.

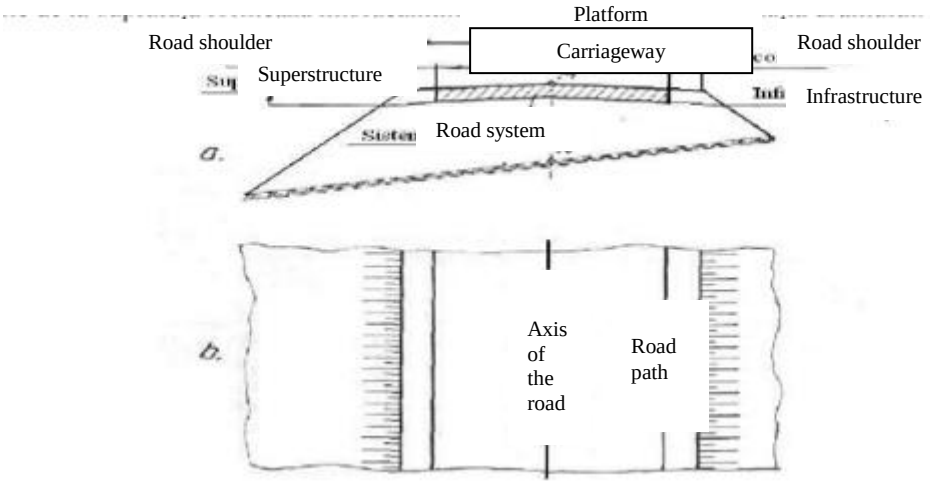


Figure.1 Names of the main component parts of a road:

a. Cross section through a road

b. Plan view

The connection is the connective contact between two parts of a work or between two elements of an accord. (DEX)

The topographical survey is a set of field and office work necessary in order to draft a topographical plan. According to their content, the topographical surveys can be: planimetric surveys - only the plan position of the points of the topographic surface, level surveys, when determining only the vertical position of the points, and combined surveys, when determining the plan position and the vertical position of the points.

The topographic plan is a conventional reduced representation of the horizontal projection of the topographic details on a restricted portion of the earth's surface, reduced to a certain scale, without considering the curvature of the earth, drawn in analog or digital format.

In Romania the topographic plan is drawn up using the Stereographic 1970 projection system and the 1975 Black Sea (Marea Neagră) reference system.

The road design must meet the following conditions:

- To be supported on triangulation and polygoniometry points
- The traversing points must be located in stable areas
- There must be a proper visibility between the neighboring points of the traversing points and from them towards the detail
- The angles and distances measuring instruments must be chosen carefully
- The distances between the traversing distances must be approximately equal

The profile method - for specific directions the landforms of the land are represented by profiles, in principle, the profile is a result of the intersection of a vertical plane containing the considered line and the ground surface.

The longitudinal profile is drafted on the axis of a road along a valley, a funicular line, the position in plan and space of the points determining the traversing locations and the cancellations.

The transverse profiles are raised perpendicular to the longitudinal profile, with hilly points, they are chosen where the slope changes or at equal distances when the slope has less variations. In plain lands, on less steep slopes, the profiles are raised on leveling points.

The leveling is a set of geodetic methods, procedures and operations that are used to determine the height of different points on the earth's surface, in order to represent the relief of those respective regions on a topographical map or a plan. (BOS N. - 1993 DIDACTIC AND PEDAGOGICAL PRINTING HOUSE, BUCHAREST - TOPOGRAPHY)

In accordance with Law 50/1991 on authorizing the execution of construction works, the execution of construction works is allowed only on the basis of a building or demolition permit. The building or demolition permit is issued at the request of the holder of the title of ownership of a property - land and / or buildings - or other act which provides the construction or demolishing right, according to this law.

The building permits for main networks, roads, facilities for land improvement, telecommunication networks or other infrastructure works that are performed outside city limits, must be issued by observing the landscaping plans, endorsed and approved by law.

According to the provisions for the infrastructure of communication networks of 07 October, the following rules must be taken into consideration:

Technical and constructive features for building the road connection:

- The installation works must be performed at least 1.50 meters under the elevation of the highway and 0.8 meters below the elevation of the ditch bottom

- The working method is directed drilling and laying of PVC or HDPE pipes with a 90 mm diameter or 110 mm diameter;

- The minimum width of the ditch will be 30-40 mm, with a depth of 7-8 meters;

- The location of the pilings will be outside the safety zone;

The technical permit is attesting the conformity, in in relation to these rules, of the technical documentation for designing, approval and implementation of systematic routes for electronic communications networks and authorizing the infrastructure works of electronic communications public networks, including the Coordinator Permit for such work.

MATERIALS AND METHODS

We used for performing the topographic surveys the GPS equipment manufactured by Leica, 1200 Series, which is a device that contains a multitude of applications. The GPS 1200 Series can be used either as a reference station or as a rover for both static and kinematic measurements (RTK). (Figure 2)

Also this device can be used, beside classical topographical surveys, for mapping, monitoring, seismic measurements. We took in consideration the fact that these 1200 Series GPS receivers are designed to work in the toughest conditions and can withstand falls and vibrations, operate in rain and snow at temperatures between - 39°0C and + 64°C.

In order to perform the GPS measurements we used the Kinematic method - RTK (Real Time Kinematic), using the reference station from Timişoara, namely TIM1_2.3. The measurement engine used is SmartTrack which acquires satellites data within seconds. We also used a dual frequency antenna GX1230 with SmartTrack, which supports GLONASS, GPS, L15 and GALILEO signals. Leica GPS1200 has a QWERTY keyboard, touch screen or normal screen, as appropriate, according to the preference, allowing the possibility to directly visualize the survey on the field, as it would have been from the office. Raw data can be exported directly from the GPS1200 receiver but for this study, the data were downloaded using Leica Geo Office Combined program. The GPS reference system is WGS 84 (World Geodetic System).

The conversion of the RAW DATA from the ETRS89 system into the STEREO'70 system was

made in the study with the application TransDatRO, and after that the points were reported in AutoCAD using the TopoLT program, a program that operates within the ACAD platform.
The trans-calculation of the coordinates from the ETRS'89 reference system into the Stereographic'70 system was performed with the TransDat 4.01 software produced by A.N.C.P.I.

Figure 2 - Leica, 1200 Series

The GNSS permanent station used to make measurements was the one from Timişoara - TIM1_2.3, RTCM-Ref 0000 with the following coordinates:

Table 1

GNSS permanent station used to make measurements

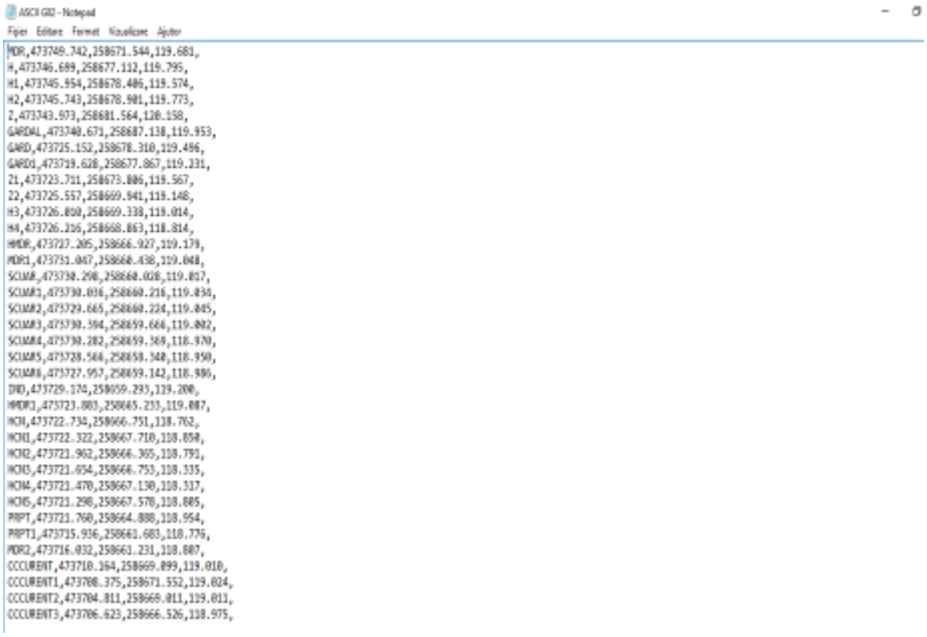
ELLIPSOIDAL / STEREOGRAPHICAL COORDINATES – ETRS89

ELLIPSOIDAL COORDINATES				
Name of the permanent station	Class	B[m]	L[m]	He[m]
RTCM-REF0000 TIMISOARA	A	45°46’47,65271”N	21°13’51,46281”E	-
STEREOGRAPHICAL COORDINATES 1970				
Name of the permanent station	Class	X(m)	Y(m)	Z(m)
RTCM-REF0000 TIMISOARA	A	482495.124	207132.249	-

The ellipsoidal coordinates that can be processed in the program are those obtained by connecting to the A-class national geodetic network (NGN), without being absolutely necessary to station the triangulation points. Thus, the conversion accuracy of new points depends largely on the current situation of the number and location of common points with common coordinates on the national territory..

From a planimetry point of view (coordinates X and Y) the accuracy requirement is satisfied, all the points have been obtained with an accuracy between 2-3 cm below the required value (5cm on the X and Y coordinates);

The points resulted from their conversion from the WGS 1984 system into the STEREOGRAPHIC 1970 reference system were reported in Autocad 1970 in order to unite the points and draft the situation plan (Drawing no. 2).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H1,473745.954,258678.486,119.574,
H2,473745.743,258678.901,119.773,
Z,473743.973,258681.564,120.158,
GARD4L,473740.671,258687.138,119.953,
GARD,473735.152,258678.310,119.496,
GARD1,473739.628,258677.867,119.231,
Z1,473723.711,258673.806,119.567,
Z2,473725.557,258669.941,119.148,
H3,473726.850,258669.338,119.014,
H4,473726.216,258668.863,118.814,
HMDR,473727.205,258666.927,119.179,
MDR1,473731.047,258668.438,119.048,
SCUAR,473730.296,258668.028,119.017,
SCUAR1,473730.036,258668.216,119.034,
SCUAR2,473729.665,258668.224,119.045,
SCUAR3,473730.394,258669.664,119.002,
SCUAR4,473730.282,258669.569,118.970,
SCUAR5,473728.568,258668.548,118.950,
SCUAR6,473727.957,258669.142,118.986,
IND,473729.174,258659.293,119.200,
HMDR1,473723.803,258665.233,119.087,
HCH,473722.734,258666.751,118.762,
HCH1,473722.322,258667.710,118.858,
HCH2,473721.962,258666.365,118.791,
HCH3,473721.654,258666.753,118.335,
HCH4,473721.470,258667.130,118.317,
HCH5,473721.298,258667.578,118.885,
PRPT,473721.760,258664.888,118.954,
PRPT1,473715.936,258661.683,118.776,
MDR2,473716.032,258661.231,118.887,
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CCCURENT1,473708.375,258671.552,119.024,
CCCURENT2,473704.811,258669.011,119.011,
CCCURENT3,473706.623,258666.526,118.975,

Figure.2 Table with points

RESULTS AND DISCUSSIONS

A topographical survey was made using a WGS 1984 projection system on the plot with the cadastral number DE425 /6/2 in order to develop a situation plan with the 1: 1000 scale according to the technical norms in force, the coordinates being converted with the TransDat4.0 program into Stereographic 1970 coordinates with the level reference system MAREA NEAGRĂ (BLACK SEA) 1975.

The plot with the cadastral number 425620, with an area of 2708 square meters is registered in the Land Register under no. 425 620 and is located outside Lugoj city, in Timiş County (Figure 3).

Figure.3 The delimitation of the area where the connection is located

The plot with the cadastral number 411 150 resulted from dismantling the building with the old cadastral number DE 425/6 with a total area before dismantling of 1524 square meters. After dismantling the DE425 / 6 building two new plots resulted, with the following areas: PLOT 1 with an area of 770 square meters and PLOT 2 with an area of 754 square meters, as it can be seen from the table of the current situation for each plot which was dismantled. (Table 2)

Table 2

The current situation according to the Land Register – LUGOJ

A. SITUATIA ACTUALA CONF. CF. – LUGOJ

NR. CRT.	NR. C.F.	NR.CADASTRAL	DESCRIERE	SUPRAF. mp.	PROPRIETAR
1.	400335 Lugoj	A420/1/1	Arabil extravilan	74515	SOCIETATEA REAL PINCO S.R.L. cota actuala 1/1
2.	411180 Lugoj	DE 455/6	Drum extravilan	1524	cota actuala 1/1
3.	411181 Lugoj	DE 451/6	Drum extravilan	3055	cota actuala 1/1
4.	..... Lugoj	PAT424	Padure tapara extravilan	14585	cota actuala 1/1
5.	..... Lugoj	PAT424/2/1	Arabil extravilan	54993	cota actuala 1/1
6.	400200 Lugoj	A421/2/1/7	Arabil extravilan	8024	MUNICIPIUL LUGOJ, - domeniul privat cota actuala 1/1
7.	400204 Lugoj	A421/2/1/8	Arabil extravilan	10030	SOCIETATEA REAL PINCO S.R.L. cota actuala 1/1
8.	400205 Lugoj	A421/2/1/6	Arabil extravilan	10030	SOCIETATEA REAL PINCO S.R.L. cota actuala 1/1
9.	400200 Lugoj	A421/2/1/4	Arabil extravilan	10030	SOCIETATEA REAL PINCO S.R.L. cota actuala 1/1
10.	400207 Lugoj	A421/2/1/5	Arabil extravilan	10030	SOCIETATEA REAL PINCO S.R.L. cota actuala 1/1
11.	400208 Lugoj	A421/2/1/2/2	Arabil extravilan	8039	SOCIETATEA REAL PINCO S.R.L. cota actuala 1/1
		TOTAL		.....	

In order to prepare this study we used the real-time kinematic RTK method, using real-time differential corrections from ROMPOS specialized service.

In order to prepare this study we used the Leica 1200 GPS device. Data processing was performed with Leica Geo Office Combined software, and the calculated points were reported in AutoCAD, with which we prepared the situation plan.

In this study the following plans were used:

- Situation plan, 1: 2000 scale (Figure 4)
- Development Site Plan, 1:10000 scale

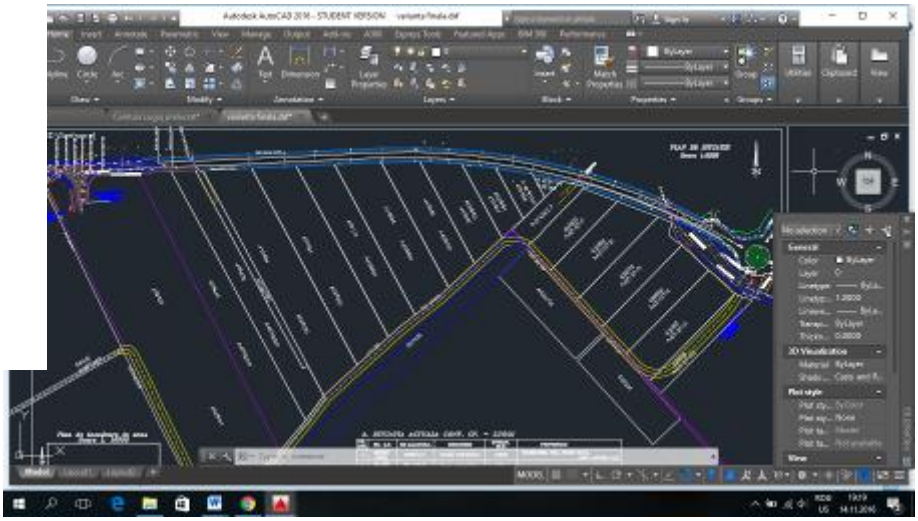

Figure.4 Situation plan 1:2000

To determine the points of the GPS station, the method Stop & Go (or Real Time Kinematic) was used, with the reference station TIM1_2.3 from Timişoara.

In order to perform the topographic surveying, the following operations were carried out:

Identification of land;

- Measurements with the local station Leica TC 805;
- GPS measurements (Global Positioning System) with the kinematic method RTK (Real Time Kinematic) using the reference station from Timişoara;
- Download from the device with the program Leiga Geo Office Combined;
- Processing raw data;
- Using the TransDat 4.0 program for the conversion from the WGS'84 system (World Geodetic System) in the Stereographic 1970 System;
- Processing data;
- Importing points in Autocad, using the TopoLT software;
- Uniting the points and drawing up the plan to the scale 1:2000.

Coordinate System:

This study was prepared using the STEREOGRAPHIC 1970 projection system and the reference level system BLACK SEA (MAREA NEAGRĂ) 1975

This study is used for the project concerning the construction of the connection road to the highway along Lugoj City, with a width of 4 meters.

CONCLUSION

- The opportunity of this work is the traffic flow decongestion in this area;
- When preparing this study, several criteria were taken into account, the most important being the feasibility study;
- This study was prepared using the STEREOGRAPHIC 1970 projection system and the reference level system BLACK SEA (MAREA NEAGRĂ) 1975.

- The total surface of the connection road is 2798 square meters, transverse profiles have been prepared in all the points of the route where the land line changed its slope.
- The maximum distance between the profiles was 50 meters.

BIBLIOGRAPHY

BOS N. - 1993 didactic and pedagogical printing house, bucharest – topography

CRISTA F. ET AL., 2012, Mineral fertilization influence upon soil chemical properties, 47th Croatian and 7th International Symposium on Agriculture. Opatija, Croatia

CRISTA F., GOIAN M., 2008, Agrochimie și agricultură durabilă, Ed. Eurobit, Timișoara

CRISTA FL., 2014, Conservarea fertilității solului și managementul nutrienților, Ed. Eurobit

CRISTESCU N. – 1978, didactic and pedagogical printing house, bucharest – engineering topography

HERBEI M., ULAR R. – Întocmirea şi redactarea hărţilor şi planurilor topografice, ed. Dalami, Caransebeş, I.S.B.N.978-973-1717-42-5, 2011:

IMBREA FLORIN,2011, Cercetarea agricola mai aproape de ferma, Agrobuletin Agir An III, nr. 1 (8),

IMBREA FLORIN,2011, Optimizarea sistemelor curente de producție a cerealelor din Banat și Câmpia de Vest, subiectul unui parteneriat public-privat de cercetare interdisciplinară la USAMVB Timișoara, Agrobuletin Agir An III,

IMBREA FLORIN,2011, Proiectele de cercetare în domeniul agriculturii în parteneriat public-privat– provocări privind managementul și finanțarea, Agrobuletin Agir An III,

LUMINIȚA LIVIA BÂRLIBA, C. A. POPESCU, C. *BÂRLIBA, Elemente de cadastru* - Note de curs şi lucrări practice, Editura Eurobit, 2013.

POPESCU C., Cadastru general, Inregistrarea sistematică a imobilelor, Editura Eurostampa, Timişoara, 2015

SMULEAC ADRIAN, MIHAI HERBEI, COSMIN POPESCU - Creating the digital terrain model of the usamvb area using modern technology, pg.282-287, vol. 44, nr. 3, 2012, citat în 2015, Digital Elevation Modeling Based on Multimodal Aerospace Data in the Context of Sustainable Development of Romania F.Boda, L.-I. Munteanu , D. Raducanu Emerging Markets Queries in Finance and Business 2014, EMQFB 2014, 24-25 October 2014, Bucharest, Romania doi:10.1016/S2212-5671(15)01559-2.

ŞMULEAC LAURA, SIMONA NIȚĂ, ANIȘOARA IENCIU, ADRIAN ŞMULEAC, DICU DANIEL - Topographic survey for the monitoring of the impact of the Brua/Rohuat pipe on water flow in the irrigation system at Fântânele, Arad County, Romania, SGEM2016 Conference Proceedings, ISBN 978-619-7105-81-0 / ISSN 1314-2704, 2 - 5 November, 2016, Book 3 Vol. 3, 333-340, 2016

ŞMULEAC, LAURA; ONCIA, SILVICA; IENCIU, ANIȘOARA; BERTICI, R.; ŞMULEAC, A.; MIHĂIESC, V., Influence of anthropic activities on ground water in Boldur, Timis county, Romania, Research Journal of Agricultural Science, Vol. 46 Issue 2, p370-375. 6p., 2014

.*** LEGEA NR. 50/1991. Codul muncii.autor marius-catalin predut.editura universului juridic.noiembrie 2016

*** HTTP://WWW.GEOTRADE.HU/,

*** HTTP://WWW.TRIMBLE.COM/,

*** WWW.LEICA-GEOSYSTEMS.US

*** HTTP://OPENTOPO.SDSC.EDU/