THE CURRENT STATE OF REHABILITATION AND MODERNIZATION OF GEODETIC AND TOPOGRAPHICAL NETWORKS

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Abstract

The case study was done by measuring the area of 111.06 hectares of a vineyard unit, located in the North West outside of the city of Iasi. The measurements necessary to achieve a thicker network of points and topographical mapping in stereograph projection system 1970 were performed with TC 705 total station, the Leica Geosystems.
The thickening of the planimetrical support network was done based on the old geodetic points of the 4^{th} and 5^{th} order, from the existing triangulation network of the stereograph projection system 1970 of Iasi. As a feature of the execution of polygonal course were included in measurements both two ordinary landmarks and two GPS landmarks from the main network of Iasi. All topographic measurements were made to update the site plan and cadastral mapping for vineyard establishment on a scale of 1:5000.
Pulling out of the data resulted in getting a clear picture of distribution of land use categories within the growing unity, indicating the number of parcels, the area in hectares and the percentage of occupancy.
Characterization of the land depending on the slope shows that the surface of 2.18 ha of arable land area and the surface of 0.33 ha of pasture land is heavily slanted, so the anti-erosion works should be made by growing rows parallel to the level curves direction.

Key words: topographical works, electronic topographical equipments, digital cadastral plan.

After 1990, the problem of building a modern geodetic network crossed the desire to get both to an upper stage and to satisfy the requirements for integration in European networks.

The initiative to define a modern surveying systems, which serve as support for geodetic and topographical works, has led to a Romanian-American cooperation, following the observations made in 1994. Finally we want to get a modern geodetic network, integrated in European network, whose unitary determined points will ensure optimum density, for the benefit of different users, regardless of intended purpose and the scope of work.

MATERIAL AND METHOD

For the purpose of getting the provisional cadastral number of the realty and for the registration of the vineyard unit in The Cadastral Register of Iasi, with indefinite character, in the year 2004 has been made the documentation accordingly with the standards of the Cadastre and Land Registration Office (O.C.P.I.).

By making The General Technical Cadastre of Iasi, between 2005 and 2008, it was accomplished the following:

- cadastral determination by materializing in the field of over 200 border points, noted with R1, R2, …, which were determined by STEREO-70 Projection System flat rectangular coordinates and by BLACK SEA-1975 reference system bench marks;
- the thickening of the geodetic network of the Iasi territory was determined by GPS technology, which included in the first stage 84 main points, noted with I1, I2, …, materialized in the field and determined by X, Y, Z coordinates.
- the extension of the geodetic network of thickening and lifting to approximately 5000 points, which assures the density needed in the detailed execution of the topographic and cadastral measurements.

The field work necessary for the lifting in plan of the vineyard unit, which is the object of the case study, consisted in making of all topographic measurements for the geodetic network of thickening and lifting in the STEREO-70 Projection System, utilizing modern methods.

The topographic lifting was made with TC705 total station, by Leica Geosystems, with direction standard error of 15^{cc} and distance measurements precision of 2 mm+2ppm.

The thickening of the planimetrical support network included the determination of the new points 201 and 205 (*fig. 1*), based on the old geodetic points of the 4^{th} and 5^{th} order, already existing in the triangulation network from the STEREO-70 Projection System of Iasi territory.

By standing with the total station on the Jewish Cemetery Landmark (Patrici Hill Landmark) was checked the planimetric position, based on the method backwards intersection, by targeting the seven geodetic points of 5th order (*fig. 1*), visible from this 4th order landmark.

To the calculation of the position in plan of the landmark contributed the average of the 11th combinations remaining from a total of 35, obtaining the next plane rectangular coordinates: X = 634886.578 m; Y = 692738.415 m.

Due to the display of the geodetic points of 5th order in the three quadrants, the backwards intersection made by the processing program TOPOSYS is half rigorous and the average plan positioning error of the landmark is 4,9 cm. According to the coordinates inventory of the triangulation network in the STEREO-70 Projection System, made by O.C.P.I. Iasi for the territory of the Iasi county , the plane rectangular coordinates of the Jewish Cemetery Landmark are: X = 634886.568 m; Y = 692738.436 m.

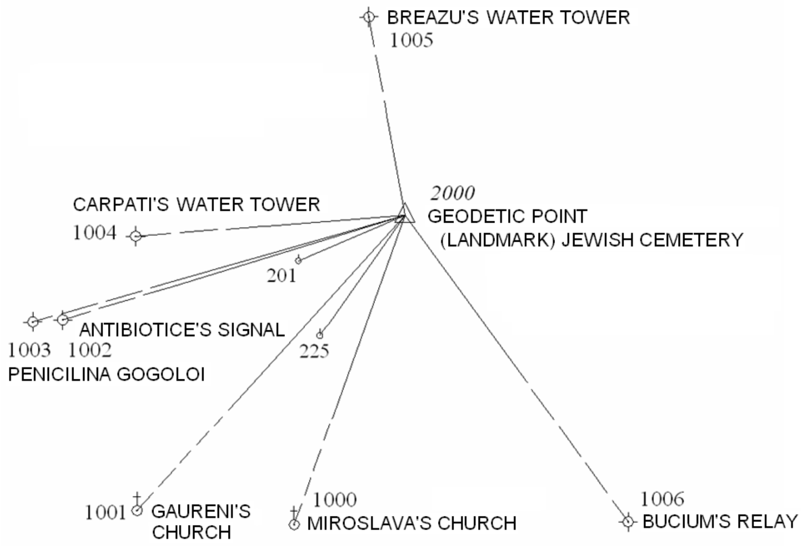

Figure 1 **The outline of the re-determination visa of the geodetic point of the 4th order, Jewish Cemetery Landmark, through the backwards intersection and the transmission of the support points 201 and 225**

The measurements for the determination of the points from the realty perimeter and all the details of the plots included, were made through the method of supported on the both ends traverse, starting from the supporting point 201 with orientation towards Gaureni Church and ending with the supporting point 225 with orientation towards Miroslava Church. The supported traverse included a number of 27 stations, from which a border landmark R31, coded 2002, and a GPS landmark from the main network of Iasi I84, coded 2004, with possibility of sighting towards the border landmark R30, coded 2001 and towards the GPS landmark I83, coded 2003 (*fig. 2*).

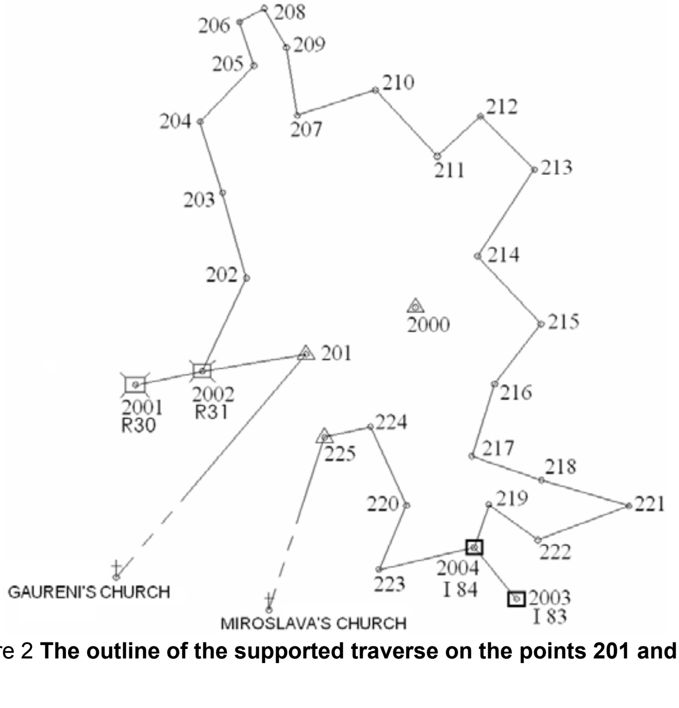

Figure 2 **The outline of the supported traverse on the points 201 and 225**

RESULTS AND DISCUSSIONS

Before making the processing of the topographic measurements obtained in the field work phase, because the processing program TOPOSYS allows us to do that, is recommended to be checked the distances between the traverse points. After the calculation, resulted the average error between forward – backward distances for the station points, which is ± 1.5 cm, and the biggest difference among the values of those distances is between the traverse points 208 and 209 and it has the following value: ± 2.4 cm.

By viewing the file where is presented the method of calculation and compensation of the supported traverse it is noted that the traverse has a total length of L = 5086,431 m, an error of un-closure on directions $e_\beta = -0^g07^c42^{cc}$, respectively an error of un-closure on the axis OX $e_x = 0.228$ m and on the axis OY $e_y = 0.404$ m.

The plane adjustment of the supported traverse was made based on the method of compensation constrained on the fixed points 201 and 225, depending on the distance. Still here are displayed for the traverse points, the values of the directions and distances measured and compensated with their corrections in seconds, respectively in centimeters. For all the 25 points of traverse witch made the object of the compensation, the average error of direction is $14^{cc}.92$ and the average error of distance is 1.70 cm.

In the end, after the phase of compensation of the traverse, by the calculation version “Automatic cancellation”, from the processing program, results the position in plan of the traverse points, of the border points on the realty perimeter and of the corners of the plots.

Confronting the plan rectangular coordinates obtained from the topographic measurements for the land marked points from the inventory offered by O.C.P.I. Iasi, we can observe in The *Table 1* the following: the total error of positioning in plan ($E_{X,Y}$) of the 5th order landmark, coded 2000, is 2.3 cm, the total error of positioning of the border landmark R1 is 7.1 cm, the total error of positioning of the GPS landmark from the main network of Iasi I84 is 46.5 cm and the total error of GPS landmark is 57.2 cm.

Table 1

Confronting the plan rectangular coordinates obtained from the topographic measurements for the land marked points

Point number	Point name	Plan rectangular coordinates in STEREO 70 Projection System				Differences	
		from the inventory O.C.P.I. Iasi		from topographic measurements			
		X (m)	Y (m)	X (m)	Y (m)	ΔX (m)	ΔY (m)
2000	Landmark Jewish Cemetery	634886.568	692738.436	634886.578	692738.415	-0.010	0.021
2001	Landmark R30	634664.079	692018.507	634664.016	692018.615	0.063	-0.108
2002	Landmark R31	634705.321	692191.508	634705.349	692191.573	-0.028	-0.065
2003	Landmark GPS I83	634137.819	693023.334	634137.429	693022.915	0.390	0.419
2004	Landmark GPS I84	634268.663	692910.234	634268.357	692909.884	0.306	0.350

The case study is the vineyard unit (*fig. 3*), with a total area of 111.06 ha, situated in the North West Side of the City of Iasi, on the Patrici Hill, on the ex-location of Copou Agricultural State Company (Huţanu, Cr., 2010), which has 102 border points and a total length of the border of 6018.98 m.

Pulling out of the data resulted in getting a clear picture of distribution of land use categories within the growing unity, indicating the number of parcels, the area in hectares and the percentage of occupancy (*tab. 2*).

Table 2

The distribution use category distribution by the type of land for the vineyard unit

No.	Use category of the land	Plots number	Plots area	
			ha	%
1	Arable (A)	21	10.0698	9.07
2	Pasture (P)	5	0.6828	0.61
3	Hay (F)	7	2.9216	2.63
4	Noble vine (VN)	97	83.9481	75.59
5	Orchard(L)	1	0.3641	0.33
6	Forest(PD)	4	0.8941	0.81
7	Land with water (H)			
	Lakes and natural puddles (HB)	1	0.0250	0.02
	Channels (HC)	2	0.2511	0.23
8	Service roads (DE)	126	9.9766	8.98
9	Yards and constructions (CC)	8	1.9251	1.73
TOTAL ON VINEYARD UNIT		**272**	**111.0584**	**100.00**

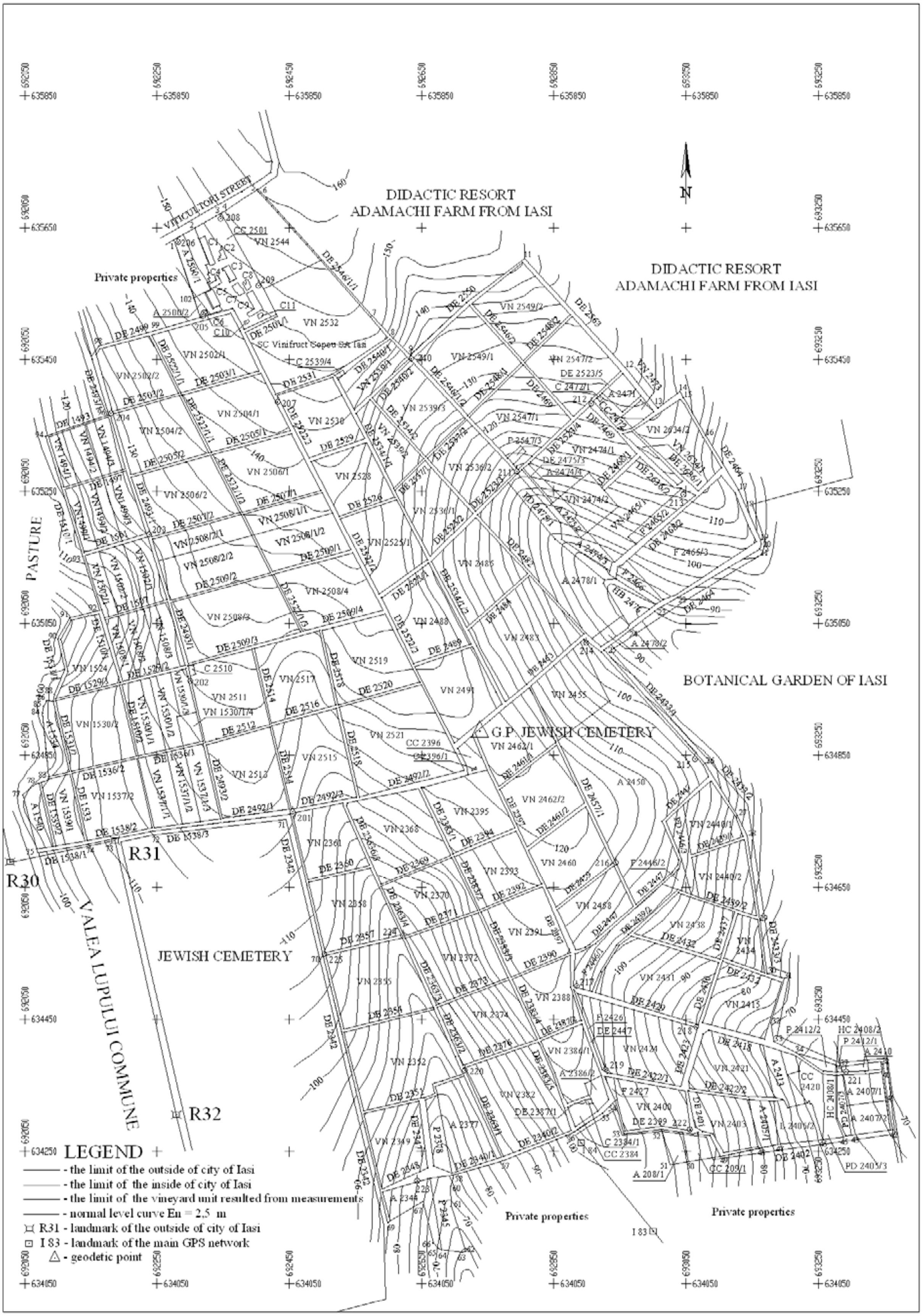

Figure 3 **Drawing the location and cadastral delimitation plan on a scale 1:5000 for the vineyard unit**

On the emplacement plan it is showed also the land relief through level curves, which normal equidistance is E_n = 2.5 m, having The Black Sea as reference plan for bench marks.

Accordingly to the characterization of the terrain slope following possibilities of application of agro works and/or anti-erosion arrangements [Moţoc, M., 1993], the 83.95 ha (75.59%) planted with noble vine are thus divided:

- 2.40 ha (2.16%) on plan surface with 0-5% slope;
- 46.25 ha (41.64%) on slightly slanted surface with 5.1-10% slope;
- 35.30 ha (31.79%) on moderately slanted surface with 10.1-15% slope (*tab. 3*).

Table 3

The distribution of the plots by agro use depending of the average slope of the vineyard unit land

No.	The use of the land	The plots classification by agro use depending on the average slope								TOTAL AGRO USE	
		0.0 – 5.0		5.1 – 10.0		10.1 – 15.0		15.1 – 20.0			
		ha	%	ha	%	ha	%	ha	%	ha	%
1	Arable (A)	–	–	1.31	1.18	6.58	5.92	2.18	1.97	10.07	9.07
2	Pasture (P)	–	–	–	–	0.35	0.31	0.33	0.30	0.68	0.61
3	Hay (F)	–	–	0.76	0.68	2.16	1.95	–	–	2.92	2.63
4	Noble vine (VN)	2.40	2.16	46.25	41.64	35.30	31.79	–	–	83.95	75.59
5	Orchard (L)	–	–	–	–	0.36	0.32	–	–	0.36	0.32
TOTAL		2.40	2.16	48.32	43.50	44.75	40.29	2.51	2.27	97.98	88.22

Characterization of the land depending on the slope shows that the surface of 2.18 (1.97 %) ha of arable land area and the surface of 0.33 ha (0.30 %) of pasture land is heavily slanted, so the anti-erosion works should be made by growing rows parallel to the level curves direction.

The emplacement and delimitation plans of the realty are executed for the next purposes:

- registration with un-determinate character in the Cadastral Register of the judicial acts and facts regarding the lands and constructions located on a territorial administrative unit for which wasn't determinate the General Land Register's documents; for those will be elaborated documentation drawing instructions (The Normative for General Cadastre, 2001);
- solving of the appeals regarding the fairness and the accuracy of the data on the realty;
- advantaging the management, planning and forecast organizations from all national economy branches, by automating the cadastre works, in the taking decisions process, in case there is a large volume of data and information about real estate properties, provided by the Land Register;
- for the elaboration of topographic and cadastral documentation, which are required by the public administration for the notices, certificates and licenses issuing and also for solving of all the aspects related on formation and reconstitution, after finalizing the general land register data processing of an administrative territorial unit;
- updating this data and information, regarding the form, the area, the category of use, the owner and others is due to the dynamics of the real estate circulation in a society with a changing market economy.

The advantages of the digital cadastral plan consist in the fact that permits:

- to the land register offices to identify on a graphic support the emplacement of the cadastre bodies and to assign them an unique identifier, in a low cost conditions. The cadastre must provide to the real estate market, when the realty is sold or mortgaged, not only elements which can prove the property right, but also the cadastral documentation necessary for localizing it;
- to integrate the cadastral information to a different level of detailing;
- to instantly updating the cadastral situation within certain territory;
- to offer efficient cost solutions, especially in the urban areas where the request for cadastral data is more pronounced than in the rural areas;
- to record systematically the cadastral documentations made within some territory, helping to realize a permanent update of the General Cadastre.
- to correlate with the land register, becoming an interface in the process of cadastral noticing;
- to connect with other geodetic data basis, especially the exchange of information with the Land Register System;

- to ease up the access to the cadastral data, influencing in a positive way the development of the real estate market.

CONCLUSIONS

According to the current technical normative, the geodetic networks made in the territory must be unitary and homogenous, because they are a secure support for the topographic and photogrammetric works, regardless the area in which were executed.

The big inequalities that appear between the sets of coordinates obtained for the points from other networks are confirming a mismatch between the different technologies of the electronic measurement devices.

The advantages of the digital cadastral plans consists in the fact that allows to the land register offices from the territory to check and to update the database, shortly and low cost , based on the works made by authorized land surveyors on the request of the interested beneficiaries.

The difficulties related on the supply of the cadastral documentation are increased by the fact that the property registration in the un-definitive land register depends by the owner's option, this being mandatory only in case of a real estate transaction.

On the heavily slanted land were made anti-erosion works by growing rows parallel to the level curves direction.

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