

## TECHNICAL ASPECTS OF SYSTEMATIC CADASTRAL WORKS PERFORMED ON CADASTRAL SECTORS

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**Abstract:** The execution of topographic measurements for the real estates from the cadastral sectors of the territorial administrative units is part of the integrated cadastral and land registration system. This unitary general cadastre system includes 3,181 territorial administrative units at national level, more precisely: 103 municipalities, 217 cities, 2,161 communes and 12,957 villages. The present stage of the systematic cadastre consists in implementing *The National Programme for Cadastre and Land Registration 2015 – 2023*. These works are performed by specialized professionals and financed by the *National Agency for Cadastre and Real Estate Advertising*. The legal frame for the general cadastral works in Romania is regulated by the *Law on Cadastre and Real Estate Advertising no.7/1996, with all the subsequent modifications and completions*. In the case of Iasi County, which covers a total surface of 5,477 km<sup>2</sup>, there are officially identified 98 administrative territorial units, which include: 2 municipalities, 3 cities, 93 communes and 418 villages. The ongoing operations at the level of the cadastral sectors of Iasi County include 52 territorial administrative units and cover a surface of almost 63,000 ha. This sums almost 87,000 owners. The selected case study highlights the cartographic and legal aspects of the technical documentation drawn up for the cadastral sector no. 22 (strip of land no. 46). From Holboca commune, Iasi County. The delimited and measured surface for this cadastral sector was of 173.3235 ha, with 244 real estates identified and a road used for agricultural purposes. The limits of this cadastral sector and of the real estates included, respectively, were set on the field, based on the identification provided by their legal owners. After processing the specialized studies, it resulted the graphic and alphanumeric data base for one cadastral sector. This data base represents the base for the opening of land registers and the official records of real estates and owners.

**Key words:** systematic cadastral works, land register, technical and legal data base, cadastral sectors and real estate

The implementation of the integrated cadastre and land registration system for the real estates from cadastral sectors represent the main goal for bringing to an end the specialized works conducted in the administrative-territorial units.

In 2019, the National Cadastre and Land Registration Program reached its fifth financing stage, for both its incorporated and unincorporated activities. By implementing these cadastral works for the 3,181 administrative-territorial units of Romania, the real estates are registered and described.

The systematic real estate registration program is financed for the territorial administrative units by the *National Agency of Cadastre and Real Estate Advertisement*. At the same time, it is also mentioned the financing received from the *European Fund for Regional Development*, allocated mainly for the cadastral system of rural areas.

The legal framework for conducting the specialized works is regulated by the *Cadastre and*

*Real Estate Advertisement Law no. 7/1996*, with the subsequent modifications and completions.

Following the finances assigned between 2015-2019 the systematic cadastral works have been completed for all the basic administrative units and also for some cadastral sectors from the incorporated and unincorporated areas.

The systematic cadastral works conducted on cadastral sectors until **September 10th 2019** were concluded for a total number of **13 485,815** real estates, managed in the integrated cadastre and land registration system.

The properties recorded at the *National Agency of Cadastre and Real Estate Advertisement* represent nearly **34%** of the approximately 40 000,000 real estates estimated at national level.

From the systematic registration activity conducted until **September 10, 2019** it resulted the process was completed in **69 administrative - territorial units** from **21** counties (<http://www.ancpi.ro/pnccf/>).

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Presently the ongoing cadastral activity is conducted, at national level, **2 298 administrative – territorial units**, the equivalent of nearly **72% of the total basic units**.

In the area corresponding to the administrative territorial unit of Iasi County, that covers a total surface of **5,977 km<sup>2</sup>** there are registered **98 basic administrative units**. They include: **2 municipalities, 3 cities, and 93 communes**, with **418 villages** (The Statistical Yearbook of Romania, 2018).

The registration of the real estates in the integrated system of cadastre and land registration was started at the end of 2015. The first administrative territorial units nominated by the *National Agency of Cadastre and Real Estate Advertisement* for implementing the systematic cadastre were the communes **Dumesti, Lețcani and Movileni**. Along with the three units of Iasi County there were also nominated 62 other administrative territorial units.

Following the European funds allocated in September 2018 the systematic registration of real estates on cadastral sectors expanded to another 23 administrative territorial units of Iasi County. At the same time, the *Cadastre and Real Estate Advertisement Office of Iasi* draw up the financing contracts for the systematic registration of real estates with another 52 administrative territorial units. In his context, the surveys estimated cover approximately **87,000 real estates**, with a total of almost **63,000 hectares**.

The conclusion of this process consists mainly in the registration of the agricultural lands from rural areas. At the same time, the surveying is ensured as well as the registration of the real estates in the digital data base of the land register.

The present status of the ongoing works from Iasi County point out, according to the technical data provided by the *National Agency of Cadastre and Real Estate Advertisement*, they have expanded in **70 administrative-territorial units**, from the total of 98 basic units (*figure 1*).

## MATERIAL AND METHOD

Cadastre and land registration have experienced, over time, various development periods and stages (Boș N., Iacobescu O., 2009).

Considering the organizational and legal context existent in the 100 years interval that passed from the Great Union, three distinct periods have been identified: 1918–1950, 1951–1989 and 1990–2018 (Moca V. *et al*, 2018).

Nowadays, the unitary cadastral and land registration system is implemented for the entire territory of the basic administrative territorial units

and also for some incorporated or unincorporated cadastral sectors (Moca V. *et al*, 2018).

For the present case study the technical cadastral operations have been conducted on the real estates identified in the cadastral sector from the *unincorporated area of the administrative-territorial unit of Holboca, Iasi County*. This commune is situated in the south-eastern part of Iasi County, in the eastern part of the municipality.



Figure 1 The ongoing systematic registration activity for the real estates from the territorial administrative units of Iasi county (According to ANCP, 2019)

The total surface of the administrative-territorial unit of Holboca includes **5,002 hectares**, including the unincorporated area and the following seven incorporated areas: *Holboca, Dancu, Valea Lungă, Ruseii Noi, Ruseii Vechi, Orzeni și Cristești* (Cârdei Mihaela, 2013).

The information for the technical data base used in the identification, delimitation, cadastral measuring and representation of real estates on the cadastral plan was conducted, for the **cadastral sector no. 22 (strip of land no. 46)** in the unincorporated area of Holboca commune. For this cadastral sector covering **173.3235 hectares** there have been delimited **244 real estates** and an exploitation road.

The limits for the cadastral sector no. 22 and for the 244 real estates included were established based on the existent cadastral technical documentation and the on field identification of the legal owners. The systematic registration of the real estates is realized by specialized service providers according to the acquisition procedure.

By **Order no. 979/05.08.2016** it was regulated the way the systematic cadastral activity is conducted on cadastral sectors for the registration of real estates in the land register. They are financed by the *National Agency of Cadastre and Real Estate Advertisement*.

The specialty works for the cadastral sector no. 22 consisted in going through all the stages and the theoretical and practical technical operations.

The graphical and alphanumeric data included in this case study were taken from the

cadastral plan, scale 1:2000 of the cadastral sector no. 22. A plan section was selected from the graphic fund of this cadastral plan.

The delimited cadastral subsector with the **identification no. 22/1** included a total surface of **32.9975 hectares** and **43 real estates** used as agricultural land.

## RESULTS AND DISCUSSIONS

Based on the cadastral delimitation of the existent boundaries between the basic administrative territorial units and the identification of the limits of the cadastral sectors from the Holboca area it was initiated the procedure for the systematic registration of the real estates from one cadastral sector.

The stages and the technical operations for the systematic registration of the real estates were

conducted on the *cadastral sector no. 22* situated in the unincorporated area of Holboca, according to the technical norms.

### a. Cadastral delimitation and cartographic framing of the Holboca territory

The Holboca administrative-territorial unit was delimited by six basic territories. The total length of the borders' perimeter following the cadastral delimitation was of **44.190 Km**.

The cadastral delimitation of Holboca's territory included **six boundaries of the commune: Aroneanu and Golăiești in the North; Ungheni and Țuțora in the East; Tomești in the South; and the border with the municipality of Iasi, in the West, respectively (figure 2).**

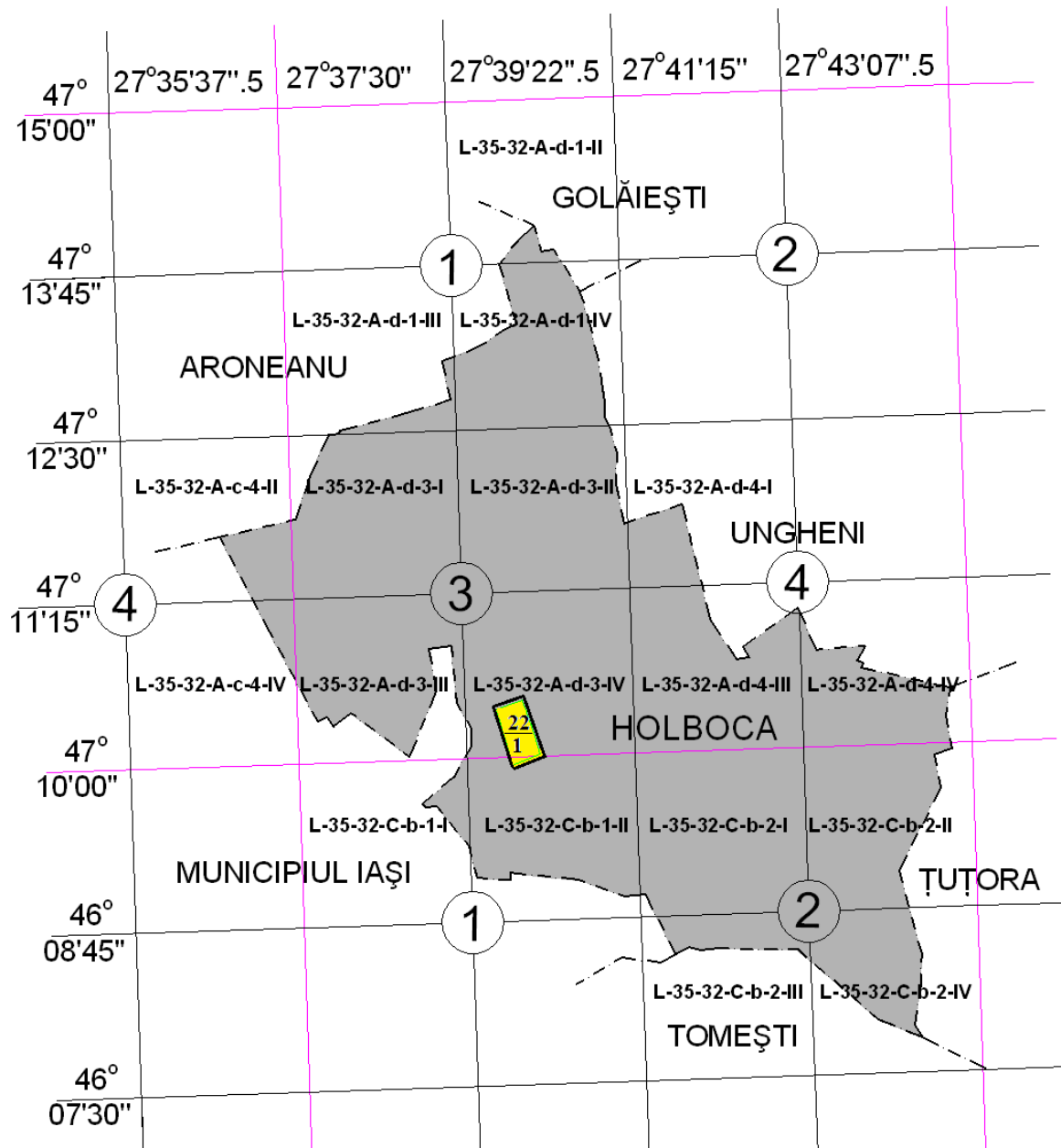


Figure 2 Cadastral delimitation and framing on geodetic trapeziums of the administrative-territorial unit of Holboca, Iași County, scale 1:5000

The real estates' graphic representation is drawn up using the national system of the **1970 Stereographic projection** and the **Black Sea - 1975** quota system. The accuracy of the graphic representation of the real estates' borders must respect the plan scale 1:5000 for the unincorporated areas and 1:2000 for the incorporates areas

The spatial distribution of the borders of the administrative-territorial limits of Holboca was cartographically framed on *7 trapeziums with scale 1:10000, 18 trapeziums with scale 1:5000 and 53 trapeziums with scale 1:2000.*

The areas of the trapeziums (plan sheets) are determined based on the geographic coordinates of the four corners used as **control surfaces** in the general and systematic cadastre works, on cadastral sectors. In principle, the geodetic trapeziums areas that are determined based on geographic coordinates are not considered deformed in the 1970 - Stereographic projection plan. The graphic fund of the systematic cadastral activity that lead to the present case study of **the cadastral sector no. 22** (strip of land no. 46) was represented cartographically on two trapeziums: **L-35-32-A-d-3-IV and L-35-32-C-b-1-II.**

Based on the graphic correlation with the control area of the geodetic trapeziums with scale 1:5000 of the total measured surface of **173.3235 ha** resulted the subsequent cartographic framing: 98.8% in the trapezium **L-35-32-A-d-3-IV** and 1.2% in the trapezium **L-35-32-C-b-1-II** (*table 1*).

Table 1  
The surface of geodetic trapeziums and of the cadastral sector no. 22

Nomenclature of the geodetic trapezium	Trapezium surface	Subsector surface	
	ha	ha	%
L-35-32-A-d-3-IV	548.8071	171.3293	98.80
L-35-32-C-b-1-II	549.1220	1.9942	1.20
TOTAL	1097.9291	173.3235	100.00

**The cadastral subsector no. 22/1** with the surface of **32.9975 hectares** and **43 real estates** was represented, on the **control area** of the two geodetic trapeziums at scale 1:5000 (*figure 2*).

The spatial distribution of the graphic fund included: 93.95% in the trapezium **L-35-32-A-d-3-IV** and 6.05% in the trapezium **L-35-32-C-b-1-II** (*table 2*).

Table 2  
The surface of geodetic trapeziums and of the cadastral subsector no. 22/1

Nomenclature of the geodetic trapezium	Trapezium surface	Subsector surface	
	ha	ha	%
L-35-32-A-d-3-IV	548.8071	31.0036	93.95
L-35-32-C-b-1-II	549.1220	1.9939	6.05
TOTAL	1097.9291	32.9975	100.00

## b. The execution of topographic measurements and drawing up the cadastral plan

For drawing up the present case study the preliminary stages of the systematic cadastre were respected. The one that stands out from all of them is drawing up the geodetic support system for cadastral measurements.

For the detailed topographic measurements on cadastral sectors and on real estates it is required the optimal density of the national geodetic network. The topographic measurements on cadastral sectors and real estates require adding to the points of the national geodetic support network **GPS – GNSS**, the necessary optimal density (Păunescu, C. et al, 2015).

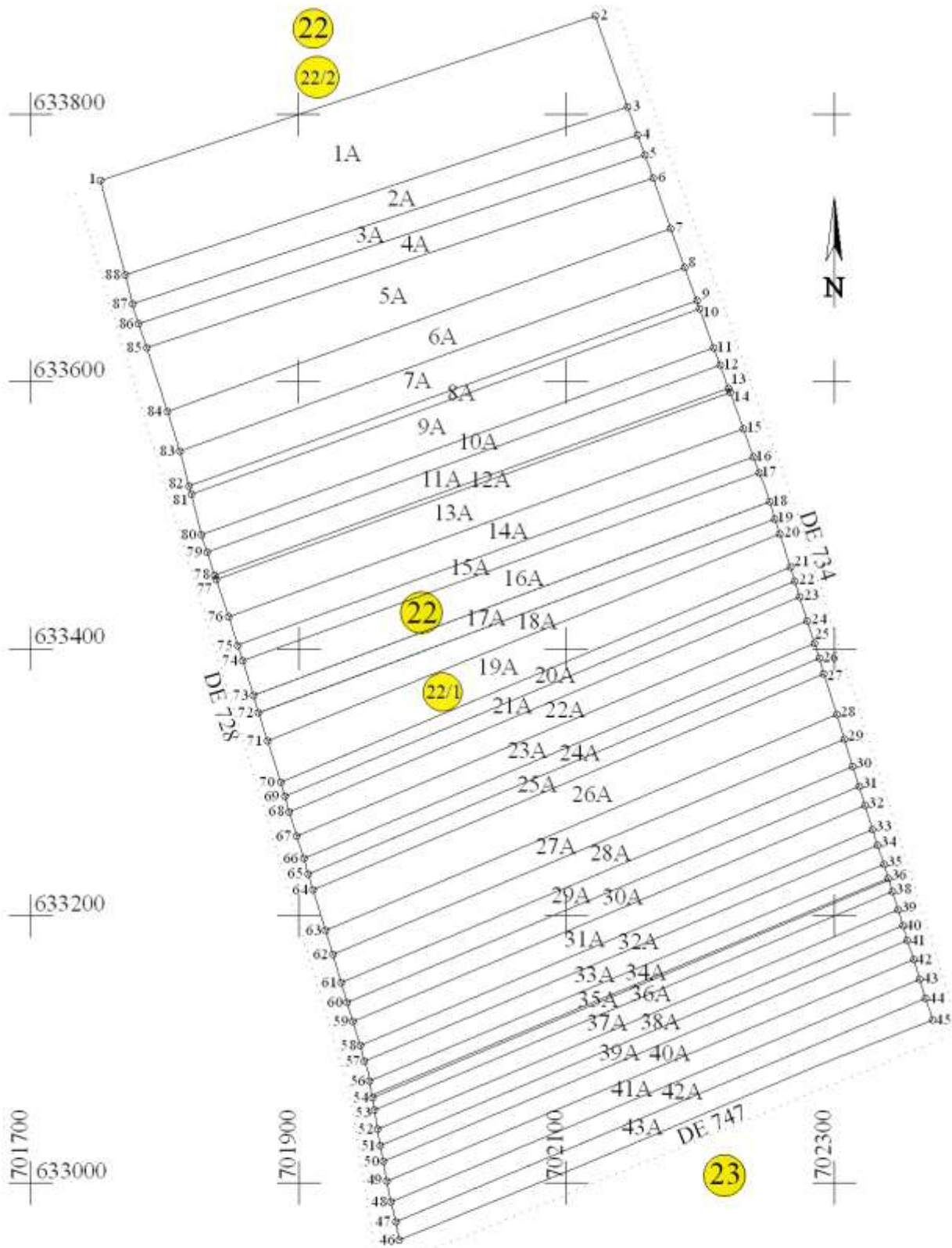
For the Holboca administrative territorial unit it was used the **GPS (Global Positioning System)** measuring technology and the double frequency **SOUTH S82T** type **GNSS (Global Navigation Satellite System)** receiver. This receiver ensures the real time **RTK (Real Time Kinematic)** measurements in both **static** and **kinetic mode**.

Using the **Carlson SurvCE** software and the **ROMPOST RTK** service the absolute rectangular coordinates were determined for four new points of **the national geodetic support network GPS-GNSS**. This geodetic support base was used for the detailed topographic measurements on the cadastral sector.

The elevation of the topographic points situated on the limits of cadastral sectors with identification numbers 22 and 22/1, and of the included real estates was made using the points of the geodetic support network. On the detailed measurements it was used the **Leica Geosystems TC-705** total station.

The measurements processing for the topographic elevation network was conducted using the specialized program named **TopoSys**. This program ensures the automatic compensation of traversing and obtaining the absolute rectangular coordinates for the measured points. At the same time, the program gives the possibility of exporting the absolute rectangular coordinates in ASCII format and the export of the graphic fund in DXF format. The topographic measurements made for the **cadastral sector no. 22** (strip of land no. 46) served for drawing up the *digital cadastral plan* and also the analogical format, scale 1:2000.

The plan metric correlation of the plan rectangular coordinates of the 88 detail points relied on a geometric grid references of the plan with the lateral of 200m. On the surface corresponding to the borders of the *cadastral subsector no. 22/1* were assigned the cadastral numbers for the 43 real estates (*figure 2*).



**LEGEND**

- |        |                                 |        |                                   |
|--------|---------------------------------|--------|-----------------------------------|
| ● 88   | Limit point of cadastral sector | ● 22   | Cadastral sector number           |
| —      | Contour limit cadastral sector  | ● 22/1 | Cadastral subsector number        |
| —      | Contour limit real estate       | 43 A   | Identification number real estate |
| DE 747 | Exploitation road               | ⊕      | Rectangular grid                  |

Figure 2 Cadastral plan for subsector no. 22/1 from Holboca administrative – territorial unit, scale 1:2000

### c. Determining the measured surface for the cadastral subsector no. 22/1

The act of establishing the limits of a cadastral sector and of all the real estates included, respectively, represents one of the key preliminary operations.

This ensures the accurate reporting of the cadastral entity and the effective management of the graphic fund reported to the cadastral plan.

The limits identified on field, for the cadastral subsector no. 22/1 are represented as linear elements established in time.

The plan *rectangular coordinates* ( $X, Y$ ) of the points from the geometric contour line that were identified in the 1970-Stereographic projection system were used to calculate the surface of the cadastral subsector no. 22/1.

In this context there were also used the rectangular coordinates of the 88 points situated on the unenclosed limit of the geometric contour of the cadastral sector. Based on the on field measurements it resulted a surface of **32.9975 hectares** that is to be registered in the primary technical database of the administrative territorial unit of Holboca (Table 3).

Table 3

**The measured surface and the perimeter of the cadastral subsector no. 22/1**

Point no.	Rectangular coordinates		Distances (m) D(i, i+1)	Point no.	Rectangular coordinates		Distances (m) D(i, i+1)
	X (m)	Y (m)			X (m)	Y (m)	
1	701752.291	633750.614	389.60	45	702373.427	633122.396	430.91
2	702121.876	633873.893	72.20	46	701975.273	632957.595	13.68
3	702145.907	633805.809	22.17	47	701972.365	632970.968	15.52
4	702153.286	633784.904	15.82	48	701969.067	632986.138	15.57
5	702158.551	633769.988	18.86	49	701965.758	633001.355	15.16
6	702164.829	633752.202	39.81	50	701963.118	633016.284	12.11
7	702178.077	633714.667	31.20	51	701961.099	633028.220	12.15
8	702188.503	633685.264	26.33	52	701959.071	633040.203	14.75
9	702197.341	633660.460	6.47	53	701956.610	633054.750	9.21
10	702199.543	633654.374	31.05	54	701955.073	633063.836	1.90
11	702210.108	633625.175	13.94	55	701954.756	633065.707	10.82
12	702214.851	633612.068	18.15	56	701952.950	633076.380	15.41
13	702221.027	633594.999	3.43	57	701949.244	633091.337	12.09
14	702222.193	633591.777	29.04	58	701945.768	633102.919	18.72
15	702232.074	633564.469	22.54	59	701940.388	633120.849	15.25
16	702239.744	633543.271	12.09	60	701936.005	633135.457	15.50
17	702243.856	633531.905	23.52	61	701931.550	633150.302	21.58
18	702251.858	633509.791	13.11	62	701925.348	633170.970	19.14
19	702255.963	633497.339	11.92	63	701919.846	633189.305	31.72
20	702259.525	633485.965	26.40	64	701910.730	633219.684	12.35
21	702267.419	633460.768	10.74	65	701907.181	633231.510	12.14
22	702270.628	633450.523	11.98	66	701903.691	633243.142	17.48
23	702274.258	633438.937	18.93	67	701898.666	633259.885	18.94
24	702279.917	633420.874	17.46	68	701893.105	633277.988	12.15
25	702285.136	633404.214	12.13	69	701889.511	633289.589	10.74
26	702288.763	633392.639	12.33	70	701886.332	633299.848	32.38
27	702292.449	633380.872	31.68	71	701876.748	633330.782	22.45
28	702301.920	633350.642	19.12	72	701870.103	633352.227	13.13
29	702307.635	633332.398	21.55	73	701866.371	633364.813	27.54
30	702314.078	633311.832	15.48	74	701858.067	633391.071	12.10
31	702318.707	633297.059	15.23	75	701854.475	633402.628	22.56
32	702323.260	633282.524	18.70	76	701847.438	633424.057	29.06
33	702328.850	633264.682	12.08	77	701838.374	633451.662	3.43
34	702332.461	633253.157	15.29	78	701837.304	633454.920	18.16
35	702337.032	633238.565	10.58	79	701831.638	633472.175	13.95
36	702340.196	633228.466	1.86	80	701827.465	633485.490	31.22
37	702340.751	633226.695	9.01	81	701819.846	633515.765	6.51
38	702343.444	633218.098	14.43	82	701818.258	633522.075	26.46
39	702347.757	633204.332	11.88	83	701811.697	633547.710	31.22
40	702351.309	633192.993	11.84	84	701802.070	633577.404	50.30
41	702354.848	633181.699	14.85	85	701786.559	633625.250	18.86
42	702359.287	633167.529	15.38	86	701780.743	633643.190	15.82
43	702363.884	633152.856	15.33	87	701775.983	633658.276	22.22
44	702368.466	633138.228	16.59	88	701770.460	633679.804	73.10
Total measured surface = 329,975 m <sup>2</sup>							
Subsector perimeter = 2,437.56 m							

According to the real situation identified in the field for the limits of the 43 real estates it is noticed, first of all, the diversity of the real estates' surface from the cadastral subsector no. 22/1.

In the present case study, the width of the real estates/parcels from the limit of the contour of the cadastral subsector D (i, i+1) ranged between a minimum of 1.86 m (D36-37) and a maximum of 73.10m (D88-1). The length of the real estates/parcels varied between 389.60 m (D1-2) and 430.91 m (D45-46).

The measured surface for the cadastral sector no. 22/1 is delimited by the perimeter length of **2,437.56 m**. The values measured on field will be registered in the chart of the cadastral sector and of the corresponding real estates

**d. Establishing the measured surface on cadastral real estates**

The areas of cadastral real estates were calculated in a similar manner as the area of the cadastral sector, according to *the Stereo-70 rectangular coordinates* of the points from the contour borderline of each real estate. 43 real estates were identified and determined in the cadastral subsector no. 22/1.

The destination and the present usage category of each real estate was established during the recognition phase of the land, according to the on field reality. The 43 real estates were classified as agricultural land under the usage category of arable land (A). The measured surface for the 43 real estates ranged between a minimum of 0.0773 ha (35A) and a maximum of 2.8500 ha (1A).

According to the present regulation regarding the systematic cadastral activity it is mentioned only the registration of the surfaces measured on field in the integrated cadaster and land registration system.

*For the unenclosed real estates situated in the unincorporated area* with the measured surface higher than the one mentioned in the documents in proof, the surface registered will be the one mentioned in the documents. This situation is applicable to the real estates that were the object of the Agricultural Real Estate Law.

*For the enclosed real estates situated in the unincorporated area* the registered surface is the one resulted from the measurements made, regardless of the surface mentioned in the owner's property documents. For the surface of the real estates from the old land registers, it is necessary to know the cartographic base of these documents. For Romania's territory there are cited six systems of plan rectangular coordinates for the cartographic projections used (Voina I. *et al*, 2018).

The sum of the surfaces of the 43 real estates was equal with the surface calculated for the cadastral subsector no. 22/1.

In this case, no surface compensation was necessary as the same rectangular coordinates from the limits of the cadastral sector and of the real estates were used.

The present configuration of the borders of the real estates from the **cadastral subsector no. 22/1** pointed out the subsequent distribution of the arable land: *34 real estates with an area of less than 1 ha: 8 real estates with the area ranging between 1-2 ha and 1 real estate with the area higher than 2 ha. (table 4).*

Table 4

**The surfaces' chart on cadastral sectors**

No. of cadastral sector	Real estate no.	Measured surface (ha)	Usage category
22/1	1A	2.8500	Arable
	2A	0.8800	Arable
	3A	0.6300	Arable
	4A	0.7520	Arable
	5A	1.8000	Arable
	6A	1.2500	Arable
	7A	1.0592	Arable
	8A	0.2614	Arable
	9A	1.2600	Arable
	10A	0.5683	Arable
	11A	0.7410	Arable
	12A	0.1400	Arable
	13A	1.1878	Arable
	14A	0.9238	Arable
	15A	0.4961	Arable
	16A	1.0497	Arable
	17A	0.5397	Arable
	18A	0.7073	Arable
	19A	1,2100	Arable
	20A	0.4421	Arable
	21A	0.5000	Arable
	22A	0.7796	Arable
	23A	0.7194	Arable
	24A	0.5000	Arable
	25A	0.5085	Arable
	26A	1.3072	Arable
	27A	0.7895	Arable
	28A	0.8905	Arable
	29A	0.6400	Arable
	30A	0.6300	Arable
	31A	0.7737	Arable
	32A	0.5000	Arable
	33A	0.6335	Arable
	34A	0.4400	Arable
	35A	0.0773	Arable
	36A	0.3760	Arable
	37A	0.6044	Arable
	38A	0.5000	Arable
	39A	0.5000	Arable
	40A	0.6300	Arable
	41A	0.6549	Arable
	42A	0.6550	Arable
	43A	0.6397	Arable
Total measured surface =		32.9975 ha	

### e. Drawing up the technical documents for the systematic cadastral works

After concluding the systematic cadastral works for one cadastral sector the graphical and reports and tables can be drawn up, outlining the real technical and legal situation of the real estates.

According to *The Law on Cadastre and Real Estate Advertisement no. 71/1996* with the subsequent modifications and completions, the following documents are made for each cadastral sector: *cadastral plan, cadastral register of real estates and the alphabetical list of the real estates.*

**The cadastral plan** represents the graphical component of the technical cadastral documents drawn up for each cadastral sector. Based on these plans the general cadastral plan for the basic administrative territorial unit is drawn up.

For the *cadastral subsector no. 22/1* situated in the unincorporated area of the administrative-territorial unit of Holboca, Iasi county, the cadastral plan was made at scale 1:2000 in the national reference system.

From the content elements of the above mentioned plan there are mentioned: *the borders and the cadastral numbers of cadastral sectors and subsectors, the borders and the cadastral numbers of the real estates, the geometric grid with the side length of 200 m and others* (Figure 3).

**The real estate cadastral register** drawn up for each cadastral sector includes the following data: *presentation of the real estate, property/possession, incumbents / divisions / mentions/trials/interdictions and observations.*

The document referring to the *presentation of the real estate* includes: identification of the land, real estate address, cadastral number, land register number, measured surface and so on.

The primary technical data regarding the measured surface of the real estates from the *cadastral subsector no. 22/1* that will be registered in the land register were presented previously in **tables 3 and 4.**

**The alphabetical list of real estates** is represented by a technical document – table – where all the real estate owners from a cadastral sector and the entire administrative territorial unit, respectively, are registered. For each owner it is mentioned the property type, that is exclusively and/or joint with other individuals.

The systematic registration activity of the real estates at the level of cadastral sectors or administrative-territorial units represents, according to the present legislation, the legal base

for recording the measured surfaces in the land register.

## CONCLUSIONS

The main objective for the systematic cadastre is the registration, at national level, of all real estates in the integrated cadastre and land registration system.

The systematic registration of real estates at the level of administrative territorial units ensures the legal security of the system keeping records of real estates and subsequently stimulates investments.

The technical documents corresponding to the systematic cadastre drawn up for a cadastral sector represent the legal support for registering the real estate in the land register.

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