

ACCOMPLISHMENT OF CADASTRAL DELIMITATION ACTIVITIES USING COMBINED WORKING TECHNOLOGIES

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Abstract

The delimitation of various administrative territorial units (U.A.T.) is an important activity in the measurements land sector considering the fact that the infrastructure of the National Land Fund has a special importance in carrying out various programs of national interest, regional or local level.

Related works of wonderful delimitation are characterized by a specific character and complexity, given the technical rules governing this activity, as well as the physical basis and existing logistics and currently unavailable.

The existence of a modern network, accessible support, corresponding to the objectives of the various cadastral works, is one of the conditions of implementation of the wonderful delimitation of the various administrative territorial units in optimal conditions.

Although currently there are modern facilities, performing spatial positioning of various details with the help of artificial satellites, total stations, are situations when their use becomes burdensome, even restrictive, because of limiting conditions (presence of forest vegetation, existence of natural or artificial obstacles, rugged relief, etc.).

Working conditions, relatively varied and complex that characterize the completion of demarcation of the built-up area, advertising the use of combined technologies, complementary, for solving problems that are identified in the field, on the occasion of the data collection.

As a result, for the realization of cadastral boundary you can use GNSS technology successfully and the conventional total station represented. Also, the use of various calculation programs, serving modern positioning technology is imperative.

Key words: (maximum 6): delimitation of the built-up area, administrative-territorial unit, modern technology, the terrestrial measurements, GNSS, total station technology, specialized programs, the final products.

INTRODUCTION

In accordance with the technical regulations for the introduction of general cadastre, land register relating to the delimitation of administrative territorial units (U.A.T.) is the basic operation identifying, measured at the ground and made the limits of administrative-territorial units, containing breaking points and border routes of administrative-territorial units, as well as the built-up area limits of the administrative-territorial unit. This work runs required before starting work general cadastre entry on a territorial-administrative unit (**Ordin nr. 534, 2001).

Setting the border line and designations of administrative territorial units shall be in accordance with the provisions of law No. 2\1968, relating to the administrative organization of the territory of Romania, republished, with subsequent amendments (**Ordin nr. 534, 2001).

The built-up area limits are established according to the General urban plans drawn up and approved according to legal provisions. In cases where there were no approved general urban plans, the built-up area limits will be those existing on 1 January 1990, according to the law, the Land Fund No. 18\1991, republished with subsequent changes (**Ordin nr. 534, 2001). To achieve these cadastral is necessary to perform following steps (**Ordin nr. 534, 2001):

- establishment of cadastral delimitation commission, called further the commission, its composition and the approval, by order of the prefect;
- the browse of the land border route planning administrative unit and the establishment of border points which will be materialized;
- the materialisation of border with borne surface used for triangulation points of order V and underground cables type 2, according to the standard SR-3446-1\96;
- the execution of measurements to determine the coordinates of the border;
- calculation of coordinates of points milestone;
- drawing up acts of confirmation with the agreement of the commission definition of register and delegates administrative-territorial units;
- the preparation of the file of cadastral demarcation and administrative borders marking.

Of objective considerations in this case study will analyze only establish and materialize the milestone points, enforcement measures for determining their coordinates and coordinates calculation in the national reference system.

MATERIAL AND METHOD

For the realization of the case study were conducted observations and data have been recorded on the itinerary and in the inpatient, and has used the experiment, simulation and comparison (Crainic, 2011).

The remark served to substantiation of technical solutions, practical sources of errors, their influence on the calculations and how to remove them.

The experiment allows to solve various differential problems which may occur in normal practice, calling the procedures, variants defined by some basic factors (logistics, working assumptions).

The simulation, in turn, using the means of modern information technology has enabled with minimal effort of various scenarios or variations of working for the establishment of relevant and effective solutions for the modernization of geotopografic works (Crainic, 2011).

The current logistical possibilities permit with the minimal effort of various scenarios or variations of it, namely for recording data and their processing (Novac, 2007, Tămăioagă, Tămăioagă D., 2007).

In order to optimise and improve the technological process for land measurement sector can simulate a range of variants that provide the ultimate in relevant, effective solutions, leading to the modernization of the respective activities (Ádám et. al., 2004).

Data collection was carried out by two different methods, with GNSS technology and GPS system and conventional technology, using total station (Crainic, Damian, 2010, Hofmann-Wellenhof, et. al. 1997).

As a result they were used four model TRIMBLE R3 GPS receivers with simple frequency.

The total station is used model 5503 DR, which it is characterized by a precision measurement of the angles of 3" and the distance of $\pm (2 \text{ mm} + 2 \text{ ppm})$.

The programs used for the collection, transfer and processing of data are represented by: Trimble Digital Fieldbook, Total Control, Business Center, Terramodel 10.4, TopoSys MapSys 7.0, 8.0 (Marton, 2007) and MapSysPDA 2.0.,

The geodesy calculation data for the global reference System WGS-84 (GRS-80) in the national application was used TransDatRO 4.01 agreed and provided free of ANCP.

With the GNSS technology were positioned with rapid static method a number of 32 points that are used for the network.

The total station was used to determine points of detail, the default limit on built-up area (Crainic, Damian, 2010, Onose, 2004).

Coordinate points known from state geodesy network used in the calculation for determining the network support and network equipment are:

- geodesy point Sălacea, I;
- geodesy point Tarcea, III;
- geodesy point La Ferma, the order IV;

The reference rate used is the geodesy point share Sălacea $Z=157.07 \text{ m}$, in the reference system Black Sea.

Land works were represented by land route through border territory administrative unit, the establishment of border points, their materialization with appropriate cables and data collection to determine their coordinates.

The workings of the Office assumed the transfer and verification of data recorded with the technologies used, proper processing and obtaining coordinates in the national system of reference, in accordance with the provisions of the technical regulations in force.

To streamline the work of land and office has been used cadastral map of Valea lui Mihai and related orthophotomap - fig. 1 and 2.

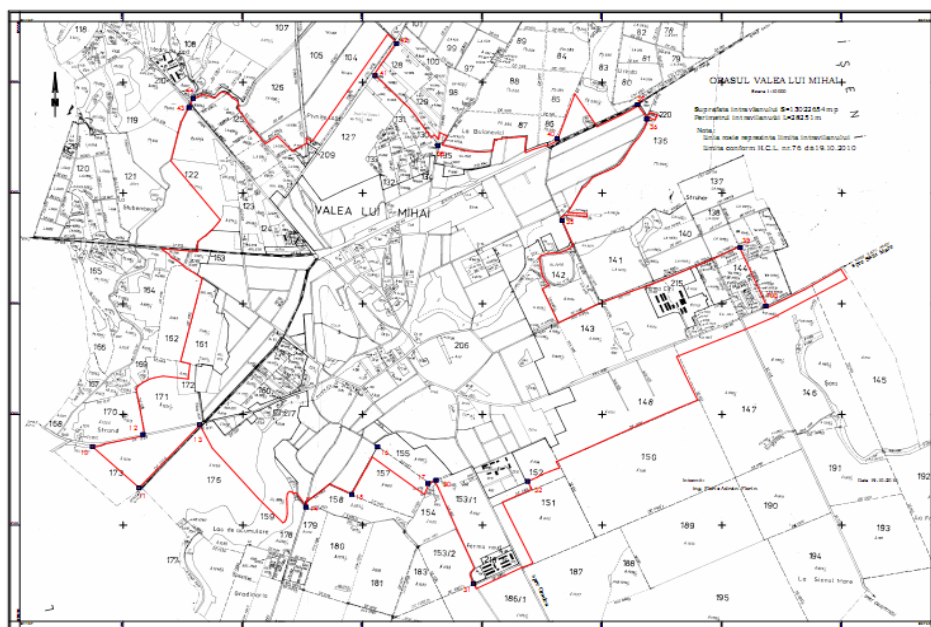


Fig. 1 Cadastral map of the administrative territorial unit of Valea lui Mihai



Fig. 2 The built-up area Limit of Valea lui Mihai transposed on orthophotoplan

RESULTS AND DISSCUSIONS

To ensure the appropriate infrastructure for cadastral delimitation, a number of 32 points were positioned with space technology GNSS, GPS system, using the static method quickly.

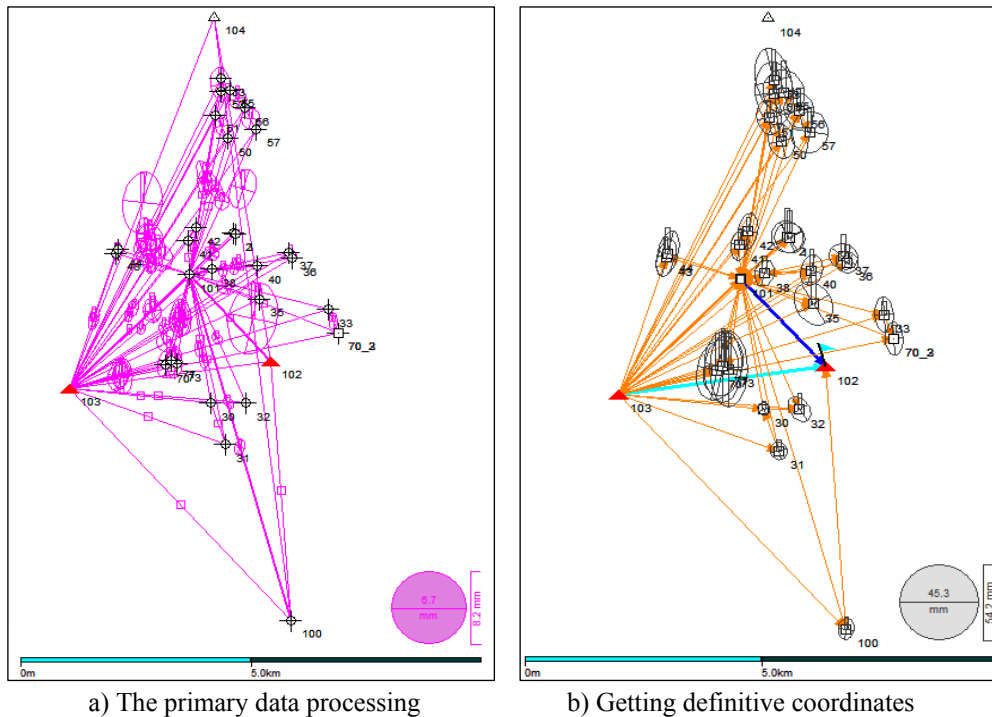


Fig. 3 The sketch of the location of vectors that have been place with GNSS technology space, primary processing and getting definitive coordinates with the TTC

The points on the built-up area contour were determined with the total station, through combined traverse, using the known points (determined) space technology positioned GNSS, GPS system, the national reference system.

The coordinates of the outline were processed with the Terramodel 10.4, obtaining default and their corresponding accuracy indicators.

Having regard to the particularities of cadastral built-up area and working conditions relatively specific to these types of activities, the use of topogeodesy differentiated and complementary technologies ensures fully positioning their success.

Table 1

The inventory positioned points with coordinates GNSS technology GPS system

No. point	X (m)	σ_x (mm)	Y(m)	σ_y (mm)	H(m)	Z(m)	σ_z (mm)
1	675214.7998	18.6	285157.7120	17.6	182.7604	165.1903	39.2
100	666515.6535	12.7	286353.7480	9.6	205.3962	157.0096	16.9
101	674298.8542	5.1	284124.5677	3.9	193.2978	173.0442	7.5
102	672346.8500	0.0	285918.2100	0.0	186.0863	158.1800	0.0
103	671728.8000	0.0	281549.8900	0.0	183.8110	155.8700	0.0
2	675230.4112	19.5	285105.4405	18.4	183.3598	165.8693	40.8
30	671405.9051	7.7	284612.6945	6.8	185.8912	155.3459	10.9
31	670472.4546	11.1	284925.4984	9.2	191.8046	157.8633	15.9
32	671395.3231	15.0	285377.1421	12.7	188.9158	157.9638	23.6
33	673508.1434	21.6	287152.3697	10.8	188.2116	163.7445	19.9
35	673750.6781	25.9	285663.8857	22.6	184.6804	161.7764	44.3
36	674668.6992	12.7	286370.8842	13.0	183.9170	163.8618	25.3
37	674798.0516	15.5	286295.4354	16.0	183.8052	164.2360	32.2
38	674426.3528	15.7	284628.6772	11.2	187.7493	167.6949	24.8
40	674490.8430	18.7	285624.8339	13.0	182.1902	161.8777	30.0
41	675060.5036	19.0	284103.2559	10.2	180.0758	162.4801	18.6
42	675350.2445	21.6	284282.8967	11.5	181.2997	164.6240	20.6
43	674771.9323	23.1	282549.9016	11.4	174.4215	156.5749	29.9
44	674854.7797	27.5	282584.3720	13.4	174.2848	156.7095	37.0
50	677364.1414	21.3	284977.5987	15.0	175.6019	165.5897	24.2
51	677882.3886	21.5	284715.3159	14.1	173.2331	165.1493	22.5
52	678425.2020	38.0	284839.5047	22.3	172.4193	166.1620	44.5
53	678706.0003	38.5	284822.7301	21.3	171.7553	166.4821	44.6
55	678446.5689	27.2	285031.0867	23.6	174.4685	168.1927	44.7
56	678041.7238	20.9	285354.1411	17.4	174.2744	166.4350	32.2
57	677567.8440	25.0	285586.4239	21.3	181.6805	172.0813	34.8
70	672263.8170	36.4	283624.5029	24.0	181.8040	154.7190	54.0
70 2	672978.6595	20.0	287365.4804	10.3	188.3864	161.9760	19.0
71	672349.4275	36.0	283747.1792	22.9	182.5047	155.6579	54.2
73	672288.5234	45.3	283867.2372	22.1	182.2712	155.1546	51.4
77	672348.4085	43.3	283755.5271	21.4	182.3451	155.4907	49.3

Table 2

Inventory built-up area points coordinates determined with total station

No. point	X(m)	Y(m)	No. point	X(m)	Y(m)	No. point	X(m)	Y(m)
1	675214.68	285157.71	71	672349.41	283747.17	150	671338.93	284629.44
2	675230.29	285105.44	73	672288.46	283867.22	160	671282.75	283904.49
10	671709.51	281743.48	77	672348.35	283755.51	160	674778.66	286305.60
11	671337.94	282132.77	79	673180.81	286428.47	161	671283.04	283907.54
12	671817.61	282165.14	80	673200.14	286472.03	161	671511.74	282290.32
13	671906.41	282639.09	100	666515.63	286353.65	162	671368.17	283736.39
14	671162.22	283525.63	101	671728.77	281549.89	163	671353.00	283763.49
15	671277.90	283908.69	102	672346.85	285918.19	164	671328.86	283814.84
16	671706.29	284124.32	103	671734.67	281844.73	165	671305.24	283861.14
17	671375.62	284545.00	103	674298.73	284124.58	167	671290.53	283912.70
18	676906.52	284863.25	104	674581.79	286353.12	168	671316.75	283927.71
21	677108.60	284919.68	104	680089.39	284689.71	169	671452.53	283998.08
26	673327.74	286755.17	105	665032.35	296047.63	170	671367.47	283954.33
30	671405.85	284612.66	105	671745.43	281904.32	171	671426.92	283984.37
31	670472.39	284925.45	107	671763.69	281983.86	173	671488.18	284013.90
32	671395.25	285377.10	108	674612.61	286364.45	174	671518.42	284033.39
33	673508.02	287152.32	109	671788.79	282093.03	193	674503.05	285288.57
35	673750.57	285663.86	110	674651.77	286377.15	194	674288.21	282399.63
36	674668.57	286370.86	112	671806.03	282167.52	200	673770.59	285654.34
37	674797.92	286295.41	113	671819.99	282176.18	202	673799.52	285679.76

Table 3

Inventory built-up area points coordinates determined with total station

No. point	X(m)	Y(m)	No. point	X(m)	Y(m)	No. point	X(m)	Y(m)
38	674426.23	284628.68	113	671808.92	282179.66	205	673789.29	285850.55
40	674490.73	285624.82	113	674681.71	286378.14	208	673711.80	285682.52
41	675060.40	284103.27	116	671416.17	282203.94	224	673174.40	286413.74
42	674597.49	284505.66	117	673169.94	286403.63	225	673178.24	286422.49
42	675350.13	284282.91	122	673397.9	286910.97	226	673210.59	286495.38
43	674771.87	282549.93	122	674679.84	286375.21	248	673104.25	286228.62
43	674768.12	284388.93	123	674708.57	286353.98	250	673114.11	286249.82
44	674854.72	282584.40	124	674732.48	286337.70	259	673474.32	285679.47
44	674984.64	284180.46	125	671173.86	283527.41	263	673463.77	285654.84
45	675085.44	284105.87	125	673374.83	286858.87	266	673458.98	285640.00
50	672048.46	282141.46	126	671173.9	283529.62	270	673456.27	285622.42
50	677364.00	284977.62	126	674509.31	285361.48	271	673457.87	285610.16
51	672288.52	282165.40	126	674755.69	286321.31	272	673457.56	285605.43
51	677882.25	284715.35	127	671185.63	283531.58	274	673456.99	285591.22
52	672345.86	282331.22	128	671245.16	283574.85	276	673456.76	285580.85
52	678425.06	284839.54	129	671241.78	283568.54	277	673452.64	285547.32
53	672320.52	282541.29	130	671210.53	283533.51	282	673438.36	285501.69
53	678705.88	284822.78	131	671227.85	283537.00	284	673434.05	285487.98
55	678446.41	285031.12	132	671244.06	283539.53	292	673425.06	285479.21
56	673238.77	282645.92	133	671243.26	283546.7	294	673417.54	285477.24
56	678041.56	285354.17	134	671241.16	283560.29	298	673408.68	285476.16
57	673173.63	286411.99	135	671241.29	283567.27	303	673396.54	285477.95
57	673297.22	282562.56	136	671270.59	283606.43	309	673378.65	285480.36
57	677567.67	285586.45	137	671290.28	283629.75	322	673332.46	285487.24
58	673167.84	286399.25	138	671303.39	283648.08	326	673313.55	285490.17
58	673495.59	282322.09	139	671331.66	283681.15	326	673647.00	282720.88
70	672263.73	283624.48	140	671353.94	283701.78	327	673668.19	282745.16
71	671892.59	282630.4	141	671375.87	283727.18	343	671693.42	282746.01
354	674502.29	285278.18	1556	674261.64	286147.42	2149	673470.52	282620.98
357	673266.87	285497.02	1557	674243.12	286124.01	2150	673476.99	282621.53
358	674498.32	285235.67	2018	674139.18	285920.36	2151	673478.50	282621.58
361	673248.67	285502.72	2019	674173.23	285985.45	2152	673493.92	282621.99
365	673241.22	285505.26	2045	674378.29	284882.93	2154	673558.41	282623.52
366	671240.18	283129.55	2046	674431.02	284669.87	2155	673564.40	282626.25
368	674495.67	285197.25	2047	674490.42	284627.13	2156	673600.09	282666.18
439	673166.77	285554.19	2048	674502.91	284574.57	2157	673615.12	282691.90
439	673513.57	285742.32	2049	674501.08	284572.21	2160	674790.63	282565.73
440	673170.25	285555.01	2051	674622.62	284489.71	2162	674842.94	282575.69
440	673495.38	285721.69	2052	674697.32	284443.47	2163	674724.29	286393.80
703	672978.54	287365.43	2053	674753.81	284400.27	2163	674859.48	282581.47
781	674203.56	286052.91	2054	674542.87	284544.25	2166	674857.15	282596.72
782	674196.07	286036.05	2055	674816.17	284338.36	2167	674870.05	282635.01
783	674216.13	286078.63	2056	674874.15	284283.28	2168	674891.02	282654.3
784	674224.06	286095.63	2057	674950.09	284209.74	2170	674891.96	282663.01
813	674419.83	286242.96	2058	674994.25	284169.46	2171	674877.07	282709.96
836	674554.04	286337.90	2061	675246.48	284209.37	2172	674636.38	282481.68
837	674557.03	286339.83	2062	675161.5	284151.61	2173	674856.09	282757.44
1024	671400.43	284600.67	2064	675041.78	284123.67	2174	674858.71	282765.91
1025	671390.57	284579.91	2075	674445.29	283532.96	2175	674698.16	282513.64
1026	671379.60	284555.58	2077	674496.46	283528.08	2176	674907.15	282813.64
1030	671395.41	284603.82	2082	674381.26	283421.16	2177	674910.12	282838.88
1031	671361.25	284618.05	2083	674407.65	283464.47	2178	674758.80	282542.43
1032	670479.58	284919.86	2084	674440.9	283516.78	2179	674889.55	282886.25
1033	670481.32	284919.39	2085	674441.26	283521.55	2180	674860.62	282907.91
1038	670599.83	284923.73	2090	671816.46	282177.64	2181	674830.84	282954.79
1039	670613.29	284932.14	2091	671890.39	282166.51	2182	674763.16	282964.74

Table 4

Inventory built-up area points coordinates determined with total station

No. point	X(m)	Y(m)	No. point	X(m)	Y(m)	No. point	X(m)	Y(m)
1040	670572.50	284904.44	2092	672031.03	282143.99	2183	674745.46	282968.47
1041	670545.54	284897.97	2094	672114.93	282129.45	2184	674512.42	283288.79
1043	670660.66	285306.48	2095	672226.70	282109.86	2185	674445.03	283187.19
1044	670661.30	285308.16	2096	672248.25	282119.12	2187	674575.09	283083.96
1046	670616.58	285329.44	2097	672270.28	282142.25	2188	674624.43	283046.2
1050	670626.44	285352.66	2098	672297.02	282182.04	2189	674375.97	283412.39
1051	670642.39	285394.35	2100	672320.96	282225.50	2191	675360.93	284280.50
1055	673194.85	285535.81	2100	674684.68	286388.79	2192	674465.99	283577.90
1056	673215.16	285522.67	2101	672332.47	282265.74	2193	675415.51	284196.72
1056	674495.52	285193.54	2102	672345.10	282330.53	2194	675435.89	284209.99
1057	673228.87	285512.92	2106	672337.11	282401.49	2195	674523.67	284601.37
1058	674496.69	285209.81	2107	672330.27	282454.39	2196	674487.45	284634.14
1068	671414.72	285421.63	2108	672320.43	282541.00	2197	674546.87	284642.99
1069	671433.32	285459.12	2108	674721.63	286400.79	2198	674512.1	284708.09
1070	671448.97	285483.84	2110	672320.50	282544.64	2199	674433.09	284664.79
1070	673486.37	285706.31	2111	672340.40	282543.82	2201	674370.16	284952.52
1072	671455.71	285495.26	2112	672394.21	282551.13	2202	674370.16	285025.6
1073	671485.66	285564.11	2113	672457.57	282559.16	2203	674378.55	285082.89
1074	671505.67	285612.75	2132	673272.97	282599.38	2204	674476.33	285101.16
1075	671516.97	285645.00	2135	673314.87	282532.03	2205	674473.37	285120.91
1547	674784.09	286301.89	2136	673330.91	282511.69	2206	674487.19	285126.34
1549	674520.73	286317.94	2137	673349.89	282495.39	2211	674489.17	285363.87
1550	674493.53	286300.38	2138	673370.71	282473.82	2212	674452.65	285361.13
1551	674475.48	286284.06	2139	673390.29	282446.51	2213	674408.40	285355.12
1552	674387.77	286224.58	2140	673414.43	282406.26	2214	674388.49	285355.44
1553	674352.77	286205.44	2141	673423.59	282398.05	2215	674370.16	285357.65
1554	674314.16	286184.57	2142	673449.36	282381.32	2216	674364.15	285361.13
1555	674280.39	286160.69	2143	673485.49	282331.55	2217	674395.13	285426.83
2218	674413.70	285483.32	2355	672963.40	287379.52	2378	671238.30	283365.6
2219	674429.11	285524.41	2356	672129.39	286796.68	2379	671189.69	283367.96
2220	674427.13	285531.91	2356	673128.53	287691.98	2379	671276.21	284514.22
2221	674422.78	285535.07	2357	672363.88	286689.37	2380	671105.14	283370.61
2222	674470.98	285623.57	2357	673312.60	287992.83	2380	671615.23	284080.29
2225	674773.37	286278.97	2358	671573.04	285615.69	2381	671074.94	283366.35
2226	674786.84	286300.54	2358	676625.74	284809.56	2382	670425.43	284948.65
2227	674743.80	286231.58	2359	671898.22	286294.71	2382	671043.59	283357.16
2228	674702.26	286158.9	2360	671688.80	285862.13	2383	671030.11	283348.92
2329	674659.86	286438.28	2360	676640.02	284751.77	2384	671020.49	283334.07
2330	674716.06	286431.71	2361	672045.24	286609.6	2384	672875.38	287426.98
2333	674662.22	286444.53	2361	676759.54	284777.47	2363	677134.48	284849.77
2334	674705.35	286460.30	2362	671321.91	285412.91	2364	677206.53	284873.79
2335	673756.96	282811.48	2362	676929.60	284815.61	2365	671207.21	285165.68
2336	674097.21	285888.12	2363	670658.66	285420.15	2365	677333.81	284911.04
2337	674059.81	285860.07	2372	671288.1	283415.98	2366	671723.81	281828.92
2338	674043.98	285834.17	2372	673515.06	287143.57	2366	677381.97	284922.74
2339	673824.60	285714.05	2373	671296.05	283411.86	2367	671709.11	281781.34
2340	673813.36	285873.87	2373	672967.89	287388.02	2367	677500.43	284848.6
2341	673787.94	285872.91	2374	671303.42	283401.55	2368	671286.92	283451.34
2342	673522.56	285760.18	2374	674895.79	285771.55	2368	677673.99	284774.14
2345	673132.52	285498.94	2375	671301.94	283387.41	2369	671292.81	283438.08
2346	672826.72	285633.78	2375	674597.98	285958.55	2369	676879.67	284867.13
2347	673001.45	285975.70	2376	671290.75	283375.03	2370	671288.98	283430.13
2351	673226.01	288042.86	2376	672478.07	282479.04	2370	677162.47	284936.87
2353	672763.33	287184.57	2377	671277.19	283370.91	2371	671283.97	283422.76
2354	672524.47	286627.68	2377	673226.31	282660.49	2371	677249.28	284958.28
2355	672521.62	286621.03	-	-	-	-	-	-

The final products of the process of delimitation of register is presented in alphanumeric format (coordinate inventory), digital-limit register vineyard being presented under the programme graphics reporting, archived on magnetic, analogue, printed on paper or synthetic and respectively in the form of tips, described properly, to identify them easily if they are used.

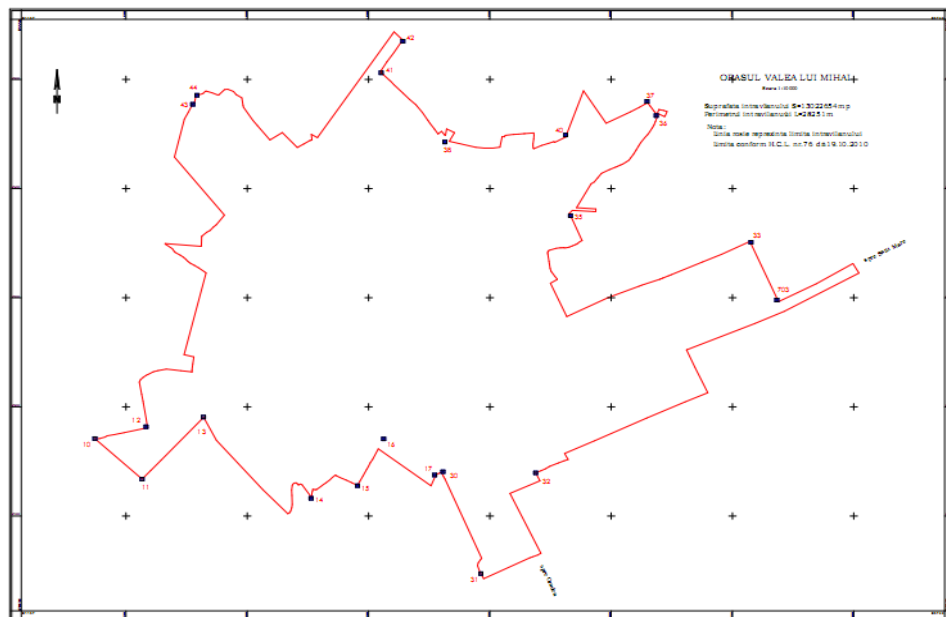


Fig. 4 Cadastral limit of the built-up area in Valea lui Mihai, achieved with combined technologies

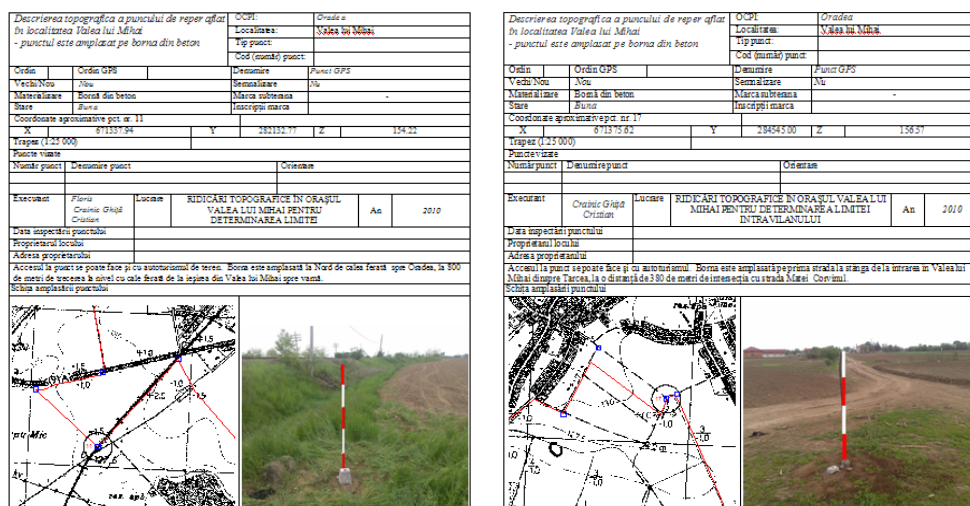


Fig. 5 Points on the built-up area materialized with the concrete and flagged tips (with benchmarks) to their corresponding description

CONCLUSIONS

Topo-cadastral works realization with modern technologies of spatial positioning ensure high efficiency in terms of efficiency and time of realization.

The use of various technologies, related terrestrial measurements, in particular working conditions, can be made successfully if the working methods are based on algorithms work.

Materialisation of corresponding points positioned spatially with various technologies becomes appropriate, when they will be used for other work, thus ensuring appropriate use of spatial databases that are set up or are in the making.

Differentiated use of modern technologies for terrestrial positioning depending on specificity cadastral works, removes a number of unnecessary financial efforts, appropriate streamlining those activities complex and enduring.

To optimize working methods with modern technologies of the sector land measurements, it is necessary to conduct regular exchanges of experience and specialized advice from different individuals and companies that have as industry marketing of these technologies and the training of qualified personnel for their appropriate use.

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