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ISSUES OF ANALYTICAL DESIGN OF LAND DIVISION WITH HIGH VALUE PER HECTARE

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Summary

The article discusses the problem of analytical design of a plot for a given value, in the cases where estimates occur in land division with high point values. Accordingly, it becomes problematic to meet the expected results of valuable design, preserved during the conduct of design work for estimated outline of "average" values. Provisions regarding technical standards for performing geodetic situational measurements determine the necessity of rounding the coordinates of boundary points to 1 cm. Maintaining the designed value with an accuracy down to 1 point generates problems linked with the compatibility between the expected value and the one obtained. Generating the report after the merger introduces unavoidable changes, and must be taken into account when conducting the consolidation work.

Keywords

land consolidation • value of parcels • value design

1. Introduction

The problem of value design has been known for decades [Banat et al. 1989, Żak 2006]. Due to the specificity of this type of work, the estimated boundaries expressing the value of the land had to be based on the actual value; the latter most often having its source mainly in the land classification, but also taking into account other factors (such as for instance location or terrain). The absolute values for the majority of consolidation objects ranged between 0 and 300 points per 1 hectare (0 for excluded lands). The values of individual plots or farms were recorded with the accuracy down to 1 point. Reconstruction of the designed equivalent was also carried out with an accuracy of 1 point. This approach was easy to understand for everyone, particularly for the participants in mergers. The value of the land presented in the registry before the consolidation was the basis for conducting design works, and designating the equivalent for the participants in accordance with the applicable regulations.

This was also reflected in the course of designing work, in information systems. The final result was consistent with the projected one, designed with the accuracy down to 0.01 point. The final result was not affected by the final rounding of the coordinates of the newly designed parcel boundaries up to 1 cm. Such requirements are currently imposed by applicable legal acts [Rozporządzenie 2011]. Designing works carried out at present usually include coordinates of points with a greater level of accuracy. This actually depends on the IT system used to support the designing work. The currently used MKSCAL software [Janus and Zygmunt 2016, Jagielski and Marczewska 2011], aimed at supporting the designing work, takes into account the method of subsequent approximations [Zygmunt 2010]. Due to the universality of its application in practice, the research was carried out using the said system. This allowed us to carry out a detailed analysis of the obtained design results, and perform an estimation of the impact of the applicable guidelines in the field of surveying performance on the accuracy of designing plots in areas with a high value of estimated boundaries. It should be noted that the selection of a system applied to the performance of designing work is not significant in this case. Instead, we focus only on the interpretation of results from the obtained works.

2. Material and methods

Due to the analogy to the linear metre method, using state-of-the-art information technology, we can talk about the linear centimetre method. For example, for an area of 100 points and the size of 1 hectare (measuring 100 × 100 metres), the value of the 1-metre wide strip is 1 point. Design with the accuracy of coordinates of up to 1 cm can be carried out with an accuracy of 0.01 points. The question arises as to how to approach the problem of valuable design for estimated boundaries described with values many times greater than those adopted and used most often?

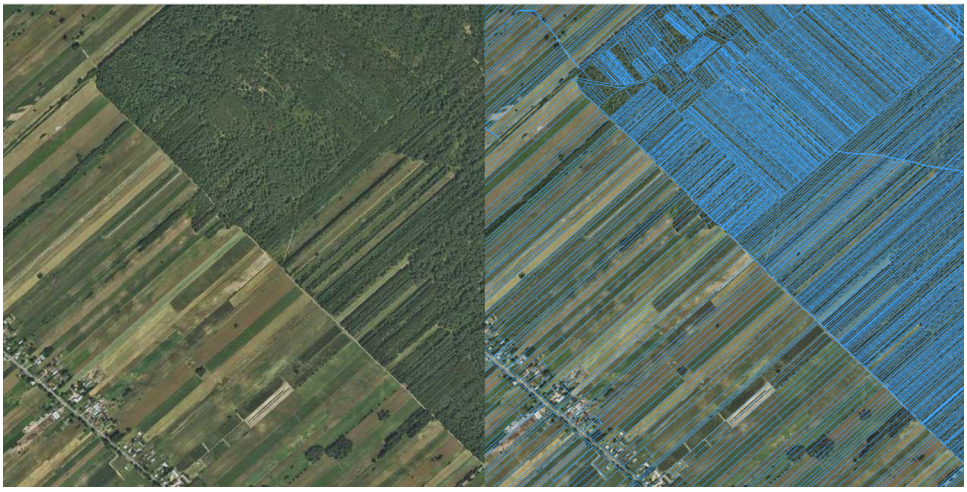
For a more complete presentation of the problem, we will use an example of estimated boundaries for forest divisions. Figure 1 shows a fragment of the consolidation area with very large fragmentation of forest-covered land plots. The approximate model of estimated complexes has been developed on the basis of the data published by the General Directorate of State Forests, on the website of the industry geoportal and the database of general geographic objects and cadastral data (Fig. 2).

For the object we study, the value of 1 hectare varies between 1000 and 50,000 points (Fig. 3).

Corresponding areas for the assumed design complexes and their values are presented in Table 1. The information contained therein shows that the values of complexes K-03, K-04, and K-05 are around 1000 times greater than those adopted using the scoring base according to on other guidelines. For instance, in the consolidation instruction no. 1 a complex is given: 25-Ł-lV-40, with a value of one hectare = 40 points.

It is a common practice to design plots within the limits of acceptable deviation of 3% of the value between the initial and newly designed state. The reasons for this may be different (for instance, discrepancies between the map and the register, result-

ing from the way the land registry survey is carried out). If we take into account this correction in the work that we conduct, then we must be aware that the final result may differ by more than the acceptable 3%.

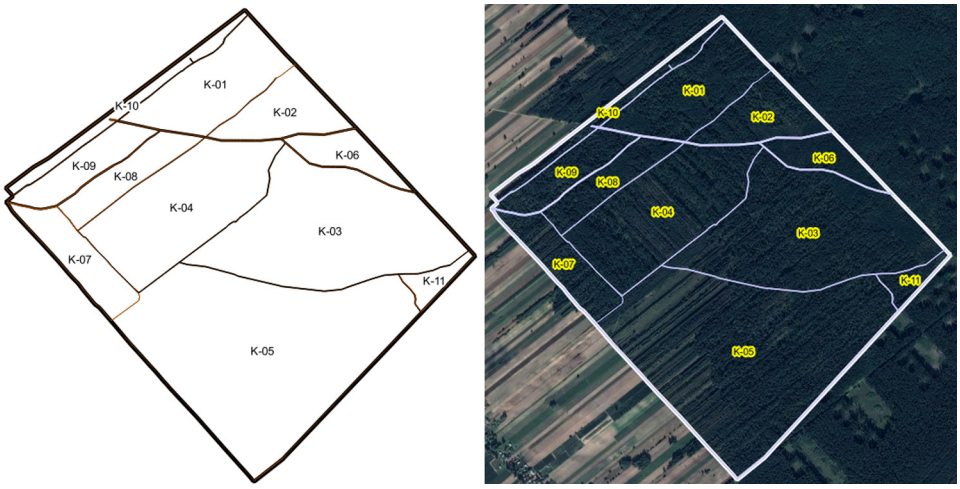


Source: thematic geoportal

Fig. 1. A sample object of consolidation. Image on the left: ortophotomap; image on the right: ortophotomap with plotted land register data

Source: thematic geoportal

Fig. 2. A sample object of consolidation. Image on the left: data from the visualisation of the Database of General Geographic Object; image on the right: ortophotomap with plotted data elaborated by the General Directorate of State Forests



Source: own study using the orthophotomap background

Fig. 3. Estimate complexes with marked roads

Table 1. Actual surfaces of design complexes and their values

No. of complex	Surface area [ha]	Value [points]
K-01	3269.6890	638413.0554
K-02	1998.6516	432504.9509
K-03	14350.7239	1609528.7109
K-04	6034.4548	1009146.4167
K-05	1543.6357	2325616.1311
K-06	2430.6517	259392.7096
K-07	345.1535	319137.6506
K-08	3086.8358	416691.9431
K-09	10012.3682	370568.6824
K-10	12757.8128	246198.3804
K-11	3176.9957	116395.5177

Source: own study

3. Results and discussion

The comparative test of the theoretical (expected) and final values was carried out on 45 designed plots (Fig. 4). For research purposes, three values of planned plots were assumed: 100,000, 250,000 and 500,000 points. The directions of the design lines were selected taking into account the natural external boundaries of the test object. The results are presented in a tabular form, listing the number of the designed plot, its practical (actual) and theoretical (designed) surface area, and relative error, expressed in [%] (Table 2).

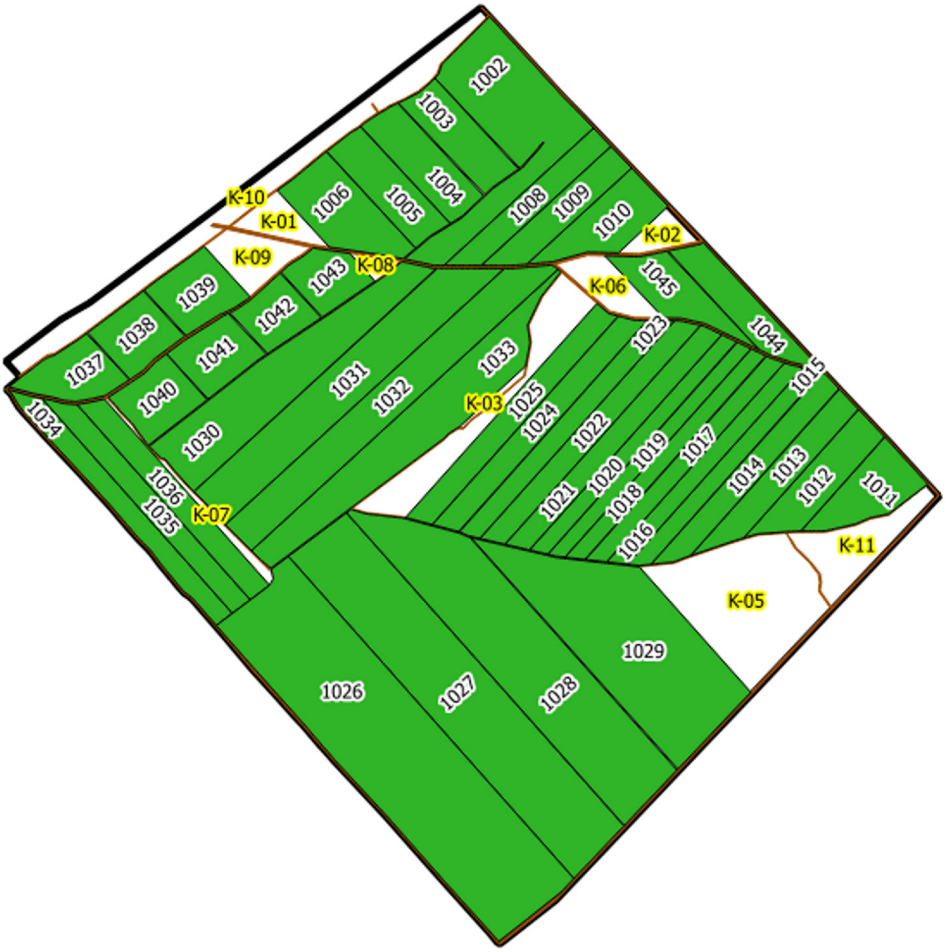


Fig. 4. Designed plots within design complexes (with sample values of 100,000, 250,000 and 500,000 points)

Table 2. Values of relative error for the designed plots

No.	Surface area [ha]	Value [points]	Theo-retical value	Relative error [%]	No.	Surface area [ha]	Value [points]	Theo-retical value	Relative error [%]
1001	960.7485	99998.57	100000	0.001	1024	522.1306	99998.97	100000	0.001
1002	2336.305	100002.27	100000	0.002	1025	9035.492	99999.80	100000	0.000
1003	177.6254	99997.76	100000	0.002	1026	1353.961	500008.42	500000	0.002
1004	1061.153	99996.91	100000	0.003	1027	189.6744	500007.83	500000	0.002
1005	3269.689	99998.67	100000	0.001	1028	1500.678	499999.92	500000	0.000

Table 2. cont.

No.	Surface area [ha]	Value [points]	Theo-retical value	Relative error [%]	No.	Surface area [ha]	Value [points]	Theo-retical value	Relative error [%]
1006	3153.188	100000.94	100000	0.001	1029	3907.268	499997.04	500000	0.001
1007	1068.652	100004.50	100000	0.005	1030	292.8193	250003.46	250000	0.001
1008	929.9998	99998.05	100000	0.002	1031	590.9551	249994.33	250000	0.002
1009	1155.614	99999.52	100000	0.000	1032	518.6446	249996.04	250000	0.002
1010	4266.666	99999.43	100000	0.001	1033	5515.81	249996.40	250000	0.001
1011	5162.684	100001.18	100000	0.001	1034	10063.76	100001.41	100000	0.001
1012	1958.957	99996.78	100000	0.003	1035	6034.677	100007.69	100000	0.008
1013	569.4873	99995.98	100000	0.004	1036	82.9282	99998.46	100000	0.002
1014	6276.885	100003.07	100000	0.003	1037	10012.37	99998.60	100000	0.001
1015	174.3529	100002.04	100000	0.002	1038	1968.094	99999.64	100000	0.000
1016	1496.19	99991.42	100000	0.009	1039	2278.534	99999.69	100000	0.000
1017	3494.4	99996.41	100000	0.004	1040	3086.836	99998.91	100000	0.001
1018	3185.202	99998.86	100000	0.001	1041	16304.22	100002.07	100000	0.002
1019	851.2425	100009.97	100000	0.010	1042	25202.43	99998.22	100000	0.002
1020	2000.78	100006.10	100000	0.006	1043	25203.03	100000.58	100000	0.001
1021	16886.45	100002.99	100000	0.003	1044	269.831	100004.63	100000	0.005
1022	14539.09	99997.58	100000	0.002	1045	2430.652	100000.12	100000	0.000
1023	664.9297	99998.05	100000	0.002					

Source: own study

4. Conclusions

Due to the increasing use of high value for the description of estimated boundaries, one should remember about the consequences resulting from their use in the design process. The authors used real data in the preparation of the present paper. The relative error value is very small, in practice not exceeding 0.01%. However, one should remember about the practical dimension of the issue in question. Having modern IT solutions at our disposal, we must be aware of the consequences resulting from the accuracy imposed by the instructions in relation to the real-life situation. Recording the coordinates of boundary points with accuracy down to one centimetre results in inevitable consequences when developing results based on such accuracy. The most important one is the impossibility to ensure the actual design of plots with the accuracy down to one point. Awareness of this fact is often lacking, even among those who carry out design work.

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