TOPOGRAPHIC STUDY ON THE REHABILITATION OF THE LAND SURFACE RELATED TO THE IZVOR SPORTS COMPLEX LOCATED IN BOCŞA LOCALITY, CARAŞ-SEVERIN COUNTY, ROMANIA

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***Abstract**: The use of engineering topography, both in the realization of works of art and in their rehabilitation, is a particularly important element in the adoption of the best technical, economic and sustainable solutions.*

In this article, we set out to present a topographic study necessary for the rehabilitation of a land area related to a sports complex located in Bocşa, Caraş-Severin County in Romania..

***Keywords:** engineering topography, 3D modeling, volume calculation, rehabilitation, contour lines*

1. Introduction

With a tradition of almost a century, the Izvor sports complex from Bocşa locality, Caraş-Severin county, has represented in the past a beautiful story in what meant the history of Banatului de Munte and the previously mentioned locality. With a football team founded in 1925, in the former Bocşa Montană locality, we can say that the Izvor sports complex represented at that time, if we can say, a part of the pioneering sport of round ball for a series of personalities from the Romanian sports world. At that time, the sports complex is now becoming a ruin, on the back of which, once every four years, the candidates of the existing public positions at the level of Bocşa locality often carry out their electoral campaign without results in the promised senses. Figure 1 shows the presentation of the current grandstand of the Izvor - Bocşa Montană stadium.

Fig. 1 "Izvor - Bocşa Montană" stadium grandstand

Given the location about 20 km from Resita and benefiting from an altitude of about 180 m above the Black Sea level, with a rich amount of oxygen, the area was declared a climate resort by the decision of the Ministry of Labor, Health and Welfare no. 46,713 of July 25, 1931. Figure 2 shows the location of the sports complex "Izvor - Bocşa Montană".

Fig. 2 Framing the studied objective in the area

Starting from what the sports complex "Izvor - Bocşa Montană" meant and from the desire to support the local community in the sense of promoting physical activities among young people and not only, from the point of view of the specialization we have, we proceeded to achieve a topographic study on the rehabilitation of the field surface related to the old football stadium, an area affected over time by a series of floods and deformations of the land surface, which can be seen in Figure 3, a study presented in this article.

Fig. 3 Presentation of the current surface of the stadium "Izvor - Bocşa Montană"

2. Materials and Methods

2.1 Surveying instruments used

In order to perform the specialized topographic measurements necessary to perform this topographic study, we used as a measuring instrument a total station with a precision of 5 seconds, which can be seen in Figure 4.

Fig. 4 Total Station

2.2 Surveying methods used

The topographic measurements in the field were performed using as support points, the old altimetric and planimetric coordinates known as SI1 and SI2, points from which using the leveling method the entire surface of the stadium area was determined, as we can observe in figure 5, some of the results obtained can be seen in tables 1 and 2.

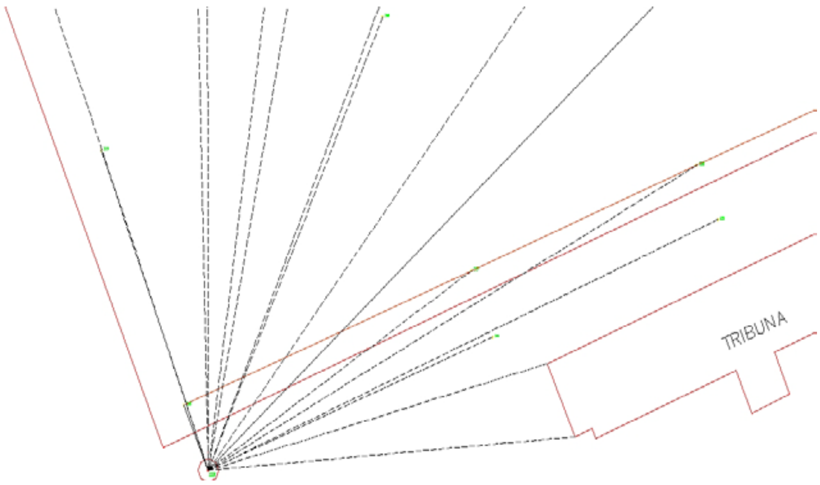


Fig. 5 Graphic extract of the method used to perform topographic measurements

PO	EAST	NORTH	ELEVATION
SI1	248790.015	434773.757	184.967
SI2	248872.896	434853.352	181.704

Table 1 Extract from the coordinate inventory of old points

PO	EAST	NORTH	ELEVATION
100	248870.571	434859.233	181.480
101	248857.443	434892.525	180.585
102	248844.036	434925.458	179.851
103	248891.643	434946.634	180.367
104	248944.869	434965.572	180.865
105	248944.658	434964.948	180.907
106	248958.148	434931.809	181.815
107	248971.280	434898.708	182.486
108	248920.612	434877.991	181.986
109	248906.389	434913.925	180.974
110	248900.538	434864.336	182.232

Table 2 Extract from the coordinate inventory of the measured points

2.3 Methods used in the process of automation and calculation of data obtained from measurements

In order to perform the process of automation and calculation of data obtained from measurements, the following methods were used:

a) for the calculation of the volumes, the 3D representation and the representation of the displacement vectors of the studied area, an automated software for measured data processing (Surfer) was used, in figure 6 being presented an extract from the calculation generated by this software:

X Variable Statistics

X Range:	127.244
X Midrange:	248908
X Minimum:	248844
X 25%-tile:	248871
X Median:	248906
X 75%-tile:	248945
X Maximum:	248971
X Average:	248910
X Standard Deviation:	40.1257
X Variance:	1610.07

Y Variable Statistics

Y Range:	106.339
Y Midrange:	434912
Y Minimum:	434859
Y 25%-tile:	434878
Y Median:	434914
Y 75%-tile:	434932
Y Maximum:	434966
Y Average:	434913
Y Standard Deviation:	35.9436
Y Variance:	1291.94

Z Variable Statistics

Z Range:	2.635
Z Midrange:	181.168
Z Minimum:	179.851
Z 25%-tile:	180.585
Z Median:	180.974
Z 75%-tile:	181.815
Z Maximum:	182.486
Z Average:	181.232
Z Standard Deviation:	0.793341
Z Variance:	0.629391
Z Coef. of Variation:	0.0043775
Z Coef. of Skewness:	-0.00568397

Gridding Report

Search Rules

Use All Data:	true

Gridding Rules

Gridding Method:	Delaunay Trianguation with Linear Interpolation
Anisotropy Ratio:	1
Anisotropy Angle:	0

Grid Summary

Grid File Name: D:\NUTU_2021\LUCRARI OCPI 2021\MAI 2021\IZVOR STADION\RAPORT EXCEL SURFER 7 YX.grd

Minimum X:	248844
Maximum X:	248971
Minimum Y:	434859
Maximum Y:	434966
Minimum Z:	179.867
Maximum Z:	182.463
Number of Rows:	84
Number of Columns:	100
Number of Filled Nodes:	4981
Number of Blanked Nodes:	3419
Total Number of Nodes:	8400

Fig. 6 Extract from data processing using the Surfer program

b) in order to materialize in the field the horizontality of the land surface afferent to the lawn, the calculations specific to the square method were used, a method that based on the data obtained by executing the geometric leveling of the respective part of the land represented network of squares with a side between 10-15 m, depending on the terrain.

Below is the calculation necessary for the materialization work of the horizontalization of the studied area, where for the beginning we calculated the average share of each square using the relation described in (2.1):

$$Hi=\frac{Hi1+Hi2+Hi3+Hi4}{4} \qquad (2.1)$$

$$H1 = \frac{179.851+180.367+180.974+180.585}{4} = 180.444m$$

$$H2 = \frac{180.367+180.907+181.815+180.974}{4} = 181.016m$$

$$H3 = \frac{180.974+181.815+182.486+181.986}{4} = 181.815m$$

$$H4 = \frac{180.585+180.974+181.986+181.480}{4} = 181.256m$$

where: H1, H2, H3, H4 - represent the average dimensions of each square.

Then we proceeded to calculate the average share of the land which was made using the relation described in (2.2):

$$Ho=\frac{H1+H2+H3+H4}{4}$$

$$Ho=\frac{180.444+181.016+181.815+181.256}{4} =181.133m$$

where: Ho - represents the average elevation of the land.

Finally, to determine the final elevations that will be materialized in the field in order to horizontalize the land surface that we will calculate with the relation (2.3)

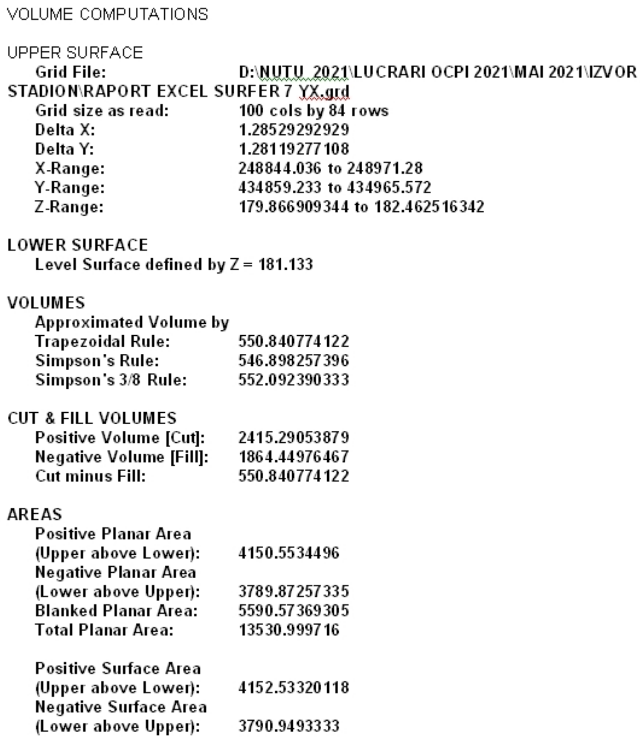
$$Cl=Ho-Hij \qquad (2.3)$$

- C1(100)=181.133-181.480 = - 0.347m
- C2(101)=181.133-180.585 = 0.548m
- C3(102)=181.133-179.851 = 1.282m
- C4(103)=181.133-180.367 = 0.766m
- C5(105)=181.133-180.907 = 0.226m
- C6(106)=181.133-181.815 = - 0.682m
- C7(107)=181.133-182.486 = - 1.353m
- C8(108)=181.133-181.986 = - 0.853m
- C9(109)=181.133- 180.974 = 0.159m
- C10(110)=181.133-182.232 = -1.099m

values against which we will have for Ci> 0 filling, and for Ci <0 excavation.

3. Results and Discussion

Once the data is calculated and processed using the Surfer program, we will obtain the calculation of the volume shown in Figure 7, the representation of the area in contour lines shown in Figure 8, the representation of the vector displacement shown in Figure 9 and the 3D model shown in Figure 10.



VOLUME COMPUTATIONS

UPPER SURFACE
Grid File: D:\NUTU_2021\LUCRARI OCPI 2021\MAI 2021\IZVOR STADION\RAPORT EXCEL SURFER 7 YX.grd
Grid size as read: 100 cols by 84 rows
Delta X: 1.28529292929
Delta Y: 1.28119277108
X-Range: 248844.036 to 248971.28
Y-Range: 434859.233 to 434965.572
Z-Range: 179.866909344 to 182.462516342

LOWER SURFACE
Level Surface defined by Z = 181.133

VOLUMES
Approximated Volume by
Trapezoidal Rule: 550.840774122
Simpson's Rule: 546.898257396
Simpson's 3/8 Rule: 552.092390333

CUT & FILL VOLUMES
Positive Volume [Cut]: 2415.29053879
Negative Volume [Fill]: 1864.44976467
Cut minus Fill: 550.840774122

AREAS
Positive Planar Area
(Upper above Lower): 4150.5534496
Negative Planar Area
(Lower above Upper): 3789.87257335
Blanked Planar Area: 5590.57369305
Total Planar Area: 13530.999716

Positive Surface Area
(Upper above Lower): 4152.53320118
Negative Surface Area
(Lower above Upper): 3790.9493333

Fig. 7 Volume calculation

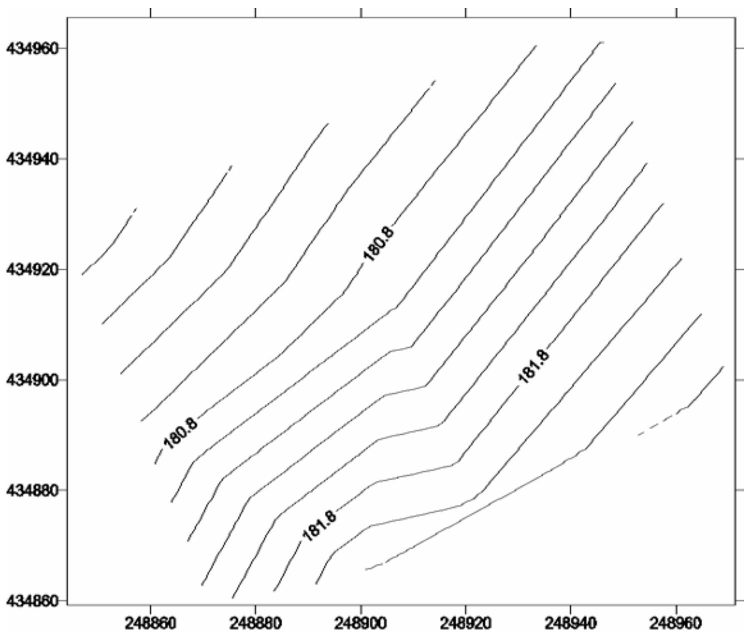


Fig. 8 Representation of the area in contour lines

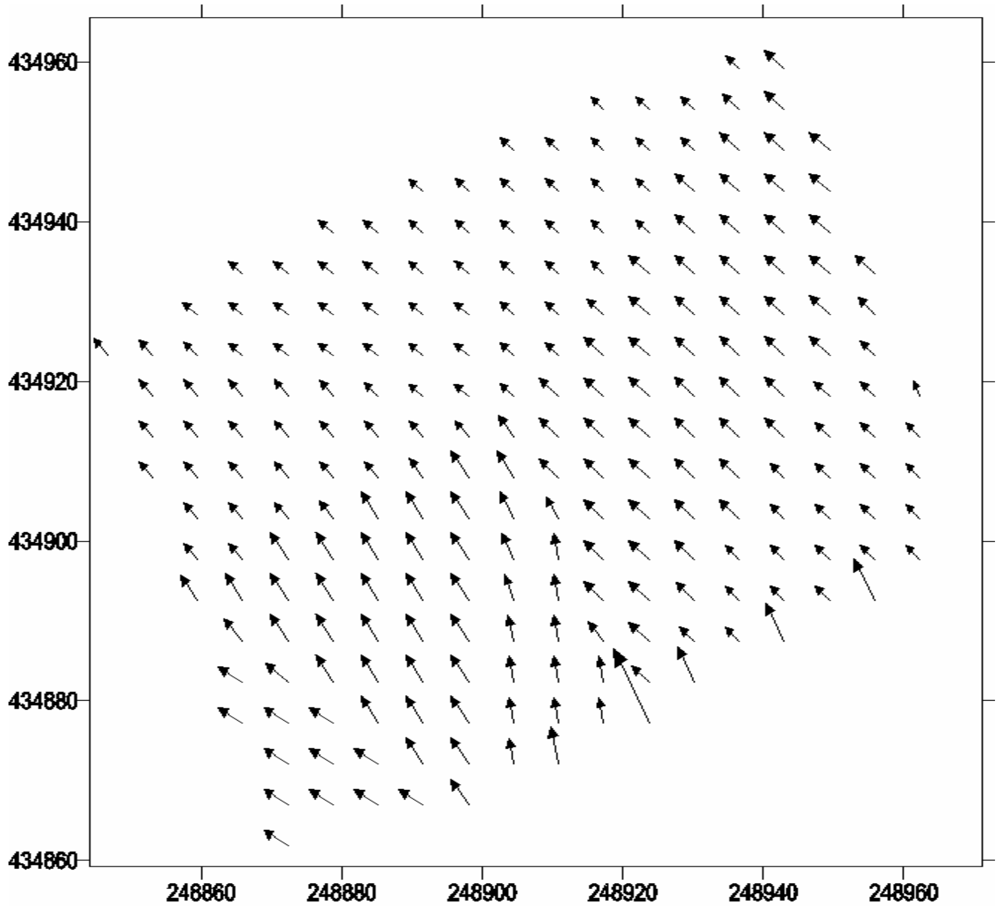


Fig. 9 Representation of vector displacement

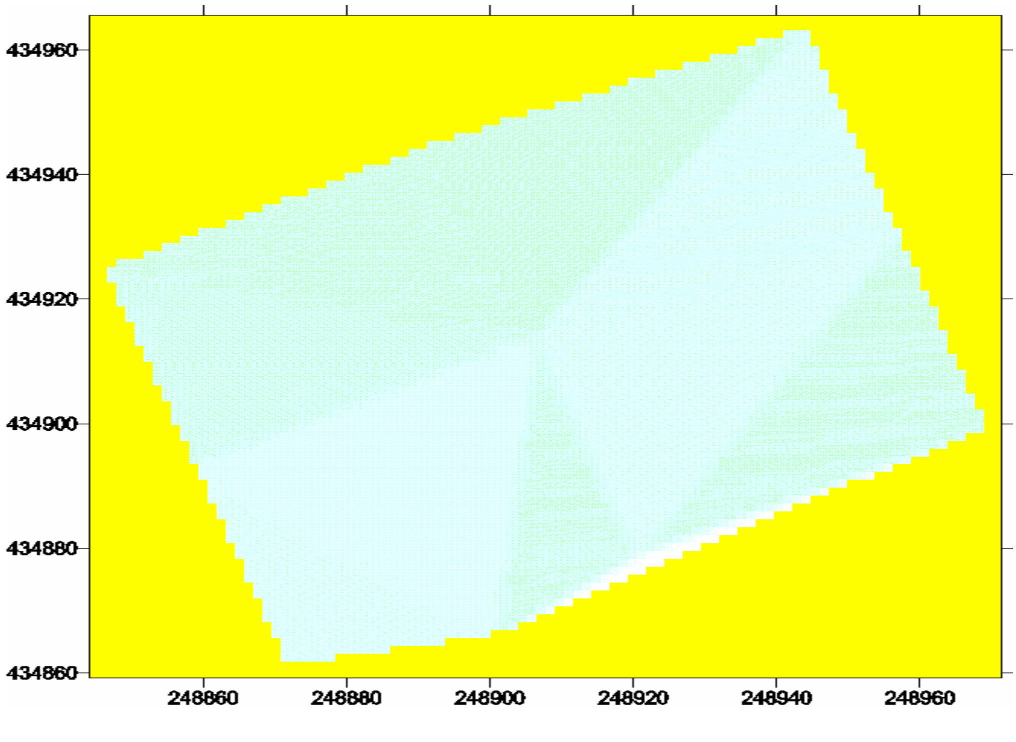


Fig.10 Representation of the obtained 3D model

4. Conclusions

Following the study we concluded that over time the measured land area has undergone some significant changes, in which case for the reduction to zero working area of the land area we consider that the working methodology adopted by us can be applied with success not only for the sports complex "Izvor - Bocşa Montană" but also for other objectives that require the horizontalization of the interested surface.

Engineering topography through the application methods that are found in the content of this discipline brings an added value in achieving or rehabilitating, depending on the case, the objectives subject to investments, in terms of technical solutions they offer, in terms of efficiency costs but also the choice of sustainable solutions for sustainable development.

As a final conclusion, we move forward with the hope that objectives such as the one studied from a topographic point of view, namely the complex "Izvor - Bocşa Montană", but also others existing in our country, be they of local, county, national interest , in UNESCO patrimony., etc., will be rehabilitated in order to restore them in the civil circuit, so that the next generations will also enjoy their benefits.

5. References

1. *Borşan, T.; Dimen, L.; Voicu, G.E., Achiziţia, prelucrarea şi gestionarea datelor spaţiale în contextul cercetărilor arheologice efectuate în cadrul staţiunii Puţul Tătarului, jud. Prahova, Pangeea, 48-56, 2015*
2. *Coşarcă C. – „Topografie inginerească", Editura MatrixRom, Bucureşti, România, 2003*
3. *Cristescu N. - ,,Topografie inginerească", Editura Didactică şi Pedagogică, Bucureşti, România, 1978*
4. *Herban, I.S.; Vîlceanu, C.B.; Grecea C., Road-Structure monitoring with Modern geodetic technologies, Journal of surveying engineering 143 (4), 2017*
5. *Herbei, M.; Sala, F., Modern Methods Of Implementation And Interpretation Of Digital Terrain Model, Revista "Lucrări ştiinţifice. Seria Agronomie" - Volumul 58 nr. 2 58 (2), 89-95, 2015*
6. *Ienciu, I.; Oprea, L., Prelucrarea automată a datelor analitice şi grafice din topografie şi cadastru, Romania, 2009*
7. *Ienciu, I.; Oprea, L., Tudoraşcu, M.M., Topografie şi cadastru, Romania, 2014*
8. *Smuleac, A.; Herbei, M.; Popescu, C., Creating the digital terrain model of the USAMVB area using modern technology, Research Journal of Agricultural Science 44 (3), 282-287, 2012*
9. *Voina,I., Bala, A. C., Brebu, F. M., ,,Research on the achievement digital terrain model to birtz quarry, Aghireş village, cluj County", Scientific Bulletin of the POLITEHNICA University of Timişoara, Romania TRANSACTIONS on HYDROTECHNICS ISSN 1224-6042 Volume 60 (74), Issue 2, 2015, Timişoara, Romania, pp82-86*
10. **** The teaching staff specialization and Cadastre Land Measurements - Faculty of Engineering - Politehnica University Timisoara "Complement of terrestrial measurements Vol. I-II, revised and enlarged edition "Publisher Politehnica Timisoara 2009*
11. *https://downloads.goldensoftware.com/guides/Surfer20UserGuide.pdf*