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ANALYSIS THE INFLUENCE OF SOIL AGGREGATES HYDROSTABILITY ON SOIL HUMIDITY FROM TĂTĂRAŞI – IAŞI STUDY ZONE

BY

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Environmental Engineering

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Abstract. This analysis was concentrated on remarked the connection between soil humidity and soil aggregates stability existing in the study area Tătăraşi. For this study were used several laboratory methods applied at international level for each soil property. In the study of soil humidity was used the vials oven drying method and to determine soil aggregates stability was applied the soil aggregates diving method using the Eijkelkamp Wet Seiving Apparatus.

Keywords: hydrostability of soil aggregates and soil humidity.

1. Introduction

In generally soil has represented, representing and will represent primordial source of supply of the population with food without which we could not exist (Stătescu & Pavel, 2011). So how much more seriously approach the problems by the excess or deficiency of humidity is the impact solving key of this soil properties variation.

Soil humidity representing the basic trait of soil which in case of absence can lead to serious damage to development support of plants (I.C.P.A., 1980).

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Congtuenting to classical literature the soil humidity is one of the most important characteristics of the soil because by it depends the majority of the soil hydraulic properties and beyond. In our paper we will discuss about relationship between the soil humidity and soil aggregates stability of soil fragments that contribute to the soil formation of a certain area (Filipov & Lupaşcu. 2003).

2. Materials and Methods

From Tatarasi area (Fig. 1 *a*) were extracted a series of disturbed samples shown in Fig. 1 *b*) one for each depth (0,...,20 cm, 20,...,40 cm, 40,...,60 cm and 60,...,80 cm).

Fig. 1 – Presentation of the location study: *a* – zone of sampling soil; *b* – samples harvested.

The study of soil humidity was achieved using drying oven soil dried soil vials method by weighing (Fig. 2 *a*, *c*) their input before and after introduction to drying machine (Fig. 2 *b*). After the humidity, soil aggregates stability analysis was performed by the Wet Seiving method.

This analysis was implemented using the Eijkelkamp Wet Seiving Apparatus (Fig. 2 *d*).

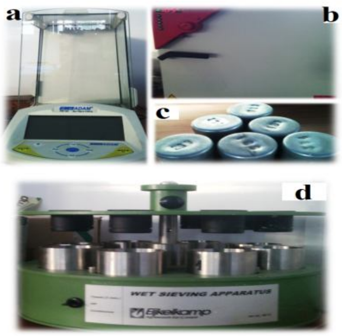


Fig. 2 – The apparatures used in research: *a*, *b* and *c* – equipment used to analyze the soil humidity; *d* – equipment used to analyze soil aggregates stability – Eijkelkamp Wet Seiving Apparatus.

Soil humidity is calculated with Eq. 1 (Dumitru, 2009)

$$W_g = \frac{b-c}{c-a} \cdot 100, \ [\%], \tag{1}$$

where: W_g is the humidity, [%], a – mass of empty vial, [g], b – mass of vial with wet soil, [g], c – mass of vial with dry soil, [g].

In the case of the soil aggregates stability was taken into account the material scraped from the 4g of soil analyzed result after drying expressed in percentages

3. Results and Discussions

In Table 1 are presents the results obtained after applying the analysis methods of the soil humidity and the soil aggregates stability for Tătăraşi study area.

Table 1

The Results of Soil Humidity and Soil Aggregates Stability for Tătăraşi Site

Sample	*W*, [%]	S_a. S., [%]
T 0-20 cm	20.33	9,2
T 20-40 cm	19.58	31.65
T 40-60 cm	14.73	27.62
T 60-80 cm	16.56	45.02

According to Fig. 3 In the case of the soil taken from the first depth can highlight the connection between soil humidity and aggregates stability that can be presented by an inverse variation of both characteristics taken into account.

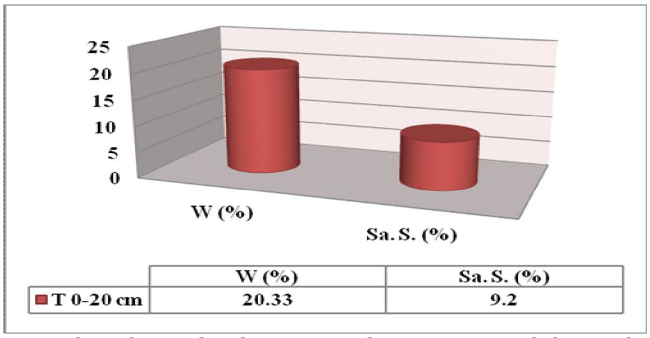


Fig. 3 – The relationship between soil aggregates stability and soil humidity for T 0-20 cm.

Compared with other data presented in Table 1 we can mention that T 0-20 cm soil sample shows the highest aggregates stability under the influence of humidity increased despite presence of predominantly dusty texture with small inserts of sand and clay that was observed in extraction stage.

This stability can be put out of existence waters organic matter to the soil surface until the first 20 cm.

In the case of soil taken from 20-40 cm situation is totally different because there is a noticeable inverse relationship than the previous case, there is an increase of soil aggregates stability at a lower humidity than where soil taken from 0-20 cm depth (Fig. 4).

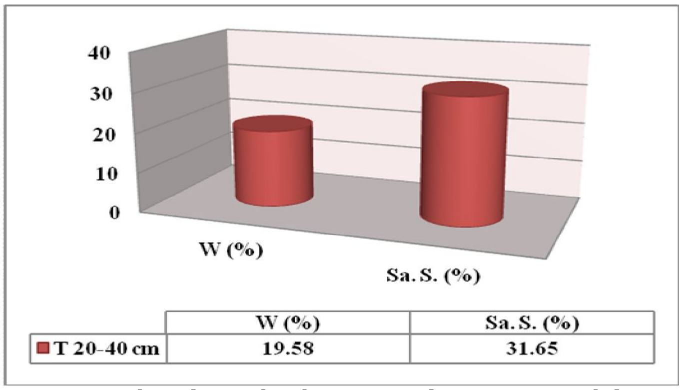


Fig. 4 – The relationship between soil aggregates stability and soil humidity for T 20-40 cm.

T 40-60 cm soil sample compared to other soil samples has posted an average value of aggregates stability of four samples to a similar value of humidity to the previous case. It can be seen direct connection between humidity and aggregates stability through a proportional variation of the two types percent. This can be attributed to increased bulk density due to compaction process triggering natural and uneven distribution of particle aspect shown in Fig. 5.

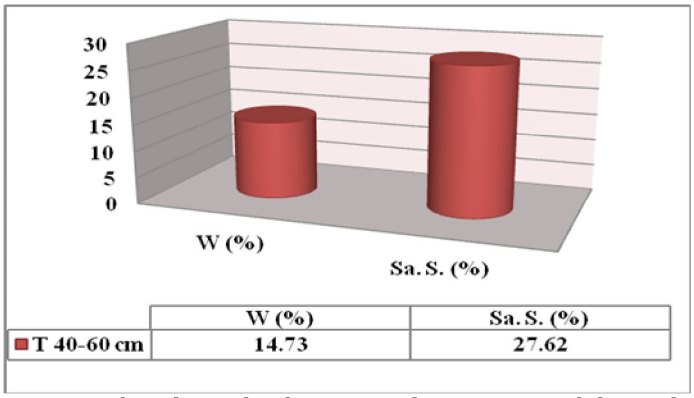
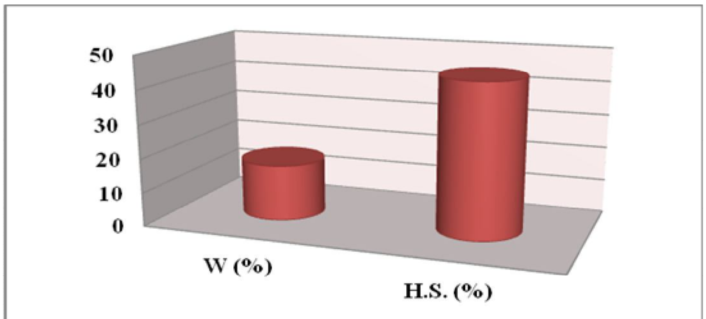


Fig. 5 – The relationship between soil aggregates stability and soil humidity for T 40-60 cm.

In the case of soil taken from the last depth (60-80 cm) was recorded the highest value of aggregate stability of the four soils under direct from an average soil humidity mentioned in Fig. 6.



	W (%)	H.S. (%)
T 60-80 cm	16.56	45.02

Fig. 6 – The relationship between soil aggregates stability and soil humidity for T 60-80 cm.

But it should be noted that compared to other soils has presented the most balanced of clay, dust and sand content.

Even if this type of soil posted a medium texture, it did not positively affect the stability of aggregates.

4. Conclusions

Making an overall analysis we can mention the following:

a) Soil from the study site shown a series of situations which differed from one to another depth.

b) Following interpretation of results was observed as the most unstable soil has been the soil sample extracted from the depth of T 60-80 cm has not shown high aggregate stability to the action of humidity compared to T 0-20 cm soil sample.

The relationship between the two hydrophysical properties (humidity and aggregate stability) is very important because it greatly affects the hydraulic properties.

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ANALIZA INFLUENŢEI HIDROSTABILITĂŢII AGREGATELOR ASUPRA VARIAŢIEI UMIDITĂŢII SOLULUI DIN ZONA DE STUDIU TĂTĂRAŞI – IAŞI

(Rezumat)

Analiza de faţă este concentrată pe remarcarea conexiunii dintre umiditatea solului si stabilitatea agregatelor de sol existente în zona de studiu Tătăraşi. Pentru realizarea acestui studiu s-au folosit o serie de metode de laborator aplicate la nivel internaţional pentru fiecare proprietate a solului.

În studiul umidităţii solului s-a utilizat metoda uscării fiolelor la etuvă iar pentru determinarea stabilităţii s-a aplicat metoda scufundări agregatelor de sol în apă cu ajutorul aparatului Eijkelkamp Wet Seiving Apparatus.

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THE EVOLUTION OF DAMS AND HYDRO-POWER IMPROVEMENTS

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Abstract. From the oldest times, human communities have developed near watercourses. By increasing the community, increased default and water requirement, and for satisfy this primordial need, people began to realize water accumulation by crossing rivers. Dams construction shows slow progress, until the industrial revolution, at which point there is a new water consuming and the water needs grows. The dams are starting to be increasingly more imposing, and the water accumulation build behind them will have volumes of the order of km^3.

Keywords: dam; accumulation; hydropower; historic.

1. Introduction

Water is essential for life being, energy is needed to improve living conditions, flood control is beneficial for protecting life and goods. All these requires water accumulation by crossing rivers (Popovici, 2002).

First made dams have been those of earth and embankment. Are registered dams like: Saad-El-Katara from Egypt (probably built about 4,800 years ago), some dams raised over 3000 years ago on the revers Amu-Daria and Sîr-Daria, dams from Ceylon, Syria, India, Japan, since the beginning of our era. The dams made of earth and embankment built in India and Japan, around 1,000 year, even today there are operative (I.P. 13 Decembrie 1918, 1984).

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2. Work Content

In 1950, worldwide there were about 5,268 dams with a height $H > 15$ m. By discovering the concrete as a building material and using it's on a large scale, to the end of XIX century it was revealed the possibility of producing concrete dams, which provides a water storage capacity higher than the earth dams. So, in only 65 years, the number of concrete dams increases about 11 times, having, in 2015, 57.651 dams with a height over 15 m (Table 1 and Fig. 1).

Table 1
Evolution of the Number of Dams with $H > 15$ m
(Popovici, 2002; www.icold-cigb.org)

Continent \ Year	1950	1982	1986	2015
Africa	133	665	763	2,098
Asia	1,554	4,194	4,569	12,308
Australia-Oceania	151	448	492	507
Europe	1,323	3,961	4,114	5,977
America	2,099	7,303	8,479	12,919
China	8	18,595	18,820	23,842
Total	5,268	35,166	37,237	57,651

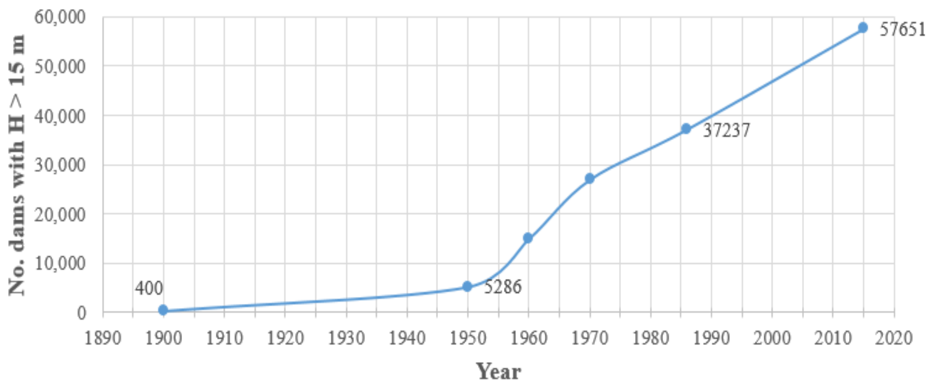

Fig. 1 – Evolution of the number of dams after during construction (Popovici, 2002; www.icold-cigb.org).

At the same time with technology evolution and computing concept, crest of wave height levels is impressive, over 300 m (Table 2), but also huge volumes of water collected in reservoirs (Table 3).

In Romania, there are 246 dams, with heights higher than 15 m, ranking place 21 in the world as number. In Table 4 is presented the highest dams and in Table 5 the highest accumulations in Romania.

Table 2
The Highest Dam in the World (www.icold-cigb.org)

No.	Name dam	*H*, [m]	Country	Type
1	Rogun	335	Tajikistan	Earth
2	Bakhtiyari	315	Iran	Arch
3	Jinping 1	305	China	Arch
4	Nurek	300	Tajikistan	Earth
5	Lianghekou	295	China	Rockfill

Table 3
The Largest Lakes in the World (www.icold-cigb.org)

No.	Name dam	*W* km^3	Country	Type
1	Kariba	180.60	Zimbabwe/Zambia	Arch
2	Bratsk	169.00	Russia	Gravity
3	High Dswan Dam	162.00	Egypt	Arch
4	Akosombo	150.00	Ghana	Rockfill
5	Daniel Johnson (Manic 5)	141.85	Canada	Buttress

Table 4
The Highest Dams in Romania (www.icold-cigb.org)

Name dam	River	Type	*H*, [m]
Gura Apelor	Raul Mare	Rockfill	168.0
Vidraru	Argeş	Arch	166.0
Izvorul Muntelui	Bistrița	Gravity	127.0
Poiana Mărului	Bistra Mărului	Rockfill	125.0
Siriu	Buzău	Rockfill	122.0

Table 5
The Highest Accumulations in Romania (www.icold-cigb.org)

Name dam	River	Type	*W* hm^3
Porțile de Fier I	Danube	Gravity/Earth	2,100
Stanca	Prut	Gravity/Earth	1,290
Izvorul Muntelui	Bistrița	Gravity	1,230
Porțile de Fier II	Danube	Gravity/Earth	600
Gogoşu	Danube	Gravity/Earth	600
Vidraru	Argeş	Arch	465

During the industrial revolution hydraulic energy played an important role on industry development. The first industrial cities were associated water energy. Dams and canals were built, and whenever fall exceeded 5 m were installed hydraulic wheels. Hydraulic energy revival occurred with the development of electricity and generators. First hydroelectric factory was done in 1880 in Cragside, Northumberland, in the northernmost county of England. Then hydro-power plants constructions increase, turbines have been improved, important hydro-technical works has appeared (Stematiu, 2008).

In 1950 existed an installed power about 100 GW in the whole world. Oil price increase, developed the rhythm improvement of existing hydroelectric potential, especially in developing countries. Thus, in 2015 find an installed power 1,212 GW in hydro-power plants over the world (Fig. 2) (IHA, 2016).

In Table 6 is presented the biggest hydroelectric plants in operation in the world an in Table 7 is classification for first five of countries by hydroelectric power.

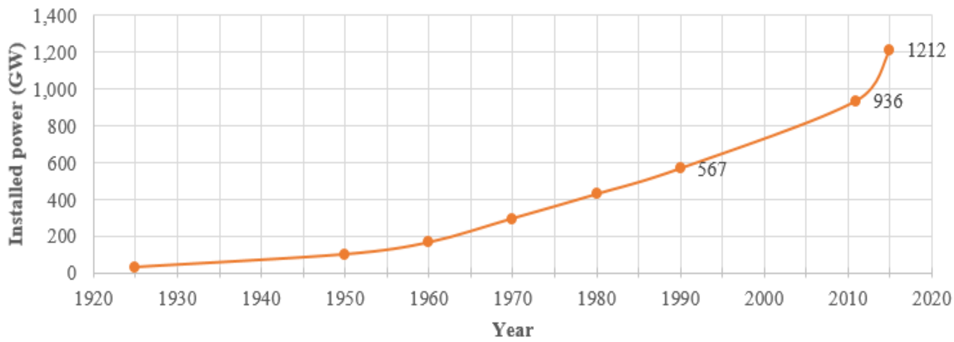

Fig. 2 – Evolution of installed capacity in hydroelectric plants (Popovici, 2002; www.icold-cigb.org; IHA, 2016).

Table 6

The Biggest Hydroelectric Plants in Operation (www.icold-cigb.org)

No.	Name dam	Installed power, [GW]	Country
1	Inga III	40.00	Congo
2	Itaipu	28.00	Brasilia/Paraguay
3	Sanxia	22.05	China
4	Baihetan	14.00	China
5	Xiluodu	13.86	China

Table 7

Classification of Countries by Hydroelectric Power (IHA, 2016)

No.	Country	Installed power, [GW]
1	China	319.37
2	SUA	101.75
3	Brasilia	91.65
4	Canada	79.20
5	India	51.50
Other		568.53
TOTAL		1,212

In Romania, in 2015 there was a total installed power (Pi) about 6705 MW, producing annually about 17,465 GWh/an, ranking 10th in Europe.

Management is divided into administrative sectors, and production capacity from branches is given by a number of (HIDROELECTRICA, 2013):

– 140 micro-hydro-power plants with installed power below 4 MW where are a total of 287 hydro-power groups totaling an installed power of 111.86 MW (Table 8);

– 23 hydroelectric plants with installed power between 4 MW and 10 MW where there are a total of 46 hydro-power groups totaling an installed power of 165.68 MW (Table 8);

– 106 hydroelectric plants with installed power higher than 10 MW, where are a total of 247 of hydro-power groups totaling an installed power of 6,074.27 MW (Table 9);

– 5 pumping stations totaling an installed power of 91.5 MW (Table 9).

Table 8

SHP Distribution Branch with Installed Capacity below 4 MW And Hydro Power Plants with Installed Capacity Between 4 MW and 10 MW (HIDROELECTRICA, 2013)

No.	Branch	SHP				SHP			
		$Pi \le 4MW$				$4\ MW < Pi \le 10\ MW$			
		Pi MW	Ep GWh/y	No. centrals	No. groups	Pi MW	Ep GWh/y	No. centrals	No. groups
1	Bistriţa	23.76	75.47	30	56	4.10	14.00	1	2
2	Buzău	6.55	23.38	9	16	33.15	121.65	4	7
3	Cluj	11.19	34.61	19	55	20.44	36.00	3	9
4	Curtea de Argeş	9.75	36.34	14	34	66.74	167.60	10	18
5	Haţeg	6.03	18.48	12	23	0.00	0.00	0	0
6	Oradea	13.16	47.92	10	23	20.00	41.10	2	4
7	Porţile de Fier	0.00	0.00	0	0	0.00	0.00	0	0
8	Râmnicu Vâlcea	3.83	11.89	4	7	0.00	0.00	0	0
9	Sebeş	0.25	1.90	2	2	4.25	6.00	1	3
10	Slatina	0.00	0.00	0	0	0.00	0.00	0	0
11	Târgu Jiu	3.37	8.10	3	5	10.00	20.00	1	1
12	Caransebeş	6.94	24.20	11	17	7.00	25.00	1	2
13	Sibiu	27.04	86.82	26	49	0.00	0.00	0	0
TOTAL		111.86	369.11	140	287	165.68	431.35	23	46

Hydro-power is a renewable form of energy, and the primary source of hydraulic energy is solar radiation and nature water cycle.

Between the various form of renewable energy, hydro-power is and will remain for a long time, the most important source used.

At the moment, the energy generated annually hydraulically is more than 2 mils. GWh, which is between 16 and 18% of electricity demand worldwide.

In Romania, are produced annually, on a par, approx. 18 TWh, that means 35% of demand, but the convertible energy potential is 38 TWh/an (Stematiu, 2008).

In Table 10 is presented the largest hydroelectric power in Romania.

Table 9

Distribution Branch of Hydropower Plants with Installed Capacity Exceeding 10 MW and Pumping Stations (www.baraje.ro)

No.	Branch	Hydropower Pi > 10 MW				Pumping stations		
		Pi MW	Ep GWh/y	No. centrals	No. groups	Pi MW	No. Stations	No. groups
1	Bistrița	598.00	1,568.35	18	43	0.00	0	0
2	Buzău	177.25	459.40	8	19	0.00	0	0
3	Cluj	298.50	537.40	4	7	0.00	0	0
4	Curtea de Argeş	525.10	972.15	18	38	0.00	0	0
5	Hațeg	507.52	883.02	13	27	0.00	0	0
6	Oradea	194.00	390.00	4	8	10.00	1	2
7	Porțile de Fier	1.462.80	6561.00	3	16	0.00	0	0
8	Râmnicu Vâlcea	1.109.90	2737.00	14	29	61.50	3	7
9	Sebeş	342.00	600.00	3	6	20.00	1	2
10	Slatina	379.00	889.00	8	26	0.00	0	0
11	Târgu Jiu	179.60	442.60	4	10	0.00	0	0
12	Caransebeş	181.00	330.10	2	4	0.00	0	0
13	Sibiu	119.60	294.40	7	14	0.00	0	0
Total		6.074.27	16,664.42	106	247	91.50	5	11

Table 10

The Largest Hydroelectric Power in Romania (www.baraje.ro)

HPC	Accumulation	River	Installed power MW
Porțile de Fier I	Porțile de Fier	Danube	1050.0
Lotru Ciunget	Vidra	Lotru	510.0
Raul Mare Retezat	Gura Apelor	Raul Mare	335.0
Mariselu	Fântânele	Someş	220.5
Vidraru	Vidraru	Argeş	220.0
Porțile de Fier II	Porțile de Fier II	Danube	216.0
Stejaru	Izvorul Muntelui	Bistrița	210.0

6. Conclusions

As was mentioned, mankind has begun to lay the foundations of hydro-technical improvements 5,000 years ago, by crossing watercourses in order to accumulate and store water which, in time, will become an essential factor that helps great civilizations reach higher levels.

At this moment,the most favorable sites for large dams and heavy-duty hydro-power plant have been already occupied. How the best sites for large dams have been already occupied,and future barrier basin are occupied by spots (cities,villages, etc.), in the future is expected theirs construction with lower heights, in order to account for environmental and social factors, but also to offer the ability to regulate water resources distributed unbalanced and disorderly.

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EVOLUȚIA BARAJELOR ŞI A AMENAJĂRILOR HIDROENERGETICE

(Rezumat)

În cadrul lucrării sunt centralizate şi actualizate datele cu privire la istoricul amenajărilor hidrotehnice şi hidroenergetice atât din lume, cât şi din România cu scopul de a crea o privire de ansamblu asupra evoluției şi dezvoltării acestora, mai ales în urma revoluției industriale, când necesarul de apă a crescut şi amploarea barajelor şi a volumului din lacurile de acumulare au atins cote impresionante.

Cum cele mai bune amplasamente pentru construirea de mari baraje au fost deja epuizate, iar viitoarele cuvete sunt ocupate de obiective (oraşe, sate etc.), în viitor se prevede o construcție a acestora cu înălțimi mai reduse tocmai pentru a ține cont de factorii de mediu şi de ordin social.

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EVALUATING OF THE EARTH GEOTECHNICAL PROPERTIES REGARDING THE EARTH DAMS EXPLOITATION

BY

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Abstract. All buildings regardless of their purpose and destination, transmit the loads to the foundation soil through foundations. For a correct solving of the building settlement on land it is necessary to know both the law that distributes the pressures on the contact surface between the foundation and the land, and the distribution of stresses and strains in the earth mass located in the influence area of the building.

Pressures on the contact surface ground**-** foundation permit rational sizing of elements which compose the foundation system and are simultaneously effective loads that generate the state of stress and strain in the foundation soil.

Knowing the stresses variation in the soil allows an effective foundation design so that the effective pressures do not exceed the bearing capacity of the soil, and the calculation of expected settlements of the foundation soil.

Keywords: dam; earth; foundation; stress; settlements.

1. Introduction

The problem of constructing durable and sustainable structures is closely linked to the environment in which they are located, respectively the foundation soil. Interest in the field has led to highlighting a variety of rocks that can be used

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as foundation soil. However, the behavior of the soil under external loads can often be unpredictable. Among the main types of rocks belonging to the land composition, the sedimentary ones represent, taking into consideration the spreading and volume, the main rocks used as construction materials or the ones that represent the foundation of the built environment (Alupoaie, 2013).

Pressures on the contact surface foundation - ground allow rational sizing and composition of the elements making up the foundation system and are, at the same time, effective loads that generate stress and strain in the foundation soil.

The theory of elasticity disposes of calculation relations for stress and strain. Thus, the case when the ground is loaded with a concentrated force was solved by Bousinesq by semispace theory and the case when the field is loaded with a concentrated force linearly distributed was solved by Flamant, using the half-plane theory

The two theories, based on the continuous environment assumption, linearly deformable, homogeneous and isotropic, have a wide applicability in solving land mechanics problems, although soils taken as disperse environments, composed of several stages, deviate from theory of elasticity.

As the earth characteristics are closer to the continuos environment conditions, linearly deformable, homogeneous and isotropic, the more justified the application of the theory of elasticity relations in calculating stresses and deformations of the earth is (Baron, 2013).

If soil behavior deviates from the assumptions of the theory of elasticity, the relations must be corrected based on observations carried out on actual behavior under loads. It was found that the theory of elasticity laws are applicable with good results for the soils with a linear behavior between stresses and strains, hypothesis corresponding to a large number of cases in earth mechanics (Athanasiu & Răileanu, 1983).

The earth is a granular medium, therefore loads transmission is performed from one particle to another, through contact between them and the water in the pores. Effective stress distribution is discontinuous, and can be treated for silty clays with fine particles, as being continous. Calculating statistically the stresses in the case of clay with particle size of 1μm, it is obtatined a 1% error compared to the continous environment hyphothesis. In the case of sandy soil, the environment can be meshed in an equivalent one made up of particles of the same size and shape, in which the distribution is like in a continuous and homogeneous medium. (Stematiu, 1988).

To determine the soil behavior under load, it should be known the nature and genesis, physical and mechanical characteristics, natural and anthropogenic factors influence , the distribution of stresses and deformation and the soil failure mode under loads (Alupoaie, 2013).

Exact determination of soil properties for each location where a structure construction is desired is a necessity.

For constructions, but especially for the foundation soil, humidity conditions represent the decisive factor that determines its mechanical properties and its behavior under extreme loading.

Because humidity conditions are continuously changing, there is interest not only for knowing the state of humidity at a given moment but also for preventing the changes that may occur. For this, it is necessary to establish internal and external factors which condition the water movement phenomena through soil and other porous environment, the laws by which this motion occurs and any phenomena it generates. Changes in humidity lead to changes in the soil volume and the occurence of further efforts in the structure (Baron, 2013).

A detailed analysis is done in the case of soil shear strength, which conditions the bearing capacity of soils. The particles that make up the soil are linked together by forces which are transmitted through contact surfaces. These forces are smaller than the efforts that can lead to deformation of the particles. For this reason, soil strength is given by the strength of the whole – solid, liquid, gas – and not by the mechanical characteristics of each of the particles (Brakensiek *et al.*, 1981).

When subjected to external loads, soils deform because the linking forces behave differently. At small deformations, some external loads will be balanced by cement cohesion. When deformations increase, friction mechanical links and primary cohesion will be solicited. By destroying these cohesions, displacements will appear, which will finally lead to soil breakage (Rațiu & Constantinescu, 1989).

Also, global climate changes have lead to significant local environmental modifications , which negatively influence the behavior of foundation soil. A change in rainfall or temperatures can lead to changes of the hydrostatic level, foundation soil humidity changes and finally, modification in the structure of the foundation soil itself.

Over time, outside the natural factors, earth shell transformation processes were increasingly influenced by the activity of the anthropic factors. At the moment, the changes made by people through the industrial revolution, represent a major cause of imbalances that occur in the environment.

Civil engineering structures interact with the environment and it can be said that they affect the environment in which they are located, but also that they are influenced by the environmental characteristics of the location. In conclusion, we can say that there is a bi-univocal correspondence between the building and the environment in which it is located. Pressures on the contact surface ground - foundation permit rational composition and sizing of the elements making up the foundation system and are at the same time, actual loads that generate stresses and strains in the foundation soil (Cotiuşcă-Zaucă, 2011).

2. Experimental

2.1. Materials

This article presents the analysis of the stress state in the body and foundation of Grăniceşti dam, using Robot Millennium v.17.0 software.
Grăniceşti facility is located on Horait brook, a left branch of the Suceava River, in Grăniceşti village, Suceava County (Boboc, 2014)

Table 1
Technical Characteristics of Grăniceşti facility

Feature	Value
Thalveg level	342.00 mdMN
Bottom discharge axil level	342.95 mdMN
NNR level	348.00 mdMN
Lateral spillway crest level	348.00 mdMN
Extraordinary maximum 1%	349.82 mdMN
5% probability level	349.15 mdMN
Crest level	354.00 mdMN
Superior elevation break wave parapet	350.80 mdMN
NNR surface	66 ha
NNR volume	1.356 mil mc
1% maximum level area	104 ha
Insurance volume 1%	2.885 mil.mc
Crest length	260.0 m
Crest width	5.00 m
Maximum height	8.00 m
Upstream embankment slope	1:3
Downstream embankment slope	1:2.5
Parapet breaking wave height	0.8 m
Footprint	49.0 m
Upstream slope protection	Plain concrete tiles BCH15
Downstream slope protection	Grassing

2.2. Methods

Robot Millennium is a graphical integrated program used for modeling, analysis and sizing of various types of structures. The program allows the user to create structures, to carry out calculations related to them and to verify the results. The program is composed of several modules which are each responsible for one specific step in the design of the structure (structural model creation, calculation, elements dimensioning). All these modules work in the same environment. Volumetric structures can be modeled in Robot using volumetric finite elements, having an approximated field of displacements based first order functions (Cercel, 2011).

The case of a concentrated force. Robot Millennium v 17. assessment by calculation of the theoretical cases considered (Figs. 1,…,4). It is considered a semi-infinite space limited by the landmass, loaded with a concentrated force *P*. Under stresses action, a point M will record a vertical displacement given by equation (1):

$$w = \frac{P}{4\pi G}\left[\frac{z^2}{R^3} + 2(1-\mu)\frac{1}{R}\right], \tag{1}$$

where: w is the vertical distance, [m]; P – concentrated force, [kN]; z – elevation of M; R – distance between the point of load P application point and M, [m]; μ – Poisson's ratio; G – soil modulus of elasticity.

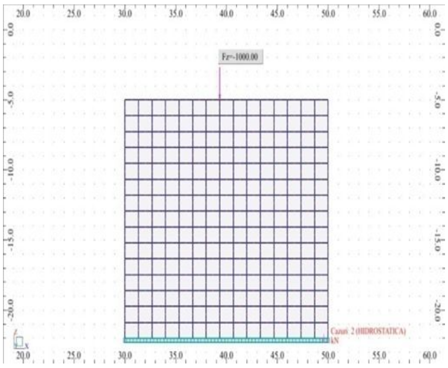


Fig. 1 – Concentrated force.

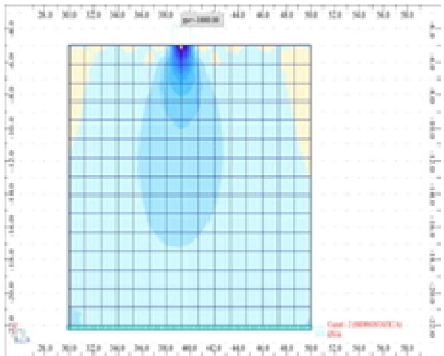


Fig. 2 – Stresses on *z* direction through maps.

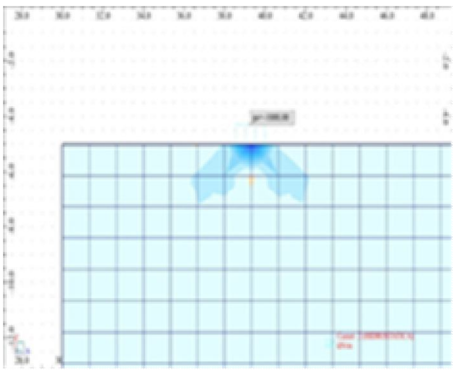


Fig. 3 – Stresses on x direction through maps.

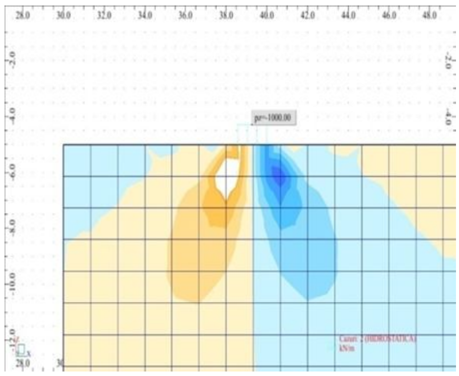


Fig. 4 – Stresses by isolines and maps

3. Results and Discussions

The steps necessary for the application of finite element method for a dam:

– geomtrical scheme of the chosen case (Figs. 5, 6 *a*, 6 *b*);
– determination of boundary conditions (Figs. 7 *a* and 7 *b*);
– determination of soil behavior law;
– mathematical scheme of the behavior law;
– entering data into the computer program;
– calculation itself;
– exploitation of results.

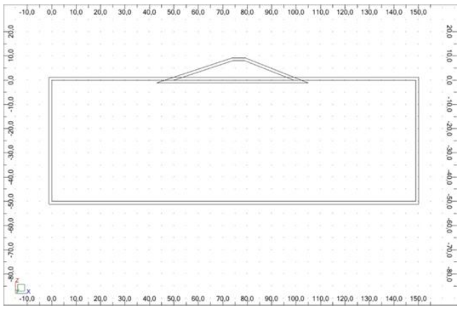
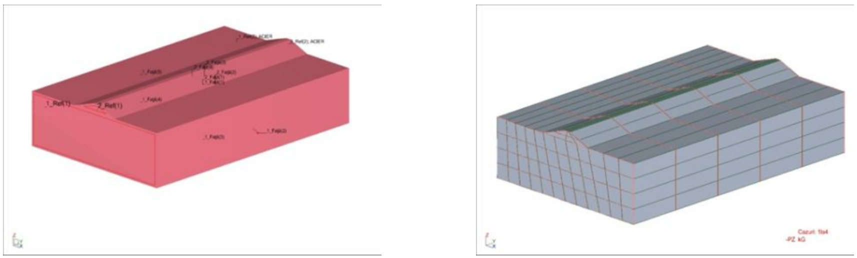
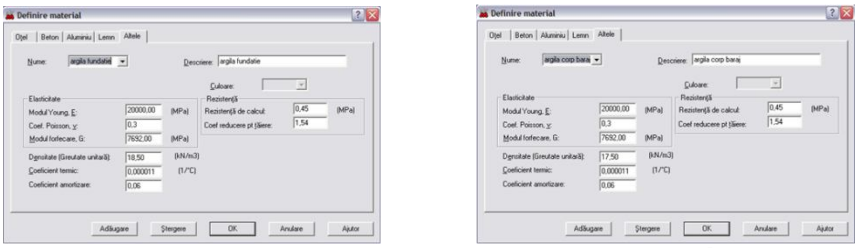


Fig. 5 – 2-D scheme of the analyzed structure.



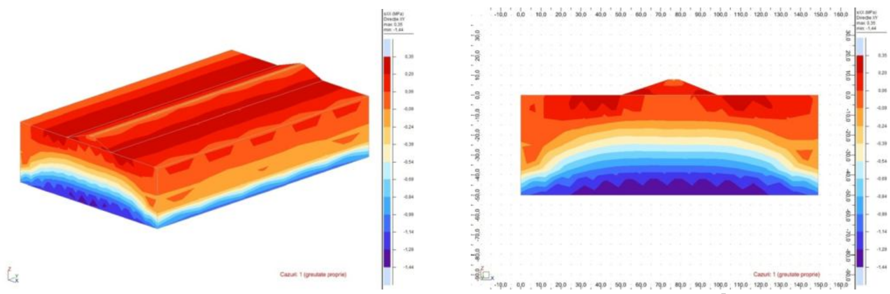
a *b*

Fig. 6 – 3-D scheme of the analyzed structure and finite element meshing.



a *b*

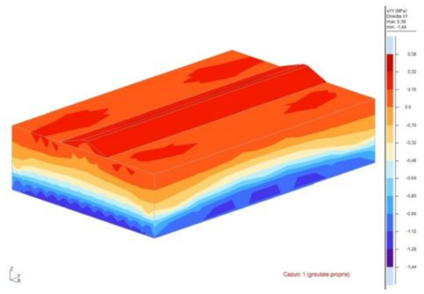
Fig. 7 – Defining the boundary conditions.



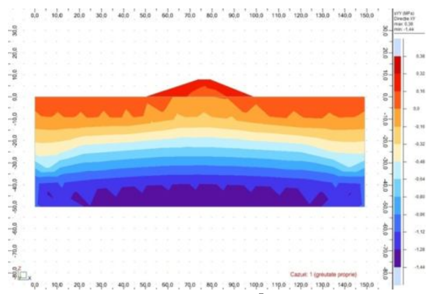
a *b*

Fig. 8 – Stresses distribution (MPa) resulted by loads from self weight on transversal direction of the dam, 3-D and 2-D.

When loaded with the self weight, the dam presents tensile stresses in the transverse direction of the dam, with values of maximum 0.20 MPa and values of 1.44 MP of the compressive stresses in the foundation of the dam at depths of 40-50 meters (Figs. 8 *a* and 8 *b*). There are observed maximum values upstream and downstream of the embankment footprint, areas where structurally there are adopted special solutions such as downstream drains for taking infiltrations from the dam, respectively a support beam for the tiles of the upstream parament, in order to reduce water infiltration and for erosion protection (Boboc, 2014).



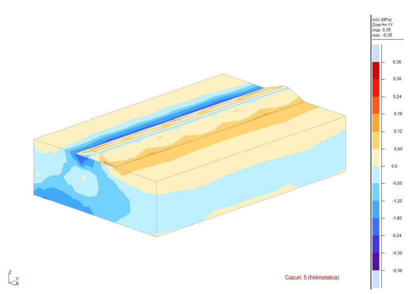
a



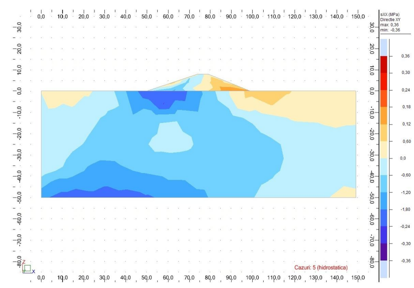
b

Fig. 9 – Stresses distribution (MPa) resulted from self weight on dam longitudinal direction, 3-D and 2-D.

When loaded with the self weight, the dam presents tensile stresses in the longitudinal direction of the dam, with values of maximum 0.38 MPa and values of 1.44 MP of the compressive stresses in the foundation of the dam at depths of 40-50 meters (Figs. 9 *a* and 9 *b*). Recorded stresses values are normal for this type of structures. Lower values are found in the center of the dam, values justified by the use of materials with different mechanical and geotechnical characteristics to get a structure which adapts to specified operating conditions. It is the case of structures which have central cores disposed to reduce infiltrations and to lower the infiltration route.



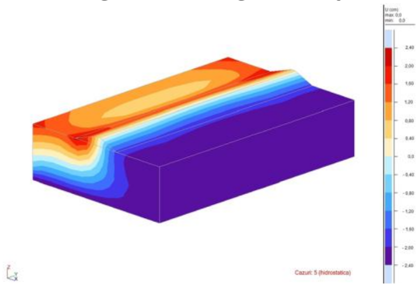
a



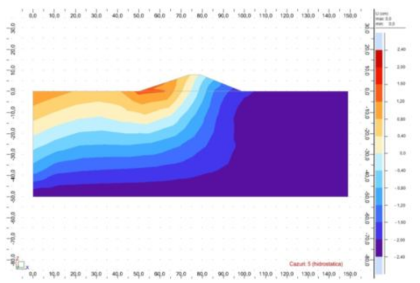
b

Fig. 10 – Stresses distribution (MPa) resulted from hydrostatic load on dam longitudinal direction, 3-D and 2-D.

When loaded with the hydrostatic load, the dam is subjected to tensile stress in the longitudinal direction, with values of up to 0.36 MPa (Figs. 10 *a* and 10 *b*). Tensile stresses which can cause damages in the structure are recorded at the downstream slope and on the downstream parament. This situation explains the necessity of verifying and checking structures for overturning and sliding stability.



a



b

Fig. 11 – Total displacement distribution (cm) resulted from the hydrostatic load, s 3-D and 2-D

Modeling the behavior of the structure loaded with hydrostatic pressure will lead to a displacement in the vertical direction of about 2 cm in the upstream slope, that is the area in which the hydrostatic pressure is the greatest. This area is additionally subjected to loads from concrete shielding of the upstream slope. Figs. 11 *a* and 11 *b* shows the stress distribution on the cross section of the dam.In the event of loads from the dam's own weight and hydrostatic pressure it can be seen that there are compressed areas in the downstream half of the dam and on the upstream parament. The distribution is justified by the combination of the two loads. This justifies the verifications that are made for this kind of structures for overturning and sliding.

Modeling the behavior of the structure loaded with hydrostatic pressure will lead to a displacement from compression in longitudinal direction of about 2 cm at the upstream slope base and a 1 cm displacement in the downstream slope.

4. Conclusions

Verifications done by calculating the magnitude of stresses in the characteristic sections of the dam made from local materials must be correlated with observations on both gauges installed in the dam structure and outside it. By comparing the results of these measurements performed on structures located in the environment with the results obtained by testing models and with the data obtained by calculations regarding the bearing capacity of the structure, a "diagnostic" on the state of the building can be obtained. Moreover, it can be discovered a possible forecast of its behavior in the future. This will allow to be taken any measures neccesssary to strengthen or further use of such construction.

Thus, there can be estimated: immediate (instant) settlements, instant settlements of non-cohesive soils, immediate (elastic) settlements or total settlements, in the case of cohesive soils (based on extrapolation of the theory of elasticity results), homogeneous and isotropic massive settlements, immediate settlements under eccentric loads, instant horizontal displacements and rotation of foundations of any form, settlements from primary consolidation, time evolution of primary consolidation settlements for homogenous foundation soils, and soil deformation by swelling.

These structural and geotechnical solutions can increase the reliability of the structure and reduce cases where this type of structures are damaged or destroyed.

The solutions adopted must resolve the problem of dam body destruction by erosion, identification of economically and structurally possible solutions for protection of the crest and the downstream parament. There are desired solutions like: gabion parament, drainage mat and other protections made of erosion-resistant materials for the downstream parament.

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EVALUAREA PROPRIETĂŢILOR GEOTEHNICE ALE SOLULUI DIN PUNCT DE VEDERE AL EXPLOATĂRII BARAJELOR DE PĂMÂNT

(Rezumat)

Toate construcţiile indiferent de scopul şi destinaţia lor, transmit încărcările terenului de fundare prin intermediul fundaţiilor. Pentru o corectă rezolvare a aşezării construcţiei pe teren este necesar să se cunoască atât legea conform căreia se repartizează presiunile pe suprafaţa de contact dintre fundaţie şi teren, cât şi distribuţia tensiunilor şi a deformaţiilor în masa de pământ aflată în zona de influenţă a construcţiei.

Presiunile pe suprafaţa de contact fundaţie-teren permit alcătuirea şi dimensionarea raţională a elementelor care compun sistemul de fundare şi sunt în acelaşi timp încărcări efective care generează starea de tensiuni şi deformaţii în terenul de fundare.

Cunoaşterea variaţiei tensiunilor în teren permite proiectarea fundaţiei astfel încat presiunile efective să nu depăşească capacitatea de rezistenţă a terenului, precum şi calculul tasărilor probabile ale terenului de fundare.

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SOLUTIONS CHOSEN FOR THE IMPLEMENTATION OF A GIS IN EROSIONAL PROCESSES MONITORING

BY

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Abstract. This paper sets out a GIS using solution for monitoring erosional processes on large areas. The selection of Geo-Graph software is motivated by the fact that the platform can be used in all database development stages. Another selection criterion consists of the possibility to create the own simulation model: in this case we are talking about the simulation of surface erosion.

The paper lists the possibilities provided by Geo-Graph software with examples from the own erosion simulation application for a hydrographic basin of approximately 4,000 ha.

The examples set out in the paper attempt to highlight the importance if using the GIS technique for monitoring the natural processes in large hydrographic basins.

Keywords: GIS; software solution; erosional processing; Geo-Graph.

1. Introduction

The use of Geographic Information Systems techniques for the management of certain parameters concerning the environment became a common fact these days. These techniques can be used for both the studies

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conducted on small areas (of few hectares) and for studies with regional or even national impact.

Within the GIS used in this paper, the georeferenced data is represented in the form of layers, fact that facilitates the analysis of spatial variables and distribution of entities on the analyzed areas, and the global analysis of the acquired information, which implies the concomitant approach of several layers, was enabled by the so-called “overlay” technique. The “overlay” technique is based on overlapping operations or on the combination of several layers (based on specific algorithms – determined by the user), generating new layers and new data and attributes, respectively. These operations can be of algebraic, logical, topological nature etc., and have graphic and non-graphic effects.

The “overlay” technique enables the performance of certain multiple spatial analyses because it refers to spatial entities and associated databases belonging to an unlimited number of layers. The quality of a GIS software is determined by the package of available overlay techniques.

The basis of the overlay operations consists of cartographic algebra and Boolean algebra. Depending on the specific structures of data, the following types of overlay exist: raster/raster, vector/vector, raster/vector.

Due to the fact that the overlay is not a mere overlapping of thematic maps (certain operations following to be performed between the layer data), in the current GIS application a special attention was given to the types of layers, quality of acquired data, the resolutions thereof, georeferencing, scale of the projection system, structure transformation of the data.

2. Presentation of the Software used in GIS Application

For the implementation of the Geographic/Territorial Information Systems techniques in the application contemplated herein we used the GEO – GRAPH Geographic Information Systems, a GIS-type software, developed by the IT Service Company Suceava.

GEO – GRAPH is a useful tool for the management and processing of graphic and non-graphic information, intended for operation of:

a) cartography of layouts and maps;

b) database interrogation.

The GEO – GRAPH system runs on the following operation systems:

a) Windows XP, 95, 98, 2000 etc.

b) Windows NT 3.5, 4,0 etc.

Within the GEO – GRAPH system, the alphanumeric-type databases are managed by Database Management Systems, such as:

a) dBase;

b) FoxPro; Visual FoxPro;

c) xBase.

The GEO – GRAPH system also supports Management Systems for Client/Server relational Databases, through the RIS (Relational Interface System) module of Intergraph company, such as:

a) Oracle;
b) MSSQL;
c) Informix etc.

2.1. Specific Characteristics of the GEO – GRAPH System

The GEO – GRAPH system stands out as an open system through the structure of input data in ASCII format. This structure enables the access to the drawing information from outside the system by facilitating the data integration with other systems or files generated by the user by means of own programs. The user can generate own programs which will create input data recognized by the GEO – GRAPH system, such as: data taken over from the total stations as files of coordinates and outline or data of.dxf type, generated following vectorization.

Due to this structure, the proficient users can use efficient text editors in order to search, modify and update the graphic information from outside the product, and can perform extremely complex functions (initially not designed within the system). For instance:

i) change of all names of objects, layers or graphic primitives;

ii) change of the displaying sequence of objects, meaning that the prior objects are no longer hidden by the color generated by further drawn objects;

The GEO – GRAPH system is designed in order to respond to the concept of objectual programming. The objects within the system consists of a package of entities and independent definitions, which can change their shapes and features depending on the requirements of the user. The GEO – GRAPH system consists of three distinctive interconnected subsystems (Fig.1).

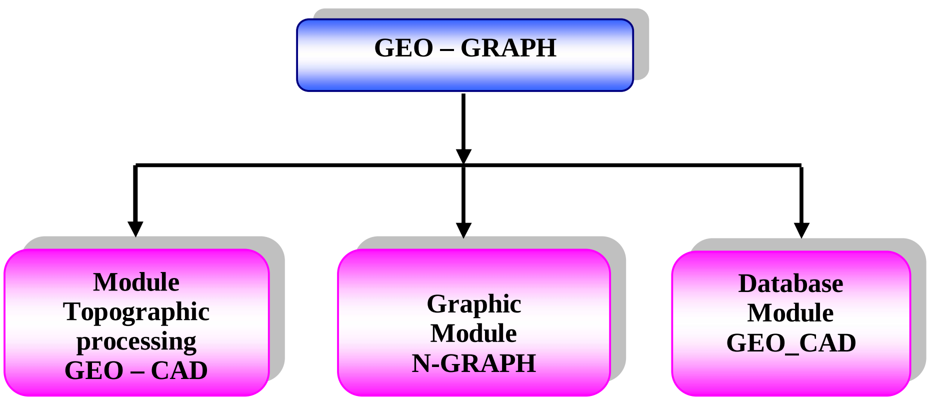

Fig. 1 – Block scheme of the logical components of GEO – GRAPH system.

Consequently, each object contains a text attribute required in order to identify the object equivalent with the definition of the centroid in the GIS systems. This ensures the identification function of the object by the system and user. The object can be passed from one primitive to another or to a graphic symbol without requiring a prior definition thereof. These facilities provide a special flexibility to the product, not provided by the usual CAD systems.

The GEO – GRAPH Geographic Information System is based on Windows technology, which represents a standard in the "user interface" area, and thus uses windows for the selection of options and buttons in order to generate orders (Fig. 2).

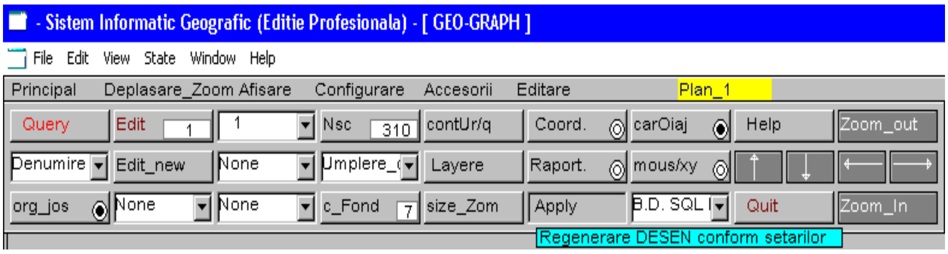

Fig. 2 – The button menu of the Geo – Graph system

2.2. Interface Menus with the Operating System

- **The File Menu**

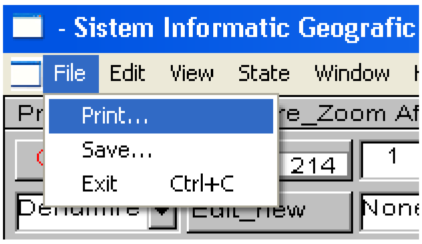

Fig. 3 – File Menu.

➪ enables the print screen;
➪ enables one to save the screen image in ***.bmp*** file;
➪ enables one to exit from the work session of the system (Fig.3).

- **The Edit Menu**

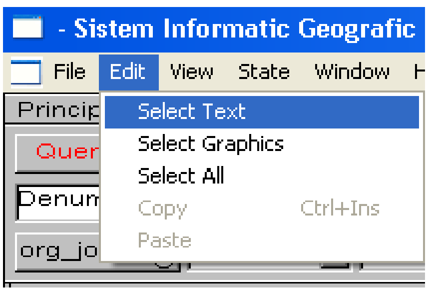

Fig. 4 – Edit Menu.

➪ enables the window-type selection for the text;
➪ enables the selection of an area of the zone graphic image which can be passed through the clipboard by means of the "copy" command or saved in ***.bmp*** file by means of the "save" command;
➪ enables one to take over from other applications the text or graphic image by means of the "paste" command (Fig. 4).

• Meniul View

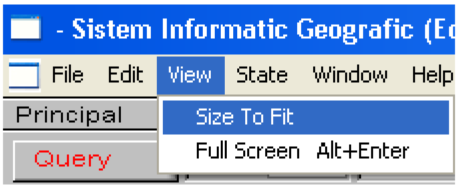

Fig. 5 – View Menu.

- the “Size To Fit” command enables one to remove and replace the arrow bars in order to move the image inside the working window;
- the “Full Screen” command enables the exclusive display of the user area on full screen, by removing all characteristic elements of the Windows operating system; this can be called back with Alt+Enter (Fig. 5).

• Window Menu

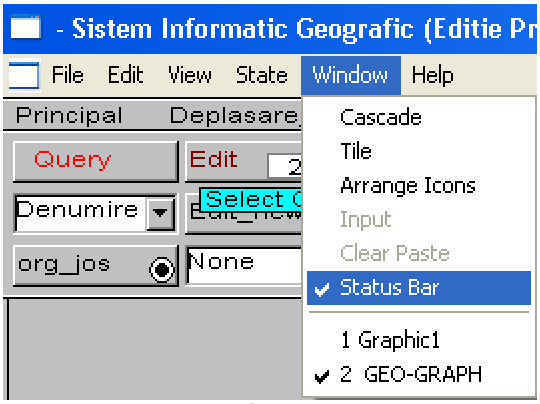

Fig. 6 – Window Menu.

- enables the arrangement of windows in cascades
- the “Status Bar” command enables the display or not of the message area in the working window footer (Fig. 6).

• State Menu

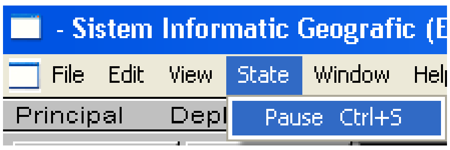

Fig. 7 – State Menu.

- enables one to stop or start the Geo – Graph system (Fig. 7)

The main menu of GEO – GRAPH software comprises 5 sub-menus (Fig. 8) which can be opened through a succession of fields solely upon the user’s request, who should select the intended command function.

The right yellow side will always display the name of the uploaded graphic drawing (or of the file if uploaded in ASCII format, or of the digital plan, if uploaded in binary form).

Fig. 8 – Main menu of GEO – GRAPH functions.

The GEO – GRAPH system was developed in order to be used mainly with the mouse, enabling a high efficiency. And, just as Windows operating system, Geo – Graph has a sensitive help by the mere mouse positioning on the work button, without generating an actual command, certain explanations of the relevant button command being displayed on the blue line (few examples are set out in Fig. 9).

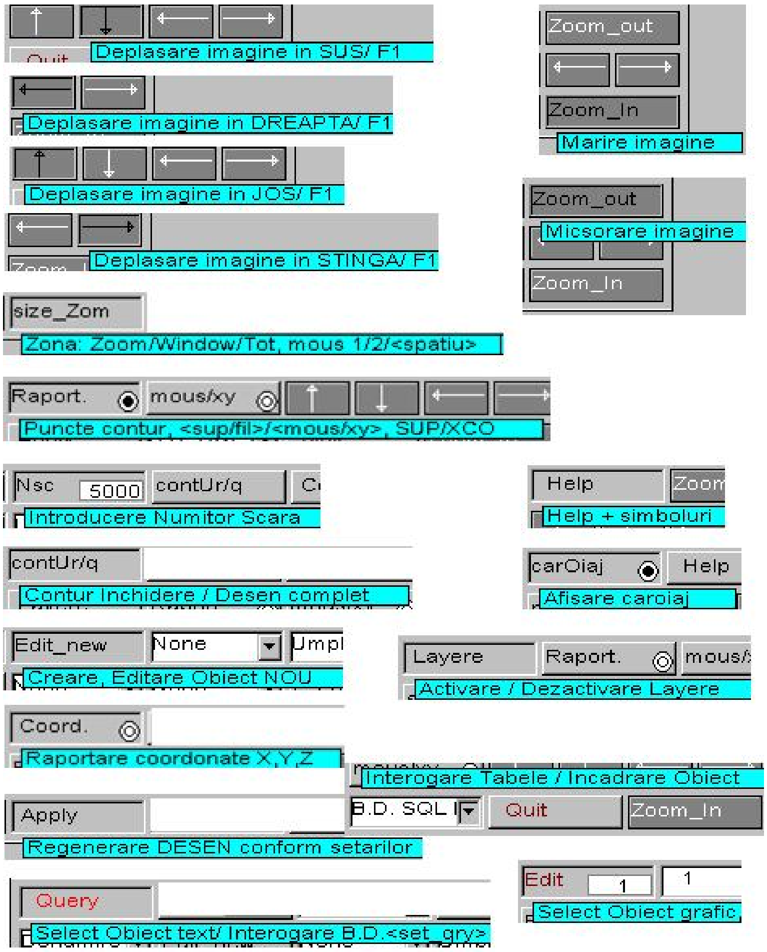

Fig. 9 – Sensitive help upon the mouse positioning on the buttons.

3. GEO – GRAPH Modules

GEO – GRAPH Geographic Information System contains the following main modules:

➩ CAD module for the representation of vectoral designs and raster images.

➩ Interrogation module of alphanumeric data, with spatial graphic localization.

➩ Import / export module of vectoral designs.

➩ Generating module for symbols and representation of cartographic elements in digital plans.

➩ Module of “drivers” for the connection to input / output peripherals.

➩ Module of vectorizing the background raster image.

3.1. CAD Module

The CAD module represents a powerful core of representation of the vectoral data, among which we can mention:

1º work with blocks (development, editing, addition, deletion of objects within the block);

2º introduction of the specific quota for all points in the selected object (*e.g.*, level curve, as selected graphic object);

3º the division of a graphic object into two objects, according to the specified point;

4º concatenation of objects, by taking into consideration the design travel sense;

5º development, insertion, addition, deletion of points in a selected graphic object;

6º deletion of objects;

7º bordering a specified text;

8º multiplying a text within the design, which was defined a single time;

9º over 30 graphic primitives that can be configured by the user.

3.2. Interrogation Module

The GIS module performs the interrogation of alphanumeric data by using the SQL commands both in xBase data management systems S.G.B.D. relational in the client/server system.

This module enables powerful facilities provided to the user for the development of the own application thereof. In this context, we would like to mention:

a) definition of the database structure;

b) definition of the index access keys to the database;

c) definition of the relations between tables (joins);

d) definition of the views (fictive tables used by the user);

e) definition of the connection relation between the graphic information and the alphanumeric information (setting the rule);

f) SQL commands editing by the user.

3.3. Import/Export Module

The import/export module of vectorial data enables the transfer between the Geographic Information Systems, as well as the integration thereof through the use of the network conection of such systems.

The import and export take place by standard interfaces, such as the DXF format (AutoCad), the HP format, standard for plotters and vectorial printers.

3.4. Generating Module for Symbols

The generating module for symbols facilitates the cartographic representation of drawings through the user of cartographic symbols, ensuring an outstanding productivity for the performance of the end cartographic product.

The library of symbols contains over 200 predefined symbols, and the user can also create other symbols by using the blocks. The variable linear symbols cannot be created by mans of blocks because they change their number of component elements depending on the segment length or the display scale, and such symbols can have an indefinite number of fragment points and any direction in the drawing.

3.5. Module for the Connection to Peripherals

The module for the connection to peripherals enables:

The performance of output reports and cadastral maps with the plotter or laser printers. The plotters which contain the HP and DMP standard are accepted by the product. The frame is assimilated to the number of the layer by means of the “plot.cfg” configuration file.

Introduction of drawings by means of any type of digitizer, by creating a digitizer configuration file, namely „digit.cfg”.

Interface with the total stations required for taking over the data through land measurements.

3.6. Module of Vectorizing the Scanned Image

The module of vectorizing the scanned image is identical with the digitizing module, with the only difference that vectorizing is performed with the mouse on the screen (on-screen), having as background the raster image, and digitizing is performed with the digitizer’s cursor, on the digitizing board.

The accepted raster images are in “bmp” format and should be of 8 bytes the size of the pixel, namely 256 colors.

4. Results

Are presented several layers of information results (Figs. 10 and 11).

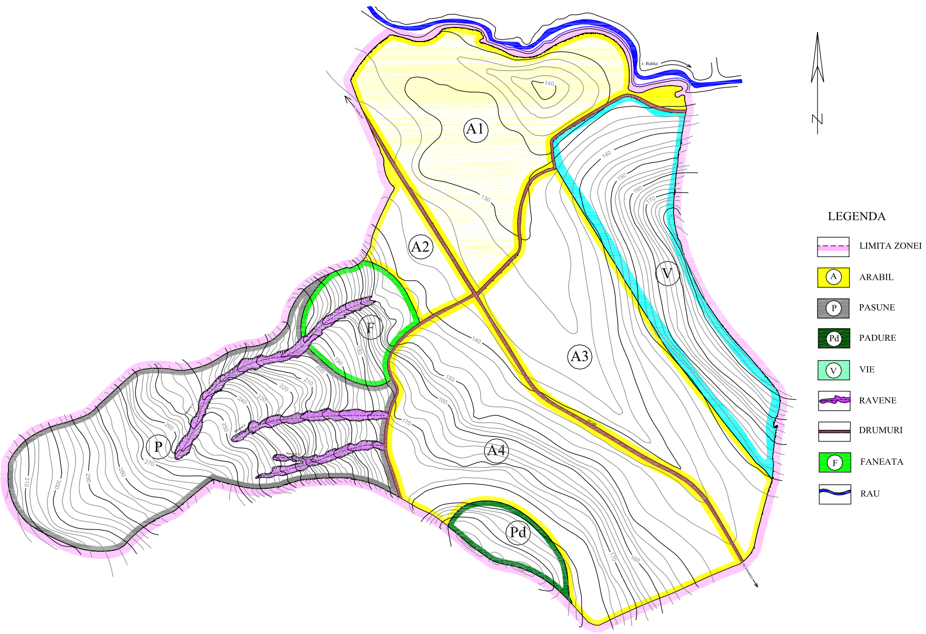

Fig. 10 – Contour map and land use.

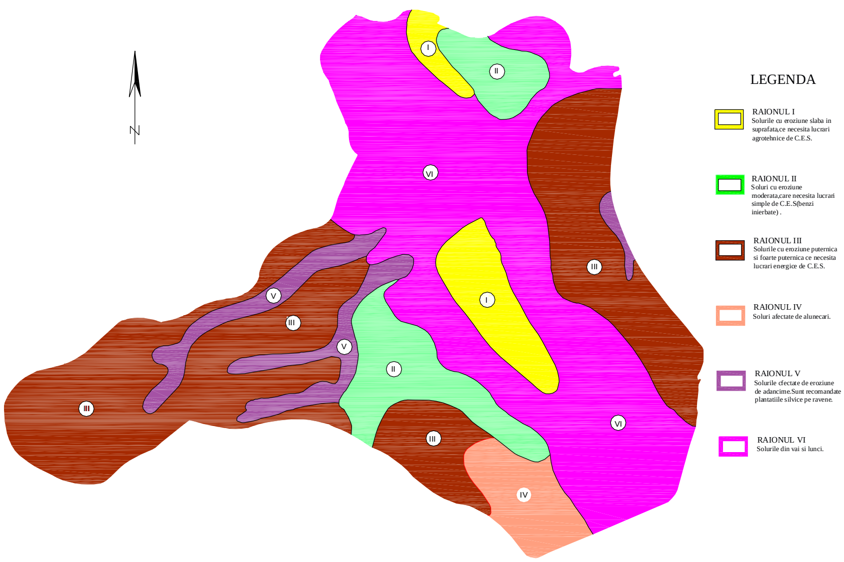

Fig. 11 – Soils map.

5. Conclusions

1. To ensure a superior quality of GIS all its components must be made to the same exacting. In this context the chosen software must find its place in the project.

2. The choice of application software must take into account the complexity of the processes analyzed the state of scientific achievements in the field to be used in GIS environment chosen.

3. This system was chosen because it is a compatible with the standards system data acquisition, processing and realization of their database.

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SOLUȚIA ADOPTATĂ PENTRU IMPLEMENTAREA UNUI GIS ÎN MONITORINGUL PROCESELOR EROZIONALE

(Rezumat)

Este prezentată o soluție de utilizare a GIS pentru monitorizare procese erozionale pe suprafețe mari. Alegerea software Geo-Graph este motivată prin faptul că platforma sa poate utilizata în toate etapele de creare a bazelor de date. Un alt criteriu de alegere este şi faptul că există posibilitatea de creare a modelului propriu de simulare: în cazul de față vorbim despre simularea eroziunii de suprafață.

Lucrarea trece în revistă posibilitățile oferite de software Geo-Graph cu exemple din aplicația proprie de simulare a eroziunii pe un bazin hidrografic de cca. 4000 ha.

Exemplificările din cadrul lucrării încearcă să pună în evidență importanța utilizării tehnicii GIS pentru monitorizarea proceselor naturale pe bazine hidrografice cu suprafețe mari.

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THE CAPITALIZATION OF MINING PERIMETERS IN THE MINING COAL BASIN OF THE JIU VALLEY THROUGH TOURISM INDUSTRY

BY

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Abstract. Research aim at developing new knowledge in the field of revaluation and re-use mining perimeters present in the coal basin of Petroşani, by their redesign into industrial tourist complexes.

At present, nationwide, there is no such an industrial tourist complex, which could emphasize the importance of the extractive activity.

Pursuant to the shutting down and greening of the mines in the mining coal basin of the JIU Valley, resulted a number of areas that are currently unused. By developing industrial tourist complexes, mining perimeter areas resulting from the shutting down and greening are revaluated through industrial tourism.

Keywords: coal basin; industrial tourist complex; geological; microregion.

1. Introduction

Jiu Valley coal basin has suffered numerous changes over time in terms of the number of mining perimeters.

The climax of the JIU Valley, from this point of view, was reached during the 1920s when they were operating 18 mining perimeters, as follows: Lupeni-Carolina, Lupeni-Victoria, Lupeni-Ileana, Lupeni-Ştefan, Lupeni-East, JIU Valley upper part, Vulcan-Dr. Chorin, Vulcan West, Vulcan-East,

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Aninoasa, Sălătruc, Dâlja, Petroşani-West, Petroşani-East, Petrila, Lonea I, Lonea II and Lonea III.

Currently, the Coal Basin of Petroşani consists of 14 mining perimeters. From among these 14 premises, only 7 are still in operation: Uricani, Lupeni, Paroşeni, Vulcan, Livezeni, Lonea and Petrila.

The other 7 mining perimeters Câmpul lui Neag, Valea de Brazi, Bărbăteni, Dâlja, Aninoasa, Iscroni and Sălătruc are closed and preserved (Fig. 1).

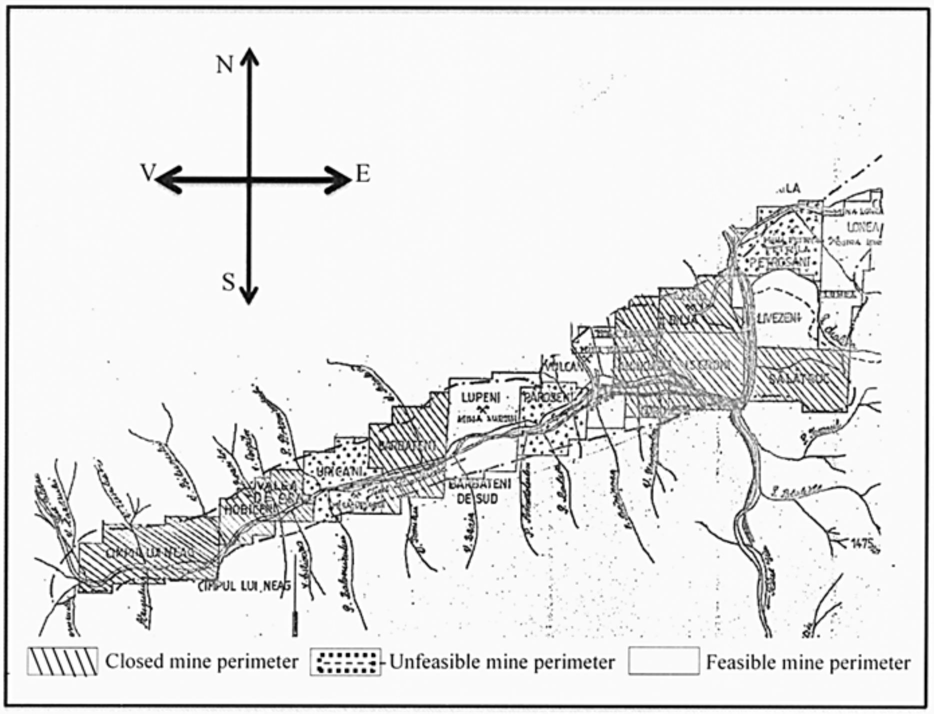

Fig. 1 – Delimitation of the mining fields in the coal basin of the Jiu Valley.

Of the seven mining perimeters of the Coal basin of Petroşani, three are included in the shutting down and greening programme: Uricani Mine, Paroşeni Mine, and Petrila Mine.

Due to the fact that the areas occupied by these three mining units are large, we propose that after the cessation of activity in the year 2018, at least one of the three mining units to be redesigned into an industrial tourist complex. This proposition is forwarded because, currently, there is no such complex in Romania, industrial tourism being poorly developed and exploited.

Choosing the location of the mine tourist complex should be based on a rigorous analysis from all points of view of the three mines that are to cease their activity in 2018. Another argument in favour of this industrial complex is represented by the fact that the JIU Valley coal basin is a tourist area.

2. Manuscript Organization

2.1 Perimeter Characterization of the Units Included in the 2018 Operational Programme of Shutting And Greening

1. Petrila Mine is the oldest and deepest coalmine in the Coal Basin of Petroşani. The mining perimeter of Petrila was exploited for the first time in 1859 (Fig. 2).

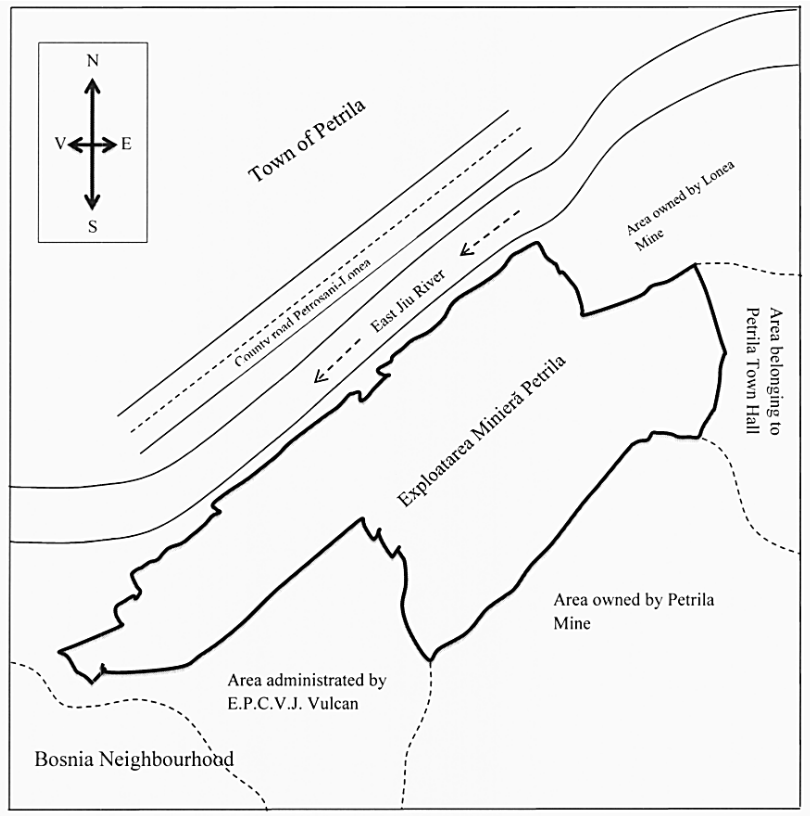

Fig. 2 – Petrila Mine perimeter.

The mining perimeter of Petrila is part of the industrial platform of Petrila and is located in the north-eastern end of coal basin of the JIU Valley, about 4 km from the town of Petroşani, being bordered as follows:

– in the north and north-east the boundary is represented by the East Jiu River;

– in the south the boundary is represented by Livezeni mining perimeter underground, while on the surface there is an area owned by Petrila Mine and an area administrated by E.P.C.V.J. Vulcan. In the South-eastern area the perimeter of Petrila Mine is bordered by an area owned by Petrila Town hall.

– in the western and south-western part Petrila Mine neighbours Bosnia neighbourhood;

– in the east the boundary is represented by the perimeter of Lonea Mine underground, and on the surface by a state area owned by Lonea Mine.

The access within the perimeter of Petrila mining is carried out via the national road DN Deva-Petroşani and the County Road Petroşani-Lonea. In addition to access by road, there is also the possibility of using the railway line Filiaşi-Simeria.

Petrila mine operates on the main premises – which have an area of 163,854.5 m^2, and geo-morphologically speaking this is a plateau-like area with great terraces formed along the East Jiu and its tributaries that form the hydrographical network.

2. The mining perimeter of Paroşeni is located in the centre of Petroşani coal basin, being bordered in the following way:

– in the western part, underground, by the perimeter of Lupeni mine, and above-ground by private properties;

– in the eastern part of the perimeter of Vulcan mine underground and in the northern part above-ground Paroşeni Mine is bordered by Retezat Mountains with Oboroca Peak.

– in the southern part, Paroşeni mine, both underground and above-ground, is bordered by the West Jiul River (Fig. 3).

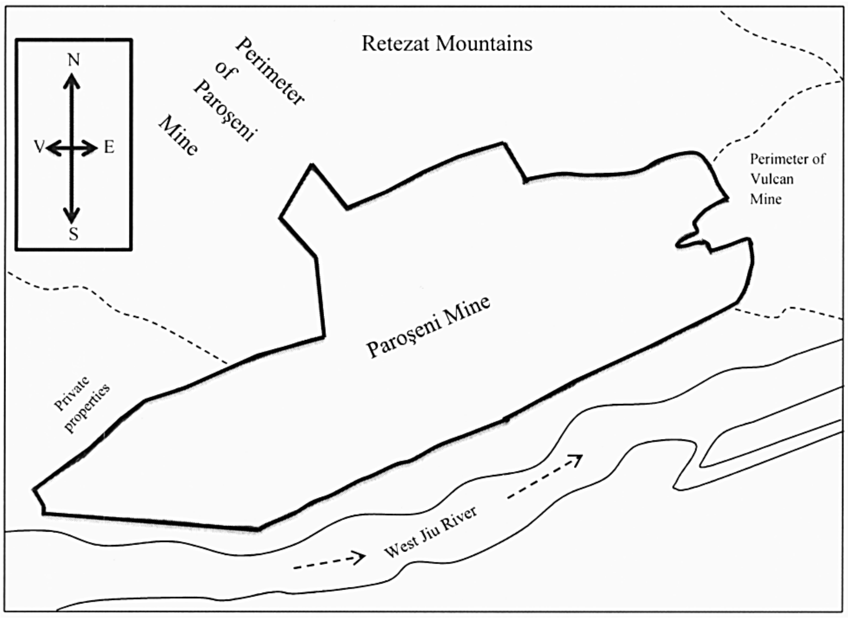

Fig. 3 – The perimeter of Paroşeni Mine.

This unit covers 356.10 hectares because Paroseni mine is located on terrace of the West Jiu and a hilly area with altitudes ranging between 600-650 m and partly alluvial lowlands near the West Jiul riverbed. Of this area 215.619 m^2 are used, because currently Paroseni mine holds an unused heap of debris.

Paroşeni mining perimeter administratively is located in the municipality of Vulcan, Hunedoara County. This operating unit is 1 km from Paroşeni power plant, and 115 km from Mintia power plant. The access to Paroşeni mine is provided by the national road 66 A.

Uricani Mine is located in the western part of Petroşani coal basin of. Administratively, it is located in the town of Uricani, a small town that lies at the highest altitude of all the Jiu Valley towns, at an altitude of 750. The mine perimeter is bordered according to the mapping in Fig. 4.

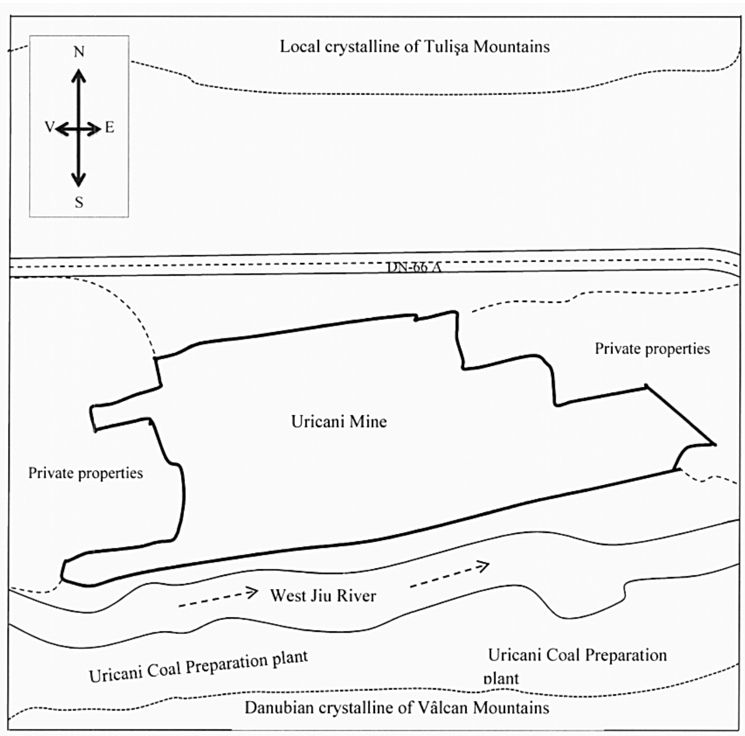

Fig. 4 – Uricani mine perimeter.

The perimeter of Uricani mine is bounded as follows:

– in the northern part by the national road DN-66, and above-ground and underground by the local crystalline of Tulişa Mountains;

– in the southern part by West Jiul River and the former coal preparation of Uricani above-ground, and underground the boundary is natural as well, being represented de Danubian crystalline of Vâlcan Mountains;

– in the eastern and south-eastern part, the boundary is represented by the perimeter of the former Bărbăteni mine which, currently, is part of the mining perimeter of Lupeni, underground and on the surface by private properties;

– in the western part of the area the above-ground boundary is represented by the town of Uricani, and underground by the mine perimeter of Valea de Brazi which is currently closed.

Uricani Mine owns land covering an area of 154,211.18 m^2, carrying out its activity through 6 premises and one heap of debris.

2.2. Description of Mining Units Included in the 2018 Shutting Down and Greening Programme

To convert one of these three mining units in an industrial tourist complex it is required a detailed analysis of the mining exploitation. This preliminary analysis will include the following criteria: access possibilities and location, surface, buildings that could be included in future techno-tourist complex, nearby attractions and accommodation possibilities.

In terms of access possibilities and layout, the situation of the three units is as follows:

Uricani Mine is the westernmost mining unit in the JIU Valley. This is part of the perimeter of the town of Uricani. The advantage of this mine regarding location is given by the fact that it is located along route DN 66 - A.

The downside of this is that the access of tourists to this area of the JIU Valley is quite difficult, and the distance from Petroşani (the main town of the JIU Valley) is about 30 km.

Paroşeni Mine is located in the centre of Petroşani coal basin and belongs to the municipality of Vulcan.

In terms of the location this mine also presents the advantage of being located near the main road, the access being assured via a bridge over the railway and West Jiul River.

In terms of distance from the main roadways in the JIU Valley, the location of this mine is not a disadvantage being located midway between Petrosani and Uricani, namely about 15 km distance.

Petrila mine is located in the eastern part of the basin of the JIU Valley. This mining unit presents, in comparison to the other two units, the advantage that European road E79 passes near the town of Petrila. The access is provided through Petroşani – Lonea County Road –or through the former enclosure 3Est which is currently used as an access road to the heap if debris.

The disadvantages include the fact that it is an area isolated from the rest of the JIU Valley, and this part of the microregion is very poorly developed in terms of tourism infrastructure. The distance from the main mountain resort in the coal basin of Petroşani, Straja ski resort, is about 35 km.

This long distance will discourage tourists in case they want to merge classic-conventional tourism present on the mining territory of the JIU Valley with this new form of tourism. The biggest development of the classic-conventional tourism takes place in the central part of the basin, through the presence of the most important mountain resorts Straja and Vâlcan.

If we look at the three mining units in the closing programme in terms of the surface available, we will find the following: Uricani Mine holds 154.211,18 m^2, Paroşeni Mina lies on a surface of 215.619 m^2, and Petrila Mine occupies 163,854.5 m^2.

Out of these three, we note that Paroşeni Mine holds the largest area, detaching itself from the other units.

Because the surface perimeters of Uricani mine and Petrila mine, the future industrial touristic complex would be rather limited within these areas. In terms of available surface Paroşeni Mine would be the ideal choice.

If we look at the number of buildings and their size, which may be part of the tourist complex, we find that Paroşeni Mine has a number of 90 buildings available, including an Administrative Building, which is located right at the entrance.

Taking into account all these data analysed, the best location suited for carrying out a techno-tourist complex is Paroşeni Mine, which has:

– the best location (the centre of Petroşani Coal Basin);
– equal distances Straja ski resort and Pasul Vâlcan resort;
– the largest area available and most of the buildings;
– easy access;
– development of tourism infrastructure and tourist attractions nearby.

2.3. Geological Analysis of Paroşeni Mine Perimeter

Petroşani basin is a distinct geological unit in the Southern Carpathians, consisting of a sequence of crystalline schist and Paleo-Mesozoic formations weakly evolved.

From the geological point of view, Paroşeni exploitation perimeter belongs to Paroşeni epistrucural Neozoic basin of Petroşani and includes three well stratigraphically particularized sedimentary layers positioned over a foundation consisting of crystalline schist, as follows:

The basal layer (Rupellian): is placed jarringly and transgressively over the crystalline foundation. The thickness of the basal clayey-conglomeratic red layer is between 350,…,550 m, being made up of clays, sandy clays, and sandstone with average grain and conglomerate.

The productive layer (Chattian): is found in sedimentation continuity over the basal layer, and it is of interest economically speaking because it includes coal layers that make up the objective of mining in the region. The productive layer thickness varies between 350 m and 400 m. This layer is made up of marl, clays, sandstone, clays, and sandstone, marl chalkstone clays, coal and carbonaceous clays.

The upper layer (Acvitian): covers the largest surface of the exploitation perimeter being crossed by conducted bore holes with variable thickness. The constituent rocks are conglomerates with cross structure, clay without bedding with a bluish-yellowish color.

3. Experimental – Problem Solution

During the shutting down and greening of Paroseni mine certain actions are anticipated to shut down the underground mining works and those related to the surface.

Demolition of structures at the surface, as well as actions meant to release the main enclosure of railways, roads, platforms will be accompanied by works of planning and greening of the land and will represent the last stage of the process of shutting down and greening Paroşeni mine.

In order to make the industrial tourist complex of Paroşeni, it is suggested the partial compliance with the stages referred to in "shutting down and greening technical project of Paroşeni mining exploitation", as follows:

– the shutting down of underground mining except the part of the 250 level which will be arranged in the form of an underground mining museum;

– demolition of buildings linked to the Paroşeni mine main enclosure, except those that are to be part of this techno-tourist complex;

– setup and greening the land related to the mine;

– restoration and consolidation of the remaining mining structures, through the actions of retooling and redesign;

– the use of the premises through the redesign;

– restoring roads that provide access to the mine.

After the completion of these partial works of shutting down and greening of Paroşeni we will move to redesign the building surface and underground spaces.

The ground on which is located the main premises of Paroşeni mine covers an area of 215,619 m^2 and the surface of the main premises of Paroşeni mine is 114,311.98 m^2.

The distribution of this area is presented in Table 1.

Table 1

The Surface of the Main Premises of Paroşeni Mine, [m^2]

Indicator	Taken surface
Total surface	114,311
Surface taken by constructions	24,613
Surface for transport	28,395
Surface for certain networks	4,239
Free surface	57,094
Uncoiled surface	26,617

In order for this to be possible, the necessary conditions for the changing of Paroşeni Mine in an industrial landmark have to be created.

4. Conclusions and Suggestions

It is considered that the implementation of an industrial complex in the coal basin of Petroşani will represent the main factor of sustainable micro-regional development.

It is advanced the proposal related to the construction of the future industrial complex, which will be made up of the following buildings: 1. Administrative Building; 2. Parking; 3. Dispatcher; 4. Lamps Building; 5. Tally room; 6. Pump House; 7. Main Well Tower (with gear); 8. Compressors Station number 3; 9. Fan Station number 1; 10. Extraction machine room number 2; 11. Auxiliary coal pit tower number 2; 12. Water treatment plant; 13. Explosives warehouse – Museum; 14. Park and green areas (Fig. 5).

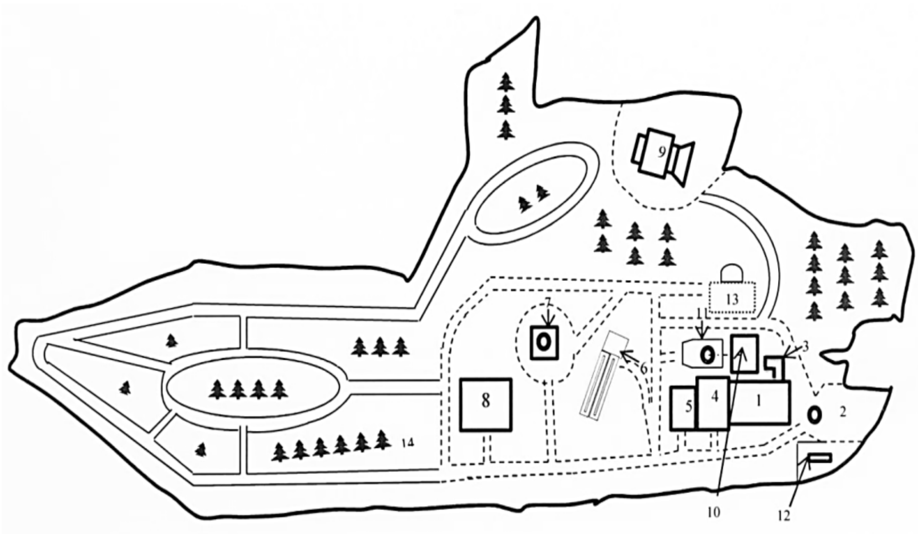

Fig. 5 – Proposal for the Paroşeni industrial tourist complex.

Following the completion of the industrial tourist complex in the JIU Valley microregion, it is estimated that the following changes in the economic and social level will be generated:

1) creating a link between the classic-conventional tourist forms within this carboniferous area, which will lead to the transformation of the microregion into one of the most important tourist centers in Romania;

2) the premises, land and mining constructions development;

3) creation of new jobs;

4) promotion of a positive image of the JIU Valley coal basin;

5) resident population income growth;

6) improving the quality of the environment and the socio-economic climate of the JIU Valley;

7) economic and infrastructural development of the entire societal community of the JIU Valley carboniferous basin.

In conclusion, the implementation of a tourism industrial system appears socially useful, leading to the JIU Valley regional economic development and to the elimination of the status of mono-industrial developed area through the reuse of held industrial potential.

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VALORIFICAREA PERIMETRELOR MINIERE ÎN BAZINUL MINIER VALEA JIULUI PRIN INDUSTRIE TURISM INDUSTRUAL

(Rezumat)

Cercetarea are ca scop dezvoltarea de noi cunoştinţe în domeniul reevaluării şi reutilizării perimetrelor miniere din bazinul carbonifer Petroşani, prin reproiectarea lor în complexe turistice industriale.

În prezent, la nivel naţional, nu există nici un astfel de complex turistic industrial, ceea ce ar putea accentua importanţa activităţii extractive. În conformitate cu închiderea şi ecologizarea minelor din bazinul minier de cărbune din Valea Jiului, au rezultat o serie de domenii care sunt în prezent neutilizate. Prin dezvoltarea unor complexe turistice industriale, aceste perimetre din zonele miniere ce au rezultat din închiderea şi ecologizarea sunt reevaluate prin turism industrial.

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FLOW MEASUREMENT CONSIDERATION PARAMETERS OF FLOWMETERS

BY

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Abstract. Research efforts of specialists is focused on continuous improvement of measuring instruments, in reducing measurement uncertainty, so that current measurements can approach to the desired accuracy. There is also a real interest in improving the metrological characteristics of measuring instruments, for increasing sensitivity measurement equipment, the immunity to interfering signals, reliability, response time, through a high level of automation, computerization of the measurement process.

Metrological characteristics of measuring equipment define their properties in relation input signals - measuring instrument - influence signals - output signals. Their expression is made by the parameters involved, input/ouput signals and influence signals, without reference to structure measuring instrument.

The terms used to describe the characteristics of a measuring instrument are applicable equally to a measure, a measuring device, a measuring transducer or a measuring system.

Keywords: linearity; uncertainty; hysteresis; calibration; random errors.

1. Introduction

Metrological characteristics of measuring equipment define their properties in relation input signals – measuring instrument – influence signals –

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output signals. Their expression is made by the parameters involved, input /ouput signals and influence signals, without reference to structure measuring instrument.

2. **Parameters of Flowmeters**

The term **linearity** usually means the maximum deviation in tracking a linearly varying quantity, such as measuring head, and is generally expressed as percent of full scale.

Discrimination is the number of decimals to which the measuring system can be read.

Repeatability is the ability to reproduce the same reading for the same quantities.

Sensitivity is the ratio of the change of measuring head to the corresponding change of discharge.

Range is fully defined by the lowest and highest value that the device can measure without damage and comply with a specified accuracy. The upper and lower range bounds may be the result of mechanical limitations, such as friction at the lower end of the range and possible overdriving damage at the higher end of the range. Range can be designated in other ways:

(1) as a simple difference between maximum discharge (Q_{max}) and minimum discharge ($Q_{\min}$),

(2) as the ratio ($Q_{\max}/Q_{\min}$), called **range ability**, and

(3) as a ratio expressed as 1:($Q_{\min}/Q_{\max}$).

Neither the difference nor the ratios fully define range without knowledge of either the minimum or maximum discharge.

Hysteresis is the maximum difference between measurement readings of a quantity established by the same mechanical set point when set from a value above and reset from a value below. Hysteresis can continually get worse as wear of parts increases friction or as linkage freedom increases.

Response has several definitions in the instrumentation and measurement fields. For water measurement, one definition for response is the smallest change that can be sensed and displayed as a significant measurement.

Lag is the time difference of an output reading when tracking a continuously changing quantity.

Rise time is often expressed in the form of the **time constant**, defined as the time for an output of the secondary element to achieve 63 percent of a step change of the input quantity of the primary element.

3. **Definitions of Terms Related to Accuracy**

Precision is the ability to produce the same value within given accuracy bounds when successive readings of a specific quantity are measured. Precision represents the maximum departure of all readings from the mean value of the readings. Thus, a measurement cannot be more accurate than the inherent precision of the combined primary and secondary precision.

Error is the deviation of a measurement, observation, or calculation from the truth. The deviation can be small and inherent in the structure and functioning of the system and be within the bounds or limits specified. Lack of care and mistakes during fabrication, installation, and use can often cause large errors well outside expected performance bounds. Since the true value is seldom known, some investigators prefer to use the term

Uncertainty. Uncertainty describes the possible error or range of error which may exist. Investigators often classify errors and uncertainties into spurious, systematic, and random types.

Spurious errors are commonly caused by accident, resulting in false data. Misreading and intermittent mechanical malfunction can cause discharge readings well outside of expected random statistical distribution about the mean. A hurried operator might incorrectly estimate discharge. Spurious errors can be minimized by good supervision, maintenance, inspection, and training. Experienced, well-trained operators are more likely to recognize readings that are significantly out of the expected range of deviation. Unexpected spiral flow and blockages of flow in the approach or in the device itself can cause spurious errors. Repeating measurements does not provide any information on spurious error unless repetitions occur before and after the introduction of the error. On a statistical basis, spurious errors confound evaluation of accuracy performance.

Systematic errors are errors that persist and cannot be considered entirely random. Systematic errors are caused by deviations from standard device dimensions. Systematic errors cannot be detected by repeated measurements. They usually cause persistent error on one side of the true value. For example, error in determining the crest elevation for setting staff or recorder chart gage zeros relative to actual elevation of a weir crest causes systematic error. The error for this case can be corrected when discovered by adjusting to accurate dimensional measurements. Worn, broken, and defective flowmeter parts, such as a permanently deformed, over-stretched spring, can cause systematic errors. This kind of systematic error is corrected by maintenance or replacement of parts or the entire meter. Fabrication error comes from dimensional deviation of fabrication or construction allowed because of limited ability to exactly reproduce important standard dimensions that govern pressure or heads in measuring devices. Allowable tolerances produce small systematic errors which should be specified.

Calibration equations can have systematic errors, depending on the quality of their derivation and selection of form. Equation errors are introduced by selection of equation forms that usually only approximate calibration data. These errors can be reduced by finding better equations or by using more than one equation to cover specific ranges of measurement. In some cases, tables and plotted curves are the only way to present calibration data.

Random errors are caused by such things as the estimating required between the smallest division on a head measurement device and water surface waves at a head measuring device. Loose linkages between parts of flowmeters provide room for random movement of parts relative to each other, causing subsequent random output errors. Repeating readings decreases average random error by a factor of the square root of the number of readings.

Total error of a measurement is the result of systematic and random errors caused by component parts and factors related to the entire system. Sometimes, error limits of all component factors are well known. In this case, total limits of simpler systems can be determined by computation (Bos et al., 1991). In more complicated cases, different investigators may not agree on how to combine the limits. In this case, only a thorough calibration of the entire system as a unit will resolve the difference. In any case, it is better to do error analysis with data where entire system parts are operating simultaneously and compare discharge measurement against an adequate discharge comparison standard.

Calibration is the process used to check or adjust the output of a measuring device in convenient units of gradations. During calibration, manufacturers also determine robustness of equation forms and coefficients and collect sufficient data to statistically define accuracy performance limits. In the case of long-throated flumes and weirs, calibration can be done by computers using hydraulic theory. Users often do less rigorous calibration of devices in the field to check and help correct for problems of incorrect use and installation of devices or structural settlement. A calibration is no better than the comparison standards used during calibration.

Comparison standards for water measurement are systems or devices capable of measuring discharge to within limits at least equal to the desired limits for the device being calibrated. Outside of the functioning capability of the primary and secondary elements, the quality of the comparison standard governs the quality of calibration.

Discrepancy is simply the difference of two measurements of the same quantity. Even if measured in two different ways, discrepancy does not indicate error with any confidence unless the accuracy capability of one of the measurement techniques is fully known and can be considered a working standard or better. Statistical **deviation** is the difference or departure of a set of measured values from the arithmetic mean.

Standard Deviation Estimate is the measure of dispersion of a set of data in its distribution about the mean of the set. Arithmetically, it is the square root of the mean of the square of deviations, but sometimes it is called the root mean square deviation.

4. Conclusions

Metrological characteristics of measuring equipment define their properties in relation input signals – measuring instrument – influence signals –

output signals. Their expression is made by the parameters involved, input /ouput signals and influence signals, without reference to structure measuring instrument.

Is opens new horizons of development of the field of measuring the flow of liquids, water consumption, design and construction of flow meters, water meters and facilities for testing, calibration and verification, by combining the possibilities of communication equipment computer with the possibility of obtaining information measuring by eye modern systems equipped with cameras and advanced signal processing.

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CONSIDERAȚII PRIVIND MĂSURAREA DEBITULUI
Parametrii debitmetrelor

(Rezumat)

Eforturile de cercetare ale specialiştilor se concretizează în perfecționarea continuă a mijloacelor de măsurare, în scopul diminuării incertitudinilor de măsurare şi de transmitere a unității de măsură, astfel încât măsurările curente se pot apropia de o exactitate cerută, dorită. De asemenea există un interes deosebit în ameliorarea caracteristicilor metrologice ale mijloacelor de măsurare, în sensul creşterii sensibilității utile, a imunității față de semnalele perturbatoare, a fiabilității, a timpului de răspuns, printr-un grad mare de automatizare şi informatizare a procesului de măsurare.

Caracteristicile metrologice ale mijloacelor de măsurare defines proprietățile acestora în relația semnale de intrare-aparat de măsură-semnale de influență-semnale de ieşire. Exprimarea lor se face prin parametric care implică semnalele de intrare, ieşire şi de influență, fără referire la structura aparatului de măsură.