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S U M A R

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HYDROTECHNICS

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EXTREME METEOROLOGICAL PHENOMENA INDUCED BY CLIMATIC CHANGES AND THEIR INFLUENCE ON THE HYDROTECHNICAL STRUCTURES

BY

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Abstract. In recent decades, man has influenced Earth’s environment, causing changes which, by their scale, have become global phenomena. These changes include: climate change, ozone layer reduction, changes in biogeochemical cycles, changes in hydrological and water resources cycle, raising of ocean levels, changes in thermohaline circulation.

The climate system comprises of five main components, namely: the atmosphere, hydrosphere, cryosphere, land surface and biosphere. To evaluate the characteristics of possible climate changes, with observations, recording the last developments in the global system, are used mathematical models that simulate the behavior of the coupled system: ocean - atmosphere – continents, in distinct conditions (Antohi *et* al., 2007).

Physical experiments are largely replaced by numerical experiments made with different complex climate models. The results of numerical models suggest another consequence of climate change, namely the intensification of the hydrological cycle.

This enhancement can increase the intensity and frequency of extreme events: droughts, floods, tropical storms in many parts of the world.

Keywords: climate changes; hydrological cycle; hydrotechnical structures.

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1. Introduction

Currently we are facing a number of environmental problems, many of which are closely related. But by far the most important issue is climate change, as it was shown in the results of a survey whose subjects were experts. During Earth's history, the climate has changed many times, sometimes dramatically. Warmer eras replaced and were replaced by glacial. The effects of global warming have consequences: climate change, sea level rise, geomorphological changes, changes in agriculture, politic changes. Climate change: global average temperature at the Earth's surface has risen by 0.3 to 0.6 degrees C and is expected to increase with 0.5 to 2.0ºC by 2050 (Cismaru *et al*., 2005). Also there is expected an increase in rainfall and a change in temperature distribution at different latitudes, an increased frequency of tropical storms. At the same time, if the average level of seas and oceans has increased in the twentieth century by 10,...,20 cm, by 2100 forecasts show an increase ranging between 20 and 88 cm. This will depend on the ice cap melting and the creation of a huge area covered with liquid water which will affect the climate system (Crăciun *et al*., 2007).

2. Phenomena Evolution

Intergovernmental Court on Climate Change of the United Nations has calculated future growth by 1.4 to 5.8 degrees by 2,100 if human activity is ongoing in the current manner. Even an expected increase at the lower level would be the fastest global warming since the last ice age ie the last 10,000 years (Fig. 1) (Giurma & Dăscălița, 2007).

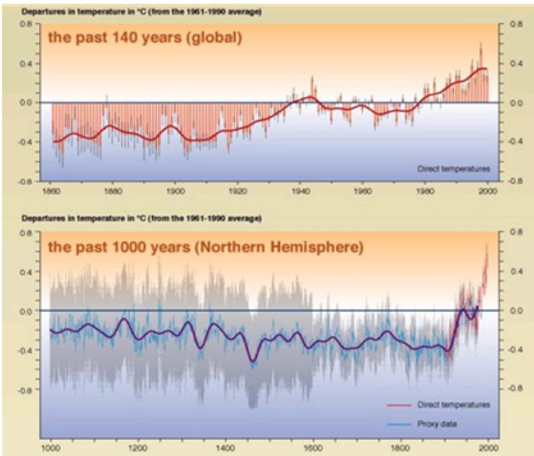

Fig. 1 – Earth surface temperature variation.

Over 80% of greenhouse emissions of the EU comes from the energy and transport fields. To complete the internal actions of the member states, the

EU Commission has developed a variety of restrictive measures based on the field situation. This is done in the ECCP program (a program on european climate change) which is a European Commission initiative. ECCP initiative has taken several measures including increasing use of alternative energy sources, reducing the fuel consumption for newer cars, more efficient energy use in new buildings, reduction of methane emissions (Giurma & Stirbuleac, 2007).

In relation to its position on the globe, Romania is located in the middle of the temperate zone, and the position on the continent adds continental character to the climate type. Under the influence of the main barometric centers of action for the movement of air masses with different properties, as well as under the influence of the role of orographic barrage which the Carpathians have, Romania acquires its own specific climate, different by the ones of the surrounding countries.

Thus, the climatic elements (temperature, humidity, wind speed, rainfall etc.) have an uneven distribution during the year due primarily to the existence of seasons and to the physical and geographical diversity of the land. In terms of precipitation, in our country about 80% of all calendar months are characterized by abnormal rainfall, the strongest fluctuations occurring in the south where monthly rainfall ranges from 0,...,300 l/m^2 and the annual ones between 250,...,1,000 l/m^2 (Giurma & Dăscăliţa, 2007).

In our country, without having a real cyclical character, there is a sequence between rainy periods and dry periods at a range of about 12,…,15 years. In the last century, very dry periods were 1894-1905 (with maximum intensity in 1897), 1942-1953 (with maximum intensity in 1946 and 1947), 1982-1996 (with maximum intensity in 1990 and 1992) and from 1998 to 2004. Hydrological droughts were more frequent than meteorological droughts, but occurred more frequent, extreme periods recorded in the years 1894-1900 and 1961-1965 in Transylvania 1943-1952, 1958-1964 and 1982-1993 in Oltenia, Muntenia and Moldova.

The most pronounced effects of global warming are hot and dry winters. Romania is significant for increased frequency of extreme weather events and rare: summer heat waves, tornadoes, floods. Meteorological records for more than 100 years show a clear trend of desertification on an area of 3 million hectares in the eastern part of the country (Dobrogea), East Muntenia and southern Moldova, of which 2.8 mln. Ha of arable land (20% of Romania's agricultural fund) (Fig. 2).

The trend of increasing of the water shortage (difference between precipitation and potential evapotranspiration) is accentuated in the summer months. Thus, it is eloquent the extreme drought of 2007 and the high frequency of periods during hot summer season. Aquatic ecosystems are affected by thermal gradients by reducing surface covered by lakes and changing water quality parameters (dissolved oxygen in rivers and lakes diminishes and eutrophication is favored) (Fig. 3) (Cismaru *et al.*, 2005).

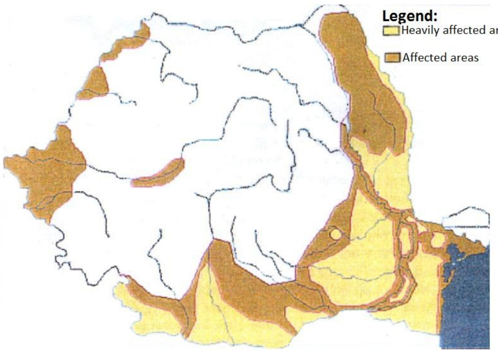

Fig. 2 – The most affected ares in Romania by drought.

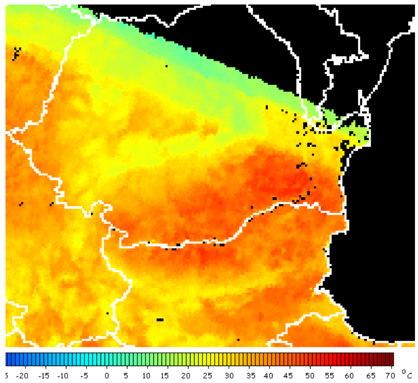

Fig. 3 – Earth maximum temperature (ºC) determined by meteosat sattelite data.

Regarding rainfall, significant regional differences are reported with a slight increase in the south, west and east and annual decreases in the remaining territory. It is obvious the emphasis of the torrential character of the rainfall which is manifested by the fall of heavy rainfall in short periods followed by long periods of drought.

Even in dry years, the rainfall produces ample floods ample during the spring when combined with snowmelt, and in the summer.

Estimating the evolution of the climate for the country territory was conducted using general circulation climate models (GCM). These studies are based on the application of the general atmospheric circulation models and climate scenarios. It was used monthly data on the amounts of precipitation and average monthly air temperatures. Climate scenarios are based on different assumptions about the growth of quantities of CO_2 into the atmosphere and the consequences of the greenhouse effect. For Romania there were conducted experiments using four models of general circulation: GISS (Godard Institute for Space Studies, USA) GFDL R-30 (Geophysical Fluid Dynamics Laboratory, USA, also known as GFD3) UK89 (United Kingdom Meteorological Office), CCCME (Canadian Climate Center Model) (Kroll, 1991).

Based on these scenarios it was established the possibility of increasing temperatures in the south of Romania with 3.9 to 4.4ºC and important variations in rainfall. Overall it is estimated that rainfall will increase in autumn and winter and will decrease during the summer. Based on analysis of trends in rainfall over the past century there were highlighted four extremely rainy periods (175 mm above average) and five dry periods (180 mm below average). For the same period the average annual temperatures are characterized by a clear tendency of temperature rise for the entire Romanian territory.

Climate change may induce changes on the loads acting on hydraulic structures. This situation contradicts the hypothesis in which it has been established the constructive solution by design.

Rainfall is the main hydro-meteorological factor for input in a hydrographic basin related to barrier lakes and is considered a hydrological system.

One way of highlighting the spatial variation of the total amount of rain is the isohyetal map drawn on a given field. Most often it is found that in a basin space of medium size, there are certain areas where almost systematic there are formed "cores" with the greatest amounts of rain. Such "cores" with amounts of rain usually occur in areas where clouds rise on slopes and are discharged massively.

The spatial variation of rain, often very significant, leads to a number of effects on the formation of the spill in general and of floods, in particular. In the areas with cores of maximum values, leak will be evidently richer, and hydrographs intensity will be greater due to the nonlinear process of integration of the discharge in the basin. Another way to highlight the spatial variation is the so-called rain curve "area-layer-duration".

For an individual rain, D_p, are calculated, starting with the maximum core, successive averages hi on each isohyet defined spaces. Each of these spaces has a specific area F_i to which it related the average amount of rain hi, resulting a curve $h = f(F)$ for a given D_p. This pattern is repeated for different periods of rain, yielding a family of curves $h = f(F, D_p)$ as can be seen in the figure below. In order to obtain for a certain territory a family of synthetic curves "area-layer-duration" , a current value h is related to the maximum value of the core hmax. In this case it is obtained a family of synthetic curves "area-layer-duration." Thus it is obtained for a give duration a curve that mediates the values $x = f(F)$ for a certain number of individual recorded rains. This curve is then used to evaluate for any rain, the rate of decrease of the maximum value in the core with the surface of the catchment area (Giurma *et al.*, 2006).

It is considered that the maximum value d_0 of the rain is found in the core of the isohyets represented by concentric circles. The ratio between the average quantity d_A of the area A (km^2) of a circle and d_0 (mm) is given by one of the formulas:

$$\frac{d_A}{d_0} = 1 - \frac{1.94}{d_0} A^{0.6}, \text{ for } F < 50 \text{ km}^2 \text{ (Woolhiser and Schalen);}$$

$$\frac{d_A}{d_0} = 1 - 0.214 A^{0.25}, \text{ (Frühling).}$$

For front rains that produce significant floods on basins with areas over 1,000,...,1,500 km^2 , the ratio is much higher for surfaces of 200,...,300 km^2 (Ionescu, 2001).

3. The Influence of Extreme Hydrometeorological Factors on the Safety of Hydrotechnical Constructions

The most important changes in the hydrological regime estimated for the territory of Romania doubled by their consequences are:

a) increased evaporation in the summer months due to increased air temperature;

b) extension of low water periods and reducing minimum flows due to increased evaporation and decreased rainfall in summer, with a reduction of 15,...,25% of minimum flow of rivers, with implications upon increasing pollution risks and restrictions imposed in water supply utilities;

c) earlier occurance of floods and reducing mixed floods (snow - rain) in spring by outsyncronizing the melting of snow with the manifestation of spring rains;

d) decreased soil humidity in the vegetation season by up to 20-30%, resulting in increased water stress on plants and decreased agricultural production.

The phenomena of dryness and drought represent a matter of the temperate continental climate, especially given the nuances of excessivity which manifest mainly in the eastern part of our country's territory (Rațiu & Constantiniu,1989.

The appearance of dryness and drought phenomena is determined by several factors: climatic, morphological, pedological, hydrological, anthropogenic.

Droughts generated by this complex factors manifests itself primarily in the air (atmospheric drought). If it persists for a long time, temperature and wind intensify the processes of evapotranspiration and reduce soil water reserves, the dryness and drought phenomena manifest also in the soil (pedological drought).

Torrential rains are the main hydrological phenomena that generate extreme events such as flooding. Flash floods are closely related to producing maximum rainfall in 24 h. In Moldova Plateau, they have a pluvial genesis in approx. 90% of the cases taken into consideration (Crăciun *et al*., 2007).

For the design of rainwater release from localities or from the precincts for torrent correction works or hydrotechnical constructions and installations, it is necessary to calculate the maximum rainfall. For this purpose it can be used intensity-duration-frequency curves. Rain intensity calculation is evaluated according to standardized frequency and duration of computed rain.

The normal frequency is the number of annual rainfall duration t, whose intensity exceeds the intensity for calculation. Frequency of calculation is determined by the class of importance of the analyzed objective.

In the winter season, when the water temperature reaches 0ºC, in all rivers and lakes from the Moldova Plateau appear conditions for the development of ice formations (ice needles, shore ice, ice bridge, floating ice). Even though in recent years barrier lakes have not recorded such events, their presence imposes some changes in the exploitation regime of barrier lakes (Giurma, 1997). Sometimes, in exceptional circumstances, at the "tail" of the barrier lake where the affluent discharges water into the lake, ice agglomerations can form, that may block lakes supplying. Recorded annual average are of approx. 1,...,2 days with such phenomena, most commonly being observed in February and March (Giurma & Dăscăliţa, 2007).

The ice bridge is a winter formation with great importance because of the effect produced on the operating manner of the hydraulic structures. Its average duration varies between 25 days in the south of the plateau and 60 days in the north part. Ice thickness varies depending on the sum of negative air temperatures and on the thickness of the water layer.

4. Conclusion

Climate changes are an extremely serious challenge to humanity and therefore also to the management activities associated with hydraulic structures.

Amplifying climate change induce additional problems both in design and in the operation of hydraulic structures.

During design will be reviewed design prescriptions and calculation requirements (flow rates and maximum levels with different probabilities of exceeding, the flows and levels with different insurers, rains computation, intensity curves of duration-frequency for heavy rains, maximum speed of wind with different probabilities, maximum / minimum design temperatures etc.).

In the operating activities of hydrotechnical works are necessary rehabilitation works and reconsideration of the operating conditions of structures given that requests for service, that are modified compared to those considered in the design (transiting flows higher than those taken into account in the design, additional volumes which must be stored or disposed from the lakes in safe conditions for the constructions and also for downstream structures, etc.).

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FENOMENE METEOROLOGICE EXTREME INDUSE DE SCHIMBĂRILE CLIMATICE ŞI INFLUENŢA LOR ASUPRA CONSTRUCŢIILOR HIDROTEHNICE

(Rezumat)

În ultimele decenii, omul a influenţat din ce în ce mai mult mediul Terrei, determinând apariţia unor modificări care, prin amploarea lor, au devenit fenomene globale. Aceste modificări cuprind: schimbările climei, reducerea stratului de ozon, modificarea ciclurilor biogeochimice, modificarea circuitului hidrologic şi al resurselor de apa, ridicarea nivelului Oceanului Planetar, modificarea circulaţiei termohaline.

Sistemul climatic cuprinde cinci mari componente şi anume: atmosfera, hidrosfera, criosfera, suprafaţa terestră şi biosfera.

Pentru a evalua caracteristicile posibilelor schimbări climatice, împreună cu datele de observaţii, care consemnează evoluţia în trecut a sistemului global, sunt folosite modele matematice, care simulează comportamentul sistemului cuplat ocean – atmosferă – continente în condiţii distincte.

Experimentele fizice sunt în mare măsură înlocuite cu experimente numerice, realizate cu diferite modele climatice complexe. Rezultatele modelelor numerice sugerează şi o altă consecinţă a schimbărilor climatice şi anume intensificarea ciclului hidrologic. Aceasta intensificare poate determina creşterea intensităţii şi frecvenţei unor evenimente extreme: secetă, inundaţii, furtuni tropicale in multe regiuni ale globului.

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ELABORATION OF TECHNICAL CADASTRAL DOCUMENTATION FOR THE SYSTEMATIC CADASTRAL WORKS, CORRESPONDING TO CADASTRAL SECTORS FROM OUTSIDE THE BUILT-UP AREA OF TERRITORIAL AND ADMINISTRATIVE DIVISIONS

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Abstract. Since 1991, a part of the terrains that compose the agricultural real estate of Romania, were given back to the legal owners. Unfortunately, due to the soft and deficit legislation together with the lack of specialized staff, the majority of the issued property titles were incorrect. In order to amend these mistakes, since 2014, the systematic cadastral works were regulated, having as main purpose the realization of a cadastre based on the *field reality*. Therefore, the technical cadastral documentation emphasize the real technical and legal situation, found during the systematic cadastral works and they are a basis for the property *ex officio registrations* in the cadastral and land register system.

Keywords: systematic cadastre; technical cadastral documents.

1. Introduction

Cadastre and land register represent an integrated unitary and mandatory system, of property recording from the entire country land (Law no.

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7/1996). From a technical, economical and legal point of view, the *property record* is achieved in the *technical cadastral documents* made for the systematic cadastral works and also in *the land register*.

The technical cadastral documents necessary for the systematic registration of properties in the integrated cadastre and land register system *are*: the cadastral register of properties, the alphabetic archive of the property real rights owners, of possessors and also other holders and the cadastral plan (Order no. *53*/2016).

The technical and economical record consists in identifying, surveying, describing and registration of the properties in the cadastral register, on the cadastral plans and in the land register.

The legal record consists in owners identification, possessors and other property owners and their registration in the alphabetic archive of the property real rights owners, of possessors and also other owners, to inscribe the rights on the properties in the land register.

By law no.*7*/1996 on cadastre and real estate publicity, the *base entities* used in the cadastre system and land register are *the property and the ow**ner***. Although, the systematic cadastral works involve the identification of the property owner and, in the lack of the property documents issued for the corresponding property, of its owner, which by law (Order no. 533/2016), can be registered as property owner in the land register, after the public notary issues the certificate for the registration of the possessor as property owner in the land register. Therefore, in fact, *the real entities that cadastre system and land register is working with, are the property and the holder*, the holder being defined (Order no. *533*/2016, page no. 21) as owner or possessor, established by 13th article from Law no.*7*/1996 on cadastre and real estate publicity.

To synthesize what has been mentioned before, *the objective of the systematic cadastre works* is represented by the *property registration* in the cadastral register, on cadastral plans and in the land register and the *property owner registration* in the alphabetic archive containing the holders of real property rights, of possessors and other owners in the land register.

The technical cadastral documents are organized on cadastral sectors, at territorial and administrative divisions level.

The main focus of the present work is to elaborate the technical cadastral documents for the sector no. 3, located outside the built-up area of the Berezeni parish, Vaslui county. The analyzed terrain surface is included in an irrigation plot (of the hydro-ameliorative Albiţa-Fălciu organization), belonging to the S.C. Agroind S.A commercial agricultural company, which took over the old's C.A.P. infrastructure and leased the terrains from the real right owners, appropriated by Law no. 18 on agricultural real estate.

2. Technical Cadastral Documents Elaboration

The elaboration of the technical cadastral documents for the systematic cadastral works, implies the flow of the following phases:

a) delimitation of cadastral sectors;
b) numbering of cadastral sectors;
c) delimitation of properties;
d) numbering of properties;
e) data acquisition for properties and owners description;
f) technical cadastral documents elaboration.

In order to *establish the limits of the cadastral sectors*, there are used the .dwg or .dxf files from the Land Registry Office, that contain the limits of the territorial and administrative divisions and of the component built-up areas, the existing ortho photomap, cadastral plans and/or topographic plans, but also the overall cadastral plan, at 1:10,000 scale (Order no. *533*/2016). In the process of systematic cadastral works, the limits of the cadastral sectors can be taken from the old cadastral archives or they can be modified, due to objective reasons, when the linear details that delimited the cadastral sectors have disappeared , or other permanent details have appeared within the cadastral sectors. By comparing the overall cadastral plan at 1:10000 scale with the existent details from the field, it was concluded that the *limits of the analyzed cadastral sector didn't modify in time* (Popa, 2015).

Founding the limits of the cadastral sectors is made depending on the landform, using the digitizing process of the existent plans and/or through topographic measurements (Order no. *533*/2016). *In the case of the cadastral sector no. 3* (in the old cadastral inventories the 83 field), for which it exists a land parcel map in .dwg format, made in the national projection system STEREO 70, drafted by the local committee and received by the Land Registry Office from Vaslui, its corresponding limits were taken from the parcel plan and integrated in the graphical database, after a check in the field using the GNSS technology, is made.

By introducing the cadastral systematic works, *the cadastral sectors numbering process* is made up in a different way, compared to the one used in the old cadastral inventories Order no. *533*/2016). The cadastral sectors numbering process is realized for each territorial and administrative unit, with Arabic numerals, starting from the north-west side of the outside built-up area with number 1 and continues in ascending order , from close to closer, so that the entire territory is covered, until the last cadastral sector located in the south.

After the numbering process of the cadastral sectors located outside the built-up area of the territorial and administrative division is ended, follows-up the numbering of the cadastral sectors located inside the built-up area, starting with the residential locality and continuing with the other localities, depending on the distance from the residential locality of the corresponding territorial and administrative division. Because of this aspect and in order to correlate the final cadastral documents with those existent previously of the systematic cadastral introduction, in the "sect_cad" table of the textual database, we included two fields (columns) containing the cadastral sector number from the old inventories, before the systematic cadastral works (field no./section) and the cadastral sector number attached by introducing the cadastral systematic works (c. s. no.).

Property limiting inside a cadastral sector is made up differently, depending on the location inside or outside the built-up area of the cadastral sector, in a common or non-common area before 1990, depending on the hedge existence or not of the property, but also depending on the cadastral parcel plans received by the Land Registry Office for the cadastral sectors located outside the built-up area etc., by integrating all the data about the property, provided by all kind of sources.

The property limits from the cadastral sector no. 3 *were taken from the parcel plan* of the field no. 83 and they were integrated in the graphical database, because after the field measurements using the GPS, it was concluded that *the property positions from the parcel plan corresponds to the real situation from field* and, also, after a check made with Digital Archive for Title Properties (DDAPT) application and of land register information extracts verification, it was concluded that the *property surface areas values from the parcel plan are corresponding with those found in the corresponding documents*.

The property numbering within the cadastral sector begins from the north-west side of the cadastral sector with number 1 and continues from close to closer, until all the surface area of the cadastral sector is covered (Order no. *533*/2016). The property numbering within this cadastral sector was made from left to right, by adding the natural number of the corresponding property location in the cadastral sector, to the cadastral number. For example, the twelfth property located in the cadastral sector number 3, will have the property number 3_12.

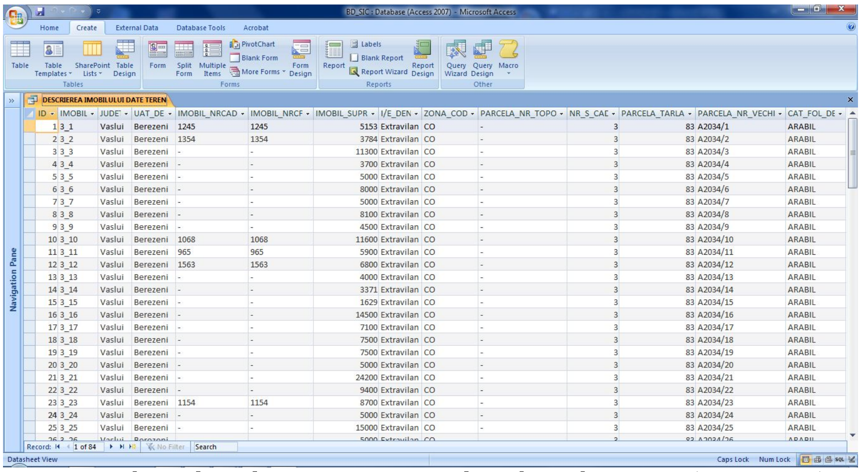
The necessary data for property description were taken from the title properties of the corresponding properties, from the land register information extracts, but also from the documents belonging to SC Agroind SA about the buildings from this cadastral sector and they were integrated in the textual database.

In order to elaborate the technical cadastral documentation, the database was interrogated, after various criteria. In this way, there are obtained:

a) information found in the cadastral Register, at property description, data about the terrain (Fig. 1) and data about buildings (Fig. 2);

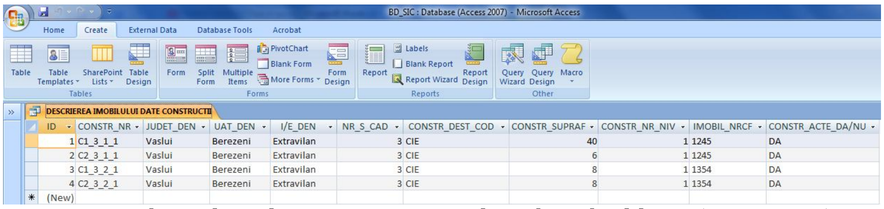
b) information contained in the alphabetical Archive of real property rights owners, of possessors and other holders (Fig. 3);

c) cadastral plan of the cadastral sector no. 3 (Fig. 4).



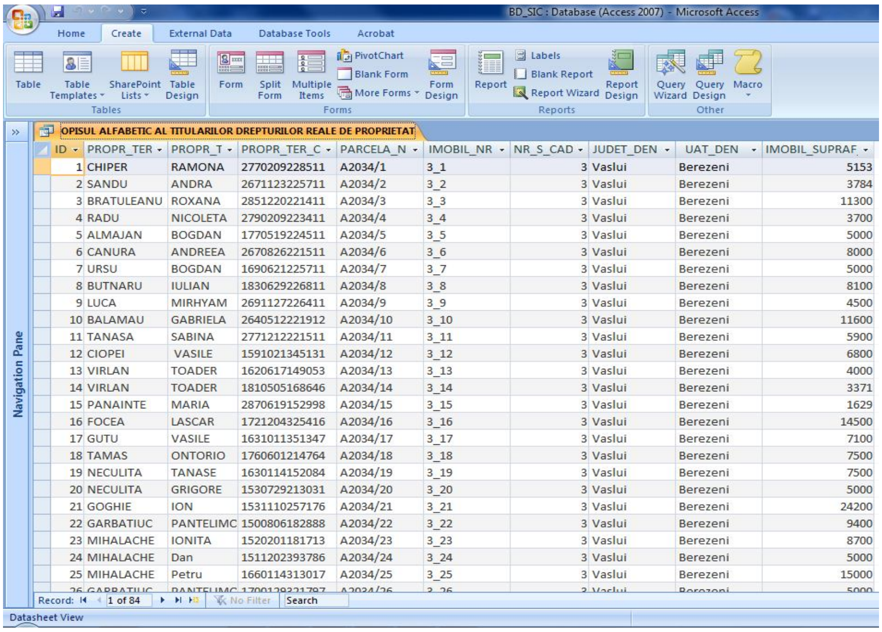
ID	IMOBIL	JUDET	UAT_DE	IMOBIL_NRCAD	IMOBIL_NRCF	IMOBIL_SUPR	I/E_DEN	ZONA_COD	PARCELA_NR_TOPO	NR_S_CAD	PARCELA_TARLA	PARCELA_NR_VECHI	CAT_FOL_DE
1	3_1	Vaslui	Berezeni	1245	1245	5153	Extravilan	CO	-	3	83	A2034/1	ARABIL
2	3_2	Vaslui	Berezeni	1354	1354	3784	Extravilan	CO	-	3	83	A2034/2	ARABIL
3	3_3	Vaslui	Berezeni	-	-	11300	Extravilan	CO	-	3	83	A2034/3	ARABIL
4	3_4	Vaslui	Berezeni	-	-	3700	Extravilan	CO	-	3	83	A2034/4	ARABIL
5	3_5	Vaslui	Berezeni	-	-	5000	Extravilan	CO	-	3	83	A2034/5	ARABIL
6	3_6	Vaslui	Berezeni	-	-	8000	Extravilan	CO	-	3	83	A2034/6	ARABIL
7	3_7	Vaslui	Berezeni	-	-	5000	Extravilan	CO	-	3	83	A2034/7	ARABIL
8	3_8	Vaslui	Berezeni	-	-	8100	Extravilan	CO	-	3	83	A2034/8	ARABIL
9	3_9	Vaslui	Berezeni	-	-	4500	Extravilan	CO	-	3	83	A2034/9	ARABIL
10	3_10	Vaslui	Berezeni	1068	1068	11600	Extravilan	CO	-	3	83	A2034/10	ARABIL
11	3_11	Vaslui	Berezeni	965	965	5900	Extravilan	CO	-	3	83	A2034/11	ARABIL
12	3_12	Vaslui	Berezeni	1563	1563	6800	Extravilan	CO	-	3	83	A2034/12	ARABIL
13	3_13	Vaslui	Berezeni	-	-	4000	Extravilan	CO	-	3	83	A2034/13	ARABIL
14	3_14	Vaslui	Berezeni	-	-	3371	Extravilan	CO	-	3	83	A2034/14	ARABIL
15	3_15	Vaslui	Berezeni	-	-	1629	Extravilan	CO	-	3	83	A2034/15	ARABIL
16	3_16	Vaslui	Berezeni	-	-	14500	Extravilan	CO	-	3	83	A2034/16	ARABIL
17	3_17	Vaslui	Berezeni	-	-	7100	Extravilan	CO	-	3	83	A2034/17	ARABIL
18	3_18	Vaslui	Berezeni	-	-	7500	Extravilan	CO	-	3	83	A2034/18	ARABIL
19	3_19	Vaslui	Berezeni	-	-	7500	Extravilan	CO	-	3	83	A2034/19	ARABIL
20	3_20	Vaslui	Berezeni	-	-	5000	Extravilan	CO	-	3	83	A2034/20	ARABIL
21	3_21	Vaslui	Berezeni	-	-	24200	Extravilan	CO	-	3	83	A2034/21	ARABIL
22	3_22	Vaslui	Berezeni	-	-	9400	Extravilan	CO	-	3	83	A2034/22	ARABIL
23	3_23	Vaslui	Berezeni	1154	1154	8700	Extravilan	CO	-	3	83	A2034/23	ARABIL
24	3_24	Vaslui	Berezeni	-	-	5000	Extravilan	CO	-	3	83	A2034/24	ARABIL
25	3_25	Vaslui	Berezeni	-	-	15000	Extravilan	CO	-	3	83	A2034/25	ARABIL

Fig. 1 – The cadastral property register, data about the terrain (Popa, 2015).



ID	CONSTR_NR	JUDET_DEN	UAT_DEN	I/E_DEN	NR_S_CAD	CONSTR_DEST_COD	CONSTR_SUPRAF	CONSTR_NR_NIV	IMOBIL_NRCF	CONSTR_ACTE_DA/NU
1	C1_3_1_1	Vaslui	Berezeni	Extravilan	3	CIE	40	1	1245	DA
2	C2_3_1_1	Vaslui	Berezeni	Extravilan	3	CIE	6	1	1245	DA
3	C1_3_2_1	Vaslui	Berezeni	Extravilan	3	CIE	8	1	1354	DA
4	C2_3_2_1	Vaslui	Berezeni	Extravilan	3	CIE	8	1	1354	DA

Fig. 2 – The cadastral property register, data about buildings (Popa, 2015).



ID	PROPR_TER	PROPR_T	PROPR_TER_C	PARCELA_N	IMOBIL_NR	NR_S_CAD	JUDET_DEN	UAT_DEN	IMOBIL_SUPRAF
1	CHIPER	RAMONA	2770209228511	A2034/1	3_1	3	Vaslui	Berezeni	5153
2	SANDU	ANDRA	2671123225711	A2034/2	3_2	3	Vaslui	Berezeni	3784
3	BRATULEANU	ROXANA	2851220221411	A2034/3	3_3	3	Vaslui	Berezeni	11300
4	RADU	NICOLETA	2790209223411	A2034/4	3_4	3	Vaslui	Berezeni	3700
5	ALMAJAN	BOGDAN	1770519224511	A2034/5	3_5	3	Vaslui	Berezeni	5000
6	CANURA	ANDREEA	2670826221511	A2034/6	3_6	3	Vaslui	Berezeni	8000
7	URSU	BOGDAN	1690621225711	A2034/7	3_7	3	Vaslui	Berezeni	5000
8	BUTNARU	IULIAN	1830629226811	A2034/8	3_8	3	Vaslui	Berezeni	8100
9	LUCA	MIRHYAM	2691127226411	A2034/9	3_9	3	Vaslui	Berezeni	4500
10	BALAMAU	GABRIELA	2640512221912	A2034/10	3_10	3	Vaslui	Berezeni	11600
11	TANASA	SABINA	2771212221511	A2034/11	3_11	3	Vaslui	Berezeni	5900
12	CIOPEI	VASILE	1591021345131	A2034/12	3_12	3	Vaslui	Berezeni	6800
13	VIRLAN	TOADER	1620617149053	A2034/13	3_13	3	Vaslui	Berezeni	4000
14	VIRLAN	TOADER	1810505168646	A2034/14	3_14	3	Vaslui	Berezeni	3371
15	PANAINTE	MARIA	2870619152998	A2034/15	3_15	3	Vaslui	Berezeni	1629
16	FOCEA	LASCAR	1721204325416	A2034/16	3_16	3	Vaslui	Berezeni	14500
17	GUTU	VASILE	1631011351347	A2034/17	3_17	3	Vaslui	Berezeni	7100
18	TAMAS	ONTORIO	1760601214764	A2034/18	3_18	3	Vaslui	Berezeni	7500
19	NECULITA	TANASE	1630114152084	A2034/19	3_19	3	Vaslui	Berezeni	7500
20	NECULITA	GRIGORE	1530729213031	A2034/20	3_20	3	Vaslui	Berezeni	5000
21	GOGHIE	ION	1531110257176	A2034/21	3_21	3	Vaslui	Berezeni	24200
22	GARBATIUC	PANTELIMC	1500806182888	A2034/22	3_22	3	Vaslui	Berezeni	9400
23	MIHALACHE	IONITA	1520201181713	A2034/23	3_23	3	Vaslui	Berezeni	8700
24	MIHALACHE	Dan	1511202393786	A2034/24	3_24	3	Vaslui	Berezeni	5000
25	MIHALACHE	Petru	1660114313017	A2034/25	3_25	3	Vaslui	Berezeni	15000

Fig. 3 – The alphabetic archive of real property right owners, of possessors and other holders (Popa, 2015).

Cadastral plan Berezeni territorial and administrative division, Vaslui county, cadastral sector no. 3.

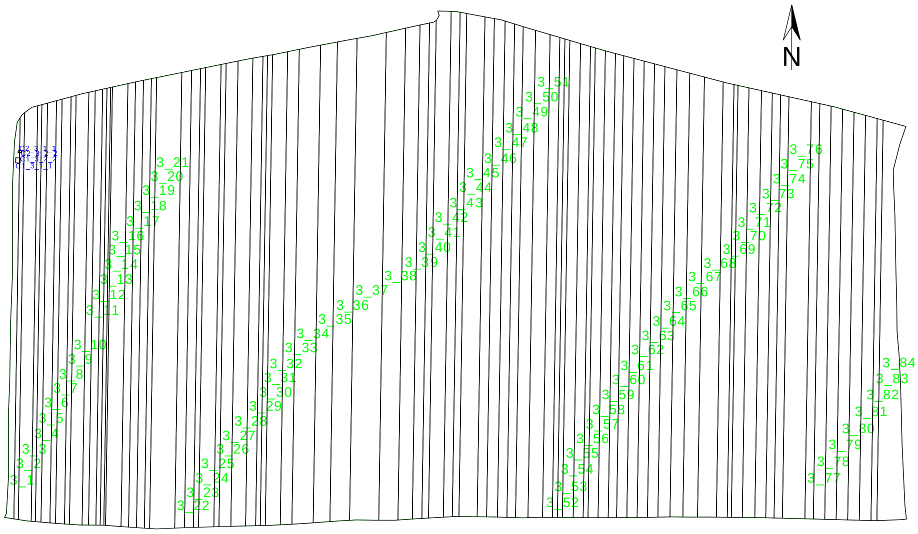


Fig. 4 – The cadastral plan of the cadastral sector no.

Further, based on the technical cadastral documents, it can be made the *properties registration into the land register*.

An interesting thing to be mentioned to the present registration of the properties included in this cadastral sector in the land register, is the fact that the Law 7/1996 (modified with the OUG from 30. 06. 2016), the 22^{8} th paragraph says that, *in case of rented farmlands, there is founded the land register of property titles from the sector, with the corresponding note for the terrain utility contribution, in favor of the agricultural entity, so in the land register there will be noted the rent on the property***.**

3. Conclusions

As the systematic cadastral works take into account the property owner identification, the Law no. 7/1996 should be modified, so the *base entities of the cadastral system and land register to be the property and the owner*.

The changes brought by the OUG no. 35/2016 to the Law no. 7/1996, protects the agricultural associations interests, because the real right property owners can transfer the respective properties, only by respecting the legislation with regard to the special destination of those terrains and to the *pre-emption right*.

Also, the *legal aspects* related to the documentations elaborated for various purposes, as it is the rehabilitation and modernization of infrastructure and/or equipments, with European funds, *are relieved*.

Simultaneously, the legal aspects related to the subvention payments, maintaining and exploiting of those terrains are clarified.

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* * * Ordinul 533/2016 a directorului general al ANCPI privind aprobarea *Specificațiilor tehnice de realizare a lucrărilor sistematice de cadastru în vederea înscrierii imobilelor în cartea funciară*, www.ancpi.ro.

ÎNTOCMIREA DOCUMENTELOR TEHNICE CADASTRALE, AFERENTE LUCRĂRILOR SISTEMATICE DE CADASTRU, PENTRU SECTOARELE CADASTRALE DIN EXTRAVILANUL UNITĂȚILOR ADMINISTRATIV-TERITORIALE

(Rezumat)

Începând cu anul 1991, o parte din terenurile care formează fondul funciar al României, au fost retrocedate proprietarilor de drept. Din nefericire, datorită legislației permisive şi deficitare, precum şi lipsei personalului specializat, titlurile de proprietate emise au fost în mare parte greşite. Pentru a corecta toate aceste greşeli, începând cu anul 2014, au fost reglementate lucrările sistematice de cadastru, care îşi propun realizarea unui cadastru bazat pe *realitatea din teren.* Aşadar, documentele tehnice cadastrale evidențiază situația tehnică şi juridică reală, constatată la desfăşurarea lucrărilor sistematice de cadastru şi stau la baza *înregistrării din oficiu* a imobilelor în sistemul de cadastru şi carte funciară.

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CONTRIBUTIONS TO THE HYDRAULIC RESEARCH OF VISITABLE SEWAGE COLLECTORS

BY

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Abstract. Visitable sewage collectors show degradation processes of flow path during operation. The flow section changes to the design, in which case it is difficult to determine the hydraulic parameters. Research conducted sewers showed significant changes in geometric flow section of visitable manifolds. Section flow is altered by silting and erosion hydrodynamic processes. The flow area was converted to curved geometric shapes mixed (lines + curved). Changing geometric sectional flow caused slowing and transported about 15,...,28%. This paper proposes a method of analysis and calculation program to determine the geometrical parameters and hydraulic of visitable manifolds. Rehabilitation requires hydraulic flow analysis parameters for modified geometric sections.

Keywords: visitable sewage collectors; modified section; hydraulic calculation.

1. Introduction

Sanitary sewer systems in Romania were designed and built in different periods of time. When designing sewers have used different technical concepts,

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materials and technologies specific to different stages of development of Romania. Visitable sewerage collectors (large and circular, ovoid, bell, mixed) shows degradation processes flow path.

Materials and technologies for the execution of sewerage collectors visit were varied, respectively stone, basalt, concrete, reinforced concrete. Most collectors are made of reinforced concrete visitable. They show a long period of operation and many presents lifespan exceeded. The location has acted on a number of factors collectors (geotechnical, hydrogeological), which have led to degradation processes continue on structural parameters.

Visitable sewers flow type shows sections ovoid, bell and mixed. In certain instances sections were made from non-standard flow collector's visit. Significant changes to the flow are determined by hydrodynamic erosion or clogging processes. Sections flow turned geometric: curved forms were turned in mixed forms (lines + curved). Changing geometric flow section determines slowing and transported by the collector. These are difficulties in calculating the geometric and hydraulic parameters.

2. Studies and Research on the Phenomena of Degradation of Flow Path to the Visitable Sewage Collectors

Research on collectors was made visitable drains in Iaşi and Paşcani (Luca & Bartha, 2005). Theoretical and experimental studies conducted present some data on the characteristics, parameters and the structuring and functioning of collectors. The collectors are analyzed in operation for a period of time (40,...,60 years). The research highlighted the following issues flow path degradation parameters:

a) collection and transport of wastewater (sanitary and storm) is achieved by the use of outdated collecting material and technology achievement;

b) collectors are located on transit routes commonly used; this led to damage to the building structure and repairs have modified the flow path geometry;

c) the ongoing process of clogging the flow path geometry modified design; a new section requires the wastewater with lower speeds than the speed of washing; debt was reduced over time;

d) loss of water causes phenomena of suffusion in the project site, affecting the stability collector.

The multitude of phenomena, hydraulic, mechanical, chemical led to a new geometric shape to some collectors visitable investigated. Knowing the time evolution of flow path hydraulic parameters necessary to determine direct influence on the geometric dimensions. Among the investigated parameters is remarkable flow, speed and roughness coefficient. Part of hydraulic parameters, change over time, may have dangerous levels to those originally by design.

Analysis of data obtained through research that some visitable collectors, such as the discharge of wastewater or storm water presents significant changes in flow path.

a *b*

Fig. 1 – Changing the flow path geometry by clogging the visitable sewage collectors; *a* – clogging during concentration and cementing; *b* – cemented deposit.

3. Hydraulic – Mathematics Model Simulation Flow of Sectional Changed Collectors

For analysis of hydraulic path modified by the damaged flow section, was made a hydraulic-mathematical model of the phenomenon of free level flow. The calculation was initiated to specific sections of flow of visitable sewage collectors. The model fulfills the hydraulic requirements imposed by visitable collectors affected by silting and hydrodynamic erosion phenomena. Repair work changes the geometry of the flow path collectors. These phenomena shape the section level of free level flow in some form. In the classical section made of curves it adds straight lines obtained a polycentric section.

The calculation is based on the observations and measurements made in the section of flow of investigated sewage collectors. Flow sections processes are changed by warping and technological works. Virtual circular section projected to ovoid and bell is replaced at the bottom of a polycentric section. A special situation presents collectors sewage flowing sections of standards, which were made by repairs. Field measurements indicated the presence of visitable collectors on collecting shows the geometry modification of flow section (Luca, 1998). For this type of collector was developed geometrical model parameters and hydraulic design. The analysis and calculation allows optimization of the mining process.

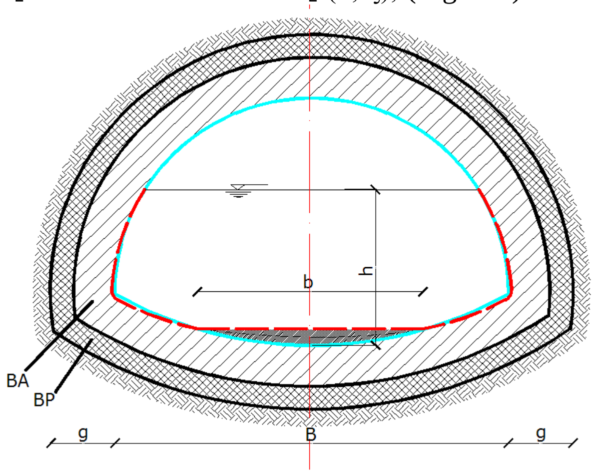
The work stages of computing model are:

1. Determination stage of plotting coordinates geometrical parameters:

a. The coordinates for setting the perimeter (y,z) bordering modified flow section, for example:

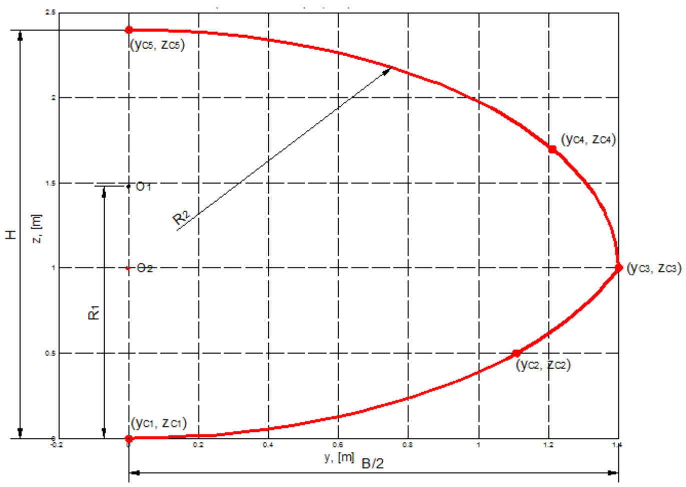
i. bell bottom section consists of a segment circle with a radius R_1, the center O_1 (0, R_1), rope length and height ζ *B*; *b* – a semi-circle at the top with a radius $R_2 = B/2$ and the center O_2 (0, ζ) (Fig. 2 *a*);

ii. bell section formed at the bottom and at the top by a semi-circle with a radius $R_2 = B/2$ and the centre O_2 (0, ζ), (Fig. 2 *b*).



a

a



b

Fig. 2 – Scheme for calculating a collector bell the ratio of non-standard sizes: *a* – parameters modified section (green line continuous - section initial dotted, red line - modified section); *b* – to map the profile of the slab and dome.

b. The coordinates of the area staking flow.
c. Plotting coordinates hydraulic radius.
d. Plotting coordinates of the centre of gravity flow area etc.

Design parameters ζ and R_1 can be evaluated according to the size of representative B and H with the following relationships:

$$\zeta = H - B/2,\ R_1 = \frac{B\left[\beta^2 + (2-\beta)^2\right]}{4\beta(2-\beta)},\ \text{with}\ \beta = \frac{B}{H}. \tag{1}$$

Bell semicircular profile is completely determined by 5 points (Fig. 2) with coordinates (y_C, z_C),

$$(y_C, z_C) \in \left\{(0,0), \left(\sqrt{\zeta(4R_1-\zeta)}/2, \zeta/2\right), (B/2, \zeta), \left(B\sqrt{3}/4, B/4+\zeta\right), (0, H)\right\}. \tag{2}$$

2. Mathematical modelling stage of the hydraulic manifold with modified geometric shape: the width of the pool $B(h)$ or $B(z)$; wetted perimeter, $P(h)$ and $P(z)$; cross-sectional area, $A(h)$ and $A(z)$; The hydraulic radius, $R_h(h)$ or $R_h(z)$; ordered the center of gravity of the section, $z_G(h)$ or $z_G(z)$.

3. Mathematical modeling of hydraulic characteristics of collector with modified geometric shape: a – speed mode, $W(h)$ or $W(z)$; b – flow mode, $K(h)$ or $K(z)$.

In the case of sewerage pipes sections consisting of $N \geq 2$ arcs of a circle and / or line segments, analytical expressions for each of the functions $B(h)$, $P(h)$, $A(h)$, $R_h(h)$, $z_G(h)$, $W(h)$ and $K(h)$ must be played by each N_a piecewise-defined functions:

$$B_i(h),\ P_i(h),\ A_i(h),\ R_{hi}(h),\ z_{Gi}(h),\ W_i(h)\ \text{şi}\ K_i(h),$$

with

$$z_i - z_{C0} \leq h \leq (z_{i+1} - z_{C0}), (i = 1, ..., N_A), \tag{3}$$

where z_{C0} (usually $z_{C0} = 0$) is the share of slab collector and z_i and z_{i+1} ordinates delimiting lower or higher points, arc or the i segment.

Collectors considered in the analysis shows a vertical longitudinal symmetry after. It follows an outline of the cross semi section completely determined by an odd number of points, N_M set of coordinates:

$$(y_C, z_C)_k,\ k = 1,2,\ldots, N_M \tag{4}$$

To determine the functions (3) we have the following steps:

a) deduction of analytical expressions for circles and/or support of the N_A lines arcs and/or line segments;

b) the determination of $N - 1$ points which border the lower and upper arches N_A and/or line segments, (y_i, z_i), $(i = 1, 2, ..., N_A + 1)$;

c) deduction of analytical portions expressions for hydraulic characteristics - functional sewage collectors.

The next step is determining analytical expressions for hydraulic and functional characteristics of collector. For each geometric and hydraulic characteristic are calculated specific equations for the type of modified section. They were used in the analysis of polycentric section:

a) The analytical expressions for the hydraulic and functional characteristics sewerage collector were deducted on N_a portions, the depth h satisfies the condition: $z_i < h \le z_{i+1}$, ($i = 1, \ldots, N_a$).

b) Uneven distribution of roughness on wetted perimeter of the tube was taken into consideration assigns a value of its own, we, each element arc or line segment i, i=1, ..., N_a.

4. Running for obtaining data flow sections of the bell also is considered non-standard hydraulic mathematical model.

Calculation software developed for the model study was called Profile_Arcs_Seg_Line.01. The program was tested for classic collector sections and non-standard bell sections.

Research follows the elaboration of calculations model for polling type polycentric networks that are commonly found in sewage systems. Calculation programs obtained for determining operating data derived from ovoid and bell section.

4. Obtained Results

Profile_Arcs_Seg_Line.01 program collector was run for non-standard bell B/H = 2,800/2,400 mm and uneven roughness (coefficient k = = 74 and $n = 1/k$ = 0.0135). The results are represented from analytical relations for geometric and hydraulic parameters. The obtained equations were plotted to generalize and use their quick calculation.

Table 1
Coordinates of the Representative Points of Channel Contour

Nr. Crt.	1	2	3	4	5
yC & y, [m]	0	1,109	1,400	1,212	0
zC & z, [m]	0	0,500	1,000	1,700	2,400
n = [0,0190 0,0170]					

The maximum absolute values, relative for hydraulic parameters R_h, W and K and absolute water depth, h and relative h/H, which are touched by these parameters are tabulated and shown in Table 2, columns 6,...,8.

Table 2
Coordinates of the Maximum Points for Geometric and Hydraulic Parameters

		Geometric parameter			Hydraulic parameter			
		B, [m]	A, [m^2]	z_G, [m]	P, [m]	R_h, [m]	W, [m/s]	K, [m^{3}s^{-1}]
1		2	3	4	5	6	7	8
Val. max.	Abs.	2,800	5,124	1,193	8,070	0.778	46,304	225.68
	Rel.	–	–	–	–	1,226	1,123	1.068
h, [m]		1.014	2,400	2,400	2,400	1,938	1,998	2,259
h/H, [–]		0.422	1,000	1,000	1,000	0.807	0.832	0.941

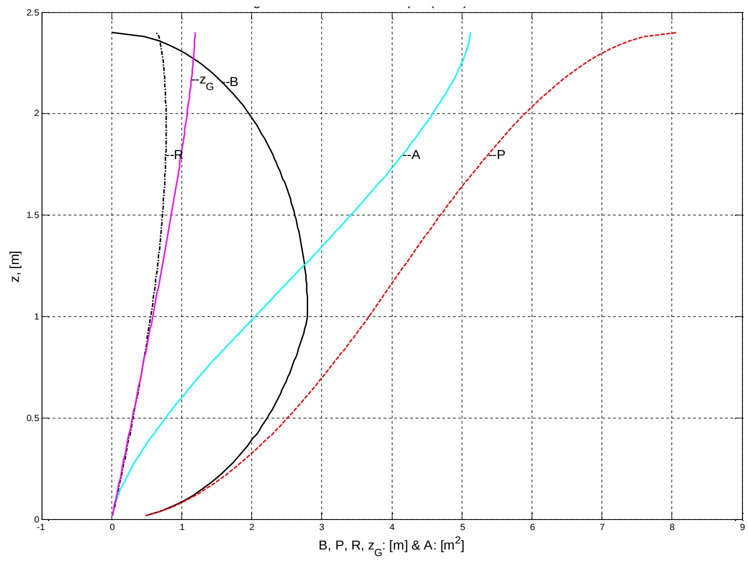


Fig. 3 – The characteristics of non - standard bell section B/H=2,800/2,400 mm, characteristics of flow path (A, P, R, z_G).

Calculation of hydraulic parameters in sewage collectors can be done by numerical program developed. Determination of geometrical parameters and hydraulic diagrams can be achieved and shown in Figs. 3 and 4.

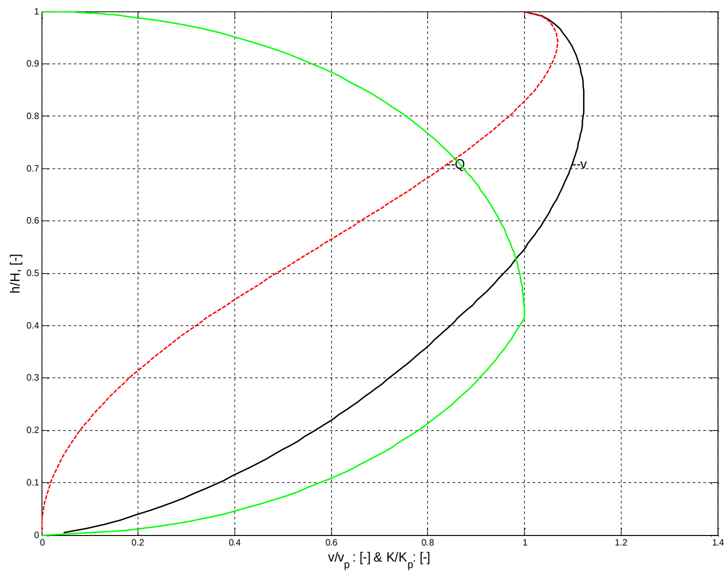


Fig. 4 – The characteristics of non-standard bell section B/H = 2,800/2,400 mm, flow characteristics (Q) and speed (W).

Since roughness is uneven on canal contour, the depths with maximum values for hydraulic radius R_h and W speed module are different.

The program of calculation can be applied to any non-standard shaped sewer collector or modified form of flow section during operation.

The program requires field measurements on actual coordinates of the perimeter flow path changed. Measurements must be carried out on a section of the collector and then processed to obtain a characteristic calculation sections. Also in the field will be measured and appreciate roughness value equivalent k_e and roughness coefficient n after Manning.

5. Conclusions

1. Main sewage collectors and outlet "visitable" type shows a relatively high life span, something that causes great implications in operation and high operating expenses.

2. Visitable sewer collectors may be amended by sections flow deposition processes, hydrodynamic erosion and technological works of repair.

3. Knowing of geometrical parameters for process control and hydraulic operation requires developing hydraulic models - mathematical calculation.

4. Calculation program developed has the advantage that allows the exact calculation of the collector operating parameters taking into account the variation roughness on wetted perimeter.

5. The mathematical model developed can be generalized to obtain the hydraulic characteristics - functional ($B = f_B(h)$, $P = f_P(h)$, $A = f_A(h)$, $R_h = f_{Rh}(h)$, $z_G = f_{zG}(h)$, $W = f_W(h)$ and $K = f_K(h)$) to sewer polycentric sections closed type.

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CONTRIBUȚII LA CERCETAREA HIDRAULICĂ A COLECTOARELOR DE CANALIZARE VIZITABILE

(Rezumat)

Colectoarele de canalizare vizitabile prezintă procese de degradare ale secțiunii de curgere în procesul de exploatare. Secțiunea de curgere se modifică față de cea proiectată, situație în care determinarea parametrilor hidraulici este dificilă. Cercetările efectuate pe rețele de canalizare au arătat modificări importante ale secțiunii geometrice de curgere la colectoare vizitabile. Secțiunea de curgere este modificată prin procese de colmatare şi eroziune hidrodinamică. Secțiunea de curgere s-a transformat geometric de la forme curbe la forme mixte (curbe + linii). Modificarea geometrică a secțiunii a determinat micşorarea vitezei şi debitului transportat cu circa 15,…,28%. Lucrarea propune o metodă de analiză şi un program de calcul care să permită determinarea parametrilor geometrici şi hidraulici la colectoare vizitabile. Reabilitarea hidraulică impune analiza parametrilor curgerii în cazul secțiunilor modificate geometric.

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THE ANCIENT FORTRESS REHABILITATION FROM DOBRUDJA, ROMANIA, USING MODERN TEHNICS -SELF COMPACTING CONCRETE TEHNICS

BY

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Abstract. Most of the ancient fortress of Dobrudja, Romania, especially those located along the Danube River, suffered deep degradation, caused by temperature changes, wind action, biodegradation factors , degradations caused by water flowing through variations in level of the watercourse and such partial or complete flooding of the fortress walls. In this context it is necessary to strengthen early intervention and restoration of these walls and further work where they were stopped. Based on these considerations the authors aim to achieve an in situ research on the state of degradation of the ancient fortress from Dobrudja and initializing rehabilitation measures using modern rehabilitation techniques, using self-compacting concrete. Research results show the advantages of self-compacting concrete to stone mansonry restauration of the ancient fortress of Dobrudja.

Keywords: self-compacting concrete; ancient fortress; rehabilitation.

Gross stone masonry usually degrades via openings vertical joints and cracks in these joints and cracks stones. Bethwen these joints and cracks

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occurs ingress of water and other destructive agents, causing local peeling of rough stone by masonry binder.

In this study the authors investigate the degradation of the rough stone walls of ancient fortress Capidava (Fig. 1), Păcuiul lui Soare, Adamclisi (Fig. 2), the first two located in the immediate vicinity of the Danube River , the third about 50 km from it. Capidava and Adamclisi fortress are located about 50 km from Black Sea Coast agressivenes, Pacuiul lui Soare fortres is located about 100 km from Black Sea Coast agressivenes.

Researches made on these three ancient fortress show visible degradation, local detachment of the binder of rough stone masonry, spacings of joints apx. 5 cm and the walls in contact water case, meeting situation of collapse.

Fig. 1 – Degraded drywall from Capidava fortres (photo author).

The solution restoration proposed by the authors, the use of self-compacting concrete, has primarily benefit that this type of concrete penetration easily even in places very inaccessible, under its own weight, without requiring any technical compaction or vibration.

Regarding the use of modern techniques and materials that can be used to consolidation the historical monuments, the Venice Charter (1964) states that these modern techniques and materials can be used, if the efficiency of these materials has been scientifically demonstrated and is guaranteed through the experience. Also, items intended to replace the missing parts of the monument should fit smoothly overall, but maintaining a distinction relative to the original so that restoration does not falsify the monument (Grămescu *et al*., 2008).

Fig. 2 – Degraded drywall from Adamclisi fortres (photo author).

To demonstrate the high workability , good flowability , resistance to segregation ,tests were carried out on a self-compacting concrete composition of the class C25/30 , having the following features :

a) cement dosage IIIA42,5 N - LH = 360 kg/m^3;
b) limestone filler dosage = 240 kg/m^3;
c) report A/C 0.5;
d) optima 203 additive dosage = 1.8%;
e) the maximum aggregate size = 8 mm.

The main tests were carried out on fresh self-compacting concrete was:

i) The spread of concrete (Fig. 3). It is an indicator that shows the ability to spread and flow of concrete. The result was 690 mm.

$$\mathrm{SF}=\frac{d_1+d_2}{2}=\frac{700+680}{2}=690\ \mathrm{mm}.$$

Fig. 3 – Determination self-compacting concrete spread (photo author).

Fig. 4 – O'Funnel test method (photo author).

ii) *O'Funnel test method* (Fig. 4), a test used to demonstrate the flowability of self-compacting concrete , give us a flow time of 7 s.

Further were conducted tests on IIIA42,5N - LH Cement, proposed to use in self-compacting concrete composition , suitable for use in the restoration of ancient fortress from Dobrudja , known for resistance to aggressive environment. IIIA42,5N - LH Cement have a high slag content, between 36,...,65% , its main feature of this type of cement is resistant to sulphate attack resistance (XA1, XA3) and sea water attack. Is also characterized by a low heat of hydration, heat of hydration developing by this type of cement is 7 days is $\leq$ 220 J/g.

The high content slag cement IIIA42,5N - LH helps the formation of hydrosilicate and hydroaluminate slow dispersed. They reduce the overall porosity of the concrete matrix with favorable effects on the durability of concrete. By increasing the amount of slag in the cement composition takes place calcium hydroxide reducing available for reaction with atmospheric carbon dioxide toghether forming the calcium carbonate.

Increasing dosage of slag in IIIA42,5N-LH Cement leads to a less permeable cement stones that offer less risk of diffusion of chloride ions from sea fog. Research has shown that cements containing more than 36% in slag composition have a pore diameter less than 0.01 μm compared with no added cements where the majority pores diametres are more than 0.1 μm. The cement with granulated blast furnace slag presents high chemical stability to sulphate ions, carbonate and chloride comparable to a portland cement CEM I.

To demonstrate the resistance of cements with high content slag to marine aggression we conducted a study on cement CEM III A 42.5 N-LH produced by, Lafarge (Romania) in 2014. It sought to determine the strength of cement IIIA42,5 N - LH in the worst case, that of sulphate attack.

To determine the resistance to sulfates of concrete prepared with CEM III A 42.5 N - LH cement were determined the expansion values to 28, 56, and 90 days on samples of mortar mantained in aggressive sulphate environment (4.4% solution of Na2SO4).

For XA2 acceptation criterion, sulphate attack, samples of mortar expansion value must not exceed their 0.5 mm/m after 90 days of maintaining a solution of 2.37% Na_2SO_4.

For XA3 acceptation criterion, sulphate attack, samples of mortar expansion value must not exceed their 0.5 mm/m after 90 days of maintaining a 4.4% solution of Na_2SO_4.

To determine the expansion of the 28, 56 and 90 days were made mortar prisms in accordance with EN196-X. After 28 days the mortar prisms were placed in aggressive sulphate environment (4.4% Na2SO4 solution) at an average temperature of 20ºC. The table below shows the values obtained for samples of mortar expansion at 56 days age, for III A 42.5 N –LH cement case.

The values obtained expansions at the age of 56 days.

Table 1
III A 42.5 N – LH Cement Expansion at the Age of 56 Days

Cement type	Environment	Readings				Differences readings		Expansion 56 days mm/m
		28 days	Average	56 days	Average	56 days-28 days	Average	
IIIA42 N-LH	Water environment	6.45	6,510	6.46	6,523	0.01	0.010	0.08
		6.58		6.59		0.01		
		6.51		6.52		0.01		
	Sulphate evironment	5.02	5,483	5.05	5,510	0.03	0.025	0.16
		5.92		5.94		0.02		
		5.51		5.54		0.03		

Expansion was determined by performing the difference between the average of the three samples immersed in aggressive sulphate medium and the average of three samples immersed in water. It is noted that at the age of 56 days the amou of expansion mortars prepared with CEM III A 42.5N - LH is under 0.2 mm/m.

Determination of expansion at the age of 90 days.

Table 2
III A 42.5 N – LH Cement Expansion at the 90 Days Age

Cement type	Environment	Readings				Differences readings		Expansion 56 days mm/m
		28 days	Average	56 days	Average	56 days -28 days	Average	
III A42 N-LH	Water	6.45	6,510	6.47	6,537	0.02	0.025	0.16
		6.58		6.61		0.03		
		6.51		6.53		0.02		
	Sulphate	5.02	5,483	5.07	5.53	0.05	0.045	0.28
		5.92		5.96		0.04		
		5.51		5.56		0.05		

It appears that the results are less than 0.5 mm/m, so the acceptance criterion is achievement for using CEM III A 42.5 N-LH cement in aggressive marine environment.

In order to achieve a material closest to the requirements of use, namely the restoration of objectives monument, namely the restoration of ancient fortress from Dobrudja, increased dosage of filler limestone to 240 Kg/m^3, whose main component is $CaCO_3$, with good results on binding of masonry stone. Also, in order to approach the original material were used limestone carboniferous from Nicolae Bălcescu Quarry, Dobrudja.

The erosion speed rate of the concrete depend on the quality of the concrete has it, which is usually expressed by compressive strength of the concrete. In this regard it was made 10 samples of self-compacting concrete class C25/30. The results are summarized in the chart below (Fig. 5), showing good mechanical strength of this type of concrete.

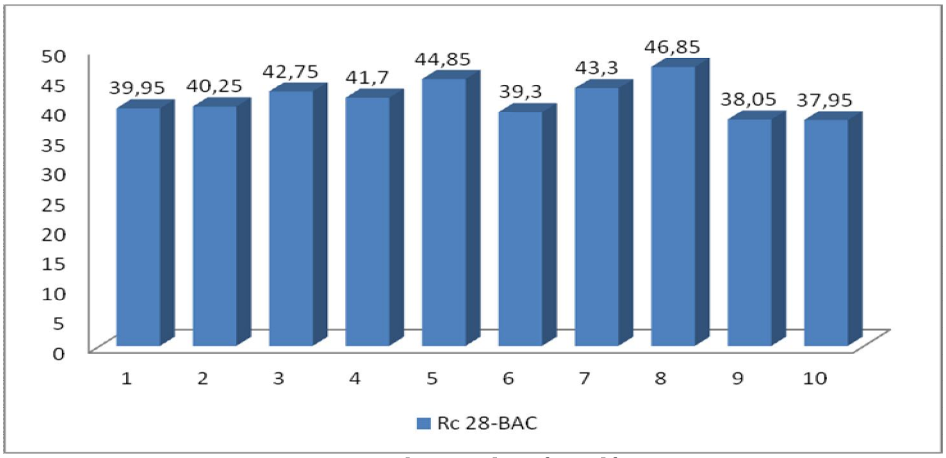

Fig. 5 – Compressive strength at 28 days for self-compacting concrete.

In the last part of these study were conducted research about restoration of masonry and other constructive elments of the Capidava fortress using conventional concrete (Fig. 6), comparative with other constructive elements also in this work made by using self-compacting concrete (Fig. 7). The results were clearly in the advantage of self-compacting concrete, in this case yield sides perfectly smooth, compact and therefore high permeability and gelevity resistance comparative with elements restored with conventional concrete where visible cracks along the masonry apeared since the start of implementation of the project.

Fig. 6 – Constructive elements from Capidava fortress using conventional concrete.

Fig. 7 – Constructive elements from Capidava fortress using self compacting concrete.

Conclusions

1º Research results showed that workability, cohesion and homogeneity of self compacting concrete are superior compared with conventional concrete.

2º The use of limestone filler in self-compacting concrete composition enhance its capability to be used as a binder to restore masonry stone monument objectives.

3º By using self-compacting concrete to restoration historical monument is eliminated the vibrate equipment needed in fresh concrete case thereby eliminating the possibilities to deploy the initial position of the constructive element undergo restoration.

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TEHNICI MODERNE DE REABILITARE A CONSTRUCŢIILOR MONUMENT ISTORIC, REABILITAREA CETĂŢILOR ANTICE DIN DOBROGEA-ROMÂNIA PRIN UTILIZAREA BETONULUI AUTOCOMPACTANT

(Rezumat)

Cea mai mare parte a cetăților antice din Dobrogea, România, în special cele amplasate pe cursul Dunării au suferit degradări profunde, cauzate de variațiile de temperatură , acțiunea vântului, factori biodeteriogeni, degradări provocate de acțiunea apei, prin variații de nivel ale cursului de apă şi astfel inundarea parțială sau totală a zidurilor cetății. În acest context se impune intervenția rapidă în vederea consolidării şi restaurării acestor ziduri, continuarea lucrărilor acolo unde acestea au fost stopate. Pornind de la aceste considerente autorii îşi propun realizarea unei cercetări in situ privind stadiul de degradare al cetăților antice din Dobrogea şi inițierea unor măsuri de consolidare folosind tehnici moderne de consolidare folosind betonul autocompactant. Rezultatele cercetării prezintă avantajele utilizării betonului autocompactant la restaurarea zidurilor de piatră ale cetăților antice din Dobrogea.

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TIME EFFECTS ON A HISTORIC BUILDING LOCATED IN THE ACTIVE AREA OF THE BLACK SEA CLIFFS ASSESSMENT OF THE LAND SLIDING POTENTIAL OF ITS FOUNDATION SLOPE

BY

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Abstract. Constanta historic centre has a rather consistent number of historic monuments, appreciated for their valuable composite elements, representing the creation of architects, engineers but also traders who spent certain periods of time in this region.

The cliffs have always been an important issue when designing the resistance and stability structures for historic urban area. This was the reason for adopting certain conservative measures in order to obtain an integrated protection, pursuant to European and national legal frame (Grămescu & Barbu, 2008).

This case study focuses on time effects on a historic building, of urban and patrimony value (Fig.1), of over 100 years old, located in the Black Sea active cliffs.

Keywords: cliffs; built; monument; time effects; damages; patrimony.

1. Introduction

The edifice studied by this work was built on the Black Sea cliffs, in the historic area of the City of Constanta and is a historic monument.

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It covers the high cliff slope (17.50 m quota on the main front aprox 1.20 m side front on the current platform of Tomis touristic marina).

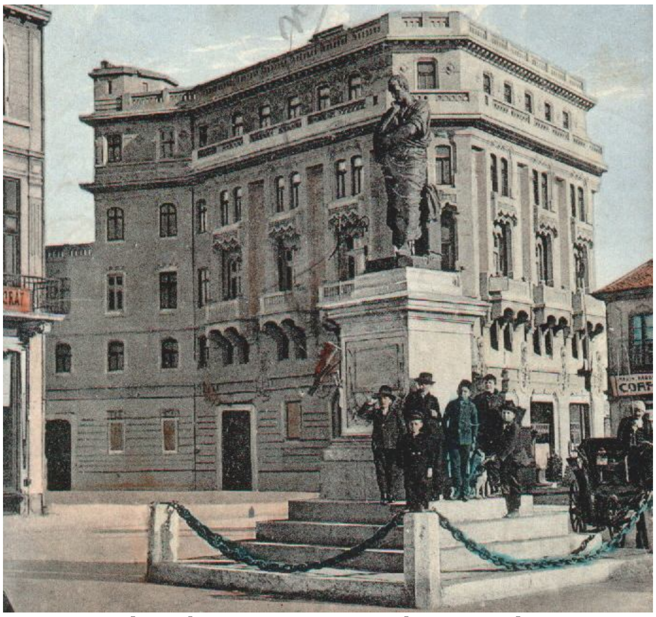

Fig. 1 – National Bank – Constanța Branch - 1 Revolutia 1989 Street.

2. Designing and Building of the Current Edifice

In 1913 Mercur Company of Bucharest assigned the design to the architect N.C. Michaescu and the building license was issued by the City Hall of Constanța and, approved also in Bucharest, by document no 5394 of 5 July 1913 (File no. *26*/1913 of Constanța). The original plans are being housed by the Constanța County Department of the National Archives in file 26/1913, part of the City Hall of Constanța (File no. *26*/1913 of Constanța).

He edifice was raised between 1913-1914. We don't know the name of the constructor. The works were done under the direct supervision of architect (Project no 225/1989).

The construction closely followed the licensed design, except for the roof which was replaced with a circulated terrace.

3. Urban and Patrimony Value

The construction has a well balanced volume framed in the Ovid Place urban assembly and on the other hand, by Tomis Marina with whom it is directly associated.

The whole building, with its three fronts, is an important example of the Neo Romanian architectural style, completing and supporting the edifice of the current Museum of National History and Archeology of Constanta, considered the central dominating point of Ovid Place.

National Bank building is also present on the List of the Historic Monuments of Constanta County - code LMI 2015, no. *538*, position CT-II-m-B-02834 as: the building of National Bank - Constanta Branch.

Ovid Place – the historic centre of Constanta City, where the National Bank has functional and historical value – is present on the List of Historic Monuments with no 486, position CT-II-s-B-02832, as urban site “Constanta peninsula area”.

4. Building Function

For 102 years, the building has been used only as financial – banking institution, and in 1948 it became the possession of the Romanian National Bank, as its branch.

5. Special Features

The monument is a 7 storey height building, an example for using over 45º slopes, during the first stage of the modern city development (Fig. 2).

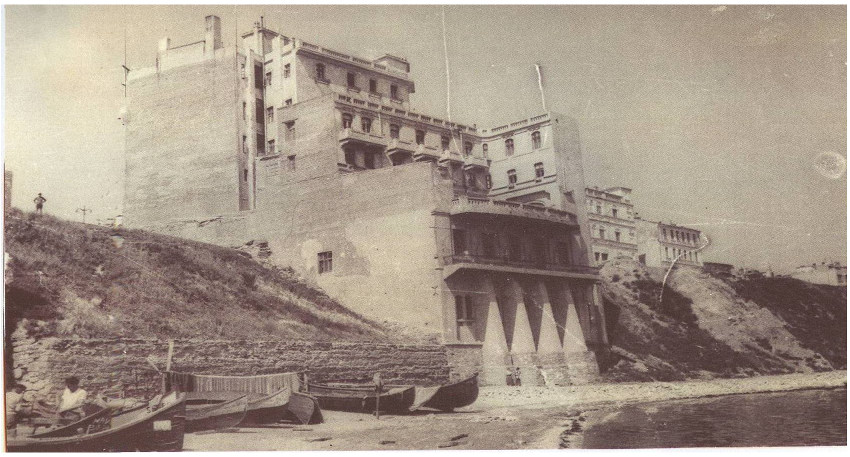

Fig. 2 – National bank – Eastern front, towards Tomis Marina
View of 1960 before the organizing works for Tomis Marina
Proiect nr. *225*/1989.

Foundations are continuous, made of concrete and pure stone. Given the land structure, they have different depths and are fixed in geological structures of various compositions: macropore löes, sensible to humidity and Sarmatia calcareous with friable upper structure.

The resistance structure (Fig. 3) is made up of raising brick masonry, with no uniform distribution, yet continuous regarding the height of the building. The walls thickness depends on the level, starting from 0.84 m, for the ground floor, and reaching 0.28 m for the highest level.

The floors are supported by metallic beams with small brick vaults over the basement 2 level, and reinforced concrete for the rest of levels. The basement 2 level has brick pillars and arches that take over the floor loading, whereas the basement 1 has metallic pillars.

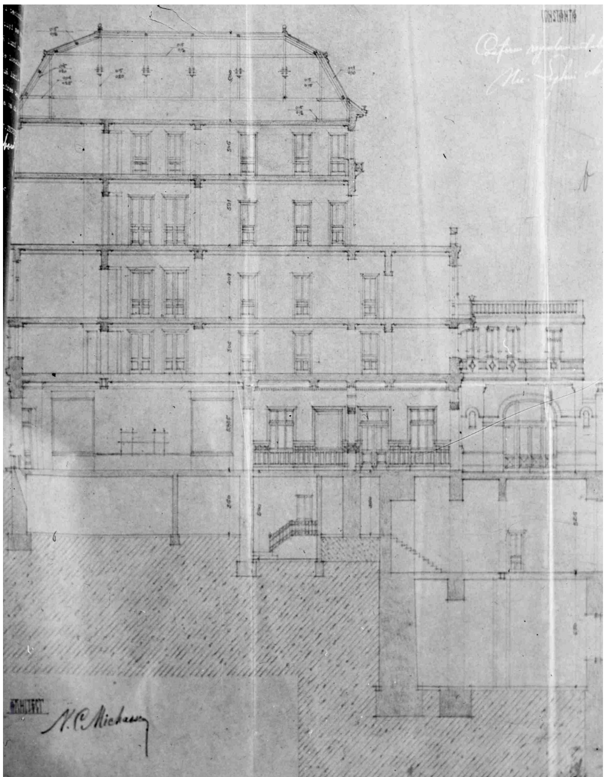

Fig. 3 – Blue print annexed to the building license no. 5394 5th July 1913 photocopy – Constanta National Archives.

6. Time Effects on the Building

There is no information on works carried out between 1914-1948.

After becoming the branch of the National Bank the most important interventions were:

a) between 1953-1954, 60 sqm extension of the 2nd floor;

b) between 1961-1963, 180 sqm extension of the ground floor.

In 1958 the building was consolidated by insertion of tyrants at basement 1 and 2 because several fissures had appeared in the resistance structure, due to unequal settling of the whole building (Project no 26/1978 - Design Institute of Constanta County).

The earthquake of 1977 produced fissures at both basements, aggravation of the old ones and the fissure and deviation of the smoke chimney.

Consequently, Project no. *26*/1978 was elaborated by the County Design Institute in order to eliminate the effects of this earthquake.

After 1990, the National Bank of Romania wanted to amplify and diversify its profitable activity, and ordered a technical expertise to consolidate and extend the old building.

Nowadays, the works are being finished.

For best results, it is necessary to analyze the entire construction together with the foundation land: time effects on the structure – by determining effective land settlings and dislocations, and watching the slope behavior – by identifying the natural and anthrop elements.

7. Sliding Potential Assessment for the Cliff on which is Built the National Bank

K_m represents the assessment of the land sliding potential, with values resulted from the quality analysis and the interpretation of natural and anthrop elements that influence the cliff stability.

$K_m = 1$ is the critical state of the cliff stability;

$K_m = 0$ is the cliff stability state.

Based on the geotechnical study for consolidation and extension of the National Bank, it was possible to establish the factors which have influence on cliff wall sliding: $K_a = 0.78$ – lithologic element (sedimentary rocks, semi-rocks) – characteristic of the sliding instability: medium to high; $K_b = 0.88$ – geomorphologic element (cliff wall inclination angle > 15º) – characteristic of the sliding instability: medium to high; $K_c = 0.75$ – structural element (geologic structures, with faults or cleavage) – characteristic of the sliding instability: medium; $K_d = 0.66$ – hydrologic and climate element (moderate rain, erosions appear vertically and horizontally) – characteristic of the sliding instability: medium to high; $K_e = 0.68$ – hydro – geologic element (phreatic water is < 6 m depth) – characteristic of the sliding instability: medium to high; $K_f = 0.50$ – earthquakes (< 6 degree on M.S.K. scale) – characteristic of the sliding instability: medium to high; $K_g = 1$ – forest element (no forest) – characteristic of the sliding instability: very high; $K_h = 0.85$ – human action (leakages of the supplying systems, lack of pluvial collection system) – characteristic of the sliding instability: high.

$$K_m = \sqrt{\frac{K_a K_b \left(K_c + K_d + K_e + K_f + K_g + K_h\right)}{6}} = 0.507 \text{ – Slope sliding potential – high to medium}$$

In conclusion, the building is placed on a cliff wall with medium to high potential for land sliding activity and therefore it is necessary to take actions in order to stabilize it.

Authorities can decide the type of interventions carried out on buildings taking into account the sliding instability factor K_m.

8. Conclusions

The vulnerability of our patrimony grows stronger every day due to deterioration, geophysical conditions, environment and human actions.

We consider it is highly important to find and develop the fundamental principles related to preservation and restoration of historic buildings, both for limiting disasters and for contributing as knowledge base to international procedures and methods in this area (Grămescu & Barbu 2008).

The Black Sea Coast has undergone general geological modifications, regionally and locally. They are complex but little approached and analyzed (Diagnostic Report Zone…).

The above calculation is the assessment of the sliding potential of the slope on which is built the edifice, using quality analysis and the interpretation of human actions and natural elements.

This work concentrates on studying a historic monument built in the active part of the Black Sea cliff, its changes and its remarkable way to resist against all natural and anthrop elements for over 100 years.

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COMPORTAREA ÎN TIMP A UNEI COSTRUCŢII MONUMENT ISTORIC, SITUATĂ ÎN ZONA ACTIVĂ A FALEZEI MĂRII NEGRE ŞI EVALUAREA POTENŢIALUL DE ALUNECARE A TALUZULUI PE CARE ESTE EDIFICATĂ

(Rezumat)

Centrul istoric al Constanţei deţine un fond apreciabil de construcţii monument istoric, caracterizate prin elemente de compoziţie valoroase, elemente ce au reprezentat creaţia arhitecţilor, inginerilor, dar şi comercianţilor ce au trecut pe aceste meleaguri.

Zona de faleză a ridicat probleme complexe de proiectare în asigurarea rezistenţei şi stabilităţii zonelor urbane istorice. Acest fapt a determinat adoptarea unor măsuri conservative de protejare integrată, conform legislaţiei europene şi naţionale (Grămescu & Barbu, 2008).

Acest studiu de caz analizează comportarea în timp a unei construcţii monument istoric, cu valoare urbanistică şi de patrimoniu (Fig. 1) (photo National Archives – Constanţa), cu o vechime de peste 100 de ani, amplasată în zona activă a falezei Mării Negre.

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TORRENTS CORRECTION
CASE STUDY

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Abstract. Torrential formations are considered basic hydrographic units that can form flash floods following heavy rains or sudden snowmelt, causing great damage to various economic and social sectors. For this reason, it is necessary, especially in conditions of market economy, efficient solutions for planning these parties to defend economic objectives and developmental arrest erosion ball in training ravines steep through breaks and landslides during floods in the flooding and coarse silt clogging farmland downstream.

Keywords: torrent; landscaping; erosion; discharge.

1. Introduction

The case study is the two torrents (Torrent 1 and Torrent 2) situated in the locality Băiceni commune Cucuteni, Iasi County. Within correcting they will have the following objectives:

a) reducing the risk and uncertainty in agriculture by reducing the incidence of natural phenomena (floods, soil erosion, etc.);

b) prevent and minimize economic loss by reducing flood risk in rural areas and farmland;

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c) strengthening the riverbed streams, bringing it to a slope to reduce the speed of water in the river bed and execution of works leading to consolidation of banks and stop of sliding.

This requires work retention and storage of silt carried by torrents and consolidation works and rehabilitation of slopes affected by erosion.

2. Content

The total area of the sector is arranged torrent of 22,400 sqm and 1,202 ml for torrents 1 and 22,500 sqm and 1,095 ml for torrent 2.

Taking into account the objectives, hydraulic works were executed specific torrential correction: dams, thresholds, cross bars.

The calculation of the maximum flows on each torrent will be made proportionately to the area from which water collects. Thus, along torrents 3 points will be present for calculating the maximum flow using "rational formula" and "formula rain zones" (Table 1).

Table 1
Maximum Discharge

Torrent	Sections for computing hydrological	$Q_{1\%}$ m^3/s	$Q_{5\%}$ m^3/s
Torrent 1	Profile 1.1	8.13	4.39
	Profile 1.2	14.6	7.88
	Profile 1.3	21.10	11.40
Torrent 2	Profile 2.1	8.13	4.39
	Profile 2.2	13.00	7.02
	Profile 2.3	16.30	8.80

For Torrent 1 will run as follows (Table 2):
a) 9 dams with heights between 2.00 m and 9.00 m;
b) 5 thresholds with heights between 1.00 m and 1.50 m;
c) 2 cross bars with height of 0.00 m and 2.00 m foundation.
For Torrent 2 will run as follows (Table 3):
a) 9 dams with heights between 2.00 m and 7.50 m;
b) 6 thresholds with heights between 1.00 m and 1.50 m;
c) 2 cross bars with height of 0.00 m and 2.00 m foundation.

Dams and executed torrents thresholds have the following general characteristics:

a) trapezoidal section, with vertical upstream face and the downstream sized fruit with a K_r value between 1.40,…,2.62;

b) foundation depth is 2.00,…,3.50 m, the gauge;

c) overflow is thin and trapezoidal sized for flow verification;

d) the spillway is provided with weepers PVC tube with a diameter of 100 mm;

e) will run from concrete C25/30.

Table 2
Correction Works for Torrent 1

Name	Height m	Energy disperser	
		Length of foundation raft, [m]	Height wall m
Dam 1B2,0	2.00	5.30	1.50
Thresholds 2B1,5	1.50	4.70	1.50
Thresholds 3B1,0	1.00	4.10	1.50
Dam 4B3,0	3.00	6.40	1.50
Dam 5B2,0	2.00	5.30	1.50
Thresholds 6B1,5	1.50	4.70	1.50
Dam 7B5,0	5.00	7.80	1.50
Cross bar 8B0/2,00	0.00	-	-
Dam 9B9,0	9.00	9.60	1.50
Cross bar 10B0/2,00	0.00	-	-
Dam 11B5,0	5.00	7.80	1.50
Thresholds 12B1,0	1.00	4.20	1.50
Thresholds 13B1,5	1.50	4.75	1.50
Dam 14B2,0	2.00	5.30	1.50
Dam 15B3,0	3.00	6.40	1.50
Dam 16B8,0	8.00	9.40	1.50

Table 3
Correction works for Torrent 2

Name	Height m	Energy disperser	
		Length of foundation raft, [m]	Height wall m
Cross bar 1B0/2,00	0.00	-	-
Thresholds 2B1,0	1.00	4.20	1.50
Thresholds 3B1,0	1.00	4.20	1.50
Thresholds 4B1,5	1.50	4.80	1.50
Thresholds 5B1,5	1.50	4.80	1.50
Thresholds 6B1.0	1.00	4.20	1.50
Dam7B2,0	2.00	7.50	2.00
Thresholds 8B1,5	1.50	6.70	2.00
Dam 9B2,5	2.50	6.80	2.00
Dam 10B2,5	2.50	6.80	2.00
Dam 11B2,5	2.50	5.80	1.50
Dam 12B7,5	7.50	9.10	1.50
Cross bar 13B0/2,00	0.00	-	-
Dam 14B7,5	7.50	9.10	1.50
Dam 15B3,5	3.50	6.70	1.50
Dam 16B5,0	5.00	8.30	1.50
Dam 17B2,0	2.00	5.60	1.50

Verification is done with the relationship section spillways for trapezoidal weirs eq. (1), and data are summarized in Tables 4 and 5:

Table 4
Checking Overflow Section, Section 1

Name	Q_v m^3/s	m	b m	tgα	Q_{ev} m^3/s	H_{calc} m	H_{ad} m	B m
Dam 1B2,0	21.1	0.42	6.00	0.20	21.33	1.50	1.50	6.00
Thresholds 2B1,5	21.1	0.42	6.00	0.20	21.33	1.50	1.50	6.00
Thresholds 3B1,0	21.1	0.42	6.00	0.20	21.33	1.50	1.50	6.00
Dam 4B3,0	21.1	0.42	6.00	0.20	21.33	1.50	1.50	6.00
Dam 5B2,0	21.1	0.42	6.00	0.20	21.33	1.50	1.50	6.00
Thresholds 6B1,5	21.1	0.42	6.00	0.20	21.33	1.50	1.50	6.00
Dam 7B5,0	21.1	0.42	6.00	0.20	21.33	1.50	1.50	6.00
Cross bar 8B0/2,00	21.1	0.42	6.00	0.20	21.33	1.50	1.50	6.00
Dam 9B9,0	21.1	0.42	6.00	0.20	21.33	1.50	1.50	6.00
Cross bar 10B0/2,00	14.6	0.42	4.20	0.20	15.17	1.50	1.50	4.20
Dam 11B5,0	14.6	0.42	4.20	0.20	15.17	1.50	1.50	4.20
Thresholds 12B1,0	14.6	0.42	4.20	0.20	15.17	1.50	1.50	4.20
Thresholds 13B1,5	14.6	0.42	4.20	0.20	15.17	1.50	1.50	4.20
Dam 14B2,0	14.6	0.42	4.20	0.20	15.17	1.50	1.50	4.20
Dam 15B3,0	14.6	0.42	4.20	0.20	15.17	1.50	1.50	4.20
Dam 16B8,0	14.6	0.42	4.20	0.20	15.17	1.50	1.50	4.20

Table 5
Checking Overflow Section, Section 2

Name	Q_v m^3/s	m	b m	tgα	Q_{ev} m^3/s	H_{calc} m	H_{ad} m	B m
Cross bar 1B0/2,00	16.3	0.42	5.00	0.20	17.91	1.50	1.50	5.00
Thresholds 2B1,0	16.3	0.42	5.00	0.20	17.91	1.50	1.50	5.00
Thresholds 3B1,0	16.3	0.42	5.00	0.20	17.91	1.50	1.50	5.00
Thresholds 4B1,5	16.3	0.42	5.00	0.20	17.91	1.50	1.50	5.00
Thresholds 5B1,5	16.3	0.42	5.00	0.20	17.91	1.50	1.50	5.00
Thresholds 6B1.0	16.3	0.42	5.00	0.20	17.91	1.50	1.50	5.00
Dam7B2,0	16.3	0.42	3.00	0.20	17.47	2.00	2.00	3.00
Thresholds 8B1,5	16.3	0.42	3.00	0.20	17.47	2.00	2.00	3.00
Dam 9B2,5	16.3	0.42	3.00	0.20	17.47	2.00	2.00	3.00
Dam 10B2,5	16.3	0.42	3.00	0.20	17.47	2.00	2.00	3.00
Dam 11B2,5	13.0	0.42	3.60	0.20	13.12	1.50	1.50	3.60
Dam 12B7,5	13.0	0.42	3.60	0.20	13.12	1.50	1.50	3.60
Cross bar 13B0/2,00	13.0	0.42	3.60	0.20	13.12	1.50	1.50	3.60
Dam 14B7,5	13.0	0.42	3.60	0.20	13.12	1.50	1.50	3.60
Dam 15B3,5	13.0	0.42	3.60	0.20	13.12	1.50	1.50	3.60
Dam 16B5,0	13.0	0.42	3.60	0.20	13.12	1.50	1.50	3.60
Dam 17B2,0	8.1	0.42	2.50	0.20	9.36	1.50	1.50	2.50

$$Q = m(b + 0.8H\mathrm{tg}\,\alpha)H\sqrt{2gH}\ \ \mathrm{m^3/s}, \tag{1}$$

where: m is the flow coefficient; b – width of the overflow; H – load overflow; tgα – overflow from the vertical tilt shoulders; g – acceleration of gravity.

The length of the blade overflow was calculated with the equation (2), and the calculation is summarized in Table 6 and Table 7:

Table 6

Blade Length Calculation Overflow and Foundation Raft, Torrent 1

Name	Y_v m	H_{calc} m	λ	L_b m	a m	L_r-calc m	L_r-ad m
Dam 1B2,0	2.10	1.50	0.44	2.60	1.16	5.28	5.30
Thresholds 2B1,5	1.55	1.50	0.42	2.30	1.13	4.70	4.70
Thresholds 3B1,0	1.03	1.50	0.4	1.98	1.10	4.10	4.10
Dam 4B3,0	3.30	1.50	0.48	3.15	1.22	6.37	6.40
Dam 5B2,0	2.10	1.50	0.44	2.60	1.16	5.28	5.30
Thresholds 6B1,5	1.55	1.50	0.42	2.30	1.13	4.70	4.70
Dam 7B5,0	5.50	1.50	0.58	3.97	1.37	7.78	7.80
Cross bar 8B0/2,00	0.00	1.50	0.3	0.00	0.95	0.00	0.00
Dam 9B9,0	9.60	1.50	0.7	5.9	1.55	15.46	15.50
Cross bar 10B0/2,00	0.00	1.50	0.3	0.00	0.95	0.00	0.00
Dam 11B5,0	5.50	1.50	0.58	3.97	1.37	7.78	7.80
Thresholds 12B1,0	1.05	1.50	0.4	2.00	1.10	4.13	4.20
Thresholds 13B1,5	1.55	1.50	0.4	2.30	1.10	4.73	4.75
Dam 14B2,0	2.10	1.50	0.44	2.60	1.16	5.28	5.30
Dam 15B3,0	3.30	1.50	0.48	3.15	1.22	6.37	6.40
Dam 16B8,0	8.30	1.50	0.64	4.82	1.46	14.24	14.30

Table 7

Blade Length Calculation Overflow and Foundation Raft, Torrent 2

Name	Y_v m	H_{calc} m	λ	L_b m	a m	L_r-calc m	L_r-ad m
Cross bar 1B0/2,00	0.00	1.50	0.3	0.00	0.95	0.00	0.00
Thresholds 2B1,0	1.03	1.50	0.38	1.98	1.07	4.12	4.20
Thresholds 3B1,0	1.03	1.50	0.38	1.98	1.07	4.12	4.20
Thresholds 4B1,5	1.55	1.50	0.4	2.30	1.10	4.73	4.80
Thresholds 5B1,5	1.55	1.50	0.4	2.30	1.10	4.73	4.80
Thresholds 6B1.0	1.03	1.50	0.38	1.98	1.07	4.12	4.20
Dam7B2,0	2.30	2.00	0.42	4.15	1.34	7.49	7.50
Thresholds 8B1,5	1.55	2.00	0.4	3.71	1.30	6.64	6.70
Dam 9B2,5	2.60	2.00	0.45	3.36	1.40	6.79	6.80
Dam 10B2,5	2.60	2.00	0.45	3.36	1.40	6.79	6.80
Dam 11B2,5	2.60	1.50	0.45	2.84	1.18	5.77	5.80
Dam 12B7,5	7.65	1.50	0.62	4.64	1.43	14.84	14.90
Cross bar 13B0/2,00	0.00	1.50	0.3	0.00	0.95	0.00	0.00
Dam 14B7,5	7.65	1.50	0.62	4.64	1.43	14.84	14.90
Dam 15B3,5	3.60	1.50	0.48	3.28	1.22	6.65	6.70
Dam 16B5,0	5.50	1.50	0.56	4.14	1.34	8.28	8.30
Dam 17B2,0	2.30	1.50	0.42	2.70	1.13	5.54	5.60

$$L_b = 1.33\sqrt{H_0(Y_v + 0.3H)}, \tag{2}$$

where: Y_v is the water dam height where the blade touches the foundation raft; H_0 – load overflow; λ – the fruit downstream of the dam; L_b – beating blade length overflowing; L_r – foundation raft length; a – the thickness of the overflow sill.

Images after 2 years of operation (Figs. 1 and 2).

Fig. 1 – Torrent 1: Dam 16 B 8.0 m.

Fig. 2 – Torrent 2: Dam 10B 2.5 m.

6. Conclusions

Constructive solutions proposed to correct the two torrential formations subject of the case study, after 2 years of operation shows that have achieved the objectives of halting erosion and flood protection of farmland and socio-economic objectives.

At the same time, these works through the effects of hydrological and erosion contributed to a very large extent to environmental protection, with the effect of "ecological restoration" amount of land.

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CORECTAREA FORMAȚIUNILOR TORENȚIALE
Studiu de caz

(Rezumat)

Datorită morfologiei suprafeței de recepție a torenților, se pot forma viituri în urma unor ploi puternice sau a topirii bruşte a zăpezii, producând mari pagube diferitelor sectoare economice şi sociale. Din acest motiv sunt necesare, mai ales în condițiile economiei de piață, soluții eficiente de amenajare a acestor formațiuni.

Soluțiile constructive propuse pentru corectarea celor două formațiuni torențiale supuse studiului de caz, după 2 ani de exploatare relevă faptul că şi-au atins obiectivele de stopare a fenomenelor de eroziune şi de apărare împotriva inundațiilor a terenurilor agricole şi a obiectivelor social-economice.

Totodată, aceste lucrări prin efectele hidrologice şi antierozionale contribuie într-o măsură foarte mare la protecția mediului, având drept efect de "reconstrucție ecologică" a suprafețelor de teren.

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SAFETY ASSURANCE ON EXISTING DAMS CASE STUDY – SÂRCA DAM

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Abstract. In accordance with a Romanian legislation, dam owners or administrators are required to periodically obtain a safety operating permit. These permits are issued for a maximum of 7 years for categories A and B and 10 years for the rest. This legislation was passed in 2002, and as dams came under close scrutiny, certain features and peculiarities regarding their design or construction were brought to light. This article references the Sarca Dam, on Valea Oii River, in Iasi County.

Keywords: storage capacity; verification flood; concrete revetment.

1. Introduction an Overview of Sârca Dam

1.1. Dam Main Body Characteristics (Fig. 1)

a) trapezoidal cross-section;
b) crown length: 334 m;
c) crown width: 6 m;
d) maximum height: 16.5 m;

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e) minimum foundation depth: 2.1 m;

f) slope: upstream 1:4.5; downstream 1:4 (3 m wide rest at 78.30 m BSL);

g) foundation elevation 65.50 m BSL (Black Sea level);

h) crown elevation 82.50 m BSL.

The dam crown features a concrete parapet which is 1m high, reaching 83.50 m BSL. It is positioned on the upstream crown edge and it is 334 m long, 1.1m wide and made entirely out of C12/15 concrete.

In order to protect the upstream slope and left bank (where the discharger is situated) and avoid their erosion due to water level variations, which may in turn lead to land slides, a protective revetment made out of reinforced concrete slabs which were cast on site (2.0 × 1.0 × 0.15) stretches from 68.50 mdMN to 76.00 mdMN. Underneath this is a 10 cm layer of ballast. This concrete protective layer rests on a reinforced concrete support (0.5 × 0.6 × × 0.4) situated at 68.50 m BSL (dead volume level).

The dam itself is homogenous and does not have any special features to ensure it being watertight. (core, etc.).

Fig. 1 – Aerial view of Sârca Dam.

Preparing the terrain for the foundation meant clearing a depth of 0.6 m worth of soil and a further 1.5 m of clay. After this stripping of the entire site on which the dam was to be built (in order to set the draining layer), a 3.5 m wide, 2.1 m deep and 173 m long trench was dug along the dam axis. A layer of ballast, 25 cm in thickness, was set in this trench, on top of which the previously excavated soil was set in 10,…,20 cm thick layers, each properly compacted ($\gamma \geq 1.7$ t/m^3). Perpendicular to this, 16 other trenches were done, each filled with 25 cm of ballast and then compacted soil. These threnches are 1.5 m wide and sloped 0.5% downstream.

At a distance of 15 m from the base of the dam, paralel to the first trench, another one was dug (1.5 m wide) and filled to the brim with ballast, thus connecting it to the drainage layer. This layer's elevation is 66.00 mdM, its length is 173 m, with a witdh of 15 m and a thickness of 0.5 m. Both its base and top is covered with a layer of nonwoven geotextile.

To cancel out the *low pressure* effect, 5 m away from the base of the dam, 12 self-unloading borings were executed, 10 m appart and roughly 12 m deep. These borings ensure a gravitational evacuation of the water pressure building up under the dam foundation.

To safely evacuate the water from the draining layer, a trapezoidal concrete gutter (b = 0.5 m and m = 1/1), fitted with a type M PVC pipe with Dn = 210 mm and and inverse filter, was built. Its end is in the dam's drain channel.

1.2. Surface Discharger. Constructive Characteristics

a) situated on the left shoulder of the dam;

b) type: triangular;

c) length: 337 m;

d) components:

d_1) access channel, which is 57 m long, the first 29 m being covered with a 30 cm layer of stone on top of 15 cm of ballast, while the other 28 m (access platform) is covered with B200 reinforced concrete slabs, on top of 15 cm of ballast;

d_2) Keuttner type discharger with 1:2.5 slopes; top side is protected with CF type 30 rail made out of B200 reinforced concrete with a length of 8.5 m; the opening width is 25 m, while it's elevation is 81 mdMN (or 81.35 according to on site measurements)

d_3) acceleration zone, totaling 100m in length, made out of 50 cm thick, B200 reinforced concrete; it is trapezoidal in shape, with a 1:2 incline and i = 0.5%;

d_4) chute channel, 155 m long, with a 10% slope, with a macro-rough finish; this layer is B200 reinforced concrete, 40cm thick and has B100 concrete cutwaters 5 m apart; to avoid low pressure forming on the channel bottom or at the slope base, holes (weepers) with Dn = 32 mm and filled with ballast were made. The transverse joints spanning the entire length of the channels are 5m apart and are not joined, while the longitudinal ones are;

d_5) hydraulic Energy dissipater is trapeze shaped, 15m across, 1:2 slopes and 25.5 m long; it is made out of C12/15 reinforced concrete, 40 cm thick, set of a 15 cm ballast layer; the water energy is dissipated my 1 m tall Rebock prongs;

d_6) riprap breakwater structure is a 32.50 m long channel, with a trapezoidal cross-section (1:2 slopes), covered with a 40 cm thick layer of rock;

d_7) tailrace channeland connecting area is a trapeze shaped (1:2 slopes) area which connects the drain channel.

Functional characteristics

1º Free functioning (no hydro-mechanical equipment).

2º Discharge capacity:

a) at crown elevation: 81.29 m^3/s;

b) at concrete parapet elevation: 174.91 m^3/s.

Table 1

Flood Hydrological Data (According to Operational Regulations)

Probability	1%	0.1%	1.2 × 0.1%
Q, [m^3/s]	110	190	228
V, [mil.m^3]	6.18	10.67	12.80

Table 2

Reservoir Parameter

Parameter type	Volume	mil.m^3
Parameters determined by natural and constructive characteristics	- global (at crown elevation)	21.130
	- total (at 1.2 x 0.1%)	13.974
	- theoretical gross (at weir crest)	16.865
	- gross (at normal water leve)	3.300

1.3. Bottom Discharger

Is located on the left bank of the riverbed and has the following components:

a) access channel – 19.5 m long;

b) control tower: rectangular section (7.35 m × 8.95 m), 18m high; its foundation is a massive C12/15 concrete block, 1 m thick, set at 62.00 mdMN; the tower itself is made out of C12/15 concrete

c) horizontal part of the bottom discharge is comprised of two section, both made from C12/15 reinforced concrete (1.60 m × 1.60 m) with length of 8 m and 9 m; the total length of the channel is 129 m; there are concrete diaphragms and sealing joints; the left section is used to discharge water, while the right one houses the Dn = 600 steel pipe that transports the water for pisciculture and irrigation;

d) the energy dissipater is trapeze shaped, with a 4.5 m base and 1:1.5 slopes and a length of 18.7 m; it is covered with 50 cm thick B200 reinforced concrete slabs set on 10 cm of screed; three 1.5 m high Rebok prongs dissipate water energy; further downstream (7.35 m) a 2 m high concrete sill (with

0.5 m × 0.5 m slits) is located; a concrete channel layered with 30 cm thick B200 reinforced concrete slabs resting on 10 m of screed; its length is 8m and its width varies from 7.5 m to 4.15 m;

e) riprap breakwater structure is trapeze shaped, with a base of 4.15 m and 1:2 slopes; it is 15 m long and covered with a layer of stone (30 cm on the slopes and 50 cm on the bottom) resting of a 80 cm concrete support;

f) downstream channel used to evacuate flood waters is 1,975 m long, its 10m wide with slope coefficient m = 1/1 and slope i = 0.75% (0.09% according to measurements); Q = 25 m^3/s.

2. Interventions Recommended by the Experts Report

2.1. Dam Main Body

Renovation of about 50% of the plastering on the concrete parapet and repainting for about 450 m.

Extending the revetment on the upstream embankment from the 1% level to the base of the concrete parapet.

Replacement of roughly 50 concrete slabs from the upstream embankment that have either cracked or warped (Fig. 2).

Fig. 2 –Upstream slab revetmentment (cracked or warped).

2.2. Flood Water Discharger (Spillway)

Continuing the execution of the revetment upstream of the discharger to reach current levels in order to protect the area between the 1% level and the discharger zone.

Continuing the execution of the revetment in the area between normal water level and water level at the minimum volume.

Unsilting the energy dissipater and its riprap breakwater structure.

The regularization of the Vadu Oii old riverbed (using concrete slabs) all the way to the Bahluieț River confluence (a length of about 1.8 km); the downstream channel has become overrun with vegetation which significantly reduces its effectiveness and needs to be cleared.

3. Commentary Regarding the Experts Report

3.1. Dam Main Body

As shown in Chapter 1, verificationn flood is V_v = 12.8 mil.m^3. The volume of the lake the dam creates is V_{CD} = 16.8 mil.m^3 at the discharger crest level. Attenuation lake volume, according to operational regulations is V_{ar} = = 13.5 mil.m^3, therefore the lake can withhold the entire volume of verification flood.

The flood water discharger is only justified in the somewhat likely scenario that when floods reach the lake the existing water level will be above normal level. The presence of the concrete parapet on the dam crown is completely unwarranted. It would make more sense to remove it entirely than to repair it.

The concrete revetments joint on the upstream slope are filled with bituminous mastic and lack weepers. Its degradation is certainly due in part to the rising pressure from behind it as the water levels drop in the lake. Weepers need to be executed in the existing revetment, and following the replacement of the damaged concrete slabs, a more porous joint sealant should be used.

3.2 Flood Water Discharger

The Valea Oii riverbed has been shaped as a trapeze with a base of 10 m and 1/1 slopes on either side. This cross-section should handle a flow of 25 m^3/s. According to operational regulations, the riverbed incline is 0.75%.

The maximum discharge possible using the bottom discharger is 20.31 m^3/s. The energy of the water is dissipated upon exiting the channel.

The riverbed is clogged to the point that its slope has decreased to 0.05% for the first kilometer after the dam. However, the slope between the riprap breakwater structure exit and the DN28 underpass is 0.09%, so the unsilting can be done without affecting the confluence with Bahluieț River. This clogging is favored by vegetation growth that increases the riverbed roughness and decrease water speeds, thus favoring deposits.

To prevent deposits, the minimum water speed should be (Priscu, 1982)

$v > 0.3$ m/s in the case of fine grain soil; $v > 0.3,\ldots,0.5$ m/s in the case of sand. (1)

After Kenedy (Kiselev) relation is:

$$v = c \cdot h^{\alpha}\,, \tag{2}$$

where: $c = 0.56$ (fine grain soil); $\alpha = 0.64$.

For $h = 0.7$ m (water depth under the considered discharge, no vegetation in channel, $n = 0.025$):

$$v = 0.44 \text{ m/s}.$$

After Levi (Kiselev) relation is:

$$v = 0{,}5\sqrt{R}\ . \tag{3}$$

For $h = 0.7$ m, the hydraulic radius is $R = 0.63$ so the water speed is:

$$v = 0.39 \text{ m/s}.$$

If vegetation develops, the roughness coefficient rises ($n > 0.075$) and water speed drops below the levels that favor deposits. Therefore, the channels issue is not erosion, so lining it with concrete slabs is not the solution and it is not recommended. This is further supported by NTLH 001-2008. Its cross-section needs to be enlarged to accommodate the flow output of the bottom discharger $Q_{0.1\%} = 17.9$ m^3/s. To achieve this, the base of the trapeze section needs to be 12 m wide (considering that the channel is kept vegetation free and $n = 0.02$).

4. Conclusions

In various other similar situations, the technical solutions that were introduced during design as well as execution might be in disagreement with current regulations. In the case of the Sarca dam, certain things need to be taken into consideration while the decisions regarding the intervention are being taken:

a) the concrete revetment on the upstream slope must ensure the passage of the water build-up in the dam body back into the lake as water levels drop;

b) the energy dissipater of the flood water discharger is clogged even though it has never seen service; the cause for this clogging must be discovered, one possible reason being the draining of rain waters from the left embankment;

c) the downstream riverbed has been built to accommodate only the bottom discharge water flow levels; while higher levels are cause for concern for the community living downstream, given that under normal conditions higher level discharge is impossible, the current situation is reasonable**.**

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PUNEREA ÎN SIGURANŢĂ A BARAJELOR EXISTENTE
Studiu de caz baraj Sârca

(Rezumat)

În conformitate cu legistaţia românească deţinătorii sau administratorii de baraje sunt obligaţi să obţină periodic autorizaţia de funcţionare în siguranţă. Acestea se emit pe durată determinată de maximum 7 ani pentru barajele din categoria de importanţă A şi B şi maximum 10 ani pentru celelalte baraje. Prevederea legislativă este din anul 2002. Această activitate de expertizare a barajelor existente a pus în evidenţă unele particularităţi şi detalii neobişnuite ale proiectării şi construcţiei barajelor. În articol se face referire la barajul acumulării Sârca de pe râul Valea Oii, judeţul Iaşi.

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ACTUAL POSSIBILITIES FOR SLUDGE TREATMENT IN WASTEWATER TREATMENT PLANTS

BY

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Abstract. This paper presents a number of current designs for treatment of sludge in wastewater treatment plants for small investments (< 10,000 P.E.), for projects with less then 50,000 P.E. and also for investments with less then 100,000 P.E.

Wastewater treatment plants have two basic treatment lines: the line of water treatment technology and sludge treatment technology. In these types of investment, sludge is being produced, sludge that has to be treated.

The examples presented into this paper are collective achievements through the design of some major investments in Romania. They present different treatment technologies with predehydrating treatment (anaerobic or aerobic mesophilic stabilization) and dehydration. There are also presented hydraulically transportation problems forthe related installations (path for biogas and heating) and storage of treated sludge.

The projects were done in the counties Bacau, Botoșani, Iaşi, Neamț, Teleorman, Vrancea and Vaslui, through applications in villages, towns and municipalities.

Keywords: sludge treatment tehnology.

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1. Introduction

Treating wastewater ,for disposal into natural receivers or recycle them, leads to detention and removal of technological line for wastewater treatment quantities of extractions defined generic sludge, takes a part polluting materials from raw water and also from wastewater treatment processes. Therefore efficiency of such treatment plants can be analyzed if it these sludges were treated well enough in the sight of capitalize them, conditioned by costs of treatmeant.

From a technological point of view sludge are different depending on their weight as primary sludge, secondary sludge or tertiary sludge, are conditioned by the wastewater line from the wastewater treatment technology segment.

Sludge resulted from wastewater treatment, whatever is their nature, sluges are colloidal systems with heterogeneous composition. They contain colloidal particles (diameter less than 1 μm) dispersion particles with diameters between 1 and 100 μm and suspended solids with jelly aspect as organic polymers of biological origin.

Sludge treatment processes are many and varied and so it can't be established recipes and technologies for general use, therefore every objective must be analyzed in its specific conditions, based on a thorough knowledge of the characteristics of the sludge being processed.

Technological line treatment sludge deals only with organic sludge from the three stages of wastewater treatment (primary, secondary and tertiary). The waste materials from racks (site) are collected, washed and composted and sent to waste materials warehouse.

Underlying sludge treatment processes are the following technological processes from sludge treatment line, namely: collecting and transporting sludge, predehydratation stage, treatment sludge stage, dehydratation stage and their capitalization.

Classification of these processes it is made after reduced humidity criterion, the criterion of reduced organic component criterion, cost price criterion, etc.

Mineral sludge (SM > 70%) extracted from sand trap is concentrated and dehydrated with different types of equipment (binders, etc.) and after that it can be used in road infrastructure. Oils and fats held in the separation chamber are processed in mechanical separator then be recovered in the chemical industry (Gyula, 1982; Tobolcea *et al*., 2010).

Taking into account the complexity of situations depending from the current situation and the outlook we presents a series of case studies of our team on many treatment plants, where we divided presentation on the two types of treatment technologies sludge:

a) anaerobic treatment technology – which is based on anaerobic processes of mineralization of organic substances contained in their composition;

b) aerobic treatment technology – which is based on mineralization by aerobic biological processes.

2. Aerobic Procedures for Treatment Sludge

2.1. Case Study 1– Wastewater Treatment Plant in Roşiori de Vede, Teleorman County

Overview of technological sludge line

Sludge treatment technology line is similar to case study 1 with anaerobic treatment.

The production line consists of the following steps:

a) predehydratation sludge stage;

b) aerobic treatment (stabilizer/mineralization) sludge stage;

c) dehydration stage.

Differences between *predehydratation stage* previously presented (case study 1) and that in this case consist of the following: sludge process is done in gravitationally process tank, a result from vertical clarifier.

Aerobic treatment stage consists of:

a) sludge pump station process goes to stabiliztion tank;

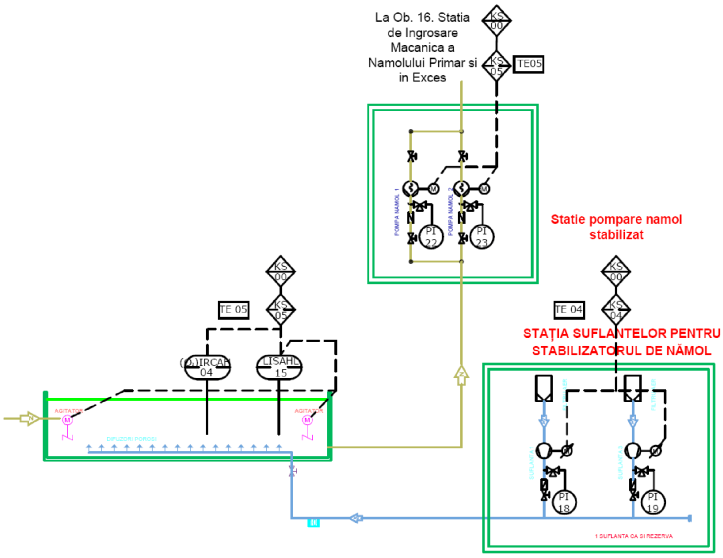
b) stabilization aerobic tank with air blowers station, air distribution network with specific Fine Bubble Diffusers and mixers.

The stabilization aerobic/mineralization process is biological aerobic process that is accomplished out at 0.1,...,1.0 mg O_2/l, depending on the load that can be carried out 30,...,60 h.

Stabilization/aerobic mineralization tank (Fig. 1) was a new object with a diameter of 30 m and depth of 3.0 m, built in ex biofilter construction of treatment plant which was used as lost formwork. The tank is equipped with overflow water and sludge sludge outtake.

Stabilized sludge pumping station – is designed to transport sludge from the stabilization tank and buffer tank (for dehydration) (Tobolcea *et al.*, 2002; NP 133-2013; ATV-DVWK-A 131E).

Dehydratation stage – after aerobic stabilization process , first is made the sludge procces thickening, centrifuging and then dewatered sludge storage respectively. Mechanical thickening is the same as in step predeshidratare from case study 1, and dewatering with centrifuges is the same as the first step of dehydration case study differences in equipment due to the differing amounts of sludge to be treated.



Legend: KS00 - central control unit located dispatcher date and SCADA; KS04 - PLC PLC / RTU version TE04 Located electrical panel; KS05 - PLC PLC / RTU version TE05 Located electrical panel; LISAHL - Circuit Measuring the level pointing to interlocking and signaling reached the minimum / maximum; (O2) IRCAH - Circuit measuring dissolved oxygen, indication, registration, metering and maximum warning level; PI - local Circuit Pressure Measurement - indicator gauges.

Fig. 1 – Aerobic treatment stage.

2.2. Other Examples for Aerobic Sludge Treatment

Wastewater Treatment Plant in Tg. Neamț Town – Prehydratation stage is similar to case study 2. Step aerobic treatment is carried out in a longitudinal primary clarifier was modified as a stabilizer. Dehydration stage is similar study caz2 with the modification that sludge thickening is gravitationally.

Wastewater Treatment Plant in Turnu Măgurele Town – The technological sludge line similar to that of Roşiori de Vede, only aerobic sludge stabilization tank is a Imhoff clarifier and it was modified as a stabilizer tank. Differences in equipment is due to the quantities of sludge quantities from case 2.

Wastewater Treatment Plant in Câmpulung Moldovenesc Town – Similar to case study 2.

Wasterwater Treatment Plant in Homocea, Vrancea County – The technological sludge treatment line is identical to that of Case Study 2, except that the treatment stage, is accomplished in a stabilization tank (new object).

The production line also features the "sanitary sludge" line in predehydratation stage.

3. Sludge Treatment Procedures by Anaerobic Treament Technology

3.1. Case study no 2 – Wastewater Treatment Plant of the City Alexandria, Teleorman

3.1.1. *Overview*

From wastewater treatment line are disposed a series of retainers which are generically called sludge. Discharged retainers are several types:

a) organic sludge is retained from primary clarifier with exceeding percent of 70% of S.O. and which requires treatment in sludge treatment technology line. Its humidity can not be less than 95% to avoid problems during transport by pumping or not to obstruct discharge pipes. Sludge from primary clarifier is called primary sludge (PS) and is collected by bridge scrapers of clarifiers into one location and from there reach in the primary sludge pumping station, where is pumped and sent to the mixing sludge tank below the technological sludge treatment warehouse;

b) on he biological reactors RB1, RB2 and RB3 is eliminated excess activated sludge (N.A.Ex.) with the help of N.A.Ex pumps.after that is sent to the mixing sludge tank below the technological sludge treatment warehouse and after that steps in the treatment technological line. Moisture content of this kind of sludge is higher than ≥ 99%. This sludge is called secondary sludge (NS);

c) from the compensation tank, the tertiary sludge is eliminated (NT) with a humidity of 98-99%. This sludge is piped (being pumped) into the mixing chamber under technological hall.

These sources of sludge (NP, NS and NT) transmit, by pumps, sludge in the mixing chamber from the technological waterline in the sludge line.

3.1.2. *Effective Sludge Treatment Line*

This stage is made of the following treatment steps:

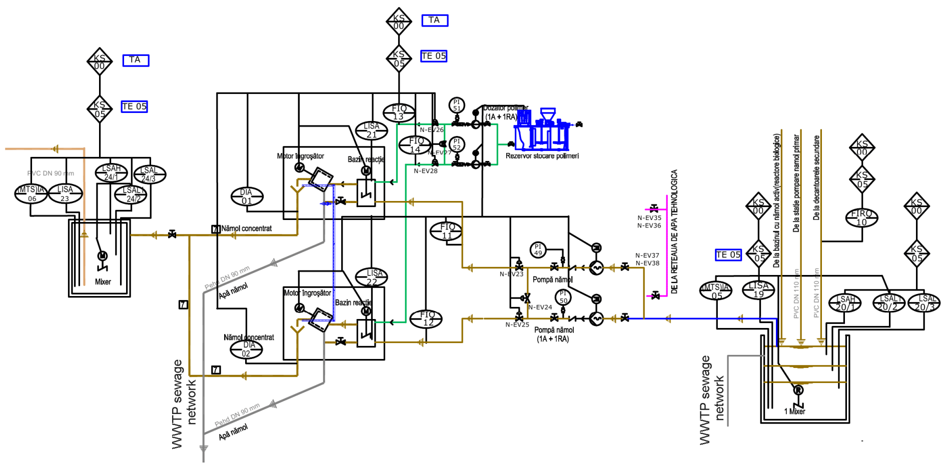
I – Predehydratation sludge treatment (Fig. 2):

a) the collection system and transport to the mixing chamber (SPNP, SPNs, SPNT);

b) mixing chamber (mixing) is performed by using mixers;

c) processing sludge – made up from transporting pumps, reagent dosing pumps household, mixing sludge tank with reagent (polyelectrolyte) - (flocculator), processing sludge. Polyelectrolyte household is automated and prepare in the compositon the solid state form polyelectrolyte , mixing it with technological water and after is processed. Sluge water is discharged into internal sewage system and sent into the water cycle. The sludge is discharged into a storage tank;

d) sludge storage tank is equipped with mixers for helping the homogenization.



Legend: KS00 - central control unit and which is given to the central SCADA; KS05 - PLC / RTU found in TE05 switchboard; FIQ - Circuit flow measurement and indication; LISA - Measuring circuit level indication, signaling and interlocking; DIA - Measuring circuit density, indication and alarm; PI - local circuit-gauge pressure measurement indicator

Fig. 2 – Predehydratation stage.

II – Sludge treatment stage: is made of the following main steps :

a) pumping station from storage tank sludge to the methane tanks through underground pipes;

b) it is home fermentation tank the loading chamber located in its upper part (outside of fermentation tank);

c) methane-tankers – realizes anaerobic treatment (mesophilic treatment);

There are four stages of anaerobic treatment:

1º *Hydrolysis*: is the process of dissolving the organic compounds with a high molecular weight complex in simple organic compounds (sugars, amino acids, fatty acids).

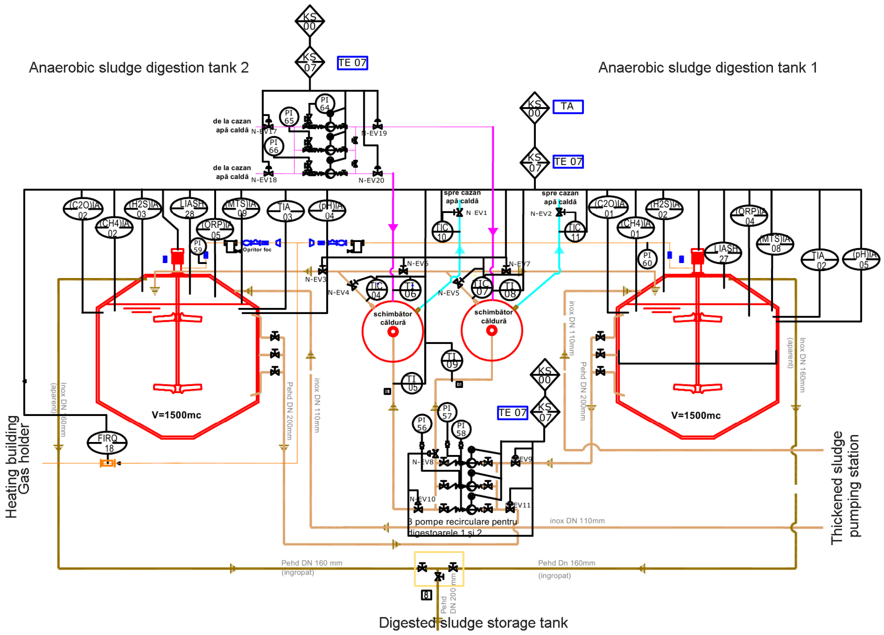
2º *Acidogenesis*: some organic matter resulting from the hydrolysis process can be taken directly by methanogenic bacteria, but other substances must be transformed into compounds that can be directly assimilated by them. Acidogenesis is the acetogenic bacteria decomposing under the action of organic substances in volatile fatty acids and ammonia, carbon dioxide and hydrogen sulfide.

3º *Acetogenesis*: the process of acidogenesis resulting from simple molecules are converted, under the influence of acetogenic bacteria, mainly acetic acid, carbon dioxide and hydrogen.

4º *Methanogenesis*: the last part of digestion is methane bacteria action on substances from previous stages, leading to the formation of methane, carbon dioxide and water, the main components of biogas (Tobolcea *et al*., 2010; Tobolcea & Tobolcea, 2004; Tobolcea *et al*., 2002).

The chemical reaction that synthesizes the above processes is as follows: $C_6H_{12}O_6 \rightarrow 3CO_2 + 3CH_4$.

The processes described above occur simultaneously in the biological reactor (methane tank) sludge requires a fairly long period of retention and are strongly influenced by a number of factors such as the homogeneity of the mixture, temperature and pH, type of S.O., etc. (Fig. 3).



Legend: KS00 - central control unit located to the central SCADA and data; KS07- PLC PLC/RTU found in TE07 switchboard; LISAH - Measuring circuit level indication, signaling and interlocking at its optimum level. (C2O) Take Measuring circuit C2O - pointing signal; (CH4) IA - Measuring circuit CH4 - pointing signal; (H2S) IA - Circuit measuring H2S - pointing signal; (ORP) IA - Redox Potential Measuring circuit - pointing signal; (MTS) IA - Measuring circuit MTS - pointing signal; TIA - Circuit measuring temperature-indicating, signaling; (Ph) IA - Circuit measuring pH - pointing signal; TI - local circuit measuring temperature thermometer indicator. ICT - Measuring circuit temperature indicator, signaling; PI - local circuit-pressure measuring gauge indicator.

Fig. 3 – Sludge treatment stage.

The two sludge digesters (1,500 m^3/unit) were rehabilitated. All the pipes have been replaced, (Figs. 4 *a* and 4 *b*). Sludge inlet and outlet are located in outside chamber of the fermentation tank.

Sludge agitators were installed in each fermentation tank. The two methane tanks have a valve chamber, where there are pipes, valves maneuver, sludge recirculation pumps, heat exchangers, all AMCs of automatic control engineering.

Fig. 4 *a* – Fermentation tank – foto.

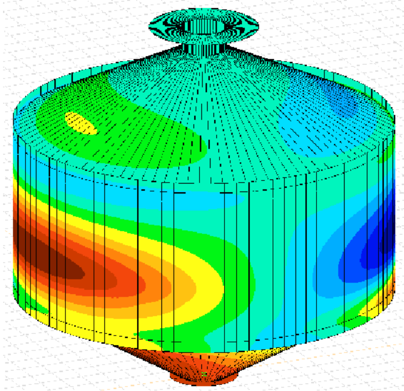


Fig. 4 *b* – Fermentation tank – 3-D model.

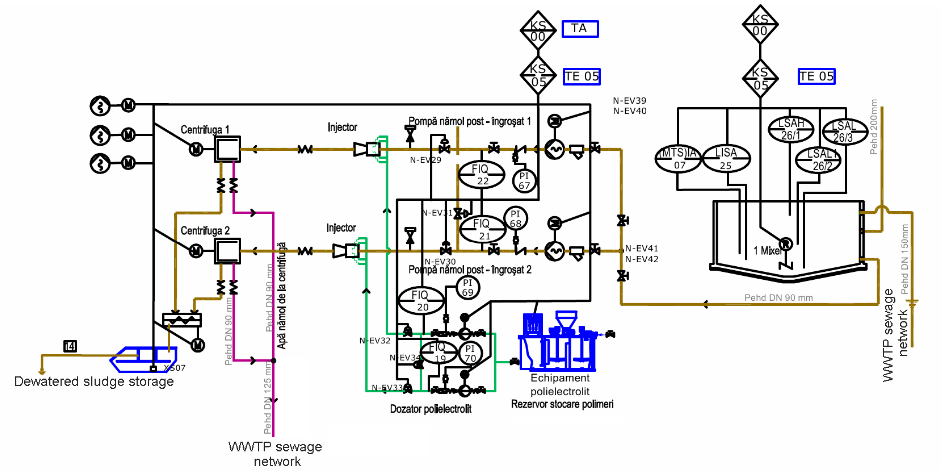
Heat exchangers are supplied with heat produced by C.T. Into and out of the water and sludge that were predicted temperature sensors for better process control. Sludge from these pools is recirculated through the recirculation sludge pumps.

d) the methane tank valve chamber in which the sludge recirculation pumps, heat exchangers for heating water produced by the boiler, various valves and fittings for maneuver;

e) home outlet pipes for transporting digested sludge and mud at bay sludge treatment technology;

f) buffer pool for storing sludge digested sludge (mineralized).

III – Sludge dehydratation and storage stage
This stage are presented in Fig. 5.



Legend: KS00 - central control unit and which is given to the central SCADA; KS05 – PLC / RTU found in TE05 switchboard; FIQ - Circuit flow measurement, indication and metering; PI – local circuit measuring pressure - pressure gauge indicator; Xs – Proximity sensor for the presence of container. LSAL, LSAL1, LSAH – Circuit detection level – signaling and interlocking Touch minimum/intermediate/peak; LISA – Circuit measurement and signal level indicator.

Fig. 5 – Dehydratation sludge stage.

3.1.3. *The Installation of Mechanical Dehydratation*

The technological dehydration by centrifugation differ technological predehydratation flow processing the sludge by centrifuges, which mainly have a much better yield. Thus, if the influent sludge moisture content in the third step of the sludge treatment is defined as a 95,...,97% dehydrated sludge to outlet may have a moisture content between 70,...,80%, depending on the needs (season, time stationary in storage) (Figs. 6 *a* and 6 *b*).

It should also keep in mind that methane-tankers haven't mineralized by anaerobic treatment, the entire quantity of organic matter in sewage influent sludge line, which is why the continuation occurs bacterial anaerobic sludge treatment. Considering this is only fair that after dehydration containers of dewatered sludge to be transported to landfill waste County, where composting to continue mineralization and possible takeover biogas and finally capitalizing compost, created warehouse, in agriculture as a fertilizer mineral.

When dehydrated digested sludge will be used in agriculture, must be a very close collaboration between the technologist station, agronomist and soil agricultural land to be fined. In this case the dehydration will be determined after the needs imposed by transportation and distribution of sludge on agricultural land. If there are no possibilities to transport the dewatered sludge was built, according to the opinions given by the Environmental Protection

Agencies, a storage building thereof, for a maximum period of six months. The warehouse is achieved by draining slab and concrete vertical walls of 1,50m. The remaining deposit is as such: the walls are free, are only metal poles and the roof is metal.

Households reagents who prepare the polyelectrolyte solution are identical with those of prehydratation with the difference that the metering pumps have another dose of the polyelectrolyte and the injection pressure in the centrifuge is different from the thickeners. During centrifugation sludge water from the plant is discharged and reintroduced into the circuit by discharging waste water treatment domestic sewage system. Dehydratated sludge is discharged directly into shipping containers or conveyors which transports it directly into the warehouse (Negulescu, 1978; Tobolcea, 2004; Tobolcea *et al*., 2015):

Fig. 6 *a* – Dehydratation installation – foto.

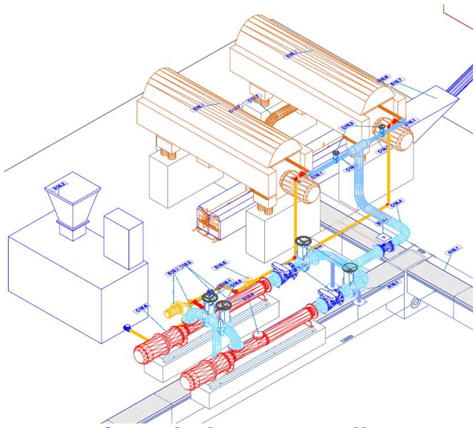


Fig. 6 *b* – Dehydratation installation.

a) transportation rails for dehydratated sludge transport in storage;

b) storage halls are open space, roofed halls and slab drainage. Water sludge is reintroduced into the water cycle and dehydratated sludge is loaded into vehicles and being exploited in agriculture.

3.1.4. *Technological Auxiliary Installation in Sludge Treatment Technology Line*

Biogas recovery technology line

Biogas, is secondary product of fermentation in methane tank, is keeped and utilized as fuel in the boiler. For this biogas is keeped with specific probes (fitted with safety overpressure), piped to the meter , used as volume compensation and then sent by pipeline to the boiler where it is used with burners specific heating boilers. On the way there is relief valves, flame burning the extra biogas, which can not be used for boiler installation of biogas remediation.

The production of thermal agent

Thermal agent necessary for heat transfer in heat exchangers valves chamber is produced by a boiler natural gas / biogas. Methane Network is own b wastewater treatment plant. The boiler is automated, which is dictated by temperature 35 ± 1°C of methane tank. The water needed in the boiler is softened by own facilities. It comes from internal process water circuit serving and other equipment that require process water (centrifuges, thickeners, barbecues, site, etc.).

Electricity networks needed

a) supply circuit for sludge technological line; b) general transformer station includes the necessary components for sludge treatment and electric generator; c) force main network that supply equipments including electrical switchpanel; d) lighting circuits, with specific switchpanel and sockets for line items sludge e) specific lightning discharger for technological line treatment (especially in the area of biogas and methane tanks).

Automation and SCADA networks - all sludge line is automated

a) sensor circuits to AMC and then to process computers and transmission level I decision (for the equipment); b) circuits to process computers at the level I to level II (groups of equipment or steps) and vice versa; c) circuits to process computers at the level II to level III (production lines) and vice versa; d) circuits to process computers at the Level III Level IV (wastewater treatment plant) and vice versa;

Water supply networks

These networks serving technology line sludge treatment are of two types: networks of drinking water and process water networks, equipped with all necessery to provide the following functions:

a) Washing machines and equipment;
b) Washing technological halls;
c) Washing storage;
d) Personal washing;
e) Process household reagents;
f) Laboratory and sanitary.

A water supply circuit very important is in areas where there is a risk of fire.

Sewers system

These networks are of several kinds;

Networks for water discharge sludge. Networks for discharge wastewater from washing technology. Sewers from the sanitary line sludge; Sewers for drainage of rainwater inside the sludge treatment line.

Low voltage electrical networks for:

a) video camera technology; b) security cameras; c) motion sensors security; d) technological warning; e) security warning.

Auxiliary constructions deservent

Administrative building/dispatcher; Laboratory; Road; Systematization and land protection (environment).

3.2. Other examples of wastewater treatment plants

Bacău Town – Expertise report reusult allowed reusing the old methane tanks but with some change in structural and technological part : rehabilitation the upper catchment area and rehabilitation of gas chambers and valves.

General technology remains the same as in the case study 1 but with the differences in the amount of sludge specification.

Târgu Mureş Town – has a general technological line similar to the following differences:

a) use gravitationally processing sludge;

b) it was among the first biogas cogeneration plant in the country and further transformation into electricity.

Iaşi Town has a line of sludge treatment technology similar but with the difference for larger quantities of sludge.

One of the current problems is the "sanitary sludge" collected by emptying septic sludge in areas nonsewerage area or from the collection (services) from various industries biodegradable organic waste liquid / semi-liquid.

In the country there are several cities that do not have a precise management of drainage, which are a big problem for water treatment line that not gives the desired yields after those „shocks”.

This kind of sludges must be managed territorial, collected and transported in the line of treatment technological sludge which after laboratory tests (which do not indicate the presence of toxic substances, jeopardizing treatment process), unloaded in special tanks where maceration are transported with special gear pumps transported in the predehydratation stage, the processed sludge catchment area and raw material mixture creates a sludge treatment stage.

At Iaşi in the treatment plant is a entire technological line.

Wastewater treatment plants from Adjud, Mărăşeşti, Panciu, Odobeşti in Vrancea county have anaerobic sludge treatment line, similar to case study 2 but having the following differences:

a) in predehydratation stage has gravitationally sludge processing;

b) stirring sludge in methane tank, if the other examples were made with mechanical agitators explosion in Vrancea county stirring is done by ejectors;

c) to protect from cold the intake chambers/outtake chambers sludge methane tanks are located inside the tanks;

d) to reduce moisture dehydrated sludge were made Solar halls (like greenhouses) with slab drainage, which have special air conditioning interior equipment and other equipment that "cut" away sludge with his wheels, allowing to evacuate easily the water retained in the sludge mass.

Also all wastewater treatment plants have the sludge treatment technology line, stage presence predehydratation line of sanitary sludge to solve septage sludge.(Fig. 7).

Vaslui Town – has a almost the same production line for sludge treatment , but it does extra gravitationally processed and methane tanks are made of synthesized glass OL protected. The differences are from different quantities of sludge (Fig. 8).

Bârlad Town – same as Vaslui.

Fig. 7 – Fermentation Tank – Odobeşti.

Fig. 8 – Fermentation Tank – Vaslui, Bârlad.

4. Conclusions

Clearly, MBBR technologies (moving bed biofilm reactor) in waste water treatment (given by the climate of our country) will be applied widely increasingly higher scale. This will significantly reduce the quantities of secondary volumes sludge and available volumes will be allocated to industrial waste biodegradable, in quantitative growth, by storing agro-industries.

Sludge treatment lines are varied, they are conditioned to the existing situation, to the perspective and the economic analysis of the costs of treatment. The greatest influence is given by secondary sludge (activated sludge excess) and the sanitary sludge (in some cases the biodegradable industrial waste have a high intake). So influences are given by wastewater treatment technology and industries from adjacent area.

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POSIBILITĂȚI ACTUALE DE TRATARE A NĂMOLULUI DIN CADRUL STAȚIILOR DE TRATARE A APELOR UZATE

(Rezumat)

Această lucrare prezintă o serie de aplicații actuale în domeniul tratării nămolului în stațiile de tratare a apelor uzate, pentru investiții mici (< 10.000 L.E.), pentru investițții < 50.000 L.E. şi pentru investiții < 100.000 L.E.

Stațiile de tratare a apelor uzateau două linii tehnologice de bază : linia tehnologică de tratare a apei şi linia tehnologică de tratare a nămolurilor. În aceste tipuri de investiții se produce nămol ce urmează a fi tratat.

Exemplele sunt realizări ale colectivului, prin proiectarea şi realizarea unor investiții majore în România. Ele prezintă diferite tehnologii de tratare cu predeshidratare, tratare (anaerobă mezofilă sau aerobă prin stabilizare) şi deshidratare. De asemenea sunt prezentate probleme de transport hidraulic, instalații conexe (cu ciruite de biogaz şi agent termic) şi depozitare a nămolului tratat.

Lucrările au fost realizate în județele Bacău, Botoşani Iaşi, Teleorman, Vrancea, etc.