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PACKAGING WASTE RECYCLING EFFICIENCY IN BUCHAREST

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Abstract

The paper aims to present the present situation and trends for evolution of packaging waste recycling in the town of Bucharest, as a model for the entire urban waste management system in Romania. The statistical data for our country and European ones entitle me to propose some simple solution to improve the process.

Key words*: Bucharest, packaging waste, recycling.*

INTRODUCTION

The recycling of reusable materials drastically reduces the consumption of natural resources(oil, water, energy) and the level of harmful emissions into the air.
Waste management involves the collection, transport, recovery and disposal, including landfill monitoring after closing.
In Romania, in Bucharest, the responsibility for waste management belongs to the local government, which by themselves or by leasing sanitation service by a licensed operator must ensure collection(including separate collection), transportation, treatment, recovery and disposal of the waste.
Nationwide, there are currently ten (10) transfer organizations (OTRs) that are licensed to operate, taking responsibility for achieving annual targets for recovery and recycling of packaging waste.
'Waste packaging' is the packaging or packaging materials which do not meet the requirements and the purpose for which they were designed and manufactured and remain after being used as packaged product.

MATERIALS AND METHODS

The quantities of waste reported as recycled/recovered in Bucharest are not representative because the packaging waste generated in other counties comes to Bucharest, caused by the fact there were no waste recyclers.
The data are obtained from the National Environmental Protection Agency and are corresponding to the period 2009-2012.
In the following I will compare the values of packaging waste recycled in Bucharest with average values of major European countries, finding causes and proposing solutions for improvement.

RESULTS AND DISCUSSIONS

In Romania, the rate of municipal waste generation per capita is 272kg, what we can say it's a little (relative to others countries).
Waste collected in biodegradable part composition and materials that can be used are shown in table no.1.
Unfortunately Romania has managed to recycle only 4.5% of municipal waste in 2012, the remaining waste reaching landfills.
Bucharest inhabitants 'produce' annual about 318 kg of household waste per capita or 0.87 kg/capita per day (Ecoteca, 2015).
According to previous researches, in Bucharest the waste collection process is determined and influenced by:
-the existence of waste containers near homes 31%
-the level of information and education made through media 24%
-the example of other people 18%

Table 1. The composition of the material on household waste collected - 2012. (ANPM-APMB, 2015)

MATERIAL	PERCENTAGE
Paper and Cardboard	12.56
Glass	4.67
Metal	2.55
Plastic Materials	11.01
Biodegradable	46.07
Wood	1.23
Others	21.91
Total	100%

The evolution of packaging waste collected in Bucharest in the period 2009-2012 (Figure 1) shows that the collection has grown in absolute terms, but the significant percentage increase was between 2009 and 2010.
In addition, dangerous fraction of packaging waste has been eliminated since 2011.

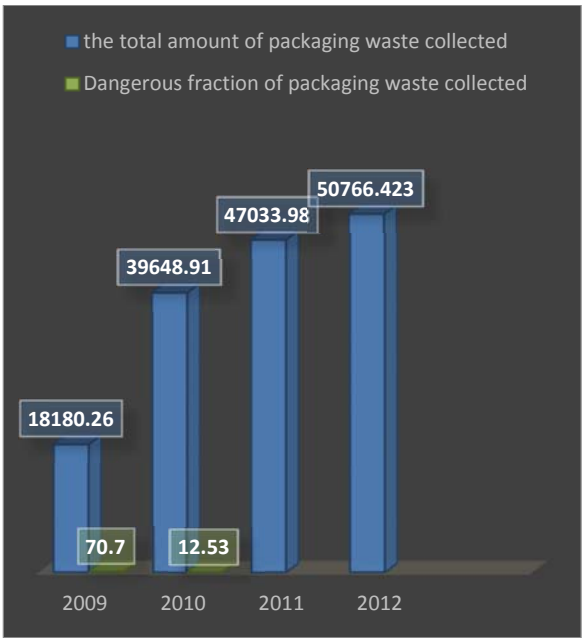

Figure 1. Quantities of packaging waste collected (t) in Bucharest 2009-2012

The packaging collecting evolution by type of material in Bucharest for 2009-2012 period shows that the majority is made up of paper and cardboard, which increased dramatically from 2009 in 2012, meaning that in 2009 the existence of collecting this type of packaging was virtually invisible (ANPM-APMB, 2015).
Only 4% of waste collected across Bucharest is recycled/recovered, the remaining 96% is sent to the dedicated landfill.
The municipal waste disposal in Bucharest is done in the selected landfills positioned near the municipal area (Chiajna, Vidra, Glina).

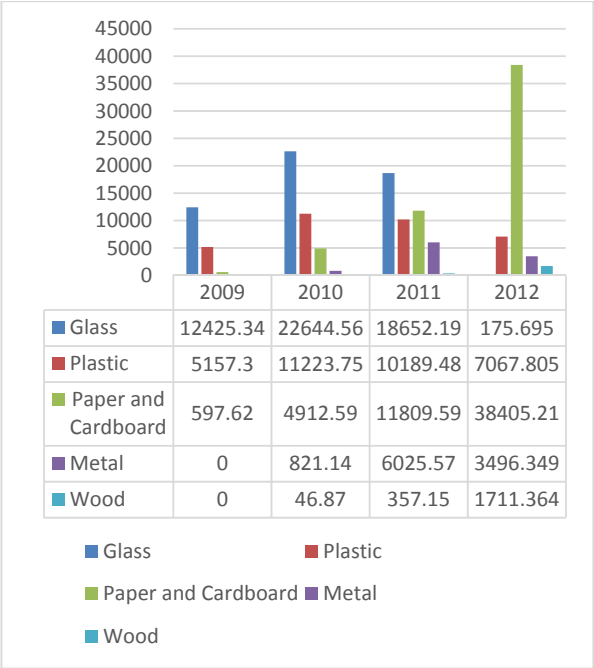

Figure 2. Quantities of waste collected (t) in Bucharest by the type of the material

In parallel, they were made sorting and transfer stations (Figure 3). There are currently in operation, serving the city, 3 waste plants for sorting, selection and transfer.
They are excluded from receiving in the mentioned stations the sludge from the urban wastewater treatmentplant and the construction residues.
Currently, there is no municipal waste incinerator to operate for Bucharest.
EU countries have generated an average amount of municipal waste of 481 kg per capita in 2012. An average of 43% was recycled or composted (Eurostat, 2015).
The quantity of generated waste fell by 8.7 % compared with the peak of 527 kg per capita in 2002. Since 2007, municipal waste generation in the EU has been decreasing steadily in the mid-90s.
Of the 481 kg municipal waste generated per person in the EU within 2012, 470 kg per capita were treated as following: 31% disposed in landfills, 28% recycled, 26% incinerated and 15 % composted.
The ratio of municipal waste recycled or composted in the EU has risen steadily in the past 60 years, from 18% in 1955 to 43% in 2012.

Figure 3. Waste sorting and transfer plant

For example: Slovenia leads the leaderboard with a degree of recycling 55% of municipal waste; Germany ranks second after Slovenia with a 47% recycling rate and preserving the performance of 0 percent for disposal in landfills (alongside Switzerland) (Ecoteca, 2015).

It's worth mentioning that Romania has the lowest rate of municipal waste generation, 272 kg per capita, while the opposite is Denmark with an amount of 747 kg per capita.

In Bucharest, there is a municipal waste generation of 318 kg per capita (Metropotam, 2014).

Until 2025 in Bucharest it will be dropped the use of the inside building housing waste throwing, and it will be adopted a long-term strategy of public sanitation.

According to a mayoralty resolution draft already submitted to public debate, it could remain in use only a waste designated room placed at the ground floor, accordingly designed for this operation.

Also, by the year 2025 it is mandatory to set up within Bucharest's districts some 'islands' of waste separate collection. It will also be implemented the collection process and separate transportations for municipal waste and waste from commercial activities (like industry, institutions), including separately collected fractions without causing prejudice to the flow of electrical waste and electronic equipment, electrical piles and accumulators.

The resolution draft stipulates as well that municipal waste should be sorted in waste sorting stations.

The proposed measures would reduce by 15% the amount of waste disposed in landfills; the implementation of separate collection system directly from owners (tenants/individual houses/ residential complexes) would reduce too the disposed waste quantity.

CONCLUSIONS

In Bucharest, municipal waste production per inhabitant is fairly lowcompared to EU countries. Likewise, the percentage of recycling of those wastes is shallow. That is caused to the inefficiency of waste collection per categories. So far, there is not a dedicated well made program, so the majority of waste packaging is thrownout in the dumpsters mixed with others materials then the waste is transported to the main landfill outside the city.

The general public should be more informed by the importance of waste recycling because, for example, in 2012 just a small proportion of

total municipal waste (4%) was exploited(recovered, recycled, reused); that means the rest of it was lost forever.

I propose for the near future, in order to transform Bucharest in an efficient city regarding the recycling activity,to place dedicated dumpsters in special assigned areas for each city block and to assess the process. Beside, people must be educated and understand the importance of this step for the mankind and the environment. Building an incinerator and a compost station for Bucharest would greatly help the city to get rid of organic waste and/or to make compost and use it as fertilizer.

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ESTABLISHING THE NOISE POLLUTION IN THE MAIN CROSSROADS IN PETROSANI CITY

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Abstract

The paper presents some elements in the analysis of noise exposure, presenting the phenomenon of noise pollution, its sources and its harmful effects. The purpose of this paper is to analyze road traffic noise, the most widespread source of noise pollution in urban areas. The object of this research is the analysis of noise recorded at major road crossings in Petrosani using a multimeter. The results of the measurements are plotted and interpreted.

Key words*:pollution,noise, Petrosani, Romania, trends.*

INTRODUCTION

Noise pollution is a very significant component of environmental pollution, not only due to its harmful traits, but also through its presence in all the compartments of modern life. This can be seen as a particularly major problem for all the economically developed countries or for the ones undergoing development. Noise pollution can be defined as a continuous aggression, which is the result of various noises produced by cars, facilities, industrial or household appliances, in the precinct of building sites or around them.

In Romania there is a tendency, which otherwise can be noticed worldwide as well, of noise level growth and vibrations production, whose sources go hand in hand with the development of all branches of the economy and of transportation. One of the disrupting factors of the environment, who influences the surroundings in which everyday activities take place, is the noise associated and identified with the noise pollution(acoustic or phonic).

The sounds are vibrations transmitted through an elastic channel, as waves. For some values of intensity and frequency, the sounds are perceived by the human ear, producing acoustic sensations.

The sounds can be simple or complex. The irritating sounds, regardless of their nature, are classified as noises. They have a harmful impact on the nervous system, inducing a state of fatigue. Because of this, sound reducing devices are necessary for both civil and industrial buildings, to stop the noise propagation which is produced inside and outside those buildings.

The sounds can travel through air – aerial noises, or through solid masses (construction elements) – structural sounds or noises. The noises made by hits are impact noises and they can propagate both through structures (elements) or air.

In the cities, the noise pollution sources are classified in:

-fixed sources, including the residential, industrial, demolition and construction sites;

-mobile sources, which are determined by the over ground network of urban means of transportation, airports.

At the Paris gathering in 1990, it was established that the road transports are the main source of noise in the modern society, with around 80% of a town's noise pollution being represented by the noises emitted by auto-vehicles.

The outcome of noise pollution on the activity and health of the environmental factors is extremely complex, the harmful effects being felt differently, according to the physical and

physiological characteristics of the perceived noise.

The significant impact of noise pollution is amplified by the reduced efficiency of sound reduction measures, by the high costs needed to fight its effects or even sometimes by the insufficient concern for the issue.Exceeding the permitted limits of the noises, according to the period of exposure and the characteristics specific to the working space on the personnel's health, may lead to:

-auditory apparatus disorders;
-organ disorders;
-reduced work productivity;
-reduced speaking intelligibility.

Auditory organs afflictions are caused by prolonged exposure to loud noises. The disorders are aggravated in the case of discontinued noises with a large spectre of frequencies which is accompanied by mechanical vibrations. The disorders which affect the human body are a consequence of the noises which go higher than 40 dB and they can manifest as it follows:

-high blood pressure;
-accelerated pulse
-intra-cranial high blood pressure
-visual acuity decline
-respiratory rhythm alteration.

In the published literature, the areas of noise levels are classified as following:

0-30 dB – area which does not affect the health;
30-60 dB – area of mental effects;
60-80 dB – area of mental and physical effects;
90-120 dB – area of pathological effects.

The harmful effect of noise on the health of organisms imposes a noise control and this can be possible in three different stages of its transmission:

-reduction of the produced noise;
-the disconnection of the sound channel;
-protecting the receiver.

Earth has become a very uncomfortable place for the animals. The loss of hearing and the fast escalation of the heart beats are only two of the effects of noise pollution on animals. The intense and loud noises induce fear, forcing the animals to abandon their habitat.

The noise can produce perturbations regarding the development of the plants as well. The plants who are located in areas where the noise is louder, tend to evolve much slower than the ones located in quieter areas.

MATERIALS AND METHODS

The allowed limits of the noise levels in the environment are established according to the characteristics of the out-in-the-open activities or of the buildings from the functional areas, considered as protected or as a source of noise.

The allowed limits of the noise levels Lech equivalent exterior to the buildings, at a 2m distance of the façade and the height of 1.3m above the ground or the level considered for the protected buildings are in the following table (Table 1):

Table 1. Buildings and corresponding admissible limit of the noise level in dB

	Protected building	equivalent admissible limit of the noise level in dB
1	Buildings, hotels, dorms, guest houses	55
2	Hospitals, polyclinics, dispensaries	45
3	Schools	55
4	Kinder gardens	50
5	Office buildings	65

To determine the noise pollution produced by the road traffic in Petrosani city, we took measurements of the noise levels in the main crossroads of the city. In Figure 1 are marked the exact locations where the measurements were conducted.

Figure 1. Measurements points

The device sued for these measurements is a PCE-222 multi-purpose instrument, which is a multi-functional decibel meter for the environment parameters (acoustic sensor, light temperature and relative humidity), with RS-232 interface and compatible software with Windows, having a ± 3.5 dB accuracy in measuring the acoustic intensity. (Figure 2)

Figure 2. Sonometer PCE-222

Air humidity during the measurements was approximately 55%, and the temperature was 22 Celsius degrees. The measurements were taken between 12 and one pm, with a low traffic. The total time of recording a chart is of 300 seconds.

RESULTS AND DISCUSSIONS

The determinations were done according to the effective STAS requirements, during the day. In figures3 and 4 are the recordings obtained from point one and two, two roundabouts situated in unpopulated areas which connect the center of the town to the city ring way. The noise pollution can reach up to 79.1 dB in these areas, where heavy duty auto vehicles also pass.

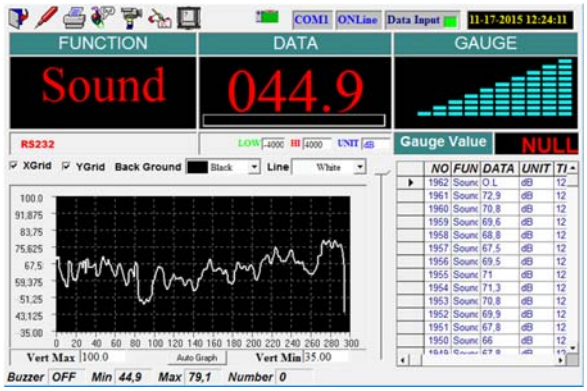

Figure 3. Recording in point one (roundabout, plane)

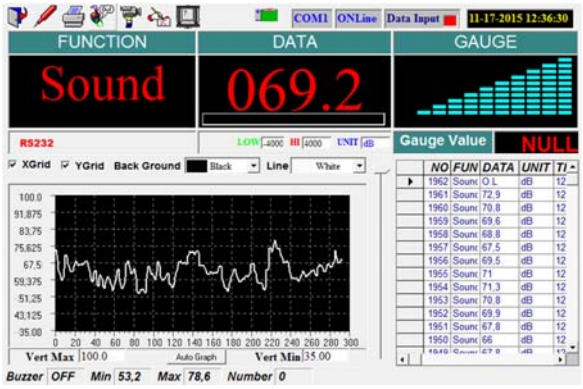

Figure 4. Recording in point two (roundabout, touristic information point)

The following two Figures, 5 and 6, are the recordings taken in two populated areas. Point number three is located nearby the emergency hospital and the Billa supermarket, with a crosswalk, a roundabout and a bus stop in the vicinity. Analyzing the recordings, we noticed high levels of noise at the departure of the means of transportation from the station.

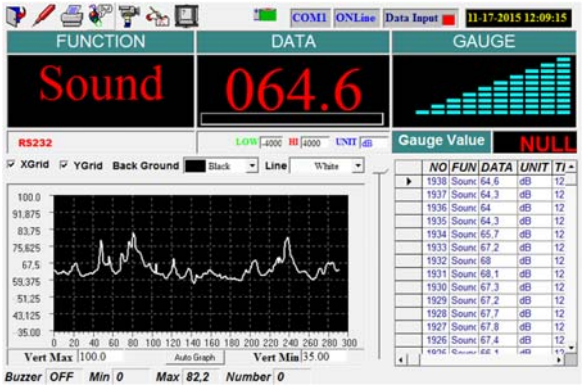

Figure 5. Recording in point three (roundabout, hospital)

Analyzing the recording obtained in point number four, the lights nearby the local market, we noticed elevated values of noise levels at the departure of the cars from the lights stop. Further analysis revealed high noise levels in the case of motorbikes.

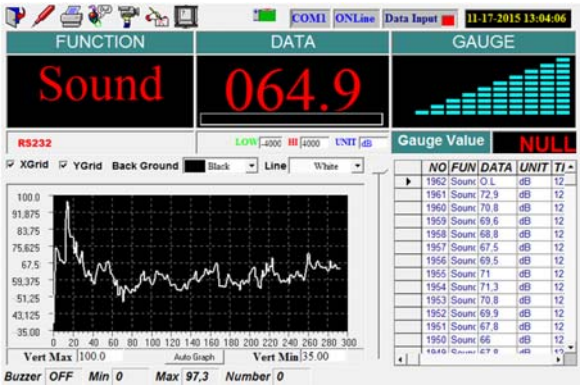

Figure 6. Recording in point four (lights, local market)

The recording in Figure 7 was obtained on the first floor of a residential building, nearby the local market, building which is not fitted with double pane glasses and which isn't soundproofed either. The recorded values don't exceed the limits permitted by the STAS for households during the day, of 55 dB .

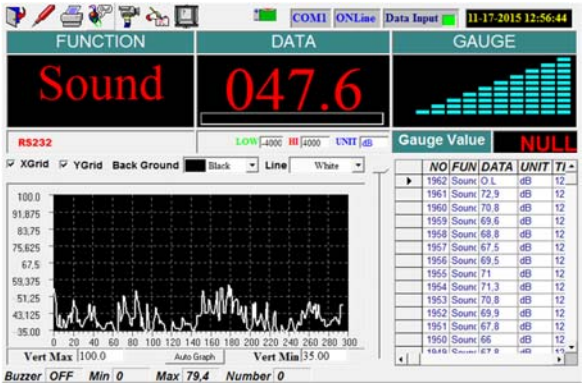

Figure 7. Recording in point five (inside building, near crossroad)

To determine the noise levels Lech equivalent exterior to the buildings, we used the following formula:

$$L_{equivalent} = L_{max} - \frac{1}{3}(L_{max} - L_{min})$$

Respecting the effective STAS, at a 2m distance of the façade and 1.3m above the ground. The results are presented in table number two.

Table 2. Measured vs permitted noise levels

Measuring Point	dB equivalent of the measured noise level	dB equivalent of the permitted noise level limit
1	67,7	70
2	70,1	70
3	74,2	55
4	65	55

CONCLUSIONS

The existence of the ring way reduces the noise pollution in the city, by diverting heavy duty traffic. The crossways and the lights are sites where the noise pollution increases due to the frequent stops and departures of the vehicles. It can be noticed that the noise levels exceed the limits in most locations, even though the hours at which the measurements were taken are not rush hours.

The consequences of noises on health population are even greater considering that they take place during the day with highs and lows according to the traffic. Noise pollution levels can be reduced by soundproofing the buildings and fitting them with double pane glasses.

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EVALUATION OF AIR AND SURFACES QUALITY THROUGH MICROBIOLOGICAL METHODS CASE STUDY – A2 STUDENT HOUSE

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Abstract

The purpose of this study was to investigate the hygiene from one Student House Of Agronomical University Camp by evaluation of airborne microflora from 12 rooms (total air cubing: 480 m^3). The degree of microbiological contamination of indoor air was checked by monitoring of 60 surface samples and 36 air samples. Qualitative analysis of indoor air and surfaces that might contain microorganisms was made by identifying colonies on Petri plate with solid culture specific to bacteria and molds. The results regarding microbes from indoor air presented fairly large variations from one room to another (from less than 100 CFU/m^3 to slightly above 2000 CFU/m^3), but in no one inverstigated space have been exceeding the admitted limit (2500 CFU/m^3).

***Key words**:* air *microflora, air contamination, pathogen germ, bvacteria, fungi.*

INTRODUCTION

Air microbiology is concerned with the study of microorganisms living in suspension in the air. Even if the organisms in the air are less than those living in the soil or in the water, there are enough microorganisms which can affect the quality of the air (Amato, 2012).

The frequency and nature of microorganisms vary by location tracking, for example in sparsely populated areas dominant the microorganisms will be originated from the nature. The structure and density of the air changes the microbial flora in areas with human intervention in areas with urban agglomerations. Thus, besides the germs in water, germs develop adaptability to human and animal parasitism, increasing their density in the air according to population density of that area. Air contamination si closly related to contamination of surfaces and objects which are often contaminated with air flora. From those surfaces, many microorganisms come in the air, along with the dust.

Usually it is not common to determine all the germs in the air, but only certain groups that can give significant information about the microbial contamination.

Assessing the health status of air in enclosed spaces is persormed based on microbiological indicators concentration as staphylococci and α - streptococci and β – hemolytic, total number of microorganism and fungus per cubic meter of air.

The environment of the educational institutions favours the apparition and development of microorganisms which need an organic source of nutrition and an environment with high humidity for surviving and spreading.

Exposure to bacteria can have negative effects on health status, even if some bacteria are useful for the good functioning of the body and we normally can find them in healthy people. *Staphylococcus aureus* can be isolated on the skin and from the nose mucus. It is responsible for different purulent infections: furuncle, osteomielitis, panaritium etc. *Staphylococcus epidermidis* is not normally pathogen, but it can cause infections in patients with immunity deficiency.

Exposure to streptococci also has an important impact on health status. For example, fecal streptococci are pathogenetically conditioned, being able to determine different diseases, as

hepatitis. Oral streptococci can determine inflammation of the respiratory and pulmonary tracts and once they enter in the circulatory system they can cause endocarditis. Pyogenic streptococci are the cause for various acute and chronical diseases.

MATERIALS AND METHODS

The microbiological analysis of the air can give a hygienic and epidemiological estimation of the air. Based on this analysis we can establish the necessary measures for the prophylaxis of aerogen infections which represent a large part from the infectious pathology.

The sampling in this study concerning quantitative and qualitative determination of microorganism from the air, was performed by gravitational sedimentation method (Koch method - which retains the germs on the surface of Petri plates containing solid culture media). The sampling under study was made by cushion method: a specific area of 100 cm^2 is marked to be examined and it is swept with a wet cushion moistened with liquid dilution at a right angle to each other. Buffer rods are aseptically cut into a test tube containing a sterile liquid dilution and subsequently homogenized manually (Figure 1). The initial suspension and if necessary, the following decimal dilutions, are used to determine the number of microorganisms under investigation.

Figure 1. Study sampling - Student House Of Agronomical University Camp

There have been selected 12 rooms with a total air cubing of 480 m^3, from one Student House Of Agronomical University Camp. In each room there have been made 2 samplings: in the morning (between 6 and 7) and in the evening (between 7 and 8), in two different days with 1-2 weeks time span. The 2 solid culture media used in the experiment:

- agar growth medium;
- YPG growth medium.

All the analyzes have taken place in the laboratory of Biochemistry Environment from Faculty of Land Reclamation and Environmental Engineering.

The plates for mesophilic aerobic bacteria with nutrient agar were incubated at 37º C, for 24, 72 and 96 hours, and the plates for filamentous fungi were incubated at 28º C, in the dark, for 3-5 days (Figure 2).The exposure time was 15 minutes. After incubation the colonies present on plates were counted, starting from the premise that each colony has been developed from a single microorganism with an colony counter. Using the table and formula from instructions guide of the device were determinated the number of bacteria and fungi expressed in CFU/m^3.

Figure 2. Thermostat with incubated samples

For expression per unit volume of air was used Omeliansky calculation formula, which is based on the observation that in 5 minutes is deposited on an area of 100 cm^2 germs from 10 liters of air:

$$\text{Germs number/m}^3=\frac{nx1000}{Sx\frac{T}{5}}\text{, with:}$$

S - surface of the box,
T - exposure time in minutes,
n - number of colonies grown on the surface of the culture medium.

NTG - total number of germs per cubic meter of air identified and isolated from five different points in the same room for the expression of an average air samples.

In order to identify microorganisms by microscopic analysis smears were performed with a simple Gram stain and double to highlight the spores.

Identification of microorganisms grown on smears was performed in drop of oil, with the objective of 100x of the Siemens microscope with camera located in the laboratory of Environmental Biochemistry.

RESULTS AND DISCUSSIONS

The obtained results showed a large variety of molds and bacteria in the environment from the student: in 80% of investigated rooms have identified the presence of Penicillium species, in 60% of investigated rooms have identified the presence of molds Aspergillius species and Mucor, in 40% of the room have identified the presence of Rhizopus species, in 30% of the rooms studied were identified Fusarium species, Streptococci, Enterobacter and 25% of the rooms have identified the presence of Aeromonas and Bacillus species (Figure 3).

Figure 3. Macroscopically identified microflora

The microbiological analysis of air microflora showed the existence of molds in all the samplings, in large quantity in room nr. 11 and and the total number of germs does not exceed the limit of 2500 CFU/m^3 .
The microbiological analysis of surfaces shows the existence of molds in all the samplings.
From the total number of 12 rooms that had been investigated, in 6 rooms the air microflora samplings presented real concern regarding the limits of bacteria and fungi, as well as pathogen germ, *Staphylococcus aureus*.

MACROSCOPIC INVESTIGATION (Figure 4):
- gray/whitish mold quick growth up to 37º C invading the whole Petri plate;
- colonies with woolly appearance, diaphane with aerial mycelium;
- white-gray colori/dark gray – sporulate.

Figure 4. Macroscopic investigation

MICROSCOPIC INVESTIGATION (Figure 5):
- sporocysts easily visible to the stereomicroscope;
- septate filaments or rarely septate, wide and irregular;
- sporangiophores.

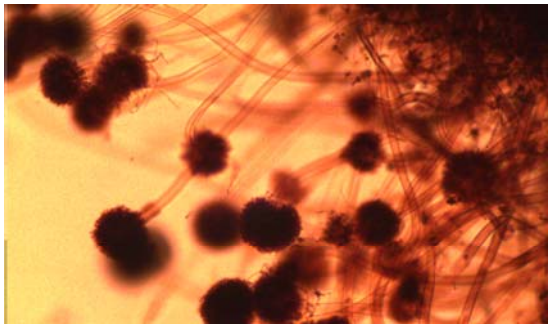

Figure 5. Microscopic investigation

The total number of germs (NTG) showed big variations among rooms, with values from 275,59 to 2180,66 CFU/m^3 of which: bacteria 44,7-572,22 CFU/m^3 actinomycete (Gram positive bacteria of the total number of isolated bacteria colonies), filamentous fungi 78,74 1608,44 CFU/m^3 and around 90-100% molds (Table 1). The quantitative evaluation of air microflora in room nr. 11 showed a total number of germs of 2180,66 CFU/m^3, that is the highest value in this environment of this study. In both measurement campaigns we discovered a significant level of microbian pollution in this room (Figure 6).

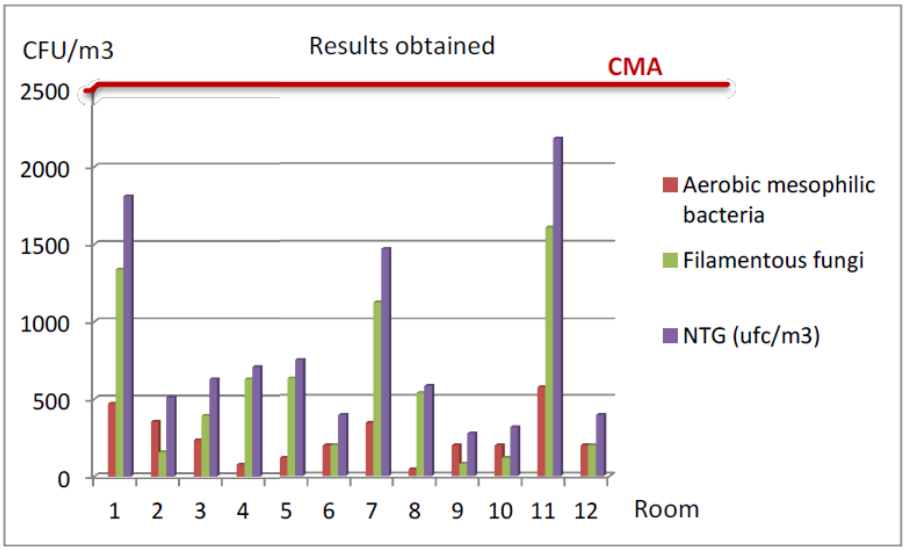

Figure 6. Graphic representation of the results obtained

Table 1. Results obtained in the rooms investigated

Room	Aerobic mesophilic bacteria	Filamentous fungi	NTG (CFU/m^3)
1	472,44	1338,58	1811,02
2	354,33	157,48	511,81
3	236,22	393,7	629,92
4	78,74	629,92	708,66
5	118,11	629,92	748,03
6	196,85	196,85	393,70
7	344,11	1125,92	1470,03
8	44,7	535,45	580,15
9	196,85	78,74	275,59
10	196,85	118,44	314,96
11	572,22	1608,44	2180,66
12	196,85	196,85	393,70

NTG results: for yeasts and molds – from 10^{-1} dilution = 508 colonies, from 10^{-2} dilution = 63 colonies and from 10^{-3}dilution = 5 colonies (Figure 7).

Figure 7. NTG results

Results from dilutions determined for yeasts and molds are highlighted in the chart below:

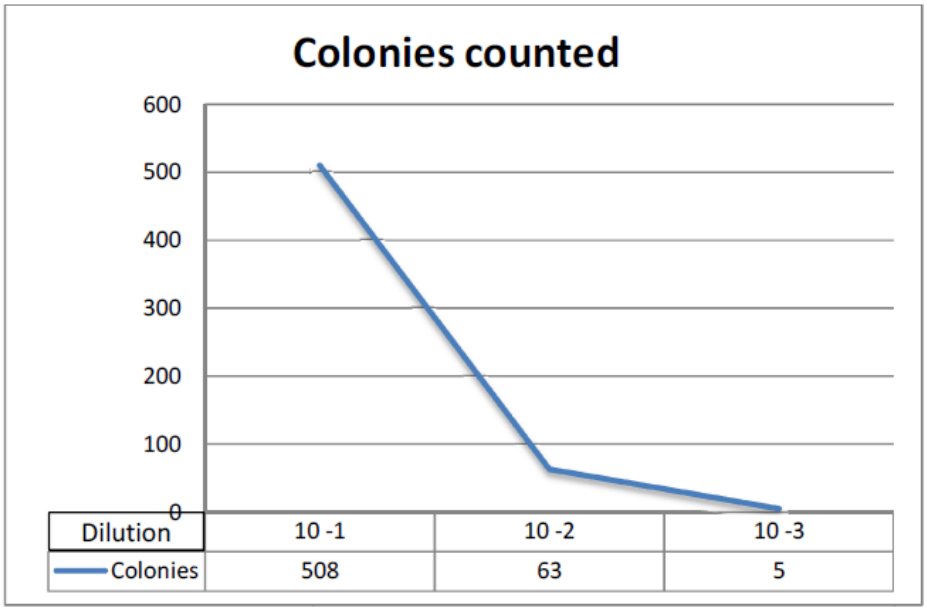

Figure 8. Results dilutions determined for yeasts and molds

CONCLUSIONS

As a result of this study, it was observed a lower degree of microbiological pollution on the down floors, compared to the upper floors. This study will be used as a starting point for further studies, as for example about the air quality in some boys rooms, kitchens etc.
Analysing studies on the working environment in the institutions of education highlighted the existence of several molds in all the studied rooms. Analyses marked out the existence of bacteria in half of the rooms under investigation. A high level of microorganisms has been discovered in room 11, and their existence signifies an insalubrious environment, because of contamination of human origin.

As a conclusion, students and auxiliary personnel is exposed to harmful conditions (biological agents) which can affect in time their health status (contact dermatitis, dermatite de contact, allergic rhinitis,pneumopathies etc.):

- Rhizopus species is an opportunistic agent, producing fungal infections in humans which in some cases can be fatal. Rhizopus infections can give serious complications for diabetics.
- Aspergillus species produces pulmonary aspergillosis or a series of allergic reactions.
- Enterobacter infections can include lower respiratory tract infections, skin and soft-tissue infections, urinary tract infections, intra-abdominal infections, septic arthritis, osteomyelitis, Central Nervous Sistem infections and ophthalmic infections.
- Infections caused by Penicillium includes: pulmonary infections, had cerebral diseases, paravertebral infections, prosthetic valve endocarditis endophthalmitis, upper urinary tract infection and intracranial infection.

To ensure a good indoor air quality is necessary to ensure a level as low microbiological contaminants through proper ventilation, reducing indoor humidity and avoid agglomeration.
Preventive measures and combating of nosocomial infections aimed at ensuring optimal hygiene conditions on accommodation, thermal environment, drinking water, food, disinfection, cleaning).

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STUDY REGARDING NITRIFICATION IN EXPERIMENTAL AQUAPONIC SYSTEM

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Abstract

The aim of this paper was to understand how nitrogen cycle evolving through early experimental aquaponic system due to growth of nitrification bacteria such as Nitrozomonas and Nitrobacter. In this respect, it was design an aquaculture system, with different composition of fish species: Carassius auratus (10 pieces) and Hypostomus plecostomus (2 pieces). After we've found that the nitrogen cycle was established, we've chosen the suitable plants for the hydroponic system. The fishes were fed by organic meal; it was used a feeding rate ratio for design calculations of (0,6 grams / day) and the feed input was kept relatively constant. The pH was controlled on a daily basis (pH was maintained constant by addition of calcium carbonate) and oxygen dissolved (that has been kept constant by using a proper pump). Nitrogen forms (ammonium - NH4, nitrite - NO2 and nitrate - NO3) were determined on a daily basis as well and in the same time with pH measurement, in order to make correlations between evolution of nitrogen concentrations and nitrification bacteria growths. After 30 days of experiment it was found that ammonium - NH4 concentrations are directly and significantly correlated with nitrite -NO2 concentrations (the Pearson correlation factor is r = 0.74). It means that Nitrosomonas bacteria formed an effective biofilm. After 10 days from initiation of aquaculture experiment we also observed that nitrate concentrations values are correlated with nitrites concentrations values (which demonstrates the Nitrobacter growing). The correlation coefficient is negative (r = - 0.75) because in the absence of plants, the nitrates were accumulated in water. In conclusion, according to experimental data, the ammonium- NH4 and nitrite -NO2 concentrations are stabilized after 30 days, reaching values which are lower than legislation in force imposing.

***Key words**: Nitrosomonas, Nitobacter, nitrogen cycle, nitrite, nitrate, aquaponic*

INTRODUCTION

Aquaponics refers to any system that combines conventional aquaculture (raising aquatic animals such as snails, fish, crayfish or prawns in tanks) with hydroponics (cultivating plants in water) in a symbiotic environment. In normal aquaculture, excretions from the animals can accumulate in the water, increasing toxicity. In an aquaponic system, water from an aquaculture system is fed to a hydroponic system where the by-products are broken down by nitrifying bacteria into nitrites and then into nitrates, which are utilized by the plants as nutrients, so the water is recirculated back to the aquaculture system.

Aquaponics has ancient roots. Aztec cultivated agricultural islands known as chinampas in a system considered by some to be the first form of aquaponics for agricultural use (Boutwelluc, 2007 and Rogosa, 2013) where plants were raised on stationary (and sometime movable) islands in lake shallows and waste materials dredged from the chinampa canals and surrounding cities were used to manually irrigate the plants (Boutwelluc, 2007 and Rogosa, 2013). Also, South China, Thailand, and Indonesia who cultivated and farmed rice in paddy fields in combination with fish are cited as examples of early aquaponics systems (FAO, 2001). These aquaponic farming systems existed in many Far Eastern countries, in USA, and Canada.

In Romania, aquaponics exists in Snagov, Focsani, and Timisoara towns.

Parts of an aquaponic system

Aquaponics consists of two main parts, with the aquaculture part for raising aquatic animals and the hydroponics part for growing plants (Rakocy, 2016 and Diver, 2006). Aquatic

effluents, resulting from uneaten feed or raising animals like fish, accumulate in water due to the closed-system recirculation of most aquaculture systems. The effluent-rich water becomes toxic to the aquatic animal in high concentrations but this contain nutrients essential for plant growth (Rakocy, 2016). Although consisting primarily of these two parts, aquaponics systems are usually grouped into several components or subsystems responsible for the effective removal of solid wastes, for adding bases to neutralize acids, or for maintaining water oxygenation (Rakocy, 2016). Typical components include:

- *Rearing tank*: the tanks for raising and feeding the fish;
- *Settling basin*: a unit for catching uneaten food and detached biofilms, and for settling out fine particulates;
- *Biofilter*: a place where the nitrification bacteria can grow and convert ammonia into nitrates, which are usable by the plants (Rakocy, 2006);
- *Hydroponics subsystem*: the portion of the system where plants are grown by absorbing excess nutrients from the water;
- *Sump*: the lowest point in the system where the water flows to and from which it is pumped back to the rearing tanks.

Live components

Animals. Freshwater fish are the most common aquatic animal raised using aquaponics, although freshwater crayfish and prawns are also sometimes used (Drive, 2006).

Plants. Green leafy vegetables with low to medium nutrient requirements are well adapted to aquaponic systems, including lettuce, basil, spinach, chinese cabbage, chives, herbs, and watercress (www.backyardaquaponics.com)(http://www.bioconlabs.com).

Bacteria. Nitrification, the aerobic conversion of ammonia into nitrates, is one of the most important functions in an aquaponics system as it reduces the toxicity of the water for fish, and allows the resulting nitrate compounds to be removed by the plants for nourishment (FAO, 2001). Ammonia is steadily released into the water through the excretion of the fishes as a product of their metabolism, but must be filtered out of the water since higher concentrations of ammonia (commonly between 0.5 and 1 ppm) can kill fish (Robert, 1997). Although plants can absorb ammonia from the water to some degree, but nitrates are assimilated more easily (Rakocy, 2016), thereby efficiently reducing the toxicity of the water for fish (FAO, 2001). Ammonia can be converted into other nitrogenous compounds by: *Nitrosomonas* bacteria that convert ammonia into nitrites, and *Nitrobacter* bacteria that convert nitrites into nitrates.

Nitrosomonas is a genus of rod-shaped chemoautotrophic bacteria (microbewiki.kenyon.edu). They are found in soil, freshwater, and on building surfaces, especially in areas that contains high levels of nitrogen compounds. Most species are motile with a flagellum located in the polar regions. They are important in the nitrogen cycle by increasing the availability of nitrogen to plants while limiting carbon dioxide fixation (http://microbewiki.kenyon.edu/index.php/Nitrosomonas). This organism oxidizes ammonia into nitrite as a metabolic process. *Nitrosomonas* use energy gained through the oxidation of ammonia to fix gaseous carbon dioxide into organic compounds. *Nitrosomonas* prefers an optimum pH of 6.0-9.0 and a temperature range of 20 to 30°C. This microbe is photophobic, and will generate a biofilm matrix or form clumps with other microbes to avoid light (http://microbewiki.kenyon.edu/index.php/Nitrosomonas)

Nitrobacter is a genus of mostly rod-shaped, gram-negative, and chemoautotrophic bacteria (http://www.bioconlabs.com). *Nitrobacter* plays an important role in the nitrogen cycle by oxidizing nitrite into nitrate in soil. Unlike plants, where electron transfer in photosynthesis provides the energy for carbon fixation, *Nitrobacter* uses energy from the oxidation of nitrite ions, NO_2^-, into nitrate ions, NO_3^-, to fulfill their energy needs. *Nitrobacter* have an optimum pH between 7.3 and 7.5, and will die in temperatures exceeding 49°C or below 0°C (http://www.bioconlabs.com). According to Grundmann, *Nitrobacter* seem to grow optimally at 38°C and at a pH of 7.9 (http://www.bioconlabs.com).

MATERIALS AND METHODS

Our aquaponic system consists of (Figure 1):

- rearing tank for raising and feeding the fishes (47x37x42 cm, V=73 cm^3);
- biofilter, a place where the nitrification bacteria can grow and convert ammonia into nitrates; biofiltration material with a high specific surface (600 m^2/m^3), is represented by expanded clay aggregates;
- a pump that flow back the water to the rearing tanks (model EHEIM compact 300, with following caracteristics: capacity 150-300 l/h, total head- 0.5 m, power - 5W).

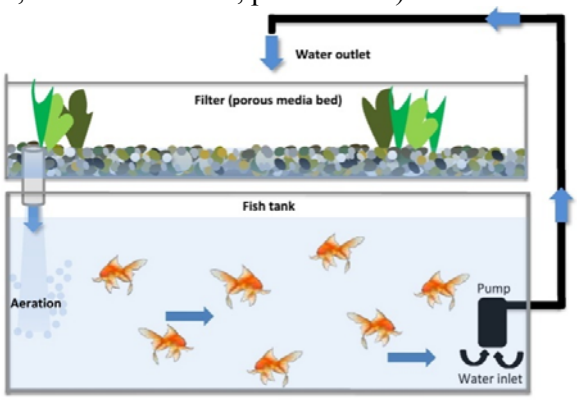

Figure 1. Aquaponic sistem

Live components:

- *Animals*. Freshwater fish (Figure 2) - *Carassius auratus* (10 pieces) and *Hypostomus plecostomus* (2 pieces);

Figure 2. The fish species from the aquarium.

- *Bacteria*. *Nitrosomonas* and *Nitrobacter* (their existence are demonstrated by our results);
- *Plants.* Our hydroponic system will include lettuce.

The fishes were feeding by organic meal and we always kept feed input relatively constant per body grams (0.6 grames per fish).
We ensure a good aeration, maintaining the oxygen dissolved at 10 mg/l. Since the nitrification process acidifies the water, calcium carbonate was added in the water to provide a buffer against acidification.
Control of growth and development nitrifying bacteria was set up by daily investigation of ammonia, nitrite and nitrate concentrations in water, pH and oxygen dissolved. We used a professional test kit for freshwater analysis (provide from JBL Company).

RESULTS AND DISCUSSIONS

Our results show that in operational 30 days of aquaculture system it develops a bacterial population (*Nitrosomonas*) capable to convert ammonium ions resulting from excretion process of the fishes, into nitrites. According to Table 1 and Figure 3 can be seen initiating the nitrogen cycle by *Nitosomonas* bacteria. Certain amounts of ammonia results in excretion processes are converted into nitrites, the coefficient correlation value being r = + 0.74, which defines direct and significant correlation. The nitrites formation is directly proportional to the concentration of ammonium ions.

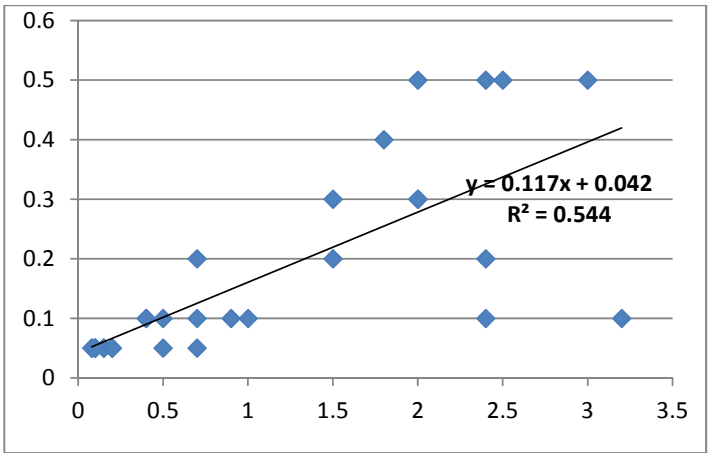

Figure 3. The correlation between concentrations of ammonium and nitrite in the aquaculture system, in the first 30 days of the experiment. Pearson correlation coefficient r = 0.74 defines a significant direct correlation

Table 1. The parameter values daily investigated: pH, ammonium, nitrite, nitrate, phosphat, and oxygen dissolved

Day	pH	NH_4	NO_2	NO_3	PO_4	OD
1	8	0.05	0.08	40	0.02	10
2	7.9	0.05	0.08	40	0.02	10
3	7.8	0.05	0.1	60	0.2	10
4	7.8	0.05	0.1	60	0.2	10
5	7.8	0.05	0.15	60	0.2	10
6	7.7	0.05	0.15	50	0.2	10
7	7.8	0.05	0.2	50	0.3	10
8	7.8	0.05	0.5	50	0.3	10
9	7.9	0.05	0.7	40	0.2	10
10	7.8	0.1	0.9	50	0.2	10
11	7.8	0.1	1	50	0.2	10
12	7.8	0.1	3.2	30	0.2	10
13	7.8	0.1	2.4	60	0.2	10
14	7.8	0.2	2.4	70	0.2	10
15	7.8	0.3	2	80	0.2	10
16	7.8	0.3	2	80	0.3	10
17	7.8	0.5	2.4	90	0.3	10
18	7.8	0.5	2.5	90	0.2	10
19	7.8	0.5	3	90	0.2	10
20	7.8	0.5	2	90	0.2	10
21	7.8	0.4	1.8	100	0.2	10
22	7.8	0.3	1.5	110	0.2	10
23	7.8	0.2	1.5	130	0.3	10
24	7.8	0.2	0.7	140	0.3	10
25	7.8	0.1	0.7	140	0.2	10
26	7.8	0.1	0.5	130	0.2	10
27	7.8	0.1	0.4	140	0.3	10
28	7.8	0.1	0.2	180	0.3	10
29	7.8	0.05	0.2	220	0.3	10
30	7.8	0.05	0.1	220	0.3	10

On the twelfth day of the experiment nitrite ions concentration recorded a growth peak, which demonstrate that *Nitrosomonas* species have grown up and developed. As a result, the concentration of ammonium ions starts to decrease. Simultaneously the concentration of nitrite are decreasing instead nitrate concentration are increasing. The concentration of nitrite ions starts to decrease linearly with decreasing of ammonium ions concentration, while the concentration of nitrate starts to increase. These facts mark the moment when *Nitrobacter* bacteria begin the activity of transforming nitrite to nitrate (Figure 4).

As nitrates are converted into nitrites they accumulate in water and become bioavailable for the plants.

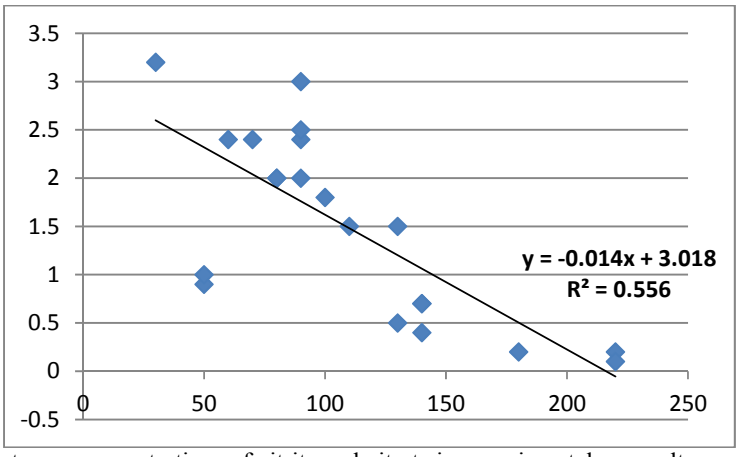

Figure 4. Correlation between concentrations of nitrite and nitrate in experimental aquaculture system, starting with the twelfth day. Pearson correlation coefficient r = - 0.75 defines a significant inverse correlation

Given that our aquaponic does not yet mounted hydroponic system, we cannot predict the future evolution of nitrates. However, conclusive data on the development of nitrifying bacteria biofilm (*Nitrosomonas* and *Nitrobacter*) supports the view that nitrates are successfully assimilated by the lettuce plants that will be cultivated on clay aggregates.

CONCLUSIONS

Bacteria are a crucial and pivotal aspect of aquaponics. The nitrifying bacteria convert the fish waste, which enters the system mainly as ammonia, into nitrate, which is fertilizer for the plants.

This is a two-step process, and two separate groups of nitrifying bacteria are involved. The first step is converting ammonia to nitrite, which is done by the ammonia-oxidizing bacteria. These bacteria are often referred to the genus *Nitrosomonas*. The second step is converting nitrite to nitrate is done by the nitrite-oxidizing bacteria. These are commonly referred to the genus *Nitrobacter*.

Nitrifying bacteria are relatively slow to reproduce and establish colonies, requiring days and sometimes weeks, and therefore the patience is one of the most important management parameters when establishing a new aquaponic system.

To develop extensive colonies of nitrifying bacteria is necessarily to use a biofiltration material with a high specific surface (optimal between 300 m^2/m^3 and 600 m^2/m^3), like volcanic gravel or expanded clay.

The water pH must be kept range of 7–8.2, not lower. Generally, nitrifying bacteria work better at higher pH, the *Nitrosomonas* group preferring a pH of 7.2–7.8, and the *Nitrobacter* group preferring a pH of 7.2–8.2. (http://www.bioconlabs.com)(http://microbewiki.kenyon.edu/index.php/Nitrosomonas).

Nitrifying bacteria are photosensitive until they fully establish a colony, and sunlight can cause considerable harm to the biofilter. It's necessarily to keep aquarium shaded from direct sunlight.

Bacterial function must be monitored by testing for ammonia, nitrite and nitrate. The test provides information on the health of the bacterial colony. Ammonia and nitrite should always be 0–1 mg/litre in a functioning and balanced aquaponic unit

(http://www.fao.org/3/a-i4021e/i4021e05.pdf). According to our experimental data, the ammonium- NH4 and nitrite -NO2 concentrations are stabilized after 30 days, reaching values lower than legislation imposed (0.05mg/l, respectively 0.1 mg/l).

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EVALUATION OF NATURAL HONEY AS CORROSION INHIBIT OR FOR BRONZE IN WEAKLY ACIDIC SOLUTION

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Abstract

Natural honey was tested as a corrosion inhibitor for bronze in a simulated acid rain solution as Na2SO4and NaHCO3 (pH 5).Electrochemical investigations (potentiodynamic polarization and impedance measurements) showed that honey exert a protective effect against corrosion bronze and, in some cases inhibiting its effectiveness exceeds 93% at concentration level as low as 500ppm. Potentiodynamic polarization method indicates that honey acts mainly as a mixed-type inhibitor with predominantly control of thecathodic reaction. The presence of honey significantly decreases the values of corrosion current density. Electrochemical impedance spectroscopy shows that the inhibition efficiency increases with the increases of honey concentration.

Key words: *Corrosion inhibitors; Natural honey; Electrochemical impedance spectroscopy; Potentiodynamic polarization*

INTRODUCTION

Nowadays, air pollution strongly contributes to the corrosion of materials (Morselli et al., 2004). Copper and copper-based alloys are widely used in various structural, architectural, electrical and electronic applications. In spite of the fact that copper is a relatively noble metal, it can suffer severe corrosion in oxygen-containing environments. Since copper and its alloys are not stable in oxygen-containing electrolytes substantial improvement in their passivity can be achieved by using corrosion inhibitors (Bostan et al., 2012).

One of the most effective alternatives for the protection of metallic surfaces against corrosion is the use of corrosion inhibitors. Usually, organic compounds that exert significant anticorrosive proprietiespossess heteroatoms such as N, S or O and conjugated multiple bonds in their molecules. In many cases, the synthesis of these compounds is expensive, and most of them are toxic for human beings and hazardous for the environment. Therefore, in line with the environment protection regulations, the new trend in industry is nowadays orientated toward finding new ecologically harmless, green corrosion inhibitors with low risk of pollution. Recently, there is an increased interest in employing naturally occurring substances and extracts which fulfil these requirements to be used as effective corrosion inhibitors (Radojcic et al., 2008).

In the last years, various works focused on the investigation of the anticorrosive properties of natural honey on aluminum, steel, tin, Al–Mg–Si alloy in various aggressive media (Radojcic et al., 2008), (Rosliza et al.,2010). Honey is a natural result that is processed by bees from the nectar of flowers or parts of plants (Gapsari et al.,2015). It containing a range of nutritiously important complementary elements: saccharides, organic acids, amino acids, polyphenols, mineral matter, colors, aromatic substances, trace amounts of fat, and some valuable but unstable compounds such as enzymes, substances of hormonal character, some vitamins and a few minor compounds. It is considered as part of traditional medicine being effective in gastrointestinal disorders, in healing of wounds and burns, and as an antimicrobial agent (Radojcic et al., 2008).

The purpose of this work is to investigate for the first time the inhibition properties of honey on bronze corrosion in a solution containing

Na_2SO_4 and $NaHCO_3$ (pH 5) that simulates acid rain in an urban environment. Electrochemical techniques, such as potentio dynamic polarization and electrochemical impedance spectroscopy measurements (EIS) were used to elucidate the inhibition properties of honey on bronze corrosion (Gapsari et al.,2015).

MATERIALS AND METHODS

Electrochemical measurements

A three-electrode cell was used for the electrochemical experiments. The counter-electrode was a large platinum grid and Calomel electrod, KCl_{sat} was used as reference electrode. An electrode made of bronze (Cu-94.03%, Sn-3.31%, Pb-0.24%, Zn-1.44%, Ni-0.25, Fe-0.22, S-0.51, at.%) was used as working electrode.

In order to avoid the electrolyte infiltration, the lateral part of the bronze rod was firstly protected by a cataphoretic paint layer, cured at 150 LC for 30 min. The rod specimen was embedded in epoxy resin (Buhler, EpoxycureTM) with an exposed area of 0.283 cm^2. Prior to measurements, the working electrode was a mechanically ground using successive grade of silicon carbide paper up to grade 2400, and then rinsed thoroughly with distilled water and ethanol.

The bronze sample was transferred into the electrochemical cell and the measurements were carried out in an aqueous solution of 0.2 g/l Na_2SO_4 + 0.2 g/l $NaHCO_3$, acidified to pH 5 by addition of dilute H_2SO_4. Appropriate weighted amounts of natural honey were dissolved in the corrosive electrolyte, in order to obtain various concentrations between 50 to 1000 ppm.

Electrochemical experiments were performed at room temperature, using a PAR model 2273 potentiostat controlled by a PC computer. Before each experiment, the bronze electrode was left at the open circuit potential for 1 h in the corrosive solution.Polarization curves were recorded at constant sweep rate of 10 mV/min in a potential range of ±200 mV vs. open circuit potential.

The corrosion inhibition efficiency (IE) was calculated from the polarization curves according to following equation:

$$IE = \frac{i\,corr0 - i\,corr}{i\,corr0} * 100(\%)$$

where i_{corr}^0 and i_{corr} are the values of the corrosion current densities in absence and in presence of the inhibitor, respectively.

Electrochemical impedance spectroscopy measurements were carried out at the open circuit potential after 1 h immersion of the bronze electrode in the corrosive medium. The impedance spectra were acquired in the frequency range 10 kHz to 10 mHzat 5 points per hertz decade with AC voltage amplitude of ± 10 mV.

The percentage of inhibition efficiency (IE) was calculated from the polarization resistance values determined from the linear polarization measurements and from the electrochemical impedance spectra, according to the following equations:

$$IE = \frac{Rp - R0p}{Rp} * 100 \quad (\%)$$

Where R_p and R^0_p are the polarization resistances in electrolytes with and without inhibitors, respectively.

RESULTS AND DISCUSSIONS

Potential dynamic polarization measurements

Fig. 1 shows representative Tafel polarization curves for bronze immersed in 0.2 g/l Na_2SO_4 + 0.2 g/l $NaHCO_3$ (pH 5) solution at in the absence and presence of different concentrations of honey.

Electrochemical kinetic parameters, such as corrosion potential (Ecorr), cathodic and anodic Tafel slopes (βc andβ) and corrosion current density (i_{corr}) were estimated by extrapolation of the Tafel lines and are presented in Table 1. The inhibition efficiencies (IE) of the honey calculated according to Eq. (1) are also given in Table 1. The polarisation resistance (Rp) values (Table 1) were determined as the slopes of the linear polarization curves recorded after 1 h immersion of the bronze in the corrosive solution.

As can be seen in Figure 1, both the cathodic and anodic branches are influenced by the presence of honey and its effect depends on the inhibitor' concentration in the electrolyte. The addition of honey in the corrosive solution leads to an important decreases of cathodic current densities as compared to the blank

solution, in the whole applied potential range. A small decrease of the anodic current densities in the presence of honey could be also observed in Figure 1. However, disregarding its concentration, honey appears to have a more noticeable inhibiting effect on the cathodic process than on the anodic one, as attested by the shift of the corrosion potential towards more negative values. These results shows that honey is able to inhibit corrosion process mainly retarding the oxygen evolution reaction and increasing the charge transfer resistance of the anodic dissolution of copper.

The values of the inhibition efficiency presented in Table 1 confirm that honey has inhibiting properties on bronze corrosion. A possible explanation for their inhibiting effect could be found in the ability of the organic molecules from honey to absorb on electrode and to form a protective layer on the bronze surface. As expected, the inhibition efficiency of honey increases with its concentration reaching a maximum value of 89.58% for a concentration of 500 ppm. Nevertheless, a further increase of the honey concentration leads to a decrease of its protective effectiveness, probably due to the saturation of the bronze surface with inhibitor molecules at a certain concentration.

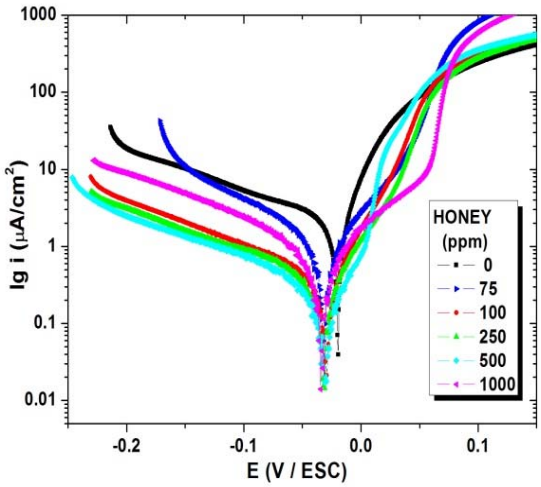

Figure 1.The polarization curves (Tafel curves) for bronze in $Na_2SO_4/NaHCO_3$ (pH 5) solution without and with various concentrations of honey

Table 1. Corrosion parameters obtained from the polarization curves

Concentration honey (ppm)	**E_{cor} (mV/ESC)**	**i_{cor} (μA/cm²)**	**V_{cor} (m²/an)**	**$\|\beta_c\|$ (mV/dec)**	**β_a (mV)**	**IE (%)**
0	-19.62	2.88	0.75	384.39	36.41	-
75	-29.02	0.41	0.11	174.62	41.79	85.76
100	-33.58	0.39	0.10	217.14	114.72	86.45
250	-30.41	0.34	0.89	126.95	63.82	88.19
500	-30.26	0.30	0.79	165.69	59.03	89.58
1000	-31.83	0.52	0.13	244.56	62.08	81.94

Electrochemical impedance spectroscopy

The corrosion behavior of bronze after 1 h immersion in the corrosive solutions without and with various concentrations of honey was further investigated by electro-chemical impedance spectroscopy (EIS). The measurements were conducted at the opencircuit potentials and the obtained Nyquistdiagram are depicted in Figure 2.

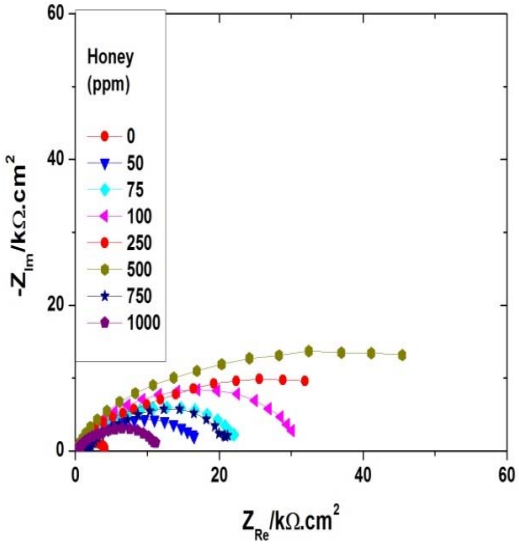

Figure 2. Nyquist impedance diagram of bronze electrode in Na_2SO_4/$NaHCO_3$ (pH 5) solution without and with various concentrations of honey.

Bronze impedance response was changed after the addition of honey in the corrosive solution; a significant increase of the impedance values at the lowest frequency (polarization resistance) could be observed in the presence of honey.

Table 2. Polarization resistance corresponding to bronze corrosion in Na_2SO_4/$NaHCO_3$ (pH 5) solution obtained in the absence and in the presence of various concentrations of honey determined from the impedance diagram

Concentration of honey (ppm)	**Rp (kΩcm^2)**	**IE (%)**
0	4.16	-
25	7.8	46.62
50	22.8	81.74
75	30.00	86.12
100	34.00	87.75
250	44.00	90.53
500	61.20	93.19
750	24.80	83.21
1000	12.50	66.69

The data in Table 2 show that the polarization resistances are relatively high in the presence of honey and their values increase with increasing honey concentration, which suggests that the layer covering the bronzesurface in the presence of honey is more protective than in its absence.The values of Rp and inhibition efficiency increase when honey was added to the blank solution, indicating a marked anticorrosion effect of this natural compound on bronze dissolution.This effect is enhanced upon increasing the honey concentration, suggesting that the protective effect of the inhibitors is due most likely to decreases of the surface area in contact with the corrosive solution. The highest inhibition efficiency of honey reaches the value of 93.19%, at a concentration of 500 ppm. Further increase in honey concentration leads to a slight decrease of IE values, in agreement with the results from measurements of polarization and could be a consequence of damage or dissolution of the layer adsorbed on the surface of bronze.

CONCLUSIONS

In this work, the anticorrosive proprieties of the natural honey were investigated in a solution containing Na_2SO_4 and $NaHCO_3$ (pH = 5) simulating acid rain in urban areas, by electrochemical methods. The preliminary results showed that honey is afairly efficient inhibitor towards bronze corrosion in weak acidic solution. In the investigated experimental conditions, the inhibition efficiency of honey increases with increasing its concentrations in the corrosive solution up to the optimum value of 500 ppm. An adherent layer of organic molecules adsorbed on bronze surface is responsible for the protective effect of the investigated compound.

Concluding it could be assessed that the environmentally friendly properties of honey and its low price make it a suitable candidate to be used in practice, replacing some toxic inhibitors, in accordance with the new ecological policies for the use of chemicals.

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"RECYCLING" OF RAW MATERIALS 1500 YEARS BC

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Abstract

The aim of this article is to present the research, which identified the prehistoric human's relation to the natural resources that can be used repeatedly. For thousands of years human have been learning how to rationally manage nature reserves. The most interesting evidence of the prehistoric "recycling" is clay tablets with Linear B writing which were used in the administrative centre of one of Europe's oldest civilizations – Mycenaean. It had been developed from about the seventeenth to twelfth century BC in the area of Greece. Clay tablets were not only made of a material that was used again, but they also contained inscriptions showing that Mycenaeans would mend and use again several of metal elements. "Recycling" could be used for the same reason for which we do it today as well – for the reasonable management of scarce non-renewable resources.

Key words*: recycling, Mycenaean culture, metals, Linear B.*

INTRODUCTION

The raw materials were in use by humanity from the beginning of civilization. The greatest proof is us the Mycenaeans'products: linguistic data (Linear B script) and archaeological finds collected in Greece and in Crete.
Useful materials for Mycenaean society were copper, tin (ingredients of bronze), gold, lead and silver.
Workers were making various of gold, bronze and silver vessels, bronze elements of armour, bronze weapons with gold decoration, furniture with silver and gold elements, metal tools, gold and silver jewellery (Dialismas, 2001; Chadwick et al., 1973; Gillis, 1997).
Researches on the Linear B script have shown inscriptions with old and new elements of metal objects (Chadwick et al., 1973; Bennett, 1955; Killen, 1999).
Tablets with Linear B writing survived accidentally. They were made of clay, the wealth of Greece, dried on the sun and stored in archive for one year. After this time, scribes wet tablets and used them again (Kaczmarek, 2002). The Mycenaean repair workshops are also known from archaeological evidence (Giardino et al., 2008).
The majority of scholars is interested in methods of production, kinds of raw materials used by the Mycenaeans and their importation from Mediterranean basin, workshops and tools for working with metals.
This research focuses on the approach of prehistoric man to the re-use of non-renewable natural resources.

MATERIALS AND METHODS

Data analyzed in this study were: clay tablets from Pylos (Sh, Ja, Jo, Jn series; Ta 641) dated between 15th and 12th century BC (Duhoux et al., 2008) and artifacts from Vivara port (Giardino et al., 2008).
The linguistic method was used to compare data gathered from the different inscriptions.

RESULTS AND DISCUSSIONS

Linguistic analysis has shown that tablet series Ja, Jo and Jn from Pylos have inscriptions about metals: bronze (Ja and Jn) and gold (Jo) as a raw material (Figure 1 and 2). It is visible on tablet Ja 1288 (Figure 3):
ka-ra-wi-so AES M 4 N 1 P 6 (probably man's name)+(ideogram of bronze) +

(weight measurements) (Raymoure, 2012).
If the bronze is specified by the weight measurement, it is actually in the simple form before melting with fire on the first step of production.
Pylos's tablet Ta 641 (Figure 1) includes ideograms of vessels, their names and number of handles.

The first verse says that tripod cauldron with one leg and other, with one leg "burnt away".
We know from archaeological excavations that this type of vessel was made of metal, usually from bronze. It shows that one leg in both of cauldrons was broken, so scribes placed them on tablets in order to be repaired by bronze workers.

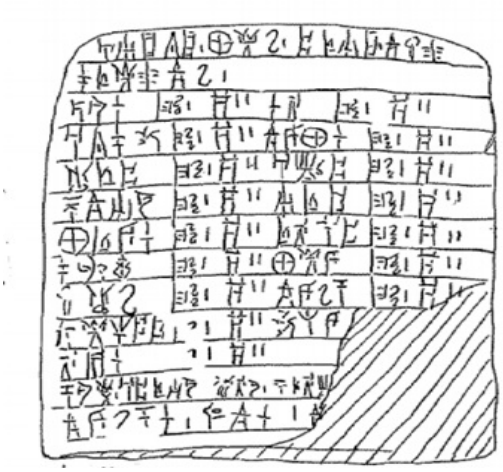

Figure 1. Tablet PY Jn 450

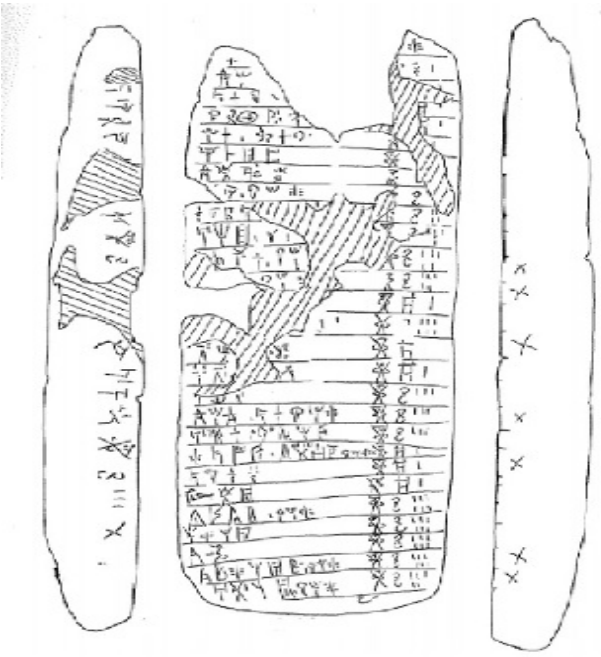

Figure 2. Tablet PY Jo 438

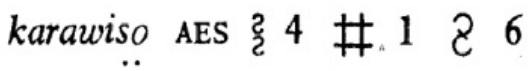

Figure 3. Inscription from PY Ja 1288

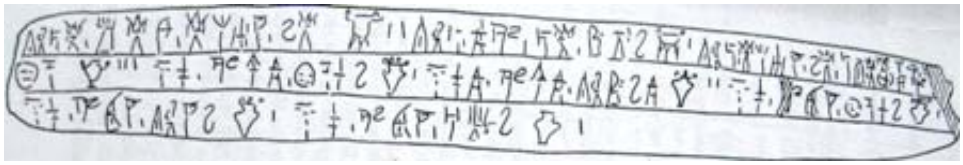

Figure 4. Tablet PY Ta 641

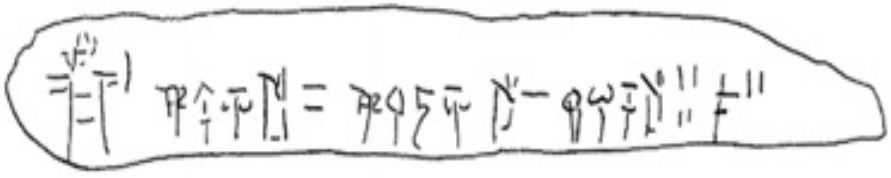

Figure 5. Tablet PY Sh 733

Inscription has also words: **me-zo-e**, which means: "old" and **me-wi-jo**, which means "new", to describe vessels (Bennett, 1955).

Probably these syllabograms are connected with the repair of metal vases. The old one was either divided into parts and components were

used for a new cauldron or it was intended to melting. Unfortunately, the inscriptions do not specify, if vessels are made from metal, or not.
Inscriptions from Sh series found in Pylos include components of the armour. For example, Sh 733 (Figure 2):

ARM 1 me-zo-a O 20 me-u-jo-a O 10 ko-ru-to O 4 PA 2

(armour) + (old) + (probably *o-pa-wo-ta* - elements) + (new) + (helmet) + (probably pa-ra-jo – old) (Killen, 1999).

Inscriptions show that one armour was made of old and new elements.
It is necessary to mention that the armour was made by sewing either metal badges on the leather/cloth or it was made from metal bands. It makes sense, only if old armours were mended. Old and damaged bronze badges were replaced with new ones.
Archaeological researches on Vivara's port led to the discovery of a metal workshop connected with proto-Mycenaeans.
Vivara is an island in the area of Northern Tyrrhenian Sea, full of various metal sources. The Mycenaean artifacts from this island are one of earliest evidence of traces between The West of Aegean and The Helladic world. It is known due to the chemical and physical analysis of ceramics found in Vivara.
Metallurgical activity included metalworking and melting. It is proven by drops of melted copper, copper ore and slag.
From the other side, evidence for "recycling" of metals is some of scrap elements. We can also see the repair of weapons in the rivets of the hilt and in grindstones, due to marks made by blades in sharpening (Giardino et al., 2008).

CONCLUSIONS

Clay tablets with Linear B inscriptions are indisputable evidence for "recycling" raw materials in prehistoric period.
Mycenaean society used clay as a renewable material in order to form tablets and would destroy them after one year to have substance for the next item.
Furthermore, inscriptions of Linear B writing, used in Bronze Age Greece, proved that many metal objects were repaired or melted by workers and used again.

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PRELIMINARY INVESTIGATIONS ON THE USE OF ELECTROCOAGULATION FOR HEAVY METALS REMOVAL FROM METAL PLATING WASTERWATER

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Abstract

The aims of the present paper was to investigate the possibility of using the electrocoagulation method (EC) for the removal of Ni2+ and Cr3+ ions from the wastewaters generated at an electroplating plant from Transylvania area. In the investigated wastewater samples, the concentration of Ni2+ and Cr3+ significantly exceeds the maximum consent limits established by Romanian Standard NTPA001/2002. The influence of the varying operating parameters, such as the applied current intensity (4,5 and 6 A), electrode material (Fe and Al) and the contact time (10 to 60 minutes) on the heavy metals removal was investigated. The results showed that the removal of the metals from electroplating wastewaters solution increases with increasing current density and operating time. Using iron electrodes, over 99.64% of nickel and 99.39% of chromium ions were removed efficiently by conducting the EC treatment at current intensity of 5A, pH of 8.09 and EC time of 60 min. By using aluminium electrodes, the removal efficiency of Ni2+ was 98.21%, at pH 6.02, a current intensity of 5A and an operation time of 60 min.

Key words: *electrocoagulation, chemical precipitation, iron electrodes, aluminium electrodes, removal efficiency.*

INTRODUCTION

Metal plating industry is one of the major chemical processes that discard large amounts of wastewaters that contain various types of harmful heavy metals such as chromium, nickel, copper, zinc (Al-Shannag et al., 2014). The most used methods for the treatment of metals polluted wastewater are precipitation and coagulation followed by the time-consuming sedimentation (Heidmann and Calmano, 2007). Various other methods based on physical, chemical and biological processes including adsorption, ion-exchange, reverse osmosis, filtration are also employed in the wastewaters treatment (Al-Shannag et al., 2014).

Precipitation of heavy metals in an insoluble form of hydroxides is the most economical method to treat the wastewaters containing heavy metals. It consists in the adjustment of the pH of wastewater and the addition of chemical coagulants, like aluminium or iron salts to remove pollutants as colloidal matter (Ferreira et al., 2013). Although the chemical coagulation technique is considered to be effective in treating industrial wastewater effluents, it has quite high cost. On the other hand, the addition of chemical coagulants to the wastewater may produce side-products that are considered as secondary pollutants (Al-Shannag et al., 2014). A variation of this method developed in the last years is electrocoagulation (EC) using iron or aluminium electrodes (Ferreira et al., 2013). During the electrocoagulation process, wastewater is subjected to a direct electrical field through sacrificial electrodes that are generally made of iron or aluminium. According to B. Al Aji et al (Al Aji et al., 2012) a range of coagulant species and hydroxides are formed which destabilize and coagulate the suspended particles or precipitate and adsorb dissolved contaminants. It is generally accepted that the EC process involves three successive stages (Al Aji et al., 2012) :

(1) Formation of coagulants by electrolytic oxidation of the electrode. The main reaction occurring at the metal anode is dissolution:

$M(s) \rightarrow M(aq)^{n+} + ne^-$

Additionally, water electrolysis occurs at the cathode and anode:
$2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-$ (cathodic reaction)

2H2O(l) → 4H+ (aq) + O2(g) + 4e- (anodic reaction)

(2) Destabilization of the contaminants, particulate suspension, and breaking of emulsions.
A direct electrochemical reduction of metal cations (Mn+) may occur at the cathode surface:
Mn+ + ne- → nM0

Furthermore, the hydroxide ions formed at the cathode increase the pH of the wastewater thereby inducing precipitation of metal ions as corresponding hydroxides and co-precipitation with hydroxides:
Mn+ + nOH- → M(OH)n(s)

(3) Aggregation of the destabilized phases to form flocs.
Electrocoagulation has been successfully applied for the removal of various heavy metal ions, like Ni(II), Cr(VI), Cu (II) from industrial or synthetic wastewaters.
Electrocoagulation process have advantages and disadvantages. In an electrocoagulation process, no addition of chemicals is necessarily needed. The volume of sludge produced by EC is smaller compared to that produced in classical chemical process and it can be easily removed by decantation. A major disadvantage of EC process is that the 'sacrificial electrodes' are dissolved into wastewater streams as a result of oxidation and need to be replaced periodically. Other disadvantages: the use of electricity may be expensive in many places, an impermeable oxide film may be formed on the cathode leading to loss of efficiency of the EC unit, and high conductivity of the wastewater suspension is required.
In present paper, it was aimed to remove Ni and Cr ions from metal plating wastewater through electrocoagulation. The impact of EC time, direct current intensity, pH and electrical conductivity on Ni and Cr ions removal by electrocoagulation was investigated.

MATERIAL AND METHODS

Wastewater composition

The studied wastewater was provided by a metal plating station from Transylvania. The pH and electrical conductivity of the wastewater were measured using a pH-meter (Hanna instruments) and a Cond 315i conductivity-meter (Hanna instruments), respectively. Chemical composition of the wastewater samples was determined in laboratory by X-ray fluorescence spectrometry (XRF) using a Quant'X ARL spectrometer (Thermo Scientific, USA).
Electrocoagulation experiments
For EC experiments, a system formed by 4 electrodes connected at a power source was used. For this process, were used iron electrodes and aluminium electrodes,
respectively. The iron (97mm x 30mm x 4mm) and aluminium (98mm x30 mm x 1,5 mm) electrodes were weigh before and after each experiment. They were vertically positioned in a Berzelius flask filled with 400 ml wastewater, in a parallel arrangement. A saturated calomel electrode was used as reference electrode. A magnetic stirrer with speed rotation 200-300 rpm was also used. The total effective surface area of electrodes immersed in wastewater was around 76.8 cm2 for iron electrodes and 99.2 cm2 for aluminium electrodes. This system was connected at a power supply providing voltage and electrical current in range of 10 pA to 600 mA , Gill AC Serial Instruments. Current densities used for EC treatment using aluminium electrodes were: 3.7 A/dm2 (at 4A), 5 A/dm2 (at 5A) and 5.6 A/dm2 (at 6A), while the current density used the iron electrodes was 6.5 A/dm2 (at 5A).

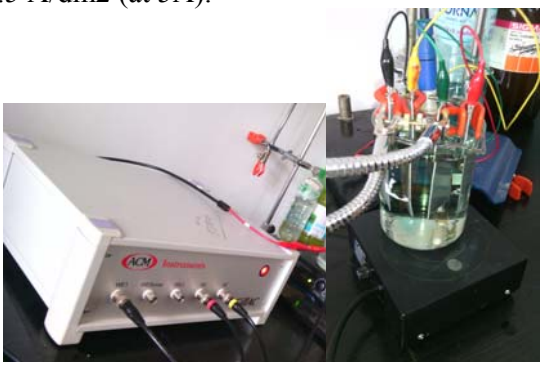

Figure 1. Electrocoagulation experimental set-up

The heavy metal ions removal was measured in terms of percent removal efficiency defined as:

$$RE(\%) = 100 * \frac{C_0 - C}{C_0} \%$$

where C0 and C are the concentrations of metals in the original wastewater sample and in the treated one at the given EC time (t), respectively.

Table 1. Average chemical composition and physicochemical parameters of plating wastewater sample

Parameter	Wastewater	Maximum consent limits*
pH	3.08	6.5 - 8.5
Ni (ppm)	280	1
Cr^{3+} (ppm)	165	1
Fe (ppm)	12	5
Ca (ppm)	82	300
Conductivity (mS cm^{-1})	2.73	

*According to Romanian Standard NTPA 001/2002.[5]

Samples of wastewater (10 ml) were taken during EC process at specified times, filtered through filter paper and then analysed by X-Ray Fluorescence (XRF).

RESULTS AND DISCUSSIONS

Characterisation of plating wastewater samples

The physical and chemical characteristics of the metal plating wastewater used in this study are listed in Table 1.

As it can be seen in Table 1, the plating wastewater is acidic (pH =3.08), present a high conductivity and contains various heavy metal ions (Ni, Cr and Fe). The concentrations of nickel and chromium in the plating wastewater exceed more than 165 to 280 times the maximum consent limits established by Romanian Standard NTPA001/2002.

Electrocoagulation

It is well-known that EC process is affected by several operating parameters, such current intensity, the nature of the electrodes, pH and the operating time. In this study, these parameters were explored in order to evaluate a treatment technology for Ni2+ and Cr3+ removal from the real wastewater.

In the first stage, experimental studies were carried out using iron electrodes at 5 A the different operating times between 10 to 60 minutes, at the original pH (3.08) of the wastewater. The variation of the residual metals concentration and the removal efficiency values during EC time are presented in Figure 2.

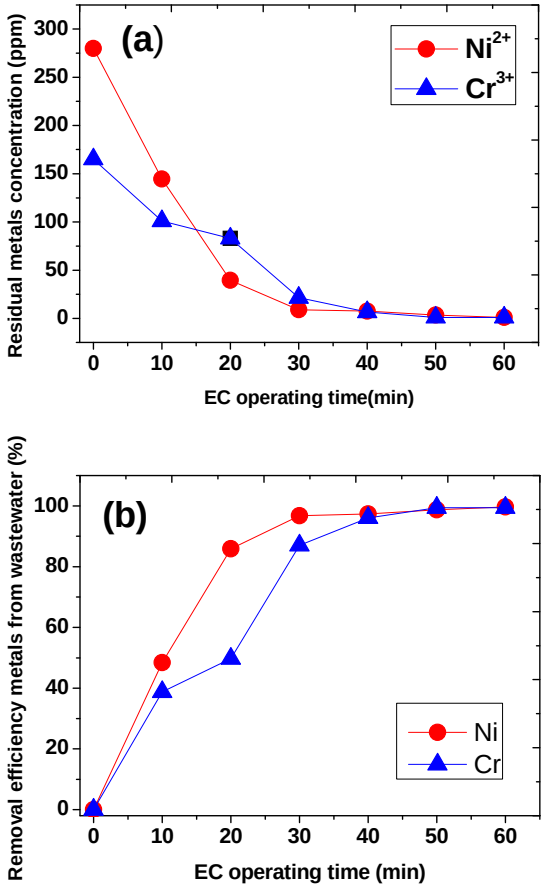

Figure. 2. The variation of residual metals concentration (a) and of the removal efficiency values (b) during EC time; iron electrodes, I=5A (i=6.5 A/dm^2).

It is depicted in Figure 2 that there is a dramatic reduction in the heavy metal ion concentrations within the first 30 min. For example, after 20

min of EC treatment, the Ni2+ ion concentration decreased from an initial concentration of 280 to 39,5 ppm and Cr3+ ion concentration decreased from initial concentration 165 to 83 ppm. Although, in investigated experimental conditions, the metals concentration exceeds 39.5 times for Ni2+ and 83 times for Cr3+ the maximum admissible limit according with NTPA001, the removal efficiency for both metals is significant. The concentration reduction was enhanced by increasing the EC time above 30 min. In the investigated experimental conditions, in the first 10 minutes of electrocoagulation, the removal efficiencies values for Ni2+ and Cr3+ are 48,39% and 38,78%, respectively. However, the RE values progressively increase during the increases of EC operating time and attain the maximum values of 99,64% for Ni2+ and 99,39% for Cr3+.

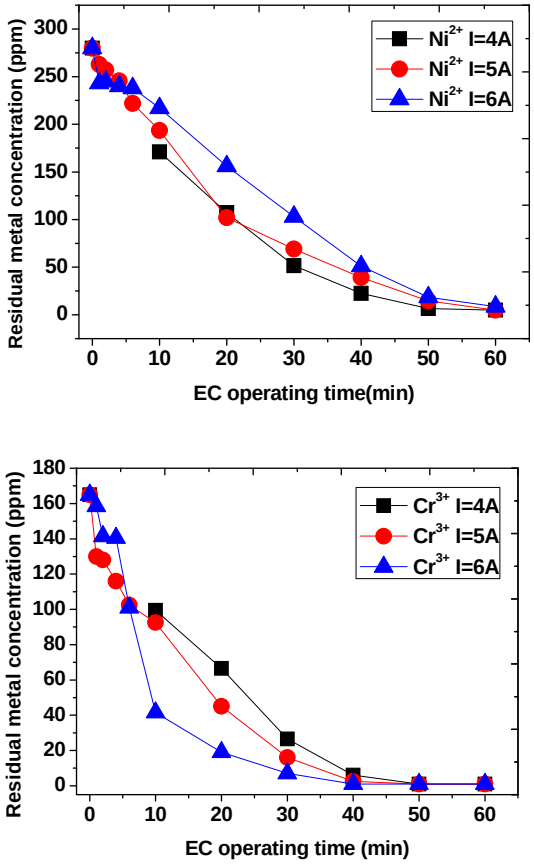

Figure. 3. The variation of residual metals concentration during EC time using aluminium electrodes at various current intensities (4-6 A).

In the second stage, electrodes made of aluminium were used in the EC experiments. Figure 3 presents the residual metals concentration and the removal efficiency values during EC time, at various current intensities(4-6A).

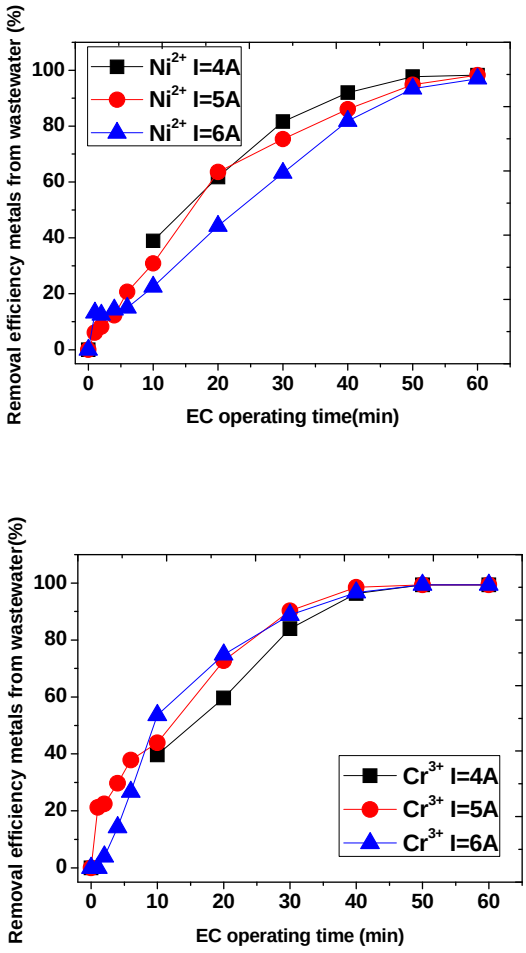

Figure. 4. The variation the removal efficiency values during EC time using aluminium electrodes at various current intensities.

Figure 3 clearly shows that aluminium electrodes are more effective in the reducing of the metal ions concentration from the plating wastewater. The decrease of metals concentrations is inversely with increasing EC operating time.

EC treatment at 4A illustrated in Figure 3 shows an obvious decreasing metal ions conc. during EC operating time. After 40 minutes of EC process, Ni2+ conc. decreased from initial conc. 280 ppm to 22.5 ppm and Cr3+ from 165

ppm to 1 ppm. After 40 minutes, the removal efficiency value for Ni2+ is 91.96% and for Cr3+ is 96.36%. The EC treatment had a progressive increasing of removal efficiency, it was reached the maximum values of 98.21% for Ni2+ and 99.39% for Cr3+, after 60 minutes.

During EC experiment at 5A, Ni2+ and Cr3+ ions concentration had a gradual decrease.

After 20 min of EC treatment, at current intensity 5A, the Ni2+ ion concentration decreased from an initial concentration of 280 to 102 ppm, and Cr3+ decreased from 165 to 45 ppm. However, in these investigated conditions, the Ni2+ concentration exceeds 102 times the maximum admissible limit while the Cr3+ concentration is 45 times higher than the limits imposed by NTPA001/2002. After the first 20 minutes, the values of the removal efficiency for Ni2+ is 63,57% and for Cr3+ is 72,72%. As the electrocoagulation process progress, the RE values progressively increasing to maximum values of 98,21% for Ni2+ and 99,39% for Cr3+, respectively.

The EC process done at 6A, show significant variation for Cr3+ ions concentration. In first 10 minutes of EC treatment, Cr3+ have a dramatic decrease from initial conc. 165 ppm to 41.5 ppm, removal efficiency value being at this point 53.63%. This value of Cr3+ concentration is 41.5 times higher than the maximum consent admissible, according with NTPA001. Forward, the Cr3+ conc. is decreasing progressively, reaching the maximum limit, 1 ppm and removal efficiency is increasing to 99.39%. The Ni2+ conc. have a constant decreasing from initial conc. 280 ppm to 8.5 ppm, removal efficiency being 96.96%, after 60 minutes of EC treatment.

As it could be seen in Figures. 2(a) and 2(b), the concentration of Ni2+ decreased from 280 ppm to 1 ppm, while the concentration of Cr decreases from 165 ppm to 1 ppm, after 60 minutes of electrocoagulation disregarding the value of the applied current intensity.

Using aluminium electrodes, the removal efficiency for Ni^{2+} ions was 98.21 % at a solution pH of 6.02, conductivity of 2.358 mS, current intensity 5A ($i = 5$ A/dm^2) for 60 min, but the nickel concentration is 5 times higher than the maximum consent limit (1 ppm) (Figure 4). On the other hand, EC treatment with iron electrodes had better results, at the same current intensity (5A) for 60 minutes and the maximum consent limit were reached for both metal ions.

It is obvious from Figure 3 that EC treatment on metal plating wastewater achieved high removal efficiency for both heavy metals from the electroplating wastewater. By increasing the applied current and operating time, the residual concentrations of the heavy metals significantly decreases, in some cases below the maximum consent limits established by NTPA001/2002. In order to maximize the removal efficiency in the operating conditions of this study, the current intensity must higher than 4A ($i > 3.7$ A/dm^2) and EC treatment time should be in the range of 30-60 minutes.

Figure 5. Sludge resulted from EC with iron electrodes (right) and aluminium electrodes (left).

An end-use of resulted sludge from EC process (Figure 5) must by sustainable to reduce the negative impact over the environment. However, sludge management and reuse became an interesting area for many researchers in the last few years, especially when the sludge contains economic compounds like metallic hydroxides as in present study (Al-Shannag et al., 2014).

CONCLUSIONS

This study aimed at analysing the potential of electrocoagulation process for the removal of Ni2+ and Cr3+ ions from the wastewaters generated at a metal plating station from Transylvania. An electro-reactor was used with four iron or aluminium electrodes in a monopolar configuration. Two of the electrodes were designated as cathodes meanwhile the other two as anodes. The results showed that the removal efficiency of heavy metal ions

increases with increasing both electrocoagulation (EC) operating time and the applied current. In the investigated experimental conditions, disregarding the nature of the used electrodes, over 98% of nickel and chromium were removed by conducting the EC treatment during 60 minutes at 5A, especially in the case of aluminium electrodes.

In conclusion, the electrocoagulation process is an efficient treatment method for the removal of heavy metal ions from real metal plating wastewater. Since the existing literature concerning the removal of toxic metals from real industrial wastewaters by electrocoagulation is quite limited and thus this research field requires further investigations.

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THE STUDY OF DISPERSION OF DUST PARTICLES FROM THE PONDS OF THE POWER PLANT PAROSENI

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Abstract

One of the sources of pollution in the Jiu Valley is the Thermal Power Plant Paroseni by the gas emissions and by storing carbon and ash resulting from the technological process in ash and slag deposits. Thermal Power Plant Paroseni has large areas of ponds decommissioned and not reentered in natural cycles, and significant quantities of powders pollutants are transported by wind. The purpose of this paper is to identify areas with high dust pollution through the study of dispersion from the slag and ash ponds of the Thermal Power Plant of Paroseni.

***Key words**:pollutants, dispersion, powders*

INTRODUCTION

Jiu Valley is characterized by a mountain climate with average temperatures range from – 5° C to +6° C in winter, and +18° C to +28° C in the summer months. Due to depression location are occurring thermal inversions, and reduced movements of air masses create favorable conditions for stagnation of masses at low height above the ground. Relative air humidity, the monthly averages are higher in winter (84-88%) and lower in the summer (62-70%). Wind is having the NS direction - direction to Jiu Valley - especially predominant in the southern sector (11%) and on the NW with a frequency of occurrence of 5.1%, calm atmosphere, in all cases analyzed, has a frequency of 69, 9%. The EV transverse direction is almost zero wind speed frequency. Affected by wind speed values were lower due to the effect of specific housing depressions; prevailing winds are from the south and north.

Central Power Plant Paroseni is situated on the lower terrace of the right side of the river Jiu in proximity to Vulcan city, 8-10 m from the railway Vulcan - Paroseni - Lupeni. This site was determined by the existence of numerous coal extractions in the area (Figure 1). It is located on the national road DN 66 A, which connects Craiova and Targu Jiu.

Neighborhood: North - Railway Livezeni - Lupeni, South - DN 66 A, East - Mining Exploitation access road Paroseni, West - Jiu River.

Thermal Power Plant Paroseni is a cogeneration power plant supplying heat and power production. Works with coal as fuel base and provide heat for the residents of the 4 mining towns in the area: Petrosani, Vulcan, Lupeni, Aninoasa.

Slag and ash deposits of the power plant Paroseni are having as surface area 56 ha:

- Ash and slag deposit for case of accidents (S = 10 ha)
- Deposit Valley Caprisoara (S = 46 ha)

Radon deposits (S = 10 ha), Ijak (S = 8 ha) and Feres (S = 10 ha) are reentered in natural circuit and covered with grass.

Paroseni Thermal Power Plant is evacuating hydraulically the ash and slag discharged from the combustion of coal in to the slag and ash deposit Caprisoara Valley. In case of accidents, slag and ash is deposited in the special deposit for cases of crash. The ratio of the water / ash is about 10: 1. Slag and ash deposit Caprisoara Valley is a valley deposit consisting of two deposits, located at 1.5 km from the Power and Thermal Plant. It occupies an area of 46 ha, with a total capacity of 5320000 m3.

Slag and ash deposition is made by levels, consisting from raised slats performed

successively in different compartments of the deposit. Water from ash and slag transport is recycled to the Power Thermal Plant by pumping.
To avoid dissipation of ash from deposits is used a water network in order to spray the deposits.

POLLUTING AGENTS

For the production of the electricity, the thermal power plants are using a source of primary energy - solid fuels. Chemical elements in contact with oxygen that produce heat (exothermic reactions) are: the carbon, hydrogen and sulfur. The final products resulting from the combustion are: carbon dioxide, water and sulfur dioxide.
Solid fuels, in addition to fuel, contain more sterile, which will be found after the combustion process in the form of slag and ash.
All products resulting from the combustion of solid are pollutants in the sense that they are changing the balance of the external environment or act directly on the animals and plants.
The main pollutants from power plants that are emitted by the chimney are: sulfur oxides (SO2 and SO3), nitrogen oxides (NO and NO2), carbon monoxide and carbon dioxide (CO and CO2), dust (fly ash particles unburned coal, clay, earth) and in smaller quantities: tars, hydrocarbons, soot, sulfates, organic acids, etc.
All the usual fuels (coal, coke, fuel oil) contain ash from non-combustible solid substances.
Thermal Power Plants are located near water sources such as rivers. The water used for cooling is reintroduced into the river at a temperature higher than that at which it was captured from the river. Therefore, power plants contribute to increasing water temperatures in the river, with all the negative effects for river ecosystem.
Slag and ash from Thermal Power Plant Paroseni has the following composition: 47.68% - silicon dioxide (SiO2), 22.16% - aluminum oxide (Al2O3) 9.44% - iron oxide (Fe2O3) 5.38% - calcium oxide (CaO) 2.28% - magnesium oxide (MgO) 0.64% - sodium oxide (Na2O) 1.08% - potassium oxide (K2O) and 10.78% of other elements.

THE EFFECTS OF PARTICLES AIR POLLUTION ON THE ENVIRONMENT

In the interrelationships between man and his ambient environment, the last one exerts multiple influences on man, one of the most important is the effect on health.
Pollutant environmental action on the human body is very diverse and complex. It can start from simple discomfort to human activity, so-called discomfort, to strong disturbances of health.
The direct influence of air pollution on human health consists from body changes that occur in people exposed as a result of their contact with various air pollutants. In most cases, the direct action of air pollution is the result of interaction of several pollutants simultaneously present in the atmosphere and only rarely action of a single pollutant.
Air pollution dust could cause serious damage to the human body. Powders are irritant pollutants, fibrosis, and allergy.
Affections that can cause air pollution with dust on the human body are inflammations, rhinitis, pharyngitis, laryngitis, and bronchitis. If action is long lasting pollutant may occur chronic diseases.
In addition to the affections listed above, powders, especially those with large density persist in the lung, lung elasticity is decreasing as foreign body reaction with formation of new tissue around, all that being causes of fibrosis.
Organic or mineral powders as gases (nitrogen oxides, sulfur, carbon) or volatile substances from insecticides, detergents, plastics, drugs, may cause acute rhinitis, asthma or ocular problems (ex.: conjunctivitis) or skin problems (eczema, hives, etc.)
On vegetation, dust particles are deposited on their leaves preventing normal development. Depending on the thickness of particles deposited on, plants can even lead to death.

EXPERIMENTAL DETERMINATION

To identify possible polluted areas with high particles from settling ponds at Thermal Power Plant Paroseni was used Meti-Lis software release 2.03.
Meti-Lis 2.03 software allows us to determine how the dispersion of certain pollutants from

human activities, taking into account the emission rate and other terms of issue such as location, the amount of pollutant, temperature and meteorological factors every hour or during the mediation.

Studies have been conducted on average values of the month of September 2014. For the study we used the following climatic data:

- The average monthly temperature – +10°C,
- Average monthly wind speed - 10 m/s
- Wind direction - NE.

Possible dispersion of powders obtained for the deposit Caprisoara, which belongs to Thermal Power Plant Paroseni is shown in Figure 1.

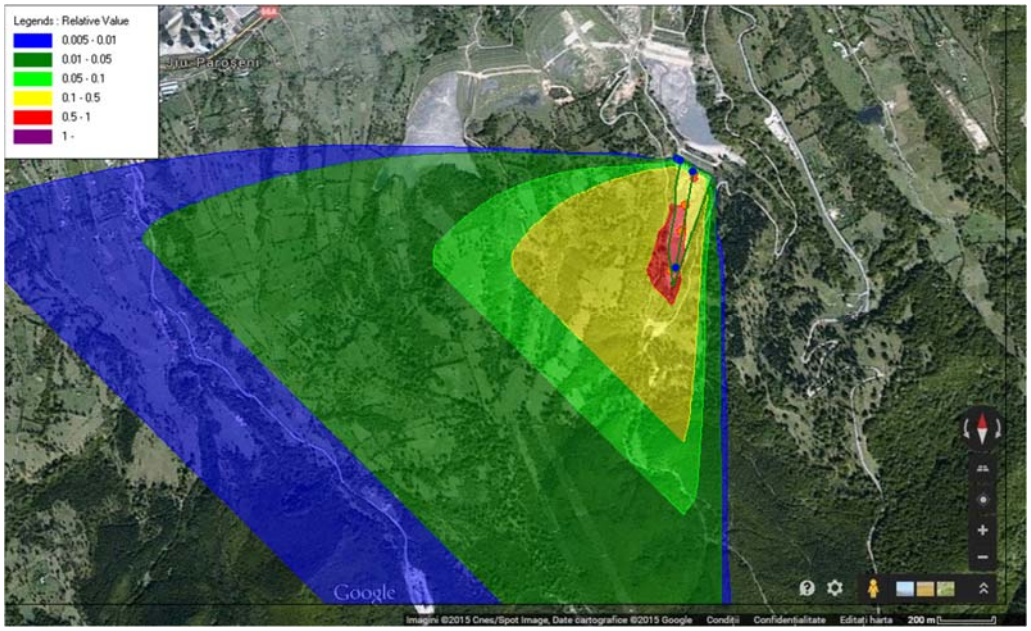

Figure 1. Wind dispersion of dust powders driven from the inactive lake Caprisoara

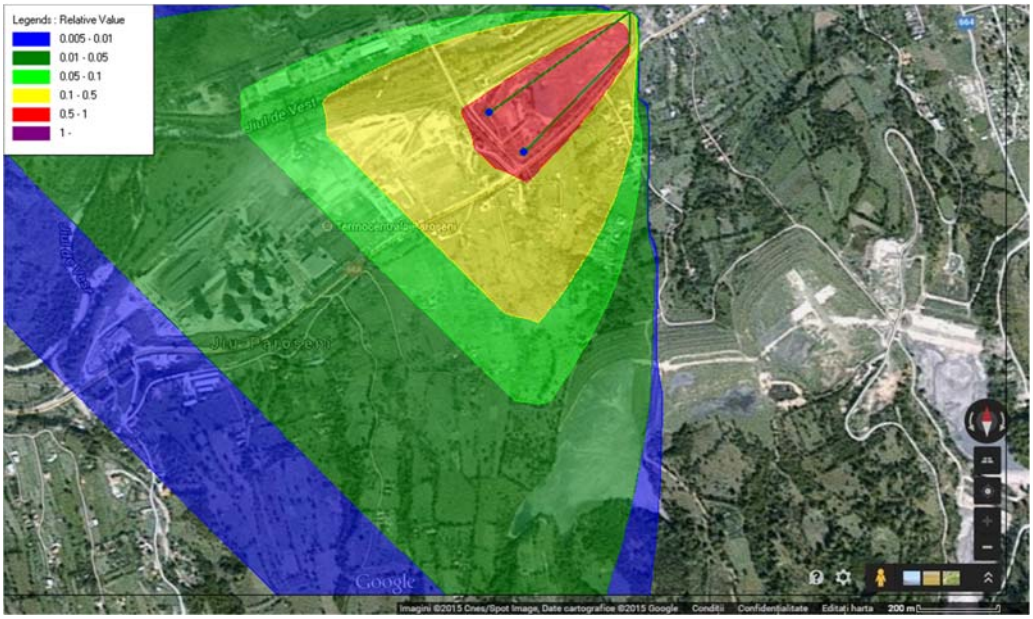

Figure 2. Wind dispersion of dust powders driven from the emergency lake deposit

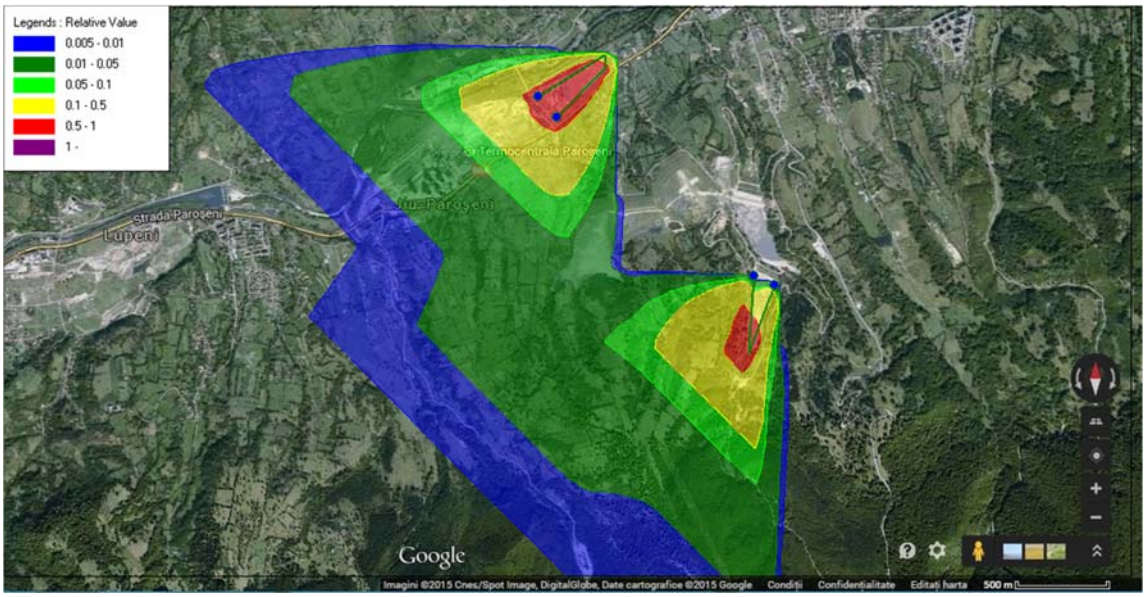

Figure 3. Wind dispersion of dust powders driven from the emergency lake deposit and from the inactive lake Caprisoara

The analysis was done for areas where ash and slag deposition ceased and for emergency deposit. The rest of the currently active surface of the deposits does not raise problems relating to entrainment of air dust particles as they are covered with water.

From the analysis of dispersion maps we can see that the dust raised from the lake Caprisoara is transported by air currents toward Valcan massif, only a small part of them reaching the habited vicinity of the Thermal Power Plant Paroseni.

In case of emergency lake deposit, wind-blown dust from its surface affects residential areas near the Thermal Power Plant Paroseni (Figure 2).

As a result of the dispersion of particles carried by wind from the slag and ash ponds lead to air pollution. Non-reduction of pollution cause serious damage to environmental factors, with greater impact on vegetation because of the way of dispersion of pollutants.

CONCLUSIONS

One of the main air pollutants produced by Thermal Power Plant Paroseni is solid particle pollution (dust).

From the lake surface of slag and ash, wind train large amounts of dust that is dispersed on the surrounding areas.

Dispersion of pollutants raised from the slag and ash ponds from Thermal Power Plant Paroseni is performed in the NE direction – to Massif Valcan, not affecting large habited areas.

Emergency lake is affecting in the highest proportion habited area near the Thermal Power Plant Paroseni.

To reduce particle pollution, redevelopment measures of the deposit are necessary to reintroduce these surfaces in natural circuit.

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SECTION 02
SUSTAINABLE DEVELOPMENT OF RURAL AREA

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SOME TECHNICAL SOLLUTIONS FOR A ROAD CONSOLIDATION AFFECTED BY LANDSLIDES

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Abstract

The paper presentssome technical solutions for the rehabilitation and modernization of a road sector, located at approx. 500m from the intersection with Marina, opposite the house no. 24 and 26, respectively P27- P27 + 60m, P28- P28 + 5m, Arges County.Crack length, measured along the road, is of approx. 18m.This area has been recently affected by landslides, which resulted in damage to the roadway, including putting difficulties into traffic.A consolidation path solution was established according to the recommendations of technical expertise and geotechnical studies. All these aspects are being achieved through: culverts drainage works controlled by collectors; civil engineering works and restoration of the road embankment.

Key words: *landslides, rehabilitation, road*

INTRODUCTION

The paper presents some general aspects concerning the technical solutions for the rehabilitation and modernization of a road sector from Arges County. The beneficiary - municipality of Curtea de Arges, have required technical documentation during PE, DE phase for "Road rehabilitation, consolidation and modernizing, Corbenilor Street to approx. 500 m with Marina Street, Argeş County" (Figure 1).

Figure 1. Corbenilor Street, map view

The area affected by landslides is approx. 500 m from the intersection with Marina Street, opposite the houses no. 24-26, respectively P27-, P27+ 50M, P28-, P28+5 m.

The crack length, measured along the road, is approx. 18m (Figure 2).

The vertical gap of fallen compartment towards Silistea Valley, it is approx. 0.5 cm downstream and approx. 13cm upstream.

Figure 2. View of the crack length on the road

MATERIALS AND METHODS

As a result of landslides, the roadway presents the following damages: longitudinal and transversal cracks and crevices, holes in the asphalt; slides and detachments of existing asphalt.

The causes that led to the degradation of the road structure have both immediate and long-term effect. They are listed below as follows:

1. Lack of a rainwater collecting culvert (Figure 3);
2. Uninsured drainage with influences over the road body;
3. Lack of the water drainage from the road body (Figure 4);
4. Lack of carrying capacity;
5. Lack of regular interventions to halt the progression of degradation (Figure 5);
6. The ageing of the asphalt structures;

Figure 3. Lack of a rainwater collecting culver

Figure 4. Lack of the water drainage from the road body

Figure 5. Lack of regular interventions to halt the progression of degradation

RESULTS AND DISCUSSIONS

There were established solutions for the implementation of the roadway rehabilitation measures, such as:

For the traffic safety:

- there will be installed on the retaining wall a an NI metal guardrail;
- it will be provided a proper road marking: pedestrian crossings, speed slowing systems where pedestrian traffic is intense;
- It was provided the achievement of signaling through horizontal and vertical road markings according to the rules imposed by standards.

In setting up the rehabilitation works it was taken into consideration the following:

- Importance of the road class;
- The possibility of execution in a timely manner;
- Adapting to the natural configuration of the land;
- Finding ways to remove water from the road;
- An easy and efficient execution that does not have a destructive impact on the environment;
- Static and mechanical resistance.

STAGES OF EXECUTION

Preparatory works:

- Marking the work area;
- Marking the field of utilities and possible obstacles;
- Drawing works;
- Supply of materials.

Excavation and transportation of debris in the road structure deposit:

- Execution gabion wall;
- Digging enclosure and gear twinning;
- Execution baskets gabion mattresses, including laying of geotextile;
- Execution baskets gabion mattresses;
- Execution of gabion baskets to wall, including the laying of geotextile;
- Execution of road embankment;
- Basic ground compaction laying geotextile;
- Making the stuffing compacted ballast in several layers of 15-20cm thickness after compaction, the laying of geogrid in 50 in 50cm (Figure 6);
- Protecting newly created vegetable earth embankment seeded.

Figure 6. Geogrids covered with ballast

Execution of water flow:

- Execution of excavations with support;
- Laying on the bottom layer of sand excavation;
- Laying steel pipe ø 355.6 x 7.9mm;
- Installation of PVC pipe ø 300 mm;
- Making the connection of pipes and manholes in the roadway ditch;
- Making compacted fill the trench to under-crossing with a grade of compaction of 98%.

In order to secure the road project is divided into 2 parts as follows:

Objective I - Road works and water drainage

The proposed works have as target to ensure monitored water drainage, both on the road platform and upstream area and water discharge downstream by making a tailboard.

The following works will be performed:

1. Demolition of the existing structure;
2. Roadway culvert (in order to eliminate the infiltrations from the road body and rainwater that moves erratically on the road surface) (Figure 7).

Figure 7. Roadway culvert

The water collected by the culvert will be drained into a manhole segment and discharged downstream by an under crossing.

Drainage in good conditions has a role in preventing degradation in the road structure. In this regard there will be made:

- New ditches, where they were missing;
- The design of tubular culverts at the entrances to properties;
- Replacing culverts where they are completely damaged;
- The design of road gutters at the intersection with side roads that have slopes towardcounty roadsin order to take over water and avoid spillage on the road surface;

3. Undercrossing

Objective II – Consolidation works

The proposed works aim the following:

- Consolidation of the road section affected by the landslide;
- Improving the bearing capacity of the land;
- Making a cross section with geometric elements that fits the legal requirements;
- Bringing the road width to the technical parameters suitable to the class importance, thus ensuring optimum safety in circulation.

This work aims to consolidate the road embankment by making a gabion wallon a length of 26m.

Objective III – road embankment restoration

Road embankment restorationconsists of ensuring the stability of the road platform maintaining the current width. Parallel with the gabion wall the road embankment will be restored too. The road embankment will be made of drainage material (ballast) reinforced with geogrid. The geogrid will be positioned from 50 to 50cm and will be anchored to the gabion wall.

MATERIALS USED IN THIS CASE

Water to Compact the Earthworks

It may come from the public network or from another source, but in this case it must meet the requirements of SR EN 1008/2003.

While using it on the site it will avoid the water to be polluted with detergents, organic matter, vegetable oils, clays etc.

Natural Aggregates

Ballast

For the embankment fillings it can be used river ballast as well. The granularity of the ballast can be between 6-61 mm, having an internal friction angle of 30 to 33 °.

The material supplying will be done from a single source. It is not accepted the presence of visible plant debris, wood pieces, organic matter, household waste.

Sand

The sand used for making the culvert and the protection pipe for the undercrossing will have to meet the requirements of STAS 662-2002.

They will be:

- The maximum size of grain, 7mm;
- The minimum size grain, 0.05mm;
- Organic matter coefficient <1%,;
- Non-uniformity coefficient> 7, STAS 7582-91.

The recommended works don't induce any negative effects on the environment, surface water, and noise level. It will be respected the current regulations regarding the execution of the works by signalling during the construction as well as final signalling.

Throughout the period of execution, it will be provided access to properties.

CONCLUSIONS

The road was in a deplorable state and because of this problem it could not be exploited in terms of road safety; therefore it was necessary to rehabilitate the affected section.

The rehabilitation was achieved by stripping processes, earthmoving, compaction, levelling and asphalting.

Following the above mentioned civil engineering works, the level of road safety has been increased significantly.

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SR EN 1008:2003 "Mixing water for concrete – Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete".

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THE DETERMINATION OF THE GEOMETRIC ELEMENTS FOR ZALĂU BYPASS

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Abstract

The paper is aimed to present the determination of road geometrical properties for the bypass of Zalău. The work is based on information provided by the Agency for Environmental Protection Zalău. The main characteristics determined in the paper are the length of alignments and the ray of circular and progressive curves. The importances of this work are the current conditions, mentioned in the paper such as high vibration and air pollution.

Key words*: road plane, bypass Zalău, progressive curves, chlotoid curves.*

INTRODUCTION

The paper aimed to present the construction of a bypass in Sălaj County, near Zalău. This alternative route will connect the national road DN1F and the county road C DJ191. (Figure 1)

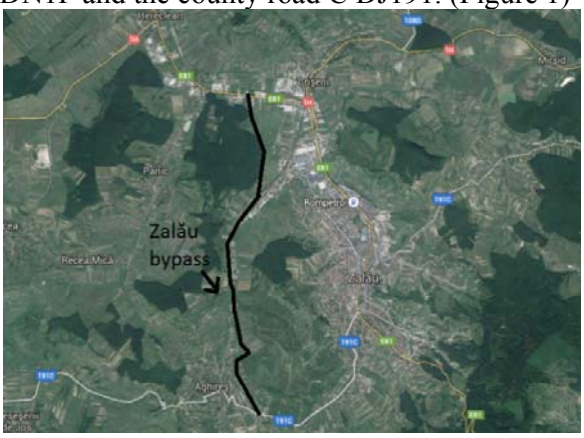

Figure 1. Representation of Zalău bypass

The importance of this work is the current situation. The national road DN 1F passes through central area of the city Zalau on a length of about 7 km, with very high declivity (12%) and a winding path that measures about 4 km.

During the route, from the data provided by the Agency for Environmental Protection Zalau and those taken from the General Urban Plan of the City of Zalau, results a range of the noise pollution and well air level above permissible limits. Also, appeared a lot of cracks on the surface of the buildings situated near the road, these cracks are caused by vibrations caused by the heavy vehicles.

Taking into account the current situation, the decision to design and construct an alternative route was taken in order to achieve a separation of transit traffic from local transit of Zalău.

This road will be fit in technical class III and will connect the national road DN 1F and DJ 191 county road C, measuring 9.63 km.

MATERIALS AND METHODS

The road plan is made up of a succession of curves and alignments (Figure 2) whose geometry have been adopted taking into account the design speed of 40 km/h (corresponding to a technical class III of the road).

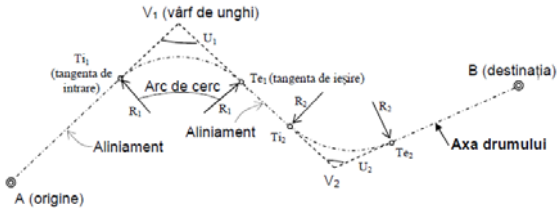

Figure 2. Representation of a road plan

The alignments have lengths between 50 m and 30 m and are connected with circular curves

and progressive curves, respectively clothoids curves rays measuring between 150 m and 1300 m.

The arc geometry is determined by the angle U between the two alignments and the radius connection R (Figure 3). The U angle between alignments result from the study route, directly measuring the land with topographic methods, or in the map studies case, by indirect trigonometrical methods

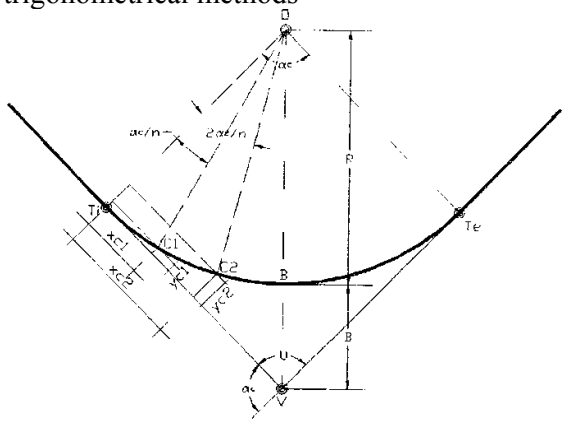

Figure 3. The main elements of connecting with arc

Basis for determining the characteristic rays is:

$$R \cong \frac{V^2}{13 * (k * p \pm g * p)} = \frac{V^2}{13 * p(k \pm g)}$$

Based on her curves ray performed following classification:

- minimum -ray $R_{min} = \frac{V^2}{13 * p_s(k+g)}$;
- current ray $R_c = \frac{V^2}{13 * p_a(k+g)}$;
- recommendable ray $R_r = \frac{V^2}{13 * p_a(k-g)}$;

V - speed design;
K - coefficient of comfort;
p - curve slope, depending on the geometry form;
g - gravitational acceleration.

Upon registration of the vehicle in a curve will emerge centrifugal force. (Figure 4) This tends to remove the vehicle from the route and at the same time will cause a shock felt in the steering wheel by the driver. The amount of centrifugal force is given by the following equation:

$$F_c = \frac{m * V^2}{R} = \frac{P * V^2}{g * R}$$

m- vehicle mass (kg)
P - vehicle weight (kg)
g - gravitational acceleration (m / s2)
v - speed of the movement of the vehicle (m / s)
R - curve radius arc (m)

To ensure a shift line, from the alignment on main circular curve it is necessary to introduce a transition curve (progressive curve) which have the property that the radius of curvature has a variable value from (ie 0) in the alignment point tangential to the R value (ie 1 / R) at the point of contact with the arc Introduction of progressive curves must satisfy two criteria:

- Geometric criteria refer to the following conditions:
  - gradual curve to be tangent to alignment points Oi, Oe, where the radius of curvature is ∞
  - the radius of curvature gradually decreases the arc length gradual curve to the point Si, is tangent to the arc, where ρ = R
  - in common with the turn point arc, Si, Se, progressive curve admits common tangent arc and radii are equal.
- Mechanical criteria refer to the condition that varies proportionally during normal acceleration, t: $a_n = \frac{V^2}{R} = j * t$ or centrifugal force varies progressively.

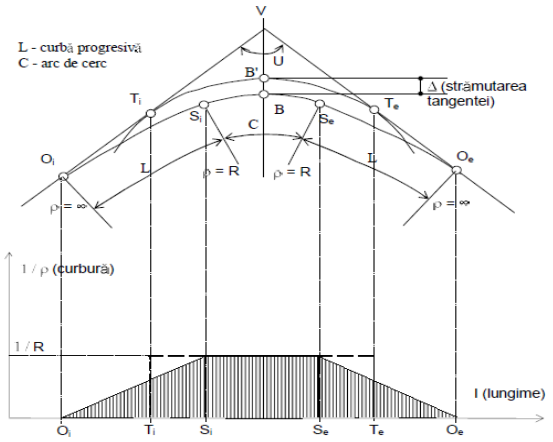

Figure 4. Represention of the variation of the centrifugal force in connection with gradual curves

Among all the progressive curves, the best option it is the clothoids curve, this curve is called the mechanical excellence trajectory because it represents a vehicle traveling at a constant speed, steering input is done evenly. In this case, the product of the radius and arc length curvature properly to any point on the curve is constant. From the viewpoint graphic is represented by two symmetrical branches with two asymptotic points I and II (Figure 5).

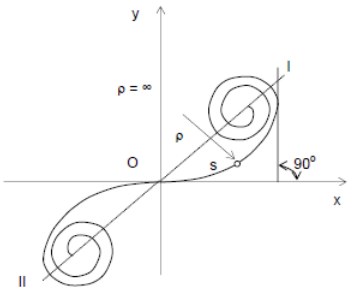

Figure 5. Graphical representation of clothoid

Is characterized by that the product of the radius of curvature (R) that decreases gradually along the clothoid and arc length appropriate (L), considered from the origin, is constant:

$A^2 = R * L$,

A – the clothoid module means length.

The minimum length of clothoid arc that connects the alignments is established by the criteria of the limiting normal acceleration, according to:

$L_{min} = \frac{V^3}{47R*J}$;

V - design speed in km / h;

R - radius in common point of clothoid arc and the radius arc

J - normal acceleration coefficient of variation, meaning a coefficient of comfort in m / s3.

J = 0.5-0.7 -for ordinary roads

J = 0.3-0.5 -for highways

Clothoid basic elements are:

α - clothoids independent variable representing the angle formed by the tangent at a point of clothoids with the positive direction of the axis abscise.

x1 - the horizontal axis of the current point;

Y1 - ordered the same point;

r1 - polar radius;

φ - polar angle;

ρ - radius of curvature;

x01 = x1 – abscissa center of curvature corresponding to the same point;

Y1 - ordered the same center of curvature;

δ1 - moving the bend arc;

s1 - clothoid arc length between the origin and point arc clothoids O1;

n1 - abscissa of the normal foot on the tangent point arc clothoids;

x "- the difference between abscissa point and corresponding center of curvature;

b1 - the normal length;

γ - the angle between the polar radius and the radius corresponding to the point.

Clothoids real elements are obtained by multiplying the basic elements determined clothoids real clothoids module A.

Aρ1=R;

RESULTS AND DISCUSSIONS

According to the methodology described in the previous chapter, it has been calculated the characteristics of the rays depending on speed (Table 1) and all the clothoids curves (Table 2).

Table 1. The ray values determined according to speed

	V	V	V
	40 km/h	32.5 km/h	25 km/h
minimum ray (m)	70	50	30
current ray (m)	165	110	65
recomandable ray (m)	495	330	195

CONCLUSIONS

Through this work it was shown the importance of the construction of the bypass in Sălaj County, near Zalău. This bypass will considerably reduce the traffic and also will reduce the air pollution in the downtown area.

Progressive curves are very important in connecting alignments, especially the excellent mechanical curves, named clothoid curves; using these curves the shocks created by the centrifugal force will be reduced.

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STAS 863-85 Lucrări de drumuri. Elemente geometrice ale traseelor. Prescripții de proiectare

Table 2. The clothoids curves characteristic values

Curve 1				Curve 2				Curve 3			
v (km/h)	40.000			v (km/h)	40.000			v (km/h)	40.000		
R (m)	75.000			R (m)	75.000			R (m)	100.000		
U	152.600			U	31.130			U	122.560		
L/R	0.488			L/R	0.488			L/R	0.336		
t	0.495			t	0.495			t	0.410		
α	15.60	clothoids real elements		α	15.60	clothoids real elements		α	10.70	clothoids real elements	
γ	89.60			γ	89.60			γ	92.86		
φ	5.20			φ	5.20			φ	3.57		
r_1	0.70	r_0	36.66	r_1	0.70	r_0	36.66	r_1	0.58	r_0	33.58
x_1	0.70	x_0	36.53	x_1	0.70	x_0	36.53	x_1	0.58	x_0	33.53
x"	0.35	x"	18.19	x"	0.35	x"	18.19	x"	0.29	x"	16.73
y_1	0.06	y_0	2.99	y_1	0.06	y_0	2.99	y_1	0.32	y_0	1.88
δ_1	0.01	δ_0	0.75	δ_1	0.01	δ_0	0.75	δ_1	0.01	δ_0	0.47
ρ	1.43	ρ	75.00	ρ	1.43	ρ	75.00	ρ	1.72	ρ	100.00
s	0.70	s	36.75	s	0.70	s	36.75	s	0.57	s	33.62
n	0.71	n	37.28	n	0.71	n	37.28	n	0.59	n	33.85
b	0.06	b	3.08	b	0.06	b	3.08	b	0.03	b	1.91
y	1.44	y	75.75	y	1.44	y	75.75	y	1.73	y	100.47
A= R/ρ	52.50	C	19.09	A= R/ρ	52.50	C	162.20	A= R/ρ	57.98	C	88.02

Curve 4				Curve 5			
v (km/h)	32.500			v (km/h)	25.000		
R (m)	55.000			R (m)	35.000		
U	118.370			U	10.800		
L/R	0.611			L/R	0.960		
t	0.555			t	0.695		
α	19.61	clothoids real elements		α	30.75	clothoids real elements	
γ	86.92			γ	79.48		
φ	6.35			φ	10.23		
r_1	0.78	r_0	33.74	r_1	0.97	r_0	33.46
x_1	0.78	x_0	33.57	x_1	0.96	x_0	33.03
x"	0.39	x"	16.68	x"	0.47	x"	16.26
y_1	0.08	y_0	3.45	y_1	0.16	y_0	5.35
δ_1	0.02	δ_0	0.87	δ_1	0.04	δ_0	1.35
ρ	1.27	ρ	55.00	ρ	1.02	ρ	35.00
s	0.78	s	33.89	s	0.98	s	33.81
n	0.80	n	34.66	n	1.04	n	35.84
b	0.08	b	3.63	b	0.18	b	6.04
y	1.29	y	55.87	y	1.06	y	36.35
A= R/ρ	43.17	C	36.64	A=R/ρ	34.40	C	82.08

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DETERMINATION OF THE CHARACTERISTICS VALUES FOR GEOTECHNICAL PARAMETERS

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Abstract

The main purpose of the geotechnical studies is to determine the physical and mechanical properties of the foundation soil. For the geotechnical studies it is necessary to be taken into account the calculation characteristics which are determined based on characteristic values. This article aims to determine the characteristic values of the geotechnical parameters resulted from the laboratory studies. The calculation of the characteristic values was done according to the Normative of Design NP 122:2010, and the laboratory studies were done according to the national standards in force.

Key words: *geotechnical study, geotechnical parameters, characteristic values.*

INTRODUCTION

The laboratory tests have been conducted regarding the elaboration of a geotechnical study in order to design a rainwater tank from a wastewater treatment plant. In order to realize the geotechnical study it is desired to identify the characteristic values of the geotechnical parameters from the site. The emplacement is located in the Romanian Plain in an area of flat land.

In order to determinate the characteristic values of the geotechnical parameters, the Romanian normative NP 122:2010 was used, according to this normative have been covered the following steps:

Step I: The identification of the soil type in the ternary diagram.

Step II: The verification of the soil type identified in the ternary diagram.

Step III: The verification of the physical properties of the soils in order to verify if they correspond with the same geological layer.

Step IV: The calculation of the characteristic values for every geological layer.

MATERIALS AND METHODS

The laboratory tests were done based on samples collected from two boreholes, named F1 and F2; these boreholes were made up to 10 meters. All the geotechnical parameters were determined according to the Romanian standards in force.

The determination of granulometry has been made according to STAS 1913/5-85 and SR EN ISO 14688-1:2004 and it represents the distribution of the weight procentual content, on fractions of the solid particles which can be found in its composition.

The moisture content (w) represents the quantity of water which is stored in the earth's pores reported to the dry mass samples, the moisture content has been determined according to STAS 1913/1-82.

Liquid limit (w_L) represents the moisture content where a soil emerges from a liquid state to a plastic one; the plastic limit (w_P) represents the humidity where a smooth soil becomes too dry to be in plastic state, these limits has been determined according to STAS 1913/4-86.

Based on the values of the plasticity limits, the plasticity index (IP) and the consistency index

(IC) can be determined with the following formulas:

$$I_P = w_L - w_P, (\%)$$

$$I_C = \frac{w_L - w}{w_L - w_P}$$

The density (ρ) of a soil is the ratio between the mass of solid particles and the total volume of the sample, according to STAS 1913/3-76.

The dry density can be determined with the following relation:

$$\rho_d = \frac{m_d}{V}, (g/cm^3)$$

where:

md – the soil mass in dry state, g;

V – the volume occupied by the soil.

The soil porosity (n) it is defined as the ratio of the volume occupied by pores (Vp) and the total volume of the soil (V).

Pores index (e) represent the ratio between the pores volume (Vp) and the solid phase volume (Vs).

The level of saturation (Sr) is defined as the ratio between the volume of the pores filled with water and the total volume of the pores.

The in situ and laboratory tests provide measured values of the geotechnical parameters. These values cannot be directly used in the geotechnical design, but must be statistically processed in order to determine the characteristic and design values of the geotechnical parameters (Olinic, 2014).

The statistical coefficient kn depends on the number of test results and on the knowledge about the coefficient of variation (case Vx known or Vx unknown). When only the values determined directly by testing are taken into account, the coefficient of variation for the soil in question is not known in advance and kn values are taken from column Vx unknown. Because in many practical cases, for a geological stratum few values are selected, leading to high values for Vx and kn, can be used the "existing knowledge" method, which takes the value of the coefficient of variation Vx from relevant documentations. In these situations, the statistical coefficient values kn are taken from column Vx known (Olinic, 2014).

Below is presented the order in which the characteristic and design values of the geotechnical parameters are determined (NP 122:2010):

- Measured values $X_1, X_2, X_3 ... X_i ... X_n$
- Mean value $X_m = \frac{\sum X_i}{n}$
- Standard deviation of the selected measured values $s_x = \sqrt{\frac{1}{n-1}\sum (X_i - X_m)^2}$
- Coefficient of variation $V_x = \frac{s_x}{X_m}$
- Statistical coefficient $k_n = f(n, V_{x\,known}\ or\ V_{x\,unknown})$
- Characteristic values $X_{k\,\sup} = X_m (1 + k_n \cdot V_x)$ $X_{k\,\inf} = X_m (1 - k_n \cdot V_x)$
- Local characteristic values $X_{k\,\mathrm{loc}} = X_m (1 \pm 2V_x)$

RESULTS AND DISCUSSIONS

From laboratory studies result the geotechnical characteristics presented in Table 1.

According to the operation methodology described by NP 122:2010 it has been followed the next steps:

Step I: The identification of the soil type in the ternary diagram

In this stage has been concluded that the foundation soil has been divided on two geological layers and it has resulted: one layer of silty clay and another one of clayey silt, according to ternary diagram from STAS 1913/5-85 (Figure 1.a).

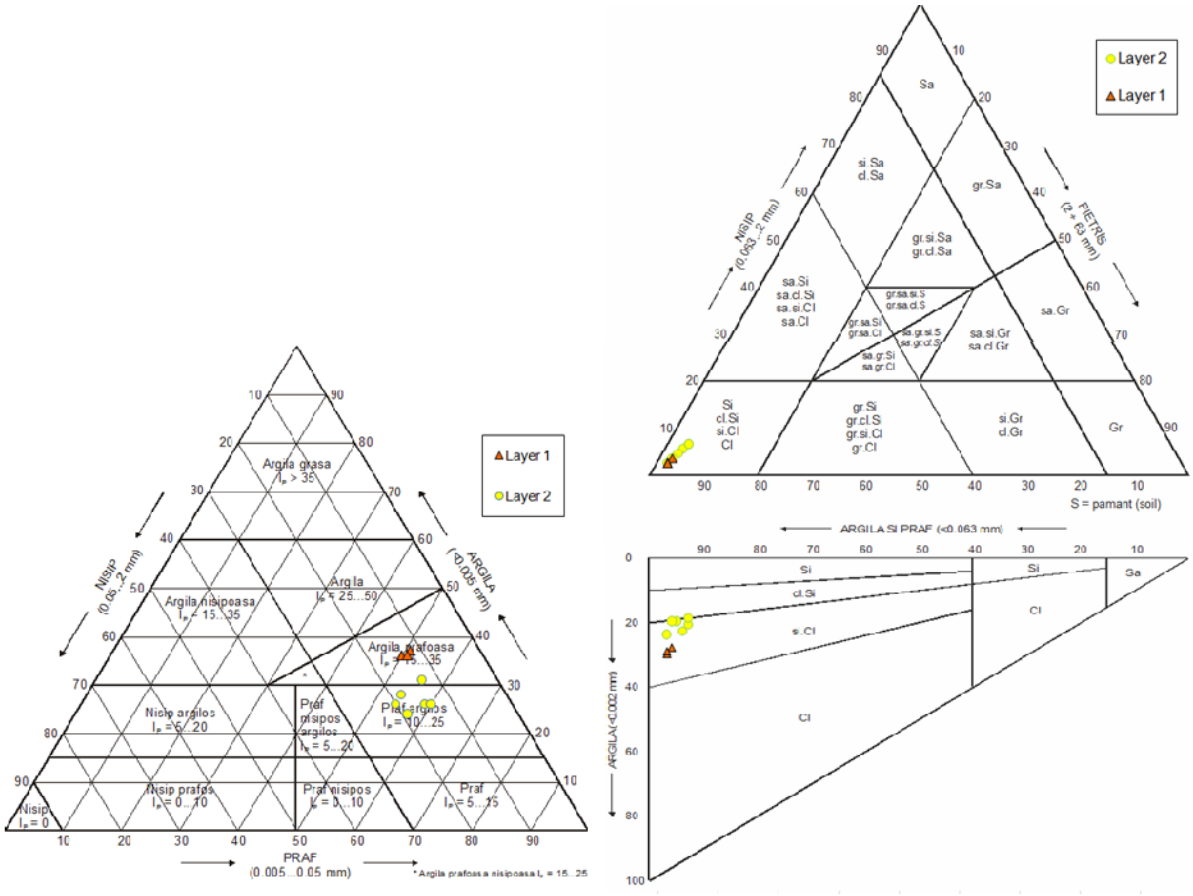
According to the ternary diagram from SR EN ISO 14688-1:2004, all the soils take part into the category of silty clays (Figure 1.b).

Step II: The verification of the soil type identified in the ternary diagram

It has been made a verification of the results from stage I. This verification has been made with the help of the data received from the site.

Table 1. The geotechnical parameters

BOREHOLE	GEOLOGICAL LAYER	NR. SAMPLE	DEPTH	PHYSICAL PARAMETERS													
				Clay	Silt	Sand	w	w_P	w_L	I_P	I_C	r	r_d	n	e	S_r
			m				%	%	%	%		t / m^3	t / m^3	%	-	-
F1	Brownish silty clay with traces of degraded chalk and rare chalky concretions, with high plasticity, hard	N2	2	36	50	14	15.8	17.6	41.5	24.0	1.08	1.74	1.50	44.0	0.79	0.56
F1	Brownish silty clay with high plasticity, vigorous plastic	N4	4	37	51	12	20.8	18.8	40.8	22.0	0.91	1.88	1.53	42.8	0.75	0.83
F2	Brownish silty clay with traces of degraded chalk, with high plasticity, vigorous plastic	N2	2	36	50	14	19.5	19.2	42.2	23.1	0.99	1.93	1.62	39.1	0.64	0.78
F2	Brownish silty clay with high plastiity, vigorous plastic	N4	4	36	51	13	21.1	18.9	39.9	21.0	0.90	1.91	1.59	40.3	0.68	0.79
F1	Light brownish clayey silt-yellowish, with rare traces of degraded chalk and chalky concretions, with medium plasticity, plastic consistency	N6	6	28	54	18	26.4	17.5	36.2	18.7	0.52	1.99	1.58	40.7	0.69	1.0
F1	Light brownish clayey silt- yellowish, with medium plasticity, solf plasticity	N8	8	31	56	13	30.2	19.2	38.6	19.4	0.44	1.95	1.52	43.0	0.75	1.0
F1	Light brownish clayey silt, with medium plasticity, solf plastic	T10	10	26	54	20	26.0	15.5	33.5	18.1	0.42					
F2	Light brownish clayey silt- yellowish, with high plasticity, solf plastic	N6	6	24	57	19	27.2	20.3	33.4	13.1	0.47	1.98	1.56	41.5	0.71	1.0
F2	Light brownish clayey silt- yellowish, with high plasticity, solf plastic	T8	8	26	59	15	28.7	17.0	34.6	17.6	0.33					
F2	Light brownish clayey silt- yellowish with chalky concretions, with medium plasticity, solf plastic	T10	10	26	60	14	29.2	17.4	34.7	17.2	0.32					



a. b.

Figure 1. The identification of the soil type in the ternary diagram

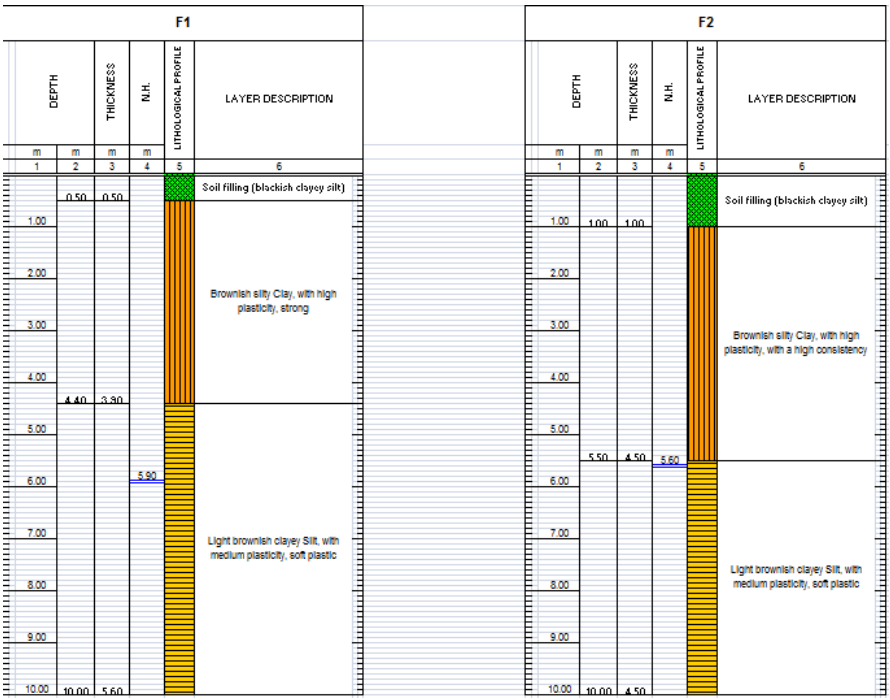


Figure 2. The borehole sheet

Table 2. The characteristic values

CARACTERISTICS	GRAIN SIZE			PHYSICAL PARAMETERS									
	Clay	Silt	Sand	w	w_P	w_L	I_P	I_C	r	r_d	n	e	S_r
				%	%	%	%		t / m^3	t / m^3	%	-	-
The calculation of characteristic values - Clayey Silt													
Minimum values Xmin	24	54	13	26.0	15.5	33.4	13.1	0.3	2.0	1.5	40.7	0.7	1.0
Maximum values Xmax	31	60	20	30.2	20.3	38.6	19.4	0.5	2.0	1.6	43.0	0.8	1.0
Average values Xmed	27	57	17	28.0	17.8	35.2	17.3	0.4	2.0	1.6	41.7	0.7	1.0
Nr. values xi, n				6.0	6.0	6.0	6.0	6.0	3.0	3.0	3.0	3.0	3.0
Standard deviation, sx				1.7	1.7	2.0	2.2	0.1	0.0	0.0	1.2	0.0	0.0
Coefficient of variation Vx				0.1	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.1	0.0
Kn for Vx unknown				0.8	0.8	0.8	0.8	0.8	1.7	1.7	1.7	1.7	1.7
Xk superior				29.3	19.2	36.8	19.2	0.5	2.0	1.6	43.8	0.8	1.0
Xk inferior				26.6	16.4	33.6	15.5	0.4	1.9	1.5	39.7	0.7	1.0
Xk local superior				31.3	21.2	39.1	21.8	0.6	2.0	1.6	44.1	0.8	1.0
Xk local inferior				24.6	14.4	31.2	12.9	0.3	1.9	1.5	39.3	0.6	1.0
The calculation of characteristic values													
Minimum values Xmin	36	50	12	15.8	17.6	39.9	21.0	0.9	1.7	1.5	39.1	0.6	0.6
Maximum values Xmax	37	51	14	21.1	19.2	42.2	24.0	1.1	1.9	1.6	44.0	0.8	0.8
Average values Xmed	36	51	13	19.3	18.6	41.1	22.5	1.0	1.9	1.6	41.6	0.7	0.7
Nr. values Xi, n				4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Standard deviation, sx				2.5	0.7	1.0	1.3	0.1	0.1	0.1	2.2	0.1	0.1
Coefficient of variation Vx				0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.2
Kn for Vx unknown				1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Xk superior				22.2	19.4	42.3	24.0	1.1	2.0	1.6	44.2	0.8	0.9
Xk inferior				16.4	17.8	39.9	21.0	0.9	1.8	1.5	38.9	0.6	0.6
Xk local superior				24.2	20.0	43.1	25.1	1.1	2.0	1.7	46.0	0.8	1.0
Xk local inferior				14.4	17.2	39.1	20.0	0.8	1.7	1.4	37.1	0.6	0.5

Step III: The verification of the physical properties of the soils in order to verify if they correspond with the same geological layer

Were analyzed the geotechnical properties resulted from laboratory test, such as: moisture content, plasticity limits, plasticity index, consistency index, density, porosity and the saturation degree. These characteristics confirmed the soil classification into those two layers resulted in the ternary diagram from STAS 1913/5-85. According to these results has been made the borehole sheet (Figure 2).

Step IV: The calculation of the characteristic values for every geological layer

This calculation was done according to NP 122:2010. It has been calculate all the characteristic values presented in the previous chapter. The characteristic values were determinate for each geological layer (Table 2).

CONCLUSIONS

The physical characteristics of soils give us some indications about the mechanical behavior of the soils and help us to schedule in a fairy mode all the laboratory tests that follow. Geotechnical design is based on design values of geotechnical parameters derived from the characteristic values, respectively measured values.

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SOLUTIONS TO AVOID LAND LOSSES IN ADJACENT AREAS OF TELEAJEN RIVER IN VĂLENII DE MUNTE

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Abstract

In the minor Teleajen riverbed, on adjacent area of dike corresponding to Valeni polder occure same deficiences consisting in erosion.
The solution proposed aims to reduce the longitudinal river slope and to protect the banks. The treshold's cross section adopted were chosen depending on stability factor obtained.

Key words: *water course planning, bank erosion*

INTRODUCTION

On the occasion of the field visit it was ascertained that in the minor Teleajen riverbed, on adjacent area of dike corresponding to Văleni polder occurred the following deficiences:

- Erosions in the embankment protection area related to the longitudinal dike of the polder
- Profound erosions on great lengths of the left bank (unprotected), with land losses
- Erosions in the Teleajen riverbed (Figure 1)

Figure 1. Teleajen riverbed

These deficiences were caused by a serie of natural characteristics of the Teleajen river (high speed flow, large longitudinal slope), as well as the riverbed narrowing due to hydraulic works in the area.

Taking into consideration the situation presented above, in order to regulate the Teleajen riverbed in the area of Văleni polder (Figure 2), it was adopted a solution consisting in measures for reducing the water flow speed, homogenizing the water distribution over the entire height of the riverbed and creating distribution channels with the main purpose of reducing the longitudinal slope of the river Teleajen.

The protection of the river banks that were subject of deep erosions was also taken into account. (Gabriela Dimu et al, 2006).

MATERIALS AND METHODS

The technical solution consists in:

- In the minor riverbed, immediately downstream the bridge, there were provided 2 concrete thersholds and one of gabions, in order to assure the bench mark of the dike's buttress. The two concrete thresholds consist of Creager-Ofiterov profiles, with 5m long sinks, provided with a row of Reboch teeth and doubled by 6m long mobile elements dissipator field (this type of threshold was succesfully used for the Izvoarele polder). Because of the land configuration, the thresholds have

different widths: threshold 1 – 60 m and threshold 2 – 50 m.

- Threshold number 3 is realised for stabilizing the thalweg of the Teleajen riverbed and is a threshold made of underground gabions: an inferior row of underground gabions of 1.00 x 2.00 x3.00 m, over which are placed three rows of gabion mattresses.
- In order to stop profound erosions on great lenghts of the left riverbank (L= 415 m) and of the right one (erosions that uncovered the regularization buttress on a length of aproximately 560 m, present in two locations) there will be implemented works for stabilizing and protecting the river banks, by strictly obeying the limit gauge or the regulated riverbed: the 50 m width at the base and also taking into consideration the deepening phenomenon, in the meantime generalized, of the thalweg projected for regularizing Teleajen river.

Figure 2. Deep erosions on longitudinal dike of the polder

In these conditions, the bank defense must be realized using a technical solution as simple and efficient as possible – resistant, elastic and stable to the hydraulic influences of the river stream, as well as easy to build up. The technical solution is applied both in plan and in longitudinal path, the characteristic section consists of executing a section of recalibrated and protected riverbed on the left bank on a length of about 415 m with gabions, boxes 1.00 x 1.00 x 5.00 m and 1.00 x 1.50 x 5.00 m, above mattresses of gabions 3.00 x 3.00 x 5.00 m. This bank protection will be adapted in the connection section with the concrete thresholds. On the right bank adjacent to the uncovered buttress, will be assured the same elastic protection, but without the last row of gabion boxes. Gabion boxes will be made from concrete steel with diameter 16 mm and galvanized wire mesh, and will be filled with river rocks twice the dimensions of the enmeshing.

Figure 3. Concrete thresholds

RESULTS AND DISCUSSIONS

In the following tables are presented the results of the calculations needed for realizing the protections. For the hydraulic computation

there were taken into consideration the next data:

- The medium roughness of the riverbed: n=0.035
- The medium width of the regulated riverbed base (b = 50.00 m), from which is eliminated the left bank's rocks defense of 3.40 m, so the net width will be b=46.60 m.
- The medium general slope of this river sector: i=5.97 ‰.

It is mentioned that the water depths calculated will be add up to the bench marks of the projected thalweg, for regularizing the river Teleajen, this way resulting absolute bench marks of water levels at given flows (by reffering to Black See Level)- Table 1.

The results of these calculations represent the base of drafting and finalizing the type sections of bank defense works, reproduced in Figure 4.

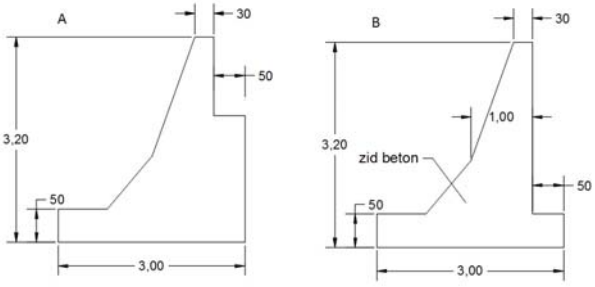

Figure 4. Croos section proposed for concrete threshold

For the given cross section it was verified the stability (Table 2) and the rezistance (Table 3). All obtained values for the verification made demonstrate that the analyzed structures are possible to be built.

Table 1. Calculation of hydraulic parameters

Parametrii	Q_{etiaj} =20 mc/s	$Q_{formare}$ =100 mc/s	$Q_{5\%}$ =275 mc/s	$Q_{1\%}$=450 mc/s
H (m)	0.38	0.98	1.79	2.40
A (mp)	17.96	47.35	89.02	121.92
P (m)	48.13	50.56	53.83	56.29
R (m)	0.373	0.937	1.654	2.166
V(m/s)	1.144	2.113	3.087	3.696
Q (mc/s)	20.55	100.06	274.83	450.55

Table 2. Verification of the stability of proposed structures

	Ca (kN/m^2)	Cr (kN/m^2)	p (kN/m^2)
A	3.09	8.75	62.12
B	2.81	7.90	56.54

Table 3. Verification of the rezistance of proposed structures

	бzam (kN/m^2)	бzav (kN/m^2)	бam (kN/m^2)	бav (kN/m^2)	бxam (kN/m^2)	бxav (kN/m^2)	б1am (kN/m^2)	б1av (kN/m^2)	б2am (kN/m^2)	б2av (kN/m^2)
A	211.24	-74.16	-169.84	-	184.74	-	368.09	57.5	27.39	0
B	142.60	-22.38	-101.20	-	116.10	-	231.41	57.5	27.29	0

CONCLUSIONS

The solution is meant to limit the development of river banks erosions, by avoiding this way any losses of land adjacent to the riverbed.
The positioning of the proposed works was made based on the hydraulic calculation of the speed flow and water depth.
It is recommended to be chosen the „B" cross section because it developes lower inner efforts and assures all the stability conditions; in addition, the geometry is simpler, so the construction time and costs will be reduced.

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AGRIFOOD SECTOR DEVELOPMENT STRATEGY FOR MEDIUM AND LONG TERM HORIZON 2020-2030

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Abstract

The agriculture constitutes an economic importance due to the products and services it offers to society and on which depends the standard of living of the population. But now, agriculture faces particular challenges due to demographic growth, the effects of global climate change and expanding urbanization. In these conditions providing the necessary food products requires appropriate policies and strategies to support this vital economic sector for society

Ke ywords: *policies and strategies, irrigation, food security, strategic objectives, rural areas*

INTRODUCTION

The world economy has a structural transformation process, due to the emergence of new global challenges with long-term effect: global population becoming more numerous, increasing pressure on natural resources and global warming plus the aging of the population, obvious in Europe. All these issues have profound implications for agriculture and rural economy (MARD, 2015.).

Global demand for food is rising, increased urbanization, rising prices on inputs, pressure on water resources and increased vulnerability of crops and animals to climate change will limit food production. It is expected that global demand for food will increase by 70% by 2050 due to population increasingly numerous and increasing revenues. It is estimated that the world population will increase from 7 billion as is currently is, to 9 billion by the middle of this century, and 95% of this increase will occur in the less developed countries. Overall up revenue will be mostly associated with increased urbanization (expect 70% of the world population live in urban areas by 2050, up from 49% currently) and rapid economic growth in some of the most populous countries.

1. The role of irrigation in agriculture development strategy

By FAO estimates, 40% of goods from agricultural products in the world are obtained by irrigation but the technique irrigate cause high consumption of water and loss of large volumes of water during transport water for irrigated land which constitutes a potential danger soil degradation by secondary salting. Even so, climate changes that are being felt increasingly expose more land at risk of drought and desertification, irrigation being the only technical protection of these vulnerable lands (FAO Statistical Yearbook, 2013). Irrigation is needed and applies not only in arid and semi-arid areas of the globe, with rainfall less than 500 mm/year but also in the sub-humid, with rainfall of 450-700 mm and even wetlands to 1000 mm/year, where half of the year is deprived of rains. Given that over 75% of the land surface lacks sufficient moisture to ensure the water needs of crops and arid and semi-arid represents about 55% of the land, irrigation is the only technique that can sustain profitable agriculture and food safety population (Botzan M, 1966).

By definition adopted by the FAO, food security is the access physically, socially and economically for all human beings to sufficient nutrition, healthy and nutritious food to enable

them meet the needs and food preferences for a healthy and active life.
Food security involves:

- the existence of sufficient quantities of healthy food of adequate quality, which is a problem of agricultural production
- individuals and their households to have access to adequate food, which is a problem related to poverty
- food to be obtained in accordance with good agricultural and environmental conditions, which is a public health problem

Increasing the volume of agricultural products can be provided by the following means: increasing area of arable land, increase cultural intensity (frequency crops) increasing crop yields through modern technology, the irrigation has dominant role.

2. Strategic objectives regarding agriculture and rural development in the period 2020-2030

Romania should ensure that the agrifood sector have an sustainable and competitive character, centered on the export of products with high added value, resistant to global challenges, ensuring welfare and living conditions in rural areas close to urban ones.
Agriculture and rural development in Romania in 2030 aimed at achieving a level of coherence between agriculture, environment and rural development by harnessing smart and sustainable agricultural land, labor and capital (Elena Constantin, 2014).
Romanian farmer of the XXI century will need to be competitive in other economic activities, reaching the same level of welfare and similar conditions of life as residents of urban areas. Romania will ensure food security and become a major player in European and international agri-food trade. For this purpose will be approached the strategic objectives outlined below which aim increasing the competitiveness of the agri-food sector.
Strategic Objective No. 1: Accelerating structural transition to an economically viable agriculture in parallel with environmentally friendly agricultural practices and the gradual reduction of the workforce in agriculture.
Romania is one of the European countries with the most favorable pedo-climatic conditions for obtaining agricultural production quality and in significant quantities, which can cover a significant share of the domestic demand for food and agriculture. Despite considerable potential yields of Romanian agriculture are modest, indicating use of factors of production is way below the optimal. Properly exploited, allows existing employment potential agricultural workforce in a more productive manner, thus contributing to record real progress towards reducing rural poverty and eliminating differences of income to those in urban areas.
Strategic Objective No. 2: Increasing coverage of food consumption from domestic production and agro food regaining net exporter status, in line with potential output and sectoral response to the growing demand for food worldwide.
Agriculture has become one of the sectors most vulnerable to climatic changes and estimates for the future that these trends will increase. The current irrigation system continues to face a number of issues, current location and technical state of irrigation infrastructure resulting in a high cost of water, which mainly commercial, large farmers afford, but it is prohibitive for small farmers. In addition to climate change, Romania faces several other environmental problems, highlighted by the deterioration quality of soil and water, in decades. Production of renewable energy from agriculture and areas of cultivated land in organic farming sector are increasing. These are areas that should be developed further in the future.
Strategic Objective No. 3: limiting carbon footprint of agriculture, promotion of organic agriculture and resistant to climate change, water management and encouraging adequate renewable energy production. GHG emissions from Romanian agriculture only slightly exceeds regional averages and the EU, because after 1990 experienced a substantial decrease (mainly due to a decline in the livestock sector). Agriculture generated 14% of total GHG emissions of Romania in 2010, while the regional average, and EU-15 and EU-27 was 10% in 2011 and 2012, GHG emissions from agriculture were raised to 18 942 Gg CO2 equivalent, respectively 18 299 Gg CO2 equivalent, down 53% and 55.21% compared to 1989.This decrease was largely determined

by the decline in the livestock sector but it was favored by reducing the area planted with rice and low use of fertilizers based on nitrogen.

Rural areas plays an important socio-economic part in Romania, as it covers 87.1% of the territory, 45% of the population in 2012 produced 32% of gross value added and provide 42% of the total workforce. The share of agriculture, forestry and fisheries in GDP was 4.9% in 2012. Romania is a predominantly rural country, where rural areas play an important socio-economic part. Romania is one of the less urbanized countries in the EU which makes the policies dedicated to specific socio-economic needs of rural residents to be essential. According to the OECD (which allows comparisons with the EU), 45.5% of the population is located in predominantly rural areas, 43.9% in intermediate zones, while only 10.6% live in predominantly urban areas.

Strategic Objective No. 4: Improving the living standards in rural areas, providing infrastructure and basic services comparable to those in urban areas, reduction of rural income differences between Romania and the EU average.

Faced with an aging population in course and in a process of decline, rural areas need consistent and sustained investment in infrastructure and services. This will help increasing the attractiveness of rural areas, especially for young and educated, which now represents almost half of employees in rural areas.

The exodus of young people and educated in rural areas will threaten the success of all other public policy interventions, together with economic stability and sustainability of rural areas. A rural zone thrives by motivating it's active population, determined by the level and stability of its revenues and its ability to support his family.

Cross-cutting strategic objective No. 5: Developing partnerships for education / consulting, ICT, R & D and improving the performance of agricultural administration as the foundation for a competitive agriculture, knowledge-based.

In Romania nearly three quarters of the utilized agricultural area is worked by farmers without training, as opposed to 40% in the EU15. Low levels of education among those who work Romanian farmland is one of the factors that hinders competitiveness. Therefore, it requires increasing the share of farmers with higher education levels than in present, so Romanian agriculture can make the transition to a knowledge-based agriculture. An important role returns both specialized education and vocational education of our targeting specific areas. The introduction of consulting and professional guidance is the transverse critical and mandatory orientation towards a knowledge-based agriculture.

In the context of climate change, there is a need for a new research in agriculture which allows the efficient use of natural and human resources, models of best practice and increasing agricultural productivity, knowledge transfer and promoting cooperation and innovation.

3. The financial support of rural development programs

For the period 2014-2020, the funds available under the CAP in Romania rises to about 20 billion euros (Table 1). This level is determined mainly by higher funds under Pillar 1, which has undergone a progressive introduction program lasting ten years, in 2007-2016.

Compared to the previous programming period, it is expected that the allocation for Pillar 2 (rural development) will be reduced by approximately 12.5% (1 billion euro). However, the biggest challenge for Romania was the use and effective absorption of these funds, as shown in absorption rate (EAFRD funds-71% committed and 44% paid by the end of 2012). But the situation in agriculture and rural development sector is better than that of sectors financed from structural funds and cohesion, where absorption rates for 2007-2012 were 12% and 70% paid contract. Despite initial difficulties, the absorption of these funds was significantly accelerated in recent years, and Romania has successfully secured the necessary public co-financing.

Table 1. CAP financial allocations in Romania in the period 2014-2020 (EUR million)

Year	Pillar I /FEGA	Pillar II/FEADR
2014	1.428,5	1.149,8
2015	1.629,9	1.148,3
2016	1.813,8	1.146,8
2017	1.842,4	1.145,2
2018	1.872,8	1.143,6
2019	1.903,2	1.141,9
2020	1.903,2	1.139,9
Total	12.393,8	8.015,6

Source: R (EU) 1305/2013 Annex I and R (EU) 1307/2013 Annex III

CONCLUSIONS

The strategic directions will be materialized through plans and complementary projects whose synthesis will be found in the institutional strategic plan of MARD (strategic planning document prepared for successive cycles every 4 years) and will be operationalized through budgetary allocations own and attracted the MARD. The MARD institutional strategic plan will be monitored (half) rated (annually) and adapted appropriately in the context of national and international policies. The success of the strategy is determined mostly by a correct approach of monitoring and evaluation stages of its implementation

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UPGRADING LOCAL ROADS IN BĂLEŞTI, VRANCEA COUNTY

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Abstract

As in Băleşti, Vrancea county roads are in an advanced state of deterioration, the paper proposes a solution to modernize local roads. For the execution of the roads there is no need for demolition or variations networks because of enforcement works in such a way as to avoid disruptions in the areas specified.
It's about asphalting the road structure consisting of layer support, link layer, wear strips, shoulders, ditches and culverts.
Road infrastructure works have a direct and indirect , positive and negative impact on the environment , take into account the protection of waters and aquatic ecosystems , the protection of the atmosphere , soil protection , environmental forestry , archaeological sites and historical and not least the human environment. By upgrading local roads ensures comfort traffic safety and promotes the development and growth of the industry of the area.

Key words: *infrastructure, modernization, road.*

INTRODUCTION

Road infrastructure consists of the communication routes (county roads, national roads, highways) device of road signage, road features, etc.
The importance of road transport has increased due to the formation of a true network of roads and various technical and technological innovations in the automotive industry.
Modernization of road infrastructure base increases safety, comfort and accessibility. Since ancient times, the most prosperous regions have been located either along major communication routes or at their intersection. The development potential of a region is better when the region has a developed transport infrastructure.
Undoubtedly, transport infrastructure is among the most important factors of national or regional economic competitiveness.
Symmetrically, the lack of adequate transport infrastructure can stifle development and regional economy stagnates or even records a setback.
The level of development and the condition of transport infrastructure also have a strong influence on tourism activity.
Numerous studies have highlighted the close link between the development of transport and tourism development.
Providing access to tourist areas and creating fast connections between regional transport infrastructures on the one hand and national and European transport buses on the other hand are prerequisites for development at national and regional tourism potential.
Based on the considerations mentioned above, the development of transport infrastructure in line with growing transport needs must remain permanently priority of national and local authorities, regardless of economic or budgetary constraints.

MATERIALS AND METHODS

In order to modernize the local roads in Băleşti, Vrancea County, there were made arrangement works for local roads, made of road structure which is composed of layer reprofiling of ballast supporting layer of crushed rock mixture optimally link layer BADPC 20 asphalt concrete and concrete wear layer asphaltic type BAPC 16 (Hutanu, 2014).
To upgrade the roads include also the arranging

shoulders protected by a layer of concrete C25 sat on a bed of sand, arranging trenches and the culverts.
The roads have areas contaminated with clay and grass surfaces, especially shoulders. Drainage and their collection and disposal are non-existent or damaged.
To begin, studies were done on the roads longitudinal and cross sections.
The project was envisaged earthworks and foundation works of ballast, which were carried out preparatory work, picketing work, execution and quality control embankments and reception work. For the implementation of layers of crushed stone ballast were chosen natural aggregates and were determined compacting characteristics and conditions of probation sectors followed by the reception of works on preliminary and final phase.
The road traffic is characterized by layer thicknesses and the design values of the dynamic elastic modulus:
Eb =0,20 x hb0,45 x Ep =0,20 x 4000,45 x 70=208 MPa.
Component strains were calculated using CALDEROM 2000 software.
For the implementation of cylindering hot bituminous coverings were defined types of mixtures, aggregates, fillers, binders and additives. Asphalt mixes were prepared and transported followed by the preparatory work, laying out, compaction, quality control materials and work reception and final phases.
For the implementation of shoulders, ditches from poured concrete monolithic and culverts for drainage preparatory works are made.
Traffic calculation is established with the following relations:
Nc = 365 x 10-6 x pp x crt x ∑5 k=1 [nk10 x (pk14+pk29)/2 x fek] (m.o.s)
Nc =365 x 10-6 x 15 x 0,50 x 16=0,044 (m.o.s)
Degradation caused by freeze-thaw represents malfunctions of complex road due to the phenomenon of swelling of non-uniform due to the accumulation of the water and transform it into the lens of the ice, the earth is sensitive to freezing.
The depth of frost in the road system is considered equal to the depth of frost in the ground foundation Z , plus a bonus Δz and road structure are verified by freeze-thaw action :
Zcrt=Z+Δz (cm)
Δz = HSR – He (cm)
(SR EN 1991-1-3:2005/NA:2006 TABLE NA1).

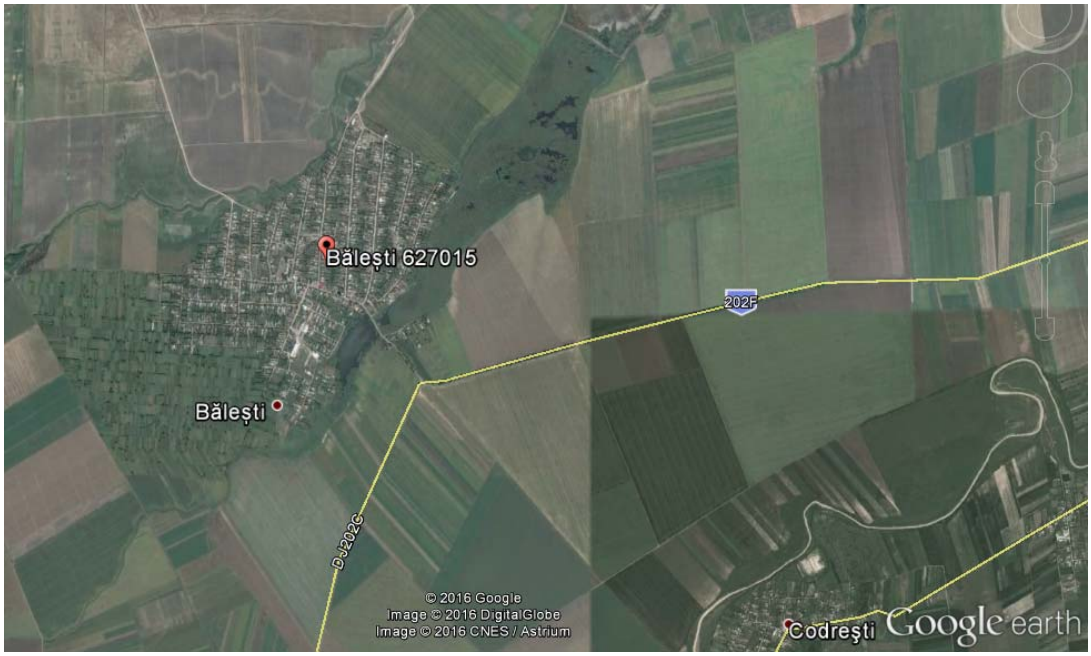

Figure 1. The local road in Băleşti, Vrancea County (Google earth)

RESULTS AND DISCUSSIONS

Traffic associated calculation results are shown in Table 1.
Road layer thickness and design values of dynamic elastic modulus and Poisson coefficient are proposed in Table 2.
Component strains obtained from the use CALDEROM 2000 sofware are:
ε_r = 12,9 microdeformations
ε_z = 12,9 microdeformations
Criterion specific tensile deformation allowable based on bituminous layers requires:
Nc = 0,044 m.o.s
Nadm=24,5 x 108 x εr-3,97 = 24,5 x 108 x 12,9-3,97 = 0,096 m.o.s
RDO = Nc/ Nadm = 0,044/0,096 = 0,46 <1,00
RDO adm=1,00
Criterion -specific vertical deformation at ground level foundation requires:
εzadm = 600 x Nc-0,28 = 600 x 0,044-0,28 = 1439 microdeformations
ε_z = 593 microdeformations < ε_{zadm} =1439 microdeformations
To check the freeze-thaw resistance, the diagram of STAS 1709 / 1-90 is considered the depth of frost in the ground foundation Z = 90 cm.
So:He=∑Hi x cti = 25 x 0,80 + 15 x 0,70 + 5 x 0,60 + 4 x 0,50 = 20 + 10,5 + 3 + 2 = 35,5 cm
Δz = HSR – He = 49-44,9 = 4,1 cm
Zcrt = 90+ 44,9 = 134,9 cm
STAS 1709 / 2-90 degree of frost penetration of insurance in complex road:
K = He / ZCR = 44.9 / 134.9 = 0.33.
The degree of penetration of insurance to frost is 0.33.

Table 1. Traffic associated calculation results

Type of vehicle	nk 2010	Pk 2014	Pk 2029	(Pk2014+Pk2029)/2	Fek	Nk*(Pk2014+Pk2029)/2*Fek
2-axle trucks	30	1,20	1,84	1,52	0,1	5
Trucks 3 and 4 axles	4	1,13	1,61	1,37	0,7	4
Articulated vehicles	1	1,16	1,81	1,48	0,9	2
Buses	1	1,12	1,65	1,38	0,6	1
Tractors , special vehicles	15	1,10	1,47	1,28	0,1	2
Road trains	1	1,09	1,48	1,28	1,0	2
Total OS 155 KN						16

Table 2. Road layer thickness and design values of dynamic elastic modulus and Poisson coefficient proposed

Name the layer material	h(cm)	E (MPa)	μ
Asphalt for the road surface BAPC 16	4	3600	0,35
Asphaltic mix for the bonding layer BADPC 20	5	3000	0,35
Base layer of crushed stone optimal mix	15	500	0,27
Foundation layer of ballast	25	208	0,27
Earth foundation	∞	70	0,42

CONCLUSIONS

Degradation of local roads in Băleşti, Vrancea County leads to improper and unsafely conduct and lack of comfort in the built-village movement.

The solution proposed for modernization will withstand traffic forecasted for the year 2029 provide water uptake and prevents stagnation, has a road structure that guarantees deformations permissible limits for class road.

By upgrading local roads is intended to ensure traffic comfort, this having a major importance for the local economy because it is a gateway to other communication channels So, the main economic activities of the inhabitants - agriculture, livestock, logging , farming, trade and service provision - use pathways to other roads, which are in benefit with the proposed modernization.

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DESIGN OF THE WASTEWATER TREATMENT PLANT BUILDING IN HULUBEȘTI VILLAGE

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Abstract

The article refers to the construction of the wastewater treatment plant building from Hulubeşti village, located in Dâmbovița county, Romania.
The building will be a new rectangular reinforced concrete semi-buried construction. It was adopted the elastic mat foundation type.
For checking the strength of the structure, it has been treated the loads given by: weight, wind, snow, service loads and seismic action. As a result of stability calculations it could be adopted the best solution regarding the building construction.

Key words*:stability calculations, loads, building, construction.*

INTRODUCTION

Wastewater treatment plant is designed to take waste water from street containers and to change its physio-chemical parameters in order to obtain values permitted by legislation for the evacuation.
Construction of the wastewater treatment plant building does not involve any special requirements in terms of structure. Wastewater treatment plant has both underground and over ground components and it is partially covered with the operational building (S.C. ProMs Concept Group S.R.L., 2012).
The positioning of tanks as well as the aboveground components is given by technological characteristics and conditions of the site.
The wastewater treatment plant building has a rectangular structure in plan and is made of monolith reinforced concrete. The foundation will be of elastic mat.

MATERIALS AND METHODS

The materials used for the construction of the wastewater treatment plant building are the following:

- Autoclaved aerated concrete bricks (B.C.A.),quality class GBN30, GBN20 (SR EN 771-4:2004/A1:2005) 30 cm and 20 cm thickness;
- Concrete for structural strength elements classC25/30 (SR EN 206-1, SR EN 13510, CP012/1-2007);
- Reinforcing bars: longitudinal- steel PC52; transversal- steel OB37.

The following material characteristics are taken into account (Table 1):

Table 1. Materials features

CONCRETE C25/30	Compressive strength of concrete	R_c= 25 N/mm^2
	Compressive strength calculation for persistent design situations	$R_{c.calc}$= 16,667 N/mm^2
	Tensile strength of concrete	R_i= 1,5 N/mm^2
	Tensile strength calculation of concrete for persistent design situations	$R_{i\text{-}calc}$= 1 N/mm^2
B.C.A	Specific weight	Y_c= 6 kN/m^3
STEEL	Feature resistance	R= 360 N/mm^2
	Strength calculation	R= 300 N/mm^2
	Elastic modulus	E= 210000 N/mm^2
	Poisson's ratio	ν = 0,3

I considered in the calculations, the following loads (Table 2):

- Weight;
- Snow (SR EN 1991-1-3:2005/NA:2006 TABLE NA1);
- Wind (SR EN 1991-1-4:2006);
- Seismic action (P100/2006);

Table 2. Loads

	Exterior Masonry	Interior Masonry	Current Floor Plate	Terrase Plate Type
Weight	8,576 kN/m	6,806 kN/m	2,16 kN/m^2	2,385 kN/m^2
Snow	-	-	-	1,6 kN/m^2
Wind	0,803 kN/m^2	-	-	0,803 kN/m^2
Seismicity-behavior factor	2	2	2	2

RESULTS AND DISCUSSIONS

The stability calculations are synthetized in Table 3 and demonstrate that the structure checks all the conditions in this regard.

Table 3. Stability verifications

Test	Equation	Value	Conclusion
The pressure on the sole foundation	$p_c = \frac{G_{str}}{A_{as}}$	140,805 kPa	Verification satisfied
Floatability	$V_{FL} = \frac{G_{str}}{R_{FL}}$	5,632	Verification satisfied

Reinforcement sizing calculations were done using SCIA ENGINEER software for plate type terrace; the bending moment diagrams in the X and Y directions are presented below (Figures 1, 2, 3, 4).

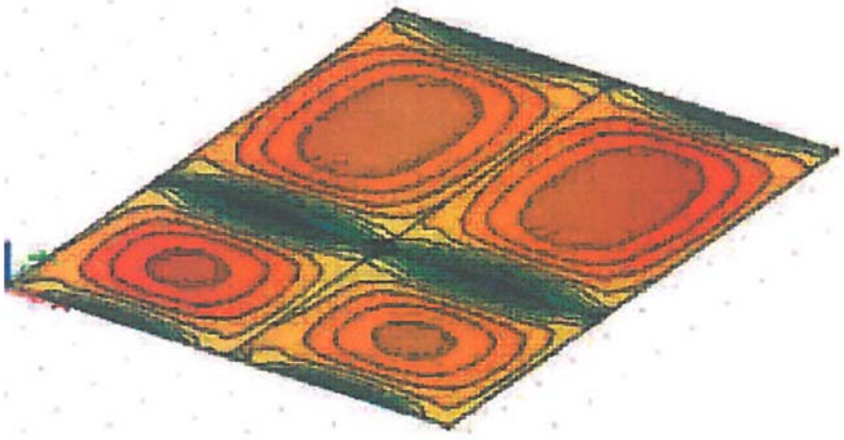

Figure 1. Bending Moment Diagram My- in Plate (Support)

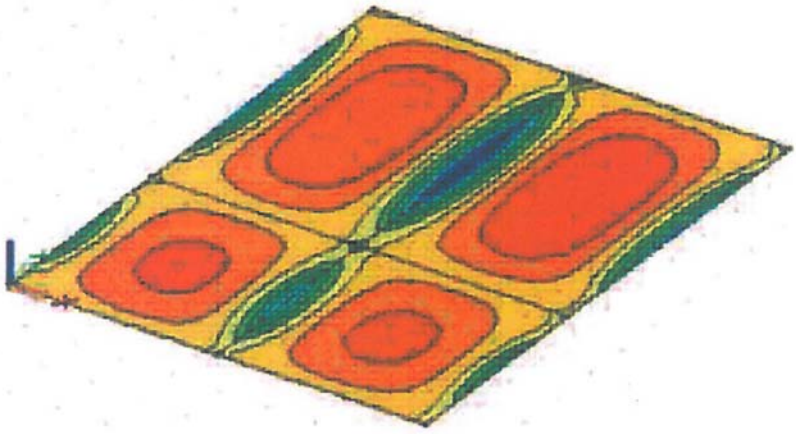

Figure 2. Bending Moment Diagram Mx- in Plate (Support)

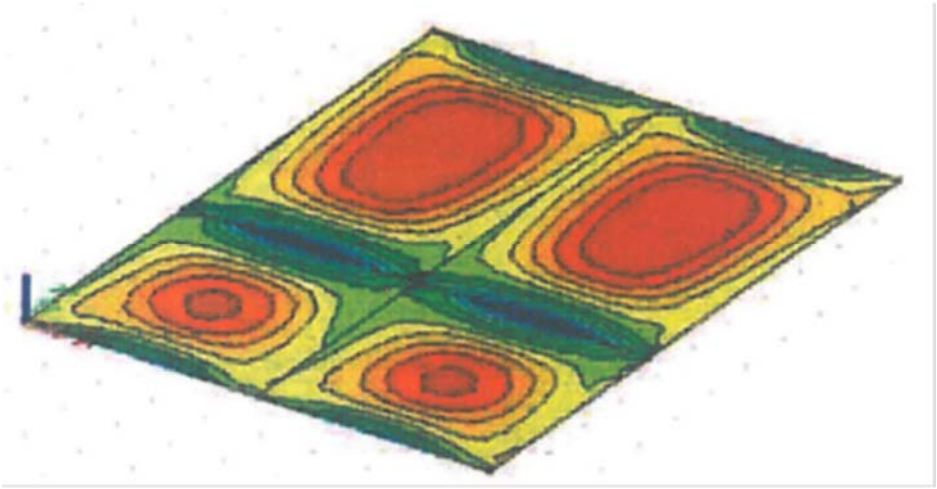

Figure 3. Bending Moment Diagram My+ in Plate (Field)

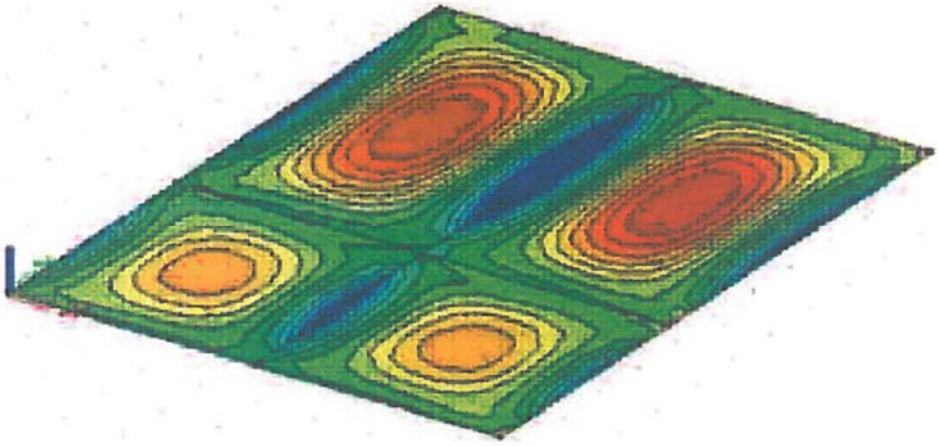

Figure 4. Bending Moment Diagram Mx+ in Plate (Support)

Structural and calculation elements for the analysed structure are presented below (Table 4).

Table 4. Structural and Calculation Elements

Element	Value			
	Field		Support	
	Direction X	Direction Y	Direction X	Direction Y
Plate thickness, t_p(cm)	15			
Maximum moment M_c (kNm)	7,67	9,81	12,25	15,115
The concrete cover plate a(mm)	30			
Effective cross-sectional height h_0(cm)	12			
Bending moment coefficient m_f	0,032	0,041	0,051	0,063
The ratio between the compression area and the effective area ξ	0,032	0,042	0,052	0,065
The minimum calculated reinforcement percentage p_{minc} (%)	0,18	0,232	0,291	0,362
Necessary reinforcement area $A_{a.nec}$(mm^2)	216,573	278,309	349,436	433,987
Reinforcement bars diameter ϕ_b(mm)	8	8	10	10
Bars distance l_b(cm)	15	15	15	15
Effective reinforcement area A_{ef} (mm^2)	335,103	335,103	523,599	523,599

Calculations and diagrams obtained (Table 4, Figures 1, 2, 3, 4) entitles me to propose the following reinforcement:

- For field- direction X and direction Y-bars ϕ 8/15 cm;
- For support- direction X and direction Y-bars ϕ 10/15 cm.

CONCLUSIONS

1. The treatment plant building is indispensable to achieve the goal of wastewater treatment.
2. The shape and size of the building are imposed by technological processes that are required for wastewater treatment.
3. The verification of stability and strength calculations supports the final solutionproposal for the plant building underlying the actual design.

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SR EN 206-1 "Concrete - Part 1: Specification, performance, production and conformity"

SR EN 13510 "Earth-moving machinery - Roll-over protective structures - Laboratory tests and performance requirements (ISO 3471:1994, including Amendment 1:1997 modified)"

SR EN 1992-1-1:2004 "Eurocode 2: Design of concrete structures. Part 1-1: General rules and rules for buildings"

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SR EN 1991-1-4:2006 "Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions"

SECTION 03
DISASTER MANAGEMENT

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RISK EVALUATION IN THE DECISION MAKING PROCESS

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Abstract

By acknowledging the fact that it is more efficient, wise, simple and cost-effective to prevent rather that repair any disaster, the present article is drawing our attention to the importance that Risk Management plays in the decision-making process. In the following article there have been pointed out the purpose and process of decision making, what role does risk management play in this process, what results should be expected and how the science of Management can be applied in the Land Reclamation field. What role does Risk Management play in Project planning and how is it helping it to increase its performances and efficiency. Towards the end, we will acknowledge the benefits of risk management in project planning and, how simulating and forecasting the results helps in achieving better results.

Key words*: decision making, risk management, disaster management, land reclamation works, management, sustainable development, risk probability, prevention/correction decision.*

INTRODUCTION

Decision is defined as "a moment, in an ongoing process of evaluating alternatives for meting an objective, at which expectations about a particular course of action impale the decision-maker to select that course of action most likely to result in attaining the o objective"(Harrison, 1999).A simpler definition it that decision-making is "a commitment to action"(Mintzberg, 1983).

Decisions can be:
structured- clear, unambiguous and easily definable or unstructured – unclear, ambiguous and difficult to define;
programmed - relay on some form of routine or non-programed – have no guidelines whatsoever;
strategic – point the direction of an organization or operational – day-to-day decisions(Teal et. al, 2003).

In order to have a positive outcome, a decision must be taken in a proper context. The context is set by the political, economic, social, legal, technological and environmental factors.

Theoretically, the purpose of the decisions must be rational and to aim an objective that must be achieved. In reality, (Anthony, 1986) states that "the inability of superordinates to learn from their subordinates about what was going on, the self-protectivefeigning of ignorance, the side–stepping of official procedures to gain personal advantage, the deliberate use of change and confusion… the construction and maintenance of ambiguous rules, and the claims and obligations of friendship" happen and affect the context in which decisions are made.
Within the managerial process there is a possibility that the task will not be accomplished and the outcome will be a negative one. This is called a risk and, like any other part of a project must be managed.Risk management can be operationalized as the number of different kinds of project risks are analyzed,and by evaluating risk probability the manager is able to choose the appropriate strategy (Cova and Holtius, 1993).

Risk Management is useful in any field of activity, including Land Reclamation. In order to ameliorate a certain land, a proper risk

evaluation must be made in order to apply the proper works in the proper way.

Our country faces all three possible issues that a land can encounter:

(i)- the excess of water – which may come from rainfall and \ or from groundwater located at a shallow depth, difficulty which can be remedied by drainage works. Another cause of excessive water are floods, situation which is remedied with works on rivers and damming. This situation is to be found on about five million hectares in our country, the land with small slopes (1-3%) and a high content of clay. Factors that cause water excess are both natural and anthropogenic. After draining the soil is more ventilated, microorganisms activity can take place in good conditions, physical and hydro conditions improve along with soil structure and its permeability. The plant root system can develop normally and healthy, chemical fertilizers are no longer washed away, hydrophilic plants are controlled, pests and diseases specific to areas with excessive water are prevented.

(ii)- water deficit which is caused by climate change.We observe this as being a problem increasingly harder to neglect. This problem can be controlled by applying a rational amount of irrigation. For irrigation it must be taken into account soil-water-plant-climate relationship and is necessary to understand the penetration processes, storage, movement, and loss of water in the soil. It also must be considered the plant vegetation stage depending on which it should be given a larger or smaller amount of water. The best way to find ground water requirement is for the engineer to go on the field, take a soil sample and determine the water deficit in a laboratory. Ideal humidity range for the plant is between minimum threshold and field capacity thresholds which differ depending on soil texture. Irrigation norm is determined by the consumption and water loss of the plant, the initial and final water reserves in the soil, rainfall and groundwater contribution. Watering methods are determined by the ground level and the culture which is planted. The most common methods are sprinkler irrigation, dropwise and for rice using submersion (Berca, 2006).

(iii)- soil erosion - due to solar radiation and gravity on the Earth's crust occurs an inexhaustible kinetic energy which is keeping the soil in a constant transformation, both water and air contributing to this phenomenon. Agriculture shows interest mostly for the first 20-30 centimeters which represents the active layer of soil, layer where there are most of the nutrients that the plant needs. Annually in our country are lost an average of 189 tons / square km. This phenomenon is produced on slopes and in our country about five million hectares are affected by erosion and the phenomenon is strong on 1.2 million hectares. Obviously the most significant soil losses are recorded in mountain and hill areas, areas that have been deforested, irrational exploited, and on lands which although it was found that the soil erosion process manifests, no action was taken. The main factors influencing soil erosion are slope of the land, slope length, vegetation and torrential rains. Methods to control this phenomenon are from the simplest such as plowing parallel with level curves, to their most complex and expensive such as embankments (Constantin and Maracineanu, 2005).

For all these problems, specific works must be made. When designing those works, a thorough planning must be aimed concerning a variety of factors. Calculating the risk plays a major role in designing land reclamation works. Besides the usual risks calculated in any project, the most important land reclamations works are designed to resist a natural disaster with a probability of 99.9%, 99% or 95%. The percentage is chosen considering economic factors.

MATERIALS AND METHODS

The planning process

In order to have a successful project a thorough plan must be made. A good planning process starts with asking the right questions. By assessing the environment, the important questions must be answered. "*Where are you now?"*What is the internal and external

situation?"*Where do you want to go*?" Know the aim. "*How can we get there?"*All the possible paths must betaken into consideration. *What is feasible, possible?* The path that will be adopted is the one that suits the goal and situation the best.

A planning process can be broke apart in four phases: Visioning, Analysis, Recommendation and Direction(Cassady, 2006).

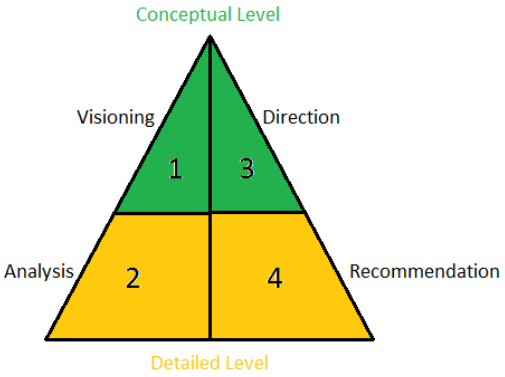

Figure 1. Planning Process Phases

Every plan must have all the important components like key objectives, vision, mision, busdgets, values, key initiatives, and so on. All these are parts of a planning process and the present paper suggests grouping these parts in to four phases. After doing that, two different process levels can be distinguished. There will be a conceptual level, which describes the holistic view of the project and is represented by Vision and Direction; and a detailed level which represents the foundation of the planning process and has as its components Analysis and Recommendation. The last two asses the environment regarding different points of view, judge how the project will be affected by different factors and how the situation will be managed.

1) Visioning

During the first phase, the planning project and process are initiated. The plan, scheduale, tasks, and deliverables are developed. The process that will be used to develop the plan will be defined. The individuals who will be involved in the planning process will be identified and their roles and responsibilities acknowledged. The process and the vehicle to communicate the status of the strategic planning is established. This phase ends by formally announcing the strategic planning effort to those involved in the process.

2) Analysis

The second phase is defined by an objectively analysis of the environment. At this phase the most common management tools used are PEST andSWOT.

PEST tool analyses the characteristics of the environment regarding four different points of view written in Table 1, and from those characteristics, management team draws the conclusions that define de environment.

Table 1. PEST tool

Political	- -
Economical	- -
Social	- -
Technical	- -

The conclusions drawn using the PEST tool can be seen as Strengths, Weaknesses, Opportunities or Threats in the SWOT analysis table.

Table 2. SWOT analysis

Internal	
S	W
O	T
External	

By using this tool, management team can have a holistic view of the internal and external environment, can evaluate it more accurately, and take the appropriate decisions.

This phase ends with a series of initial recommendations for all areas of the project (Zecheru and Năstase, 2016).

3) Direction

In the direction phase, the mission and vision are articulated using the project situation and direction as a basis. The strategic objectives are formulated and each goal and way to achieve that goal is reviewed. The important part of this

phase is to determine how to measure the value of progress. Last but not least, at this phase you prioritize your tasks. (Cassady, 2006)

4) Recommendation

In this phase, the roadmap outline is detailed for a longer period of time. The costs, time and resources are summarized. Various options of tackling the situation are identified and, advantages and disadvantages of each option are analyzed. At this stage, risk analysis plays a major role. As seen in Picture 2, each risk is evaluated, and according to that a proper form of mitigation is established.

$$E_i = p_1 c_{i1} + p_2 c_{i2} + ...p_n c_{in} = \sum_{j=1}^{n} p_j c_{ij}$$

Where:

E_i - Monetary value expected to be paidfor the project's case scenario adopted

p – Payment value to fix/prevent the unwanted outcome

c_i - Probability that the event will happen

Of course, the probability for a certain event to occur, in economics, is subjective and the situation can be seen from an optimistic or pessimistic point of view.

RAM		Probability				
Severity		Frequent	Likely	Occasional	Seldom	Unlikely
		A	B	C	D	E
Catastrophic	I	Extremely				
Critical	II	High	High			
Moderate	III		Medium			
Negligible	IV				Low	

Figure 2. RiskAssesmentMatrix (RAM)

"There are three key aspects of risk. Probability is the estimate of the likelihood that a hazard will cause a loss. Some hazards produce losses frequently, others almost never do. Severity is the estimate of the extent of loss that is likely. The third key aspect is exposure, which is the number of personnel or resources affected by a given event or, over time, by repeated events. To place hazards in rank order we must make the best possible estimate of the probability, severity, and exposure of a risk compared to the other risks that have been detected" (ICMA, 2016).

In order to reach a rational decision while evaluating the impact of a certain hazard two factors can be taken into consideration: economic andsocial. The economic evaluation of one project's risk can be calculated by addingthe products between each amount of money spent to fix or prevent a risk that may appear and its probability of occurrence.

In engineering, on the other hand, the probability for a certain event to happen it is deducted empirically by counting the number of events occurred in the last one hundred years. So, depending on the nature of the decision that is taken, the manager will tackle the situation accordingly.

By the end of this phase you will have a detailed roadmap of the process, summarized costs, and identified risks, a developed communication plan and an ongoing process to keep the plan up-to-date(Zecheru, 2014).

RESULTS AND DISCUSSIONS

In order to understand complex situations organizations break the problems into well-defined parameters by using modeling and simulations. These practices are useful while forecasting the future of the project. As an ancient dictum suggests, "You cannot manage what you do not measure". The cause and

effect relationship between parameters can be measured, or estimated and quantified. Nowadays with the help of technology, i.e. computer, risk models can be easily developed and analyzed.

Accurate forecasting and planning are vital for the health of a project and should be defined by realism and sensitivity to change. Working forecast ought to be the result of a high-quantity data analyzed by a competent managerial judgment.

Forecasts are most commonly interpreted by using graphs (see Figure 3). The graphs are monitoring how a certain characteristic evolves in time. Traditionally, there are three characteristics and effects in a time series model that present interest for the forecasters:

- *trend* - which can be downward or upward
- *seasonal variations*–repeated peaks which occur during a certainperiod, which are obvious and significant.
- *random effects*–the frequency with which events that do not fit the pattern occur.

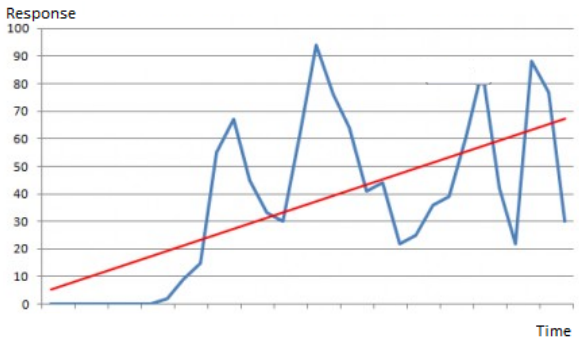

Figure 3. Response in Time (example)

Following a thorough analysis of the graph, the management team can plan more accurately, diminish the unpredictable outcomes and have a better control over the situation.

The general structure of decision-making outcomes is summarized in Table 3. An effective Risk Management will lead to outcomes that are framed in box "A", predictable and under control.

Table 3. Matrix of decisions and outcomes

MDO	Predictable Outcome	Unpredictable Outcome
Decision under voluntary management control	A	B
Decision under involuntary management control	C	D

The factors involved in the decision analysis are experience, judgment, team work and factual data which used to develop estimates of the chance of success or failure. The present article suggests four ground rules that must be followed:

i) Decision making must be a combination of human values and factual evidence.
ii) The core element in decision-making is the interpretation of factual data.
iii) While making a decision, the values can be seen as a filter that will affect the individual perception of factual data and there is no such thing as a set of universal human values.
iv) Within complex problem situations,inconsistency, human bias or personal agenda must be acknowledged(Teal et. al, 2003).

To summarize, it can be stated that in the decision making process two parts can be distinguished: one human and one factual; and both of these parts must be taken into consideration while assessing the risks.

CONCLUSIONS

Risk Management is one of the most important tools in the Decision-Making process and without it the chance of success of a project is diminished.

Risk is a factor the must be taken into consideration before a project starts, during a project and after a project is completed, especially in Land Reclamation field. If a risk is foresee and measures are taken against it, it can no longer be called a risk, is just another part of the project that must be managedfor the aim to be achieved. So, ideally a manager\engineer predicts all the risks that he

may encounter and transform them into tasks that must be completed. Experience taught us that there is no such thing as foreseeing all the risks so all that a leader can do is to predict as many issues as he can and, to be ready for the unpredictable.

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THE BEHAVIOUR OF REINFORCED CONCRETE BUILDINGS UNDER VRANCEA EARTHQUAKE

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Abstract

From all natural catastrophes the earthquakes are the only unpredictable and the most destructive actions that in a few seconds change the fate of people with their goods. The paper presents a type of structural intervention on reinforced buildings and solutions for determine the dynamic building response. On basis of dynamic response recorded for buildings, a methodology for analysing the structural behaviour of this typology of buildings by adequate software for 3D seismic analysing is presented. For this purpose non-destructive and geodynamic methods were used. All the aforementioned ideas are illustrated through a study case.

Key words*: seismic action, nondestructive tests, seismic instrumentation, structural analysis*

SEISMIC HAZARD OF VRANCEA AREA

The seismicity of Vrancea is characterized by a source process and some spectral characteristics of this intermediate-depth source in a narrow epicentral and hypocentral region. Thus, according to some studies (Heidbach et al, 2007; Oth et al, 2008; Lungu et al, 2008), for Vrancea source the following characteristics are considered:

- the subduction zone is no longer an active Benioff-Wadati zone, but rather a passively sinking almost detached slab; although the area of high seismicity naturally coincides with high deformation rates this does not necessitate this depth as the actual breakoff zone;
- the seismic events have a maximum instrumentally measured magnitude of 7.7;
- the average amount of seismic moment released per year by Vrancea earthquakes is proportional to the elastic energy release rate, maximum possible magnitude of Mw = 8.0, and it was obtained for 1940, 1977, 1986, 1990 earthquakes;
-indicate large stress release and a difference in attenuation much stronger in the epicentral area and much lower attenuation in the foreland;
- the frequency content of the Vrancea ground motions shows significant differences in source mechanisms, a directivity between events and an asymetric distribution of the ground motion;
- soil condition in Bucharest with long predominant period of ground vibration Tg=1.4-1.6s;

MATERIALS AND METHODS

Behaviour analysis of different types of buildings and the earthquake effect evaluation on them, in addition to a detailed visual inspection of building's state and recording the damage found, in many cases, involves a series of tests and experimental research. Theseare made for both the hidden effect detection and to specify the real characteristics of materials and structural components that have suffered damage.

In Romania seismic protection was provided by P100: 1992 and from 2006, and 2008 respectively, the code P100 was in forced with parts 1:2013 and 3:2008 - which is made in accordance with Eurocode 8. In Romania the

Ordinance no. 20/1994 was promulgated, which includes intervention measures on existing buildings and the Government Emergency Ordinance no. 21/2004 which has institutionalized the National System of Management of Emergency Situations. But now there is no specific legislation to protect university buildings which according to codes above mentioned are included in 2nd Class of importance.

Non-destructive test presented in Fig.2 are used for establish quality of construction materials in new and old buildings. From old buildings is necessary to know the concrete strength to know what strengthening measures to take, and for the new ones to know each execution errors. Measurements were performed with Profometer 5+, Digi Schmidt and Pundit Lab devices (Figure 1), and these measure the rebound index, respectively the propagation speed of the ultrasounds.

a. *Profometer 5+* device b. *Digi Schmidt* device 5. Pundit Lab device

Figure 1. Equipment used for non-destructive tests

In terms of dynamic, a building can be modelled as an elastic system embedded in the ground through a rigid foundation and the ground can be modelled as elastic half space.

The ground motion is usually a chaotic feature and for this reason the time variation of various kinematical parameters can't be described in mathematical terms by simple analytical functions. Such phenomena must be modelled by so-called random functions, defined as functions of time for which the values at a time are random variables.

Spectral composition of these oscillations is influenced by the nature of disturbances. It is necessary that the excitation meets a fundamental condition to allow emphasis on the response of the dynamic characteristics of the building. This condition refers to the spectral density of excitation, which should be "broadband", with a constant value on a range of frequencies (pulses) as large as possible.

The use of experimental determinations to identify proper periods, as well as other dynamic characteristics of the constructions, is based on theoretical developments in dynamic structures. Between the period (the term most often used in engineering practice), frequency and pulse exists the simple relationship, as Eq. 1.

$$T = \frac{1}{f} = \frac{2\pi}{\omega}; \quad f = \frac{1}{T} = \frac{\omega}{2\pi}; \quad \omega = \frac{2\pi}{T} = 2\pi f \quad (1)$$

An important element involved in calculating the building subjected to seismic forces, is the proper vibration period of the building, whose value, determined experimentally, can give an indication of the stiffness and resistance capacity level of these structures to horizontal seismic forces.

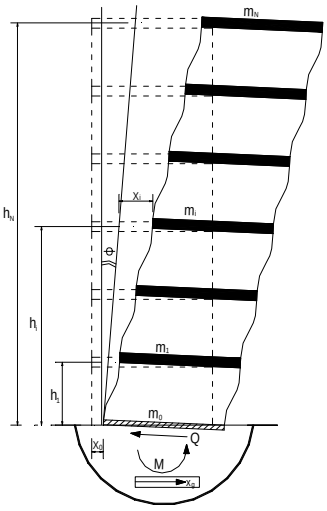

Figure 2. Structure-ground dynamic model

During the earthquake all buildings behave beyond the elastic range, which implies changing of all dynamic characteristics. It is

obvious that after the ground motion ends, the structure will remain with modified physical and mechanical characteristics. Thus from the degradation caused by the earthquake, the building' stiffness decreases, the proper periods are increased and the percentage of critical damping increases. So the higher a building is damaged, the higher are the proper periods than their initial ones. But the rigidity and proper period values of the constructions are influenced not only by visible degradations, but also by a series of deformations and invisible cracks accumulated in the building structure, which can be important. Such deformation occurs sometimes later, as observed after the earthquake of 03.04.1977, when to the number of damaged buildings, it was found later, long after the earthquake, an increased occurrence of cracks or appearance of new ones.

Therefore, measuring of proper vibration periods of the buildings in their different situations, namely: after being released to service, before the earthquake, after the effect of the earthquake that caused damages and weakened the structure, or after the strengthening and reinforcement so it allows a determination of the rigidities and therefore very useful assessment of the degree of damage and resistance capacity of buildings.

The equipment presented in Figure 3 is installed in the laboratory of concrete from the Faculty of Land Improvement and Environmental Engineering and it is an integral part of the National Seismic Network for Construction of the National Institute of Research-Development for Construction, Urban Planning and Sustainable Territorial Development (Dragomir, 2010).

Figure 3. Digital Accelerograph GMS-18 GeoSIG.

RESULTS AND DISCUSSIONS

For the structural analysis Autodesk Robot Structural Analysis Professional software was used (Dragomir, 2009). As methods of structural analysis method of equivalent static seismic forces and the method of modal analysis with response spectra were used.

In Figure 4 it can be seen structure of the building before and after the structural interventions. Figure 5 presents the space deformations of building under seismic actions graph that contains, in two cases: before and after structural intervention consisting in reinforced concrete walls.

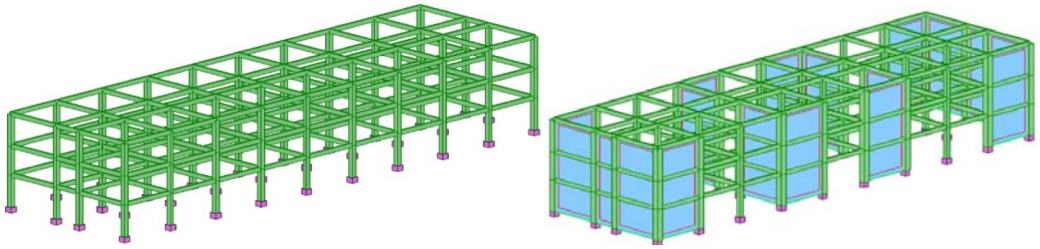

Figure 4. The space structure of the building before and after the structural interventions

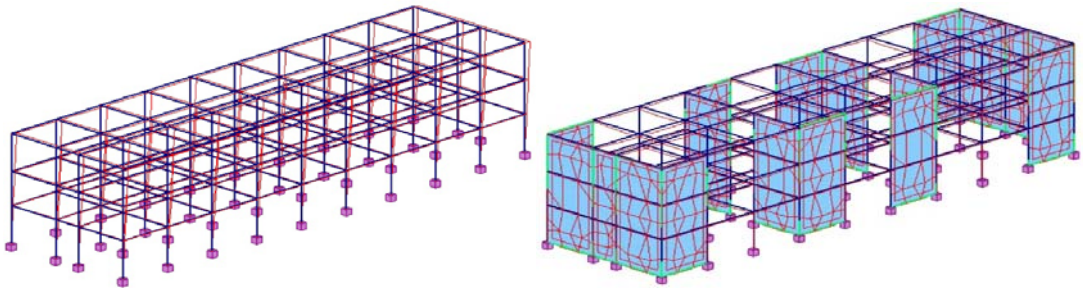

Figure 5. The building deformations before and after structural interventions under seismic action

The results of structural analysis are emphasised in table 1 and 2. It can be seen the increase of the stiffness with 20% after introducing the reinforced concrete walls.

Table 1. Reduction of the seismic risk after the structural interventions

The building	The class of seismic risk		Reduction rate of the seismic risk
	Before seismic intervention	After seismic intervention	
Body C	II (4,77)	III (7.42)	**56%**

Table 2. Increase of the stiffness after the structural interventions

The building	Frequency		Increase of the stiffness
	Before the seismic intervention	After the seismic intervention	
Body C	2,92	3,49	**20%**

CONCLUSIONS

The model for assessment of buildings performances proposes the validation of calculations with a program dedicated to structural analysis using instrumental data processing techniques. The input data are based on non-destructive methods as auscultation, rebar locating, ultrasound velocity, percussion with Schmidt hammer, and the seismic monitoring methods using the GMS 18, GeoSIG equipment.

Applying themodel based on structural analysis and buildings seismic instrumentation can obtain buildings behaviour under seismic actions.

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A MODERN SYSTEM FOR BUILDING UP REINFORCED CONCRETE STRUCTURES

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Abstract

The article presents a modern method of building up constructions, increasingly used at international and European level. The method consists in the introduction of isolation devices to the interface between superstructure and infrastructure so that seismic force acting on the structure to be absorbed by the isolation system Finally, it presents an example of design calculation for the isolation system according to the new design code in Romania, indicative P100-1: 2013.

Key words*: earthquake, shock-absorption, seismic isolators*

INTRODUCTION

One of the particularities in the design of structures in Romania is the presence of seismic hazard. Seismic action is often the base action which dimensions the structural elements of buildings.

Starting with the aftermath of the devastating earthquake of 10 November 1940 in our country there have studied and have been gradually introduced mandatory norms for seismic design of buildings in relation to the development knowledge and data in the country and abroad, as well as to the scientific research.

In 1963, 1970, 1981, and most recently in 1991, new norms of anti-seismic design, standards, guidelines and specialty rules for different types of building structures were introduced in practice. The relatively moderate effects of the earthquake of 1977 in our country on buildings designed according to the norms in force in the year1963 and 1970 in comparison to the damaging effects on tall buildings which had been executed without earthquake protection before 1940 are conclusive about the proper concept basis of our norms.

Of course some deficiencies have occurred and will occur in some cases even for buildings after 1940 because progress is achieved through a continuous confrontation with reality by improving calculation and quality control methods.

At the same time, only after 1977 and 1990 there have been obtained, through INCERC network of seismographs, engineering data about the characteristics of strong seismic movements in our country, needed for a modern approach on calculations.

The new regulatory framework for the design and the construction of earthquake resistant buildings SI.100 / 1991 provides measures similar to regulatory norms in countries with high seismicity.

Thus, the seismic protection of buildings aims to limit degradations, failures, and to avoid the falling of structural elements (resistance), of the non-structural (partition walls, other secondary elements), of equipment and installations.

Land seismic oscillation is transmitted to buildings which respond through their own oscillation depending on their dynamic and constructive characteristics.

Constructions withstand either well or improperly the seismic movement particularly depending on their ability to take reactionless side forces induced by an earthquake.

The vertical load bearing capacity (gravitational) was generally well secured as far as the early stages of construction science

development. Traditional construction methods in our country provide, considering the experience of living in a seismic area, a certain level of resistance to lateral seismic forces.

The introduction of modern materials (reinforced concrete) at the beginning of our century determined, in our country as well, an excessive reliance on the quality of bearing frame structures, but which in reality could not provide the ability to take over strong seismic (side) forces because anti-seismic calculation methods had not developed enough up to that time.
The structures of brick, metal, wood, reinforced concrete etc. currently used in our country are designed to take over seismic forces.
Earthquakes can cause disastrous problems by:

-blocking main crossroads, due to the collapse of buildings;
-preventing rescue- first aid operations;
-destruction of vital utility networks (water supply, gas, electricity, transport, communications) and the isolation of areas;
-destruction, or lack of functionality of hospital facilities and the occurrence of epidemics;
-the large-scale destruction of residential buildings and the impossibility to provide temporary accommodation for large groups of population in the area.

So far, in our country, the preceding earthquakes have not caused massive disasters of the above-mentioned type.
In the traditional design, in case of a major seismic event, degradation occurs in case of both structural elements, as well as of non-structural ones. This involves carrying out post-earthquake repair and consolidation works. The average recurrence interval considered for relevant earthquakes (MRI = 100 years - According to P100-1 / 2006) reported to the lifetime of a construction makes the traditional design to be more advantageous in terms of initial cost.

Modern methods of design requires for certain phases the use of finite element analysis which allows to obtain safe projects from the point of view of structural strength and durability by: reducing the cost of design and production, material saving, recognizing weaknesses, increasing the quality of the project, optimizing the construction.

MATERIALS AND METHODS

Base isolation method is one of the modern methods for reducing the effects of seismic action on buildings by introducing an isolation system between the land and the structure.
The four fundamental functions of a seismic isolation system are:
1. Transmission of vertical loads;
2. Allowance of displacements on the horizontal plane;
3. Dissipation of substantial quantities of energy.
4. Assurance of self-centring.
These functions can be realized by so called isolators and dampers.
The isolation system consists in seismic isolators (have high rigidity on the vertical and are flexible on the horizontal) and shock-absorbers. In the traditional method, the energy generated by the seismic action is dissipated by controlled degradations in the superstructure elements. In the base isolation method seismic action is taken on the isolation layer and superstructure will remain in elastic behavior area. The idea of the method consists in the fact that for a rigid construction, with its own vibration period corresponding to the maximum amplification area of elastic response spectrum, by introducing the isolation layer, the structure becomes flexible, the natural period of vibration increases significantly, and the effects of the seismic action are reduced.
Base isolation method consists in the introduction of an isolation layer between the land and the structure that isolates the movement of superstructure from the land movement. In the event of a major seismic event no degradations of the structural and non-structural elements are caused, but the method involves a much higher initial cost. Some of the major advantages of the base isolation system is to ensure the continuous operation of their construction and to limit intervention works only to the isolation layer. Base isolation method is effective for constructions with low height and where side displacements are not

prevented (the system works with large side displacements). The idea of the method consists in the fact that for a rigid construction, with its own vibration period corresponding to the maximum amplification area of elastic response spectrum, by introducing the isolation layer, the structure becomes flexible, the natural period of vibration increases significantly, and the effects of the seismic action are reduced. For the isolation system to be effective the ratio between the non-insulated and insulated structure period must be above 3.
The insulating layer consists of seismic insulators and necessarily shock-absorbers. The insulators have a high vertical rigidity to ensure the secure transmission of gravity loads and a low side rigidity to perform the isolation of seismic movement. The ratio between the two rigidity values is between 2500 and 3000.
The main types of insulators are the following:

- natural rubber insulators (NRB);
- Natural rubber insulators with lead core (LRB)
- Synthetic rubber insulators with damping properties (HDRB)
- Devices allowing sliding (SB)

HDBR insulator type consists of several layers of synthetic rubber with cushioning properties, with thickness of 3-10 mm, between which steel plates of 2,5-4 mm are included. These insulators are manufactured with diameters ranging from 500-1500 mm, but the most commonly used diameters are of 600-1200mm. The main parameters of the insulator are S1 factors, S2 respectively. S1 factor is a dimensionless size of the form ratio for a single layer of rubber; for a circular insulator with diameter D and the thickness of the rubber layer tR, the ratio is:

$$S1=D/A*tR.$$

The value of this ratio is between 35 and 40. S2 form factor is the ratio between the insulator diameter D and the total thickness of the rubber layer Tq. The value of this report is about 5. The unitary effort of long-term compression is 10-15N / mm2, and the unitary effort of short-term compression is 15-20N / mm2. The design deformations of these insulators are of 250-300%, and the last deformation of 400%. Due to slow drainage, aging, temperature effects, history of loads, frequency of loading/unloading cycles etc., a reduction of 20% of the insulator parameters occurs. For a side displacement of 300%, an equivalent viscous shock-absorption is obtained of about 20%.

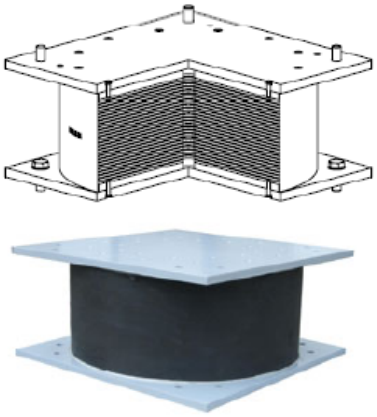

Figure 1. Isolator HDRB

The shock-absorbers are laid to reduce relative movements of the isolation layer, and to stop the movement. The main types of shock-absorbers are: hydraulic shock-absorber (viscous damping type), lead shock-absorbers and steel shock-absorbers (hysteretic damping).
In practice, the principle of Seismic Isolation is that of shifting the fundamental period (= reciprocal value of the frequency) of a building (Figure 2) by the installation of devices with a low horizontal stiffness between foundation and building (Figure 3).

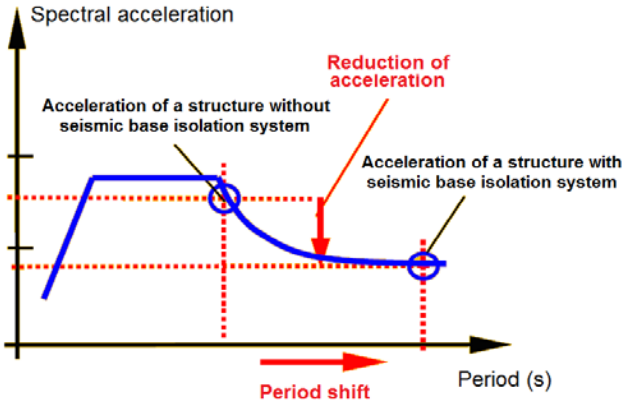

Figure 2. Response spectrum

Figure 3 below shows the effects of seismic movements on both a non-isolated and an

isolated structure. Many non-isolated buildings have fundamental periods of 0,2-0,5 sec, especially old buildings with lowest height regime, i.e. the same fall within the typical range of high spectral acceleration (i.e. where the maximum energy content of the response spectrum is concentrated). Thus, the non-isolated buildings undergo resonance that results in dramatic amplification of ground accelerations within the structure as well as large inter-storey displacements. In the case of an isolated building, the fundamental period is shifted into an area with lower spectral accelerations. Resonance effects can be avoided and the building moves smoothly without showing appreciable structural deformations (Dragomir, 2008).

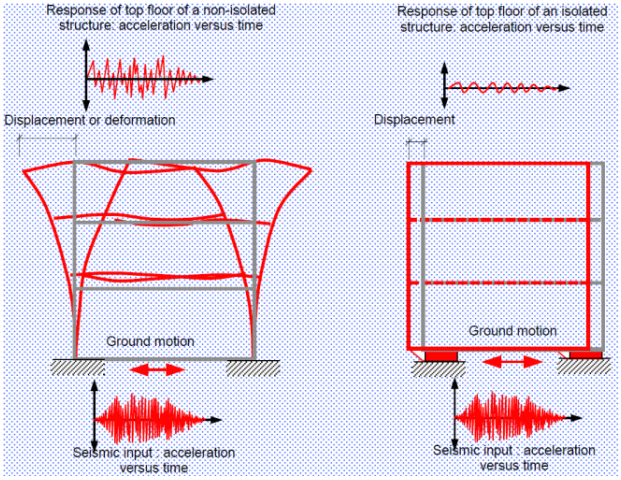

Figure 3. Displacements and deformations of a non-isolated and of an isolated structure

In Figure 4 it can see the general installation of isolation system with High Damping Rubber Bearings.

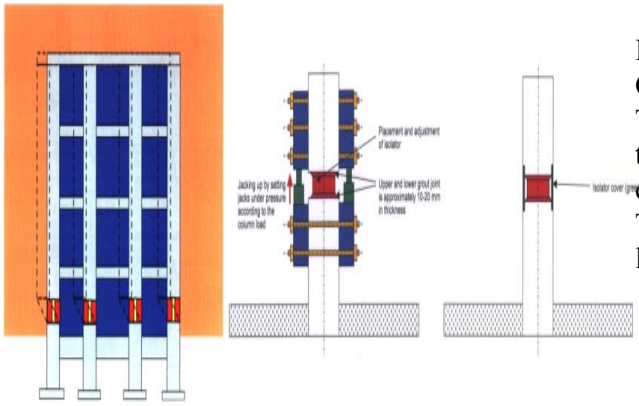

Figure 4. General installation of isolation system

Figure 5. Example of application of base isolation method

We will analyze base isolation method technology for a technological hall with space frames made of reinforced concrete floor (Figure 6).

Hall structure consists of 12 pillars;

Hall area is S=15.00x9.00 m;

Cross-sectional dimensions of the frame are: HframexLframe=4.80x9.00 m.

Under each pillar structure will be placed a seismic isolator.

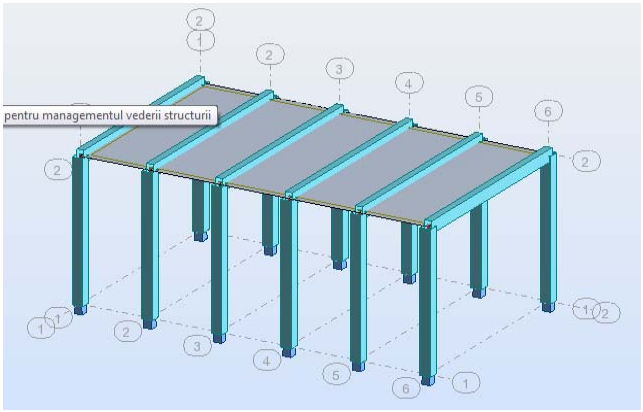

Figure 6. Technological hall

Isolators used will be supplied by MAURER Company, Germany.

The geometrical characteristics of isolators and their number will be established for each body corp.

To set these features was used as the equivalent linear calculation code P100-1/2013.

In determining the number of isolators needed and to determinate the type of isolators we have made the followings calculations:

-Period T = 0,48 s
-Mass M = 74.12 t
-Number of pillars = 12
-Vertical load P =726.86/12 kN=60.57 kN

MAURER Company sells 7 types of seismic isolators:4 types are rubber insert (Table 1) and 3 types are spherical isolators (Table 2). Their features are shown in the tables below:

Table 1. Types of seismic isolators with rubber insert

Maximum upload service (kN)	Type system of seismic isolation	Maximum longitudinal and lateral displacement "s" (service/seismic) (+/- mm)					
		D (mm)	s (mm)	H (mm)	D (mm)	s (mm)	H (mm)
600	V2S	530	35/70	155	530	41/80	175
600	VE2S	530	35/70	185	530	41/80	210
370/450	LRB	280x170/ 280x220		79/90			79/90
600	LRB2E	530	35/55	195	530	41/65	220

Table 2. Types of spherical isolators

Vertical load (kN)	Type system of seismic isolation	Horizontal displacement d (mm)	Dimension Q of the isolator SI (mm)	Seismic isolator height SI (mm)
500	SI	+/- 350	944	90
500	SIP-S	+/- 350	944	194
500	SIP-D	+/- 350	944	184

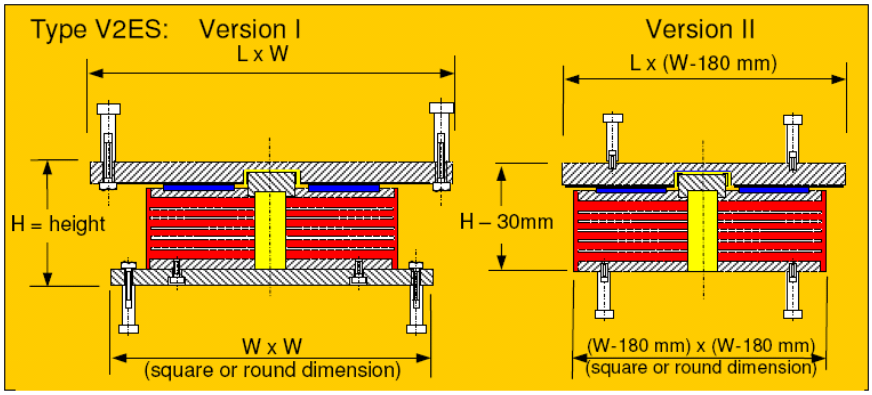

Figure 7. The principle of construction of seismic isolators type LRB-2E

Table 3. Particular type of seismic isolator

Pos.	Load (kN)	No.	Type	Length	Width	Heigh	Rubber height	weight	Price
1	600/1000	12	MLRB	300	400	310	195	300	3500

RESULTS AND DISCUSSIONS

In most cases where the base isolation method is adopted, the layer of isolation is placed at the base of the structure – the case of civil constructions. However, there are some situations when it is more convenient to insulate only a certain amount of mass (in the case of industrial structures with grouped mass).

A very important aspect related to the seismic isolation method is the proper placement of insulators and shock absorbers. They always will be placed so that to avoid torsion.
For the isolation system to be effective the ratio between the non-insulated and insulated structure period must be above 3
By seismic isolation method, due to flexibility of structure, leading to a significant reduction in the level of structure accelerations, the effects of seismic action will be reduced and the amount of materials used will be also reduced. By the reduction of the dynamic amplification factor, the effects of seismic action on the building will be reduced. This reduction represents the idea of seismic isolation method.
A major disadvantage of this method, which limits its use, is that it works with very large side displacements. During the entire duration of the seismic action, the free deformation of the isolation system should be provided. Particular attention must be given to the placement of the isolation, so that to avoid torsion. The seismic isolation method involves a higher initial isolation cost compared to the traditional method, but post-earthquake intervention is more simple, faster and it is limited only to the isolation system level, thus allowing the continuous use of the structure.

CONCLUSIONS

By seismic isolation method, due to flexibility of structure, leading to a significant reduction in the level of structure accelerations, the effects of seismic action will be reduced and the amount of materials used will be also reduced.
A major disadvantage of this method, which limits its use, is that it works with very large side displacements. During the entire duration of the seismic action, the free deformation of the isolation system should be provided. Particular attention must be given to the placement of the isolation, so that to avoid torsion.
The seismic isolation method involves a higher initial isolation cost compared to the traditional method, but post-earthquake intervention is more simple, faster and it is limited only to the isolation system level, thus allowing the continuous use of the structure.

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SECTION 04
WATER RESOURCES MANAGEMENT

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INTEGRATED MANAGEMENT OF WATER RESOURCES IN BERCA VILLAGE, BUZAU COUNTY

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Abstract

Integrated management of water resources approach promoted the development and management of water, land and their resources in order to optimize, balanced economic and social development without compromising the sustainability of ecosystems. The paper is presenting how water resources management was done in Berca community, from Buzau County, covering the full cycle of water use – from water intake of raw water, water treatment, water distribution, collecting waste water and discharging of treated wastewater in natural water bodies, and issues associated with the sustainable services of water supply and sewerage. In this work are presenting all the works contained in the systems of water supply and waste water, describingalso the water treatment plant(WTP) and the wastewater treatment plant, under construction at present.Currently, the Berca villageis supplied from groundwater sources, water treatment is made only through chlorination,the system works gravitational, and the wastewater treatment plant(WWTP) has a physico-mechanical leveland a biological level treatment.Some public institutions and businesses in Berca and neighboring villages, have their own pre-treatment equipment - septic tanks of wastewater resulting from these activities, the wastewater from these tanks are discharged into the Berca WWTP. These systems are managed by the company SC APAPRIMA BERCA SRL, founded in 2011, with only one shareholder, the Local Council of Berca. In conclusion, proper management of water resources in Bercavillage ensures environmental protection and elimination of risk factors for human health.

Key words*: integrated water management, natural water bodies, water supply system, wastewater, sludge management, public health.*

INTRODUCTION

Buzau County is located in the south-east part of Romania, with an area of 6,102.55 sq km, representing 2.6% of the country.

It occupies most of the Buzau River Basin, including harmoniously all forms of relief: mountains in north and plains in south, between them is located Carpathian hilly.

Maximum altitude records in Penteleu peak (1,772 m) and the minimum in the valley Călmăţui (40 m).

It is bordered to the North-West with Brasov and Covasna counties, North-East with Vrancea County, at East with Braila, at South with IalomitaCounty, and in the West part with Prahova County.

In terms of administrative organization, Buzau County has 85 villages, of which 2 municipalities - Buzau and Ramnicu Sarat, 2 cities – Nehoiu and Pogoanele and 81 communes with 481 villages. The City of Buzau is the capital county**.**

Figure 1. Buzău County

The objective under study is situated mainly on the administrative territory of Berca and

Vernesti, commune Berca is located in the central area of the county at 29 km from the town of Buzau and is disposed on the side of the River Buzau. This valley has developed in the area a lot of terraces were are located the 13 villages of the commune.
Being on a lowland,the relief predominantly hilly,is completed with a relatively small riverside. 2% of the commune Berca area is includedwithin the protected area of the Riverside Buzau.
Berca commune is formedof 13 villages, namely: Baceni, Berca (residence) Cojanu, Joseni, Mânăstirea Rătești, Pâclele, Pleșcoi, Pleșești, Rătești, Satuc, Tâțârligu,Valea Nucului și Viforâta.

Figure 2. Berca village

According to the census of January 2011, the population of Berca localityamounts to 8,534 inhabitants, lower then the previous census in 2002, when 9,602 inhabitants had registered.
Berca territory is crossed by 4 km of the national road, 20 km from the county road and 12 km of municipal road, all rehabilitated. The villages are served by 18 km of gas network, 15km of cable TV network,wich is in expansion.
In terms of local tourism here is the most interesting reserves mixed (geological and botanical) in Romania, namely the mud volcanoes from Pâclele Mari and Pâclele Mici. Berca village is also known for its authentic Plescoi sausages,wich are trade-marked recognized at European level.

Figure 3. Pâclele Mari Mud volcanoes

The approach of an integrated management of water resources promotes the development and coordination of water, land and their resources, in order to optimize and balance economic and social development, without compromising the sustainability of ecosystems.
Development policies can not be effective without taking into account water resources. The concept of integrated management of water resources requires, in contrast to traditional water resource management, an integrated approach to both their physical and technical level and at the level of regional planning and management. The level of integration is the catchment area forming a natural unit of water resources.
The most important aspects of system development of water resources are, as follows:
-physical aspects of sustainability - which means maintaining the natural cycle of water and nutrients;
-environmental sustainability - "*zero tolerance*" for pollution exceeding the self-purification capacity of the environment; no long-term effects or irreversible effects on the environment;
-social sustainability - maintaining water requirements and the need for insurance payment of water resources;
-economic sustainability - economic support measures that ensure a high standard of living in terms of water for all citizens;
-institutional sustainability - maintaining the capacity to plan, manage and operate the water resources system.
After Romania's accession to the European Union, Romanians must benefit from the same standards for the water services within the other

EU countries, that have drinking water of good quality and sufficient quantity of water, clean environment and protection from floods and droughts risks.

However, in our country, water management is still facing numerous problems, especially regarding the provision of water services to meet the European standards. Among these difficulties, it is mentioned:

-lackof water sourcesof qualityneeded for water supply to some urban and rural areas;

-precarious situation of infrastructure of centralized water supply and sewerage systems;

-improperly quality of water flowing on some sectors, of lakes, groundwater in numerous hydrostructures, mainly due to pollution by sewage and industrial wastewater;

-insufficient hydro facilities in rural areas;

-large agricultural areas and numerous localities at risk of flooding;

-difficulties in mitigating the effects of drought due to the impossibility of using the entire surface arranged for irrigation;

-intensified erosion and land degradation.

Proposed investments by local authorities and providers of water and wastewater services

Figure 4. Approach for integrated management of water resources

must cover the full cycle of water use - from capturing and treating raw water, distribution of treated water, wastewater collection and discharge of treated wsstewater into natural bodies of water, and issues associated with the provision of sustainable water supply and sanitation, as shown in the figure below.

This approach to integrated water management is in full compliance with current national legislation, and also meets the provisions of the relevant EU Directives for the water supply and sewerage development.

It is understood that such an integral approach is associated with high costs for investments that have been prioritized and developed in multiple phases of implementation, depending on financial resources available locally or at county level.

MATERIALS AND METHODS

The source for water supply of localities of the Berca commune,is groundwater abstracted by drilling medium depth wells, as follows:

-Wells in the area Vernesti, which has 10 medium depth drilling wells, completed at a depth of 150-153 m each, and located north ofVernesti village, on the right side terrace of Buzau River, upstream of the confluence with the Niscov stream.

Figure 5. Drilling area

-Source Valea Nucului, consisting of two drilling wells in Valea Nucului, one well is working and the second is under conservation.

-Source Niscov, consisting of three drilling wells, of which 1 well is under operation feeding the village Niscov, and two are under conservation.

The water from groundwater sources (from those three fronts) is treated in a semi-automatic chlorination station, located within the water treatement plant Vernesti. The plant is equipped with chlorination device and warehouse for chlorine tanks. The water treatment is made with chlorine, with an injector in the water storage tank, so after treatment, free residual chlorine should not exceed 0.5 mg / l water.

From Vernesti water source (intake Vernesti) to household water Vernesti basin storage, water is transported through a pipe culvert steel in length of 1,800 m, of which 800 m pipeline

steel Dn 358 mm, and 1,000 m steel Dn 521 mm.
At the household water Vernesti, a water tank of reinforced concreteis placed, which is playing simultaneously roles, as basin pump discharge of drilling and tank suction for the pump station of Vernesti, the basin has a storage capacity of V = 500 mc.
The pumping station Vernesti is placed in a brick building with the following destinations: pump room, board room, warehouse, workshop, dressing room, transformer station.

Figure 6. Vernesti pumping station

Water supply in the localities benefiting from the analyzed components, is done by pumping water through pumping station Vernesti and repumpingstation Satuc, in culvert underground pipes totaling a length of about 39.9 km.
Culvert pipe water from the pumping station SatuctoBerca, Satuc, Plesesti, Plescoi,ValeaNucului localities, is a steel pipe of L = 11.2 km length, of which:
-SRP Satuc culvert section BercaDn 250 mm, L = 1.9 km in that branch network of water distribution to consumers (distribution pipes in Berca) totaling a length of 2.25 km.
-Section of water main inSatuc isof L = 1.2 km, in that branch network of water distribution to consumers (distribution pipes in Satuc), totaling a length of 2.65 km. For industrial culvert pipe through the manhole connection; other consumers - public and private are supplied from a pipeline pumping station Satuc.
-Section Berca – Plesesti with Dn 100 mm and L = 1.3 km in that branch network of water distribution to consumers (distribution pipes in Plesesti) totaling a length of 1.2 km.
-Section Plesesti - Plescoiwith Dn 100 mm and L = 4.7 km in that branch network of water distribution to consumers (distribution pipes in the town Plescoi) totaling a length of 7.2 km.
- Section Plescoi – ValeaNuculuiwith Dn 150 mm and L = 2.585 km in that branch network of water distribution to consumers (distribution pipes in ValeaNucului) totaling a length of 2.4 km.
Berca pumping station is a building of brick masonry ofstructure from reinforced concrete, with ground floor and basement, with a total area of 174.77 sqm. The building is divided into rooms that serve as pumping station operation: the pump room on the ground floor, storeroom, transformer station and pump room in the basement.
Overground tank for pumping station Berca is made of concrete with a capacity of 1,000 cubic meters and it is in conservation.
The distribution network currently measures about 18 km of pipelines only for Berca and will be completely rehabilitated; it is composed in 88% of old pipes from steel leading to high losses of water and pressure. Also the new polyethylene of high density (PEHD) pipes with diameter of Dn 110 mm, which is over 4km, are undersized and must be replaced at least 50%.
Of the four localities, only Bercahas a collection system and wastewater discharge. The system contains sewerage networks - collecting secondary, wastewater treatment plant and main wastewater collector. It collects wastewater from subscribers connections (population - apartment buildings and individual households) from Berca.
The sewerage network length is approximative 7,500 m, it is made of concrete pipes with Dn 300-500 mm and discharges the wastewater in the wastewater treatment plant, located on the left side of the River Buzau.
The entire sewer system in Bercaworks gravitationally. In the main sewer pipeline routes are placed concrete manhole, through them are connected main wastewater collection pipes from various areas. Also are located homes line for maintenance of sewerage networks (cleaning, water pressure wash valves, etc.)
Rainwater collected from a network of gullies street of the village, is taken from a rainwater collector wich works gravitational with directly discharge into the River Buzau.

The wastewater treatment plant is located on the left side of the River Buzau, in the village Plesesti, on an area of 5,200 square meters, and serves Berca commune.

Figure 7. Berca WWTP

The existing sewerage system presents deficiencies inoperation, such as:
-sewage and stormwater systems from Berca should be in a separate system, but actually work in some areas, as an unitary system, so in the wastewater treatment plant arrives also stormwater, and in addition in different areas thesewerage is undersized.
-the existing wastewater treatmentplant works without biological stage, leading to overcoming the conditions imposed to treated wastewater discharge into the River Buzau.
The components of existing wastewater treatment plant are: grill withdesander, grease separator, flowmeter, primary sedimentation tanks, aeration basin, secondary sedimentation tanks, mud pumping station, chlorine contact basin, mud drying platform.

RESULTS AND DISCUSSIONS

Currently, the rehabilitation of the water supply system, sewerage and wastewater treatment for common Berca, are the following:
-uptake rehabilitation, replacement of culvert pipe;
-rehabilitation of pumping station Satuc;
-replacement ofpipes leading to the storage tank of 1,000 cubic metersvolume, and its repairement;
-installation of two new pumping stations in the water network;
-resizingof all pipes in the network and replacement of undersized or life exceeded (very old steel pipe) with polyethylene pipes;
-fitting all the requiredflowmeters, valves and fittings.
At the wastewater treatment plant, the following worksare included:
-replacing existing grill, corroded, low-efficiency retention with a new grill with the distance between bars of 10 mm, made of galvanized steel or stainless steel;
-the existing desander wich has low volume of retention time and efficiencyrelatively low in retention of sand will remain, but will be completed with a module for mechanical treatment;
-grease separator will be keept, but it will be used with blowing air from a compressor;
-replace existing aerators biological cleansing, with purification module, with two parallel lines and the possibility of future expansion;
-quitting platforms mud existing and mud will be pumped periodically from the collecting mud basinto mud dewatering container, where mud is collected in bags and stored on the drying beds that will be rearranged as aplatform for temporary storage containers and filter bags;
-quitting the chlorine contact tank and treated water to be disinfected with ultraviolet;
-the existing operating pavilion with two more containers, includinga laboratory, reagent storage tank, a bathroom and a cloakroom.
Following the rehabilitation of the wastewater treatment plant,it is expected to have an increase in the wastewater treatment capacity and compliance with quality parameters of treated wastewater within the limits imposed by current standards, respectively NTPA-001.
All investment objectives presented above, fall into theapproved urban planning and land management development for the area.
These water and wastewater systems in the Berca village are managed by SC APAPRIMA BERCA S.R.L, company founded in 2011 with only one shareholder, the Local Council of Berca Commune.

CONCLUSIONS

The existence of a centralized water supply and wastewater sewage system, including a wastewater treatment plant,is contributing to the development of the commune, with all its component villages, with the following advantages:

-elimination of risk factors for human health;

-ensuring environmental protection;

-creating better conditions of living that would lead to stabilization of the population and reducing migration of the inhabitants;

-attracting potential investors;

-the possibility of economic development by activating old occupations or creating new activities;

-the development of public services, which would lead to employment of local human work force.

Works with potential environmental aggression (earthworks, installation, fitting, PVC pipes, metal and reinforced concrete) will be done only in intravillan area and are insignificant taking into account their dispersion area, similar in extravillan area.

Waste resulting from the work site will be properly collected in bins, and these will be evacuated to the nearest landfill. Any household waste resulted from the exploitation of the system are collected in a suitable container and disposed of in landfills.

It can be appreciated that all objectives achieved or in progress will have a positive influence multivalent for rural residents and for the ecology and environment of Berca Commune.

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ASSESSMENT OF WATER AND SEDIMENTS QUALITY FROM BRATENI LAKE, BISTRITA NASAUD COUNTY

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Abstract

This article presents a study about sediments and water qualityof Brăteni Lake. This lake is generally used for fishing and leisure. The lands that are close to the lake had been previously used for intensive agriculture. Six surface sediment samples and six surface water samples were collected from three representative points from Brăteni Lake, during two seasons (autumn 2015 and winter 2016). The sediments and water samples were analyzed using a portable multiparameter (WTW Multi 350i). Each sample was analyzed for: total dissolved solids, electrical conductivity, oxido-reduction potential, salinity and pH. Due to the allochtonous materials used in the construction of the dam, the sediment samples collected from near the dam had different parameter values.

Key words*: Brateni Lake, physico-chemical parameters, sediments,water.*

INTRODUCTION

Brateni Lake is located near the Brateni village from Bistrita-Nasaud county.The lake is located in the Transylvanian plain, in an intensive exploited agricultural area. Lands near the lake are used for agriculture: cereal and fodder crops or pasture. Currently the lake is used for fishing and leisure. In the near future, the lake could be an excellent source for irrigating . Due to the intensive agriculture in the study area there were used largequantities of pesticides and chemical fertilizers. Nutrient losses from agriculture are a major constituent of diffuse water pollution (Zhang, 2015). Water pollution from agriculture can affect the ecosystem and causes losses for aquaculture and fisheries (Smith,2015).

MATERIALS AND METHODS

Study area

The investigated water body (Brateni Lake) is approximately 25 hectares. The lake is anthropic, water is retained with one dam, with a length of 176 m.Brăteni Lake is not particularly deep, in only some points it exceeded 2.5 m depth. The geographical coordinates are: latitude of 46 ° 54'25.81 "N and longitude of 24 ° 23'31.91" E. The area is characterized by a moderate continental climate with an annual average temperature of 8.5 degrees C and rainfall between 550 - 650 mm / year.

Geological characteristics

From geologically point of view the area is characterized of Bessarabian and Volhynian floors in Transylvan Plain with strong marl in alternating with sand concretions and sandstone slabs. Near the surface, lithology becomes more sandy and sometimes contains intercalations of conglomerates and tuffs (Szilagy I., 2015).

RESULTS AND DISCUSSIONS

Methodology

Water and sediment samples were collected in November 2015 and February 2016. The samples were collected from 3 different points according to Fig. 1. Sediment samples were collected with stainless steel instruments and

subsequently placed in polyethylene bags.Each sample was between 300 and 500 grams of sediment.Water samples were collected in plastic containers, each containing 500 ml of water. Using a portable multiparameterWTW Multi 350i the collected water samples were analyzed *in situ*, for physico-chemical parameters like pH, total dissolved solids, electrical conductivity, oxido-reduction potential and salinity.At the beginning the sediment samples were air dried in laboratory and after that in a suspension of soil: deionized water of 1:5 v:v ratio were determined the physico-chemical parameters such pH, total dissolved solids, electrical conductivity, oxido-reduction potential and salinity using the same portable multiparameter WTW Multi 350i as in the case of water samples.The device was calibrated using standard solutions before each determination.

Figure. 1. Study area with sampling points

Table 1. Sampling points description

SAMPLING POINTS	DESCRIPTION
P 1.1 A	**SAMPLING POINT ONE FROM FIRST SET, WATER**
P 2.1 A	**SAMPLING POINT TWO FROM FIRST SET, WATER**
P 3.1 A	**SAMPLING POINT THREE FROM FIRST SET, WATER**
P 1.2 A	**SAMPLING POINT ONE FROM SECOND SET, WATER**

P 2.2 A	**SAMPLING POINT TWO FROM SECOND SET, WATER**
P 3.2 A	**SAMPLING POINT THREE FROM SECOND SET, WATER**
P 1.1 N	**SAMPLING POINT ONE FROM FIRST SET, SEDIMENT**
P 2.1 N	**SAMPLING POINT TWO FROM FIRST SET, SEDIMENT**
P 3.1 N	**SAMPLING POINT THREE FROM FIRST SET, SEDIMENT**
P 1.2 N	**SAMPLING POINT ONE FROM SECOND SET, SEDIMENT**
P 2.2 N	**SAMPLING POINT TWO FROM SECOND SET, SEDIMENT**
P 3.2 N	**SAMPLING POINT THREE FROM SECOND SET, SEDIMENT**

RESULTS AND DISCUSSIONS

The data generated from water and sediment analysis is presented in the charts below. In Romania sediment there is no specific legislation which set the maximum admisible limits in terms of physico-chemical paramaters.

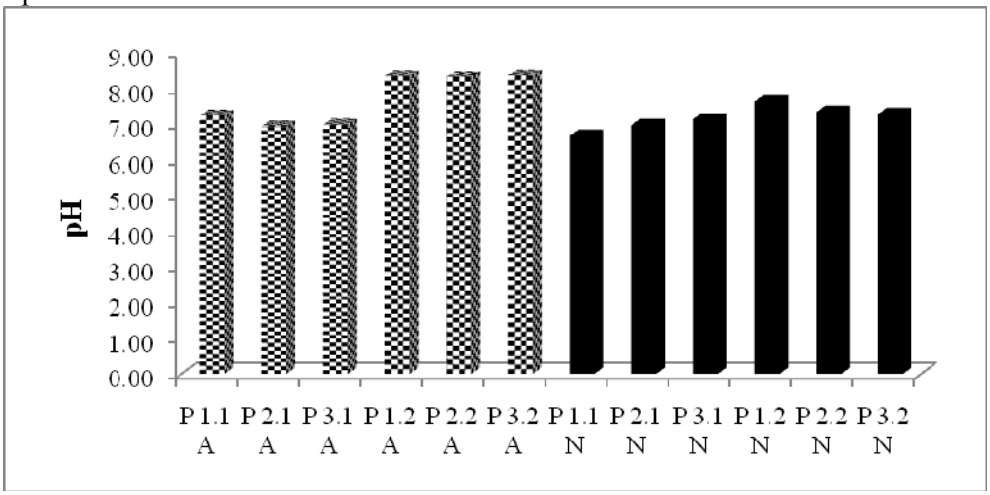

Figure 2. pH values depending on the sampling point (A-water, N-sediment)

In Figure 2 a neutral pH can be observed. Only the second set of water samples is slightly basic, pH values exceeding 8 pH units. A direct proportional correlation between the samples of water and sediment can be observed, but a perfect proportionality cannot be considered.

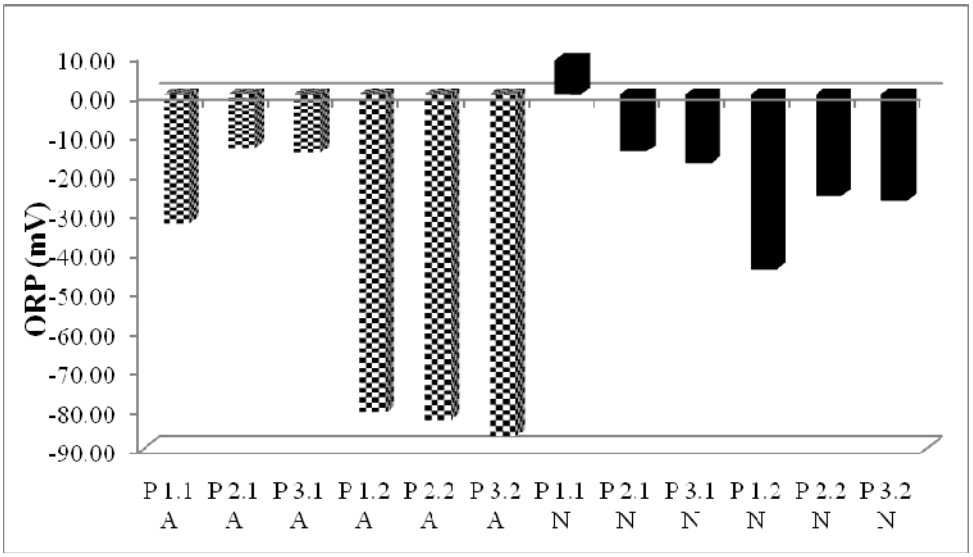

Figure 3. ORP values depending on the sampling point (A-water, N-sediment)

For the second sample set, high values of the oxido-reduction potential were determined. For all three sampling points the ORP values are over -80 mV. For the first set of water samples, only one sampling point had a value close to -40 mV, the other sampling points having lower values. For the sediment samples negative values of the ORP were recorded, with the exception of sample P 1.1 N.

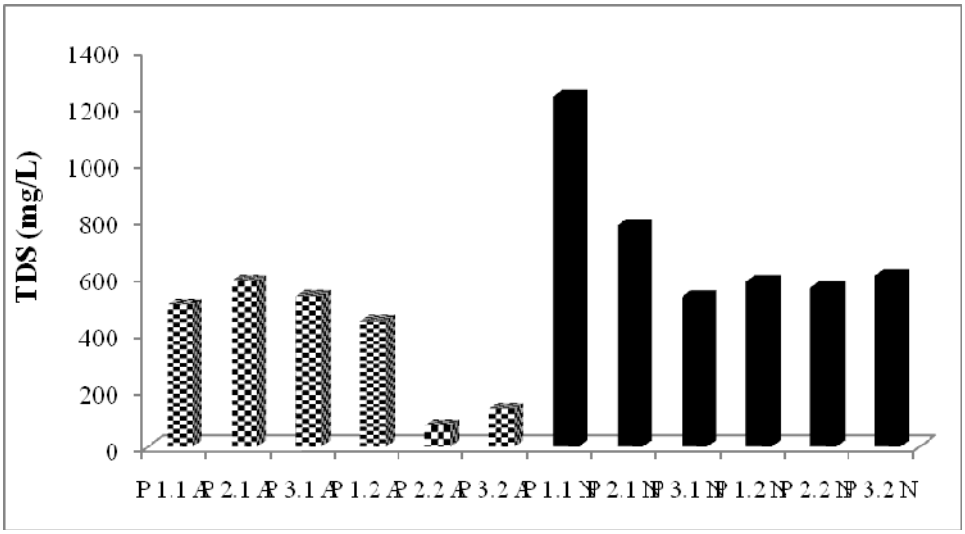

Figure 4. TDS values depending on the sampling point (A – surface water, N-sediment)

For TDS it is observed that sediment samples have higher values compared with water samples. Although the samples are taken from the same points and the same day, with the exception of sediment sample P1.1 N which has a higher value compared to all samples collected in both sampling campaigns.

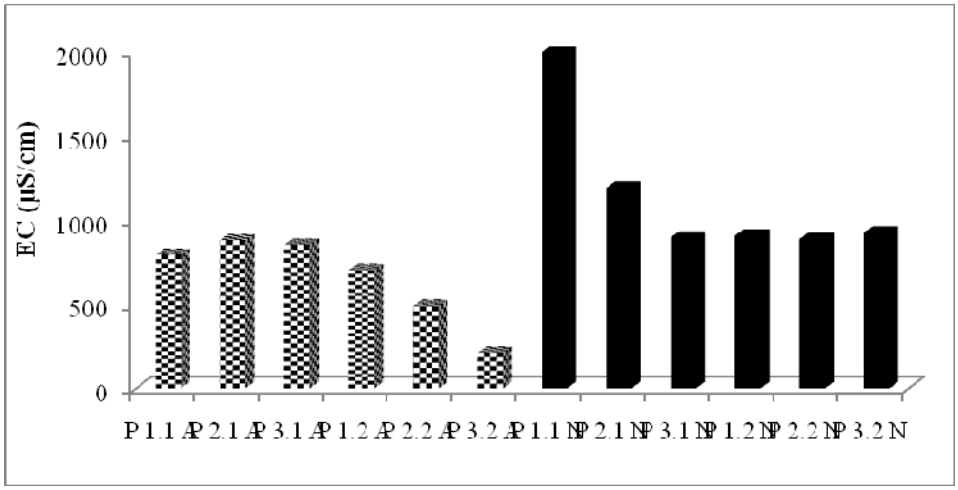

Figure 5. EC values depending on the sampling point (A-water, N-sediment)

In Romania there is not a maximum permissible limit for electrical conductivity regarding the surface water and the sediment. A linear trend can be observed with the exception of sediment sample P1.1 N (wich has a higher value than all other samples, nearly 2,000 µS/cm) and water sample P3.2 A (wich decreases the posibility of a linearity having a considerably lower value compared to all other samples, a value of 211 µS/cm).

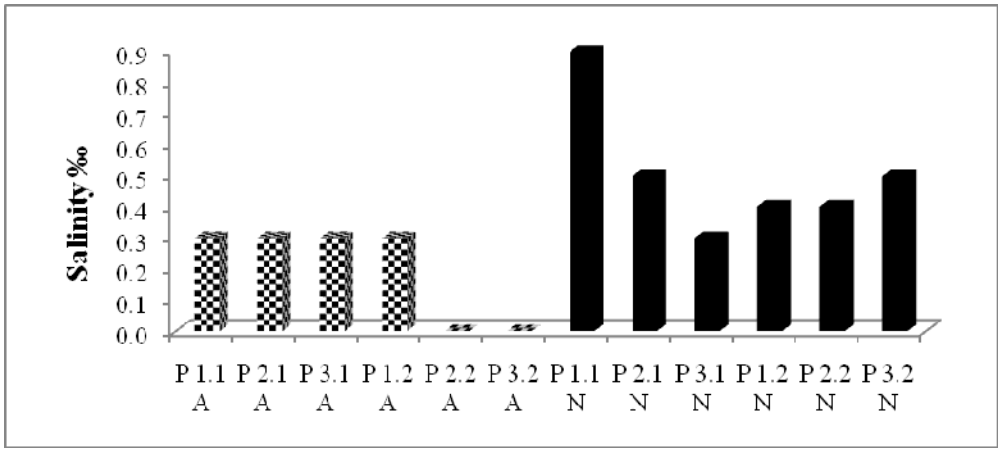

Figure 6. Salinity values depending on the sampling point (A-water, N-sediment)

In terms of salinity values the water samples do not exceed the value of 0.3 ‰. For sediment samples the salinity values were ranged between of 0.3 ‰ and 0.5 ‰. The only sample with a high salinity is sediment sample P1.1 N which had a value of 0.9 ‰, more than 20 % comparative with water sample P3.1 N.

CONCLUSIONS

Sediment sample values did not reach levels that should be of concern, with the highest values recorded of sediment sample P1.1N (with 1995 µS/cm for electro-conductivity and 1237 mg/l for TDS). The ORP value of this sample had a value of 8,8 mV. The different values of this sediment sample compared to the other sediment samples can be due the location of the sample collection point (P1.1N), near the dam. The difference of these values can be attributed to the allohtonous materials used in the construction of the dam. The value of the pH for this sample was also different, having recorded 6.5 units of pH. The water samples had normal parameter values and no major fluctuations were recorded. For the second water sample set (P1.2A, P2.2A and P3.2A) the values of TDS, electro-conductivity and salinity are slightly lower. This fact can be attributed to the decrese in ambient temperature and the freezing of the lake, meaning that in the upper part of the lake the

water is almost purest (distilled). In order to fully understand the fluctuations and interdependence of the parameters, we will continue this study, collecting sample (in all points) for the two other seasons and moreover, we will add supplementary analysis procedures for determining anions and cations in the water samples. Another aspect that must be monitored is heavy metal concentration in the collected samples.

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SECTION 05
CADASTRE

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INTRODUCTION IN ARCHITECTURAL PHOTOGRAMMETRY

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Abstract

The work suggests the theoretical first step on close new-range photogrammetry, in general, and architectural photogrammetry, in particular. The purpose is that to promote the new geomatics technologies, very useful for our world, specialists but non-specialists too, to solve many civil engineering works, old buildings, historic bridges, castles, feudal fortress, archeological sites, historic and art monuments, to protect them, to restore them in order to point out the real, original values of a people, his works, his true achievements.
A complete approachment of analytical and digital photogrammetric methods using CAD systems, combined with laser scanning and other non-destructive research techniques of remote sensing has the purpose of finding the best solution for surveying, inventorying, monitoring, restoration and conservation of space-objects. The benefit of combination closing-range photogrammetric methods with others geomatics and geophysics researches is that it provides a solid technical documentation of a space-object as a basis for technical rehabilitation or restoration planning, a total inventory, both quantitative and qualitative. In the framework of our research, we are going to talk about photogrammetric work in general, about representative techniques of space object obtained by photogrammetric methods in close-range photogrammetry, about methods to obtain the photogramma.

Key words*: Architecture, Close-Range Photogrammetry, Photogrammetry, Stereographic Restitution*..

INTRODUCTION

For a good definition of the Photogrammetry concept, it is necessary for us to refer the Remote sensing too. Photogrammetry is a measurment tehnologies of obtaining reliable information about physical objects or about the environment, using the process of recording, measuring and interpreting photographic radiant energy and other phenomena.
We consider that we need aerial photography for having a good plotting of different objects: buildings, castles, fortress, archeological sites, settlements, historic and art monuments etc.
Unlike the map, which is a vertical projection of a landscape elements on a zero level plane surface, the photogram is the image into a plan of these elements, seen from a space-point.
In photogrammetry, we can draw up topographic maps with level curves, based on measurements and data, obtained from aerial photos, with analogical instruments, optical or/and analytical computers.
Similarly, the principles of topographic measurements accuracy are being applied on close range photogrammetry, for representing the objects which cannot be studied other ways, or whose studying is very difficult on other ways, to register deformations of measured value in engineering models.

MATERIALS AND METHODS

Compared with aerial photogrammetry, close range photogrammetry and particularly architectural photogrammetry isn't limited to vertical photographs, with special cameras. The methodology of terrestrial photogrammetry has changed significantly and various photographic acquisitions are widely in use.
New technologies and techiques for data acquisition (CCD cameras, Photo CD photoscanners), data processing (computer vision), structuring and representation (CAD, simulation, animation, visualization) and archiving, retrieval and analysis (spatial information systems) are leading to novel systems, processing methods and results.
The Close-Range Photogrammetry (CRP) relies on the reconstruction of the object

simultaneously from several images from different and best possible perspective, to ensure a suitable geometry of intersecting rays.
So that, close-range photogrammetry is meant to be in that situation when the distance (range) from the camera to the object of interest is somewhere from 1 m to aprox.300 meters.
The improvement of methods for surveying historical monuments and sites is an important contribution in recording and monitoring of cultural heritage , in preservation and restauration of any architectural or cultural monument, object or site, as a support of architectural, archeological and other art-historical research.
Images processing. Close range photogrammetry is a technique for getting geometric information (position, size and shape) of any object, that was imaged on photos before.
To achieve a restitution of a 3D point, it is necessary to have the intersection between at least two rays (from the camera to the object you are going to take the photo) in space.
If more than two rays are available, the solution is that we will have a better restitution of the object or the monument. That solution provides from all the measurements and, in that situation, it will be more accurate.
Single images. A very common problem is that we know the shape and position of an object's surface in space (digital surface model), but we are interested in having details on that surface: patterns, texture, additional points etc. In that case, a single image restitution can be appropriate to obtain the fotogramma (figure 1.)

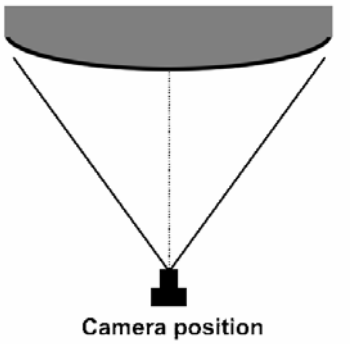

Figure 1. Photogrammetric restitution from a single image.

a) When there are known camera parameters and exterior orientation.In that case, there is necessary to know the interior orientation of the camera and camera's position and orientation. That so, we can reckon the points, by intersection of rays from camera with the surface whose shape and position we know.
Interior orientation does not mean only the calibrated focal length and the position of the principal point, but also the the polynomial coefficients for describing lens distortion (if the photo does not provide from a metric camera).
If the camera position and orientation is unknown at least 3 control points on the object (points with known co-ordinates) are necessary to compute the exterior orientation.
When there are unknown camera parameters.
This is a very frequent problem in architectural photogrammetry. The shape of the surface is restricted to planes only and a minimum number of four control points in two dimensions have to be available. The relation of the object plane to the image plane is described by the projective equation of two planes:

$$X = \frac{a_1 x + a_2 y + a_3}{c_1 x + c_2 y + 1}$$

$$Y = \frac{b_1 x + b_2 y + b_3}{c_1 x + c_2 y + 1}$$

Where X and Y are the co-ordinates on the object's plane, x and y the measured co-ordinates on the image and ai ,bi, ci the 8 parameters describing this projective relation, the measurement of a minimum of 4 control points in the single photo leads to the evaluation of these 8 unknowns (a1, a2, a3, ... , c2).

As a result, the 2D co-ordinates of arbitrary points on this surface can be calculated using those equations. This is also true for digital images of facades. Digital image processing techniques can apply these equations for every single pixel and thus produce an orthographic view of the object's plane, a so-called orthophoto or orthoimage. (Popescu, 2015)

Stereographic processing. If its geometry is completely unknown, a single image restitution of a 3D object is impossible. In this case, the use of at least 2 images is necessary. According to the stereographic principle, a pair of "stereo images" can be viewed together, which

produces a spatial (stereoscopic) impression of the object. This effect can be used to achieve a 3D restitution of the facades (Figure 2).

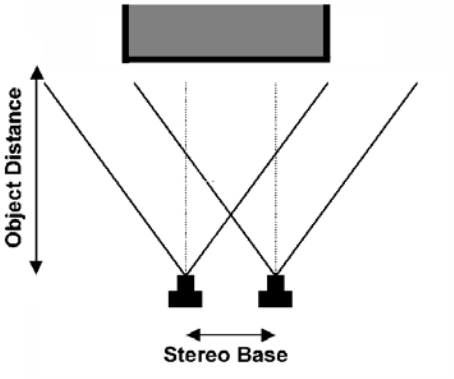

Figure 2. Photogrammetric restitution (stereographic) from a pair of images

Using "stereo pairs of images", arbitrary shapes of a 3D geometry can be reconstructed as long as the area of interest is shown on both images. The camera directions should be almost parallel to each other to have a good stereoscopic viewing. This process can be seen in a suggestive way in our experiment, of creating the 3D model of the Chemistry building façade (Figure 3).

Figure 3. a. Pair of images of Chemistry laboratory building

Figure 3. b. Pair of images of Chemistry Laboratory building

Before taking the photos we have to plan a shooting sesion which consists in a sketch that contains the locations of the object is photographed, so to respect both the transverse and longitudinal coverage (between 60-70 % for longitudinal coverage and 25-30 % for trasverse coverage). In order to that, we have taken two photos in front of the building

Metric cameras with well known and calibrated interior orientation and negligible lens distortion are commonly used in this approach. To guarantee good results, the ratio of stereo base (distance between camera positions) to the camera distance to the object should lie between 1:5 and 1:15.

Results of stereographic restitution can be: 2D-plans of single facades, 3D-wirefame and surface models, lists of co-ordinates, eventually complemented by their topology (lines, surfaces, etc). For our study work, we have made these photos (Figure 3) with a Sony camera that has a focal length of 4.7 mm and resolution of 12 MP.

Figure 4. The Chemistry laboratory after the stereographic processing

Bundle restitution. In many cases, the use of one single stereo pair will not suffice to reconstruct a complex building. Therefore, a larger number of photos will be used to cover an object as a whole. To achieve a homogenous solution for the entire building and also to contribute additional measurements, a simultaneous solution of all photo's orientation is necessary.

Another advantage is the possibility to perform an on-the-job calibration of the camera. This helps to increase the accuracy when using images of an unknown or uncalibrated camera. So this approach is not any more restricted to metric or even calibrated cameras, which makes the application of photogrammetric techniques a lot more flexible. It is also

adjustable concerning the geometry of camera positions, meaning one is not forced to look for parallel views and stereo pair configuration. Convergent, horizontally, vertically or oblique photos are now well suitable. Combination of different cameras or lenses can easily be done.

In Figure 5 and Figure 6, we have examples of different configurations for bundle solution, for a circle building or paralelipipedic one.

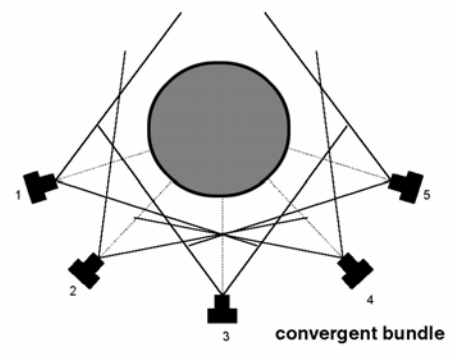

Figure 5. Bundle restitution for a circle building.

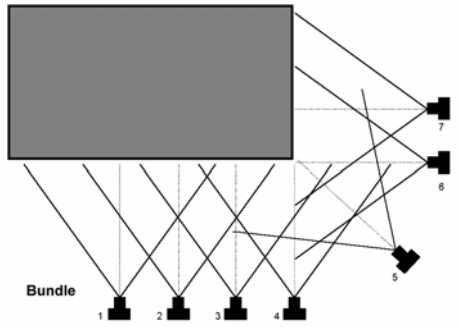

Figure 6. Bundle restitution for a paralelipipedic building.

The strategy of taking photos is that each point to be determined should be intersected by at least two rays of satisfactory intersection angle. This angle depends only upon the accuracy requirements. Additional knowledge of e.g. parallelism of lines, flatness of surfaces and rectangularity of features in space can be introduced in this process and helps to build a robust and homogenous solution for the geometry of the object.

The entire number of measurements and the full range of unknown parameters are computed within a statistical least squares adjustment.

Bundle adjustment is a wide spread technique in digital architectural photogrammetry of today. It combines the application of semi-metric or even non-metric (amateur) cameras, convergent photos and flexible measurements in a common computer environment. Because of the adjustment process, the results are more reliable and accurate and very often readily prepared for further use in CAD environments.

Results of bundle restitution are usually 3D-wireframe and surface models of the object or lists of co-ordinates of the measured points and their topology (lines, surfaces, etc) for use in CAD and information systems. Visualizations and animations or so-called "photo-models" (textured 3D-models) are also common results. Usually the entire object is reconstructed in one step and the texture for the surface is available from original photos.

Photogrammetric Architectural Survey Methods. For simple photogrammetric documentation of architecture, simple rules which are to be observed for photography with non-metric cameras have been written, tested and published by (Waldhaeusl & Ogleby, 1994). These so-called “3x3 rules” are structured in:

3 geometrical rules: preparation of control information, multiple photos all-around coverage, taking stereo-images for stereo-restitution.

3 photographic rules: the inner geometry of the camera has to be kept constant, select homogenous illumination, select most stable and largest format camera available.

3 organizational rules: make proper sketches, write proper protocols, don’t forget the final check.

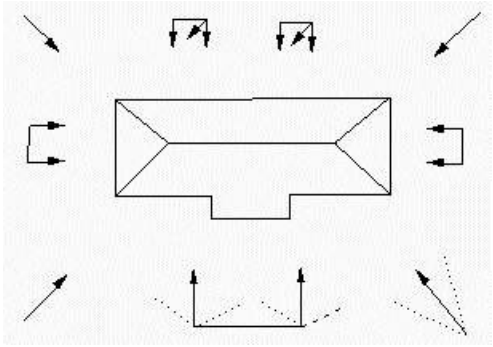

Figure 7. Ground plan of a stable bundle block arrangement all around building, as recommended in the 3x3 rules

Usually, metric cameras are placed on a tripod,

but shots with small or medium format equipment are often taken "by hand". Recently, digital phototheodolites, combining total-station and digital cameras have been developed. Digital images are then referenced from object points or targets placed in the field. In this way, the determination of the exterior orientation is simple and the images are directly usable for restitution.

RESULTS AND DISCUSSIONS

Many parts of architectural objects can be considered as plane. In this case, even if the photo is tilted with regard to the considered plane of the object, a unique perspective is enough to compute a rectified scaled image. We need at least 4 control points defined by their coordinates or distances in the object plane. The data base is usually one or more photogrammetric images which are rectified at any planes defined by the user. Simple drawings (in vector-mode), image plans (in raster-mode) are processed as a result of the rectification. Photographs of building façades should be taken the most perpendicular to the reference planes and only the central part of the image should be considered for a better accuracy.

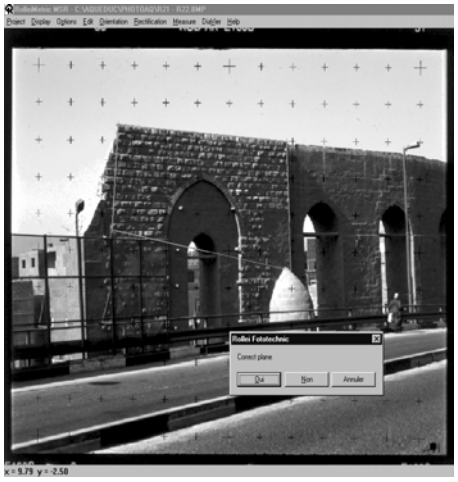

Figure 8. Building photogrammetric image.


Figure 9. Building rectification after photogrammetric images.

In the case of a perspective rectification, radial image displacements in the computed image will occur for points outside the reference. The rectification obviously fails if the object isn't somewhat plane.

Some packages include functions for the photogrammetric determination of planes, according to the multi-image process from two or three photographs that capture an object range from different viewpoints. Digital image maps can be produced by assuming the object surface and photo rectification. In the resulting orthophoto, the object model is represented by a digital terrain model. Image data of different planes can be combined into digital 3D-computer models for visualisation and animation with the help of photo editing or CAD software.

Systems presented allow more than two images but homologous points are measured in monoscopic mode. Problems may occur for objects with less texture when no target is used to identify homologous points. Only stereo-viewing allow in this case a precise 3D measurement. Therefore stereopairs of images (close to the normal case) are required. Systems can then be assimilated to 3D plotters for the measuring of spatial object co-ordinates. 3D measurements are required for the definition of digital surface models which are the base of the orthophotos.

CONCLUSIONS

The traditional photogrammetry is based on stereo or multi-image restitution of a block of overlapping images and collinearity equations allow us to determine the 3D model of the overlapped area. A sequence of overlapping images is acquired with calibrated digital cameras. It will be get geo-referencing and block control, depending on hardware and processing facilities:

- measuring a set of ground control points by Total station or GPS;
- determining the camera position by a GPS tied to the camera and synchronized with the image acquisition.

Homologous image point coordinates are measured (manually or automatically by image correlation software) in every image. Bundle block adjustment provides image orientation. Object point coordinates are determined by triangulation or multiple intersections. (Curtaz M., 2012).

In conclusion, the low-cost photogrammetric technology has a lot of possibilities to process the images, no matter how they are being taken (with nonmetric cameras, with metric cameras or with a multi-spectral camera) if we consider conditions above.

The new geomatics technologies, very useful for contemporary world, specialists but non-specialists too, are able to solve many civil engineering works, old buildings, historic bridges, castles, feudal fortress, archeological sites, historic and art monuments, to protect them, to restore them in order to point out the real, original values of our civilization. Collectting also single images, or if it is possible, pairs of images for stereographic restitution, or even bundle restitution (which cannot be done only with pairs of photographs sometimes), anytime people can restore the authentic buildings facades, historic and art monuments, elements which confer value to contemporary world.

Nevertheless we can process images with a goood precision using a low-cost equipment.

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SURVEY PLANIMETRY USING DIFFERENT INSTRUMENTS

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Abstract

In our contemporary context world is more and more necessary to have a better accuracy in everything we do. So that, in scientific field, there is an explosion of smart devices, which are better and betterevery new year, and whose advantages are obvious for our daily work. Our paper presents the differences between two surveying measurements, the first made with an theodolite Leica Builder 100, and the second one with a total station, Leica TC 407. The measurements were done in UASVM campus, Bucharest.

Key words*: planimetry, total station, theodolite, survey.*

INTRODUCTION

Planimetry is the study of plane measurements, including angles, distances, and areas.
To measure planimetry, a planimeter is used. This rather advanced analogue technology is being taken over by simple Image Measurement software tools like, ImageJ, Adobe Acrobat, Google Pro Earth, Gimp, Photoshop and KLONK Image Measurement which can help do this kind of work from digitalized images.
Planimetric elements in geography are those features that are independent of elevation, such as roads, building footprints, and rivers and lakes. They are represented on two-dimensional maps as they are seen from the air, or in aerial photography. These features are often digitized from orthorectifiedaerialphotography into data layers that can be used in analysis and cartographic outputs.
A planimetric map is one that does not include relief data.

Our theme work was making a traverse inside the campus of the University of Agronomic Sciences and Veterinary Medicine, Bucharest, with points by known coordinates as GPS 1 and GPS 2, in orderto determine the coordinates of a set of new, unknown points(Figure 1).

Figure 1. Satellite view of station points

MATERIALS AND METHODS

Working with the task of accurately determining the coordinates of some certain points clearly defined into a measurement, depending on the points with known coordinates of our route and those who have to determine, we can follow one of the Traverse methods listed below.
Traverse is a method of thickening geodetic network to determine coordinates of the detail points in the pitch.
Planimetric Traverse is a polygonal broken lineand the mutual points position is determined by measuring distances between points of breaking and measuring angles in the break points of the route polygonal.
Depending on the number of points with known coordinates identified in the field and the type of work to be performed on the ground, traverses may be classified as:

■ **the traverse at the ends to points with known coordinates** - field identifies four points with known coordinates, arranged two on one end (A, B) and two at the other end of the traverse (C, D) - (Figure 2)

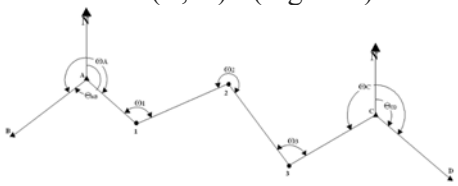

Figure 2.Graphical representation: traverse supported at the ends on points with known coordinates and orientations

■**traverses closed circuit** - identifies land at least 2 points with known coordinates (A, B - Figure 3) of which start and stop measurements:

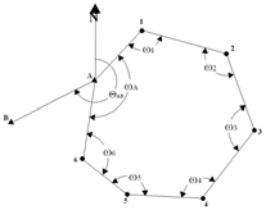

Figure 3. Graphical representation:closed circuit traverse

■ **traverse the hub** - is made up of a minimum of 3 traverses that start from some 2 points with known coordinates (A, B, C, D, E, F) and meet all three in - a common point (N) called hub with visa for a foothold (S) which is not necessary to know the coordinates (Figure 4):

Figure 4. Graphical representation: traverse with hub point

Traverse supported at the ends, closed circuit traverse and traverse the hub (as described above) are the methods by which we can determine the coordinates of new pointsreading, knowing other key points of our measurement.

Work appliances needed are either classic theodolite or total station – a modern and improved version of the theodolite.

About theodolite

Surveying theodolite is an instrument used to measure angular field of horizontal and vertical directions. With theodolite can measure longer distances using staff and through an indirect method of measurement.

Figure 5. Theodolite Otto Fennel Sohne Kassel – 1920

Classical theodolites, which were built in the early eighteenth century (Figure 5), **modern theodolites (optical)**, which have almost the same principle constructive, but contain internal optics that enable readings in two circles through a microscope reading whose eye is next to the telescope eyepieceare the first precise measuring devices, before the occurof**electronic theodolites** (Figure 6).

Figure 6. Teodolit electronic LEICA Builder T100

The **electronic theodolites**,occurred in seventh decade of the XX century, have been rapidly improvedand are the most used and precise instrumentation of surveying. The electronic theodolite contain a microprocessor which serves to put up on a display similar to that seen in microcomputers (consisting of liquid crystals) of the measurement results, as well as a number of elements automatically calculated (the length of the inclined, the difference in height, the horizontal distance, direction, coordinates , etc.)

Rangefinder electro complete with functions of a theodolite led to the Electronic Total Station, equipped with digital display automatic meter readings, with the possibility of automatic recording in external memories and by "tracking", which offers the advantage of displaying horizontal directions every second and a new distance value every 3 seconds, with the opportunity to move without interrupting targeting mobile reflector. Making electronic book field allows connection to PC and plotter.

A **total station** or TST (total station theodolite) is an electronic/optical instrument used in modern surveying and building construction (figure 7). The total station is an electronic theodolite (transit) integrated with an electronic distance meter (EDM) to read slope distances from the instrument to a particular point.

Figure 7. Total station Leica TC 407

Some models include internal electronic data storage to record distance, horizontal angle, and vertical angle measured, while other models are equipped to write these measurements to an external data collector, such as a hand-held computer.

A total station is superior to a theodolite because it can directly process data in the device. When data is downloaded from a total station on computer, application software can be used to compute results and generate a map of the surveyed area. The newest generation of total stations can also show the map on the touch-screen of the instrument immediately after measuring the points.

Figure 8. The measurement principle with reflector

The measurement principle (Figure 8) is the same of the theodolite: the operator targetsthe reflector from the station pointand records data using ***All*** command (to register distances and angles, too – figure 9). All data are being recorded in device memory, on a ***Job***, and then the field bookwill be developed on PC, where from is easy to reconstruct thesite plan and delimitation, on correct coordinates, of the area we hadto identify and account for drawing.

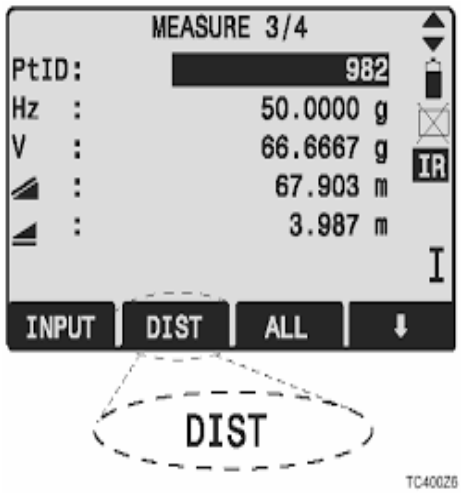

Figure 9. Display of a total station

In our work, we used both devices - Leica Builder TC 100 and Leica TC 407, in order to identify, in the field, enhanced effectiveness of a device in front of the other.

RESULTS AND DISCUSSIONS

Technical differences between the two instruments have repercussion in the results.If the electronic theodolite Builder T100, precision machine is 9"equivalent of 28cc, the 407 TC precision is 7 ", equivalent of 20cc.
This fact is noticeable on measuring results:
The measurement performed with the theodolite , we had an angleserror(-0.035) , being smaller than the tolerance (4.47) and the distance errors were 0.07 (X)and -0.06 (Y).
The measurement performed with the total station , the angle error was -0.025 , which is lower than the tolerance (2.26) . The total station distance errors were 0.04 for X and -0.03 for Y.

CONCLUSIONS

Using different surveying instruments we obtained planimetric coordinates for the points measuredin the U.A.S.V.M Bucharest campus.
The paper hashighlightedthe capabilities and the importance of the accuracy of two different surveying instruments.

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SURVEYING THEODOLITE BETWEEN PAST AND FUTURE

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Abstract

Surveying instruments have evolved over time since the 19th century until present. One of the surveying instruments is the theodolite. A theodolite is a precision instrument for measuring angles in the horizontal and vertical planes. The paper aims to highlight the improvements made over time on this instrument in constructive and operational terms.

Key words*: surveying,evolution,theodolite.*

INTRODUCTION

Prior to the theodolite, instruments such as the geometric square and various graduated circles and semicircles were used to obtain either vertical or horizontal angle measurements. It was only a matter of time before someone put two measuring devices into a single instrument that could measure both angles simultaneously. GregoriusReisch showed such an instrument in the appendix of his book Margarita Philosophica, which he published in Strasburg in 1512(Maurice D., 1989). It was described in the appendix by Martin Waldseemüller, a German topographer and cartographer, who made the device in the same year.Waldseemüller called his instrument the polimetrum.

The first occurrence of the word "theodolite" is found in the surveying textbook A geometric practice named Pantometria (1571) by Leonard Digges.

There is some confusion about the instrument to which the name was originally applied. Some identify the early theodolite as an azimuth instrument only, while others specify it as an altazimuth instrument. In Digges's book, the name "theodolite" described an instrument for measuring horizontal angles only. He also described an instrument that measured both altitude and azimuth, which he called a topographicall instrument. Thus the name originally applied only to the azimuth instrument and only later became associated with the altazimuth instrument. The 1728 Cyclopaedia compares "graphometer" to "half-theodolite"(Cyclopaedia, vol. 2).Even as late as the 19th century, the instrument for measuring horizontal angles only was called a simple theodolite and the altazimuth instrument, the plain theodolite.

The first instrument more like a true theodolite was likely the one built by Joshua Habermel (de:ErasmusHabermehl) in Germany in 1576, complete with compass and tripod.

Figure 1. Eight-inch theodolite, c. 1898

The earliest altazimuth instruments consisted of a base graduated with a full circle at the limb and a vertical angle measuring device, most often a semicircle. An alidade on the base was used to sight an object for horizontal angle measurement, and a second alidade was mounted on the vertical semicircle. Later instruments had a single alidade on the vertical semicircle and the entire semicircle was

mounted so as to be used to indicate horizontal angles directly. Eventually, the simple, open-sight alidade was replaced with a sighting telescope. This was first done by Jonathan Sisson in 1725.

Figure 2. Soviet theodolite, 1958

The theodolite became a modern, accurate instrument in 1787 with the introduction of Jesse Ramsden's famous great theodolite, which he created using a very accurate dividing engine of his own design(Turner 1983).The demand could not be met by foreign theodolites owing to their inadequate precision, hence all instruments meeting high precision requirements were made in England. Despite the many German instrument builders at the turn of the century, there were no usable German theodolites available. A transition was brought about by Breithaupt and the symbiosis of Utzschneider, Reichenbach and Fraunhofer. As technology progressed, in the 1840s, the vertical partial circle was replaced with a full circle, and both vertical and horizontal circles were finely graduated (Figure 1). This was the transit theodolite. Theodolites were later adapted to a wider variety of mountings and uses. In the 1870s, an interesting waterborne version of the theodolite (using a pendulum device to counteract wave movement) was invented by Edward Samuel Ritchie. It was used by the U.S. Navy to take the first precision surveys of American harbours on the Atlantic and Gulf coasts.

In the early part of the 20th century, Heinrich Wild produced theodolites that became popular with surveyors (Figure 2). His Wild T2, T3, and A1 instruments were made for many years, and he would go on to develop the DK1, DKM1, DM2, DKM2, and DKM3 for Kern Aarau company. With continuing refinements instruments steadily evolvedinto the modern theodolite used by surveyors today (Figure 3).

Figure 3. Modern theodoliteNikon DTM-520

MATERIALS AND METHODS

Parts of a Theodolite

Like other leveling instruments, a theodolite consists of a telescope mounted on a base. The telescope has a sight on the top of it that is used to align the target. The instrument has a focusing knob that is used to make the object clear. The telescope contains an eyepiece that the user looks through to find the target being sighted. An objective lens is also located on the telescope, but is on the opposite end as the eyepiece. The objective lens is used to sight the object, and with the help of the mirrors inside the telescope, allows the object to be magnified.

The theodolite's base is threaded for easy mounting on a tripod (Figures 4 and 5).

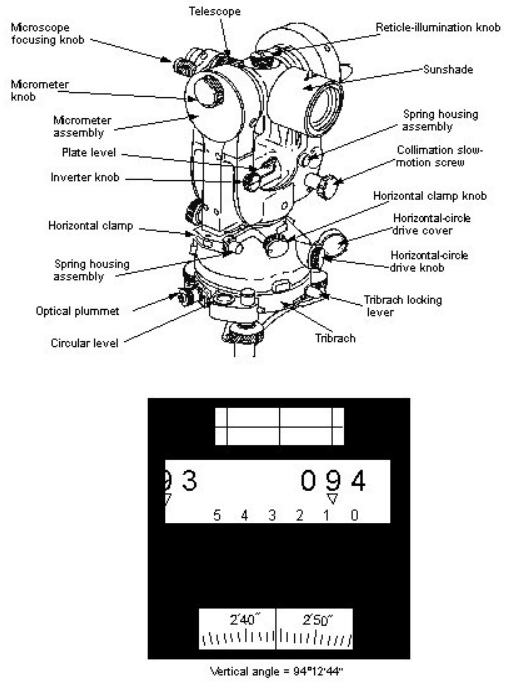

Figure 4. Diagram of an Optical Theodolite

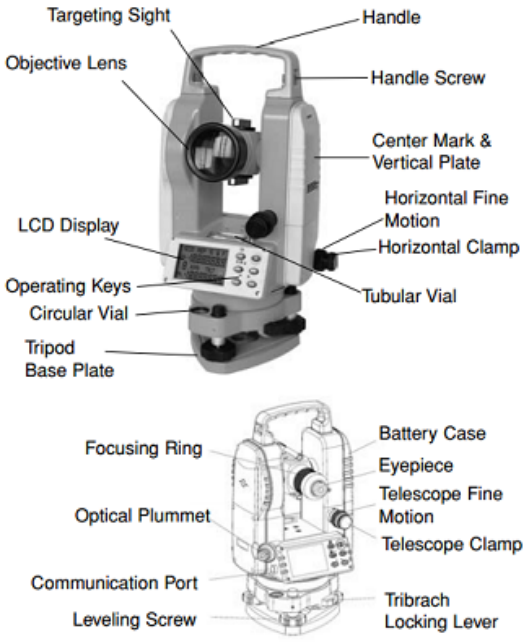

Figure 5. Diagram of an Modern Theodolite

How Does a Theodolite Work?

A theodolite works by combining optical plummets (or plumb bobs), a spirit (bubble level), and graduated circles to find vertical and horizontal angles in surveying. An optical plummet ensures the theodolite is placed as close to exactly vertical above the survey point. The internal spirit level makes sure the device is level to the horizon. The graduated circles, one vertical and one horizontal, allow the user to actually survey for angles.

How to use a theodolite:

1. Mark the point at which the theodolite will be set up with a surveyor's nail or a stake. This point is the basis for measuring angles and distances.
2. Set up the tripod. Make sure the height of the tripod allows the instrument (the theodolite) to be eye-level. The centered hole of the mounting plate should be over the nail or stake.
3. Drive the tripod legs into the ground using the brackets on the sides of each leg.
4. Mount the theodolite by placing it atop the tripod, and screw it in place with the mounting knob.
5. Measure the height between the ground and the instrument. This will be used a reference to other stations.
6. Level the theodolite by adjusting the tripod legs and using the bulls-eye level. You can make slight tunings with the leveling knobs to get it just right.
7. Adjust the small sight (the vertical plummet) found on the bottom of the theodolite. The vertical plummet allows you to do ensure the instrument remains over the nail or stake. Adjust the plummet using the knobs on the bottom.
8. Aim the crosshairs in the main scope at the point to be measured. Use the locking knobs on the side of the theodolite to keep it aimed on the point. Record the horizontal and vertical angles using the viewing scope found on the theodolite's side.

RESULTS AND DISCUSSIONS

Theodolites have many advantages when compared to other leveling instruments:

- Greater accuracy.
- Internal magnifying optical system.
- Electronic readings.
- Horizontal circles can be instantly zeroed or set to any other value.
- Horizontal circle readings can be taken either to the left or right of zero.
- Repeat readings are unnecessary.

Theodolites have an internal optical device that makes reading circles much more accurate than other instruments.
Also, because the theodolite allows you to take fewer repeat readings, these measurements can be made much more quickly. Theodolites with optical instruments have advantages over other layout tools. They have more precise measurements, they are unaffected by wind or other weather factors, and they can be used on both flat ground and sloped ground (Figure 6).

Figure 6. Theodolites evolution

NIKON NE-20S ELECTRONIC THEODOLITE (Figures 7,10)

Magnification: 26X.
Image: Erect.
Minimum focusing distance: 1.3m/4.3'.
Angle accuracy: 10"/3 mgon.
Angle minimum display reading: 10"/20".

CARL ZEISS THEO 020 B (Figures 8, 9)

Average error of measurement - two positions of the telescope 1 mgrad (3 ").
Zoom: 30 times.
View Angle: 1,3 °.
Looking A distance of 1 km 23 m.
Minimal Referred to 1,5 m away.
Maximal Sight distance when using the rack with inch graduations:

Angle detecting system: Dual-side reading.
Angle units: Switchable between degrees or gon.
Optical plummet: Erect 2.2X.
Weight: 3.8kg, 8.4lbs including tribrach and battery.

- 120 m.
- Rules evaluation with precision 0.5 cm 500 m.
- Permanent Multiplier 100.
- Angular error of the cylindrical vial.
- Displacement of the bubble of 2mm 30".
- Interval of graduation grad 1.

The value of the division in the reporting scale 10 mgrad.

Figure 7. Nikon ne-20s electronic theodolite

Figure 8. Carl Zeiss Theo 020 b

Figure 9. Optical theodolite

Figure 10. Electronic theodolite

CONCLUSIONS

This study was conducted to highlight the evolution of surveying instruments over the years. Our study demonstrates that people have managed to achieve the dream from decades ago by bringing innovations to old equipment and they manage to make our work increasingly easier.

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STUDIES AND RESEARCH ON SYSTEMATIC REGISTRATION DATA MANAGING APPLICATIONS

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Abstract

The systematic registration represents the identification, description and registration of the immovable properties in the cadastral documents, their measurement and representation on cadastral plans and the data recording on digital formats and the identification and registration of all immovable holders and of UI from condominium constructions, for the registration in the land Book. This paper will address two scientific applications that work with logical data units, thereby bringing each a database . These applications developed for the management of systematic registration data relate to : CG 1.5 , developed by Geotop company and NetSetCAD developed by Data Invest.

***Key words**: database, systematic registration, alphanumeric data, plots, individual unit.*

INTRODUCTION

The Systematic Registration is the unitary and mandatory technical, economic and legal registration system for all the immovables across the country. A Systematic Registration work is a project which is carried out during a specific period of time, which aims at collecting, validating, correlating, aggregating and delivering the technical and legal data belonging to the Systematic Registration register to the Beneficiary.
The systematic registration represents the identification, description and registration of the immovable properties in the cadastral documents, their measurement and representation on cadastral plans and the data recording on digital formats and the identification and registration of all immovable holders and of UI from condominium constructions, for the registration in the land Book. The large volume of data and information collected during previous stages of systematic registration of immovable properties projects which are used to create geographical related databases made necessary the development of data managing applications. These applications are developed according to The National Agency for Cadastre and Land Registration specifications.

Next I will present two application that manage systematic registration data: CG 1.5 (developed by Geotop) and NetSetCAD (developed by Data Invest).

SYSTEMATIC REGISTRATION DATA MANAGING APPLICATIONS

CG 1.5 is an application designed in order to manage systematic registration data according to National Agency for Cadastre and Land Registration specifications. CG along with MapSys GIS (Geographic Informational System) allows creation, validation and management of a geographical relate database and generates all information necessary to systematic registration work. The final results of this process are creating vector data and CGXML files. The application allows you to enter information in distributed client-server system using Microsoft Access database.
The main functions of this application are: entering data related to immovable properties, plots, buildings, individual units, registration, database validation (missing details/duplicates),

generating relational database using MapSys tools, Import/ Export MapSys vector formats, Import/ Export CGXML/CPXML/ CG, Export CGXML from MapSys and generating charts such as immovable and holders cadastral register, interview records, interview records of individual units, and holders' alphabetical index. These functions are represented in Figure 1 too.

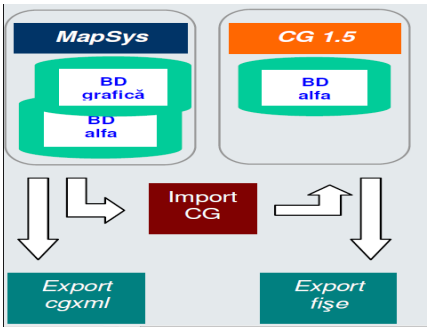

Figure 1. Main functions of CG

To create databases alphanumeric data entry is required. Entering this data is done in specialized sections such as:
General data of immovable properties
Plots
Buildings/ Individual Units
Registration
Alphanumeric data entered into specialized sections represents basic features for each unit. From these I will list: E-Terra ID, topographic number of cadastral sector, address, measurements and documents area for immovable properties, land use category and topographical number for plots, group, purpose and common parts for buildings and individual units and ownership data, deeds, way of acquiring the records.

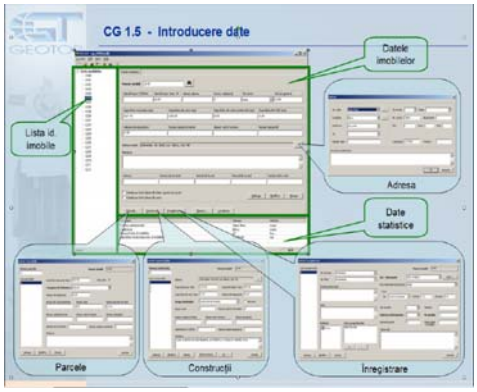

Figure 2. Alphanumeric data entry in CG 1.5

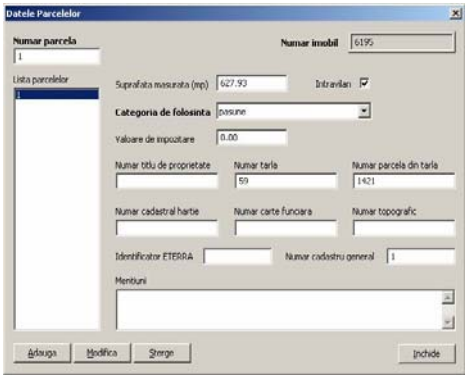

Figure 3. Entering alphanumeric data (exemplified for plots)

Adding people as landlords can be done directly by entering data directly from the application interface (adding data directly in the database) or by importing them from an ASCII file previously prepared.
Relational database of CG application can be accessed simultaneously by multiple users, and the information on landlords, addresses, can also be used in a centralized manner.
The verification function of CG database corrects errors that can be automatically corrected.
When a project is opened (CG database), the application checks the database structure. The project is compared to CG model database (cg15_model.mdb), which is saved the directory where the application was installed. The window below automatically appears if there are differences between the two database.

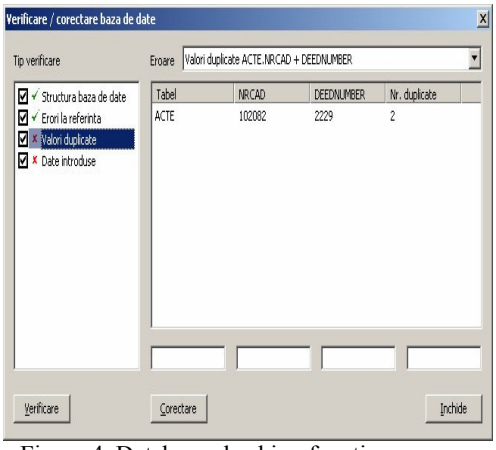

Figure 4. Database checking function

Database checking is made to correct any errors that may appear on the database structure (missing fields), reference errors, duplicate values, imported duplicate immovable properties and input (difference in area

property / plots , entities with no registration documents / persons that are not used for any entry, address, blank building with individual units and with no common parts, building area is larger than the area of immovable properties, part and number fields of Land Book are not filled).

Unlike CG 1.5 application, NetSET (Network Spatial Editing Tool) is an integrated tool for editing, analyzing and managing maps / digital plans with an associated database. It is a system with a friendly interface and a flexible set of predefined functions for spatial analysis of database. NetSET includes tools for converting existing GIS, raster images and vector maps from / to various formats and allows import / export files in formats as ESRI Shapefile, DXF, TIGER, S57, MapInfo File, DGN, CSV, GML, CGXML. The structure of the database tables in NetSetCAD application is managed by MS SQL Server. By its GIS structure updates and view both graphic elements from the layers and corresponding attributes in the database.

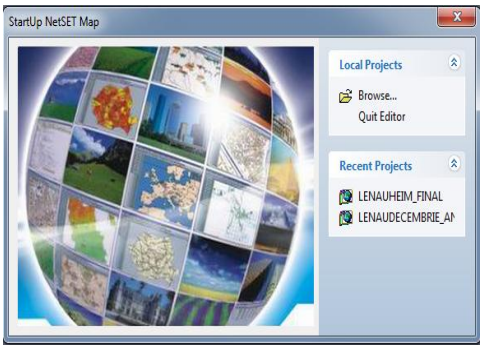

Figure 5. Applications graphic interface

The software NetSetCAD developed by the company Data Invest is suitable for use in a production environment. It has the following main functions: storage of information in a system of local data, based on the file structure of CGXML file, data conversion from holding existing digital data (import CGXM, CPXML files and DDAPT database) Import / Export in CGXML file format, the opportunity for consultation Agricultural Register and Register of Fiscal Role, automatic generation of cadastral records such as interview records, holders' alphabetical index and database checking. Alphanumeric data and information used in the real estate cadastre are managed within the application NetSET CAD, with a direct connection to vector layers referring to graphic components of cadaster. Graphical elements are organized on layers. This is presented in the picture below.

Layer Name	Layer Type	Characteristics
UAT_Limi (ex. Lenauheim)	Polygon	county data to which it belongs to and its name SIRUTA code,territorial administrative unit, the measurements and documents area
Townlimit(ex. Sat Grabat, etc.)	Polygon	SIRUTA code the measurements and documents area
SectorCad	Polygon	data relating to the name of the town that belongs to, the number allocated the cadastral sector,area
Immovable properties	Polygon	Number of cadastral sector, cadastral number of body ownership, code for areas that are inside or outside town, destination address, measured area (GIS area), etc
Buildings	Polygon	the number and category of use of thelocated plot body building number, name, year of construction, area levels, destination, etc..

Figure 6. Organising elements on layers

Alphanumeric data on immovable properties, plots, buildings, individual units exemplified in the above figure, determine the structure and CGXML file fields. This file structure and fields are predetermined and imposed by the National Agency of Cadastre and Land Registration.

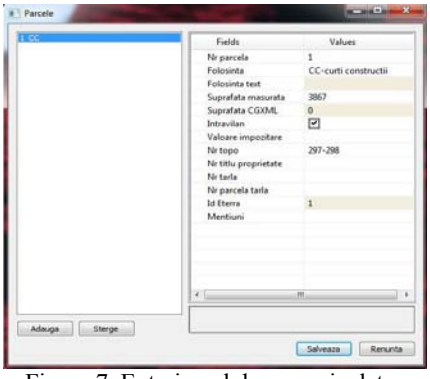

Figure 7. Entering alphanumeric data (exemplified for plots)

NetSetCAD application contains a verification and validation module of data stored in the local database. The database is checked for errors referring to the database structure, duplicate values, imported duplicate immovable properties and input data.

This function is very important to generate the correct CGXML files.

RESULTS AND DISCUSSIONS

CG 1.5 and NetSetCad applications can generate specific cadastre reports after the data has been entered for each graphical unit separately. This can automatically generate deliverables for major systematic registration projects: CGXML Files, the Immovable Cadastral Register, alphabetical list of real property rights holders, the owners and other owners.

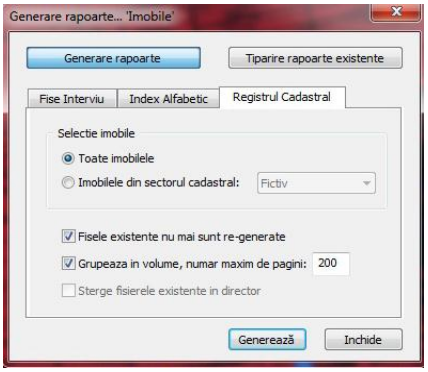

Figure 8. NetSetCAD Menu for generating reports

In addition, with NetSetCAD can be generated the cadastral plan overall scale of 1: 10,000 by "extracting" the elements specified in the SQL database that can be found throughout the graphic administrative territorial unit's (ATU's limits, community and neighborhood, Urban limits and the names, numbers and cadastral sectors boundaries, etc). Later, they can add elements such as title, grid, legend, performer's name etc. All the elements were created on separate layers.

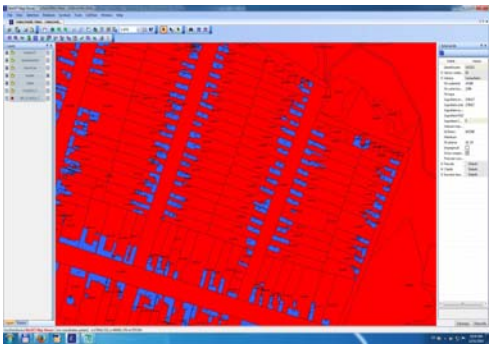
Figure 9. NetSetCAD Menu for generating reports

CONCLUSIONS

Using applications for accounting and data management in systematic registration projects has numerous advantages. Among the advantages of using this type of product are:
-Representing graphics accurately and suggestive of the actual situation on the ground on land and buildings,
-Creating and managing a comprehensive database with the most comprehensive information on land and building owners,
-developing and printing all kinds of reports used in survey
-giving a true and complete picture of a territorial-administrative units, support for administrative management,
-Direct and fast access to information on land and building owners with all aspects of it.

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COMPARATIVE STUDY FOR DETERMINING ALTITUDES

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Abstract

Levelling or terrestrial elevation is the part of the topography that studies the tools and methods for determining the point's altitude on the terrain surface and representation in plan. With these measurements will be obtaining the third coordinate of a point H - altitude.
The article aims to determine rates using three surveying instruments (classical level, total station and digital level) and two survey methods: closed geometrical levelling traverse and trigonometric levelling.
Measured points are inside the University of Agronomic Sciences and Veterinary Medicine, Bucharest.

Key words*: comparative study, altitude, levelling, surveying instruments*

INTRODUCTION

Levelling or terrestrial elevation is the part of the topography that aims to determine altitudes (quotas) points on the topographic surface and relief representation on plans and maps.
Levelling is performed with specifically instruments and is eligible for use mainly in surveying and construction.
Any point on the earth's surface must be determined by the three coordinates X, Y, H.
The odds are absolute if determined from surface-level or if it is determined relative to a reference surface set arbitrarily. Figure 1 can be seen in absolute and relative shares of the points A and B :

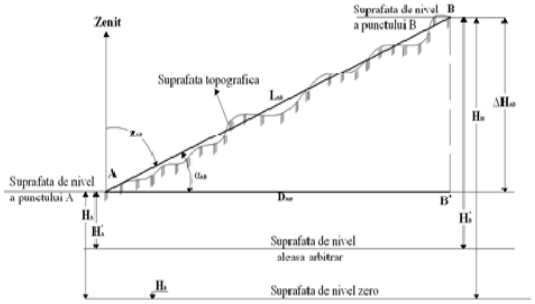

Figure 1. Defining altitudes

H_A si H_B absolute altitudes;

H'_A si H'_B relative altitudes

MATERIALS AND METHODS

For comparative study, we used: Leica RUNNER 20/24, Leica TC407 total station and Leica Sprinter 100M.
1) RUNNER 20/24 is a member of the new generation of automatic levels for manufacturers. Its innovative technology makes the measurement easier to achieve.
The instrument is ideal for all applications of a reliable and robust levels. The easy operation of the instrument can be easily learned, even by non-initiates.

Figure 2. Leica grade level RUNNER 20

Important parts:

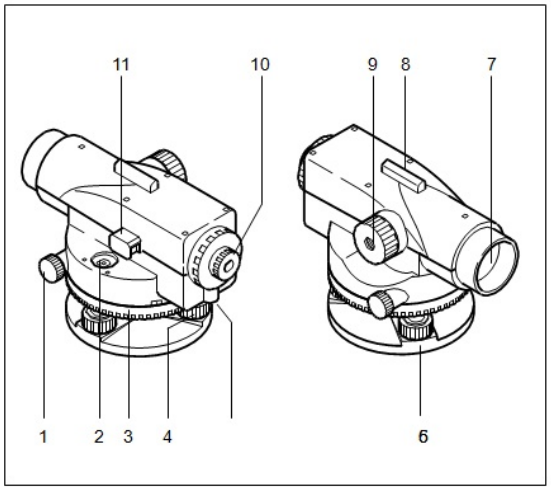

Figure 3. Instrument components

1. Endless drive (both sides)
2. Circular level
3. Knurled ring of adjustable horizontal circle
4. Footscrew
5. Compensator test knob
6. Base plate
7. Objective
8. Optical sight with point marking
9. Focusing knob
10. Eyepiece
11. Level prism

Figure 4. Leica TC407 total station

2) The Leica Geosystems TC407 is a high-quality electronic total station designed for the construction site.
Its innovative technology makes the daily surveying jobs easier.
The product is ideally suited for simple construction surveys and setting out tasks.
The easy operation of the product functions can be learned without problems in no time.

Important parts:

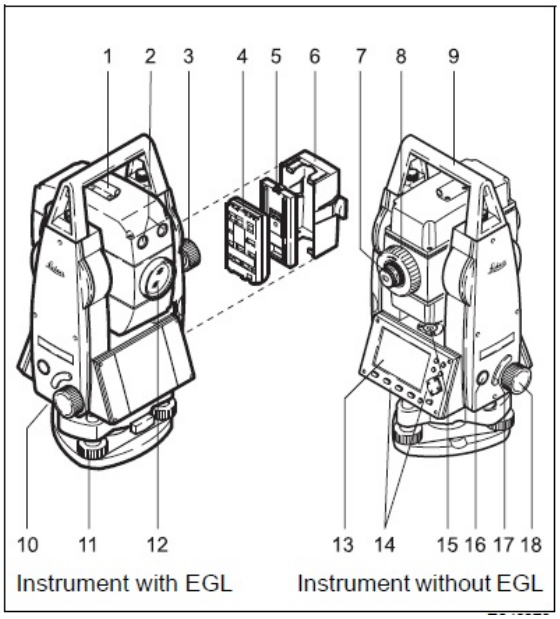

Figure 5. Instrument components

1) Optical sight
2) Integrated guide light EGL (optional)
3) Vertical drive
4) Battery
5) Battery stand for GEB111
6) Battery cover
7) Eyepiece; focusing graticule
8) Focussing telescope image
9) Detachable carrying handle with mounting screws
10) Serial interface RS232
11) Foot screw
12) Objective with integrated Electronic Distance Measurement (EDM); Beam exit
13) Display
14) Keyboard
15) Circular level
16) On/Off key
17) Trigger key
18) Horizontal drive

3) SPRINTER 100M is the new high quality electronic digital level produced by Leica Geosystems. It is designed to make levelling easier and quicker in any construction site. It employs techniques that electronically read the special bar-coded staff and the gathered data is displayed on the screen almost instantly. Its innovative technology makes the daily surveying jobs easier.

Figures 6, 7. Leica Sprinter 100M digital level

Instrument components:

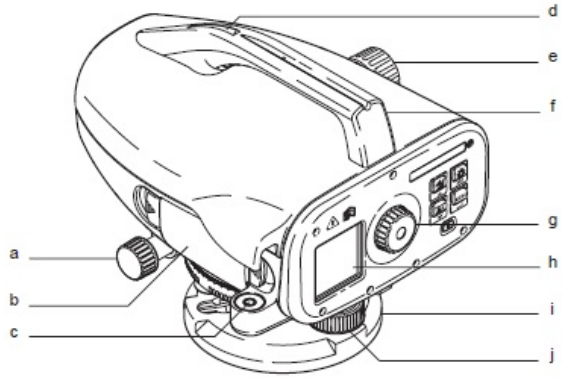

Figure 8. Instrument components

a) Horizontal fine motion screw
b) Battery compartment
c) Circular level
d) Gunsight
e) Focusing knob
f) Handle
g) Eyepiece
h) LCD display
i) Base plate
j) Levelling foot screw

M*ethods used*:

Traverse levelling method applies when we want to determine the odds of several points that can not be measured from a single point of station. By making their support network will thicken altimetry or there will be a network where there are no points in the studied area known quota.

Levelling classification can be based on the measurement tools used and depending on the methods of measurement and processing adopted in the following categories:

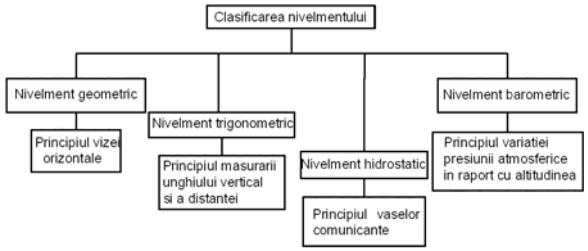

Figure 9. Classification levelling

1) Levelling traverse closed circuit - starts from a known point share (RN1) and closes on the same point of share known (RN1).

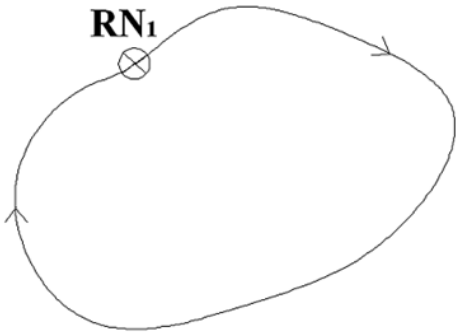

Figure 10. Scheme levelling traverse closed circuit

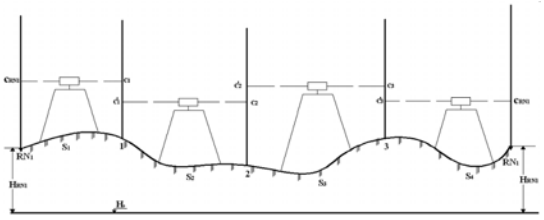

Figure 11. Traverse levelling geometric middle closed circuit

Stage field:
Measurements on the field will follow the same rules as to traverse the geometric levelling supported at the ends. The difference that arises is that will turn on the landmark know RN1 share and close measurements on the same landmark as it is the only point of time share. All measurements will be centralized in the book field.
Checking measurements:
Since the mark is the same departure and destination, the difference between the average readings back and average readings before the amount should be zero.

$$\sum a - \sum b = H_{RN1} - H_{RN1} = 0$$

$$e_h = (\sum a - \sum b)$$

The condition is: $e_h \le T_h$ Where tolerance is calculated using:

$$T_h = 3\sigma_h \sqrt{\sum D_{ij}(km)}$$

Verification:
HRN1 calculated by transmission rates equals HRN1 known data of the problem.

2) Trigonometric levelling
Trigonometric levelling method is applied in special circumstances when the terrain is rugged (steep slopes), and distances between points can reach up to several kilometres. It is recommended to apply only in such situations because they are more complex measurements, angles and distances are measured, which leads to decreased accuracy of determining the differences in level. Depending on the evolution of the field and measured distances between points, we have several situations:
• trigonometric levelling visas spaced upward (Figure 12) - the angle of slope is positive and the distance between points is small, the focus might be surprised at the height of the device;

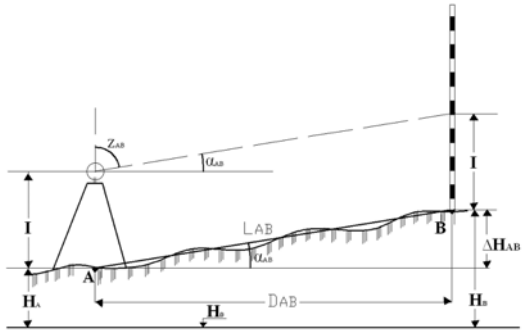

Figure 12. Trigonometric levelling visas spaced upward

• trigonometric levelling upward visas great distances (Figure 13) - the angle of slope is positive, but the distance between points is great, it can not be targeted to wonder at the height of the device;

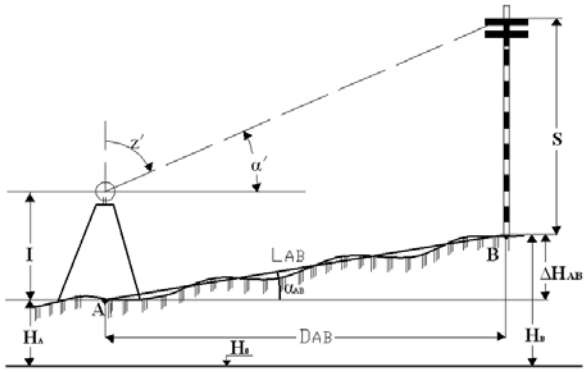

Figure 13. Trigonometric levelling upward visas great distances

• trigonometric levelling downward visas (Figure 14) - the angle of slope is negative.

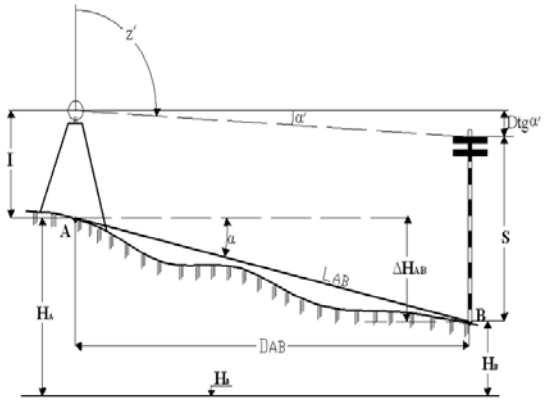

Figure 14. Trigonometric levelling downward visas

RESULTS AND DISCUSSIONS

Table 1. Study results

Comparative study								
Classic level Leica RUNNER20 			Digital level Leica Sprinter 150M 			Total station -Leica TC407 		
Precision: • Standard deviation per km double run RUNNER 20 - 2,4 mm			**Precision:** Standard deviation per km double run (ISO 17123-2): Electronic measurement with SPRINTER aluminium barcode staff: 2.0mm (SPRINTER 100/150M)			**Precision:** • Accuracy standard deviation Hz, V (acc. to ISO 17123-3) - TC(R)407 -7" (2 mgon)		
Nr Pct	ΔH	H	Nr pct	ΔH	H	Nr Pct	ΔH	H
GPS1	0	87.631	GPS1	0	87.631	GPS1	0	87.631
1	0.009	87.640	1	0.007	87.648	1	0.011	87.656
P5.1	-0.157	87.581	P5.1	-0.156	87.582	P5.1	-0.159	87.594
GPS1	0.051	87.637	GPS1	0.050	87.633	GPS1	0.053	87.643
e_h	0.006		e_h	0.002		e_h	0.012	
T	0.0061		**T**	0.005		**T**	0.016	

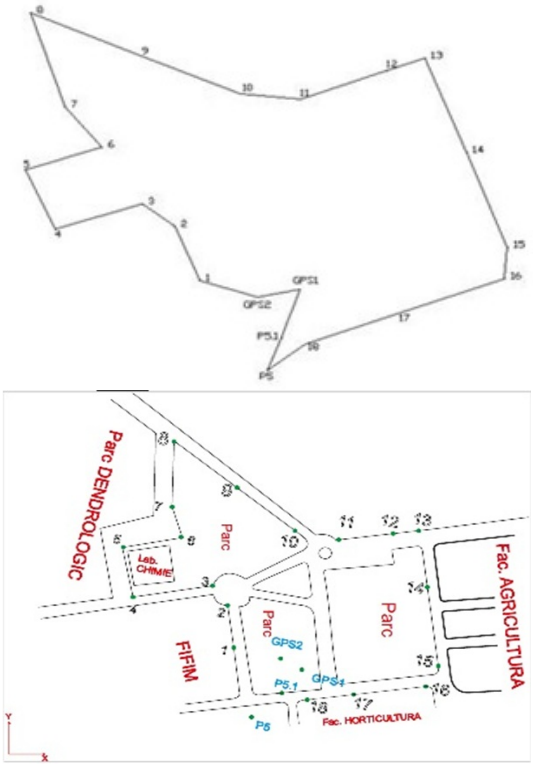

Figure 15. Drawing support network

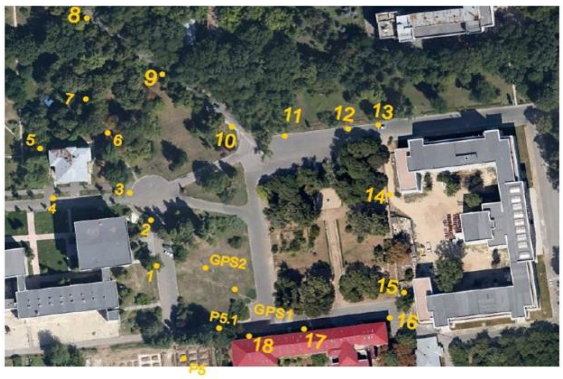

Figure 16. Catch the framing in Google Earth

CONCLUSIONS

Using measurements made with different surveying instruments we obtained H-altitude.
The paper was aimed to determining the altitudes of several points situated in the U.A.S.V.M Bucharest campus with three different surveying instruments (classical level, digital level and total station), demonstrating their capabilities and accuracy.

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User manual Leica Sprinter 150M
User manual Leica TC407

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USING THE GIS IN THE FIELD OF ENVIRONMENTAL PROTECTION

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Abstract

This paper aims to highlight the facilities that Geographical Information Systems make them available to the users in order to determine optimal solutions for the distribution of stands to be exploited. It also highlights opportunities available to control these systems and suggested solutions. For the study area were chosen vectorized cadastral plans and have taken some points and GPS equipment. After this were measured diameters and heights of trees with which the volumes were determined and then the allowable cut

Key words*: Geographical Information Systems (GIS), Visual Basic for Applications (VBA), forest*.

INTRODUCTION

Using geographical information systems in environmental protection is a key issue, which is seen not only through the advantages of the moment, but also of the future advantages. Forest ecosystem should be managed so that "the future generations should benefit at least as the current generation" (Hartig, 1785, in Leahu, 2001). In order to achieve this challenge a proper scheduling of cuttings is necessary. Until 90s this problem was solved simply in the sense that a calculation of the allowable cut of an entire management unit (which is overlapping, in the hills and mountains zones, over one watershed) was being perform. For the calculation of the allowable cut the growth indicator was used and, for control, the method of age classes was used (Leahu, 2001). After the 90s, with the appearance of property laws, the situation became more complicated due to the fact that there were many owners in the same watershed. Forest management projects that regulated the production forest were replaced by the so-called summary forest management studies which were performed for each owner (Leahu, 2001). These studies have a number of drawbacks among which two are notable:

- ✓ If in a watershed there is a surplus of exploitable stands (stands with age difference comparing with exploitability age is greater or less than 10 years) and they belong to different owners, the cutting of a large amount of wood may be legally proposed, a situation that inevitably leads to the manifestation of torrential processes in the area (Tereşneu, 2016).
- ✓ When clear cutting treatment is proposed to exploit the wood. There is a restriction on such cuts to only 3 hectares. If exploitable stands are large areas within a watershed and belong to different owners, requests may occur (while being still legal) to apply this treatment on adjoining surfaces of more than 3 hectares. In conditions of a high quality forest management for an entire watershed such a situation can be solved by adopting the so-called exploitability sacrifices which means some stands were exempted from cuts even if it had exploitability age (Leahu, 2001, Tereşneu, 2016).

Consequently, we intend to develop a GIS methodology by which the watershed wood cuts may be rigorously verified. This challenge is necessary since the massive deforestation combined with the chaotic manifestations of weather in recent years have led to serious material damages and even losses of human lives (Clinciu et al., 2015).

STUDY AREA

This study has been conducted in Bran (45051’38’’N 25036’57’’E), Brasov with a total area of 1335 ha.

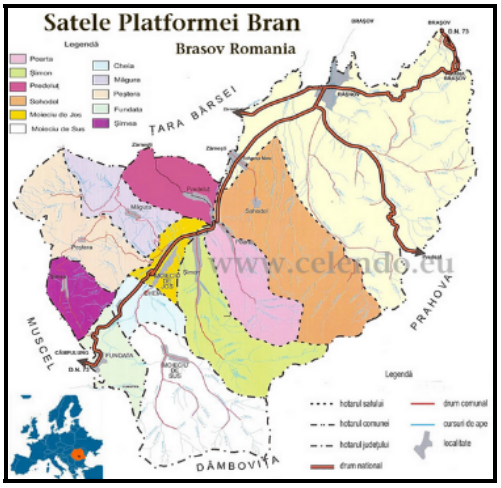

Figure 1. Study area

From the geomorphological point of view the study area includes stands that are placed on sites with slope angle ranging 50 to 400; altitude is between 900 and 1700 m (Tereşneu, 2016).

MATERIALS AND METHODS

28 scanned cadastral base plans, scale 1:5.000 dating from 1970, but updated in terms of forest boundaries, were used from which the interest data was taken through vectorization. For the same purpose, ortophotos, scale 1:5.000 resulting from flights in 2012 have been used. In the Romanian forest practice cadastral plans were and are still used, with the boundaries of compartments and subcompartments overlaid. Other data sources are orthophotos. Using these some boundaries were update and a number of changes that occurred in time were identified, like for example changes in the routes of forest roads. Also, there were used two types of GPS receiver Trimble PROXT and PROXH. GPS equipment was used in numerous situations and two dendrometric devices were used, namely: a precisely caliper for determining the diameters of trees and a hypsometer Vertex type (Vertex III with transponder T3) for measuring the height of the trees (Tereşneu, 2016).

To solve the studied problem direct field measurement method, statistical methods and (mostly) GIS methods: georeference, vectorization and GIS analyzes were used (Tereşneu, 2016).

REALIZATION OF GIS PROJECT

Compartments belonging to UB Bran were identified on plans and maps for the realization of the GIS project. For the correct determination of individual forest area bodies and total area, the position of boundary lines was determined using GPS equipment. The data field, after they have been corrected properly, were stratified by several criteria: general category (forest, forest line, forest road, open wood - forest at the upper limit altitude – alpine zone), stand characteristics (composition, consistency - the closeness of the crowns - age), orographic characteristics (valley, slope, edge, exposition). The overall accuracy of the position points is shown in Figure 2, wherein the 5 categories on the abscissa are intervals of 0.5 m (1 – 0-0.5m, 2 – 0.5-1.0m, 3 – 1.0-1.5m, 4 – 1.5-2.0m, 5 >2.0m).

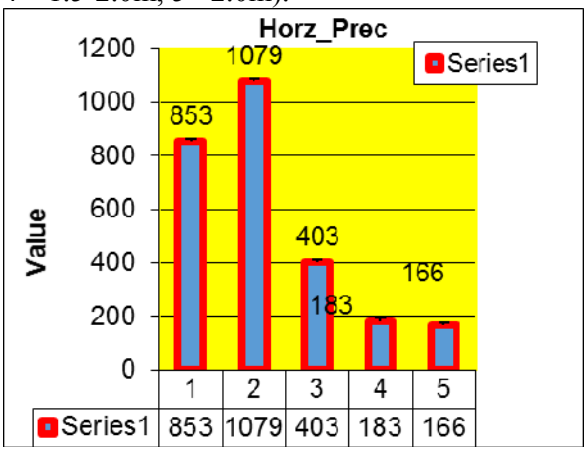

Figure 2. The horizontal precision of points taken with GPS equipment

Data were processed using Statistica software and some conclusions could be drawn on the accuracy of determining the points coordinates in areas with forest vegetation: the lack of vegetation on the one side is not necessarily an advantage, highest precision is obtained in high landforms (edge) regardless of the stand characteristics, the orientation of the exposition positively influences accuracy so far as it is close to the satellites route (Tereşneu et al., 2014, 2016).

Forwards the hybrid method AutoCAD-ArcGIS was used for the project GIS of study area (Tereşneu, 2007).

Below, were made in the database GIS specific calculations of forest planning (Tereşneu, 2016).

In order to have accurate data regarding the amount of wood that can be extracted from a forest in a year is need that the volumes of trees to be correctly determined. Volumes computation was achieved using the method of relative heights series (Giurgiu et al., 2004).

With the purpose of determining a mathematical model that should allow the automation of the determinations specific to the method of indicating growth, there an adapted variant of the SIMBIOF was used (Tereşneu, 2007, 2008). The adaptation of this software Referred to the conditions imposed to every stand with the purpose of its being fit within one of the 6 groups presented above.

Determining the measure of the allowable cut of main products through the intermediary of this model implies compulsorily going through two stages:

a) Repartition of the stands included within the production fund, through the intermediary of a condition of separation in six groups (C1…C6). In the framework of every group, for every stand there the growth of the principal production in different moments specified in the relations described within the algorithm will be calculated. There the condition for every stand to be placed in a single group imposes itself (Tereşneu, 2006, Tereşneu and Vasilescu, 2006);
b) Calculation of the indicators XV1…XV6 and application of the procedure for determining the allowable cut.

The obtained result for the allowable cut indicator through the method of the indicating growth is 2802 m^3. In order to verify, this indicator was determined with the help of two other types of software: the software AS which is still being used on the national level in view of determining the allowable cut and the software Microsoft Excel. The obtained results were identical (Tereşneu, 2007, 2008, 2016).

The indicator calculated above is not the only element necessary to establish the cutting wood. Also, it is necessary a spacing of these cuts in time and space. For this a review of the distribution of the forest stands by age class is performed, by achieving a proper thematic map (Tereşneu, 2006) (Figure 3).

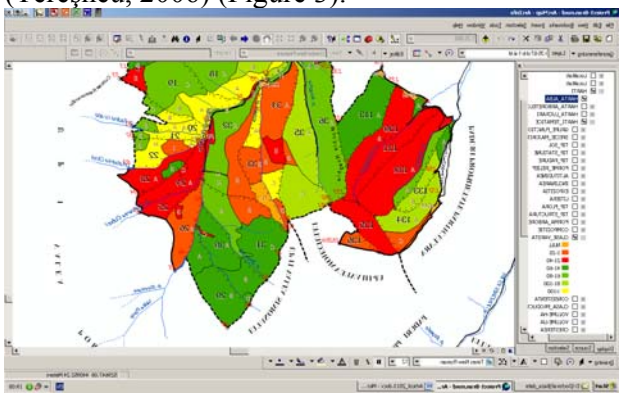

Figure 3. GIS project

In order to realize a control of how the stands are proposed for exploitation, the following way of thinking way was followed:

- storing all data on a central server, which is organized by localities and watersheds;
- obligation to surrender the forest management control projects in a common format – ArcGis (this measure is already beginning to be implemented);
- importing the data from the new project in the properly project of the locality and watershed and linking the new database via functions *Relate* and *Join* ;
- verifying the accuracy of calculated data. For this purpose a series of tests are made, such as: correctness of the calculated volumes (it is create a new field that is completed by a VBA sequence which is recall from the old project memory; this sequence was created in the manner described above); correctness of calculations relating to allowable cut (VBA sequences are used to calculate the indicators presented in pct. 4.2 and, finally, the allowable cut can be determined). If these calculations are correct the following steps are done;
- realization of a thematic age classes map with common data across watershed and following the possible critical situations (which will be indicated automatically, by creating a distinct color in thematic map) (Figure 4) (Welch et al., 2002; Butler and Schlaepfer, 2004);

- rescheduling the cuts after new observed situation (Tereşneu, 2016).

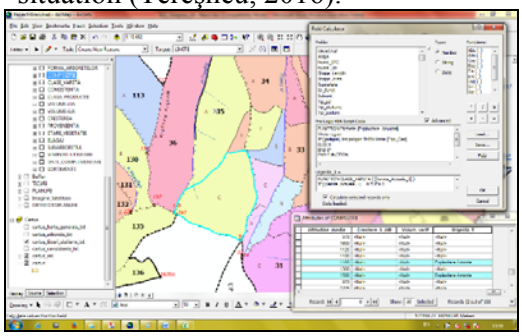

Figure 4. Reporting the problematic situations in GIS

The method is easy to implement and facile to control (Tereşneu, 2016).

CONCLUSIONS

Using Geographic Information Systems proves to be not only desirable but also highly effective in solving these environmental problems. As shown in this paper is not enough just to calculate the correct amount of wood that can be exploited in a forest, but a similar importance is the way in which the areas that follow to be exploited are distributed in space. On this line, this paper has demonstrated that it can use this modern tool for an optimal solution for this situation.

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MAP TRANSFORMATION SCALE 1:25000 FROM ANALOG TO DIGITAL VECTOR WITH ArcGIS 10.3

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Abstract

Vectorization can involve a series of procedures to achieve an acceptable raster-to-vector conversion. It can be as simple as executing one command to generate the vector features. Depending on the state of the input raster data you are working with, the vectorization process varies. This section is intended to provide an overview of the automatic vectorization experience. For vectorization we chose a trapeze in eight colors,scale 1:25.000.The software we work with isArcGis 10.3.

***Key words**: vectorization,vector,raster,ArcGIS,maps*

INTRODUCTION

ArcGIS is a geographic information system (GIS) for working with maps and geographic information. It is used for: creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and geographic information in a range of applications; and managing geographic information in a database. The system provides an infrastructure for making maps and geographic information available throughout an organization, across a community, and openly on the Web.

MATERIALS AND METHODS

ArcGIS Extension:

1. ArcGIS Spatial Analyst

ArcGIS Spatial Analyst provides a broad range of powerful spatial modeling and analysis tools. You can create, query, map, and analyze cell-based raster data; perform integrated raster/vector analysis; derive new information from existing data; query information across multiple data layers; and fully integrate cell-based raster data with traditional vector data sources. Integrated with the geoprocessing framework, ArcGIS Spatial Analyst offers easy access to numerous functions in ModelBuilder™, a graphic modeling tool.

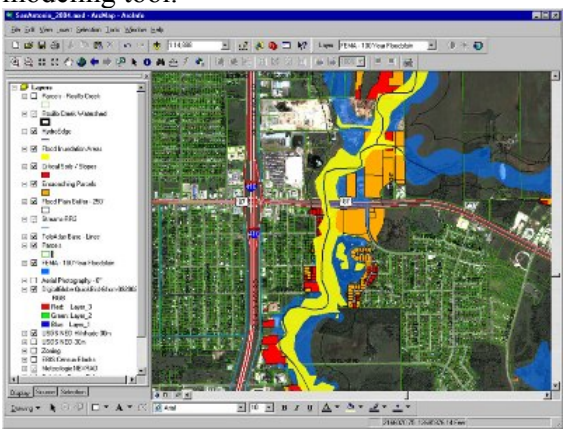

Figure 1. ArcGIS Spatial Analyst

2. ArcGIS 3D Analyst

ArcGIS 3D Analyst provides powerful and advanced visualization, analysis, and surface generation tools. Using ArcGIS 3D Analyst, you can seamlessly view extremely large sets of data in three dimensions from multiple viewpoints, query a surface, and create a realistic perspective image that drapes raster and vector data over a surface.

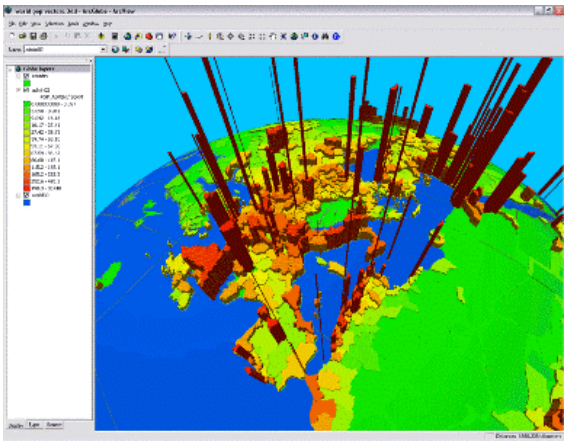

Figure 2. ArcGIS 3D Analyst

3. ArcGIS Geostatistical Analyst

ArcGIS Geostatistical Analyst provides a powerful suite of statistical models and tools for spatial data exploration and optimal surface generation. It allows you to create a statistically valid prediction surface, along with prediction uncertainties, from a limited number of data measurements. From determining whether an environmental safety threshold has been exceeded to locating mineral deposits, ArcGIS Geostatistical Analyst lets you model spatial data in a reliable and intelligent way. ArcGIS Geostatistical Analyst enables you to take advantage of these tools and techniques in an interactive graphical user interface (GUI) and as web services.

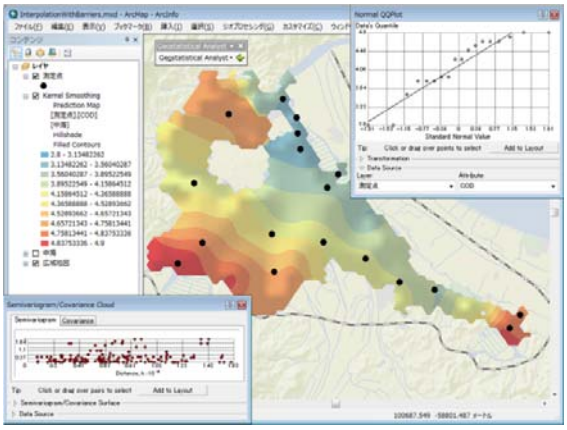

Figure 3. ArcGIS Geostatistical Analyst

4. ArcGIS Network Analyst

ArcGIS Network Analyst provides network-based spatial analysis, such as routing, fleet routing, travel directions, closest facility, service area, and location-allocation. Using a sophisticated network data model, users can easily build networks from their GIS data. ArcGIS Network Analyst enables users to dynamically model realistic network conditions, including one-way streets, turn restrictions, height restrictions, speed limits, and variable travel speeds based on traffic.

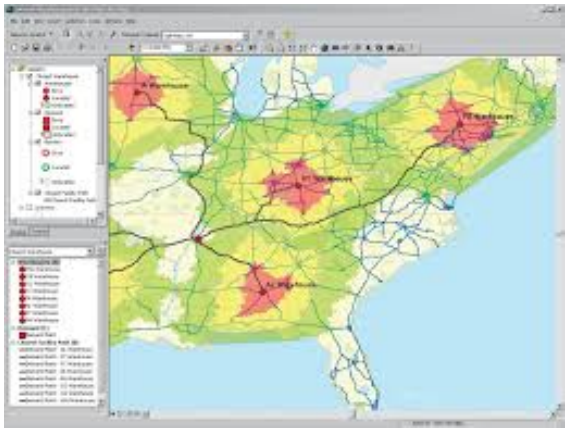

Figure 4. ArcGIS Network Analyst

5. ArcGIS Schematics

ArcGIS Schematics provides a powerful suite of tools to automate schematic representations of spatial or nonspatial data by taking advantage of core ArcGIS symbology and labeling. It allows you to schematically represent any kind of physical network including utilities (telecommunication, electric, gas) and transportation (railways, aviation, roads) and visualize virtually any logical network including social and economic networks. ArcGIS Schematics lets you rapidly visualize and check your data connectivity, quickly understand network architecture, and shorten the decision cycle by presenting focused views of the data.

6. ArcGIS Tracking Analyst

ArcGIS Tracking Analyst extends the time-aware capabilities of ArcGIS with advanced functions to let you view, analyze, and understand spatial patterns and trends in the context of time. By providing tools for time-dependent symbolization and time-based analysis, Tracking Analyst automates and enables the tracking and discovery of time-related trends and patterns. When combined with Tracking Server or GeoEvent Processor for Server, ArcGIS Tracking Analyst can be used to create a real-time GIS tracking system.

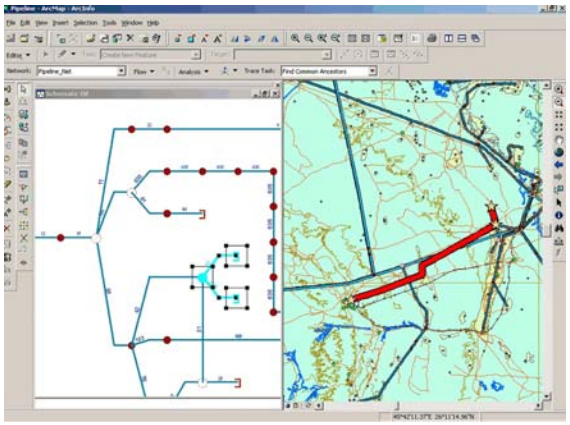

Figure 5. ArcGIS Schematics

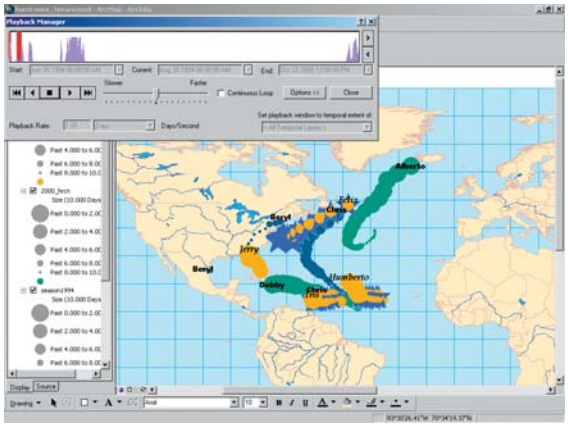

Figure 6. ArcGIS Tracking Analyst

7. ArcGIS Publisher

ArcGIS Publisher gives you the freedom to easily share and distribute your GIS maps, globes, and data with anyone. ArcGIS Publisher converts ArcGIS map and globe documents to Published Map Files (PMFs). PMFs are viewable through ArcGIS for Desktop products including ArcReader™, a free downloadable application from Esri. PMFs contain instructions about the location and symbology of data layers (rendering rules, scale dependencies, etc.) so you can quickly, easily, and securely share dynamic electronic maps locally, over networks, or via the Internet. ArcGIS Publisher also enables you to easily package PMFs together with their data, if desired. Developers can use the ArcGIS Publisher extension's ArcReaderControl to create and distribute royalty-free, customized ArcReader application 2D or 3D maps.

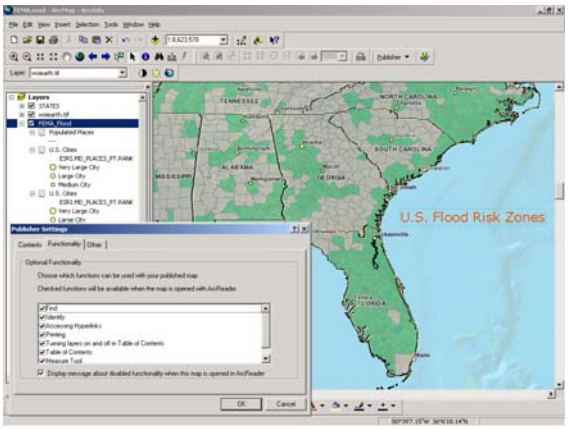

Figure 7. ArcGIS Publisher

8. ArcGIS Data Interoperability

ArcGIS Data Interoperability eliminates barriers to data sharing by providing state-of-the-art direct data access; data translation tools; and the ability to build complex spatial extraction, transformation, and loading (ETL) processes. Jointly developed by Esri and Safe Software— an Esri corporate alliance—this extension is built on Safe Software's industry-standard FME technology. ArcGIS Data Interoperability allows you to use any standard GIS data, regardless of format, within the ArcGIS for Desktop environment for mapping, visualization, and analysis. The Workbench application, included with the extension, enables you to build complex spatial ETL tools for data validation, migration, and distribution.

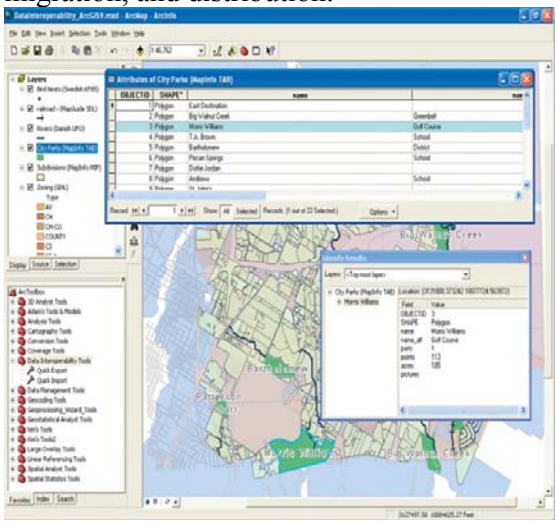

Figure 8. ArcGIS Data Interoperability

RESULTS AND DISCUSSIONS

For vectorization we chose a trapeze in eight colors scale 1: 25.000. We work with ArcGIS software is version 10.3 Desktop.

Create a theme in ArcGIS 10.3

- To create a theme launch project in ArcGIS with extension **.mxd** and then click with your mouse on catalog.
- Click with the mouse to create a new theme **Home - 9201\New\Shapefile**
- Add a theme name in the window **name** and then choose the appropriate type (**Feature Type)** of entity theme we want to represent in vector format.

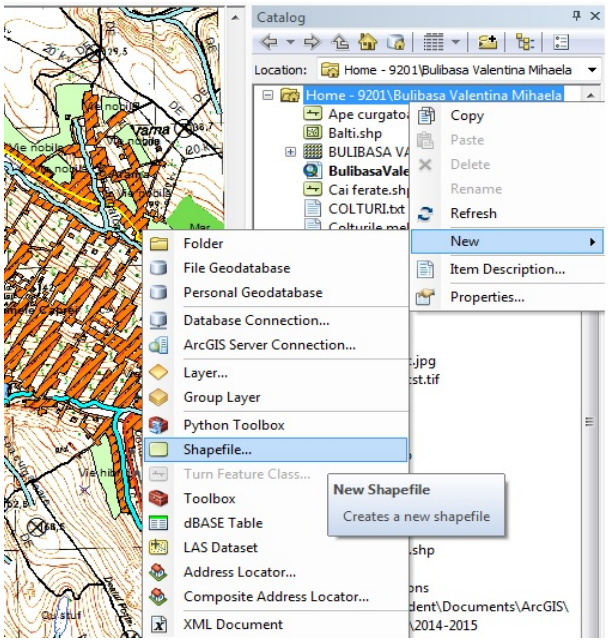

Figure 9. Creating a new shapefile

- Click the Edit button to select the projection system(**Projected Coordinate Systems/National Grids/Europe/Stereo 1970)** and then we press **Ok**.

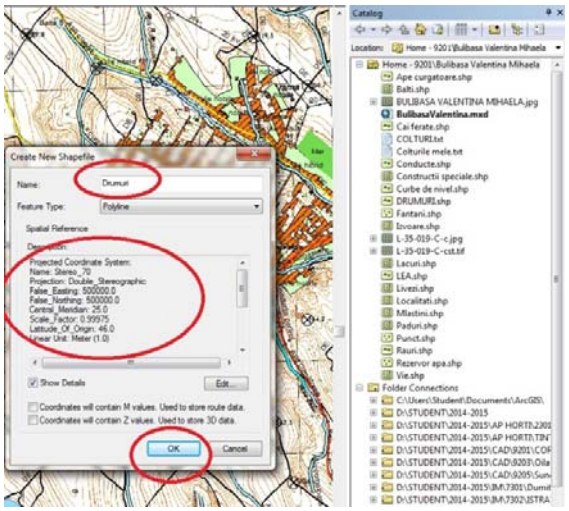

Figure 10. We choose coordinate system -Stereo 1970

- The new theme apper in the Table of contents/Layers.
- The new created theme is saved with the name we want and the extension .dbf , .prj , .shp , .shx

Editing a theme in ArcGIS 10.3

- Check the existence of the **Editor toolbar**on the menu toolbar. If this dosen't exist we click **Customize/Toolbars** and then we thick the **Editor toolbar**.
- Before starting the actual editing we must complete columns of table attributes. We click on the **Table Of Contents/Layers** on the shapefile.Right click on the Atribute table opens a submenu proper attributes table, there are already three default fields:**Fid, Shape, ID.**

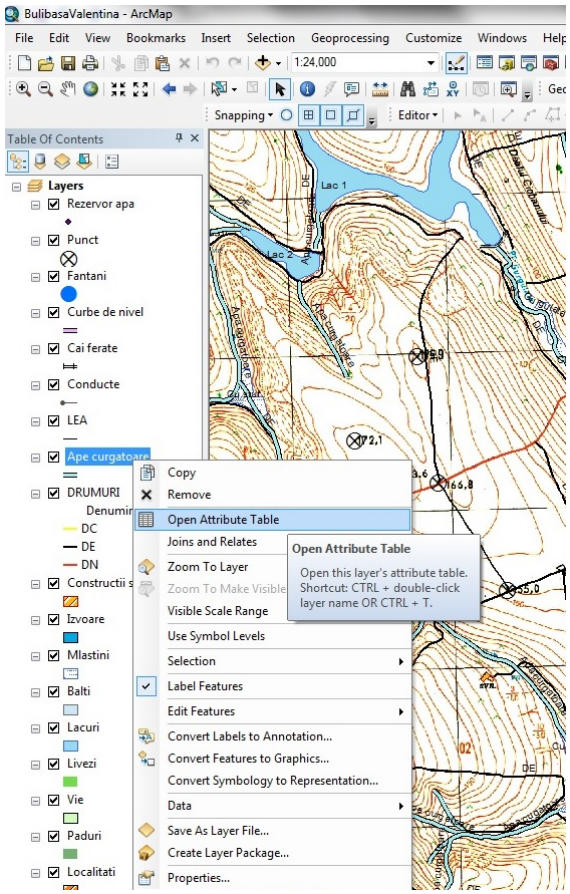

Figure 11. Open the attribute table of the theme

- If we want to add new fields click on the table options and then we click **<u>Table/Table Option/Add Field</u>.**

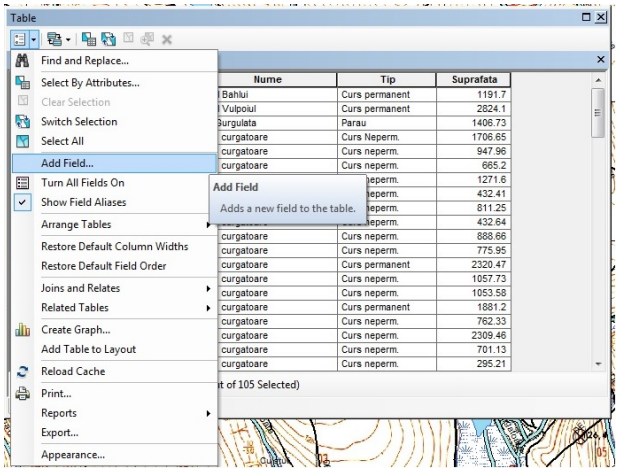

Figure 12. Add the necessary columns theme

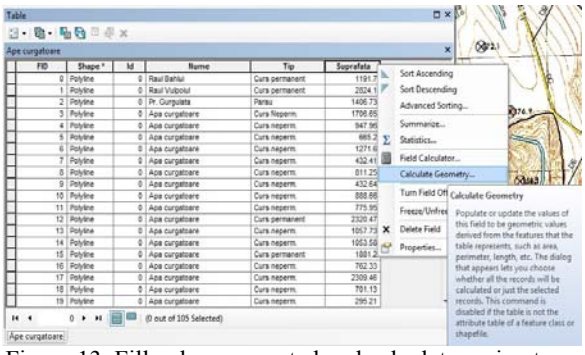

Figure 13. Fill columns created and calculate perimeter / area

- To start the actual editing we position ourselves with the mouse on the desired theme and we click on the **Start editing.**
- After vectorization open the attribute tableand fill in the fields created.
- After we finished vectorized we close the editing session: **Stop editing** and **Save edits.**

CONCLUSIONS

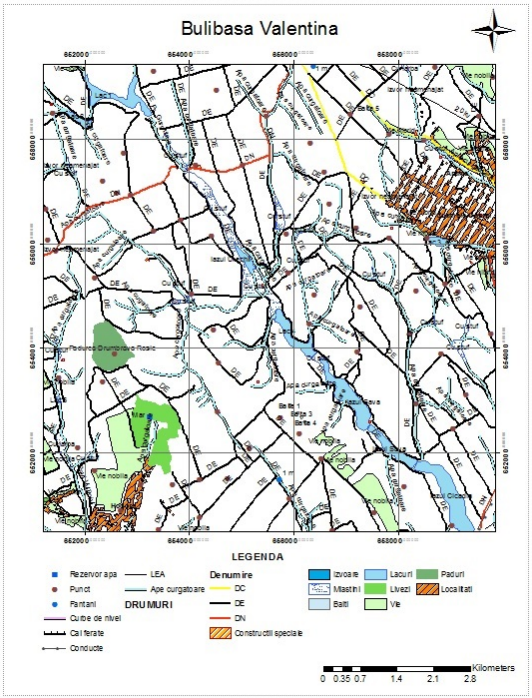

Figure 14. Vectorised map with Arcgis 10.3

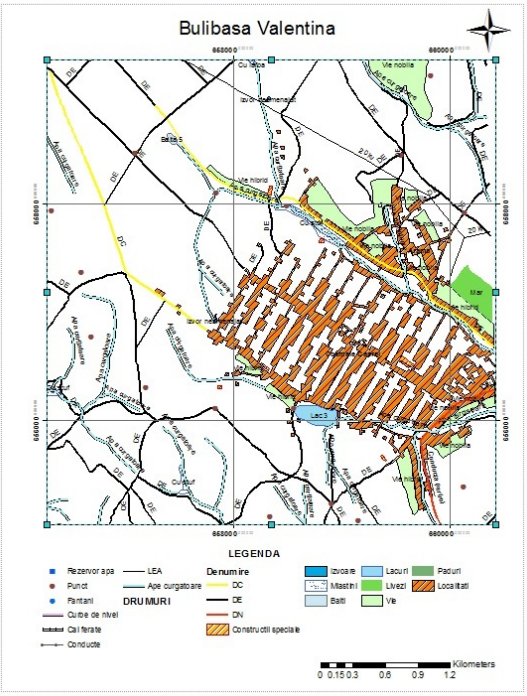

Figure 15. Detail vectorised map with Arcgis 10.3

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LATEST TECHNOLOGIES HANDHELD 3D SCANNING AND PHOTOMODELLING THE EYESMAP TABLET

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Abstract

In this presentation we are focusing on the latest technologies for 3D scanning and photomodelling. As the needs for better land survey and better digitalisation of the real word, such as buildings, archeological sites, nature, etc., grew larger and with the implementation of new technologies, many innovative devices have been created as to ensure the best result for real world 3D surveying. This is the case of the device presented in this project, the EyesMap tablet. Implemented by Ecapture, this handheld device gives its user the freedom of use and a full solution in just one device. EyesMap ensures full data processing, by acquisitioning data using the embedded cameras and also using the embedded depth sensor and direct processing of such data on its own EeysMap Software. EyesMap is the 3D modelling solution available to your fingertips.

Key words*: photomodelling, 3D SCANNING, EyesMap.*

INTRODUCTION

Surveying or land surveying is the technique, profession, and science of determining the terrestrial or three-dimensional position of points and the distances and angles between them. Surveyors work with elements of geometry, trigonometry, regression analysis, physics, engineering, metrology, programming languages and the law. They use equipment like total stations, robotic total stations, GPS receivers, retroreflectors, 3D scanners, radios, handheld tablets, digital levels, drones, GIS and surveying software.

Surveying has been an element in the development of the human environment since the beginning of recorded history. The planning and execution of most forms of construction require it. It is also used in transport, communications, mapping, and the definition of legal boundaries for land ownership. It is an important tool for research in many other scientific disciplines.

Surveying instruments have characteristics that make them suitable for certain uses. Theodolites and levels are often used by constructors rather than surveyors in first world countries. The constructor can perform simple survey tasks using a relatively cheap instrument. Total stations are workhorses for many professional surveyors because they are versatile and reliable in all conditions. The productivity improvements from a GPS on large scale surveys makes them popular for major infrastructure or data gathering projects. One-person robotic-guided total stations allow surveyors to measure without extra workers to aim the telescope or record data. A fast but expensive way to measure large areas is with a helicopter, using a GPS to record the location of the helicopter and a laser scanner to measure the ground.

Figure 1. Surveying equipment: optical theodolite, robotical total station, optical level, RTK GPS base station

MATERIALS AND METHODS

As the needs for better land survey and better digitalisation of the real word, such as buildings, archeological sites, nature, etc., grew larger and with the implementation of new technologies, many innovative devices have been created as to ensure the best result for real world 3D surveying.

A 3D scanner is a device that analyses a real-world object or environment to collect data on its shape and possibly its appearance (e.g. colour). The collected data can then be used to construct digital three-dimensional models.

Figure 2. Lidar scanner that can be used for creating 3D models for buildings

Many different technologies can be used to build these 3D-scanning devices; each technology comes with its own limitations, advantages and costs. Many limitations in the kind of objects that can be digitised are still present, for example, optical technologies encounter many difficulties with shiny, mirroring or transparent objects. For example, industrial computed tomography scanning can be used to construct digital 3D models, applying non-destructive testing.

Collected 3D data is useful for a wide variety of applications. These devices are used extensively by the entertainment industry in the production of movies and video games. Other common applications of this technology include industrial design, orthotics and prosthetics, reverse and prototyping, quality control/inspection and documentation of cultural artefacts.

Handheld laser scanners create a 3D image through the triangulation mechanism: a laser dot or line is projected onto an object from a hand-held device and a sensor measures the distance to the surface. Data is collected in relation to an internal coordinate system and therefore to collect data where the scanner is in motion the position of the scanner must be determined. The position can be determined by the scanner using reference features on the surface being scanned or by using an external tracking method. External tracking often takes the form of a laser tracker (to provide the sensor position) with integrated camera (to determine the orientation of the scanner) or a photogrammetric solution using 3 or more cameras providing the complete Six degrees of freedom of the scanner. Both techniques tend to use infrared light-emitting diodes attached to the scanner which are seen by the cameras through filters providing resilience to ambient lighting.

As needs for 3D modelling changed in the past years, new solutions have been implemented for 3D scanning and photomodelling. But also as the technology went on developing, the devices became each time harder to use and handle. It became a general problem for 3D modelling in general.

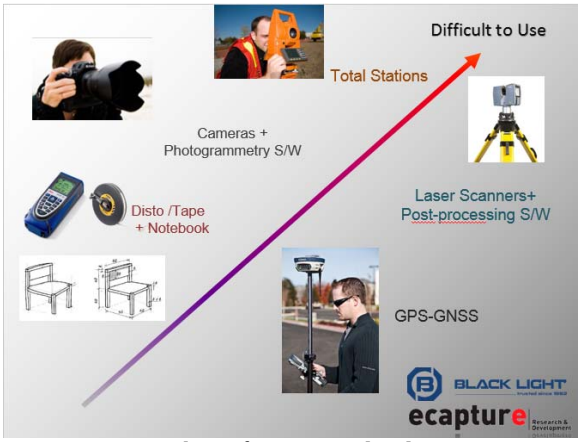

Figure 3. Chart of surveying development and its difficulty of use

This was the starting point for 3D modelling expert companies to begin designing and implementing new solutions that can offer its users an easy to use, light weight device, as also a full data processing directly on the field without needing an external computer and other software.
This is the case of the handheld tablet designed and offered by Ecapture called EyesMap.

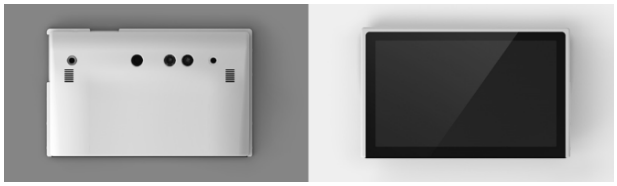
Figure 4. Ecapture EyesMap 3D scanning tablet

Using this device, the users can obtain points, distances and surfaces measured by just touching the screen using their fingertips.

The EyesMap embedded software allows its users to create 3D models using the following possibilities:
- 3D Photomodelling: a powerful automatic 3D point cloud generator for small, medium and large objects. This tool generates point clouds using multiple overlapping images. This images can be done with any external camera, but also with the embedded stereo cameras.

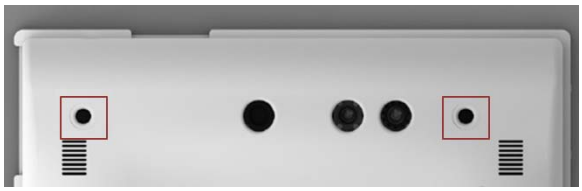
Figure 5. The EyesMap stereo cameras

This tool uses the principle of triangulation which means that it will create a point in 3D through two or more homologous points (2D) in different images. The point is calculated through crossing lines in the space (using the calibration and orientation data).

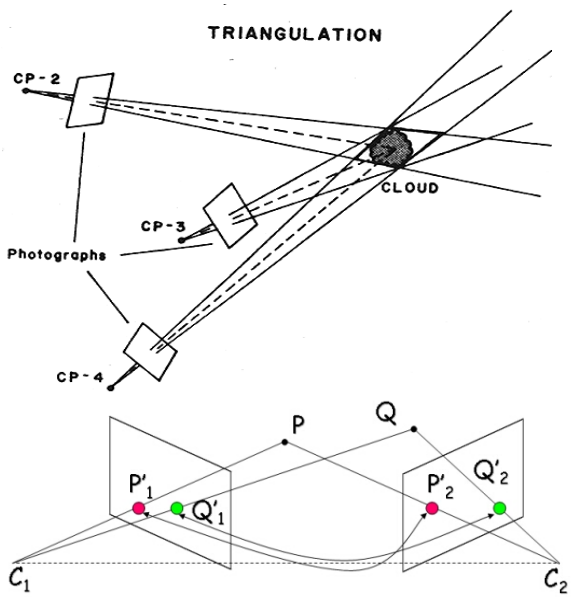

Figure 6. Triangulation method

- 3D Depth Sensor: Real time short range scanner. The depth sensor scanner is an easy and fast way to capture scenes indoors at short range distances (< 4m).
The user can get a 3D points cloud of the scene while moving (the entire object can be bigger than 4 meter). This tool is useful for: indoor scanning, (outdoors without direct sunlight), road accidents or crime reconstructions, industry motor engines or machines and so on.

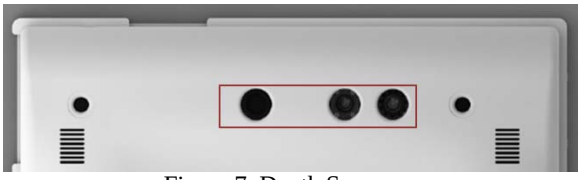
Figure 7. Depth Sensor

- Orthophoto: Automatic true orthophoto generator. Using this tool, true orthophotos can be easily generated automatically using images.

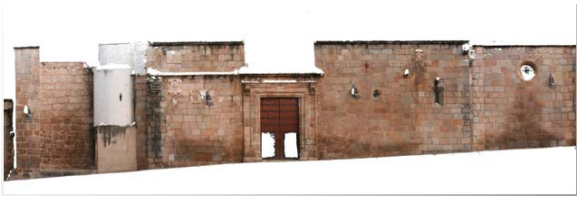

Figure 8. Orthophoto generated using images

- Georeference: this tool will georeferenced your data using GPS-GNSS GPS, GLONASS, GALILEO, QZSS, COMPASS & SBAS L1 Ideal for GIS applications. It can achieve sub-meter real time coordinates accuracy, or even better after post processing.

RESULTS AND DISCUSSIONS

Thanks to its easy to use design, the handheld tablet EyesMap can be used in a wide rage of applications, such as:

- Architecture / heritage. The EyesMap tablet can create 2D/3D facades and interiors, 3D/Orthophoto captures and it can be used for the process of buildings renovation, building change of use/destination.
- Archeology. The EyesMap tablet can create small objects 3D documentation, 2D/3D profiles of archeological sites, detailed full colored site documentation, GPS georeferencing.
- Road accidents reconstruction. The EyesMap tablet can create 3D reconstruction of road accidents, insurance 3D documentation, and instrument certification.
- CSI / Insurance: The EyesMap tablet can be useful for Crime Scene Investigations, Insurance investigation, home and labour accidents certification / traceability.
- Interior design.
- Industry. The EyesMap tablet can be useful for automotive industry, petrochemical industry, reverse engineering, as-built documentation.
- 3D video gaming / Entertainment industry. The EyesMap tablet can be useful for capturing virtual reality.
- Biology / Geology. The EyesMap tablet can create detailed 3D small animals capturing.

CONCLUSIONS

The digitalisation of real-world objects is of vital importance in various application domains. This is the main reason why devices as the EyesMap tablet is becoming an important tool in the 3D scanning and photomodelling market.

The general tendencies of 3D scannig experts is to create or the require devices that cand offer high quality results without forgeting about the need for ergonomic and easy to use designs. As result, this will be the main cause and effect for the implementation for new designs to go on and keep being developed in the need for reaching perfect digitalisation.

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https://en.wikipedia.org/wiki/3D_scanner
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GEOREFERENCING WITH ArcGIS 10.3 OF A MAP SCALE 1:25.000

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Abstract

Georeferencing is a methodology for converting maps from analogue to digital vector. Graphic information can be of two types: raster or vector . Raster graphics is a way to represent imaging software Matrix pixels while vector graphics representation is a method of imaging using geometric primitives (points,segments , polygons) , characterized by mathematical equations . For georeferencing we chose a trapeze in eight colors ,scale 1:25.000.The software we work with is ArcGis 10.3.The corners of the trapezoid will be converted from geographic coordinates in coordinates stereo 1970.

Key words*: georeferencing, vector, raster, ArcGIS,maps.*

INTRODUCTION

Geography Information Systems (GIS) are part of the largest class information systems treating its main feature information considering its location or spatial location, Geography, in territory coordinates.
Georeferencing requires image alignment to a coordinate system, the stage where the image becomes a form of spatial data defined by parameters such as projection and point of origin. The first consequence of this is that the map scale becomes variable: you can navigate "over" image in different "high places" controlled by the zoom factor.

MATERIALS AND METHODS

For georeferencing we chose a trapeze in eight colors scale 1: 25.000. We work with ArcGIS software is version 10.3 Desktop. For the begin we must transform the corners of geographic coordinates in coordinate Stereo 1970. We can use several softwares transformation: TransDatRo , Toposys , Geotools , PlanServMDI , Total Transform. These applications can either turn over the keystone of geographic coordinates in coordinate stereo or points or files of points. For example with PlanServMDI software help we can insert nomenclature of the trapeze and can be obtained directly over the keystone coordinate stereo in 1970.

RESULTS AND DISCUSSIONS

Steps:
1. We believe that trapezius has coordinates : These coordinates will be supplied software inverse transformation (X geodetic will be noted in column Y 's mathematically) .

	Xgeodezic	Ygeodezic
1.	350898,21	335057,25
2.	360837,51	334833,89
3.	360636,70	325575,38
4.	350683,05	325798,90

2. Make the connection to the folder where we want to work , or we want to bring our data setting "Folder Conections" and then "Conect To Folder" then press the "OK" button.
3. Then click with the mouse selecting the path that we want to bring our data that we want to work or we want to use .
4. Accessing data that we need is achieved as: Press the button in the toolbar at the top of the screen Add Date shaped sign (+).

5. Now save the project by going to File in the menu bar and then selecting Save As in our directory.
6. Now we go to View in the menu bar and then select Data Frame Properties / General / Units where the drop-down list to select Map Meters and go to the Display drop-down list putting everything Meters. Then do click with the mouse on Apply and OK. Control visualize the lower right corner of the ArcMap window on the display should go on X and Y coordinates Besides writing Meters instead of Unknown.(Figure 1).

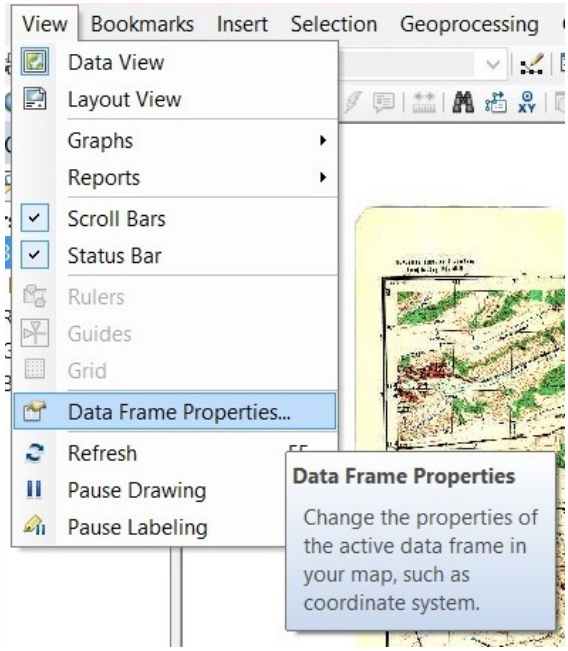

Figure 1. Data frame properies

7. Verify that appears in the main menu bar , toolbar georeferencing called georeferencing . If we do not appear in the main menu bar , go to Customize / Toolbars and select georeferencing , then drag the georeferencing in the menu bar in the area that we want . (Figure 2).
8. Zoom in on the corner of the trapeze that we want to introduce coordinates using the button in the main menu bar .
9. Now we go to the bar georeferencing Add Control Points button and go about one 's corner keystone of georeferenced , after previously we did with the + button in the menu bar a convenient zoom (Figure 3).

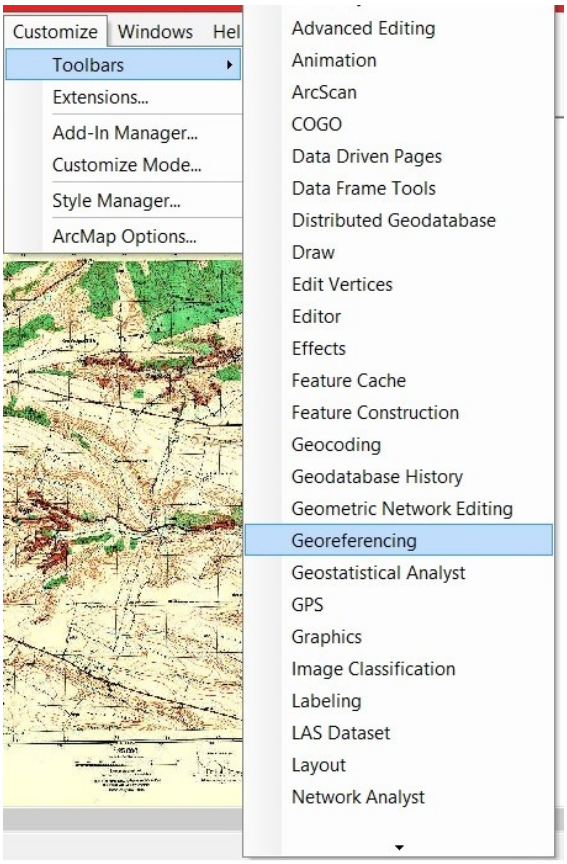

Figure 2. Georeferencing

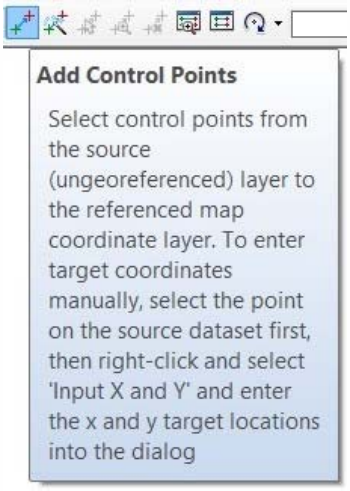

Figure 3. Add control points

10. Now we introduce the X and Y coordinates of all corners of the trapezoid ,starting with the top corner from the left and continuing clockwise order 1, 2 , 3, 4.The software transform the coordinates X and Y in reverse,the first column is Y and second column is X. Zoom with the + button in the menu bar on the corner of trepezului No.1 , and then we click with the right mouse button when

positioned at the intersection corner trapezius (upper trapezoid is given by the intersection of geographical coordinates) and immediately without moving the mouse we click with the left and right click with right Input X , Y , passing that the entering coordinates.(Figure 4, Figure 5, Figure 6, Figure 7).

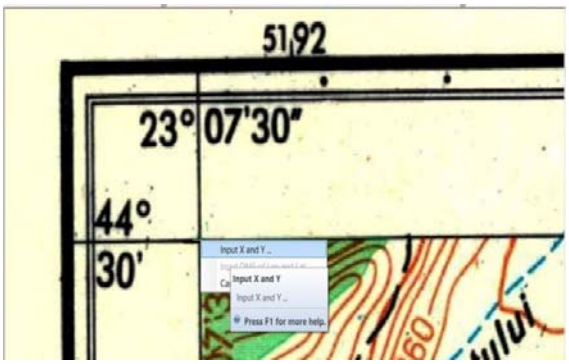

Figure 4. Point 1

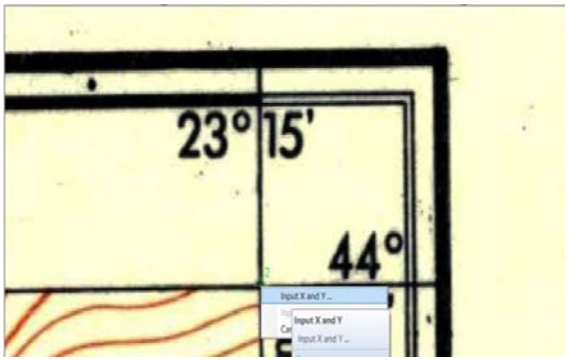

Figure 5. Point 2

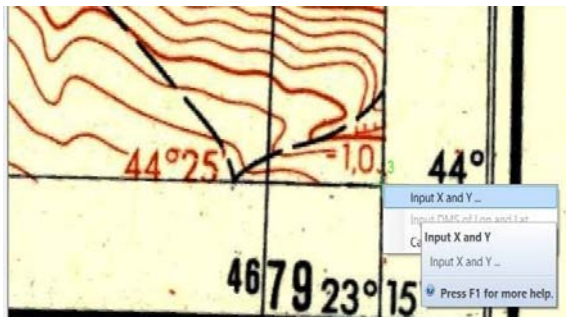

Figure 6. Ponit 3

11. Now visualize the whole trapeze with corresponding coordinates entered for the 4 corners of the trapezoid that we want to georeferencing (Figure 8).

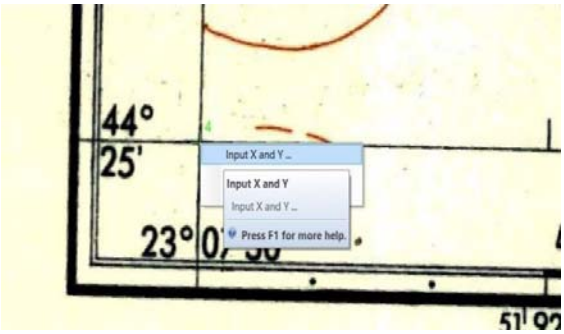

Figure 7. Point 4

Figure 8. The whole trapeze

12. We go to the bar georeferencing , click with the mouse on View Link Table to examine the pairs of X and Y coordinates of the four corners of the trapezoid (Figure 9).

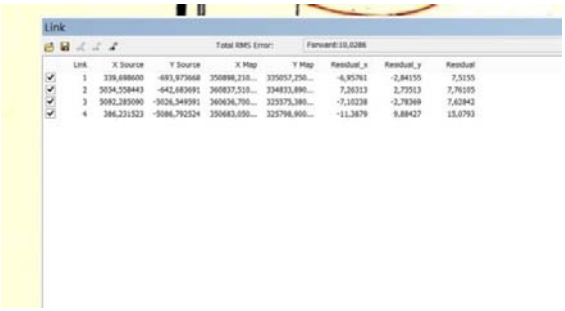

Figure 9. Table of coordinates

13. We have to check if we have correctly entered the 4 corners of the trapezoid that we want to referencing.

14. The trapeze is a little rotated spatially referenced and is a .tif file extension, we can recognize that it is correctly georeferenced reading every corner of the trapeze and confronting coordinates of the four corners of a trapezoid in Stereo 1970.We go to the menu

bar and save the project thus ending georeferencing (Figure 10).

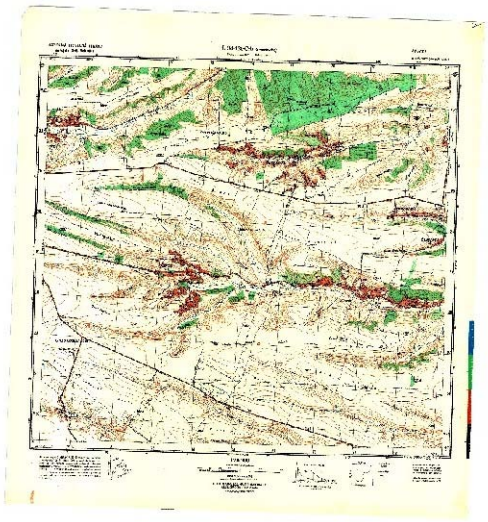

Figure 10. Final map

CONCLUSIONS

GIS is a technical working increasingly used in the modern world both in theoretical research and in many practical activities. In fact, GIS is a system that has several components on information reported to the geographical coordinates. Entry, storage, handling and component analysis is done by computer; output of, first, the visualization of complex information spatially referenced to real geographic coordinates , and secondly , the possibility of carrying out analysis and correlations of great complexity, unachievable with classical techniques effectively.

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STATISTICAL ANALYSIS OF A DIGITAL ELEVATION MODEL USING ARCGIS

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Abstract

The aim of the paper is to eliminate the redundant data included in a geographical information system (GIS) involving surface analysis. Because the GIS applications are used to solve problems from miscellaneous domains,is recommended that the spatial information and the particularities of the area involved to be combined in one raster layer. Principal component analysis applied to raster layers gives such a facility. The studied surface is about 2.5hectares and is a part of the campus of University of Agricultural Science and Veterinary Medicine from Cluj-Napoca. The digital elevation model for the studied area will be generated and the slope and aspect raster layers derived from DEM will be combined using the principal component analysis in order to eliminate the redundant values from the new raster but to keep the particularities of the surface.

Key words*:digital elevation model, principal component analysis, ArcGIS.*

INTRODUCTION

The ability to model the Earth surface is very important in order to understand the phenomena derived from environmental science(Griffith & Peres-Neto, 2006), (Verfaillie, Du Four, Van Miervenne, & Van Lancker, 2009) and to provide a more sustainable management for environmental resources as well as to understand complex life science problems, (Abson, Dougill, & Stringer, 2012). The common point of all these, is the importance of the spatial references of the data in order to analyze the mentioned problems; in most of the cases the elevation is one of the factor that will influence the studied phenomena. Spatial references will be included in the studied model through digital elevation model (DEM) that is a gridded array of elevations.(Mihai, Radu, & Cazanescu, 2009). No matter what software will generate the DEM, there will be involved a large amount of data. Most of the analysis performed on DEM will be based and will include the elevation. From this point of view it appearsthe problem of data redundancy from raster images derived from DEM. The slope and aspect for the surface use the elevation as primary source. The most suitable way to manage large amount of data is to use a statistical analysis of them and the statistical method used to eliminate redundant value is principal component analysis (PCA) (Jolliffe, 2002), (Demsar, Harris, Brunsdon, & Stewart Fotheringham, 2013).

In this paperthe DEM will be generated from points obtained from survey measurements using ArcGIS software and the raster images provided by the Spatial Analyst tools for surface analysis. These will be studied using PCA in order to eliminate the data redundancy due to the fact that all raster images are based on elevation.

MATERIALS AND METHODS

The approach proposed by this paper combines the spatial aspect of data with statistical analyses of those data in order to obtain a geographical information system that eliminates the redundancy of data. The software application used for this is ArcGIS 10. The spatial aspect of data is included in DEM and the raster and statistical analyses are made using Spatial Analyst extension of ArcGIS.

The studied surface is included in the University of Agricultural Sciences and Veterinary Medicine from Cluj-Napoca campus.In order to represent our terrain in ArcGIS we took measurementsusing the GNSS technology with GPS receiver Trimble R10, which has a precision of +/-8mm+1 ppm in horizontal plane and +/-15mm+1ppm in vertical plane, using the kinematic method. In this wayweobtained the coordinates of the points used to create the digital elevation model (DEM). Using the ArcGIS software, we created the geodatabase `usamv.gdb`in which is included a feature dataset where we imported our coordinates and also created other feature classes for details like roads and polygons that delimited the studied area as well as the building. Using the above elements was created the DEM for the investigated surface and were generated raster images for the slope and the aspect of the land using the 3D Analyst toolbar (Price, 2014). Furthermore, we used the PCA to compress data by eliminating redundancy. This statistical technique is widely used in the social and physical sciences to identify the spatial dominant patterns that will be the principal component and all other spatial data will be reconstructed using the principal component. (Demsar, Harris, Brunsdon, & Stewart Fotheringham, 2013).

The main idea of PCA is to reduce the dimensionality of a data set consisting of a large number of interrelated variables, while retaining as much as possible of the variation present in the data set, (Jolliffe, 2002). This will be obtained by transforming to a new set of variables, named principal components (PCs), which are uncorrelated and which are ordered so that the first few retain most of the variation present in all of the original variables.

Appling this method to raster, PCA from the input multivariate attribute space transforms the data into a new space in which those axes are rotated respect the original space. In our case, theraster images involved are elevation, slope and aspect. Since slope and aspect are usually derived from elevation, most of the variance within the study area can be explained with elevation. All the procedure is made in ArcGIS software using Multivariate Tools.

RESULTS AND DISCUSSIONS

As a first result we obtained the TIN Layer (Figure 1), that was created from our points, based on terrain tools. Every node is joined with its nearest neighbors by edges to form triangles. One or more polygons, which contain the entire set of data points, form the hull of the TIN. The hull polygons define the zone of interpolation of the TIN. As a result, the TIN generator creates a convex hull to define the bounding edges of the TIN.

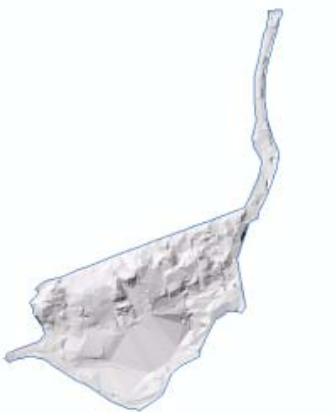

Figure 1. TIN layer

Based on the TIN Layer we created the Raster Image(Figure 2), of the terrain, represented in the image below. The darker partitions show higher elevations and the brighter ones show lower elevations. We can notice that the elevation varies between 48.8 m and 402.4 m.

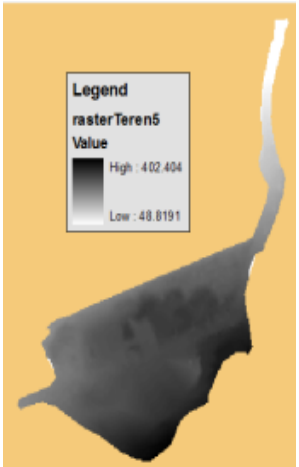

Figure 2. Raster Image

Using the slope tool implemented in surface analysis it was obtained a raster image, Slope

Layer illustrated in (Figure 3). Analyzing this we can observe the slope inclination of the surface. The inclination varies between 0.19% and 89.45%. However after reclassifyingthe slope raster, the mean value is 20.1 and the standard deviation is 20.32, (Figure 6.b).

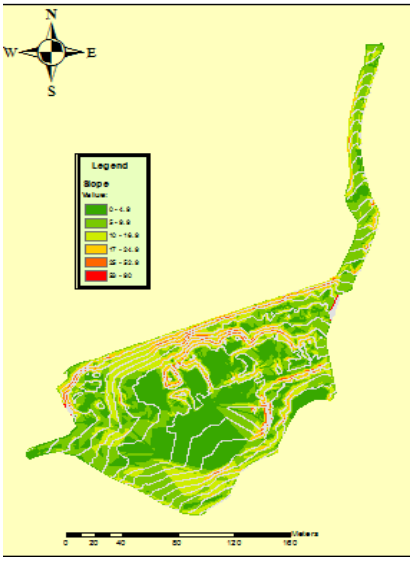

Figure 3. Slope

From elevation raster was created the Aspect Layer (Figure 4) of the surface, in order to identify the slope direction or the compass direction of hill faces. In our case, we can observe that the north-facing and northwest-facing slopes are predominant, in comparison with the southeast-facing slopes which are less visible on the map.

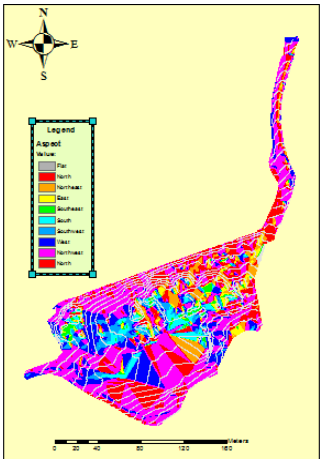

Figure 4. Aspect

For a better view of the surface we generated the contours (Figure 5), lines that connect points of equal height (Z). The distribution of the lines shows how values change across this surface:where there is little change in a value, the lines are spaced farther apart;where the values rise or fall rapidly, the lines are closer together.

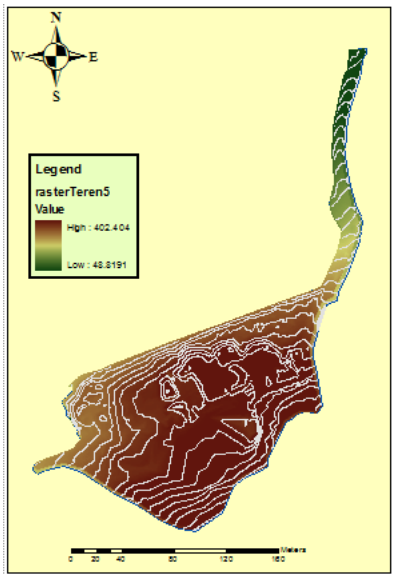

Figure 5.Contours

Using the Band Collection Statistics implemented in Multivariate tools of Spatial Analyst in the next figure (Figure 6) emphasize the variance involved in each generated raster.

(a)

bandcol_teren5_2

#	STATISTICS of INDIVIDUAL LAYERS			
# Layer	MIN	MAX	MEAN	STD
1	26.4721	401.8434	391.0721	12.2930

(b)

bandcol_slope_t1

#	STATISTICS of INDIVIDUAL LAYERS			
# Layer	MIN	MAX	MEAN	STD
1	0.1857	89.4496	20.0986	20.3184

(c)

bandcol_aspect_1

#	STATISTICS of INDIVIDUAL LAYERS			
# Layer	MIN	MAX	MEAN	STD
1	0.0634	359.9373	237.8685	108.8054

Figure 6. (a) statisctics for elevation (b) statisctics for slope
(c) statisctics for aspect

Appling PCA to elevation, aspect and slope raster was obtained the raster image given in (Figure 7) which does not contain redundant

data but keeps all the characteristics of the patterned surface.

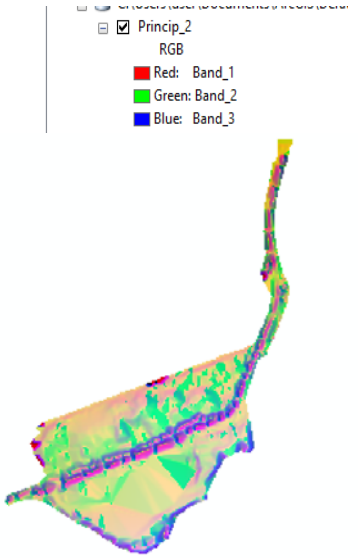

Figure 7. Investigated surface after the PCA

Analyzing the output data file obtained after the PCA implementation results that the cumulative value of the variance is given by the first layer of the multiband raster obtained from PCA in 95%. (Figure 8).

#	==========			
#	EIGENVALUES AND EIGENVECTORS			
# Number of Input Layers	Number of Principal Component Layers			
3	3			
# PC Layer	1	2	3	
#	----------			
# Eigenvalues				
	3090.53781	110.41004	33.85117	
# Eigenvectors				
# Input Layer				
1	0.99953	-0.03037	0.00509	
2	-0.03062	-0.96272	0.26874	
3	0.00326	0.26877	0.96320	
#	==========			
#	PERCENT AND ACCUMULATIVE EIGENVALUES			
# PC Layer	EigenValue	Percent of EigenValues	Accumulative of EigenValues	
1	3090.53781	95.5403	95.5403	
2	110.41004	3.4132	98.9535	
3	33.85117	1.0465	100.0000	
#	==========			

Figure 8. Output file for PCA

CONCLUSIONS

When PCA is applied to raster data the principal component are calculated for a data set where data are raster's cells. The result is a new raster where for each cells is assign a value based on new principal components space. The new raster image is suitable to be used in subsequent spatial analysis based on map algebra such as combining raster from meteorology with soil type or census data. In all of this cases the amount of data is considerable large and it is important to work with one layer that includes the characteristics and particularities of all layers considered input data for PCA. In the case considered for this paper the investigated surface has 2.5 hectares and the initial number of points is 1631.

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THE REALIZATION OF AN ELEVATION NETWORK IN ORDER TO REVISE THE SITUATION PLAN OF UASVM CLUJ-NAPOCA

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Abstract

In the beginning, from TăieturaTurcului, we made a backwards multiple intersection. We have chosen this method because the points we had as visas areunstationable and the station point is stationable. After finishing the measurements on the field, the backwards multiple intersection and the polygonal route, the next step was processing the data from the measurement. For processing the data, we applied the matrix method for the backwards multiple intersection and for determining the provisional coordinates of the beginning point we used the baricentric procedure of the backwards intersection method.

Key words:*geodesy, network, plan.*

INTRODUCTION

The aim of this paper was to create a supported polygonal route by a targeted departure visa/sign from Taietura Turcului up to the GPS point inside the University of Agricultural Sciences and Veterinary Medicine Cluj - Napoca in order to review the USAMV Cluj-Napoca situation plan.
We achieved a backwards multiple intersection from Taietura Turcului taking as sings/visas the following points of Cluj-Napoca support network : 47 (hill Hoia) , 215 (Steluta) , 46 (St. Michael Cathedral) and 844 (relay TV) . We have chosen this method because the points in question are nonmobile and the station point is mobile.
First, we calculated provisional coordinates of the point 01 by the backwords intersection method (Moldoveanu, 2004), the barycentric coordinates procedure (Ortelecan and Pop, 2005; Ortelecan, 2006).

MATERIALS AND METHODS

In order to calculate the weights of each point, the coordinates of point 01 respectively we used the following formulae:

$$X_{01} = \frac{X_{47} \times P_{47} + X_{215} \times P_{215} + X_{844} \times P_{844}}{P_{47} + P_{215} + P_{844}}$$

$$Y_{01} = \frac{Y_{47} \times P_{47} + Y_{215} \times P_{215} + Y_{844} \times P_{844}}{P_{47} + P_{215} + P_{844}}$$

$$P_{215} = \frac{1}{ctg215 - ctg1}$$

$$P_{844} = \frac{1}{ctg844 - ctg2}$$

$$P_{47} = \frac{1}{ctg47 - ctg3}$$

RESULTS AND DISCUSSIONS

On the basis of the known coordinates we calculated the guidelines of the points. The results obtained by means of the baricentric coordinates method are presented in Table 1.

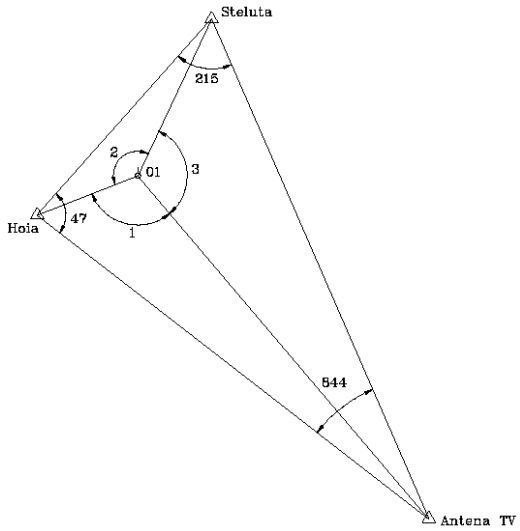

Figure 1. The angles used in intersection

Angles	1	120.8640
	2	151.7423
	3	127.3937
	47	95.9168
	215	72.2156
	844	31.8676
Shares	P47	1.911278101
	P215	1.240039584
	P844	0.346707109
Coordinates	X	587266.1267
	Y	390436.1529

Table 1.The provisional coordinates of point 01

After the calculation of point 01 provisional coordinates, we switched to calculating the final coordinates calculation through the matrix method.

Calculation of the guidelines:

$$\theta_{A\text{-}B} = \arctan\frac{y_B - y_A}{x_B - x_A}$$

Table 2. Guidelines calculated

Orientation		DY	DX	DY/DX	θ
01	Hoia	-2037.7759	-800.7457	2.5448	276.1640
	Steluta	1492.1311	3183.0933	0.4688	27.9063
	Sf Mihail	1976.2051	-687.9397	-2.8726	121.3262
	Antena TV	5896.7781	-6970.4767	-0.8460	155.2999

Distances calculation :

$$D_{A\text{-}B} = \sqrt{(y_B - y_A)^2 + (x_B - x_A)^2}$$

$$a_i = \rho^{cc} \times \frac{\sin\theta_i}{D_i}$$

Table 3. Distances between given points

Distance		D
01	Hoia	2189.457567
	Steluta	3515.471214
	Sf Mihail	2092.52183
	Antena TV	9130.144453

Table 4. Coefficients a1

a1	-270.6223108
a2	76.86352116
a3	287.3242858
a4	45.03396208
[ ]	138.5994582

Calculating the directioncoefficients:

$$b_i = \rho^{cc} \times \frac{\cos\theta_i}{D_i}$$

Table 5. Coefficients b1

b1	-106.341336
b2	163.969293
b3	-100.0208049
b4	-53.23376482
[ ]	-95.62661279

Table 6. Free terms

Point		θ	Ri	Zi	Zm	θ M	l
St 01	HOIA	276.1640	276.1665	-0.0025	-0.0004	276.1661	-0.002075
	STELUTA	27.9063	27.9088	-0.0025		27.9084	-0.002075
	SF MIHAIL	121.3262	121.3203	0.0059		121.3199	0.006325
	TV	155.2999	155.3025	-0.0026		155.3021	-0.002175
[ ]							0.000

where:

Ri-(directions measured on the ground)

$$Zi = \theta i - Ri$$

where : n – visa number

[Zi] – Zi sum

$$\theta \mathrm{M} = \mathrm{Zm} + \mathrm{R}$$

$$l = -(\theta M - \theta)$$

The equation system:

$$\begin{cases} -a_1 \times \Delta x_0 - b_1 \times \Delta y_0 - \Delta z_0 + l_1 = v_1 \\ -a_2 \times \Delta x_0 - b_2 \times \Delta y_0 - \Delta z_0 + l_2 = v_2 \\ -a_3 \times \Delta x_0 - b_3 \times \Delta y_0 - \Delta z_0 + l_3 = v_3 \\ -a_4 \times \Delta x_0 - b_4 \times \Delta y_0 - \Delta z_0 + l_4 = v_4 \end{cases}$$

Applying the 1-3 Schreiber rule , the system is:

$$\begin{cases} -a_1 \times \Delta x_0 - b_1 \times \Delta y_0 + l_1 = v_1 \\ -a_2 \times \Delta x_0 - b_2 \times \Delta y_0 + l_2 = v_2 \\ -a_3 \times \Delta x_0 - b_3 \times \Delta y_0 + l_3 = v_3 \\ -a_4 \times \Delta x_0 - b_4 \times \Delta y_0 + l_4 = v_4 \\ [a] \times \frac{i}{\sqrt{n}} \times \Delta x_0 - [b] \times \frac{i}{\sqrt{n}} \times \Delta y_0 = v' \end{cases}$$

For the matrix solving we used direction coefficients matrix (A) , the matrix free terms (L) and correction matrix (X).

The correction matrix is obtained with the formula:

$$X = \left(A^* \times A\right)^{-1} \times A^* \times l$$

$$A = \begin{pmatrix} a1 & b1 \\ a2 & b2 \\ a3 & b3 \\ a4 & b4 \\ [a] & [b] \end{pmatrix} \quad l = \begin{pmatrix} l1 \\ l2 \\ l3 \\ l4 \\ l5 \end{pmatrix}_{15 \to 0} \quad X = \begin{pmatrix} \Delta X \\ \Delta Y \end{pmatrix}$$

$$A = \begin{pmatrix} -270.622311 & -106.34134 \\ 76.86352116 & 163.969293 \\ 287.3242858 & -100.0208 \\ 45.03396208 & -53.233765 \\ 138.5994582 & -95.626613 \end{pmatrix}$$

$$A^* = \begin{pmatrix} -270.6223 & 76.8635 & 287.3243 & 45.0340 & 138.5995 \\ -106.3413 & 1639693 & -100.0208 & -53.2338 & -95.6266 \end{pmatrix}$$

$$P = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & -1 \end{pmatrix}$$

$$I = \begin{pmatrix} -0.002075 \\ -0.002075 \\ 0.006325 \\ -0.002175 \\ 0.000000 \end{pmatrix}$$

$$X = \begin{pmatrix} 0.0114319 \\ -0.0100045 \end{pmatrix}$$

The calculation of the final coordinates:

Table 7. The final coordinates of point 01

Pct	$X=X'+\Delta X_0$	$Y=Y'+\Delta Y_0$
01	587266.138	390436.143

On the basis of point 01 final coordinates, we achieved a supported polygonal route by two spots inside USAMV Cluj-Napoca (Figure 2).

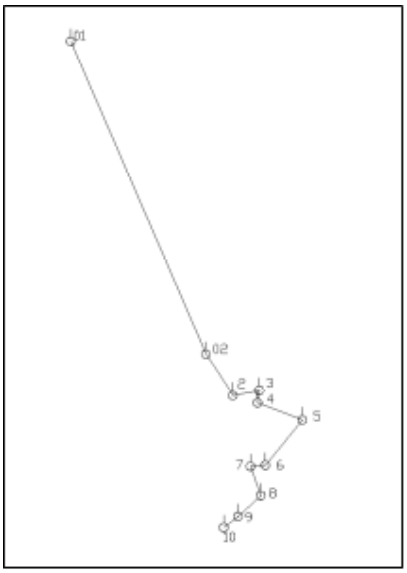

Figure 2. Polygonal route

For the preparation of the route we conceived the table that comprises the guidelines calculation, horizontal distance, provisional rectangular coordinates, coordinates correction and final rectangular coordinates (Table 9).

Table 8. Coordinates

Coordinates		
Pct	X	Y
01	587266.138	390436.143
10-GPS	585592.769	390963.405

We also calculated the overall length of the route, the total coordinates error(X , Y),and the coordinate unit error (Table 10).

Table 9. Polygonal route coordinates

Point		Orientation	Hz	Provisional coordinates		Corrections		Final coordinates		Point
St	V			X'	Y'	X	Y	X	Y	
01	02	173.9918	1173.4030	586189.302	390902.296	0.0778207	-0.0255467	**586189.380**	**390902.271**	**02**
02	2	163.0973	169.1940	586047.747	390994.971	0.0890417	-0.0292303	**586047.836**	**390994.942**	**2**
2	3	88.4501	92.8740	586064.504	391086.321	0.0952012	-0.0312524	**586064.599**	**391086.290**	**3**
3	4	209.9547	43.0850	586021.945	391079.611	0.0980586	-0.0321904	**586022.043**	**391079.579**	**4**
4	5	123.1465	165.2450	585963.179	391234.054	0.1090177	-0.0357880	**585963.288**	**391234.018**	**5**
5	6	243.5281	201.2510	585807.166	391106.925	0.1223648	-0.0401695	**585807.289**	**391106.884**	**6**
6	7	294.4491	51.5520	585802.677	391055.568	0.1257837	-0.0412919	**585802.803**	**391055.527**	**7**
7	8	178.2184	106.3520	585702.489	391091.250	0.1328371	-0.0436073	**585702.622**	**391091.207**	**8**
8	9	252.5309	106.0210	585630.560	391013.362	0.1398684	-0.0459156	**585630.700**	**391013.316**	**9**
9	10	258.6250	62.6900	585592.625	390963.452	0.1440261	-0.0472804	**585592.769**	**390963.405**	**10**

Table 10. Coordinates errors

Total length of the polygonal route	2171.6670
Total error on X	-0.144
Total error on Y	0.047
Unit error on X	-0.0000663205
Unit error on Y	0.0000217715

CONCLUSIONS

Because of the fact that the non-openings ranged within tolerance limits, we considered the points to be fixed , thus checking the entire network of the university (points marked in red on Figure 3).

Review plan USAMV situation inside Cluj-Napoca was the figuration of the plan of the new building on campus , " Life Sciences Research Center " completed in 2009 and the bridge over the PârâulȚiganilor facilitating access to the building. Since the situation of the university plan was last updated in 2006, these buildings did not exist at that time, it was necessary to update the plan (Figure 3).
All details of the building or bridge , were taken from station 192, 315 respectively in the immediate proximity of the two structures (Figure 3).

Figure 3. UASVM Cluj-Napoca situation plan

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ROMANIAN CADASTRE-FROM WISH TO ACHIEVEMENT

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Abstract

This paper aims to highlight the evolution of cadastre mainly through a comparative between Romanian cadastre against the German .It is well known that Germany occupies a leading technology and methods of land measurements..Along with this our country belongs to Permanent Committee on Cadastre in the European Union.
With a history of about 150 years both Germany and Romania have gone through different phases of technology. At the moment Romania is in full process of national cadastral measurements, given that only 20% of the cadastral approx 40mil are measured, although modern cadastre appearance was registered since 1933.With a long history of land registration in Germany it is a proven fact that a good working system of security of land tenure is very important for a developed society. Investments in land and buildings are very difficult or even impossible without a land registration system. Lessons learned during the reunification process in Germany and the establishment of a market driven economy in the former socialist part of the country. The re-introduction of a cadastral system in the new states was a big task for the surveying professionals in the public and the private sector. Why should Romania invest to follow the German example? Is the technology used by the cadastre workers expired or do we need new ways of exploiting resources?

Key words*: cadastre, history, comparative, land measurements.*

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INTRODUCTION

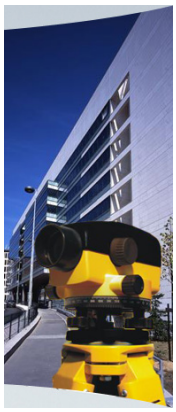
Although in the past 25 years, in Romania there were fundamental changes in land structure, general cadastre of agricultural land has not been done for over 50 years. Last cadastre made before 1989 do not have today no value, because they have targeted agricultural land owned collective farms and state farms set up in the 50s and disbanded after 1990, when these lands were returned to their former owners.
At the moment, the situation in the area does not look too good: in total assets, 40 million (8 million in urban areas and 32 million in rural areas) are recorded only 7.4 million, 36 million in urban areas and 3.8 million in rural areas. On the other hand, as a result of mistakes made in the process of restitution or heirs of doubt about many records, especially land, are superimposed on the same area appearing two or more owners. All these issues will be clarified, the documents will be corrected, so the land registers and the notary, according to the law Germany's tradition in cadastre is more than 150 years old. During the last three decades of the 20th century the analogue maps and records were digitised. Both digital cadastral maps and digital records are stored in separate systems. Since 1997 the Working Group of the Surveying Authorities of the States of the Federal Republic of Germany (AdV) has been developing a model of an integrated Official Cadastral Information System called ALKIS®. This system is the first one world-wide described by using ISO standard UML (Unified Modelling Language). The leading GIS companies will develop the software and distribute it to the authorities.

MATERIALS AND METHODS

Theodolites are precise tools for measuring angles horizontally and vertically. Theodolites are mainly used for making topographic weighed but have been adapted to be used for other purposes in various fields such as meteorology, astronomy, construction and aerospace technologies. A theodolite consists

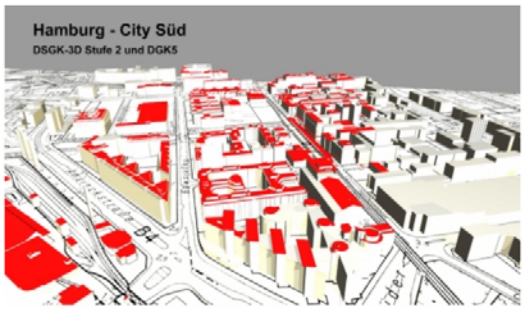
of a telescope cell mounted between two axes perpendicular - axis and the vertical axis. When a point on a target object is targeted by telescope, the angle formed by these axes can be measured with great precision, usually seconds of arc.

Both axles are fitted with graduated circles on the read-through lenses that increase image.
Modern models of theodolites reading circles, horizontal and vertical- is done electronically, centring on point no longer made with lead but with wire or optical devices and laser levelling errors is corrected by compensating precise. The models also modern theodolites incorporate distomate (electronic measuring distances) or infrared laser.



Total stations are “smart theodolites " , which based on the functioning principles of theodolites (as precise tools for measuring angles horizontally and vertically), perform measurements, determining distances with millimetre accuracy and saves data in internal or external units. Number points of internal memory, memory cards existing facilities and data transfer (USB, Bluetooth, etc) books by land / PDAs, Windows compatibility are parameters that define the level of performance total station. Using total station with PDA (field book) compatible software can enhance competitive performances on line data processing unit directly into the ground.

3D city model of an office district in Hamburg, Germany with detailed roof structure

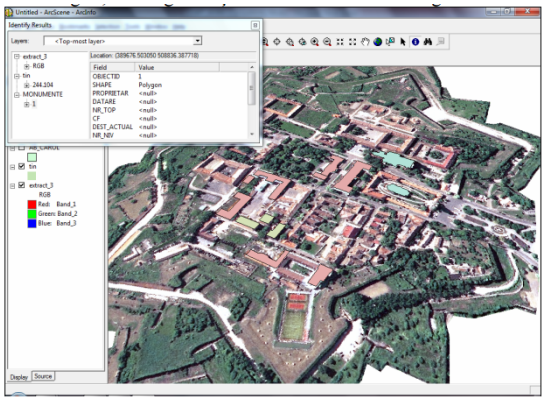


The simplest levels horizontality and verticality used to ensure are mundane "barrels" used by masons.
To perform leveling precision and longer distances using optical instruments, so-called optical levels, which measure the level differences on the line scale (stages or groom) through a telescope.
For optical levels are the most important parameters precision leveling, standard deviation 1000 m double leveling, and sensitivity compensator.
In direct correlation with levelling precision optical and technical level of its power telescope are (eg X28 or X32 noted, which essentially involves the telescope larger image / "approaching" 28 respectively 32 times) and the leveling system.
First-satellite system called the American- GPS (Global Positioning System) has become the generic name for topographic measurements that uses satellite signals for positioning and for this type of instruments. Therefore generation of GPS devices used receivers with one frequency (L1), which could receive only a single frequency modulated signals from the American GPS system.
Currently, the most used devices are the GNSS-RTK, with an increased number of channels that can connect to multiple systems of satellites (GPS, the Russian GLONASS system, or channels reserved for other systems that will appear later - European Galileo system and the Chinese Compass under implementation).
If GPS systems simple frequency (L1) can be used only on measurements of static or

kinematic results are to be obtained after a post-processing of data recorded in the field, GNSS-RTK can be used both in measurements of static and kinematic and the measurements in real time, so-called RTK (real time Kinematic). To determine in real time with centimeter accuracy of the coordinates of the points needed as GPS devices GNSS RTK corrections from the stations to receive landline. This is done either by radio UHF from its own base (in this mode requiring two devices - base and rover), or use modems GSM to connect to the internet for receiving RTK corrections from fixed stations permanent existing many countries (ROMPOS for Romania). GSM modules Internet works with GSM cards from local mobile operators.
Lasers are devices used primarily for builders, plumbers, decorators, architects for checking alignments horizontality or vertically using one or more laser beams that sets out the level / alignment onto the surface wanted by dots or lines.

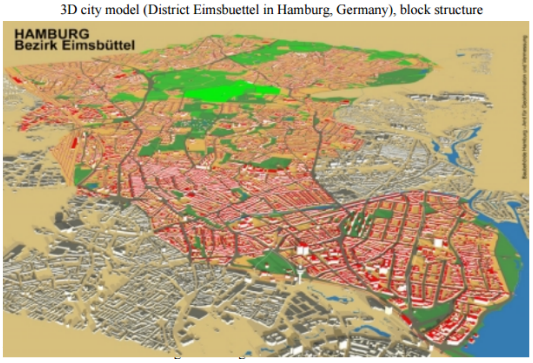
RESULTS AND DISCUSSIONS

The Land registration system in Germany is a duplex system. The legal situation of each parcel is described in the land register called "Grundbuch". The geometric description of all boundaries in the Automated Cadastral Map (ALK), field records and textual records in the Automated Property Register (ALB) are in the hand of the cadastral authorities. Only Grundbuch and cadastre in combination give a complete overview about legal and de facto land tenure. Both registers must be constantly updated and kept in correspondence with each other (DVW 1993).



The roots of the ALB and ALK systems date back to the 70s and 80s of the last century. Further development of these software systems seems not to offer future oriented solutions. Therefore the 'Arbeitsgemeinschaftder Vermessungsverwaltungen der Länder der Bundesrepublik Deutschland' (AdV) (Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany) decided to design a new and future oriented system ALKIS® in combination with a re-design of the Official Topographic and Cartographic Information System ATKIS (Hawerk 2001).

3D city model (District Eimsbuettel in Hamburg, Germany), block structure



ALKIS in combination with ATKIS is designed to: − Process all necessary cadastral and topographical data for a parcel based map and register of land owners, land use and more unified basic data for the entire Republic, − Control the use and maintenance of the system and to − Enable the use of the entire geographical data of the surveying authorities for all users via a meta data system including quality information for all data and a standardised data interface for ALKIS and ATKIS. Of course links of the users' specific data they already linked to ALK, ALB or ATKIS still have to be possible in the new systems without reasonable new investments on their side. They shall trust in the sustainability of their investment in data.

CONCLUSIONS

We are using the same equipment like Germany but the system is different .They have more institutions for this domain, but each of them is doing different things, in the final they put everything in the same system so this way everything looks good on the final. My personal opinion is that Romania need more

implication by the all sides, the citizens and the government too if we all attend for a cadastre of our country. Everybody wants to sell or buy houses, the first needing for that is a good plan of the land we want to buy or sell. We can learn from Germans, from their program ALKIS.

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ARDUINO BASED CALIBRATION OF AN INERTIAL SENSOR IN VIEW OF A GNSS/IMU INTEGRATION

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Abstract

The aim of this paper is to present the testing and calibration of an Inertial Measurement Unit (IMU) by using an Arduino Uno microcontroller. To accomplish this, the Arduino microcontroller will be programmed through Matlab, considering the number of built-in math and engineering functions and the advantages of the numerous plotting methods. Furthermore, filtering algorithms will deal with the calibration of the sensor and analysis of its behaviour in order to reduce the errors caused by the bias and drift rate of the sensor. The last part of the article will focus on future improvements for the application, in terms of model used, general architecture and tuning techniques as well as the coupling of a GNSS sensor.

***Key words**: Arduino, IMU, Matlab, GNSS.*

INTRODUCTION

Arduino was created at Ivrea Interaction Design Institute with the purpose of being a tool for prototyping, but when it reached the mass marked it evolved into a complex tool with various parts adapted for certain needs and a wide library complementary to most of the projects.
Arduino is "an open source prototyping platform" according to the providers, which has both hardware and software parts.

There are various Arduino boards as it is the main component of a project, depending on facts such as power consumption, number of pins for input/output, working voltages as well as physical size, storage capacity, processing resources, processor frequency rate, evolution of the hardware part, price and more considerations. The board we used is the most basic one, namely an Arduino UNO v3.

The first step in any Arduino project is to make the initialisation of the board and write a set of commands in Arduino programming language using the Arduino Software (IDE) that will be sent to the microcontroller of the board, so it will know what to do. However, the uploading should not be performed until an errorless compilation is achieved.
The combination of the hardware and software can perform actions such as reading inputs (e.g. from gas, alcohol, dust, fingerprint, light, vibration, InfraRed (IR), magnetic, sonar, sound, weather sensors) and writing outputs (e.g. with LCD screens, Light Emitting Diodes (LEDs), speakers, motors or just Tweet a message and much more).
As examples of Arduino projects, it could be an electronic piano, a rocket stabilizer, a drone, electronic nose, sonic eye, mp3 player, a phone, RC car, thermostat, intruder alarm, 2D plotter, even a 3D printer and much more.
Besides the Arduino Software (IDE) and Arduino hardware components, we also used MAtrix LABoratory software (MATLAB), which is a strong enginnering tool, which uses a programming language developed by

Mathworks and it is well suited for such applications.
MATLAB is dealing with tools for mathematical calculations, statistics, optimization, communications, control systems, parallel computing, and application deployment and much more.

Because of the Arduino evolution and spreading, Mathworks is now supporting it, through integrating tools for connection between the two.

MATERIALS AND METHODS

As stated above, in order to build this project, we used an Arduino Uno v3 board as "the brain" of the project, an external IMU sensor – MPU6050 – from Sparkfun, a breadboard and connection wires.
The board used is the basic one as we considered it being enough for our project, when speaking about resources. It has an ATmega328P microcontroller, with 5V operating voltage, 16 MHz quartz crystal, 14 digital pins (6 of them can be Pulse Wide Modulation pins PWM), 6 analogue pins, USB connection and a power jack.
An Inertial Measuring Unit is an electronic device capable of measuring angular rate and specific force of a body using accelerometers and gyroscopes. As destination usage, some examples might be the manoeuvre of aircrafts (also Unmanned Aerial Vehicles UAVs), spacecraft, satellites, landers and much more.
The gyroscope is an angular velocity sensor. It is measuring the rate of change of an axis at the real moment, in time.
The IMU we used for this project is an MPU6050 from Sparkfun, which integrates a triple axis accelerometer and a triple axis gyroscope (angular rate sensor). It works with 2.3-3.4 input voltage and it has a Digital Motion Processing (DMP) capable of complex readings as well as gesture detecting and time synchronisation, a digital temperature sensor and an I2C connection used to reduce the noise. For this project we used only raw data reading from the gyroscope.

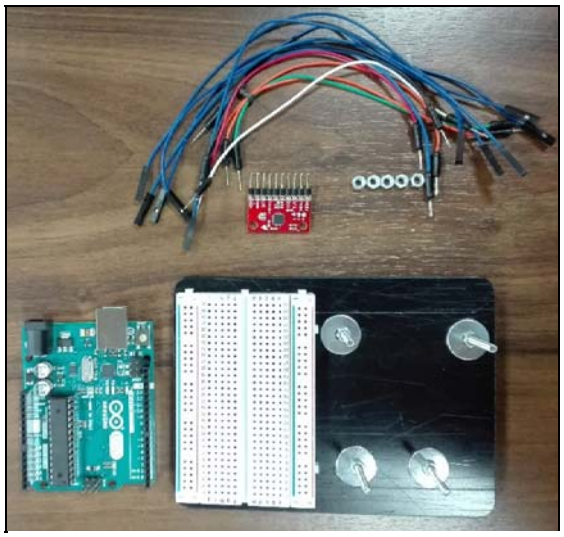

Figure 1. Materials used in the project

As for the methodology used, we divided this into three steps.
The first step refers to the general architecture used in connecting the board with the sensor and breadboard, using connection wires, according to the provider's schemes and breadboard capabilities. Also, we mounted the board, breadboard and sensor on a platform so the assembly resulted will be fixed, this being relevant for the sensor readings and plot.
The second part consisted in working under Arduino software to initialize the board and sensor, access the libraries linked to it and also consisted in writing command lines in order to have an export of the data collected through the sensors within the Arduino software, using Serial Monitor tool.
Once the script has been finished, a compilation is required to be performed, so there will be no errors, with respect to the programming language used.
If the compilation test passes, the script uploaded to the board will be performed as long as it is connected to a power source, regarding that the Arduino (IDE) software divides the script into two parts, one being performed when the board is plugged in or at any reset of it, while the second one is performed in loop after the first part is complete.
The third step regards the Matlab algorithm implementation, where we have processed the data collected from the sensors into a two iteration approach adjustment model, in order

to determine the offset and the drift of the sensor. The adjustment approach was represented by a least squares linear regression. The output of this step can be observed in Figure 7 where one can observe the difference between raw data and the corrected one.
The Matlab scripts were then fed into a very simple Graphical User Interface (GUI) which runs with the software itself and has only four buttons. The buttons can be pressed by the user to perform: connection to Matlab and calibration of the device (including here the measurement number desired) and create plots.

RESULTS AND DISCUSSIONS

The results of the first part, namely the connection between the components and the mounting on support can be seen in the figure below (Figure 2).

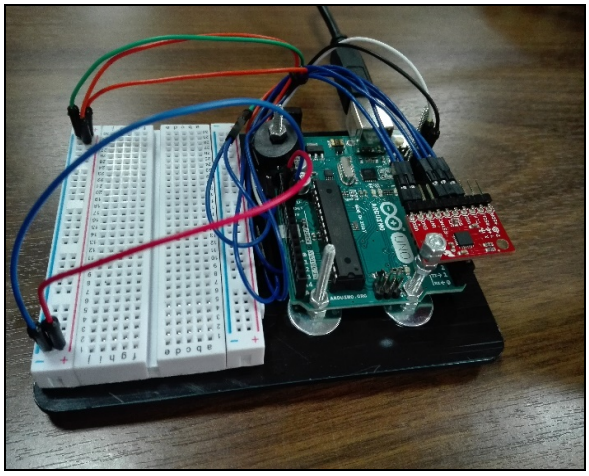

Figure 2. Connection between the components

As said, we first coded in Arduino (IDE) software and the output was achieved using a tool called "Serial Monitor" available in the software.
The Serial Monitor is used to print data collected by the sensor, after we have selected the so called baud rate (down corner on the right side from Figure 3), which represents the communication rate between the computer and the board.

Before uploading the code, the software is making a compilation that verifies if the code was errorless, with salute to the programming language used.
In this case, we have selected to print only the gyroscope data, on columns, with a rate of 10 measurements per second in the following order: the first column is represented by degrees measured along X axis, second column with degrees measured along Y axis and the third column, with degrees measured along Z axis.

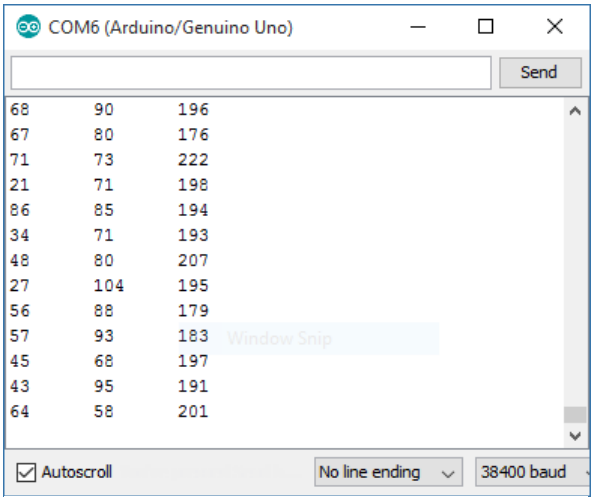

Figure 3. Output from the Serial Monitor tool

However, those are not the real values, because every measurement must be divided by the sensitivity of the sensor, which, with a reading rate set at 250 degrees every second is 131 LSB/dps (Least Significant Bit/degree per second).
After the code is uploaded to the board, the initialization and other commands are stored in the board's memory and it will perform the required tasks until it is unplugged from the power source or we want to upload a new code (or change the existing one).
After the initialization is done, the next step was to connect the Arduino board to the Matlab.
For this, we coded in Matlab software. The following picture is presenting the part of the main code responsible with the connection between Arduino and MATLAB.

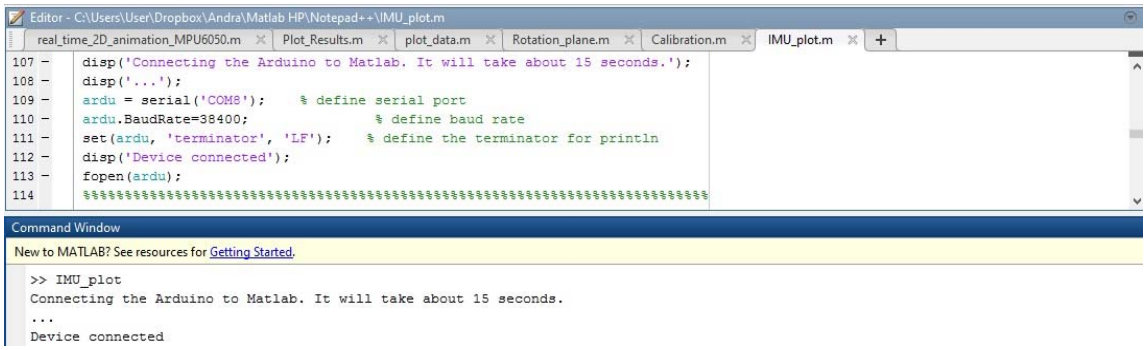

Figure 4. Connection between Arduino board and Matlab

Because the data obtained from the sensor was affected by errors namely, drift and offset, we had to do a calibration. This calibration is based on an adjustment model with two iterations.
The aim of the calibration is to reduce the offset (fixed) and the eventual drift (time dependent) and by combining those two errors we obtain a form similar to linear equations.
As said, we have two iterations. The model used for the first iteration may be seen in the picture below:

$$V_1 = AX_1 - L_1$$

$$\begin{bmatrix} v_1^1 \\ \vdots \\ v_n^1 \end{bmatrix} = \begin{bmatrix} t_1 & 1 \\ \vdots & \vdots \\ t_n & 1 \end{bmatrix} \cdot \begin{bmatrix} a_0 \\ b_0 \end{bmatrix} - \begin{bmatrix} m_1 \\ \vdots \\ m_n \end{bmatrix}$$

$$X_1 = N^{-1} A^T L_1$$

$$N = A^T A$$

Figure 5. Adjustment method

The V_1 is the vector of residuals, A is observations matrix and L_1 is a free term vector. Also, $t_{1...n}$ is the time of the corresponding measurement $m_{1...n}$, and the parameters a_0 and b_0 correspond to the bias and namely the drift of the sensor on a specific axis.
As there were no initial values for the parameters, we had to ensure that the estimation is convergent, and therefore we did a second iteration taking as initial values for the parameters the ones determined in the first step.
The second iteration is described in the below picture (Figure 6):

$$V_2 = AX_2 - L_2$$

$$\begin{bmatrix} v_1^2 \\ \vdots \\ v_n^2 \end{bmatrix} = \begin{bmatrix} t_1 & 1 \\ \vdots & \vdots \\ t_n & 1 \end{bmatrix} \cdot \begin{bmatrix} \delta_a \\ \delta_b \end{bmatrix} - \begin{bmatrix} m_1 - t_1 a_0 - b_0 \\ \vdots \\ m_n - t_n a_0 - b_0 \end{bmatrix}$$

$$X_2 = N^{-1} A^T L_2$$

Figure 6. Adjustment method (second iteration)

The final parameters were then obtained as the sum of the two:

$$X = X_1 + X_2 = \begin{bmatrix} a_0 + \delta_a \\ b_0 + \delta_b \end{bmatrix}$$

With the offset and drift determined, we have applied the correction to raw data in real time. As a result, one can see the improvements (Figure 7) which it is showing how the measurements were corrected comparing with the raw gyroscope data.
One can note that the drift is very small compared to the measurement error and thus it could be considered as null.

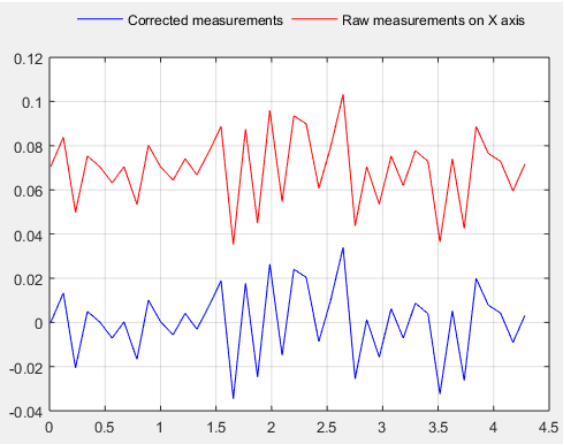

Figure 7. Raw measurements compared with corrected measurements

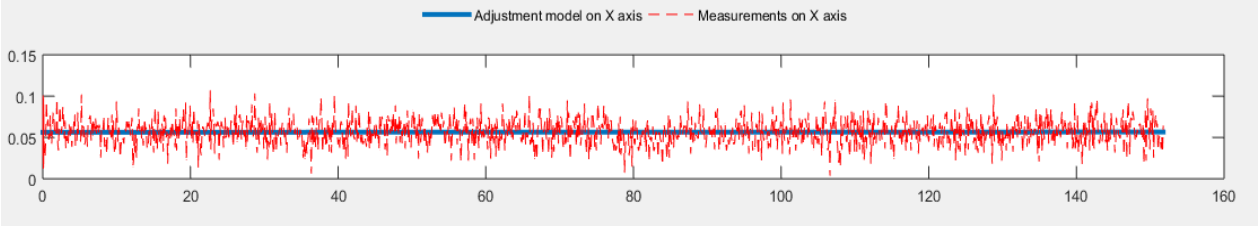

Figure 8. Raw measurements and adjustment model

The third plot is represented by an arrow that is associated with the orientation of the IMU sensor (Figure 9). When the sensor is fixed the arrow is fixed too and when is moving the arrow is moving too. The arrow is moving with the same rate, which the sensor is moving.

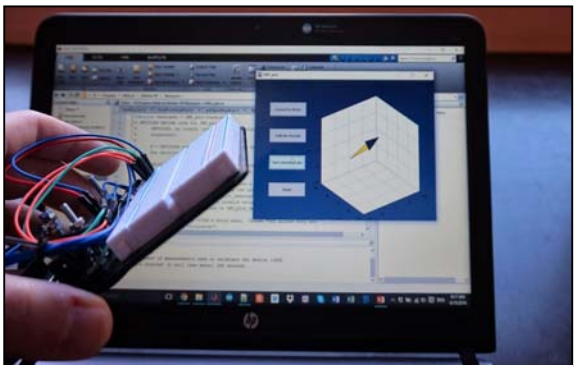

Figure 9. Inertial Measuring Unit orientation

In order to make a good visual representation, we wrapped all in a GUI which stands for Graphical User Interface. Using the buttons in the GUI, the connection between the Matlab and the board and the calibration can be realized together with the plots.

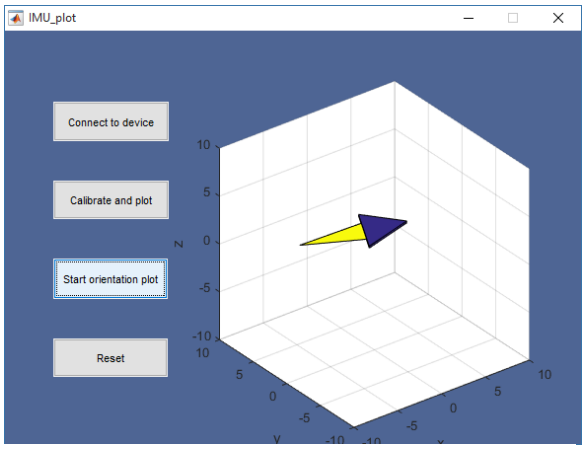

Figure 10. Graphical User Interface with buttons

FUTURE WORKS

Regarding future works, we will firstly want to obtain ever better results by optimizing the scripts and functions for the gyro calibration. Afterwards, we will develop a method for calibrating the accelerometer.

The second step will be represented by the loosely integration of a GNSS receiver and the IMU sensor for navigation purposes. So far we have connected the GNSS sensor and also coded the Arduino IDE part obtaining the individual positions. Those steps will be followed by creating a Kalman filter in order to obtain the position of a moving GNSS receiver considering the error model proposed for the IMU.

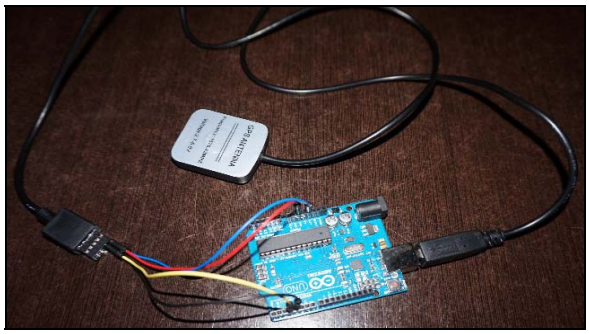

Figure 11. GPS sensor connected to the Arduino board.

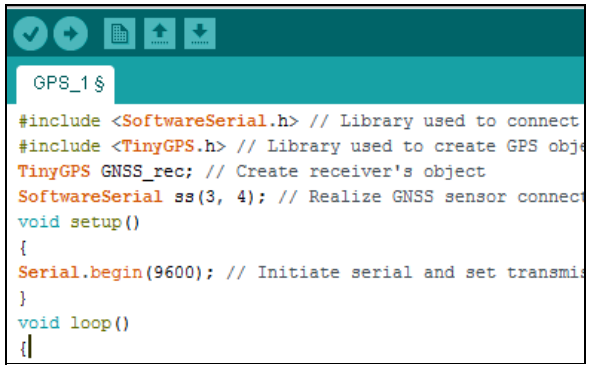

Figure 12. Code section from IDE software that represent the initialization.

CONCLUSIONS

In conclusion, using Arduino hardware and software, together with the Matlab capabilities represents a good tool when we are speaking about small to medium scale projects, especially for student applications which do not require a great initial investment.

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USING OF LASER SCANNING TECHNOLOGY IN A CLOSED AREA

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Abstract

This paper aims to present the technology of laser scanner which digitally captures the shape of physical objects using a line of laser light. Three dimensional laser scanner creates point cloud of data from the surface of an object. In another words 3D laser scanning technology is a way to capture a physical object exact size and shape into the computer world as a digital 3 dimensional representation. The first step of this kind of project is the field part. In this case was used a static way of measuring because of the scanner which was fixed during the measurements and was not placed on a moving platform such as airplanes, helicopters. The second step is the modelling part which can be done only by using special software for 3D modelling. This part is the most durable because of the point cloud data. In our software that we have chose to use, this data will be represented in a couple of colors such as: white, blue, red, green and yellow, each color having a meaning. Even though nowadays laser scanning technology is expansive represents a most suitable, better, faster way to take different type of measurements with a large type of data, than using a theodolite, a total station or even GPS technology.

***Key words**: laser scanning, point cloud, modelling, colors, measurements, surface.*

INTRODUCTION

The laser scanner is a fast developing technology, which as grown at an amazing rate since its existence. The most important feature of three dimensional laser scanner is the measurements of fine details and capture free form shapes to quickly generate highly accurate point clouds. 3D laser is ideally suited to the measurements and inspection of contoured surfaces and complex geometries which require massive amount of data for their accurate description.

The data obtained can be used later to realize digital reconstructions, bi-dimensional plans or 3D models, all of these can be harnessed to make different applications.

During the measurements, when the scanner is in a fixed position its being called static laser scanning. The advantages of this method are high accuracy and huge density of points. All static laser scanning can be seen as terrestrial laser scanning. The second method is dynamic laser scanning where the scanner is being fixed on a moving platform. This method requires positional systems like INS and GPS, which makes it more complex and expansive.

At the beginnings laser scanning had a short range of action being mostly used in cars building industry.

Using a scanner to take measurements of a building does not mean just pushing a button and waiting for the cloud points to show up, it requires a few steps.

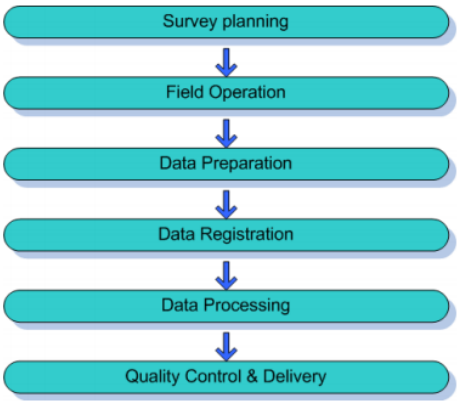

Figure 1. Steps of terrestrial laser scanning

MATERIALS AND METHODS

The first step in this project was to make a plan as in the picture that follows.

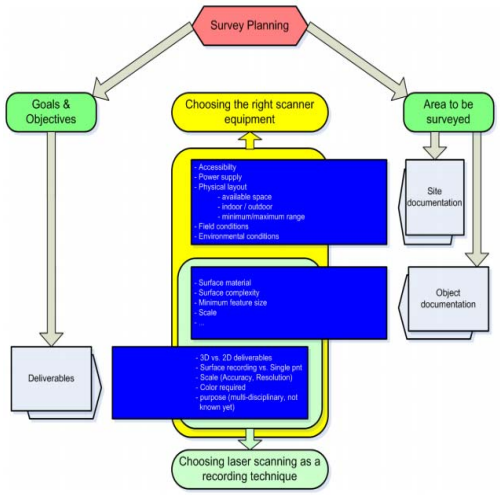

Figure 2. Planification of terrestrial laser scanning

We chosed our area to survey wich is a room placed into a building.The next step was to choose our apparature, and we have chosen Leica ScanStation C10.This apparata has an accuracy of a single measurement for position of 6 milimeters, for distance of 4 milimeters and for angles, horizontal and vertical 60 µrad / 60 µrad. The field of view is different in horizontal and vertical view. For horizontal has 360° and for vertical has 270° which is maximum value.

Figure 3. Leica ScanStation C10

Beside the scanstation also were used 4 targets.After the equipment has been chosen the next step was to analize the room where we can place our targets and the scanstation.For a better visibility and to capture every corner in the room, the scanstation was placed in 4 places, so we had 4 scanning sessions, with targets being in the same position.
An important step is also to decide the resolution.Resolution is defined as the smallest detail of the surface structure that needs to appear in the final project and as highest the resolution will be the processing data will be the same.

During the scanning session the scanned data can be filtred using primary filtres.Primary filtration is used to assure that the collected data are placed in accuracy boundaries of scanner registre, or to eliminate the points with a low value of reflexion, because those will have a low accuracy.

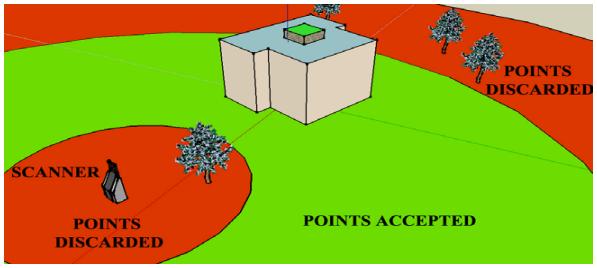

Figure 4. Primary filtration of points

To carry out with the measurements firstly we have to realize the planning of the bases, we have to cover the largest area with the less bases possible and plan the distribution for the targets that we will use to get through the alignment of the targets. This step is of great importance mainly because of the columns that created some blind spots because of that reason we have to be especially careful and establish the targets in a strategical location.When scanning the targets, the scan must have a high resolution, and the software of the scanner can automaticly calibrate the shape of the target, and then to fiind the exact central point of the target.It is very important to check the scan after we finish scanning, because if one scan is missing it will be more expansive, will require more money, checks.

RESULTS AND DISCUSSIONS

This paper is not ready yet, we still have to do some office work. Back in the office we have to check and compare the sketches and notes that we took from the field.It is recommended to begin our work with a copy of the original scan, and to keep the original as a back-up.It is important that the scan file to be seen and easily to be recognized.The software that we used for this it is Cyclone, this software is in charge of geocode and georeference of the cloud points from different positions. From each station there are areas that are not covered by the cloud points due to the possible obstacles, which are the main reason that we have to make 4 stations from different point of views instead of only one in the centre of the room. There are two different ways to do the modelling, one of them is mostly automatic but the other requires more manual work.

With targets is the first way of how to do the modelling, wich is more automatic, fastest and easiest. First we create a registration and in that registration we join the scans using the targets. It is an automatic process and we only have to auto-add constraints and in the constraint list register the bases with the targets. When it is done we can see the whole room with all stations joined together creating a point cloud, the colors in the following picture are green, yellow, orange and red. The targets are colored in blue and white. And finally we can take our report.

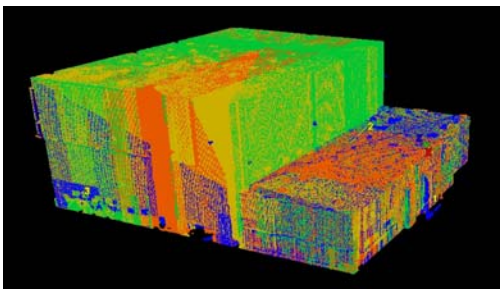

Figure 5. Cloud points

The second way of modelling is without targets. This way is more laborious than the other one, the main difference is that this is not automatic and we can only join two stations at once and this takes longer to complete the model. We create a new registration since this is a new method, in this registration we can only add two scans in the add-scan world, so we will add the first and second scans. The next step is to find at least 5 pairs of points, we need to find the same point in both scans to make the pair. With the clouds constraint wizard we create two screens where we match the pairs then we press register to save them and finally we create the model with create scan world/freeze. In this model it will only appear the two first stations matched.

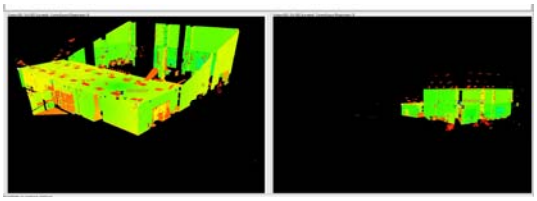

Figure 6. Scan pair

With this last step we can advance and create the report. With the model already done we create another model space “open models pace”. We choose a part of the model with a rectangle tool and with right clicking we open it in a new space model. To finish with the final model we clear out the outside parts of the room with the fence tool, these parts are created mainly because there are filmy materials that let the light pass through.

CONCLUSIONS

Using an scanner it’s not only just to press a button and wait for the results, it requires a deep knowledge of the equipment and scanning process, some steps of the scanning process are automatic while others require and intense labor. By using a laser scanner we have lots of advantages like: minimizing our field work and also office work, less opportunities to have a small area not scanned, the possibility to scan different types of angles, and to overight the results, complex results of a high accuracy, instead of measuring just a few points we take a full scan of our object.

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3D MODELING OF URBAN AREA USING SketchUp SOFTWERE

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Abstract

The most powerful method of representing relief is to construct a mathematical model of the earth's surface: a digital terrain model (DTM) or digital ellevation model (DEM). 3D modeling of urban areas objects is an expanding application. This paper aims to present haw to create a 3D model for a digital terrain model (DTM) or digital ellevation model (DEM) using low cost programs and technologies. 3D modeling of urban area using SketchUp softwere it is a reliable solution. The choice of data sources, terrain sampling techniques and interpolation method used in model construction are critical for the quality of the resulting DTM.
***Key words**: GIS, digital terrain model, 3D Modeling, SketchUp*

INTRODUCTION

A system may be defined as a set of elements that are in a structural relationship of mutual interdependence and interaction, forming an organized all working together to fulfill a purpose.
A geographic information system is basically software that links geographic information (where things are) with descriptive information (what things are). Unlike analogue maps, where information is limited to what is displayed on the piece of paper, a geographic information system can display multiple "layers" with different types of information.

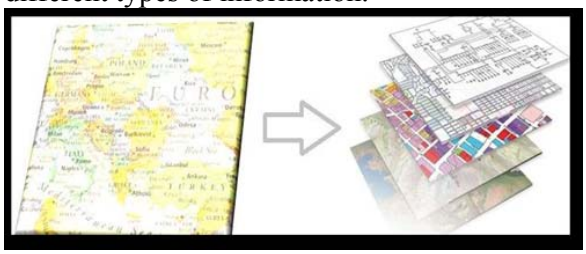

Figure 1.

A geographic information system is mainly composed of five components:

- Hardware (this component is represented by computer and peripheral equipment)
- Software (represented by the particular design and management programs)
- Data (is the most important component of GIS)
- Personal (component is made up of users, designers and those who are dealing with maintenance)
- Methods or procedures (specific operating models and practical application)

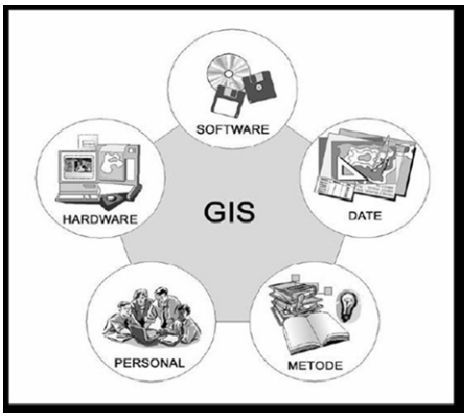

Figure 2.The components of GIS

Data models usually use a networked structures points called raster or vector called coordinate system. What is the model generates a geographical database (Geodatabase).

A geographic database is a collection of real-world data and relationships between them.

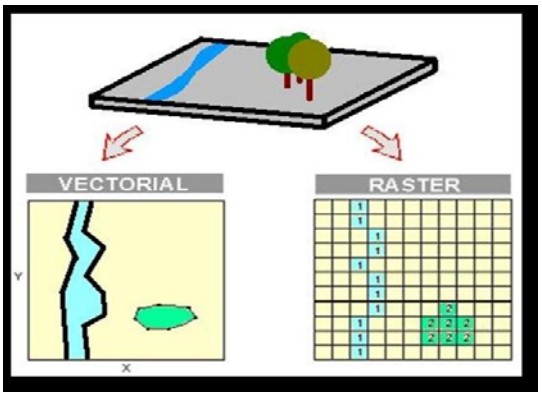

Figure 3. Raster vs Vector

URBAN AREA AND GIS

Today, more people lives in cities then rural areas.Europe is one of the most urbanized continents.About 75% of this population lives in urban areas. Starting with 2020 the proportion will be 80%. Consequently, the demand for land in and around cities is becoming acute. The extension o urban areas is reshapeing landscapes and affect the quality of people's lives and the environment more than ever.

In Romania, urbanization has not yet reached so high a share, but the Roman population living in urban areas is large and growing than in rural areas. Today in Romania urbanization has reached 54%.

The new software solution facilitates the implementation of these models. Of these remark software promoted by Google and the company recently purchased Trimble “"SketchUp" whose models are compatible with the software "ArcSIG" and can be inserted into Google Earth.

3D MODELING

3D models represent a 3D object by a collection of points in 3D space, connected by various entities geometry, such as triangles, lines, curved surfaces, etc. Being a database (points and other information), 3D models can be created manual, algorithmically (procedural modeling), or scanned.

Figure 4.

Besides the issue of achieving a system capable of delivering 3D modeling possibilities the problem arises type of 3D model chosen as the basis for the representation of a 3D GIS. The model consists of information about the real world so you have to take into account the type of object that we want to represent.

Two entities of different type such as a building and a tree will be different fundamentally 3D representations when it comes to shape and form as a building location and boundaries delineated officials may be more accurate than the crown of a tree.From the need to shape the environment in the same two types of entities were born following 3D modeling solutions: *The 3D Grid; The Shape; The Facet; The Boundary Representation (B-rep); Matrix 3D model; The Octree; Constructive Solid Geometry model (CSG); 3D TIN (tetrahedral network, TEN);*

MDE –digital model of elevation

MDE models are used to represent the topographical surface of the Earth. Surface models as they are called, are frequently used to create maps of topography, watercourses modeling, correction and analysis of aerial photographs of land geomorphology.MDE are usually constructed from data from remote sensing (LIDAR or SAR) or traditional topographic and can be divided into two categories account if the target data source used to create them. Raster data derived models are built in areas known points of allowances distributed symmetrically spaced constant. The second category is based on vector data and most often they are provided by a TIN. In this case the surface is formed by irregularly distributed on the known points.

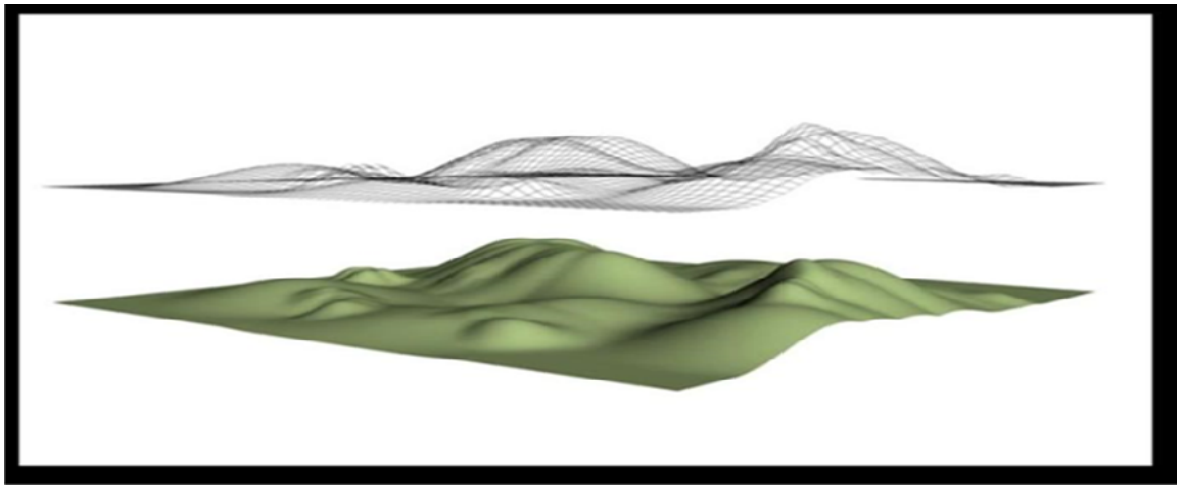

Figure 5. Digital model of elevation

DATA SOURCES

Data acquisition is the process by which data is obtained from an external source Geographic Information System and convert them into a digital format specific SIG. Data acquisition should be viewed carefully because the quality depends on the accuracy of collected data.
These data sources are acquired from many fields such as surveying; Remote sensing and airphotogrammetric; Topographic maps; GPS.

SketchUp- CASE STUDY

SketchUp, Trimble officially named SketchUp is a 3D modeling program that can be used for a wide range of applications such as architecture, civil engineering, mechanical design video.It is available in two versions, that is a variation Make SketchUp Free and Pro SketchUp, a variant of payment.Google SketchUp was detained although it was created in this company and in 2012 was acquired by Trimble Navigation. The program is focused on ease of use and building models that can be published online. A key elements of this program is "3D Warehouse" version of the "3D Warehouse" which is an online database of 3D models part of which can be downloaded for free. SketchUp is also often integrated with Google Earth allowing geolocation models in this program and viewing in Google Earth 3D environment.

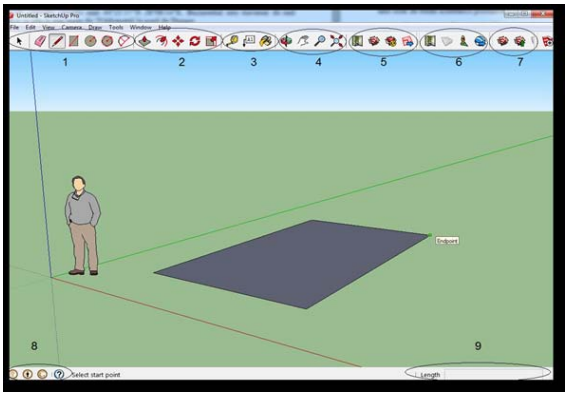

Figure 6. The interface of SketchUp program

Making a 3D modeling works of a building following steps be taken:
The first step was the actual measurement of body geometry and construction details that define facades. For this was used a total station which observations were made using laser Reflectorless how to define the points that we considered to be characteristic of the construction.
The second stage involved the 3D model of the building. For this operation on the data obtained from measurements and scale of topographic plan 1:500 I took photos that you have worked to obtain textures for finishing the model.
The third step was the creation of the geographical database (GBD) using the program
ArcCatalog ArcGIS suite of software from ESRI. This database was populated with data from the following sources at their disposal (3D model of the building created in SketchUp and other templates downloaded from the "3D Warehouse" (online database of 3D modeling

tools offered by Trimble in partnership Google), vectorization over maps provided by ESRI as "Basemap" within ArcMap program).
In the next step the database previously created was imported in procedural 3D modeling program called CityEngine offered by ESRI. Following procedural generation of 3D models base.

CONCLUSIONS

Modeling is executed directly by the user where each model is built in part through the intervention of this which commands a modeling program. The interface of such a program is populated with geometry editing commands such as those presented in SketchUp.
Procedural modeling is based on sets of rules. These rules are essentially sets of instructions or software algorithms then performed models and can be used to create more content at once.
The main advantages and disadvantages in modeling and direct modeling Procedure.

Direct method

Advantages:

- High detail
- High accuracy
- Easy texturing
- Ease of bringing further changes

Disadvantages:

- Laborious process of realization
- Working for long time

Method procedure:

Advantages:

- Process modeling for fast multiple models
- Modelling rules written serve to a several projects
- Rules can return different models depending on the attributes you read.

Disadvantages:

- Application difficult texture
- Require workstation performance for large projects
- Require special programming knowledge for editing
- Modest precision of models

of road network, vegetation and remaining construction, the database has been supplemented with these models.
In the final stage of this case study, it has imported ArcScene database program that allows viewing and running analysis 3D models contained in the data

In conclusion such a system presents both advantages and disadvantages, if it is cost effective or not depends strictly user and the problems it seeks to solve one thing is certain, the future geographical information systems 3D will surely escalate and the classic two-dimensional analogue representations or even digital will only be a tab in history.

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GPS IN TOPOGRAPHY

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Abstract

Global positioning system (GPS) equipment, the world's best electronic distance measuring machines (EDMs), are becoming faster and easier to use. Not only does one use this new portable equipment to establish distance, but three-dimensional positioning is quickly available. The use of GPS as a tool for accomplishing boundary surveys; topographic surveys; location surveys; control surveys for GIS/LIS, photogrammetry, national, state and local coordinate systems; etc. The GPS locations can be performed by established methods, which may be presented as working solutions, depending on the situation on the field and the logistics you have endowed.

***Key words**: GPS, EDMs, surveys, topography, working solutions.*

INTRODUCTION

The aim of this paper is to present the purpose of the GPS (Global Positioning System) in topography.

Surveying or land surveying is the technique, profession, and science of determining the terrestrial or three-dimensional position of points and the distances and angles between them. A land surveying professional is called a land surveyor. These points are usually on the surface of the Earth, and they are often used to establish land maps and boundaries for ownership, locations like building corners or the surface location of subsurface features, or other purposes required by government or civil law, such as property sales.

Surveyors work with elements of geometry, trigonometry, regression analysis, physics, engineering, metrology, programming languages and the law. They use equipment like total stations, robotic total stations, GPS receivers,retroreflectors,3D scanners, radios, handheld tablets, digital levels, drones, GIS and surveying software.

Surveying has been an element in the development of the human environment since the beginning of recorded history. The planning and execution of most forms of construction require it. It is also used in transport, communications, mapping, and the definition of legal boundaries for land ownership. It is an important tool for research in many other scientific disciplines.

The Global Navigation Satellite System (GNSS) uses the technique of positioning objects that are moving or static, anytime, anywhere – whether they are on land, in air or under water.

Figure 1. Permanent GNSS Network – Romania

Starting in 1991 with the first GPS equipments and continued in 1999, when it was installed the first GPS permanent station in Romania (BUCU) at the Faculty of Geodesy – Technical University of Civil Engineering Bucharest in cooperation with Federal Agency for

Cartography and Geodesy Frankfurt (Germany), the new methods of global satellite positioning were introduced in Romania. Our country provides GNSS augmentation services under ROMPOS (Romanian Positioning Determination System) – Figure 1. ROMPOS is a part of the Central and East Europe ground station augmentation system named EUPOS – Figure 2.
ROMPOS services includes DGNSS service (dm accuracy), RTK service (cm accuracy) and GEO (geodetic service – cm/mm accuracy) DGNSS/RTK service can deliver augmentation data (corrections) based on single base or network concepts and the data are transmitted continuously by internet and NTRIP protocol – free of charge; GEO service is charged.

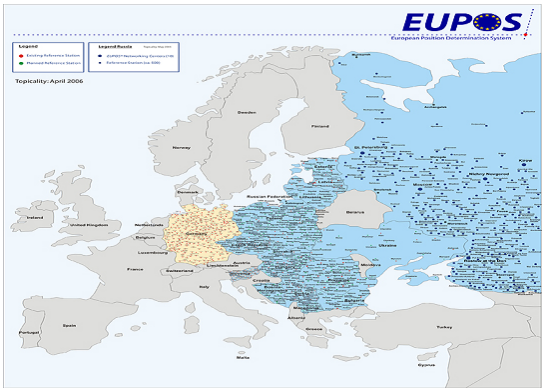

Figure 2. Permanent GNSS Network - Europe

MATERIALS AND METHODS

A Global Positioning System (GPS) is just a part of GNSS, used only for determining some points on the surface of Earth.
The GPS was first used for surveying in the 1980's and the only way to obtain centimeter-level positioning was via post-processing. Users were required to place a base station receiver on a known monument and set it to record data – the same had to be done with the other receiver for lengthy period of time. After a couple of hours, both units were brought to the office in order to download the data and post-processed on a desktop computer.
In general, the GPS's purpose is to provide the coordinates X, Y, Z of some points on the field, into the system that the user requires, stating from the basic ellipsoid of the 84 WGS system. The further progress of the GPS consists in automating the measurement work, which is used to cover the needs of surveyors at a rate of 100 % as regards the supporting network, 75 % for tracking, 75 % to the data acquisition of land in topographic surveys, etc.
The main target of the GPS is to provide the position, speed and synchronization (time) at any point on the surface of Earth, in relation to a reference system of the world (ellipsoid 84 WGS) and this 24/24 hours. In addition, the GPS should operate in all the climatic conditions and to accept an unlimited number of users.
The user can make GPS measurements if he has a compatible GPS receiver. There are many prestigious companies which produce such receivers which are very competitive. They allow you to make measurements on many satellites simultaneously.

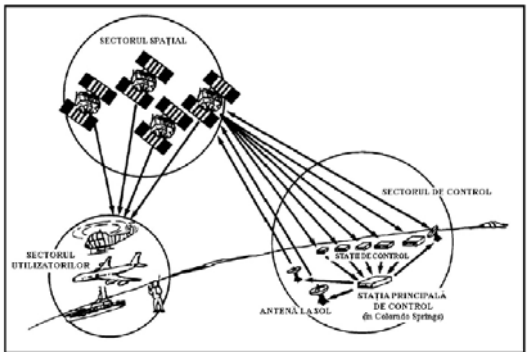

Figure 3. How the GPS works

In topography, GPS is used at the support networks of lifting equipment to the execution of longitudinal profile in cinematic mode, as well as finding out the coordinates of the detailed points. In addition, in the topography engineer, GPS is used in tracing in real-time and to the pursuit how the constructions (buildings, houses, etc.) behave in time.

There are two types of measurements:
a) Code measurements (pseudodistances) - which are used to find an absolute location-instant navigation type (meter accuracy precision)
b) Faze measurements – which allow obtaining the results of the relative location in differential mode (starting from a point known to an unknown point).

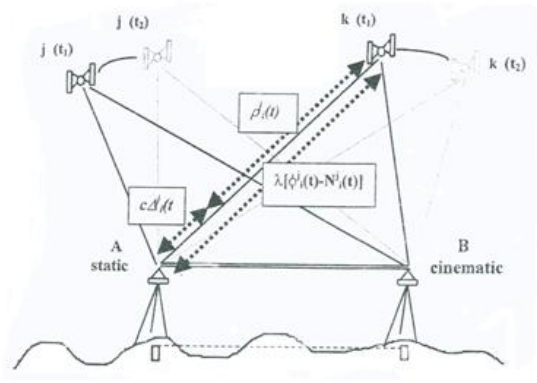

Figure 4. Static and Cinematic Mode

Regarding **the acquisition of data** there are two main ways:

a) Simple Static Mode – when the receivers are motionless on the ground for more than an hour. This mode gives the highest precision (+/- 1mm)

b) Fast Static Mode - normally used for receivers, with phase measuring and frequency, and leading to an accuracy of approximately 2cm. It takes less than the mode static simple, depending on the number of satellites that can be observed.

- baselines must be less than ten kilometers in length
- manufacturer's documentation should be consulted for determining the occupation period
- dual frequency receivers are preferred
- five or more satellites should be observed
- the recording rate may vary between five and fifteen seconds

c) Simple Cinematic Mode - uses the faze measurements and lead to the same accuracy as and faster static mode –stop and go system with two handsets: one on the known point and the other moving from one point to another in the field.

d) Cinematic Mode with Static Initialization- on the known points, in order to increase the accuracy of measurement.

After the manner of **data processing** there are two possibilities:

a) Post – Processed Kinematic (**PPK**)– the files must be recorded on each receiver, after which follows the data processing - the most accurate method of obtaining the coordinates of the points in the field.

- five or more satellites should be observed
- receivers should be initialized per the manufacturers recommendations
- each point should be occupied in a different session with different satellite geometry when measuring fixed points.
- the recording rate should be between one and five seconds Page 31 of 66
- single frequency receivers may be used although dual frequency receivers are preferred

b) Real Time –it does measurement and results at the same time, even in the field. The procedure can be used in order to determine an isolated point (with an accuracy of about 100m), in DGPS (with an accuracy of 1-5m), but the best is cinematic, when the mobile receivers are moving at a speed of approximately 40km/h and make a determination on every 3-5 seconds. So it is possible to obtain the coordinates at every 50m.

- Five or more satellites should be observed.
- Receiver specifications should be adhered to for consistent results.
- Each point should be occupied in a different session with different satellite geometry, unless collecting data while moving.
- The recording epoch rate should be either one or five seconds.
- Single frequency receivers may be used although dual frequency receivers are preferred.

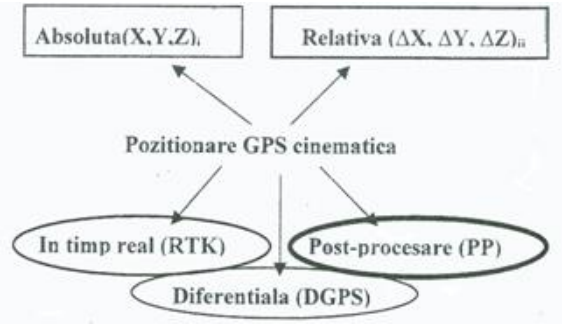

Figure 5. GPS cinematic position

In the early 1990's, **RTK** technology (*Real Time Kinematic*) was born and the GPS industry hasn't

looked back. RTK allows the user to obtain centimenter-level positioning in real-time – that's the point when the GPS for staking became possible and the GPS for topo surveys became very efficient. RTK is the fundamental technology that makes machine control possible.

The basic concept behind RTK is that you have a base station receiver set on a known point somewhere around the project site. The base station receiver sends correction data to the surveyor who is operating the survey receiver. The correction data is typically sent via UHF or spread spectrum radios that are built specifically for wireless data transfer. The corrections from the base station receiver can be sent to an unlimited number of rovers.

Real-time positions on the rover receiver are calculated as fast a s 20 times per second. For staking and topo where the rod person will be carrying the range pole, once per second is plenty fast enough. In cases where RTK is used for machine control or topo surveys where the GPS is mounted on a four-wheeler or other vehicle and traveling at a good clip, faster data collection rates might be useful.

Topo surveys can be done very efficiently with RTK. One person can collect a tremendous amount of data in a day. The data collector can be set automatically take a shot every 25 feet or every 10 seconds or when there's an elevation change of more than five tenths. Otherwise, the operator has full control to name a point however they choose, and occupy the point as long as they choose.

Most systems RTK GPS, use the small radio modems on the frequency of the UHF.Radio communication is that part of the RTK system with which most users are struggling. Deserve to be taken into account the influence of the following factors at the time of the test to the optimization of the performance of the radio:

Figure 6.1. Data processing on a site (for two buildings) at PiataMuncii, Bucharest

Figure 6.2. Data processing on a site (for two buildings) at Piata Muncii, Bucharest

RESULTS AND DISCUSSIONS

Experience has shown that during a static GPS survey (using dual-frequency geodetic equipment), it is possible to get good loop closure and have very small residuals in the network adjustment, yet still have a large errors in the adjusted positions of some stations. This can happen if stations are occupied in one session only. In one situation, later traversing revealed an error of 2.4 meters in a station's coordinates that was occupied only once. Reprocessing the vectors in and out of the point, from a single session, changed the position by 2.4 meters to a position just a few hundredths different from one measured by ground traverse. Both the original and reprocessed GPS networks had good loop closure through the station in question. The vectors through the station in question had high variance numbers. There were compensating errors in the vectors in and out of the station. This can be attributed to the fact that both

vectors into the station are computed from the same data set.

Figure 7. RTK GPS

CONCLUSIONS

The use of GPS equipment has the advantage that it does not require angular and distance measurements and the inconvenience of using total stations is also eliminated. At the same time, it is worth mentioning that with the RTK method (Real Time Kinematic) it is possible to determine coordinates with an accuracy that is comparable to that of the total stations and in a suitable period of time. One must also take into consideration the necessity to align Romania to the European and international standards by developing a GPS reference geodetic network of high-precision, whose points should be determined and included in the EUREF European GPS geodetic network

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USING GIS FACILITIES IN ORDER TO MAINTAIN EVIDENCE OF PROPERTIES

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Abstract

The Earth, through his specific characteristics - immobile, indestructible, limited and perceptible for everyone - it's fundamentally different from the rest of goods required to meet the basic needs of individuals, and by his nature he is necessary for basic needs of human being, providing food and housing. For the state, the land is one of the safest sources of income through "land tax". For this reason, ever since the states, their leaders paid particular attention to land inventory and registration in public registers of holders of rights and legal relationships

Key words*: GIS, GPS, GNSS, RTK, STOP&GO, MAPSYS, INTERGRAPH, ACCESS, TIFF, DWG, DXF.*

INTRODUCTION

Nowadays, many local government institutions are increasingly concerned to achieve geographical information systems (G.I.S.). This interest came in front because a lot of the decisions taken at the local government level, requires spatial reference information.

Many institutions of transport, design, public services, emergency services, insurance, environmental protection and, of course, institutions of record of property and urban networks can benefit from an integrated and automatized system of computer records.

But a GIS is not implemented by simply purchasing programs and data processing equipment. These and many other system components must be made in accordance to the needs and specific activities of a particular institution.

To determine what functions must the system meet, which data must be entered in the database thereof, which are the procedures for processing and accessing these data and which will be the formats and data types exported, purpose of seeking the implementation of the system must be defined correctly and full.

This paper describes the stages of projecting design and implementation of a geographic information system (GIS) which aims to introduce and maintain general cadastre.

Initially, the client of the project, wanted to finalize the operations of establishing the rights of private property on land.

To complete documentation of livery agricultural land situated in the administrative territory of "Sinca Veche" village, we have taken the following steps:

1. Delimitation of the territorial administrative unit - including setting urban limits;
2. Delimitation of special purpose lands (SPL);
3. Delimitation of land belonging to the public people;
4. Updating existing topographic and cadastral plans (recovery of parcelling plans);
5. Identifying the land's categories of use;
6. Identifying the owners;
7. Restoration of cadastral numbering;
8. Calculating the surfaces in and between urban areas;
9. Preparing property bodies's sheets;
10. Preparation of technical documents (of the general cadastre):

- cadastral register of land plots;
- alphabetic index of owners and their residence;
- cadastral register of owners;
- register of property bodies;
- Centralizing sheet, cadastral parcels by owners and categories of use;
- Cadastral plan.

And finally:

11. Drawing plans of parcels, reports of livery and sketches of site.

MATERIALS AND METHODS

GEOGRAPHICAL LOCATION AND GENERAL ASPECTS OF THE AREA

"Sinca Veche" village is located in centre of Brasov County in the south-east extreme of Fagaras area. Administrative territory of the village stretches from "Persani" mountains, in the north and east sides, through the Fagaras Mountains, in the south, with a wide opening to Fagaras depression in the west side. (Figure 1)

Figure 1. Geographical location of "Sinca Veche"

The commune's territory consists of hills crossed by numerous rivers of which the most important one is "Şinca" River, an affluent of Olt River. In the mountain area are districts of forest consisting mainly of beech and mixed beech and resinous. Mountains have an average height, the most imposing one being "Taga" massive with a height of 1648 m.

"Sinca" village has a population of 3575 inhabitants, distributed in six villages: Şinca Veche, Valcea, Ohaba, Şercaita, Bucium and Persani, in 1408 houses and 1299 households, on a total area of 18059.95 hectares, of which:

Build-up area: …….293,90 ha

Outside build-up area: 17766,05 ha

By categories of use:

- Agricultural ……..3345,18 ha
- Non-agricultural …743,38 ha
- Pasture ……2541,45 ha
- Hay …….2961,29 ha
- Forest ……..8131,40 ha

LEGISLATIVE CONTENT

In making this piece of work, involving the realization of technical documentation, necessary for reconstitution or establishment of property right and maintenance of property records, have been respected the following laws:

- Land Law no. 18 of February 19, 1991;
- Law 1/2000;
- Law of cadastre and real estate advertising No.7 / 1996;
- Law 247/2005 and the law of technical standards and implementing regulations of these laws.

PROJECT'S STRUCTURE AND INFORMATION RELATING TO GIS

G.I.S is a set of informational flow streams organized into a unitary concept. It is getting input processes, which it processes and provides outputs. The inputs and outputs of an information system are data, information and decisions.

A GIS is a system consisting of three interconnected components, each one being equally important and necessary. These components are:

- Spatial data;
- Software / hardware tools;
- Specific studied goal or problem.

Creating a GIS is a problem linked to:

- Establishing the clear purpose for achieving the system;
- Identification of the types of data that must be included;
- Defining the specific functions that must be fulfilled;
- Creating graphic and non-graphic databases;
- Developing or obtaining capabilities of obtaining information;
- Selecting and implementing of software and hardware appropriate making changes to procedural, organizational and personnel required for successful use and operation of the system.

In this way, knowledge of how the system will be used will be the basis of determining the procedures by which the information will be stored in the system and what additional technical, organizational and legal resources will be required to allow the use of information. Actually, there is already a hierarchy of functions and activities of each department, of how they determine necessary data and procedures by which the data will be processed to fulfil these functions.
Data and how they will be processed, in their turn, helps to determine the necessary hardware and software, which, in their turn, will have a major impact on staff and its training for maintenance and operating the system.

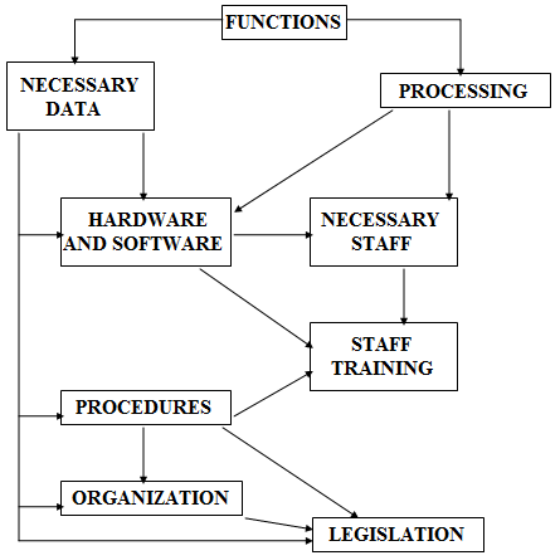

Figure 2. Scheme of hierarchical process

DOCUMENTATION BY CONSULTING MAPS AND TOPOGRAPHICAL PLANS

In the initial stage, we have achieved the following:

- have identified the geographical administrative order of studied territory;
- analysed topographic and cadastral documentation previously prepared and have been selected the materials that may be used in this paper;
- materials provided by the client were the following:
  - "Sheets of possession" made in the 50s;
  - Sketches of lots made on the basis of "Sheets of possession";
  - an agricultural register - for the years 1959 - 1973;
  - a validated annexes to the Land Law, from the Law 18/1991 to the Law 247/2005;
  - At the request of a contractor of the project, was also viewed the Land Register (lagarbuch) from 1932, and sketches of lots annexes.
- were purchased, from the National Geodetic Fund and OCPI Brasov, cadastral plans at 1:20000 scale, topographic plans at 1: 5000 scale (Figure 3) and georeferenced digital photographs (orthophotomap) (Figure 4) for the identified geographical area;
- on these graphic materials were identified: administrative boundaries of the studied area, limits of the buildable area, limits of surfaces with special purpose, geodetic points from the national reference network (Figure 5), channels of communication, waterways, etc.

Figure 3. Topographic plan

Figure 4. Orthophotomap

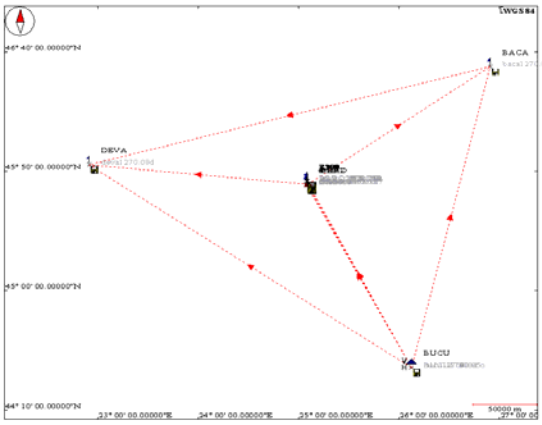

Figure 5. Geodetic points from the national reference network

TYPES OF TOPOGRAPHIC, GEODETIC AND INFORMATIC USED EQUIPMENTS

Execution technical solutions chosen for implementation of this work are:

- measurements are made with GPS equipment from "survey-mapping" precision class, namely:
  - Trimble 4600LS receiver (for-GRAD - pole of lifting network)
  - receiving terminals for collecting descriptive information (GIS type):
  - Trimble PRO XR TDC1 collector;
  - Thales PROMARK3 with incorporated terminal.
- GPS data processing is performed with:
  - GPSURVEY (Trimble) - support and lifting networks;
  - GNSS and MOBILE MAPPER OFFICE for radiated points (determined by "stop & go" or "real-time" measurement types.
  - Personal applications for a transformation of coordinates in national reference coordinate system.
- graphical data processing is done with the following programs:
  - MOBILE MAPPER OFFICE;
  - INTERGRAPH Civil Office - for importing data from GPS applications,
  - INTERGRAPH Iras Iras-B and Iras-C - for processing digital aerial photographs and scanned plans;
  - INTERGRAPH - Parcel Vec and Geo Vec for vectorization of images (where necessary);
  - MAPSYS - for processing in terms of cadastre (lots, cadastral numbering, etc.)
  - Database applications.

For network points of support / lift, measurements were performed using the static method, and method for lifting topographic details, STOP & GO and RTK methods.

RESULTS AND DISCUSSIONS

DATA PROCESSING AND STORAGE

Cadastral measurements are the technical basis of cadastre, representing the biggest part of topographic measurements. These measurements should contribute to establishing the boundaries of properties, while providing the necessary data for graphic representation of properties and determine their areas.

To introduce the general cadastre in an administrative territory, is necessary to wade through, in a mandatory sequence, some certain stages of works whose complexity and volume are established according to the following situations:

- age and quality of topographic plans that exist in the area and the condition, in the pitch, of the geodetic network points markings;
- quality and age of documentation about oldersystems for recording lots (land registration, land cadastre, real estate cadastre);
- size and category of use of the total surface of the land;
- density of topographic details, etc.

The sequence of these steps is shown in Table 1, the structure of which is as follows:

- Nr. order = serial number of stage of works;
- Phases of work = description of work's phase;
- Entries = type of works or other mentions;

Table 1 - Sequences of topographic-cadastral works

Order number	Sequences of works
1	Drafting the technical project for the entire job, based on analyzes of existing documentation and and territory's size and complexity.
2	Cadastral delimitation and marking cadastral administrative territory borders with terminals, perimeters of build-up areas and other destinations which occupy large areas of land.
3	By case determination of geodetic points for providing the support network, necessary for locating photogrammetric surveying.
4	Field measurements for preparation of new topographical and cadastral plans or updating those obtained by selecting and extracting content from other types of plans.
5	Calculations for stages 3 and 4 (if necessary).
6	Execution of land originals (compilation) on the basis of new measurements or by derivation from basic topographic plan of the country.
7	Identifying the property owners on the field and land's categories of use.
8	The cadastral numbering and equipping topographic plans with symbols of updated categories of use.
9	Surface calculation.
10	Uploading data files and organizing the general cadaster database for the administrative territory.
11	Writing cadastral records by automatic data processing devices and data output listing devices.
12	Mapping and editing (basic scale) cadastral plans and multiplication in the number of copies required for users.
13	Mapping and editing the overall cadastral plan of the whole administrative territory (smaller scale than the basic cadastral plan) and multiplying in the number of copies required.

Considering the quality of topographic and cadastral existing plans, from step 4 described in Table 1, came off two categories of works:

a) For the areas in which was ascertained the need of topographical surveys in order to update cadastral plans, or, if there are some previous surveys, useful for the system, will be performed the following:

- Making networks of support and thickening for studied areas;
- Identifying new or modified details;
- Execution of the topographic and geodetic measurements, necessary to determine coordinates of new detail points;
- Processing data resulted of surveying and preparing them for introducing into the system;
- Introduction in the system, by categories and layers, of elements measured in the field. Verification and validation of graphical and non-graphical data and the links between them;
- Verification and introduction in the system of any previous measurements;

b) For areas where it was found during the phase of projecting the system that cadastral and topographic plans correspond to the situation in the ground, will be performed next operations:

- The distribution of digital model in drawing files corresponding totopographic and cadastral plan sections;
- Scanning and plugging topographic and cadastral plans that match the area where are made measurements into the system. Checking raster files;
- Manual or automatic introduction, in database tables, of alphanumeric information associated to graphic details contained by topographic and cadastral plans;
- Indexing database's tables and defining relationships between them;
- Defining procedures of interrogating the system;
- Generate numeral reports and printed documentation (result of graphic and non-graphic queries).

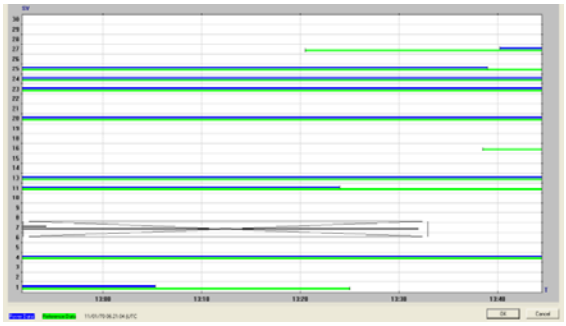

Figure 6. Processing of GPS measurements

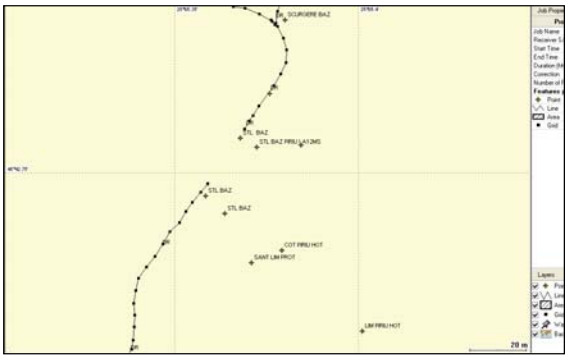

Figure 7. Automatic creation of digital model

DRAWING PLANS AND DIGITAL MAPS

As previously stated, in a GIS can be found two broad categories of data: graphical and non-graphical data.
The graphic data are digital descriptions (computerized) of images and elements of detail shown on plans and maps.
The images and topographical detail elements are converted to digital format by determining (measuring) 2D coordinates of their positions in a known projection system. Using this data, system will generate digital plans that will be displayed on the computer screen or printed on a printer or a plotter.
Graphic data can be obtained by various methods:

- Digitizing from sheets of maps and plans;
- Scanning plans and then vectorization of resulted raster image;
- Photogrammetry;
- Topographic surveying;
- Measurements with GPS technology - (Global Positioning System)

Depending on their origin, graphical data can be:
Raster files resulted by scanning:

- Satellite images;
- Old plans and maps;
- Schemes and other drawings;
- Photos of studied objects.

Files with vector representation (digital model of terrain), resulting from:

- Vectorization of scanned images;
- Digitizing old plans;
- Processing topographic surveys.

Non-graphic data from a GIS are generally tabular data. They are recorded in the database in the form of alphanumeric characters and codes that describe the characteristics of different topographic details and other associated entities of them.
Tabular data can be:
identification data (legal, administrative or geographical);
data that define parcels (indexes, descriptions, etc.);
Specific data of software application system (functions, primary data).
Basic identifiers of a geographic information system are usually the address of property and parcel identifier, and join, in the digital terrain model, the centroids of surfaces (gravitational centers of surfaces).
Address of real estate defines the geographical position of the lot towards street network. This link is usually provided through the cadastral index plan.
Parcel identifier can be:
an index automatically generated by the system;
postal parcel's number;
topographic number of the parcel (if assigned);
cadastral number of the plot (if they have completed general cadastre works in the studied area).
Non-graphical data can be extracted from:
- Field notepads;
- Files of object identification (ex. Real estate file, artery file, etc.);
- Cadastral registers;
- Nomenclatures, etc.;
- Document files (* .doc, * .txt, * .dat, etc.);
- Tabular files (* .xls);
- Databases of textual data, created in ACCESS, INFORMIX, ORACLE, etc.

Digital files format differs depending on the programs CAD or GIS solutions used to create a digital terrain model.
Thus, graphical data that will be integrated into the system it is advisable to have one of the following standard formats of digital files:
• TIFF, JPEG, BMP, etc. - Raster files with standard formats, usable in most applications CAD / CAM / GIS, that can be used into the system as reference information (history), or will be vectorised in order to create a digital model;
• DXF, DWG - files containing vector elements, usable in CAD / CAM / GIS products of Autodesk, Bentley, Intergraph, ESRI, Microsoft, etc ;
• DGN - digital files specific of CAD / CAM / GIS programs made by Bentley, Intergraphand Microsoft.

CREATING GIS DATABASE

Methods of inputting data into the information system are directly dependent on the source of the data.

Applying the technical functions of the system can modify the organizational conditions regarding the training of personnel, structure of departments and tasks of constitutive services.
Once the functions that must meet system have been set must be established technological flow of takeover, processing and data maintenance. The following figure reflects a general pattern of technological flow.
For each stage of data processing, must be mandatory to achieve their validation in accordance with the law, the functions that must meet the system and the structure.

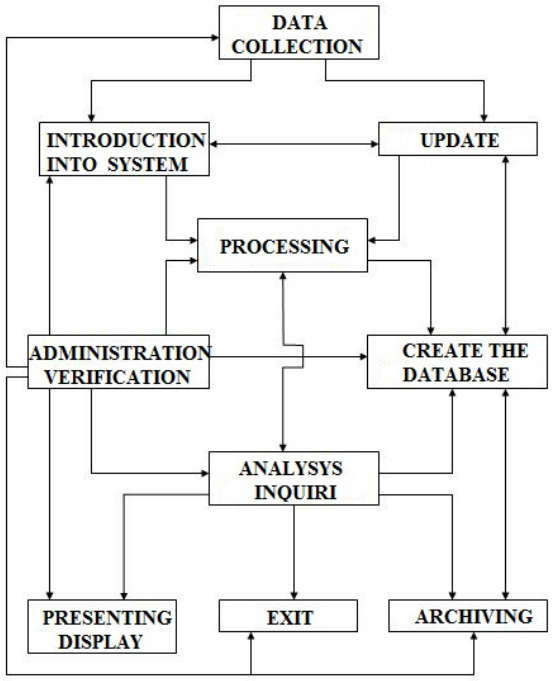

Figure 8. Data flow in a GIS

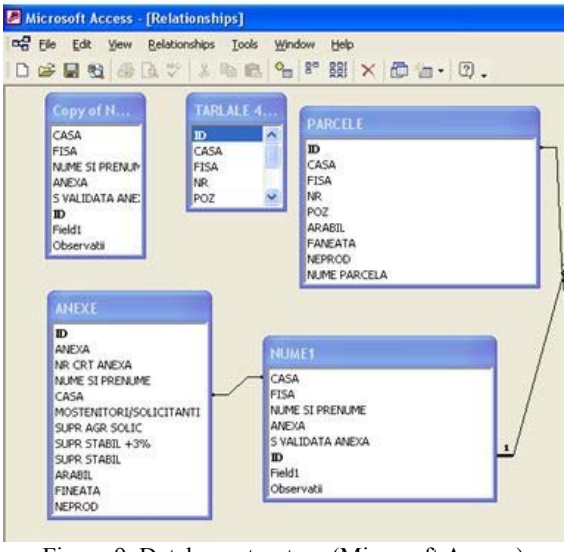

Figure 9. Database structure (Microsoft Access)

Management functions of the database are:
The association of attributes to the graphic details;
Facilities of introducing information referring on data quality;
Facilities recording the number of data's rows;
Facilities of tracking transactions or updates;
Access to attribute type data:
- directly - through attribute's identifier
- directly - by selecting geographic detail;
- Via a relational "key";
- through natural language or SQL instructions
Creating, displaying and manipulating complex data functions;
Operations in the database:
- sort tabular or graphical files according to attributes or locations;
- calculating new values through arithmetic or logic expressions;
- binding ("link") data files by common small identifiers;
- defining the rules governing the component elements of data;
- creating, storing, reconstituting and generating standard reports;
Generating status reports of database and system;
The ability to add files without being necessary to size or scale;
System security features:
- access password protection;
- selecting the "read only" access or "read write" for different users;
Computer network operations:
- access to common data files in the file server;
- procedures to verify the data input / output;
Geographic data automation functions are:
Manual digitization of bi-dimensional data like dot, line, or polygon;
Automatic "Bonding" ("snap-to") to previously digitized detail;
Incorporate photogrammetric digitized data;
Methods to determine geometric coordinates:
- tracing lines, angles and curves;
- Linear intersections (create "nodes")
- Bisecting angles, determining tangents;
Association functions of attributes are:
Associating attributes of topographic details;
Setting attributes;

Check on the attributes
Verifying the format of attributes;

CREATING THEMATIC MAPS AND INQUIRY OF DATA
Were made different types of thematic maps which show, for example:
situation of land by categories of use (Figure. 10);
lands belonging to the same owner; (property body, cadastral match, etc.);
lands belonging to public domain;
special purpose lands;

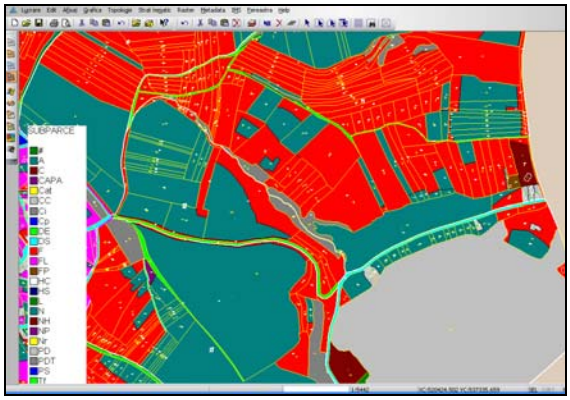

Figure 10. Situation of land by categories of use

For viewing, enquiring, but also modifying or supplementing nongraphic and graphic database were created following reports and interfaces ("forms"):
1. Tabular reports generated solely from the nongraphic database that comply with technical norms for introducing general cadastre:

- APPENDIX 4.6.1 - Sheet of body ownership;
- APPENDIX 4.6.2 - Cadastral register of parcels;
- APPENDIX 4.6.3 - Alphabetical index of owners and their residence;
- APPENDIX 4.6.4 - Cadastral register of owners;
- APPENDIX 4.6.5 - Register of property bodies;
- APPENDIX 4.6.6 - Centralizing sheet of cadastral matches by owners and by categories of use;

And other reports required for the project, created by the author of this paper:

- APPENDIX 4.6.7. - Centralizing the surfaces from (validated) appendixes on property laws (Figure 11);
- APPENDIX 4.6.8. - Report containing the original data extracted from old sheets possession (Figure 12);

ANEXE VALIDATE

NUME SI PRENUME	CIRSTEA ELENA						CASA
ANEXA	NR CRT	MOSTENITORI/SOLICITANTI	SUPR AGR SOLIC	SUPR ARABIL	ARABIL	FINEATA	NEPROD	6
22	76	CIRSTEA ELENA	5.09	0.15	0	0	0	
2A	48		5.09	4.79	3.4	1.39	0	
		Suma	10.18	4.94	3.4	1.39	0	S+N 4.94

Figure 11. Appendix 4.6.7

TABEL CENTRALIZATOR - DIFERENTE ANEXE - FISE DE POSESIE

CASA	TOTAL CASA DIN ANEXE	TOTAL CASA DIN FISE	DIFERENTA ANEXE - FISE
6	494	493	1

NUME SI PRENUME	CIRSTEA V VICTOR				FISA	53
	S VALIDATA ANEXA	Sum Of ARABIL	Sum Of FANEATA	Sum Of NEPROD	TOTAL FISE	331
	0	180	151	0		
Suma	0	180	151	0		
NUME SI PRENUME	CIRSTEA V ELENA				FISA	54
	S VALIDATA ANEXA	Sum Of ARABIL	Sum Of FANEATA	Sum Of NEPROD	TOTAL FISE	162
	494	128	34	0		
Suma	494	128	34	0		
Suma CASA	494	308	185	0		

Figure 12. Appendix - 4.6.8

- APPENDIX 4.6.9. - Report showing the difference of area between the values contained in validated appendixes and those from property sheets (Figure 13);

FISE DE POSESIE

CASA 6 — Sumar pentru 'CASA' = 6 (25 inreg): Suma A 308 F 185 N 0

SUNT DE ACORD DA / NU — Total arabil 493
NUME SI PRENUME — SEMNATURA — Arabil + neproductiv 493

NUME SI PRENUME: CIRSTEA V VICTOR (16 inreg)
FISA: 53 — Suma A 180 F 151 N 0
Observatii: A: 2A SA=4.79 — Totalpers. 331

TARLA	POZ	ARABIL	FANEATA	NEPROD	NUME PARCELA
2	101	13	0	0	DUMBRAVA
6	301	14			G.MINEI-CIMPSOR
10	151	30			C. GASPOR
20	55	17			RACHITA
21	50	18			C. DUMBRAVII
21	108	28			C. DUMBRAVII
23	36	22			C DUMBRAVII
31	112		17		PESTE MANEA
36	48		28		RADACINI
37	98	13	13		MALIN
39	131	15			INTRE VAI
40	54		10		RASTOCI CV+V
41	13		16		GHIRCIUG
47	20	10	12		VIRFU POENII
47	106		18		VIRFU POENII
55	61	0	37	0	CARPENE

NUME SI PRENUME: CIRSTEA V ELENA (9 inreg)
FISA: 54 — Suma A 128 F 34 N 0
Observatii: — Totalpers. 162

TARLA	POZ	ARABIL	FANEATA	NEPROD	NUME PARCELA
2	94	21	0	0	DURAITOARE ???
6	46		5		TARNAROAGE
6	300	28			G.MINEI-CIMPSOR
8	73		9		TRESTIE+VALE
9	70	32			GRUI
26	22	24			GOGOSIE
41	12		12		GHIRCIUG
50	9	23			VADICI
54	26		8		SEST

Figure 13. Appendix 4.6.9

2. Reports resulted from the system interrogation (+ nongraphic and graphic data):

- APPENDIX 4.6.10. - Protocol of livery and annex draft;

- APPENDIX 4.6.11. - Parcels plans;

3. Interfaces (Forms) for introducing and interactive enquiring of data:

- APPENDIX 4.6.12. - Introduction and/or textual data enquiry (Figure 14);
- ANNEX 04.06.13. - Introduction and/or graphic or textual data enquiry;

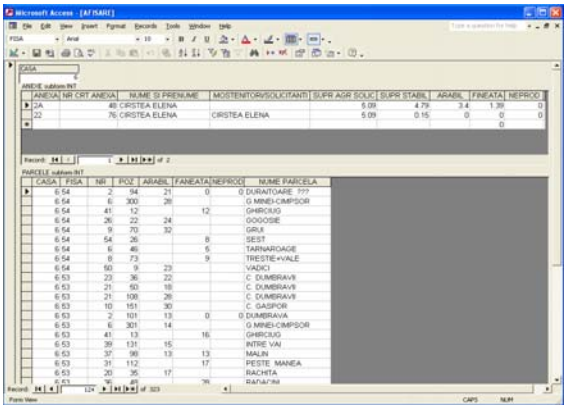

Figure 14. Appendix 4.6.12

CONCLUSIONS

The purpose of achieving and implementing an integrated information system that provides the necessary support for automatic processing, in particular of data for the preparing, updating and maintaining specific database record property, have been started from the basic idea to develop a project of execution of a flexible information system, open, multifunctional, which can be used in the near future in other areas of special social interest, such as:

- Introduction of the general cadastre;
- Registration of population;
- Monitoring of environmental pollution, floods, etc.,
- as well as any other areas that require an information system based on a precise digital model and its associated relational database.

Whether a small business, a multinational organization, a government department or a local authority, however there are at least two items in common, namely:

- A big part of the handled information should be geographically referenced;
- As the volume of information grows, it will be harder to manipulate and interpret them.

It is an already known fact that more than 70% of all information in circulation has a common denominator: their geographical location (geographic reference). In this situation, GIS becomes important for the information's user as it helps in making decisions that are based on geographic located information.

Unlike any other type of applications that manipulate information, information system can interpret the concept of geographic location.

Consider, for example, a system that allows the user to combine and manipulate demographic data, or referring on the living standards of the population or other data of social or economic-specific areas, in order to determine the appropriateness of developing business. This process of social and economic prediction and monitoring grows the chances of success in a new business.

The processing, recording, storage and playback of cadastral records content should be standardized and codified.

Dramatic advances in computer technology have opened up new opportunities for achieving cadastral records. To use electronic computers for achieving these records, raw data must be processed and converted to standard formats, as simple as possible, including basic information on study objectives.

The use of automatic devices of achieving cadastral records offers a lot of advantages:

- reducing the time for routine work such as:
  - The introduction of new data;
  - Study existing data;
  - Releasing some excerpts through various printing equipment of the system.
- optimize the maintenance work and updating the information contained in the database system;
- reduce costs of maintenance by increasing productivity records;
- increase the amount of information that can be processed and stored (compared to manual methods);

- performing some complex enquiries on information about the properties, landlords, utility networks, etc. (This information can be selected and combined in different variations depending on user requirements)

In conclusion, the future belongs to geographical information systems.

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A SOLAR CADASTRE

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Abstract

A solar cadastre is also called as a roof cadastre or a solar potential map. This solution is to provide a geo-portal for potential users, which allows to define potential of solar energy for specific locations. It is based on a Digital Terrain Model and climate information available for this area. This kind of geoportals are made mainly as an initiative of the local government of the city. The aim is to increase public awareness of the advantages of using solar energy. Analysis of sunlight and solar potential maps can be used in various fields (like civil engineering, energy engineering and spatial planning) and stage of investment. These systems should be user-friendly, ie they should clearly show the information about the energy potential of the location and facilitate decision-making in investment in solar collectors.
The aim of project was to analyse the available methods, which allow to determine the value of solar potential for the area (roof of the building) from DTM and energy possible to obtain from this area. The project shows examples of different models of the solar cadastre available to users of the world and their use. Selected solar cadastre maps available to users on the Internet since 2008 have been analysed. Then the maps were compared in terms of their usability and usefulness of the work related to spatial planning. The results will be used to create a solar cadastre concept in Poland.

***Key words**: Digital Terrain Model, solar cadastre, solar potential.*

INTRODUCTION

All fossils fuels, ascoal, natural gas and oil, are the result of plant decomposition that happened millions of years ago – under water. When a man found use for these materials, energy, within 50 years the world has changed beyond recognition. The development caused that the population has doubled,industry has developed,transport capacity has increased.Agriculture has been modernized so that developed countries produce a surplus of food. A liter of oil generates as much energy as the work of one hundred people.The current statistics show that globally, fossil fuels provide for over 85% of all the energy we consume.

Our environment is paying a high price. The increase in the concentration of CO^2 in the atmosphere causes the expansion of the ozone hole. Emission of sulfur dioxide and nitrogen from coal combustion is the cause of acid rain and smog. Great Smog, which held only a few days in 1952 led to the deaths of thousands of people. In January 2014, Beijing limit safe for health (25 micrograms per cubic meter of dust concentration in the air) was exceeded 26 times and reached 671 micrograms per cubic meter.

Oil and coal run out. First, it comes to an increase in their prices and dependence on countries that have reserves. Environmental damage because of over-exploitation will be irreversible. This could be avoided. In 1992 in Rio de Janeiro Poland participated in the Earth Summit (United Nations Framework Convention on Climate Change), so that Poland could sign the Kyoto Protocol in 1997, which talks about reducing greenhouse gas emissions.

The most important solution is renewable energy sources: sun, biomass, wind, water,geothermal power, wave and tidal power.So one of the ways to reduce the concentration of CO^2 in the air is the use of renewable energy sources, including energy coming from the Sun. (Nowicki, 2012). Figure 1 shows the annual energy consumption of humanity in 2010, compared to the size of the annual amount of energy from various

renewable sources. The colourblue is a global demand for energy. Colours red, brown, green and black are other kind of energy (wind, gas, oil, coal).

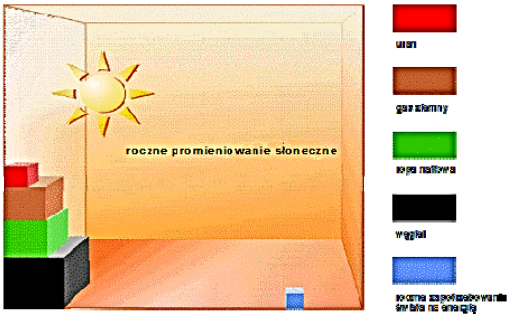

Figure 1. The annual energy consumption of humanity, 2010

Source: www.unfccc.int

Solar energy is radiant light and heat from the Sun harnessed using a range of ever-evolving technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture and artificial photosynthesis.It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on the way they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air.

The large magnitude of solar energy available makes it a highly appealing source of electricity. The United Nations Development Programme in its 2000 World Energy Assessment found that the annual potential of solar energy was 1,575–49,837 exajoules (EJ). This is several times larger than the total world energy consumption, which was 559.8 EJ in 2012.

Poland in terms of the intensity of the radiation, if divide its territory into two parts, the south can be compared with northern France, and in the north of neighboring Germany. (Figure 2, Figure 3). Sunlight is the sum of solar radiation at the time and on the surface. It is a quantity that describes the resources of solar energy at a given place and time, it expressed in Wh/m² per day, month or year. The average amount of solar energy in Poland is estimated at approximately 900 - 1100 kWh / m2 per year. This gives the equivalent of the energy resulting from the combustion of approx. 110 m3 of natural gas or 100 liters of heating

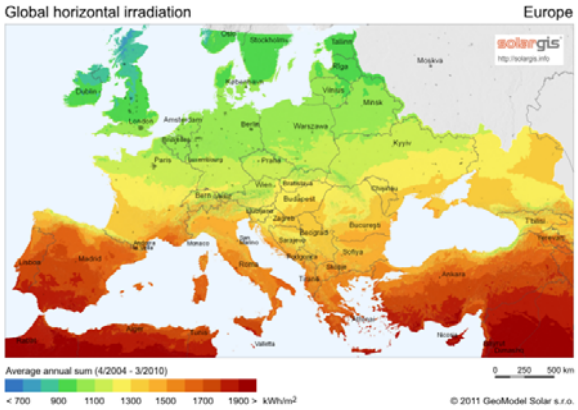

Figure 2. Global horizontal irradiation in Europe

Source: www.solargis.info

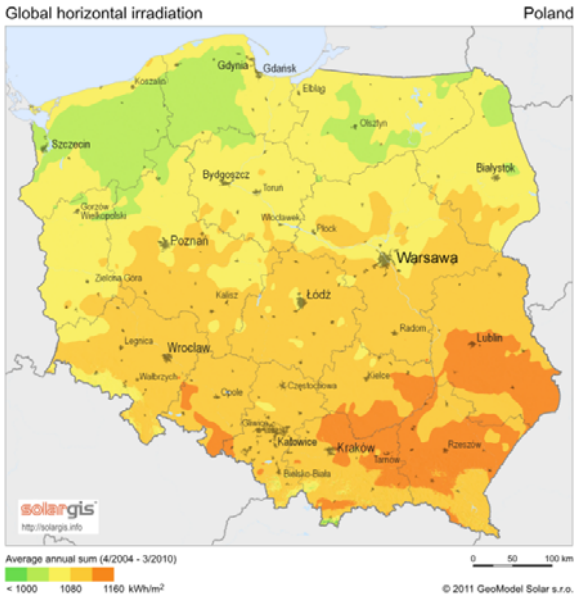

Figure 3. Global horizontal irradiation in Poland

Source: www.solargis.info

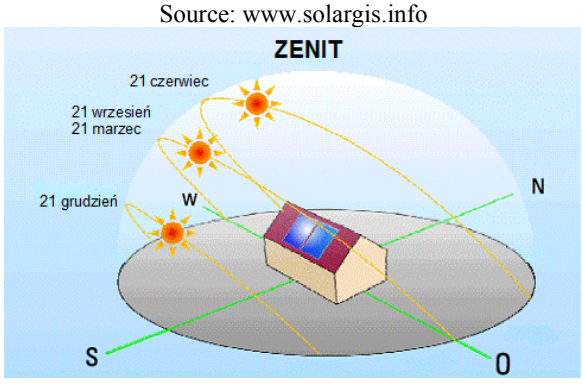

Figure 4.Sun Angle and Seasons

MATERIALS AND METHODS

In order to analyse various types of solar cadastre were used: geoportal or city GIS service, which are available on city website in Europe and in the world.
The work was prepared in several steps. First, a list of all cadastral solar was created. Then rated each system: described and evaluated their advantages and disadvantages for a potential as a user.The results will be used to create a solar cadastre concept in Poland.

RESULTS AND DISCUSSIONS

A solar cadastre is also called as a roof cadastre or a solar potential map. This solution is to provide a geo-portal for potential users, which allows to define potential of solar energy for specific locations. It is based on a Digital Terrain Model and climate information available for this area. (Table 1). This kind of geoportals are made mainly as an initiative of the local government of the city. The aim is to increase public awareness of the advantages of using solar energy. Analysis of sunlight and solar potential maps can be used in various fields (like civil engineering, energy engineering and spatial planning) and stage of investment. These systems should be user-friendly, ie they should clearly show the information about the energy potential of the location and facilitate decision-making in investment in solar collectors (Królikowski, 2011).

Table 1.Information for a solar cadastre

Information whichareneeded	
NMT	known coordinates X, Y, Z
Meteorological data	Climate data from long-term record of information on solar radiation, cloud cover, fog. Internet website of the Ministry of Infrastructure and Development "Typical summer weather and statistical climate data for the Polish territory for the calculation of energy buildings"
The algorithm for the calculation of the solar potential	Solar Radiation from Esri, (ArcGIS Saptial Analyst), GrassGISr.sun model
Server, available on the internet	Easiness and clarity "readability" for the user,
	Map makes easy to decide on the installation of correctors Information on additional permits eg. construction on the historic building

Countries such as Germany or Austria have found away how to broaden awareness of their citizens and invest in solar installations. Cities put solar map on their official website. Solar map is a geoportal, where the interested can assess whether the roof of his house is favorably located towards the sun, to install photovoltaic cell or solar collector.
In 2008, for the city of Osnabrück (Germany)
It created the first map of the solar potential. Germany and the United States are the countries that were the first in this field.List of cities currently have solar portal was presented in Table 2 along with Internet addresses, technology of calculating potential, and technology to share Web GIS.
The solar map of the city of Boston was created on the initiative of the government, whose idea is to reduce by 2020 greenhouse gas emissions to 25%. After entering the official website of the city (www.cityofboston.gov) on the menu of the page, click the link "Maps" shows a series of maps, including searched "Solar Map". On the target card shown is the goal, and the current implementation of the program. In addition to assisting the user in estimating solar energy and the representative of the potential value of the solar system, there is also set of information about solar panels and about what you need to know before installing.
The Map Solar was created in the program ArcGIS ESRI, which allows you to create, edit and analyze data. Calculation of the solar radiation is calculated in the extension Solar Analyst. Geoportal contains three overlays informing the user about [www.cityofboston.gov]:
- monument zone,
where it is necessary to obtain additional permits,
-electricity grid NSTAR, where building photovoltaic system may be limited,
-the usefulness of roof for installation, where by means of the intensity of colour from yellow to red is shown the total annual radiation on the roof.

Table 2. Solar cadastre in the world

City/Region	Web address	The technology of calculation	Technology of Web GIS
Europe and Africa	http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php	Joint Research Centre	MapServer
Austria			
Graz	http://gis.graz.at/	ArcGIS Desktop	SynerGIS, Esri ArcGIS Server
Vienna	http://www.wien.gv.at/ umweltgut/	-	bd. (część Vienna GIS)
Chile			
Calama	http://www.geopm-kom5.de/geoapp /catastrosolar/calama	Sun-Area, ArcGIS Desktop	Mapbender
Germany			
Berlin	http://www.virtual-berlin.de/	Sun-Area, ArcGIS Desktop	Google Earth (3D), Map-Guide (2D)
Bielefeld	http://www.bielefeld01.de/	Sun-Area, ArcGIS Desktop	Mapbender
Bremen	http://www.solarkataster-bremen.de//	-	-
Gelsenkirchen	http://geo.gkd-el.de/ website/solar/	AeroWest	EsriArcIMS
Hamburg	http://www. hamburgenergiesolar.de/	Hamburg Energie	OpenLayers+WMS
Monachium	http://maps.muenchen.de/	-	OpenLayers+WMS
Osnabrück	http://www.osnabrueck.de/ sun-area	Sun-Area, ArcGIS Desktop	EsriArcIMS
Zw. powiatów Neckar-Odenwald-Tauber	http://www.leader-neckar-odenwald-tauber.de	Sun-Area, ArcGIS Desktop	Mapbender
USA			
Boston	http://gis.cityofboston.gov/ solarboston/	ArcGISDesk	EsriArcGIS
Denver	http://solarmap.drcog.org/	Woolpert Inc., NREL	Google Maps API
Los Angeles County	http://solarmap.lacounty.gov/	CH2M Hill, NREL	Bing Maps API
San Francisco	http://sfenergymap.org/	CH2M Hill, NREL	Google Maps API

Figure 5. The solar cadastre of Boston city – ortophotomap

Source: www.cityofboston.gov

Figure 6. The solar cadastre of Boston city - map

Source: www.cityofboston.gov

The map shows, where there are places of existing installations. After moving the cursor on the symbol ("sun"), show the data on location, type of solar energy system, power, and also the company which installed it. Some descriptions are enriched with a picture of a building with installed solar collectors or solar cells. The user can calculate also solar potential for selected area.

Figure 7. The solar cadastre of Boston city – calculation of solar potential

Source: www.cityofboston.gov

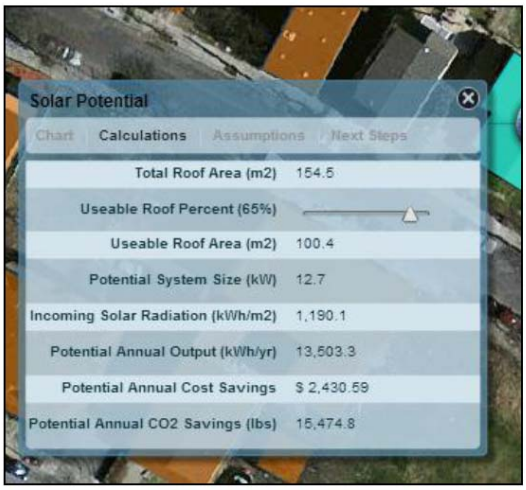

Figure 8. The solar cadastre of Boston city – "Calculations"

Source: www.cityofboston.gov

Geoportal unfortunately created a model of the detail CityGML LoD110, which assumes that each roof is flat. This is a big minus. Installations with sloping roof facing to the north do not agree.It is true that the tabs for solar calculations, calculated the surface area which is suitable for development, but included here are only obstacles, for example in the form of chimneys. The roof is further adopted as a flat. The result is that the user must ask for help from specialist companies to install solar installation in his home.

Solar geoportal for Vienna, is placed on the official website of the city in the "Umweltgut." The program includes the potential of solar energy for the production of heat and electricity.Solar cadastre was created through the use of ALS data saved in the form of GRID (mesh opening of 0.5 m). Finding the web application and its use, it is very easy for a potential user. The program assesses the orientation and slope of the roof, shading caused by plants, buildings, and terrain. Direct radiation and scattered radiation from the period of 18 years, were averaged. On the map shown is only sunlight above 900 kWh / m2 [www.wien.at].After clicking the cursor on a specific building, it shows the information about the solar potential of this building (Figure 9).Solar Portal for Vienna based on the model takes into account the actual shape of the roof, determined on the basis of detail CityGML LOD2, so we know exactly which part of the

roof is suitable for installation. Innsbruck Laser DaneGmbH is a company that made a map of the solar potential for the Austrian capital. This is one of the best prepared, clear and having much information solar map. Anyone interested in installing the solar installation can also read from it,if he needs some additional permits for the construction or must adhere to specific laws.

Figure 9. The solar cadastre of Vienna city (Wien Umweltgut: Solarpotenzialkataster)

CONCLUSIONS

As shown there are different types of solar cadastre. The differences result from the selection of data, detail of the model, the information provided on the site, layout of the page. All, however, are designed to promote the use of renewable energy from the Sun and estimate the efficiency of future installation.
In Poland, unfortunately, no city does not have an Internet portal, which are placed the solar potential map.

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UPDATE OF LAND USE ON THE BASIS OF SURVEYING AND ORTHOPHOTOMAP

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Abstract

The aim of the study is to show the methods of determining the borders of cultivated land and show problems during the update of their status. The current surface of cultivated land is necessary to be known in detail for calculating the exact amount of taxes and subsidies of agricultural land.Discrepancies in the measurements as well as in the use of outdated data can lead to errors in the methods of calculation. The study compared two methods based on differences in determining the land. GPS measurements and the results obtained from orthophotomap were used. The study used agricultural parcels in the possession of the Wroclaw University of Environmental and Life Sciences in Lower Silesia. The research has shown differences in the determination of land borders by using different methods and sources of measurement.

Key words:*Ortophotomaps, GPS measurement, land use*

INTRODUCTION

Land survey issues in Poland are regulated by Act of 17 May 1989 - Geodesic and Cartographic Law.The scope of the Law covers the following matters:
– national system of land information, i.e. spatial databases, concerning specific areas, aswell as procedures and techniques used for the systematic data collecting, updating andproviding;
– registry of land and buildings (real estate cadastral survey), i.e. a uniform, systematicallyupdated set of data on land, buildings and flats, their owners, as well as other naturalor legal persons who manage those properties;
– state surveying and mapping stock, i.e. collections of maps and photogrammetricmaterials, remote sensing materials, registers, lists, databases, survey data directoriesand other documents prepared as a result of completed land surveying and mappingoperations;
– inventories and lists of utilities, i.e. all types of overground, ground-based andunderground ducts and water pipelines, sewers, gas pipeworks, district heat networks, telecommunications, power engineering and other cabling (with the exclusion of detailedland melioration equipment), as well as registry of underground structures, such astunnels, underground passes, parking yards, tanks, etc. (Act of 17 May 1989)
Land and Property Register, according to the Polish law, is a unifiedfor the country, regularly updated collection of information about land, buildings and premises, their owners and other natural or legal persons managing the land, buildings or premises.(Regulation, 2015; Regulation, 2001).According to the Law, data included in the Land andBuilding Register provide a basis for:business planning and spatial planning, as well as public statistics, taxation and benefits, and marking of properties in Land Registers (Surowiec Stanislaw, 1982). The register covers the whole territory of the Republic of Poland, without any areas of the territorial sea. The head of the district leadsLand and Property Register and Soil Classification Register.
According to the Polish law the land use is continuous area of land, separated due to a uniform usage. There is eight land use types.

According to the Polish land register, agriculture areas comprise arable land, orchards, grassland, andpastures. Forests and forest land include areas with a minimumsurface area of 0.1 ha containing tree stands and areas temporarilydevoid of tree stands. Settlement areas are further divided intodeveloped, non-developed, and green areas. Developed settlementareas are then further divided into housing, industrial, and otherareas. Other developed settlement areas include land plots withbuildings connected with the government, education, health care,services and worship. The non-developed settlement areas encompassthe areas that are situated in the settlement investment zoneand are not intended for agricultural or forest purposes, but havenot been developed (non-developed plots that are not used in anyother manner). The green areas include recreational and sportsareas, and plots with historic buildings. In Polish Register there is also category like: wasteland, land under water, ecological areas and other unclassified lands. Every land use has own symbol, for example: ecological land has "E" as a symbol, wasteland – "N", forestlands – "L". The symbols and classification is defined in Regulation of the Minister of Regional Development and Construction of 29 March 2001 on the registration of land and buildings (Regulation, 2015; Malina Ryszard, Kowalczyk Marian, 2009).

According to the Polish law, the allocation of land to the various land use is determined by:

1) the information contained in the documentation of soil classification of land,

2) the actual way of using the land determined by the criteria of Annex 6 of Regulation of the Minister of Regional Development and Construction of 29 March 2001 on the registration of land and buildings.

3) The findings contained in the existing legislation concerning the internal waters and land use (Regulation 2001; Regulation, 2015).

The aim of the work is to analyze of data accuracy the course of borders of land use, their measurement to determine the new boundaries using GPS measurement and the calculation of the area of new land use and update area accordance with applicable law.

MATERIALS AND METHODS

In order to update the cultivated land boundarieswere used:ortophotmaps of selected area,surface data fromthe Agency for Restructuring and Modernisation of Agriculture ARMA and GPS survey date.

The data, collected from the Agency for Restructuring and Modernisation of Agriculture ARMA, Land and Property Register and Geodesy Documentation Centre, have been analysed and used to calculate the area changes for selected area (percel number 103/4 in the village JanowiceWielkie, close to Jelenia Gora city, Lower Silesia District – Figure 1). The land use boundary of selected parcel has been calculated two times with date from two sources: ortophotmap date and GPS survey data The program C-GEO was used to calculate the surface of parcel and land uses.

Figure 1. Topography map of the area (Source: geoportal.gov.pl)

Figure 2. Boundary map of the selected area

RESULTS AND DISCUSSIONS

Update of land use is important for the cadastral system. Data registration fulfill its task only if these date are up to date.

Calculation of taxes or subsidies based on these data. Information contrary to the facts lead to false calculations of charges. Outdated data make difficult any work associated with land development and spatial planning.

According to the "Act of 18 December 2003 on the National Register of Producers, Register of Farms and Register of Applications for Payment", the Agency for Restructuring and Modernisation of Agriculture ARMA, creates and caries out the National Register of Producers, Register of Farms and Register of Applications for Payment.One of the components of the national system is the Land Parcel Identification System LPIS. The Agency for Restructuring and Modernisation of Agriculture provides the cadastral data in a WMS service within the polish territory with the exception of some larger cities. The shared layer contains information about the approximate boundaries of the parcels. Therefore, they can be used only for the approximate identification and spatial location of the parcel and to estimate its area.Cadastral data is not the Land and building registration within the meaning of "Regulation of the Minister of Regional Development and Construction of 29 March 2001 on the land and building registration".Register of Applications for Payment is based on data from ortophotomaps. These date are more current than date from the Land and Building Register.

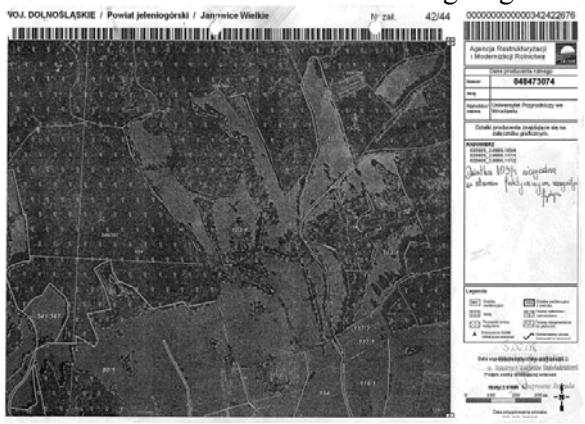

Figure 3. Ortophotomap of the selected area – the parcel 103/4

Table 1. The current state (before the update) for parcel 103/4

	Number of parcel	Surface of parcel [ha]	Type of land use	Soil class	Surface of land use of selected parcel [ha]
1	103/4	40.7597	Ls	III	0.1878
			Ls	IV	4.2948
			Ł	V	0.1609
			Ps	IV	31.4237
			Ps	V	4.6925
					40.7597

Table 2. The new state (after the update) for parcel 103/4

	Number of parcel	Surface of parcel [ha]	Type of land use	Soil class	Surface of land use of selected parcel [ha]
1	103/4	40.7597	Ls	III	0,1610
			Ls	IV	9.6820
			Lz		0.0989
			Ł	V	0.1406
			Ps	IV	26.4764
			Ps	V	4.2008
					40.7597

Ls – forest area
Lz – bushes and wooded area
Ł – meadow/ grassland area
Ps - pasture area

Table 3. Differences between surfaces of annualized area

Number of parcel	Surface of parcel [ha]	Surface of forest areas [ha]	Surface of agriculcural area, which are used PU	The area reported to subsidies Pz	Surface from ortophotomaps data PA	The diffrence Pz - PU	The difference of surface PA - PU
103/4	42,04	9,73	32,31	37,28	32,18	4,97	-0,13

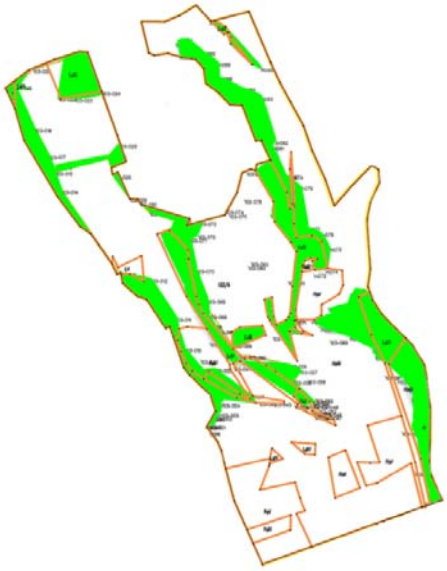

Figure 4. The differences between GPS and ortophotomap measurement on map – parcel 103/4
Green colour – forest land: GPS measurement, orange lines: ortophotmaps measurement
(Source: own work, program C-GEO)

Table 1 and 2 shows the differences between the current state and the new state. GPS Survey showed the changes that have taken place in the parcel. It has changed the amount of land use and their size. It has grown forest area, it has appeared bushes and wooded areas. Agricultural areas (pastures and meadows) accounted for 36.2771 ha (89%) in the parcel and other areas (forests) 4.4826 ha (11%). After measuring, the situation has changed: the new state of the surface of the agricultural land is 30.8178 ha (76%) and the forest area is 9.9419 ha (24%). The area of agricultural land decreased by 13%. The largest decrease was observed in the surface of pastures, class IV and the area decreased by 4.9473 ha (by 16% of the state before measurement). The changes are shown on Figure 4. This situation is caused by bad agricultural procedures and practice. The decrease in agricultural area resulted in a reduction of subsidies for these areas.

Table 3 shows a surface summary. The calculated differences showed surface changes. It showed that the actual surface, which is declared for subsidies, it is about 4.97 ha less than previously declared. Another difference showed changes between the measurement surface using GPS and orthophoto. The difference is 0.13 ha (0.4%). The most precise measurement technique is a GPS method. However, it is more labor intensive and costly method. Measurement using orthophoto is less accurate, but for the purposes of subsidies, the accuracy is sufficient.

CONCLUSIONS

Orthophotomap is an effective tool for obtaining data on current land use.

Calculated surfaces are close to the measured surface of the orthophotomap. It testifies to the fact that to determine the land area is preferable to retrieve data from aerial and satellite materials than the materials from the land register, because these are not updated for a long time.

Calculations showed a discrepancy between the survey surface of parcel and cadastral surface of parcel.

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