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8. **Tudor Sălăgean**, Dumitru Onose, Mircea Ortelecan, Paul Sestras, Dan Vele, Mariana Calin, Raluca Farcas. Aspects Regarding the Observations of Vertical Displacements of Rockfill (Riprap) Dams. Scientific Papers. Series E. Land Reclamation, Earth Observation & Surveying, Environmental Engineering. Vol. IV, 2015, ISSN 2285-6064, pg. 165-170.
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DETERMINING STOCKPILE VOLUMES USING PHOTOGRAMMETRIC METHODS

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Abstract

Stockpile volume measurement is very important, especially in highway construction sites. Monitoring inventories, as well as keeping records of stockpiles, is one of the key elements in the success and optimizing the construction site works. Inventories in the case of construction sites are constantly changing; the raw material stored is on the one hand supplied by the suppliers and on the other hand transported and used on the site. Within this paper we aim to compare different methods of measuring and determining volumes. We also develop a workflow for UAV photogrammetric measurements and compare the volumes obtained with different specialized software. Using different software even on the same UAV data set, we obtained relatively similar results, the differences being due mainly to the different 3D modelling of the surfaces. To determine as precisely as possible highway construction sites, stockpile volumes the UAV photogrammetric method is the most precise in terms of the accuracy of the results obtained. This method also saves a lot of time on the site and is also risk free.

Key words: *drone, photogrammetric, point cloud, stockpile volume, UAV technology.*

INTRODUCTION

Determining stock volumes is an activity of particular importance.
Monitoring inventories, as well as keeping records of raw materials as accurate as possible, is one of the key elements in the success of the works.
Inventories in the case of construction sites are constantly changing; the raw material stored is on the one hand supplied by the suppliers and on the other hand transported and used on the site. We can compute the stockpile volumes using various methods like: terrestrial measurements using a total station, GNSS techniques, photogrammetry and the newest technology, laser scanning (Raevaa et al., 2016).
In order to manage efficiently a stockpile, it is required a fast and accurate data gathering. Gaining up-to-date information consists of continuous surveying the constantly changing shape of the stockpile and its elements and computes the volume. Monitoring could take place weekly, monthly or every 3 months (Mazhrakov, 2007).
The UAV techniques combine aerial and terrestrial photogrammetry but also introduce low-cost alternatives to the classic methods (Carvajal et al., 2011).
Comparing to classical volume measurement methods, close range photogrammetry is a more efficient method. The time required for collecting spatial information id much reduced. The accuracy of the volume calculation is proportional to the presentation of the land surface. The presentation of the surface on the other hand is dependent on the number of coordinated points, their distribution and its interpolation (Raevaa et al., 2016).

MATERIALS AND METHODS

Nowadays UAV platforms are becoming more and more accessible, and photogrammetry is used frequently.
Classical measurements, which are very time consuming, can be easily replaced by laser

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ASPECTS REGARDING THE ANALYSIS OF HORIZONTAL DISPLACEMENTS AT CUMPĂNA DAM, ARGEŞ COUNTY

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Abstract

The paper presents the tracking of the behavior in time of Cumpăna Dam by establishing the horizontal displacements (dx and dy) compared to the base tranche and the previous tranche, and also the processing of these measurements and establishing conclusions and recommendations regarding the behavior of the objective taken into study. The planimetric tracking network used in the case study consists of 7 pilasters and 25 tracking marks. The azimuth and zenith observations made in the case of Cumpăna Dam were conducted with the total station of geodesic order, Leica TM 30 which provides an angular accuracy of 0.5 " or 1" and a distance measuring accuracy of 0.6 mm + 1 ppm on the prism, respectively 2 mm + 2 ppm to any surface. A condition for the accurate determination of absolute displacements of the construction is the stability of geodetic network points. The compensation of the micro-triangulation network was performed in block, using the least squares method.

Key words: *concrete dam, horizontal displacements, micro-triangulation, tracking marks.*

INTRODUCTION

In order to ensure protection and safety of dams it should be considered the action that water exerts on these hydro-technical constructions (Hann, 2015).

By creating accumulation lakes, dams produce a variety of effects on the environment such as the change of: climate regime, biological regime, groundwater regime from the slopes which support the dams (Brebu et al., 2010; Herban et al., 2015).

In order to avoid natural hazards such as breakage of dams, their overthrow, landslides, water spilling in the downstream etc. It requires the monitoring of the behavior in time of these hydro-technical constructions, beginning with the construction period, during commissioning, as well as during exploitation.

The aspect regarding the monitoring of the behavior in time and ensuring dam safety is regulated by Law no. 466 from 18th of July 2001, for approving the Government Emergency Ordinance no. 244/2000 (Hann, 2014; Popa, 2012; Burghila et al., 2016).

Support networks related to the tracking of concrete dams, of hydro-technical or hydro-energetic objectives are in the form of a micro-triangulation local network with high accuracy (Dima, 1999; Ghitau, 1983; Ortelecan, 2006; Salagean et al., 2016).

Support network points (pilasters) of which are made the zenithal, azimuth and distance observations are constructed of reinforced concrete that are embedded in solid bedrock, giving them the certain stability.

At the top of the pillars, immediately after their concreting, is placed a special plate for forced centering the geodetic instruments (Ortelecan et al., 2012).

Paper presents the tracking of the behavior in time of Cumpăna Dam by establishing the horizontal displacements (dx and dy) compared to the base tranche and the previous tranche, and also the processing of these measurements and establishing conclusions and recommendations regarding the behavior of the objective taken into study.

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PROSPECT OF A GIS BASED DIGITIZATION AND 3D MODEL FOR A BETTER MANAGEMENT AND LAND USE IN A SPECIFIC MICRO-AREAL FOR CROP TREES

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Abstract

There is a great need for an efficient geographic information system (GIS) implementation in interdisciplinary domains for providing useful information for scientific and managerial processes of further improving land-use planning and decision making in horticulture. The main goal of this study was the creation of a digital map and GIS application for the Fruit Research Station in Cluj-Napoca, North-Western Romania. The benefit of this implementation is a fully integrated land information system, where information is accessed omnipresent for processing, value adding and further analysis. The created model is as a modern solution for obsolete analogue maps, sketches, inventory and land records that are usually unreliable and poorly represented in agricultural productive units. Using the created GIS database and spatial analysis there were obtained a very useful orchard mappings that incorporate management and economical attributes essential in land planning. Future focus and development will be mainly on system maintenance, including system enhancement and upgrading rather than to create a new systems. Under the constant pressures of urban sprawl and land degradation in this area, the paper conducts towards a guideline and model for an effective use of land resources to the best advantage and capacity.

Key words: GIS database, land planning, management, orchard mapping, spatial analysis

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1. Introduction

Land is one of the most important resource without which humankind cannot survive (Brevik et al., 2015; Keesstra et al., 2016). Recently, the population growth and urbanization, effects of climate change, erosion, pollution etc. are increasingly affecting this resource (Berland et al., 2017; Carlson and Dierwechter, 2007; Martinez-Hernández et al., 2017; Nikolic et al., 2019; Rodrigo Comino et al., 2016). Land plays an essential component for the creation of economic growth in developing countries

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THE USE OF LASER SCANNING TECHNOLOGY IN LAND MONITORING OF MINING AREAS

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Abstract: The use of laser scanning for topographic monitoring in areas of closed mines is useful for preventing and detecting problems which can negatively influence the environment and the population. In Romania, almost all perimeters with salt deposits present the phenomena of instability, both underground as well as at ground surface. Terrestrial laser scanning was performed with a 3D laser scanner on the corresponding surface of mine Victoria, Slănic Prahova salt deposit, Prahova County with a network support made using GNSS technology. The density of the approximately 23 million points was of 600 points/m^2 with an accuracy of less than 1 cm on a surface of 38515.84 m^2 (3D surface), respectively 36717.30 m^2 (2D surface - in horizontal projection). For comparison and control of the registration, two methods have been applied, namely using a scanning interface control for the first and making of the registration using the *traverse method* for the second. Based on data obtained from laser scanning we realized the DEM (Digital Elevation Model) and the level curves, both obtained using the model TIN (Triangulated Irregular Networks), which is a network of spatial triangles. The volume of the resulting material by overlapping areas (that generated by 3D scanning and the one generated by vectorizing contour lines) was -250 490.01 m^3. The most important deformation of the studied area is outlined on the right side of the stream Baia Verde, in the area of Slănic relay, having a value of -14.7 m. Tulburea stream slopes are affected to an extent of 60-70% by landslides of areal nature. In terms of displacements and deformations active geomorphologic processes shaping the landscape on large surfaces are present in the studied area. The most intense and widespread are sliding processes, erosion and dissolution of salt. In the mining area more and more frequently are recorded landslides, which make the formation of water sources infiltrations through unveiling at certain points the massif of salt. The use of laser scanning reduces the time to perform measurements, which helps the correct interpretation of scanned targets.

Keywords: level curves, land shifting, digital design, salt mine, 3D scanning

1. INTRODUCTION

Topographic monitoring of lands and buildings in the area of closed mines is made in order to prevent and detect possible problems that may occur after completion of closure and rehabilitation carried out in the area and can impact of the gravest the environment and the population (Prokop & Panholzer, 2009).

As a result of extracting a volume of useful minerals from a deposit, the state of stress and strain

sustainability

MDPI

Article

Landslides Susceptibility Assessment Based on GIS Statistical Bivariate Analysis in the Hills Surrounding a Metropolitan Area

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Abstract: In the highly populated analysed territory, the expansion of the construction zones and the pressure imposed on the slopes by the housing and transport infrastructure led to the appearance and reactivation of mass movement processes that affects the population and the environment. The purpose of this study consist in applying the principles of bivariate statistical analysis in order to determine the dynamic potential of a territory, taking into account the statistical relationship between the independent variables represented by predisposing and triggering factors of landslides (slope, geology, land use etc.) and dependent variables, in this case: landslides. The identification of the degree of validation of the results was determined by calculating the AUROC (Area under the Receiver Operating Characteristic) value, whose value of 0.854 highlights the representativeness of the chosen model. The analysis of landslides susceptibility highlights the inclusion of the territory represented by the hills surrounding Cluj-Napoca metropolitan area, Romania, on the classes of spatial occurrence of these processes.

Keywords: BSA (Bivariate Statistical Analysis) model; GIS (Geographic Information System) analysis; Landslide modelling; ROC (Receiver Operating Characteristic) curve

1. Introduction

Landslides along with erosion processes represent natural hazards with a large area of manifestation in Romania [1–3], affecting the transport and removing significant land areas from the category of production lands, which makes it necessary to identify measures to mitigate the negative effects and reintegrate these territories into useful build-up areas and infrastructure, as well as productive agricultural circuit [4,5]. Landslides are part of the gravitational processes that occur when the steady state of the slopes is affected as a result of overgrowth of the geological substrate of

Creating the Cartographic Database and Informatization of the Systematic Cadastre Works Process

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Abstract

The main objective of this paper is to correlate the current cartographic database with the old one, in the systematic cadastral works. Implementing a GIS and a geodatabase containing the cartographic database is necessary for identifying the buildings in the systematic cadastral works. In order to obtain the actual mapping database, a Phantom 4 PRO drone was used, with a 20 mp resolution camera. For determining the ground reference points there were used two South S82V GPS receivers with double frequency L1, L2, in base-rover radio mode. The existing cartographic database has been taken over from the Cadastre and Land Registration Office and integrated into the newly created geodatabase. With a unique GIS database, the process of identifying new buildings with old land data is done in a fast and efficient way. The accuracy of the new cartographic database provides greater security identifications, which can be affected even in the office, especially for those owners who have not submitted the stage of identifying the land. The exploitation of UAV photogrammetric measurements come in support of specialists carrying out systematic cadastre works, especially in the context of the low price per building imposed by the National Agency of Cadastre and Real Estate Advertising.

Keywords: geodatabase, GIS, systematic cadastre

Introduction

Taking into account the National Cadastre and Land Book Program developed by the National Agency of Cadastre and Real Estate Advertising, the realization of the cartographic database is a topical subject. The correlation of the current cartographic database with the old one is of great importance, especially because in the northern part of the country, in the area of influence of the old Austro-Hungarian Empire, there are topographic maps at scale 1: 2880, respectively old land records in which property records were made.

Considering the provisions of Law 18/1991 and later those of Law 247/2005, respectively the provisions of land retrocession are in contradiction between the two laws, the first stipulating the mass restitution of the land, in the order of filing the application, and the second retrocession on the old location, integration of the old database and its correlation with the new database is absolutely necessary.

One of the turning points in terms of agricultural land was 1990, when the political regime and, implicitly, the legislative regulations changed, similarly happened in all other countries

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Original Article

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Ameliorative, Ecological and Landscape Roles of Făget Forest, Cluj-Napoca, Romania, and Possibilities of Avoiding Risks Based on GIS Landslide Susceptibility Map

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Abstract

The functions and conventional roles of the forests have to be largely reconsidered when such forests are located in the close proximity of urban centres. The subject of this study was to evaluate different natural risks, especially landslides at an experimental study area that is located in Făget Forest, near the city of Cluj-Napoca, North-West of Romania. Although most of this area is stabilized, human activity became in the last period the most aggressive and active factor that can induce changes in slopes stability. The evaluation based on new changes at the terrain and constructions has clearly revealed the effect of the unprecedented urban sprawl and the expansion of infrastructure elements and residential buildings. Landslide susceptibility map was elaborated using a bivariate statistical analysis and the Geographical Information System (GIS) technology on a predetermined path inside the forest, as well as obtaining valuable information about the tree species. Based on 14 surveys, each of them covering an area of 500 m^2 on a longitudinal transect of the forest, there were identified relatively few tree species with a significant share: *Carpinus betulus* (42.9%), *Fagus sylvatica* (24.9%), *Quercus petraea* (23.2%) and other species (9%). Their positive roles in avoiding or limiting the flow on slopes, flooding, landslides are different depending on the position, terrain, forest composition, trees density, slope, exposition, but it is fundamentally beneficial. Furthermore, these species can assure productive (as wood), ameliorative, ecological, landscape, cultural, educational, relaxation roles, and consequently inestimable values.

Keywords: database, forest inventory, GIS, landslides, landscape, spatial analysis

Introduction

The biodiversity of ecosystems is under a permanent threat and a similar menace is found at national as well as at the global level due to the reduction of forest areas, excessive pollution, climate change and anthropogenic interventions with destructive effects. Increased operational work, performed poorly and aimed to financial goals only, leads to failure in ensuring continuity of ecosystem functions, affecting the quality of forest genetic resources and biodiversity (Aerts and Honnay, 2011; Davis *et al.*, 2017).

Forests and green spaces are essential to the urban ecosystem and can mitigate temperature, decrease pollution,

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ASPECTS REGARDING THE OBSERVATIONS OF VERTICAL DISPLACEMENTS OF ROCKFILL (RIPRAP) DAMS

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Abstract

The paper refers to the monitoring of vertical displacements of rockfill (riprap) dams, displacements caused by the process of material compaction of dams. In order to monitor the vertical displacement, on the weir crest and berms situated on the downstream-side were placed tracking markers. To determine the vertical displacements was used a DNA 03 level and DNA levelling invar staff. Measurements processing was done rigorously through the method of conditional measurements and indirect measurements. The case study was conducted on the Belis Fantanele dam using the measurement periods of May to October 2013, respectively from March to November 2014. The maximum recorded value of compaction is 312 mm on the RN10 landmark located on the dam weir crest.

***Key words**: compaction, geometric levelling, rigorous processing.*

INTRODUCTION

In the case of hydrotechnical planning, an important component is the upstream dams that form the lake basin which constitutes the driving force (Li and Wang, 2011).
Dam stability is very important considering that if it succumbs, great materials and sometimes life losses occurs downstream (Kalkan et al., 2010).
Considering this fact, dam stability is monitored through topographic measurements regarding their vertical and horizontal movements (Manea, 2013; Onose et al., 2014).
In the case of concrete arch dams, horizontal displacements predominates, and in the case of rockfill dams, vertical displacement predominates (Ortelecan et al., 2014; Sails et al., 2014).

MATERIALS AND METHODS

To determine the vertical displacements on the weir crest and downstream face, tracking landmarks are placed to observe vertical displacements.
Considering the small values of displacements, to record these displacements is used high precision geometric levelling and the measurement processing is performed by rigorous methods using functional models from conditioned measurements and from indirect measurements (Dima, 2005; Onose et al., 2009).
For a levelling traverse with known height points at the ends, a correction equation can be written as presented:

$$a_1 v_1 + a_2 v_2 + \cdots + a_n v_n + w_1 = 0; \qquad (1)$$

where:
a_i – correction coefficients;
v_i – measured elements corrections;

Original Scientific paper

The Automatization of Forest Management Works in Romania using GIS and UAV Photogrammetry

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Abstract

Developing forestry management maps, in Romania, is essential especially in the context of illegal logging. Specialized law requires elaboration of forest management maps to regulate the work of cutting, sanitation, conservation, harvest optimization etc. The area taken into study is around Lake Nistru, Maramureș county, Romania. This paper aimed to develop a workflow in order to automate the forest management mapsrealization and also to highlight the benefits of using digital photogrammetry and GIS techniques. We acquired highresolution data (0.0589 m spatial resolution) using a consumer-grade Unmanned Aerial Vehicle (UAV) a having on board a 24.3 megapixels digital camera. By processing the photogrammetric data we obtained a point cloud with a density of 18 points/m2 and a digital elevation model with a resolution of 23.6 cm/pixel. By using some GIS spatial analyst tools, we obtained the cartographic support for forest management. Based on the high accuracy point cloud we analyzed the possibility of computing the wood mass, applying methods like the regression equations. We also determined the necessary forest management elements: surface, consistency, exposure, medium altitude. For referencing the photogrammetric measurements 8 ground control points (GCP) were used for which we computed the root mean square error (RMSE) related to the spatial coordinates (X, Y, Z): 6.059 cm on X, 3.761 cm on Y and 4.596 cm on Z.

Keywords: Forest management map, GIS database, point cloud, UAV photogrammetry

Introduction

The role, importance and methods for forest management maps

The importance of forests for our planet and for humanity is well known, the forests offering materials and shelter for satisfying the needs of living (Giliam, 2014).

For a durable management of the forests, knowing them both from a quantitative perspective, as geospatial extent, as well as from a qualitative perspective, as structure and condition is necessary. Taking into consideration the high costs of forestry arrangements by classical means, new methods have to be implemented. The forest is a complex, whose exploration under the two aforementioned aspects was realized in the beginnings of the management by classical methods, involving movements and measurements, often in rough and barely accessible terrain(Vauhkonen *et al.* 2014; Clark *et al.* 2000).

The investigation methods of the standing crop evolved, so that for the aid of foresters, new techniques and modern remote sensing methods have evolved, offering a superior efficiency that

Using Photogrammetric UAV Measurements as Support for Classical Topographical Measurements in Order to Obtain the Topographic Plan for Urban Areas

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ABSTRACT

This article aims to highlight the benefits of UAV photogrammetric measurements in addition to classical ones. It will also deal with the processing and integration of the point cloud, respectively the digital elevation model in topo-cadastral works. The main purpose of this paper is to compare the results obtained using the UAV photogrammetric measurements with the results obtained by classical methods. It will briefly present the classical measurements made with the total station. In the present project, the closed-circuit traverse and the supported on the endings traverse were made using known coordinate points. Determining the coordinates of the points used for the traverses was done by GNSS methods. The area on which the measurements were made is 67942m^2 and is covered by 31 determined station points. From these points, 13 were used as ground control points, respectively components of the aero-triangulation network and 17 points were used to control the obtained results by comparing their coordinates obtained by classical methods with those obtained by the UAV photogrammetric method. It was intended that the constraint points of the aero triangulation to be uniformly distributed on the studied surface.

Keywords: *photogrammetric measurements, point cloud, topographical plan, UAV*

INTRODUCTION

In the close past, the development of cheap high quality digital cameras and the computation power of personal computers has led to rebirth of what was once "the old cartographic dream" of modelling the world in 3D.

With UAV photogrammetric technology, topo-cadastral panelling is becoming a relatively easy task. Of course, as all the emerging technologies have to be tested, constantly improved, but especially to gain the attention to gain the trust of specialists in the field, it has to be tested compared to classical methods. The main purpose of this article is to identify the main advantages and disadvantages of UAV photogrammetry technology compared to classical methods. (Popescu, 2009; Popescu, 2010) We ask ourselves to analyse both from the efficiency point of view, in terms of time spent in the field, but also from the point of view of precision.

For geomatics applications, the first experiences were carried out by Przybilla and Wester-Ebbinghaus (1979). In the last years, more and more applications of UAVs in the geomatics field became common (Remondino *et al.*, 2011).

UAV photogrammetry indeed opens various, new applications in the close range aerial domain and introduces also a low-cost alternatives to