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USING IMAGES ACQUIRED FROM A RURAL AREA WITH UNMANNED AERIAL VEHICLE IN ORDER TO ACHIEVE THE LAND AND CONSTRUCTIONS CADASTER

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Abstract: *The present paper aims to establish whether and to what extent Unmanned Aerial Vehicle (UAV) technology proves to be useful and what precision can be obtained within the build-up area with this type of data. The methodology was applied on a series of photogrammetric surveys from the build-up area of Crizbav, Brasov, Romania, that were compared with official data obtained following the registration of all properties from this village. Two cartographic products as orthophotomaps have been obtained for the studied surface (with and without the use of ground control points). The high precision orthophotomap of was used for the vectorization of lands and constructions, and the data obtained have been compared to the official ones, the results being analyzed from different point of views. So, it was discovered that the differences between the coordinates are distributed according to Gauss curve, a percentage of 42 is registered in differences of up to 20 cm, and between them and the surface differences is a connection given by a high correlation coefficient.*

Key words: *UAV, build-up area, ortophotomap, vectorization, coordinates.*

1. Introduction

1.1. UAV in Different Applications

The development of the economy takes place continuously and rapidly, being necessary new products and technologies in order to answer the human needs and requests related to urbanism, environment, cadaster, with the purpose to ease people's work [13].

In our days Unmanned Aerial Vehicle technology is used on large scale in photogrammetry worldwide, because the flight is completely autonomous and allows the reception of images from the area studied automatically. The reduced cost and automatic flight feasibility, above the interest objectives, may be considered as the main advantages of this technology in photogrammetric applications. Using the GNSS/IMU (Global Navigation Satellite System/Inertial Measurement Unit)

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positioning technology, the images may be taken over according to a pre-established flight project, and the exterior orientation parameters (X, Y, Z coordinates and ω, ϕ, k angles) of the perspective center may be directly determined [5].

At present, the use of UAV in photogrammetry is in the process of development and the information regarding the newest progresses and discoveries in the field come from the results published in the main research centers from the whole world. For example, Colomina and Molina (2014) describe the evolution and the technique stage of aerial systems without pilot in the photogrammetry and remote sensing field putting the accent on regulations, acquisition systems, navigation and orientation.

The use of UAV in applications such as the environment monitoring, landslide, mapping, surface mining, urban cadaster, are described by [8-10, 16, 23]. The results obtained demonstrated that UAV technology has a great potential in this field. Other studies related to UAV use, as mean of image taking over, are presented by [17, 20, 31]. Also, UAVs are used in different mapping applications, such as historical sites mapping, landslides, for topographic and disaster management purposes [4, 15, 21, 25, 30].

In relation to the achievements in the cadaster field, a study made by van Hinsberg et al. (2013) presents the use of UAV for taking over aerial images based on which the lot delimitations have been achieved with a precision of up to 3 cm, similarly with the precision obtained by classical topographic measurements. Also, [11] shows that UAV may take over aerial images with a very high precision and, in a lot of situations, it may be an advantageous alternative for replacing the classical topographic measurements. Studies regarding the use of UAV in the field of measurements and cadastral applications also have been achieved by [1, 6-7, 24].

The use of UAV for topographic – cadastral purposes means the achievement of high precisions, and for this purpose they must be placed at ground control points (GCPs) [22]. These GCPs must be carefully selected, must be evenly distributed and visible in as many images; also CGPs must be easily identified in the acquired images, and, in the field, to be determined with the help of GNSS technology [33].

1.2. The Use of UAV in Romania

For Romania the problem is related to the cadaster materialization within the build-up rural areas, which is significant because, according to the proposed methodology until not long ago, it was based on the use of old mapping materials, which do no longer give the real situation on the field [2]. According to the information given by the National Agency for Cadaster and Land Registration, the institution that governs, operates and checks the works in the cadaster and land registration field from Romania, approximately 29% (August 2018) from the lands are registered in the digital system [35].

The update of cadastral plans in digital format using different techniques is an important preoccupation in Romania. For this subject, different editions of orthophotomaps have been achieved in the period 2003-2005, 2009, 2010, 2012, 2016, but on small sections from the country surface. These, along with the cadastral maps obtained by stereorestitution method according to the technology and methodology of the ’70, are used for the resolution of different problems, but they are insufficient. Moreover, the precision offered by these products is no longer present for the capabilities offered by the new technologies.

Although UAV technology is intensely used worldwide, on the national plan there is no culture for UAV use equipped with digital sensors in order to obtain mapping products of high precision. Still, there are many private companies that make researches in this field with notable results, one of them managed to develop his own UAV that was used for taking over aerial images for forest development, recognition and achievement of systematic cadaster, etc.

In the study achieved by Munteanu (2009) was used the orthophotomap in order to achieve the cadaster plans in the agricultural fund outside the build-up area of localities. The results obtained by comparing the data collected by classical measurements with other obtained by the vectorization of orthophotomaps were satisfactory in terms of precision, according to the regulations in force.

Palamariu et al (2015) used a Dji Phantom UAV equipped with a digital camera Nikon Coolpix L810 and a total station Leica TCR 805 in order to make a work methodology fir 3D cadaster realization for a build-up area of a rural region from our country. The study shows no results regarding the details positioning precisions and it did not introduce into discussion the limitations of the methodology proposed to be used.

The main objective of this study is the use of orthophotomaps obtained with UAV system flights of small dimensions in order to make the cadaster for properties from the build-up area of rural regions. The specific objectives were: (1) drafting the orthophotomap using UAV by using the ground points and without using the points; (2) the identification and realization of differences between the boundaries and surfaces obtained by vectorization of orthophotomap and those from the official database of the National Agency for Cadaster and Land Registration (e terra 3); (3) identification of constructions on the orthophotomap comparatively with terrestrial measurement.

2. Material and Methods

2.1. Study Area

The area studied is located between 45o 48’ 50”and 45o 48’ 56” northern latitude and 25o 28’ 07” and25o 28’ 37”eastern longitude, and is part of the territorial administrative unit of Crizbav from Brasov County, Romania (Figure 1). This area was chosen because here were made and received works of cadaster with the program CESAR (Complementing EU Support for Agricultural Restructuring Project), and this way, these data are references for the results obtained from the researches.

The flights with UAV technique, GNSS observations and terrestrial measurements have been done mainly on the Main Street for all the properties with exits at this street. In total there have been collected data from a surface of approximately 45 ha, of which were studied approximately 150 properties on which are about 300 constructions with different usage.

Fig. 1. Localization of researches

2.2. Materials

For the present study there were used materials from different sources. The reference data have been downloaded from the digital platform of the National Agency for Cadaster and Land Registration, named *e terra 3*, where the geometries of all lands and construction can be found and registered in the national graphic database. For the design of the optimal position of photogrammetric points for the office stage was used the orthophotomap edition of 2006. The determination of photogrammetric points coordinates on the field was achieved with GNSS ASHTECH PROMARK 800 system.

The digital images taking-over was performed with UAV DJ Phantom 4 PRO system, equipped with a digital camera, whose general characteristics are mentioned in the table below (Table 1).

The digital images processing was achieved with Agisoft Photoscan software, and the vectorization with AutoCAD software and the application TopoLT. The high number of images obtained and their size, determined the use of a computer with the following characteristics: two processors *Intel Xeon E5 2.10GHz*, two video cards *3071MB NVIDIA GeForce GTX 780* with *64 GB DDR3 RAM, 802MHz.*

Table 1

Main characteristics of
UAV DJ Phantom 4 PRO system

UAV Model	DJI Phantom 4 PRO
Camera	FC6310
Resolution	20 MP
Sensor width × height	6.48525 × 4.86394 mm
Image width × height	5472× 3648 pixels
Pixel size	2.41 μm
Focal length	8.8 mm
Maximum flight time	28 min

2.3. Methods

2.3.1. Determination of Photogrammetric Points

In order to assure the connection between the land and the aerial images, 12 photogrammetric points have been designed. Their selection was in visible places in order to be identified on the images and determined by GNSS technique, but it was also considered their uniform distribution on the area studied. Ground marking was achieved with metal bolts for the build-up area and special construction landmarks for the areas outside the built-up surfaces. The determination of the coordinates was done by using GNSS technique, Real Time Kinematic (RTK) method, Virtual Reference Station (VRS) work variant. For the determination of coordinates with high precision, the standing time for each photogrammetric point was of 10 minutes.

2.3.2. Taking Over the Aerial Images

In every project involving the use of UAVs or classic procurement techniques, the first stage must begin with the flight planning. For mapping purposes, this stage requires activities such as: obtaining flight permission, software selection, detailed area analysis and ground sample distance (GSD). In addition, other important aspects must be taken into account such as the flight height, the possibility of using the GNSS technique and inertial navigation system (INS), the location of the photogrammetric points in the field prior to the flight and the determination of their coordinates are also to be considered.

The aerial images were taken from a flight plan made with PIX 4D software with 80% longitudinal overlay of images and 70% band overlay (Figure 2). The images were acquired in the form of a photogrammetric block, from an altitude of 80 m, with a flight speed of 14 m/s.

Fig. 2. Flight plans made with PIX 4Dsoftware as four photogrammetric blocks

Due to the safety measures imposed by the UAV construction and control software, the size of the surface that can be overrun could not exceed certain dimensions. For this reason, in order to cover the entire study area (6.5 ha), four separate flights were performed with overlapping areas between them so that, when processing the images, to be enough common pixels between the end bands of the four flights.

2.3.3. Making the Orthophotomap

The main objective of photogrammetry is to extract 3D information from 2D images [18]. For this purpose, the inner orientation (IO - defines the perspective center of the camera view in relation to the image according to the main distance or focal length and the lens distortions) and the outer orientation (EO - defines the position of the camera according to the coordinates of the perspective center and the rotation of its optical axis assembly relative to the mapping frame) of the images that must be calculated. In traditional photogrammetry (with human onboard), the sensors used are metric cameras. These cameras have stable internal orientation parameters, usually estimated by the manufacturer through a camera calibration.

The first models of metric cameras which can be equipped with UAVs have recently been developed [19], but this study envisages the use of low-cost equipment, currently most of the sensors installed on UAVs are non-metric [1]. The consequence of using cameras in this category is that IO parameters need to be evaluated from their own data [18].

If there is GNSS / INS information, then the collected data helps to automatically extract the tie points between images, as it is possible to restore the position of the image at the time of the flight. Moreover, navigation data helps to georeferentiate the whole image, because the image projection centers are known (GNSS-assisted sensor orientation). When these data are unavailable or they have a low precision, the indirect orientation of sensors is made by using GCPs.

Once the IO and EO parameters are available, an alignment technique should be applied to represent the object space through daytime clouds. These point clouds must be structured, interpolated if necessary, simplified and textured for which the presentation and visualization to be as close as possible to reality [27]. A large number of computer-assisted image alignment techniques have been developed and featured over the last decade. They can be divided into two main classes [18]: (1) patch-based approaches and (2) semi-global approaches. In the first class is the multi-image approach presented in Furukawa and Ponce (2010), and in the second is the approach of Hirschmuller (2008) which was later improved [29, 34]. Patch-based approaches are often multi-image (that is, they use multiple images simultaneously to determine their homologous points and their 3D position), while semi-global approaches work with stereo pairs and then merge the clouds of generated points into one data set. Their quality is influenced by flight parameters such as GSD, image overlay and sensor quality.

The images taken with the DJI Phantom 4 PRO UAV were processed with Agisoft Photoscan software in order to get the orthophotomap in the studied area. The steps taken are those in digital photogrammetry [3, 33], but adapted to the system and technique used there in (Figure 3).

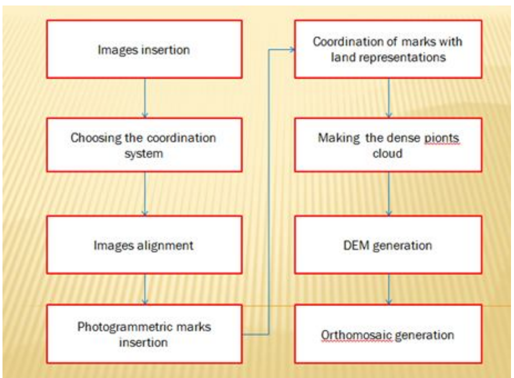

Fig. 3. Steps for realization of orthophotomap

The number of nadiral digital images taken over for the drawn flight project was of 1293 with their size comprised between 8 and 9 Mb.

Obtaining the orthophotomap with Agisoft Photoscan is based on the alignment operation of raw digital images and involves the identification of common pixels from each digital image by finding its position and orientation at the time of takeover. Thus, in the first alignment process a cloud of 786 943 common points was formed. In this process, each point is associated with the corresponding coordinates of the perspective image center from the time of takeover (image coordinates). The software allows the generation and view of a dense cloud of points obtained by the camera's position at the time of shooting for which it recalculates the depth of the information (pixel) in each digital image and combines it in a single cloud of points. Through this process, from the common points previously determined (786 943), 532 046 044 points were reached in the form of a dense cloud. The processing operation lasted 15 hours due to the large number of points determined.

For the orthophotomap with ground references, the dense cloud points are associatedwith the coordinates which result from the process of mark coordinates materialized on ground (land space) with their correspondent from the image space (Figure 4).

Fig. 4. Dense point cloud and distribution of photogrammetric marks within the studies area

The digital surface model (DSM) and the orthomosaic are obtained based on dense cloud points. These two sub-stages are linked to each other, because of the dependence between dense cloud and DSM and between DSM and orthomosaic. In this way, for the generation of DSM, the source is the dense cloud, and for the orthomosaic, the source is the DSM. Since the source of orthophotomap formation is DSM, it is called true-orthophoto (Koeva, 2016). Using these data sources, the risk of lateral images emergence or other type of errors is reduced.

2.3.4. Vectorization of Boundaries

The vectorization of boundaries was achieved by using the orthophotomap based on digital images taken with the

UAV. The boundaries between the buildings in the area studied were tracked manually and placed in different layers. After the vectorization of all reported boundaries, it was performed an overlaying over the official boundaries exported from the ANCPI database (e terra 3) and a visual inspection was made for the first time (Figure 5). At the same time, the coordinates of the two sets of boundaries were agreed in order to determine the possibility of using the orthophotomap in the description of the cadastral limit (Figure 5).

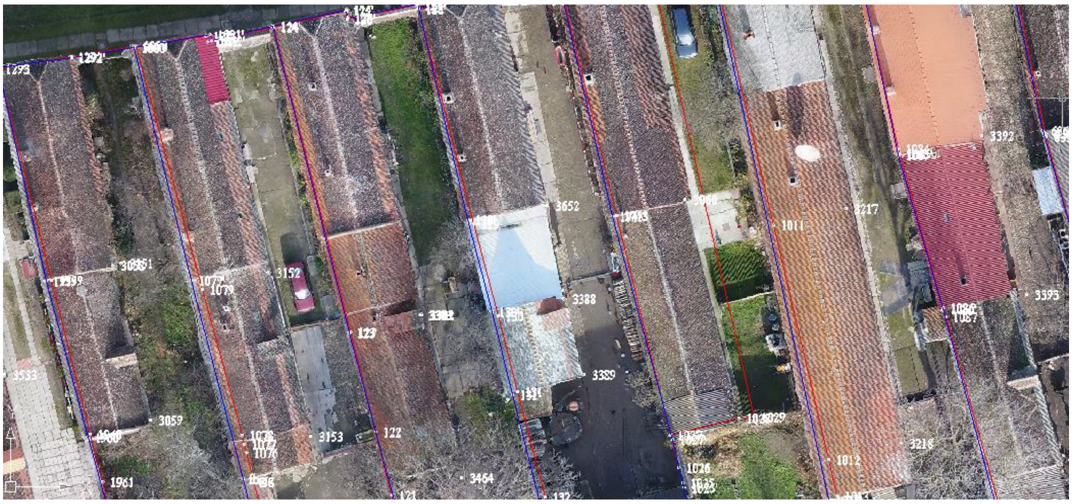

Figure 5. Part of the orthophotomap vectorized: red color-official limit of ANCPI (e terra 3); blue color-vectorized limit based on the orthphotomap made based on the images received with the UAV

3. Results

3.1. Ground Control Points

GNSS devices equipped with UAV of low costs have an increased precision. Phantom 4 PRO has a GNSS system incorporated with the code signal in simple frequency (L1) and with an estimated precision of the position in horizontal plan of ±1.5 m and of ±0.5 m in vertical plan. Due to a low precision, unsatisfactorily for cadaster works, it was compulsory to place and to determine the photogrammetric marks in the study area.

The determination of photogrammetric marks in land stage was achieved with different precisions, but all of them were enclosed in the tolerance admitted by the Romanian norms and regulations from the cadaster for outside the build-up area, namely ±10 cm.

From the GNSS observation sheet, it was noted that the precision indicators given by HRMS (Horizontal Root Mean Square) and VRMS (Vertical Root Mean Square) fall within the range of 0.2-1.2 cm for HRMS and 0.3-1.5 cm for VRMS respectively. The determinations were made directly in the Romanian stereographic 1970 projection system.

3.2. Ortophotomaps

The final representation, which will be used for mapping purposes, is done by orthorectification, which requires precise surface-related information to eliminate the projective distortions of the original images. The orthophotomap represents all the details in a projection perpendicular to the projection plan. The surface on which an orthophotomap is made can be obtained by using the digital terrain model (DTM) or DSM; In the latter case, the result of the orthorectification is called true-orthophoto [18].

Orthophotomaps obtained from aerial image processing with the help of Agisoft Photoscan software are true-orthophoto. The spatial resolution of the orthophotomaps is of 2.14 cm and a root mean square error (RMSE) value dependent on the use or not of the photogrammetric marks in the orthophotomap production process.

From the reports provided by Agisoft Photoscan software at the end of the image processing, the precisions obtained for each case study have been centralized (Table 2).

Figure 6 shows the error ellipses for all photogrammetric marks. These ellipses are determined on the basis of the operator's assessments regarding the position of the photogrammetric mark from the image space and are found in the final report provided by the software. The position of each landmark was identified in at least 20 images due to overlapping of large images.

Table 2

Precisions obtained for the two types of orthophoto map

No.	Error	Crizbav Locality	
		With marks	Without marks
1	axis X (m)	0.008	1.41
2	axis Y (m)	0.007	3.88
3	axis Z (m)	0.003	1.45
4	axis X and Y (m)	0.011	4.12
5	RMSE (m)	0.011	4.37

Fig. 6. GCP location and error estimates Z error is represented by ellipse color. X, Y errors are represented by ellipse shape

Estimated GCP locations are marked with a dot or crossing.

An important factor in the performance of the works is also the time necessary to obtain the final product. Thus, with the help of the computer, the processes of execution lasted for 18 hours in the case of orthophotomap without ground marks and 19 hours with marks.

4. Discussion

4.1. Orthophotomap Obtained

The orthophotomap obtained from images taken with low altitude and ground marks UAVs was compiled according to the methodology of digital photogrammetry. Its accuracy depended on the quality of digital images, image acquisition, quality and accuracy of photogrammetric render measurements. Regarding the ellipse of errors in determining the photogrammetric marks and their identification in the image space, no connection was found between the size and direction of the orientation of the large axis of the ellipses. The obtained orthophotomap has served as a support for manual vectorization of land boundaries and building sites, the most important factors in their establishing being the contrast and texture of the image, but also the operator's experience and intuition.

The quality of the image orientation and, implicitly, of the orthophotomap, were analyzed from the qualitative and quantitative point of view. Due to the conditions encountered on the field, different distortions may occur within the orthophotomap. Therefore, a qualitative and quantitative assessment and the correction of the orthophotomap are necessary. For example, in true-orthophoto, lateral dense details should not appear, although in the row image the lateral view is visible (Figure 7).

Fig. 7. Raw images in which can be seen lateral view of details (a) and orthorectified images based on DSM (b)

The visual inspection of the orthophotomap did not reveal errors in terms of lateral views, but there were noticed distortions caused by differences in texture and color (Figure 8).

In all the analyses performed below was used the orthophotomap obtained from images taken with UAV and using GCP.

Fig. 8.Types of distortions caused by: a-color differences; b- texture differences

4.2. Analysis of Coordinates of Land Boundaries

From the visual comparison of the boundaries obtained following the vectorization of the orthophotomap with the official ones in the National Agency for Cadaster and Land Registration database it was found that in many cases they do not correspond.

Based on the differences between the coordinates of the boundaries in which the reference value was considered that from the National Agency for Cadaster and Land Registration (e terra 3) database, the movements on the X and Y axes were calculated, and then the total movements have been calculated and classified on groups of 20 cm (Figures 9 and 10).

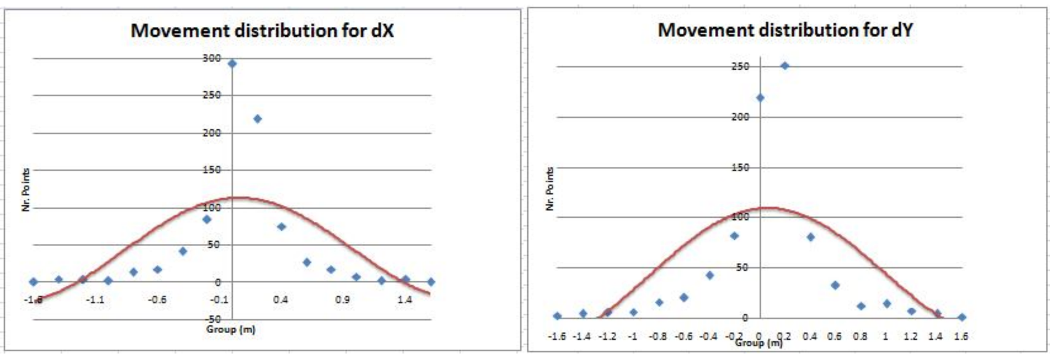

Fig. 9. Movement distribution on axis X and Y

Analyzing the number of points for a particular group it was noted that the highest frequency corresponds to the groups of 0-20 cm and 20-40 cm, with 42%

and 23% percentage of the total number of points (Figure 10). The movements on the X and Y axes are arranged after a Gauss curve, with the symmetry given around zero. The standard deviation shows that the average set boundaries are within ± 35 cm for the X axis and ± 49 cm for the Y axis. According to Romanian technical norms,if the ± 10 cm tolerance is considered for the lands within the build-up area, it is found that there are no correspondences between the existing official data and those obtained on the basis of the orthophotomap performed with UAV, only 15% of the total score being within ± 10 cm tolerance.

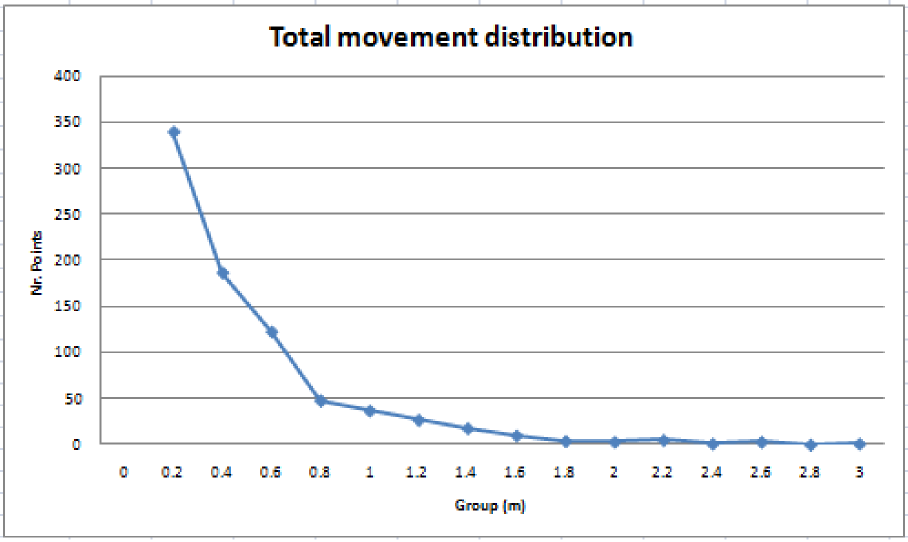

Fig. 10. Total movement distribution

Significant differences identified by analyzing the coordinates of the official database with those from vectorization may be explained, in particular, by the working methodology adopted for the implementation of the CESAR program (Complementing EU Support for Agricultural Restructuring Project). It was found that the points describing the street boundary have movements that fall within the allowed tolerances, instead of the ones inside the buildings and many more have movements that can reach up to 1.5 m. One possible explanation would be that precise measurements were made for the street frontage of the real estates, while the points forming the inside existing boundaries were extracted from the old cadastral plans morally outdated and of unsatisfactory precision.

Figure 11 shows the distribution of the cumulative percentages corresponding to the groups in which the total movements were classified. Thus, total movements of up to 10 cm represent 15%, those up to 0.5m 73%, and movements up to 1m 91%. Therefore, only a small part of the boundaries in the official database falls within the tolerance currently allowed in Romania. For the other, much more numerous, the limits in the National Agency for Cadaster and Land Registration database does not reflect the situation on the ground, which shows that it is necessary to modify the boundaries by updating cadastral works.

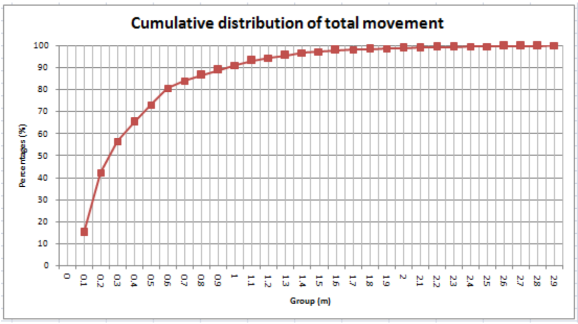

Fig. 11. Cumulative percentage distribution according to the groups of total movements

4.3. Identification and Analysis of Land Surfaces

The non-correspondence of the boundaries between the official database and those vectorized on the orthophotomap leads also to surface differences for each building. The base surface, considered reference, was the surface in the National Agency for Cadaster and Land Registration database and downloaded from the platform e terra 3.

According to the results obtained from the comparison of the two surfaces for the properties studied, it was determined that 30% of the total properties are in 1%, 59% in 2%, and all real estate's fall into one percentage of 10% (Table 3).

Table 3

Summarization of surface differences on classes, number of properties and percentages

No.	Class	No. of properties	Cumulated no.	Percentage of properties	Cumulated percentages
1	[0-1%]	33	33	30	30
2	(1-2%]	32	65	29	59
3	(2-5%]	37	102	34	93
4	(5-10%]	8	110	7	100

Based on the total movements of each point describing the boundaries of a building, a mean total displacement was calculated and analyzed in relation to the value of the surface difference of the same building considered in the module. From the graphical representation of the obtained values it is deduced that there is a tight connection between the two variables considered, given by a determination coefficient of 0.56, respectively a correlation coefficient of 0.75 (Figure 12).

The study of the graph, together with the high correlation coefficient value (0.75), suggests that the differences of significant coordinates may lead to surface differences that are directly dependent on their size, even though basically it can be brought into discussion the rotations and translations of vector geometries compared to the official ones.

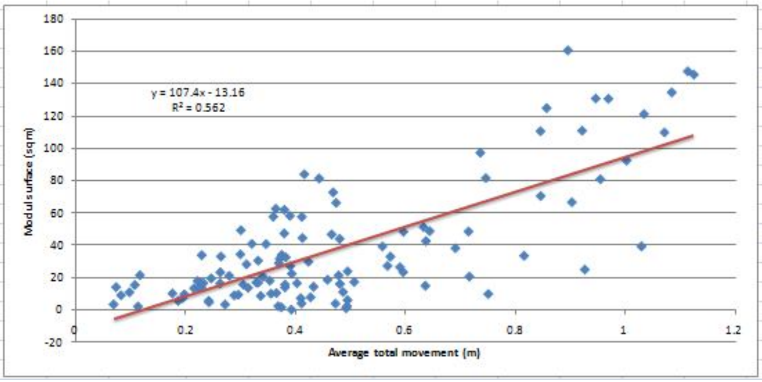

Fig. 12. Predictive model between total mean movements and the surface differences in module

The separation of the properties on the orthophotomaps, their correct identification and delimitation, is an important operation as it illustrates, from the beginning, the possibilities of vectorization of the orthophotomap. In this sense, the reals estates resulting from the vectorization were identified and counted and then compared with those existing in the official database. From the 146 official properties there were identified 110 obtained by the vectorization process, this result totalizing 75% of the identified real estates, the rest being unidentified (Figure 13).

The lack of identification of all the properties can be explained by the specificity of the locality (whether or not it has been part of the co-operative areas), as well as the legal aspects that characterize that building. In the present case, with the co-operative process that began in the 1950s, there were many cases in which the owners by right had abusively taken over part of their land, leaving only 250 square meters of land to be built. Thus, this process led to the formation of two Cadaster Registers, even though the land actually forms a single property. Crizbav was part of the cooperative process and implicitly the situation described above.

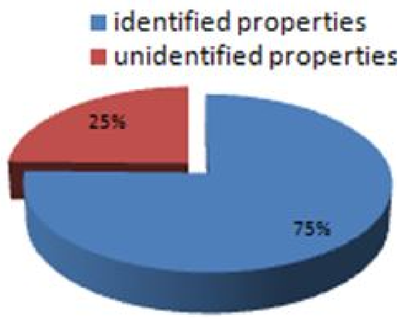

Fig. 13. Identification situation of the properties by vectorization on orthophotomap

4.4. Identification of Constructions

The specificity of the build-up area inside the localities of any rank is given by the existence of the constructions. They can be of different shapes and sizes regulated by law and local authorities depending on the specificity of the area. The obligation of each owner of a new building is to register the property in the Real Estate Register when it is completed, and if the locality is subject to a full registration process in the Cadaster, it is necessary to register all the constructions, regardless of the year of construction or acquisition. Through the CESAR (Complementing EU Support for Agricultural Restructuring Project) program from which Crizbav was part of, once the land registration was completed, all the constructions were registered, regardless of form, size and destination.

According to the legislation in force [36] the registration of the constructions is done by measuring the ground footprint of the buildings, this mark footprint being given by the walls of the constructions and not by the projection of other details that make up the construction (the rain shadow). Being an orthogonal projection, the orthophotomap obtained based on digital images taken with the UAV renders the upper part of the buildings (including the rain shadow), making it impossible to render the walls that make up the construction. For this reason, it is not recommended to use the orthophotomap exclusively in the measurement process, even if it is made by using DSM, but to combine these measurements with terrestrial measurements involving the use of some technologies such as total stations, robotic stations or multiscan stations, even terrestrial photogrammetry.

The high-precision orthophotomap obtained for the studies surface captures constructions of different shapes and sizes and was used in particular for checking the accuracy of the building site. From the study of about 300 constructions, the following general and specific conclusions were drawn: (1) within the build-up rural areas, the UAV technology is insufficient to establish precisely the perimeter and including the surface of the constructions (the surface built on the ground) (2) the obtained orthophotomap can be used as a mapping support, (3) accurate measurement of the construction with rain shadow is impossible, but the measurement of the dead wall (without rain shadow) construction can be done with high precision, (4) from the comparison of the building site from the official data with that deduced from the orthophotomap, there are few cases that fully correspond to one another.

5. Conclusions

The achievement of high-precision orthophotomaps has become a rather mild task with low costs, and their use is increasingly necessary given the social-economic changes that have taken place in Romania since 1989. A result of these changes is the lands that were scattered a lot, reaching up to several hundred square meters for a building. In this sense, building a general cadaster, using current field data collection techniques, such as UAVs combined with terrestrial techniques, can be a viable alternative. Large-scale and increasingly accurate digital orthophotomaps are becoming more and more practical, ensuring both the metricity of the product and the presentation of the land as a representative image. Moreover, by using this technology, it is possible to quickly and efficiently perform a status check for a certain area, and to overcome the changes that have been made to continuously update the maps.

In this study, the steps taken to develop a high-precision orthophotomap, the possibilities of use, as well as its limitations, were highlighted. The results show that the implementation of the general cadaster through the CESAR

(Complementing EU Support for Agricultural Restructuring Project) program for the Crizbav locality has not been carried out according to the norms and regulations in force, the results obtained by comparing the coordinates and the surfaces, giving an overall picture suggesting deficiencies in the establishment of the land boundaries and the location of the constructions. At the same time, the necessity of using GCP was brought up into discussion in the process of obtaining the orthophotomap, the comparison of the precisions obtained in the two situations and presented in the report of Agisoft Photoscan program being persuasive.

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