INFLUENCE OF CADASTRAL MEASUREMENTS ON THE CONTENT OF THE REGISTRATION

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Abstract: *Knowledge of the spatial location of the right to land is an objective necessity. In the cadastral process, the land measurements by identifying the right to the land in kind and its registration, represent two component parts of the "protection of the right of ownership". Over time, including at the current stage, the identification of the right in kind for the purpose of registration is carried out in the "x, y" coordinate system. The cadastral plan, as well as a legal document, is elaborated in the "x, y" coordinate system. Land policies (mainly urban) require us to rethink the concept of land rights registration and respectively to move from the "x, y" coordinate system to a 3D system in order to take into account the vertical components (z/h).*

Keywords: *identification of the right; cadastral registration; spatial location; real estate*

1. Introduction

The cadastre is recognized as the nucleus of land administration systems. (Kaufmann and Steudler, 1998). [1] For the registration of rights, restrictions and responsibilities (RRR), qualitative and complete spatial information about all real estate properties must be represented in the cadastral plan.

The cadastral registration is the "mechanism" for achieving the purpose of the cadastre – the protection of the right to the real estate. In the Republic of Moldova, the "Real Estate Register" is the "mechanism" for accumulating, analyzing and disseminating textual information, and the "Cadastral Plan" is the "mechanism" for accumulating, analyzing and disseminating spatial (graphic) information. The answer to the question "where is the right of ownership in kind, in space", has proven to be the most effective (main) current mechanism in the protection of the right to real estate.

Currently, the cadastral legislation provides for the measurement, modeling, visualization and analysis of cadastral data, only in 2D, but the rights over real estate property can also refer to above-ground or underground spaces.

The land, represented as a polygon on the cadastral plan in the coordinate system "x, y", can be easily recorded in the cadastre, but for more complex objects such as: buildings with a complex architecture, built on a slope or with levels of different sizes, underpasses, overpasses, tunnels, bridges, viaducts, underground structures, etc., in which several real estate properties with different property rights are contained, The cadastral legislation is not yet ready.

2. General requirements when drawing up the "Floor Plan"

According to the Law on Cadastre of Real Estate No. 1543 of 25.02.1998, in the Republic of Molova, the right of ownership and other real rights over land, buildings, isolated rooms, parking spaces in the building and others are registered. [2]

In order to answer the question "where is the ownership of the isolated rooms or parking spaces in the building, in the Republic of Molova, the "Floor Plan" is drawn up for each level of the main buildings, in the "Inventory 11" curriculum, in digital format *.dxf, and contains graphic elements (represented in millimeters) and informational objects. The floor plans in .dxf format are kept by the Public Institution Cadastre of Real Estate in the "FloorPlan" module. The example from the "FloorPlan" module is shown in Fig. 1.

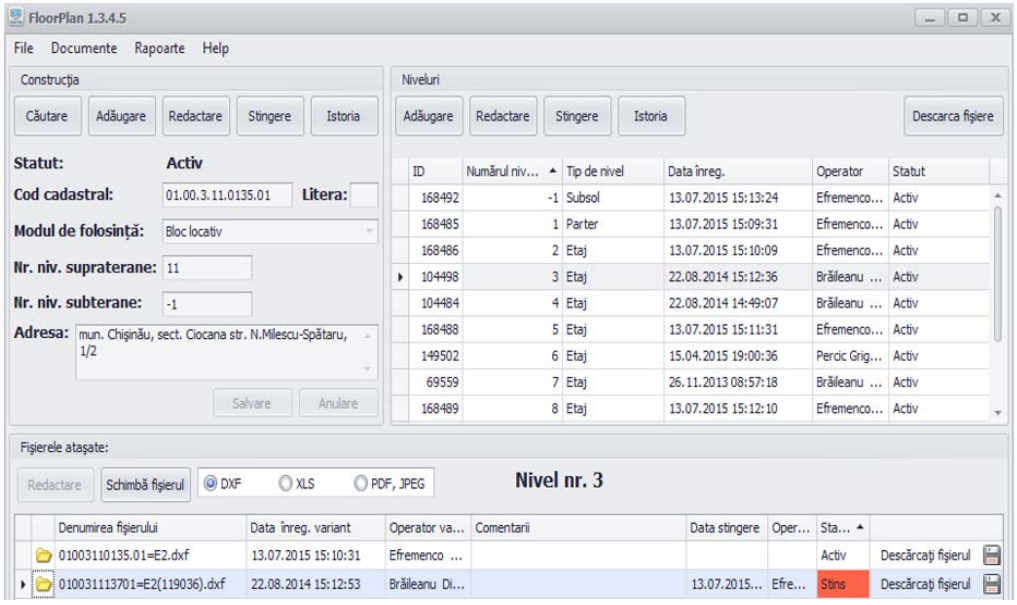

Figure 1. Example from the "FloorPlan" module

Informational object is a virtual reflection of the existing entities, both material and non-material such as: the level, the isolated room, the parking lot, the encumbrance, the room. The structure and content of the informational objects of the floor plan are indicated in **Table 1.** [3]

Table 1. Structure and content of the informational objects of the floor plan

№	Name of the information object	Name of the field (property) in the *dxf file	Description	Data type	Mandatory completion
1	**Level**	Outline	Level contour, the closed line that borders the outer surface of a building level	Poligon	obligatory
		Number	Level number	Integer (negative or positive)	obligatory
		Level Type	Level Type	Text in accordance with the classifier	obligatory
		Geopoint1 Geopoint2	Coordinates of contour points		Not mandatory
		Contour air	Level contour surface	Accurate counting down to tenths (m.p.)	automatic system
		Area	Total interior area of the level	Accurate counting down to tenths (m.p.)	automatic system

		Interior height	The interior height of the level is used to display the interior height in the floor plane	Text with the value "h=" followed by the value of the height in number with the precision down to tenths (m)	optional
		Letter	The letter of the basic construction is used to display the letter of the building in the floor plan and in the floor plan indicator	Text	optional
		Exterior height	The external height of the floor or, as the case may be, of the building, shall be used to display the external height in the floor plan	Text with the value "H=" followed by the value of the height in number with the precision down to tenths (m)	optional
		Entries	The text of the statement that must exist on the floor plan according to the requirements of this instruction	Text	obligatory
2	**Isolated room/ Parking**	Outline	Contour of the isolated room: the closed line that borders the surface of an isolated room within the level plan of the building	Poligon	obligatory
		Cadastral number of the isolated room	Cadastral number of the isolated room	Positive integer	obligatory
		Number	Address number of the isolated room/number of the parking space in the project	Positive integer and, where applicable, letter	optional
		Status	Status of the insulated room	Text in accordance with the classifier	optional
		How to use the insulated room	How to use the insulated room	Text in accordance with the classifier	obligatory
		Destination	The destination of the isolated room	Text in accordance with the classifier	optional
		Contour air	Surface of the contour of the isolated room	Accurate counting down to tenths (m.p.)	automat de sistem
		Area	Total area of the isolated room	Accurate counting down to tenths (m.p.)	automat de sistem
			Total area of the isolated room by type of surface	Accurate counting down to tenths (m.p.)	automat de sistem
		Part	The part of the isolated room within the building	Number accurate to tenths (%)	optional
		Index of the condition of the isolated room	Condition of the isolated room	Text in accordance with the classifier	optional
		Scale Number	Indicator by which the informational objects are sorted in the report of the Annex to the building plan	Positive integer	optional
		Entries	The text of the statement that must exist on the plan of the insulated room according to the requirements of this instruction	Text	optional
3	**Encumber**	Outline	Part outline: the closed line that borders the surface of the part of an isolated room or part of a level within the floor plan of the building (transmitted in the lease/sublease or common space)	Poligon	obligatory
		Type of encumbrance	type of encumbrance, including common areas	Text in accordance with the classifier	obligatory
		Number	Portion Number (P1, P2,…)	Positive Integer Associated Uppercase	obligatory
		Contour air	Surface of the encumbrance contour	Accurate counting down to tenths (m.p.)	obligatory
		Metoda	Method of obtaining data	Text in accordance with the classifier	obligatory
		Part	shall be completed if the mode of use is established	Text	optional
		Entries		Text	optional
4	**Room**	Contur	Contur	Poligon	obligatory

		Number	Room number assigned as required	Positive integer and, where applicable, letter	obligatory
		Area	Room surface	Accurate counting down to tenths (m.p.)	obligatory
		How to use the room	How to use the room according to the requirements	Text in accordance with the classifier	obligatory
		Destination	Assigning the type of area required for the calculation of the total area by the type of area	Text in accordance with the classifier	obligatory
		Scale Number	Indicator by which the informational objects are sorted in the report of the Annex to the building plan	Positive integer	optional
		Entries		Text	optional

The outline represents a polygon that is established for each informational object according to the requirements. Each informational object contains only one outline, except for informational objects with the configuration of a polygon with voids, in which case the void will also be represented by the outline.

The contour of the level is drawn on the outer edge of the perimeter walls of the floor plan and includes all the constructive elements of the building on the horizontal section of this building. On the contour line, all the connection points between the elements of the basic construction and the annexed constructions are indicated, as well as the connection points of the information objects.

The contour of the isolated room is established on the outer edge of the perimeter walls and on the axis of the partition walls that delimit the insulated room given on the floor plan. The contour of the isolated room includes all the information objects that constitute the isolated room, as well as the encumbrances that are attributed to this isolated room.

The contour of the parking space is established on the delimitation elements of the parking space.

The contour of the encumbrance is superimposed on the rooms or portions of rooms that are the object of the encumbrance and represents a hatched polygon that is established on the outer edge of the perimeter walls and/or on the axis of the interior walls that delimits the encumbrance given on the floor plan, and if the walls are missing, it is established on the delimitation elements indicated by the applicant. [3]

Examples of contours drawn up in the Inventory 11 program, in digital *.dxf format, are shown in Fig. 2.

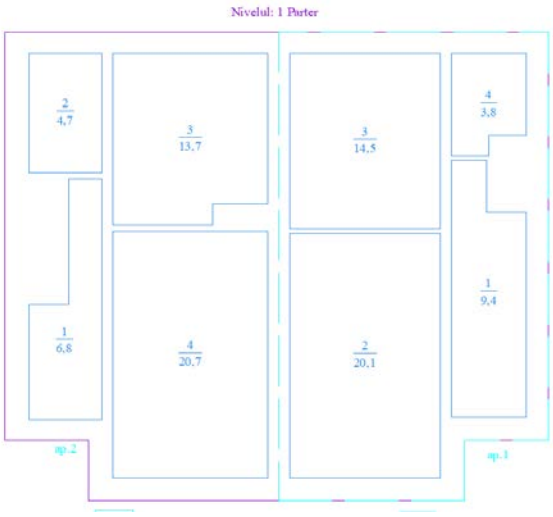

Figure 2. Outline Example

When drawing up information objects, it is not allowed to extend the contour of isolated rooms, parking spaces, rooms and encumbrances in the contour of the level, it is necessary that the contours comply with the topology and not overlap with each other, and the sum of the contour surfaces of all isolated rooms and parking spaces must not exceed the surface of the contour of the level.

The file in digital format *.dxf, contains only a floor plan of the building and is named with the cadastral number of the building, with the number and type of the level. As an example, PN_0100101.1195.01=1P, which means that the given file contains the floor plan from level 1 of type "Parter".

3. Correctly determining the number and type of the floor

In order to identify the real estate property on which a right is established, cadastral works are carried out. Within the cadastral works at the building level, the floor plans are drawn up only for the main buildings. One of the basic requirements for the execution of cadastral works is the correct establishment of the number of levels in the building and what is the type of levels identified.

"Level number" means the number indicated on the level in the technical drawing of the floor plan. The levels are numbered taking into account the following:

a. consecutively from bottom to top, with positive □rabic numerals, starting with the digit "1" for the above-ground levels;
b. consecutively from top to bottom, with negative □rabic numerals, starting with "-1" for underground levels;
c. the floor number cannot have a value of "0".

The establishment of the levels in the building takes place only with the exit to the field, on site. The method of establishing the level numbers are shown in Fig. 3 and Fig. 4.

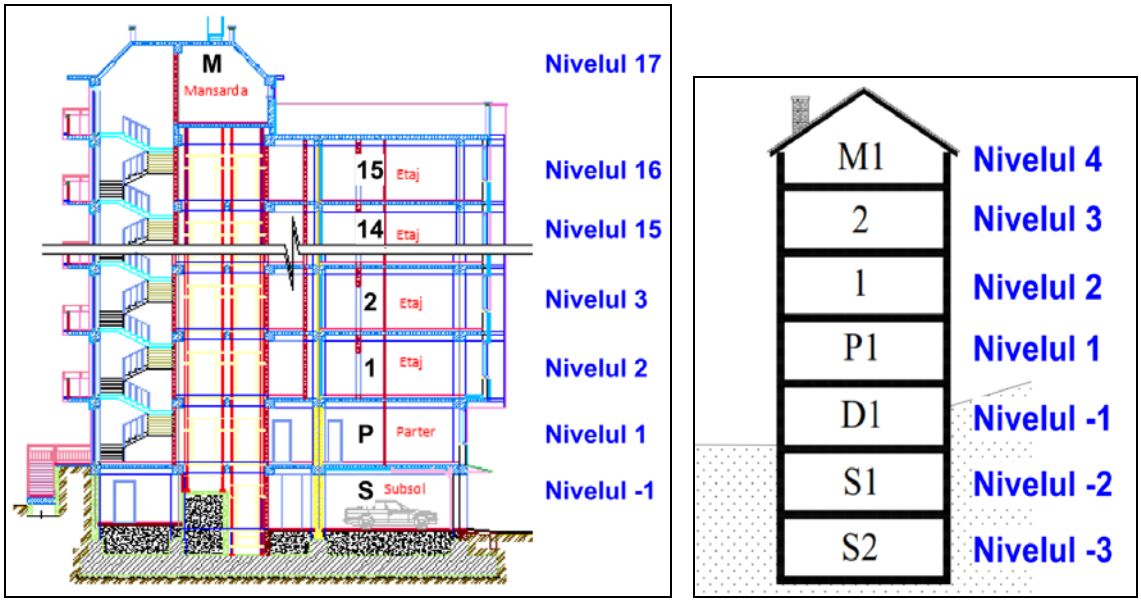

Figure 3. Establishing the levels in the building

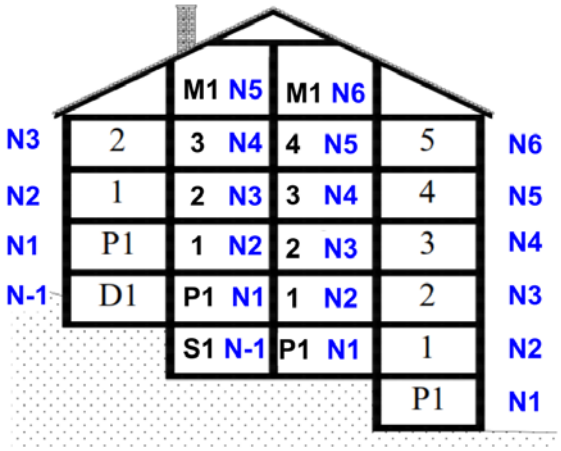

Figure 4. Establishing the levels in the building located on a sloping land

The "level type" represents the location and functionality of the level and is completed by selecting the value from the classifier presented in Table 2, which is integrated into the Inventory 11 software, taking into account the following:

a. the underground levels are assigned the type: Basement (S) or Semi-Basement (D);
b. above-ground levels can be of the type: Ground floor (P), Floor (E), Attic (M), Technical floor (ET);
c. the level with the number "1" is necessarily assigned the type: Ground floor (P) and can only be a level of this type;
d. the Antresol type level (A), represents a "arranged level" in the volume of another level and can be both underground and above-ground, provided that the height of the rooms is not less than 2.1 m. The number of the level of the Antresol type (A) represents the number of the level at which the Antresol is located. In the case of multi-storey entrances, they will be assigned an additional number, so the first level of the basement will be A1, followed by A2, A3, etc. For example, the multi-storey basement located on level 1 Ground floor will be indicated as 1 A1 the first level of the basement, 1 A2 the second level of the basement, etc.;
e. the Roof type level is drawn up if the object of the main right of exclusive use or of the accessory right of exclusive use has been delimited on the roof.

Table 2. Classifier for "Level Type"

No. d/o	Abbreviation	Level Type
1	A	Antresol (mezanin)
2	AC	Acoperiș
3	M	Mansarda
4	ET	Etaj Tehnic
5	E	Etaj
6	P	Parter
7	D	Demisol
8	S	Subsol

4. Checking the correctness of the "Level Plan"

The level plan is subject to the verification and self-control procedure. In this regard, the Inventory 11 software has a specialized tool that allows the verification to be executed automatically.

The level plan checks the quality of the graphic elements of the technical drawing, the correctness of the structure and content of the informational objects, the verification of the geometry and topology of the contours of the informational objects.

When checking the quality of the graphic elements of the technical drawing, the following shall be checked:

a) *quantitative verification of layers* - a level plan cannot have layers other than those established;

b) *checking the correctness of the name and parameters of the layers* used to create the technical drawing of the level plan;

c) *checking the correspondence of the graphic elements and informational objects* in the respective layers.

When verifying the correctness of the structure and content of the information objects, the following shall be verified:

a. verification of the correctness of the classification of the informational objects:
   - at the top of the hierarchy of informational objects there should be only one object – *Level*;
   - the information object "*Level"* must contain at least one *room*;
   - the information object "*Isolated room*" must contain at least one *room*;
   - all informational objects must contain outline;
b. verifying the fulfillment of the mandatory attributive information;
c. checking the correctness of the fulfillment of the number and type of level.

When checking the geometry and topology of the contours of the information objects (checking for errors), the following are checked:

a. verification of the existence of double dots in the outline of the informational objects;
b. verification of the existence of self-intersections of the contours of informational objects;
c. checking the existence of overlaps of the contours of isolated rooms/parking spaces within a level;
d. verifying the existence of the extension of the contours of the isolated rooms/parking spaces within the contour of the level;
e. verifying the existence of the extension of the encumbrance contour within the contour of the informational object to which it is attributed;
f. checking the existence of several contours for an informational object (each informational object must contain only one outline, except for informational objects with the configuration of a polygon with voids, in which case the outline will contain the outline of the void);
g. checking the sum of the contour surfaces of the insulated rooms/parking spaces compared to the contour area of the level (the sum of the contour surfaces of the insulated rooms/parking spaces must be less than or equal to the contour area of the level).

5. Peculiarities of the representation of the level plan of the building in sections

The section (section) represents the part of a building with a distinct particularity and delimited from the rest by certain connecting elements. Depending on the connecting elements of the sections, we can distinguish the following types of buildings:

1. *building in sections joined by galleries* – building in sections of the same level or with different levels located one in relation to the other at a certain distance, and the connecting element "gallery" ensures circulation within the building. As a rule, the gallery consists of a single level and can provide connection at any level of the building.

The outline of the building in sections at the level where the gallery is located is indicated on the exterior wall of the building, including the gallery, see Fig. 5.

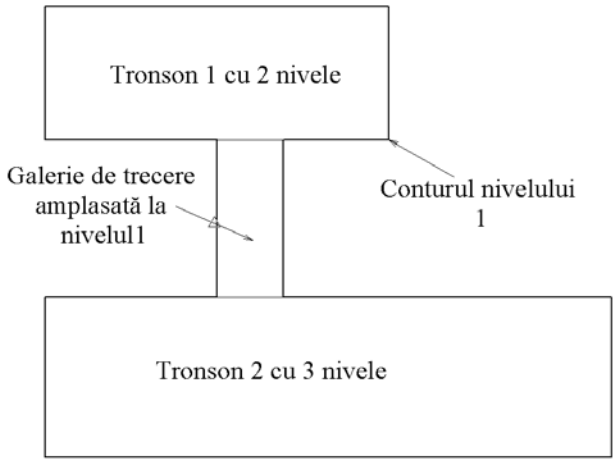

Figure 5. Representation of the outline of the building in sections joined by the gallery. Level 1

For the other levels, the contour will be established on the exterior walls of the building, including the walls of the gallery, with the addition of the outline for the gap on the contour of the gallery Fig. 6.

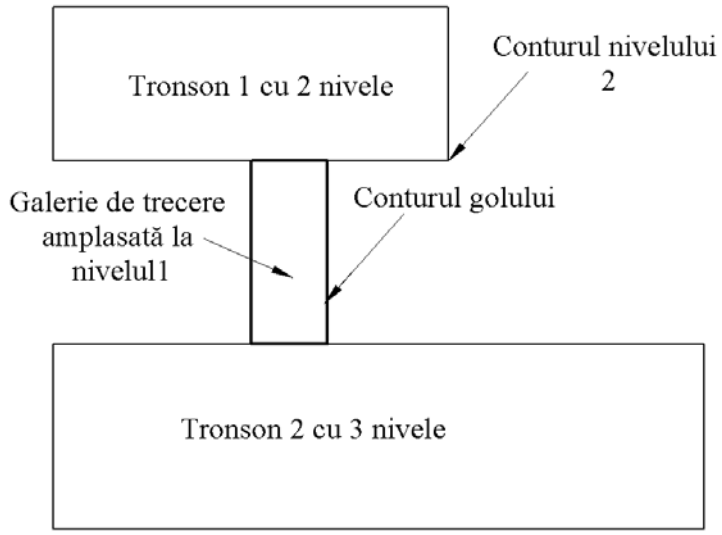

Figure 6. Representation of the outline of the building in sections joined by the gallery. Level 2

If the sections are of different levels, the contour of the upper level will be established on the contour of the existing walls at the given level, the contour of the gallery and the section on the lower level, with the addition of an overlapping contour (empty) established on the contour of the gallery and the lower section Fig. 7.

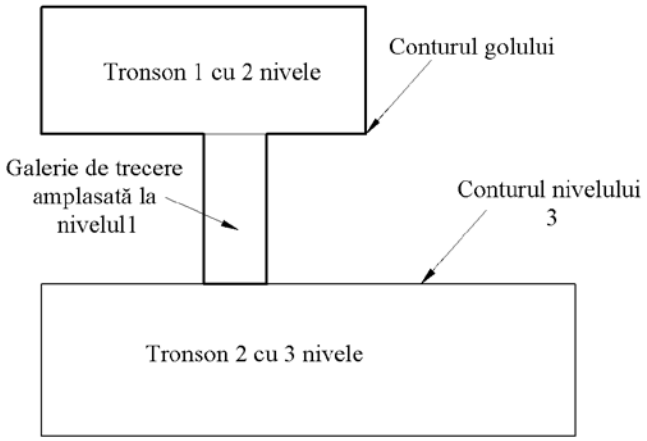

Figure 7. Representation of the outline of the building in sections joined by the gallery. Level 3

2. *section-type residential block* – building, composed of one or more sections, separated from each other by capital walls, in which the apartments in each section have a stairwell with access to it directly from the apartment or through a corridor (definition according to NCM C.01.08:2016). [4]

In the case of section-type buildings, all sections fit within the contour of the building. The outline of the building is established on the basis of the existing cartographic materials (export of the building layer from the graphic database of the cadastre or the existing data on paper from the technical file of the building: the plan of the lot or the working sketches) or on the basis of the measurements of the positioning of the sections executed within the cadastral work. See Fig. 8.

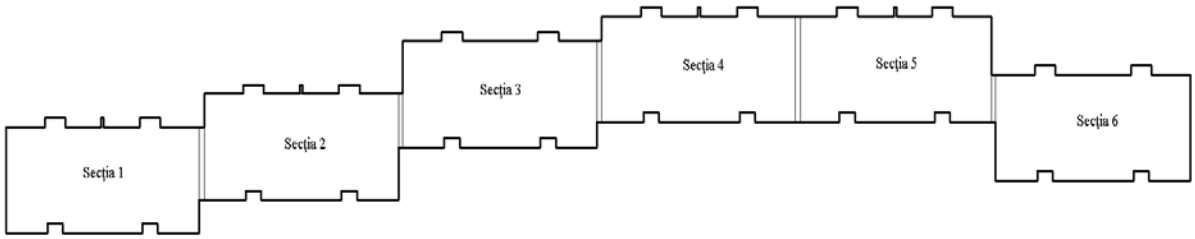

Figure 8. Representation of the section-type housing block

If the building is located on a sloping plot of land in such a way that the situation arises when the level level differs from section to section, the number and type of level shall be established for each section, and the level plan shall indicate the sections with the same level number according to the model shown in Fig. 9, unless otherwise provided in the project documentation.

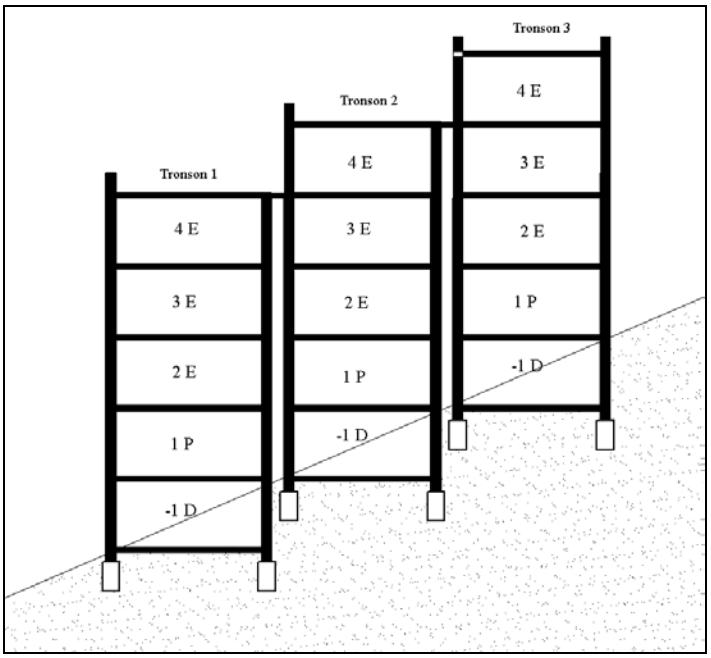

Figure 9. Representation of the level plan in the case of buildings in sloping sections

6. Conclusions

1. The analysis of modern practice shows us that the visualization of space in the 3D system is not a technological or methodological problem, but is related to the content of the registration process, and thus also to the protection of the right over vertical objects.
2. The graphic registration of the immovable property requires detailed information on its location (location) and the legal registration requires a clear picture of the property rights and the beneficiary.
3. In order to determine the location of isolated rooms and encumbrances within buildings, "level plans" are drawn up in the Republic of Moldova, which are kept and updated in the specialized module "FloorPlan".

7. References

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