THE NEED TO CREATE A 3D CADASTRE

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Abstract: *During last two centuries population density has increased considerably resulting in a more intensive use of the land. This phenomenon increased the importance of property which also changed the perception of people in relationship with land. This change required a system in which land ownership was clearly and indisputably established. 3D technologies are more effective than 2D ones, especially when urban and regional planning and management are included, and especially when there is underground and aboveground 3D spatial infrastructure.*

Keywords*: 3D cadastre; land; property; administration; real estate advertising*

1. Introduction

The cadastre performs the identification, measurement, description and registration of buildings in the cadastral documents and their representation on cadastral maps and plans. Real estate refers to land, with or without buildings, located in an administrative-territorial unit, with one or more owners, which has been assigned a unique cadastral number.

The land registers opened in the administrative territory of each locality form, together, the cadastral register of real estate advertising of the territorial administrative unit, which is kept by the territorial office within the territorial office in whose territorial range of activity the respective building is located.

The cadastre and real estate advertising offices carry out real estate advertising for the buildings within their scope of activity.

The purpose of real estate advertising is the registration in the land register of the legal documents and facts of real estate in the same administrative-territorial unit, for the purpose of transmitting or establishing real real estate rights or the opposition of these entries to third parties.

Initially, the cadastral registry appeared to help in taxing land. Currently, the cadastre offers and improves the efficiency of land transactions by offering them security.

Currently, the existing pressure on certain lands, especially in the areas of business, commercial and industrial centers has led to an overlapping and interconnection of constructions. Because of this, there is a challenge when registering these constructions when they will be designed on the ground, in a simple cadastral plan, with a cadastral registry that records information on 2D plots.

2. Materials and methods

3D technology is in a continuing evolution with the changing paradigms of urban planning and land policy, because it affects not only the way the city is seen but also the way property rights are described by other restrictions in space. As a result, a new urban legal framework based on 3D laws and 3D property registers will be needed to describe objects in space instead of flat outlines. 3D laws affect the rights in space, not in the projection plane and in this context it is possible to define 3D land policies.

Such a system refers to "cadastre" although there are currently several systems with different names in the world that hold similar responsibilities such as cadastral registry, cadastral system, land records, property register or land register. There is no single form of cadastre. For this reason, it is impossible to define, in a universal way, the cadastre which is concise and comprehensive having the distinctive characteristics of a technical registration of parcels located in any territory, but also legal registrations regardless of the fiscal nature of the property.

The realization of a 3D cadastre deals with formal-logical and content-genetic aspects necessary for such a situation. The formal logical part includes the collection and processing of materials specific to the research theme, and the content-genetic part deals with theoretical generalization using laws. The research method determines:

- the phases of a 3D cadastre, representing the essential, such as an idea of land management and conservation in their administration system;
- the use of connections, relationships, quantity, quality, contradictions in identifying the functions of the three-dimensional cadastre;
- the purpose of a three-dimensional cadastre in carrying out administration and urban planning works;
- determining the purpose and possibilities of creating a 3D cadastre on the real estate market.

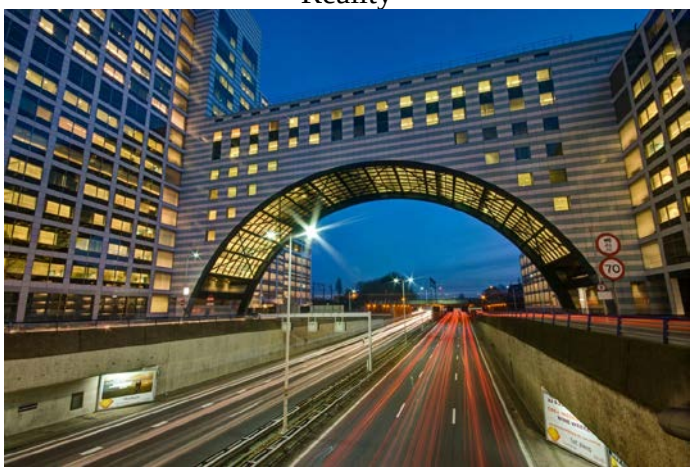
3. Results and discussion

In populated cities, land is used more and more intensively, currently meeting different types of land use. In other words, there are lands located below and above other lands. They represent an unsolved problem for the current cadastral system, which does not offer the possibility of registering these buildings without the use of the third dimension (Figure 1).

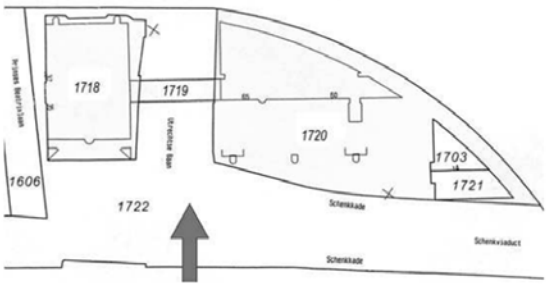
The 3D cadastre registration application can use objects with different types of space use, such as:

- objects located one above the other;
- objects with aboveground and underground infrastructure;
- a lot of cables, pipes;
- buildings with several floors.

Reality



2D cadastre plan



3D representation of the building

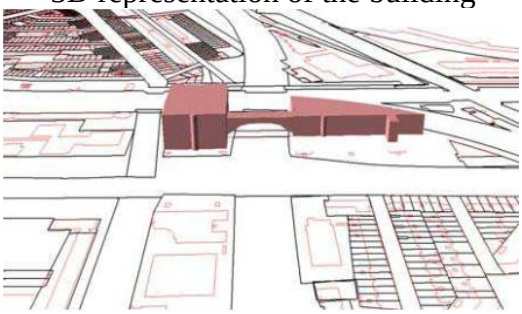


Figure 1: Represention 2D and 3D of the business center building in The Hague, which is built across the road – the Utrechtse Baan artery

Regarding the legal component, these 3D physical objects do not correspond to the current system. For this reason, they cannot be represented as cadastral objects on cadastral plans, that is, they cannot be used as a basis for registration. The realization of a 3D cadastre requires the existence of a complete cadastre model. General registration in 3D cadastre is a process of implementing rights in a three-dimensional space. The legal environment, real estate and cadastral registration, must support the implementation and transfer of 3D rights. Information is entered into the system when registering an object. Therefore, the three-dimensional cadastral registration must provide a guarantee for the completeness of the 3D data about real estate objects and provide a real support for data from all fields of production.

Even when property rights over complex constructions are established according to existing legislation, problems may arise in their description and appearance. The challenge is the registration of overlapping and interconnected constructions when following their design on the ground, on a simple cadastral plan, in a cadastral register that contains information about 2D parcels.

The question that arises is whether the traditional cadastre, existing on a large scale today, based on two-dimensionally represented parcels, is suitable for recording all types of situations that occur in the modern world, or should the cadastre develop a 3D approach?

Figure 2: National road DN 1 over the A10 highway

The property, in these cases, is located one above the other (Figure 3 and Figure 4) or it is possible that a property crosses another property underground and/or above ground. Therefore it shows the need for the cadastral registry to expand into the third dimension.

If the availability of registration is better and better (in the case of geometrically simple objects), then the legal security of ownership is also improved. The introduction of a 3D registration entails the creation of a three-dimensional cadastral registration. In the legal field, three-dimensional registration requires the introduction of the concept of 3D legal objects, thus leading to changes in the legislative field, which are a long process.

Through the cadastre, the rules should be established and the rights over the properties should be legislated in the previously presented cases.

The growing interest recognized for a 3D cadastre worldwide is the result of a multitude of factors, such as:

- the obvious increase in property value;
- the lack of spaces located on the ground of intensively populated or industrialized centers and those that are in a continuous development;
- the need for new access roads, parking lots, roads and alternative routes needed in intensively populated areas, thus calling for their location underground or above ground;
- more tunnels, passageways, wiring and pipelines underground parking lots, buildings built over roads and highways, highways built over buildings and even through them, intersections of uneven roads and railways (Figure 2);
- modern architectural development, thanks to the propulsion given by technological and scientific evolution;
- the 3D approach in other fields (3D GIS – Geographic Information Systems, 3D planning, 3D scanning devices and tools, software for processing and viewing 3D data) that make the approach of a 3D cadastre feasible from a technological point of view.

Figure 3: The "railway" construction built over the "dyke" construction

Figure 4: 2D plan representation of the superimposed constructions

For example, a 3D image of the basic element and the actual area ratio for a set of parcels would facilitate the land management use of tools such as levies for the purchase of building rights. To support a 3D legal framework it is necessary to have spatial data systematized on 3D cadastres, which create and maintain up-to-date spatial databases and volumetric representations of cities, as well as the 3D property register where each property and its restrictions are identified and documented.

In order to implement a 3D cadastre, the following aspects must be followed:

- how can 3D property units be created in the current legal system?
- which is the main reason for creating properties in 3D?
- can there be 3D property rights without being registered in the land register?
- which can be the disadvantages of 3D property registration today?

Reality 2D cadastral plan

Figure 5: Representation of reality in 2D plane

4. Conclusions

One of the purposes of the cadastre is the fact that it provides real data regarding real estate (position, size, use, owner) used in all branches of the national economy. It is also a very important tool because it provides the documents that form the basis of the transactions that take place in the real estate market.

Despite its promise as an urban planning tool and extensive research in practice to date, no country has a true 3D cadastre with full functionality. The concepts involved in the evolution of this new process should be based on the field of land administration which

provides support for 3D representations. Even if the technologies used to measure, represent and collect information are evolving towards 3D, urban and land legislation still perceives the city as a flat land surface. The competent authorities with decision-making in urban environment follow the advancement of procedures regarding the 3D visualization of buildings and existing restrictions on properties.

5. References

1. *Erba D.A., 2012, Application of 3D Cadastres as a Land Policy Tool, Lincoln Institute of Land Policy, Land Lines*
2. *Oprea L., Ienciu I., 2020, Cadastru urban, Seria Didactica, Alba Iulia*
3. *Platforma Ettera (https://eterra.ancpi.ro accesat la 05.10.2023)*
4. *M. Jurca, Tehnici de realizarea a cadstrului 3D prin scanare https://www.academia.edu/42246961/TEHNICI_ DE_REALIZARE_A_CADASTRULUI_3D_PRIN_SCANARE_Cuprins_Pagina accesat la 06.10.2023*
5. *Legea 7/1996 – Legea cadastrului şi a publicităţii imobiliare*
6. *Atazadeh B., Olfat H., Rajabifard A., 2021, 3D Cadastre in Australian and New Zealand Jurisdictions: Similarities and Differences, 7th International FIG 3D Cadastre Workshop*
7. *Stoter J., 2004,Teză de doctorat - 3D Cadastre, Universitatea Tehnică din Delft*
8. *Stoter J., Ploeger H., 2003, Property in 3D–registration of multiple use of space: current practice in Holland and the need for a 3D cadastre. Computers, Environment and Urban Systems 27 (2003) 553-570, Elsevier*
9. *J. O. Garcia, L. I. Virgos Soriano, A.Velasco Martin-Vares 2011, 3D modeling and representation of the Spanish cadastral cartography, 2th International Workshop an 3D Cadastres, Delft, The Netherlands*
10. *B. A. Rodriguez, 2012, Integracion del Cadastro 3D en una Platforma de Simulacion 3D, Trabajo Fin de Master, Master en Teledeccion y Sistemas de Informacion Geografica, Universidad de Oviendo*