3D REAL ESTATE CADASTRE -ASPECTS AND POSSIBILITIES

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1. INTRODUCTION

The importance of real estate cadastre and cadastral data in urban planning and urban regulation is significant. Adequate geodetic and cadastral data, as well as the possibilities of their acquisition and updating, are also important for the urban planning process itself. In other words, quality spatial and urban planning is only possible by using quality and up-to-date representations of the physical space. On the other hand, the existing boundaries of land parcels and other cadastral data are presented in a 2D plane (by using traditional cadastral maps). This fact results in difficulties to register and visualize properties in complex 3D situations. The possibilities of visualizing the physical space by using the 3D geometry are opened with the development of modern technologies, such as 3D GIS and 3D visualization. Furthermore, this enabled research on developing and implementing 3D cadastres. 3D Cadastral data will new quality to the urban planning process and its results.

2. 3D CADASTRE

A 3D real estate cadastre can be defined in many ways. It depends on the legal framework of a country and whether a fully 3D approach or some kind of hybrid approach is implemented. The most comprehensive definition is given by Stoter (2004): "A 3D cadastre is a cadastre which registers and gives insight into rights and restrictions not (only) on parcels but on 3D property units." There is much research related to the development and implementation of a 3D real estate cadastre (Stoter 2004; Aien 2013; Van Oosterom 2013; Van Oosterom & Dimopoulou 2018; Višnjevac 2019).

3D Cadastre could be also explained by three aspects: technical, legal and organization. The technical aspect of 3D cadastre is primarily oriented to data models, technologies and methods used to develop 3D cadastre. The legal aspect contains legislation that would support and enable implementation of

3D real estate cadastre. The organizational aspect could also be described as an institutional aspect and it is significant for the successful implementation of 3D cadastre.
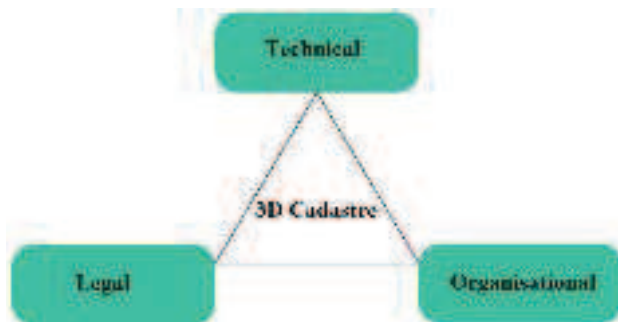

Figure **Error! Main Document Only.** : 3D Cadastre aspects

3. THE USAGE OF 3D CADASTRE

In the urban area, the number of overlapping structures that form complex 3D situations is increasing. Current cadastral systems have difficulties to register and visualize complex situations. This comes from the fact that all properties are projected on 2D cadastral maps resulting in unreadable maps with too many details. Figure 2 shows an example of cadastral data for the overpass in Belgrade. Based on the 2D cadastral data it is not possible to get real information about physical space. A similar situation is for bridges, underground structures or overlapping properties (for example, a tunnel located below the building).

*Figure **Error! Main Document Only.** : Cadastral map over orthophoto at the location of the overpass*

The usage of 3D real estate cadastre is based on the assumption that the registration and visualization of 3D physical space can be successfully modeled and implemented by using modern GIS technologies, technologies for visualizing and storing 3D data.

The initial assumption also considers that it is possible to develop an optimal 3D cadastre data model which will be usable (enable to register and visualize complex 3D situations) and relatively easy to keep data updated. Figure 3 shows the main classes of a proposed 3D cadastral data model for the Republic of Serbia.

Such a data model, based on international standards enables overcoming the difficulties of the current real estate cadastre when it comes to registration of 3D situations and it provides a basis for the development of a modern cadastral system.
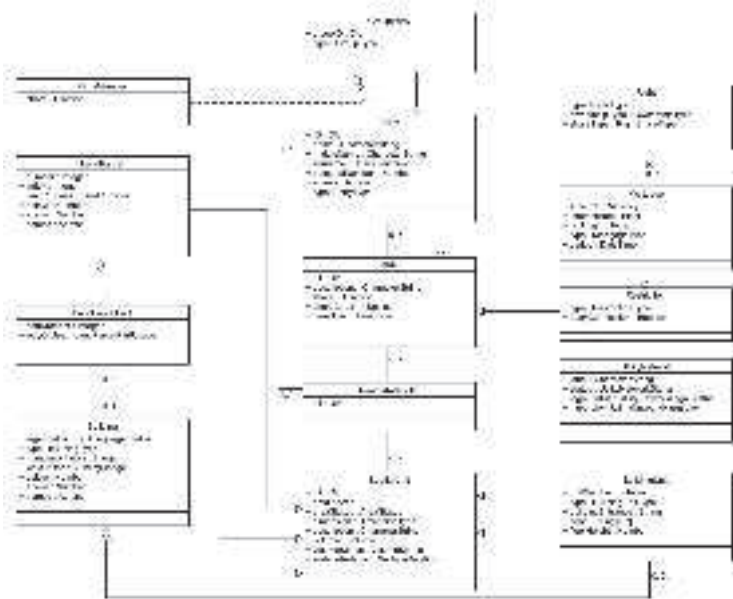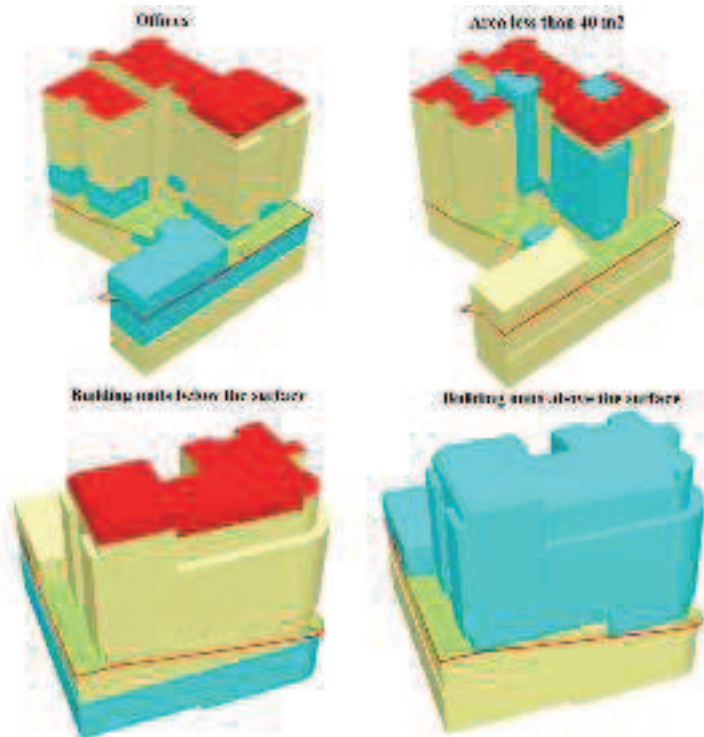
Figure **Error! Main Document Only.** *: The main classes of the proposed 3D real estate cadastre data model.*

In addition to the benefits and improvements of the cadastral system, the future 3D cadastral system will have a large amount of spatial data in 3D space. Consequently, the 3D cadastral system will go beyond its original role and be applied in various other areas that need this data. One of the applications of 3D real estate cadastre will be in spatial and urban planning. The new information provided by the 3D real estate cadastre, especially the 3D terrain model, will provide a new perception of the physical space and enable better implementation of spatial planning projects. Also, 3D space visualization will reduce the possibility of potential design errors.

Figure **Error! Main Document Only.** *: Example of analyses based on 3D cadastral data*

The potentials of the 3D real estate cadastre can be further exploited in different analyzes based on 3D cadastral data which can be implemented as automated processes. The results of these analyses, together with other factors, can be included in the process of spatial planning. Figure 2 shows examples of analyses based on 3D cadastral data.

According to the introduction of the third dimension in the structure of cadastral data, 3D cadastral systems have more complex technical solutions and more complex data set than traditional cadastral systems. A more complex data set creates new challenges in maintaining real estate cadastres that did not exist or were of lesser intensity in traditional cadastral systems. One of the aspects that need to be taken into account when developing and implementing a 3D cadastre system is the validation of 3D cadastral data.

Validation of cadastral data aims to prevent conflicts between properties (overlapping properties, empty space between properties, etc.) but also to check are the geometry and attributes defined in accordance with a pre-determined 3D real estate cadastre data model. This is important since rights are guaranteed by registration in the real estate cadastre database.

4. CONCLUSION

Considering the possibility of using 3D real estate cadastre, it can be concluded that 3D cadastral data have potential applications in different spectrums and that this fact should be taken into account when implementing 3D real estate cadastre. However, it is important to keep in mind the original goals and problems that are solved by establishing a 3D real estate cadastre - registering and visualization of properties by using 3D geometry. This enables unequivocally registration of complex 3D situations.

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