# Initial 3D Cadastre Registration in the Republic of Croatia by Cadastral Resurvey

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**Key words**: cadastral resurvey, 3D cadastre, public rights, LADM

## SUMMARY

By using the formal methods, this paper will present the model of the cadastral reform from the register of land into the contemporary register which is the backbone of a modern Multipurpose Land Administration System. Model will include its static components but also related processes. The Land Administration Domain Model (LADM), which in 2012 become ISO 19152 standard (Lemmen et al. 2013), will be used as the basis.
This paper gives proposal for cadastral resurvey improvements, better registration of special legal regimes and registration of special parts of properties. It will identify and explore critical points and make recommendations to bring Real Property Cadastre closer to become real 3D register.

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## 1. INTRODUCTION

The development of 2D Land Cadastre on the present territory of Republic of Croatia begun 200 years ago as part of a comprehensive project of the survey and establishment of Land Cadastre for the entire territory of the Austro-Hungarian Monarchy. It was originally designed to support a tax system where its basic purpose would be a fair collection of taxes based on the capability for agricultural production of the land. By this measure it was intended to encourage the population to work harder and gain higher income from agricultural production (Roić 2012).

In the following period, until the independence of the Republic of Croatia, cadastral documentation of 2D Land Cadastre was renewed for about 25% of cadastral municipalities, mostly large and medium-sized cities and administrative municipalities but also some land consolidated municipalities mainly in the eastern part of the country. After the independence, new regulations were being adopted, initiating the radical reform of the cadastre. Instead of the Land Cadastre, the Real Property Cadastre has been introduced as a register of land parcels, parts of properties, buildings and other structures permanently lying on or below the Earth's surface or special legal regimes established on the Earth's surface. The role of the cadastre has also changed. Its purpose is no longer entirely tax related – it should become multipurpose cadastre. The regulations proposed two models of development of Real Property Cadastre, the one being based on cadastral resurveys for the whole or part of the cadastral municipality (Mađer and Roić 2011) and the second one referring to sporadic upgrading of cadastral parcels from Land Cadastre into the Real Property Cadastre. Although Real Property Cadastre is not explicitly 3D register, many rights for which the registration must be supported, are overlapping, e.g. private land and special legal regimes (public rights). Cadastral resurveys are being conducted, but with very slow progress. Special legal regimes, although specified by legislation, are not registered. The use of 3D property rights has for many years been a tool for providing secure and lasting rights for the use of space and has become a common feature internationally. In order to efficiently manage these complex situations of ownership - and other rights, restrictions and responsibilities, the procedures for 3D property formation and registration also have to be addressed (El-Mekawy 2014). Special parts of real property in Croatian Land administration are registered in 2D diagrams with indication of the floor where they are located. One could consider this as a 2.5D approach. This approach temporarily enables registration of rights of special parts, but it does not support changes. Hence, it is necessary to develop spatial representation component in registration of 3D objects (Vučić et al. 2011). Best solution would be to add 3D data in cadastral maps. This would facilitate registration and better description of 3D objects.

First section of the paper is introduction. Second section deals with old Austro-Hungarian cadastral surveys from 1817-1900 and also deals with cadastral resurveys in 20$^{th}$ century in

former Yugoslavia. Third section describes new cadastral resurveys in the Republic of Croatia in 21st century. Fourth section describes Real Property Cadastre in Republic of Croatia which is being developed since the year 2000. Fifth section deals with upgrading the cadastral resurveys to meet the 3D requirements. The paper ends with conclusion.

## 2. HISTORICAL BACKGROUND OF CADSTRAL SURVEYS

Croatian cadastral system is based on the Germanic model of cadastre primarily because of its Austro-Hungarian heritage. Croatian cadastral system is similar to those in Austria and Germany. Development of land data registration in Croatia is conditioned by different countries of which regions of Croatia were a part during the past. This is why land data is registered with different dynamics and according to different conditions depending on the social structures in these countries.

### 2.1 Cadastral surveys in Austro-hungarian monarchy

Early attempts to establish a land cadastre resulted with an unprofessionally made Josephine Cadastre – hence it was soon put out of use. Proper development of the land cadastre in Croatian region under Austro-Hungarian governance began with proclamation of the Imperial Patent (Grundsteuerpatent) on December 23rd 1817, ordering surveys, land classification and preparation of the cadastral documentation for the whole territory of the Monarchy. This date represents the beginning of the Franciscan Cadastre by which a two-dimensional cadastre was established for the entire area of Austro-Hungarian Monarchy. Basic principles of this cadastre remained in use over a hundred years. Today's land registers are founded in the period from 1880 to 1900 based on these data (Roić et al. 2005).

### 2.2 Cadastral resurveys before and after the World War II

Land Register Law, not much different than Austro-Hungarian Imperial Patent, was passed in the Kingdom of Yugoslavia in 1929, after World War I. In fact, this law was accepted as a translation of the Imperial Patent, so the cadastre simply continued to serve for a tax purpose. Advancement of technologies in cadastral surveying, and especially development of numerical methods, initiated in this period enactment of a number of bylaws regulating these processes, some of which are used in practice even today.

After 1945 and implementation of radical changes in the society by introducing communist ideology, attitude towards ownership and other real property rights also changed. The cadastre and land registry did not enjoy support in this time period, but were instead neglected and finally terminated when private ownership was abolished and everything became common. For this reason, the cadastre was not updated at all until 1953 when Land Cadastre Legislation was passed. Lack of funds in the treasury caused this legislation since new sources of funding the state budget had to be found. Cadastral office revived owing to this situation, and revision of the cadastral record, content of which has not been maintained in the last circa ten years, was initiated. Land registry, however, remained neglected. The cadastre obtained its role in society, but as an institution for registering land ownership in service of taxing income from agriculture. This resulted in mismatch between cadastral land data and ownership data in land

registry, since land registry items corresponding to the cadastral items registered in the new cadastral record were not updated from 1953 to 1991 (Roić et al. 2005).

In 1953, Expert Council of the Geodetic Administration of the People's Republic of Croatia adopted conclusions on the issues important for development of the geodetic profession, reflecting both on its earlier development and the opportunities for developing state cadastral surveys in the future (Vučić and Šantek 2018). Expert Council gathered many of the most respectable and most experienced surveyors from the whole People's Republic of Croatia, defining the geodetic policy with respect to state survey and the land cadastre as based on the following:

1. intensive implementation of administrative reviews of land cadastre data;
2. rare and less successfully implemented technical reambulations of existing cadastral surveys;
3. renewal of graphical cadastral survey using numerical measurement methods (tachymetry and orthogonal);
4. aerial photogrammetric surveys starting from the late 1960s;
5. carrying out land consolidation 1956-1980.

## 3. NEW CADASTRAL SURVEYS (CADASTRAL RESURVEYS) IN THE REPUBLIC OF CROATIA

In the independent Republic of Croatia, the State Geodetic Administration, the Government and the Croatian Parliament adopted several programs for new cadastral surveys (cadastral resurveys), into which intensive efforts have been invested.
Given the wartime events, there were fewer cadastral resurveys in the 1991-2000 period. Following the adoption of the State Survey and Real Property Cadastre Act in late 1999, cadastral resurveys were launched throughout Croatia. Since 2000, cadastral resurveys are being carried out for 408 cadastral municipalities as follows (status as of 24 November 2017):

- 189 cadastral municipalities have been put in use;
- 38 cadastral municipalities are in the process of cadastral resurvey being carried out;
- 12 cadastral municipalities are in the process of geodetic reports being reviewed;
- 90 cadastral municipalities have been reviewed and are in the process of waiting for public presentation;
- 79 cadastral municipalities are in the process of public presentation being carried out.

The total area covered by the cadastral resurveys, intended for creating the Real Property Cadastre, is 378.707 hectares (Vučić and Šantek 2018).

## 4. REAL PROPERTY CADASTRE

In Croatia, there are number of activities proposed for improving the data, business processes, and the organization of land administration, and all of these fall under the National Real Property Registration and Cadastre Program known as Organized Land (URL 1). One of the project's key objectives is to realize and implement a Joint Information System of Land Registry and Cadastre (JIS) to combine both the land registry and a cadastre. The JIS is a unique system which replaced previously used different databases, cadastral data models, and associated applications in the cadastral offices of the State Geodetic Administration (SGA), as well as the land register databases and applications in the offices of the municipal courts. The SGA implemented the JIS in all cadastral offices in Croatia by November 2016. Today, the JIS provides support for the implementation of all regulated business processes and tasks, as well as transparent monitoring and data reporting from the cadastre and land registers. This system has special values in its administration and functionalities, and is hosted in a highly secure environment. The establishment of the JIS accelerates registration as it:

- integrates the spatial and legal data of real property in both cadastral and land register systems;
- raises the level of security in real property transactions;
- provides better management of both systems;
- streamlines business processes;
- improves customer relations;
- increases the speed and quality of service.

To provide the best speed and quality of services to key users and the general public, the State Geodetic Administration and Ministry of Justice developed (and continue to develop) a public One-Stop-Shop (OSS) web application that represents the link to the cadastral and land register data (or JIS). OSS allows all users to search and access an overview of the basic cadastral and land register data, but also contains a section for registered users who can then view the data, apply for public documents, view their case status, and receive issued documents into an electronic mailbox. Other additional cadastral data functionalities (currently being implemented) such as the electronic exchange of data between cadastral offices and licensed geodetic engineers, and the delivery of digital geodetic reports in cadastral offices, will standardize and speed up the review and confirmation of geodetic reports as well as accelerate the process of real property registration. Furthermore, this will also provide citizens with easy and quick access to public documents and data (Vučić et al. 2017).

When real properties (land parcels, cadastral parcels) registered in the cadastre and land registry do not correspond to the actual situation in the field, this situation can be changed on the basis of an appropriate geodetic report. For historical reasons, this lack of harmonization exists in large areas, and the State Geodetic Administration has launched a comprehensive program of organizing the cadastral data and its harmonization with the actual situation in the field. This program is financed from the state budget and the county, city and municipality budgets. Furthermore, legal and physical persons who are real property title holders can also provide financial resources. The cadastral resurveys make the basis of this program.

Municipal cadastral documentation refers to the total cadastral records kept for a cadastral municipality. Cadastral survey is the gathering and processing of all necessary data in order to form cadastral parcels, record buildings and other structures, record special legal status of the land and the land usage as well as the creation of the cadastral documentation of the Real Property Cadastre.

The State Geodetic Administration, in agreement with the Ministry of Justice, conducts the cadastral survey for a cadastral municipality or a part of it, and specific works within the cadastral survey are conducted by licensed private geodetic companies (Figure 1). Licensed geodetic companies are selected at public tenders. Since the cadastral survey is conducted for a specific area, all persons affected by the survey on that area must be notified about it. As stipulated by the law, a Decision on the cadastral survey is passed by the Director-General of the State Geodetic Administration, and such Decision must be published in the Official Gazette. Along with the above-mentioned, the information on the cadastral survey implementation is also published in the local media (newspapers, radio). All local government units where surveys are conducted organize public meetings for citizens where the survey procedure is explained and instructions given regarding the marking of land borders with visible and permanent (boundary) markers. Along the roads passing through the area under surveying, boards are placed which mark the worksite.

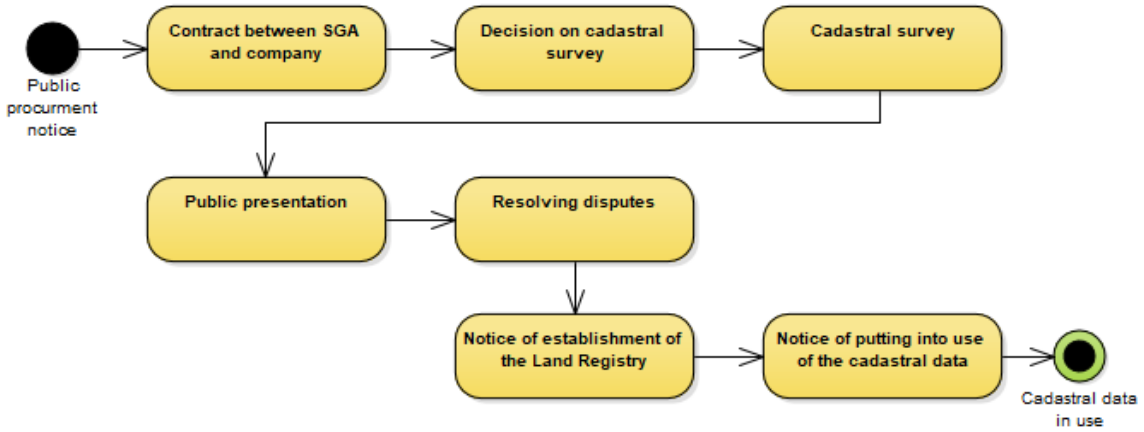


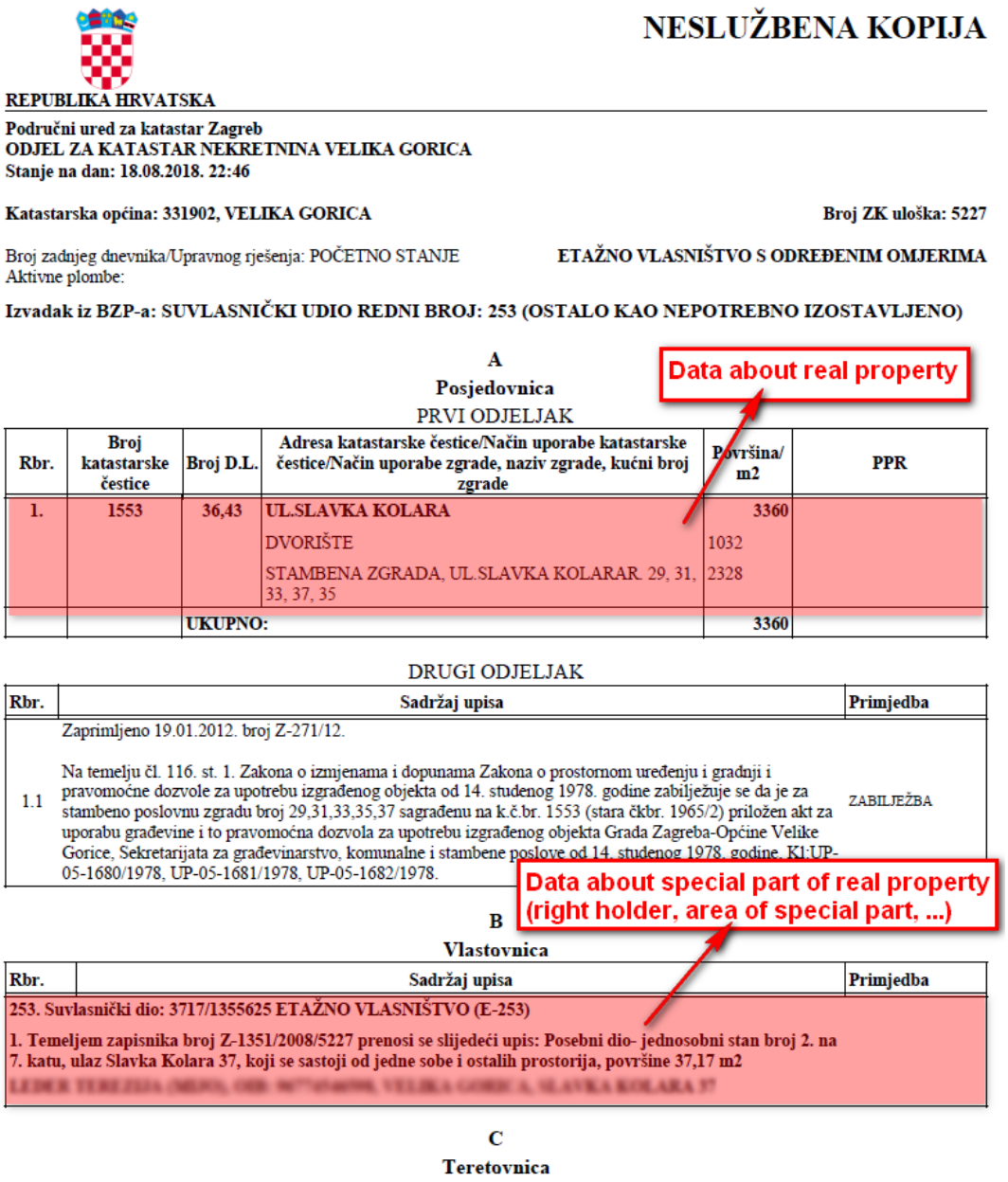

**Figure 1. Existing cadastral survey workflow**

When the cadastral survey is conducted in a cadastral municipality, the land title holders are obliged to mark, using visible permanent markers, the borders of the land they own, hold other rights or manage, at their expense and within the time period stipulated by the Decision on the cadastral survey. The title holders receive a written notification on the delineation. The title holders are provided with professional assistance, free of charge, in the delineation process. The delineation is conducted for all breakpoints of a cadastral parcel, and depending on the type of terrain, can be conducted with a concrete pillar, iron wedge, ceramic pipe, plastic marker with an iron core, or by carving a cross in a solid rock. Those cadastral parcel breakpoints that are clearly recognizable in the field, such as fences, houses, etc., doesn't need to be specifically marked.

When all of the necessary data are collected and processed in a cadastral survey, a cadastral survey report is produced. Along with all other parts, a cadastral survey report must include the cadastral map and evidential sheets. The cadastral map shows cadastral parcels with their boundaries, as well as the buildings constructed on them and the numbers of cadastral parcels (Figure 2). The cadastral map also shows the house numbers and borders of different land usages on the cadastral parcel. The evidential sheets show all of the collected and processed attribute data on the cadastral parcel, data on the real property title holders collected on the basis of available documents (land registry and cadastre), as well as the statement of the interested parties.


**Figure 2. Cadastral resurvey in urban area (cadastral municipality Velika Gorica) (URL 2)**

In urban areas with large number of buildings which are composed of lots of apartments and offices, during the cadastral resurveys 3D data on special parts of real properties (apartments, offices) are collected to a certain extent. One example is recently finished cadastral resurvey of cadastral municipality Velika Gorica. The town of Velika Gorica is one of the larger cities in the Republic of Croatia. Public document – excerpt from a Land Database (LDB) (Figure 3), in which the land registry data and cadastral data are harmonized, shows the ownership data structure describing the separate parts of the property for one apartment from the previous figure (Figure 2). 3D Cadastre data can always be improved and more detailed as we will propose in the next chapter.



NESLUŽBENA KOPIJA

REPUBLIKA HRVATSKA

Područni ured za katastar Zagreb
ODJEL ZA KATASTAR NEKRETNINA VELIKA GORICA
Stanje na dan: 18.08.2018. 22:46

Katastarska općina: 331902, VELIKA GORICA — Broj ZK uloška: 5227

Broj zadnjeg dnevnika/Upravnog rješenja: POČETNO STANJE — ETAŽNO VLASNIŠTVO S ODREĐENIM OMJERIMA
Aktivne plombe:

Izvadak iz BZP-a: SUVLASNIČKI UDIO REDNI BROJ: 253 (OSTALO KAO NEPOTREBNO IZOSTAVLJENO)

A
Posjedovnica

Data about real property

PRVI ODJELJAK

| Rbr. | Broj katastarske čestice | Broj D.L. | Adresa katastarske čestice/Način uporabe katastarske čestice/Način uporabe zgrade, naziv zgrade, kućni broj zgrade | Površina/ m2 | PPR |
|---|---|---|---|---|---|
| 1. | 1553 | 36,43 | UL.SLAVKA KOLARA | 3360 | |
| | | | DVORIŠTE | 1032 | |
| | | | STAMBENA ZGRADA, UL.SLAVKA KOLARAR. 29, 31, 33, 37, 35 | 2328 | |
| | | UKUPNO: | | 3360 | |

DRUGI ODJELJAK

| Rbr. | Sadržaj upisa | Primjedba |
|---|---|---|
| 1.1 | Zaprimljeno 19.01.2012. broj Z-271/12.<br><br>Na temelju čl. 116. st. 1. Zakona o izmjenama i dopunama Zakona o prostornom uređenju i gradnji i pravomoćne dozvole za upotrebu izgrađenog objekta od 14. studenog 1978. godine zabilježuje se da je za stambeno poslovnu zgradu broj 29,31,33,35,37 sagrađenu na k.č.br. 1553 (stara čkbr. 1965/2) priložen akt za uporabu građevine i to pravomoćna dozvola za upotrebu izgrađenog objekta Grada Zagreba-Općine Velike Gorice, Sekretarijata za građevinarstvo, komunalne i stambene poslove od 14. studenog 1978. godine, KI:UP-05-1680/1978, UP-05-1681/1978, UP-05-1682/1978. | ZABILJEŽBA |

Data about special part of real property (right holder, area of special part, ...)

B
Vlastovnica

| Rbr. | Sadržaj upisa | Primjedba |
|---|---|---|
| 253. Suvlasnički dio: 3717/1355625 ETAŽNO VLASNIŠTVO (E-253) | | |
| 1. Temeljem zapisnika broj Z-1351/2008/5227 prenosi se slijedeći upis: Posebni dio- jednosobni stan broj 2. na 7. katu, ulaz Slavka Kolara 37, koji se sastoji od jedne sobe i ostalih prostorija, površine 37,17 m2 | | |

C
Teretovnica

**Figure 3. Excerpt from a Land Database - example**

## 5. UPGRADING CADASTRAL RESURVEYS TO MEET THE 3D CADASTRE REQUIREMENTS

Procedures within cadastral resurveys in the Republic of Croatia can be upgraded to meet the 3D Cadastre requirements. Scope of the data collected during the conventional 2D resurvey would have to be expanded which would, on one hand, increase the overall expenses of cadastral resurvey, but on the other hand, only for some small extra cost. It is because the amount of additional 3D data, which is currently not collected but would be beneficial for

good land governance, is not too big. That's why the approach in which the ongoing process of the renewal of 2D cadastral data would be used (with minor adjustments), represents the most efficient way for development of rudimental 3D cadastre.

This idea can be conceptually described by extending the Land Administration Domain Model (LADM), which in 2012 become ISO 19152 standard (Lemmen et al. 2013). Extending classes, related to 3D data on buildings, are added as a specializations of the class LA_LegalSpaceBuildingUnit from the Spatial Unit package (Figure 4).

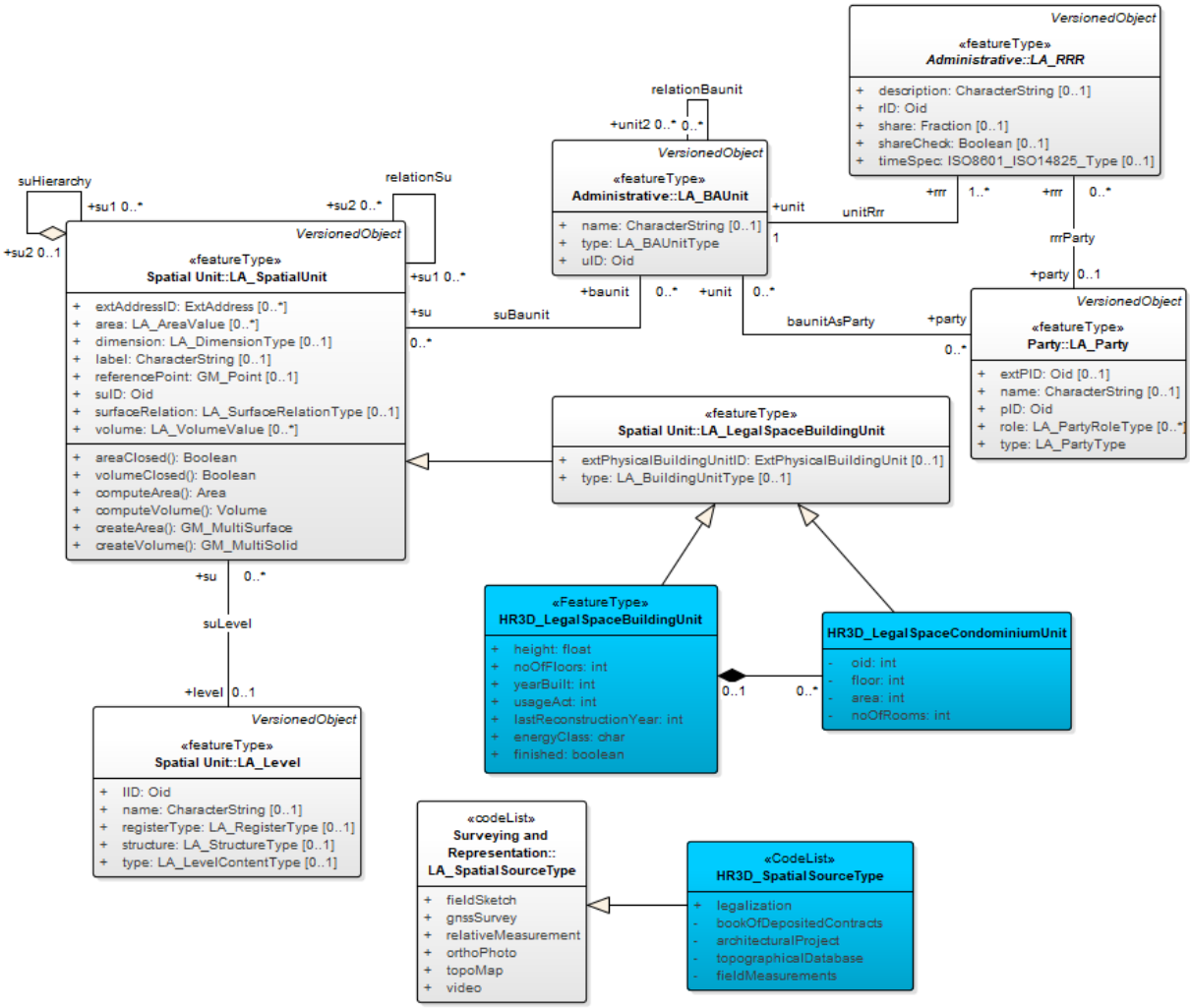



**Figure 4. Extension of LADM to support transition towards Croatian 3D cadastre**

Classes HR3D_LegalSpaceBuildingUnit and HR3D_LegalSpaceCondominiumUnit are descendants of LADM class LA_LegalSpaceBuildingUnit which is a descendant of the class LA_SpatialUnit. Class HR3D_LegalSpaceBuildingUnit is an extension of LADM class LA_LegalSpaceBuildingUnit and holds attributes about buildings which according to valid legislation needs to be collected during cadastral survey. Currently, data about condominiums are not collected. Therefore, class HR3D_LegalSpaceCondominiumUnit is created which is related via composition relationship to class HR3D_LegalSpaceBuildingUnit. One of the most

important information related to condominiums are related rights. Since condominium is descendant of the spatial unit, rights can be attached to condominiums via class LA_BAUnit. Because of various sources of 3D data, LADM class LA_Level can be used to model various geometrical representations. For example, if 3D geometry is unavailable, point profile can be used to represent the building or condominium feature. To such feature, rights can be attached and later geometry can be improved.

Figure 5 represents proposal of improvement of cadastral survey workflow. 3D data can be collected from cadastral survey data or during public presentation of survey results if some data were not collected during cadastral survey. However, 3D geometry of condominium units cannot be created from data which is currently being collected during cadastral surveys. Additional efforts and resources have to be invested to create these 3D geometries. For condominiums that have documentation of legality, some kind of 3D data are available. However, these data are mostly on paper so automatic or semi-automatic methods have to be developed.

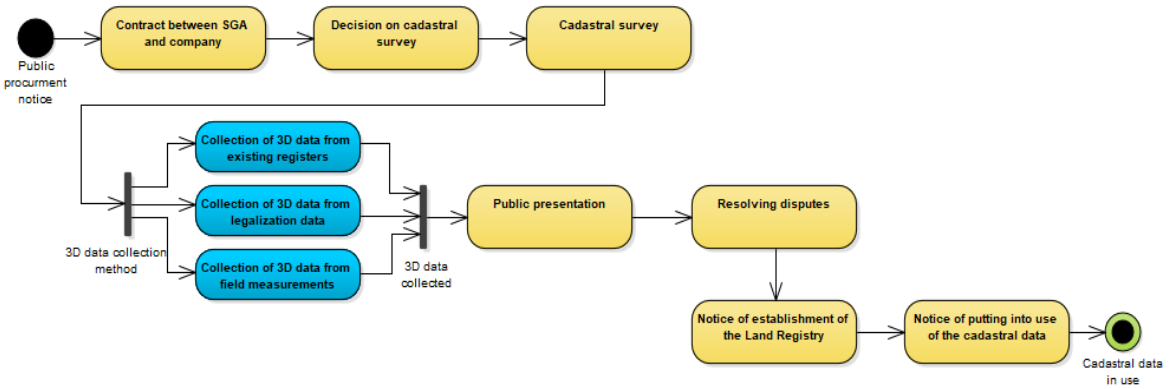



**Figure 5. Proposal of improvement of cadastral survey workflow**

Collection of 3D data represented in previous figure implies also collection of rights related to 3D units. Workflow needs to be further developed in more details but it shows that with little effort 3D data can be collected. In following sections, we describe in more detail each methodology for collection of 3D data.

## 5.1 Collecting the 3D data in cadastral resurvey from the existing registers and other relevant sources

According to the Regulation of the Connecting Land Register and the Book of Deposited Contracts (Official Gazette 2010), the legal obligation of the building manager is to start the procedure of connecting the land register with the Book of Deposited Contracts. This regulation was brought about as it was noticed that many buildings built several decades ago were not registered in the cadastre or the land registry, and have not been partitioned. According to the mentioned regulation, the description of the special part of a real property contains the data on intended use (office space, apartment, or other), number of rooms, position of special part in a building, and the area of the special part (for example, a two-bedroom apartment on the first floor, right side, with the usable area of 52,00 $m^2$). Furthermore, the description of a special part of a real property also refers to the additions (for

example, a woodshed, a garage, a parking space, a balcony, a garden, a terrace, and similar), along with their area, if there is such data. Data on special part of a real property are the most interesting 3D data for the Land administration.

In the cadastral resurvey, data on special parts of buildings (apartments and offices) are collected from existing registers – cadastre and land registry but also from other records and statements of property rights holders involved in the process of cadastral resurvey. For the apartment buildings it is proposed by this paper to collect data such as: height of the building, number of floors, year when the building has been built, type of usage, year of the last reconstruction, energy class of the building, the completion status, data on right holders of special parts of buildings. Majority of those data can be found in construction building plans, Reports on partition of real property or can be gathered from real property holders on the field.

### 5.2 Collecting the 3D data in cadastral resurvey from the Legalization report

Legalization of buildings was the process of registering illegally constructed buildings which took place recently in the Republic of Croatia. Interest of real property holders has been large and resulted by the year 2013 with 826.078 claims for the initiation of the legalization process. A lot of these buildings were built for agricultural purposes or as upgrades of existing residential buildings. In the year 2018 a new round of legalization process started. Current status of those cases is available at the Ministry of Construction and Physical Planning portal (URL 3). During this process Legalization reports have been made for illegally constructed buildings and based on those Reports the registration into cadastre and land registry were enabled for such buildings. Because of the large number of claims, legalization process represents a significant source of 3D data. The legalization reports contain detailed information on buildings which can further be used as a fundamental data for building 3D cadastre (architectural survey of the as-built situation with calculation of the volume of buildings and parts of buildings, geodetic survey of the as-built situation).
Following example presents a family house that has gone through the process of the legalization of illegally constructed buildings (Figure 6).

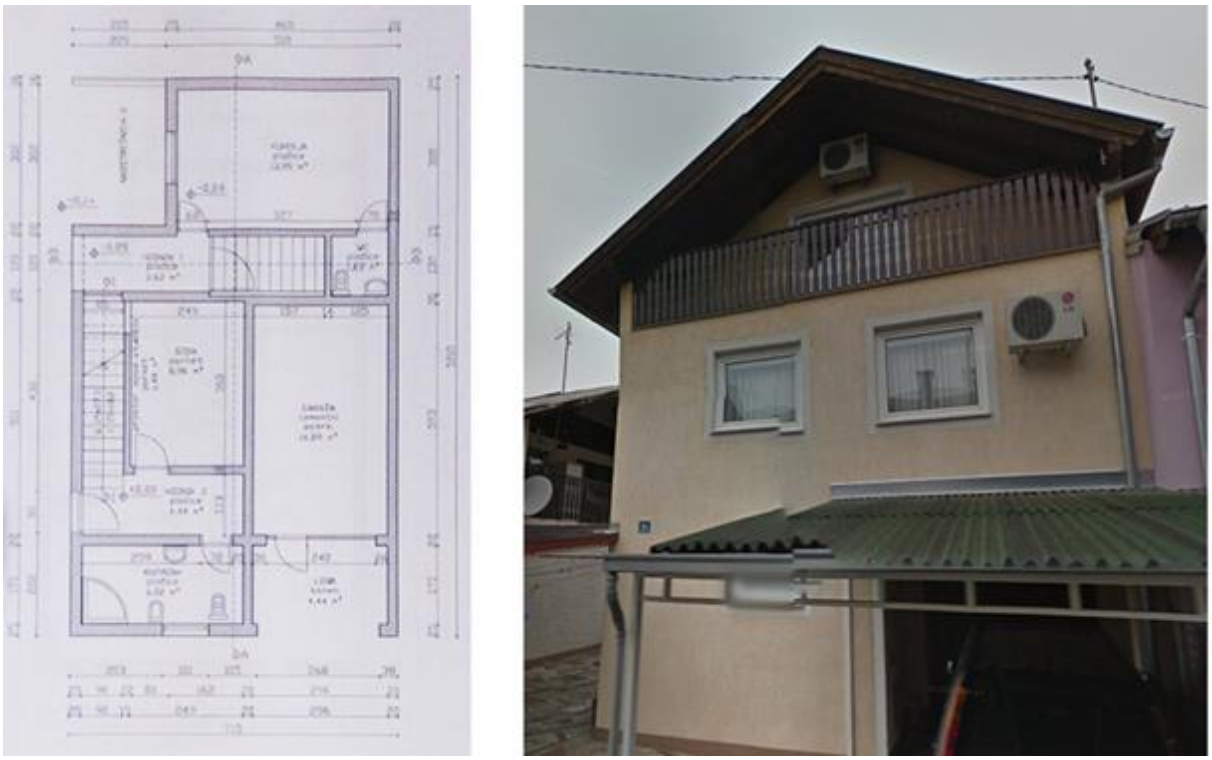


**Figure 6. Example – family house (part of architectural survey report)**

An integral part of the legalization report is a geodetic survey report and the architectural survey report which contains general information on the location of the building (street and house number, cadastral parcel number and cadastral municipality name), additional attributes of the building (area, number of floors and the height of the building), volumes (Table 1) of the building according to special regulations for the calculation of the municipal contribution and the water contribution (Official Gazette 2012).

**Table 1. Part of documentation provided by licensed architect in legalization process**

| **VOLUME OF BUILDING** | |
|---|---|
| **Basement** | V1 = 28,59 $m^3$ |
| **Ground floor** | V2 = 221,93 $m^3$ |
| **I. floor** | V3 = 208,12 $m^3$ |
| **Attic** | V4 = 148,14 m3 |
| **TOTAL** | **V= 606,78 $m^3$** |

Data on volume, precisely calculated in the process of legalization, could be also delivered through crowdsourcing – over the mobile application, web service or web portal of the company which is conducting the cadastral resurvey (Vučić et al. 2015). Similar temporary web services are already developed (only for the use of cadastral resurvey) enabling the two-way communication between all interested subjects of cadastral resurvey (Figure 7).


**Figure 7. Private geodetic company service for cadastral resurvey project (URL 4)**

## 5.3 Collecting the 3D data by field measurements in cadastral municipalities for which the land registry isn't established

In the Republic of Croatia land registry isn't established (Figure 8) for approximately 150 cadastral municipalities out of the total number of approximately 3382 cadastral municipalities. At the same time cadastral records exist for all cadastral municipalities. Croatian legislation (Official Gazette 1996) recognizes establishment of land registry (in cadastral municipalities where it doesn't exist) and renewal of land registry (in cadastral municipalities where it already exists but cadastral resurvey has been undertaken so land registry can be renewed with up-to-date data). Establishment of land registry can be done according to the data resulting from cadastral resurvey or even from old cadastral data – if it is estimated that the quality of those data is sufficient and resurvey is not necessary.

**Figure 8. House in the cadastral municipality Postranje for which land registry isn't established (simple 3D situation)**

The existence of land registry is a basic prerequisite for legal security in real property transactions because the registration in land registry is the most credible proof of the ownership. It is therefore the duty of the state to establish land registry for those cadastral municipalities where it doesn't exist. Ultimately, the state would have a great deal of benefit, and right holders – citizens and companies would have the same opportunities as those in the areas where land registry exists.

During the cadastral resurvey besides the 2D data on cadastral parcels and buildings which are collected according to the current legislation (Official Gazette 2008), it can be defined by investors (State Geodetic Administration and Local government) which additional data should also be collected. Besides the accurate data on right holders, which are missing because of the lack of land registry, other real property 3D data mentioned in subsection 5.1 can also be collected. Since the majority of these 150 cadastral municipalities, for which the land registry hasn't yet been established, are mostly in rural areas, it would be a rather easy task with today's modern surveying technologies to upgrade to 3D cadastre, as there are not too many complex 3D situations with overlapping rights like the ones shown in the following figure (Figure 9).

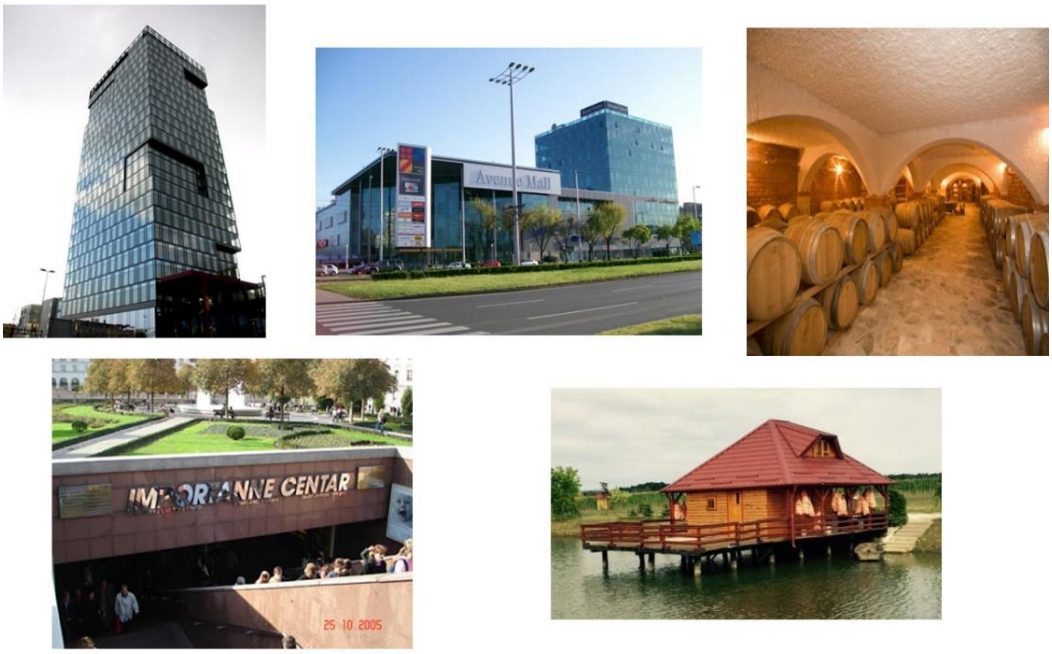



**Figure 9. Example of complex 3D situations**

## 6. CONCLUSION

Overlapping rights represent the most complex real-life situations for handling by the land administration systems which are traditionally 2D oriented. Incorporating the 3D data into those systems is one great task that has to be done for them to be able to cope with the requests of today's society and become modern Multipurpose Land Administration Systems. The lack of systematically collected 3D data, well-structured, organized and maintained in

land registers according to the latest technological achievements is the main obstacle for efficient registration of overlapping rights.
One way to improve this is to try to use the current ongoing processes for the renewal of land data. In the situation where cadastral resurvey is chosen as the best practice for improving the land administration data, with only small extra cost it would be possible to adjust and improve this process so it would also be suitable for systematic establishment of 3D cadastre in the most efficient way. In order to achieve this, it is necessary to partially update the regulations and to improve the data model of the JIS, which is currently the basic tool for Land Administration. In this paper only the 3D data which are the most frequently requested by the users and which are needed in everyday demands by the institutions and citizens are considered. In the future other and more detailed 3D data can be included.

## ACKNOWLEDGEMENTS

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