

LADM in the Republic of Croatia – making and testing country profile

Nikola VUČIĆ, Danko MARKOVINOVIĆ and Blaženka MIČEVIĆ, Croatia

Key words: LADM, Croatian cadastre, land book, class, testing

SUMMARY

Land Administration Domain Model (LADM) covers basic information related to components of land administration (including elements above and below the earth surface and including water areas). It includes agreements on data about administrative and spatial units, land rights in a broad sense and source documents. The rights may include real and personal rights, informal rights as well as indigenous, customary rights. All types of restrictions and responsibilities can be represented. Overlapping claims to land may be included. Cadastral and land books data play important role in many fields directly or indirectly associated with their use (land surveying, civil engineering, architecture and urban planning, agronomy, transport, forestry, tourism, etc.).

So far, similarities and differences between the existing Croatian land administration system and LADM have been investigated. Objective of this paper is to determine compatibility between Land Administration Domain Model and Croatian Land Administration System. Compatibility is determined with following questions:

- What are users' requirements for the Croatian land administration system?
- Which LADM classes can be applied directly to the Croatian land administration system?
- Which LADM classes have to be modified to be suitable for the Croatian land administration system?
- How to design a land information system for the Croatian land administration system complying with LADM?

This paper gives answers to the previous questions. LADM country profile Croatia has been developed and key requirements, concepts, and functionalities of Croatian Land Administration System (LAS) have been identified. Conceptual Croatian LAS model comprising the LADM framework have been elaborated. This paper proposes two new classes are in the model (HR_OldCadastralSurvey and HR_LegalityOfTheBuilding). Some types in the code lists have been changed and added to suit to the Croatian LAS.

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1. INTRODUCTION

The requirements from future land governance are related to improving registration of public restrictions, registration of public benefits, registration practices with regard to public land, registration of public goods and its spatial extents as well as policy implications. As a platform independent model LADM provides generic view of the main objects associated with land administration. Therefore it is independent of any considerations regarding implementation method (such as computer platform, data representation, database schema and other details).

Basic step in the direction of domain modelling of Land Administration has been made with Land Administration Domain Model. Data needed for Land Administration in a broad sense can be represented in the LADM. In some countries LADM profiles are already done, while in others country profiles are still under development. It is expected that in the future there will be a need for the development of other non-LA (Land Administration) domains. Within LADM these non-LA domains are explicitly indicated as external classes, such as persons, addresses, valuation, taxation, land use, coverage, physical utility networks, etc.

Croatia is currently in the process of land administration reform. In this paper we focus on making and testing the Croatian profile of LADM. This paper is organized as follows:

- Land Administration in Croatia (Section 2)
- Land Administration Domain Model (Section 3)
- Country profile Croatia – making and testing (Section 4)
- Conclusion (Section 5).

2. LAND ADMINISTRATION IN CROATIA

The Croatian Land Administration System is based on two registers: the cadastre and the land book. In cadastral offices (20 regional cadastral offices with their 92 branches and the Municipal Office for Cadastre and Geodetic Works of the City of Zagreb), the real properties are registered according to their technical characteristics. The cadastral data on the real property (cadastral parcels) is the basis for the establishment, renewal, keeping and maintenance of land books that are kept in 109 land book offices of 65 municipal courts. In land book, the data on cadastral parcel title holders is associated to the data on cadastral parcels defined by the cadastre. Real property in Croatian real property law is, according to the *superficies solo cedit* principle, a land surface parcel to include everything relatively permanently associated with this parcel on or below the land surface (primarily buildings, houses, etc.). A real property, in legal terms, may consist of one or more land parcels registered in the land book in the same property sheet, as they are hence legally combined in a single body (registered land unit). Grass, trees, fruits and all valuable commodities the land provides on the surface are parts of this real property until this land is divided. The Croatian Land Administration system has several objectives such as statistical support, support for

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spatial planning and construction, support for agriculture (cooperation with LPIS – Land Parcel Information System). But the most important include the introduction of security in the real property legal transactions and the protection of titles registered in the registers.

In past 10 years Republic of Croatia had significant changes in legislation concerning the official spatial data which are also reflected on the cadastral data. The most important changes are renovation of cadastral offices, cadastral maps are vectorized and stored in the Digital Cadastral Map Central Database, production of Digital Orthophoto Maps in the scale of 1:5000 covering the entire territory of the Republic of Croatia, National Spatial Data Infrastructure (NSDI) Study, the introduction of new geodetic datum and map projection, transition from land cadastre to real estate cadastre, development of the Joint Information System of Land Book and Cadastre (JIS) and increasing the usage of national network of reference GNSS stations (CROPOS – Croatian Position System). New State Geodetic Administration Geoportal (<http://geoportal.dgu.hr/>) was launched in 2012. In April 2013 Croatia has adopted the Law on National Spatial Data Infrastructure. The subjects obliged to participate in the National Spatial Data Infrastructure establishment, maintenance and development are State administrative bodies, local and regional government units and legal entities having public authority. Also these following achievements were made: land book management sector establishment, court network rationalization, digitization of land book, reduced backlogs, improved customer relationships, the Ministry of Justice e-land book portal and the cadastral database has been available on the Internet since 2005 and improved legislation. For the purpose of establishing the real property cadastre and renewing the land registers, the process of cadastral surveys ensures harmonized data between cadastre and land registers and the actual situation in the field (Markovinović et al, 2013).

But still we have two key problems in Croatian Land Administration System:

- how to embed current very precise geodetic measurements into the old cadastral maps which are still the official cadastral records for more than 75% of the state territory. These cadastral maps are old between 100 and 150 years.
- non harmonized data between cadastre and land book: special cases such as cadastral municipality in which the survey was made between the 1950 and the 2000 and is recorded in the cadastre, but isn't recorded in the land book.

2.1 Current situation of Land Administration system in Croatia

Real property cadastre is defined as a register in which data about location, shape, area, type of use and buildings are kept for each cadastral parcel. Those data are official data for description of parcels in the transfer of real property rights, and they are official data for establishment and maintenance of the land book. Location and shape of cadastral parcels and buildings are presented in cadastral maps (Roić et al, 2012). Written cadastral data are systematised in possessory registration sheets, with number of cadastral parcel, name and type of use of cadastral parcel, buildings and area for each cadastral parcel. Data about owners in the possessory registration sheet are the land book data.

Over the last few years State Geodetic Administration (SGA) and Ministry of Justice, recognizing the need for development of the Croatian economy, systematically carried out the real estate registration activities as well as the modernization of land administration in the Republic of Croatia.

In addition to regular activities and numerous bilateral projects the most important part of land administration reform is Real Property Registration and Cadastre Project. Main objective of this project is to build an efficient land administration system in order to develop an efficient real estate market. Final Report of the Project provides information on compliance two state registers for the period 2003-2010:

- completely harmonized data on the 5% of the state
- 5.56% harmonized cadastral parcels in the state
- 2.63% cadastral municipalities harmonized data
- 3.67% harmonized cadastral parcels by the geodetic elaborate
- in progress is the public presentation of cadastral surveys and land restoration book for 2 % cadastral municipalities
- in progress is the cadastral survey for 4.36% of cadastral municipalities.

2.2 Users' requirements for Land Administration system in Croatia

This section describes the basic requirements from land users and land managers in Republic of Croatia. Requirements are defined by collecting rules and regulations in the legal documents, by analyzing data, reports and complaints from citizens, and from authors experience in work with citizens and users of Land Administration System (LAS) in the State Geodetic Administration of the Republic of Croatia.

2.2.1 Cadastral parcel information

Basic spatial unit of the real property cadastre is a cadastral parcel. One cadastral parcel is a unit of a cadastral municipality or cadastral region at sea determined by a parcel number and its boundaries. Unique identifier of the cadastral parcel consists of an identification number of the cadastral municipality or cadastral region at sea and the parcel number. Boundaries of the cadastral parcel may be borders or other boundaries defined by legal relations on the land surface (Official Gazette, 2007). The basic information of cadastral parcel is shown in Table 1.

Table 1. The basic cadastral parcel information

No.	Name	Description
1	Cadastral parcel identifier	Uniquely identified for each cadastral parcel. It consists of an identification number of the cadastral municipality or cadastral region at sea and the parcel number. Sometimes cadastral parcel number in the cadastre may be different than the cadastral parcel in the land book (old and new cadastral survey for one cadastral municipality, when new cadastral survey is not recorded in land book).
2	Area	In last 6 years there are no differences between cadastral parcel area on the map, on the field and in the document for new made parcels, because of good legislation (article 74. of Law on state survey and the real property cadastre). But older data may have those differences because of respecting registered areas, measured and calculated by old geodetic instruments and methods.
3	Duration of land use	Property - permanently, to the legal transactions or inheritance. Usufruct - a period of time. Lease - a period of time.
4	Land use type	Data on land use type is required by law and implemented in the current information system.
5	Legality of the building	Cadastre is one of key institution in the process of controlling legality of the buildings which are built on the cadastral parcels.
6	Land prices	Not directly in the system of land administration (cadastre and land book). Jurisdiction of the Ministry of Finance.

7	Land restrictions	Data regarding to land restrictions are provided for cadastral parcels in some cases such as cannot sell a house (for ten years period) rebuilt with the program for renovated houses that were destroyed in the war.
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2.2.2 Person information

Data related to persons includes land managers and land users. For land managers' role there are two types as organizations and authorized companies. For land users' role, there are three types as natural person, legal person and group. By 1st July 1999 the spouses' property acquired in marriage has the status of joint ownership, and from 1st July 1999 the status of co-ownership. The basic information about person in Croatian LAS is shown in Table 2.

Table 2. The basic person information

No.	Type	Information
1	Natural person	Name, permanent address, unique person identifier of Ministry of Finance
2	Legal person	Name, permanent address, unique person identifier of Ministry of Finance
3	Group	Name of ex. "Land community", permanent address

2.2.3 Buildings and other structures

Buildings and other structures are registered in the cadastre with the following attributes: area, intended building use, building name, and house number. Land book adopt cadastral data and register listed two-dimensional data about real property parts. Real property may be further divided into common and particular parts and registered in the land book based on the report on partition of real property.

2.2.4 Public utility networks

Formation and management of the Utility Cadastre is responsibility of the local government bodies (Official Gazette of the Republic of Croatia, 2007). It contains data about type, purpose, basic technical features, and the location of built utility lines, and it lists the names and addresses of their managers.

2.2.5 Surveying, gravimetric and map information

Before 2004, the national coordinate system in Croatia was Croatian coordinate system HDKS (established on the Bessel ellipsoid, Gauss-Krüger projection and orthometric heights). From 2004, the Croatian Terrestrial Reference System (HTRS96) was defined as a new positional system – Croatian realization of ETRS89 (European Terrestrial Reference System 1989). The new vertical system of the Republic of Croatia – HVRS71 (Croatian Vertical Reference System 1971) is determined by the geoid datum defined by the mean sea level for the epoch 1971.5 on five tide gauges equally distributed along the Adriatic coast (Dubrovnik, Split, Bakar, Rovinj and Kopar). The implementation of these new official geodetic datum's in practice and in the official cadastral database is currently in progress

The materialization of gravimetric reference system is made up of fundamental gravimetric network consisting of 6 absolute gravimetric points and 36 points of the first order gravimetric network, and this reference system was named as the Croatian Gravimetric Reference System 2003.

The Decree on establishing new official geodetic datum and map projections for the Republic of Croatia stipulates that the transverse aspect of Mercator's (Gauss-Krueger) projection with

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the mean meridian 16° and 30' and with linear scale of 0.9999 is determined to be the official map projection of the Republic of Croatia for the field of cadastre and detailed state topography (Official Gazette, 2004). The Lambert conformal conical projection with defined standard parallels 43° 05' and 45° 55' is determined as official map projection for the needs of general state cartography. Both projections are based on the GRS80 ellipsoid as the mathematical model, i.e. the HTRS96 reference system. For the needs of the Republic of Croatia Armed Forces and in accordance with the recommendations and obligations towards NATO, the Universal Transverse Mercator projection (UTM) was adopted.

2.2.6 Cadastral maps

Cadastral maps originate from different time periods, between 1850 till present days. First employable maps, most of which are in scale 1:2880, arise with proclamation of the Imperial Patent and preparation of the land cadastre in Croatia region under Austria-Hungary. Seven coordinate systems with different starting points had to be used as surveys were performed without projection in plane rectangular system (Borčić and Frančula, 1969).

Kingdom of Yugoslavia introduces the Gauss-Krüger projection with maps prepared in scales 1:500, 1:1000, 1:2000, and 1:2500. Technical purpose of the cadastral system during the Socialist Federal Republic of Yugoslavia demanded preparation of the topographical and cadastral maps and introduction of the new real world features. Cadastral maps were digitalized for the whole Croatia by 2010.

Croatia has:

- 3346 cadastral municipalities,
- 55867 cadastral maps,
- 14.428.790 cadastral parcels.

3. LAND ADMINISTRATION DOMAIN MODEL (LADM)

The Land Administration (LA) standard has been available since 1st December 2012 as a formal International Standard, published as ISO 19152 (ISO, 2012). This standard is expected to have an impact on the development of Land Administration Systems (LAS).

The International Standard for the Land Administration Domain serves the following goals:

- Establishment of a shared ontology implied by the model.
- Support to the development of the application software for Land Administration.
- Facilitation of cadastral data exchange with and from a distributed Land Administration Systems.
- Support to data quality management in Land Administration (Lemmen et al, 2013).

LADM can be extended and adapted to local situations; in this way all People to Land relationships may be represented. This can be supportive in the development of software applications built on database technology. LADM describes the data contents of land administration in general. Implementation of the LADM can be performed in a flexible way; the standard can be extended and adapted to local situations (Lemmen, 2012).

In any effort to reform of existing Land Administration System, or to create a new one according modern technical and methodological capabilities, a key point to consider is the modelling of the legal framework concerning Real Rights. Or simply, land related Rights,

where Roman law concepts are absent. This follows naturally from the fact that, in the majority of Land Registration system, the Basic Administrative Unit represents the extent of ownership rights (Hespanha, 2012).

The latest researches of LADM use the classification of interests in land described in the newly developed Legal Cadastral Domain Model (LCDM), to further develop the LADM. The LCDM is based on comparative international legal investigations, including case studies from Portugal, Germany, the Netherlands, Ireland and Sweden (Paasch et al, 2013).

When generating country profile based on LADM it is necessary to review administrative, legal and technical regulations of a particular country's existing land administration framework.

4. COUNTRY PROFILE CROATIA

First version of Croatian country LADM profile was developed 2012 (Vučić et al, 2013). It is based on LADM and adds some new classes, attributes and types to the code list (to differentiate LADM in Croatia from other models, their names are given with HR_ as prefix). Compared to previous research in this study prefix CRO_ is replaced with prefix HR_ according to ISO 3166 standard (Figure 1a and Figure 1b).

As we already said in the Section 2 we have dual system of real property registration and the land administration institutions in Croatia decided not to get merged into one institution but opted for a unique Croatian solution of linking the institutions at the level of data and business processes to be maintained according to respective jurisdictions. It was precisely the harmonization of business processes in accordance with the jurisdictions in data maintenance between the institutions that presented the biggest challenge during the Joint Information System (JIS) implementation. The amendments to the Land Registration Act of 2007 defined for the first time the JIS establishment. The contract for the JIS development and establishment was awarded in July 2007. Its initial closing date was extended from July 31, 2009, to June 30, 2010. JIS includes the Land Database (LDB) and the Digital Cadastral Map Database (DCMD). LDB manages both - land book and the cadastre run by the electronic data processing. The JIS technical solution enables IT communication with the basic State registers: databases comprising the data on OIB (Personal Identification Number), spatial data register, State Geodetic Administration (SGA) Geoportal, SGA digital archives and will be linked to the One Stop Shop system (Markovinović et al, 2013).

Implementation of the JIS will have following benefits:

- integrated cadastre and land book data - a unique land database
- integrated graphical and alphanumeric data
- single centralized application for all cadastral and land book offices
- inimitable data maintenance
- avoiding the generation of copies of data due to different applications at cadastral and land book offices
- integration with the Geoportal and the ability to view digital ortho-photo data
- integration with the Register of Spatial Data
- JIS is process-oriented application, accelerating business processes and increasing internal transparency
- the ability to review and edit graphical data

- digital signing of electronically generated documents as the basis for the electronic exchange and centralized printing
- integration with the VAT (value added tax) system.

During the implementation and establishment of the JIS in cadastral and land book offices, LADM can be used as a basis for the control of business processes.

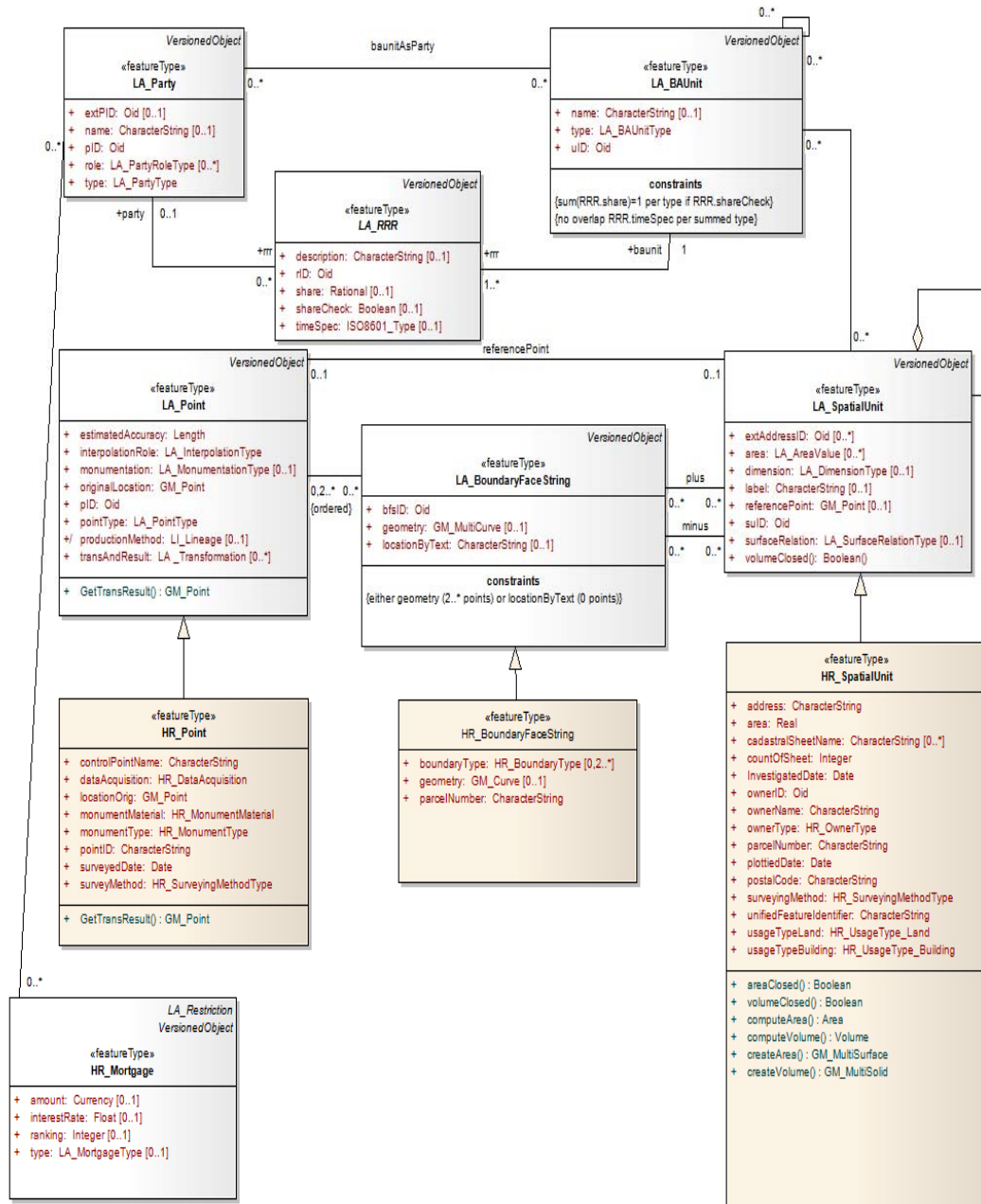


Figure 1a. Country profile Croatia

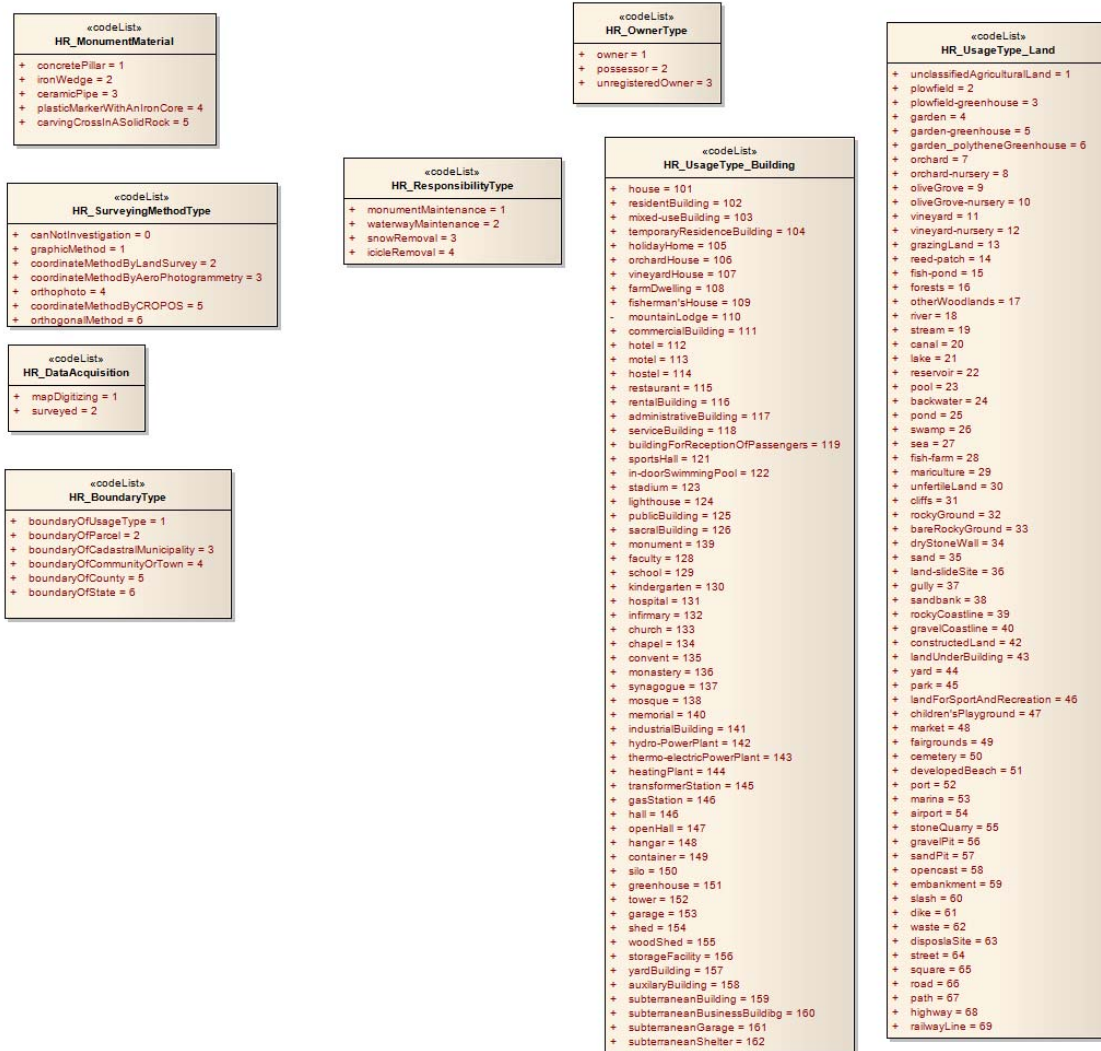


Figure 1b. Country profile Croatia (code lists)

4.1 Party package

The main class of the party package is class LA_Party with its specialization LA_GroupParty. A party is a person or organization that plays a role in rights transaction. An organization can be a company, a municipality, the state or church community (in Croatia - usually legal persons). A “group party” is any number parties, forming together a distinct entity (in Croatia - usually ex. “land communities”). Classes LA_Party with its specialization LA_GroupParty can be applied directly to the Croatian Land Administration System (Figure 2). The types in the code lists have been changed and added to suit to the Croatian LAS.

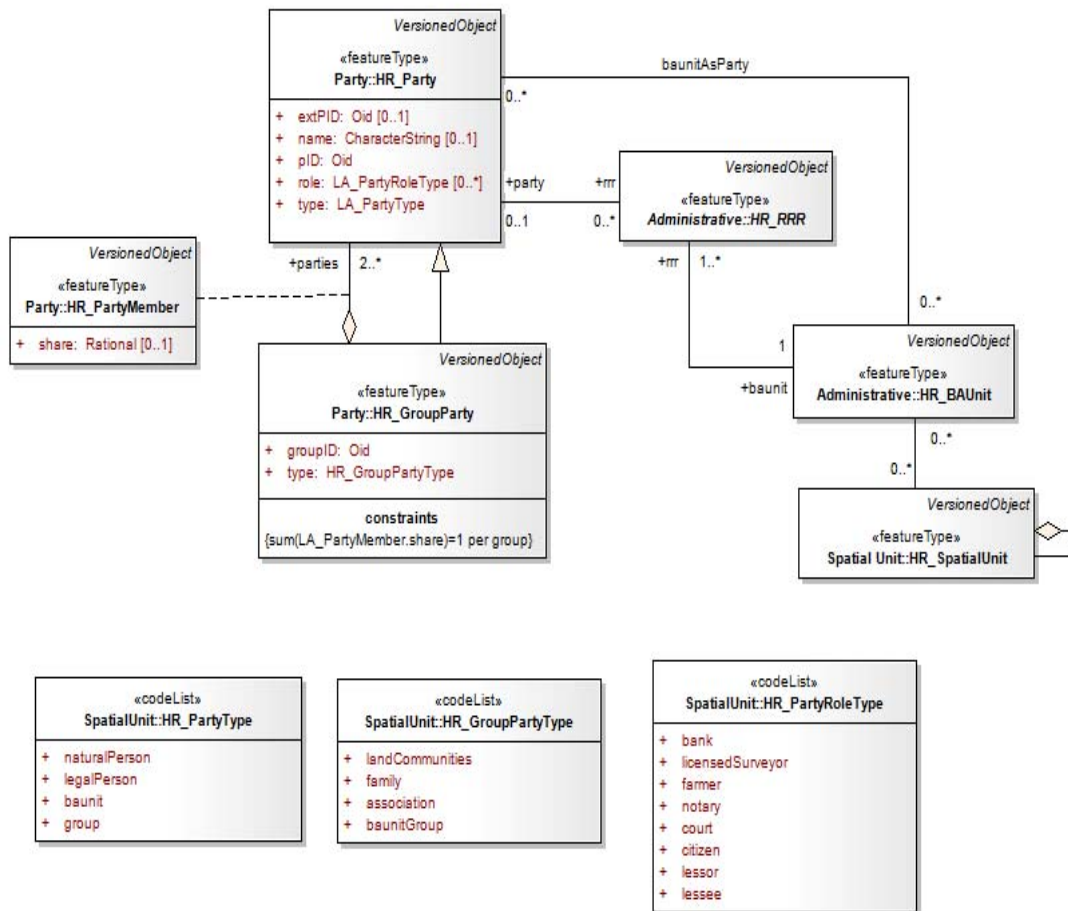


Figure 2. Content of Party package

4.2 Administrative package

The attributes and relationships in the administrative package of Country profile Croatia are similar to LADM and all classes of Administrative package can be applied directly to the Croatian Land Administration System. The types in the code lists have been changed and added to suit to the Croatian LAS (Figure 3).

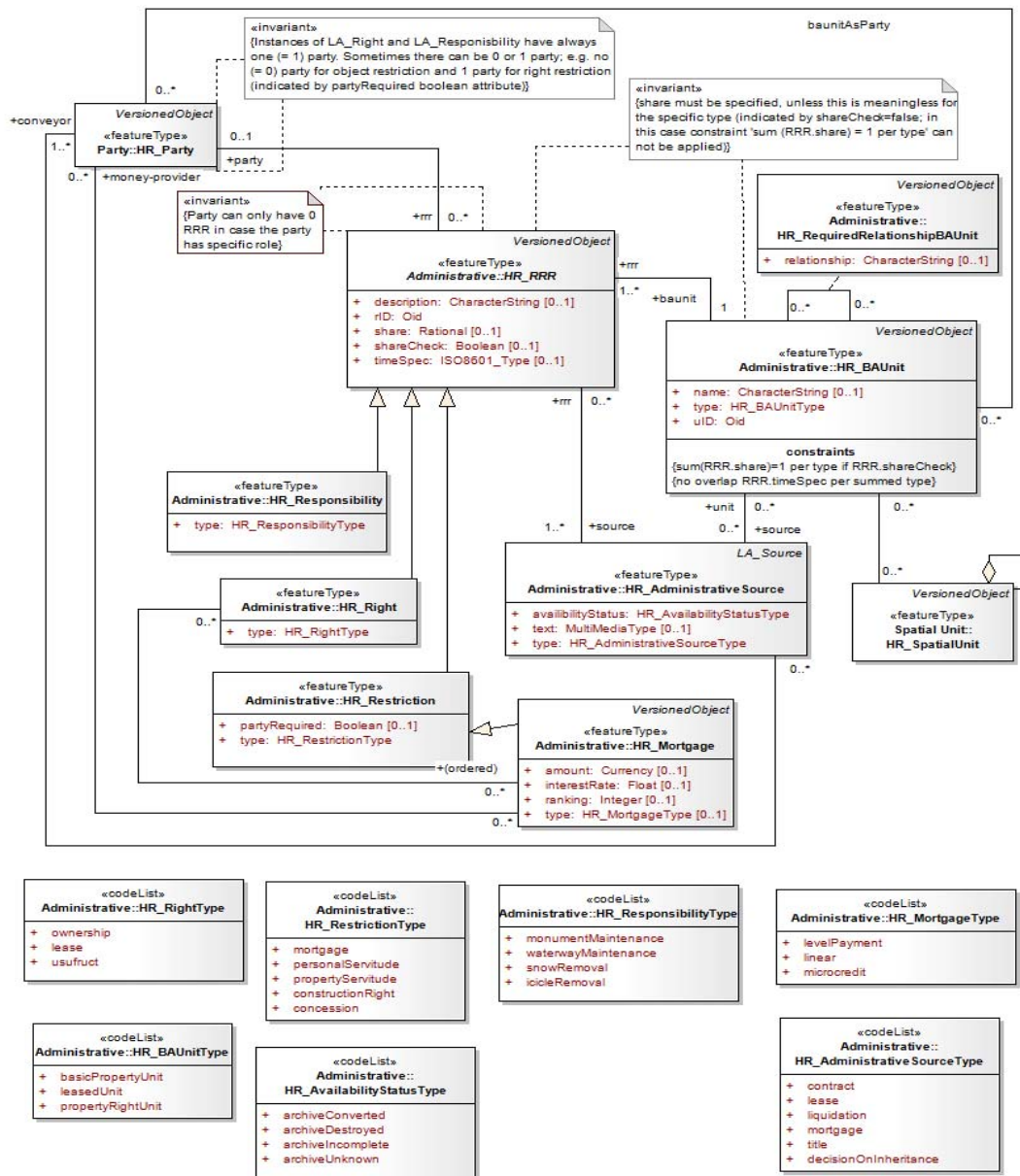


Figure 3. Content of Administrative package

4.3 Spatial unit package

The spatial unit package presents the attributes of the land parcels, buildings and other properties associated with land. According to the analysis of users' requirements in Section 2, some attributes related to the cadastral parcel should be added: area, duration of land use, land use type, legality of the building.

This research proposes two new classes called HR_OldCadastralSurvey and HR_LegalityOfTheBuilding (Figure 4). First class is required for special cases such as cadastral municipality in which the survey was made between the 1950 and the 2000 and is recorded in the cadastre, but isn't recorded in the land book. Second class is required because cadastre is one of key institutions in process of controlling legality of building.

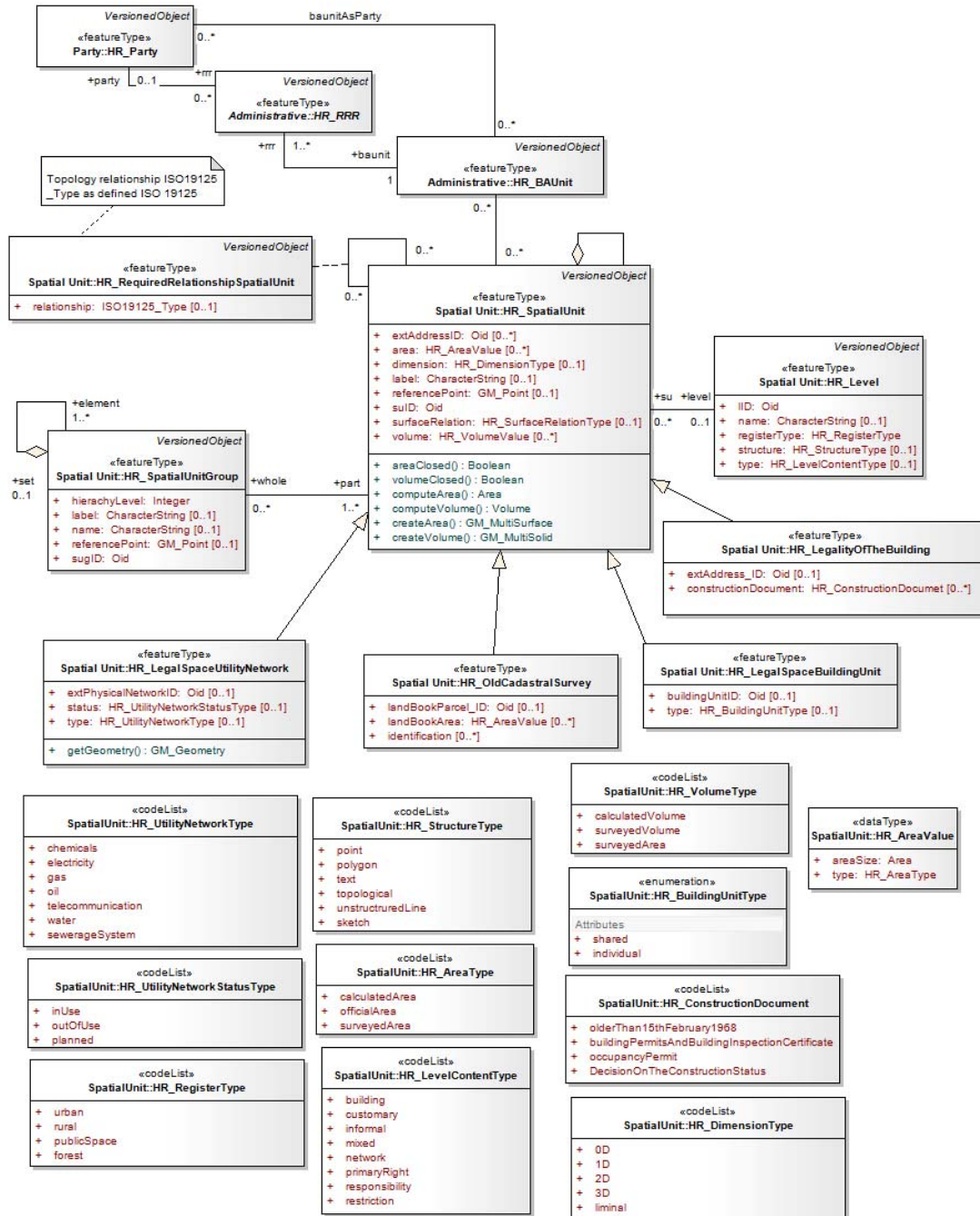


Figure 4. Content of Spatial unit package

4.4 Surveying and Representation Subpackage

The surveying and representation subpackage shows the data related to technical features about land use. All classes of surveying and representative package can be applied directly to the Croatian Land Administration System.

4.5 Conformance testing

The abstract test suite is in conformance with ISO 19105. The test suite in Annex A of the LADM specifies the requirements that the implementation under test has to meet in order to be conformant to this International Standard. For each test the metadata conformity element takes one of the following values:

- Conformant (conformant). The resource is fully conformant with the cited specification
- Not Conformant (notConformant). The resource does not conform to the cited specification
- Not evaluated (notEvaluated). Conformance has not been evaluated.

5. CONCLUSION

There are several countries that use LADM to establish a country profile for their land administration system. LADM can be used as the reference model for the development of the Croatian Land Administration System. Design a land information system for the Croatian land administration system complying with LADM can be possible by methodology includes a Model Driven Architecture process where the LADM supplies just the starting point in a transformation chain to a country Platform Independent Model. To express modeling constraints over a diversity of possible data structures, the UML extension mechanisms were used, through the specifications of spatial profiles and patterns.

In conclusion, the adoption of LADM in the Republic of Croatia is possible. Most of LADM classes can apply directly to Croatian Land Administration System (LAS). The types in some code lists have been changed and added to suit to the Croatian LAS. This research proposes two new classes called HR_OldCadastralSurvey and HR_LegalityOfTheBuilding which are solving specifics of the Croatian LAS.

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BIOGRAPHICAL NOTES

Nikola Vučić graduated in Geodesy from the University of Zagreb, Faculty of Geodesy. He is the employee of the Department for Administrative and Professional Supervision at the State Geodetic Administration of the Republic of Croatia. He is a PhD student in Geodesy and Geoinformation at University of Zagreb, Faculty of Geodesy. The topics that he specializes in are land administration systems, cadastres and geoinformation. He is a member of the Croatian Geodetic Society.

Danko Markovinović is director general at the State Geodetic Administration of the Republic of Croatia. In 2009 he received a PhD from University of Zagreb for this thesis 'Gravimetric Reference System of the Republic of Croatia'. He has been employed at the Faculty of Geodesy of the University of Zagreb since 1995 till 2012. He is chartered geodetic engineer at Croatian Chamber of Chartered Geodetic Engineers. He is vice-president of the Council of European Geodetic Surveyors.

Blaženka Mičević is deputy director at the State Geodetic Administration of the Republic of Croatia. She has master's degree from University of Zagreb, Faculty of Geodesy and currently is a PhD student in Geodesy and Geoinformation at University of Zagreb, Faculty of Geodesy. She is chartered geodetic engineer at Croatian Chamber of Chartered Geodetic Engineers, member of the Croatian Geodetic Society and vice-president of Association of Surveyors of Brodsko-posavska County.

CONTACTS

Nikola Vučić
State Geodetic Administration
Gruška 20
Zagreb
REPUBLIC OF CROATIA
Phone: +385 1 6165439
Fax: +385 1 6165 454
E-mail: nikola.vucic@dgu.hr
Website: <http://www.dgu.hr>

Danko Markovinović
State Geodetic Administration
Gruška 20
Zagreb
REPUBLIC OF CROATIA
Phone: +385 1 6165444
Fax: +385 1 6157389
E-mail: danko.markovinovic@dgu.hr
Website: <http://www.dgu.hr>

Blaženka Mičević
State Geodetic Administration
Gruška 20
Zagreb
REPUBLIC OF CROATIA
Phone: +385 1 6165444
Fax: +385 1 6157389
E-mail: blazenka.micevic@dgu.hr
Website: <http://www.dgu.hr>