REPUBLIC OF CROATIA
State Geodetic Administration

Croatian Presidency of the Council of the European Union

Building Register – Basis for 3D Cadastre

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Needs for 3D cadastre

- increasing demand for property development in urban areas,
- resulting in the division of property ownership so that different owners can own delimited space on, above or below ground surface.
- Under 3D cadastre, the 2D cadastre management of data cannot meet the real land management of the three dimension space aspect and property.
- It is essential to introduce the 3D cadastre

3D cadastre – real life situations – Republic of Croatia


G A R A Ž A
K V A T E R N I K O V T R G
2,1m
2,1m

Registers

- In the Republic of Croatia (and other countries where cadastre was established a long time ago), many registers and official databases on land and interests were created where certain overlaps between some segments are evident.
- These were most often established independently and therefore contain a lot of redundant data.
- However, their interaction can be used to gain new values and establish Multipurpose Land Administration Systems.

3D cadastre

- Cities are increasingly adopting 3D city models. Providing further value and additional utility over 2D geo-datasets, 3D city models are becoming ubiquitous for making decisions and for improving the efficiency of governance.
- In the Republic of Croatia, the new State Survey and Real Property Cadastre Act stipulates the establishment of a new register called the "Building Register”

CROATIAN LADM (ISO 19152) PROFILE

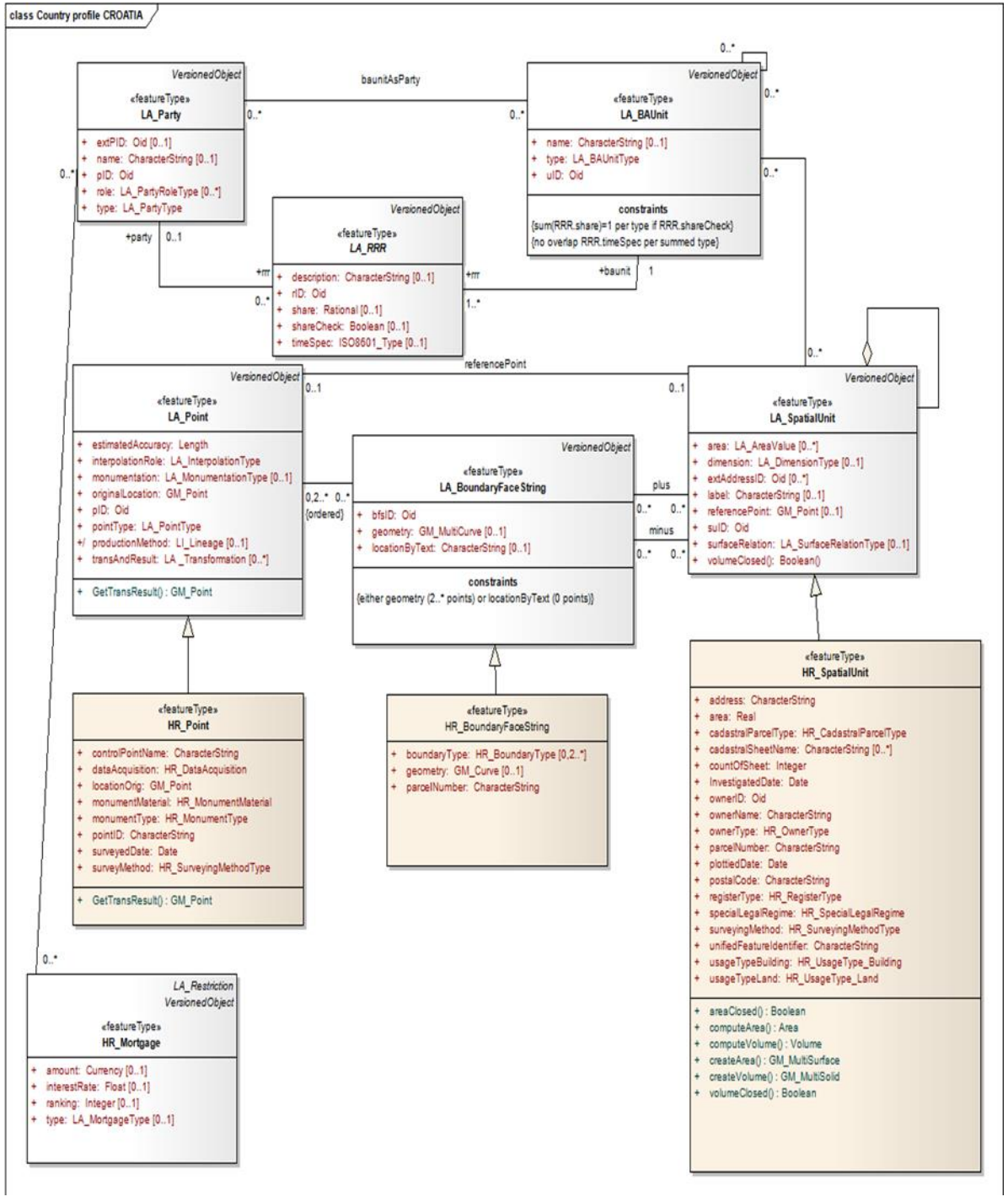
- The first version of the Croatian LADM profile was developed in 2012.
- New classes, attributes, and types were added in the code list. For the attributes added in classes HR_SpatialUnit: HR_UsageTypeLand and HR_UsageTypeBuilding, the corresponding code list was created according to the Regulation on Land Cadastre and according to the Regulation on the Content and Form of Real Property Cadastre Documentation.
- The code list was also created for HR_OwnerType, HR_MonumentMaterial, HR_BoundaryType attributes, in accordance with the current State Survey and Real Property Cadastre Act.

CROATIAN LADM (ISO 19152) PROFILE

- The unique identifier of special parts of real property is a solution for all objects that are needed for the development of 3D Cadastre (buildings of various purposes, underpasses, overpasses, tunnels, bridges, viaducts, underground buildings, etc.).
- The unique identifier could be used for denotation of separate parts of buildings, such as flat, apartment, business space, where each separate part gets a unique identifier in the Croatian land management system.

- **The unique identifier of a special part includes:**
  - identification number of the cadastral municipality
  - number of land registry file
  - number of land registry sub-file.

CROATIAN LADM (ISO 19152) PROFILE



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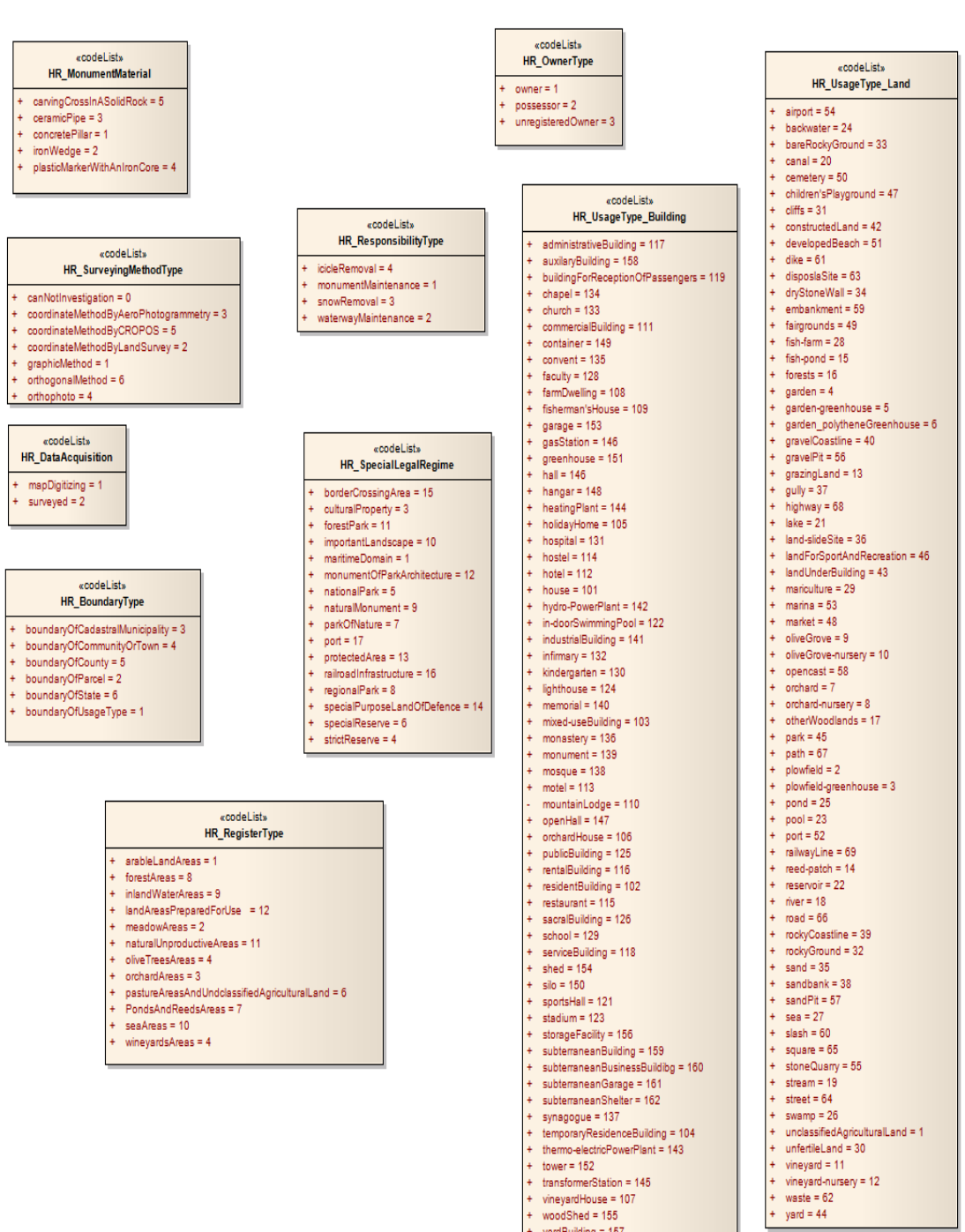
CROATIAN LADM (ISO 19152) PROFILE code lists



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REGISTERING BUILDINGS IN THE CROATIAN LAND ADMINISTRATION SYSTEM

- Data about buildings are entered into land books based on information delivered to the land registry by the cadastral office.
- Ownership of a separate part of real property (e.g. an apartment or office space) is realized through registration in the land registry.
- Such separate parts may be registered if they constitute independent units of use. Separate parts may include balconies, terraces, basements, and attics, under the condition that they serve exclusively a single particular part and are clearly separated from other parts of the real property

REGISTERING BUILDINGS IN THE CROATIAN LAND ADMINISTRATION SYSTEM

- The elaborate on condominium partition of real property establishes the size and shape of the common and separate parts of a single real property (apartment, office space, etc.) and draws connections for reference purposes against the real property as a unit.

ELEMENTS FOR ESTABLISHING THE BUILDING REGISTER

The standard attempts to assign standardized classes to generally differentiate grades of 3D data. The geometric detail and the semantic complexity increase with each level

The five LODs of the OGC CityGML 2.0. (source: Biljecki 2017)

ELEMENTS FOR ESTABLISHING THE BUILDING REGISTER

- Proposed attributes of the objects are:
- **building** (identification code of the building, identification code of the cadastral parcel, address of the building, footprint of the building, 3D building model, parameters of positional and height accuracy, real use of the building, land area under the building, altitude of the building (minimum, terrain, maximum), height of the building, number of floors, number of the ground floor, number of apartments/business premises in the building, building permit, level of construction, condition of property, year of construction, year of facade renovation, year of roof renovation, electricity, sewerage, water supply, gas, energy certificate, type of investors, type of foundation, material of bearing structures)
- **floor** (identification code, footprint of the floor, type of floor (underground/above ground), number of the floor, altitude of the floor, height of the floor)

ELEMENTS FOR ESTABLISHING THE BUILDING REGISTER

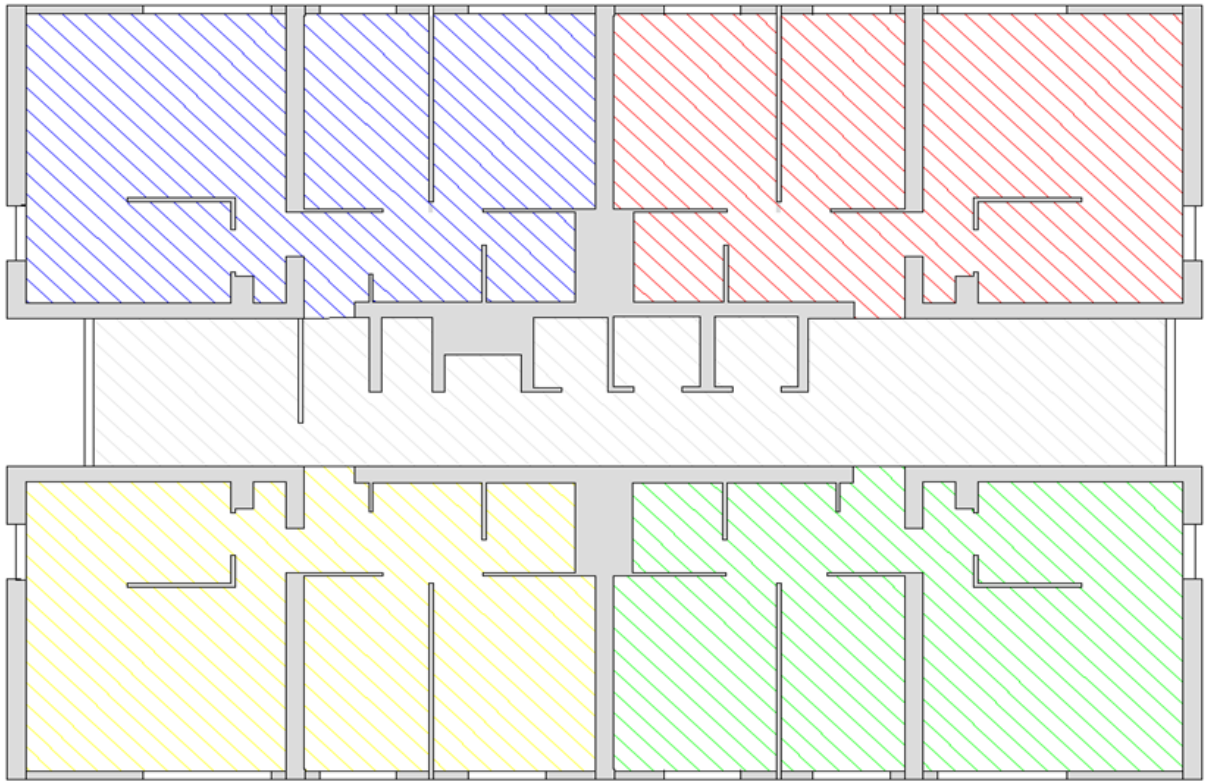
- Proposed attributes of the objects are:
- **roof** (footprint of the roof, ridge of the roof)
- **building unit** (identification code, address, land registry file, owner, real use of the building unit, area, method of determining area, building manager, number of rooms, bathroom, toilet, kitchen, year of the renovation of installations, energy certificate)
- **part of the building unit** (identification code, footprint of the part of the building unit, 3D model, parameters of positional and height accuracy, real use of the part of the building unit, area, energy certificate, type of heating)
- **rooms** (real use, area)

BUILDING DATA COLLECTION

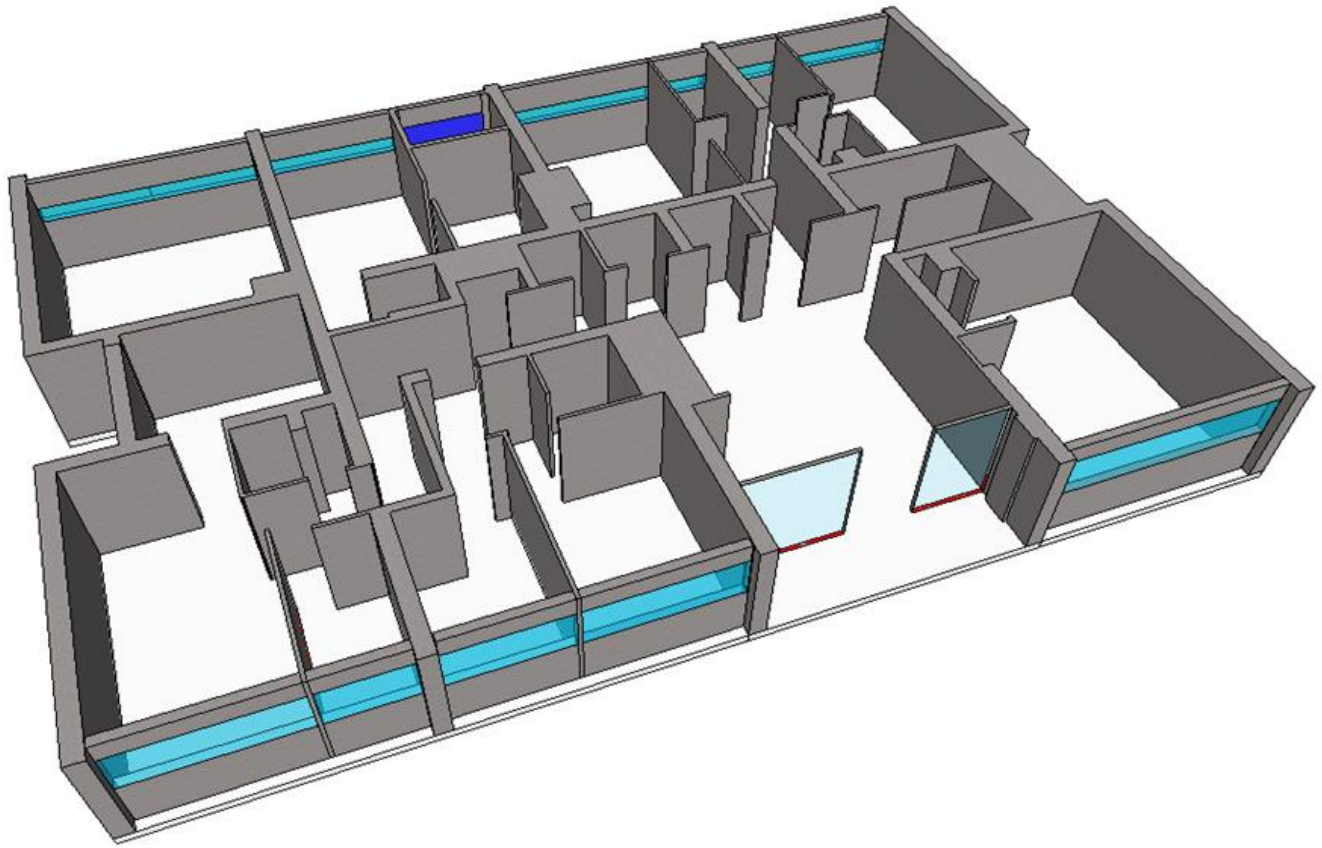
- To complement those already registered in the cadastre and land registry, information can also be collected by aerial imaging (stereo restitution) or LIDAR scanning.
- With stereo restitution, the height of the surface near the building is collected, the highest point of the building, the main ridge of the roof, and the height and layout of the outer edge of the roof. Based on these data, a simple 3D model consisting of the building with a roof can be created and on the basis of measured heights, the height of the building can be calculated.

- Collecting the building layout data and its height is also automatically recorded by characteristic contours of the building using LIDAR data. Use of the automatic classification of LIDAR data is the easiest way to create point clouds of buildings. With software applications, characteristic contours of the buildings can be created, which can be used for the establishment of the initial building register.

The method of registering elaborates on condominium partition of real property

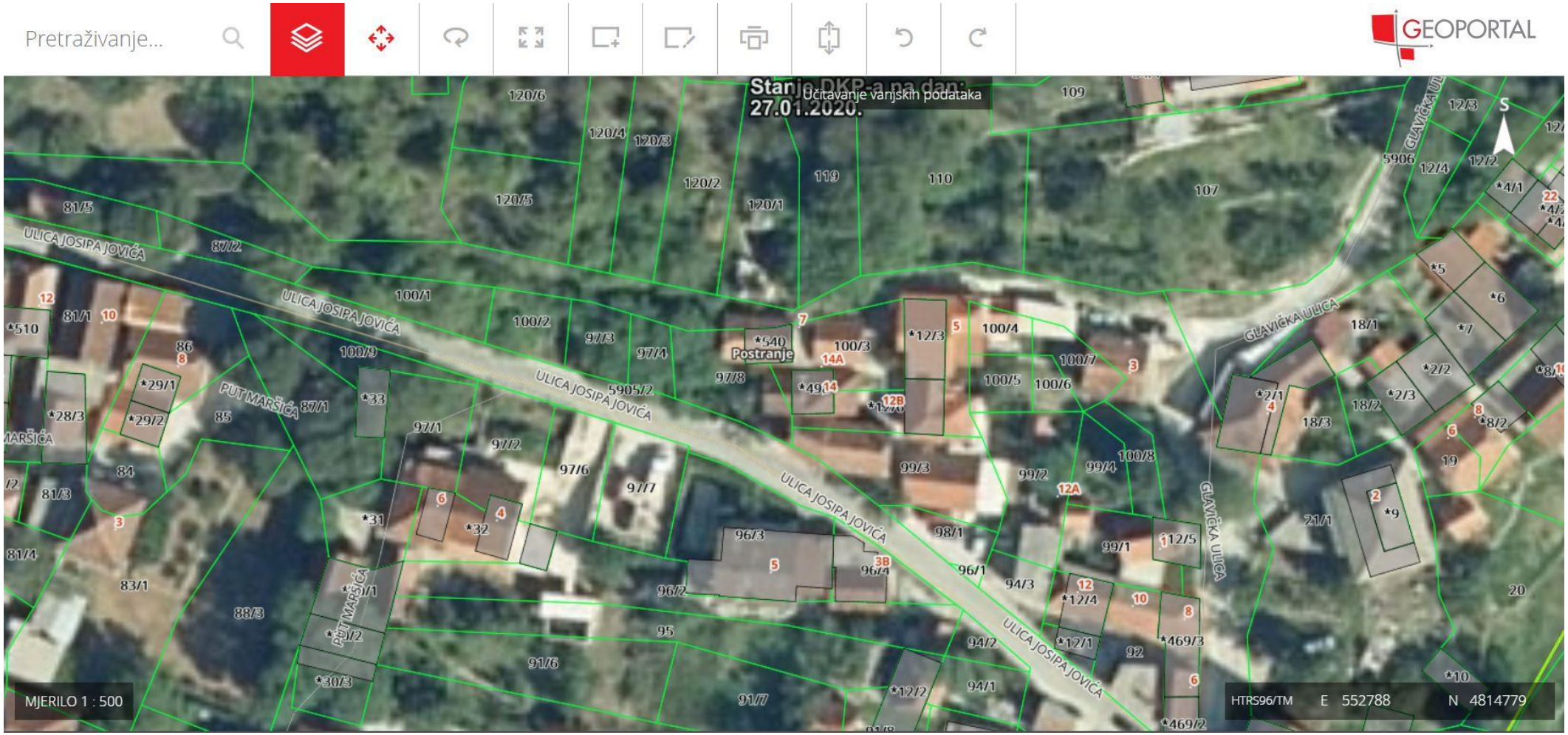


3D model of a floor



Residential building - 3D model (whole building)

SPATIAL DATA QUALITY IN 3D CADASTRE



SPATIAL DATA QUALITY IN 3D CADASTRE

- Based on the appropriate processing of 3D data
- Respectively in the alignment of the graphic data of the floor plans of special parts of buildings with the written data on the surfaces of special parts.
- It is possible to introduce the volume of special parts of a building as a collected or calculated data.
- In order to control the quality of the data it is necessary to perform additional field measurement with affordable handheld laser distance meter.
- To achieve higher level of accuracy quality control can be integrated on the application level, e.g. applications responsible for cadastre management and maintenance

CONCLUSION

- Implementation of the Building Register project in the Republic of Croatia, as a new part of the real property register, is essential for the establishment unique register of buildings.
- The biggest problem in establishing the building register is the large number of buildings unregistered in the cadastre and land registry, as well as the large number of apartment buildings where a partition into condominium units has not been conducted.
- The project of establishing the building register should, among other things, resolve this problem.

CONCLUSION

- Building register will served as a platform for:
- developing a good, complete and fair basis on which property tax can be established,
- for improving management of real property and resolving legal issues in multi-residential buildings,
- for better management of spatial and construction planning and housing policy,
- promoting the development of community and infrastructure planning,
- providing a better overview of apartments and office spaces,
- providing a systematic census.

THANK YOU FOR YOUR ATTENTION!

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