3D CADASTRE AND LADM: NEEDS AND EXPECTATIONS TOWARDS LADM REVISION

EFTYCHIA KALOGIANNI
EFI DIMOPOULO
PETER VAN OOSTEROM

• April 12, 2018
Zagreb, Croatia
Motivation/Approach

Need for MULTI-purpose, multi-dimensional management of RRRs attached to land/water/air

http://www.asmecbg.com/projects.html

https://www.pinterest.com/Storpweber/

https://www.tap-ag.com/

Kitsakis and Dimopoulou, 2014

https://marinecadastre.gov/

3D Cadastral Information Systems
Motivation / Approach

**New Working Item Proposal for LADM v2**

**AMBITION:** go beyond just a conceptual model by providing steps towards implementations (e.g. more specific profiles, technical model in various encodings, etc.)
Today, NO country has a complete & fully operational 3D Cadastral Information System. However, in terms of:

- 3D legislation
- 3D survey/data acquisition techniques
- 3D RRRs registration
- Management, validation & dissemination of 3D parcels
- Correspondence to parcel’s physical counterparts

There are countries that already successfully implement 1 or a combination of 2 or more of those aspects in the context of 3D Cadastral Information Systems.

GAP between LADM conceptual model and its technical implementation. Multiple implementation approaches according to user needs, end product, available data and technologies.

* Land administration is treated as an isolated activity, not as part of the whole chain of spatial development activities.
Motivation/Approach

1. Identify current possibilities of LADM v1 - in terms of 3D support - derived from LADM experience

2. Explore the needs and prospects towards further 3D modelling of LADM v1

3. Estimate the LADM user requirements need to be updated in the context of the upcoming revision

3D Cadastres within the Spatial Development Chain

- Data visualization & dissemination
- Real world
- Data storage & management
- Data Acquisition
- Data Registration

Zoning, Designing, Permitting, Surveying, Registering, Maintaining, Constructing
2

3D CADASTRE DEVELOPMENTS

3D CADASTRE EFFORTS
CURRENT POSSIBILITIES OF LADM
3D Cadastre Efforts / Current Possibilities

- CityGML, IndoorGML
- IFC/BIM, LandXML
- INTERLIS

ISO 19152: 2012 (v1)

- LADM implementation approaches
- LADM - based country profiles

- Israel, Shenzhen China, Korea, Malaysia, Czech Republic, Croatia, The Netherlands, Russian Federation, Serbia, Trinidad and Tobago, Colombia, Greece, Turkey, Poland, Cyprus, ...

“Fully operational” implementations

- applying a holistic approach
- achieved in different levels of maturity

“Partly operational” implementations

- submission of 3D survey plans,
- prototype stage,
- link with physical models,
- focus on visualization,
- focus on constraints & validation
LADM provides an abstract framework to model the components in land administration domain, offering several representations ranging from text to 3D topology.

- **“true” 3D representation of spatial units**
- **mixed (2D and 3D) representations of spatial units**

### LA_BoundaryFace

- **topological information alone is not sufficient to describe a spatial unit**

### LA_BoundaryFaceString & LA_BoundaryFace

6 spatial profiles based on the “structure” attribute in class LA_Level:

- 2D point based,
- 2D Text based,
- 2D Unstructured line based,
- 2D Polygon based,
- 2D Topological based,
- 3D Topological based.

Geometrical information must be associated with each topological primitive.
3 LADM REVISION: REQUIREMENTS

REQUIREMENTS TO BE UPDATED
LA_Parcel class specializations are usually created ~usually related to 3D
(eg. PL_3DParcel; PL_CadastralParcel; MY_Shared3DInfo; GR_SRPO)

- corresponding classes at the Surveying Representation sub-package are created
  (eg. 3D_Surveying and Representation Sub-package)

- LA_Level: used for spatial units classification or categorization in modules
  (eg. Czech Republic, Malaysia, Greece)

- Encoding of LADM spatial representations (map LADM classes with encoding schemas)
  (eg. within LandXML, LA_BoundaryFace volumetric approach can be encoded in 2 different schemes)

- Need to close the gap between LADM country profiles and their technical implementation

- External classes links → in which LoD do they refer to?
  (eg. ExtPhysicalBuildingUnit represented according to CityGML or IndoorGML or BIM/IFC in terms of which LoD levels are being referred to?)

- Need for explicitly model the use cases of 3D Cadastre, including different types of spatial units
  (eg. marine, archaeology, planning, mining, etc.)

**New/Current users needs**

**CONCLUSIONS**

from LADM collective experience regarding 3D support

**Requirements**

- **Requirement C08**, “System boundary of LADM, external classes and information infrastructures”: considering external classes more explicit and specific relations with the physical models that those classes are linked should be established.

- **Requirement C10**, “Miscellaneous”: new requirement may derive regarding code lists → more explicit modelling & semantics of code list are needed (ISO 3166 principles could be discussed).

- **New requirements**
4 OPPORTUNITIES FOR REFINEMENTS
- explore more explicit modelling of links with external physical objects to enhance a fit for purpose approach.

- explicitly model all use cases of 3D Cadastre, including different types of spatial units (marine, archaeology, planning, mining, air, etc.) → could be added as a new user requirement.

- update of LADM User Requirements paying attention in placing 3D Cadastres in context the whole chain of spatial development.

- explore multiple approaches to further model current (e.g. topological profile) or sharpen new spatial representations & spatial profiles (e.g. point clouds profile, for non-topological 3D parcels).

- validation of the new spatial profiles is crucial (rules & tests, functions, spatial database types, cross-model constraints between legal and spatial attributes, etc.).

- Consider also the semantic aspect of data sources, not only the geometrical, as data in BIM/IFC, CityGML LandXML, InfraGML, IndoorGML are produced based on different domain knowledge → conceptual & terminological differences between data sources.

there is no single spatial profile/model best suitable for all types of applications → it depends on the type of each application and thus its requirements should be defined accordingly
THANK YOU!