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COMMITTEE OF EXPERTS ON
GLOBAL GEOSPATIAL
INFORMATION MANAGEMENT

Role of 3-dimensional data – 3D Cadastre, Marine Cadastre

19/03/17

Peter van Oosterom, based on joint work TU Delft and Kadaster colleagues

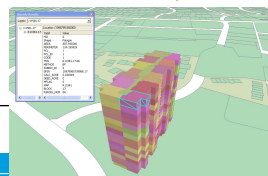
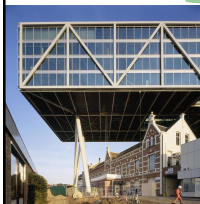
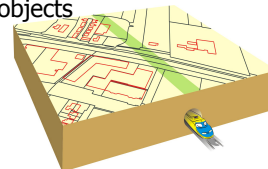
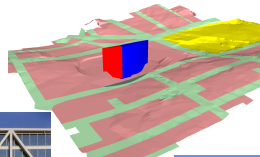
UN-GGIM Expert Group on Land Administration and Management
Delft, 14-15 March 2017



Challenge the future

International Federation of Surveyors

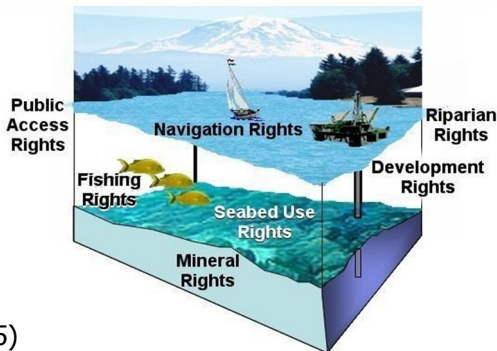
- Working group **3D Cadastres**, scoping questions:
 - What are the types of 3D cadastral objects?
Related to (future) **constructions** (buildings, pipelines, tunnels, etc.)
any part of the 3D space, airspace, water bodies or subsurface?
 - 3D Parcels for infrastructure objects, such as long tunnels, pipelines,
cables: **divided by surface parcels** or one object?
 - For representation of 3D parcel, has legal space **own geometry** or
specified by referencing to existing topographic objects



2

International Hydrographic Organization (IHO)

- The objective of the S121 project team is to develop IHO S-121 Maritime Limits and Boundaries Product Specification (LADM based)
- Other Marine application related to LADM is Marine Spatial Planning (MSP)
- 3D important
- Water-land boundary

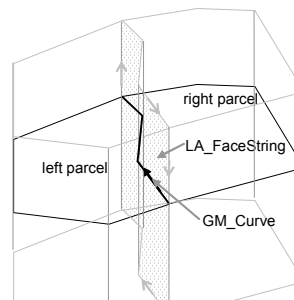
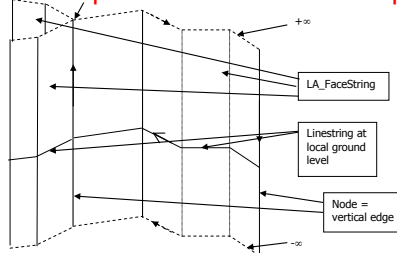


(image from Sutherland, 2005)

Spatial Units in 3D

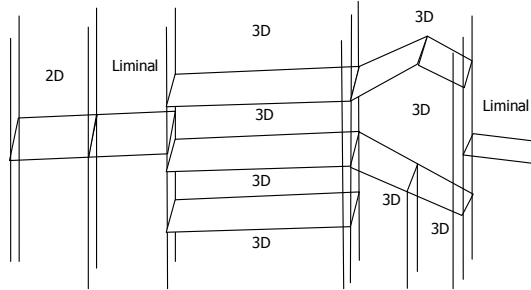
- Extend the equivalent concept from 2D to 3D
→ 3D parcels are in areas of highest land values
- point-line-area becomes point-line-area-volume
- **Challenges:**
 1. Majority of parcels is in 2D and should not be lost
→ integrate 2D/3D
 2. 3D parcels can be unbounded (up/down) according to National law
→ does not fit in ISO 19107 (spatial schema), so alternative needed

→ 2D parcels and their 3D interpretation



2D and 3D Integration

- between 2D and 3D spatial unit transition via **liminal** spatial units



- Liminal spatial units are 2D parcels, but are stored as 3D parcels

- Liminal spatial units are delimited by a combination of LA_BoundaryFace and LA_BoundaryFaceString objects

Simple 2D spatial unit	Liminal 2D spatial unit	3D spatial units	3D spatial units	Liminal 2D spatial unit
			Liminal 2D spatial unit A	

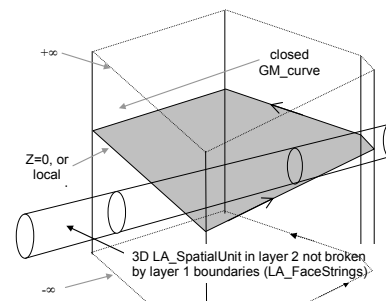
The 3D use of LA_Level

- organization based on content or structure:
 - example 1, content-based: one layer with 'primary' (strongest) rights, another layer with rights that can be added/subtracted (e.g. restrictions)
 - example 2, structure-based: one layer with topologically structured parcels (one part of the country), another layer with (unstructured) line based parcels (other part of country)

- can also be used in 3D context: one layer 'normal' parcels, another layer with subtracted 3D parcels

- based on independence principle

- each country design own levels



Cost of realizing 3D Cadastral system

- Some cadastral organizations estimate limited cost for realization as often: 3D data will originate from **outside**
- But **registration guidelines** are crucial
- Possible sources:
 1. Survey in 3D
 2. Old floor plan upgraded to 3D volumes
 3. New architecture design (CAD) directly in 3D
- In all cases:
 1. Agree on submission format (LADM, encoding CityCML/LandXML/..)
 2. Rules for valid 3D objects
 3. Automated checking as much as possible

Intention often more than 3D Cadastre ...full life cycle in 3D

Involved steps (order differs per country):

1. Develop and register zoning plans in 3D
2. Register (public law) restrictions in 3D
3. Design new spatial units/objects in 3D
4. Acquire appropriate land/space in 3D
5. Request and provide (after check) permits in 3D
6. Obtain and register financing (mortgage) for future objects in 3D
7. Survey and measure spatial units/objects (after construction) in 3D
8. Submit associated rights (RR)/parties and their spatial units in 3D
9. Validate and check submitted data (and register if accepted) in 3D
10. Store and analyze the spatial units in 3D
11. Disseminate, visualize and use the spatial units in 3D