3D Cadastres

FIG article of the month May'11

World-wide inventory of the status of 3D Cadastres in 2010 and expectations for 2014

31-5-2011

Peter van Oosterom, Jantien Stoter, Hendrik Ploeger (The Netherlands), Rod Thompson, and Sudarshan Karki (Australia)

FIG Working Week 2011, Bridging the Gap Between Cultures, 18 – 22 May 2011, Marrakech, Morocco

TU Delft Delft University of Technology

Challenge the future

FIG

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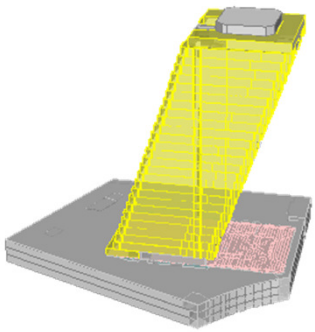
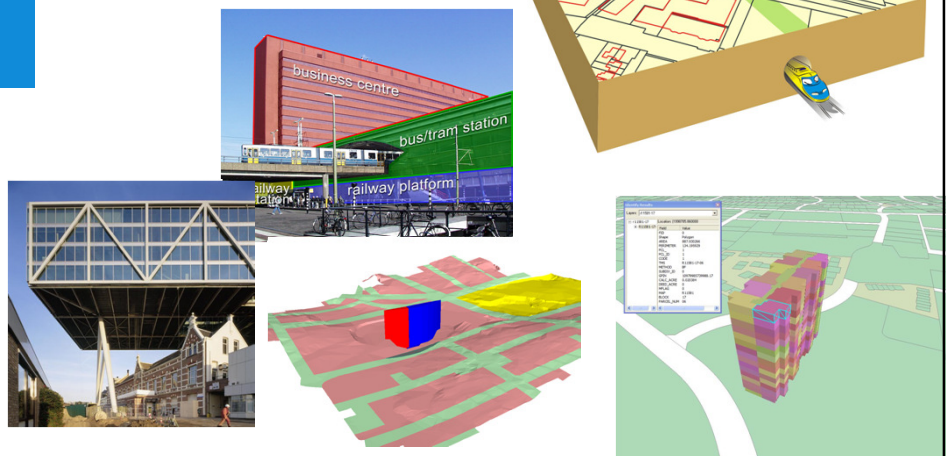


1. Introduction



2D registration for a 3D world?

1. Introduction (cont.)

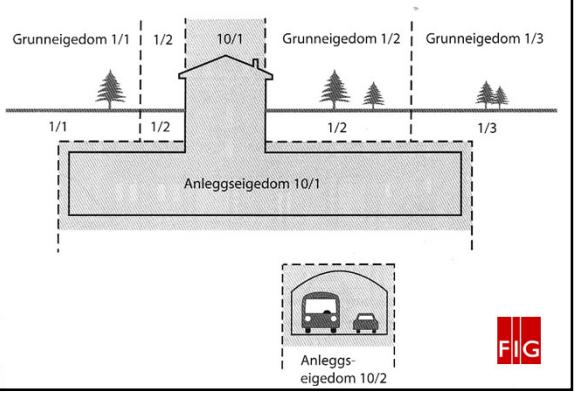
- Increasing complexity in land (space) use
- Initial FIG working group 3D Cadastres 2002-2006
- 3D Cadastres sessions at every FIG WW or congress since
- Despite progress no country with true 3D Cadastre, always somehow limited; e.g. only 3D in public register (not in map) or just specific object types (buildings, infrastructure)

- Working group 3D Cadastres 2010-2014, scoping questions:
  1. What are the types of 3D cadastral objects?
     Related to (future) constructions (buildings, pipelines, tunnels, etc.)
     any part of the 3D space, both airspace or subsurface?
  2. 3D Parcels for infrastructure objects, such as long tunnels,
     pipelines, cables: divided by surface parcels or one object?
  3. For representation of 3D parcel, has legal space own geometry or
     specified by referencing to existing topographic objects

2. FIG Working group objectives

- Common understanding of terms and issues involved; ISO 19152 Land Administration Domain Model: LADM with 3D
- Guidelines/checklist for implementation of 3D-Cadastres: 'best practices' legal, institutional and technical aspects

Note: 3D Parcels in broadest sense: land & water spaces, both above & below surface.



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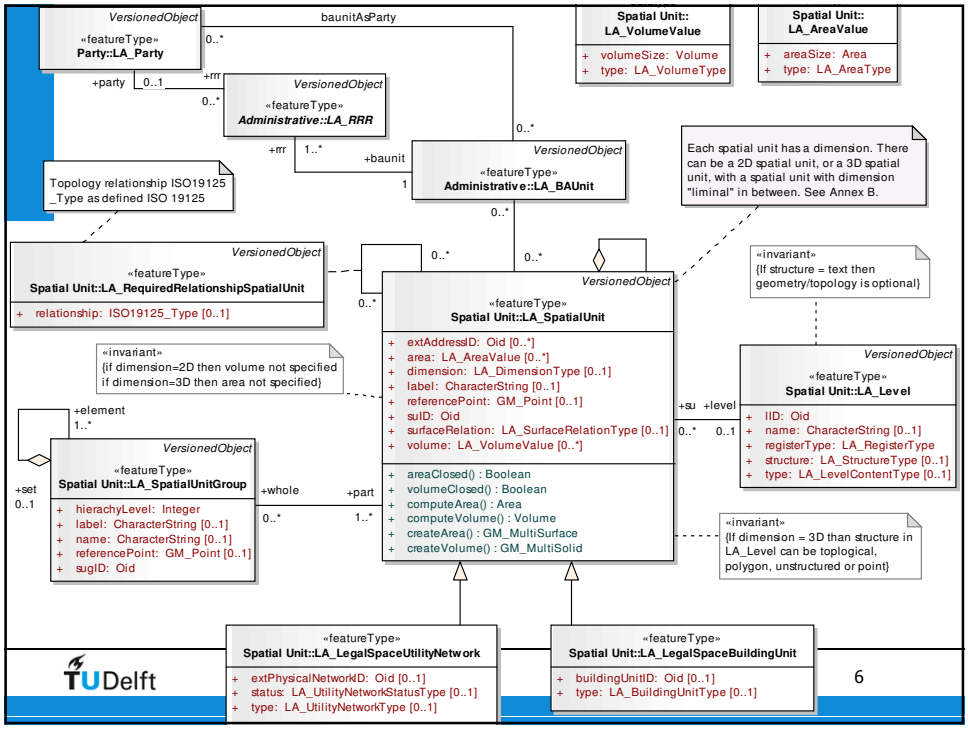

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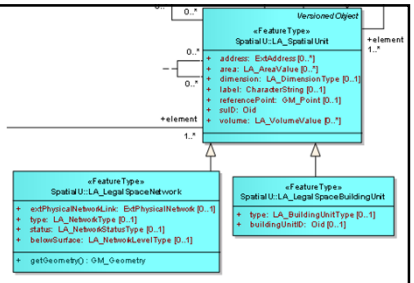
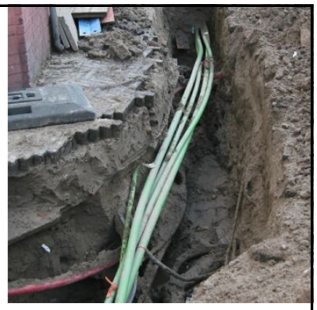
2. Research Topics



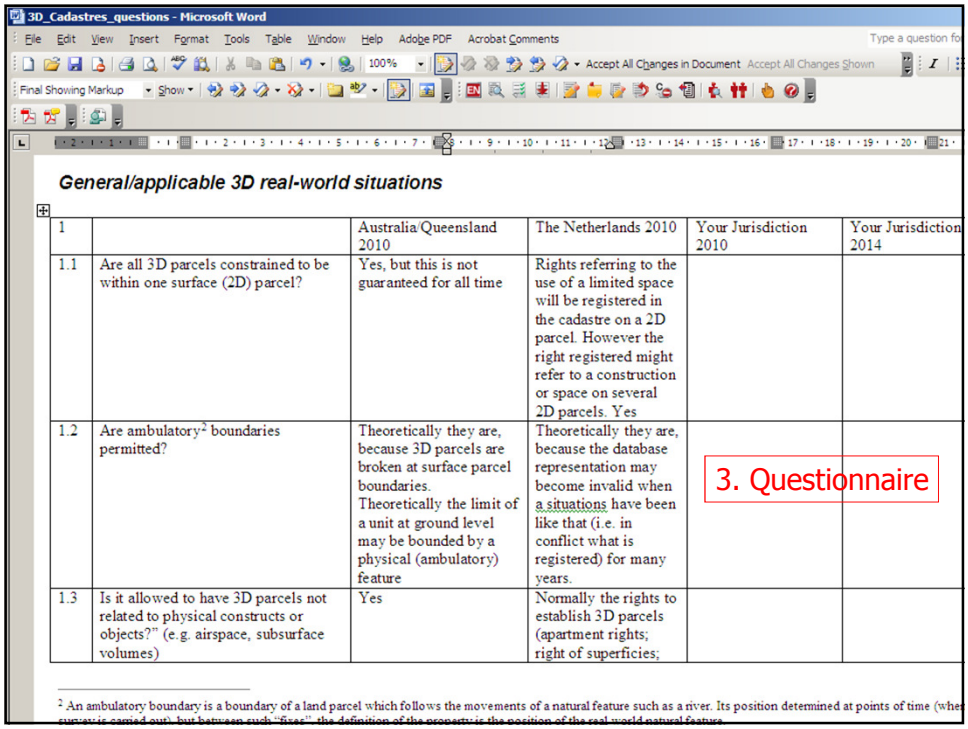
- 3D-Cadastres and models: role of earth surface, 3D parcels open at top and bottom, topology structure, relative height,…
- 3D-Cadastres and SII: legal objects (cadastral parcels and associated rights) and their physical counterparts (buildings or tunnels) result into two different, but related registrations
- 3D-Cadastres and time: partition of legal space into 4D parcels: no overlaps or gaps in space of time
- 3D-Cadastres and usability: graphic user interface (GUI) for interacting with 3D cadastral data; e.g. Google Earth

2. Deliverables and operation



- 2010: creation of web-site and interest-group www.gdmc.nl/3DCadastres (inc. literature)
- 2010: initial questionnaire status 3D Cadastres
- 2011: 2nd workshop on 3D-Cadastres (16-18 nov, Delft)
- 2011-13: 3D Cadastres session at FIG working weeks
- 2013/14: 3rd workshop on 3D-Cadastres (option)
- 2013/14: FIG-publication on 3D-Cadastres
- 2014 : final questionnaire status 3D Cadastres
- 2014: presentation of the results FIG-congress


3D-Cadastres Literature - Mozilla Firefox
http://www.gdmc.nl/3DCadastres/literature/
3D Cadastres
FIG
FIG joint commission 3 and 7 working group on 3D-Cadastres - Work plan 2010-2014
Introduction
Objectives
Topics
Scope
Realization
Deliverables
Literature
Operation
Timetable
Participants
Organization
Literature
This page lists a number of (important) publications and other documents related to 3D Cadastres.
Click on the title to download or view the corresponding PDF file.
2010 2009 2008 2007 2006 2005 2004 2003 2002 2001
2010
Fatih Döner, Rod Thompson, Jantien Stoter, Christiaan Lemmen, Hendrik Ploeger, Peter van Oosterom and Sisi Zlatanova
4D cadastres: First analysis of Legal, organizational, and technical impact - With a case study on utility networks
In: Land Use Policy, Volume 27, pp. 1068-1081
Christiaan Lemmen, Peter van Oosterom, Rod Thompson, João P. Hespanha and Harry Uitermark
The Modelling of Spatial Units (Parcels) in the Land Administration Domain Model (LADM)
In: Proceedings of the XXIV FIG International Congress 2010, Sydney, 28 p.
Tarun Ghawana, João P. Hespanha, Jaap Zevenbergen and Peter van Oosterom
Groundwater Management in Land Administration: A Spatio-temporal Perspective
In: Proceedings of the XXIV FIG International Congress 2010, Sydney, 21 p.

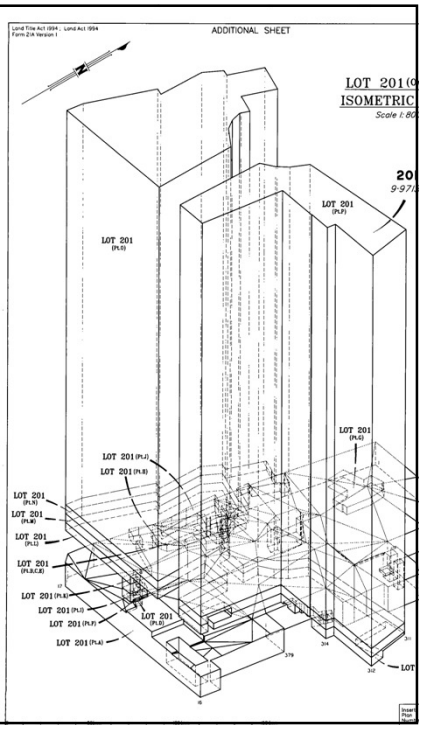

3D_Cadastres_questions - Microsoft Word
General/applicable 3D real-world situations
1 | | Australia/Queensland 2010 | The Netherlands 2010 | Your Jurisdiction 2010 | Your Jurisdiction 2014
1.1 | Are all 3D parcels constrained to be within one surface (2D) parcel? | Yes, but this is not guaranteed for all time | Rights referring to the use of a limited space will be registered in the cadastre on a 2D parcel. However the right registered might refer to a construction or space on several 2D parcels. Yes
1.2 | Are ambulatory[2] boundaries permitted? | Theoretically they are, because 3D parcels are broken at surface parcel boundaries. Theoretically the limit of a unit at ground level may be bounded by a physical (ambulatory) feature | Theoretically they are, because the database representation may become invalid when a situations have been like that (i.e. in conflict what is registered) for many years.
1.3 | Is it allowed to have 3D parcels not related to physical constructs or objects?" (e.g. airspace, subsurface volumes) | Yes | Normally the rights to establish 3D parcels (apartment rights; right of superficies;
3. Questionnaire
[2] An ambulatory boundary is a boundary of a land parcel which follows the movements of a natural feature such as a river. Its position determined at points of time (whe

3. Design of questionnaire

- Difficult to design clear questionnaire for abstract topic 3D Cadastres (quite abstract, everybody has own interpretation)
- Questionnaire starts with introduction notes, including formal and informal definition of 3D parcel: 'spatial unit against which (one or more) unique and homogeneous rights (e.g. ownership right or land use right), responsibilities or restrictions are associated'
- Important distinction between 3D physical and 3D legal object
- Questions grouped into 9 thematic blocks (next slide)
- Two blank columns: status 2010 and expectation 2014
- Two example set of answers (Queensland/Australia, Netherlands)
- Questionnaire distributed among members of FIG working group 3D Cadastres (via commissions 3 and 7)
- During time of completion 2 requests for clarification received

3. Thematic blocks of questions

1. General/applicable 3D real-world
2. Infrastructure/utility networks
3. Construction/building units
4. X/Y Coordinates
5. Z Coordinates/height repr.
6. Temporal Issues
7. Rights, Restrictions & Responsib.
8. DCDB (Cadastral Database)
9. Plans of Survey, incl. field sketch

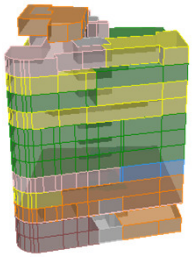


4. Analysis of responses

- 36 FIG completed questionnaires received (Argentina, Australia, Austria, Bahrain, Brazil, Canada, China, Croatia, Cyprus, Denmark, Finland, France, Germany, Greece, Hungary, Indonesia, Israel, Italy, Kazakhstan, Kenya, Macedonia, Malaysia, The Netherlands, Nepal, Nigeria, Norway, Poland, Russia, South Korea, Spain, Sweden, Switzerland, Trinidad and Tobago, Turkey, and United Kingdom) → on website www.3dcadastres.nl

- Nearly all jurisdictions (except Poland & Nepal) allow registration of 3D parcels, in practise often (limited to) apartments
- Despite efforts concept '3D cadastre/parcel' still ambiguous
- Hardly any responses for 2014, some exceptions: Switzerland, Denmark, Israel, Bahrain, Russian Federation,…
- Completed questionnaires give overview of the different systems: organizational, legal, technical

4. Some observations (1)



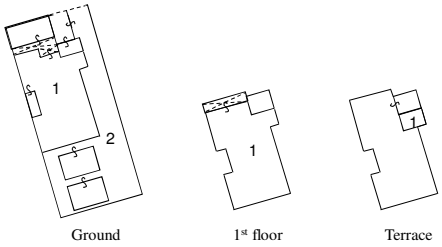
- 3D parcels within surface parcel?
  - Yes, in most cases
  - Building might be on multiple parcels (Netherlands)
  - Norway, Sweden allow 3D parcels to extend over/under multiple surface parcels (planned for Finland)
  - Queensland: split of surface parcel without affecting 3D parcel

- Empty spaces or existing constructions?
  - Most countries no explicit rule
  - Australia, Canada allow empty space (and Finland for subsurface)
  - Norway, Sweden require construction (Norway within 3 years)

4. Some observations (2)

- Boundaries of 3D parcel
  - Often reference to wall, ceilings, floors
  - France (no explicit rules) but virtual boundaries possible
  - Z-axis/height often no directives; however, Australia/France absolute height, Canada/Sweden relative height

- Registration of 3D parcel in cadastral database
  - Does not exist in any country
  - 'Floor plans' boundaries per floor and are in public register
  - Reference to 3D parcel from 2D map Australia, Cyprus, Croatia, Norway and Sweden
  - Italy has separate 'Cadastre of Buildings' with 3D
  - Spain converts floor plans to 3D parcels (with 3m height)



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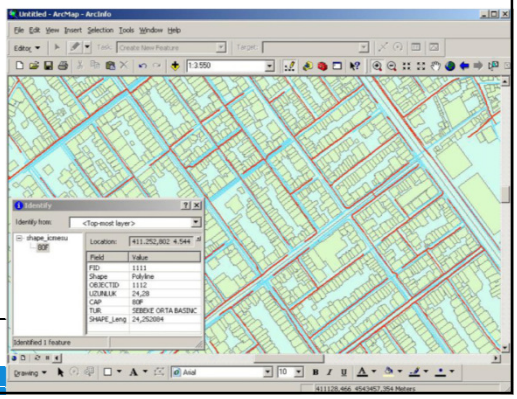
4. Cable and pipeline networks

- Specific type of 3D object: below/above over several land parcels
- Netherlands, Switzerland, Kazakhstan, Russia (limited practise) and Canada allow registration of right spaces related to networks
- Others are developing this: Denmark, Hungary, Israel and Italy
- Some countries have seperate 'utility' maps/ registrations (Victoria/Aus, Croatia)

- Last group: no registration or very limited registration; e.g. in Turkey only high voltage power lines (but other networks at level of municipality; e.g. Istanbul →



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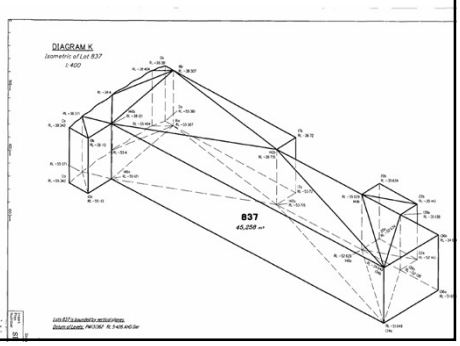
5. Australian perspective

- Questionnaire idea was 'born' in Australia
- Specialized questionnaire conducted in parallel
- All jurisdictions of Australia (Queensland, Australian Capital Territory, New South Wales, Northern Territory, South Australia, Tasmania, Victoria and Western Australia) responded

- States have different procedure (attempt to have consistent regulations to public)
- All states allow 3D parcels
- Wide range of definitions (includes curved surfaces)
- 2D and 3D procedure equal
- No temporal/moving boundaries
- 'heaven to centre of earth'



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6. Conclusion and future actions

- WG position in FIG: inter-commission activity commissions 3 & 7
- True 3D Cadastre (public register & map) does not yet exist (perhaps Spain most close, 3D apartments)
- 3D data acquisition, management & distribution in reach
  → exploit how to apply this to serve needs
- International cooperation, full 3D session
  → FIG publication 'Primer on 3D-Cadastres' (2014)

- Newly completed questionnaires will be put on website
- Interested in participation? → Contact chair WG 3D-cadastres: Peter van Oosterom, TU Delft (P.J.M.vanOosterom@tudelft.nl)
- 2nd FIG/EuroSDR workshop 3D Cadastres: 16-18 Nov'11 (Delft) Abstract submission 31 May'11 (www.3dcadastres2011.nl)

3D Cadastres

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FIG

WG participants

Diego Erba, Ali Aien, Don Grant, Mohsen Kalantari, Gerhard Muggenhuber, Gerhard Navratil, Neeraj Dixit, Ammar Rashid Kashram, Andréa Flávia Tenório Carneiro, Francois Brochu, Louis-André Desbiens, Paul Egesborg, Marc Gervais, Jacynthe Pouliot, Francis Roy, Renzhong Guo, Zhang Ning, Shen Ying, Miodrag Roic, Elikkos Elia, Lars Bodum, Esben Munk Sørensen, Christian Thellufsen, Jani Hokkanen, Arvo Kokkonen, Tarja Myllymäki, Claire Galpin, Hervé Halbout, Markus Seifert, Efi Dimopoulou, Gyula Iván, Andras Osskó, Trias Aditya, S. Subaryono, Yerach Doytsher, Joseph Forrai, Gili Kirschner, Yoav Tal, Bruno Razza, Enrico Rispoli, Fausto Savoldi, Natalya Khairudinova, David Siriba, Gjorgji Gjorgjiev, Vanco Gjorgjiev, Alias Abdul Rahman, Babu Ram Acharya, Benedict van Dam, Chrit Lemmen, Thomas Dabiri, Lars Elsrud, Olav Jenssen, Lars Lobben, Tor Valstad, Jaroslaw Bydlosz, Vladimir Tikhonov, Natalia Vandysheva, Youngho Lee, Amalia Velasco, Jesper Paasch, Jenny Paulsson, Helena Aström Boss, Robert Balanche, Laurent Niggeler, Charisse Griffith-Charles, Cemal Biyik, Osman Demir, Fatih Döner, Gareth Robson, and Carsten Roensdorf. → Many, many thanks for completing the questionnaires!