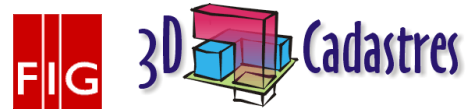


3rd Questionnaire 3D-Cadastres: status November 2018



The Netherlands

This questionnaire is an activity of the FIG working group 3D-Cadastres 2018-2022. The purpose of the survey is to make a world-wide inventory of the status of 3D-Cadastres at this moment and the plans/expectations for the near future (2022). By sharing this information, it should be possible to improve cooperation, learn from each other and support future developments. This is the third time that the questionnaire on 3D-Cadastres is conducted by the FIG working group on 3D-Cadastres. The first time was in 2010 in order to document the status in 2010 and expectations back then for 2014. This was followed by second questionnaire in 2014 (with status 2014 and expectations 2018). The earlier responses have been analysed and reported on (van Oosterom et al. 2011, Karki 2013, van Oosterom et al. 2014). For more information on the FIG working group on 3D-Cadastres see the website www.gdmc.nl/3DCadastres. Now a few notes and suggestions, which should be helpful when completing the questionnaire:

- The conceptual model used as background for the 3D Cadastres questionnaire is the ISO 19152 standard (ISO, 2012): the Land Administration Domain Model (LADM).
- In this questionnaire the concept of 3D-Cadastres with 3D parcels (or 3D spatial units in LADM terminology) is intended in the broadest possible sense. However, what exactly is (or could be) a 3D parcel is dependent on the legal and organizational context in the specific country (state, province). 3D parcels include land and water spaces, both above and below surface.
- A more formal definition: A 3D parcel is defined as the spatial unit against which (one or more) unique and homogeneous¹ rights (e.g. ownership right, lease or other land use right), responsibilities or restrictions are associated to the whole entity, as included in a Land Administration system.
- As the definition above is quite abstract, it is tried in the questions to be more specific and real world situations are used. Many examples with partial/preliminary answers from 2010 and 2014 are available on-line at <http://www.gdmc.nl/3DCadastres/participants/>. Inspecting some of the completed 2010 and 2014 questionnaires from different other countries might help when formulation the answers for your jurisdiction.
- A 3D parcel is a 'legal object' describing a part of the space. Often there is a relationship with a real world/physical object, which can also be described in 3D. Please be aware of the difference between these two types of objects and that the focus in the context of 3D-Cadastres is on spaces of the legal objects and not the registration of the physical objects as such.
- If a certain question is not relevant or if you have no clue what to respond, do not spend any time on this (and leave the field blank).
- The questionnaire has been prepared by Rod Thompson, Sudarshan Karki, Alias Abdul Rahman, Hendrik Ploeger, Christiaan Lemmen, Anna Shnaidman, Peter van Oosterom. The questionnaire is grouped in the number of blocks. This has no meaning in the sense of priority and it is often the case that a question could belong to multiple blocks. Please do not feel disturbed by this.
- Similar to the earlier Questionnaires on 3D-Cadastres, the completed forms will be made available on website of FIG working group on 3D Cadastres.
- Please complete this questionnaire before *15 December 2018* and send it to A.Shnaidman@tudelft.nl (or Anna Shnaidman, TU Delft, OTB, P.O. Box 5043, 2600 GA Delft, The Netherlands).

¹ Homogenous means that the same combination of rights equally apply within the whole 3D spatial unit. Unique means that this is the largest spatial unit for which this is true. Making the unit any larger would result in the combination of rights not being homogenous. Making the unit smaller would result in at least 2 neighbour 3D parcels with the same combinations of rights.

1. General/applicable 3D real-world situations

This part of the questionnaire refers to the applicable 3D real-world situations to be registered by 3D parcels. It also addressed the types of 3D geometries, which are considered to be valid 3D representations for these parcels.

	Status 2018	Expectations 2022
1.1. Are all 3D parcels (3D spatial units in LADM terminology) constrained to be within one surface 2D parcel?	There are no 3D spatial units defined. There is one registration of a 3D volume in .pdf: the Delft underground railway station. This is published in: <i>Jantien Stoter, Hendrik Ploeger, Ruben Roes et al.</i> ‘First 3D Cadastral Registration of Multi-level Ownerships Rights in the Netherlands’; 5th International FIG Workshop on 3D Cadastres, 18-20 October 2016, Athens, Greece	A 3D Cadastral System based on the LADM and other ISO and OGC standards is under discussion and design in the Netherlands Cadastre, land Registry and Mapping Agency. The impact of this development from a legal, regulatory, organisational and technical perspective is substantial. The expected status of this development in 2022 cannot yet be announced. This answer should be accepted as valid for the questionnaire as a whole.
1.2. Are 2D and/or 3D ambulatory ² boundaries permitted?	No	
1.3.a. Is it allowed to have 3D parcels (spatial units) not related to physical constructs or objects? (e.g. airspace, subsurface volumes)	In principle there is a relation. The Civil Code and rules of property law allow to create rights that are limited to a certain space without a construction (e.g. easement, lease). However such a space, as described in the registered deed, is no specific spatial unit in the Dutch system of land registration. This issue is under research – building “The Eye” Amsterdam	
1.3.b. If 1.3.a positive: approximately what proportion of new 3D parcels	Will increase	

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 (when a survey is carried out), but between such “fixes”, the definition of the property is the position of the real world natural feature.

(spatial units) would involve such cases (not related to physical object)?		
1.4. Are disconnected parts of a single 3D parcel allowed?	May be in the future, see 1.1 expectations 2022	
1.5. Spatial limitation – e.g. must the 3D parcel be related to a closed volume or is it allowed to have ‘open’ or unbounded 3D parcels (e.g. towards the sky).?	Under discussion, see 1.1 expectations 2022	
1.6. Are curved surfaces to bound the 3D parcels allowed?	Under discussion, see 1.1 expectations 2022	
1.7. Must the curved surfaces (if allowed) be cylindrical sections, or any other constraint?	Under discussion, see 1.1 expectations 2022	
1.8. Any other constraints – e.g. all surfaces must be horizontal or vertical?	Under discussion, see 1.1 expectations 2022	
1.9. Is there legislation (law and/or regulations) for 3D descriptions of parcels? If so please, mention law and article(s).	Yes. <i>In fact the law “avoids” the need for a 3D description.</i> Civil Code, Book 5 Real property rights, Article 5:3 (and for land esp. Article 5:20) Accession As far as the law does not provide otherwise, the owner of a thing is the owner of all its components. See also https://en.wikipedia.org/wiki/Accession_(property_law)	
1.10. Is the legal text available in original language?	Book 5 of the Civil Code in Dutch: http://www.wetboek-online.nl/wet/Burgerlijk%20Wetboek%20Boek%205.html	
1.11. Is the legal text (relevant part) available in English translation?	Book 5 of the Civil Code in English: Title 5: Common Ownership Title 9: Apartment Rights http://www.dutchcivillaw.com/civilcodebook055.htm	
1.12. Do you have example descriptions of typical 3D parcels; either ‘prototype’ or ‘operational’?	See the publication as presented under 1.1	
1.13. Is there a formal model for the 3D parcels (UML style); e.g. based on ISO TC211 series (especially LADM, ISO 19152)?	Under development. ISO 19152 LADM Based.	
1.14. Are natural resources (groundwater, mining rights, geo-thermal extraction and storage) shown in your land administration? If yes, are they considered as 3D parcels (spatial units) with RRRs attached? What about	There is a separate key registration for subsurface (Basisregistratie Ondergrond), established 1 January 2018. Examples are the use of subsurface information in spatial planning, subsurface	

mining concessions (could be limited in time)?	constructions, geothermal energy and CO2 storage. See: https://www.tno.nl/media/3064/010591_r71engelstalige-factsheet-dec-20112.pdf See also: https://www.elra.eu/authentic-registers-in-the-netherlands/	
1.15. Are legally restricted spaces, above or below, such as polluted areas considered as 3D parcels?	Not considered as 3D Parcels. Public law restriction, such as obligations to clean up pollutions are registered in 2D	
1.16. Are spatial plans considered as 3D parcels (as rights or restrictions are related to them)? Sometimes also called spatial development plans, zoning plans or physical plans (land use, urban, regional, environmental,...)	There is a paradigm shift from “maps to rules” under the Environment and Planning Act. See https://www.omgevingsweb.nl/cms/files/2017-01/english-translation-environment-act.pdf	
1.17. Is there a Marine Cadastre? And if so, are 3D parcels included in this registration. Is the IHO Maritime Limits and Boundaries standard (S121) in use or under implementation?	No. The territorial waters in 12 miles zone are included in the authentic cadastral registration For the Netherlands Exclusive Economic Zone see http://www.marineregions.org/gazetteer.php?p=details&id=5668 See Ministry I&M https://www.rijkswaterstaat.nl/water/vaarwegenoverzicht/noordzee/index.aspx	
1.18. Is there any organised legal instrument for the management of common property?	Yes. See: Book 5 Titels 5 (Common Ownership) and 9 (Apartment Rights) http://www.dutchcivillaw.com/civilcodebook055.htm Book 3 Title 7 of the Civil Code (Community of Property): http://www.dutchcivillaw.com/civilcodebook033.htm	
1.19. Which agency is responsible for the recording of titles information?	The Netherlands cadastre, Land Registry and Mapping Agency	
1.20. Which agency is responsible for recording cadastral transactions?	The Netherlands cadastre, Land Registry and Mapping Agency	
1.21. Are transactions for standard 2D lots and 3D lots done by the same	Yes	

agency or titles office?		
1.22. Are there any 3D storage permissions recorded (e.g. underground storage of CO2)?	Yes. See: https://www.tno.nl/media/3064/010591_r71engelstalige-factsheet-dec-20112.pdf Examples are the use of subsurface information in spatial planning, subsurface constructions, geothermal energy and CO2 storage.	
1.23. Any other geometric issues related to 3D parcels?	n/a	

2. Infrastructure/utility networks

This refers to the situation where an infrastructure network is considered to be defined within the land administration. For example in some jurisdictions, an underground network might be privately constructed for the purpose of leasing space in it for other organisations to run cabling. In this case, a network, or part of that network may be considered to be a real estate object.

	Status 2018	Expectations 2022
2.1. Do you register networks as an entity in the land administration? (e.g. subterranean conduit networks)	Yes	
2.2. If so, then (a) can the network structure be viewed graphically in the land administration? (b) can the network structure be traced in the database(s)? (c) are networks registered by means of a cadastral identifier (such as a 'parcel number')? (d) are RRRs and parties attached to these network objects?	(a) Sometimes, registration of networks is not mandatory (b) Sometimes, see (a) (c) Yes (d) Yes	
2.3. Does the jurisdiction have private networks? If so please, mention law and article(s).	Yes. See Article 5.20, paragraph 2 of the Civil Code Article 5:20 Scope of the right of ownership of land - 1. The ownership of land comprises, as far as the law does not provide otherwise: a. the topsoil; b. the layers of earth beneath the topsoil; c. the groundwater that comes to the surface naturally or through an installation; d. the water above the soil unless it has an open connection to water covering another's land; e. buildings and constructions permanently attached to the soil, either directly or through a connection with another building or construction, unless they are a component of someone else's immovable thing; f. plants (vegetation) and trees connected to the soil. - 2. Contrary to paragraph 1, the ownership of a network, existing	

	of one or more cables or pipelines which are used for transporting fixed, liquid or gaseous substances, energy or information, which are or will be installed in, on or above the land of others, belongs to the person who has lawfully installed them or to his legal successors.	
2.4. If so, are they registered as 3D property parcels (spatial units)?	No. Route of network is depicted in 2D on the 2D cadastral map	
2.5. Is the text of relevant laws or regulations (question 2.3) available in original language? If so, give references to relevant document(s).	See 1.10	
2.6. Is the text of laws and regulations (relevant part) available in English translation?	See 1.11	
2.7. Do you have example descriptions of typical 3D parcels (spatial units) for networks; either 'prototype' or 'operational'?	Not in 3D	
2.8. If the network (legal) objects break at the surface parcel, how do you deal with intersecting networks or vertically parallel networks?	Overlaps are represented in 2D	
2.9. Any other geometric issues related to the registration of networks?	Note: the complete geometry of the network in 3D is not available in the registry – but with network owners/constructors	

3. Construction/building units

This refers to 3D properties that are related to constructions and apartment (condominium) buildings. The individual units are often defined by the actual walls and structure of a building, rather than by metes and bounds. E.g. “unit 5 on level 6 of ... building”.

	Status 2018	Expectations 2022
3.1. Do you register legal spaces for 3D construction/building units (separate from the land)?	Not in the Authentic cadastral registration. We can deliver this information as a separate service.	
3.2. If so, what are the conditions for doing so, and what are the most important types? E.g. apartment units (at least 2 or more in building), or also other buildings or even more general constructions (infra related; such as bridge, tunnel or even other, such as windmills,...)	N/a	
3.3. Does the jurisdiction have construction/building units? If so please, mention law and article(s).	See 1.9. In case of right of superficies there is Accession. This means a 3D spatial unit is not really needed.	
3.4. Is the legal text available in original language?	http://www.wetboek-online.nl/wet/Burgerlijk%20Wetboek%20Boek%205.html	
3.5. Is the legal text (relevant part) available in English translation?	http://www.dutchcivillaw.com/civilcodebook055.htm Title 9	
3.6. Do you have example descriptions of typical 3D parcels; either ‘prototype’ or ‘operational’?	In this moment only the Delft Case – see 1.1	
3.7. What would be typical 3D boundaries in an apartment complex: middle of the wall and floor/ceiling, or walls, floors/ceiling as neutral/shared 3D space? Is it mentioned in any legislation or is	This is not applicable: see Article 5.106 (Establishment of apartment rights), paragraph 4: - 4. An apartment right is a share in the assets (registered properties) which are involved in a split up, and which share includes the exclusive right to use certain parts of the building, which parts are to be used, according to their functional arrangement, as a separate private unit. The share may include the exclusive right to use certain parts of the land belonging to that building. In the situation	

it the convention?	referred to in paragraph 2 the share includes the exclusive right to use certain parts of the bare land plot, which parts are to be used, according to their functional arrangement or denomination, as a separate private section of land.	
3.8. Is common property inside the building registered? If so, how?	Yes. Shares are not geographically visualised at “wall level”/ a drawing connected to a deed visualises common and private parts of the common property	
3.9. Who owns the common property inside the building?	The joint owners. All owners are member of the Association of Owners - mandatory	
3.10. Who owns the land on which the apartment is built?	The joint owners. All owners are member of the Association of Owners - mandatory	
3.11. Do you allow sub-division of apartments or apartment blocks?	Yes	
3.12. Can the land on which the building is built be sub-divided or sold or mortgaged without the consent of majority of the apartment owners?	Consent is a condition	
3.13. What is the numbering convention for apartments (please specify in terms of cadastral parcel as well as street addressing)	Parcel_id, Complex_id, Index See (in Dutch) https://zakelijk.kadaster.nl/-/complexaanduiding-vaststelling-	
3.14. Any other geometric issues?		

4. X/Y Coordinates

	Status 2018	Expectations 2022
4.1. Do the plans of survey guarantee X/Y coordinates? (and are they relative or in an absolute spatial reference system?)	Yes. Plans are archived with coordinates in 2D. Observations during survey and adjustments are performed in 3D.	
4.2. Are the cadastral database coordinates authoritative?	No. For reconstruction purposes the coordinates calculated in a local reference are used. Not the adjusted coordinates in the global system.	
4.3. If not, what is the authoritative source of X/Y coordinates?	See 4.2	
4.4. Do you have parcels defined by the walls of a building (with no recorded geometry)?	Yes – but with recorded geometry	
4.5. What is the spatial reference system for X/Y Coordinates?	RD (Rijksdriehoeksmeting) In addition to RD coordinates, other (international) coordinate systems are also used in the Netherlands, such as ITRS, ETRS89 and WGS84. You can use RDNAPTRANS to transform between RD coordinates and ETRS89 coordinates.	
4.6. When owners receive or purchase a copy of the plan what can they see on the plan to help them identify their parcel/lot (e.g. bearings and distance, identifying corners or recovery marks, neighbouring lots, coordinates etc.)?	Depiction of the parcel combined with neighbour parcels and parcel_id. Coordinates available after payment. Boundary reconstruction requires field plans with terrestrial coordinates.	
4.7. Have there been any changes made in the way cadastral information is recorded and represented from a historical point of view?	Land consolidation activities resulted in title renewal with new cadastral maps based on surveys with latest technologies. Improvement of the geometric quality cadastral map has been performed at the beginning of the 21 st century.	
4.8. Any other X/Y coordinate issues?	This process (4.7) is ongoing. Field plans are used	

	for this (under test)	
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5. Representation of 3rd dimension: height (or depth)

	Status 2018	Expectations 2022
5.1. Are the height values of 3D parcels relative to local ground?	See expectations under 1.1	
5.2. Are height values reduced to a standard datum (absolute)? If so, what is the spatial reference system for this 3 rd ordinate?	See expectations under 1.1	
5.3. In principle possible to store both relative and absolute height values?	See expectations under 1.1	
5.4. Is the earth surface (elevation) explicitly stored (in the DCDB or other accessible register)?	See expectations under 1.1	
5.5. What is the source of height values for the 2D surface parcel?	Very accurate elevation model available via Ministry I&M	
5.6. How is elevation information recorded in the cadastral plan or database?	See expectations under 1.1	
5.7. Do you expect the elevation recorded in cadastral plans to be used for any other purpose (e.g. city models or civil constructions etc.)?	See expectations under 1.1	
5.8. Any other 3rd dimension ordinate value issues?	See expectations under 1.1	

6. Temporal Issues

	Status 2018	Expectations 2022
6.1. Are temporal limits part of the definition of a parcel (2D or 3D)?	N/a but See expectations under 1.1	
6.2. Are moving parcels allowed?	Ship that is permanently connected to quay can be registered via Accession. Floating parcels (houses) on water is a phenomena.	
6.3. Are there any limitations on the range of temporal limits? (e.g. only on 3D apartments).	N/a but See expectations under 1.1	
6.4. Are there any attempt to integrate 3D space and temporal representations, into a single 4D space/time representation?	N/a but See expectations under 1.1	
6.5. In the case of tidal boundaries, what happens to the 3D ambulatory parcel if the 2D land parcel changes extent due to the movement of High Water Mark?	Book 5, Article 5:29 (Land at a bank line) The boundary of land alongside water moves together with the bank line, except in case of intentional draining or a temporary flood. A flood is not temporary if, ten years after it first occurred, the land is still flooded and drainage has not yet begun. Related Accession can be overruled by separate agreements	
6.6. In case 3D Marine Cadastre is present and moving boundaries are allowed, how is this represented? E.g. using 4D geometry and topology.	N/a	
6.7. Can time bound rights be created and extinguished in the title? (e.g. temporary titles created for a period and when the time is up it can be extinguished)?	Yes , E.g. a ground lease for a limited period of time (usually 30–75 years) The lease right will end by law. Time share is unknown in Dutch property law.	
6.8. Is it possible to identify all the changes made by any operator to the cadastral plans or database and to rollback if there is an error made?	Yes	
6.9. For Cadastral transactions, how far in time do buyers need to make a search to ensure the title or deed is legal?	In theory the complete chain back to establishment of Cadastre, however the rule of adverse possession will restrict the need to search a	

	title for 20 years. However in most cases this is just legal theory. In practise a notary will only look in the last deed of transfer. Parties put much trust in the work of the notary and the Kadaster.	
6.10. Any other temporal issues?		

7. Rights, Restrictions and Responsibilities

	Status 2018	Expectations 2022
7.1. Range of RRR on 3D parcels.	Same as to 2D parcels.	
7.2. Are there any limitations on the range of rights related to 3D spatial units? (e.g. subterranean parcels must be owned by Govt).	No	
7.3. Are there any limitations on the range of restrictions or responsibilities related to 3D spatial units? (i.e. currently in use and related to 2D spatial units, but that would not be applicable to 3D).	No	
7.4. Are there RRRs that are only allowed in 3D (and not valid for 2D)	N/a	
7.5. Is there specific legislation (laws, regulations) defining 3D RRR types? If so, provide details, e.g. references to documents/ articles.	No	
7.6. Can 3D sub-surface/above-surface parcel be owned by someone other than the person owning the land parcel?	Yes, applicable for underground networks, see above	
7.7. What applications do you foresee for 3D land administration?	Better registration of complex buildings and constructions and better visualisation of this registration	
7.8. Are the administrative source documents (source of RRRs) title or deed based?	Deed based	
7.9 Who is responsible for the correctness of the specified 3D boundaries in spatial source documents (which authority)?	Notary for apartments Surveyors for other boundaries – but n/a in this moment	
7.10. Is registration of 3D parcels done inside the cadastral mapping agency, the land registry or elsewhere?	Y One single organisation for Cadastre and Registry	
7.11. Are 3D registrations handled by the same organisation that handles traditional (2D) land administration?	Yes	
7.12. Do you supply paper-based titles or deeds or proof of ownership? If yes, does this contain depictions of the 2D or 3D parcel?	Yes – sometimes drawings, sometimes coordinate listings	
7.13. Is the 3D registry separate or integrated with the 2D registry?	Integrated – 3D pdfs. Integrated also in the sense of identifications	
7.14. Any other RRR issues?		

8. DCDB (The Cadastral Database)

	Status 2018	Expectations 2022
8.0. Is database schema LADM based?	Yes	
8.1. Does the DCDB contain representation of 3D parcels (in any form)?	In pdf in the public registers (registration of deeds, not the cadastre)	
8.2. If so, how are they represented (in the DCDB)?	In pdf in the public registers	
8.3. If so, how are they presented on cadastral “maps” (including screen presentations)?	(8.3 till 8.15) under development, LADM based	
8.4. Are there possibilities to store geometry of 3D parcels in the DCDB?		
8.5. Is it possible to manage a 3D topological structure in the DCDB?		
8.6. Are constraints/rules defined for valid 3D objects (closed volume, no overlap, no gap in 3D)? What about rules for a mix of 2D and 3D representations?		
8.7. How can internal and external user query and visualize the 3D content supporting rotating, slicing, transparency, perspective (3D web/view service, 3D pdf documents,...)?		
8.8. What Spatial DBMS software do you use? Any 3D capabilities included and used?		
8.9. Do you have any validation rules for 3D representation in the database?		
8.10. What (GIS/CAD) software is used for updating, editing, analysis, and visualization of the cadastral data? Any 3D capabilities included and used?		
8.11. What web software is used for remote data access/distribution and visualization? Any 3D capabilities included and used?		
8.12. Is your DCDB organised as Multi-Layers or Object Oriented or some other data model?		
8.13. How do you query 3D objects in your DCDB?		
8.14. Is it possible to query neighbourhood parcels to a 3D object, vertically as well as horizontally?		
8.15. Any other DCDB issues?		

9. Plans of Survey (including field sketches)

	Status 2018	Expectations 2022
9.1. Do the survey plans carry 3D parcel representations?	Data acquisition is in 3D, archiving in 2D	
9.2. If so, how are they represented?	N/a (9.2) – (9.26)	
9.3. Is there specific legislation (regulations) describing the requirements for Plans of Survey in 3D? This could cover: a. accuracy/quality, b. 3D survey method, c. conceptual information model survey plan, d. portrayal rules for graphic representation, e. format or encoding for submission. If so, please give link to the relevant documents.		
9.4. Is sketch level allowed (low geometric quality, but in principle enough to indicate the 3D object)?		
9.5. Is it possible to define a 3D parcel by referring to other 3D real world objects/ topography (and not specifying coordinates)?		
9.6. In what format are the 3D parcels submitted for registration; attached to legal document in a single pdf (which has good 3D capabilities) or in an extension of (city)GML for 3D parcels, or....?		
9.7. Are the 3D parcels somehow checked for spatial validity; e.g. volume is closed, does not overlap with neighbour volume (and also no unwanted 3D gaps)?		
9.8. Do you have examples of (prototype or production) 3D survey plans available?		
9.9. Are any reference objects visible on the survey plan (e.g. real buildings, roads, that is 3D topography)?		
9.10. What form of 3D data acquisition is used (CAD, terrestrial surveying, sketches, stereo/oblique images, laser scanning,...)?		
9.11. What software do you use for creating and processing survey plans? Any 3D capabilities included and used?		
9.12. Can 3D parcels be subdivided, consolidated or nullified?		

9.13. Is there any existing technical circular or directive to assist Surveyors in 3D data collection in the field?		
9.14. Are the surveyors required to undertake a field survey for 3D cadastral data?		
9.15. Are building construction plans used to compile 3D cadastral information for apartments?		
9.16. Is 2D/3D field survey done by private licensed surveyors or by government surveyors?		
9.17. Are plans of survey created for each new 2D/3D parcel or are they updated in an index map or a cadastral database.		
9.18. Do you show dimensions or isometric views of 3D parcels on survey plans (do you also store this in a database)		
9.19. Do the cadastral survey plans differentiate between different types (e.g. volumetric plans, building plans and standard 2D plans)?		
9.20. What are the usual elements shown on the plan (e.g. North Arrow, Marks table, Observation table, Administrative data, Plan face and dimensions etc.?)		
9.21. Are authoritative cadastral surveys carried out by government surveyors or private licensed surveyors or both?		
9.22. What is the legal description of a cadastral boundary (e.g. coordinates or bearing and distance or lines on plan or any other)?		
9.23. How much time does it usually take for a subdivision process to complete?		
9.24. What is the legal source for cadastral representation (e.g. cadastral plans, or DCDB or index plans or descriptive sketch/text etc.?)		
9.25. What is the positional accuracy of the cadastral plans (e.g. boundaries may be accurate but may not be referenced in datum properly)?		
9.26. Any other survey plan issues?		

10. Dissemination of 3D Cadastral information

	Status 2018	Expectations 2022
10.1. Is there a general purpose web-based dissemination of 2D cadastral (graphical or text) information (e.g. a portal for the public or for professionals)? If yes, does it include 3D data?	3D source documents are available on demand. Further n/a or under development	
10.2. Are specific file formats or standards used to distribute 3D Cadastral information? (e.g. LandXML, CityGML, BIM/IFC, 3D pdf,...)		
10.3. Are there specific cartographic styling rules for representing 3D cadastral plans, or to represent 3D cadastral objects on 2D cadastral maps?		
10.4. Are there specific cartographic styling rules for 3D cadastral maps (models; e.g. as disseminated in 3D pdf)? If yes, are there 3D specific cartographic rules developed or being developed?		
10.5. Is the 3D Cadastral information accessible in integrated manner with the 2D Cadastral information?		
10.6. Are there specific symbols on the 2D cadastral map (paper, digital or web-based) indicating the presence of 3D Cadastral objects (and in web-context perhaps even linked)?		
10.7. Is the legal information (RRRs and Parties) available in integrated manner in dissemination portal with the 3D Cadastral objects? (even if source of legal data may be a different organization, but then use information infrastructure approach)		
10.8. Are 2D/3D cadastral data available to the general public or just to the relevant parties?		
10.9. Any other 3D cadastral information dissemination issues?		

11. Statistical information

This part of the questionnaire refers to statistical information (and is most relevant for jurisdictions with parts of 3D Cadastre registration operational, but all are encouraged to complete this section, and especially the expectations for 2022).

	Status 2018	Expectations 2022
11.1. What is the smallest 2D and 3D parcel that is present/ allowed to be registered in the land administration?	2D: 10x10 cm	
11.2. What is the largest 2D and 3D parcel that is present allowed to be registered in the land administration?	Should fit to 1:2000 paper map (70x50cm)	
11.3. What is the typical (or average) size of 2D and 3D parcels which are registered in the land administration? Subdivide by nature of 3D parcel when relevant (e.g. related to building, apartment, airspace, tunnel,...)	Territory 42.000km ² , 7.8 mln parcels....	
11.4. How many 2D and 3D parcels do you currently have in your land administration?	7.8 mln in 2D	
11.5. Which year did you start registering 3D parcels in the land administration?	2016	
11.6. What is the ratio of 3D parcels in rural vs. urban areas?	N/a	
11.7. Please specify names of cities or towns or suburbs or regions or locations where there are significant numbers of 3D parcels.	Delft, several 3D volumes (with identifier in the pdf) are created around the railway station. However also in this case the cadastral parcels are still 2D	
11.8. Please provide the following data: (a) Size of jurisdiction in square kilometres (b) Current number of 2D parcels (c) Current number of 3D parcels (d) Current population	See 11.3	
11.9. Approximately what are the proportions of various types of the 3D parcels (related to apartments, subsurface parking, subsurface shopping centres, bridges, tunnels, airspace, utility networks, etc)?		
11.10. Approximately what surface area of the jurisdiction is affected by 3D parcels (the total area of all the footprint of all 3D parcels).		
11.11. Any other interesting statistical fact(s)?		

12. Reflection

This section is only relevant in case also in 2010 and/or in 2014 the 3D cadastres questionnaire for your jurisdictions was completed (otherwise skip this section).

	Remarks
12.1. Compared to the 2010 and 2014 expectations, which 3D land administration developments did go faster than expected?	A 3D cadastre is under design and development. International Standards are used. Research is done together with Universities in this moment. The new Environment and Planning Act. sets new requirements
12.2. Same question, but now, which developments did go slower than expected?	
12.3. If some (limited) form of 3D Land administration functionality has become available, what are the observed benefits? And for who?	More transparency for users, e.g. by restricting (in future) the need to subdivide 2D parcels. This could also save surveying costs.
12.4. What are the (top-3) challenges of issues to be addressed to realize further 3D Land administration progress?	A workable and financial feasible solution.
12.5. In case of not yet fully operational status, were there any 3D Cadastre registration pilots to take steps towards more full implementation?	See the Delft case
12.6. In case of known legal barriers, have there been made progress in creating and adopting new legislation to support 3D land administration?	Under research
12.7. Any other reflections?	

13. Other Issues

Please include any other issues that may be of interest in an international context. For example, in some foreign jurisdictions 3D parcels can only be separated by horizontal planes.

	Remarks
13.1. Country (State, Province)	The Netherlands
13.2. Your name, function/position and your organization	Ruben Roes, Chief Registrar Klaas van der Hoek, Process Manager Authentic cadastral registration Christiaan Lemmen, Geodetic Advisor
13.3. Contact details: address email, telephone	Netherlands Cadastre, Land Registry and Mapping Agency Hofstraat 110 7311 KZ Apeldoorn The Netherlands +31 88 183 3110
13.4. Other issues	

References

ISO 19152:2012 'Geographic information - Land Administration Domain Model (LADM),
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=51206

Peter van Oosterom, Jantien Stoter, Hendrik Ploeger, Rod Thompson and Sudarshan Karki (2011). World-wide Inventory of the Status of 3D Cadastres in 2010 and Expectations for 2014. presented at the FIG Working Week 2011, Marrakech, 21 p.
http://www.gdmc.nl/3DCadastres/literature/3Dcad_2011_02.pdf

Sudarshan Karki (2013). 3D Cadastre Implementation Issues in Australia. MSc Thesis, University of Southern Queensland (Master of Spatial Science Research), 162 p.,
http://eprints.usq.edu.au/23560/1/Karki_2013_whole.pdf

Peter van Oosterom, Jantien Stoter, Hendrik Ploeger, Christiaan Lemmen, Rod Thompson, Sudarshan Karki (2014), Initial Analysis of the Second FIG 3D Cadastres Questionnaire: Status in 2014 and Expectations for 2018, In: Proceedings 4th International Workshop on 3D Cadastres, pp. 55-74,
http://www.gdmc.nl/publications/2014/Second_FIG_3D_Cadastres_Questionnaire.pdf