4th Questionnaire on 3DLand Administration: status December 2022

Scotland

This questionnaire is an activity of the **FIG Working Group 3D Land Administration 2022-2026**. The purpose of the survey is to make a world-wide inventory of the status of 3D Land Administration Systems/ Cadastres at this moment (2022) and the plans/ expectations for the near future (2026).

This is the first time that the questionnaire 3D-Land Administration is conducted as a successor of the questionnaire on 3D-Cadastres that was conducted three times by the FIG working group on 3D-Cadastres. The first time was in 2010 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) and the third one conducted in 2018 (status of 2018 and plans for 2022).

The earlier responses have been analysed and reported on van Oosterom et al. 2011, Karki 2013, van Oosterom et al. 2014 and Shnaidman et al., 2019. The results of the three earlier questionnaires are available via the participants pages of the 3D Land Administration Working Group website: http://www.gdmc.nl/3DCadastres/participants/.

The purpose of this survey is to make a **world-wide inventory of the status of 3D Land Administration** at the current moment and the plans/ expectations for the near future (2026). By sharing this information, it should be **possible to improve cooperation, learn from each other and support future developments**.

A few notes and suggestions, which shall be helpful when completing the questionnaire, are given below:

- The conceptual model used as background for the 3D Land Administration questionnaire is the **ISO 19152:2012 standard** (ISO, 2012), **the Land Administration Domain Model (LADM).** A new edition of the LADM is **under further development in ISO/TC 211** and is being developed as multipart standard, comprised by the following parts: **Part 1** – Generic Conceptual Model; **Part 2** – Land Registration; **Part 3** – Marine Georegulation; **Part 4** – Valuation Information; **Part 5** – Spatial Plan Information and **Part 6** – Implementations.
- In this questionnaire the concept of 3D Land Administration 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 of the specific country/ state/ province. Therefore, **3D parcels include land and water spaces, both above and below the earth's surface.**
- A more **formal definition**: A **3D parcel** is defined as "*the spatial unit against which (one or more) unique and homogeneous*[1] *rights (e.g. ownership right, lease or other land use right),*

[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 (ISO19152:2012).

responsibilities or restrictions are associated to the whole entity, as included in a Land Administration system."

- 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 Land Administration is on the spaces of the legal objects and not the registration of the physical objects as such.
- As the definition above is quite abstract, at the questions below, more specific and real-world examples are being used. Inspecting some of the completed 2010, 2014 and 2018 questionnaires from other countries might help when formulation the answers for your jurisdiction.
- 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).
- Similar to the earlier Questionnaires on 3D- Land Administration, the completed forms will be made available on website of FIG Working Group on 3D Land Administration.
- Please complete this questionnaire before *15 December 2022* and send it to E.Kalogianni@tudelft.nl (the word document completed, or the link with the google document completed) and state as email subject **"Completed FIG Questionnaire on 3D Land Administration 2022-2026 for xxx"** and at the "xxx" name the country.

The questionnaire has been prepared by Peter van Oosterom, Eftychia Kalogianni, Abdullah Kara, Rod Thompson, Sudarshan Karki, Anna Shnaidman, Alias Abdul Rahman, Hendrik Ploeger, Christiaan Lemmen. The questionnaire is grouped in various 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.

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.

Questions	Status 2022	Expectations 2026
1.1. Are all 3D parcels (3D spatial units in LADM terminology) constrained to be within one surface 2D parcel?	In theory, no. In our 2D mapped implementation, a strata right to e.g. subsurface ownership of mineral right could match, extend beyond or be fully within the boundaries of surface land ownership rights.	We may consider 2.5D categorisation of parcels which contain flatted properties, subject to the availability of data on floor levels and expected return on investment.
1.2. Are 2D and/ or 3D ambulatory[2] boundaries permitted?	Yes (2D).	
1.3. Regarding the legal/ physical relation of 3D objects: (a) Is it allowed to have 3D parcels (spatial units) not related to physical constructs or objects? (e.g. airspace, subsurface volumes) (b) If 1.3.a positive: approximately what proportion of new 3D parcels (spatial units) would involve such cases (not related to physical object)?	No. In our 2D mapped implementation, geometries must be created in relation to features shown on the base map.	
1.4. Are disconnected parts of a single 3D parcel allowed?		
1.5. Spatial limitations – e.g. the 3D parcel 'must be' related to a closed volume or is it allowed to have 'open' or unbounded 3D parcels (e.g. towards the sky)?	In our 2D mapped implementation, the volume can be narrated as open or closed.	
1.6. Are curved surfaces to bound the 3D parcels allowed?		
1.7. Must the curved surfaces (if allowed) be cylindrical sections, or any other constraint?		
1.8. Any other constraints – e.g. all		

[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.

Questions	Status 2022	Expectations 2026
surfaces must be horizontal or vertical?		
1.9. Is there legislation (law and/or regulations) for 3D descriptions of parcels? If so please, mention law and article(s).	Land Registration etc. (Scotland) Act 2012, Part 1, Section 11 (3) "The cadastral map may (but need not) show the boundaries of cadastral units on the vertical plane."	
1.10. Is the legal text available in original language? For example, professional or scientific papers/reports, which explain and justify the registration of 3D parcels.		
1.11. Is the legal text (relevant part) available in English translation at an official document?		
1.12. Do you have example descriptions of typical 3D parcels; either 'prototype' or 'operational'?	"Subjects cadastral unit… being that section of airspace at… measuring upwards from the level 5.5m above Newlyn Datum to the level 8.0m above the said datum containing…" "…the parts of the subsoil and under surface parts… with an upper limit of 0.5 meters and a lower limit of 20 meters below the surface." "Subjects part of cadastral unit…. together with a two thirds pro indiviso share in and to the roof and roof space immediately above the said flat…"	
1.13. Is there a formal model for the 3D parcels (UML style); e.g. based on ISO TC211 series (especially LADM, ISO 19152)?		
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 mining concessions (could be limited in time)?	Yes, e.g. Ownership of Mineral Rights, Ownership of Salmon Fishing Rights can be registered separately from ownership of land. Mapped as 2D, can be narrated as 3D.	
1.15. Are legally restricted spaces, above or below the earth's surface, such as polluted areas		

Questions	Status 2022	Expectations 2026
considered as 3D parcels?		
1.16. Are spatial plans considered as 3D parcels (so rights or restrictions are related to them)? Sometimes they are called 'spatial development plans', 'zoning plans' or 'physical plans' (land use, urban, regional, environmental, ...).		
1.17. Regarding the Marine Space: (a) Is there a Marine Cadastre established? And if so, are 3D parcels included in this registration? (b) Is the IHO Maritime Limits and Boundaries standard (S121) in use or under implementation? (c) Is there a Marine Spatial Plan established? And if so, are 3D marine parcels included in this registration?	a) No. Near shore seabed titles can be registered in the Land Register.	
1.18. Is there any organised legal instrument for the management of common property? For example, does the law, regulations or systems recognize/require a specific right type for common property?	Shared Plots can be registered.	
1.19. Which agency is responsible for the recording of titles information?	Registers of Scotland	
1.20. Which agency is responsible for recording cadastral transactions?	Registers of Scotland	
1.21. Are transactions for standard 2D lots and 3D lots done by the same agency or titles office?		
1.22. Are there any 3D storage permissions recorded (e.g. underground storage of CO_2)?		
1.23 Has there been developed any country profile based on LADM ISO19152[3]?	Yes. a) Yes b) No	

[3] If yes, is it included at the index presented at the Table 1 of the publication Kalogianni et al. 2021? If it is included, are there any further developments/ publications related to it apart from those mentioned at the table? In case there are, could you please provide with a link of a relevant publication?

Questions	Status 2022	Expectations 2026
(a) Does it support 2D spatial units? (b) Does it support also 3D spatial units? (c) Is there any provision to include/ align with the new LADM developments of the second Edition of the standard (inclusion of valuation information, marine spaces, spatial plans, interoperability/ reuse of BIM/IFC, ..)?	c) No	
1.24. Any other geometric issues related to 3D parcels?		

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.

Questions	Status 2022	Expectations 2026
2.1. Do you register utility networks as an entity in the land administration? (e.g. subterranean conduit networks)	No	
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? (e) in which format are usually the utility networks submitted for registration (i.e. CityGML Utility ADE, IFC, MUDDI, shp, …)?		
2.3. Does the jurisdiction have private networks? If so please, mention law and article(s).		
2.4. If so, are they registered as 3D property parcels (spatial units)?		
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).		
2.6. Is the text of laws and regulations (relevant part) available in English translation of an official document?		
2.7. Do you have example descriptions of typical 3D parcels (spatial units) for networks; either 'prototype' or 'operational'?		
2.8. If the network (legal) objects		

break at the surface parcel, how do you deal with intersecting networks or vertically parallel networks?		
2.9. Any other geometric issues related to the registration of networks?		

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*".

Questions	Status 2022	Expectations 2026
3.1. Do you register legal spaces for 3D construction/ building units (separate from the land)?	No. Separation is defined by the address.	
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, ...)		
3.3. Does the jurisdiction have construction/building units? If so please, mention law and article(s).	Land Registration (Scotland) Act 2012, Part 1, Section 16	
3.4. Is the legal text available in original language?		
3.5. Is the legal text (relevant part) available in English translation at an official document?		
3.6. Do you have example descriptions of typical 3D parcels; either 'prototype' or 'operational'?	"Subjects all and whole the flatted dwellinghouse… being the eastmost flat on the first floor above ground within the block…"	
3.7. Regarding the boundaries' definition: (a) What would be typical 3D boundaries in an apartment complex: i) middle of the wall and floor/ceiling, ii) interior/ exterior of the wall or iii) walls, floor/ceiling as neutral/ shared 3D space? (b). Is it mentioned in any legislation or is it the convention?		
3.8. Is common property inside the building registered? If so, how?	Can be narrated, yes.	
3.9. Who owns the common property inside the building?	Common ownership.	
3.10. Who owns the land on which the apartment is built?	Common ownership.	

3.11. Do you allow sub-division of apartments or apartment blocks?		
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?		
3.13. What is the numbering convention for apartments (please specify in terms of cadastral parcel as well as street addressing)	Multiple conventions in use.	
3.14. Are there any mandates[4] that set specifications on the delivery of design/ construction drawing of properties in BIM-based format, when registering new 3D parcels (from design)?		
3.15. Are there any operational or in prototype stage platforms. implementations that reuse BIM information from design as cadastral/ land administration input?		
3.16. Any other geometric issues?		

[4] That arise through legislation or from the procurement process.

COORDINATES

This refers to the use of **x, y coordinates** and the relevant issues.

Questions	Status 2022	Expectations 2026
4.1. Do the plans of survey guarantee X/Y coordinates? (and are they relative or in an absolute spatial reference system?)		
4.2. Are the cadastral database coordinates authoritative?		
4.3. If not, what is the authoritative source of X/Y coordinates?		
4.4. Do you have parcels defined by the walls of a building (with no recorded geometry)?		
4.5. What is the spatial reference system for X/Y Coordinates? (Please , provide the EPSG)		
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.)?	Title polygons are mapped in relation to and displayed against Ordnance Survey base map data.	
4.7. Have there been any changes, w.r.t. the spatial reference system, made in the way cadastral information is recorded and represented from a historical point of view?		
4.8. Any other X/Y coordinate issues?		

REPRESENTATION OF 3rd DIMENSION: HEIGHT (OR DEPTH)

This section refers to the representation and registration of the **third dimension**.

Questions	Status 2022	Expectations 2026
5.1. Are the height values of 3D parcels relative to local ground?		
5.2. Are height values reduced to a standard datum (absolute)? If so, what is the spatial reference system for this 3rd ordinate?		
5.3. In principle, is it possible to store both relative and absolute height/ depth values?		
5.4. Is the earth surface (elevation) explicitly stored (in the DCDB or other accessible register)?		
5.5. What is the source of height values for the 2D surface parcel?		
5.6. How is elevation information recorded in the cadastral plan or database?		
5.7. Do you expect the elevation recorded in cadastral plans to be used for any other purpose (e.g. development of 3D city models or civil constructions etc.)?		
5.8. Are there any 3D City Model/ Digital Twin developments carried out at a national or city level that can be used for orientation or reference purposes?		
5.9. Any other 3rd dimension ordinate value issues?		

TEMPORAL ISSUES (4th DIMENSION)

This section refers to the representation and registration of the **fourth dimension**.

Questions	Status 2022	Expectations 2026
6.1. Are temporal limits part of the definition of a parcel (2D or 3D)?	No	
6.2. Are moving parcels allowed?	No	
6.3. Are there any limitations on the range of temporal limits? (e.g. only on 3D apartments).		
6.4. Is there any attempt to integrate 3D space and temporal representations, into a single 4D space/time representation?		
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?		
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.		
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)?		
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?		
6.9. For Cadastral transactions, how far in time do buyers need to make a search to ensure the title or deed is legal?		
6.10. Are there object classes in the registration that require both real-world (or valid) times and database load (or system) times, i.e. bi-temporal support?		
6.11. Any other temporal issues?		

RIGHTS, RESTRICTIONS AND RESPONSIBILITIES (RRRs)

This section refers to the **RRRs and their registration at the LA system.** At a vast majority of the countries, the restrictions and the responsibilities are not registered at the LAS.

Questions	Status 2022	Expectations 2026
7.1. Please provide the range of RRRs on 3D parcels. If there is an online depository, provide the link.		
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).		
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).		
7.4. Are there RRRs that are only allowed in 3D (and not valid for 2D)		
7.5. Is there specific legislation (laws, regulations) defining 3D RRR types? If so, provide details, e.g. references to documents/ articles.		
7.6. Can 3D sub-surface/above-surface parcel be owned by someone other that the person owning the land parcel?		
7.7. What applications do you foresee for 3D land administration?		
7.8. Are the administrative source documents (source of RRRs) title or deed based?		
7.9 Who is responsible for the correctness of the specified 3D boundaries in spatial source documents (which authority)?		
7.10. Is registration of 3D parcels done inside the cadastral mapping agency, the land registry or elsewhere?		
7.11. Are 3D registrations handled by the same organisation that handles traditional (2D) land		

administration?		
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?		
7.13. Is the 3D registry separate or integrated with the 2D registry?		
7.14. Any other RRR issues?		

THE CADASTRAL DATABASE (Digital Cadastral Database - DCDB)

This section refers to the **structure and functionalities of the cadastral database**.

Questions	Status 2022	Expectations 2026
8.0. Is the database schema LADM based?	Yes	
8.1. Does the DCDB contain representation of 3D parcels (in any form)?	No	
8.2. If so, how are they represented (in the DCDB)?		
8.3. If so, how are they presented on cadastral “maps” (including screen presentations)?		
8.4. Are there possibilities to store geometry of 3D parcels in the DCDB?	Yes	
8.5. Is it possible to manage a 3D topological structure in the DCDB?	No	
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?	PostGIS. 3D possible, but is not 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?		

PLANS OF SURVEY (INCLUDING FIELD SKETCHES)

This section poses questions about the data acquisition process and **cadastral survey plans**.

Questions	Status 2022	Expectations 2026
9.1. Do the survey plans carry 3D parcel representations?		
9.2. If so, how are they represented?		
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?		

DISSEMINATION OF 3D LAND ADMINISTRATION INFORMATION

This section refers to the **dissemination of 3D LA-related information** and the advances in this domain.

Questions	Status 2022	Expectations 2026
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, please provide the link and refer it includes 3D data?		
10.2. Are there specific file formats or standards used to distribute 3D LA/ 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?		

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).

Questions	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?	No minimum, provided it is not a souvenir plot.	
11.2. What is the largest 2D and 3D parcel that is present allowed to be registered in the land administration?	No prescribed maximum, but large areas may be registered as separate titles for operational reasons.	
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,…)		
11.4. How many 2D and 3D parcels do you currently have in your land administration?	c. 1.9M 2D	
11.5. Which year did you start registering 3D parcels in the land administration?		
11.6. What is the ratio of 3D parcels in rural vs. urban areas?		
11.7. Please specify names of cities or towns or suburbs or regions or locations where there are significant numbers of 3D parcels.		
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		
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)?		

Questions	Status 2018	Expectations 2022
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)?		

REFLECTION

This section is only relevant in case also one of the previous questionnaires for your jurisdiction (2010, 2014 and/ or 2018) was completed (otherwise skip this section).

Statements	Remarks
12.1. Compared to the 2010, 2014, 2018 and 2022 expectations, which 3D land administration developments did go faster than expected?	
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?	
12.4. What are the (top 3) challenges of issues to be addressed to realize further 3D Land administration progress?	
12.5. In case of not, yet, fully operational status, were there any 3D LA/ Cadastre registration pilots to take steps towards a more complete implementation?	
12.6. In case of known legal barriers, have there been made progress in creating and adopting new legislation to support 3D land administration?	
12.7. Any other reflections?	

OTHER ISSUES

At this section, 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).

Contact Details & other issues	Remarks
13.1. Country (State, Province)	Scotland
13.2. Name	Alan Howie / Marguerite le Riche
Function/ Position	Chief Data Officer / Data Scientist
Organization	Registers of Scotland
13.3. Contact details:	
Address	Meadowbank House, 153 London Road, Edinburgh, EH8 7AU
Email	Alan.Howie@ros.gov.uk, Marguerite.leRiche@ros.gov.uk
Telephone	0800 169 9391
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.

Kalogianni, E., Janečka, K., Kalantari, M., Dimopoulou, E., Bydłosz, J., Radulović, A., Vučić, N., Sladić, D., Govedarica, M., Lemmen, C.H.J. and van Oosterom, P.J.M. (2021). Methodology for the development of LADM country profiles, In: Land Use Policy, Elsevier, 105(105380), pp. 1-12, 2021. Available at: http://www.gdmc.nl/publications/2021/LUP_CountryProfile.pdf

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

Shnaidman, A., van Oosterom, P.J.M., Lemmen, C.H.J., Ploeger, H., Karki, S. and Abdul Rahman, A. (2019). Analysis of the Third FIG 3D Cadastres Questionnaire: Status in 2018 and Expectations for 2022, Proceedings FIG Working Week 2019: Geospatial Information for a Smarter Life and Environmental Resilience. Available at: https://repository.tudelft.nl/islandora/object/uuid%3A1c65db49-404c-4b88-8b78-11dca1bc151b

van Oosterom, P.J.M., Stoter, J., Ploeger, H., Thompson, R. and Karki, S. (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. Available at: http://www.gdmc.nl/3DCadastres/literature/3Dcad_2011_02.pdf.

van Oosterom, P.J.M., Stoter, J., Ploeger, H., Lemmen, C.H.J., Thompson, R. and Karki, S. (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, Available at: http://www.gdmc.nl/publications/2014/Second_FIG_3D_Cadastres_Questionnaire.pdf.