

4th Questionnaire on 3D Land Administration: status December 2022



Spain

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 homogeneous¹ 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.

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.

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?	The cadastral parcels are 2d but we show them on the digital model of the terrain in 3D. Only buildings have 3D	Not other plan
1.2. Are 2D and/ or 3D ambulatory ² boundaries permitted?		
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)?	Not in cadastre	No other plan
1.4. Are disconnected parts of a single 3D parcel allowed?	not	No other plan
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)?	not	No other plan
1.6. Are curved surfaces to bound the 3D parcels allowed?	not	No other plan
1.7. Must the curved surfaces (if allowed) be cylindrical sections, or any other constraint?		
1.8. Any other constraints – e.g. all surfaces must be horizontal or vertical?		

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.

1.9. Is there legislation (law and/or regulations) for 3D descriptions of parcels? If so please, mention law and article(s).	The law that describes the division by floors and units of buildings is the law of horizontal property	No other plan
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.	https://www.boe.es/biblioteca_juridica/abrir_pdf.php?id=PUB-PR-2022-142	
1.11. Is the legal text (relevant part) available in English translation at an official document?	not	
1.12. Do you have example descriptions of typical 3D parcels; either 'prototype' or 'operational'?	https://inspire.ec.europa.eu/events/conferences/inspire_2012/presentations/16.pdf	
1.13. Is there a formal model for the 3D parcels (UML style); e.g. based on ISO TC211 series (especially LADM, ISO 19152)?	Not, We have our own format. FXCC https://www.catastro.minhap.es/documentos/formatos_intercambio/formato_fxcc.pdf	
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)?	Not in the cadastre. Only building or some constructions under the ground.	We are thinking about
1.15. Are legally restricted spaces, above or below the earth's surface, such as polluted areas considered as 3D parcels?	Not all in the cadastre. Only building and constructions	We are thinking about
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, ...).	Not all in the cadastre. Only building and constructions	We are thinking about

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?	Not in the cadastre	No other plan
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?	yes	
1.19. Which agency is responsible for the recording of titles information?	Land Registry and Cadastre. Both exchanged information	
1.20. Which agency is responsible for recording cadastral transactions?	Cadastre and exchange information with land registry	
1.21. Are transactions for standard 2D lots and 3D lots done by the same agency or titles office?	yes	
1.22. Are there any 3D storage permissions recorded (e.g. underground storage of CO ₂)?	not	No other plan

1.23 Has there been developed any country profile based on LADM ISO19152³? (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, ..)?	not	No other plan
1.24. Any other geometric issues related to 3D parcels?	not	

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?

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.

Questions	Status 2022	Expectations 2026
2.1. Do you register utility networks as an entity in the land administration? (e.g. subterranean conduit networks)	Only transport network and hydrography above the earth's surface	We are thinking about include others
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, ...)?	Only for transport network and hydrography above the earth's surface a...yes b....yes c....yes d....only rights e.... GML and others	We are thinking about include others
2.3. Does the jurisdiction have private networks? If so please, mention law and article(s).	We have only real estates, privates or public.	We are thinking about
2.4. If so, are they registered as 3D property parcels (spatial units)?	If they are constructions, yes	
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).	https://www.boe.es/eli/es/rdlg/2004/03/05/1/con	
2.6. Is the text of laws and regulations (relevant part) available in English translation of an official document?	no	

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?		

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”*.

Questions	Status 2022	Expectations 2026
3.1. Do you register legal spaces for 3D construction/ building units (separate from the land)?	yes	
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, ...)	The different private elements that are susceptible of independent use, subject to the special regime of horizontal property, as well as the set constituted by different mutually linked private elements and acquired in unity of act and, under the conditions determined by regulation, the storage rooms and parking spaces in pro indiviso assigned to the exclusive and permanent use and enjoyment of a holder. The attribution of the common elements to the respective properties, for the sole purposes of their cadastral valuation, will be carried out in the manner determined by regulation	
3.3. Does the jurisdiction have construction/building units? If so please, mention law and article(s).	Real Decreto Legislativo 1/2004, de 5 de marzo, por el que se aprueba el texto refundido de la Ley del Catastro Inmobiliario.	
3.4. Is the legal text available in original language?	Yes https://www.boe.es/eli/es/rdlg/2004/03/05/1/con	
3.5. Is the legal text (relevant part) available in English translation	no	

at an official document?		
3.6. Do you have example descriptions of typical 3D parcels; either 'prototype' or 'operational'?	You can visit our webpage that it is open and free, Cadastral Electronic Site - Start (sedecatastro.gob.es)	
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?	a: i) middle of the wall and floor/ceiling b: yes	
3.8. Is common property inside the building registered? If so, how?	Yes. But it is not a real estate independent	
3.9. Who owns the common property inside the building?	The owners of the privative parts. Each with its corresponding percentage	
3.10. Who owns the land on which the apartment is built?	The owners of the privative parts. Each with its corresponding percentage	
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?	not	
3.13. What is the numbering convention for apartments (please specify in terms of cadastral parcel as well as street addressing)	Within a parcel there may be 1 or several buildings. Inside a building there may be one or several addresses. The address of a specific apartment has: Administrative unit (municipality), postal code, ThoroughfareName, number (portal), staircase,	

	floor and door	
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)?	not	No plans
3.15. Are there any operational or in prototype stage platforms. implementations that reuse BIM information from design as cadastral/ land administration input?	not	No plans
3.16. Any other geometric issues?		

⁴ That arise through legislation or from the procurement process.

4. 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?)	There only an official cadastral continuous map that guarantee X/Y coordinates. They are in absolute spatial reference system	
4.2. Are the cadastral database coordinates authoritative?	yes	
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)?	no	
4.5. What is the spatial reference system for X/Y Coordinates? (Please , provide the EPSG)	ETR89, EPSG 4258 And in Canarias Island REGC 95 EPSG:4326. WGS84 (Coordenadas geográficas)	
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.)?	They can obtain the information from Cadastral Electronic Site - Start (sedecatastro.gob.es) Representation, coordinates, neighbouring lots, ortophoto etc...	
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?	Yes we transform everything from UTM, ED50 to ETR89	
4.8. Any other X/Y coordinate issues?		

5. 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?	Height of buildings is estimated. For cadastral parcels we use digital terrain model.	We planning use absolute height.
5.2. Are height values reduced to a standard datum (absolute)? If so, what is the spatial reference system for this 3rd ordinate?	There is an official reference system in Spain for the altimetric model. The records of the average sea level in Alicante for the Peninsula and the local mareographic references for each of the islands will be taken as a reference for altitudes.	An official geodetic reference system will be maintained
5.3. In principle, is it possible to store both relative and absolute height/depth values?	Yes, they are attributes of each object. Now in rural subparcels there is an attribute with the value of the absolute height and another with the slope	We planning to add attributes of absolute and relative heights in the geometry of building parts
5.4. Is the earth surface (elevation) explicitly stored (in the DCDB or other accessible register)?	We have the digital model of the terrain and elevations in files and as web services	Develop more efficient integration procedures between altimetric models and cadastral objects. API's
5.5. What is the source of height values for the 2D surface parcel?	For cadastral parcels we use digital terrain model. From LIDAR data	Accuracy improvement
5.6. How is elevation information recorded in the cadastral plan or database?	As attributes in cadastral objects (subparcels)	Extend altimetry attributes to other cadastral objects (building parts)
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.)?	Mainly in the valuation of rustic plots. And in buildings, 3D model allows the best identification of real estate.	There are many utilities that require a 3d model for mapping with the level of detail of cadastral mapping. Energy efficiency, shadow map, noise map, coverage of telephone antennas,...
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?	There are many organizations and companies that are already using cadastral data to generate 3D City Model/ Digital Twin, for different purposes.	The number of users who demand 3D information will increase

5.9. Any other 3 rd dimension ordinate value issues?	The problem is the volume of data and ongoing maintenance	It will increase the capacity of data storage and calculation process
---	---	---

6. 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)?	yes	
6.2. Are moving parcels allowed?	yes	
6.3. Are there any limitations on the range of temporal limits? (e.g. only on 3D apartments).	Not.	
6.4. Is there any attempt to integrate 3D space and temporal representations, into a single 4D space/time representation?	It is already in the case of buildings	
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)?	Yes, for example concessions	
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?	10 to 20 years	
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?	We have the 2 dates in cadastre: real world and in database	
6.11. Any other temporal issues?		

7. 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.	right of ownership, real right of usufruct, right of surface or administrative concession on the real estate or on the public services to which it is assigned.	Not change is planed
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. the rights are the same for 2D or 3D	Not change is planed
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. the rights are the same for 2D or 3D	Not change is planed
7.4. Are there RRRs that are only allowed in 3D (and not valid for 2D)	No. the rights are the same for 2D or 3D	Not change is planed
7.5. Is there specific legislation (laws, regulations) defining 3D RRR types? If so, provide details, e.g. references to documents/ articles.	No. the rights are the same for 2D or 3D	Not change is planed
7.6. Can 3D sub-surface/above-surface parcel be owned by someone other that the person owning the land parcel?	According to what is indicated in the civil code, what is built on other people's land is incorporated or belongs to the ownership of the land on which said construction has been carried out (the owner of the land is also the owner of what is built on it)	Not change is planed
-	Improves legal certainty in the cadastral property description which is especially useful for its inclusion in the Land Registry. Enables users to georeferenced sub-addresses inside a building	

	to complete data of street and number with more detail information such as floors and doors. Enables users to locate the address in a 3D space. Provides a powerful tool for the emergency services to plan interventions. Offers useful information for many applications, including the calculation of energy efficiency. Allows users to have a better knowledge of the properties and makes the real estate market easier.	
7.8. Are the administrative source documents (source of RRRs) title or deed based?	Titles	No change is planed
7.9 Who is responsible for the correctness of the specified 3D boundaries in spatial source documents (which authority)?	Cadastre	No change is planed
7.10. Is registration of 3D parcels done inside the cadastral mapping agency, the land registry or elsewhere?	Geographical data is responsibility of cadastre, obligatory; the ownership title in front third is responsability of Land registry, voluntary	
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?	We provide cadastral certificate now in 2d	Working in 3d certification
7.13. Is the 3D registry separate or integrated with the 2D registry?	integrated	
7.14. Any other RRR issues?		

8. THE CADASTRAL DATABASE (Digital Cadastral Database - DCDB)

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

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?	no	
8.1. Does the DCDB contain representation of 3D parcels (in any form)?	Yes but only buildings	
8.2. If so, how are they represented (in the DCDB)?	The viewer system is based in the document (FXCC) that has scaled graphic representation of the units, floors and interior spaces forming the building. Users can select each unit within a building and see its characteristics as the FXCC is transformed into a GeoJSON format that is read and drawn through THREE.js. This is an abstraction of the widely supported WebGL API for representing 2D and 3D graphics directly in a web browser. Users can also obtain a certificate with the graphical, juridical and economic characteristics of this unit.	
8.3. If so, how are they presented on cadastral “maps” (including screen presentations)?	The cadastral map is 2d but it is possible to obtain the 3D of the building clicking in the map <u>Cadastral Electronic Site - Start (sedecatastro.gob.es)</u>	
8.4. Are there possibilities to store geometry of 3D parcels in the DCDB?	not	We are working on it
8.5. Is it possible to manage a 3D topological structure in the DCDB?	not	
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?	not	We are working on it
8.7. How can internal and external user	Owner 3D web/view service	Standard formats

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?	For 3d modeling by floor we only use CAD files (DXF). In building part geometry 2d in ORACLE an number of floors like attribute	Building units by floor in 2d geometry ORACLE and attributes of level an height. Building part with 2d geometry in ORACLE and attributes: real height ,elevation, number floors...
8.9. Do you have any validation rules for 3D representation in the database?	not	We are working on it
8.10. What (GIS/CAD) software is used for updating, editing, analysis, and visualization of the cadastral data? Any 3D capabilities included and used?	Owner software	
8.11. What web software is used for remote data access/distribution and visualization? Any 3D capabilities included and used?	Owner software	
8.12. Is your DCDB organised as Multi-Layers or Object Oriented or some other data model?	Object Oriented	
8.13. How do you query 3D objects in your DCDB?	Only to 2D objects	
8.14. Is it possible to query neighbourhood parcels to a 3D object, vertically as well as horizontally?	NO	
8.15. Any other DCDB issues?	No	

9. 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?	We exchange the FXCC format http://www.catastro.minhap.gob.es/documentos/formatos_intercambio/formato_fxcc.pdf	
9.2. If so, how are they represented?	We exchange the FXCC format http://www.catastro.minhap.gob.es/documentos/formatos_intercambio/formato_fxcc.pdf	

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.	Yes, FXCC it is an official exchange format defined in legislation http://www.catastro.minhap.gob.es/documentos/formatos_intercambio/formato_fxcc.pdf	
9.4. Is sketch level allowed (low geometric quality, but in principle enough to indicate the 3D object)?	not	
9.5. Is it possible to define a 3D parcel by referring to other 3D real world objects/ topography (and not specifying coordinates)?	Yes	
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....?	In addition to FXCC The data of 3D is open to the notaries and registrars in our virtual office Currently only 2D in legal documents	We are working in a 3d certificate for real state property in buildings.
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)?	not	
9.8. Do you have examples of (prototype or production) 3D survey plans available?	See FXCC in Cadastral Electronic Site - Start (sedecatastro.gob.es)	
9.9. Are any reference objects visible on the survey plan	Only buildings part	

(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, ...)?	FXCC, CAD file DXF format	
9.11. What software do you use for creating and processing survey plans? Any 3D capabilities included and used?	Owner software or any CAD software.	
9.12. Can 3D parcels be subdivided, consolidated or nullified?	YES, by FXCC format for buildings	
9.13. Is there any existing technical circular or directive to assist Surveyors in 3D data collection in the field?	NOT. Only for buildings in FXCC format	
9.14. Are the surveyors required to undertake a field survey for 3D cadastral data?	NOT	
9.15. Are building construction plans used to compile 3D cadastral information for apartments?	YES , floor by floor.	
9.16. Is 2D/3D field survey done by private licensed surveyors or by government surveyors?	Competent Technicians	
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.	New parcels are created directly in the database, after a cadastral procedure	
9.18. Do you show dimensions or isometric views of 3D parcels on survey plans (do you also store this in a database)	We visualize 3d models building by building	We are working on it
9.19. Do the cadastral survey plans differentiate between different types (e.g. volumetric plans, building plans and	There is a data model, where the parts of the buildings of the entire territory are assigned the volumetry of the number of floors, above and below ground. And there is another data model that collects the geometry of each cadastral unit for	

standard 2D plans)?	each floor of each building.	
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.?)	Most of them	
9.21. Are authoritative cadastral surveys carried out by government surveyors or private licensed surveyors or both?	Competent technicians	
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)?	The coordinates of the vertices that define its geometry	
9.23. How much time does it usually take for a subdivision process to complete?	It depends on the volume of work of the cadastral offices and the requirements of the procedure. The law put the limit of 6 months, but always is much less.	
9.24. What is the legal source for cadastral representation (e.g. cadastral plans, or DCDB or index plans or descriptive sketch/text etc.?)	Cadastral plans	
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)?	In the specifications of the capture of the cadastral cartography, the quality controls of positional accuracy were defined, based on the capture scale of the cartography 1: 1000 for urban cartography and 1: 5000 for rural cartography. Work has been systematically done to improve that accuracy.	
9.26. Any other survey plan issues?	NOT	

10. 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-	YES	

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?	https://www.sedecatastro.gob.es/	
10.2. Are there specific file formats or standards used to distribute 3D LA/ Cadastral information? (e.g. LandXML, CityGML, BIM/IFC, 3D pdf,...)	Own FXCC and KML only for building	GeoJSON
10.3. Are there specific cartographic styling rules for representing 3D cadastral plans, or to represent 3D cadastral objects on 2D cadastral maps?	NOT	
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?	NOT	We are working in pdf with 3d Objects
10.5. Is the 3D Cadastral information accessible in integrated manner with the 2D Cadastral information?	YES	
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)?	YES Buildings	
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)	Yes but only rights and parties	
10.8. Are 2D/3D cadastral data available to the general public or just to the relevant parties?	All unprotected cadastral information is free for the general public.	
10.9. Any other 3D cadastral information dissemination issues?	NOT	

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).

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?		
11.2. What is the largest 2D and 3D parcel that is present allowed to be registered in the land administration?		
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?	2D: 53.097.474 3D: aprox 20.000.000	
11.5. Which year did you start registering 3D parcels in the land administration?	2003	
11.6. What is the ratio of 3D parcels in rural vs. urban areas?	In rural areas aprox 50% In urban areas aprox 75%	
11.7. Please specify names of cities or towns or suburbs or regions or locations where there are significant numbers of 3D parcels.	The main cities of Spain. For example Madrid	
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	a)505.990 km2 b) 53.097.474 c) aprox 20.000.000 d)47.420.000	

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)?	For all cadastral parcels we use digital terrain model. From LIDAR data And FXCC of 70% of constructions	
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).	For all cadastral parcels we use digital terrain model. From LIDAR data And FXCC of 70% of constructions	
11.11. Any other interesting statistical fact(s)?		

12. 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?	

13. 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)	Spain
13.2. Name	Amalia Velasco
Function/ Position	International Coordinator
Organization	Spanish Directorate General for Cadastre
13.3. Contact details:	
Address	
Email	Amalia.velasco@catastro.hacienda.gob.es
Telephone	+34660538686
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.