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

Canada, Quebec

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.

IMPORTANT PRELIMINARY NOTES:

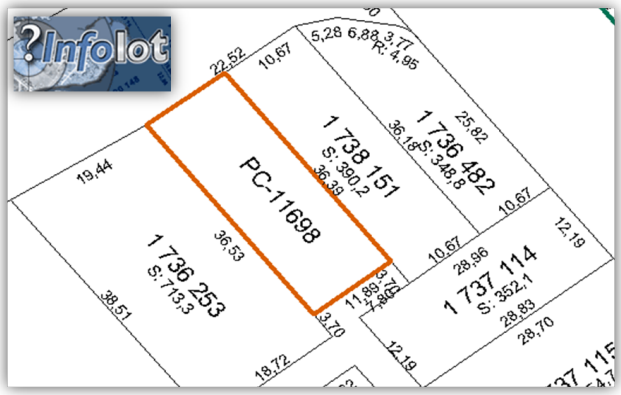
This questionnaire was fulfilled by Alain Grégoire, Guillaume Devost, Christian Lord and Pierre Giguère from *Direction de l'enregistrement cadastral at Foncier Quebec*, a sector of the Ministry of Natural Resources and Forests (MRNF), responsible for the cadastre and land rights registration covering both private territory and public land and Jacynthe Pouliot, professor at Université Laval-Geomatics Department.

In Québec, the State has taken responsibility for the protection of land rights, but it fulfils its responsibility differently according to whether the rights involve public or private land, depending on the legal rules that apply. Private land comes under the civil law, which regulates relations between individuals, where public land comes under the administrative law, which regulates relations between individuals and the state. Public land are registered in the Register of the Domain of the State while rights related to the private territory are published in the Land Register.

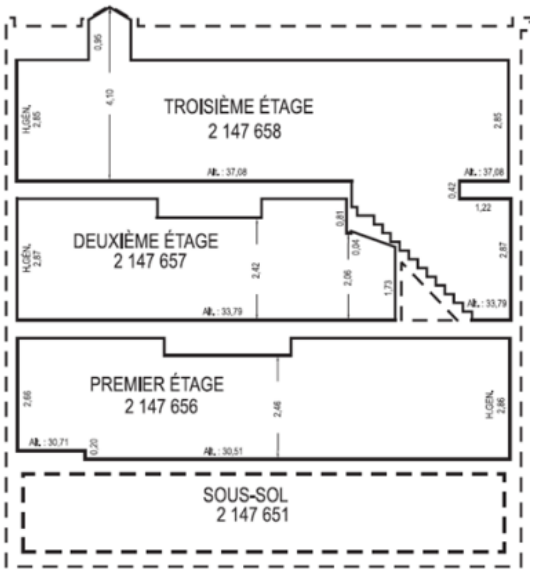
The rules governing the *Land Register* are set out in the *Civil Code of Québec* (C.C.Q.) and are applied uniformly throughout Québec[2]. The Code establishes a system for the publication of rights that is based on the cadastral plan systematically updated. The cadastral plan is the material support for the land book, just as the land book is the legal support for the publication of rights[3]. Each immovable property is designated by a number and represented graphically on the plan, with its dimensions, area and boundaries, and located in relation to surrounding properties.

The cadastral plan is a 2D graphical description of the limits and the size of the lot where each property has its own ID (unique lot number). In the case of superimposed properties, called "cadastre vertical", the cadastral plan shows a polygon with a specific number (PC-XX) but without any official measures. The PC number refers to one or more complementary plans (PC). Theses PC plans are prepared by land surveyors (private firms). The private firms usually stored the original PC as a CAD file but this file is not available for others users. The users of the PC have access to paper format or a 2D pdf file (an image of the draws) resulting from a scanning process. On the PC we can find vertical profiles of each vertical lot and horizontal plans. The following pictures show an example of the cadastral plan with a PC polygon and an example of a vertical profile available on a PC. You can get another example of the content of a PC file at http://cadastre.mrnf.gouv.qc.ca/documents/produits-services/pdf/plancomplementaire.pdf.

A)



B)



A- An example from Infolot (Accueil - Infolot (gouv.qc.ca)) of the cadastral plan that refers to a complementary plan (PC)

B- A vertical profile of the superimposed properties extracted from the PC plan

[2] In Québec, the land registration and cadastral systems are established by the state for the entire province. However, various organizational mechanisms ensure that municipalities systematically receive cadastral data and data on property transactions, allowing them to establish and update their land taxation systems.

[3] *Commentaires du ministre de la Justice – Le Code civil du Québec*, Volume ll, p. 1910.

It is thus important to understand that the current Quebec cadastral system does not offer volumetric representation of 3D parcels. Instead, it proposes vertical profiles from which the third dimension can be derived. This is why, some questions hereafter are not applicable to the Quebec context.

Finally, we have to specify that the following answers of the questionnaire represent the point of view of land surveyors who are involved in the process of producing/managing cadastral plans. We are not necessary fully aware about the application of the concept "3D parcels" and RRR related to public properties or natural resources, such as mines or subterranean infrastructure, although we tried to fulfilled questions related to theses topics.

To answer the questionnaire and for some questions, we assumed that 3D parcels = 3D lots = 2 1/2D representation of the lot, even if this hypothesis is not fully adequate.

Some of our references are:

MERN 2017. Instructions pour la présentation des documents cadastraux relatifs à la mise à jour du cadastre du Québec. Version 4.1, Available at this link https://foncier.mern.gouv.qc.ca/Portail/media/2358/instructions_version-4-1_2017.pdf.

MERN 2013. Instructions pour la réalisation d'un mandat de rénovation cadastral. Version 6.1, Janvier 2013, Document rédigé par le ministère des Ressources naturelles du Québec (MRNF), Direction générale de l'arpentage et du cadastre, Gouvernement du Québec. Available at this link https://foncier.mern.gouv.qc.ca/Portail/media/1824/instructions_version-6-1_2013.pdf.

- Pouliot, Roy, Fouquet-Asselin, Desgroseilliers, 2010. 3D Cadastre in the province of Quebec: A first experiment for the construction of a volumetric representation. In Advances in 3D Geo-Information Sciences (Series: Lecture Notes in Geoinformation and Cartography), Springer-Verlag, Eds: Kolbe, König and Nagel. Berlin, Nov. 3-4. P. 149-162.

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 2023	Expectations 2026
1.1. Are all 3D parcels (3D spatial units in LADM terminology) constrained to be within one surface 2D parcel?	Yes it is constrained to surface parcel but not necessarily to one parcel. The volumetric dimension is not supported by our cadastral system. The 3rd dimension of a 3D parcel is represented on 2D plans (available via "Plan complémentaire (PC)" plans) that do not contain volumetric representation but vertical profiles. In the context of condominium, one land parcel is usually enough (but not always) to indicate the PC number, but this is not a restriction. This is especially true in the case of properties having large spatial extent such as subways where several land parcels are used to refer at the PC plans.	
1.2. Are 2D and/ or 3D ambulatory[4] boundaries permitted?	Theoretically they are, but we did not yet face this kind of situation in the vertical dimension, only for horizontal representation.	
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)?	1.3 a Yes. Usually, the3D parcels do refer to constructions (buildings, subway, tunnel), but it is not a restriction since we can apply it to mining properties for example. 1.3b Information not available, possibly less than 5%	
1.4. Are disconnected parts of a single 3D parcel allowed?	No	

[4] 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.

1.5. 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)?	No, the parcels can be unbound towards the sky (zenith) or towards the nadir	
1.6. Are curved surfaces to bound the 3D parcels allowed?	Yes, no specific restrictions about this technical aspect.	
1.7. Must the curved surfaces (if allowed) be cylindrical sections, or any other constraint?	No restrictions.	
1.8. Any other constraints – e.g. all surfaces must be horizontal or vertical?	No	
1.9. Is there legislation (law and/or regulations) for 3D descriptions of parcels? If so please, mention law and article(s).	There is no legislation for the description of parcels but guidelines exist for the production of cadastral plan (horizontal plans and vertical profiles). (see MERN 2017) There are legislations (Loi sur le cadastre and the Civil code) that refer to cadastre and regulation issues. Civil code of Quebec : rules 3026 to 3045.	
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.	Yes, French and English	
1.11. Is the legal text (relevant part) available in English translation at an official document?	Yes.	
1.12. Do you have example descriptions of typical 3D parcels; either 'prototype' or 'operational'?	See MERN 2017 and a prototype presented in the article Pouliot et al., 2010	
1.13. Is there a formal model for the 3D parcels (UML style); e.g. based on ISO TC211 series (especially LADM, ISO 19152)?	No.	

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)?	Mining rights are currently published in the Register of real right of State resource development, a section of the Land Register which the law declares to be property separate from the land on which it is exercisable. This kind of object is not necessary represented in the cadastral plan, but could be if the owner request this action. We find few of them in the cadastral plan.	
1.15. Are legally restricted spaces, above or below the earth's surface, such as polluted areas considered as 3D parcels?	N/A since the cadastre system does not include this kind of information	
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, ...).	N/A since the cadastre system does not include this kind of information	
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 marine cadastre in Quebec. B) N/A C) N/A	
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?	Declaration of co-ownership	
1.19. Which agency is responsible for the recording of titles information?	The MRNF is responsible for the management of the Land Registry, which is the official register in which deeds are published.	

1.20. Which agency is responsible for recording cadastral transactions?	The MRNF is responsible for managing the cadastral register.	
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)?	No	
1.23 Has there been developed any country profile based on LADM ISO19152[5]? (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, ..)?	No A) N/A B) N/A C) N/A	
1.24. Any other geometric issues related to 3D parcels?	Visualization for the general public of the 3D image of the parcel may be complex.	

[5] 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)	A railway network or a network of cable communications, water or gas distribution, power lines, oil or gas pipelines or sewage conduits are currently immatriculated in the Register of real right of State resource development which the law declares to be property separate from the land on which it is exercisable. These kinds of objects are not necessary represented in the cadastral plan, but could be if the owner requests this action. We currently find few of them in the cadastral plan.	
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, …)?	Not the network traces itself but an approximate view of its shape via the number of land surfaces intersecting the network (i.e. all PC-Polygons intersected).	
2.3. Does the jurisdiction have private networks? If so please, mention law and article(s).	Yes, private networks may be registered separately. Civil Code of Québec article 3031.	
2.4. If so, are they registered as 3D property parcels (spatial units)?	The networks are registered but not necessary represented (see 2.1). They are approximately described in text document.	
2.5. Is the text of relevant laws or regulations (question 2.3) available in original language? If so, give references to relevant	Yes. Civil Code of Québec;	

document(s).		
2.6. Is the text of laws and regulations (relevant part) available in English translation of an official document?	N/A	
2.7. Do you have example descriptions of typical 3D parcels (spatial units) for networks; either 'prototype' or 'operational'?	We can find some.	
2.8. If the network (legal) objects break at the surface parcel, how do you deal with intersecting networks or vertically parallel networks?	N/A	
2.9. Any other geometric issues related to the registration of networks?	N/A	

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, ...)	Most apartment units.	
3.3. Does the jurisdiction have construction/building units? If so please, mention law and article(s).	Yes. See for examples (the list is not exhaustive) C.c.Q : rules 996, 1007, 1009, 1010, 1011, undivided co-ownership (1012, -1037), Divided co-ownership (1038-1109), 1787-1794, Cadastral plan (3033, 3041, 3061, 3066)	
3.4. Is the legal text available in original language?	Yes, French and English	
3.5. Is the legal text (relevant part) available in English translation at an official document?	Yes.	
3.6. Do you have example descriptions of typical 3D parcels; either 'prototype' or 'operational'?	See MERN 2017 and Pouliot et al., 2010	
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?	The external boundary of the walls, the floors and the ceiling.	
3.8. Is common property inside the	The common property that	

building registered? If so, how?	includes the land, the walls, the stairs, etc, is registered under a unique lot number. They are represented in the complementary plans (PC). Common parts are indicated in the deed and in the Declaration of co-ownership.	
3.9. Who owns the common property inside the building?	All co-owners and manage by a "syndicate of co-owners".	
3.10. Who owns the land on which the apartment is built?	Idem The land parcel is part of the common property.	
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?	No	
3.13. What is the numbering convention for apartments (please specify in terms of cadastral parcel as well as street addressing)	Each apartment has a unique lot number like any other 2D lot. The street addressing doesn't appear on the cadastral plan. The lot number and the street address are independent.	
3.14. Are there any mandates[6] that set specifications on the delivery of design/ construction drawing of properties in BIM-based format, when registering new 3D parcels (from design)?	No	Under consideration but no specific plan
3.15. Are there any operational or in prototype stage platforms. implementations that reuse BIM information from design as cadastral/ land administration input?	No	
3.16. Any other geometric issues?		

[6] 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?)	No. They are stored in an absolute spatial reference system (MTM) but it is its relative position that make it official (see C.c.Q. 3026).	
4.2. Are the cadastral database coordinates authoritative?	No. They have no official value but they could serve for cadastral operation.	
4.3. If not, what is the authoritative source of X/Y coordinates?	None. XY coordinates have no official roles, the cadastre is what we called : graphical cadastre only.	
4.4. Do you have parcels defined by the walls of a building (with no recorded geometry)?	Yes, in the case of internal common parts such as walls they act as a boundary instead of X/Y coordinates.	
4.5. What is the spatial reference system for X/Y Coordinates? (Please , provide the EPSG)	MTM, NAD83, GRS80.	MTM, NAD83SCRS or NATRF GRS80
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.)?	The lot number identifies the parcel being acquired. The measurements, area, elevation (vertical only) and the bounds of the parcel also appear on the plan.	
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?	No	
4.8. Any other X/Y coordinate issues?	No	

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?	On the PC plans and on the vertical profile we do not find any Z coordinates but an orthometric altitude (geoid) and H (height) relative to the altitude.	
5.2. Are height values reduced to a standard datum (absolute)? If so, what is the spatial reference system for this 3rd ordinate?	datum CGVD-Canadian Geodetic Vertical Datum 1928 and CGVD-Canadian Geodetic Vertical Datum 2013.	
5.3. In principle, is it possible to store both relative and absolute height/ depth values?	both	
5.4. Is the earth surface (elevation) explicitly stored (in the DCDB or other accessible register)?	No.	
5.5. What is the source of height values for the 2D surface parcel?	Datum CGVD28 or datum CGVD2013.	
5.6. How is elevation information recorded in the cadastral plan or database?	The elevation is indicated only on the PC plan	
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.)?	No	Could be useful in flood studies.
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?	N	
5.9. Any other 3rd dimension ordinate value issues?		

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)?	No.	
6.2. Are moving parcels allowed?	No.	Organic cadastre is under the radar but no specific plan.
6.3. Are there any limitations on the range of temporal limits? (e.g. only on 3D apartments).	No	
6.4. Is there any attempt to integrate 3D space and temporal representations, into a single 4D space/time representation?	No	Under consideration but no specific plan
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?	N/A	
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.	No	
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)?	Some rights may expire over time.	
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, the cadastral update history is recorded in internal system.	
6.9. For Cadastral transactions, how far in time do buyers need to make a search to ensure the title or deed is legal?	Not part of the land registry. This verification is carried out by a notary at the time of the transaction.	
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?	No	

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.	The cadastral system only shows the boundary of the property (the parcel); the ownership component. There is no other RRR graphically represented on the 3D parcels. Infolot is the Web interface for cadastre plan and information https://appli.mern.gouv.qc.ca/infolot/ For public lands (state-owned lands), it is possible to use the following link to visualise the parcel and related information: https://appli.mern.gouv.qc.ca/rde	Reflection for the identification and representation of restrictions on the cadastral plan (eg. Easements, superficies)
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, with the exception of the building shell which must exist prior to registration.	
7.4. Are there RRRs that are only allowed in 3D (and not valid for 2D)	No.	
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 that the person owning the land parcel?	Yes	
7.7. What applications do you foresee for 3D land administration?	- PC validation - For the representation of complex situation of superimposed properties - To have a complete overview of the geometry of the property and thus improve other systems like taxation, water supply and sewer systems - To be able to apply 3D spatial	

	analysis	
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)?	The land surveyor who produced the plan.	
7.10. Is registration of 3D parcels done inside the cadastral mapping agency, the land registry or elsewhere?	The State is responsible of the registration of the cadastral plans and the management of the cadastral system. Ministère des Ressources naturelles et des Forêts – Secteur de l'infrastructure foncière et de l'information géospatiale.	
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?	The on-line Land register of Québec site gives access to the titles and cadastral plans for all the lots covering the territory	
7.13. Is the 3D registry separate or integrated with the 2D registry?	No	
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**.

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)?	Not directly, as explained before.	
8.2. If so, how are they represented (in the DCDB)?	As 2D polygons and specific identifying (PC-Number).	
8.3. If so, how are they presented on cadastral "maps" (including screen presentations)?	Idem.	
8.4. Are there possibilities to store geometry of 3D parcels in the DCDB?	No.	
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?	The control is done manually and refers at having no overlapping between vertical and horizontal geometry.	
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, ..)?	The 3rd dimension is currently available via paper plan or 2D PDF image file. And it only shows vertical profiles.	
8.8. What Spatial DBMS software do you use? Any 3D capabilities included and used?	Oracle Spatial (descriptive and geometric components);	
8.9. Do you have any validation rules for 3D representation in the database?	No.	
8.10. What (GIS/CAD) software is used for updating, editing, analysis, and visualization of the cadastral data? Any 3D capabilities included and used?	ArcGis is used for editing geometry stored on an Oracle Spatial database. The 2D cadastral plans are distributed in DXF, SHP and FGDB formats. The PCs are available as image (2D PDF file) or DXF.	
8.11. What web software is used for remote data access/distribution and visualization? Any 3D	Land Register on line (http://www.registrefoncier.gouv.qc.ca) and Infolot Web interface (https://appli.mern.gouv.qc.ca/infolot/)	

capabilities included and used?	No 3D capabilities. PDF format for the PC plan.	
8.12. Is your DCDB organised as Multi-Layers or Object Oriented or some other data model?	MultiLayers.	
8.13. How do you query 3D objects in your DCDB?	The only way to query 3D objects is by the PC polygons number. But we only get a 2D polygon and some information about the lots attached to it. We can also get the PC file but no direct access to 3D 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?	--	

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?	First the survey plans are not available to users. Second they do not contain 3D representations but only vertical profiles of the properties.	
9.2. If so, how are they represented?	See 9.1	
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.	MERN 2017	
9.4. Is sketch level allowed (low geometric quality, but in principle enough to indicate the 3D object)?	No.	
9.5. Is it possible to define a 3D parcel by referring to other 3D real world objects/ topography (and not specifying coordinates)?	No.	
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….?	As 2D drawings see 9.1 - DXF	
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)?	Land surveyors are doing some visual and manual control. MRNF does internal validation process.	
9.8. Do you have examples of (prototype or production) 3D survey plans available?	As mentioned, the survey plans only contain vertical profiles. See MERN 2017 and Pouliot et al., 2010.	
9.9. Are any reference objects visible	Footprint of the buildings are	

on the survey plan (e.g. real buildings, roads, that is 3D topography)?	graphically show on the PC plan	
9.10. What form of 3D data acquisition is used (CAD, terrestrial surveying, sketches, stereo/oblique images, laser scanning, …)?	No specific instructions from this point of view but land surveyors usually work with terrestrial surveying.	
9.11. What software do you use for creating and processing survey plans? Any 3D capabilities included and used?	The surveyors mainly use Autocad, Microstation or CivilCAD.	
9.12. Can 3D parcels be subdivided, consolidated or nullified?	Yes.	
9.13. Is there any existing technical circular or directive to assist Surveyors in 3D data collection in the field?	No.	
9.14. Are the surveyors required to undertake a field survey for 3D cadastral data?	Yes.	
9.15. Are building construction plans used to compile 3D cadastral information for apartments?	No.	
9.16. Is 2D/3D field survey done by private licensed surveyors or by government surveyors?	Private licensed surveyors make field survey and make the cadastral plans.	
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.	Both. A new plan is created for each new parcel and a global cadastral database is updated.	
9.18. Do you show dimensions or isometric views of 3D parcels on survey plans (do you also store this in a database)	Yes, on the cadastral plan, each lot has dimensions (area, height, altitude, volume, …). No isometric view	
9.19. Do the cadastral survey plans differentiate between different types (e.g. volumetric plans, building plans and standard 2D plans)?	The parcel plan represents the lot in 2D. The complementary plan (PC) shows 3D information and vertical profile See preliminary notes.	
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.?)	See MERN 2017.	
9.21. Are authoritative cadastral surveys carried out by government surveyors or private	The surveys are carried out by private licensed land surveyors. MRNF (government surveyors) oversees the analysis and official	

licensed surveyors or both?	publication of the plans.	
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)?	Réf. Art. 3026 C.c.Q. (boundaries, measurements, size, and relative position).	
9.23. How much time does it usually take for a subdivision process to complete?	It varies depending in the complexity, usually between a number of weeks to many months. It involves many stakeholders.	
9.24. What is the legal source for cadastral representation (e.g. cadastral plans, or DCDB or index plans or descriptive sketch/text etc.?)	Code civil du Québec Loi sur le cadastre	
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)?	Relative position is precise. Absolute position is variable.	
9.26. Any other survey plan issues?		

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-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?	Yes, see 8.11. Infolot shows the perimeter of the PC. The PC plan can be visualised on the on-line Land register of Québec site.	PC plan available on the web interface Infolot
10.2. Are there specific file formats or standards used to distribute 3D LA/ Cadastral information? (e.g. LandXML, CityGML, BIM/IFC, 3D pdf,…)	PC distributed in PDF format	
10.3. Are there specific cartographic styling rules for representing 3D cadastral plans, or to represent 3D cadastral objects on 2D cadastral maps?	There are instructions (Instructions pour la présentation des documents cadastraux relatifs à la mise à jour do cadastre du Québec (version 4.1)) for presenting the cadastral plan and vertical cadastre (PC)	
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?	N/A	
10.5. Is the 3D Cadastral information accessible in integrated manner with the 2D Cadastral information?	Yes, see 1.1.	
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, a PC number.	
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	The on-line Land register of Québec site give access to all the titles/deeds and cadastral plan for all the lots. The deed shows some RRRs that affect the lot. The land surveyors and notaries must refer to others authorities to collect all the RRRs.	

information infrastructure approach)		
10.8. Are 2D/3D cadastral data available to the general public or just to the relevant parties?	It is available to the general public.	
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).

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?	There is no specific rule.	
11.2. What is the largest 2D and 3D parcel that is present allowed to be registered in the land administration?	There is no specific rule.	
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,…)	The average size of a 2D parcel is 15 meters by 30 meters. The average size of a 3D parcel (apartment) is 93 meters² by 2,5 meters (height).	
11.4. How many 2D and 3D parcels do you currently have in your land administration?	In the Cadastre du Québec (CQ), there is actually ~ 620 000 3D lots and ~3 900 000 2D lots. About 1% of the lots are not yet compiled in the CQ.	
11.5. Which year did you start registering 3D parcels in the land administration?	~1970	
11.6. What is the ratio of 3D parcels in rural vs. urban areas?	Mostly in 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.	Montréal, Québec,	
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)The territory of Québec covers close to 1,7 millions km² of which 92% is public land. b) c) see 11.4 d) 8,7 millions	

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)?	About 90% of the 3D parcels are related to apartments.	
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).	Information not available.	
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?	N/A
12.2. Same question, but now, which developments did go slower than expected?	N/A
12.3. If some (limited) form of 3D Land administration functionality has become available, what are the observed benefits? And for who?	No change since 2010 Decisions were made to keep the same strategy as it is currently to manage the third dimension (with complementary plans).
12.4. What are the (top 3) challenges of issues to be addressed to realize further 3D Land administration progress?	Providing spatial representation for any kind of overlapping properties, Having integrated strategy for immatriculated and not immatriculated real estate, Modernization of stakeholder practices (e.g. land surveyor, notary, etc) The evolution of laws and regulations
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?	No
12.6. In case of known legal barriers, have there been made progress in creating and adopting new legislation to support 3D land administration?	N/A
12.7. Any other reflections?	Having an approach that integrate BIM data for condominium parcels Propose a valorization strategy for which it will make the cadastral data more widely used, integrated into planning/management systems related to infrastructure, land use, civil security, or digital twin. Promote multipurpose cadastre.

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)	Quebec, Canada
13.2. Name	Alain Gregoire; Guillaume Devost; Pierre Giguere; Christian Lord; Jacynthe Pouliot
Function/ Position	
Organization	Direction de l'enregistrement cadastral at Foncier Quebec, Ministry of Natural Resources and Forests (MRNF)
13.3. Contact details:	
Address	
Email	Alain.Gregoire@mern.gouv.qc.ca Guillaume.Devost@mern.gouv.qc.ca pierre.giguere@mern.gouv.qc.ca christian.lord@mern.gouv.qc.ca Jacynthe.Pouliot@scg.ulaval.ca
Telephone	
13.4. Other issues	-

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