Questionnaire 3D-Cadastres: status September 2014 Canada, Quebec

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

- The conceptual model used as background for the 3D Cadastres questionnaire is the ISO 19152 standard (ISO, 2012): the Land Administration Domain Model (LADM).
- In this questionnaire the concept of 3D-Cadastres with 3D parcels (or 3D spatial units in LADM terminology) is intended in the broadest possible sense. However, what exactly is (or could be) a 3D parcel is dependent on the legal and organizational context in the specific country (state, province). 3D parcels include land and water spaces, both above and below surface.
- A more formal definition: A 3D parcel is defined as the spatial unit against which (one or more) unique and homogeneous[1] rights (e.g. ownership right, lease or other land use right), responsibilities or restrictions are associated to the whole entity, as included in a Land Administration system.
- As the definition above is quite abstract, it is tried in the questions to be more specific and real world situations are used. Many examples with partial/preliminary answers from 2010 are available on-line at http://www.gdmc.nl/3DCadastres/participants/. Inspecting some of the completed 2010 questionnaires from different other countries might help when formulation the answers for your jurisdiction.
- A 3D parcel is a 'legal object' describing a part of the space. Often there is a relationship with a real world/physical object, which can also be described in 3D. Please be aware of the difference between these two types of objects and that the focus in the context of 3D-Cadastres is on spaces of the legal objects and not the registration of the physical objects as such.
- If a certain question is not relevant or if you have no clue what to respond, do not spend any time on this (and leave the field blank).
- The questionnaire has been prepared by a mixed Australian (Rod Thompson/Sudarshan Karki)/Dutch (Jantien Stoter/Hendrik Ploeger/Christiaan Lemmen/Peter van Oosterom) team. The questionnaire is grouped in the number of blocks. This has no meaning in the sense of priority and it is often the case that a question could belong to multiple blocks. Please do not feel disturbed by this.
- Similar to the Questionnaire 3D-Cadastres, the completed forms will be made available on website of FIG working group on 3D Cadastres.
- Please complete this questionnaire before *1 October 2014* and send it to P.J.M.vanOosterom@tudelft.nl (or Peter van Oosterom, TU Delft, OTB, P.O. Box 5030, 2600 GA Delft, The Netherlands).

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

IMPORTANT PRELIMINARY NOTES:

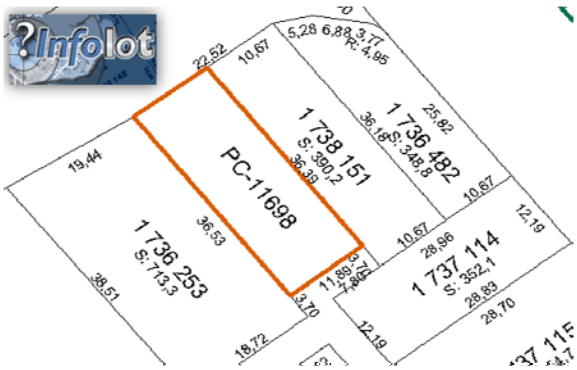
This questionnaire was fulfilled by Jacynthe Pouliot, professor at Laval University-Geomatics Department and Louis-André Desbiens, Direction de l'enregistrement cadastral at Foncier Quebec, a sector of the Ministry of Natural Resources and Wildlife responsible for the cadastre and land rights registration covering both private territory and public land.

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.

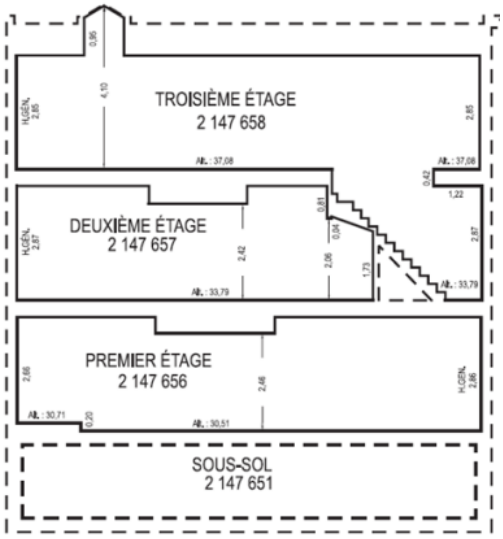
The rules governing the *Land Register* are set out in the *Civil Code of Québec* (C.C.Q.) and are applied uniformly throughout Québec[2]. The Code establishes a system for the publication of rights that is based on the cadastral plan systematically updated. The cadastral plan is the material support 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 (http://infolot.mrnf.gouv.qc.ca/ddci/index.asp) 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:

- MRNF 2011. Instructions pour la présentation des documents cadastraux relatifs à la mise à jour du cadastre du Québec. Version 3.01, mai 2011, document rédigé par le ministère des Ressources naturelles du Québec (MRNF), Direction de l'enregistrement cadastral, Gouvernement du Québec.
- MRNF 2009. Instructions pour la réalisation d'un mandat de rénovation cadastral. Version 6.0, Mars 2009, Document rédigé par le ministère des Ressources naturelles et de la Faune du Québec (MRNF), Direction générale de l'arpentage et du cadastre, Gouvernement du Québec. Available at this link http://cadastre.mrnf.gouv.qc.ca/documents/produits-services/pdf/instruction-V6-0.pdf.
- Pouliot, Roy, Fouquet-Asselin, Desgroseilliers, 2010. A First experiment for the construction of a volumetric representation. Presented at the 3DGeoinfo conference, Berlin, De. Nov. 3-4. 2010.

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.

	Canada (Quebec) - Status 2014	Expectations 2018
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 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 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.	No change for this section
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	

[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.

	horizontal representation.	
1.3.a. Is it allowed to have 3D parcels (spatial units) not related to physical constructs or objects? (e.g. airspace, subsurface volumes)	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.	
1.3.b. If 1.3.a positive: approximately what proportion of new 3D parcels (spatial units) would involve such cases (not related to physical object)?	Information not available, possibly less than 5%	
1.4. Are disconnected parts of a single 3D parcel allowed?	No	
1.5. Spatial limitation – e.g. must the 3D parcel be related to a closed volume or is it allowed to have 'open' or unbounded 3D parcels (e.g. towards the sky).?	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 MRNF 2003) 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?	Yes, French and English	
1.11. Is the legal text (relevant part) available in English translation?	Yes.	
1.12. Do you have example descriptions of typical 3D parcels; either 'prototype' or 'operational'?	See MRNF 2003 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) shown in your land administration? If yes, are they considered as 3D parcels (spatial units) with RRRs attached?	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, 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 (as rights or restrictions are related to them)? Sometimes also 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. Any other geometric issues related to 3D parcels?	--	

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.

	Canada (Quebec) - Status 2014	Expectations 2018
2.1. Do you register 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.	No change for this section
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?	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.	
2.4. If so, are they registered as 3D property parcels (spatial units)?	The network are registered but not 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 document(s).	Yes.	
2.6. Is the text of laws and regulations (relevant part) available in English translation?	Must be.	
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	N/A	

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”.

	Canada (Quebec) - Status 2014	Expectations 2018
3.1. Do you register 3D construction/building units?	Yes.	No change for this section
3.2. If so, what are the most important types? E.g. apartment units, 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?	Yes.	
3.6. Do you have example descriptions of typical 3D parcels; either ‘prototype’ or ‘operational’?	See MRNF 2003 and Pouliot et al., 2010	
3.7. What would be typical 3D boundaries in an apartment complex: middle of the wall and floor/ceiling, or walls, floors/ceiling as neutral/shared 3D space? Is it mentioned in any legislation or is it the convention?	The external boundary of the walls, the floors and the ceiling.	
3.8. Is common property inside the building registered? If so, how?	The common property that 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 addressing are independent.	
3.14. Any other geometric issues?	--	

4. X/Y Coordinates

	Canada (Quebec) - Status 2014	Expectations 2018
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.	
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?	MTM, NAD83, GRS80.	MTM, NAD83SCRS, GRS80
4.6. Any other X/Y coordinate issues?	--	

5. Z Coordinates/height representation

	Canada (Quebec) - Status 2014	Expectations 2018
5.1. Are the Z coordinates 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.	No change for this section
5.2. Are Z coordinates reduced to a standard datum (absolute)? If so, what is the spatial reference system for the Z coordinate?	datum CGVD-Canadian Geodetic Vertical Datum 1928.	
5.3. In principle possible to store both relative and absolute Z coordinate?	Only relative.	
5.4. Is the earth surface (height) explicitly stored (in the DCDB or other accessible register)?	No.	
5.5. What is the source of elevation for the 2D surface parcel?	Datum CGVD28.	
5.6. Any other Z coordinate issues?	--	

6. Temporal Issues

	Canada (Quebec) - Status 2014	Expectations 2018
6.1. Are temporal limits part of the definition of a parcel (2D or 3D)?	No.	No change for this section
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).	Maybe on Emphyteutic Lessee.	
6.4. Are there any attempt to integrate 3D space and temporal representations, into a single 4D space/time representation?	No.	
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. Any other temporal issues?	Emphyteutic Lessee.	

7. Rights, Restrictions and Responsibilities

	Canada (Quebec) - Status 2014	Expectations 2018
7.1. Range of RRR on 3D parcels.	No specific rules although those related to co-ownerships (see C.c.Q. 3041. The immatriculation of the private and common portions of a vertical divided co-ownership may not take place before the foundation and main walls of the building in which they are situated allow measurement of their boundaries).	No change for this section
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).	C.c.Q 1049 Alienation of a divided part of a private portion (apartment) is without effect. The cadastral plan must be altered prior to the alienation.	
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, it is what we call right of superficies.	
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?	Title based	
7.9 Who is responsible for the correctness of the specified 3D boundaries in spatial source documents (which authority)?	The land surveyor (private) who has made the plan.	
7.10. Is registration of 3D parcels done inside the cadastral mapping agency,	The State (Direction de l'enregistrement cadastral, from the	

the land registry or elsewhere?	Ministère de l'Énergie et des Ressources naturelles-Secteur Territoire) is responsible of the registration of the cadastral plans and the management of the cadastral system.	
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. Any other RRR issues?	---	

8. DCDB (The Cadastral Database)

	Canada (Quebec) - Status 2014	Expectations 2018
8.0. Is 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 (for the descriptive component), the geometry is stored on an Arc/Info system.	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?	The 2D geometric primitives are currently stored in an Arc/info file. The 2D cadastral plans are distributed in DXF format. The PCs are available as image (2D PDF file).	ArcGis should be used for editing geometry stored on an Oracle Spatial database.
8.11. What web software is used for remote data access/distribution and visualization? Any 3D capabilities included and used?	Land Register on line (http://www.registrefoncier.gouv.qc.ca) and Infolot Web interface (http://infolot.mrnf.gouv.qc.ca/) No 3D capabilities. We can download CGM and CPC lite images.	CGM and CPC lite images should be transformed in an other format.
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)

	Canada (Quebec) - Status 2014	Expectations 2018
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.	No change for this section
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? If so, please give link to the relevant documents.	There is instructions (see instructions de l'arpenteur général du Québec, MRNF) for the preparation of the survey plans. The only information which refers to the 3rd dimension is about the obligation to be linked to the datum CGVD28.	
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	
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.	
9.8. Do you have examples of (prototype or production) 3D survey plans available?	As mentioned, the survey plans only contain vertical profiles. See MRNF 2003 and Pouliot et al., 2010.	
9.9. Are any reference objects visible on the survey plan (e.g. real buildings, roads, that is 3D topography)?	No, even though we can find an approximate representation of the spatial extent of the real building (for condominium)	
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, …).	
9.19. Any other survey plan issues?	---	

10. Dissemination of 3D Cadastral information

	Canada (Quebec) - Status 2014	Expectations 2018
10.1. Is there a general purpose web-based dissemination of 2D cadastral (graphical or text) information (e.g. a portal for the public or for professionals)? If yes, does it include 3D data?	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.	No change for this section
10.2. Are specific file formats or standards used to distribute 3D Cadastral information? (e.g. LandXML, CityGML, BIM/IFC, 3D pdf,…)	The PC plans can be visualised as CGM and CPC lite images.	
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 3.01)) 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 information infrastructure approach)	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.	
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. The coordinates are not available from the on-line Land register of Québec site and from Infolot.	
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 2018).

	Canada (Quebec) - Status 2014	Expectations 2018
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. It could be few millimetres.	No change for this section
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. It could be more than 2000 meters.	
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 ~235 000 3D lots and ~2 800 000 2D lots. About 19% 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, Mont-Tremblant	
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) 8,2 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 in 2010 the 3D cadastres questionnaire for your jurisdictions was completed (otherwise skip this section).

	Remarks
12.1. Compared to the 2010 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?	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,
12.5. Any other reflections?	---

13. Other Issues

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

	Remarks
13.1. Country (State, Province)	Canada (Quebec province)
13.2. Your name, function/position and your organization	Louis-André Desbiens, Direction de l'enregistrement cadastral, from the Ministère de l'Énergie et des Ressources naturelles-Secteur Territoire (MÉRN). MÉRN-Secteur Territoire is responsible of the design and the management of the cadastral system. Jacynthe Pouliot, professor at Laval University-Geomatics Department
13.3. Contact details: address email, telephone	Jacynthe.pouliot@scg.ulaval.ca and louis-andre.desbiens@mern.gouv.qc.ca
13.4. Other issues	

References

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

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

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