

3D Cadastre Modelling in Russia

G2G10/RF/9/1

Mission Report 2

Version

1.0

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3D-cadastre modelling in Russia

G2G10/RF/9/1

Mission Report No 2

27 September - 01 October 2010

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1. General

The second mission of the "3D-cadastre modeling in Russia¹" project took place in the period 27 September - 01 October 2010. The mission team was composed of the following members:

- Rik Wouters (Project Manager, Kadaster)
- P.J.M. van Oosterom (TU Delft: GIS Technology: 3D Modeling)
- Christiaan Lemmen (Kadaster: Land Administration Domain Model and Cadastre in General)
- Jantien Stoter (TU Delft: 3D cadastre processes)
- Veliko Penkov (Project leader, Kadaster).

From the beneficiary side the working meetings and discussions were attended by representatives of (names included):

The Ministry of Economic Development of the Russian Federation

- Sultanoiv, Roman Sergeevich

The Federal Service for State Registration, Cadastre and Mapping (Rosreestr)

- Nedyuk, Pavel Vladimirovich
- Fefelov, Dmitriy Aleksandrovich

Federal Cadastral Centre Zemlya

- Tikhonov, Vladimir Vasilievich
- Vandysheva, Natalya Mihaylovna

Pilot Region of Nizhny Novgorod

- Korionova, Natalya Evgenyevna
- Yufereva, Irina Evgenyevna

Moscow Aerogeodetical Enterprise

- Kozeev, Nikolay Konstantinovich.

The meetings were held in a very constructive atmosphere and mutual understanding, showing the commitment of both sides to achieve marked project results.

¹ In this report 'Russia' is synonym to 'The Russian Federation'



2. Venues and programme

The working presentations/discussions on the first day were held at the World Trade Centre, in the very close vicinity of the FCC Zemlya office, and the rest of the days working meetings took place at the meeting room of FCC Zemlya.

The mission programme which was drafted and sent before the mission was adapted according the newly estimated priorities suggested by Russian counterpart. (See mission programme in Annex 1).

3. Working meetings, presentations and discussions

3.1. Working meetings and discussions

Tuesday, 28 September

After the introduction of the present experts, some of the topics from the originally drawn up agenda were pulled up to be addressed during the first day of the mission as this was only day in Moscow for the Project Manager Rik Wouters (see annexed Mission Programme).

Issues discussed and agreements made:

1. Inception Report

- One important issue that the efforts and input from Russian side have to be shown bigger in the inception report than the input as it is described now
- the IR will be officialized by the approval signature of Mr Kislov on the Russian version
- the user interface in the prototype software will be in Russian and Cyrillic alphabet and based on using Russian keyboard

2. Mission goals and agenda

- the intention was that mainly legal and administrative issues will be discussed

3. Study Tour organization and participation

- provisional timing - Week 48, starting 29 November, arrival on Monday, departure on Friday
- about 8 participants shall form the group
- an official invitation letter is needed for the Russian participants

4. Legal environment

Roman Sultanov from the department of Dimitry Minakov at Ministry of Economic Development presented (without slides) the Russian legal framework. In summary: there is nothing in the law against 3D cadastre, but also no explicit mentioning of 3D. Three codes (which can be seen as high level, general frames) are relevant:

- Land Code, this code includes the definition of land parcel, this definition is straightforward (a plot of land with boundaries) and expected to be ok in relation to 3D Cadastre,
- Housing/dwelling Code, and
- Urban development Code for City Planning.

The next level in the legal consists of laws, of which the federal law on State Cadastre was first shortly introduced and next a number of laws on Rights Registration, Cadastre, Mineral Resources, Housing Reconstruction and Servitudes (Easements). Further, there are a number of changes on the way; e.g. amendments to the Urban Development Code (in general the laws are also quite dynamic). It was specifically



mentioned that in the area of Servitudes the availability of a 3D cadastre would be fruitful. Also in Construction and Utility Planning code.

The English versions of the codes and the laws are not (easily) available; there are some (but these may be outdated and others only available from commercial organizations). Best approach here is to select the relevant parts of in the Russian versions in consultation with the Dutch counterpart: mark these and only translate these relevant parts to English.

5. Tooling, software, data in Russian Federation available

- Cadastral System is based on Oracle 10.2.
- ArcGIS, MapExtreme are in use. Web based. Other tools under discussion.

In Oracle 10 3D objects can be stored using the multi-polygon data type (in 3D space). A multi-polygon is a data type that consists of a number of independent polygons. Therefore there are limited quality checks in Oracle 10 to detect errors and inconsistencies in those 3D multi-polygons based objects; e.g. non-closed volumes or overlapping volumes. In fact this implementation just consists of independent faces. In Oracle 11 solids can be used to define 3D objects (not independent faces). This implies a far better guarantee on the quality that can be delivered based on a set of consistency rules.

6. Next mission

- Beginning February 2011, week 6 or 7

7. Others

- Presentation on the pilot in Nizhny Novgorod (Russian Federation - RF, Natalya Vandysheva)

An overview was given of the area (oblast 8 mln ha) with focus on the urban part and the proposed objects to be included in the pilot: two complex buildings and one gas pipeline (above/underground and connected to a building). Two of the cases have a true 3D ownership situation. Details have been discussed on Thursday 29th September.

- Presentation 3D Pilot in the Netherlands (Jantien Stoter)

There are no standards (yet) for 3D topographic and cadastral data in general in the Netherlands. The 3D pilot covers the whole range from data acquisition to visualization. The pilot (planned until they middle of 2011) will provide a better awareness of problems. 50 organizations co-operate. There is a basic data infrastructure with topographic and elevation data. Four groups work on a specific subjects and work together to get the complete overview: data provision, standards/models, testbed, use cases (see the PowerPoint in annex 5). The intention is to use the experiences for the prototype in the development of a production environment.

The motivation for 50 organizations (private and public) to participate in the NL pilot is recognized at Russian side to be very important in Russia.

On 9 November 2010 there is a meeting on the Dutch Pilot 3D in NL.

- Presentation on activities 2010 – 2014 of the Working Group on 3D Cadastre's of the International Federation of Surveyors (FIG) (Peter van Oosterom)

The main objective of the working group is to establish an operational framework for 3D-Cadastres. The operational aspect addresses the following issues:

1. A common understanding of the terms and issues involved. After the initial misunderstandings (due to lacking shared concepts and terminology) in the early days, the concepts should now be further refined and



agreed on, based on the ISO 19152 Land Administration Domain Model (LADM), which provides support for 3D representations.

2. A description of issues that have to be considered (and to what level) before whatever form of 3D-Cadastres can be implemented. One could think of a checklist for the implementation of 3D-Cadastres. These will provide 'best practices' for the legal, institutional and technical aspects. These findings will be translated in basic guidelines for the implementation of 3D-Cadastres.

The Working Group will be active in 3D Cadastre and Spatial Data Infrastructure, Modelling aspects (legal and physical objects, etc). Active participation from Russia would be very good: exchanges ideas at international level and learn from each others experiences..

- Presentation on the backgrounds of 3D Cadastre (Jantien Stoter)

What is a 3D Cadastre, approach in registration, case studies, combinations of 2D and 3D cadastre, etc.

The last part of the day was spent on the FIG 3D Cadastres questionnaires (and section 1 was completed). Observation: tunnels/pipelines are initially to be subdivided in fragments in relation to land parcels (to obtain the rights within the column implied by the surface land parcels), next the parts may be merged into a single 3D parcel (cadastral object).

Wednesday, 29 September

Nizhny Novgorod

Joint mission with Vladimir Tikhonov (FCC Zemlya), Roman Sultanov (Ministry of Economic Development), Gofried Barnasconi and Rik Wouters.

Goal: official meetings in the framework of 3D pilot

Programme

1. Welcome by Head office of local office Rosreestr Nizhny Novgorod

2. Meeting with Deputy Governor Nizhegorodskaya Oblast

Deputy Governor is very much interested. He already briefed the Governor on the project, but request to emphasis on the benefits of a 3D cadastre

3. Meeting with Mr. V. Shantsev, Governor of Nizhegorodskaya Oblast

Objective of the project were explained as well as the results including the role of the pilot. The governor is very much interested and offers all possible help .The oblast was front runner in many initiatives

4. Meeting with Head Rosreestr regional office, representative Ministry of Economic Development

Detailed discussions on the activities and the role of local office. Discussions about he 3D objects. Buildings are important. Underground infrastructure is not yet important. However this kind of 3D object to include in scope of project. Local office is prepared to gather data needed for the pilot.

5. Press conference (tv and newspapers) with interviews to local authorities and Gofried Barnasconi and Rik Wouters.

Moscow

- FIG Questionnaire



The morning (in Moscow) of 29th was, amongst others, spent on sections 4 and 5 (on respectively the horizontal/x,y and vertical/z coordinates and reference systems). During this part the day Nikolay Kozeev was present (as geodetic expert). The national coordinate reference system is not public. However, for cadastral purposes a local (Oblast level) projections are used based on linkings in relation to central meridians (6 degrees based zones). Important is that the delivered field work produced by a person (in the model with "role" licensed surveyor) contains the correct co-ordinates; the Russian Cadastre does not re-survey. Accuracy of co-ordinates depends on type of land use. Ortho photo's are in use as a basis for production of co-ordinates. There may be different representations in co-ordinates for the same objects (this has been demonstrated from the data base; 10% difference in area is allowed). There may be incorrect co-ordinates in the database. Land parcels may be described in a textual way. Topology may be correct or not. Land parcels may be represented as polygons; there can be gaps and overlaps. Rosreestr is very much aware that quality improvements are required and also that geometric data need to be further completed. There was a discussion that the switch from 2D to 3D for presentation of existing objects in the database can be seen as a transaction. Buildings and apartments can have just a textual description – not linked to co-ordinates. In fact, currently about 70% of the land parcels only have a textual description (and no geometry). A Digital Terrain Model is available, elevation data are in use for urban land parcels. There is a local system of elevation in used within Russian Cadastre. It was agreed that Vladimir Tikonov was the contact person for the questionnaire.

- Presentation - Introduction to the ISO 19152 Land Administration Domain Model (LADM) and the importance/ relevance of the MDA approach in this project (Christiaan Lemmen)

LADM has already 3D capabilities, which could be used in this project. For this reason a review of the LADM at Russian side is most relevant, the idea is to use LADM as the basic data model in this project (with some extensions, see the UML² diagram below).

Thursday, 30 September

A. Conference of CIS and Baltic countries "Systems of State Registration and Cadastre: Creation, Development and Perfection" (Thursday and Friday)

Rik Wouters made a presentation on new developments with spatial reference to 3D cadastre and the use of 3D data in infrastructure design, city planning and others.

B. FCC Zemlya office

- Cases review - the actual right (RRR)³ and cadastral registration process was explained by the Russian-team by looking at the examples of selected Nizhny Novgorod cases (more details on next pages)..

- Actual procedures for registration followed (Register of Rights, Land Cadastre, Register of Buildings).

There are two (three) main types of registrations in Russian Cadastre:

1. Public register of right (RRR): jointly for all cadastral objects (land parcels, buildings and other constructions). Data are:

a. Index overview (including history of index)

b. (l)For the land parcel: document number (id), cadastral land parcel number, previous cadastral parcel number, address, name zone, land use category, area, description of the legal ground for the RRR, record of changes (logged per changed attribute; this is identified as a sub id to the original document id)

² Unified Modelling Language

³ 'Right' includes 'Restrictions and Responsibilities': RRRs



c. (II.1) For the right: cadastral number, registration of right id, kind of right, share, name of the owner, legal ground/notarised, (II.2) price, (III.1) lease, (III.2) mortgage (III.3) servitude, (III.4) registration record, (III.5) seizure, (III.6) restrictions), (III.7) other.

2. cadastral land registration: separate database⁴ for land parcels (cadastral land parcel database; from this the cadastral passport is created). There can be a superimposition of land parcels to an image as background.

3. for buildings and other cadastral objects (building id, address, technical drawings/floor plans).

The data sets of the three registrations for buildings, land parcels and rights are in a process of full integration, see figure 1. Licensed surveyors deliver the survey plan and conveyors deliver contracts or other agreements. Contracts can be notarised. Surveyors and conveyors are outside the organisation, but their names are known in relation to transactions. From 2013 on the survey plan and the outline of the building has to be delivered in one file according to new legislation.

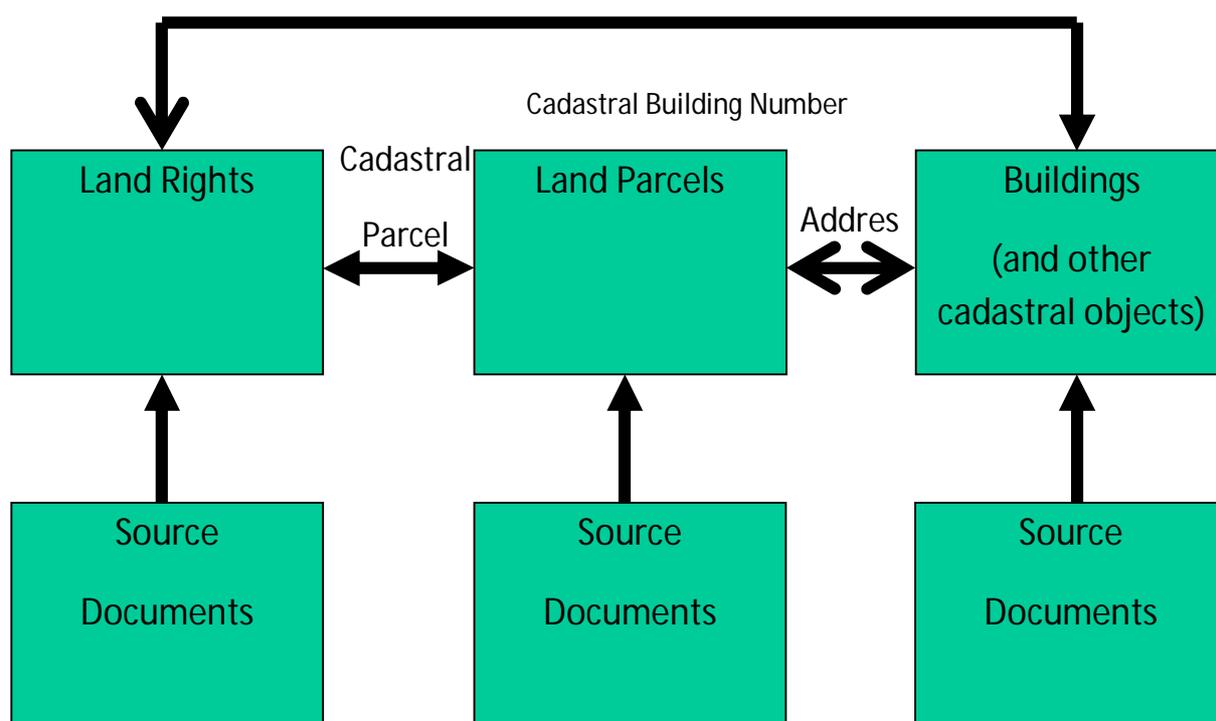


Figure 1: Overview of the Cadastral Registrations in the Russian Federation

The link between land parcel data and building data needs further optimization; improvements are ongoing. Apartments units are linked to buildings. The Russian Cadastre knows 5 types of cadastral objects (see Figure 2):

1. Land parcel

⁴ Land parcels are seen as objects. Apart from the spatial representation with co-ordinates in a local system there can be other types of spatial representation, e.g. textual descriptions of the objects. There may be topological inconsistencies. The same object may be available from 2 sources and may be represented as 2 different polygons. Names of owners are not included in this data set.

2. Building
3. Apartment unit
4. Other construction (bridge, pipeline, etc)
5. Unfinished objects (building, bridge, pipeline, etc)

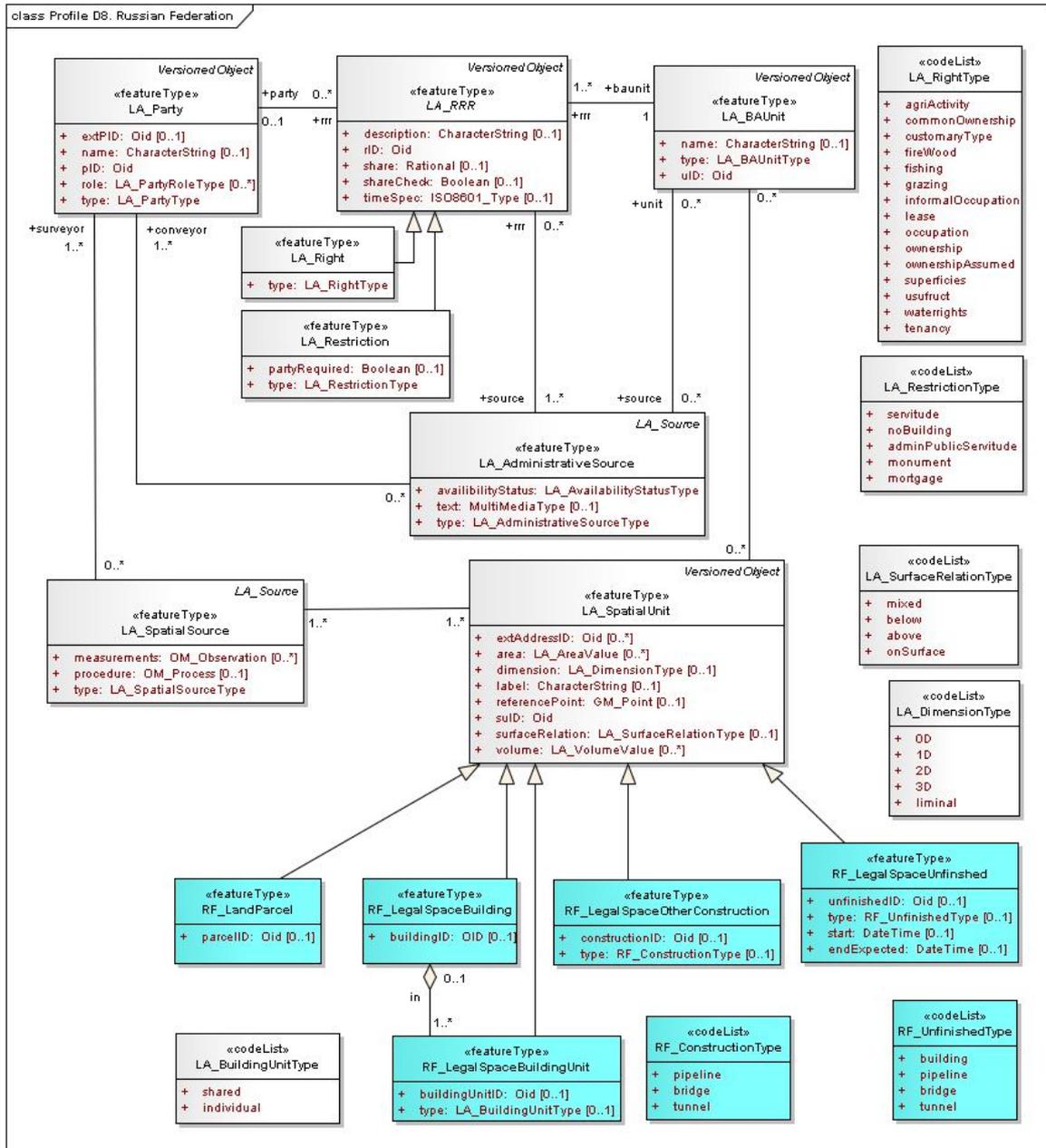


Figure 2: Initial LADM model for the 3D Cadastre pilot project in the Russian Federation, showing the five different types of cadastral objects (LA_SpatialUnits in LADM terminology)

Unfortunately the database (ICT) experts were not available during this mission to further discuss the information model. In future these should become involved, mentioned was Alexander Rudolf. Some ICT related questions (posed by Dutch team where answered during mission):

- Currently Oracle v10.2 is used (has 3D multi-polygon), but not Oracle v11 (with 3D volume support)

- Use of current Russian tools (Oracle, ArcGIS, Map Extreme) is preferred in the project
- However, it is good to jointly explore alternatives

Detailed analysis of the cases: how are they currently registered in the 2D cadastre environment and what are the true 3D aspects? Cases are all from Nizhny. The Oblast has in total 1.353.000 parcels and 1.225.000 apartment units for 3.500.000 inhabitants (including for the city respectively 90.000 parcels and 552.000 apartment units for 1.800.000 inhabitants). With these numbers the registration of apartments must be quite complete. The three cases that are prepared: 1. World trade centre, 2. Telecom building, 3. Above ground gas pipeline. Photographs of these cases are taken from the power point presentation by Natalia.

Case 1. World Trade Center, a semi-round building: Long lease of land (ownership of land is by municipality), because of its location in the historic city centre, only after some years the land ownership is also possible (when building created). Single full ownership of a building object by owner group with two members: one with 99% and other with 1% share, not registered who owns what in 3D spatial sense (from cadastre perspective). Two shares are for: 1. offices + 2. exhibition area/shops. Subdivision of use could be described in a contract (separate, not registered by Cadastre). This building was registered according to the 'new way of working': only outline of building (not geo-referenced) is submitted with the registration. The building outline is created from aerial photograph by external cadastral/private companies doing the survey. In 2014 building plans will have geo-referenced coordinates. The photograph (Figure 3) and maps (Figure 4) below give an impression of the location of this case. However as there is no 3D configuration of the rights (that need their own 3D legal spaces), it was decided that this case will not be further used in the cadastral prototype/pilot.



Figure 3: The Nizhny Novgorod World Trade Center

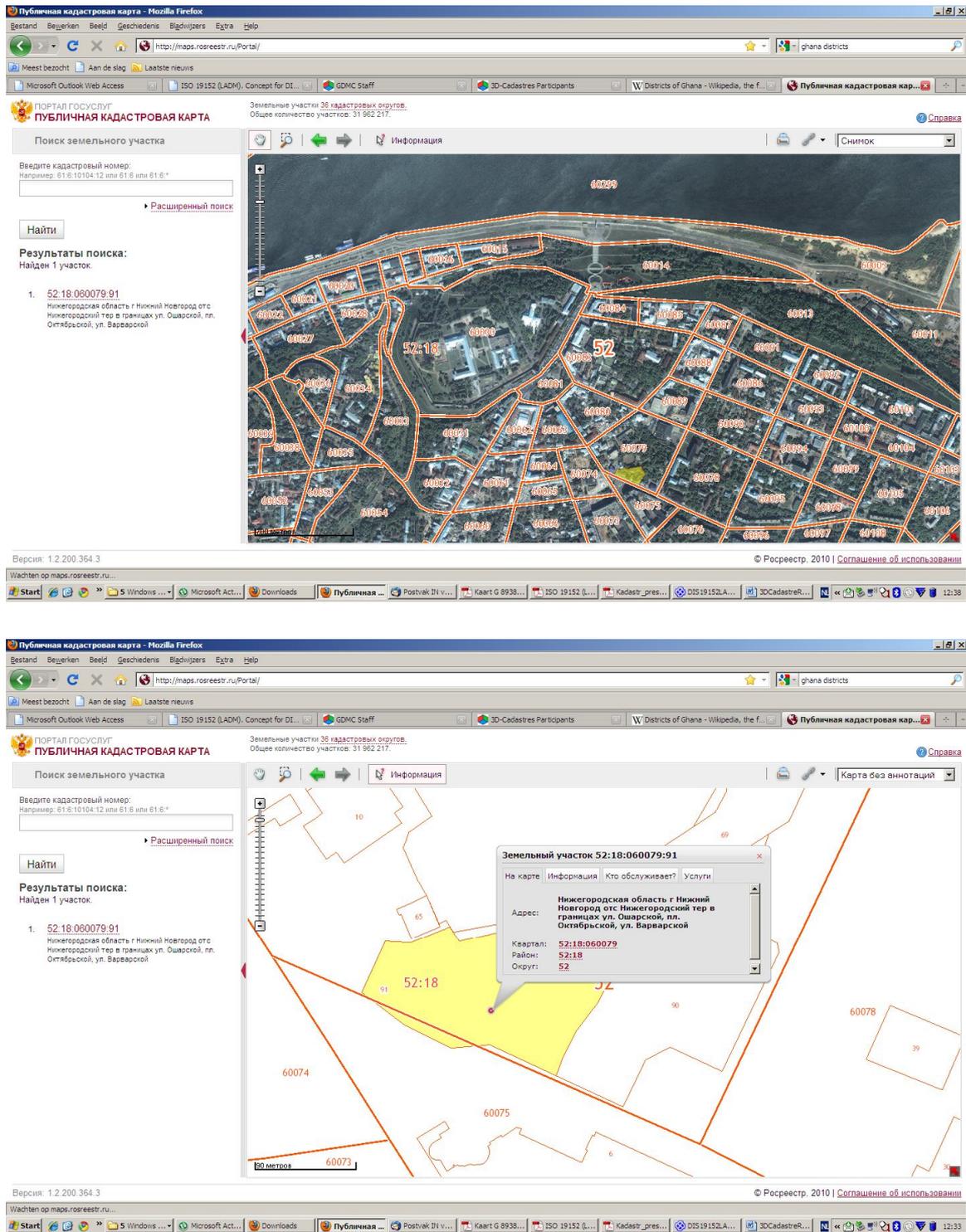


Figure 4: The location of the Nizhny Novgorod World Trade Center

Case 2. Teledom building (near the television tower). This is an 'older' type of registration in technical building database including the floor plans. The rights of the various units are individually recorded in the rights register. The building has subsurface parts and above air overhangs. With the 'older' registration approach, the floors are either in DWG⁵ format or scanned images (roughly 'geo-referenced' by cadastral block or street address, not yet via parcel level). The basement (for underground parking) and first 2 floors are owned by a bank. Second owner has above this a multi-floor column (same part at every floor) and leases the different units (floors) to different users. If lease is longer than one year, then also the lease needs to be registered. In total 20 units in the building, with 10 different owners. The building has interesting overhangs (possible above neighbor parcel with shops and also possible above public road/ footpath). Because of the interesting 3D configuration of legal spaces, this is a very good case to be further used in the prototype. Below some pictures (Figure 5) and maps (Figure 6) indicating the location.

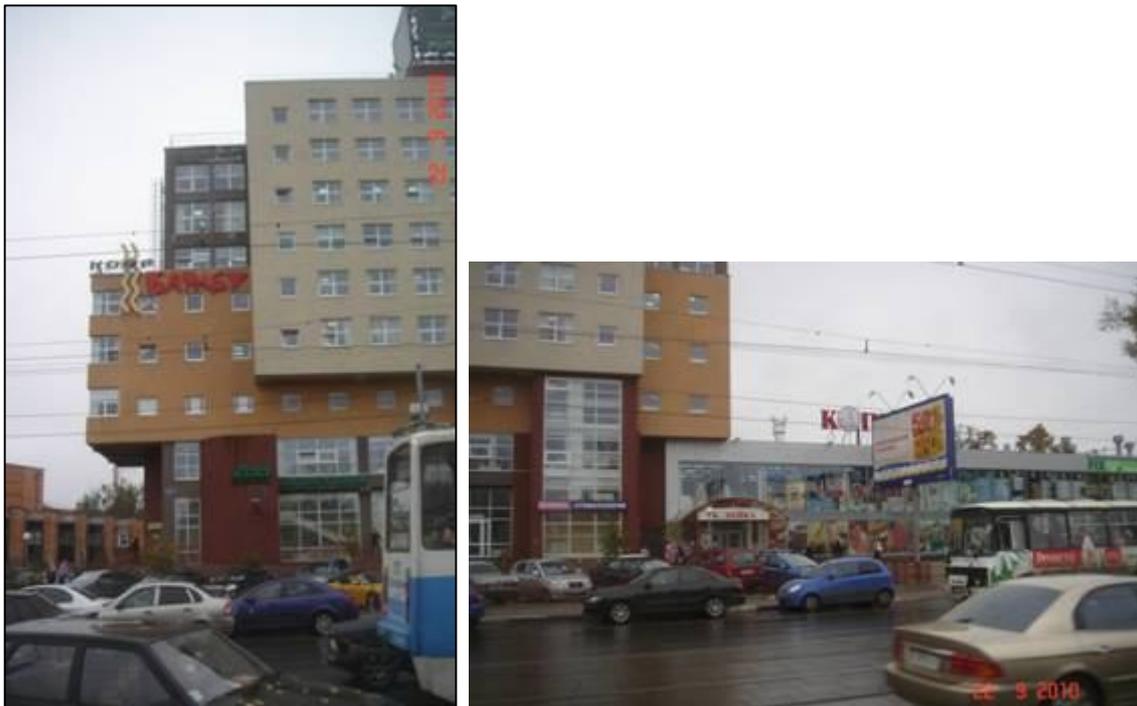


Figure 5: The Teledom building (near television tower)

⁵ Drawing

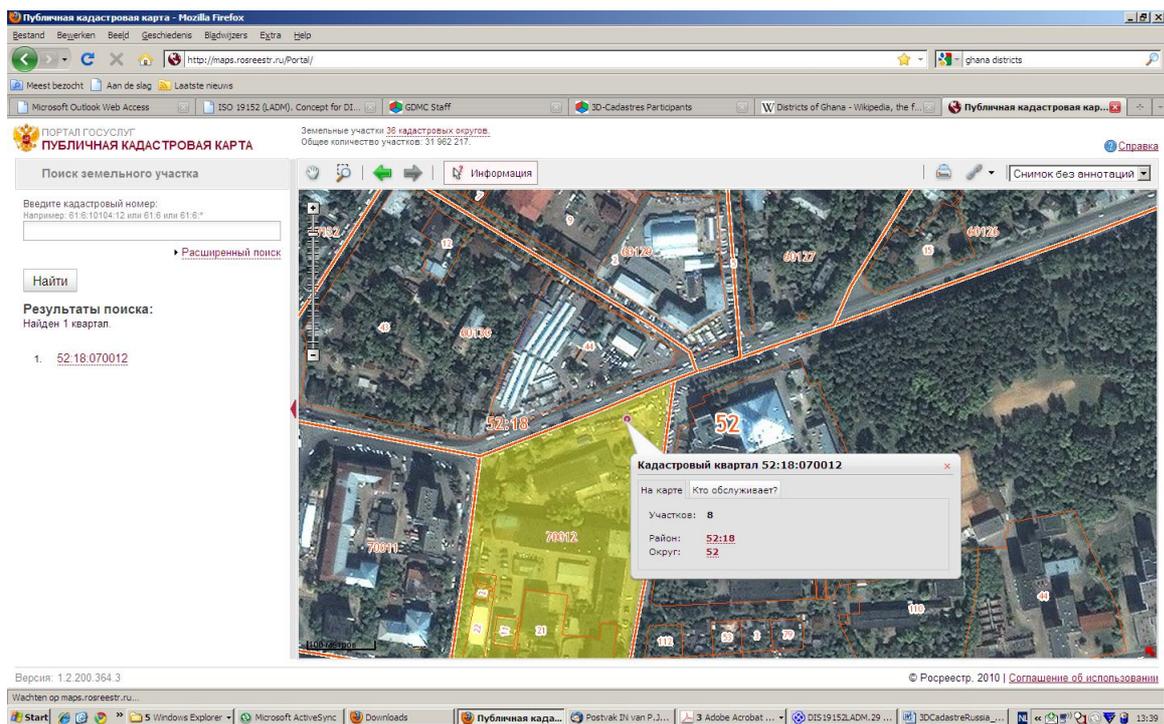
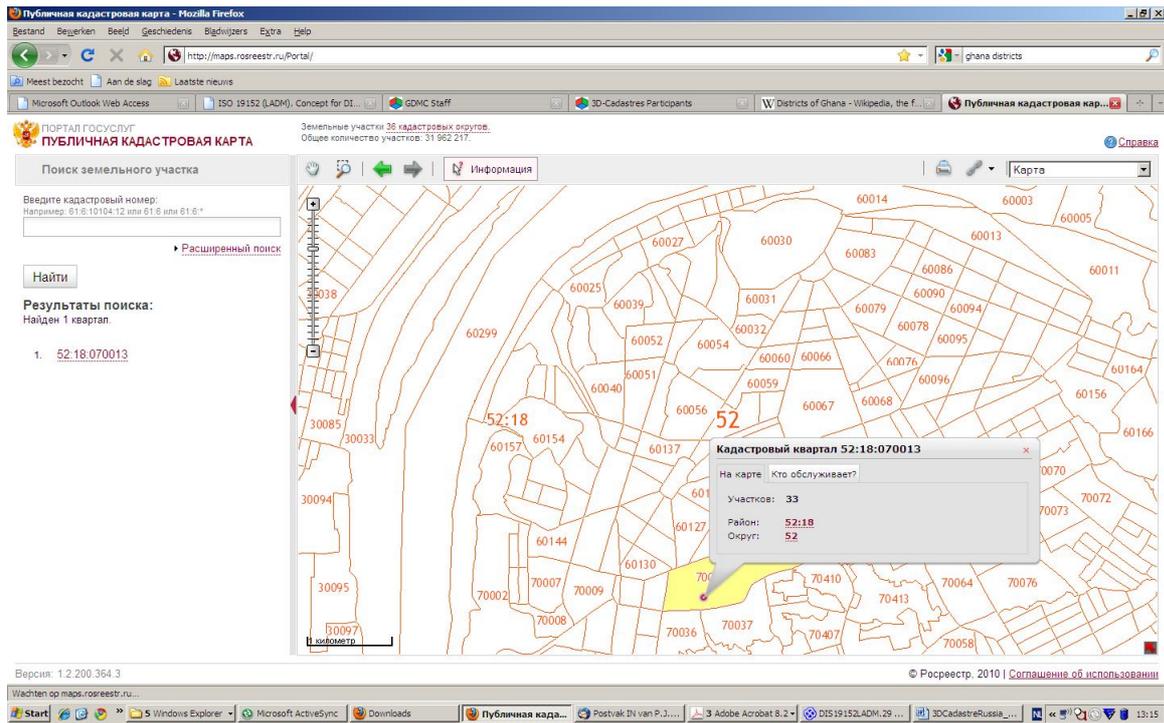
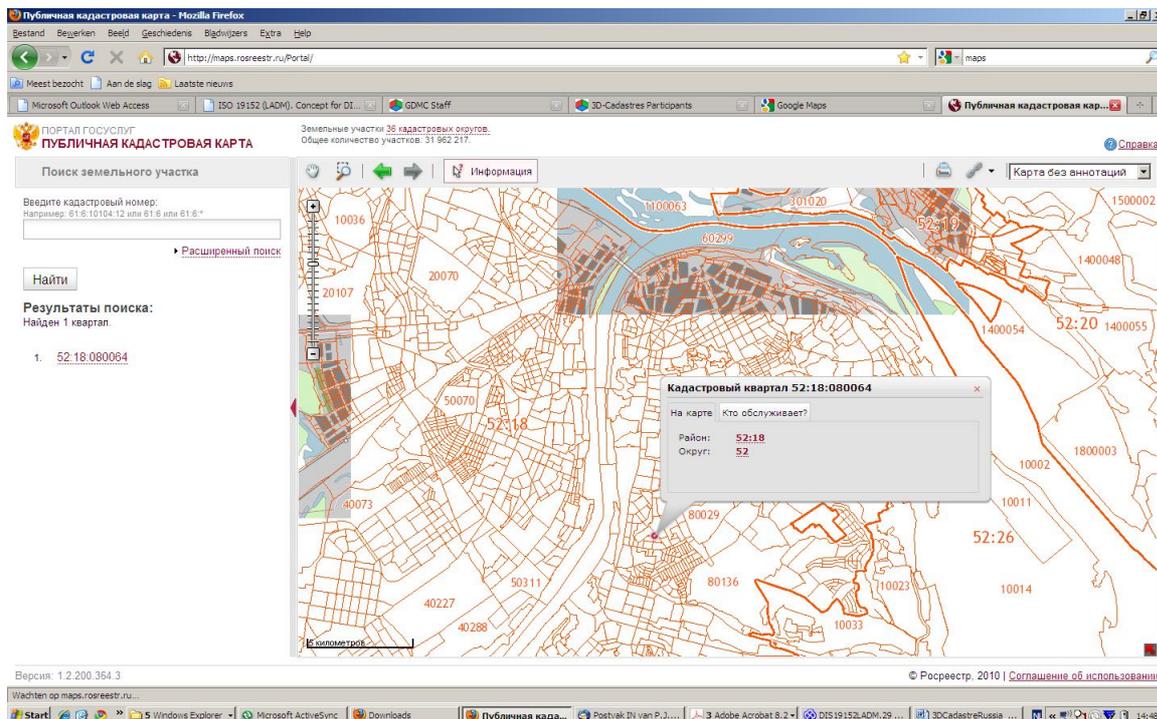


Figure 6: The location of Teledom building (near television tower); note top map highlights neighbor parcel

Case 3: Above ground gas pipeline. Normally the owners of a pipeline are either the municipality or the utility company (e.g. Gazprom). In this case it is the municipality owing the pipeline. However, the land is the property of another owner, which is the same as the owner of the building to which the pipeline connects. This short pipeline connects the building to the main pipeline. The pipeline is a cadastral object. Separation based on use: main pipeline, local connection of building, etc. In principle all parts of the pipeline should be registered. There are technical drawings of the pipeline (as submitted for the registration) in the building database. Pipeline attributes include: above/below surface, pressure, etc. Technical passport shows these attributes. Rights are attached to this pipeline and other pipelines (as cadastral object). This case (or similar) will be further used in the project as the 3D legal (rights) situation has added value: above ground pipeline needs legal space with different owner from the land parcel below. Below a few maps that indicate the location of this (sample) pipeline.



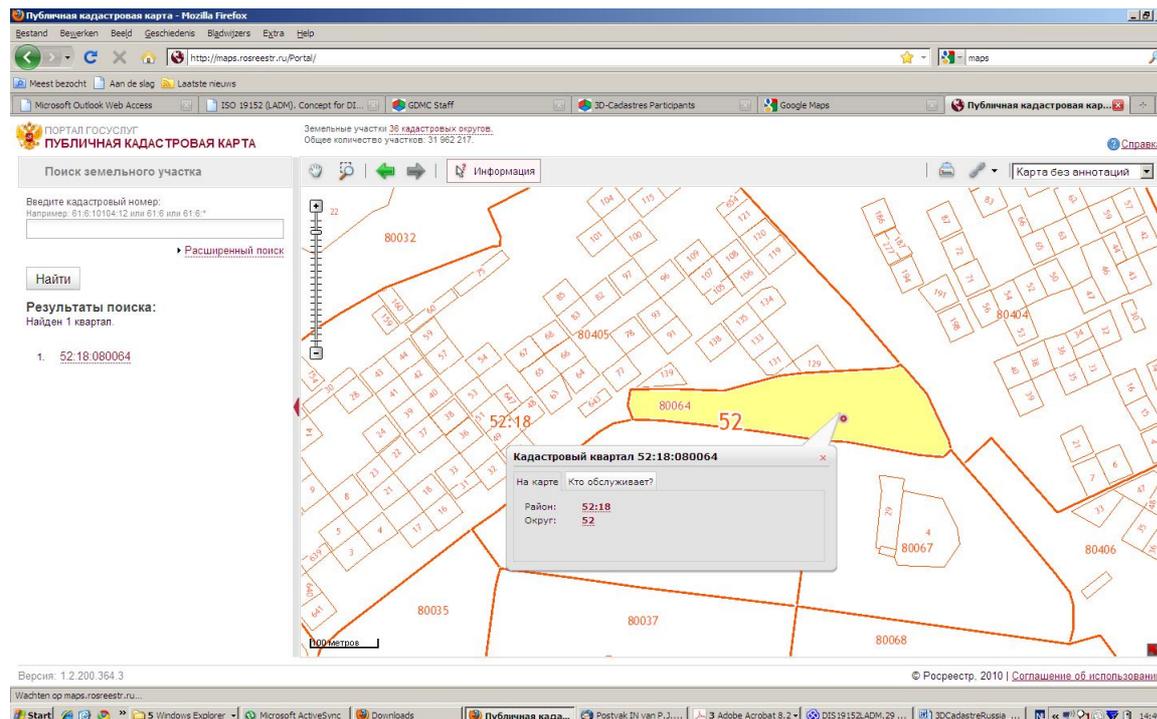


Figure 7: The location of the (sample) above ground gas pipeline

3.2. Wrap-up session

Friday, 01 October

The wrap-up meeting was held on 01 October and chaired by Peter van Oosterom. Results obtained and further agreements for the next steps actions in the project were summarized and presented in PowerPoint presentation by Peter van Oosterom (see the summary below). The second half of the morning was used to have a look at other countries that somehow have a form of 3D cadastre and it was indicated how the cases with various types of 3D cadastral objects are registered. This was the international (legal) overview presentation by Jantien Stoter, with more focus on the actual 3D cadastral objects and their description and with less emphasis on the legal issues.

A summary of the findings was made and confirmed by the Russian experts:

1. RF cadastre recognises 5 types of cadastral objects:
 1. Land parcel
 2. Building
 3. Apartment unit
 4. Other construction (bridge, pipeline, etc)
 5. Unfinished objects (building, bridge, pipeline, etc)
 2. The register of rights contains documents for all types of cadastral objects – land parcels, buildings etc.
 3. Cadastral registration contains separately the register of land parcels and the register of buildings (including also other cadastral objects). Technical drawings, floor plans etc are also kept there.
 4. The building “Teledom” was agreed to be included in the pilot system together with the presented example (or similar) of a small above ground gas-pipeline.
- In addition it was agreed to find 3 more cases:

- a long pipeline (sub-surface) crossing many land surface parcels;
- a small bridge (if possible);
- a 'typical' apartment building.

If possible the pilot objects shall be not too far apart so they can be placed in the same prototype environment. With regard to the set of data needed for each of the case the following requirements apply:

- map with the 5 types of cadastral objects: land parcels, building (units), constructions (pipelines, bridges), unfinished objects (of object and surroundings)
- cadastral index map
- detailed terrain/surface elevation
- current technical drawings
- RRR (Rights, Restrictions, Responsibilities) for objects (ownership, use, long lease, etc)
- Persons (parties of Objects)
- Topographic reference map (largest scale available)
- NEW: 3D geo-referenced representation/model of the objects (including internal subdivision and optionally main floors/walls)

The data formats for existing data are the currently used data formats.

The data format for the new 3D data to be discussed, attention points:

- CityGML (or other formats 3D formats, such dwg, dng, shape with 3D):
- pipeline: 3D (multi) polyline (or cylindrical shaped primitives),
- volume objects: closed polyhedron (flat or curved)

4. Actions

For the coming period the following actions/responsible persons/deadlines were agreed:

	Action	Responsible persons	Time
1	Agree the date for study tour (provisionally: week 48, starting 29 November)	Rik Wouters/Vladimir Tikhonov	08/10/10
2	Check of refined activities for project results 1 and 2 and communicate to project teams	Jantien Stoter	08/10/10
3	NL team will send Mission Report 2, including English version of the FIG Questionnaire as annex.	Villy Penkov	08/10/10
4	An official invitation letter is needed for the Russian participants upon submission of list of participants by Russian side	Rik Wouters	15/10/10
5	Communicate final version of IR to all involved partners (note language change of prototype English -> Russian and increase the actual input Russian side)	Rik Wouters	15/10/10
6	Russian team checks the completed Questionnaire (Russian language version) and sends to Villy Penkov	Vladimir Tikhonov	22/11/10
7	Russian team sends current Database schemas (models) from the register of rights database, land parcels database, technical building (including other constructions) database	Database expert from Russian Cadastre	To be determined

8	Finding the 3 additional cases (see above)	Russian (Nizhny Novgorod) project members	15/11/10
9	Process diagram of registration & cadastre (UML sequence diagram-like: actors, actions, communication input/output) ⁶	Irina Yufereva	10/10/10
10	Relevant Russian legislation (only selected extracts from codes, laws, regulations etc. – 2-5 pages) in Russian language sent to Dutch team	Roman Sultanov	29/11/10
11	Sending documentations (maps, photographs, text, legal documents, database content etc.) of cases: the 2 agreed cases + the 3 additional (all together 5)	Russian team	29/11/10
12	Russian team experts read the ISO LADM 19152	Russian team	29/10/10
13	Creation of the model of current Rosreestr registrations (LADM country profile) of current system (2D)	Peter van Oosterom with confirmation of the Russian modeling/database experts	29/10/10
14	Translation of legal documents' extracts (see above)	Villy Penkov	13/12/10
15	Create first recommendation on the Russian Country profile UML model - able to support registration of 3D case	Peter van Oosterom	12/11/10
16	Overview international legal frameworks relevant to 3D cases	Hendrik Ploeger, Jantien Stoter, Peter van Oosterom	12/11/10
17	Analysis of the relevant parts Russian legislation	Hendrik Ploeger	12/11/10
18	Organization of 3-weekly communications: deliverables, statements, input – communicated by email (before 12:00h Moscow time, followed by maximum 30 min telecom afternoon communication on deadline day for discussions, questions where needed	Initiation by Villy Penkov, supported by Kadaster International back-office, Chair – Rick Wouters, communication language – English Participants (persons depending on topics): 1. Russia, members of 3D Cadastre working group (FCC Zemlya, Nizhny Novgorod, ICT/database expert, legal/ministry) 2. Netherlands, members of 3D Cadastre working group (1 person from every organization: Kadaster, Veliko, TUDelft, Grontmij, Haskoning)	Every 3 weeks, more/less frequent, depending on needs

⁶ Please make a detailed overview where in each step also the data which are changed in the data base are included (as far as applicable)



An urgent issue with respect to organization is the first Study Tour.

A possible set of topics to be addressed within the Study Tour to the Netherlands were discussed as follows:

- Current registration of apartments, utility networks
- Actions to include 3D drawing in registration (Wim Louwman, notary)
- Creating 3D object description (data)
- First results from the Dutch pilot 3D
- Presentation on international legal 3D frameworks
- Presentation on five alternative options to implement 3D Kadaster
- Other

In addition the following results are expected to be achieved within the Study Tour:

- Discuss analysis of finished documentation of Russian use cases (in current 2D systems)
- make final description of future 3D counterpart Russian use cases

In important precondition for the successful impact from the ST to the project implementation is the delegation membership. The Dutch team proposed Study Tour members to incorporate operationally involved experts like:

- Federal Cadastral Centre Zemlya (Vladimir Tikhonov/Natalya Vandyshva)
- Nizhny Novgorod (Irina Yufereva/Natalya Korionova)
- ICT/database expert
- Legal expert/ministry



5. Annexes

5.1. Mission programme 3D cadastre, Mission No2 – 27 September – 01 October 2010

Flights Schedule

PETRUS VAN OOSTEROM, JANTIEN STOTER

AMSTERDAM – MOSCOW	SU 230	27SEP	13:10 - 18:25
MOSCOW – AMSTERDAM	SU 403	01OCT	18:00 - 19:25

CHRISTIAAN LEMMEN

AMSTERDAM – MOSCOW	SU 230	27SEP	13:10 - 18:25
MOSCOW – AMSTERDAM	SU 403	30SEP	20:55 - 22:25

RIK WOUTERS

AMSTERDAM – MOSCOW	SU 230	27SEP	13:10 - 18:25
MOSCOW – AMSTERDAM	SU 227	30SEP	20:55 - 22:25

VELIKO PENKOV

SOFIA – MOSCOW	SU 172	27SEP	12:30 - 16:25
MOSCOW – SOFIA	SU 425	01OCT	19:55 - 21:55

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ROYAL HASKONING



Programme Kadaster team September 2010 Mission on 3D Project

Moscow 27 September - 01 October 2010

Monday 27 September

Time	Activity	Participants	Location	Remarks
	ARRIVAL	Jantien Stoter, Christiaan Lemmen, Rik Wouters, Veliko Penkov	Sheremetyevo Airport (SVO)	

Tuesday 28 September

Time	Activity	Participants	Location	Remarks
	Introduction, discussion on the week programme	NL Mission Team, RF project team	Business Center – WTC	
	Review of the Inception Report	--	--	
	Presentation on Russian legal framework	--	--	By Roman Sultanov
	Presentation on the Pilot Nizhny Novgorod	--	--	
	Presentation on 3D NL pilot overview (case studies from the Netherlands)	--	--	By Jantien Stoter
	Presentation on the activities 2010 – 2014 of the Working Group on 3D Cadastre's of the International Federation of Surveyors (FIG)	--	--	By Peter van Oosterom
	Presentation on 3D cadastres background	--	--	By Jantien Stoter
	Review of FIG 3D Cadastres questionnaire - part I	--	--	

Wednesday 29 September

Time	Activity	Participants	Location	Remarks
	Review of FIG 3D Cadastres questionnaire - part II	--	FCC Zemlya	
	Presentation Introduction to the ISO 19152 (LADM)	--	--	Christiaan Lemmen

Thursday 30 September

Time	Activity	Participants	Location	Remarks
	Review of the actual RRR (Rights, Restrictions, Responsibilities) – Russian situation	NL team members(PvO, JS, CL, VP), RF team	FCC Zemlya	
	Detailed analysis of cases from the pilot	--	--	
	DEPARTURE	Rik Wouters, Christiaan Lemmen		

Friday 01 October

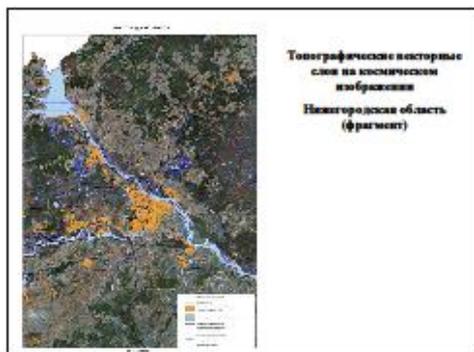
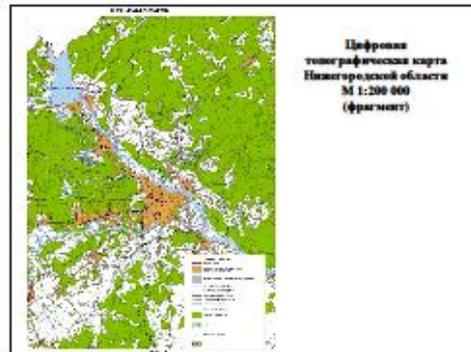
Time	Activity	Participants	Location	Remarks
	Wrap up and marking next steps	NL team members(PvO, JS, VP), RF team	FCC Zemlya	
	Review of situations in countries with some form of 3D cadastre: cases, international overview	--	--	By Janien Stoter
	DEPARTURE	Petrus van Oosterom, Jantien Stoter, Veliko Penkov	Sheremetyevo Airport (SVO)	

5.2. Presentations

During the mission a number of presentations were given (see below). The PowerPoint slides were delivered to the counterpart for their purposes. In case of an external presentation there must be a reference to the author (with courtesy).

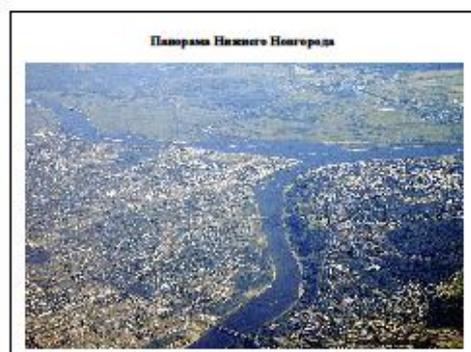


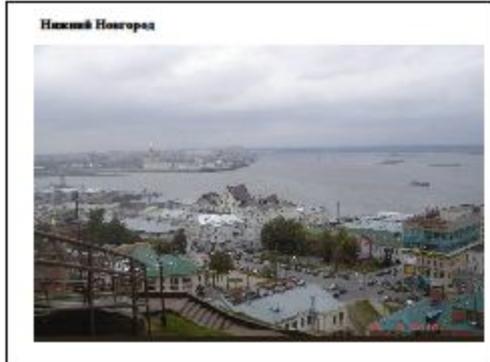
- Presentation on the pilot in Nizhny Novgorod (RF, Natalya Vandysheva)



Данные о земельном фонде Нижегородской области
на 01.04.2010 г.

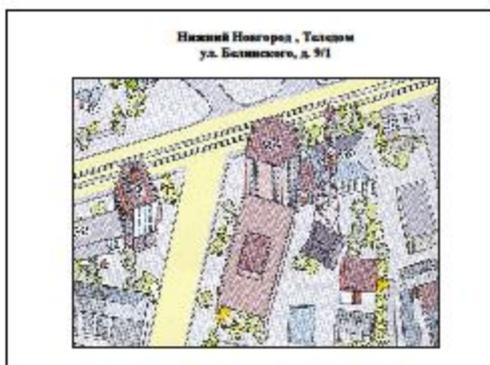
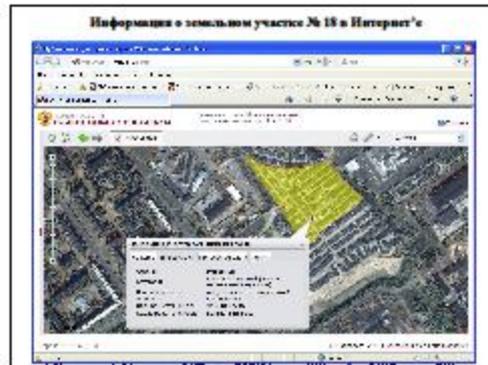
№ п/п	Категория земель	Кадастровая стоимость, тыс. руб.	Площадь га	Количество земельных участков, шт.
1	Земли с.-х. назначения	64 593 840	3 885 494	239 151
2	Земли населенных пунктов	641 971 336	335 507	1 061 512
3	Земли промышленности, энергетики, транспорта, связи,	8 733 260	264 707	47 582
4	Земли особо охраняемых территорий и объектов	2 271 635	13 602	902
5	Земли лесного фонда	42 224 889 152	3 779 971	1 981
6	Земли водного фонда	36 368	995	52
7	Земли запаса	57 608	22 921	402
8	Категории не установлены	2 028 050	10 893	1 853
Всего по области:		42 944 573 149	8 153 488	1 353 435

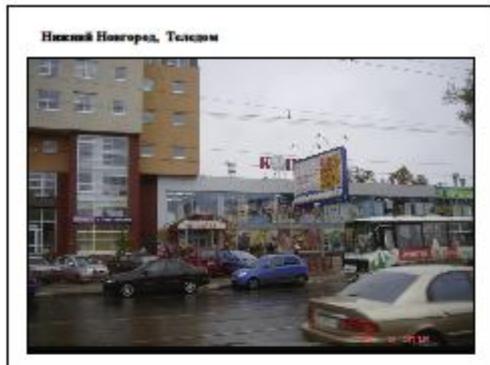




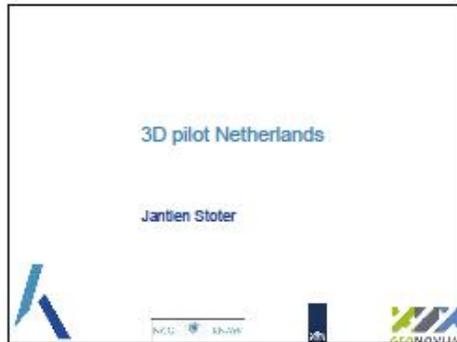
Данные о земельном фонде Нижнего Новгорода
на 01.04.2010 г.

№ п/п	Категория земель	Надстроившая стоимость, тыс. руб.	Площадь, га	Количество земельных участков, шт.
1	Земли с.-х. назначения	-	-	-
2	Земли населенных пунктов	382 653 697,11	23 938,73	90 665
3	Земли промышленности, энергетики, транспорта, связи.	7 197,01	0,37	3
4	Земли особо охраняемых территорий и объектов	-	-	-
5	Земли лесного фонда	176 389,40	50,23	31
6	Земли водного фонда	57,94	0,02	1
7	Земли запаса	-	-	-
8	Категории не установлены	1 418 371,36	50,69	71
Итого:		384 255 712,82	24 046,07	90 771



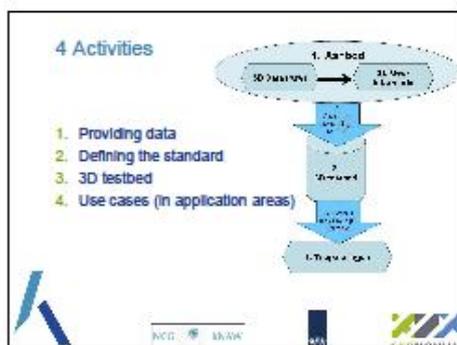


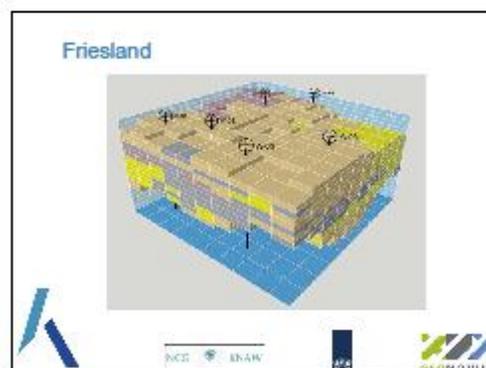
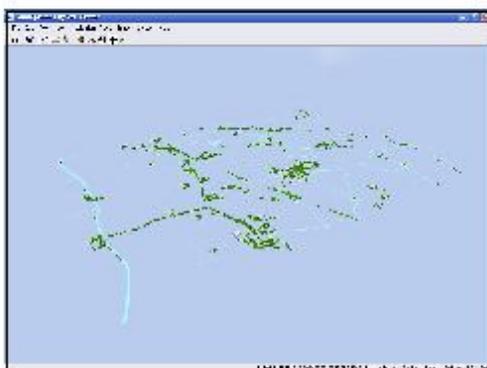
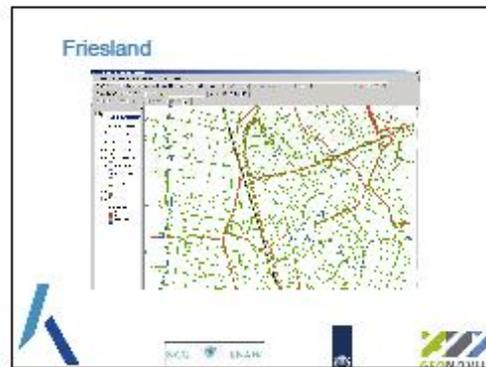
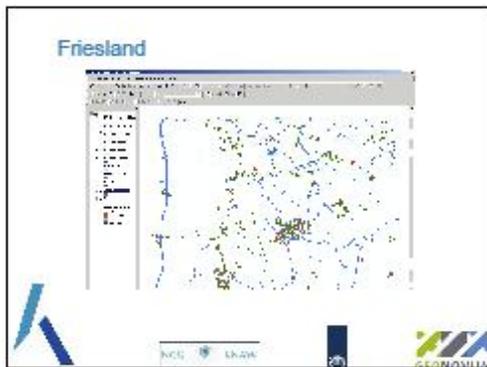
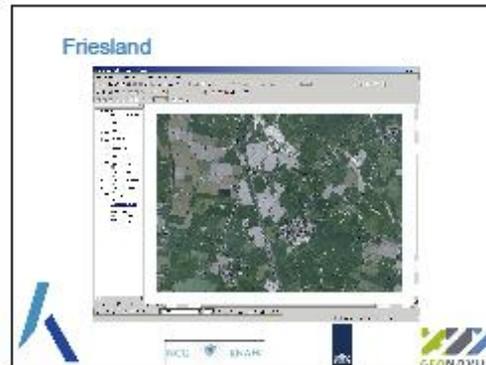
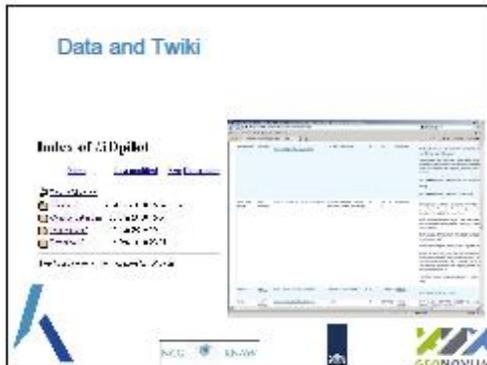
- Presentation 3D Pilot in the Netherlands (Jantien Stoter)

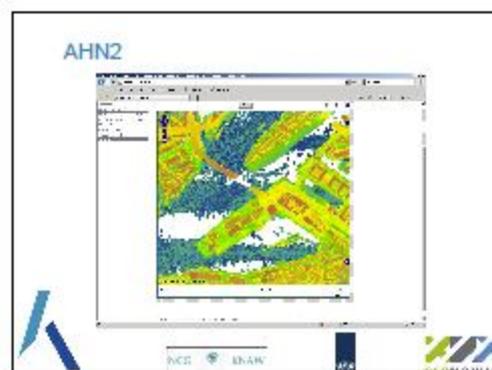
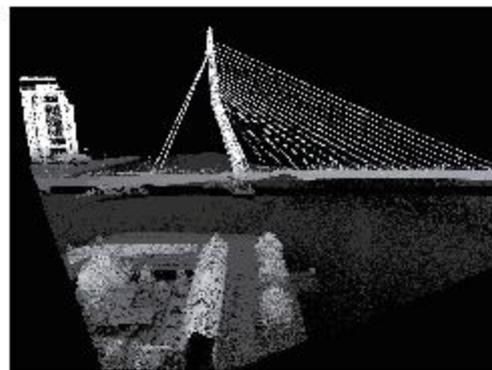


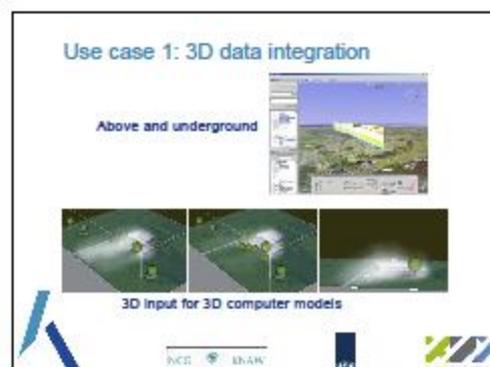
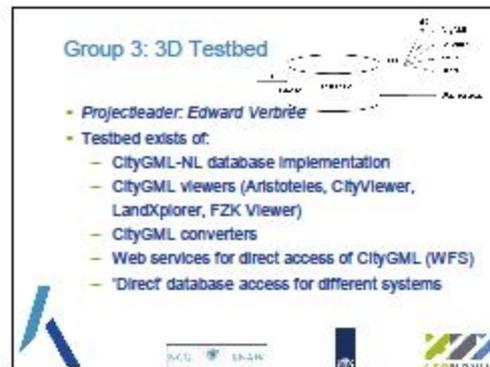
Participating organisations

Administratie	Lyons/maas	Geonovum	Integratie	Geonovum
Height	EGRI	Grontmij	Rac	TNO Bouw en Ondergrond
Aerodata	Eurosense	Hansa Luftbild	Reg. Lucht en Ruimtevaartlaboratorium	TNO Defensie en Veiligheid
AGIV	Fugro	NOOS (Delft and Groningen)	Object Vision	TNO ICT
AHW	Gemeent Apeldoorn	Delft	ARFACT (Cottbus/Leipzig)	TOPOSCOPIE
Ben Bay	Gemeente Amsterdam	Intergraph	Oracle	ITC Science (USA)
LDV G&M	Mechelen Rotterdam	TK - U Twente	Draaglood	TNO Computer Graphics
SDM NL	Landschap Tilburg	Wageningen	Provincie	Utrecht/OTIS
Calre	Geodan	KPG, Polen	Provincie NB	TNO Lucht en Ruimtevaart (Netherlands)
Crotac	Geodata	MERITOR	RWS	Wageningen

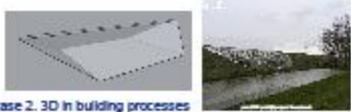








Use cases 2 & 3



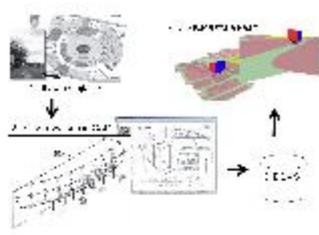
Use case 2. 3D in building processes



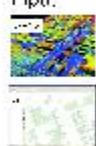
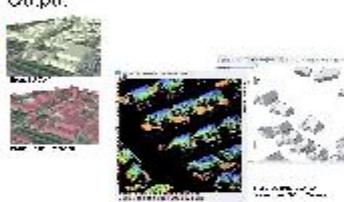
Use case 3. 3D Spatial Planning



Use case 4: 3D Cadastre




Use case: 3D Topography Basic model

Input:  Output: 



Where do we stand now

- Story boards of the different use cases
- Test data almost ready
- Version 1.0 testbed Implemented (coarse is given)
- Working on the demonstration prototypes of the use cases: September/October
- Next meeting: 9 November
 - Demonstration of the use cases



Next steps (end time of Pilot: March 2010)

- Finalise Deliverables
 - Test data
 - Demonstration prototypes of the use cases
 - CRs for OGC
 - And more
- Congres in the NL, March 2011
- 3D standard for NL → CityGML
- Advice for national covered 3D basic dataset
- Evaluation and if needed extra new activities (after 03-2011)



- Presentation on activities 2010 – 2014 of the Working Group on 3D Cadastre's of the International Federation of Surveyors (FIG) (Peter van Oosterom)



FIG Working group 3D Cadastre
9-10-2010

Prof Peter van Oosterom
GIST, OTB, TU Delft

Joint work with Dr Jantien Stoter and Prof Hendrik Ploeger, TU Delft



FIG joint commission 3 and 7 new working group on 3D-Cadastres

- Objectives:
 - Common understanding of terms and issues involved;
 - ISO 19152 Land Administration Domain Model: LADM with 3D
 - Guidelines/checklist for implementation of 3D-Cadastres: 'best practices' legal, institutional and technical aspects
- Work plan 2010-2014 on www.gdmc.nl/3DCadastres

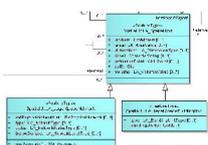
Note: 3D Parcels in broadest sense: land & water spaces, both above & below surface.



3D Cadastre 2

Topics

- 3D-Cadastres and **models**: role of earth surface, 3D parcels open at top and bottom, topology structure, relative height,...
- 3D-Cadastres and **SII**: legal objects (cadastral parcels and associated rights) and their physical counterparts (buildings or tunnels) result into two different, but related registrations
- 3D-Cadastres and **time**: partition of legal space into 4D parcels: no overlaps or gaps in space of time
- 3D-Cadastres and **usability**: graphic user interface (GUI) for interacting with 3D cadastral data; e.g. Google Earth




3D Cadastre 3 FIG

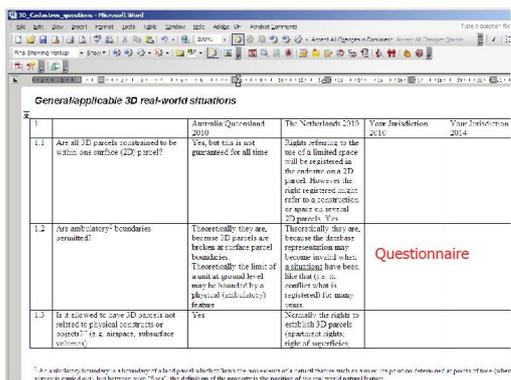
Deliverables time table



- 2010: creation of web-site and interest-group
- 2010: initial questionnaire status 3D Cadastres
- 2011: 2nd workshop on 3D-Cadastres
- 2011-13: 3D Cadastres session at FIG working weeks
- 2013/14: 3rd workshop on 3D-Cadastres (option)
- 2013/14: FIG-publication on 3D-Cadastres
- 2014: final questionnaire status 3D Cadastres
- 2014: presentation of the results FIG-congress



3D Cadastre 4 FIG



General/applicable 3D real-world situations				
Q	Q description	Q answer	Your jurisdiction 2010	Your jurisdiction 2014
1.1	Are all 3D parcels contained to be within one surface (2D) parcel?	Yes, but this is not guaranteed for all time	The Netherlands 2010: Stable reference to the use of a limited space will be registered in the cadastre on a 2D parcel. However, the right registered in an office is occupiable or space of several 2D parcels. Yes	Questionnaire
1.2	Are sub-surface boundaries possible?	Theoretically they are, because 3D parcels are below or on other parcel boundaries. Theoretically the limit of a unit on ground level may be bounded by a physical (sub-surface) feature	Theoretically they are, because the doctrine representation may become invalid but advantages have been like that (i.e. conflict) what is registered what is required for many cases	Questionnaire
1.3	Is it allowed to have 3D objects not related to physical occurrence or objects? (i.e. airspace, subsurface features)	Yes	Normally, the rights to establish 3D parcels (physical or digital) right of superficies.	Questionnaire

1. A sub-surface boundary is a boundary of a body of land which lies in the space between a natural surface such as a river, the ground, seabed or parts of those (other) surfaces extended out, but between such "body", the distribution of the elements to the bottom of the sea, "real" natural feature.



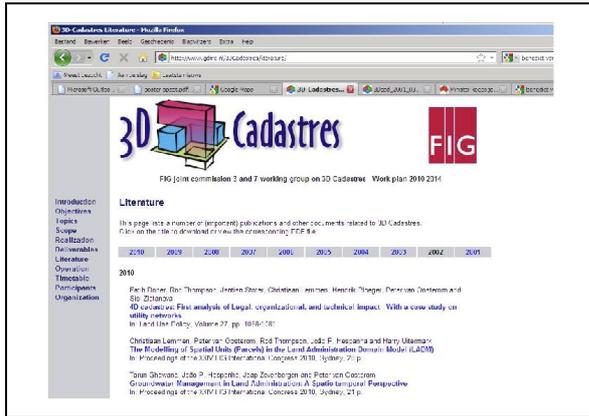
3D Cadastre 6 FIG

Mode of operation

- Identify specific 3D-Cadastres topics (legal, institutional and technical), which investigations are lead by limited number of experts (and other members can join)
- Questionnaire status 3D-Cadastres 2010 and again 2014
- Chair of 3D-cadastres WG should start/encourage theme groups
- Evaluation after one year
- Progress reports to all members and FIG comm. 3 and 7
- Repository of relevant literature on 3D-cadastres
- Communication supported by website www.gdmc.nl/3DCadastres



3D Cadastre 6 FIG



Current list of participants

- Argentina (Diego Erba)
- Australia/Queensland (Rod Thompson)
- Bahrain (Neeraj Dixit)
- Canada (Francis Brochu, Paul Egesborg, Marc Gervais, Jacynthe Pouliot, Francis Roy)
- China (Renzhong Guo, Zhang Ning, Shen Ying)
- Denmark (Lars Bodum)
- Finland (Arvo Kokkonen)
- France (Hervé Halbout)
- Greece (Efi Dimopoulou)
- Hungary (Andras Osskó)
- Italy (Bruno Razza)
- Israel (Yerach Doytsher, Joseph Forrai, Yoav Tal)
- Indonesia (Trias Aditya)
- Macedonia (Gjorgji Gjorgjiev, Vanko Gjorgjiev)
- Malaysia (Alias Abdul Rahman)
- The Netherlands (Benedict van Dam, Hendrik Ploeger, Jantien Stoter)
- Norway (Tor Valstad)
- Russia (Natalia Vandysheva)
- South-Korea (Youngho Lee)
- Spain (Amalia Velasco)
- Sweden (Jesper Paasch)
- Switzerland (Laurent Niggeler)
- Turkey (Cemal Biyik, Osman Demir, Fatih Döner)
- USA (Alex Smith)

TU Delft 3D Cadastre 8 FIG

Working group organisation

- Position within FIG:
inter-commission activity between commissions 3 and 7
- Return questionnaire before 31 October 2010
- Chair WG 3D-cadastres: Peter van Oosterom, TU Delft
P.J.M.vanOosterom@tudelft.nl
tel (+31) 15 2786950, fax (+31) 15 2784422

TU Delft 3D Cadastres 9 FIG



- Presentation on the backgrounds of 3D Cadastre (Jantien Stoter)



3D Cadastre background

9-10-2009

Dr. Jantien Stoter
GSI, OTS, TU Delft & Kadaster, Apeldoorn

Joint work with Prof Hendrik Ploeger, TU Delft

TU Delft

Content

- Introduction
- Case studies from The Netherlands
- 3D Cadastre from different perspectives
 - juridical perspective
 - cadastral perspective
 - technical perspective
- Conclusions

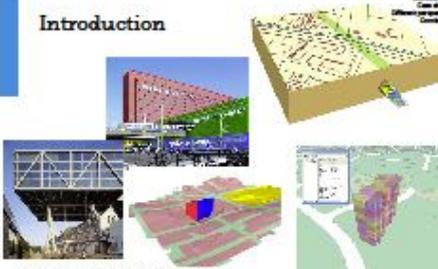
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Tasks of a cadastral registration

- Registration of juridical status of real estate
- Provide information on juridical status of real estate

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Introduction



2D registration for a 3D world?

TU Delft

What is a 3D Cadastre?

- 3D map (visualisation)?
- Parcel boundaries in 3D?
- 3D DBMS?
- "A 3D cadastre is a cadastre which registers and gives insight into rights and restrictions not (only) on parcels but on 3D property units. A 3D property unit is that (bounded) amount of space to which a person is entitled by means of real rights."

TU Delft

Content

- Introduction
- Case studies from The Netherlands
- 3D Cadastre from different perspectives
 - juridical perspective
 - cadastral perspective
 - technical perspective
- Conclusions

TU Delft

Case 4: Apartment complex

TUM 3D Cadastre 13

Cadastral registration of apartment

- Spatial part:
- Administrative part:

PARCEL	KIND_OF_RIGHT	RIGHT_OWNER
5218 00 VE		VER. VAN EDELRANDI BOORBEHEERMAAT 51-55 DELFT
6408 A3 VE		BALLOEIJM
6408 A2 VE		SMOUTEN
6408 A1 VE		STOYEN

TUM 3D Cadastre 14

Deed of division

TUM 3D Cadastre 15

Complications apartment complex

- Individual apartments cannot be found on the cadastral map
- Public Registers have to be queried to find the plan of division
- Ownership is indicated for each floor: no 3D description

TUM 3D Cadastre 16

Case 5: Railway tunnel

TUM 3D Cadastre 17

How are the rights of property on the tunnel registered?

- 104 intersecting parcels
- 226 rights are established on these parcels
- 80 rights belonging to the Ministry of Transport and Public Works:
 - 44 right of property
 - 36 right of superficies
- 34 parcels with an 'OB' notification (existence of underground construction)

TUM 3D Cadastre 18

Possibilities to find location railway tunnel in current registration

TUM 3D Cadastre 28

Conclusion on case studies

- It is clear which persons have a right on the concerning parcels, but: spatial component of rights is not registered (and not available)
- Location of 3D object cannot be found
- Queries that cannot easily be performed:
 - who is the owner of the tunnel or building complex
 - to what height or depth does the right of superficies extend
- Relationship right of superficies-3D object is not clear
- Ownership to objects above and below the surface is always related to parcels on the surface

TUM 3D Cadastre 29

Content

- Introduction
- Case studies from The Netherlands
- **3D Cadastre from different perspectives**
 - Juridical perspective
 - cadastral perspective
 - technical perspective
- Conclusions

TUM 3D Cadastre 30

3D Cadastre from different perspectives

- Juridical aspects
- Cadastral aspects
- Technical aspects

TUM 3D Cadastre 31

Juridical aspects and 3D (1/2)

- **Space of property:**
 - Space above and below the surface
 - Property reaches as high/low as user has interest
 - Third parties can use parcel-column as long as user has no reason to object

TUM 3D Cadastre 32

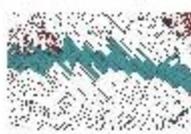
Juridical aspects and 3D (2/2)

- **Ownership of parcel-column can be restricted by:**
 - Limiting rights (right of superficies, right of long lease, servitudes)
 - Right to an apartment
 - Public Law restrictions
 - Volume parcels
- Juridical situation registered in LA

TUM 3D Cadastre 33

Cadastral aspects and 3D

- Translation from information in LA into cadastral map (for providing information)
- Parcel is main entrance:
 - Ownership rights, limited rights, Public Law restrictions are registered per parcel, example of railway tunnel:



TUM 3D Cadastre 25

Cadastral aspects and 3D

- People are always entitled to volumes or objects and not to just a surface
- 3D Cadastre reconsiders 2D parcel as only base for registration of real estate objects
 - volume parcel, physical object

TUM 3D Cadastre 26

Technical aspects and 3D

- Collecting 3D information
- 3D objects in DBMS (maintenance, validation, 3D functions)
- 3D cadastral map:
 - Access of (visualising/editing) 3D objects in DBMS:
 - Via GIS/CAD software
 - Via Internet techniques (X3D, VRML)
- Combination of 2D and 3D geo-objects in DBMS by integrated model of parcel boundaries and point heights

TUM 3D Cadastre 27

3D objects in DBMS

```

INSERT INTO polyhedron table (id, geometry) VALUES
(1,mdsys.sdo_geometry(3002, NULL, NULL, mdsys.sdo_elem_info
array(1,2,1, 25,0,1006, 29,0,1006, 33,0,1006, 37,0,1006, 41,0,1006,
45,0,1006),
mdsys.sdo_ordinate_array( 1,1,0, 1,3,0, 3,3,0, 3,1,0, 1,1,2, 1,3,2, 3,3,2,
3,1,2, 1,2,3,4, 8,7,6,5, 1,4,8,5, 2,6,7,3, 1,5,6,2, 4,3,7,8)));
    
```

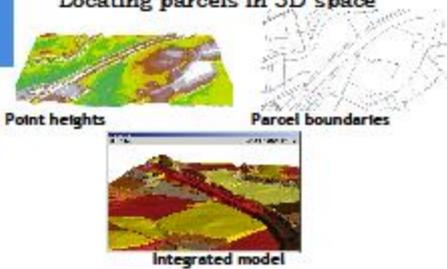
TUM 3D Cadastre 28

Accessing 3D objects in DBMS



TUM 3D Cadastre 29

Technical aspects of 3D cadastre: Locating parcels in 3D space



Point heights Parcel boundaries Integrated model

TUM 3D Cadastre 30

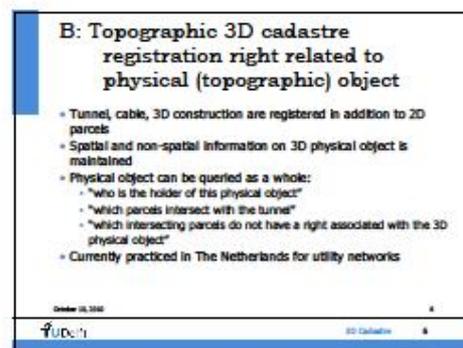
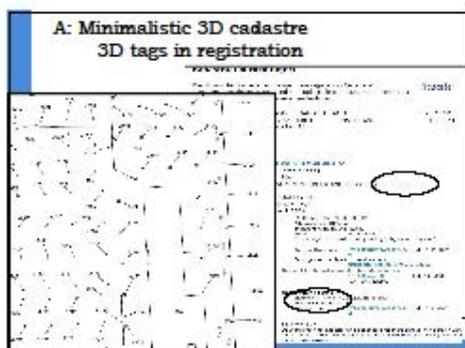
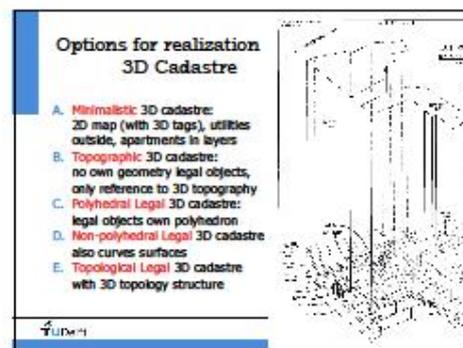
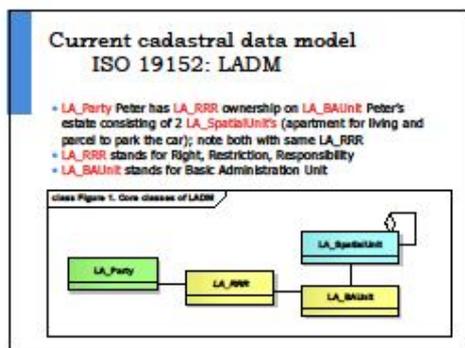
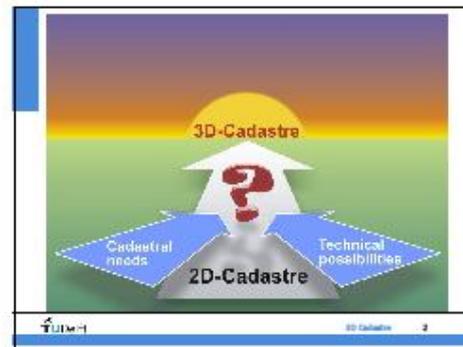
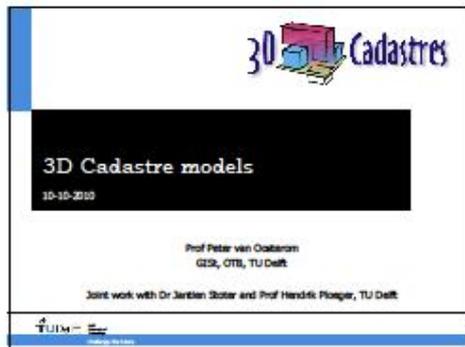
Concluding remarks

- Cadastral systems are capable to register 3D situations administratively
- But: 3D information is not (or little) maintained (although often available in LA)
- No implementation exists to spatially define properties in cadastral DBMSs
- Better accessibility of information on 3D situations is needed
- Several alternatives for registering 3D properties in cadastral DBMSs; some within current juridical doctrine and others need a new legal basis for 3D parcels

TUM 3D Cadastre 31



- Presentation - Introduction to the ISO 19152 (LADM) and the importance/ relevance of the MDA approach is this project (Christiaan Lemmen)



Registration of utilities: The Netherlands

- **Technical registration:** the registration of the geometry, in order to avoid damage to the utility
- **Legal registration:** the registration of the utility network as an object of property rights.

Dutch Supreme Court in 2003: underground (telecom) networks are real estate objects

Dutch Civil Code was modified in 2007: "a network ... constructed in, on or above the land of an other person, is owned by the competent constructor"

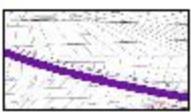


A registered telecommunication network in the Netherlands cadastre

Network map in NL



Registration of physical objects

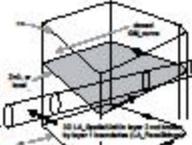



C: Polyhedral Legal 3D cadastre: 3D right-volume

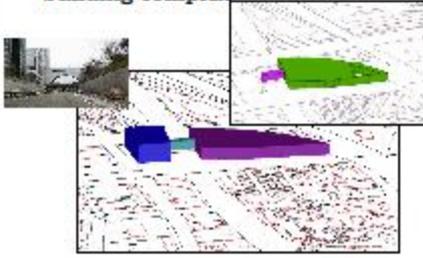
- 3D right-volume: to register individual 3D parcels
 - 2D (parcel) boundary forms the basis
 - 2D boundary is extended into 3D by upper and lower limits of the right
 - All 3D right-volumes belonging to one physical object (e.g. tunnel) refer to the same physical object
 - Relationship right-3D object

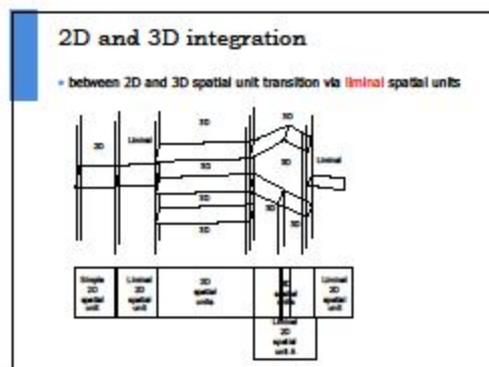
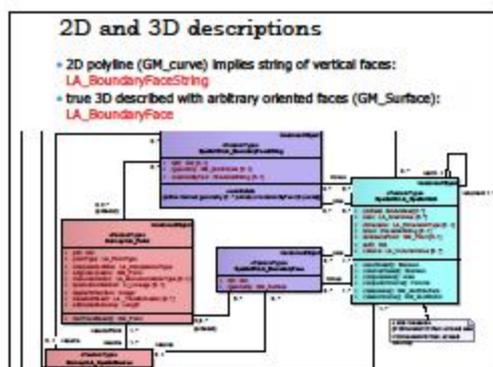
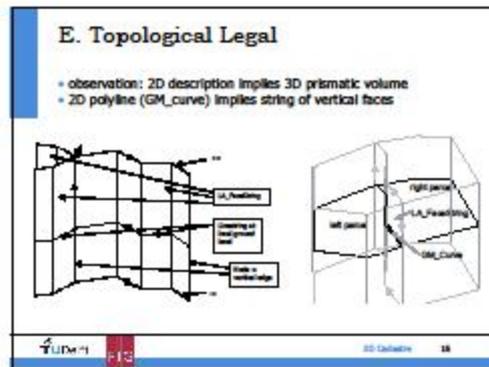
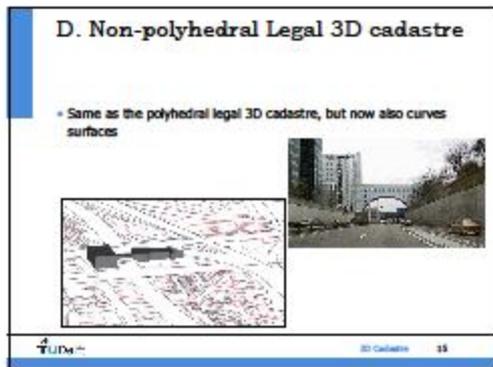
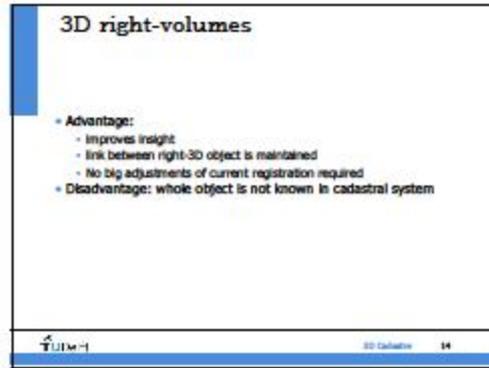
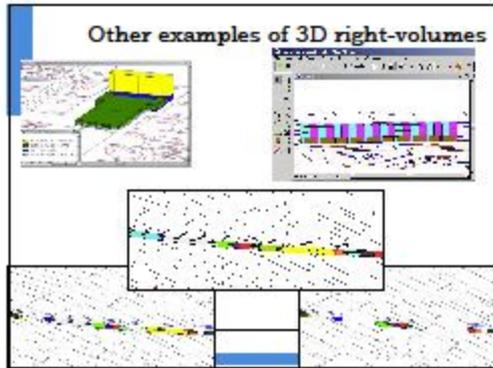
Introduction of LA_Layer (in LADM)

- organization based on content or structure:
 - example 1, content-based: one layer with 'primary' (strongest) rights, another layer with rights that can be added/subtracted (e.g. restrictions)
 - example 2, structure-based: one layer with topologically structured parcels (one part of the country), another layer with (unstructured) line based parcels (other part of country)
- can also be used in 3D context:
 - one layer 'normal' parcels, another layer with subtracted 3D parcels
 - based on independence principle
 - each country design own layers



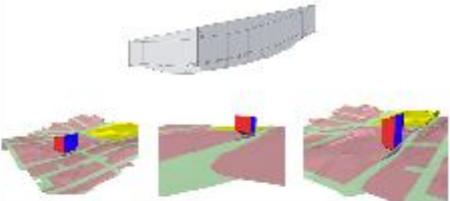
Registration of 3D right-volume, building complex





Solution with extension of juridical/cadastral doctrine:

- 3D registration of volume parcels as part of cadastral map



TUM 3D Cadastre 18

Concluding remarks

- 3D registration, several alternatives possible, some within current juridical doctrine and others with legal basis for 3D parcels
- However.....
 - In many countries juridical and cadastral systems is still very surface oriented
 - Registration of right-volumes and physical objects (elsewhere within SEI) provides insight into current 3D property situations

TUM 3D Cadastre 19

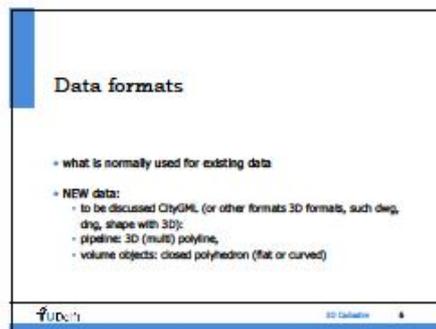
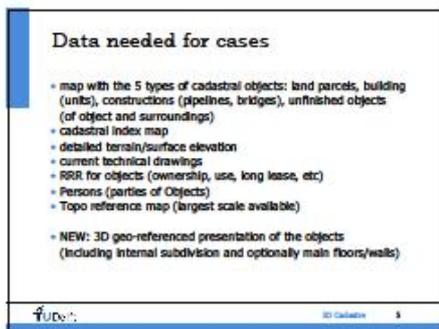
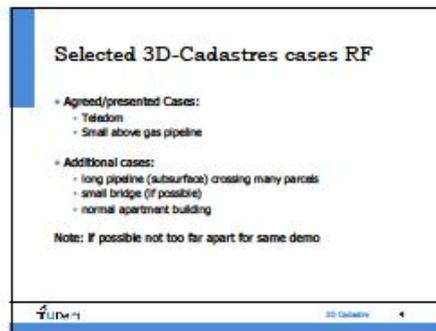
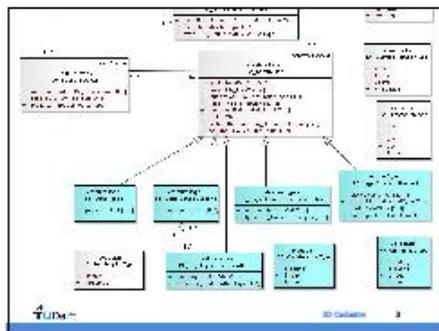
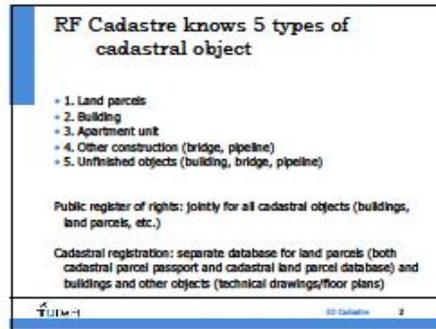
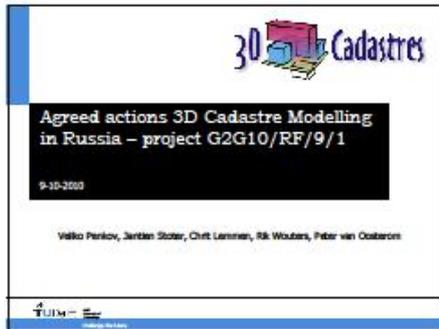
Conclusion: Define own scope

- What are the types of 3D cadastral objects? Related to (future) **constructions** (buildings, pipelines, tunnels, etc.) any part of the 3D space, both airspace or subsurface?
- 3D Parcels for infrastructure objects, such as long tunnels, pipelines, cables: **divided by surface parcels** or one object?
- For representation of 3D parcel, has legal space **own geometry** or specified by refereneing to existing topographic objects



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- Presentation – Wrap-up mission results and agreements on next steps (Peter van Oosterom)



Work from now on
(reference date 1 oct'10) 1/3

- Rik/Vladimir set the date for study tour (week from 15 nov?) within 1 week
- Communicate final version of IR to all involved partners (note language change of prototype EN -> Russian) by Rik within 4 days
- RF (Vladimir) checks the completed questionnaire within a 2 weeks (Russian language version) and send to Velko
- Jantien checks refined activities for project results 1 and 2 within 4 days and send back to others.
- NL send mission report, including translated interim questionnaire as annex, within a week by Velko (input Jantien, Chrit, Peter)
- RF send current database schema's (models) register of rights database, land parcel database, technical building (incl. other constructions) database within 2-3 weeks.
- RF (local) find the three additional cases in 3 weeks
- RF send documentation of cases: 2 existing and 3 additional (5 total) in 4 weeks (maps, photographs, text, legal docs, database content,...)

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Work from now on
(reference date 1 oct'10) 2/3

- Process diagram of registration & cadastre (UML sequence diagram-like: actors, actions, communication input/output) input by experts (Nizhni; e.g. Irina or ...) within 3 weeks
- Create model of current Rosreestr registrations (LADM country profile) of current system (2D) within 4 weeks (by Peter with confirmation by the Russian modeling/database experts)
- Russian relevant codes and laws (relevant part) to be made available in 1. Russian 9th 2-5 pages selected) within 3 weeks, by Roman Sultanov (Ministry economic development), 2. translation to English within 3 weeks by Velko?
- Create first recommendation 3D extension (RF UML model) able to support registration of 3D case by Peter within 6 weeks.
- International overview of legal frameworks relevant van 3D cases (Hendrik, Jantien, Peter) within 6 weeks
- Analysis of the relevant parts of Russian code/laws within 6 weeks by Hendrik

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Work from now on
(reference date 1 oct'10) 3/3

- About every 3 weeks communication: deliverables, statements, input by email (before 12:00 hours Moscow, followed by max 30 min telecom in afternoon on deadline day for discussions, questions where needed (Initiative Velko, support by KI back-office, chaired by Rik?, language EN?). To be planned by Rik. If needed more often (more tasks) or less often (fewer tasks)

Participants (persons depending on topics):

- RF, members of 3D Cadastre working group (FCC Zemlya, Nizhny Novgorod, ICT/database expert, lega/ministry)
- NL, members of 3D Cadastre working group (1 person from every organization: Kadaster, Velko, TUD, Grontmij, Haskoning)

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Study tour possible topics, prepare program

- NL current registration of apartments, utility networks
- NL actions to include 3D drawing in registration (Wim Louwman, notary)
- Creating 3D object description (data)
- First results from the Dutch pilot 3D NL
- Presentation on international legal 3D frameworks
- Presentation on five alternative options to implement 3D Kadaster
- Other?

- Discuss analysis of finished documentation of RF use cases (in current 2D systems)
- make final description of future 3D counterpart RF use cases

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Study tour participants RF

- FCC Zemlya (Vladimir/Natalya)
- Nizhny Novgorod (Irina/Natalya)
- ICT/database expert,
- Legal expert/ministry



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5.3. FIG Questionnaire – Russian Federation case

Questionnaire: status 3D-Cadastres - September 2010

This questionnaire is an activity of the FIG working group 3D-Cadastres 2010-2014. The purpose of the survey is to make a world-wide inventory of the status of 3D-Cadastres at this moment (fall 2010) and the plans/expectations for the near future (2014). By sharing this information, it should be possible to improve cooperation, learn from each other and support future developments. For more information on the FIG working group on 3D-Cadastres see the website of this working group www.gdmc.nl/3DCadastres. Now a few notes and suggestions, which should be helpful when completing the questionnaire:

- In this questionnaire the concept of 3D-Cadastres with 3D parcels 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 homogeneous⁷ rights (e.g. ownership right or 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 below to be more specific and real world situations are used. Also two example sets of partial/preliminary answers are included from Australia, Queensland and The Netherlands, to support the questions and to be of 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 3D parcels (spaces of legal objects).
- 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).

⁷ 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.

- 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.
- Please try to fill in this questionnaire before *31 October 2010* 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. 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.

	Australia/Queensland 2010	The Netherlands 2010	Your Jurisdiction 2010	Your Jurisdiction 2014
1.1. Are all 3D parcels constrained to be within one surface (2D) parcel?	Yes, but this is not guaranteed for all time.	Rights referring to the use of a limited space will be registered in the cadastre on a 2D parcel. However the right registered might refer to a construction or space on several 2D parcels. Yes.	Not all. It is possible to register rights on an immovable object, located on several 2D parcels	

1.2. Are ambulatory ⁸ boundaries permitted?	Theoretically they are, because 3D parcels are broken at surface parcel boundaries. Theoretically the limit of a unit at ground level may be bounded by a physical (ambulatory) feature.	Theoretically they are, because the database representation may become invalid when situations have been like that (i.e. in conflict what is registered) for many years.	Yes	Yes
1.3. Is it allowed to have 3D parcels not related to physical constructs or objects?" (e.g. airspace, subsurface volumes)	Yes.	Normally the rights to establish 3D parcels (apartment rights; right of superficies; right of long lease) do refer to constructions. But this is not a restriction.	No	No
1.4. Are disconnected parts of a single 3D parcel allowed?	Yes.	No (also not in 2D).	Yes	Yes
1.5. Limitation – e.g. must the 3D parcel be described by a boundary	Anything is permitted as long as it can be described unambiguously and an	No. Apartment unit boundaries	Boundaries, as a rule, are described by elements and characteristics of the	

⁸ 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.

<p>definition?</p>	<p>isometric drawing supplied.</p> <p>Unit boundaries are generally described as Floors, Walls and Ceilings. Other subsidiaries such as car parks need dimensions or reference to physical objects.</p>	<p>are generally described as Floors, Walls and Ceilings. Other subsidiaries such as car parks need dimensions or reference to physical objects. It is possible to show which volume is affected with the right by indicating boundaries on a drawing added to the deed registered in the public registers. But no guidelines exist for these drawings. In case of apartments it is mandatory to register in the public registers a drawing indicating the boundaries of the apartment units. These drawings are made in 2D (for each floor level), and therefore do not give any 3D information on the dimension of the units.</p>	<p>structure of the respective construction or premises. Description of boundaries of objects, that are not constructions or premises, is based on measurements, for example by coordinates.</p>	
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1.6. Are curved surfaces to bound the 3D parcels allowed?	Yes.	Yes. As no legal requirements exist nor guidelines are given; this is allowed. Currently practiced when the constructions have these types of shapes.	Yes	Yes
1.7. Must the curved surfaces (if allowed) be cylindrical sections, or any other constraint?	No. 2D boundaries can be described by radius etc.	No. No restrictions.	No	No
1.8. Any other constraints – e.g. all surfaces must be horizontal or vertical?	No.	No.	No	No
1.9. Is there generic legislation (law and/or regulations) for 3D descriptions of parcels? If so please, mention law and article(s).		No.	No	
1.10. Is the legal text available in original language?			No	No
1.11. Is the legal text (relevant part) available in English translation?	N/A.		No	No

1.12. Do you have example descriptions of typical 3D parcels; either 'prototype' or 'operational'?	Yes (Stoter and van Oosterom 2006), (Thompson 2007), (Lemmen, Van Oosterom et al. 2010).		Not yet	Yes
1.13. Is there a formal model for the 3D parcels (UML style); e.g. based on ISO TC211 series?	No.	No.	No	
1.14. Are natural resources (groundwater, mining rights) considered as 3D parcels?	No.	No.	No	No
1.15. Are polluted areas considered as 3D parcels (as legal restrictions are associated to these spaces: above and below surface)?	No.	No.	No	No
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,...)		No.	Yes – regarding restrictions	Yes

1.17. Any other geometric issues?			No	
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2. Infrastructure/utility networks

This refers to the situation where an infrastructure network is considered to be defined within the cadastre. 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.

	Australia/Queensland 2010	The Netherlands 2010	Your Jurisdiction 2010	Your Jurisdiction 2014
2.1. Do you register network parcels? (e.g. subterranean conduit networks)	Yes.	No. However we do register the ownership of networks, and therefore the networks itself as legal objects. The property rights in land (e.g. right of superficies pr easements) are still related to the surface parcels that overlap with the network.	It is possible, but in practice – it is not done. Rights on immovable objects and restrictions (encumbrances) of rights (servitudes) are registered.	Possible
2.2. If so, can the network structure be traced in the database(s)?	No (The networks are broken at the surface parcel, and may not be defined below roads etc.)	Yes. As physical objects.	Yes, but not linked to the land parcel	Yes, linked to the land parcel
2.3. Does the jurisdiction have private	Yes (Overhead cable	Yes.	Yes	Yes

networks? If so please, mention law and article(s).	networks). Privately constructed road tunnels fall into this category.			
2.4. If so, are they registered as 3D property parcels?	Yes.	Yes (see 2.1).	Yes – there are several unique objects (Moscow metro, Moscow-Peterborough railroad)	Possible
2.5. Is the legal text available in original language? If so, give references to relevant document(s).		Yes (regulation).	No	
2.6. Is the legal text (relevant part) available in English translation?		No.	No	
2.7. Do you have example descriptions of typical 3D parcels for networks; either 'prototype' or 'operational'?		Yes.	No	
2.8. If the network (legal) objects break at the surface parcel, how do you deal with intersecting networks or vertically parallel networks?	The DCDB does not record network objects as a network.		Objects are registered independently from each other, and the land parcel has encumbrances	Objects are registered independently from each other, and the land parcel has encumbrances
2.9. Any other geometric issues?		Networks are registered as lines.	Networks are registered as lines.	Networks are registered as lines.

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".

	Australia/Queensland 2010	The Netherlands 2010	Your Jurisdiction 2010	Your Jurisdiction 2014
3.1. Do you register 3D construction/building units?	Yes.	Yes.	Yes (not in 3D format)	Yes (not in 3D format)
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 common are building units.	Most apartment units.	4 types: buildings, constructions, premises, objects under construction	4 types: buildings, constructions, premises, objects under construction
3.3. Does the jurisdiction have construction/building units? If so please, mention law and article(s).		Dutch Civil Code, Book 5, Article 106, Cadastre Act, Article 20.	Yes. Federal Law of 24.07.2007 No. 221-ФЗ «On the State Real Estate Cadastre», (Art.1, Art.7)	Yes. Federal Law of 24.07.2007 No. 221-ФЗ «On the State Real Estate Cadastre», (Art.1, Art.7)

			Federal Law of 21.07.1997 No. 122-ФЗ « On state registration of rights to immovable property and transactions involving such property » (Art.1) Housing Code of the Russian Federation (Art.16)	Federal Law of 21.07.1997 No. 122-ФЗ « On state registration of rights to immovable property and transactions involving such property » (Art.1) Housing Code of the Russian Federation (Art.16)
3.4. Is the legal text available in original language?		Yes.	Yes	Yes
3.5. Is the legal text (relevant part) available in English translation?	N/A.		No	No
3.6. Do you have example descriptions of typical 3D parcels; either 'prototype' or 'operational'?	Yes – these are stored in the DCDB, but with no graphical extent (just the unit number and the surface area of each unit).	Prototype (they are not registered in 3D).	No	Yes
3.7. What would be typical 3D boundaries in an apartment complex: middle of the wall and floor/ceiling, or	Typically the unit is defined to the middle of the walls/ceilings.	In general the unit boundaries will be defined in the deed to the middle	No 3D registration. Boundaries can be according to internal	Possible

walls, floors/ceiling as neutral/shared 3D space?		of the walls/ceilings.	measures of walls, ceilings, floors.	
3.8. Is common property inside the building registered? If so, how?	Yes. They are registered as community titles under the Community Management System (CMS) and usually is shown as Lot 0.		Yes. As common ownership of common property. (Housing Code)	Yes. As common ownership of common property. (Housing Code)
3.9. Who owns the common property inside the building?	Usually the body corporate.		The owners of individual premises	The owners of individual premises
3.10. Who owns the land on which the apartment is built?	Usually the body corporate.		The owners of individual premises	The owners of individual premises
3.11. Any other geometric issues?		Apartment units are related to one or several surface parcels.	No	

4. X/Y Coordinates

	Australia/Queensland 2010	The Netherlands 2010	Your Jurisdiction 2010	Your Jurisdiction 2014
4.1. Do the plans of survey guarantee X/Y coordinates? (and are they relative or in an absolute spatial reference system?)	No.	Yes of 2D parcels.	Yes, for 2D parcels, in local coordinate system	Yes, for 2D parcels, in local coordinate system
4.2. Are the cadastral database coordinates authoritative?	No. The DCDB cadastral point positions at any time are the best estimate based on survey information and control point data. As such, point positions will change with time.	Yes.	Yes, but there are cases of incorrectly defined coordinates for land parcels, registered earlier. The correction is made upon request by the interested party.	Yes, but there are cases of incorrectly defined coordinates for land parcels, registered earlier. The correction is made upon request by the interested party.
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 – “Building Unit Plans”. Units usually defined by centre of floors, walls and ceilings.	Yes. Apartment units; building units established with right of superficies.	For land parcels – by coordinates, for new construction objects – without coordinates	For land parcels – by coordinates, for new construction objects – without coordinates

4.5. What is the spatial reference system for X/Y Coordinates?			Local rectangular coordinate system	Local rectangular coordinate system
4.6. Any other X/Y coordinate issues?				

5. Z Coordinates/height representation

	Australia/Queensland 2010	The Netherlands 2010	Your Jurisdiction 2010	Your Jurisdiction 2014
5.1. Are the z coordinates of 3D parcels relative to local ground?	No. Z coordinates only used for volumetric plans or complex features. Most unit plans do not have z value as extent of units defined by the physical building.	No guidelines.	No, only 2D data	
5.2. Are z coordinates reduced to a standard datum (absolute)? If so, what is the spatial reference system for the Z coordinate?	Yes.		Not applicable at the moment.	Subject of study in the frame of the project on 3D cadastre in the RF
5.3. In principle possible to store both relative and absolute z coordinate?			No – if to use the software currently used in the RF cadastre	Subject of study in the frame of the project on 3D cadastre in the RF
5.4. Is the earth surface (height) explicitly stored (in the DCDB or other accessible register)?			Accuracy of 20m and worse – free access; higher accuracy – not free access. DTM is not	

			available for the whole territory of RF	
5.5. What is the source of elevation for the 2D surface parcel?	Surface elevations are not recorded in the DCDB.		Elevation of surface is not registered in the digital cadastral database.	Elevation of surface is not registered in the digital cadastral database.
5.6. Any other z coordinate issues?				

6. Temporal Issues

	Australia/Queensland 2010	The Netherlands	Your Jurisdiction 2010	Your Jurisdiction 2014
6.1. Are temporal limits part of the definition of a parcel (2D or 3D)?	No. All parcels are unlimited temporally. For example, a 1 week timeshare apartment is treated as a 1/50 share in the apartment. The registering authority does not specify which week of the year it applies to.	No.	No	No
6.2. Are moving parcels allowed?	No – apart from ambulatory boundaries. These are not represented as a curve in time.	No.	No – apart from ambulatory boundaries.	No – apart from ambulatory boundaries.
6.3. Are there any limitations on the range of temporal limits? (e.g. only on 3D apartments).	N/A.		No	No
6.4. Are there any attempt to integrate 3D space and temporal		No.	No	No

representations, into a single 4D space/time representation?				
6.5. In the case of tidal boundaries, what happens to the 3D ambulatory parcel if the 2D land parcel changes extent due to the movement of High Water Mark?	This is not determined yet.		It does not change. No regulatory documents.	It does not change
6.6. Any other temporal issues?			Temporary status of land parcel before the registration of rights (for land parcels – 2 years, for construction objects – 1 year)	

7. Rights, Restrictions and Responsibilities

	Australia/Queensland 2010	The Netherlands 2010	Your Jurisdiction 2010	Your Jurisdiction 2014
7.1. Range of RRR on 3D parcels.	Same as 2D although may involve responsibility for common property and ownership of subsidiaries such as car parks.	No specific rules.	No. No restrictions or special rules are set.	No. No restrictions or special rules are set
7.2. Are there any limitations on the range of rights? (e.g. subterranean parcels must be owned by Govt).	No.	No.	Yes	Yes
7.3. Any other RRR issues?	Now possible for a Unit complex to be part of a community title. Thus owners have shared responsibilities outside the unit land parcel.			

7.4. Are there RRRs that are only allowed in 3D (and not valid for 2D)	No.	No.	No	No
7.5. Is there specific legislation (laws, regulations) defining 3D RRR types; if so, provide details, e.g. references to documents/ articles.	Queensland Government. Land Title Act 1994, reprinted as in force on 16 May 2003.	No.	No	No
7.6. Can 3D sub-surface/above-surface parcel be owned by someone other than the person owning the land parcel?	Yes, this happens most often in Mining areas.		Yes, it can (for example under a lease contract)	Yes, it can
7.7. What applications do you foresee for 3D cadastre?	Ensuring unique definition of property rights, to serve complex property markets, 3D city models etc.		3D modelling in the field of urban development, registration of underground utilities, registration of multi-level road junctions, for fiscal purposes	

8. DCDB (The Cadastral Database)

	Australia/Queensland 2010	The Netherlands 2010	Your Jurisdiction 2010	Your Jurisdiction 2014
8.1. Does the DCDB contain representation of 3D parcels (in any form)?	Yes. (But not in all jurisdictions).	No. Attribute values of parcels may indicate a 3D situation (i.e. pollution; mining; right of ease; underground construction).	No	Depending on the outcomes of the project
8.2. If so, how are they represented (in the DCDB)?	As 2D polygons in a layer above (below) the base layer.	Always related to the 2D parcels and represented through the geometry of 2D parcels. Exceptions are the networks (line representations).	No	No
8.3. If so, how are they presented on cadastral "maps" (including screen presentations)?	As polygons is a contrasting colour to the base parcels.			
8.4. Are there possibilities to store geometry of 3D parcels in the DCDB?	No.	No.	No	

8.5. Is it possible to manage a 3D topological structure in the DCDB?	No.	No.	No	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?	No constraints are enforced in the DCDB between 3D objects and other 3D or 2D objects.	N/A.		
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,...)?	Only as a map with the presence of 3D parcels indicated in colour.	Not.		
8.8. What Spatial DBMS software do you use? Any 3D capabilities included and used?	Informix.	Oracle. No 3D used at the moment.	Oracle 10.2	
8.9. Do you have any validation rules for 3D representation in the database?	These are still being specified.		No	No
8.10. What (GIS/CAD) software is used for updating, editing, analysis, and visualization of the cadastral data? Any		Fingis (future Intergraph Geomedia). No 3D used at the	MapExtreme	

3D capabilities included and used?		moment.		
8.11. What web software is used for remote data access/distribution and visualization? Any 3D capabilities included and used?			ArcGIS Server	
8.12. Is your DCDB organised as Multi-Layers or Object Oriented or some other data model?	Object-oriented (but with layer as an attribute).		Object-oriented	
8.13. How do you query 3D objects in your DCDB?	As all other objects, (but with only the 2D footprint returned).		-	
8.14. Is it possible to query neighbourhood parcels to a 3D object, vertically as well as horizontally?	Yes.		No	
8.15. Any other DCDB issues?			No	

9. Plans of Survey (including field sketches)

	Australia/Queensland 2010	The Netherlands 2010	Your Jurisdiction 2010	Your Jurisdiction 2014
9.1. Do the survey plans carry 3D parcel representations?	Yes.	No, but in theory it would be possible.	No	Depending on the outcomes of the project
9.2. If so, how are they represented?	<p>As a tabulation of corner positions, associated with plan, and isometric views (on paper).</p> <p>Each floor is represented on a separate diagram. Heights (AHD) are given for corners of non horizontal surfaces.</p>	Fully depends on the surveyor.		
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.	<p>Yes.</p> <p>Queensland Government. Registrar of titles directions for the preparation of plans. Queensland, Australia, 2003.</p>	No.	No	Depending on the outcomes of the project

9.4. Is sketch level allowed (low geometric quality, but in principle enough to indicate the 3D object)?	Yes.	Yes.	No	Depending on the outcomes of the project
9.5. Is it possible to define a 3D parcel by referring to other 3D real world objects/ topography (and not specifying coordinates)?	Only in the case of a building unit plan.	Yes.	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....?	At present, on paper, but will be submitted in "LandGML".	As drawings registered in the public registers. Not on the cadastral map nor cadastral surveys.		
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)?	Visually at present.	No. Mostly relate to existing physical constructions or constructions to be built.		Possible
9.8. Do you have examples of (prototype or production) 3D survey plans available?	Yes – figures 15 and 16 (Lemmen, Van Oosterom et al. 2010).		In principle yes (see 2.4.)	
9.9. Are any reference objects visible	No.	No.	No	No

on the survey plan (e.g. real buildings, roads, that is 3D topography)?				
9.10. What form of 3D data acquisition is used (CAD designs, terrestrial surveying, sketches, stereo and/or oblique images, laser scanning,...)?			All listed forms can be used	All listed forms can be used
9.11. What software do you use for creating and processing survey plans? Any 3D capabilities included and used?				
9.12. Can 3D parcels be subdivided, consolidated or nullified?	Yes, they can even change vertical extents and the new extents are noted on the plans.		In principle yes	In principle yes
9.13. Is there any existing technical circular or directive to assist Surveyors in 3D data collection in the field?	Not exclusively. However, various documents exist on Preparation of Plans etc to assist Surveyors.		No	No
9.14. Any other survey plan issues?				

10. 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.

	Your Jurisdiction
10.1. Country (State, Province)	Russian Federation
10.2. Your name, function/position and your organization	Dr. Victor Stepanovich Kislov Deputy Head Federal Service for State Registration, Cadastre and Mapping (Rosreestr)
10.3. Contact details: address email, telephone	Federal Cadastral Centre "Zemlya" 11, Gusiatnikov pereulok, 101000 Moscow, Russia inter-pro@fccland.ru +7(495) 663-20-73
10.4. Other issues	

Lemmen, C., P. Van Oosterom, et al. (2010). The Modelling of Spatial Units (Parcels) in the Land Administration Domain Model (LADM). FIG Congress 2010, Sydney, Australia.

Stoter, J. and P. van Oosterom (2006). 3D Cadastre in an International Context. Boca Raton FL, Taylor & Francis.

Thompson, R. J. (2007). Towards a Rigorous Logic for Spatial Data Representation. PhD thesis, Delft University of Technology, Delft, The Netherlands, Netherlands Geodetic Commission.



5.4. 3D Cadastre Modelling in Russia G2G10/RF/9/1, more details on project results 1 and 2 (28 sept'10)

1. *Legal framework and organisation of 3D-cadastre data collection, storage and distribution in the Netherlands (and other countries) studied and comparison made with the Russian situation;*

- 1.1. To study legal framework for 3D-cadastre modelling in the Netherlands and other countries. To compare with the kindred Russian legal framework (consultations, the exchange of information about legislations of the Russian Federation, the Netherlands and other countries, a working visit of experts for drafting recommendations on the Russian legislation).

Result: Chapter in Report WP1: on legal framework for a 3D Cadastre in Russia, also compared to other countries

- 1.2. To study the organisation of 3D-cadastre, w.r.t. data collection, storage and distribution in the Netherlands and other countries: stakeholders, their interaction; the distribution of rights to information resources and the distribution of responsibilities for their management; types of services; the contents, validity, actuality and format of collected and delivered data; standards used for 3D-cadastre data generation, collection and delivering. To compare with the situation in Russia (reciprocal working visits of experts, the training of Russian specialists, consultations).

Result: Chapter in Report WP1: on the organisation of 3D-cadastre

Study tour for 8 staff and 5 days.

Training (comb 2.1)

- 1.3. To prepare a comparative overview on the situation in Russia, the Netherlands and other countries. To study the organisation in Russia of the current situation, for objects that might be included in the future 3D-cadastre (i.e. cases), w.r.t. data collection, storage and distribution. Identify the most important use cases and analyse these in higher detail.

Result: Chapter in Report on 3D-cadastre approach as envisaged by the project

2. *3D-cadastral model for data generation, storage and distribution developed*

- 2.1. To study technologies and technical solutions for the representation of 3D-cadastre information (a mechanism for the generation and delivery of this information) in Russia. To compare with international analogues. (a working visit of Russian specialists to the Netherlands, the training of Russian specialists). This concerns the conceptual model covering both the 3D spatial and legal administrative information. This model is crucial for the future registration (description of 3D parcels in exchange format) and data management (representation in DBMS of the 3D parcels). To document the full scope of the Russian 3D Cadastre, the UML use cases should be developed (Annex E already contains the initial use cases for the more limited prototype/pilot to be developed within scope of this project). In annex C of the Inception Report, 5 models for Russian 3D Cadastre are proposed, ranging from the 'Minimalistic 3D cadastre' to the 'Topological Legal 3D cadastre'. These should be further explored and based on the results of WP1 the most optional/ selected model must further be developed in a UML class diagram (based on existing standards).

Result: Chapter in Report WP2: on the basic concept 3D in Russia (conceptual model; UML use case diagram(s) and UML class diagram(s)).

Study tour for 8 staff and 5 days.



Training (comb 1.2)

- 2.2. To study how 3D is defined in the ISO 19152 Land Administration Domain Model (LADM) and how this can be fitted to the Russian requirements. The spatial profile(s) for the selected 3D Cadastre should be developed together with the legal profile for the Russian situation. At least the scoping and legal aspects as described in Annex C should be taken in consideration when developing this 3D Russian country profile of ISO 19152 LADM.

Result: Chapter in Report WP2: technical design of the conceptual model 3D cadastre in Russia based on an ISO LADM spatial profile

- 2.3. To study technologies and technical solutions for the description of 3D-cadasre objects and data distribution in the Netherlands and other countries. (a working visit of Russian specialists to the Netherlands, the training of Russian specialists). This task is focussing on the initial registration of the 3D cadastral objects (parcels and other Russian cadastral objects). The 3D spatial description is new w.r.t. the current situation. The format for the description of a 3D parcel (or unit) should be derived from the conceptual model of the 3D Cadastre (see 2.1 and 2.2 above) and transformed into the data transfer platform; could be a XML schema (e.g. a cadastral extension of CityGML) or alternative (such as Adobe's 3D pdf format), generated in a 3D editing program (CAD).

Result: Chapter in Report WP2: technical design exchange format for generation, registration (input), but also for distribution (output)

Study tour (optional not budgetted!)

- 2.4. To define 3D-cadastre objects in Russia. To formulate principles of 3D cadastre using international experience. Which types of real world situations will be modelled as 3D cadastral objects (see also results from 1.3) and what are the relevant characteristics these objects (which have to be captured, stored and disseminated): apartments, pipelines and cables, underground constructions or constructions above other constructions (house above road), spatial plans/restriction zones, mining rights, polluted areas, etc. Both their spatial and legal/administrative aspect should be covered and described in terms of the model in 2.1/2,2.

Result: Chapter in Report WP2: on the 3D objects

- 2.5. To develop models for selected 3D-cadastre objects (a working visit of Dutch experts, consultations). Transform the conceptual schema of 2.1/2.2 in a database storage schema; that is SQL DDL (data definition language) for the target database; e.g. Oracle spatial. Note that parts of this transformation may be automated in modern modelling tools (e.g. Enterprise Architect), but that specifically the spatial parts of the model do need additional manual labour to complete.

Result: Chapter in Report WP2: on 3D-models for DBMS storage

