3D registration of real property in Denmark

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Content and message

FACT:
- Real property and spatial legal rights in the physical world is in three dimensions !

HISTORY:
- Until today registration of properties has always been done in one dimension (text) or two dimensions (cadastral maps). Accessible technologies for describing and measuring registration and communication have been used through history.

Content and message

THE TECHNOLOGY-DRIVEN POSSIBILITIES:
- Facing three-dimensional digital technologies, it becomes still more interesting to discuss and investigate methods and needs for three-dimensionall description and registration of spatial legal objects.

THE PAPER:
- The paper in the procedings discusses the result of a case study on the spatial legal objects in Denmark trying to create transparency in the understanding of the three dimensions of real property and spatial legal objects. Finally, the need for 3D registration is discussed.

Introduction

- The growing interest for 3D cadastral registration is caused by a considerable increase of value of property, by increasing situations with property on top of each other - the number of tunnels, apartments, cables and pipelines, underground parking places and shopping malls have grown considerably the last 40 years - and by an upcoming 3D approach in other domains (3D GIS, 3D planning) which makes a 3D approach of cadastral registration technologically realisable.

- Dutch research was started to study the needs and to see if other countries than the Netherlands meet the same problems, a comparison case study was carried out on 3D situations and cadastral registration in Denmark.

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4 Registers of Property in Denmark

1) Cadastral register
   (Min. of Environment)
2) Land register /Land Book
   (Min. of Justice)
3) Building and Dwelling Register
   (Min. of Business and Economy)
4) Property Valuation Register
   (Min. of Taxation)

Cadastral register

- In the beginning a system supporting the collection of land taxes. Nowadays is to support an efficient land market, as well as to provide a basis for appropriate land management.

- The cadastral register consists of four elements:
  » a register of real properties (*ejendom*) and land parcels (see below)
  » a cadastral map (see below)
  » measurement sheets related to boundaries
  » register of control points used for cadastral surveys

- **The parcel and property register**
  information on parcels such as parcel identifier, area, area of road, area of protected forest, area of coast protection zone, area of dune protection zone, number of separate land units of which a parcel consists, share in common parcel, registration as protected forest, registration as coastal zones, polluted land parcel, land use. . Apartment units are not known in the cadastral system.

- **Cadastral map**
  Legal overview map that shows the registered boundaries of land parcels and roads.
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  Also other information such as other boundaries, t.ex.in case the stream is a boundary, road boundary, railway boundary, edge of lake, coastline, parish boundary) and areas of public restrictions which restrict owners to use the land freely (protected forest, dune protection zone, coast protection zone, polluted land parcel).

Land register

- The land registry is a register of rights in real properties and falls under the responsibility of the Ministry of Justice.
- It contains legal data like titles, name of landowners, mortgages and easements (servitudes).

- Since 2000, the land register is fully digitised although the legal documents are still only analogously available.
- The state guarantees the contents of the land register. The land registry is decentralised to the (100) local courts. The land register uses the identifications of real property established by the cadastre.

Building and Dwelling Register

- The municipalities (275 in total) are responsible for the updating of two real property registrations: the building and dwelling registration (BDR) and the valuation registration (SVUR). The Ministry of Economic and Business Affairs is responsible for BDR.
- Information on three levels of registration:
  - Property (related to buildings) that is the same property as registered in the cadastral system. The attributes maintained at property level are type of ownership, water supply system, sewage disposal system, etc.
  - Building. The main attributes maintained at building level are the purpose for which the building is used, accessibility from the street, number of dwellings, year of construction (rebuilding, extension), basement area, top story area, number of floors, etc.
  - Units. The main attributes maintained at unit level are the purpose of dwelling/unit, type of dwelling, area of dwelling (demarcated by outside boundary of walls), area used for living, area used for business, number of rooms, etc.
- A property (consisting of one or more land parcel(s)) may consist of one or several buildings; a building may be subdivided into units.
- New buildings and every renovation of a building has to be apporved by municipality, accompanied by drawings. An an archive containing detailed information on construction and renovations of every building is maintained.
- No spatial information.

Valuation register

- The municipality also maintains a sales and valuation register, to record valuation on single properties to assist authorities in calculating and collecting property valution for property taxes.
- The tax authorities use the sales and valuation register for calculation and collection of taxes.
- The valuation registration contains information concerning identification of the property (cadastral number and property number), land area of each parcel and all results of taxation. The valuation contains two parts: valuation of land and valuation of buildings. When a property is transferred, the value used for buying the property is entered into the valuation registration.
- The property number is the property number from the cadastral registration. However, in case of apartment units, the properties are not known as individual properties in the cadastral registration.
- Therefore self-owned apartment units get identifiers for property in the valuation register although they are not known as individual properties in the cadastral registration. These properties cannot be subdivided into buildings and units.

Cross-reference register (KKR)

- Originally the building and dwelling registration, the valuation registration and the cadastral registration (and the land registration) were created as separate registrations.

- To be able to link these separate registrations, the cross reference register was created in 1978.

- The cross reference register contains all key identifications and the unique cross-reference data between the building and dwelling register, the valuation register and the cadastral register by which it is possible to exchange data between the different registers.

- The register has no data contents. It only contains common keys as well as the relations between these keys. Beyond functioning as a property map the digital cadastral map can also be used as a key of access to the other property-related registers.

The logic property datamodel
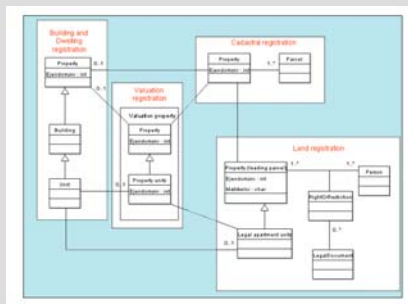
A street

3 similar buildings

Self-owned apartment units

Apartment complex owned by one person

Owned by private housing association

Cadastral Map

Cadastral Register

Matrikeloplysninger:		Matrikeloplysninger:		Matrikeloplysninger:	
Aalborg Bygrunde		Aalborg Bygrunde		Aalborg Bygrunde	
Ejerlav	2005051	Ejerlav	2005051	Ejerlav	2005051
Matr.nr.	61b	Matr.nr.	61p	Matr.nr.	61q
Beregning		Beregning		Beregning	
Lodantal	1	Lodantal	1	Lodantal	1
Areal	394 m²	Areal	309 m²	Areal	371 m²
Vejareal		Vejareal		Vejareal	
Jordforureningsforhold efter jordforureningsloven ikke oplyst		Jordforureningsforhold efter jordforureningsloven ikke oplyst		Jordforureningsforhold efter jordforureningsloven ikke oplyst	
Journalnr.	M1898/03297	Journalnr.	M1910/01404	Journalnr.	M1924/04065
Ændringsdato	01-jan-1900	Ændringsdato	01-jan-1900	Ændringsdato	20-feb-1902

Land Registry

Self-owned apartment units
19 properties

Apartment complex owned by one person
1 property

Owned by private housing association
1 property and information about owners

Building and Dwelling Register.

-At unit level, information on the individual units (apartment units) is maintained for all three cases. The following units (addresses) are known in the building and dwelling registration at Holbergsgade 2, 3 and 5:

1. Holbergsgade 2, 1 TH
2. Holbergsgade 2, 1 TV
3. Holbergsgade 2, 2 TH
4. Holbergsgade 2, 2 TV
5. Holbergsgade 2, 3 TH
6. Holbergsgade 2, 3 TV
7. Holbergsgade 2, 4 TH
8. Holbergsgade 2, 4 TV
9. Holbergsgade 2, ST TH
10. Holbergsgade 2, ST TV
11. Holbergsgade 3, 1 TH
12. Holbergsgade 3, 1 TV
13. Holbergsgade 3, 2 TH
14. Holbergsgade 3, 2 TV
15. Holbergsgade 3, 3 TH
16. Holbergsgade 3, 3 TV
17. Holbergsgade 3, KL
18. Holbergsgade 3, ST TH
19. Holbergsgade 3, ST TV
20. Holbergsgade 5, 1 TH
21. Holbergsgade 5, 1 TV
22. Holbergsgade 5, 2 TV
23. Holbergsgade 5, 2 TV
24. Holbergsgade 5, 3
25. Holbergsgade 5, 4 TH
26. Holbergsgade 5, 4 TV
27. Holbergsgade 5, KL
28. Holbergsgade 5, ST TH
29. Holbergsgade 5, ST TV

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3 similar buildings

	Self-owned apartment units (*Ejerlejlighedsejendom*)	Apartment complex owned by one person (*Udlejningsejendom*)	Owned by private housing association (*Privat Andelsboligforening*)
Cadastral parcel registration	Only ground parcel	Only ground parcel	Only ground parcel
Cadastral property registration	Only ground parcel(s)	Only ground parcel(s)	Only ground parcel(s)
Land registry	Individual apartment units	Ground parcel(s)	- Ground parcel(s) - Inf. on association
Building and dwelling registration	Individual apartment units	Individual apartment units	Individual apartment units
Valuation registration	Individual apartment units	Whole apartment complex	Whole apartment complex

A tunnel – two roads crossing

Cadaster Property Information

The Metro in Copenhagen
Registration in Land Registry

The tunnel is not considered as real property
Restictions for neighbourparcels and effected
parcels is registred as servitudes in the Land Registry

Water-pipeline

Køge, near Copenhagen.
-crossing several private parcels.
The legal status of this infrastructure object
has been registered by means of servitudes
established on the intersecting parcels.

In order to avoid that a part of the parcels,
which are not crossing with the pipeline, are
encumbered with servitudes, new parcel
boundaries were generated.
Although this solution makes it possible to
indicate the location of water-pipelines on the
cadastral map, the subdivision process leads
to very small parcels (figure 9).

A disadvantage is that the pattern of parcels is
dictated by infrastructure below the surface.

Conclusion 1(3)

- The legal instruments in Denmark are sufficient to establish rights needed in 3D.
- However, the main objective of (Danish) cadastral registration is to support an efficient land market, as well as to provide a basis for appropriate land management. Consequently, the cadastre and the land registry should not only secure rights on real properties but also provide insight in the legal status of real properties. Concerning 3D, the current Danish cadastre does not provide insight into the third dimension for a number of reasons.

- Since information on real estate is maintained in four different registrations, information on real properties in general is not straightforward accessible. Different registrations need to be queried to get insight in the factual situation.

"Theoretical and transparancy" problems - 2(3)

- The cadastre does not maintain:
  - information on different types of land use on one parcel (only the main use of a parcel is maintained)
  - information on rights, restrictions and subjects of rights and restrictions (with the exception of public restrictions)

- Information on condominium rights and other 3D spatial legal rights to apartment units is not maintained in the cadastral system.
  - The land registry only provides additional information in case of self-owned apartments. A visual overview of every floor of an apartment complex is available in the land registry, although the overviews are only analogously maintained in 2D and not geo-referenced. These drawings are maintained in titles and can therefore not be queried.

  - Information on self-owned apartment units as well as information on other types of apartment units (indirect ownership and rented apartment units) can be found in the building and dwelling registration, although this information does not include the person who uses (owns or rents) the apartment unit.

- The use of servitudes in case of infrastructure objects meets some complications.
  - The physical object is subdivided into as many pieces as there are surface parcels servitudes need to be established and spatially determined for all intersecting parcels

If 3D approach is considered 3(3)

- *Juridical level*: To be addressed how real property on top of each other can be established. At this moment condominium rights is the only juridical instrument to establish a horizontal division of real property.
- The registration of rights is only a matter of the land registry. On the other hand, the registration of real property is only a matter of the cadastre. Therefore, a first step is to bring the real right registration of the land registry and the cadastral real property registration together.

- *Political level*: To decide reorganisation on the Ministries involved and to confirm a common conceptual model for registrations.

- *Cadastral level:* Extending the cadastral map into 3D to be able to incorporate 3D information on rights and physical objects requires further study and decisions at the *cadastral* level, i.e. how to organise and implement a system that supports 3D information. 3D information on physical objects could be obtained from companies outside the cadastre.

- *Technical level* covering different aspects .(DBMS to maintain 3D data, 3D CAD to model 3D data, 3D GIS to analyse 3D data, Virtual Reality to visualise 3D data) need to be studied to be able to effectuate a 3D cadastre (or a 3D real property registration) in Denmark.