

## **3 Dimensional Property Rights in Denmark**

### **3D Property Design and Registration is Working – Visualization not**

**Esben Munk SØRENSEN, Denmark**

**Key words:** 3D Cadaster, Land Book, Property Right, Property Design, Visualization, Boundary

#### **SUMMARY**

In Denmark there is a widespread practice of forming properties as condominiums in complex buildings with several floors and where the formation of properties of buildings with their own cadastral parcel not is possible. Condominiums are a full property with a location, an individual owner, with possibilities for individual rights and restrictions and individual object for taxation and individual mortgage. Condominiums are registered as real estate in the land book and a building on a cadastral parcel can be divided into independent properties and also on top of each other and "intertwined" vertically. The registration procedure includes formation of an estate in the land register (1), maps of each property and its part the common property and those maps are drawn both as horizontal and vertical maps (2). The maps are registered in the document database. The registration process also includes a statute for the owners association (3) which regulates the management and the economy in the association. The documents for registration also include a list of the individual owner's part (x/100) and describe how the operation of the association takes places and decisions are made. The documents are registered in document database and determine the detailed building objects that are common property and which is individual property.

Condominium Act was adopted primarily aimed at housing. In practice, condominiums is used as a form of ownership by all building units approved in the Building and registered as buildings in the Building Act and the Act on Building registration. This article will examine an example of a new building for residential purposes (a), an old building which is divided to condominiums (b), a newly constructed building (Friis, Aalborg) which is used for hotel, shopping center and office space (c). Finally, a case with the conversion of factory building for business and entertainment industry and the formation of condominiums (d) being reviewed (Northern Power, Aalborg). Owner apartment system in Denmark is very well organized and is always used when properties are formed with horizontal ownership limits in the building. Visualization of condominiums as 3D property objects is difficult and requires a standard to determine the generality level of distribution between the individual property and common property.

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### 1. INTRODUCTION

Real property attached to the surface. The delineation of the property to the neighboring property is expressed with the property boundary. The real estate is a 3D object and exercising ownership is spatial and can relate to three dimensions.

The registration of the property takes place in cadaster and land register and a number of additional property and administrative records. The organization of the property registration varies widely from country to country. The themes of this property is the property registration **location** (*beliggenhed*), **ownership** (*besiddelse*), **buildings and use** (*bygning, benyttelse*), **restrictions** (*beskyttelse, bevaring*), **taxation** (*beskatning*), **mortgage** (*belåning*).

In agricultural society and the traditional urban areas cadastral map has recorded the vertical extension and boundaries of the property. Cadastral maps have thus expressed the spatial extent of the 3-dimensional real estate using the maps in 2 dimensions. The horizontal boundary of the right - the use of water and natural resources for development has been defined by jurisprudence and - usage or land use laws.

In modern cities, there has been a need for and possible to develop properties in several vertical horizontal layers. Such properties in the "multiple layers" must be registered as real estate and there are developed procedures to describe and record these properties and their rights even if the property is located on top of each other. These procedures for registration and formation properties by horizontal property boundaries are in Denmark anchored - for historical reasons - in various laws and not one single law.

The need for these 3 D properties in several layers - with horizontal property boundaries - has been and is markedly increased in the development of modern cities with higher population density - more homes and businesses in smaller areas - and increasingly complex infrastructure and service delivery. These needs, along with the CAD technology and the associated modeling possibilities in three dimensions has intensified the academic and scientific interest in developing a framework for a 3D cadaster that can both register and visualize property rights in several layers (Stoter et al, 2004).

## 2. PROPERTY DESIGN IN 3D LAYERS

A real property on land in Denmark is formed and created when it is registered in 4 property records. It must have a location in an area that is a land parcel number and registered in **(1) The Cadaster** (*Ministry of Environment*). The property must be created in **(2) The Land Book** (*Ministry of Justice*) and the property must be registered in **(3) Property Valuation Register** (*Ministry of Finance*) awarding a score value, and finally be assigned an official address, and recorded in **(4) Building and Housing Register** (*Ministry of Housing and Building and Rural Areas*).

3D properties in multiple layers can be created using procedures in 2 different Laws: The **Condominium-Law** permits a formation of condominiums in a new or fully restored building on one parcel **(1)**. These condominiums can be real properties if they meet building and fire safety requirements of the Building Act. A condominium is an independent real property with registration in the Land Book **(2)**, Property Valuation Register **(3)** and a unit address of Building and Housing Register **(4)**. Condominiums can be created for both residential and commercial purposes.

Condominiums are not registered in Cadaster and there is no notification in the Cadaster that tells whether the building on the parcel is divided into several property units. The Land Book registers a "mother property" on parcel number and the archive-file for this property all "The Condominium-maps" are stored. A "condo-map" is a map of each condominium with an indication of its position relative to others in the apartment block. In this archive also the statute of the owners association is kept. The statute regulates and the common property in the construction (building envelope and floors, stairways, water and heating) and common areas (access, parcel, parking area and the like).

The Land Registry Act (Land Book) allows the formation of a property "on top of another property" under a special procedure. The property is recorded in the land book as an independent property object with its own record. This property type is a "property on leased land" and can be a building or a technical plant. This procedure has been used on buildings in waterfront areas, windmills and other special constructions. The starting point has been a need to register the mortgage in the plant for use in securing loans / mortgage.

Using these procedures it is possible to create properties in "layers". Particularly condominium law has been used to create a very large number of properties in several layers for many different purposes. In the following practice, experience and extent of formation of properties in multiple layers will be discussed based on only condominium law.

When the concepts of "3D buildings" and "3D property" are used in this article it is about real estate in several horizontal layers and a situation where there are horizontal property boundaries between the individual property objects. This deselects the understanding that the common ownership of real property - without horizontal boundaries - also is a real estate object that can be described in 3 dimensions.

### 3. DESIGN AND REGISTRATION OM 3D PROPERTIES.

The Danish Condominium Law is from 1966 and not changed radically in relation to the registration, approval procedures and necessary documentation. When a building ore a physical structure fulfill the rules for formation the procedure can take place.

Formation of the condominiums requires that the building is finish to a level so the physical structures being the incoming property boundaries can be measured. The surveying of the properties has be done on the buildings “as built. It means that there must be base, outer walls and inner walls, floors and roof construction as well as, doors and windows, stairs and access. This "as built-measurement" must survey property boundaries of individual property units and thus form the basis for the production of maps of each apartment, which shows the extent and form of this well indicates the size of whole m2.

These Condominium maps include also plotting of the common areas inside the building owned by the owners association. This may also indicate how large these are in m2. “Condo-maps” also include a cross section of the current building, so that you can see how the individual property units are located in relation to each other in the buildings vertical levels.

Based on these maps distributional numbers are decided for the owners' association. Each apartment gets a distributional number corresponding to the size of the apartment in relation to the other apartments in the association. The distributional number is used in the “owners democracy to run the business. The distributional number indicates the number of votes in decisions and share of financial duties by payment of common expenses. Distributional numbers is determined typically by one of 2 methods. Either as a percentage compared to 100 or as "m2 size" relative to the total number of individually owned m2 meters in the owner association's individual share. There may also be defined secondary distributional numbers if the owners' association own special constructions - such as elevators or garages - which requires a different cost-sharing.

A licensed chartered surveyor prepares a notification and sends it to be registered in the Land Registry. The Notification must specify the use of the new property that are created and with which number the condominium number relate to the cadastral number of cadastral (1), and the distributional number and extent of common property. The notification shall also provide a statute of the owners 'association which regulates - economic, democratic, legal and physical-factually - the situation in the owners' association, including rules about the General Assembly and Executive.

When condominiums are formed a record - "the property page" - for each condominium in the Land Registry (2) are created and a record of the mother property. Each condominium has or will have an address (4) and a determination of the apartment's property valuation will be done and stored in the Property Valuation Register (3). The Mother Property is only recorded in the Land Registry (2), have no address and the valuation are decided to be the value of "0". In the file to the parent property are stored notification letter with distributional numbers, condominium maps and The Statute of the Owners Association.

When a condominium is sold and changes ownership a deed is signed: Attached to this deed is the notification letter, condominium map, as well as statutes and minutes of the last three years of general meetings.

#### **4. PRIMARILY FOR HOUSING - THE LAW FROM 1966**

The Condominium Law is decided in 1966 and was primarily for the purpose of forming condominiums in buildings with several apartments and thus where there were horizontal property boundaries. In and around these buildings it is necessary to organization the use and management of the common areas on the parcel and inside the building.

The legislation was primarily to the formation of property for residential purposes, but it has also been used to create property units for commercial purposes such as offices, shops and other service buildings as garage and technical installations.

In the period since 1966, condominium law proved useful for the formation of property units in three dimensions with many different purposes. It's made a quantitative calculation of the number of apartments on purpose to link records from the Building and Housing Register (4) with the land registry (2) (Sørensen, 2011).

In Denmark there are 300,000 condos - 3D properties - and most of these are located in the four largest cities. The vast majority of 3D properties formed for housing purposes. However, there are also condominiums registered recorded for other use. It is within a wide range of other uses: agriculture, social institutions, forestry, industrial manufacturing, energy and utilities, cinemas, entertainment and other business types.

#### **5. 3D PROPERTY-BOUNDARIES AND THE PROPERTY OBJECT.**

In buildings with condominiums it is important to highlight that there is a difference between property boundary and determining the location and extent of such common property in relation to operation and maintenance.

The common property consists of the building envelope (windows, doors from common areas, plinth, walls, floors and the constructions other structural elements and frames), and common access areas and parcel (mother property). Furthermore common property is also common installations and drainage common property of all "vertical tubes". The individual property comprises besides the right to use the apartment of interior space, floors, walls, ceilings, horizontal supply installations and heating in the apartment, including kitchen and bathroom.

The common property in relation to operation and maintenance may well be "behind the property boundary" and thus in the area which is established as a delineation of the individual property by property boundaries. This differs from traditional housing areas with one property on one parcel. The property boundaries in condominiums don't define the extension of the boundary objects – it may differ.

For 3 D properties the horizontal property boundaries between 2 estate objects are located in the community owns common property. The horizontal property boundary is located in the soffit as physical-design is part of the joint construction that allows the formation of real estate objects. In relation to liability and maintenance obligation it is the owners' association that "owns" the soffit as property object. All costs for maintenance and renovation of the soffit fall under the owners' association, although not marked by the drawing of parcel maps that there is no common property object.

Ownership of the physical space as soffit represent is shared between the two apartments and separate property boundary which is surveyed to be in the middle of the soffit. In other words we can say that although there are only registered and measured and drawn above the other buildings are still common property on both sides of the property boundary. This common property is not visualized on the map of apartments.

The same reasoning can be carried out by the walls inside the building where the vertical property boundary between 2 condos are measured - quite geometrically exact - to be the center of the common wall between two apartments: There will still be a "stranger" property object - the common owned wall positioned over property boundary between the two independent properties.

Defining a unique, single property boundary between the individual 3D properties is thus not possible because the individual property objects physically and legally are "interwoven" and only with difficulty and with a very high degree of detail can be described individually in proportion to their and you must therefore consciously work with a "generalized" property boundary as a basis for digitization.

## **6. MULTIFUNCTIONEL URBAN STRUCTURES AND 3D PROPERTIES**

Condos in Denmark are used in modern urban renewal and city building increasingly to organize property in 3 dimensions and to organize public-private partnership in the operation of complex structures. With the use of 3 D property objects is it possible to design complex byfunktionalitet and adapt ownership forms to the relevant property structures.

**Case 1:** A newly built multi-functional complex in Aalborg city center, Friis, consists of a hotel, a car park below ground and out under a public road or a shopping center with retail leases that go beyond public roads, a university department and a gym. The building complex is designed in terms of property as a condominium association, which consists of 5 apartments. and a joint board (Sørensen 2011).

**Case 2:** A municipally owned former power station located in a large building on the waterfront in Aalborg is transformed into a cultural and business center. The power plant includes restaurants, theaters, cinemas, universities, sports centers, sports clubs, gyms, etc.. Power plant's new property development, 20 flats of varying size and sub-areas of the individual flats intertwined on the building's 13 floor plans. Public access to the owner

association's common areas are secured with a registered easement allowing public access inside the building (Sørensen 2011).

Design of 3D properties in both buildings for housing and in more complex and multifunctional structures in the modern city is possible in Denmark and implemented in practice by advising on 3D property development is an integral part of the construction process and often takes place within the civil engineering work on new construction or byningsændringer initiated.

The Danish practice has developed into a functional relationship between contractors, surveyors and a very cooperative authority interaction with focus and considerable professional freedom to develop the properties in accordance with needs and investment opportunities.

It must therefore be concluded that "overall" Danish Property Registration system (1 to 4) is a de-facto functioning "3D Cadastre", where it is possible to create properties and register rights to and restrictions on these 3D properties and to design governmental issues as it passes to the local relationship.

## **7. THE PROBLEM IS VISUALIZATION**

The design of 3D buildings works in Denmark. The established procedures in accordance with current legislation makes it possible to form different 3D properties to suit site requirements and the planning ambitions and desires.

There are no known examples where ideas and plans to design and form condominiums in newly constructed building have not been possible due to the registrations procedures or legal barriers.

There is however a problem with the visualization of these 3D properties in a digital environment. There is no trouble visualizing ownership when it comes to 2D techniques and use of traditional digital cartographic methods for visualization. The existing data models for the representation of the object property in databases and 2D CAD environment exists and is the basis of the current modeling.

But the market now expects that real estate objects can be visualized and communicated in a 3D-oriented digital environment of wired network standard desktops and laptops smartphones and gadgets. Within the entertainment and military industries the users are familiar with 3D modeling and communication. It is nearby mainstream in the younger part of modern population and both private and professional users of property information expect that the 3D properties can be visualized and value added using current analysis and visualization technology.

To meet this need is difficult because 3D property objects formed in the legal environment in different definitions of the real estate. Property formation is rooted in different academic

environments ministerial and ministerial responsibility. The four property records, (1) The land register, (2) Things book, (3) Assessment Registry and (4) Building and Housing Register is rooted in different academic environments. Thus, different data models for presentation and recording of the object. This should be added to these data models are not prepared to work in 3D digital environments.

## **8. STEPS FORWARD TOWARDS AN EMPOWERED 3D CADASTRE**

The need to visualize 3D buildings is recognized and innovation should be made to promote opportunities. From theory and research side has identified three approaches (Bodum and Sørensen, 2009):

On the short term:

1. Notification of the “mother property” in the Cadaster to the actual land parcel number when the parcel is owned by a condominium association.
2. Develop the Localization Database for easements (GML format) so properties on leased land can be visualized as special easements in a web environment with digital cadastral maps.

On the medium-term:

3. Develop the Localization Database to be able to visualize easements in 3 dimensions and thus presentation across ministering property.
4. Identification and registration of Condominium Maps as easements with a height of about visualizing storeys.

Proposals on the long run:

5. Full 3D object-oriented modeling of Property Rights (1 +2) and Building Registry (4) units in a digital environment with common matched and accepted spatial model for real property (Cadaster, Land Registry, Valuation, Building Unit).

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## **BIOGRAPHICAL NOTES**

**Esben Munk Sørensen** is chartered surveyor, PhD and has been full professor at Aalborg University, Denmark since 2003. He has done research within rural development and spatial planning and published more than 100 articles and book chapters within these subjects. He has former been associate professor at Aalborg University (88-96) and research professor at Danish Research for Forest and Landscape (97-03). He has been editor-in chief for the Danish Journal for Mapping and Landuse from 1988-2003. Esben Munk Sørensen is experienced and used supervisor for master and PhD-students within Land Management and Geoinformation.

## **CONTACTS**

Esben Munk Sørensen  
Aalborg University  
Fibigerstræde 11  
DK-9220 Aalborg  
DENMARK  
Tel.: +45 9940 8437  
Fax: + 45 9815 6541  
E-mail: [ems@land.aau.dk](mailto:ems@land.aau.dk)  
Website: [www.land.aau.dk/~ems](http://www.land.aau.dk/~ems)

Esben Munk Sørensen

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