

# THE DANISH WAY

An international publication series  
on surveying, cadastre and  
land management in Denmark.

Published in  
Copenhagen, Denmark, by:

The Danish Association of  
Chartered Surveyors  
Lindevangs Allé 4  
DK-2000 Frederiksberg  
Denmark

Phone: +45 3886 1070  
Fax: +45 3886 0252  
E-mail: [ddl@ddl.org](mailto:ddl@ddl.org)  
Web-site: [www.ddl.org](http://www.ddl.org)

ISSN 1399-591X

PUBLICATION No.: 1

APRIL 2002

## Land Administration in Denmark

By Stig Enemark

The Danish Association of  
Chartered Surveyors

## **Introduction**

The modern cadastral system is primarily concerned with detailed information at the individual land parcel level. As such it should service the needs both of the individual and of the community at large. Benefits arise through its application to e.g.: guarantee of ownership and security of tenure and credit; facilitate efficient land transfers and land markets; management of assets; town and country planning; development and environmental control. In short, benefits arise through cadastral applications for land management in general.

Appropriate cadastral systems should provide the basic infrastructure for managing economic interest in land as well as supporting environmental and development interests. In this regard, the importance of the use of the cadastre to support land management has steadily increased. Historically the purpose of the Danish cadastre was to collect land taxes. Today the cadastre has a much broader objective, and it is accepted that when cadastral information is a part integrated information systems, it can improve the efficiency of the land transfer process as well as the overall land management process.

The last two decades has seen moves to establish a complete computerised cadastral information system to support these growing users. In short, the Danish cadastral system has met the challenge into the modern digital GIS-world.

## **The Danish Cadastral System**

The Danish cadastre, which derived from the results of the enclosure movement, was established in the year 1844. From the beginning the cadastre consisted of two parts; the cadastral register and the cadastral maps. Both of these components have been updated continually ever since.

As a result of the enclosure movement, the former feudalistic society was changed into a society based on private ownership to land. The necessary maps were surveyed by plane

table at a scale of 1:4,000. The resulting property framework from the enclosure movement formed the basis for the new cadastral maps. Each map normally includes a village and the associated cultivated areas. As a result the maps are "island maps" covering different areas and not based on any local or national control network.

The boundaries of the urban parcels in the villages were shown very approximately on the cadastral maps since these urban properties were not important for land valuation purposes. The provincial towns were surveyed separately based on a provision from 1863. The maps are established by traversed surveys, most of them in the scale of 1:800.

The parcels within each village area were numbered and recorded in the cadastral register showing parcel areas, parcel numbers, and the valuation of each property (being an aggregation of several parcels in the property) with the cadastral maps showing the location of the cadastral parcels. The present cadastral system is still based on these historic village areas which constitute the framework for the register and the cadastral maps.

Even if the primary purpose of the cadastre was to levy land taxes, the cadastral identification was also used to support the land ownership and land transfer system. Even though the cadastre was established in 1844, and it has been a requirement since 1810 that all subdivisions of land and all changes of boundaries had to be undertaken by private licensed surveyors. Simultaneously, in the year 1845, the Land Registry System was established by the local district courts for recording and protecting legal rights of ownership, mortgage, easements and leases for land.

The land tenure system was established as follows:

- \* the cadastral register identifies real properties - which might include more than one land parcel - by cadastral number(s) and area,
- \* the cadastral map shows all land parcels graphically,
- \* legal survey measurements are used to precisely identify all new parcel boundaries determined by cadastral surveys such as subdivision etc., and
- \* the Land Book identifies the legal rights based on the cadastral identification.

Over time the Danish cadastre has changed from being primarily a basis for land valuation to a legal cadastre supporting a land market. The cadastre is maintained by a state agency, while the cadastral surveys are carried out by the private licensed surveyors.

## **The process of the cadastral work**

When land is to be subdivided or property boundaries changed, both private or public landowner must apply by law to a private licensed surveyor for the necessary legal surveys and for the preparation of documents needed for submission of an application to the National Survey and Cadastre for updating the cadastre. The application must contain a copy of the cadastral map showing the alteration of the boundaries, measurement sheets

showing the new boundaries, documentation for legal rights, as well as documentation showing the approval of the future land use according to planning regulations and land use laws. The approval from the National Survey and Cadastre, showing the updated cadastral register and the updated cadastral map, is returned to the licensed surveyor. Simultaneously, the approval is forwarded to the municipality for updating of the property tax register, and to the local Land Registry Office for updating the Land Book. Deeds or mortgage may then be entered in to the land book based using the updated cadastral identification. The process of the cadastral work is controlled by the Act of Subdivision and Land Registration providing very detailed regulations.

To determine the existing boundaries the surveyor must compare the legal survey information (the cadastral map and the measurement sheets) to the actual state of conditions, placement of fences etc. If discrepancies are found the surveyor has to clear up the reason. Maybe the land owners have agreed for another boundary without taken care for updating the cadastre, or maybe the boundary in the field has been accepted by the landowner for more than 20 years which may lead to the establishment of a prescriptive right. In these cases, the licensed surveyor must involve the landowners, and if they cannot agree on the reason for the discrepancy the problem must be solved through a special legal procedure for boundary determination carried through by the licensed surveyor.

Boundaries are surveyed to a high accuracy in a local sense and corners are typically marked with iron pipes. Today most surveys are connected to control points and linked into the national geodetic network (since 1934). Within a few years the demands for a fully digitised cadastral process tends to be mandatory.

## **The computerised cadastral system**

The cadastral register was computerised during the period 1984-86. The register includes 2.5 mill parcels representing about 1,5 mill properties. The computerisation of the cadastral maps was completed by the end of 1997. The computerisation of the Land Book is ongoing and will be completed before the year 2000.

The basic function of the cadastral map will still be the same even if the maps are computerised. The benefits will be multipurpose use of the maps, in combination with other land data registers and maps, leading towards cadastral based GIS-systems. The concept of a modern digital cadastre therefore has to face the challenge of being an effective tool for the cadastral process of subdivision and land transfer, as well as being an efficient tool for land management and administration. The challenge will be to use the lowest acceptable standard for fulfilling these objectives in order to minimise the costs of computerisation.

The multipurpose use of the map requires in principle consistency with the topographic map. The demand for consistency refers to topographic maps at a scale of 1:1,000 in urban areas and 1:4,000 in rural areas. On the other hand, the historic legal identification of the boundaries must be kept intact even if the maps are computerised for multipurpose uses.

The analogue cadastral maps are island maps that are not related to the national grid. Over time they have become distorted due to shrinkage, redrawing and updating procedures. Just

digitising the analogue maps will not result in a multipurpose map.

Recognising these problems, and accepting that the cost of computerisation of the cadastral maps must be reasonable, this computerisation process is undertaken in two stages:

- \* State control points and cadastral surveys connected to the national grid form a "skeleton cadastral map. In urban areas about 40 % of the boundary points are entered this way and in rural areas about 20 %.
- \* The remaining parcel areas are inserted in the map by digitising the analogue cadastral map and fitting in these to "skeleton map" by transformation. Identified elements in the digital map are also used to control the transformation of the analogue map.

By using this approach the accuracy of the boundary co-ordinates may vary considerably, ranging from a few centimetres in some urban areas to several metres in some rural areas. Therefore, the digital cadastral may not totally compare to a digital topographic map. However, it must be considered that the nature and origin of those two kinds of maps are fundamentally different. It must be considered that the nature and origin of those two kinds of maps are fundamentally different.

It must also be noted that the digital cadastral map is a graphic map, not a numeric map. This means, that the co-ordinates for the boundary points only represent the boundary in the graphic map. The final determination of boundaries must be done according to the cadastral regulations. The parcel co-ordinates in the DCDB therefore may not be used for exact calculation of parcel areas and dimensions.

The procedures for updating the digital cadastral map or DCDB will be just opposite to the procedure for updating the analogue map. In the analogue map new boundaries were adjusted graphically to the position of existing mapped boundaries. In the digital cadastral map any new cadastral measurement will be used for adjusting the position of the existing boundaries. This will establish a process of continual improvement of the accuracy of the DCDB, - a dynamic element. It is however recognised that some problems may arise in practice when a decision has to be made on the area to be included in the adjustment. Furthermore, adjustment of existing boundaries in the DCDB may cause problems in those cases where other administrative boundaries or features were based on cadastral boundaries in a Geographical Information System. These problems of upgrading the DCDB will continue to be investigated so that sustainable solutions can be developed to suit all users.

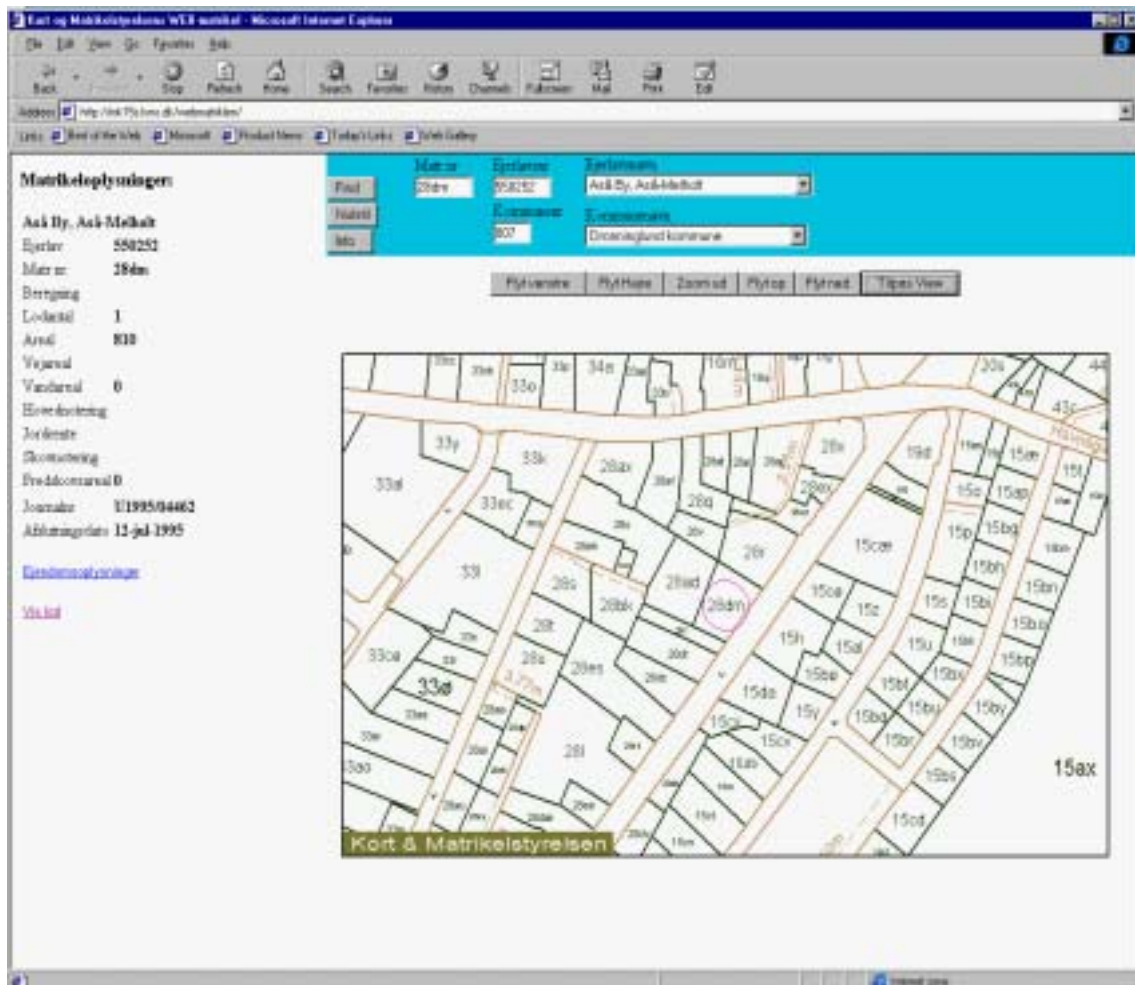
A general understanding of these problems related to the process of establishing and maintaining the digital cadastral map are essential for all users. In other words, the success of the digital cadastral map will depend on the degree of educated use of the map.



The cadastral process itself will also be improved. A concept for a digital format to be used for the exchange of information between the private licensed surveyors and the National Survey and Cadastre is currently being developed. This will allow for a fully digital cadastral process which was implemented by 1<sup>st</sup> of January 1999.

To establish a country-wide digital cadastral map has been a major challenge to the National Survey and Cadastre as well as to the surveying profession. However, the real challenge will be to make this advanced product understandable and useful to a wide range of users.

One way of doing this will be to introduce the product on the Internet and make it available just like any other kind of spatial information. Therefore, the cadastral register as well as the digital cadastral map is made available on the Internet by April 1998. Another way of doing it will be to educate the public about a number of applied uses of the digital cadastral map. In fact, this is already taking place. The era of the multipurpose cadastre is just around the corner.



The Danish cadastral information on the Internet. The textual information is presented on the left side of the screen by pointing on the relevant property (circled) in the map or by asking for this property by cadastral number or address. Zoom facilities etc. is available as well.

## **The Role of the Cadastre in Land Management**

Historically the purpose of establishing the cadastre was to collect land taxes based on the productivity of the soil. The cadastre is still used for this purpose but to a much smaller extent, since land tax is now based on the market value of the individual properties. Today the objective of the cadastre has a much broader objective, which is mainly to support an efficient land market, as well as a providing a basis for appropriate land management.

Today Denmark's cadastre is accepted as providing basic infrastructure for managing economic interests in land as well as supporting environmental and development interests (Enemark, 1992). The interaction between the cadastre and the Land Book operates very efficiently even though the two systems are maintained in different organisations.

The importance of the use of the cadastre to support land management has steadily increased. During the first half of this century the cadastral system served as a basis for managing the regulations of the Agricultural Holdings Act. During the second half of the century the cadastral identification has also become an important component for managing a number of environmental acts. In addition the cadastre provides the basic information to support many activities including the operation of town and country planning processes, construction planning and implementation, and utility administration.

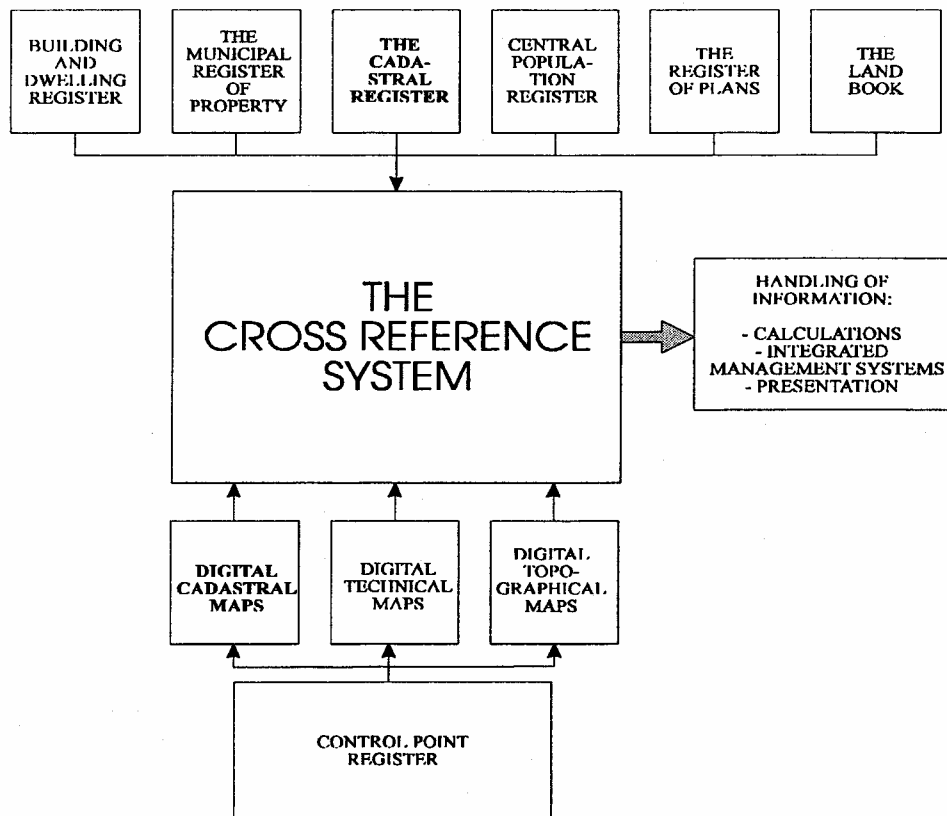
The last two decades has seen moves to establish a complete computerised cadastral information system to support these growing users. It is accepted that when cadastral information is part of integrated information systems, it can improve the efficiency of the land transfer process as well as the overall land management process. In short, the Danish cadastral system has met the challenge into the modern digital GIS-world.

## **The GIS concept**

The Danish concept for integrated land management is organised as a network of interactive subsystems containing the information that are used very often.

The automatic linkage between the subsystems is achieved by establishing the Cross Reference Register , which contains all key identifications within each subsystem (e.g. the parcel number, the building number, the address, etc.) and the cross-reference between these identifications. This means that it is possible to obtain all available information on a specific property or building by knowing only one of the keys. Furthermore, the identification-keys are linked into the relevant physical element represented in the digital maps, e.g. the parcel, the building, etc.

The main feature of this concept is that the daily running of the individual subsystems should, whenever possible, be decentralised and the maintenance should rely on an integration of the data collection within the administrative process. The responsibility for the vitalisation of the systems should rest with those (custodians), who need the data and therefore care for updating and applications as a part of their daily administrative routines.



*The Danish GIS concept for land and property data. The system includes a number of interactive subsystems linked together through the Cross Reference register*

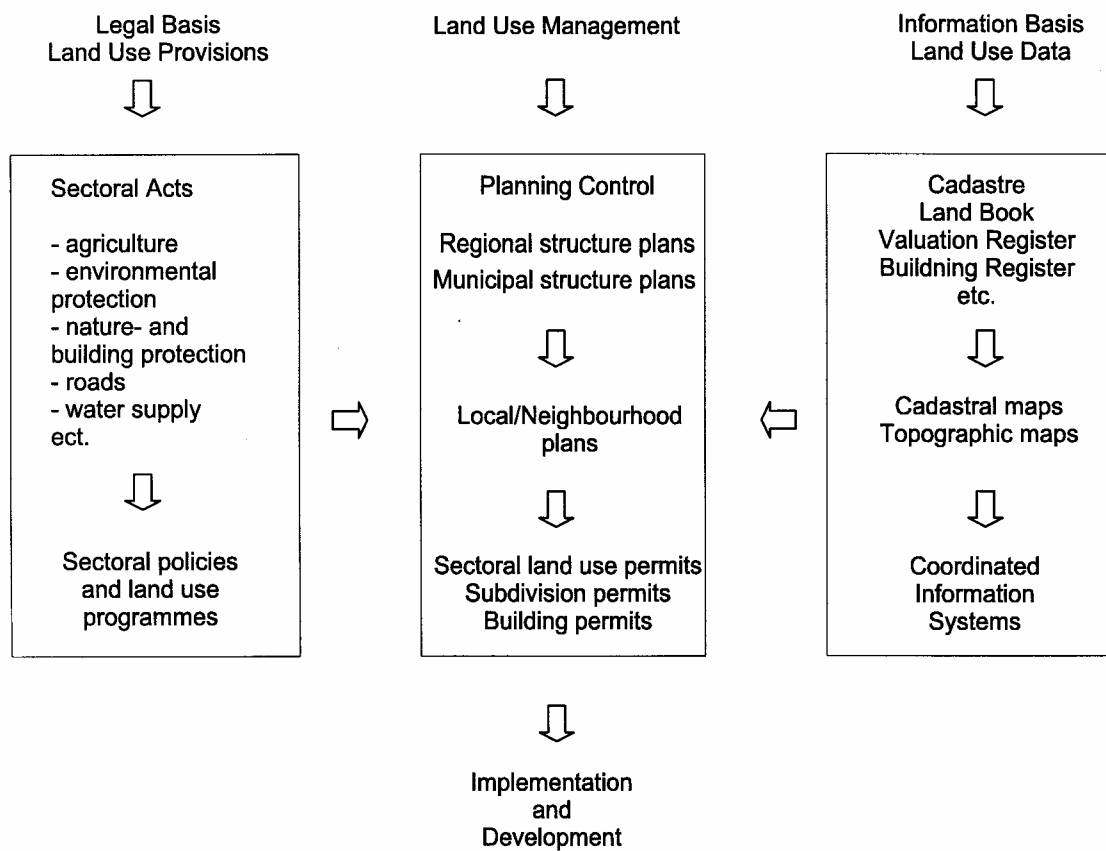
The digital cadastral system is designed for application into this GIS-concept, and the benefits for improving the process of land management should be obvious.

## **The Danish Approach to Land Management**

The system of Planning Control is based on the principle of framework control, in which plans must not contradict the planning decisions at higher levels. In general, the county councils carry out regional planning with emphasis on the regional infrastructure and the sectoral interests of the countryside, while the municipal councils are responsible for municipal planning with emphasis on the local issues and the function and development of the urban areas. The municipal councils are also responsible for the legally binding detailed planning of specific neighbourhood areas, and for granting of building permits which serves as the final control-plug in the system. The Minister for the Environment can influence the planning at regional and local levels through regulations, national planning directives and public information.

The system of Planning Control is supported by the sectoral Land Use Acts, such as agricultural regulation, environmental- and nature protection, road administration, water supply, etc.. These sectoral land-use provisions are administrated by the county and municipal authorities based on sectoral land use programmes which also form the basis for comprehensive planning at regional and local level.

Furthermore, the system of Planning Control is based on appropriate and updated Land Use Data Systems, such as the Cadastral Register, the Land Title Register, the Property Valuation Register, the Building and Dwelling Register, etc. These registers are organised to form a network of integrated subsystems that are connected to the cadastral and topographic maps.



*The Danish Concept for Land Use Management*

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## Authors Address:

Stig Enemark  
Reader in Land Management  
Department of Development and Planning  
Aalborg University, Fibigerstrede 11  
DK 9220 Aalborg, Denmark  
Phone +45 9635 8080 Fax +45 98 156541  
Email: [enemark@i4.auc.dk](mailto:enemark@i4.auc.dk)