

Interactive Graphic Software for Creating Cadastral Alterations

Arne GØTØ, Denmark

Key words: Cadastre, Updating system, GIS, Co-operation, Private chartered surveyor.

ABSTRACT

The process of change in cadastral registrations is under constant development. Throughout the 1980s, the cadastral register was changed from protocols to a digital register, and in the 1990s, the cadastral map was digitized. After this, the road was open for changing the whole process of updating into a digital one, which again opens the possibility for the parties engaged in the cadastral process of doing their case work digitally. The basis of the digital casework is the software MIA (Matrikulært Informations- og Ajourføringsystem: Cadastral Information and Updating System) which has been developed by the initiative of the National Survey and Cadastre, Denmark (Kort & Matrikelstyrelsen: KMS). With the introduction of MIA, the allocation of work between the private chartered surveyors and the public authorities will change, so that more work and greater responsibility will be placed in the private sector. An account of the development and functionality of MIA and its importance to the parties involved is given below, preceded by a short exposition of the cadastral system in Denmark.

CONTACT

Arne Gøtø, Chartered Land Surveyor
National Survey and Cadastre, Denmark
Rentemestervej 8
Copenhagen
DENMARK
Tel. + 45 35 87 56 59
Fax + 45 35 87 50 62
E-mail: ag@kms.dk
Web site: www.kms.dk

Interactive Graphic Software for Creating Cadastral Alterations

Arne GØTØ, Denmark

1. PURPOSE

The purpose of MIA has been to change the process whereby cadastral alterations are produced by the private chartered surveyors in their computer systems and subsequently sent analogically by post to the authorities charged with handling applications for such alterations in the cadastral registrations. The intention has been that in the future alterations will be made in such a way that they can be interchanged via the Internet and used digitally by the authorities at the receiving end without their having to key in the data anew.

2. THE DANISH CADASTRAL SYSTEM

The essential parts of the cadastral system in Denmark are handled partly by the KMS, partly by the 275 municipalities and 14 counties and partly by 110 private chartered surveying firms employing from 1 to 75 persons. The KMS is the national authority responsible for the Act of Parcelling Out. The municipalities and the counties are responsible for legislation pertaining to public and private roads, planning, environmental protection and buildings.

When private persons or public authorities wish to institute cadastral alterations, they must turn to a private chartered surveyor (See the dataflow in figure 1). He checks up if the alterations can go through and requisitions the relevant information about the property at the KMS. On the basis of this information and the wishes of the applicant, a survey is done, and the new boundary points are marked with iron posts. The surveyor must obtain permission for the projected alterations at the local authorities, of which the municipality is the most important. It may be necessary to get permission from several other authorities depending on the alterations in question and their location. When permission is obtained from the local authorities, the private chartered surveyor posts the documents in the case to the KMS, which checks that the necessary permissions are in place before updating the cadastral register and the cadastral map. When this is done, the change is communicated to the private chartered surveyor who can then inform his client. The KMS also informs the municipality who updates the property tax register. Finally, the KMS informs the Land Registry where property rights, easements and mortgages are registered.

3. DEVELOPMENT

3.1. Co-operation between chartered surveyors, municipalities and the KMS

The development has taken place in a close co-operation between the essential parties to the cadastral process who are the private chartered surveyors, the municipalities and the KMS. During the whole process of development, which was intensified in the autumn of 1997, the project has been followed by a management group with representatives from the private chartered surveyors, the municipalities, the KMS and the School of Chartered Surveying at Aalborg University. This group has set out the superior guidelines for the development.

Concurrently, a project group with representatives from the same organizations as the management group has worked with the technical problem solutions. During the whole process, the KMS has done the practical work.

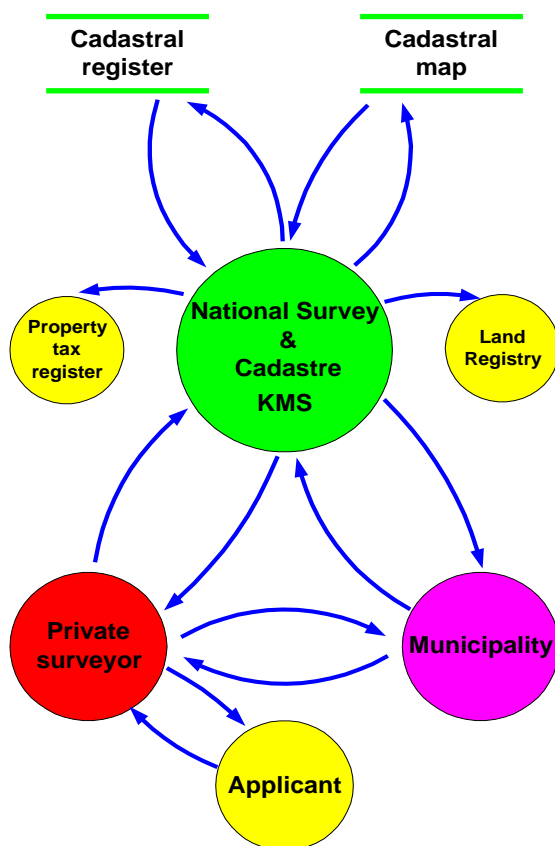


Figure 1. The dataflow between the parts in the cadastral process.

3.2. Public call for tenders for MIA

As MIA was to be developed on the basis of a public call for tenders, a specification of requirements was prepared. This was ready in January 1999, and tenders for the work of development were invited from all the EU countries. In April, the KMS received 7 offers for the development work with subsequent support for 3 years.

The given offers were ranged widely. The cheapest offer was for 1.258,000 Dkr (US\$ 152,500), and the costliest was for 13.983,000 Dkr (US\$ 1.697,000), both including 3 years support. To identify the best and cheapest offer, a thorough evaluation was done. All the firms were visited, some of them several times. On the basis of the answers given by the different firms to the questions asked, the final evaluation report was produced. This pointed unambiguously to the firm that had given the third highest offer of 5.600,000 Dkr (US\$ 680,000).

At the end of June 1999, a contract was signed with the firm chosen to carry through the development work. The firm in question was LEC A/S, one of the largest private computer

development firms in Denmark. The firm is a subsidiary company under the Maersk-Sealand shipping company. As one of the conditions of the tender had been expertise as regards cadastral matters, the chosen firm had entered into co-operation with one of the biggest Danish private chartered surveyor firms, Nellesmann and Bjørnkjær. Furthermore, the firm had co-operated with the Danish distributor of ESRI products, as MapObjects was to be the graphical platform for the software.

A management group was set up to monitor the co-operation between LEC and the KMS as regards adherence to the superior guidelines and the resolve of possible conflicts. Also, a contact group was established to follow up on the ongoing development.

3.3. Testing MIA

In the first months of 2000, the KMS did a test of the software that resulted in a temporary endorsement. In order to test the software in a working situation, the Private Chartered Surveyors' Association had made an arrangement with 6 private chartered surveyor firms. These had the MIA software installed and started the practical testing of MIA in September 2000. According to the contract with the development firm, the working test was scheduled to last for 6 months, so that it was finished by the end of March 2001. 6 months for testing may sound like a long time, but as it turned out, it was really too short a time which meant that not as many cases as desired were tested which again meant that not all types of cadastral changes were tested. As a result, the KMS had to arrange a supplementary test where they imitated the working processes of the private chartered surveyors, and in that way went through a number of cases.

3.4. Co-operation between the computer supplier (LEC) and the KMS

During the whole of the development phase, an intense dialogue has been going on between LEC and the KMS in order to clear up various points which were not sufficiently described in the claims specification. After delivery, the KMS established a database of the errors and inexpediencies found which had to be corrected, and of the changes which were found to be necessary during the testing period. By means of the database, to which both the chartered surveyors involved in the test period, the KMS and LEC had access, corrections could be placed in order of priority, their execution by LEC could be monitored, and it could be verified whether the KMS had supervised the corrections.

Concrete errors found should be corrected by LEC without a fee from the KMS. As regards the inexpediencies found, each individual case had to be assessed in order to clear up whether LEC could have avoided the introduction of the point in question, in which case the correction should be made without remuneration, or whether it could not have been foreseen, in which case the KMS had to pay for the correction. As regards the necessary changes, the point in question was whether it was a change in relation to the claims specification, in which case the KMS had to pay, or whether the claims specification had been clear on the wishes of the KMS.

The co-operation between LEC and the KMS has been good, but has still shown that it is important to have as detailed a claims specification as possible.

3.5. Production of the evaluation report

In order to get an unbiased evaluation of the course of the working test and the possibilities of implementing the MIA widely with the private chartered surveyors in Denmark, the KMS asked a private chartered surveyor firm (Birk and Boe I/S) and Aalborg University to produce an evaluation report. This report concluded that there was no doubt that MIA would be the tool of the future for effecting cadastral alterations, but at the same time it pointed to instances where MIA ought to be changed. Subsequently, an agreement has been made with the Private Chartered Surveyors' Association and the development firm about how these changes should be effected.

The evaluation shows that it is important to have the financial opportunity for changes in the software after some practical test. This in spite of a detailed specification of requirements.

4. THE PRINCIPLES OF MIA

4.1. The purpose of MIA

As the name MIA (Cadastral Information and Updating System) suggests, the software should be able to deliver updated data from cadastral registers and cadastral maps to the private chartered surveyors. Furthermore, the software should form the basis of the updating of the cadastral register and the cadastral maps in the KMS after the private chartered surveyors have put in their data for the suggested changes. The software should also be able to deliver data to the municipal authorities' processing of cases (Figure 2 shows the MIA - system).

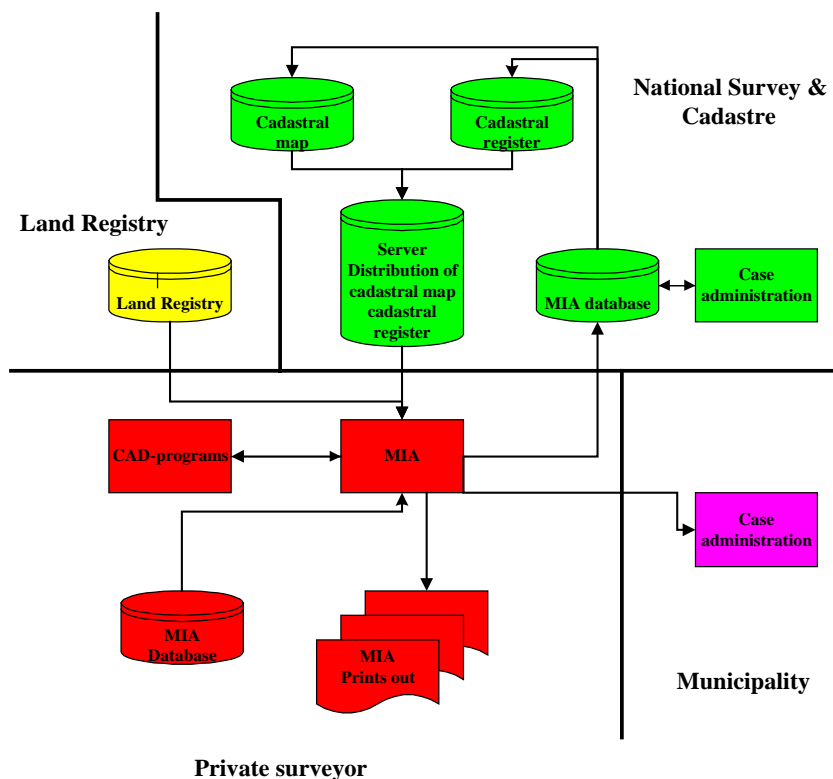


Fig 2. The MIA-system

4.2. Import of updated data from the KMS

The information part of MIA consists in the possibility of keying in or choosing from the KMS's web site the cadastral description of the properties forming part of the wished-for changes and subsequently to download the relevant data. Besides keying-in the cadastral description, the properties can also be pointed out graphically in the cadastral map. After the properties have been chosen, the vector data for the area in the cadastral map where the properties are situated together with the register data for the corresponding properties will be created and packed in a zip-file which can be downloaded to the chartered surveyor's computer. The web server where the data are situated is updated every night with the changes of the preceding day, so that the data fetched by the chartered surveyor are always up to date.

After having put in his data in MIA, the chartered surveyor can see the cadastral map and data from the cadastral register.

4.3. The working process

All data which are downloaded and subsequently created are kept in table form in an Access database. The graphical operations are developed on the basis of MapObjects.

The cadastral map cannot be manipulated by means of MIA. This is due to the fact that in Denmark there are firms which market CAD-software which are specially developed for revisions of the cadastral map. The KMS and the Private Chartered Surveyors' Association have agreed, during the whole process of development, that public money should not be used to develop something which would compete with the CAD-softwares being marketed by private firms.

As a result, MIA can create a file in the Danish exchange format (DSFL) which can be imported in the chartered surveyors' CAD-software. Here new boundaries are created and, if necessary, the position of existing boundaries is improved. Subsequently, a file is created in the exchange format, which is imported in MIA. By the input of this file in MIA, surfaces are created from the cadastral vector map, and the cadastral register's information about areas and use are linked to the surfaces.

Now information about the owners, their addresses, existing and future uses can be linked to the properties.

Subsequently, the creation of data which define the cadastral properties can start. In a dropdown list can be found all the types of cadastral change, which are legitimate according to the law of cadastral changes. When one type is selected, the new boundaries are pointed out in the map, and those areas are marked which are to be parcelled out or transferred to another property. The changes of the surfaces thus defined are stored in the Access database. When all changes in a case are defined, it is possible to print out surveys of the alterations in table form and to print out maps which show which alterations the chartered surveyor wants.

The special feature about MIA is that the desired changes are stored in tables from which it is possible to create documents with exactly the desired content.

4.4. Data for the municipalities and the KMS

Besides printing out documents, MIA can create the surveys as html-documents and the maps as raster files in the formats jpeg, gif or tiff. These documents can be sent with an e-mail to the local authorities charged with giving permission in accordance with the existing legislation. As the documents can be sent as html and jpeg, it is not necessary for the receiving authorities to have other software than a standard netbrowser.

When the case is sent to the KMS for registration, a zip-file is created with the contents of the current case in the Access database. The file is sent by e-mail to the KMS. Here the staff also have a version of MIA where the changes applied for can be seen. If the case is approved, MIA creates files, which can update the cadastral register and cadastral map.

5. CONTROLS

Throughout the process as many controls as possible have been inserted. This is to ensure that the data received by the KMS are as near error-free as possible. There are evaluations in all possible data fields. To a large degree, MIA will avoid that the chartered surveyor defines changes which are not allowed or which cannot be carried out. For instance, the chartered surveyor cannot apply for a joining of two properties, if they do not have the same owner. Nor is it possible to involve one cadastral number under another cadastral number, if the two cadastral numbers do not have a common boundary.

In the development there has been a great dilemma between standardization and flexibility. All parties in the project have agreed to a highed standardization, but primary the private surveyors have felt the higher standardization as a recuction in the flexibility.

6. IMPLEMENTATION IN THE CHARTERED SURVEYOR FIRMS

6.1. The start at the chartered surveyors

In the above-mentioned working test, 7 chartered surveyor firms took part. When it finished, many other firms were interested in beginning to use MIA, but only 7 firms were selected with the intention of getting greater experience before a general distribution. Before they started, the staff of the firms attended a two-day course in the use of MIA. The courses were offered by an educational committee under the Danish Chartered Surveyors' Association and paid for by the participants.

In spite of the fact that the chartered surveyor firms who have adopted MIA have done so voluntarily, it has proved difficult for them to get the case work going with MIA.

This is probably because an extra effort is needed to start something new. So if time has been short, the chartered surveyor firms have kept doing their casework in the old well-established way. Some firms have chosen to start with only one employee being taught the use of MIA, while other firms have chosen to have several of their employees learn the use of MIA. It seems that the private firms must make a greater effort to change the attitude to doing casework in a new way. It has turned out, though, that the firms who have got off to a good start are pleased with their progress and are of the opinion that time has been saved by using MIA in their work.

6.2. Standardization

The introduction of MIA also involves a high degree of standardization. The data that can be presented on the screen will naturally be uniform for all chartered surveyors, but also the printouts coming from MIA will be uniform. This is expected to be an advantage for the authorities that have to handle the cases, primarily the municipalities and the KMS.

Some chartered surveyor firms have been of the opinion that the documents printed out from MIA have an inferior lay-out to the documents which can be printed out from their own applications in the existing CAD-software. This is probably correct, but from the KMS point of view the documents from MIA include the necessary cadastral data.

6.3. Supplementary module developed by the Chartered Surveyors' Association

Concurrent with the development of MIA, the Chartered Surveyors' Association has developed a module for MIA. On the basis of property information in MIA, this can download data concerning owners, mortgages and easements from the Land Registry as well as data concerning addresses and property evaluations from the municipalities' property and evaluation register. Furthermore, on the basis of the definition of the individual types of cadastral changes in MIA, the module can create a list of the documentation it takes to get the desired changes registered. In the module there are links to those legal paragraphs in which the demand for the documentation in question is mentioned.

7. IMPLEMENTATION IN THE MUNICIPALITIES

7.1. Lack of experience in the municipalities

As mentioned above, it is not necessary to install specific applications in the municipalities in order to receive, open and print out the digital documents which can be created in MIA and sent by e-mail to the municipalities. As yet, work with the MIA documents in the municipalities has not benefited by much experience. Only a few municipalities have tried to use the possibilities inherent in the cadastral documents being available in digital form.

7.2. Experiences from Herning Municipality

One municipality in particular (Herning) has worked at introducing digital case work in cadastral cases.

Here all digital cadastral documents received from the chartered surveyors are placed on a central server. The different departments are then notified over the Intranet that a case has been received and must be dealt with. All departments can open the documents at the same time and deal with the case in accordance with that particular area of law that the department is charged with. By using this method, the municipality has been able to quicken the work process significantly. The use of resources for case work, however, has not yet been reduced.

7.3. New problems

The introduction of digital case work opens up other problems than the purely technological ones. Is it possible for municipal case workers to do their work solely by having digital data on a screen and totally avoid paper work on their desks? Are the pc-screens of sufficient quality to make it bearable to do all case work on the screen?

These problems must be solved in the near future, for there is no doubt that in the future, the possibility of doing digital case work must be open.

8. IMPLEMENTATION IN THE NATIONAL SURVEY AND CADASTRE

8.1. Technical conditions

Surprisingly, the place where the implementation has given the greatest problems is in the KMS. This is probably due to several different causes.

In the KMS the cases received from the chartered surveyors are treated under five different districts which each represents one fifth of the country. At the start of the working test, one of the staff was appointed for each district to handle the cases which were done in MIA by the chartered surveyors.

One of the causes of the problems in the KMS has been technical problems with input of data from MIA to the systems charged with updating the cadastral register and the cadastral map. These problems have been the cause of great irritation for the people who have been chosen to treat the MIA cases. The irritation has probably been heightened by a feeling that they have not to a sufficient degree been made parties to the development from the start. It is important in such projects that the collaborators are motivated for the introduction of new technology. It is also important that it is clear from the beginning, what is to be expected from the new technology. When unexpected situations arise, the collaborator must be able to assess whether the unexpected situation is due to faulty case work by the private chartered surveyor, to an error in MIA, or whether it is an acceptable situation which has been agreed between the chartered surveyors and the KMS. A correct assessment here will make it possible to get on faster with changes in the case work or changes in the MIA software.

8.2. Staff conditions

A probable contribution to a certain, quite natural scepticism on behalf of the staff might be the fear of losing jobs, when the cuts in the case work which are expected with the introduction of MIA materialize. And this despite the assurance by the management of the KMS that MIA is not expected to be the cause of lay-offs.

Great support from management is, incidentally, an unconditional requirement for a successful implementation of new technological systems. This has been so at the introduction of MIA in the KMS. The management has felt from the start that MIA is a necessary step on the way to introducing digital casework in the cadastral area.

9. FINANCING

In connection with the development, the KMS has at first paid the basic costs to the systems development firm LEC. After delivery of the software in the first version, there has been a need of several changes which have also been paid for by the KMS. Furthermore, the KMS has paid the labour costs of the staff in the KMS who have worked with the drawing up of claims specifications, the subsequent follow-ups and the instruction of new users.

Part of the cost of establishing MIA is included in the fee paid by the private chartered surveyors for registering cadastral changes in the KMS, so that even if they do not contribute directly to the cost of the software, they have shared in the financing through the fee.

The chartered surveyors do not pay for the data which are downloaded to the surveyor from the cadastral register and the cadastral map in the KMS. The chartered surveyors' payment for the use of data appears from an agreement between the Chartered Surveyors' Association and the KMS.

10. DISTRIBUTION OF MIA

The KMS expects that the savings inherent in the use of MIA by the private chartered surveyors will be so great that they will sign up voluntarily for the use of MIA, when it is finally released. In an inquiry made by the KMS in the Spring of 2001 among the chartered surveyor firms, 75 % answered that they wanted to use MIA when it was fully developed. Therefore, there are great expectations for a rapid distribution of MIA, so that the expected savings by the chartered surveyors and the KMS can be quickly realised. Presently there are no plans for making the use of MIA obligatory for the chartered surveyors. However if KMS sometime find it suitable, it cannot be ruled out that the KMS will make the use of MIA obligatory at a time when only a few chartered surveyors are left who do not use it.

11. THE FUTURE

11.1. The future as regards the municipalities

The way MIA has been developed and tested, only three primary parties have been involved in the cadastral process: the private chartered surveyors, the municipalities and the KMS. In order for MIA to develop into a fully digital case work system, other parties must be involved, and the communication between chartered surveyor and municipality must be widened to include also the chartered surveyor's information to the municipality about the relationship between the desired cadastral changes and the areas of legislation for which the municipality is responsible. A group of representatives for the chartered surveyors, the municipalities and the KMS is currently looking into what information the chartered surveyor should pass on to the municipality. When this question is cleared up, it must be examined how this information can be passed on to the municipality in digital form in a system which will be named the Authority Treatment System.

11.2. The future as regards the counties, the state and others

The counties must also be involved in the digital case work effecting cadastral changes. In the cadastral process, the counties are responsible for the legislation pertaining to conservation, the superior road network, coastal protection, streams, agriculture etc. Finally, the national administrations responsible for the legislation pertaining to agriculture, harbours, woodlands etc. must also be involved.

11.3. The scope of MIA and the introduction of digital signatures

MIA is only developed to handle the principal documents in an application for registration of cadastral changes.

In such a case, there will also appear documents that are signed by the parties in the case, for instance the claimant in the case, the buyers of new properties, the sellers and the users. The users of neighbouring properties can also have signed documents regarding rights of way and the placement of boundaries. All such documents appear in analogue form. It is the intention, however, that these documents will become digital. As there is no prospect within the next few years of all citizens being able to turn over digital data, it is considered digitalizing these documents by scanning.

At the moment, while MIA is still being tested, the chartered surveyors, besides the digital case, also send a printout of the documents in the case to the KMS. It is, however, a situation that the KMS wishes to dispense with as quickly as possible. When this can happen depends partly on when a digital signature can be introduced which ensures who the sender is and whether the data are correct on reception. In Denmark, work is currently (December 2001) going on to establish a general agreement on digital signatures.

12. JOB ALLOCATION BETWEEN THE PRIVATE AND THE PUBLIC SPHERE

On the introduction of MIA, the allocation of work and responsibility between the private chartered surveyor and the public authorities will be changed.

The fact in itself of the case work being done in MIA removes the greater part of the task of transferring data changes to the cadastral register and the cadastral map from the KMS to the private chartered surveyor. Those evaluations which are incorporated into MIA should mean that part of the control which is administered by the KMS can be dispensed with. However, the KMS will still as the responsible authority exercise a certain control with the cases. Where until now the KMS has introduced the cadastral changes in the cadastral map, and in that connection considered how the cadastral map can be improved by map adjustment and map rectification, it will in the future be the chartered surveyor who transfers the data and considers how the map can be improved.

On introduction of the Authority Treatment System vis-à-vis the municipalities, the chartered surveyors will to a greater degree become obliged to do the necessary research to make clear whether the desired cadastral changes can be done in accordance with the existing legislation. The module developed by the Chartered Surveyors' Association will also provide an added quality security in the casework done by the chartered surveyor.

13. WHAT IS GAINED?

The development of MIA is regarded as a major step on the way to digital casework on cadastral changes. As digital casework is introduced in Denmark in more and more areas, it has become necessary to treat cadastral changes digitally as well. In connection with the introduction of digital casework, it is often necessary to revalue organization and working processes. This demands quite a few resources from the parties involved, which is why no immediate savings are obtained in introducing digital casework. There is no doubt, however, that the introduction of digital case work will lead to advantages in the longer run. It is expected that the casework can be done with fewer resources, and that easier access to digitally stored data will result. This is important internally in the organizations, but it also opens up for the possibility of supplying chartered surveyors, private citizens and other users with digital data over the Internet.