

# **The Multi-Purpose Cadastre: Experiences from the Automated Census Project in Norway**

**Gotfred RYGH, Norway**

**Key words:** Cadastre, Multiple use, Census, Technical, legal and institutional challenges.

## **ABSTRACT**

A milestone was reached last year when the infrastructure for an automated census was established as a part of the census 2001 project. The cadastral register (in Norway named the GAB system) together with the National Population register, are the basic elements in this infrastructure. Central issues are awarding addresses at apartments in multi-apartment buildings, technical issues related to improvement of the GAB system, the so-operation of various governmental agencies, legal issues and also the information strategy. This paper describes the background of the project, the goals and how it was undertaken. Through this project, the cadastre will not only serve the purpose of land administration, but it is also a vital element in the infrastructure the census and of population statistics.

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## **1. CHARACTERISTICS OF THE AUTOMATED CENSUS**

### **1.1 Introduction**

Every ten year there have been produced a national census in Norway since the first was undertaken in 1769, at a time when Norway was in union with Denmark. At the first time the population of Norway included a little more than 700 000 people, and 90% lived in rural areas. Since then, the population have increased to 4.5 million inhabitants, despite huge emigration to USA and Canada in the 19<sup>th</sup> and 20<sup>th</sup> century. Until present the methods have in general been the same; A form have been filled in by the household themselves, or by a civil servant. The data have been treated mostly by manual methods.

The data sets can be grouped in two parts:

- Data on persons
- Data on the state of the dwelling.

The key to both data sets are the addresses.

The form includes questions on who live on a specific address, their names, ages and sex. There are questions on the family structure, marriages, religious beliefs etc. Important information is given on the standard of living: Therefore the form also includes questions on the dwelling: location, size, number of rooms, age, heating, water supply or for instance if there are lifts in the apartment buildings.

By combining the information from the two groups, a census is produced.

### **2.2 Problems linked to the census production by manual methods**

Traditionally, a census is very resource demanding. It was calculated that the Norwegian census 2001, accomplished in the traditional way, would cost more than 130 mill NOK, which is equivalent to 16 mill US\$. The huge expenses have lead to cheaper methods in the last censuses at a cost of poorer quality. The overall goal is to reduce these costs.

Another important goal is having background census data that allows flexible use. A census reflects the situation at a specific date. There is also a problem that the census is carried out every 10<sup>th</sup> year. The results from the census are very much used for planning purposes at all levels; regional planning, planning purposes in the municipalities, school planning, etc. By the end of the period, the data are obsolete. On this background, there is a growing need for updated data and data that could be dissolved at multiple levels. The overall goal are geo-referenced background census data instantly updated.

To meet these problems, The Central Bureau of Statistics wanted to investigate the possibilities of establishing an infrastructure of automated census production. By the term Automated Census, we mean that the census are produced by the use of existing updated administrative registers. Thus the households will no longer need to fill in the forms as described above.

In Finland, the last three censuses have been done by using data from approximately 30 public registers.

In Norway it seemed obvious that the most appropriate would be using and elaborating the exiting national registers, the National population register and the GAB system.

## **2. SHORT DESCRIPTION OF THE GAB SYSTEM AND THE NATIONAL POPULATION REGISTERS**

### **2.1 The GAB system**

#### 2.1.1 General information

The Cadastral register in Norway is called the GAB system. Hereby shortened GAB. GAB was established during the 1980's. It contains basic information about parcels, buildings and addresses. GAB is an abbreviation of **G**round parcel, **A**ddress and **B**uilding register. All objects in Norway are registered. Physically GAB is run on a mainframe computer operated by a private computer company.

The register is defined in the Norwegian law on land sub-division, which is under revision. Norway Mapping Authority is given the responsibility of managing the system. The register is continuously updated by the municipalities, as result of land subdivisions, issuance of building permits and assignment of street addresses. The municipalities may choose to report by printed forms or by using online terminals. 80% of the municipalities are currently linked to the system through local terminals. Information regarding ownership to land is transferred daily from the Judicial Land Register where property transactions have to be registered.

The GAB register will be included in the new cadastre in Norway, which will, according to present plans, be released in January 2004. The Cadastre will integrate the cadastral map and register to a seamless and uniform system for the whole country.

#### 2.1.2 Data content

**The ground parcel** part of the register contains information about area, owner and owners residential address and also co-ordinates of one point of representation. Information about the border line of the parcels are to be found in the cadastral map database.

**The address** part of the register contains information about the address' location related to school district, constituency, basic statistical unit and postal code area. All addresses have co-ordinates. Important in this respect, is that only 50 % of the addresses are traditional addresses with street names ant house numbers. In rural areas, the parcel identifier is used as

a substitute for “address” in the register. This is functional for population registering and statistical purposes, but highly inadequate as navigation tool.

**The building** part of the register contains information about size of building, year of erection, kind of building and co-ordinates. The data of buildings erected after 1983 have high data quality and are complete, while the older buildings are registered with limited data. Every building covering a surface area bigger than 15m<sup>2</sup> is registered and have co-ordinates. It is registered data on flats in dwellings built after 1983, while older buildings have no data on flats. Inside a building with more than one flat, the flats are given e unique identifier, a flat number, along with data on the area of the flat in square meters, number of rooms and bathrooms etc.

There are established references between the G, A and B-parts of the register. One building can be related to many ground parcels and many addresses. One ground parcel can be related to many buildings and every building can have one or many addresses. One address can be related to one building, but to one or many ground parcels. In other words, we talk about a many to many relationship in the data model. It may look complicated, but this reflects the situation in the real world.

### 2.1.3 The most important users

The data are distributed by Norway Land Information, which is a state owned share holding company.

The most important users are the municipalities themselves, which in Norway generally are responsible for water supply, sewerage, physical planning, building permits, primary and secondary schools and social welfare. Other important users are banks and insurance companies, agriculture and forest agencies, tax authorities, Central Bureau of Statistics, and others.

Identifiers of the GAB system are in accordance with national standards and they are used as primary keys in others national and local databases. Thus the users may combine information from various sources for instance in GIS applications. The National Population Register uses the same address standard as the GAB register.

## **2.2 The Population Register – in short.**

### 2.2.1 General information

The National Population Register is a centralised database, which is administered by the Directorate for taxation. GAB and the Population Register use the same standard for the addresses, which means that the Population Register also uses the parcel identifier as address in rural areas.

### 2.2.2 Data content

The address is the primary key. To the addresses every person is registered with a unique 11-digit code, name, age, sex, family relationship and religious belief.

### 2.2.3 The most frequent use

The data were initially collected for taxation purposes, but are now spread through out the society. The data are used for planning purposes and very much used in quality enhancement in external registers. The named and living addresses on owner information in GAB are regularly washed against the Population Register.

## **3. THE PROJECT**

### **3.1 Project start**

The Norwegian government initiated the project when inviting the parliament to decide establishing an infrastructure for automated census by improving the GAB and the Population registers and link them more closely together.

The project cost were 75 mill NOK, which with today's exchange rate equals 8,3 mill US\$. The project started in January 1999, and should be finished by Oct. 2001.

### **3.2 Technical issues**

#### 3.2.1 Co-ordinating the addresses in the GAB and the Population Registers

In principle the addresses in GAB and the Population registers should be the same. This is of vital importance since the planned infrastructure is based on combining data from the two registers. But there have never been any established routines, that on a regular basis check and handle addresses in the GAB register, that do not occur in the Population Register and vice versa. In the first phase the addresses in the two registers were matched, mismatches were identified and corrected. The task was done mainly by the municipalities and the municipal branches of the population register. Initially the mismatch for the addresses in the country as a whole, were approximately 50 000 or 4 %. The number was reduced to almost 10 000 after some months of hard work. Since the registers not yet are linked electronically, it is believed that there is only with huge efforts, possible to further reduce the mismatch.

#### 3.2.2 Identify and award addresses to flats in multi-flat buildings

In multi-flat buildings every person and household must be related to a unique flat, which implies that there must be awarded addresses to every flat in these buildings. The first problem was to identify in which buildings were more than one flat. There were two sources: GAB and the Population Register.

In GAB every building was registered with a code, indicating kind of building. The code differ between single living house, apartment building, etc. In an ideal world this would have been sufficient. But there are always possibilities of errors, and the project had to take this into account.

In the population register, the persons located to an address are grouped in households, a fact that gave a possibility for cross-checking. The traditional family with father, mother and children form one household. Singles form a household on their own. Two people, not married, living on the same address form two households. On this background, it was assumed that if there is more than one household on one address, it indicates a possibility of more than one flat in the building.

Combining this information, helped identifying multi-flat buildings with a high degree of security.

As a result, more than 900 000 flats were awarded apartment addresses.

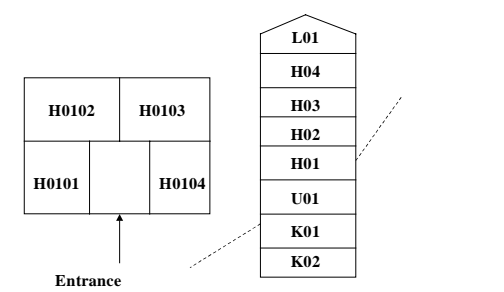


Figure 1. The principle of awarding apartment number:

The floors are given a unique identification as shown at the right on the figure above. The apartments at each floor are numbered according to the figure on the left.

### 3.2.3 Give a visible plate to the flats identified in 3.2.3

Every household should for the last time fill in the census forms. If they live in multi-apartment buildings they must have knowledge of the correct address of the single apartment. Since people continuously move from one dwelling to another, it was anticipated that people would not be able to fill in the forms with correct apartment address if the apartments were not physically marked with a visible apartment number.

It was the responsibility of the owner to mark the flats, alternatively it could have been done by the ones that resides in the flat, the tenants. The first option was chosen because then also flats not present in use would be marked properly.

Another issue was where to put the mark. A straightforward thought would be to put it at the front door. However, it was decided to slightly hide it – in the door frame, for the reasons of

personal integrity. Then it is put at the same place in every apartment, it is accessible for the dweller, and invisible for everyone else, which is the whole point.

However, the apartment addresses proved very useful for the fire brigades, the police, the ambulances etc. They saw, and still see this as a useful tool to locate the single apartment in huge dwelling complexes. For this purpose the marking must be placed at the front door of the apartment. It all ended in a compromise: The markings can on a voluntary basis be put at the front door. Where to put it is shown on figure 2 beneath.

The present tendency is that the marking will be put at the front door, a tendency that will be enhanced when the National Post Service takes the apartment addresses in use.

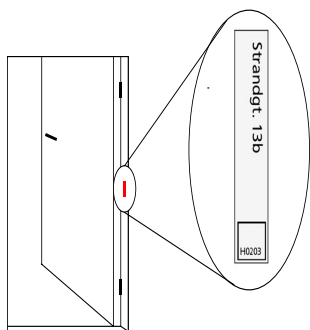


Figure 2. Illustrates where to put the mark for apartment addresses

#### 3.2.4 Link person (household) and flat and introduce apartment address in the Population Register

The introduction of apartment addresses could be a mayor challenge to those who administer the Population Register. At present, the households in multi-apartment houses have the same address, which could be the house number. The persons must be split and transferred to the correct apartment. The following method was chosen:

The households fill in the form with address and if necessary apartment address. To this address, data on the persons that constitutes the household are registered. The apartment address is found in the door frame. In this way, the form itself contains the necessary information that links persons to apartment via the address. The forms will be read optically, a file will be produced and the Population register will be properly updated. There are possibilities of errors, the persons may despite all information forget to fill in the correct apartment address, etc, but this situations are properly taken care of.

#### 3.2.5 Collect technical information on each flat and update the flat table in the GAB Register

Initially the GAB register does only have data on apartments built after 1983. The households give details on the apartments and also correct apartment address. This information will be read optically, and data will be transferred to the GAB register.

### 3.2.6 Establish joint routines for data maintenance.

Special attention must be made to establish adequate routines for data maintenance.

### **3.3 Legal issues**

A central issue was whether awarding addresses and collecting rather detailed information about the apartments, violates the personal integrity of the people and if it contradicts the Personal Data Act. The Data Inspectorate had no objections. In Sweden a similar project was stopped by the Parliament for these reasons. The Data Inspectorate put emphasis on the introduction of correct addresses, and the data quality improvement which is beneficial to the people. In short: Poor data quality is a threat to the personal integrity of the people. They had no objections to the issue of collecting detailed data about each apartment and store the data in a central database. The benefits for the society was stronger than a possible violation to the personal integrity.

Amendments had to be made in the law on Statistics, Law on Population registration and law on Land sub-division. Trough these laws - or by-laws - the people were enforced to fill in the formula, the municipalities were enforced to contribute according to the procedures and the legal basis was established to introduce apartment numbers both in GAB and the Population register. Further GAB could be supplemented with data from the census forms.

### **3.4 Project administration**

The project was defined as a sub-project in the Census-2001 project “owned” by the Central Bureau of Statistics.

Norwegian Mapping Authority had the overall responsibility and there was appointed a national project leader. In the counties, there were project leaders who coordinated the work in the municipalities.

### **3.5 Project economy**

The total costs of the project were 75 mill NOK, which were distributed among the various agencies according to this table:



<b>Central Bureau of Statistics</b>
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- Project management..... 4
- Information etc..... 5
- Total..... 9

<b>Norway Mapping Authority</b>
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- Project management..... 9
- Address marks..... 10
- Total..... 19

<b>The municipalities</b>
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- Awarding addresses etc.... 45

<b>The Directorate for Taxation</b>
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- Pop. Register impr.ment 2

### 3.6 The role of the municipalities

The project could not have been carried out without the assistance of the municipalities. This is due to the fact that they are the authorities of giving building permits and awarding addresses. They have the best possible archives, and local knowledge. In short, the municipalities had to

- Identify apartments in multi-apartment houses.
- Award apartment number
- Establish relations between apartment number and address
- Establish relations between apartment number and parcel identifier
- Check and correct code indicating kind of building
- Other quality controls and improvements
- Assist the public in questions related to where to put the address label.

Most municipalities saw the benefits from improved data quality, and would contribute at own expenses. But the requirements from the government was that the project should be carried out in every single municipality in the whole country. On this background a by-law was put into force, forcing the municipalities to contribute. However, the whip was supplemented with the carrot. The municipalities were given economic contribution for the work done. The contribution was based on key figures from a test project in small scale.

The formalities were that the municipalities had to sign a contract with the Norwegian Mapping Authority.

### 3.7 Information to the Public

An elaborated information strategy is a key success factor in this project. In addition to the municipalities, every citizen in the country is contacted, directly or indirectly. Emphasis were laid on having good and straightforward connections with the media. Information in general

about the census and especially about the issue of numbering apartments, were given to the public, through media like radio and television. It was news headlined in the national, regional and local newspapers. Press conferences, interviews and also the web sides proved very useful.

The location and the use of the apartment number is a critical issue. A free telephone number was put into effect two months before the day of the census. Five people were continuously answering any question related to the project. Also the municipalities had this function.

Special attention was paid to the immigrants. Shopping bags was distributed to the immigrant stores with textual information in Arabic, Vietnamese or any other language. And the director himself at the Central Bureau of Statistics was very visible when he at the day of the census, dressed in costumes from 1769, handed out information to the public in central Oslo; a venue which was broadcasted to the whole country.

Major efforts were made to avoid the project to be controversial on the political agenda. Parts of the public may have the opinion that there should be limitations in respect what kind of information related to persons should be included in public registers. The GAB register have since its beginning been easy accessible. Data are widely used by the municipalities, by the tax authorities, and also by the private sector like banks, insurance and construction companies.

In this case, questions could be made why it is necessary to include detailed data on each apartment – including the apartment address.

### **3.8 Data Maintenance**

The investments in this infrastructure would be wasted, if stable and secure routines for data maintenance were not established. It is decided that the municipalities shall:

- Award addresses at apartment level
- Report all changes in information about flats

The Population Register shall

- Introduce apartment addresses in the Population register
- Register people at the same apartment addresses.

Norway Mapping Authority who is responsible for GAB shall together with the Directorate for taxation establish routines that ensures no mismatches in addresses in the future.

## **4. CONCLUSION**

The project has proved its importance in many ways. For instance it is now known for sure the number of dwellings in Norway. We will also get better statistical data on the family structure, singles and live-ins. The numbering of apartments, especially if the number is placed visible at the front door of the apartment, gives better possibilities of finding the correct apartment for ambulances etc. in critical situations, when a few minutes in difference may be the difference between life and death.

On the technical side, the project have resulted in 900 000 new addresses, complete and better data on each apartment, for instance the age and area of older dwellings, and in general higher data quality.

I would also emphasise that this successful project, has resulted in better mutual understanding between the authorities involved; The Norwegian Mapping Authority, the Central Bureau of Statistics and the Directorate for Taxation. The municipalities have in general contributed with great enthusiasm, and have gained a better understanding og the potential for use and increased efficiency in a high quality cadastre.

The next challenges will be to award ordinary addresses with street names and house numbers also in rural areas, and succeed in the efforts of making the National Post Service use the apartment addresses. Our experience is that extensive use leads to better data quality.