A NEW SET OF RECOMMENDATIONS FOR SURVEYING AND LARGE SCALE MAPPING IN SWEDEN

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Abstract

This paper deals with the production and the introduction of the new series of handbooks for surveying and large scale mapping in Sweden. It provides a brief description of the contents and the structure of all the handbooks although the Handbook for Cartography will be discussed more thoroughly. It is devoted to large scale map production which is used within the mapping of utility services, official regulations and legal decisions regarding land use. One part of the handbook of Cartography deals with the aspect of creating multi-purpose databases instead of analogue map overlays. Samples of recommended map layouts are provided in the paper.

1 Background

For many years there has been a great need for a new handbookseries for surveying and large scale mapping in Sweden. The old handbook was produced in 1976 and since then both technology and legislation have changed substaintially. Some fields, for instance databases and GPS, were not covered at all in the old handbook, others such as photogrammetry and cartography had not been updated since 1976.

Now, a new series of handbooks has been produced by the National Land Survey of Sweden in its capacity as supervisor of surveying and large scale (1:400-1:5 000) mapping and to provide more detailed specifications to the Surveying Statute (SFS 1974:339). The new series of handbooks consists of nine volumes:

- Geodesy, geodetic network and grid reference system
- Geodesy, GPS
- Geodesy, surveying of land, buildings and utility services
- Geodesy, marking of geodetic network and property boundaries
- Databases, design, construction and quality assessment
- Photogrammetry
- Digitising
- Cartography
- Law, a guide to the legislation concerning surveying and mapping.

The series of handbooks describes surveying and mapping issues from a technical and professional point of view. It contains descriptions of techniques and provides information and advice for the planning and carrying out of surveying and large scale mapping projects in order to satisfy the Surveying Statute and user requirements.

2 Establishing the project and introducing the handbooks

The handbooks contain recommendations not regulations. Only those recommendations that can be directly referred to by legislation are considered to be regulations and therefore compulsory. In order to make the recommendations acceptable, it was necessary to have strong support from other interested parties within the business. A project for producing the handbooks, was established. Both in the management of the project and in the actual writing of the documents, there has been a broad representation from the business. Apart from the National Land Survey, the Swedish Association of Local Authorities, several local governmental authorities, the Swedish National Road Administration and the National Board of Housing, Building and Planning have participated in the project.

The project decided that it was impossible to produce handbooks which would cover every aspect of surveying and large scale mapping. Instead the idea was to produce basic handbooks which to a large extent could function also as textbooks. These documents should be later followed by more detailed handbooks for certain applications produced by groups of interested parties. At present, the building industry and the National Road Administration amongst others, are working on specifications for surveying and mapping related to building and construction. These specifications will be based on the general handbooks. The title of this new handbook will be - The Handbook for Building and Construction and it will be published during 1995. Other surveying and large scale mapping applications which also need more detailed specifications are for example the technical work in the establishment of new properties and the surveying and mapping related to the planning and building process.

The first chapter in all these handbooks provides basic definitions of the terminology used in each respective handbook. This was necessary because the terminology within this domain is, to a large extent, not standardised. It has been considered to be especially important to establish definitions of the terminology since one of the applications of these handbooks is to form the basis for specifications of contract work in surveying and large scale mapping. The theme throughout these documents deals with the need for specifications and the fact that in a surveying or mapping project a substantial part of the production process is to work out a specification for the survey, map or database. The specification should also include an account for the amount and execution of the control that has to be carried out in order to meet the quality requirements of the user. By working out a detailed specification at an early stage in the surveying project you will have a good foundation for your final documentation.

In connection with the publication of the handbooks an intensive period of training started. This training was mainly initiated from the National Land Survey. About three thousand people have received some sort of training related to the handbooks during 1994 and 1995 . At the National Land Survey sixty tutors have been trained. These tutors have then trained staff at their home office. About two thousand people have received their training by these tutors. Staff from the National Land Survey has also conducted training seminars at the Head Office as well as at branch offices and at local authorities. Some local authorities and other organisations have also performed their own training. The handbooks have also played a major role as textbooks in general education and training at, for example, universities and colleges.

3 The structure and contents of the handbooks.

The Handbooks for Geodesy consist of four volumes containing recommendations and technical descriptions for the planning and carrying out of the establishment of geodetic network, GPS-surveying, surveying of land, buildings and utility services and the establishment of survey monuments. The Handbook in GPS has a different approach than the others, as it describes a technique rather than an application. Since GPS was considered to be a comparatively new field and there did not exist any detailed documentation about the technique and the implementation of GPS in Swedish, the project decided that a special handbook in GPS was required. This document also therefore stronger has the character of a textbook than the other Handbooks for Geodesy. In the beginning, GPS was used mainly in surveying of geodetic network and therefore this document has focused on this application.

A second Handbook for Geodesy provides recommendation and technical descriptions for the establishment and maintenance of geodetic network. It also provides detailed specifications on how and when to control geodetic instruments and a chapter devoted to theory concerning reference grid systems. The two remaining Handbooks for Geodesy are meant to function mainly as just handbooks, They provide practical advice for surveying and marking of geodetic network and property boundaries. Special attention has been paid to the improvement of standard of survey monuments, especially in the sense of identification. Samples of recommended designs and placements of survey monuments are provided in an appendix. In all the geodetic handbooks there are extensive appendices providing required mathematical formulas and parameters for the carrying out of geodetic calculations.

The Handbook for Databases is totally different from the other handbooks. It is intended to be only a textbook and it does not provide any recommendation or advice at all. The handbook project concluded that due to present circumstances it was not yet appropriate to write a handbook in a field within which the development was so rapid. There was an obvious risk that the book would be out-of date already at the time of publication. Furthermore, the intention was to connect this handbook to the ongoing standardisation work in Sweden and internationally and at the time of the publication this was not yet possible. A new version of this handbook is planned to be published within the next three years.

Although this handbook does not provide any actual recommendations it does describe a model for how to design, specify and document the contents and structure of a geographical database. Conceptual modelling is accounted for as one of the useful tools in this work. The conceptual modelling is based on user requirements, and user participation in the modelling process is crucial.

The Handbook for Law is more of a guide to the legislation related to surveying and large scale mapping than a handbook. It was not possible to write a handbook of about 100 pages covering all the legislation concerning our profession somehow. Therefore this document is regarded as a general description of the legislation relating to the business. Under no circumstances can legal decisions be based entirely on the contents of this handbook.

Digitising is a fairly well known area. Digitising projects have been going on since the late seventies. Although, recently these projects are more and more focused on data capture for the purpose of building multi-purpose databases than just producing a map. The recommendations for planning and carrying out a digitising project are written for that perspective. The same approach is used in the Handbook for Photogrammetry which also deals with a well-known application. Although, the use of GPS in photogrammetry, for example, has improved its applicability during last years.

The Handbook for Cartography

The digital technique of data capture, storage, combination and presentation has radically changed the large scale mapping in Sweden, during the last decade. It has provided opportunities to build multi-purpose databases from which different maps in different presentation forms can be derived. The Handbook for Cartography deals mainly with three issus within the field of large scale cartography:

- cartographic presentation
- quality standards
- general recommendations for the construction of databases from analogue source material.

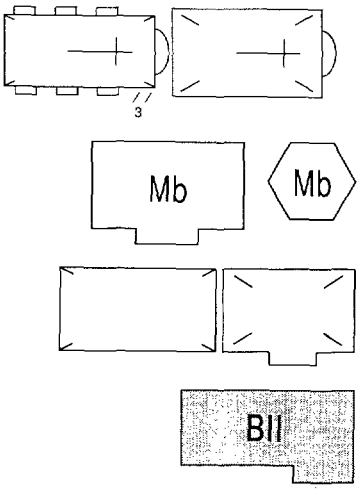
For the first issue, cartographic presentation, there is a general discussion on how to present areas, line elements and point elements. Text placement is discussed and also the choice of text fonts and sizes for the map text. The handbook recommends the use of linear typefaces and no more than two main typefaces in a map. These typefaces can be modified as shown below:

1pt=0,36 mm		Normal	Bold	Point size mm	Capital height mm
Normal	13p	Gagnef	**Gagnef**	4.68	3.38
	16p	Gagnef	**Gagnef**	5.76	4.16
	20p	Gagnef	**Gagnef**	7.20	5.20
Condensed	13p	Gagnef	**Gagnef**	4.68	3.38
	16p	Gagnef	**Gagnef**	5.76	4.16
	20p	Gagnef	**Gagnef**	7.20	5.20
Expanded	13p	Gagnef	**Gagnef**	4.68	3.38
	16p	Gagnef	**Gagnef**	5.76	4.16
	20p	Gagnef	**Gagnef**	7.20	5.20
Italic	13p	*Gagnef*	***Gagnef***	4.68	3.38
	16p	*Gagnef*	***Gagnef***	5.76	4.16
	20p	*Gagnef*	***Gagnef***	7.20	5.20

Figure 3.1 The figure has been reduced

Coloured maps can be produced more easily from databases with the aid of computer software and hardware to a screen presentation or a colour plot. Since there still is no definite international standardisation regarding colour definitions in the digital world, the Handbook for Cartography recommends the Natural Colour System (NCS). The NCS has its platform in the perception of colour hues and not in the technical and graphical production of colour inks. The NCS colour model is based on the concepts of "whiteness", "blackness" and "colourness" for each defined colour hue. The NCS colour coding can be translated to the traditional process colour system or Pantone Matching System when printing or plotting a coloured map.

As an appendix to the design section of the handbook there are map specifications, recommending line weights and colours for cartographic presentation in the scale range 1:400 - 1:2 000.



0,25 Church mapped according to the perimeter of the walls of the building and the eaves of the roof respectivly.

0,25 Classified historical buildning.

0,25 Building mapped according to the perimeter of the walls of the building and the eaves of the roof respectivly.

0,25 Residential building , presented in a yellow-reddish hue CMYK 0370; the letter "B" for "Bostad" (Residence) and roman numbers stating the number of floors may also be added.

Figure 3.2 Samples of map specification, presenting buildings for the scales of 1:400 and 1:500

The second main issue is the recommendation for establishing quality standards for up-to-dateness, accuracy and completeness. These recommendations are defined according to the type of map or database to be produced. As long as the quality levels are defined and directly tied to its objects, the user has all the information necessary for assessing the applicability of the data according to his needs.

The third principal section in the Handbook of Cartography deals with the transition process from analogue map overlays to databases. Apart from the hardware and software considerations, this process implies the need to assess the benefits of converting the analogue maps into digital form. Sometimes it might be better, and cheaper in the long run, to undertake a new data capturing process, including both geodetic and photogrammetric methods according to established and defined quality standards. By doing so, it might also be possible to satisfy the user requirements for database contents and structure at a lower cost and the databases will also be more applicable for various users.

Concluding remarks

The aim of producing these handbooks was to establish a framework that can be used by the producers as well as the customers. An increasing number of surveying and mapping projects are carried out as contract work and therefore the demands for technical specifications are increasing. It is our objective that the Handbooks for Surveying and large scale Mapping will play an important role in this process.