# STANDARDS IN CADASTRE - SENSE OR NONSENSE ?

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**ABSTRACT**

Following the 1998 FIG Bureau's activities improving the co-operation between FIG and the International Organisation for Standardisation (ISO) by the establishment of the FIG Task Force on Standards, FIG-Commission 7 Working Group 7.1 established a corresponding Task Force on Standards with the idea to promote the work of standardisation in the field of cadastre and land management. As a first activity 'The Statement On Cadastre', a paper developed by Commission 7 in 1994, was given to the ISO Central Secretariat as an input for the standardisation process in ISO.

This paper discusses the issue whether this statement or other papers, developed by Commission 7, shall be transformed into ISO standards. Does it make sense trying to establish standards with papers generally discussing the developments in cadastre or does it make more sense to develop technical standards for cadastre data bases and which role can FIG play in ISO and OGC for practicable standards in this field? This paper tries to find a few answers using the current developments in Germany's cadastre, the ALKIS® project as an example.

ALKIS® is the new German Integrated Cadastral Information System, integrating digital cadastral maps and records in one object-oriented data base. The modelling of ALKIS® was carried out by using ISO standard UML (Unified Modelling Language). It seems to be the first cadastral project world-wide using this ISO standard.

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## INTRODUCTION

The world seems to become smaller in a growing globalisation. Therefore global standards play an increasing role in the daily life to make things a little easier for each of us and from an economic perspective for companies to be able to act globally in their field of e.g. the production of computers or TV sets.

Standardisation activity has been becoming of increasing importance to surveyors. The application of technical and professional standards is one element which sets professionals apart from others. In 1997, therefore, the FIG Bureau decided to place an emphasis on developing FIG's work in the standardisation field, whilst recognising the limitations of what FIG's resources could achieve. FIG's aim in the field of standards is to assist in the process of developing workable and timely official and legal standards covering the activities of surveyors.

The FIG Task Force on Standards will provide the necessary coordination in planning of activity to achieve these goals, recognising that it is through the Commissions and Member Associations that most of the necessary work and liaison will be achieved (Greenway, 2001).

## THE INTERNATIONAL ORGANISATION FOR STANDARDISATION (ISO) AND THE GLOBAL ROLE OF STANDARDS

International standardisation began in the electrotechnical field: the International Electrotechnical Commission (IEC) was created in 1906. A lot has been standardised but a lot still can be done. We still travel around with a set of adapters to plug in our shavers and hair dryers, but at least not every country has its own standard for plugs.

1946 delegates from 25 countries decided to create the International Organisation for Standardisation (ISO) "the object of which would be to facilitate the international coordination and unification of industrial standards ". The official goals of ISO are to facilitate trade, exchange and technology transfer. ISO as a non governmental organisation is a world-wide federation of national standards bodies from 135 countries. ISO's work results in international agreements which are published as international standards.

ISO is governed by a General Assembly of its member associations. This is supported by a Central Secretariat of about 150 permanent staff, based in Geneva. The management of ISO's technical work is the responsibility of its Technical Management Board (TMB). The engine house of ISO is its 218 Technical Committees (TC) and its 2,867 technical bodies (technical committees, subcommittees, working groups and ad hoc study groups). At the end of 1999, there were 12,524 ISO standards in print, amounting to 356,427 pages.

The first ISO standard was published in 1951 with the title, "Standard reference temperature for industrial length measurement". Official standards like the well known ISO 9000 series of standards on quality management have always been important in production operations. Many surveyors have come across ISO 9000 and other official standards.

The adoption of ISO standards is voluntary, but users tend to have more confidence in products and services that conform to international standards. Assurance of conformity

can be provided by manufacturers' declarations, or by audits carried out by independent bodies.

Turning to the benefits of standards, recent research in Germany on the economic benefits of standardisation undertaken by the Technical University of Dresden and the Fraunhofer Institute for Systems and Innovations found that:

- The benefit to the German economy from standardisation amounts to more than US$ 15 billion per year;
- Standards contribute more to economic growth than patents and licences;
- Companies that participate actively in standards work have a head start on their competitors in adapting to market demands and new technologies;
- Transaction costs are lower when European and International Standards are used; and
- Research risks and development costs are reduced for companies contributing to the standardisation process.

## IMPORTANT RELATIONS FOR FIG COMMISSION 7

The ISO TCs to which FIG currently has Class A Liaison status are:

- TC59 Sub-Committee 4 – Dimensional Tolerances and Measurements (Lead: Jean-Marie Becker);
- TC172 Sub-Committee 6 – Geodetic and Surveying Instruments (Lead: Jean-Marie Becker); and
- TC211 – Geographic Information/ Geomatics (Lead: Iain Greenway).

These are as well the fields in which most contacts to the business of FIG-Commission 7 are and will be, specially TC211.

All of us are increasingly subject to de facto standards in all that we do – for instance Microsoft personal computer operating software and TCP/IP standards on the World Wide Web. The most successful de facto standard in the GIS business is DXF for data exchange between different software systems, initially developed by Autodesk. Standards, in all of these manifestations, are becoming increasingly important for surveyors.

The current activities of the OpenGIS Consortium (OGC), a commercial body representing the manufacturers of GIS hardware and software, and the providers of geographic data have an important impact to future GIS software solutions. The OGC is working towards the adoption of open standards, allowing the flow of data between different GI systems.

Together with the very important tasks of TC211 which will have an important impact to our future business the OGC activities are very interesting and will hopefully make life a little easier in future, both fields in which FIG-Commission 7 could contribute effectively.

## GLOBAL STANDARDS IN CADASTRE ?

National governments are important sources of regulations for cadastral surveyors. These regulations can be defined as legal standards. Inevitably, the move to globalisation has also affected legislation, with the role of the European Union being the prime example and the requirements of the North American Free Trade Agreement

being another. It is very important for our profession to work together on a supra-national level to ensure that the international fit into the national activities. In Europe together with CERCO (Comité Européen des Responsables de la Cartographie Officielle) on the field of cartographic activities the United Nations Economic Commission for Europe Working Party on Land Administration (UNECE-WPLA) guarantee an excellent co-operation on the field of cadastre and land registration.

Whereas UNECE-WPLA on the one hand is supposed to focus especially on problems in transition countries, its work has on the other hand to aim at improving land administration in all countries of the ECE region. The problems of western countries in maintaining and updating their existing land administration systems are being considered and addressed as well (Creuzer 2000).

It seems that these organisations will be involved together with others when European activities will start to develop a European network of laws and regulations in future. These activities have started slowly, but in a growing European Union it will become a dynamic process - only a question of time.

It will be the European, American or Asian level where legal standards will play an important role in future. A definition of global legal standards will be difficult or even impossible. This shows the activity of the FIG Task Force on Standards for implementing the FIG Commission 7 Statement on the Cadastre (FIG 1995) as an ISO standard. The paper was transferred into the ISO pipeline considering the very complicated and sizeable 'ISO/IEC Directives, Part 3, Rules for the Structure and Drafting of International Standards'.

Once launched this important paper to the ISO General Secretariat, ISO found out that none of the 218 TCs could deal with its contents because ISO seems to be more technical oriented not legal. The result was that the ISO TMB couldn't move this paper and then decided to launch it in a special procedure called 'Fast Track Processing'. Following this procedure papers may reach a status as Draft International Standards in a very short time if no TC is responsible directly for it and less than 25 % of the ISO members don't vote against the acceptance of the paper. Unfortunately the Statement on the Cadastre was not accepted.

ISO/TC211 may use this paper in future as an interesting definition of cadastre but will probably not introduce it as an ISO standard. The experience for FIG should be that it might be a better way to co-operate by providing ISO with papers like this or the Cadastre 2014 paper on a more informal way without the intention to establish it as an official ISO Standard.

It seems to be more successful for FIG-Commission 7 to co-operate with ISO in the field of technical standards. For the description of object-oriented data bases ISO TC211 has been producing a standard Unified Modelling Language (UML) and for the definition of data interfaces Extensible Markup Language (XML), documented in ISO standards 15046.

Germany's new cadastral data base ALKIS® is modelled by using UML and XML. It is the first data base which is described by using UML and XML. ISO therefore established a test-bed for ALKIS® in order to test the modelling languages in practise. This could be a future oriented example as well for FIG, not looking on ALKIS® from a technical perspective on practicability of a description language, but focussing on legal

aspects. Developments and experiences from other countries in the same field could be collected by FIG-Commission 7 and will be a well accepted contribution for the future work in ISO.

## DEVELOPMENT OF THE GERMAN CADASTRAL DATA BASE ALKIS®

The development of the Integrated Official Cadastral Information System ALKIS® is a good example how ISO standards are used successfully for the description of a national cadastral data base standard in Germany.

With respect to the federal constitution of Germany the responsibility for legislation in the field of cadastre is in the hand of the states. The 16 states have passed various, basically uniform, laws in the field of surveying. The state survey offices and the responsible Ministries of the states co-operate through the 'Arbeitsgemeinschaft der Vermessungsverwaltungen der Länder der Bundesrepublik Deutschland' (AdV) (Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany) to discuss technical matters of fundamental and national importance with a view to finding uniform regulations. Among others a main task of AdV is co-operation in the development and application of technical procedures like the cadastral data bases.

The Land registration system in Germany is a duplex system. The legal situation of each parcel is described in the land register called "Grundbuch". The geometric description of all boundaries in the Automated Cadastral Map (ALK), field records and textual records in the Automated Property Register (ALB) is in the hand of the cadastral authorities. Only Grundbuch and cadastre in combination are able to give a complete overview about legal and de facto land tenure. Both registers must be constantly updated and kept in correspondence with each other (DVW 1993). The roots of the ALB and ALK development date back to the 70s and 80s of the last century. Further development of these software systems seems not to offer future oriented solutions. Modern developments in object-oriented data bases, international standards and computer technology and the need to avoid double work are the reasons for the German Surveying Authorities to follow a new and future oriented design of ALKIS® in combination with a re-design of the Official Topographic and Cartographic Information System ATKIS®.

The approaches aiming at GIS interoperability like the ones which are coming up from the concepts of the European Standardisation Body CEN and ISO and especially from the Open GIS Consortium OGC play an important role for future decisions (AdV 1999, Jäger 1998). An object oriented data base model of the entire cadastre seems to be meaningful and, as a result of a market observation of current GIS software, as well feasible.

ALKIS® in combination with the new ATKIS® is designed to

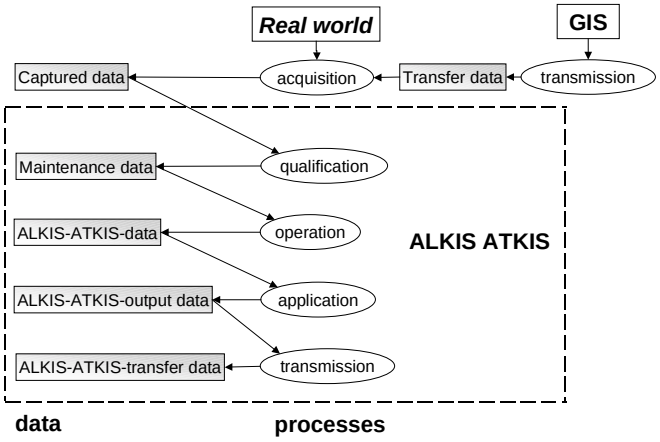
- process all necessary cadastral and topographical data for a parcel based map and register of land owners, land use and more unified basic data for the entire Republic,
- control the use and maintenance of the system and to
- enable the use of the entire geographical data of the surveying authorities for all users via a meta data system including quality information for all data and a standardised data interface for ALKIS® and ATKIS®. Of course links of the users' specific data they already linked to ALK, ALB or ATKIS® still have to be possible in the

new systems without reasonable new investments on their side. They shall trust in the sustainability of their investment in data.

The object catalogues and data of ALKIS® and ATKIS® shall be harmonised in order to allow a vertical data flow avoiding data redundancy and double work in data acquisition and data processing. AdV followed the idea only to design and to describe the data base model. The GIS industry shall carry out the software solutions. The new ALKIS® standard therefore has to guarantee sustainability for the GIS industry in order to protect their long-term investment in the future ALKIS® software development. The use of a standardised data base description language with graphical and lexical features is essential for this approach (AdV 1999).

Initially ALKIS® was modelled by using the draft documents of the data base description language EXPRESS (EXPRESS-L for the lexical and EXPRESS-G for the graphical part) developed by CEN. New developments on the fields of international standards forced AdV to reshape the description on the ISO standard Unified Modelling Language (UML) and for the definition of the data interface Extensible Markup Language (XML).

## DATA AND PROCESSES




picture 1: ALKIS®-ATKIS® data and processes

The surveying authorities' tasks are data acquisition, qualification, operation (setting up and maintenance of data), application and data transfer. Each of these tasks may be defined as a process. Relations between data and processes in AdV-terminology are shown in picture 1. By definition through AdV the data acquisition process and the results of this process in form of captured data shall not be modelled by ALKIS® because this process may be designed individually by each state depending on different survey methods or data sources.

### Data Acquisition Process

The sources for the data acquisition can be found in the real world with its objects and natural manifestations. The methods for data acquisition are the well known survey methods as well as data capture by digitising or import from other GIS.

The target data of this process are the captured data which are basic for the maintenance of the official data bases.

### Qualification Process

In this process the captured data are transformed into maintenance data. This process of quality assurance guarantees that the data are in accordance to the required quality conditions of ALKIS®. The data are tested for actuality, consistency and plausibility. After having passed this tests successfully the data are used directly to maintain the data base.

### Operation Process

This process combines the activities for implementation and maintenance of ALKIS®. The implementation is seen as a special case of data maintenance. In this process the data (the data as such and the meta information) that were produced in the qualification process are transformed into ALKIS® and ATKIS® data by the methods deleting, registering, changing or changing their spatial reference.

### Application Process

This process transforms ALKIS® or ATKIS® data into output data due to the given standards as

- data sets for universal data processing by the users via the new Standard Data Exchange Interface NAS,
- processed data with a defined content in a unique presentation on paper or as digital data in TIFF or DXF or other data formats or
- maintained data after the operation process (difference updates) via the NAS.

### Transfer Process

In this process data from other GIS shall be imported or ALKIS®-ATKIS® data shall be distributed to customers. This process supplements the output data with transfer functions to produce transfer data for the customers' GI systems.

### Standard Data Interface NAS

The development of a standard data interface operating with most GIS is an important factor for data distribution. The currently existing interfaces for ALK and ALB can only be used for a limited time in future. They need to be re-designed. The new NAS interface will be derived automatically from the UML model using ISO standards 15046 (Geographic information) for XML.

## STATE AND FUTURE DEVELOPMENT OF THE PROJECT

AdV's activities in modelling ALKIS® and ATKIS®, the definition of standard output products based on a XML interface and the meta data catalogue based on UML are completed. The NAS interface will be an instant product derived from the UML model. This means that most AdV activities concerning the process of modelling ALKIS® and ATKIS® are completed. The member states in AdV agreed upon the basic contents of ALKIS® to guarantee a unique standard for the system and data in ALKIS® for the entire country.

An AdV task force of representatives in co-operation with the Ministries of Justice developed a data interface for the data exchange between ALKIS® and the Grundbuch systems in order to enable data exchange and direct update of both data bases.

Some GIS companies introduced already ALKIS® prototypes during the INTER**GEO**® 2000 Exhibition in Berlin. Most of these prototypes have been developed with OGC simple features under Oracle 8i spatial. The results shown there confirm that ALKIS® seems to be an excellent cadastral model for the next decade.

Some states in Germany are already on the track to establish ALKIS®, most states are planning and preparing the migration process. All states committed themselves to start with the implementation of ALKIS® not later than 2005.

Both the public sector and the GIS companies have successfully designed and developed a future oriented cadastral information system. Most statements of FIG Commission 7 paper Cadastre 2014 are no longer science fiction in Germany.

## CONCLUSION

The benefits from standardisation have a high economic value for a modern society. As remarked above the estimated benefit to the German economy from standardisation amounts to more than US$ 15 billion per year. The benefits of a standardised cadastral data base in a country like Germany with its federal structure are evident. National standards in cadastre of course make sense! International standards for surveying procedures or the calibration of surveying instruments are of course very helpful in a growing international competition in the field of surveying.

Standards for cadastral systems on a supra-national level would make sense if the cadastral systems are comparable. It seems neither helpful nor feasible to set standards for a cadastral system in Europe or world-wide facing the fundamental different land registration systems e.g. in Germany, the UK or Australia. The description of the structure of cadastral data bases by using ISO standards UML and XML like in Germany is perhaps a way to make systems a little bit comparable from a technical point of view.

A proposal for the future work of FIG-Commission 7 in the field of standardisation could be made as follows:

It's a global trend in the developed and the developing world to establish national spatial data infrastructures. The cadastre and its national or regional data bases play an important role in that field. Maybe it would be helpful for us to start activities in the field of setting global standards for these data starting with a definition of a minimum content of a cadastral data base and the way how to provide a national and later a supra-national spatial data base with basic contents for statistics, planning etc. Is it worth to get in contact to ISO/TC211 with this possible future work item? Standards in cadastre will then not be nonsense.

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