Challenges for the multi purpose cadastre

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Key words: Multi purpose cadastre, 3d-cadastre, land use, SDI, solar cadastre

SUMMARY

Over the past 30 years, with the progress of information technologies the development of a multi purpose cadastre was in the focus of the cadastral community. New cadastral visions came up, models and roles were discussed on the national and the international level. Currently Germany is implementing the so called “3A model” as an integrative approach for all spatial information systems. In this context the potential and the concepts of real estate cadastre have to provide solutions for upcoming social needs. Climate change, demographic changes, land use restrictions - the data of the cadastre and of official surveying and mapping should meet the requirements. In this paper, some strategic approaches and some examples will be presented.

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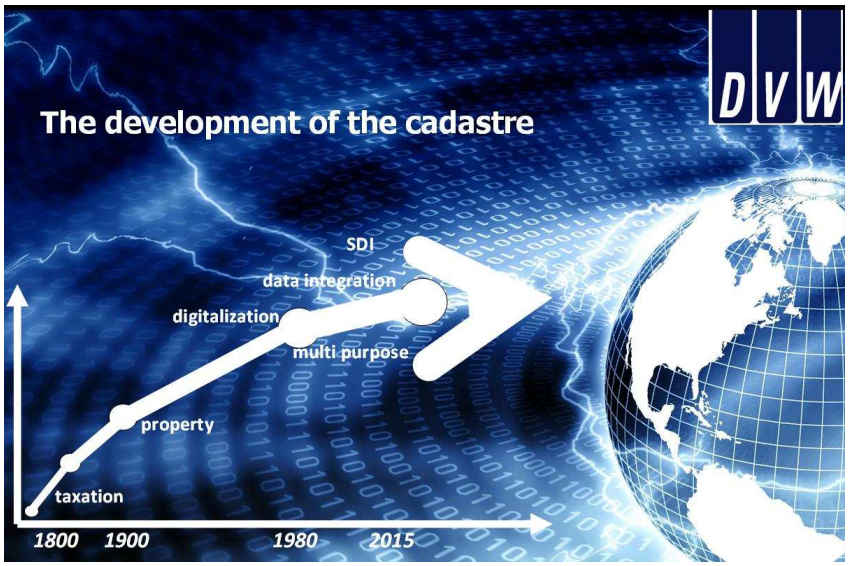
1. Tasks of the Cadastre

From the point of the individual or citizen the central task of the cadastre is the documentation of the ownership. This is the base for the access of mortgage loans as a fundamental requirement for economic development. This in fact is not only an individual interest on the cadastre but at least as important for the government. In addition the governments interest is to establish an efficient and equitable system for land or property taxation. In Germany for example the taxation issue was the reason for the establishment of the cadastre in the beginning of the 19th century. One hundred years later (1900) the property cadastre was established. The property cadastre in Germany is a parcel-based system, i.e. information is geographically referenced to unique, well-defined units of land. These units are defined by formal boundaries marking the extent of land. Each parcel is given a unique parcel-number. The cadastre, based on cadastral surveying, shows the division of the ground in form of parcels and contains information about the de facto status of property (location, size, land use etc.). The land register contains the describing parts of the cadastre. Therefore only both systems in combination are able to give a complete overview about legal and de facto land tenure. Both registers are constantly updated and kept consistent.

Real estate cadastre is the official register of the land plots for the proof of ownership in the land register. However, that does not mean that the cadastre builds a register in the sense of ISO 19135 Procedures for registration of geographical information items. The position of the freehold property is presented and described in the form land parcels. If needed, the boundaries of the land parcels can be shown locally with legal effect. The real estate cadastre also documents the results of the soil assessment. In the last decades the cadastre was increasingly used for other necessary mapping and (planning) uses - it became a so called multi purpose cadastre as a geo-basis LIS and nowadays as a part of the NSDI.



Looking closer to the multi purpose potential the cadastre should be mapped to the upcoming social needs. Climate change, demographic changes, land use restrictions – how could the cadastre contribute to this (and other) challenges?

The cadastre in Germany performs the basic function for other areas. By collecting not pure cadastral data but also data that are related to cadastral processing, e.g land use, soil evaluation, protected sites, which achieve the same quality level in terms of accuracy and actuality than the parcel information. Those data can be used for several applications, also in monitoring the earth surface in different perspectives. So, the German cadastre currently meets the requirements of legal relations, the administration and the economy and, in particular, take appropriate account of the needs of the state planning, the development planning, real estate regulations, the determination of land plot values and environmental and nature protection.

Today the cadastre fulfills all legal demands and demands of administration and the private sector. It is a basic Land Information System (LIS) of great variety and flexibility in planning, environmental protection etc. The cadastre shows the de facto status of land properties in both graphic and textual records. In Germany maps and cadastral records are stored in computer systems. Although cadastre in Germany is in the responsibility of the 16 states the computerized systems are unique with some small exceptions. These systems are the automated cadastral map and the automated property register. The formerly parcel register is operated in a digital system called Automated Property Register (ALB) in most parts of Germany. The cadastral maps are fully digitized in Germany. This system is called Automated Cadastral Map (ALK). Both systems are harmonized in all states, so that a nation-wide user can have access to the same structure of data across the whole nation. Both information systems, ALB and ALK define the basic Land Information System. A new project called ALKIS is currently replacing ALK and ALB and store all information in one object-oriented database system in compliance with the standards set by the ISO/TC 211 and the Open Geospatial Consortium. ALKIS is the fundamental part of the 3A data model which

also contains geodetic reference points and topographical information. To provide 3A data model as a fundamental part of the emerging German spatial data infrastructure (SDI Germany, GDI-DE) is one of the current challenges the German cadastral administration working on.

2. Land use and the cadastre

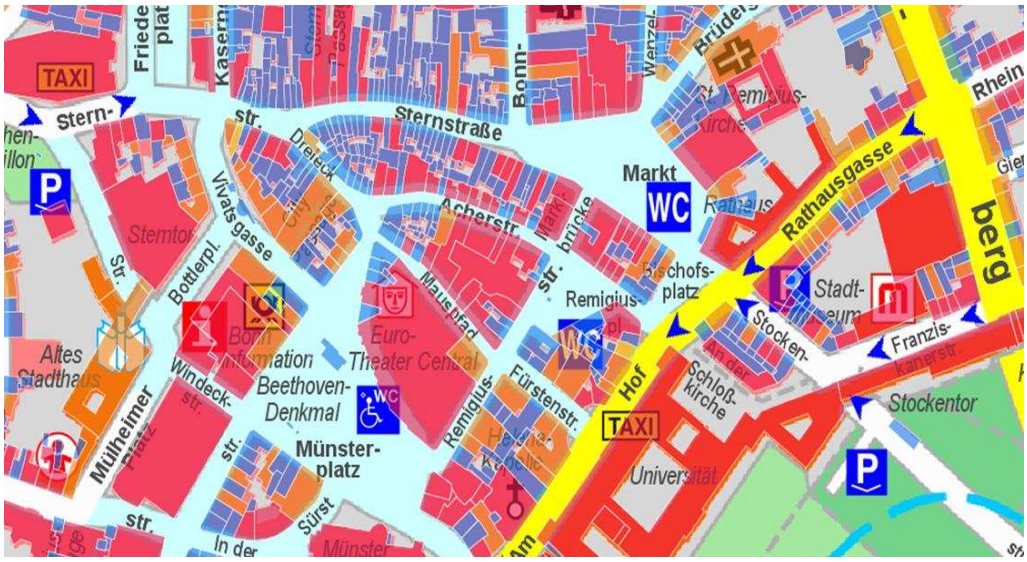
In the German national sustainability strategy, the goal is formulated to reduce the use of land of 129 ha / day (in 2002) to 30 ha / day by 2020. Primarily the German states and municipalities are requested to fit regional and urban planning to this goal. Important indicators are the ratio of indoor to outdoor development, population density in new residential areas and the extent and degree of integration of new areas in existing settlement areas. As a data bases, the land use and the geometry of houses are important information provided by the cadastre. To meet the monitoring requirements, the cadastre must provide this information. In the future 3D building information will gain additional importance.

The figure above shows a cadastral map and various land use objects (e.g forest areas, residential areas, lakes etc). With the application of ALKIS the cadastral agencies in Germany will provide up-to-date land use information throughout the country. ALKIS allows to distinguish between more than 100 different land use objects. So an effective monitoring on land use changes can be automatically derived from those data in order to support decision making processes in the field of environmental protection.

3. cadastre, urban planning – the need for 3 dimensional building information

3D building information are currently used to build so-called 3D city models. In a 3D city model all the buildings and the terrain can be highlighted and viewed from different perspectives. These models may be used for urban planning. In Germany LoD 1-models are provided by the state surveying and mapping agencies. These models are used as the basis for noise mapping.

In the future more detailed LoD 2-models could be used to build up solar cadastres. It should be a challenge for the multi purpose cadastre to provide this information. Therefore the next German 3A-standard will provide this option.

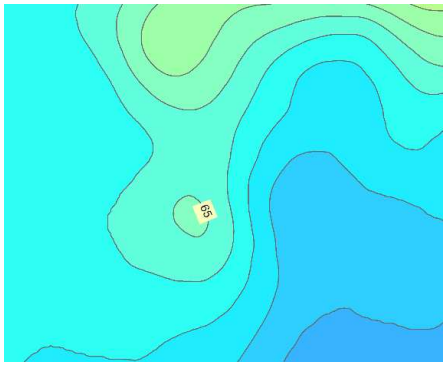


City of Bonn, http://stadtplan.bonn.de
LoD1 – city model and solar cadastre (red=excellent, brown = good, blue = bad)

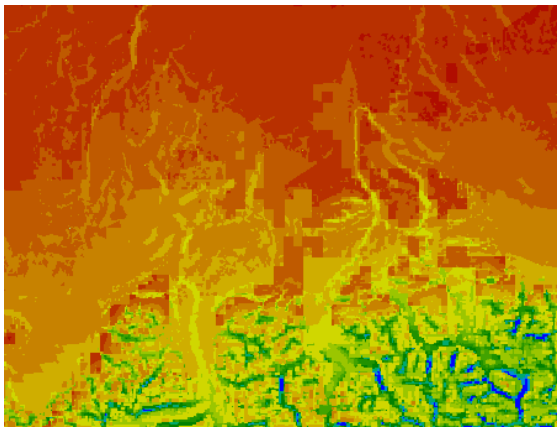
4. Overlaying cadastral data with alternative energy resources for climate change measures

Cadastral information enables lots of analysis in the field of exploring alternative energy resources. For planning purposes not only the specific thematic data, e.g. areas of specific

geothermal energy but also cadastral information for planning concrete geothermal power station.



The figure shows the geothermal temperature in 1000m depth. The SDI Germany provides those data by using web services, currently as Web Map Services and in future as Web Feature Services which allows more powerful analysis than a maps. Many other application and use cases are possible. In Bavaria also information about the daily sunshine period is available for the whole state.



For planning solar power plants those data are very useful in combination with cadastral information and other date from the mapping agencies like the DTM. Again the buildings are relevant and especially their roof shapes for the evaluation of the effectiveness of solar panels on roofs. Of course the collection of those data is currently not a legal task of the cadastral agencies. However, a solar cadastre is currently under development to collect and provide the data to the users. The challenges for the future are the interoperable combination of cadastral data with data from different sources, which is the main objective of the spatial data infrastructure in Germany and Europe.

5. Conclusion

The public geospatial data are already variously used and widely available at different geo-portals. By integration of various datasets in the ALKIS data model or using the same or similar (standard based) methodology the use and further processing of the public geospatial data will be simplified substantially. The main reason is the consistent application of

standardized web services (WMS, WFS) for providing the data. So some essential advantages will arise for the users by the new conception:

- The implementation of the concept under consideration of international standards will ensure investment safeguarding, vendor independence and standardization of public geospatial data. This strongly supports the cross theme analysis for climate change analysis.
- Definition of a universal, browser readable interface (XML encoding) for all public geospatial data to provide object oriented data in interoperable formats.
- The data based on cadastral information becomes a core data base that can easily be combined or extended with other data from various administrations in order to build up a spatial data infrastructure in Germany.

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BIOGRAPHICAL NOTES

From 2002 to 2007 Dr. Jens Riecken was chair of the business area “Cadastral Information Systems” in the Surveying and Mapping Agency of North-Rhine Westphalia. During this period he was responsible for the standardization of spatial information and cadastre in the administration of surveying and mapping in North-Rhine Westphalia. Jens Riecken was one of the main actors in the SDI developments and was member of several state and federal working groups and the EU expert group INSPIRE.
From 2008 on, when Surveying and Mapping became the department “GEObasis.nrw” in the North-Rhine Westphalia Government Office for the Cologne District, Jens Riecken was chair of “Data Standards, Geodetic Reference”. He was in charge for the standardization of spatial information and in addition for the realization of the geodetic reference, nowadays by satellite positioning services. From 2010 on Jens Riecken was working for two years in the Ministry of Interior of North-Rheine Westphalia. He is responsible for GIS-developments (AFIS, ALKIS, ATKIS) and products. Since 2012 he is again in charge of “Data Standards, Geodetic Reference” at GEObasis.nrw.

Jens Riecken is Vice-president of the DVW e.V. - Society for Geodesy, Geoinformation and Land Management in Germany.

Markus Seifert is head of the project team “SDI Standards” of the Surveying Authorities of the States of the Federal Republic of Germany (AdV) that is modeling the conceptual schema of the AAA data model. Furthermore he represents the Bavarian Organization for surveying and cadastre in several national working groups concerning the standardization of public geospatial data. On behalf of the Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany (AdV) he is the head of the German delegation at ISO/TC 211 and CEN TC 287 and chair of the INSPIRE Working Groups “Orthoimagery” und “Protected Sites”. He currently is also in charge with the implementation of the spatial data infrastructure in Bavaria and Germany as head of the SDI office in Bavaria.

Markus Seifert is member of the DVW Working Group on Geoinformation and is national delegate to FIG Commission 7 “Landmanagement”

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