PRESENT TRENDS AND EXPERIENCES IN CADASTRAL ENGINEERING CONTEXT

TENDINȚE ŞI EXPERIENȚE PREZENTE DIN INGINERIA CADASTRALĂ

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Abstract: *As a consequence of increases in population and industrialization, society has become more complex for both government and other institutions, with the result that more complex and complicated tasks have to be performed. In order to solve these tasks properly, more and more information is required. Having passed through the stages of agricultural and industrial societies, we now live in an information society. The paper presents a few aspects of cadastral tasks involving the Local Administration Agencies and also the students during their practical activity, considering that the educational process is of major importance for these problems.*

Rezumat: *Ca importanță a creşterii în populare şi industrializare, societatea a devenit mult mai complexă deoarece ambele guvern şi alte instituții, în ciuda rezultatului atât de complex, iar sarcinile complicate trebuiau să fie executate. Pentru a rezolva corect aceste sarcini, este nevoie de informare. Trecând peste aceste etape de agricultură şi industrializarea societății, noi trăim acum într-o societate informată.*

Hârtia prezintă câteva aspecte din sarcinile cadastrului implicând Administrațiile Locale şi de asemenea studenții în timpul activității lor practice, cu privire la care procesul didactic este de o importanța majoră pentru aceste probleme.

Key words**:** *database, cadastre, digital data processing, GPS*
Cuvinte cheie: *bază de date, cadastru, prelucrarea datelor digitale, GPS*

INTODUCTION

During last century, the relationship between the human world and the planet that sustains it has undergone a profound change.

When the last century began, neither the people nor technology had the power to determine radically, modifications in the planetary systems. As the century closed, not only the huge increasing of population and it's activity, but other unbelievable changes are occurring in the atmosphere, in soils, in waters, among plants and animals in the human species and in the relationships among all of these.

We all are more or less aware that, at present and in the near future, especially the threats of explosive population growth and poverty (in some cases to the living environment threaten human well-being are strongly interrelated).

It is evident that all the identified phenomena or threats to the human race are very much connected with land.

We all need land to live on, to build our homes on and to secure food from; land includes also water, which becomes more and more important with respect to underground resources.

All land management activities from various disciplines are strongly interrelated and need to be developed or improved.

GENERAL CONCEPTS OF ACTUAL CADASTRE

Cadastre can be defined as a methodically arranged public inventory of data of all properties (parcels) within a certain country or district, based on a survey of their boundaries. A large definition of cadastre implies also the component of land registration; both of them

have the task to complement each other inside the cadastral land information system, answering the questions: “who, how, where and how much?”

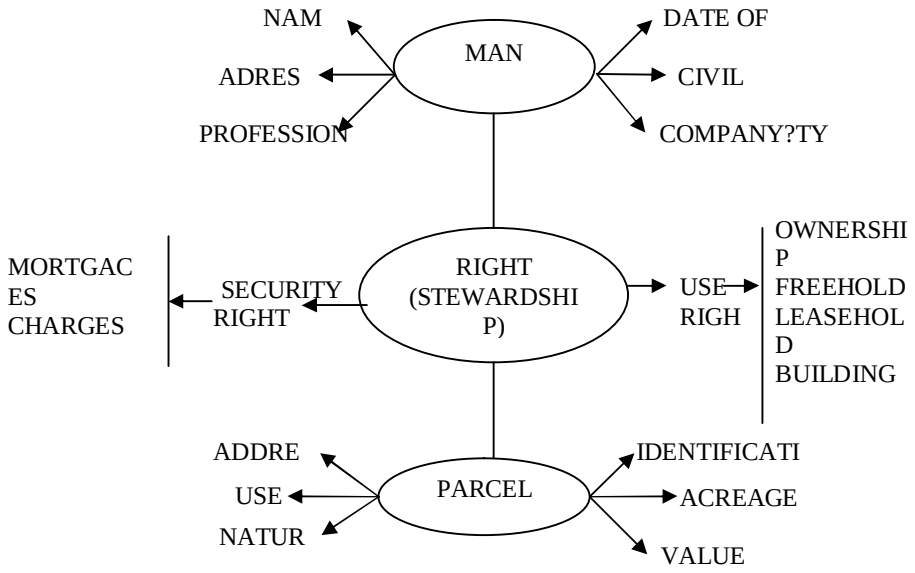

Figure 1. The basic cadastre

During its evolution in Romania, the cadastre activities deled with many economical and political changes and obstacles.

That’s why, nowadays, the most important task of the new cadastral policy is to assure the informatization of this activity, related to general and multipurpose cadastre, to provide a complete evidence of lands and buildings in order to design the territory in a convenient way with environmental protection.

In time, it’s role remained just the same, but the methods, technical tools and principles in organization changed a lot due to the progress in informatics and technology specific to cadastral work and also due to the inner conditions of the Romanian society.

Through cadastre work one can collect and store a big amount of technical, juridical or economical information and all this job can be efficient if the access to these documents is quick, convenient and reflects the reality.

The main quality of a modern cadastre is represented by the use of digital data at any level of the process.

Transformation of the present informational system into database system supposes the organization of all information into separate files, which are closely, related one to another.

Another important aspect of process is the acquisition and use of the modern, electronic total stations together with proper software models, which are used in accordance with our national standards. The cadastral digital data can be collected and processed in an unitary automatic system as follows:

-GPS information

-total stations data

- Aerial Photography, Orthophotography, and Photogrammetric Based Systems

- digital data

The primary data processing for computation of the land surfaces for a property are quite simple at this first level but it becomes very difficult due to the huge number of parcels and owners and also to the existence of a great amount of corrections in the adjustment of the territory (around 6 million owners and a total surface of about 9 million hectares, and if we take into consideration a medium number of 6 parcels/owner, it's necessary to create and determine by cadastral survey a number of about 30 million parcels).

This situation makes possible the elaboration of special, modern methods for data processing inside the local agencies for cadastre. These offer the following possibilities:

-to collect the primary information using the electronic equipment which provides a convenient processing in addition;

-to collect by graphical tools the data which can be obtained by digitizing the parcels directly on the cadastral plans (this aspect implies the use of the existing data);

-to compute and evaluate specific elements useful for the preparation of the final cadastral registers in the form of individual files;

-to draw up the new cadastral plans or to update the old ones;

-to create the database of the general cadastre;

In the previous period, all topographic and cadastral maps and plans were restored completely in a graphical from to different scales and accuracy depending on the methods.

The new tendencies of automation in this research aria, imposed the necessity of restoration the topographic and cadastral plans in the digital form.

This profound transformation supposed the use of the computer systems as the main element of this new conception of data base creation and provides some advantages;

- the storage of spatial data in a very detailed way and with high accuracy; each of these can be later on expressed by optional selection, at a general level, to different scales and for different preferential area chosen by the user
- the necessity of using a non-deformation support disappears due to the storage of data in a digital form
- using the computers for processing spatial data, very accurate possibilities come in addition expressed by specific software for a deep analysis of the process itself.

THE USE OF AUTOMATIC PROCESSING DATA METHODS

Processing primary measured data in order to compute and evaluate property surfaces implies simple, common operations at this initial level, but very complicated because of the big amount of parcels and owners for an administrative territory.

This happens also due to the general rules in cadastral works regarding adjustment of closing errors found after the comparison of these surfaces with the corresponding ones from geodetic coordinates.

Such adjustments regards:

- corrections for parcels
- corrections for cadastral plans sheets
- corrections for the entire surfaces of all categories of land

Going further on, the computation should become more complex due to the necessity of expressing the evaluation in a selective and interactive way, graphical or numerical of all data referring to:

- owners and land destination
- land categories
- quality of lands for agriculture and others

Operations of data processing are performed in connection with normal evolution of cadastral works, such as:

- processing primary, initial data
- processing intermediate data
- processing final data, obtaining the cadastral registers

The necessity of using automatic processing tools is justified by the advantage of storage the big amount of collected information. Also, these technical advanced methods of processing data must satisfy the requirements of the general and multipurpose cadastre, as well as periodically updating of data and final information.

Today, the Cadastral GIS offers specialized functionality for each stage of processing including the digital map creation, plotting cadastral and topographical plans, generating and combining geo-referenced data in order to obtain a validated relational geo-database.

GIS as modern technology of analysis and graphical-textual database processing method is very important element in environment resources management. This is a particular crucial purpose in case of multifunctional spatial system.

THE REFERENCE STATIONS IN ROMANIA

One of the most convenient methods (in efficiency, accuracy, costs) for data aquision implies the GPS technology. Going further on, the GPS reference station frame is more and more useful.

Cadastral and other detailed surveys require positioning methods that supply accurate, reliable positioning solutions in short time. GPS is such a highly flexible tool, able to provide cm accuracy in less than one minute over distance of few tens of kilometers, if an active reference network is employed.

According to the development tendencies of the services at European and global level of the GPS technology, after 1990 in Romania was also implemented the technology of global positioning (GNSS). At present, the most used GNSS (Global Navigation Satellite System) system in our country is the NAVSTAR-GPS system.

For long-term requirements of Geodesy it was projected and accomplished in our country a National Network of Permanent GPS Stations (RN_SGP).

The main objectives aimed for the accomplishment of this network were:

- Realization of an active space-temporal reference system;
- Use of the satellite observations for determining the position of the points from the National Geodesic Network;
- Use of the satellite observations for determining the position of the points from other networks of planimetric and altimetric support;
- Use of the satellite observations for determining the position of some points of interest in different fields: Topography, Cadastre, GIS, Cartography;
- Use of the satellite observations in the scientifically research.

History of the realization of the RN-SGP in Romania had the following stages:

- Stage 1 – year 1999- realization of the first permanent GPS station, within the Faculty of Geodesy from Bucharest;
- Stage 2 – 2000-2003 – establishment of the RN-SGP as a “passive” network including a number of 5 stations installed at: Braila, Cluj, Sibiu, Suceava , Timisoara;
- Stage 3 – 2004-2005 – establishment of the Extended National Network of Permanent GPS stations as active network of gathering/transmission of the data and extension of that, with other stations installed at: Craiova, Constanta, Deva, Baia Mare, Bacau, Sfantu Gheorghe, Cluj, Oradea;

- Stage 4 – 2005-2006 – Modernization and continuation of the RN-SGP extension through installation of 10 new permanent GPS;
- Stage 5 – 2006-2007 – Continuation of the RN-SGP extension through the installation of new permanent stations that will ensure a cover area of 70 km around of those on the whole territory of Romania;
- Stage 6 – 2007-2008 – Modernization and continuation of the RN-SGP extension, simultaneous with the preparation for the learning of the new technology provided, the European navigation system (Virtual Reference Station, GALILEO).

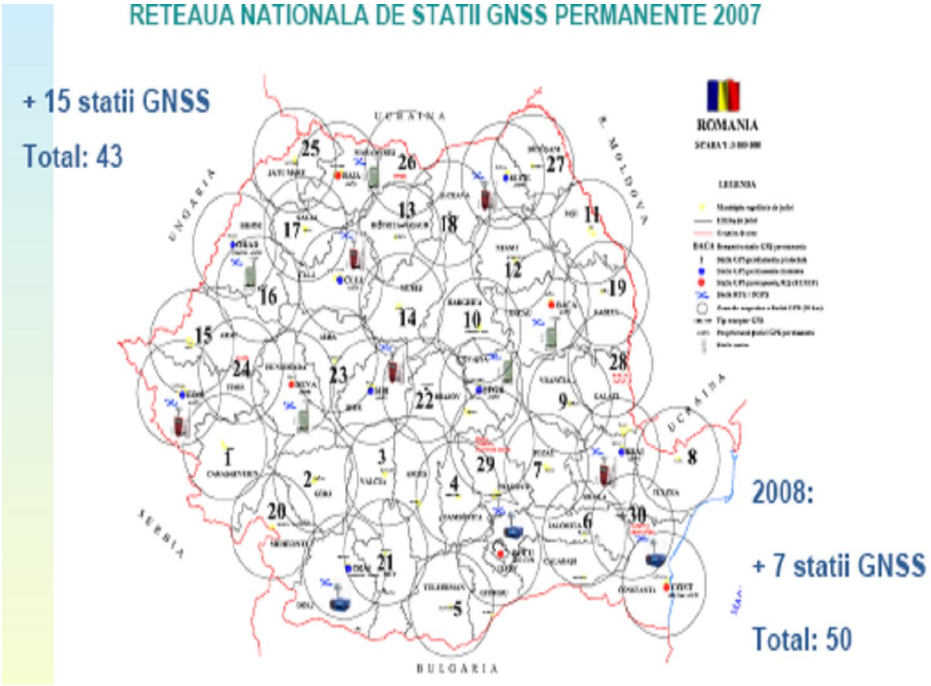

Figure 2. The National Network of Permanent GNSS Stations in Romania

According to these trends in Geodetic Engineering, Timisoara represents an example in the process of automation of land registration.

The Town Hall of Timisoara is the first institution from Romania starting the GIS for urban purposes, at present, being the most advanced city in this domain.

The educational process is also of major importance for these problems.

A useful connection between the state agencies, Local Administration Departments, Private companies and school must provide a deep and realistic understanding of the situation by the students.

That's why, the students participate, together with universities to contracts and research projects, being involved in both, field and office operations.

Here is such an example, for the updating the database for urban cadastre in Timisoara. The field campaign lasts from summer 2007, and the results completed the information from the Urbanism Department of the Local Administration Agency.

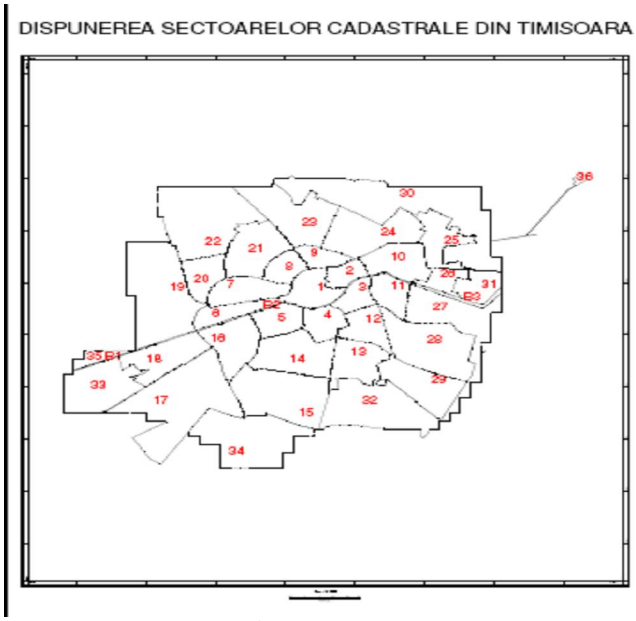

Figure 3. Disposal of the Cadastral Sectors in Timisoara

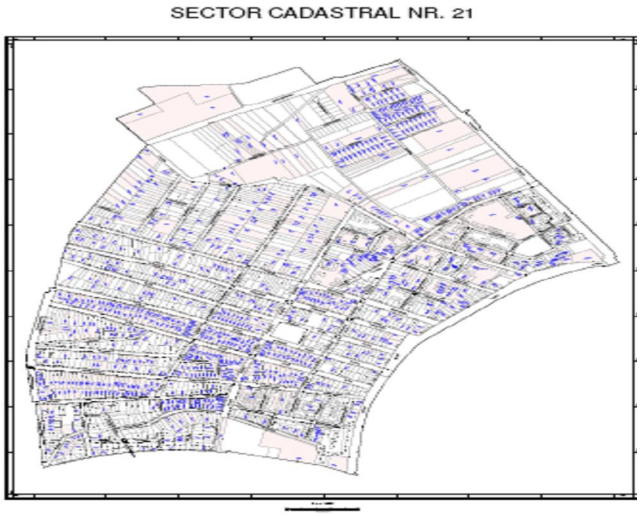

Figure 4. Example for Cadastral Sector no.21 (out of the database)

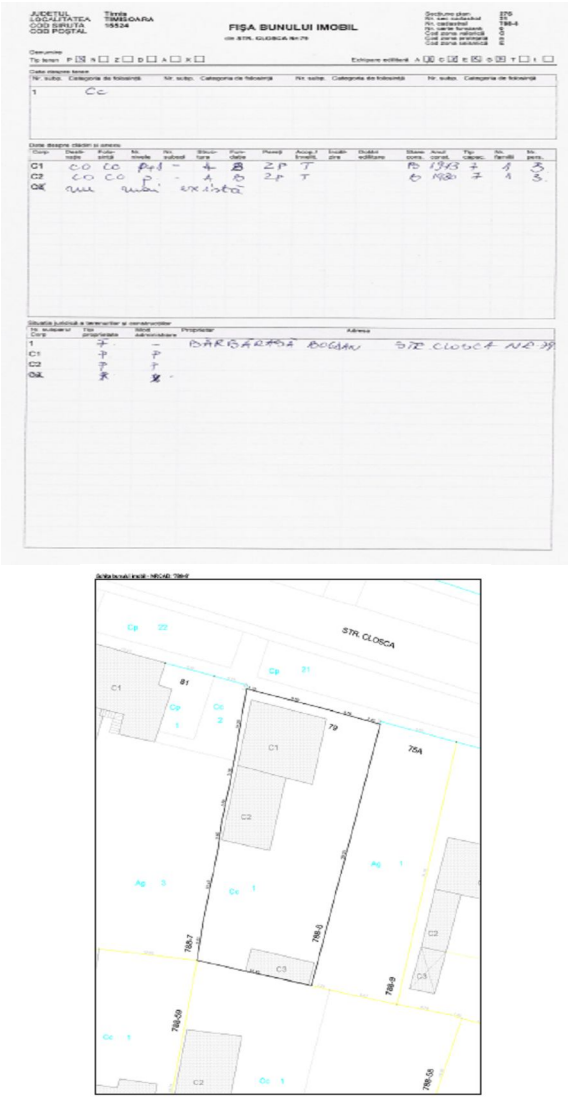

Figure 5. Property Sheet (student's "job")

CONCLUSIONS

The large use of the automatically tools of measurement and processing, the elaboration of digital plans and maps lead to a modern cadastre which can face the present request from this field of activity.

The applicability of the informational systems will last a long period of time, while both categories of classic and digital cadastral materials will operate.

During all this period, the technical equipment for data collection, processing, storage and overview will continue developing, in order to accelerate the complex project of informational systems achievement.

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