Geodetic Education at the "Politehnica" University of Timisoara – Romania

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1. Introduction

The paper describes the engineering programs and specific educational objectives in geodetic higher education from Politehnica University of Timisoara"; it offers a short presentation of the Romanian cadastral situation and aspects of the transition in the educational system.

2. Generals on the Romanian Cadastre

During its evolution in Romania, geodetic activity, especially cadastral works dealt 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 land 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 geodetic work and also due to the inner conditions of the Romanian society.

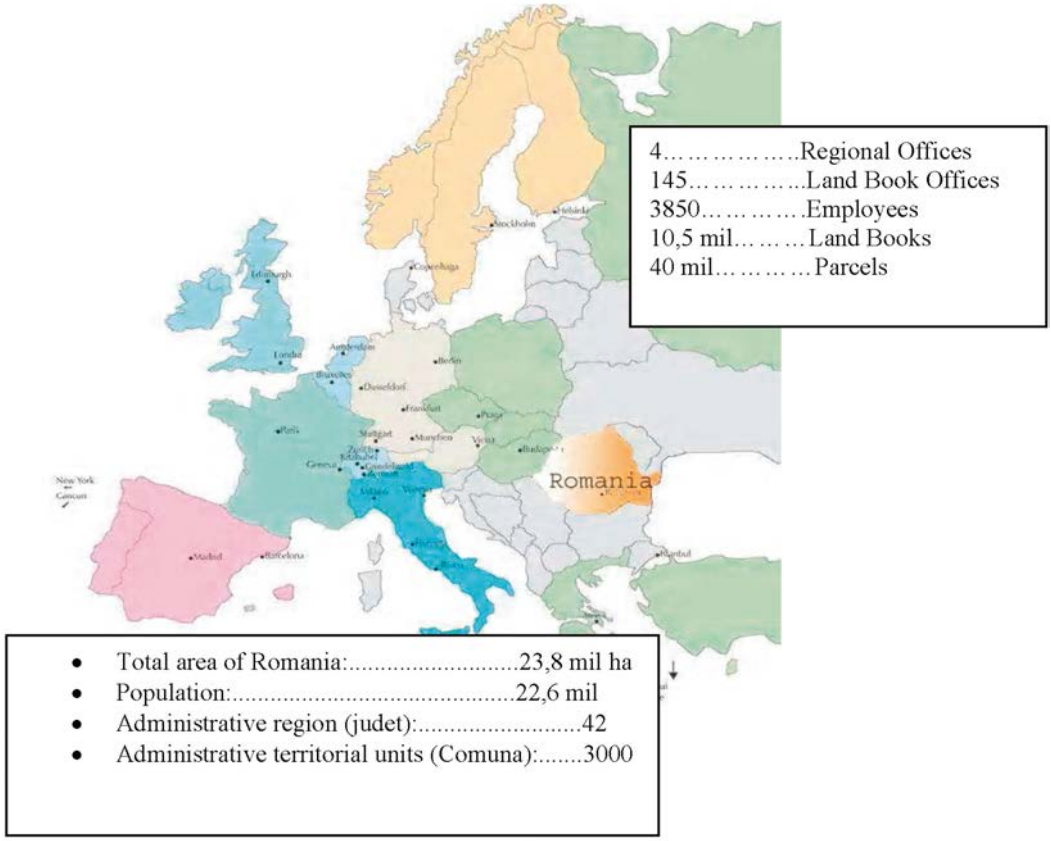


Fig. 1: RO - General context

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.

The primary data processing for computation of the land surfaces for a property is 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 7 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 40 million parcels – for Romania), fig.1.

This situation requires the elaboration of special, modern methods for data processing inside the local agencies for cadastre which 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.

The new tendencies of automation in this research area impose the necessity of restoration the topographic and cadastral plans in the digital form.

3. Surveying and Cadastre Education in Romania

The education and training in Geodetic Engineering are at graduate and postgraduate levels. Graduates from the branch of *Terrestrial Measurements and Cadastre* can spatially locate and map natural and artificial configurations, develop control point networks, perform engineering and cadastral measurements. Graduates can also design and manage economic solutions for geodetic problems at a high engineering level. They can develop relevant technologies and perform scientific research.

The program taught in Romanian Universities (fig.2) follows a traditional European curriculum and leads to the Dipl.Ing.Degree, which is regarded as an equivalent to the M.Sc.Degree. The Romanian educational program operates with the credit system, the teaching period is four years long, in total 240 credits. The curriculum consists of compulsory subjects, optional and elective subjects, including in the eighth semester a period of 7 weeks which is reserved for preparing the diploma project. According to the strict requirements every student has to learn a foreign language and take a language exam of medium degree. Postgraduate or Ph.D. courses normally take three years to complete.

3.1 B.Sc. Degree

The first 3 semesters of B.Sc. feature a universal, fundamental education, while the subsequent semesters exclusively include the subjects of Geodetic Engineering and Cadastre. The students take 4 exams each semester and 4 colloquia.

In the first four semesters, students take a 27 hour/week block of compulsory subjects that provide fundamental education in the branch of study. During the other four semesters, they have 26 hour/week of compulsory, optional, and elective subjects in order to diversify and extend their knowledge. Part of the eighth semesters is reserved for planning diploma project (7 weeks), completed by another 7 weeks of teaching. On successful completion of the eight semesters, final exams and the diploma project, a student will be granted with B.Sc.Degree.

3.2 M.Sc.Degree

Students who already hold B.Sc. Degree, can pursue an M.Sc.Degree in the same field of study. They generally follow an approved curriculum, but elective subjects allow personal interests. Courses are run for small groups and the students are expected to work individually under the direction of a personal advisor.

A M.Sc. programme is 4 semesters, or 2 years in duration and consists of 14 hours (usually) of instruction per week and 4 examinations per semester (starting with academic year 2009/2010

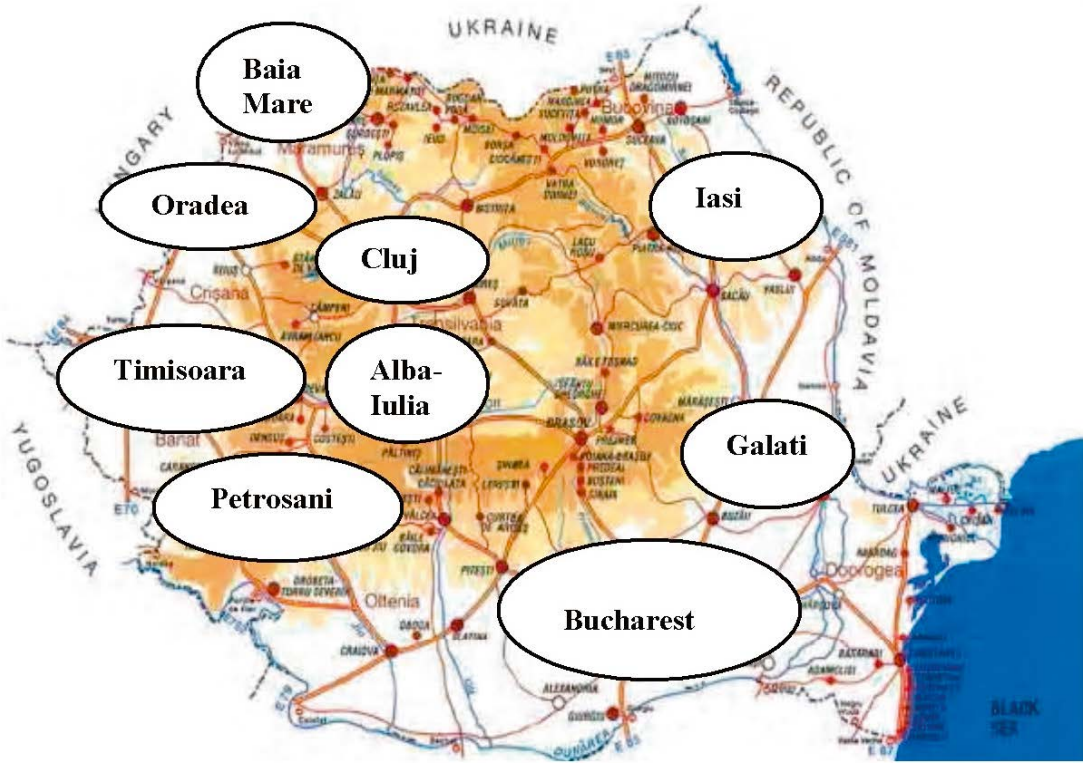


Fig. 2: Geodetic Educational Training in RO

for the Bologna program). A M.Sc. degree is granted on the successful completion of thesis and final exams.

Governmental Accreditation Committee and the Romanian Agency for Quality Assurance in Higher Education review the applications for each study program and each of its specializations for the given period. The assessment relates primarily to content of the program (specialization), number, quality and age of teachers, facilities of the given university. The accreditation is taken away from the university in case the requirements are not satisfied.

4. Educationin the "Polithenica" University of Timisoara

Timisoara is a large economic and cultural town in Banat region, in the west of the country.

It is also the capital of Timis county. The city is also called "Little Vienna", because it belonged for a very long time to the Habsburg Empire and the entire city center consists of buildings built in the Kaiser era, which is reminiscent of the old Vienna.

In recent years, Timisoara has enjoyed a significant economic boom as the number of foreign investments has risen constantly. It is considered to be the second most prosperous city in Romania (following Bucharest). Timisoara is an important university center with the emphasis on subjects like medicine, engineering, humanistic.

The "Politehnica" University is one of the largest and best-known technical universities in Central and Eastern Europe. For 80 years it has been an outstanding, modern university with a well-deserved reputation for excellence. This excellence is demonstrated by the academic programs, the research on which these programs are based, the support given to students, the employability and employment record of the students and the physical environment of the University. The "Politehnica" University of Timisoara has 10 faculties and several independent departments Ydelivering the academic programswhich are modern, relevant, intellectually stimulating and represent the highest quality in their respective disciplines. Being aware of the importance of the international collaborations,

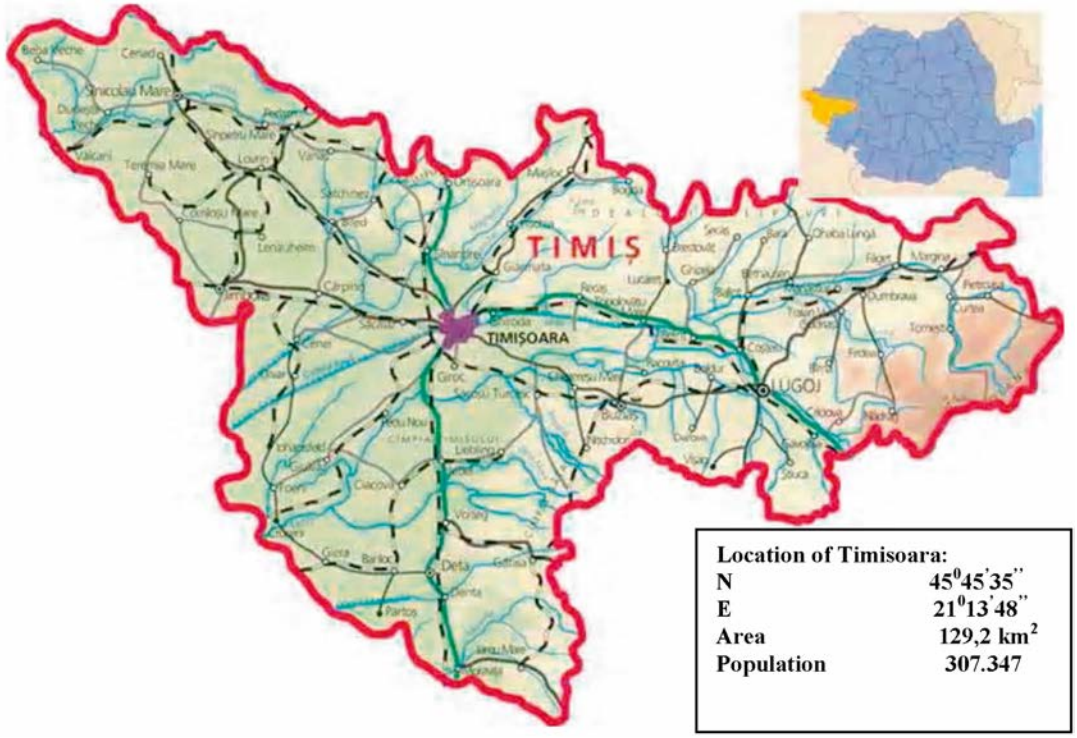


Fig. 3: Timisoara - Location

directly related to the mission and the objectives already stated, the "Politehnica" University of Timisoara has continuously extended and developed the relations with foreign partners through projects, programs and activities of learning and scientific research. The developing strategy for cooperation programs between the University and foreign partners is based on two coordinates:

- to take part in programs and projects financed by the European Union;
- to establish as many bilateral agreements as possible with universities from Europe and other continents.

The "Politehnica" University of Timisoara has focused on concluding agreements with universities from all over the world. Due to the agreements signed between the faculties, the departments have established mutual relations and facilities.

Speaking about the strategy of the management of international relations, in the "Politehnica" University of Timisoara was created the Department for International Programs and Relations. This department is directly coordinated by the Rector and the Scientific Secretary and it assures the coordination, the evidence and monitoring of the international programs. This department has the following functions:

- representation, protocol and public relations in the international agreements field;
- evidence and monitoring of the programs and activities of academic collaborations;
- initiates the international collaboration, gathers information and acquires it;
- keeps the evidence of the official trips;- offers advice for the use of the financial resources needed in collaborations.

Starting with academic year 2005/2006 the University adhered to the Bologna System with 3 levels for studies:

1. Bachelor's Program – **B.Sc. Degree,**
2. Master's Program – **M.Sc.Degree,**
3. Doctoral Program – **PhD,**

so that, in the current academic year four programs are part of the Bologna project (I-II-III-

IV years of study), and one program is part of the old project (Vth year of study).

The educational program at the "Politehnica" University of Timisoara is based on the credit system (ECTS). **The branch of Terrestrial Measurements and Cadastre** from the Faculty of Civil Engineering offers full-time degree programs in Romanian language only.

5. Program of terrestrial Measurements and Cadastre in Timisoara

Within the "*Politehnica*" University of Timisoara, Faculty of Civil Engineering this programme was founded in **1991**, being registered in the Romania's Official Monitor of 13 May 2002, in the section accredited specializations.

The development of the geodetic profile was imposed, both locally and nationally, out of the economic and scientific needs, i.e. the lack of experts in this field of activity.

This speciality belongs to the field of *Geodetic Engineering,* a distinct profile in the Romanian National Nomenclature of Specialities.

The structural changes, which occurred in our country after 1989, due to the development of the private properties and the passing to the market economy, also led to fundamental changes in the field of cadastre; both in what the record of the real assets and cadastral plans are concerned.

The update and the modernization of the cadastre, in order to make it multifunctional, require a large number of specialists and if at all possible a uniform national distribution.

At the University of Timisoara, from 1991-2008 more than 300 geodetic engineers were formed in the 12th series of graduates.

The curriculum is adapted for the open higher education system, and the syllabuses are correlated to similar national and international programs, in order to comply with the European Credit Transfer System.

In order to meet the required future objectives, the geodetic engineer needs a thorough training in the field of terrestrial measurements. This can only be ensured by the study of both fundamental courses (mathematics, physics, techniques of calculus, etc.) and speciality courses (Topography, Geodesy, Cartography, Photogrammetry, Cadastre, etc), Table 1,2.

Nr.	Discipline	Hours				Weight	ROregimentations
		C	S	L	TOTAL	%	
1	FUNDAMENTAL	308	168	126	602	18,59	min.18%
2	IN DOMAIN	518	–	767	1285	39,68	min.38%
3	SPECIALITATY	497	–	700	1197	36,97	min.25%
4	COMPLEMENTARY	14	140	–	154	4,76	max.8%
TOTAL		1337	308	1593	3238	100	100%

Table 1: Number of hours and distribution per discipline (1)

Nr.	Discipline	Hours				Weight	ROregimentations
		C	S	L	TOTAL	%	
1	COMPULSORY	994	308	1194	2496	77,08	60 – 80%
2	OPTIONAL	343	–	399	742	22,92	20 – 40%
Total: compulsory and optional		**1337**	**308**	**1593**	**3238**	**100**	**100%**
3	ELECTIVE	119	161	–	280	8,65	5 – 10%

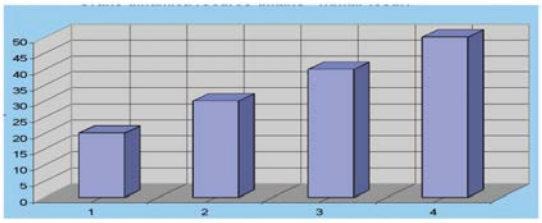
Table 2: Number of hours and distribution per discipline (2)

For the complex training of the future specialists, a substantial contribution is brought by disciplines belonging to the beneficiary fields of these activities, such as: Constructions, Urbanism, Transportation, Local and Regional Administration, etc. .

Nowadays, at the speciality of ***Terrestrial Measurements and Cadastre*** of Timisoara, 200 students are studying. Starting with the academic year 2005/2006 a new educational plan was introduced, structured on 4 years for the technical domain (licensed engineer) plus 2 years for the Master degree (diplomat engineer) – the Bologna Process.

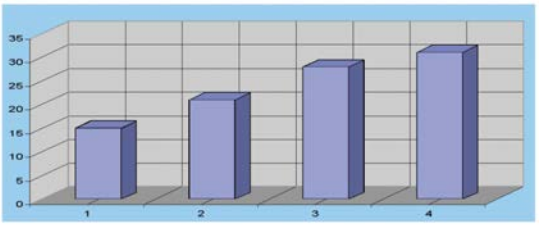
The Bachelor Program (**B.Sc. Degree**) was evaluated in 2008 by the Romanian Agency for Quality Assurance in Higher Education obtaining the accreditation in the Bologna system.

The second level of the educational training including the Master Program (**M.Sc.Degree**) will be evaluated until summer in Timisoara.



1 – period of time 1991-1995
2 – period of time 1996-2000
3 -period of time 2001-2004
4 – period of time 2004-2008

Graph 1: Dynamics of the human resources- number of places



1 –year 1996
2 – year 2000
3 – year 2004
4 – year 2008

Graph 2: Dynamics of the Human Resources- number of graduates

The only institution that offered until now Master Programmes in Surveying and Geodesy in the old system was the Faculty of Geodesy in Bucharest; it has been accredited also for new Master Programmes in Bologna system.

The specialization of Terrestrial Measurements and Cadastre in Timisoara has had an ascending evolution since its foundation, 18 years ago, justifying its existence completely (graph.1,2). The mission of training cadastre specialists includes not only the students but the teaching staff as well. The quantitative and the qualitative level of the students follows an ascending direction, being reflected in the increasing number of places (graph.1,), the increasing number of graduates (graph.2) and the marks obtained by the students. The students' evolution, since the admission until graduation, also reflects the interest and the preoccupation of the teaching staff in order to meet the requirements of the teaching process.

The speciality consolidation *strategy* envisages the following objectives:

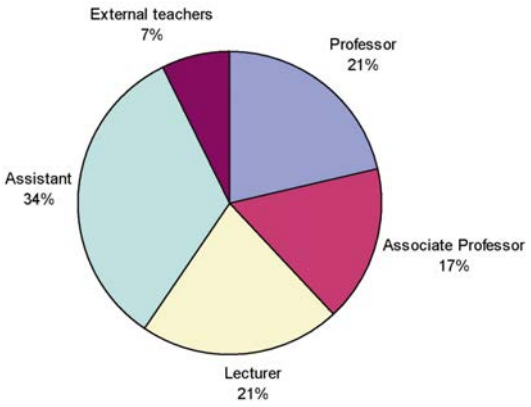
- Continuous development of the curriculum and of the syllabuses, in conformity with the evolution of the techniques in the domain of Geodesy, and in correlation with similar Romanian and European Union institutes;
- PhD development studies for the teaching staff and specialized training for external professors, i.e. people who work in the field of cadastre.
- The development of some current research fields in cadastre such as: informatization of the land register, land information systems, GIS, satellite technologies.

Since 1991, the well individualized speciality of Terrestrial Measurements and Cadastre part of the "Politehnica" University of Timisoara, has produced 12 series of alumni who have covered successfully the whole design and execution work in this field, mainly for the west part of the country.

The graduates, geodetic engineers, are employed by state institutions (offices of the National Agency for Cadastre and Land Registration, Local Councils, Design Institutes, Autonomous administrations, etc.) private companies (trading companies) specialized in cadastre or having related activities (constructions, urbanism) or, they are freelancers.

The University, and the faculty respectively, ensure the adequate material basis required by a qualitative education, teaching spaces, adequate laboratories, a specialized library, and obviously a

constant teaching staff and external professors, adequately trained.



Graph 3: Distribution of teaching personnel

All the teaching staff has been involved in scientific research. The various research themes in the field of geodesy engineering are made public either by the publication of scientific articles, in various speciality magazines, manuals, courses, laboratory works, or by presenting the findings at different national or international symposiums. The staff is also involved in research contracts with various companies. The teachers also belong to different professional associations such as: AGIR-the General Association of the Engineers in Romania, UGR-Romanian Geodesy Union, the Local Geodesy Association, the Romanian Society of Geotechnical Engineering and Foundations, the Romanian Road Society, etc.

5.1 Evolution and the perspective of the study programme

The speciality of Terrestrial Measurements and Cadastre was conceived as an interdisciplinary speciality, capable to train competent specialists and to provide efficient solutions for the design, realization and exploitation of works in the field of terrestrial measurements, for different purposes (topographic engineering works, cadastre works, systematization, urbanism, GIS, etc,)

6. Thematic Priorities in Research

The "Politehnica" University of Timisoara has a long term strategy and short and middle term programs which contain the objectives, the projects and the foreseen results of the research, as well as to the means of reaching them.

These are some of the main directions of the research team, formed from teachers and students, of the speciality of ***Terrestrial Measurements and Cadastre***.

- Topo-geodetic studies to monitor the tectonic processes in the western part of Romania;
- Topographic documentation to draw up the urban area plan projects in the western part of Romania;
- Technical solutions for ensuring the stability of certain industrial objectives with various destinations;
- Updating the data base of the Geographic Informatic System of Timisoara – the capital of the Timis County;
- Updating the database for urban cadastre ;
- Updating the road cadastre data base;
- Cemeteries Cadastre

The findings of the research are made know in different ways: they are published in different publications for didactic purposes or scientific publications; they are presented in doctoral theses, or are rendered profitable in university research contracts, since our department is accredited by the National Agency for Cadastre and Land Registration.

Man's wish and need for information has always been accompanied by new discoveries. Our field is not an exception. New wide perspectives are opened towards the understanding of the environment by the use of new technology and informatization.

In the field of terrestrial measurements, a constant concern of people, for more than two millenniums, to measure and study the shape and the form of our planet, new problems keep occurring, problems which have to be solved by the present and the future geodetic engineers.

This field of activity is of large perspective in Romania and its mission is to find adequate technical and technological solutions for various problems that the specialists in the field have to face, i.e. either topo.-geodetic works, cadastre and land register works, or setting up new appropriate information systems to monitor the specific engineering works, thus ensuring their stability in time.

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