

# Modernizing High school and University Curricula for Surveyors in Croatia

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**Key words:** surveying technician, land administration technician, modernizing curricula

## SUMMARY

The economic growth in Croatia in the first decade of the 21<sup>st</sup> century, which was especially expressed through the expansion of the real estate market, and the modernization of the overall Croatian legislative system, strongly stimulated by the process of accession to the European Union, have created a new framework for land administration institutions in Croatia. Therefore, in the past five years, respective legal acts have been modernized and business processes reengineered, especially in the area of the real estate (cadastre) and ownership (land registry in municipal courts) registration. These changes have been implemented in the establishment of the Real Property Registration and Cadastre Joint Information System, which is in the initial implementation phase.

To be able to create and maintain such a redefined Croatian land administration environment, the question of existence of educated and trained personnel, especially surveyors, lawyers, IT experts, and well trained technicians, has been detected as the key question to the whole reform. At the end of 2010, the new curriculum for geodetic and geo information technician has been adopted which will be implemented in 2012 in the high schools teaching surveying professionals. As a continuation to these efforts, the State Geodetic Administration of Croatia has, within the scope of its responsibilities, launched a project to develop and modernize other geodetic curricula. In the frame of the Integrated Land Administration System Project, activities have been defined and launched in order to define and implement a new high school profile – “cadastre-land registry technician” as well as support the modernization of surveyors university curriculum in Croatia.

This paper describes the present situation and needs of the society, new professional profiles, respective projects which aim to support the development of preconditions for education of new modern surveying professionals who will be able to satisfy the needs of private and public sector in the field of land administration in Croatia.

## SAŽETAK

Gospodarski uzlet u prvoj deceniji XXI stoljeća, koji je bio posebno izražen kroz procvat tržišta nekretnina s jedne strane te modernizacija cjelokupnog hrvatskog zakonodavstva, posebno potaknuta procesom pristupanja u Europsku uniju, stvorili su novi okvir za djelovanje institucija zemljišne administracije u Hrvatskoj. Stoga je tijekom zadnjih pet godina modernizirano odgovarajuće zakonodavstvo te proveden reinženjering procesa,

pogotovo u segmentu registracije nekretnina (katastar) i vlasništva (zemljišne knjige pri općinskim sudovima) što je materijalizirano uspostavom Zajedničkog informacijskog sustava, koji je u početnoj fazi implementacije.

Da bi se tako redefinirano okruženje zemljišne administracije u Hrvatskoj moglo uspostaviti i kvalitetno održavati pitanje educiranih i osposobljenih kadrova, prvenstveno geodeta, pravnika, informatičara te osposobljenih tehničara, detektirano je kao ključno pitanje cjelokupne reforme. Tako je krajem 2010. godine usvojen novi curriculum za geodetsko-geoinformatičkog tehničara, koji će se od 2012. implementirati u srednje tehničke škole koje educiraju geodetske stručnjake. Nastavno je Državna geodetska uprava, u dijelu svoje odgovornosti, pokrenula projekt razvoja i modernizacije drugih geodetskih curriculumuma. U okviru projekta “Implementacije integriranog sustava zemljišne administracije” osmišljena je i pokrenuta aktivnost definiranja i implementacije novog srednjoškolskog profila - “katastarsko-zemljišnoknjižnog tehničara” i modernizacije sveučilišnog curriculumuma kojim se obrazuju geodeti u Hrvatskoj.

U ovom radu opisani su sadašnje stanje i potrebe društva, novi profili stručnjaka, odnosno projekt koji ima za cilj podržati stvaranje pretpostavki za osposobljavanje novih modernih geodetskih stručnjaka, koji će moći zadovoljiti potrebe privatnog i javnog sektora u području zemljišne administracije u Hrvatskoj.

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## 1. GEODETIC PROFESSION AND LAND ADMINISTRATION REFORM

After Croatia had gained its independence, a new legal, social and economic framework was created that, after the end of the Homeland War in 1997, enabled accelerated economic growth of the entire Croatian economy (regardless of the transition problems) with the special emphasis on the large investment cycle in the construction sector and the related real estate market along with the parallel process of re-evaluating private ownership (regulation of State assets, return of the property alienated during Socialism, regulation of land registers and cadastre). As a consequence, all professions involved in one of the afore-mentioned fields of action have also experienced accelerated growth and prosperity. Since the geodetic profession participated in all of the afore-mentioned activities, the development and prosperity of the geodetic profession have been more than visible in the past fifteen years.

The current organization of the geodetic profession in Croatia is based on the first Law on State Survey and Real Property Cadastre (Republic of Croatia, 1999) amended in 2007 (Republic of Croatia, 2007) and furthermore the Law on Performance of Geodetic Operations (Republic of Croatia, 2008). The latter regulation today defines the performance of geodetic operations in Croatia, origins of the operations between the civil service and the developed private sector (geodetic companies and small trades) whose business is based on the system of licensing individuals (licensed expert) or licensing geodetic companies and small trades. The responsibility for licensing a licensed expert – licensed geodetic engineer, a precondition for licensing a geodetic company or small trade, is conveyed to the Croatian Chamber of Licensed Geodetic Engineers (hereinafter: CCLGE), established in accordance with the afore-mentioned Law on Performance of Geodetic Operations while, pursuant to the same law, the licensing of geodetic companies and small trades is the jurisdiction of the State Geodetic Administration (hereinafter: SGA). Apart from the afore-mentioned institutions in Croatia, the Croatian Geodetic Association and Croatian Cartographic Society are also active as professional bodies along with the Geodetic and Geo-Information Employers' Association under the Croatian Employers' Association and high school and high education institutions educating geodetic experts. Thus, along with 1,400 civil servants at the SGA and Municipal Office for the Cadastre and Geodetic Works of the City of Zagreb, in Croatia there are 900 licensed geodetic engineers who are members of the CCLGE and who are the basis for 560 licensed geodetic companies and small trades performing geodetic operations for all users in the State (Bačić, 2011).

As a consequence of the newly created legislative framework, the Republic of Croatia, or rather the Ministry of Justice and SGA, as the project stakeholders, carried out between 2002 and 2010 the Real Property Registration and Cadastre Project, representing the basis for the land administration reform program entitled „Organized Land“. The Real Property

Registration and Cadastre Project was funded from several sources i.e.g State budget, co-financing of the local government units, World Bank loan, European Union grants. A significant part of the project and one of its four components, was dedicated primarily to the training and education of experts in cadastral offices and land registries of municipal courts as well as the education of geodetic and legal experts acting in the land administration system. The afore-mentioned education programs and trainings encompassed both the professional and computers skills as well as skills of managing human capacities and communicating with the parties.

The result of the afore-mentioned reform can be summarized in several basic characteristics of the current moment of land registers and land administration in Croatia.

- all alphanumerical data of the cadastre and land registers is digitized and the cadastral maps are vectorized while the operations at cadastral offices and land registries of municipal courts rely greatly on information technology,
- new topographic maps and digital orthophoto maps have been produced for the entire State territory
- program solutions keeping the registers are modernized and central data repositories have been established, being instantly (on-line) updated with changes,
- backlogs, especially in land registers, have been reduced to less than 10% of the initial status of 2002 while the registration time has been shortened from 900 to 37 days,
- 7% of the Croatian territory has been encompassed by new cadastral surveys and register data has been fully harmonized with the situation in the field,
- the corresponding legislation has been harmonized several times in order to create a framework for the JIS establishment based on new business processes and a single data model.

The afore-mentioned changes have additionally influenced the work modifications at cadastre offices and land registries of municipal courts so it can be said with certainty that in the past ten years the work and working environment of both geodetic technicians as well as cadastral and land registry clerks have been drastically changed. The changes are the results of modified surveying techniques, introduction of information technologies and especially data digitization as well as linking alphanumerical and graphical databases, changes to the overall significance of spatial information and registers based on the afore-mentioned databases and the modified modes of managing the society at all levels, which has reflected in the changes conducted over the past ten years. Namely, numerous laws regulating the most varied fields contain a standard provision that modern GIS-supported systems based on official spatial data and products of the SGA are being established in order to keep the records and registers grounded in respective regulations.

## **2. EDUCATION OF GEODETIC EXPERTS**

The education of geodetic experts in Croatia is part of the overall educational system based on the combination of the general and vocational high schools i.e. faculties specialized in respective fields or professions. In such a context, today geodetic technicians are educated in seven high schools as a special professional profile and at two level of geodetic experts at

two faculties i.e. undergraduate and graduate studies (Bachelor and Master in Surveying), see: table 1.

Table 1: Overview of the institutions educating geodetic experts in Croatia

School/University	Students	Annually	Comment
Geodetic Technical School Zagreb	387	100	
Civil Engineering-Geodetic School Osijek	140	35	
Civil Engineering-Geodetic Technical School Split	120	30	
Civil Engineering Technical School Rijeka	105	25	
Technical School Pula	120	30	
High-School A.M.Reljković Slavonski Brod	54	25	Biannually
High-School Metković	30	-	Only one generation
Total:	956	245	
Faculty of Geodesy, University of Zagreb	825	95	
Faculty of Construction, Architecture and Geodesy, University of Split	60	30	Study started in 2010
Total:	885	125	

Under pressure due to fast modernization of the profession and the fact that the geodetic profession has become one of the most heavily IT supported professions due to the development of the global navigation and satellite positioning systems (hereinafter: GNSS), remote sensing satellite systems, geographic IT systems (hereinafter: GIS) and communications technologies and that in the past ten years, it has experienced great prosperity and boom, the high schools educating geodetic technicians have realized that the existing curriculum and program can no longer satisfy the needs of the economy and State administration. This is not a new notion and it has already been considered how to initiate and streamline the educational reform for geodetic specialists (e.g. Maurer, 2006). Therefore, at the initiative of highschools, ASO (the corresponding State institution setting up the professional standards, qualifications and curricula for professionals) has initiated the procedure of developing new standards for the geodetic technician profile. After two years, the experts from the State Geodetic Administration, Faculty of Geodesy, geodetic schools, geodetic economy and, of course, the afore-mentioned Agency have produced a draft proposal for the new profession of geodesy and geo-information technician and the corresponding qualifications and modifications of the curriculum and program. These documents, the Profession Standard (ASO, 2010), Qualifications Standard (ASO, 2010) and Amendments to the Separate Professional Part of the Curriculum and Program: geodesy and geo-information technician (ASO, 2010), have undergone ASO control and will be implemented, upon the approval of the Ministry of Science, Education and Sports, in all highschools educating geodetic technicians.

Since 2009, the university programs and the education of geodetic engineers (six semesters) have been organized at the Faculty of Geodesy in Zagreb and, for the first time in 2010/2011, at the Faculty of Construction, Architecture and Geodesy of the University of Split while the master's education of the geodetic engineers (ten semesters) has been organized only on the Faculty of Geodesy of the University of Zagreb. After the erroneous

politics of increased (double quota) enrolment of students in 2005/2006 and 2006/2007 at the Faculty of Geodesy that has smitten both the quality of education and, consequently, to the quality of experts graduating from the faculty, the total number of students enrolled at both universities in Zagreb and in Split has been reduced in 2011/2012 to 125, out of which 95 in Zagreb and 30 in Split. Given the previously excessive number of students, it can be stated today that even this number of students remains large but that it is certainly a positive step forward in the right direction.

### **3. CONTINUATION OF THE GEODETIC CURRICULA REFORM AND MODERNIZATION**

As a follow-up to the Real Property Registration and Cadastre Project which brought the land registers, cadastre and landbooks to the level of digital and IT readiness for the implementation into modern IT systems supported by GIS technologies ("digital ready" status), the SGA and Ministry of Justice have, at the proposal of the SGA, started to define a follow-up project to be co-financed with a new World Bank loan and IPA European Union assistance programs. The objective and purpose of the new project are unambiguously contained in its title: „Integrated Land Administration System Project (hereinafter: ILAS). It actually denotes two interlinked projects because it would not have been possible to join the funding sources which has given us the ILAS WB Project cofinanced by the World Bank and State budget as well as the ILAS EU project, cofinanced by the IPA 2010 assistance of the European and State budgets. In total, these two projects, as well as EU IPA 2008 „One stop shop“ Project, undertaken by the Ministry of Justice, have ensured in the next four years further EUR 24 million for the land administration reform continuation. These projects focus on the implementation of the data and solutions developed with the view of completing the system establishment to efficiently meet the needs of the land administration users and guarantee the updated, accurate and reliable registration of the real property and corresponding titles.

One of the projects planned under the ILAS WB project is further definition of the profiles of both highschool and higher education experts needed in the modern land administration and geo-enabled society of Croatia. The afore-mentioned project encompasses a number of activities such as:

- support to defining, developing and adopting the new professional profile of the cadastre and land registration profile
- support to updating and modernization of the curricula and programs of high education profiles of geodetic engineer and masters of geodetic engineering
- equipping high schools and institutions of higher education with IT, geodetic and other equipment in order to implement the new curricula and programs.

Among the afore-mentioned activities, the idea to define, develop and adopt the new professional profile of the cadastre and land registration technician stands out. This professional profile – profession in the new economic circumstances in Croatia has even wider scope of activities than the geodetic and geo-information technician. Namely, apart from the cadastral and land registration technicians that number about 1,000 in both systems,

it must be underlined that one of the most propulsive branches in Croatia in the past fifteen years is the activity of real property agents and that the number of employees in other segments of State, regional and local government, public and utility systems and in the commercial sector, using the spatial information, GIS and GNSS in the performance of their tasks, is ever growing.

The basic knowledge and skills to characterize and differentiate the cadastre and land registration technicians from other professions are as follows:

- basic knowledge and understanding of land registration and administrative law,
- familiarity with basic land administration registers and their functioning,
- familiarity with other related fields, physical planning, environmental protection, real property market, utilities, agriculture and forestry,
- familiarity with and ability to use GIS technologies,
- understanding of spatial information stored in GIS systems, and
- familiarity with and ability to use GNSS technology and surveying techniques.

This specialist profile has a wider platform and perspective of recruitment and should be stronger numerically than the geodetic or geodetic and geo-information technicians.

The current activity status of the ILAS WB Project is that started in November 2011, upon the Loan Agreement ratification in the Croatian Parliament. With regards to the project of modernizing and expanding the professional profiles of land administration experts itself, all stakeholders that need to participate on the project such as high schools, faculties, ASO and professional geodetic associations have been mobilized through several meetings and a basic consensus has been reached about this initiative and the idea of defining the new professional profile of the cadastre and land registration technician has been supported together with the concept of the entire project. When producing draft reports on the new expert profile to be presented before the Professional Council, the next steps are the submission of a formal proposal to the Sector Council for Construction and Geodesy active under ASO with the objective of initiating a formal process to define the new professional profile, form a working group to work on this issue and ensure support for its work from the ILAS WB Project.

#### **4. HIGHER EDUCATION OF GEODETIC EXPERTS**

The Faculty of Geodesy of the University of Zagreb, just like any other faculty of the University of Zagreb, has reorganized the teachings in line with the Bologna declaration starting with the school year 2005/2006, passing a new curriculum and program (Faculty of Geodesy, 2005) that will be subsequently implemented by professors in the educational process. The existing undergraduate and graduate curricula and program are certainly the topic that requires a separate discussion because the author has found a number of gaps in them. However, although burdened with an excessive number of students in the past years, inadequate and illogical curriculum and programs and the drop in the teaching criteria quality that only a small number of individuals successfully fended off, numerous professors have continuously improved in the past years the teaching and content of their classes, following the changes that were relevant for specific classes.

The modernization of the study curricula is more than necessary because the needs of a modern society have also dramatically changed in only the last ten years. It must be underlined that intense changes are underway, initiated not only by the technology modernization and change of lifestyle but also the shift of the economic power in the world. The globalization, tied with accelerated ICT revolution, has created a completely new framework for interaction between social communities and individuals, both in positive as well as in crisis situations, and imposed completely new requirements before all professions and, in particular, the geodetic profession. From the point of view of the geodetic profession, the afore-mentioned requirements can be described in several groups as follows:

- Definition of literacy must be extended to computer literacy,
- The entire society must be linked by communications (at least wireless telephone and internet)
- Global navigation and satellite systems (hereinafter: GNSS) will become a wide platform for the comprehensive orientation and navigation as well as the basic technology for geodetic and all other precise measurement on the Earth,
- Mobile and all other communications will contain as an integral service the GNSS equipment and GIS-supported services in the function of orientation and navigation as well as completely new areas,
- All information, especially the official one, collected by the community must be publicly accessible,
- Spatial information become the basis for managing and every system will be supported by the spatial datasets available in the GIS environment,
- Spatial information, especially official, must be updated, reliable and accurate with a special emphasis on up-to-datedness which must sometimes be at the detriment of accuracy and reliability,
- New methods for collecting the spatial information based on numerous sources, official and non-official (crowd sourcing etc.) will be even more developed which will result in a great need for understanding the origin and quality of the data i.e. the verification of various types of use.

The afore-mentioned will result in a great need for spatial information that will be, in many segments, updated in real time and the bodies in charge of the official spatial information will be faced with enormous challenges to satisfy the needs. The afore-mentioned has been known for a while and together with the problems of organizing the collection, processing, keeping and distributing the spatial data, it represents a great challenge for geodetic and geo-information community. New concepts, e-Government, e-business, key registers and National Spatial Data Infrastructure represent the response of the experts to the challenges in question. Although the afore-mentioned concepts differ in terms of their content and goals and resolve various problems, the concepts of e-Government and key registers are aimed at concrete rounded wholes in the State administration (State registers) and their efficient functioning while e-business is aimed at efficient business economy, it must be underlined that only the concept of the National Spatial Data Infrastructure is of general nature not defined according to the stakeholders but focused on spatial information.



Taking the afore-mentioned changes into account, the Faculty of Geodesy in Zagreb has started to consider the modernization of its curriculum and program aimed at creating such a curriculum that will open up to the needs of a modern geo-enabled information society of the future but also offer to the geodesy, in the widest sense of the word i.e. including the terms such as geo-information and geomatics, an even wider depth and understanding of other areas of social activities linked with the geodesy in order to seek and use geo-referenced information. With the help of the ILAS Project, this process should result after three years in a new university curriculum and study program at the Faculty of Geodesy in Zagreb as well as the geodesy chair in Split.

## 5. CONCLUSION

The development and needs of a modern society can rightly be characterized as a geo-enabled society seeking new profiles of specialists having the know-how required to ground this development on the efficient spatial data use. Recognizing this fact, the geodetic stakeholders in Croatia, primarily the SGA and scientific educational institutions in cooperation with the ASO, have initiated the definition of a new professional profile (cadastral and land registry technicians) as well as modernization of the new curriculum and program for the undergraduate and graduate geodetic studies in accordance with the needs of the citizens, economy and the overall community, as a follow-up to the redefinition of the professional profile of geodetic and geo-information technician.

In this context, the WB ILAS Project, to be carried out over the next four years by the SGA in cooperation with the Ministry of Justice, envisages the project of modernizing and expanding the professional profiles of land administration experts that will also ensure the creation of preconditions to implement the afore-mentioned education by ensuring the necessary IT and surveying equipment.

The afore-mentioned activities should be ensure in the near future that the geodetic profession is ready to embrace the changes generated by the modern society and not only to satisfy the needs of this society but also be in the position to carry out these changes.

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