

# Professional Education of Surveyors in Serbia

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**Key words:** Serbia, Education of Surveyors

## SUMMARY

In Serbia, like in many other countries, there are three various levels of schools for surveyor's education: secondary, higher and academic (faculty). Except these, we must mention two academic, faculty levels – Master and PhD. Secondary type of school lasts four years and they are located on several different places. After finishing this level, the students can work or continue their studies in higher school or on Faculty, both with three year study period, on basic level. There are one higher school and two faculties in Serbia which students can attend their studying. We are now at the middle of accreditation process in accordance with Bologna rules and a lot of changes were made toward acceptance of strong standards of a new European education unification process. This article will show what recent measures were taken through that unification process and the authors of this article will try to give some comments about outcomes of education curricula in all types of surveyor's education schools at this moment.

## REZIME

Slično kao u drugim zemljama, u Srbiji postoje tri nivoa obrazovanja geodetskog kadra: srednjoškolski, visokoškolski i fakultetski nivo. Srednjoškolski program traje četiri godine i u Srbiji one se realizuje na pet različitih mesta. Nakon završetka srednje geodetsko-tehničke škole učenici se mogu zaposliti ili nastaviti školovanje na Visokoj Građevinsko-Geodetskoj školi ili na Građevinskom fakultetu u Beogradu, na Odseku za geodeziju i geoinformatiku, odnosno Fakultetu tehničkih nauka u Novom Sadu, gde takođe, odskora postoji jedan geodetski smer. U radu su ukratko prikazani sadržaji pojedinih programa sva tri nivoa studija iz čega se može videti osnovni ciljevi procesa obrazovanja geodetskog kadra u Srbiji.

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## 1. SHORT HISTORY OF SERBIAN GEODESY

The first activities in the field of Geodesy in Serbia dated to the end of XVIII century, when Geodetic service of Austro-Hungarian Empire started the survey at the northern part of Serbia. The first Serbian geodetic institution was Geodetic Institute of Serbian Military Forces which was founded on 1878, and since then the serious activities were started to work. The first tasks were of fundamental meaning – basic geodetic works which were connected with neighboring countries, especially to the west where Serbia had a border with Austro-Hungarian Monarchy. Between two World Wars detail survey of the great part of Serbia was finished. The main task of that survey was to make the base for establishing tax system which had to be based on property ownership and real volume of property units. The last period of Serbian history is very close to the modern cadastre which is unified with land registry into the unified registry, called Real Estate Cadastre. Nowadays there are two separate professional geodetic sectors in Serbia –private and state with more than 4500 people who work in the market.

For doing such comprehensive work at the field of geodesy, Serbia always took care about the education of the surveyors. In Serbia we have secondary and higher type of education. On secondary level there are five places (towns) where the diploma of technician surveyor could be obtained. On higher education area there are professional and academic schools. Both are in Belgrade – the capital of Serbia.

## 2. EDUCATION SYSTEM OF SURVEYORS IN SERBIA

### 2.1. Secondary education

Secondary professional education in Serbia is regulated by Law on secondary education (LSE) which put into erection in 1992. LSE offers general and professional education that guarantee getting knowledge for doing jobs at the market or continuation of education process, on the choice of the scholars.

The main goal of professional education at this level is to get general and professional knowledge, to develop the skills and prepare the scholars for the next levels of education (higher education).

This type of school the scholars attends after finishing elementary schools which lasts eight year in Serbia. It means that they are 14-15 years old. The secondary school is realized as three or four years program here, but surveying education program at this level lasts four year. The education profiles are the base for definition the curricula in secondary schools. All profiles in Serbia are classified into 15 working area, one of which is geodesy and civil engineering as unic one.

The main characteristics of the secondary level geodetic schools at this moment (2008/2009) in Serbia are:

- Four years program
- 250 students per year
- Diploma title: Geodetic Technicians – Surveyor.

In table 1, it is shown the program at the Technical-Geodetic School in Belgrade which educates the biggest part of scholars in Serbia.

*Table 1*

In table 2 it is possible to see the schedule of the scholars disposal around existed schools in 2008/2009.

*Table 2*

## **2.2. Higher education**

The Law on Higher Education (LHE), which fully implements the Bologna Declaration, came into effect on 10 September 2005. The LHE stipulates that the activity of higher education shall be carried out by the following higher education institutions:

- University;
- Faculty or academy of arts within university (offers academic studies, i.e. basic /undergraduate/, graduate and post-graduate studies, and may offer professional studies too);
- Academy of professional studies (basic and specialized professional studies);
- Higher school (basic and graduate academic studies); and
- Higher school of professional studies (basic and specialized professional studies).

### 2.2.1 Higher Civil Engineering-Geodetic School of professional studies

In the Higher Civil Engineering-Geodetic School there are three study programs of professional type:

- Civil Engineering,
- Geodesy – geomatics
- Architecture

The main characteristics of the Higher Civil Engineering-Geodetic School program (Geodesy - Geomatics profile) at this moment (2008/2009) are:

- Three years program
- 140 students per year

- Diploma title: Bachelor appl. (strukovni inženjer geodezije)
- The program on each profile lasts three years and takes 180 ECTS
- The program is mainly technically oriented

### *Table 3*

On specialist level the School offers three different programs also:

- Management in Civil Engineering,
- Real Estate Cadastre and Utility Cadastre,
- Urban Reconstruction.

The program on each profile lasts one year and takes 60 ECTS.

The whole number of lessons must be between 600 hours and 900 hours, exempted internships when the number of hours could be bigger. The courses last one semester and one week lasts 40 hours. There are 30 working weeks in one year for lessons and 12 weeks for consultation, exams preparation and exams.

The student who finishes the specialist level takes diploma title – specialist of professional study in appropriate area.

After finishing the study program and passing all the examinations, the students will take Diploma Supplement, also.

### 2.2.2 The Faculty of Civil Engineering

Studies of Geodesy and Geoinformatics on the equally named section of the Faculty of Civil Engineering is in line with new Law on high education and Bologna process. 60 to 80 new students are admitted annually. Studies are divided into three parts: basic academic studies, where the degree of university Geodesy and Geoinformatics engineer is acquired (BSc), graduate academic studies, where the degree of Geodesy or Geoinformatics graduate engineer is required – master and PhD studies. The basic studies last for three years (six semesters) and have the value of 180 ECTS credits, and the graduate academic studies (master studies) last for additional two years (four semesters) with the additional value of 120 ECTS credits. PhD studies last three years and takes 180 ECTS.

The program of basic academic studies of Geodesy and Geoinformatics is given in Table 4. After finished studies, the student acquires the degree of university Geodesy and Geoinformatics engineer, so he/she could get employed or continue academic studies.

Graduate academic studies are divided into three groups: Geodesy group, Geoinformatics group and Land Law and Economy group. They consist of the set of obligatory courses (approximately 80% of total classes), choice courses (approximately 20% of total classes) and graduate (master) thesis, for which the last semester of studies is reserved. Overview of the obligatory and choice courses per groups on graduate academic studies – Land Law and Economy (new profile) is shown in Table 5.

The subjects in the programme under considerations are classified into three core subjects: 1) Surveying and Mapping, 2) Geographical Information Management and 3) Land Management. Several courses are outside above mentioned core subjects and could be classified under two types, namely: 1) Mats and 2) Others.

*Table 4*

From these tables it is clear that the study programme, exempting master program in Land Law and Economy profile, is purely technical, not interdisciplinary. The emphasis of the skills profile is on surveying, especially at the basic level course, but on master level the students choose one of three before mentioned profiles.

*Table 5*

*Table 6*

Elective subject 1:	Project management WEB GIS Geodesy in space and urban planning
Elective subject 2:	Negotiation and communication Rural Land Development
Elective subject 3:	Project management WEB GIS Geodesy in space and urban planning
Elective subject 4:	Infrastructure Natural Resources
Elective subject 5:	Environmental Protection Professional English
Elective subject 6:	Real Estate Project Geodetic Project in Urban Planning

### 3. CONCLUSION

The education programme should match not only the requirements of the job market but on the some extent the way the profession should go in the future. The surveying education in Serbia is trying to be pursuant to European education experiences in this field. We also know that there is a gulf between surveyor professional activities and the profile of education process. Like the others we also tend to have different subjects priorities to those preferred by practitioners but very often some new subjects are results of lack of skills or resources. There is, however, important conclusion that a European perspective should be applied to the study programme and land management, geoinformatics, land law and land economics must be more incorporated into education process. The property market and credit institutes could provide almost completely new markets for surveying students. That is reason for introducing some subjects taking economics/legal specialties. Not only curricular content is of interest but some attention should be paid to educational model and methods of quality assurance in accordance to European education quality assurance system.

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## BIOGRAPHICAL NOTES

### **Branko Bozic**

From 1982 to 2006 employed at the Military Geographic Institute in Belgrade. Work activities related to surveying lasted until going to the Faculty. Since 2000 assistant professor at the Department of geodesy at the Faculty of Civil Engineering in the area of surveying. From 2003 to 2005 head of the Institute for geodesy at the same Faculty. From 2001 to 2005 head of Belgrade's Geodetic Society. Since 2006 as associate professor engaged in several subjects related to the adjustment and calculation. During the same period head of Belgrade's other technical discipline designers in Serbian Engineering chamber. Local coordinator in TEMPUS III project – MsC study programme in Land Law and Economy. Author of more than 30 articles and projects and editor of 3 university books.

### **Jelena Gucevic**

BUSINESS EXPERIENCE: 2006. Assistant Professor at Faculty of Civil Engineering, Belgrade University; 2002-2006. Become the Deputy manager at Institute of Geodesy, Faculty of Civil Engineering; 2002. Begin to work at Faculty of Civil Engineering, Department of Geodesy as a Teaching Assistant for subjects: Geodesy 1, Geodesy 2 and Geodesy 3; 1996 – 2002. Worked as a Research Assistant at Faculty of Civil Engineering, Department of Geodesy. Members of The Tempus Project "Master study program in land law and economy" (<http://tempus.ac.yu/projects/jep-41037-2006>) Author of more than 20 articles and projects and critic of 3 university books.

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Table 1: The structure of curricula at the Technical Geodetic School in Belgrade

	<b>The year</b>	1	2	3	4
	<b>The subject</b>	<b>The number of hours per course</b>			
1	Mother language	3	3	3	3
2	Foreign language	2	2	2	2
3	Physical training	2	2	2	2
4	Mathematics	4	4	4	4
5	Informatics	2	-	-	-
6	Physical geography	2	-	-	-
7	The Physics	2	2	2	2 (elective)
8	Descriptive geometry	2	-	-	-
9	Technical drawing	2	2	-	-
10	Surveying	3	4	3	2
11	Applied surveying	-	-	2	2
12	Geodetic maps	-	-	2	2
13	Real Estate Cadastre and Land Development	-	-	-	3
14	Photogrametry	-	-	-	2
15	Computer using in surveying	-	2	2	2
16	Surveying measurements and calculations	4	7	6	4
17	Elective course	1	1	1	1
	<b>Total hours per week</b>	29	29	29	29

Table 2: The schedule of the scholars disposal

	<b>The School</b>	<b>The number of scholars enrolled</b>
1	Belgrade	140
2	Naise	30
3	Vladimirci	30
4	Pancevo	30
5	Novi Sad	20
	Sum	250

Table 3: The structure of curricula at the Geodesy-Geomatics profile

	Course/semester/ECTS	1	2	3	4	5	6
1	Practice surveying 1	8					
2	Mathematics 1	9					
3	Physics	6					
4	Descriptive geometry	7					
5	Detail surveying		11				
6	Mathematics 2		9				
7	Informatics for engineers		7				
8	English Professional		3				
9	Practice surveying 2			9			
10	Uncertainty of measurements			8			
11	Computers using			7			
12	Geodetic Maps			6			
13	Engineering surveying - basic				6		
14	Photogrametry - basic				6		
15	State surveying and Real Estate cadastre				7		
16	Adjustment calculation				4		
17	Geodetic networks in state surveying – E				7		
18	Geodetic networks in Engineering surveying – E				7		
19	Real Estate Cadastre – E					6	
20	GIS – E					7	
21	Land Development - E					5	
22	Geodetic Metrology – E					4	
23	Engineering Surveying – E					6	
24	Photogrametry and Remote Sensing – E					6	
25	Global Positioning System – E					4	
26	Utility Cadastre - E					4	
27	The rules and Management in Geodesy – E					4	
28	Basic Civil Engineering – E					3	
29	Internship (216 h)						17
30	Diploma work (120 h)						13
	Number of exams	4	4	4	5	6	2

E – Elective courses

Table 4: Structure of courses in ECTS values per MSc profile

Profile	Geodesy	Geoinformatics	Land Law and Economy
Surveying and Mapping	94	40	0
Geographical Information Management	16	69	12
Land Management	0	20	116
Others	28	21	14
Total amount of ECTS	138	150	142

Table 5: The curricula at BSc academic study level on FCE – Belgrade

No.	Courses / Semester/ECTS						
		1	2	3	4	5	6
1	Mathematics 1	10					
2	Technical Physics 1	5					
3	Calculate geometry	4					
4	Geosciences - basic	2					
5	Informatics in Geodesy	5					
6	Elective 1	3					
7	Mathematics 2		6				
8	Technical Physics 2		5				
9	Programming - Basic		5				
10	Technics of geodetic measurement		7				
11	Theory of errors of geodetic measurement		5				
12	Elective 2		3				
13	Mathematics 3			6			
14	Surveying 1			5			
15	Geoinformatics 1			5			
16	Real Estate Cadastre 1			5			
17	Cartography 1			4			
18	Adjustment Calculations - basic			5			
19	Surveying 2				4		
20	Practical exercises in surveying				4		
21	Theoretical Geodesy				3		
22	Photogrametry and Remote Sensing 1				5		
23	Geoinformatics 2				5		
24	Land Development				4		
25	Geodetic Metrology				5		
26	Cartography 2					5	
27	Satellite geodesy					3	
28	Photogrametry and Remote Sensing 2					5	
29	Engineering Surveying 1					5	
30	Elective 3					5	
31	Elective 4					5	
32	Elective 5					3	
33	Management in Geodesy - basic						3
34	Engineering Surveying 2						4
35	Practical exercises in Engineering surveying						3
36	Elective 6						5
37	Elective 7						3
38	Internship						2
39	Diploma work						9
	Total ECTS	29	31	30	30	31	29

Table 6: MSC on FCE – Land Law and Economy profile

No.	Courses	7		8		9		10	
		ECTS	L+E	ECTS	L+E	ECTS	L+E	ECTS	L+E
1	Real Property Law	7	6						
2	Environmental and Planning Law	6	5						
3	Property Market	5	5						
4	Geographic Information Systems	7	5						
5	Elective course 1	5	4						
6	Project Methodology			5	4				
7	Land Development and Consolidation - basic			5	4				
8	Real Property Investment Analysis			5	5				
9	Real Estate Cadastre 2			5	4				
10	Urban Land Development			5	5				
11	Elective course 2			5	4				
12	Land Development and Consolidation - continuous					5	4		
13	Real Property Valuation and Taxation					5	4		
14	Elective course 3					5	4		
15	Elective course 4					5	4		
16	Elective course 5					4	4		
17	Elective course 6					4	5		
18	Internship					2	3		
19	Master Thesis							30	30
	Total ECTS	30	25	30	26	30	28	30	30

L+E – Lessons and Exercises