CIVIL ENGINEERING STUDIES AT THE SILESIAN UNIVERSITY OF TECHNOLOGY ACCORDING TO THE BOLOGNA DECLARATION

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EXTENDED ABSTRACT

In 1945, after World War II, the Polish government established new technical universities. The Silesian University of Technology was one of the first among those and it consisted of four faculties: Mechanical Engineering, Electrical Engineering, Metallurgical Engineering and Civil Engineering. The name of the Civil Engineering Faculty has been changed a few times; since 1977 it has been called “Faculty of Civil Engineering”. The academic staff of the new university was recruited from Lvov University of Technology (Politechnika Lwowska), which was moved from a former eastern part of Poland to the western part, in Wroclaw and Gliwice. The present structure of the university consists of 13 faculties with more than 30 000 students. The Faculty of Civil Engineering consists of eight departments and one laboratory and employs about 190 academic staff (including 9 full professors) and currently teaches 2500 students.

The methods of education have been continually improved during the history of Faculty. According to the Bologna Declaration, and in order to provide the unified educational level to the students in Civil Engineering Faculty, the Ministry of Science and Higher Education introduced the so-called educational standards. It is noted that the educational standards are created for all the faculties of studies, independently from the faculties themselves. The new type of studies according to the Bologna Declaration has been introduced to the educational system of the Faculty of Civil Engineering since the 1999/2000 academic year. As a result, the studies currently consist of three-tiers (three levels):

- tier I – lasts 8 semesters, includes 2880 hours of teaching (full-time studies), concludes with a Final project and leads to a BSc degree (Engineer degree in Poland);
- tier II – lasts 3 semesters, includes 1080 hours of teaching, concludes with an MSc thesis and leads to an MSc degree;
- tier III – lasts 8 semesters, concludes with a PhD thesis and a defence of the doctoral thesis and leads to the degree of PhD in Science (PhD Engineer in Poland).

The Faculty of Civil Engineering at the Silesian University of Technology takes pride in the many years of tradition of higher education and the high quality of the graduates entering the job market. In order to meet the demand of the constantly changing job market, the curricula of studies have been prepared in such a way that they give students the possibility to study in European universities within the Erasmus program, taking part in the international student exchange system. Enabling the students to study partially in universities abroad significantly broadens their possibilities of entering the open European job market. The curricula of studies are adjusted to the standards prepared by the Ministry and the positive opinion of the State Accreditation Committee guarantees the high level of education for future graduates. Thanks to the constant development of the staff of science experts and their devotion to the didactic process, education should remain on a high level. Close connections with the industry enable to create such plans of studies, so that the knowledge and the abilities of the graduates meet the needs of the industry of today.

KEYWORDS
Two-tier studies, Civil Engineering education, requirements of civil engineering degrees in Poland, Erasmus program

1. SHORT HISTORY OF CIVIL ENGINEERING FACULTY ESTABLISHMENT

The Faculty of Civil Engineering at the Silesian University of Technology was created in 1945 as one of the first four university faculties (Mechanical Engineering, Electrical Engineering, Metallurgical Engineering, Civil Engineering). The name of faculty has been changed over the years. The first name, Faculty of Sanitary and Civil Engineering, was used up to 1955 and then it was changed to Faculty of Civil Engineering for Industrial and Building Structures (1955-1969), Faculty of Civil Engineering and Architecture (1969-1977). Since 1977 and up to the present, it has been called the Faculty of Civil Engineering. The academic staff of the new university was recruited from Lvov University of Technology (Politechnika Lwowska), which was moved from a former eastern part of Poland to the western part, to Wroclaw and Gliwice. During the first academic year, 198 academic staff (including 32 Professors) lectured at the university, educating 2750 students. Presently, the university consists of 13 faculties with more than 30 000 students. The Faculty of Civil Engineering consists of eight departments and one laboratory, as listed below:

- Laboratory of Civil Engineering Faculty
- Department of Building Structures
- Department of Road and Bridges
- Department of Material Engineering and Building Processes
- Department of the Theory of Building Structures
- Department of Structural Engineering
- Department of Geotechnical Engineering
- Department of Theoretical Mechanics
- Department of Buildings and Building Physics

The Faculty of Civil Engineering employs about 190 academic staff (including 9 full professors) and currently teaches 2500 students.

2. BOLOGNA DECLARATION - GENERAL PROVISIONS

The rapid development of science, particularly in the area of information technologies, caused uneven scientific potential growth in various parts of the world. Europe was significantly left behind by scientific centres in the USA and the Far East. Because of that fact, Bologna Declaration [1] was created in 1999 and signed by Poland and other European countries. The basis of the declaration is the creation of a process towards a harmonized higher education system in Europe, raising the prestige of European universities in comparison to the American universities, and approving a comparable system for academic titles. The declaration introduces of three-tier system of higher education: a minimum of 3-year studies in the first tier (leading to a diploma of BSc or BA), 2-year studies of the second tier (leading to an MA or MSc degree) and 4-year-long studies of the third tier, which leads to the PhD degree [2]. According to the assumptions of the Bologna Process, the unification of the higher education systems is bound to occur due to the following reasons:

- introduction of the European credit transfer system (ECTS) for points earned;
- division in two tiers of studies;
- monitoring of education quality (accreditation and certification systems etc.);
- promoting the mobility programs of students and lecturers;
- promoting lifelong education.

Thanks to the early introduction of changes in the educational process by the former board of the Faculty, the requirements of the Bologna Process are now being realised in the present educational process. Changes in the methods of teaching were initiated in the year 2000 and the transformation process has been smooth.

3. HIGHER EDUCATION IN CIVIL ENGINEERING FACULTIES ACCORDING TO POLISH REQUIREMENTS

In order to provide the unified educational level to students of Civil Engineering Faculties, the Ministry of Science and Higher Education introduced the so-called educational standards (the educational standards are created for all the faculties of studies, independently from the faculties). The standards define first and foremost the educational outcomes that should be reached at each level of education and the subjects together with the necessary number of hours required to achieve a certain goal. For the first tier of studies, the Studies Plan should include at least 7 semesters of education with a minimum of 2500 hours, including 315 hours of basic science knowledge and 660 hours of faculty-specific knowledge [3]. Additionally, it is assumed that a student should be taught a foreign language, arts subjects, physical education and information technology (IT) education. The remaining hours may then be used for education in the field of specialised training.

Upon graduation from the first tier, a graduate should possess knowledge from the following areas:

- construction of structures, such as apartment buildings, municipal type constructions, industrial estate type and transportation structures;
- design of the basic objects and structural elements, technology and organisation of building /construction procedures;
- managing a team and a construction company;
- manufacturing, choosing and applying construction materials and computer technologies and other modern technologies in engineering practice.

A graduate is also prepared for:

- management of construction process of all types of building structures;
- co-operation in designing of public buildings, industrial and transportation buildings;
- organisation of structure element production (precast);
- supervision of construction process and continuing self-education and skill upgrading.

A graduate is prepared to work in:

- executive enterprises;
- building inspection;
- concrete and construction element factories;
- building materials industry;
- public administration units and councils connected with construction and architecture.

A graduate should have the knowledge of foreign language on B2 advancement level of the Common European Framework of Reference for Languages of Council of Europe and should be able to use the technical language within the chosen faculty of studies. A graduate is prepared to start studies at the second tier. The list of basic education subjects and faculty-specific education subjects for the studies of the first tier are presented in Table 1.

Second tier of studies should include Plan of Studies, which consists of minimum 3 semesters of learning with 900 hours of education divided into 30 hours of basic education

subjects and 150 hours of faculty education subjects. The number of subjects suggested by the Ministry of Science and Higher Education is much shorter in this case – see Table 2.

The number of required hours to teach the suggested subjects (both basic and faculty-specific) does not comprise the total number of teaching hours in this tier of studies, and therefore gives a possibility to each of the faculty to implement its own programme of specialised education. The completion of each semester should be based on the rules of ECTS points, whereas the level of education should be based on the appropriate procedures of supervision and assessment. It is also recommended to co-operate with related units (faculties) in Europe in order to allow for unlimited student exchange.

Table 1. Ministry of Science and Education list of required subjects for the first tier of studies in Civil Engineering Faculties

No.	Basic education subjects	No.	Faculty education subjects
1.	Mathematics	1.	Drawing & Geometry
2.	Applied Physics	2.	Surveying
3.	Applied Chemistry	3.	Building Materials
4.	Engineering Geology	4.	Mechanics of Materials
5.	Mechanics	5.	Structural Mechanics
6.	Computer Science & Computational Methods	6.	Buildings
		7.	Soil Mechanics
		8.	Foundation Engineering
		9.	Structural Concrete
		10.	Metal Structures
		11.	Building Installation (system)
		12.	Transportation Infrastructure
		13.	Building Physics
		14.	Fluid Mechanics and Hydraulics
		15.	Organisation of Building Process
		16.	Technology of Building Process
		17.	Managing an Investment Process
		18.	Economics of Building Process

Table 2. Ministry of Science and Education list of required subjects for the second tier of studies in Civil Engineering Faculties

No.	Basic education subjects	No.	Faculty education subjects
1.	Advanced Aspects of Mathematics	1.	Elasticity and Plasticity Theory
		2.	Computer Methods
		3.	Complex Concrete Constructions
		4.	Complex Metal Constructions
		5.	Construction Enterprise Management

4. EDUCATION SYSTEM IN THE FACULTY OF CIVIL ENGINEERING OF THE SILESIAN UNIVERSITY OF TECHNOLOGY

The Faculty of Civil Engineering at the Silesian University of Technology actively participates in efforts towards defining the unified education system in faculties of civil engineering all over Europe. A network of faculties within the EUCEET organisation (European Civil Engineering Education and Training) worked out the basis of the so-called

core subjects that should be taught in civil engineering faculties of European universities. Professor S. Majewski, the former Dean of the Civil Engineering Faculty, was an active participant of this organisation and developed the new programmes of studies based on the two-tier system. The first group of students who studied according to the new system started their education in academic year 1999/2000. The education of students following the older model of integrated studies ended in academic year 2004/2005. Currently the studies consist of the three-tier system:

- tier I – lasts 8 semesters, includes 2880 hours of teaching (full-time studies), concludes with a Final project and leads to a BSc degree (Engineer degree in Poland);
- tier II – lasts 3 semesters, includes 1080 hours of teaching, concludes with an MSc thesis and leads to an MSc degree;
- tier III – lasts 8 semesters, concludes with a PhD thesis and a defence of the doctoral thesis and leads to the degree of PhD in Science (PhD Engineer in Poland).

Besides the introduction of full-time education, which is free of charge, the Faculty also offers part-time studies with tuition fee. At present, part-time studies are conducted only in an “extramural“ system: part-time studies are conducted during 12 weekend meetings (from Friday to Sunday) in each semester. The number of didactic hours is limited to 60% in comparison to full-time studies, but the curriculum of the subjects includes the same teaching materials. Equivalency was achieved by placing emphasis on individual work of students outside classes. In 2010, the Faculty started part-time studies of the third tier – PhD studies.

The faculty offers only one branch of studies – Civil Engineering. Qualifications of research and teaching staff enable the conduction, in the main building in Gliwice, of four main specialisations on the first tier of studies:

- Structural Engineering;
- Construction Processes Engineering;
- Transportation Building and Infrastructure;
- Railroads.

Studies in tier II offer further directions within specialisations and students may choose more detailed profiles of diploma studies, including the following:

- Structural Engineering (specialisation)
  - Urban and Industrial Structures;
  - Bridges;
  - Geotechnical and Underground Structures;
- Construction Processes Engineering (specialisation)
  - Ecological Buildings;
  - Building Technology and Management;
- Transportation Building and Infrastructure (specialisation)
  - Roads;
- Railroads.

Studies on the third tier (PhD studies) are not divided into specialisations, but each student cooperates with a particular department of the faculty, which determines the field of the student’s specialisation. Coursework includes only general subjects, such as foreign languages, advanced topics from material mechanics, doctoral seminars etc. The emphasis is placed on the individual research and co-operation with the PhD thesis supervisor. PhD students are not considered to be university staff but they receive a governmental (Ministry of Science and Higher Education) scholarship in the form of money

in the course of their studies. It is not predetermined, however, if after being awarded the degree of the PhD in Science the graduates will have the possibility to be employed at the university.

The university has also a daughter faculty in Rybnik (called in Polish: CKI), which is a Centre for Teaching Engineers (Bachelors in Science). Because of the fact that most lecturers are employed in the parent university in Gliwice, the studies in CKI Rybnik are conducted only at the first tier. The specialisations in Rybnik are different than those in Gliwice and include:

- Construction-architectural (only full-time studies);
- Urban Infrastructure Engineering (full- time and extramural studies).

Students from the Construction-architectural specialisation have the possibility to receive a "double diploma" due to the bilateral agreement with the VIA University College in Horsens (Denmark). They have the possibility to attend half of the classes in Poland and half in Denmark and the course of such studies concludes with a BSc Final project written and defended in two languages – Polish and English.

The new way of practical placement realization was introduced simultaneously to the new system of study. Thanks to this, a 13 week time period was obtained, during which the students are required to work in contractor companies or businesses related to construction. The 7th semester of the 1st tier of study (BSc level) was dedicated to this task. During the last two weeks of the semester (semester lasts 15 weeks), "Practical Placement Commissioning" is carried out. Within commissioning, the students are obliged to present their works: projects, building site or processes, in which they were employed. Presentation of the practical placement is limited the poster introduction and a short daily routine description. The presentations are held before the department staff and representatives of contractor companies that employed the students. It gives a very good opportunity to compare the work conditions, and also creates an opportunity to exchange experiences between the students education unit and contractors or designers who will employ further graduates.

It should be pointed out that a system of studies in English has been introduced – both in the first and second tier. Currently there is only one specialisation conducted in English – Structural Engineering. Due to their excellent knowledge of technical language, the graduates are particularly well-prepared to enter both the national and international job market. In addition, students of all the faculties and all types of studies have the possibility to take part in the international exchange Socrates-Erasmus program. The program includes one- or two-semester-long visits and education periods to the European universities. Because we offer classes conducted in English, students from other European countries are able to study in our Faculty.

The Teaching Standards for the Faculty of Civil Engineering appeared in 2007 after the introduction of the new type of education at the whole university. As a result, the process of evolution into full assimilation with the new Plan of Studies continues, so as to meet the requirements of the Standards. In order to achieve the required education results for the university as a whole and for each faculty separately, a System of Education Quality Assurance has been introduced. Following this system, the methods used in the didactic process, the grades and the methods of control of the classes offered have been unified.
The State Accreditation Committee is the statutory body which controls if the didactic process is conducted in the right way. The Faculty of Civil Engineering has received a positive opinion from the Committee in 2003 and 2010. The last visit of the Committee allows our Faculty to teach for the next six years.

5. SUMMARY

The Faculty of Civil Engineering at the Silesian University of Technology takes pride in many years of tradition of higher education and high quality of the graduates entering the job market. This was made possible due to both the close cooperation with the civil engineering industry and meeting their demand for employees, as well as due to the adjustment of the teaching methods to the requirements of the Ministry of Science and Higher Education. In order to meet the demand of the constantly changing job market, the curricula of studies have been prepared in such a way that they give students the possibility to study in European universities within the Erasmus program – international student exchange system. Enabling the students to study partially in the foreign universities significantly broadens their possibilities of entering the open European job market.

At present, the Faculty offers the possibilities to study on 3 tier of studies (according to Bologna Declaration) both of full-time and part-time (extramural) type. In addition, the Faculty offers studies conducted in English, which raises the prestige of the faculty and makes the mutual international exchange of students easier. The curricula of studies are adjusted to the standards prepared by the Ministry and the positive opinion of the State Accreditation Committee guarantees the high level of education for the future graduates.
Thanks to the constant development of the staff of science experts and their devotion to the didactic process, the education should remain at a high level. Close connections with the industry enable to create such plans of studies, so that the knowledge and the abilities of the graduates meet the needs of the industry of today.

The implementation of Civil Engineering teaching course completely in English language allows for the competitiveness of graduates in the labour market. This competition is not limited only to the internal Polish market, but graduates can look for an employment abroad. According to our observation the graduates are benefiting from the possibility of gaining work experience abroad and returning to the homeland after a few years. This phenomenon results in raising the quality of management and the building industry. Another aspect of the teaching course in English language takes the opportunity to use the ERASMUS student exchange program. The confirmation of the high quality education is verification of the young civil engineers by the labour market. The graduates of the Faculty of Civil Engineering do not have many problems with finding an employment in their profession in our country and abroad. The appreciation of the graduates qualifications, as attested by employers, as well as the easiness of finding occupation are confirmation of the proper selection of the CE course for future employees, which is a basic task of the university.

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