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## Technical Universities for Civil Engineering Career in Republic of Poland

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### Abstract

In the article the basics of the higher technical education system in Poland, in particular civil engineering, was presented. Scientific and professional degrees, educational programmes and grades were listed. Nevertheless the rankings useful for comparing universities were detailed. Due to them the students interested in the international exchange should have a better choice of the higher school.

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### 1. Introduction

Poland reformed an educational system, what was essential since the country joined the European Union [11]. Along with 29 other countries, Poland signed the Bologna Declaration, which aims at the creation of the European Area of Higher Education. The current reforms being made in the Polish Higher Education System follow the Bologna Process recent action lines. The system of educational degrees is based on three stages structure and strictly tied in the European Credit Transfer and Accumulation System – ECTS [24]. Nowadays the higher education in Poland is one of the faster developing sectors of its economy. The structure of study fields has been changing for more than twenty years [6]. This process is essential because the economy has been strongly reshaped and the private education sector has been established.

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In November 2013 there were 467 universities, among them 326 private ones, with total number of students almost 1.5 million. The basic act of law for the higher schools in Poland is called ‘Prawo o szkolnictwie wyższym’ [21] and following it there are three grades of study:

The first grade studies – Bachelor’s degree programmes, in technical science such as civil engineering lasts 7 semesters as a minimum. The final achievement is a civil engineer degree ‘inżynier’ (abbreviated ‘inż.’) which allows for basic functions in a construction process and obtain some limited building qualifications. The degree, in non-engineering science, is similar to the bachelor’s degree ‘licencjat’ and requires at least 180 ECTS credits. The student can join the study after completing his A-levels.

The second grade studies – Master’s degree programmes for civil engineering, 3 to 4 semesters at a minimum, to study this grade the student must obtain an engineer degree in specializations: the civil engineering (it is recommended by author), environmental engineering or architecture. After accomplish this grade a degree of:

- ‘magister inżynier’ (abbreviated ‘mgr. inż.’) it refers to the Master of Science in Engineering, equal to the Master in non-engineering sciences can be achieved. The studies are focused on theoretical knowledge, as well as the application and development of creative skills. Master of Science in Engineering degree holders may enter doctoral programmes (the third grade studies). To obtain this degree, students must earn at least 90 ECTS credits. In the civil engineering the second grade studies allow to participate in the construction process after achieved special job qualification (described below).
- The continuous studies of civil engineering – Master’s degree programmes, lasting for 10 to 12 semesters leading to the professional title of Master of Science in Engineering. To obtain this degree, students must earn at least 300 ECTS credits (10 – semesters studies). The single continuous studies are based on an integrated study program, which contains both basic studies and in-depth specialization.
- The third grade studies – doctor studies lasting for 6 to 8 semesters, leading to the professional title of Doctor of Philosophy (Ph.D.). These can be completed only at detailed universities, faculties or even inner institutes as well as in the units of the Polish Academy of Sciences. The Ph.D. degree is obtained by the students, who are able to graduate under promoter. The subject of this graduating work must be accepted by the authorized unit first. It is obligatory that the doctor exams must be passed. The graduating work is noticed by two persons. The supervising promoter must have the degree professor or Ph.D. D.Sc.

Two first grades can be accomplished by three types of studies:

- postgraduate learning in civil engineering – for this type of study it is essential to have the engineer or engineering degree as a minimum.
- the first and the second grade stationary learning – traditional and strongly recommended type of higher education. At least 50% of learning program has to be accomplished directly by attending classes, including laboratories, auditorium and projects.
- the first and the second grade non-stationary learning – classes take place on Saturdays, Sundays and other days appointed by the authorities of the university. Remote learning is accepted for the less demanding faculties. These studies are essential for all working people who need to upgrade their professional qualifications and who want to stay active.

The whole learning process in the civil engineering studies is characterized by very specific features. The most significant is the great number of lab classes which are based on devices, computer programs and well trained supports of teachers [9, 13, 14, 16 - 18]. These are also restricted by the obligation of employing some numbers of professors and Ph.D. in each department. As a result of numerous requirements and high costs the private universities are not generally interested in expanding in this area of education [6, 19]. In Poland the future civil engineers are educated mainly by public technical universities which are called ‘Politechnika’. They are presented on Fig. 2 and listed as below:

- Białystok University of Technology (Politechnika Białostocka) [31],
- Częstochowa University of Technology (Politechnika Częstochowska) [32],

- Gdańsk University of Technology (Politechnika Gdańska) [33],
- Silesian University of Technology (Politechnika Śląska) [34],
- Kielce University of Technology (Politechnika Świętokrzyska) [35],
- Koszalin University of Technology (Politechnika Koszalińska)[36],
- Cracow University of Technology (Politechnika Krakowska) [37],
- University of Science and Technology (Akademia Górniczo-Hutnicza)[38],
- Lublin University of Technology (Politechnika Lubelska) [39],
- Łódź University of Technology (Politechnika Łódzka) [40],
- Opole University of Technology (Politechnika Opolska) [41],
- Poznań University of Technology (Politechnika Poznańska) [42],
- Rzeszów University of Technology (Politechnika Rzeszowska) [43],
- Wrocław University of Technology (Politechnika Wrocławska) [44] showed in Fig. 1,
- Warsaw University of Technology (Politechnika Warszawska ) [45].

The civil engineering is also a learning sector at some agricultural universities such as Wrocław University of Environmental and Life Sciences ‘Uniwersytet Przyrodniczy’ and also at some military high schools such as Military Technical Academy in Warsaw ‘Wojskowa Akademia Techniczna’.



a) Aerial tramway ‘Polinka’ over the river Odra for students, it links ‘Geocentrum’ with main campus



b) New building for lectures, restaurant, coffee bar, places to work especially for disability students (i.e. blind)

Fig.1. Modern campus elements of Wrocław University of Technology

## 2. Studying in English

Polish higher education institutions offer a wide range of faculties in English including civil engineering. Unfortunately there is a less choice of possible specializations than for those studying in Polish language. The very detailed information for studying in English can be found on the websites of the universities [31 – 45]. This offer depends mainly on specific needs, financial situation and implementation of educational projects connected with the European agenda such as the operational programme ‘Kapitał Ludzki’ and a programme Erasmus+. The Ministry of Science and Higher Education website contains extensive information for prospective students, including a list of higher education institutions in Poland [31 – 45].



Fig.2. The map of Poland [47] with locations of technical universities

### 3. The costs of studying in Poland

Full-time studies at public Higher Education Institutions are free of charge for all Polish citizens and holders of the document called ‘karta Polaka’ as well as for those who commence studies in Poland on terms applicable to Polish citizens [29]. Free of charge studying is possible also for all citizens of the European Union. The students from the third countries have to be conscious of fees as follows [24]:

- Master’s programme costs 2000€ per year,
- Doctoral, postgraduate and specialist courses cost 3000€ per year,
- Language courses, including preparation for studying in Polish cost 2000€ per year.

The fees at non-public higher education and public non-stationary mode institutions are established on their own. The fees differ from 2000€ to 4000€ per year for the civil engineering faculty.

### 4. The employers’ requirements and the students’ expectations

The ‘Wprost’ magazine holds an annual ranking of polish technical universities. The last edition comes from the year 2013 [25]. The list below shows ranking which technical universities are most wanted by the prospective employers. The list contains only universities which offer civil engineering course:

- I Warsaw University of Technology,
- II Wrocław University of Technology, its historical part is presented on Fig. 3
- III University of Science and Technology,
- IV Silesian University of Technology,
- VII Gdańsk University of Technology,
- VIII Łódź University of Technology,

IX Poznań University of Technology,

X Cracow University of Technology.

In the survey 500 biggest income-bringing companies in Poland were inquired. The companies had to state which faculty graduates are needed mostly and additionally which university graduates would meet the company requirements the best. The persons who took part in a survey were mostly the board members responsible for employment policy. Although the survey had some weak points (medical universities were not taken into account) it shows the real needs of the labour market [2, 11, 15] and should become a helpful indicator for all students planning their career carefully.



a) Historical buildings: administration and b) Institute of Geotechnics and Hydroengineering hydrotechnics laboratory

Fig.3. Historical part of Wrocław University of Technology campus

The best-estimated universities providing the civil engineering faculties were:

I Warsaw University of Technology,

II Silesian University of Technology,

III Gdańsk University of Technology,

IV Wrocław University of Technology,

V Cracow University of Technology,

VI Łódź University of Technology,

VII Poznań University of Technology,

VIII Częstochowa University of Technology,

IX Rzeszów University of Technology,

X Military Technical Academy in Warsaw.

Polish young people choose the technical universities the most often, there are usually 4 candidates for each place. Due to the report done by the Ministry of Science and Higher Education [25] civil engineering has been chosen by almost 19 thousand students [26] and is the 4th most popular faculty. The Polish universities are listed also in the world rankings. In the Ranking of Worldwide Research Institution coming from the year 2011 [30] based on the multi-rating account of scientific research the following Polish technical universities were noticed (3039 universities in total):

- Warsaw University of Technology (538),
- Wrocław University of Technology (603), its general buildings are showed on Fig. 4,
- University of Science and Technology (735)
- Łódź University of Technology (896),

- Gdańsk University of Technology (1057),
- Silesian University of Technology (1099),
- Poznań University of Technology (1226).

In the based on an alternative methodology QS World University Ranking by faculty of engineering and technology 2013 [46] there were two technical universities from Poland: Warsaw University of Technology (193) and Wrocław University of Technology (307).

The challenge for Polish universities for next couple of years is to upgrade in the international rankings.



a) Department of Civil Engineering



b) Rector's office and official space – the core of university.

Fig.4. Important buildings of Wrocław University of Technology campus

## 5. The learning standards and minimum requirements for faculties

Learning programmes for all faculties and grades of learning are defined in the annexes linked to the act of the higher education system. The list of required subjects and their content can be found there [28]. The minimum number of classes required on both types of studies (stationary and non-stationary) is defined in documents. Number of classes for civil engineering studies has been strictly assigned and it is strongly recommended to plan for more than 7 semesters and the number of classes should be not less than 2500. Another requirement are ECTS (European Credit Transfer System ) at a minimum level of 210.

The profile of a candidate has also been defined and nevertheless learning programmes have been divided into basic (315h/31ECTS) and specialist (660h/64ECTS). The second grade studies last for at least 3 semesters with a minimum of 900 classes. The number of ECTS points should be not less than 90. The choice of additional subjects is strictly connected with a selected specialization.

The public universities with a long history have been erected mostly before II WW. They occupy high ranks and usually offer significantly more classes than required minimum. The Wrocław University of Technology is a very special institution, because it continues traditions of Lviv Polytechnic erected by Polish King Jan Kazimierz (currently under name Lviv Polytechnic National University in Ukraine). Lviv Polytechnic was one of the most important Polish universities before 1945. After the traumatic events during the war the professors-survivors from Lviv were transferred to Wrocław (i.e.: Edward Sucharda, Hugo Steinhaus, Henryk Kuczyński, Kazimierz Idaszewski, Jan Bogucki, Stanisław Ochęduszko, Edwin Płazek, Kazimierz Zipser, Włodzimierz Trzebiatowski, Czesław Kanafojski, Zdzisław Gergowicz) [3, 5].

The contribution of lab, seminar and project classes are expected. However the standards pressure on remarkable effects of learning process that can be proved easily. The idea of minimum requirements in learning process allows to supervise the quality of it, this has got some disadvantages too. In practice public funds for public universities

depend on the effectiveness of learning process and thus the universities have to balance between quality and quantity what often leads to a specific compromise. Because of business purposes private universities often choose a low cost learning. That means that the number of students paying for their diploma becomes the most important aspect and together with a very strong competition on the market may easily corrupt the pure idea of learning.

## 6. Qualifications – professional certification

The profession of a civil engineer is protected by the acts of law [22,23]. Due to them any independent technical functions in the construction sector are strictly restricted. These independent functions are:

- construction design, inspection of building projects and independent author supervising,
- leading construction works,
- investor supervising,
- the technical controls of any structures.
- The certified engineer who are allowed to proceed these functions must:
- have a referent higher appropriate technical education of I or II grade (see Tab. 1),
- have a professional work experience,
- passed an exam on the building process and the ability of practical implementation of technical knowledge.

Table 1. Education grade required to proceed some independent functions in construction sector

The branch	The required education	
	unlimited permission	limited permission
civil engineering (overall)	civil engineering (Master of Science in Engineering)	architecture, environmental engineering or urban planning (MSc), civil engineering (engineer)
road construction	civil engineering (Master of Science in Engineering)	civil engineering (engineer)
bridge construction	civil engineering (Master of Science in Engineering)	civil engineering (engineer)
railway construction	civil engineering with spec. railways (Master of Science in Engineering)	civil engineering with spec. railways (engineer)

The work experience to certified by Polish Chamber of Civil Engineering [48] of candidates are depend from kind of permission (limited and unlimited) and types of work (project and work on construction site):

- to have an unlimited and limited permission to project and to supervising of projects it is required to have a 2 year work experience by preparing projects and one year apprenticeship at a construction site,
- to have a limited permission to managing works on construction site it is required 2 year apprenticeship at a building site and a 3 years for unlimited permission.

## 7. Conclusions

The Polish higher education system is fully compatible with the other respecting the Bologna process. Along with the more and more popular English courses at civil engineering faculty it allows the almost unlimited conversion between the similar faculties and specializations (including I and II grade studies). The perfect implementation of English course on the civil engineering at the technical university of Wrocław could be the best example since not only the foreign students but many Polish ones attend it too. Polish universities have become well-known for their Slavic hospitality which can be contributed to numerous student exchange programmes and newest method of teaching [1, 4, 7 - 10, 18, 20].

These are often co-financed by the European Union. However it is important to remember that being a civil engineer in Poland is limited for non EU alumni by numerous additional formal restrictions, permission and as a result completing all the obligatory courses and learning along with the following professional apprenticeship is not enough to start one's career.

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