



# **ASIIN Seal & European Labels**

## **Accreditation Report**

**Bachelor's Degree Programme**  
*Civil Engineering*

**Master's Degree Programme**  
*Civil Engineering*

Provided by  
**University of Belgrade**

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## A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for <sup>1</sup>	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC) <sup>2</sup>
Основне академске студије - Грађевинарство	B.Sc. in Civil Engineering	ASIIN, EUR-ACE® Label	NEAQA	03
Мастер академске студије - Грађевинарство	M.Sc. in Civil Engineering	ASIIN, EUR-ACE® Label	NEAQA	03
<p><b>Date of the contract:</b> 11.04.2024</p> <p><b>Submission of the final version of the self-assessment report:</b> 01.07.2024</p> <p><b>Date of the onsite visit:</b> 17.-18.09.2024</p> <p><b>at:</b> Faculty of Civil Engineering</p>				
<p><b>Expert panel:</b></p> <p>Prof. Dr.-Ing. Tim Ricken, University of Stuttgart</p> <p>Prof. Dr.-Ing. habil. Manfred Krafczyk, Technische Universität Braunschweig</p> <p>Christin Matela, Head of Planning and Construction Management Department at Rhein-Erft-Kreis</p> <p>Milan Jovin, student at Faculty of Technical Sciences, University of Novi Sad</p>				
<p><b>Representative of the ASIIN headquarter:</b> Yanna Sumkötter</p>				
<p><b>Responsible decision-making committee:</b> Accreditation Commission for Degree Programmes</p>				
<p><b>Criteria used:</b></p> <p>European Standards and Guidelines as of May 15, 2015</p>				

<sup>1</sup> ASIIN Seal for degree programmes; EUR-ACE® Label: European Label for Engineering Programmes

<sup>2</sup> TC: Technical Committee for the following subject areas: TC 03 - Civil Engineering, Geodesy and Architecture

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ASIIN General Criteria, as of March 28, 2023

Subject-Specific Criteria of Technical Committee 03 – Civil Engineering, Geodesy and Architecture as of September 28, 2012

## B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF <sup>3</sup>	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Инжењер грађевинарства	B.Sc. Civil Engineering	/	6	Full time	/	6 Semester	180 ECTS	Annually / 01.10.2021
Мастер инжењер грађевинарства	M.Sc. Civil Engineering	Structural Engineering Geotechnical Engineering Hydraulic and Environmental Engineering Organization, Technologies and Informatics in Civil Engineering Roads, Railways and Airports	7	Full time	/	4 Semester	120 ECTS	Annually / 01.10.2024

The University of Belgrade is the oldest and largest university in Serbia. It consists of 31 faculties with around 90,000 students, as well as 11 research institutes, the university library, and 7 university centres, most of which are located in the capital city. According to the latest ranking of universities around the world, better known as the "Shanghai ranking list", the University of Belgrade has been ranked among the best 400 universities in the world.

Faculties of the University are organised in 4 groups: social sciences and humanities, sciences and mathematics, medical sciences, and technology and engineering sciences. The Bachelor's and Master's degree programme in Civil Engineering are offered by the Faculty of Civil Engineering (among the technology and engineering sciences group) which is the

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<sup>3</sup> EQF = The European Qualifications Framework for lifelong learning

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oldest and leading educational and scientific institution in the field of civil engineering and geodesy in Serbia and in territory of former Yugoslavia.

For the Bachelor's degree programme Civil Engineering the institution has presented the following profile in the self-assessment report:

“The degree programme of BSc in Civil Engineering at the Faculty of Civil Engineering, University of Belgrade has a clearly defined purpose and role in the education system of the Republic of Serbia and Europe. It has an overall societal objective of educating personnel for civil engineering sector, whose role in the overall development of society is of crucial importance. In Serbia the design and implementation of several large infrastructure projects is underway and further intensification of such activities is expected in the coming period. Therefore, there is a clear need for qualified and adequately educated civil engineers who should be involved in these activities.

Primary objective of the programme is to provide students with knowledge in fundamental sciences related to the civil engineering and basic professional knowledge necessary for everyday engineering work. The programme provides a wide range of skills and competencies in the field of design and construction of various types of relatively simple civil structures. The graduates who decide to continue their academic studies at higher levels, through this programme will receive the necessary knowledge, skills and competences, and solid foundations for successful following of more complex studies on MSc degree programme in specific areas of civil engineering.

This programme includes a total of 33 modules (25 compulsory and 8 elective) and an internship, with a total of 180 ECTS, over the period of 6 semesters (3 years). It is designed in accordance with the EQF level 6. In the first semesters, the degree programme includes fundamental theoretical modules such as mathematics, physics, descriptive geometry, geology, engineering mechanics, etc. and after that, the student becomes familiar with the basics of civil engineering through scientific and professional modules, in the domains of: building materials, strength of materials and structural analysis, soil mechanics, hydraulic and environmental engineering, road and railway infrastructure, concrete, steel, timber and masonry structures and geotechnical structures. The internship is carried out in civil engineering companies (design bureaus or construction sites) and lasts for two weeks.

After completing this degree programme, students can continue their studies on the MSc in Civil Engineering Degree Program at the Faculty of Civil Engineering in Belgrade, or on related studies in the country and abroad.”

For the Master's degree programme Civil Engineering the institution has presented the following profile in the self-assessment report:

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„The degree programme of MSc in Civil Engineering at the Faculty of Civil Engineering, University of Belgrade has a clearly defined purpose and role in the education system of the Republic of Serbia and Europe. It has an overall societal objective of educating personnel for civil engineering sector, whose role in the overall development of society is of crucial importance. In Serbia the design and implementation of several large infrastructure projects is underway and further intensification of such activities is expected in the coming period. Therefore, there is a clear need for qualified and adequately educated civil engineers of different specialization areas, who should be involved in these activities on the highest complexity level.

MSc in Civil Engineering programme is primarily designed as a continuation of the BSc in Civil Engineering programme, where students acquire further scientific and professional knowledge in the field of analyses, design and construction of various types of complex and larger buildings, structures and infrastructural systems. Through one of five offered areas of specialization (Structural Engineering; Hydraulic and Environmental Engineering; Roads, Railways and Airports; Organisation, Technology and Informatics in Civil Engineering and Geotechnical Engineering) students gain additional knowledge in specific areas of civil engineering that, besides everyday engineering practice, includes rather complex civil engineering problems that require additional knowledge and abilities to analyse and conceive rational and safe engineering solutions.

The programme includes compulsory and elective modules, internship, preparation and defence of MSc thesis, with total 120 ECTS credits, over the period of 4 semesters (2 years). In the list of modules, specific areas of civil engineering are represented, which include rather complex areas that require additional knowledge and abilities to understand and solve them. This programme is in accordance with the EQF level 7. The internship is a mandatory part of the curriculum, and it is carried out exclusively in design bureaus, lasts four weeks and is worth 4 ECTS credits. The FCEUB actively tracks the quality of the internship, in terms of its content and structure, along with the participating companies.

Finally, this programme represents a necessary intermediate step towards academic education at the PhD level.”

## C Expert Report for the ASIIN Seal<sup>4</sup>

### 1. The Degree Programme: Concept, Content & Implementation

<b>Criterion 1.1 Objectives and Learning Outcomes of a Degree Programme (Intended Qualifications Profile)</b>
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**Evidence:**

- Objective-module-matrices
- Self-Assessment Report
- Study plans
- Module descriptions
- Website
- Discussions during the audit

**Preliminary assessment and analysis of the experts:**

The experts refer to the respective ASIIN Subject-Specific Criteria (SSC) of the Technical Committee 3 (Civil Engineering, Geodesy and Architecture), the objective-module-matrices for the degree programmes, the matching learning objectives and the modules as a basis for judging whether the intended learning outcomes of the Bachelor's and Master's degree programmes Civil Engineering correspond with the competences as outlined by the SSC. The descriptions of the qualification objectives are comprehensive and include the achieved competencies and possible career opportunities of the graduates.

The University of Belgrade (UB) has described and published programme learning outcomes for the two degree programmes under review. The learning outcomes are subdivided into three categories as they describe in great detail the knowledge (K), skills (S) and competences (C) the students should acquire during their studies. By being published on

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<sup>4</sup> This part of the report applies also for the assessment for the European subject-specific labels. After the conclusion of the procedure, the stated requirements and/or recommendations and the deadlines are equally valid for the ASIIN seal as well as for the sought subject-specific label.



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the faculty's website, the learning outcomes are easily accessible for students as well as other stakeholders.

The Bachelor's degree programme has been converted to a three year and 180 ECTS programme in 2021 (compared to the previous four year and 240 ECTS programme; see chapter 1.3 for more details) and the first cohort will graduate in September 2024. The same applies to the Master's degree programme, since it has been converted to a two year and 120 ECTS programme which will start in October 2024 (compared to the previous one year and 60 ECTS programme, see chapter 1.3 for more details). The new programme structure is supposed to be coherent to other higher education system across Europe and comply with the Bologna Process.

In general, UB put regular revision processes in place that take into account feedback by external and internal stakeholders. Minor curriculum adjustments are done every year whereas major revisions including consultations of stakeholders take place every three years. Moreover, the programmes are assessed by the National Entity for Accreditation and Quality Assurance in Higher Education of the Republic of Serbia (NEAQA) every seven years.

When looking at the objective-module-matrices, the experts note that the relationship between the modules and learning outcomes have been established in a comprehensible and logical manner. The development of the learning outcomes of both study programmes involve both internal and external stakeholders so that the curricula can be adapted and modified according to the needs of the industry and the graduates on a regular basis. For example, UB regularly conducts surveys, through which the different stakeholders get the chance to assess both programmes and their main objectives and adapt them if necessary. Moreover, the academic staff maintain regular contact with employers through events such as the Scholarship Fair at the faculty. Internal stakeholders include all of UB's members (students, teaching staff, and non-academic employees), while the external stakeholders include the industry, alumni, curricula from other universities, and society.

At the end of their studies, graduates of the Bachelor's degree programme Civil Engineering should have knowledge in fundamental sciences related to civil engineering and basic professional knowledge that is necessary for everyday engineering work. In order to prepare students for further academic studies at higher levels, the programme provides a wide range of skills and competencies in the field of design and construction of various types of civil structures. Students, for instance, learn how to design the elements of structures made of solid timber, as well as calculate the load capacity of simple connections within timber structures. Moreover, they are able to apply deterministic principles in hydrology, water management and hydraulic infrastructure design and operation in urban and natural environments, as well as assess the impacts of those activities. They know how to apply the

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basic analyses for planning, design, construction and maintenance of road and railroads infrastructure and airports; perform design, construction and maintenance of access and uncategorized roads; design the organization and construction technology of construction works as well as apply the knowledge on the cost structure in civil engineering projects, basic concepts of costs of works estimations and basic contract management. Finally, they can perform basic tasks of geodesy in civil engineering, application of modern methods for collecting, processing and analyzing geospatial data in solving engineering tasks.

Upon completion of the Bachelor's programme, graduates can primarily take the jobs described within the engineer license by the Serbian Chamber of Engineers: construction project management and construction works of buildings for which the construction permit is issued by the local governments, with up to 4 floors, whose total area does not exceed 2,000 m<sup>2</sup> gross; objects with less complex structure (spans up to 12 meters); local and uncategorized roads and streets; internal water supply installation and sewerage; finishing and installation works and works on interior design; simple geotechnical structures, as well as the jobs of professional supervision during construction and technical inspection of constructed structures/facilities. In addition, graduates can take jobs as associates in design preparation, field investigation works, and associates in public and private companies responsible for operation and maintenance of various structures and facilities, as well as to perform technical tasks in various competent authorities on state/city/municipal level responsible for construction, infrastructure, housing and industry.

By the end of their studies, graduates of the Master's degree programme Civil Engineering have acquired further scientific and professional knowledge in the field of analyses, design and construction of various types of complex and larger buildings, structures and infrastructural systems. Through one of five offered areas of specialization (Structural Engineering (SE); Hydraulic and Environmental Engineering (HEE); Roads, Railways and Airports (RRA); Organization, Technology and Informatics in Civil Engineering (OTI); Geotechnical Engineering (GE)) students gain additional knowledge in specific areas of civil engineering that, besides everyday engineering practice, includes rather complex civil engineering problems that require additional knowledge and abilities to analyze and conceive rational and safe engineering solutions. For a detailed list of the learning outcomes per specialization, please refer to the learning outcomes listed in the annex of this report.

Upon completion of the Master's programme, graduates can primarily take the jobs described within the licenses by the Serbian Chamber of Engineers for each of the five specializations:

SE:

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- independent professional preparation of designs and studies and technical control of designs, for: all types of buildings and engineering structures (including geotechnics)
    - management of construction of all building types and engineering structures
    - management of other construction works, finishing and installations works, including geotechnics
    - performing expert supervision during construction, as well as technical inspection of constructed structures/facilities
  - jobs in designing and execution of all types of field investigation works
  - technical and managerial jobs in construction companies responsible for construction or production of prefabricated construction elements
  - expert jobs related to operation and maintenance of various structures and facilities, prepare expert opinions, real estate valuations, assessment of damage to all types of structures
  - technical and managerial tasks in various competent authorities on state/city/municipal level responsible for construction, infrastructure, housing and industry.

HEE:

- independent professional preparation of designs and studies and technical control of designs for:
  - hydraulic structures (including geotechnics)
  - management of construction of hydraulic structures and installations of water supply and sewerage
  - performing expert supervision during construction, as well as technical inspection of constructed structures/facilities
- jobs in designing and execution of all types of hydrology measurements and forecasting
- expert jobs in public and private companies responsible for operation and maintenance of various hydraulic structures and systems, including water pollution control facilities, prepare expert opinions, real estate valuations, assessment of damage to water infrastructure
- technical and managerial tasks in various competent authorities on state/city/municipal level responsible for water supply, sewerage, irrigation, drainage, flood defense, hydropower, water resources management, water pollution control and environmental protection.

RRA:

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- independent professional preparation of designs and studies and technical control of technical designs for:
    - transport infrastructure (including geotechnics)
    - management of construction of transport and other infrastructure
    - preparation of field and laboratory tests for the needs of preparation of geotechnical studies for roads
    - design of soil improvement measures during the construction of traffic infrastructure facilities
  - jobs in execution of various types of geotechnical anchors, injection and other geotechnical works, retaining walls and rehabilitation of landslides and other forms of terrain instability, as well as other construction geotechnical works
  - expert supervision during construction, as well as technical inspection of constructed structures/facilities
  - expert jobs in public and private companies responsible for operation and maintenance of roads, railroads and airport infrastructure, prepare expert opinions, real estate valuations, assessment of damage to transport infrastructure
  - technical and managerial tasks in various competent authorities on state/city/municipal level responsible for transport and infrastructure.

OTI:

- independent expert work on designs of construction technology and construction management of:
  - projects in construction of buildings for which a building permit is issued by the local government, with up to 4 floors, whose total area does not exceed 2,000 m<sup>2</sup> gross
  - buildings with less complex structure (span up to 12 meters)
  - local and uncategorized roads and streets
  - internal installations of water supply and sewerage
  - execution of finishing and installation works and works on interior design
- expert supervision during construction, as well as technical inspection of constructed structures/facilities
- jobs in contract management of various construction projects
- expert jobs in public and private companies responsible for operation and maintenance of buildings and infrastructure, prepare expert opinions, real estate valuations, assessment of damage to water infrastructure
- technical and managerial tasks in various competent authorities on state/city/municipal level responsible for construction, housing, infrastructure and industry.

GE:

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- independent professional preparation of designs and studies and technical control of designs, for:
    - all types of geotechnical structures, buildings and engineering structures
    - management of construction of all building types and engineering structures
    - management of other construction works, finishing and installations works, including geotechnics
  - expert supervision during construction, as well as technical inspection of constructed structures/facilities
  - jobs in designing and execution of all types of geotechnical investigation works
  - technical and managerial jobs in construction companies responsible for construction of underground structures and geotechnical engineering
  - expert jobs related to operation and maintenance of various geotechnical structures, prepare expert opinions, real estate valuations, assessment of damage to geotechnical structures
  - technical and managerial tasks in various competent authorities on state/city/municipal level responsible for construction and infrastructure.

Next to the professional skills, the students of both study programmes are supposed to acquire personal and social skills such as critical and creative thinking, communication skills, adaptability, leadership skills and the capacity to work in (international) teams. In addition, they should be able to solve engineering problems through research and the application of different concepts and methods.

In the experts' opinion, the intended qualification profiles of both degree programmes are clear, plausible and allow students to take up an occupation, which corresponds to their qualification. They learn that the graduates of UB are much sought after in the labor market. The representatives of industry emphasize the high quality of the graduates of the programmes under review and students as well as graduates are satisfied with and well aware of their good job perspectives.

In summary, the experts confirm that the Bachelor's and Master's degree programmes in Civil Engineering adequately reflect level 6 and 7 of the European Qualification Framework (EQF). The programme learning outcomes are consistent with the respective ASIIN Subject-Specific Criteria of the Technical Committee of Civil Engineering, Geodesy and Architecture as well as the EUR-ACE framework standards of engineering programmes. They aim at the acquisition of specific competences and are well anchored, binding and easily accessible to all stakeholders.

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<b>Criterion 1.2 Name of the Degree Programme</b>
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**Evidence:**

- Self-Assessment Report
- Diploma Supplements

**Preliminary assessment and analysis of the experts:**

The degree programmes are taught in Serbian, which is matched by the Serbian names of the degree programmes: “инжењер грађевинарства” for the Bachelor’s programme and “мастер инжењер грађевинарства” for the Master’s programme. As Serbian is the official language for all Higher Education Ministry documents in Serbia, the degree certificates as well as official documents are in Serbian. Furthermore, UB issues English translations of these documents. The experts confirm that the English translation and the original Serbian name of the degree programmes under review correspond with the intended aims and learning outcomes as well as the content of the degree programmes.

<b>Criterion 1.3 Curriculum</b>
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**Evidence:**

- Self-Assessment Report
- Study plans
- Academic regulations
- Teaching calendar
- Module descriptions
- Overview of student’s mobility
- Objective-module-matrices
- Discussions during the audit

**Preliminary assessment and analysis of the experts:***Structure and content*

In the Self-Assessment Report and the objective-module-matrices, UB describes how the learning outcomes of the two degree programmes are to be achieved in the individual modules and thus explains the significance of each module for the programmes as a whole. The curricula are reviewed by the experts in order to identify whether the described programme learning outcomes can be achieved by the available modules. The current study

plans from 2021 for the Bachelor's programme and the Master's programme, module descriptions as well as matrices matching the learning outcomes (subdivided into three categories) and the module contents were provided for a detailed analysis.

Both degree programmes are managed by the Faculty of Engineering. Since the 1950's, five year academic study programmes in civil engineering have been implemented at this faculty. Originally, the two programmes under review had the structure 4 + 1 years: while the Bachelor's degree with 240 ECTS was spread over four years, the Master's degree comprised 60 ECTS in one year. In 2021, the faculty decided to adjust the structure of the two programmes. Since then, the Bachelor's degree programme is designed for three years while the adjusted Master's degree programme will start in October 2024 and is designed for two years. Both programmes are offered as full-time study programmes and have been accredited by the National Entity for Accreditation and Quality Assurance in Higher Education of the Republic of Serbia (NEAQA).

Table 1: Overview of the changes in accredited degree programmes in Civil Engineering at FCEUB in last 30 years

Year	Short description
1993	Revised 5-year study programme in Civ. Eng.
1998	A new 5-year study programme in Civ. Eng. with updated curriculum
2005	Implementation of the Bologna Process, first accreditation of 4-year BSc studies (240 ECTS) + 1-year MSc studies (60 ECTS)
2008	Re-accreditation of study programmes: 4-year BSc studies (240 ECTS) + 1-year MSc studies (60 ECTS)
2014	Third accreditation of 4-year BSc studies (240 ECTS) + 1-year MSc studies (60 ECTS)
2017	1-year Specialization studies implemented (Energy Efficiency), 60 ESTC
2021	<b>First accreditation</b> of 3-year BSc studies (180 ECTS) + 2-year MSc studies (120 ECTS)

The Bachelor's degree programme includes 33 modules (25 compulsory and 8 electives) as well as an internship, with a total of 180 ECTS credits. In the first semesters, the degree programme includes fundamental theoretical modules such as mathematics, physics, descriptive geometry, geology, engineering mechanics, etc. In addition, students acquire basic practical knowledge in the application of computer technology for civil engineering purposes (computer drawing, introduction to computer programming). This phase is supposed to help students understand the main aspects of the engineering profession. After that, the curriculum covers a set of scientific and professional modules related to the fundamentals of civil engineering: building materials, strength of materials and structural analysis, soil mechanics, hydraulic and environmental engineering, road and railway infrastructure, concrete, steel, timber and masonry structures as well as geotechnical structures. Through the

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elective modules offered in the last semester, students should focus more closely on certain areas of civil engineering and establish a solid foundation for certain areas of specialisation on the Master's level.

The Master's degree programme includes 21 modules or 22 modules (according to the chosen specialization) with a total of 120 ECTS credits. Each option in this programme includes a soft-skill module, an internship as well as the preparation and defense of the thesis. In addition to these 4 modules, students must choose one of a total of five specializations, each of which comprises either 17 modules [12 compulsory and 5 electives for the Hydraulic and Environmental Engineering specialization (HEE); 11 compulsory and 6 electives for the Roads, Railways and Airports specialization (RRA)] or 18 modules [12 compulsory and 6 electives for the Structural Engineering (SE), Organization, Technology and Informatics in Civil Engineering (OTI) and Geotechnical Engineering (GE) specializations].

The Structural Engineering specialization (SE) deals with subjects to train students to design and construct the most complex structures, such as residential and commercial buildings, bridges, antenna towers, water towers, industrial facilities, dams, underground structures, etc. Theoretical modules that provide the basis for complex research works and/or complex engineering modelling of structures are taught (e.g. nonlinear structural analysis, surface supports, structural dynamics etc.), as well as professional modules regarding application in structural engineering (concrete, steel, composite and timber structures etc.).

The Hydraulic and Environmental Engineering specialization (HEE) prepares students for the design, construction and operation of hydraulic structures and systems related to the water utilization, protection of water quality and prevention of harmful effects of water. Modules in the field of stochastic hydrology, groundwater hydraulics, water supply and sewerage, drinking and waste water treatment, river engineering and inland waterways, hydropower engineering, flood defense, irrigation, drainage, hydroinformatics, advanced numerical modelling methods, as well as advanced measurement methods in hydraulics are taken. Special emphasis is given to water resources management within the framework of the protection of the environment.

The Roads, Railways and Airports specialization (RRA) teaches planning, design, construction and maintenance of non-urban roads, urban roads, railways and airports. Along with this, students learn how to develop the ability to analyze and develop projects of more complex systems by application of geo-information systems, system optimization, computer aided design, etc.).

The Organization, Technology and Informatics in Civil Engineering specialization (OTI) prepares students to participate in the implementation of construction projects both from a technical-technological point of view and the organization of the execution of the works,



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development and application of building information systems, contact and project management, finance, legal and professional aspects of construction projects. This knowledge is giving students the competencies to participate in the implementation of large construction projects and a broad basis for research in various areas, including operational research, BIM and other areas in civil engineering.

The Geotechnical Engineering specialization (GE) provides students with fundamental knowledge in the field of soil and rock mechanics and numerical methods in geotechnical analysis, as well as knowledge related to analyses, design and construction of specific geotechnical structures, such as foundations, embankments and retaining structures, soil improvement methods, geo-ecological and geotechnical earthquake engineering, underground structures.

In the self-assessment report, UB states that it considers practical training a fundamental basis for engineering students to constitute the strength of the qualification granted by the diploma. As such, the study programmes under review currently entail four different kinds of practical trainings. First, practical work is carried out in the laboratories. Here, students put into practice the theoretical knowledge they have received during their courses. Second, students undertake projects. Here, students develop and research a theme relating to a subject of their field of study and capture the findings in a report and/or a presentation. Third, students have to participate in a mandatory internship that has two weeks standard duration in the Bachelor's programme and four weeks standard duration in the Master's programme, in order to gain an understanding of the nature of working in design bureaus (or construction sites) of their chosen area. Finally, the Master's thesis research project enables students to carry out practical work associated with this project. Here, they must apply all the theoretical and practical knowledge they have received during their years of study. The Master's graduation research project can be completed at UB, a research laboratory or a partner university. The extent to which the Bachelor's programme must also include a final project is described in more detail in chapter 2.

The practical training is valued by the students as this allows them to apply the skills they learned in the programme in a real working environment. The students point out that the university is very supportive in finding placements for the internship and always encourages them to gain as much practical experience as possible. Moreover, the Scholarship Fair gives the students the possibility to meet potential employers. The experts are also generally satisfied with the practical aspects of the programmes as this can additionally help the students to specialize in a particular field of interest. However, the students as well the industry representatives report that students usually extend their internship voluntarily in order to gain a better insight into the workings of an office or company. The expert group appreciates the commitment of the students, but in view of this, recommends to extend

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the standard duration of the internship in both programmes. This would also give students the opportunity to be more involved in practical work (e.g. on the construction sites).

During the audit discussions, the university proves that they have established useful guidelines for the internship and every student has one advisor at the company and one at the university to ensure that the work contributes to achieving the programme's learning outcomes. The assessment methods to evaluate this phase are comprehensive and include a diary of professional practice. However, as the expert group did not have an example of such a diary at the time of the audit, they ask UB to submit one together with its response statement.

With regard to the programme-specific learning objectives and curricula, the expert group notes that the two degree programmes under review cover the eight thematic blocks of the EUR-ACE framework standards for engineering degree programmes. These include 'Investigations', 'Making Judgements', 'Communication and Team-working' and 'Lifelong Learning'. The expert group also considers the subject block 'Knowledge and understanding' to be fulfilled, as the mathematical and scientific knowledge taught in the degree programmes is considered sufficient to be able to work on appropriate engineering tasks with regard to 'Engineering Analysis', 'Engineering Design' and 'Engineering Practice'.

Moreover, the experts notice that the concept of turbulence modelling is not mentioned for the Hydraulic and Environmental Engineering (HEE) specialization in the curriculum of the Master's programme. The teaching staff explains that these contents are covered by the modules "Fluid mechanics" in the Bachelor's programme as well as "River Engineering" in the HEE specialization of the Master's programme. However, they concede that only isolated parts of this concept are taught in the programmes under review and only dealt with in full in the PhD programme. As essentially most applications in civil and environmental engineering are related to turbulent flows, the experts point out that contents of turbulence modelling have to be explicitly included in the HEE curriculum, as the use of Computational Fluid Mechanics (CFD) codes in practical applications require substantial knowledge in choosing the right turbulence models (and their parameters) for specific problems.

Furthermore, during the audit, the experts learn that the integration of BIM in civil engineering programmes will be required by Serbian law on Higher Education from January 2028. The experts therefore ask to what extent BIM is already taught in the two programmes under review. In the Bachelor's programme, students are introduced to the basic concepts of BIM in the module of the same name. In the Master's programme, there is an "Advanced Course" that builds on this module. However, as this module is currently only a compulsory module in 3 of a total of 5 specializations in the Master's programme, they

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recommend to include BIM as a compulsory module in all specializations of the Master's programme.

Additionally, the experts ask how data driven modelling is included in the Master's curriculum. The programme coordinators explain that especially the department of Geoinformatics works on data driven methods. As the use of data-driven methods in various civil engineering applications ranging from structural analysis to Building Information Modeling is to be expected to play a substantial role in the near future, the experts recommend to include elective modules that deal with data driven modelling in all specializations of the Master's programme.

Finally, the experts discuss with the programme coordinators and students of the degree programmes what offers exist in order to strengthen students' and lecturers' English skills. The programme coordinators note that the University's Center for Career Development offers a series of workshops titled "Improve Business English." These workshops are open to all students aiming to enhance their business English skills and consist of three 2-hour sessions led by an English professor from the Faculty of Technical Sciences at the University of Novi Sad. The workshops provide guidance on participating in business meetings in English, leading meetings, and conducting meeting simulations. Additionally, in the final semester of the Master's programme, students have the option to select the elective module "English Language in Civil Engineering" (2 ECTS). This course helps students achieve the English proficiency needed for academic writing, correspondence, and professional communication. Upon completion, students will have mastered the key lexical and syntactic features of scientific and technical writing and be able to comprehend both oral and written English, including professional literature, project assignments, technical documentation, and relevant norms and regulations.

In summary, the experts are convinced by the curricula of the two study programmes allow students a promising education in the field of Civil Engineering. They conclude that the curricula enable students – besides the mentioned restrictions – to achieve the intended learning outcomes of the programmes and that they are in line with the SSC of the Technical Committee Civil Engineering, Geodesy and Architecture as well as the EUR-ACE framework standards of engineering programmes. The experts see a need for improvement in the Master's programme, particularly in relation to contents of turbulence modelling. Apart from that, minor curricula related topics have been recommended.

#### *Periodic Curriculum Review*

The curricula of the degree programmes under review are designed to comply with the learning outcomes and they are, according to UB regulations, subject to constant revision

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processes (see also chapter 1.1 and chapter 5). As such, the curricula will be reviewed regularly and commented on by students and teachers as well as by external stakeholders such as alumni or industry partners. Regular changes are made to ensure that the curricula are up to modern standards. Both curricula have been subject to change in 2021. Besides the learning outcomes defined by UB itself, the curricula also take into account recommendations from graduates, industry, international standards of higher education and curricula from other universities worldwide. The faculty keeps in touch with former students through the faculty alumni network on LinkedIn. Data on the employment dynamics of graduates are obtained from the National Employment Service of the Republic of Serbia, while market needs are assessed through occasional surveys of job advertisements, as well as through contacts with employers achieved through events such as the Scholarship Fair.

### *International mobility*

The Self-Assessment report as well as the discussions make it very clear that international recognition is one of UB's primary goals for the next years. The experts point out that international mobility, with regard to lecturers as well as students, is a key factor in these efforts.

The experts learn that the university already provides various mobility opportunities for students. These include semesters abroad, short programmes, internships, and international conferences. To foster these, the faculty has 16 cooperation agreements with several partner institutions in Europe: Ruhr University Bochum (Germany), University of Naples Federico II, University of Pisa, Politecnico di Milano (Italy), University of Vienna, TU Graz (Austria), Bialystok University of Technology (Poland), University SJEVER, University of Split (Croatia), Université Paris Cité (France), UC Louvain (Belgium), Aarhus University (Denmark), University of Oslo (Norway), Politehnica University of Timișoara (Romania), Rotterdam University of Applied Sciences (the Netherlands). Additionally, UB is part of the Circle U alliance, a research-driven and interdisciplinary network dedicated to providing education, research, and innovation to foster more sustainable, democratic, and healthier societies. This alliance offers the faculty's students unique opportunities for diverse and innovative learning, international experiences, cultural exchange, and language training, focusing on inclusive, intercultural, and interdisciplinary skills.

Student mobility is managed through the Erasmus + programme, an EU initiative that funds cooperation projects in education, youth, and sports. The Erasmus + programme aims to enhance young people's potential for active participation in society, develop leadership skills, and promote solidarity and cultural understanding. Erasmus scholarships for outgoing students range from 500 to 540 EUR per month, with an additional 250 EUR per

month available for students with fewer opportunities participating in the mobility program.

An International Office has been established in order to coordinate UB's efforts and to support the students in the administrative, legal and financial process of international mobility. Despite the faculty being an independent legal entity, student mobility is managed at the university level using UB's MobiON online mobility platform. This platform is designed to streamline the registration process for incoming candidates (visiting students and staff from partner universities) and the application process for outgoing candidates (students and staff from UB) who are interested in participating in mobility programmes.

Students are encouraged to go on exchange specifically during the final stage of their studies. Although the Erasmus + programme provides opportunities for students to acquire international exposure, there is little motivation on the part of Civil Engineering students to spend time abroad. This is due to the fact that the previous 4+1 structure of the study programmes offered at the Faculty of Civil Engineering was not fully complementary to programmes at other international universities. This is why students in particular appreciate the switch to the 3+2 structure. Most exchanges are performed during the last semester of the Master's degree programme, where students prepare their Master's theses in collaboration with domestic and international supervisors. Partly due to the COVID-19 pandemic, the number of students participating in mobility programmes between 2020 and 2021 was relatively low, but has been increasing again after the pandemic in 2022.

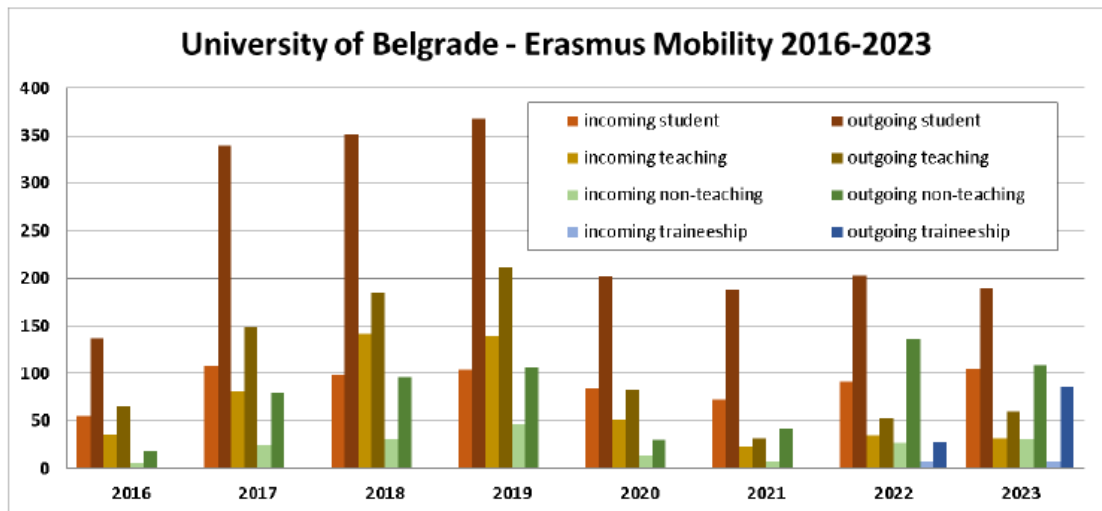


Figure 2. Number of completed Erasmus mobility actions at the UB

Since 2016, only 4 international students have spent a semester at the faculty, primarily because Serbian is the language of instruction for both programmes. In contrast, 18 of the

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faculty's students have completed a semester abroad. Additionally, there have been 9 incoming and 11 outgoing teaching exchanges.

Qualifications obtained at other universities in Serbia or abroad are recognized in line with the courses at UB. Before a stay abroad, the university concludes a learning agreement with the respective student to ensure that the courses taken are relevant to the study programmes and can thus be recognized. However, the experts learn from the students during the audit that the programme coordinators are quite strict when it comes to recognizing externally completed modules and often look for modules at other universities that are 100% the same as those at the faculty. However, this should not be the aim of international exchanges. It should be much more about broadening horizons and changing perspectives. Therefore, the experts recommend to make the acceptance for recognizing externally acquired modules more flexible.

Finally, in their discussion with the experts, the students confirm the existence of opportunities for international academic mobility. The experts appreciate the efforts to promote international mobility and encourage UB to continue in this direction.

#### **Criterion 1.4 Admission Requirements**

##### **Evidence:**

- Self-Assessment Report
- Rulebook on the Enrolment of Students in Study Programs
- Rulebook on the Method of Determining Status of Candidates and students with Disabilities
- Website
- Discussions during the audit

##### **Preliminary assessment and analysis of the experts:**

The formal and subject-specific admission requirements are governed by the Law on Higher Education (LHE) and the "UB Rulebook on the Enrolment of Students in Study Programs," which ensures that students meet the intended competence profiles. This rulebook also outlines admission requirements for international students (Articles 4-6), who may enroll under the same conditions as domestic students. Admission criteria for students with disabilities are specified in the "UB Rulebook on the Method of Determining the Status of Candidates and Students with Disabilities", allowing these candidates to take the entrance exam in a manner suited to their needs and abilities.

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The announcement for admission to the first year of the Bachelor's and Master's programmes is made through UB's and the faculty's website. All applicants must pay an admission fee of approximately 30 EUR.

The number of available places for enrolment is determined annually based on societal needs and professional interests. The number of students funded by the state budget and those who self-finance is proposed by the faculty's Teaching-Scientific Council (TSC) and approved by the Government of the Republic of Serbia. For the Bachelor's programme, the TSC allocates 240 places for state-funded students and 90 for self-funded students. For the Master's programme, 225 places are allocated for state-funded students and 40 for self-funded students. This means that, out of a total of 265 available places, 105 candidates can be admitted to the SE specialization, 40 to HEE, 40 to RRA, 60 to OTI, and 20 to GE. As UB is a public university, state-funded students do not pay tuition fees, while self-funded students pay a yearly fee of around 1000 EUR. All students also pay a diploma issuance fee of about 60 EUR upon completing their studies.

The admission process is managed by the Admission Committee (AC), appointed by the faculty's dean. The AC is responsible for organizing the submission of documents, entering data into the information system, ensuring the proper conduct of entrance exams, and providing technical support.

For admission to the Bachelor's programme, all candidates who have completed a four-year high school are eligible to apply, regardless of their final grades. Applicants must take an entrance exam in mathematics. To assist candidates in preparing, the faculty offers optional preparatory classes in mathematics, both online and on-site. Candidates who have won prizes in mathematics competitions during high school may be exempted from the entrance exam. Those who have passed the mathematics entrance exam at other technical faculties of UB (e.g., Faculty of Mechanical Engineering, Faculty of Electrical Engineering) may enroll as self-funded students if there are still available spots. Specific enrollment requirements are detailed in the "Rulebook on the Enrolment of Students in Study Programs."

The ranking list is based on the total score, which combines high school grades (worth 16 to 40 points) and the entrance exam score (up to 60 points). To enroll as a state-funded student, a candidate must have a total score of at least 51 points and rank within the number of available places. For self-funded enrollment, a minimum of 30 points is required, along with a ranking within the available spots for self-funded students.

Students from other degree programmes or those who have completed previous studies can also apply for the Bachelor's degree in Civil Engineering. The Teaching Committee (TC) assesses the applicant's prior education to determine the appropriate year of study for enrollment. Exams from other programmes may be recognized fully or partially. If a student

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transfers from a higher education institution with which the Faculty of Civil Engineering or UB has a credit recognition agreement, the TC determines the number of ECTS credits recognized and any remaining academic obligations.

The following table provides the statistical data on the number of applicants and admitted students in the Bachelor's degree programme in Civil Engineering:

Table 3. Number of applicants and admitted students in the BSc in Civil Engineering degree program in the last 3 years

Academic year	Number of applicants	Admitted students	Ratio
2021/2022	577	311	53.9%
2022/2023	484	311	64.3%
2023/2024	448	295	65.8%

For the Master's degree programme, candidates who have completed a Bachelor's degree in Civil Engineering at any higher education institution, with a minimum of 180 ECTS, are eligible to apply. Additionally, candidates must have earned at least 45 ECTS from scientific-professional and professional-applied modules in Structural Engineering in order to apply for the SE, GE, or OTI specializations. For the RRA specialization, they need at least 20 ECTS from modules related to Roads and Railways, and for the HEE specialization, they must have at least 20 ECTS from modules in Hydraulic Engineering.

Similar to the Bachelor's admission process, candidates for the Master's programme must take an entrance exam that covers all fields of civil engineering studied at the Bachelor's level, ensuring that applicants have adequate foundational knowledge. The order of admission is determined by a ranking list based on the average grade from Bachelor's studies, the duration of the studies, and the entrance exam score. Candidates from other degree programmes may also apply, and their applications are reviewed by the faculty's AC, which evaluates their previous education.

The following provides the statistical data on the number of applicants and admitted students in the Master's degree programme in Civil Engineering (no data on the newly structured Master's studies exists so far):



Table 5. Number of applicants and admitted students in the MSc in Civil Engineering degree program in the last 3 years (NEAQA Accreditation 2014)

Academic year	Number of applicants	Admitted students	Ratio
2021/2022	270	234	86.7%
2022/2023	231	220	95.2%
2023/2024	203	191	94.1%

During the audit discussions, the experts inquire about the slight decrease of admitted students to both programmes since the academic year 2021/22. The programme coordinators explain that Serbia has experienced a general decline in student numbers of around 10 to 15% in recent years. Since the Covid19 pandemic and especially since the onset of the high inflation rate, it has been observed that some students go directly abroad to study or work after graduating from high school, as salaries are often significantly higher. To counteract this trend, the programme coordinators regularly visit high schools and present the study programmes. The “Open Day” is also intended to increase the attractiveness of the programmes for prospective students. This is confirmed by the students. The expert group understands that the slight decline in student numbers in both programmes is not a structural problem, but is caused by external factors that the university can hardly influence. Nonetheless, the expert group recognises that the programme coordinators are taking various measures to further underline the attractiveness of the two study programmes.

During the discussion with the students, the experts gain the impression that students are well informed about the admission requirements and procedures as all necessary information is gathered on UB’s website. Since the rules are based on decrees by the ministry, the experts deem them binding, transparent and adequate for selecting the best students for both degree programmes.

<b>Criterion 1.5 Workload and Credits</b>
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**Evidence:**

- Self-Assessment Report
- Academic regulations
- Statistical data about drop-outs and study duration
- Website
- Discussions during the audit

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**Preliminary assessment and analysis of the experts:**

All modules in both programmes are assigned ECTS credits and last for one semester. The workload is spread relatively evenly over the semesters. Every semester comprises between 28 and 32 ECTS credits in both degree programmes while each credit is valued 30 working hours (including lecture hours and self-study hours).

The experts confirm that the workload in hours is indicated in the module descriptions and the distinction between classroom work and self-studies is made transparent and is in line with the credits awarded. Feedback concerning the workload is collected through the course evaluation survey at the end of each semester and adaptations are made if necessary.

According to the module descriptions, the modules in both programmes have a scope of 4 to 8 ECTS credits. An exception to this is the internship in the Bachelor's programme, which only has 2 ECTS credits as well as the "Research Preparation and Presentation", "Innovation and Entrepreneurship" and "English Language in Civil Engineering" modules in the Master's programme, which are also awarded 2 ECTS credits. The experts notice that in both programmes many modules are quite small in terms of credit points (2-4 ECTS credits) and they worry that this might lead to a high number of exams per semester and consequently to a heavy workload for the students. They learn that this is to some extent countered by the fact that modules worth 2 or 4 ECTS credits do not require both written and oral exams, whereas those worth 6 or 8 ECTS credits, for instance, include multiple types of exams. Additionally, the duration of the exams is proportional to the number of credit points assigned to each module. The students also emphasise that they consider the workload high but manageable.

However, they also underline that they would welcome a decrease of the exam load. As the statistical data provided by UB shows, the average length of study was 6 years and 10 months in the last 5 years in the Bachelor's programme (data for the previous 4 year programme) and 2 years and 2 months in the Master's programme (data for the previous 1 year programme). The programme coordinators explain that on one hand this is due to the fact that according to the previous structure of the Bachelor's programme, students had to choose a specialization area already after the third semester. The students felt that this was too early, which is why there was a lot of module transfer. Accordingly, in the new structure of the programme, students only have to select electives from a total of 3 specialization groups in the final semester, which can then be studied in more depth in the Master's programme. In addition, the workload in numerous modules in the old structure of the Bachelor's programme was described as disproportionate to the ECTS awarded. In order to compensate for these inconsistencies, the pre-exams and examination formats have been adapted. Care has also been taken to ensure that less content is repeated in

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different modules. On the other hand, the programme coordinators explain that most students, Bachelor's, but especially Master's students, already work alongside their studies. The experts appreciate that student feedback has been taken into account and that changes have been implemented. The feedback from students is also consistent with the programmes' average length of study (according to the old structure 4+1) already mentioned above.

Notwithstanding, the experts also see that almost all students complete the degree programmes as the average success rate is 76 % in the Bachelor's programme, while the average drop-out rate is 22 % for the academic years 2018/19 – 2022/23. Most students drop out during the first year of studies. The data for the academic years 2021/22 and 2022/23 corresponds with the 3 year programme that is a subject of this assessment, while the previous three years correspond with the previous 4 year programme. During the same period, the average success rate is 75 % in the Master's programme, while there hasn't been any student dropping out of the programme. This data corresponds to the previous 1 year programme, because the 2 year programme that is subject to this assessment starts in October 2024. Therefore, the experts recommend to combine small modules in order to reduce the total number of exams per semester which can have a positive long-term effect on graduation within the standard period of study.

During the on-site visit, the students confirm that the workload in the programmes' new structure is generally well reflected by the number of credits awarded and more or less equally divided through the study years and programmes. They emphasize that they also to work on the side in order to finance their studies. The experts consider the workload to be overall manageable and transparent. Nevertheless, the recommend reviewing the module sizes and the associated number of examinations.

#### **Criterion 1.6 Didactic and Teaching Methodology**

##### **Evidence:**

##### **Evidence:**

- Self-Assessment Report
- Study plans
- Module descriptions
- Discussions during the audit

##### **Preliminary assessment and analysis of the experts:**

As UB explains in the self-assessment report, a variety of teaching methods is used to promote achieving the intended learning outcomes and support student-centred learning and

teaching. Especially in the Bachelor's programme, most class hours consist of lectures and calculus tutorials using a combination of blackboard and PPT presentations. However, there are also laboratory exercises in a certain number of modules (Engineering Physics, Building Materials 1, Building Materials 2, Fluid Mechanics, Soil Mechanics and Water Quality). The content of certain professional-applicative modules includes practical work on solving practical engineering problems from all areas of civil engineering (Theory of Concrete Structures 2, Steel Structures 2, Timber and Masonry Structures, Roads and Airports Construction, Computer-Aided Road Design, Hydrotechnical Engineering, Cost Planning and Control in Civil Engineering 1). Overall, the modules and individual forms of teaching are divided as follows:

- academic-general education modules 14.44%;
- theoretical-methodological modules 23.33%;
- scientific-professional modules 37.78%;
- professional-applied modules 24.44%.

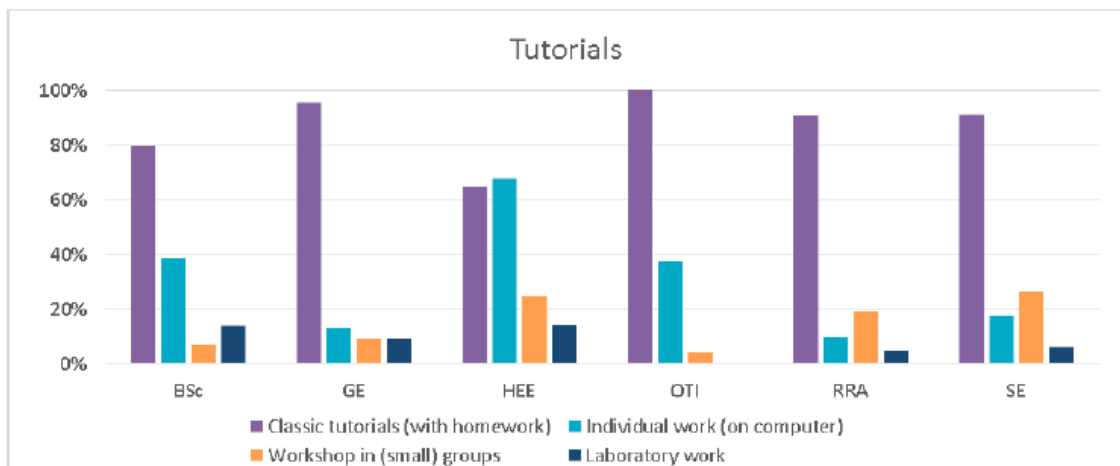
In the Master's programme, this distribution changes according to the chosen specialization:

Table 1.1. Percentage representation of areas of specialization.

Module type	SE	HEE	RRA	OTI	GE
academic-general education	0.56%	0.56%	0.56%	0.56%	0.56%
theoretical-methodological	25.00%	25.00%	26.11%	24.44%	24.44%
scientific-professional	49.00%	45.83%	34.44%	41.11%	43.33%
professional-applied	25.44%	28.61%	38.89%	33.89%	31.67%

Compared to the Bachelor's programme, the Master's programme shows a notable increase in both scientific-professional and professional-applied modules.

Unlike traditional lectures, statistical data indicates that most tutorials in both programmes involve lectures with homework assignments (usually every 1-2 weeks), followed by individual work, workshops in small groups, and, to a lesser extent (under 20%), laboratory work. The faculty aims to enhance this aspect by expanding lab capacity through the development of new laboratory infrastructure, primarily funded by a growing number of research projects each year.



In this context, the experts ask how the teaching staff and the prospective employers evaluate the soft skills of the students. They learn that the students from UB are particularly resilient in many respects: both in terms of self-confidence and in terms of their perseverance. In spite of this, the industry representatives also underline, that specific soft skills as the ability to publicly speak, present in front of an audience and work in a team could still be improved. Consequently, the experts recommend to include more presentations of group work into the lectures.

During the audit discussions, the experts learn that both programmes use appropriate software for teaching and research purposes. In the field of programming, MATLAB (Campus-Wide License), PYTHON and BLUEJ are used. At the Bachelor's level, AUTODESK EDUCATIONAL (Autocad, Civil 3D, Bim360, Flame, Fusion, Inventor, Navisworks, Revit, Robot, 3DS Max, Maya, Advance Steel, Structural Bridge Design, VRED etc.) and ARCHICAD are used for engineering drawing. At the Master's level, a number of software solutions for structural analysis and steel/concrete detailing is used: DLUBAL RFEM, RSTAB & RSECTION college license, IDEA STATICA, Radimpex ARMCAD, Radimpex TOWER, SCIA ENGINEER, NEMETSCHKE ALLPLAN, SOFISTIK, SIMULIA ABAQUS, TNO DIANA. In addition, the different specialization areas include specialized software solutions used at the faculty, such as FINESOFTWARE GEO5. During the audit discussion, the students report that they do not have full access to Microsoft Office, because no student licences are available. The experts are surprised by this, as MS-Project is a common software programme in this area. They therefore recommend to offer students access to Microsoft Office licenses, especially as this seems to be available in other faculties in the university.

Moreover, the experts appreciate that the faculty rewards the independent scientific work of the students by providing financial support from faculty institutes, former professors,

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and partner companies. Master's students also benefit from collaboration on research-oriented theses and joint research papers with lecturers and associates, which are presented at national and international conferences or published in academic journals.

Additionally, the faculty regularly reviews whether the teaching and learning methods used effectively support the achievement of the programme objectives. This is done through survey evaluations conducted twice a year, after each semester, to assess whether the didactic tools and methods employed help achieve the desired learning outcomes and if all teaching staff effectively use the most appropriate methods for this purpose.

The experts consider the teaching methodology employed in the two degree programmes to be diverse, interactive and to show a healthy mixture between traditional and modern/alternative methods, which is confirmed by the students. They are well adapted to the aims and conditions of the individual courses and suitable to support the students in achieving the intended learning outcomes.

**Final assessment of the experts after the comment of the Higher Education Institution regarding criterion 1:**

Criterion 1.3:

With regard to the requirement to include contents of turbulence modelling in the specialization area “Hydraulic and Environmental Engineering” (HEE) of the Master’s curriculum, UB explains in its response statement that the concept of turbulence modelling has been introduced within 2 modules of the HEE specialization in the Master’s degree programme: “Open Channel Hydraulics” and “Ecohydraulics”. UB submits the corresponding updated module descriptions. The corrections have been implemented in pages 2 and 29. Described corrections have also been implemented on the faculty’s website. The experts confirm that UB has integrated the required content into the HEE Master's curriculum accordingly and therefore consider the requirement to be fulfilled.

Moreover, regarding the additional material to be provided together with the university’s response statement, UB submits a sample of an internship diary both in Serbian and in English. The experts find that the document corresponds to the learning objectives and learning content specified in the module descriptions and also consider this point to be fulfilled.

With regard to the recommendation to extend the standard duration of the internship in both programmes, UB states that this topic will be discussed during the regular department meetings of the faculty, and the changes will be proposed to the Committee for Quality Assurance and Improvement at the faculty (CQAI). Then, the Teaching-Scientific Council of

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the faculty (TSC) will discuss the proposed improvements of the curriculum, in order to extend the internship duration to min 1 month at the Bachelor's level and min two months at the Master's level, in the re-accreditation cycle at NEAQA. The experts appreciate the faculty's plan to extend the duration of the internship in both programmes. However, as these changes are only planned and have not yet been implemented, the experts continue to adhere to this recommendation.

Likewise, the faculty plans to implement the following recommendations as suggested by the experts and will proceed in the same way as explained for the previous recommendation:

- recommendation to include BIM as a compulsory module in all specializations of the Master's programme
- recommendation to include elective modules that deal with data driven modelling in all specializations of the Master's programme
- recommendation to make the acceptance for recognizing externally acquired modules more flexible in both programmes

As these changes are only planned and have not yet been implemented, the experts continue to adhere to these recommendations as well.

#### Criterion 1.5:

With regard to the recommendation to review the module sizes and the associated number of examinations, UB states that the faculty will discuss this recommendation during the regular department meetings, in order to encourage the module coordinators to combine small modules into the larger ones, during the next re-accreditation cycle at NEAQA. As these changes are only planned and have not yet been implemented, the experts continue to adhere to this recommendation as well.

#### Criterion 1.6:

With regard to the recommendation to include more presentations of group work into the lectures, UB states that the faculty plans to discuss this topic during the regular department meetings, in order to encourage the minor changes in module contents, wherever possible, in order to include more presentations of group work. The changes will be proposed to Teaching Committee at the FCEUB (TC). Then, the Teaching-Scientific Council (TSC) will discuss and approve the proposed improvements. As these changes are only planned and have not yet been implemented, the experts continue to adhere to this recommendation as well.

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Regarding the recommendation to offer students access to Microsoft Office licenses, especially as this seems to be available in other faculties in the university, UB explains that the faculty will invest substantial efforts in procurement of student licenses of MS Office, in order to allow the full access to all included software packages within MS Office. The faculty also plans to seek support and assistance from the Ministry of Education of Republic of Serbia, in solving this issue. The experts appreciate the faculty's efforts. However, as these improvements are only planned and have not yet been implemented, the experts continue to adhere to this recommendation.

## 2. Exams: System, Concept and Organisation

### Criterion 2 Exams: System, Concept and Organisation

#### **Evidence:**

- Self-Assessment Report
- Module descriptions
- Website
- Rulebook on Taking the Exam and Grading
- Teaching calendars
- Samples of written exams and final theses

#### **Preliminary assessment and analysis of the experts:**

At UB, assessment is conducted according to the regulations defined in the "Rulebook on Taking the Exam and Grading". The faculty has adopted the concept of multi-component assessments to measure the achievement of the learning outcomes. Modules usually comprise assignments/course work (tests, colloquia, preparation of essays, homework, etc.) and a final examination. Laboratory work is assessed through reports and practical work exams. The final exams typically consist of a written (calculation) and an oral (theoretical) part and are used to display whether the course objectives have been met at the end of each semester. This is transparently communicated in the module info boards, which can be accessed via the faculty's website as well as in the module descriptions, which also contain detailed information about the weight of each examination component. The experts as well as the students welcome the continuous learning assessment as it not only allows a close monitoring of the students' learning progress, but also encourages students' moti-



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vation throughout the semester. By way of helping students to consciously assess their actual state of knowledge, the assessment procedure at the same time contributes to an adequate exam preparation. To what extent the combination of modules could help reducing the exam load has been discussed in detail under criterion 1.5.

The final grade of each module is calculated based on the score of these individual kinds of assessment. At the first meeting of a course, the students are informed about what exactly is required to pass the module and about how the final grade is determined through the teaching and learning plan. Successfully passed exams are evaluated by lectures with a grading system based on a 100-point scale:

- up to 50 points – grade 5 (failed);
- from 51 to 60 points – grade 6 (sufficient);
- from 61 to 70 points – grade 7 (good);
- from 71 to 80 points – grade 8 (very good);
- from 81 to 90 points – grade 9 (excellent);
- from 91 to 100 points – grade 10 (excellent-exceptional).

After the exam, the lecturers are obliged to enter exam results into the Faculty of Civil Engineering Information System (FIS). After that, the FIS generates the aggregate report on the conducted exam, which contains information about the distribution of students per achieved grade, the average grade, the number of students who passed the exam compared to the number of students who registered for the exam as well as the number of students who passed the exam compared to the number of students who attended the exam.

Based on the corresponding rulebook, to be eligible to take the final exam students must attend all course sessions. The experts learn from the students that this regulation creates a significant amount of pressure. The experts understand that every individual student lives in different life and health circumstances and also has different learning speeds and interests. Therefore, the experts think it could be useful to reconsider the full attendance requirement. To pass the course, a student must obtain at least 50 out of 100 points in the module's total score. Students who fail an exam have the opportunity to retake the exam. Exams generally consist of a written (calculation) part and an oral (theoretical) part. Students who pass the written portion are allowed a maximum of two attempts to pass the oral portion. If they fail the oral part twice, they must retake the entire exam. This rule applies to all modules and study programmes within the current academic year. Students who cannot take an exam due to illness or other reasons must submit a request to the

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Student Affairs Office (SAO), which is reviewed and approved by the Vice-Dean for Teaching. Students unable to take an exam due to illness or professional commitments lasting at least three months may reschedule for the next exam period. The students confirm that these regulations are effective and properly managed, and experts agree that provisions for disability accommodations, illness, and other exceptional circumstances are clearly established. Nevertheless, they think it would be useful to give students the possibility to take an exam twice (instead of only once) per year order to avoid waiting times.

According to the academic calendar, there are six regular exam periods for Bachelor's students (January, February, June, July, September 1, and September 2) and five for Master's students (February, June, July, September 1, and September 2). Each exam period lasts for 11 days. At the Master's level, there are also two additional exam periods in November, where students may sit for one exam per period. A detailed schedule, including the exact time, date, and format of each exam, is published on the faculty's website at the beginning of each semester. Even though the students welcome the amount of exam periods as they help avoiding delays in students' progress, the experts realize that this means an enormous additional effort for the exam organisation and that no learning progress can be expected if exams are repeated at short intervals. Therefore, they recommend to reduce the exam periods.

In their final year of studies, Master's students have to prepare a thesis demonstrating knowledge, skills and competences gained in the course of the preceding semesters. From the information in the self-assessment report and in the audit discussions, the experts gain the impression that the theses in the Master's degree programme are thoroughly planned major academic works conducted in distinct stages from the first proposal to the final report. The regulations for thesis examination are communicated to students through the FIS and the faculty's website.

Prior to the actual research work, the students are required to write a research proposal and present it in a seminar attended by lecturers and other students who form a research group ("research Preparation and Presentation" module in the Master's programme). The research proposal is discussed during the monthly department meetings and defence committee members are nominated. After the thesis proposal is accepted, students start their collaboration with a nominated thesis advisor. The student's thesis advisor is supposed to ensure that the research work contributes to achieving the programme's learning outcomes. Regular (usually weekly) meetings are organized between each candidate and the advisor, in order to actively track the progress of the candidate. Also, other committee members may be involved in the development of the thesis. In case the student writes the thesis in collaboration with another institution or the industry, the student is also assigned a co-supervisor. After completing the work on the thesis, the student has to present and

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defend the results in front of a graduation jury. The experts discuss with the programme coordinators, the members of the teaching staff and the students about the process of finding a suitable topic for the thesis. They learn that usually students propose their own ideas after consulting their thesis advisor. Students also have the opportunity to write their thesis as part of an exchange programme at another institution. The experts learn about a Master's student who defended the thesis in the frame of an Erasmus + exchange between UB's Faculty of Civil Engineering and Politecnica Universitatea Timisoara in Romania.

During the audit discussions, the experts are inquiring about the scope and the content of the thesis in the Bachelor's degree programme as they couldn't find any related module in the corresponding study plan. The experts learn from the programme coordinators that in the previous structure of the programme (4 + 1 years), the students were required to write a thesis. The students confirm this statement. Instead, as it was not required by NEAQA, for the new structure of the programme that has been introduced in 2021, the programme coordinators decided to include three groups of elective modules (structural engineering/geotechnical engineering/project management or road engineering or hydraulic engineering) that the students can choose from. The experts can understand these explanations. However, according to ASIIN's General Criteria, study programmes must include a final thesis or final project which demonstrates that the students are able to work independently on a task at the intended level of the degree programme. Therefore, the experts urge UB to include a final project as a mandatory part of the curriculum and to provide the corresponding module descriptions and guidelines.

During the on-site visit, the university proves that they have established useful guidelines for the final thesis of the Master's degree programme. Moreover, the experts were provided with a selection of exams and theses of the previously 4 +1 structures programmes to check. They confirm that these represent an adequate level of knowledge as required by the EQF level 6 for the Bachelor's programme in Civil Engineering and EQF level 7 for the Master's programme in Civil Engineering. The forms of exams are oriented toward the envisaged learning outcomes of the respective courses, and the workload is distributed in an acceptable way. The experts conclude that the criteria regarding the examinations system, concept, and organization are fulfilled. As for the Bachelor's degree programme (new structure), the university must include a final project into the curriculum.

**Final assessment of the experts after the comment of the Higher Education Institution regarding criterion 2:**

With regard to the requirement to include a final project as a mandatory part of the Bachelor's curriculum, UB states in its response statement that the final project has been introduced within the final elective module group in the last semester, while other elective module groups have been slightly re-arranged. In the updated version of the study plan, the

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students select to complete a final project within one of the following modules (worth 6 ECTS credits): “Theory of Concrete Structures 2”, “Computer-Aided Road Design” or “Hydraulics of Pressurized Systems”. This is motivated by the fact that after completion of the Bachelor’s programme, the students have the fundamental knowledge from the above areas for working independently in the civil engineering sector. In addition, the above areas are those that engineers will encounter most often in engineering practice.

UB further explains that the improvement of the Bachelor’s curriculum will take place immediately, thus the first generation of graduates will complete the studies according to the improved programme in September 2025. UB submits the corresponding updated study plan and module descriptions (pages 45-47) together with its response statement. This document. The mentioned corrections have also been implemented on the faculty’s website. The experts appreciate that UB took their comments into account and modified the curriculum so that a final project is now implemented in the last semester and the corresponding learning outcomes can be achieved. Therefore, they consider the requirement to be fulfilled.

With regard to the recommendation to reduce the exam periods, UB states that they appreciate the experts’ recommendation and agree. Nevertheless, the large number of exam terms is allowed and prescribed by the Serbian Law on Higher Education, and thus the faculty is obliged to organize the comparably large number of exam terms. The experts understand these circumstances and cancel the recommendation.

Regarding the experts’ hint to reconsider the full attendance requirement, UB states that this topic will be discussed during the regular department meetings of the faculty, in order to encourage the module coordinators to be more flexible in demanding the full attendance requirement. The experts appreciate that the faculty is taking this suggestion into consideration.

### 3. Resources

<b>Criterion 3.1 Staff and Development</b>
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**Evidence:**

- Self-Assessment Report
- Staff Handbook
- Standards and Procedure for Accreditation of Study Programs
- Rulebook on the Procedure of obtaining the Title and the Employment of Teachers

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- Rulebook on Minimum Requirements for obtaining a Teacher Title
  - Faculty's statutes
  - Module descriptions
  - Discussions during the audit

**Preliminary assessment and analysis of the experts:**

In the self-assessment report as well as the staff handbook, the university presents data about the number and overall qualification of the teaching staff for the Bachelor's and Master's degree programmes in Civil Engineering. In accordance with the Serbian Law on Higher Education (LHE), the faculty's teaching staff consists of lecturers (professors, associate professors and assistant professors) and associates (assistants and teaching associates). The academic position of each staff member is based on research activities, publications, academic education, supervision of students, and other supporting activities. All full-time teaching staff members are expected to be involved in teaching/advising, research, and services that are beneficial to stakeholders. However, the workload can be distributed differently between the three areas from teacher to teacher, depending on the academic position. The main difference of tasks and responsibilities based on academic staff position lies on the proportion of teaching and research activities. The higher the academic staff position is, the greater is the proportion of research activities, but the lower is the proportion of teaching activities. The latter may become professors once they have earned a certain amount of credits with regard to their academic work.

In total, the staff involved in both programmes under review is composed of 99 lecturers and 27 associates. In addition, 11 visiting professors, who are the leading experts in their respective fields of research, are involved in the study programmes. 98 lecturers and all associates in these study programmes are employed full-time. The assignment of lecturers and associates to specific modules is guided by an assignment plan proposed by the faculty's departments for each academic year and approved by the Teaching Staff Council (TSC). These plans form the basis for developing the module schedule for every semester, which is made available through the FIS. The average workload for lecturers and associates in each study programme is outlined in the "Rulebook on the Standards and Procedure for Accreditation of Study Programs," established by the National Council for Higher Education (NCHE) of the Republic of Serbia. According to these guidelines, lecturers are limited to a maximum teaching load of 7.2 hours per week, and associates to a maximum of 12 hours per week over the academic year. This framework is intended to ensure that the faculty maintains sufficient staff resources to deliver all study programmes effectively while minimizing the risk of diminished research and teaching quality due to excessive workload. In cases of staff shortages, which are rare, the faculty typically hires a student demonstrator

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for one or two semesters or brings in a part-time lecturer from another faculty or university.

During the audit discussions, the experts learn that UB has established a solid recruitment process for teaching staff. The “Rulebook on the Procedure of Obtaining the Title and the Employment of Teachers” and the “FCEUB Statute” ensure the quality of the teaching staff, while the “Rulebook on Minimum Requirements for Obtaining a Teacher Title” provides the basis for their selection. For a candidate to be appointed as an assistant professor, they must deliver an entrance lecture in their field of expertise, achieve positive evaluations in student surveys throughout the previous selection period, publish at least two peer-reviewed journal articles in their discipline, and participate in two international scientific or professional conferences. Additional optional criteria include serving on the editorial boards of scientific journals, participating in organizing professional or scientific conferences, or being a member of thesis defense committees. For promotion to a full professor, a candidate must also fulfill these additional criteria, such as mentoring a doctoral dissertation and publishing at least five peer-reviewed journal articles in the last 10 years in their field of teaching.

During the audit discussions, the teaching staff expressed satisfaction with their working relationship with UB. The experts also observed that the faculty members were highly motivated and confident in the study programmes they offer.

Regarding staff development, the faculty actively encourages training for its academic staff to enhance their teaching skills and methodologies. Faculty members regularly participate in training sessions on pedagogy, teaching and research methodologies, leadership, and quality assurance. At the end of each semester, teaching staff in the programmes under review meet to discuss the curricula and identify training needs for various departments. Additionally, staff members are occasionally trained to keep them updated with the latest teaching technologies and methods.

The faculty places particular emphasis on promoting research activities among its teaching staff by providing incentives for junior staff members to publish papers in international scientific journals listed by the Science Citation Index (SCI). The faculty has also introduced an annual award to recognize the most valuable contribution to scientific research by its lecturers.

All thesis projects involve active research in the field of Civil Engineering. Collaborating with partner institutions in several European countries on co-supervised thesis projects has led to the development of new research topics. Faculty members participating in staff exchange programmes are typically assigned to partner universities abroad that have coop-

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eration agreements with UB. The teaching staff also mention that there are several opportunities to apply for research funding, not only from UB or the faculty but also from the government or large companies with which the university collaborates.

Nevertheless, the experts also learn from the programme coordinators that there aren't any faculty members who exclusively focus on research, as they are mainly (60-70 %) involved in teaching and industry cooperation. In order to support faculty members in terms of research activities, the Ministry of Education grants 30 % salary increase for successfully completed research projects. Moreover, the programme coordinators explain that in the past few years, the Faculty of Civil Engineering hired international consultants who helped them develop strategies to increase their involvement in international research projects. As the increase of international exposure is one of the faculty's primary goals for the upcoming years, the experts point out that the involvement in (international) research projects is one of the main paths to follow. Therefore, they recommend to increase the ratio of lecturers who are actively involved in research as well as the number of lecturers with international experience. This could also offer students the opportunity to become assistants and be included in their professor's research projects.

In summary, the experts highlight the well-engaged staff members and confirm that the composition and scientific orientation of the teaching staff are suitable for successfully implementing and sustaining the two degree programmes under review. Furthermore, they appreciate the university's efforts in the further development of its employees and consider the support mechanisms for the continuing professional development of the teaching staff adequate and sufficient. Nevertheless, the experts see room for improvement with regard to the share of research projects as well as the academic staff's international profile.

### **Criterion 3.2 Student Support and Student Services**

#### **Evidence:**

- Self-Assessment Report
- Discussions during the audit

#### **Preliminary assessment and analysis of the experts:**

During the on-site discussions with programme coordinators, teachers, and particularly the students, the experts gained a thorough understanding of the available support services for students. The faculty provides both subject-specific academic counselling and general non-academic guidance. The Vice-Dean for Teaching is responsible for all student-related

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matters, while the Student Affairs Office (SAO) manages various administrative tasks, including admissions, module schedules, exam timetables, student requests, and other academic-related activities.

The faculty's Student Parliament is actively involved in many aspects of the teaching process and initiates actions to enhance teaching quality. It also plays a significant role in organizing the Scholarship Fair. Since 2019, more than 15 companies have offered over 100 scholarships to the faculty's Bachelor's and Master's students, demonstrating the attractiveness of the competence profile for both domestic and international careers in civil engineering.

The Student Parliament also introduced a brochure called "Dovitljivko," which provides essential information on navigating the faculty, student canteens, cultural events, and student organizations. The brochure includes a concise description of all first-year modules, with advice from senior students on how to efficiently prepare for and pass exams. Additionally, each student is paired with a mentor (a senior student) who serves as a point of contact for both academic and non-academic guidance. Annually, 40 to 50 students participate in the "student mentor project," earning an additional 1 ECTS credit for their involvement. At the beginning of each academic year, the faculty hosts a welcome event for first-year students to familiarize them with the faculty building and introduce them to their peers.

For building new connections, almost all faculties, higher schools, and universities from the former South East Europe participate in the "Građevinijada," an event that brings together Civil Engineering and Geodesy students for competitions, lectures, workshops, and social activities.

At the university level, the Centre for Career Development and Student Counselling offers support to students throughout their career paths. The Centre's primary function is to provide information on training and job search strategies to help students develop career plans, understand the workplace, and prepare for a smooth transition after graduation. The Centre aims to increase the number of students and graduates who gain relevant work experience during or shortly after their studies.

The experts observed that there are sufficient resources available to offer personalized support and guidance to all students. This support system enables students to achieve their learning goals and complete their studies successfully and on time. The students confirm that they are well-informed about the available services. Overall, the extensive tutorial and support system for students is one of the key strengths of the degree programs under review and the university as a whole.



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### Criterion 3.3 Funds and equipment

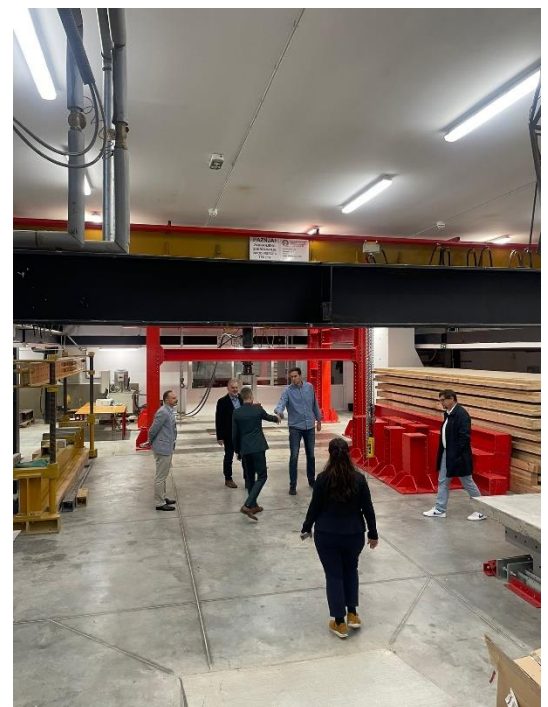
#### Evidence:

- Self-Assessment Report
- Room and laboratory list
- On-site visit of the faculty facilities
- Discussions during the audit

#### Preliminary assessment and analysis of the experts:

According to the self-assessment report, as a state-owned institution, funding for the operations and degree programmes at the Faculty of Civil Engineering comes from two main sources: the Republic of Serbia Government (state budget) and other sources (revenue from student scholarships, fees, and other third-party contributions). Prior to the on-site visit, the faculty provides an overview of its annual income for the past three years, per income sources and per faculty accounts. This data shows that the total income received from both sources in recent years has been adequate to support all planned activities and degree programmes. Each year, the faculty submits financial reports and income statements to the Ministry of Finance, and all reports have been approved so far.

During the on-site visit, the experts were able to gain a comprehensive impression of the faculty facilities and laboratories. The Faculty of Civil Engineering utilizes various facilities including an amphitheater, classrooms, laboratories, faculty offices, a library with a reading room, and spaces for the secretary, legal service, accounting, student affairs, technical service, information technology center, computer laboratories, and the Dean's office. In addition to its main building, the Faculty also shares part of the Department of Physics building with the Faculties of Mechanical and Electrical Engineering. In this shared building, the Faculty has offices, a classroom, and a hydraulic laboratory. The faculty operates 24 laboratories, with 5 of these laboratories accredited by the national accreditation body under the ISO 17025 standard. These accredited laboratories include the Laboratory for Materials, Laboratory for Structures, Soil Mechanics Laboratory, Laboratory for Pavement Structures, and the Metrology Laboratory for the Calibration of Angle



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and Length Meters. A detailed overview of the faculty's facilities is given in a room and laboratory list that is submitted prior to the on-site visit.

Over 70 % of the classrooms are equipped with projectors and connected to the faculty's computer network that links all classrooms and offices, a compute centre, servers, and both computer and teaching laboratories. The computer classrooms at the faculty are equipped with 193 computers, all installed with relevant licensed software (see criterion 1.6 for more details) and Internet access. To what extent it is recommended to offer student licenses for Microsoft Office has been discussed in detail in chapter 1.6.

The faculty also provides space for student individual work and club activities (see criterion 3.2 for more details). Apart from the (computer) laboratories, the faculty library features a reading room with 58 seats for students and a separate reading room for lecturers with 8 seats. Through the academic computer network of Serbia and the unified library acquisition system KOBSON, faculty members and students have continuous access to numerous scientific and professional journals across various fields, including civil engineering. The faculty library holds more than 40,000 items, including over 36,000 books, 390 foreign journal titles, over 80 domestic journal titles, more than 500 master's theses, and over 300 doctoral dissertations. Moreover, the faculty ensures that all modules of the Civil Engineering programmes under review are supported by appropriate textbook literature. This literature list is accessible on each module's webpage, and students are informed about the required readings at the start of each module. Sufficient copies of the literature are available in the faculty Library, on the faculty's website, or for purchase at a bookstore on campus. Most of the literature is provided in Serbian, which is why the experts think it would be useful to use more international literature. The students express their satisfaction with the faculty's classrooms, laboratories and library. Moreover, from the students' point of view, there is sufficient access to current literature.

The experts appreciate the range of learning tools and resources available to the students and lecturers and consider the faculty's facilities and available equipment in the laboratories to be of appropriate standards. In summary, the expert group judges the available funds, the technical equipment, and the infrastructure (laboratories, library, classrooms etc.) to comply with the requirements for adequately sustaining the two degree programmes.

**Final assessment of the experts after the comment of the Higher Education Institution regarding criterion 3:**

Criterion 3.1:

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With regard to the recommendation to increase the ratio of lecturers who are actively involved in research as well as the number of lecturers with international experience, UB explains in its response statement that the faculty invested efforts in strengthening the capacity of teaching staff in the participation in research projects. At the beginning of the 2018/19 academic year, the total value of research projects contracted by the faculty was app. 180k EUR, while at the beginning of the 2021/22, this value raised to 1.1M EUR. In the last 3 years, the faculty signed contracts for total 14 national and 8 international research projects, with the faculty budget of total 2.3M EUR. UB believes that this rising trend in number and value of research projects will continue which would provide more opportunities for teachers, associates and students to be involved in high-quality research activities and projects. The experts welcome the rising value of contracted research projects and the corresponding faculty budget. They support the faculty in pursuing this trend and are therefore adhere to their recommendation.

## 4. Transparency and Documentation

### Criterion 4.1 Module Descriptions

#### **Evidence:**

- Module descriptions

#### **Preliminary assessment and analysis of the experts:**

The experts review the module descriptions for both programmes and find that they provide adequate information about all relevant and required aspects: module identification code, respective content, learning outcomes, examinations, credit points and workload distribution, grading, person responsible for the module, teaching methods, admission requirements and the recommended literature. The students confirm during the discussions that information about the courses is always available online through the module info board section and that details concerning examinations and contents are provided at the beginning of each course by the teaching staff.

To what extent contents of turbulence modelling have to be explicitly included in the curriculum and consequently also in the module descriptions of the HEE specialization of the Master's degree programme of Civil Engineering has been discussed in chapter 1.3 in more detail.

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### **Criterion 4.2 Diploma and Diploma Supplement**

#### **Evidence:**

- Diploma Supplements
- Diplomas
- Rulebook on the Content of Public Documents

#### **Preliminary assessment and analysis of the experts:**

The experts confirm that the students of both degree programmes under review are awarded a Diploma and a Diploma Supplement after graduation. The experts note that the statistical data specified in the ECTS Users' Guide is not included in the Diploma Supplement. The programme coordinators explain that this is due to the fact that the format and content of both the Diploma and the Diploma Supplement are strictly regulated by the "Rulebook on the Content of Public Documents" issued by the Ministry of Education, Science, and Technological Development of the Republic of Serbia, and cannot be altered by the faculty. However, recognizing that future employers often require details about a candidate's performance relative to their class, the SAO can provide this information upon request. Rankings based on the average grades for all study programmes can be generated from the FIS. If requested by a student, this ranking information can be included in "Part 6.1 Additional Information on the Student" of the Diploma Supplement. The experts understand these circumstances and confirm that the Diploma Supplements contain all necessary information about the degree programmes.

### **Criterion 4.3 Relevant Rules**

#### **Evidence:**

- Self-Assessment Report
- All relevant regulations on the studies, examination, admission and quality assurance are published on the university's website

#### **Preliminary assessment and analysis of the experts:**

The experts confirm that the rights and duties of UB, the Faculty of Civil Engineering and the students are clearly defined and binding. All rules and regulations are published on the university's or faculty's website and hence available to all stakeholders. In addition, the students receive all relevant course material at the beginning of each semester.

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The experts appreciate that the English and Serbian websites of the programmes include sufficient information about the intended learning outcomes, study plans, module descriptions and academic guidelines of the degree programmes and are made available to all relevant stakeholders.

**Final assessment of the experts after the comment of the Higher Education Institution regarding criterion 4:**

As UB does not comment further on this criterion, the expert group adheres to its previous assessment of this criterion. They consider the criterion to be fulfilled.

## **5. Quality management: quality assessment and development**

<b>Criterion 5 Quality management: quality assessment and development</b>
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**Evidence:**

- Self-Assessment Report
- University rulebooks
- FCEUB Quality manual
- Faculty rulebook on the work of quality assurance committees
- Discussions during the audit

**Preliminary assessment and analysis of the experts:**

The expert panel acknowledges that the Faculty of Civil Engineering has put in place a quality assurance system for its degree programmes. According to the self-assessment report, the faculty's "Quality Manual" strictly defines the competences and responsibilities for the implementation of the quality assurance processes and instruments. The "Committee for Quality Assurance and Improvement" (CQAI) and the "Committee for Monitoring and Improving the Quality of Teaching" (CMIQT) at the faculty, have been formed to follow up, organize and cooperate with all programmes to implement the different evaluation instruments. These committees also include student representatives. Apart from the mentioned committees, the faculty's departments are jointly responsible for all procedures and implementation of the quality systems in their programmes. While especially CMIQT is supposed to monitor the implementation of the quality assurance strategy, propose measures to remedy identified weaknesses and follow up the measures taken to improve the quality

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performance, the departments conduct yearly programme evaluations through internal and external evaluators. Moreover, the faculty's Student Parliament is actively involved in many aspects of the teaching process and initiates actions to enhance teaching quality.

The self-assessment report and the evidences also demonstrate that the faculty makes significant efforts to include the experience and expertise of different stakeholders from within and outside the faculty and the university (for instance, experts from the industry, and alumni/graduates) in the process of designing and further developing the programmes under review. The curricula of the two programmes have been updated in 2021 for the last time.

On the programme level, the continuous development mainly relies on a multitude of survey instruments such as course evaluations, laboratory evaluations as well as staff member evaluations of students' study performance. These instruments appear generally to be adequate to collect meaningful information about whether the programmes' educational objectives and contents actually fit the academic and professional needs of the students, graduates and employers. They are expected to deliver findings about the students' actual achievement of the educational objectives and learning outcomes. The significance of these quality assurance tools with respect to their capacity in detecting weaknesses or major shortcomings of the programmes are highly dependent on the respective response rate. Students of the Faculty of Civil Engineering are required to participate in the course evaluations in order to be admitted to the respective exam. Given this, the faculty has plausibly argued to make good use of the evaluation results for the improvement of the programmes.

According to the faculty members, all surveys are carried out on a regular basis. Employers, for instance, are asked for their feedback once a year. Course evaluations are conducted at the end of each semester for each module. Through FIS, students can give their feedback anonymously on aspects such as the teaching quality, the course content and their learning progress. Afterwards, the results of the surveys are reviewed during the faculty's department meetings as well as at the TSC meeting for further improvement of the courses and teaching. In the audit, the experts inquire whether the results of the surveys are also shared and discussed with the students. The programme coordinators explain that students receive the survey results. The discussion with the students confirms the closed feedback loop and reveals that those in charge are always eager and open for feedback aside from the official evaluations and that students have the impression that their comments are taken into consideration with regard to the further improvement of the programmes. During the CQAI and CMIQT as well as Student Parliament meetings for instance, student representatives from each level have the opportunity to make comments with regard to aca-

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ademic issues. The importance attributed to programme development also becomes apparent in the already mentioned constant curricular revision process that is performed under participation of students and industry partners. The experts are glad to hear that students are satisfied with the programmes and included in the feedback loop.

The faculty also regularly consults the industry for the assessment and development of the programmes. In extensive surveys, employers are asked among other things about changes in the labour market, expected qualifications of the graduates, and their satisfaction with interns and graduates from UB. On this basis, at the regular management review meeting of the faculty, staff members discuss whether the curricula and the learning objectives of the individual programmes need to be revised. In the audit discussions, the industry partners report to be satisfied with the students from UB, especially in terms of their work ethic. Furthermore, the industry partners confirm that their suggestions are generally adopted by UB and the faculty.

The experts appreciate that UB and specifically the Faculty of Civil Engineering have a close relationship with the industry partners and regularly collect feedback from them. Thus, the experts agree that the quality management circles at the university and the faculty are well established and work under participation of all stakeholder groups, such as students, alumni and representatives from the industry.

**Final assessment of the experts after the comment of the Higher Education Institution regarding criterion 5:**

As UB does not comment further on this criterion, the expert group adheres to its previous assessment of this criterion. They consider the criterion to be fulfilled.

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## **D Additional Documents**

Before preparing their final assessment, the panel ask that the following missing or unclear information be provided together with the comment of the Higher Education Institution on the previous chapters of this report:

D 1. Sample of diary of professional practice



## E Comment of the Higher Education Institution (29.10.2024)

The institution provided a detailed statement as well as the following additional documents:

- Updated module descriptions for Ba and Ma Civil Engineering
- Updated study plan for Ba Civil Engineering
- Sample of internship diary

## F Summary: Expert recommendations (12.11.2024)

Taking into account the additional information and the comments given by UB the experts summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Civil Engineering	Without requirements	30.09.2030	EUR-ACE®	Subject to the approval of the ENAEE Administrative Council
Ma Civil Engineering	Without requirements	30.09.2030	EUR-ACE®	Subject to the approval of the ENAEE Administrative Council

### Recommendations

#### For both degree programmes

- E 1. (ASIIN 1.3) It is recommended to make the acceptance for recognizing externally acquired modules more flexible.
- E 2. (ASIIN 1.3) It is recommended to extend the standard duration of the internship.

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- E 3. (ASIIN 1.6) It is recommended to include more presentations of group work into the lectures.
  - E 4. (ASIIN 1.6, 3.3) It is recommended to offer students access to Microsoft Office licenses.
  - E 5. (ASIIN 1.5, 2) It is recommended to combine small modules in order to reduce the total number of exams per semester.
  - E 6. (ASIIN 3.1) It is recommended to increase the ratio of lecturers who are actively involved in research.
  - E 7. (ASIIN 1.3, 3.1) It is recommended to increase the number of lecturers with international experience.

**For the Master's degree programme**

- E 8. (ASIIN 1.3) It is recommended to include BIM as a compulsory module in all specialisations of the programme.
- E 9. (ASIIN 1.3) It is recommended to include elective modules that deal with data driven modelling in all specialisations of the programme.

## **G Comment of the Technical Committee 03 – Civil Engineering, Geodesy and Architecture (21.11.2024)**

*Assessment and analysis for the award of the ASIIN seal:*

The Technical Committee discusses the procedure and follows the assessment of the experts without any changes.

*Assessment and analysis for the award of the EUR-ACE® Label:*

The Technical Committee deems that the intended learning outcomes of the degree programmes comply with the engineering specific parts of Subject-Specific Criteria of the Technical Committee 03 – Civil Engineering, Geodesy and Architecture.

The Technical Committee 03 – Civil Engineering, Geodesy and Architecture recommends the award of the seals as follows:

<b>Degree Programme</b>	<b>ASIIN Seal</b>	<b>Maximum duration of accreditation</b>	<b>Subject-specific label</b>	<b>Maximum duration of accreditation</b>
Ba Civil Engineering	Without requirements	30.09.2030	EUR-ACE®	Subject to the approval of the ENAEE Administrative Council
Ma Civil Engineering	Without requirements	30.09.2030	EUR-ACE®	Subject to the approval of the ENAEE Administrative Council

### **Recommendations**

#### **For both degree programmes**

- E 1. (ASIIN 1.3) It is recommended to make the acceptance for recognizing externally acquired modules more flexible.
- E 2. (ASIIN 1.3) It is recommended to extend the standard duration of the internship.
- E 3. (ASIIN 1.6) It is recommended to include more presentations of group work into the lectures.

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- E 4. (ASIIN 1.6, 3.3) It is recommended to offer students access to Microsoft Office licenses.
  - E 5. (ASIIN 1.5, 2) It is recommended to combine small modules in order to reduce the total number of exams per semester.
  - E 6. (ASIIN 3.1) It is recommended to increase the ratio of lecturers who are actively involved in research.
  - E 7. (ASIIN 1.3, 3.1) It is recommended to increase the number of lecturers with international experience.

**For the Master's degree programme**

- E 8. (ASIIN 1.3) It is recommended to include BIM as a compulsory module in all specialisations of the programme.
- E 9. (ASIIN 1.3) It is recommended to include elective modules that deal with data driven modelling in all specialisations of the programme.

# H Decision of the Accreditation Commission (06.12.2024)

*Assessment and analysis for the award of the subject-specific ASIIN seal:*

The Accreditation Commission discusses the procedure and only makes one editorial change to recommendation E 3. Apart from that, the Accreditation Commission follows the assessment of the experts and the Technical Committee without any changes.

*Assessment and analysis for the award of the EUR-ACE® Label:*

The Accreditation Commission deems that the intended learning outcomes of the degree programmes comply with the engineering specific parts of Subject-Specific Criteria of the Technical Committee 03 – Civil Engineering, Geodesy and Architecture.

The Accreditation Commission decides to award the following seals:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Civil Engineering	Without requirements	30.09.2030	EUR-ACE®	Subject to the approval of the ENAEE Administrative Council
Ma Civil Engineering	Without requirements	30.09.2030	EUR-ACE®	Subject to the approval of the ENAEE Administrative Council

## Recommendations

### For both degree programmes

- E 1. (ASIIN 1.3) It is recommended to make the acceptance for recognizing externally acquired modules more flexible.
- E 2. (ASIIN 1.3) It is recommended to extend the standard duration of the internship.
- E 3. (ASIIN 1.6) It is recommended to include more presentations of group work into the curricula.
- E 4. (ASIIN 1.6, 3.3) It is recommended to offer students access to Microsoft Office licenses.

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- E 5. (ASIIN 1.5, 2) It is recommended to combine small modules in order to reduce the total number of exams per semester.
  - E 6. (ASIIN 3.1) It is recommended to increase the ratio of lecturers who are actively involved in research.
  - E 7. (ASIIN 1.3, 3.1) It is recommended to increase the number of lecturers with international experience.

**For the Master's degree programme**

- E 8. (ASIIN 1.3) It is recommended to include BIM as a compulsory module in all specialisations of the programme.
- E 9. (ASIIN 1.3) It is recommended to include elective modules that deal with data driven modelling in all specialisations of the programme.

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# I Appendix: Programme Learning Outcomes and Curricula

According to the faculty's website the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor's degree programme Civil Engineering:

The programme provides students with the following **knowledge**:

- KB1 – Students have knowledge of fundamental scientific disciplines (mathematics, physics, chemistry, engineering geology, mechanics, etc.) in the field of civil engineering;
- KB2 – Students know to apply methods of mechanics, statics, strength of materials, structural analyses and soil mechanics for analyses of structures.
- KB3 – Students have knowledge on building materials and to perform load analyses and dimensioning of simple concrete, steel, masonry and timber structures.
- KB4 - Students know statistical analyses of hydrology data, hydrostatic forces, steady and uniform open channel and close conduit flows.
- KB5 - Students know basic aquatic chemistry and fundamental aspects of environmental engineering.
- KB6 - Students know to analyse simple transportation infrastructure structures.
- KB7 - Students know organisation and technologies of construction works, as well as basic concepts of project management of civil engineering projects.

By completion of the programme, students acquire the following **skills**, so they can:

- SB1 - Apply knowledge from mathematics, physics, geology and chemistry to recognize, describe and solve standard civil engineering problems;
- SB2 - Write computer program codes for solving problems in civil engineering and make engineering drawings by using computer, including design, creation and processing of building information models;
- SB3 – Identify soils and define basic physical and mechanical properties of soil, apply geostatic calculations for design and construction of basic geotechnical structures;
- SB4 – Analyse, design and draw plans of formwork and reinforcement of simple elements of reinforced concrete structures;
- SB5 – Analyse the layout of steel halls and floor structures in buildings, perform load analysis and design of secondary elements;
- SB6 – Design the elements of structures made of solid timber, as well as calculate the load capacity of simple connections within timber structures;
- SB7 - Apply the basic principles and rules of design and construction of masonry structures and calculation of the bearing capacity of masonry walls;
- SB8 - Apply deterministic principles in hydrology, water management and hydraulic infrastructure design and operation in urban and natural environments, as well as assess the impacts of those activities;
- SB9 – Apply basic analyses of hydrostatic and hydrodynamic forces, perform design and steady

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state analysis of pressurised systems, apply the basic hydraulic calculations for planning and design of hydraulic structures and water management systems;

SB10 - Apply the basic analyses for planning, design, construction and maintenance of road and railroads infrastructure and airports;

SB11 – Perform design, construction and maintenance of access and uncategorized roads;

SB12 - Design the organization and construction technology of construction works;

SB13 – Apply the knowledge on the cost structure in civil engineering projects, basic concepts of costs of works estimations and basic contract management;

SB14 – Perform basic tasks of geodesy in civil engineering, application of modern methods for collecting, processing and analysing geospatial data in solving engineering tasks.

Upon completing of the degree programme, student acquires the following **competences**:

CB1 – Manage construction, rehabilitation and maintenance works of simple building structures

CB2 – Participate in construction, rehabilitation and maintenance works of all structures;

CB3 – Participate in preparation of studies and designs for all types of structures;

CB4 – Independently participate in discipline-specific and interdisciplinary collaboration development projects.



The following **curriculum** is presented:

#	Module Title	Sem.	Workload (hours per week)				ECTS
			L	T	O	ISW	
<b>FIRST YEAR</b>							
1	Mathematics 1	1	3	4	0	9	8
2	Engineering Mechanics 1	1	2	3	0	7	6
3	Engineering Physics	1	3	1	1	7	6
4	Geodesy	1	2	2	0	4	4
5	Descriptive Geometry with Computer Drawing	1	2	3	0	7	6
<b>Total workload (hours per week) and ECTS</b>			60				30
6	Mathematics 2	2	2	3	0	7	6
7	Engineering Mechanics 2	2	3	2	0	7	6
8	Transportation and Spatial Planning 1	2	3	0	0	5	4
9	Fundamentals of Engineering Geology	2	2	1	0	5	4
10	Building Materials 1	2	2	1	1	4	4
11a	Fundamentals of Matlab Programming (1 of 2)	2	2	3	0	7	6
11b	Fundamentals of Python Programming (1 of 2)	2	2	3	0	7	6
<b>Total workload (hours per week) and ECTS</b>			60				30
<b>SECOND YEAR</b>							
12	Mathematics 3	3	2	3	0	7	6
13	Strength of Materials	3	4	3	0	9	8
14	Fluid Mechanics	3	3	2	0	7	6
15	Building Materials 2	3	2	1	1	4	4
16	Buildings	3	2	2	0	4	4
17a	Legal Regulations in Construction (1 of 2)	3	2	0	0	2	2
17b	Economics in Civil Engineering (1 of 2)	3	2	0	0	2	2
<b>Total workload (hours per week) and ECTS</b>			60				30
18	Structural Analysis 1	4	4	3	0	9	8
19	Soil Mechanics	4	3	2	0	7	6
20	Hydraulic Engineering	4	3	2	0	7	6
21	Road Infrastructure	4	3	2	0	7	6
22a	Building Physics (1 of 2)	4	2	2	0	4	4
22b	Chemistry in Civil Engineering (1 of 2)	4	2	2	0	4	4
<b>Total workload (hours per week) and ECTS</b>			60				30
<b>THIRD YEAR</b>							
23	Theory of Concrete Structures 1	5	4	3	0	9	8
24	Steel Structures 1	5	3	2	0	7	6
25	Fundamentals of Geotechnical Structures	5	2	2	0	4	4
26	Fundamentals of Environmental Engineering	5	2	1	0	5	4
27	Basics of Organization and Construction Technology	5	3	2	0	7	6
28a	Building Information Modeling (1 of 3)	5	2	2	0	4	4
28b	Geoinformation Systems (1 of 3)	5	2	2	0	4	4
28c	Computer-Aided Drawing in Civil Engineering (1 of 3)	5	1	3	0	4	4
<b>Total workload (hours per week) and ECTS</b>			64				32
29	Timber and Masonry Structures	6	3	2	0	7	6
30a	Fundamentals of Construction Project Management (1 of 2)	6	2	2	0	4	4
30b	Cost Planning and Control in Civil Engineering 1 (1 of 2)	6	2	2	0	4	4
31a	Theory of Concrete Structures 2 (1 of 3)	6	2	3	0	7	6
31b	Railway Infrastructure (1 of 3)	6	3	2	0	7	6
31c	Hydrology (1 of 3)	6	3	2	0	7	6
32a	Structural Analysis 2 (1 of 3)	6	3	2	0	7	6
32b	Computer-Aided Road Design (1 of 3)	6	2	3	0	7	6
32c	Hydraulics of Pressurized Systems (1 of 3)	6	3	1	1	7	6
33a	Steel Structures 2 (1 of 3)	6	2	2	0	4	4
33b	Roads and Airports Construction (1 of 3)	6	2	2	0	4	4
33c	Water Quality (1 of 3)	6	2	0	2	4	4
34	Internship	6	0	0	4	0	2
<b>Total workload (hours per week) and ECTS</b>			56				28

L – lectures, T – tutorials, O – other, ISW – individual study work

According to the faculty's website the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master's degree programme Civil Engineering:

MSc in Civil Engineering – area of specialization: Structural Engineering (SE)

The programme provides students with the following **knowledge**:

- KM-S1 – Students master the properties of contemporary building materials and possibilities for their application;
- KM-S2 – Students have deep insight in the behaviour of structures under static and dynamic loadings, including buildings, engineering structures, bridges, dams, tunnels, underground and geotechnical structures;
- KM-S3 – Students know to design and construct all types of reinforced concrete, steel, timber, masonry and composite structures (buildings, halls, special and engineering structures, bridges), as well as knowledge of the basic steps of construction elements prefabrication and assembly and concrete technology
- KM-S4 – Knowledge on the basics of experimental analysis of structures, practical aspects of structural testing, along with the basic principles of data acquisition and structural monitoring;

By completion of the programme, students acquire the following **skills**, so they can:

- SM-S1 – Perform structural modelling, stability control and vibration assessment of complex structures, using linear and non-linear methods, by classic procedures and by using computer programs;
- SM-S2 – Perform structural design and construct the prestressed concrete structures, structures of thin-walled steel cold-formed profiles, aluminium alloys, glued laminated timber and cross-laminated timber;

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- SM-S3 – Perform numerical modelling, design and detailing of steel and timber structure joints;
  - SM-S4 - Create parts of technological projects in the field of construction of concrete structures;
  - SM-S5 – Perform condition assessment and propose the maintenance works, strengthening and rehabilitation of reinforced concrete, timber and masonry structures;
  - SM-S6 – Perform planning, implementation and control of installation and finishing works on high-rise buildings, quality assessment and calculation of finishing works;
  - SM-S7 - Design and construct different types of dams and other hydraulic structures;
  - SM-S8 - Design and construct shallow and deep foundations, classic and special geotechnical structures, propose protection measures of deep excavations and design of underground structures;
  - SM-S9 – Perform analysis and interpretation of the results of geotechnical tests;
  - SM-S10 – Perform energy certification of structures;
  - SM-S11 – Communicate research-based knowledge and discuss professional and academic issues related to structural engineering;
  - SM-S12 – On an academic basis, set up new analysis and solution models for analyses of structures.

Upon completing of the degree programme, student acquires the following **competences**:

- CM-S1 – Manage construction, rehabilitation and maintenance works of complex structures (buildings, halls, towers, high-rises, bridges, underground structures, dams, etc.)
- CM-S2 – Manage preparation of studies and designs for all types of buildings and civil structures;
- CM-S3 – Independently initiate and carry out discipline-specific and interdisciplinary collaboration and assume professional responsibility.
- CM-S4 – Manage work situations and developments that are complex, unpredictable and require new solution models in civil engineering.

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MSc in Civil Engineering – area of specialization: Hydraulic and Environmental Engineering (HEE)

The programme provides students with the following **knowledge**:

- KM-H1 – Students master deterministic and stochastic hydrological methods and models;
- KM-H2 – Students master hydraulic mathematical modelling of all types of steady and unsteady water flows in pressurised (closed conduit), open-channel systems and in underground;
- KM-H3 – Students master contemporary numerical methods for the analysis of transport processes in surface and ground waters;
- KM-H4 – Students master experimental analysis and measurement techniques of various types of water flows, basic water quality properties and practical aspects of flow measurements;
- KM-H5 – Students have deep knowledge of integrated water resources management principles and applications, as the coordinated development and management of water, land and related resources to maximize economic and social welfare in an equitable manner, without compromising the sustainability of vital ecosystems.

By completion of the programme, students acquire the following **skills**, so they can:

- SM-H1 – Prepare complex hydrological studies and models for planning and designing of various structures and for water resources management plans and systems;
  - SM-H2 – Analyse, plan, design, construct, operate and maintain water supply and sewerage systems, drinking water sources management and protection, drinking water and wastewater treatment plants of all types and capacities;
  - SM-H3 – Analyse, plan, design, construct, operate and maintain hydrotechnical structures and facilities of all types and capacities: hydropower systems, spillways, weirs, channels, culverts, surface and ground water intake structures, hydrotechnical systems in solid waste management;
  - SM-H4 – Analyse, plan, design, construct, operate and maintain irrigation and drainage infrastructure and systems of all types and capacities;
  - SM-H5 – Analyse, plan, design, construct and maintain river training works, inland waterways and ports and flood defence structures and systems at all types of watercourses;
  - SM-H6 – Apply acquired knowledge in the design and construction of hydrotechnical structures in geotechnical engineering (dikes, embankments, earth fill dams, etc.).
  - SM-H7 – Create new, or use existing, computer models (management, simulation, optimization and prognostic) and hydro-information systems for the analysis and management of hydrotechnical structures and water management systems of various types;
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- SM-H8 – Apply methods for assessing the impact of hydrotechnical structures and systems on the environment and determining environmental protection measures in the process of planning, design, construction and operation of various structures and water management systems;
- SM-H9 – Communicate research-based knowledge and discuss professional and academic issues related to hydraulic engineering.
- SM-H10 – On an academic basis, set up new analysis and solution models for hydraulic engineering.

Upon completing of the degree programme, student acquires the following **competences**:

- CM-H1 – Manage construction, rehabilitation and maintenance works and operation of complex hydraulic structures and systems (water supply, sewerage, water treatment plants, irrigation and drainage infrastructure, river training works, channels, inland waterways and ports, flood defences, hydropower, water resources management systems, etc.)
- CM-H2 – Manage preparation of hydrology and hydraulic studies and designs for all types of hydraulic structures and water infrastructure;
- CM-H3 - Independently initiate and carry out discipline-specific and interdisciplinary collaboration and assume professional responsibility.
- CM-H4 - Manage work situations and developments that are complex, unpredictable and require new solution models in hydraulic and environmental engineering.

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MSc in Civil Engineering – area of specialization: Roads, Railways and Airports (RRA)

The programme provides students with the following **knowledge**:

KM-R1 – Students know how to apply methods for analysing the impact of traffic infrastructure on the environment, in construction and operation (maintenance) phases;

KM-R2 – Students know how to analyse and interpret the results of geotechnical investigation works in rock.

KM-R3 – Students master methods of calculation of the stability of the road structure and the surrounding terrain, methods of planning, design and construction of traffic infrastructure, including traffic tunnels.

By completion of the programme, students acquire the following **skills**, so they can:

SM-R1 – Perform calculation of the stability of the road structure and the surrounding terrain and apply the adequate measures for slope stabilization and soil improvement;

SM-R2 - Plan, design, construct, manage and maintain traffic infrastructure: urban and non-urban roads, local and uncategorized roads, all types of railway infrastructure, urban rail systems, traffic areas at airports, passenger piers, ports and industrial plants;

SM-R3 - Rehabilitate and reconstruct traffic infrastructure structures;

SM-R4 - Implement traffic infrastructure maintenance management systems;

SM-R5 - Design and construct traffic tunnels;

SM-R6 - Construct, inspect and maintain bridge structures and design, construct, inspect and maintain culverts.

SM-R7 – Communicate research-based knowledge and discuss professional and academic issues related to transport infrastructure engineering.

SM-R8 – On an academic basis, set up new analysis and solution models for transport infrastructure structures.

Upon completing of the degree programme, student acquires the following **competences**:

CM-R1 – Manage construction, rehabilitation and maintenance works of transport infrastructure structures and systems (all types of roads, highways, railroads, airports, earth works for transport corridors, culverts, etc.)

CM-R2 – Manage preparation of studies and designs for all types of transport infrastructure (roads, railways, airports);

CM-R3 - Independently initiate and carry out discipline-specific and interdisciplinary collaboration and assume professional responsibility.

CM-R4 - Manage work situations and developments that are complex, unpredictable and require new solution models in transport infrastructure structures.

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MSc in Civil Engineering – area of specialization: Organisation, Technology and Informatics in Civil Engineering (OTI)

The programme provides students with the following **knowledge**:

KM-O1 – Students master project management methodologies in civil engineering;

KM-O2 – Students master construction management methodologies in civil engineering;

KM-O3 – Students master value engineering, lean construction, quality management systems and human resources management methods in civil engineering projects;

KM-O4 – Students have deep knowledge of analyses and design of concrete and steel structures;

KM-O5 – Students master of informatics in civil engineering, including databases creation and management, building information modelling (BIM), operational research and data management in civil engineering;

By completion of the programme, students acquire the following **skills**, so they can:

SM-O1 – Manage preparation of designs of organization and construction technology for all types of structures in urban and rural environments, with optimization of technological procedures and construction machinery;

SM-O2 – Manage preparation of dynamic plans for construction sites, control of dynamics of works and analysis of work delays for all types of construction works;

SM-O3 – Perform cost planning and control, measurement and calculation of works, preparation of payment documentation, assessment of project feasibility, assessment of market values

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- of real estates;
- SM-O4 – Manage preparation of quality management systems, value engineering studies, risk and human resources management;
  - SM-O5 – Manage construction companies and works on construction sites of complex projects (high-rise buildings, craft and finishing works, road and railway infrastructure, airports, urban water infrastructure, geotechnical structures, dams and other water and engineering structures);
  - SM-O6 – Manage projects using BIM, creation of databases for construction purposes, information management in construction projects;
  - SM-O7 – Participate in contract management of civil engineering projects;
  - SM-O8 – Participate in energy certification of building structures and maintenance management;
  - SM-O9 – Participate in analyses and design of reinforced concrete and steel structures;
  - SM-O10 – Communicate research-based knowledge and discuss professional and academic issues related to construction and project management in civil engineering;
  - SM-O11 – On an academic basis, set up new analysis and solution models for construction and project management in civil engineering.

Upon completing of the degree programme, student acquires the following **competences**:

- CM-C1 – Project and construction management of construction, rehabilitation and maintenance works of complex structures (buildings, halls, towers, high-rises, bridges, underground structures, dams, etc.)
- CM-C2 – Manage preparation of studies and designs of reinforced concrete and steel structures of standard buildings (up to GF+4 floors, area up to 2000 m<sup>2</sup>) and halls and their production, construction and/or assembly;
- CM-O3 - Independently initiate and carry out discipline-specific and interdisciplinary collaboration and assume professional responsibility.
- CM-O4 - Manage work situations and developments that are complex, unpredictable and require new solution models in project and construction management in civil engineering.



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MSc in Civil Engineering – area of specialization: Geotechnical Engineering (GE)

The programme provides students with the following **knowledge**:

- KM-G1 – Students master the properties of contemporary building materials and possibilities for their application;
- KM-G2 – Students have deep insight in the behaviour of structures under static and dynamic loadings, including buildings, halls, bridges, dams, tunnels, underground structures, retaining walls, embanked and other geotechnical structures;
- KM-G3 – Students know to design and construct all types of geotechnical structures (tunnels, underground structures, retaining walls, embanked structures, landfills, shallow and deep foundations), including basic steps of construction elements prefabrication and assembly;
- KM-G4 – Knowledge on the basics of soil or rock field and laboratory testing, preparation of geotechnical studies, interpretation of results of laboratory and field tests.
- KM-G5 – Students know the basics of the interaction between the structure and the soil during earthquake and application of different soil improvement methods.

By completion of the programme, students acquire the following **skills**, so they can:

- SM-G1 – Perform computational modelling of common building structures under static and dynamic loadings by using classic procedures and computer programs;
- SM-G2 - Design typical reinforced concrete and steel building structures and halls;
- SM-G3 – Construct, inspect and maintain bridge structures and design, construct, inspect and maintain culverts and bridges with a span of up to 12 m;
- SM-G4 - Design and construct: tunnels, underground structures, all types of retaining walls and similar structures, embanked structures and landfills, all types of shallow and deep foundations of simple and complex structures, system for draining excavations and underground structures, different types of dams and other hydrotechnical structures;
- SM-G5 – Propose landslide rehabilitation measures and measures for protection of deep excavations;
- SM-G6 - Develop a program of soil or rock field and laboratory testing and supervise standard geotechnical field tests, prepare geotechnical studies, interpret the results of laboratory

and field tests;

SM-G7 – Create parts of technological projects in the field of construction of concrete structures;

SM-G8 - Prepare and participate in tender procedures and use BIM models for various analyses.

SM-G9 – Communicate research-based knowledge and discuss professional and academic issues related to geotechnical engineering and underground structures.

SM-G10 – On an academic basis, set up new analysis and solution models for geotechnical engineering and underground structures.

Upon completing of the degree programme, student acquires the following **competences**:

CM-G1 – Manage construction, rehabilitation and maintenance works of complex geotechnical and underground structures (foundations, deep excavations, tunnels, retaining walls, piles, soil improvement, etc.)

CM-G2 – Manage preparation of geotechnical investigations and studies, as well as designs for complex geotechnical and underground structures;

CM-G3 - Independently initiate and carry out discipline-specific and interdisciplinary collaboration and assume professional responsibility.

CM-G4 - Manage work situations and developments that are complex, unpredictable and require new solution models in geotechnical engineering and underground structures.

The following **curriculum** is presented:

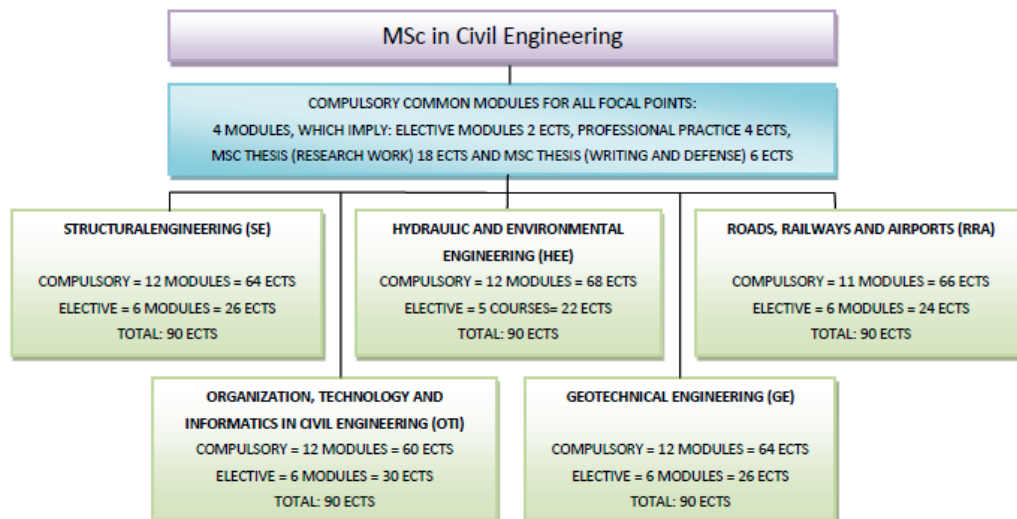


Figure 1. Scheme of the MSc in Civil Engineering Degree Program with its areas of specialization