ASBau

Akkreditierungsverbund für
Studiengänge des Bauwesens

Reference Framework

for Civil Engineering Courses (Bachelor)

The ASBau Reference Framework for Civil Engineering Courses (Bachelor)

Why us? Why now?

The European Higher Education Reform („Bologna Process“) introduced a new study structure and a new quality assurance system in Germany in 2002. The Magister and Diploma degrees that had been common until then were converted to the two-stage system of Bachelor‘s and Master‘s degrees in almost all degree programmes.

A decisive aspect was to create a uniform and transparent system of study within Europe and to facilitate the mobility of European students and employees. For this reason, it was also decided that the Bachelor Programme should be the first certification that qualifies students for a profession.

In addition to the new study structure, a new quality assurance system has also been introduced. This provides for study programmes to be accompanied and assessed in the sense of quality assurance. As a rule, this takes place either within the framework of system accreditation by the higher education institution itself, or within the framework of programme accreditation by private accreditation agencies. In the latter case, the study documents and conditions are subjected to a review to the extent that they can ultimately be accredited by the Accreditation Council.

The introduction of the new study structure led to a high degree of uncertainty in the field of civil engineering, as it was feared that the transition from internationally recognised engineering diploma courses to Bachelor‘s and Master‘s degree programmes could jeopardise the quality of the content and thus the high level of recognition. For this reason, since 2002, the key players, the representatives of the construction industry, the universities and colleges, the chambers of engineers, the consultant engineers, the public authorities as well as the students have organised themselves in the Accreditation Association for Study Programmes in Civil Engineering (ASBau). The aim of this association is to promote the quality of study programmes in civil engineering within the framework of the graduated study structure. To this end, coordinated study standards for study courses in civil engineering were developed and published among all stakeholders for the first time in 2003. These were updated in 2010 and are now being reviewed again and on the basis of previous implementation experience developed into a reference framework.

The members voices

„The construction industry and thus also the whole field of civil engineering is being revolutionised by the advances in digitalisation and a complete rethink regarding process management. A training system that is based on the ASBau reference framework sets the right course for a successful professional career."

Dipl.-Ing. Klaus Pöllath, Vice President of the Hauptverband der Deutschen Bauindustrie e.V.,
Chairman of ASBau e.V.

„The ASBau Reference Framework stands for a broad-based course of study that strengthens the professional and social skills of the future civil engineers. With this contribution from all the central actors within the civil engineering sector, the necessary basis for a future-orientated and high-quality civil engineering education has been laid."

Dipl.-Ing. Hans-Ullrich Kammeyer, President of the Bundesingenieurkammer e.V.,
Deputy Chairman of ASBau e.V

„The learning outcome-oriented ASBau Reference Framework describes the current professional understanding in civil engineering. With its accreditation practice, it is a transparent basis for ensuring professionalism for Bachelor's degree programmes in civil engineering."

Prof. Dr.-Ing. Birger Gigla, Chairman of the Fachbereichstag
Bauingenieurwesen und Umweltingenieurwesen

„A university education in civil engineering is subject to constant change. The various faculties and their respective professors with a high sense of responsibility, regularly scrutinise and update the course contents in order to prepare the next generation of academic engineers for the changing professional requirements, as well as to take into account the changing learning habits of the students. The members of the Faculty Association for Civil Engineering, Geodesy and Environmental Engineering are proud of the fact that a fully updated reference framework for academic civil engineering education as agreed with all stakeholders has now been adopted."

Prof. Dr.-Ing. Hans-Joachim Bargstädt, Chairman of the Fakultätentag für
Bauingenieurwesen, Geodäsie und Umweltingenieurwesen (FTBGU) e.V.

„The engineering offices count on the fact that each of the Bachelor programmes impart a broad, well-founded general knowledge of civil engineering. The reference framework sets the standards which helps companies to compare the degrees offered by the various universities."

Dipl.-Ing. Jörg Thiele, President of the Verband Beratender Ingenieure VBI e.V.

„The frame of reference of the ASBau is the basis for a professionally balanced and demand-oriented Bachelor's civil engineering programme. Graduates can be sure of excellent career prospects in the construction industry."

Dipl.-Ing. Reinhard Quast, President of the Zentralverband des Deutschen Baugewerbes e.V

„As students, we see a broad-based bachelor's education as the basis for our future in an interdisciplinary environment. Whether in the implementation of research projects, the planning or realisation of projects in the (building) industry or in the continuation of studies within the framework of a Master's degree programme, the contents summarised in the frame of reference provide an important tool to this end."

Yves Reiser (Hochschule Darmstadt), Louis Schröder (Technische Universität Braunschweig),
Benjamin Sauer (Technische Universität Berlin), Vertreter der Bauingenieur Fachschaften Konferenz

Members of the ASBau

- **Bundesingenieurkammer e.V.**
- **Bauingenieur-Fachschaften-Konferenz**
- **Fachbereichstag Bauingenieurwesen und Umweltingenieurwesen**
- **Fakultätentag Bauingenieurwesen, Geodäsie und Umweltingenieurwesen e.V.**
- **Hauptverband der Deutschen Bauindustrie e.V.**
- **Oberprüfungsamt für den höheren technischen Verwaltungsdienst**
- **Verband Beratender Ingenieure e.V.**
- **Zentralverband des Deutschen Baugewerbes e.V.**

- **Bauindustrieverband Hessen-Thüringen e.V.**
- **Bauindustrieverband Niedersachsen-Bremen e.V.**
- **Bauindustrieverband Nordrhein-Westfalen e.V.**
- **Baukammer Berlin KöR**
- **Bauverband Mecklenburg-Vorpommern e.V.**
- **Bauwirtschaft Baden-Württemberg e.V.**
- **Bayerische Ingenieurekammer-Bau**
- **Bayerischer Bauindustrieverband e.V.**
- **Bundesvereinigung der Straßenbau- und Verkehrsingenieure (BSVI) e.V.**
- **Bundesvereinigung Mittelständischer Bauunternehmen e.V.**
- **BVMB Deutscher Beton- und Bautechnik-Verein e.V.**
- **Hamburgische Ingenieurkammer-Bau**
- **Ingenieurkammer-Bau Nordrhein-Westfalen**
- **Ingenieurkammer Niedersachsen e.V.**

What we want to achieve and why

The aim of the ASBau Reference Framework is, in particular, to support the accreditation agencies and peers who are responsible for the assessment and thus the quality assurance of the study programmes in their evaluation within the building sector. It should also serve prior to accreditation as a guideline for universities in the development of their civil engineering study programmes.

As with the previous ASBau study standards 2010[1] - the formal framework for the development of the frame of reference is provided by the countries' common structural specifications in accordance with the resolution at the conference of the Ministers of Education and Cultural Affairs on 10th October 2003 (as amended on 4th February 2010)[2], which in turn are based on the recommendations for standards and guidelines for quality assurance in European Higher Education Institutions[3]. The new State Treaty through the Organisation of a Joint Accreditation System for Quality Assurance in Studies and Teaching at German Higher Education Institutions (State Treaty on Accreditation in Higher Education)[4] as well as the relevant Model Law Regulations[5] also refer to these basic rules.

Article 2 paragraph 3 of the contract adopted at the end of 2017 stipulates that quality assurance and quality development must be guaranteed by compliance with formal and technical criteria. Within the technical-content criteria, reference is made, among others, to technical-content standards that are state of the art in the areas of science and research and the qualification required for qualified employment is specified. The ASBau in particular with its reference framework refers to this.

The group targeted for the reference framework are thus universities that offer and further develop civil engineering degree programmes, but above all the specialist peers in the accreditation procedures.

1 www.asbau.org

2 https://www.kmk.org/fileadmin/Dateien/veroeffentlichungen_beschluesse/2003/2003_10_10-Laendergemeinsame-Strukturvorgaben.pdf

3 https://www.hrk.de/uploads/media/ESG_German_and_English_2015.pdf

4 https://www.kmk.org/fileadmin/Dateien/pdf/PresseUndAktuelles/2018/SO_170601_StaatsvertragAkkreditierung.pdf

5 http://www.akkreditierungsrat.de/fileadmin/Seiteninhalte/KMK/Vorgaben/Musterrechtsverordnung.pdf

The ASBau is based on the following 5 principles

1. **The graduate's professional qualification must be ensured in all civil engineering Bachelor's degree programmes.**

2. **The content and competence goals of the studies are decisive for the selection of the study programme and for the orientation of the students These must be detailed by the higher education institutions. Certification and study duration are of little meaning without knowledge of the course contents and competence goals.**

3. **The freedom to research and teaching at the universities must be preserved. It must be possible to create a study profile with an appropriate emphasis on higher education.**

4. **The specialist peers should be provided with criteria for Bachelor programme accreditation procedures that are easy to handle and to review.**

5. **The recommendations should not be applied in a rigid formal manner but should provide a framework for guidance. Deviations should be made transparent and need to be justified.**

We will work to ensure that the reference framework we have developed will be used for designing the study courses at all colleges and universities in Germany that offer civil engineering study programmes and as the basis for the accreditation procedures.

Assumptions on which the reference framework is based

Study Organisation

In order to teach the essentially required civil engineering skills to the students, at least 6 theoretical semesters (lecture semesters) are required for the Bachelor's programme.

Every Bachelor's programme graduate must also have some initial practical professional experience. For didactic reasons, this experience should be gained during the study period. The practical phase should be managed by the university and should not normally be shorter than 12 weeks. In exceptional cases, a previous practical phase may be considered

Study contents

The members of the ASBau have agreed on fields of competence within the reference framework, which include the absolute minimum basic knowledge as well as important subject-related knowledge and the associated skills and competences required. The description is based on existing qualification frameworks (European Qualifications Framework[6], German Qualifications Framework[7]) and adopts the categories „knowledge" (theoretical and factual knowledge), „skills" (application of knowledge/information) and „competences" (ability to solve problems independently).

All fields of competence should be adopted within the framework of the course of study and the contents listed should be presented as broadly as possible. It is up to the respective higher education institutions to assign and group them to study modules. Deviations from the specified content should be made transparent and should always be justified by the detailed requirements of the specific degree programme (e.g. greater emphasis on other fields of competence). In principle, ASBau is of the opinion that all the above-mentioned course contents are important for later employment in civil engineering and should already be taught within the Bachelor's programme. This is to ensure that a prospective civil engineer has an overview of the entire civil engineering spectrum and can on this basis decide regarding future specialisation.

So-called soft skills must also be the subject of higher education, but their content cannot be specifically assigned to any field of competence. For better understanding, the ASBau has, therefore, defined a catalogue of competences that should be taught throughout the course of study and integrated into the teaching of the subject content. Interdisciplinary projects, which are at the same time an important element regarding future activities in civil engineering, are particularly suitable for teaching. The earlier the

experience is gained, the more successful the transition to professional life will be.

6 https://ec.europa.eu/ploteus/sites/eac-eqf/files/leaflet_de.pdf

7 https://www.dqr.de

Catalogue of cross-sectional competences

- **Analytical thinking and abstraction skills**
- **Ability to take responsibility**
- **Interdisciplinary work**
- **Oral and written skills of expression**
- **Moderation and presentation techniques**
- **Ability to work in a team**
- **Cost and risk assessment**
- **Problem-solving competence**
- **Research and working techniques**
- **Ability to reflect**
- **Self-learning competence**
- **Social competence**

For the acquisition of cross-sectional competences, participation in for example student competitions, excursions, internships, experiments/simulations, living abroad and practical lectures, are also regarded as being conducive to achieving the objectives.

Options

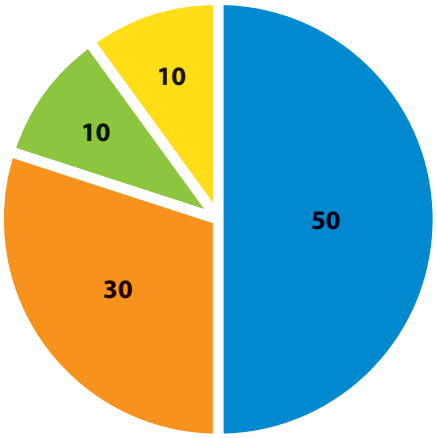
The universities should be given the opportunity to provide specific orientation for a degree programme and to take for this purpose profile-forming subjects into account. In addition to this, students can be offered options for certain parts of the programme. Nevertheless, a minimum standard of common fundamentals should be taught. This is the only way to ensure that graduates will achieve the required civil engineer profile (see page 11).

Gewichtung der Kompetenzfelder/der Studieninhalte

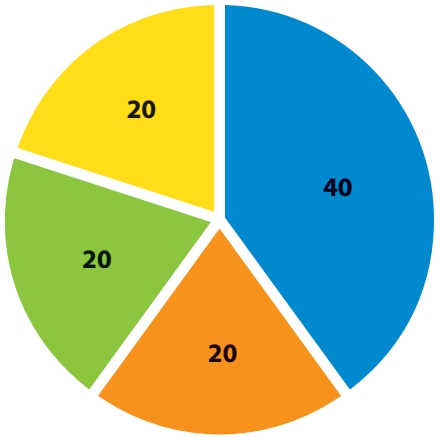
Since the introduction of the Bachelor's and Master's degree programmes, modularisation of the study programme has also been implemented. Thematically related lectures are combined into modules, for the completion of which credit points (CP) are awarded. The credit point system reflects the workload of an average student. Lecture hours, exercises, term papers, examinations as well as the respective preparation and follow-up work are all included. In total, an average of **900 working hours per semester** is estimated for a full-time study programme. For this a total of 30 credit points is awarded, i.e. **1 credit point corresponds to 30 hours of student work**.

A total of **180 credit points** is awarded for a **6-semester Bachelor's programme**. **In addition**, the ASBau recommends an internship of at least 12 weeks. The „compulsory programme" listed in the reference framework should correspond to at least 135 credit points. The additional credit points required are awarded within the framework of the Bachelor's thesis and with the acquisition of further, possibly interdisciplinary, competences. In order to give the universities scope in the design of their degree programmes, the members of the ASBau have agreed not to make any concrete stipulations with regard to the weighting of the individual fields of competence. Rather, a comprehensive recommendation has been made that 40% of the entire study programme should cover the competence aspect **Fundamentals of Engineering** and 20% each the competence aspect **Project Design, Structural Design** and **Management**. Large parts of the course will cover all four areas.

Example of conventional study competencies



Competencies in accordance with the ASBau reference framework



Fundamentals | Project Design | Structural Design | Management

For example, modules such as „structural engineering" contain elements from Project Design, Structural Design and Management. – Therefore, if necessary they cover all areas of competence in different proportions accordingly. This should at the same time make clear the complexity of construction tasks and the current reality of engineering activities in the construction industry.

When designing degree programmes, this should, as far as possible, be taken into account and made transparent. For this purpose, a study programme matrix was developed (Annex 2), on the basis of which each educational institution can carry out the actual weighting of the course content and also make clear to what extent it deviates from the ASBau reference framework (in terms of content and overall weighting, see example in Annex 3). This creates transparency for all interested parties regarding the range of courses offered and the competences acquired.

Study courses whose contents correspond to the ASBau reference framework have a „STEM" share of at least 75%. From the point of view of ASBau, graduates therefore always meet the requirements placed on an engineer.

University facilities

The quality of a study programme is also determined by the faculty's facilities and all participating professorships, institutions and areas of expertise. The universities must be enabled to offer the broad foundation needed in civil engineering. From the point of view of ASBau, the following catalogue of questions is decisive for the assessment:

Number of areas of expertise	Is every necessary areas of expertise represented by professorships or institutions?
Funding	Is adequate financing ensured with regard to personnel, material and investment resources?
Organization of the course	Is there a person responsible for the degree programme?
Coordination of courses	Who coordinates the courses?
Fine Tuning of the subjects	Will there the content be agreed upon??
Lecture halls and seminar rooms offered	Are there sufficient rooms available? What is the quality of the equipment?
Laboratory and equipment available	Are sufficient laboratories available and is their use ensured? (e.g. building materials laboratory, geotechnical laboratory, laboratories for building physics, fire protection and structural damage)
IT Equipment	Is there access to hardware and relevant software applications available?
Learning infrastructure	Are libraries, group rooms, communication zones and digital learning rooms available?
Academic regulations	Are all examination, study, internship and other regulations up-to-date and published? Are the module descriptions available?
Collaboration	Are there co-operations with industry/administration etc.?

Why will the implementation of the Framework be worthwhile?

Ensuring professional qualification

The main concern of ASBau and its members is to **ensure the professional qualification of its civil engineering Bachelor's degree course graduates**. The later and often wide-ranging professional activities (including academic activities at universities) must determine the basic orientation of the degree programme. Newly developed job profiles as well as the supply and demand for occupational jobs must be taken into account.

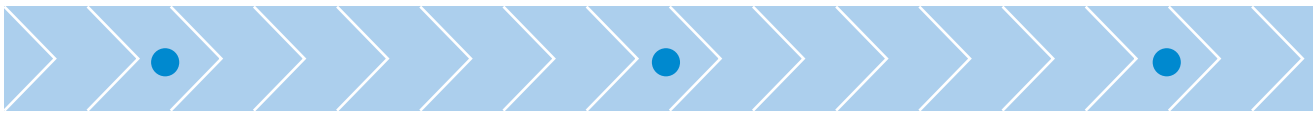
In principle, however, a broad basis for engineering education should first be created, especially in the Bachelor's programme, before targeted specialisation or orientation towards emerging innovations can take place. If necessary, this should be taken up within the framework of the Master's programme. If possible, the profile of an all-rounder should be at the forefront of the Bachelor's programme. It is , however, still possible within the options available, to develop in a certain direction at an early stage, by setting priorities and pursuing one's own specialist interests.

In addition to the consideration of the reference framework, the continuous involvement of professional representatives in the design of the study programmes is decisive for its practical orientation. This requires a broad-based understanding of the relevant profession. It is particularly expedient if degree programmes are developed on the basis of a scientific-theoretical basis that correspond with the desired professional activity. It should therefore also be ensured that students gain sufficient insight into the relevant occupational works during their studies. This should be evident from the curriculum.

From the point of view of the members of the ASBau, graduates of a first professional qualification in civil engineering should fulfil the following profile:

The professional profile of a civil engineer

The work of civil engineers aims to achieve a future-oriented and sustainable design and the transformation of the built environment. It covers the following life cycle phases of buildings or structural facilities of any kind:



Planning, Design

Construction, Execution

Operation, maintenance, Dismantling

Civil engineers must be able to assess the **implications, consequences and economic viability of decisions**. With appropriate professional experience, these skills will be significantly further developed and follow the professional requirements. The Bachelor's programme must be set to achieve this goal and the mandatory basic competences taught as well as a corresponding awareness

developed. Graduates of the Bachelor's programmes in Civil Engineering should be able to recognise technical problems in various specialist fields as well as contribute to solving them - regardless of the field of application.

They must be able to carry out engineering activities largely independent and partly under their own responsibility. However, as a rule, at the beginning of their professional career, they must be accompanied by a suitably qualified, experienced and responsible personnel.

Outlook

A civil engineer's profession is characterised by a broad and varied range of activities. It goes hand in hand with a significant long-term social responsibility. We are already aware of the numerous challenges that civil engineers will have to face in the future, such as climate change, resource limitations, increasing mobility, urbanization and, finally, digitization. Other new fields of activity as yet unknown or that cannot be precisely specified are certain to be added to the list. Civil engineers must be able to tackle these challenges on the basis of their sound training and to develop professional solutions accordingly.

We are firmly convinced that civil engineers who have acquired their skills in accordance with the recommendations of the ASBau reference framework will be very well equipped and thus optimally prepared for the future. Nevertheless, we will regularly review our recommendations and make any necessary adjustments. However, in our understanding, the reference framework already offers a significant scope for considering new developments which should be implemented accordingly.

Frame of reference (Annex 1)

The following frame of reference represents the areas of competence which the members of the ASBau consider to be essential and which should be covered within the framework of a Bachelor's programme in Civil Engineering. These areas of competence are as follows:

- **Fundamentals of engineering (mathematics, technical mechanics of elastic bodies, computational engineering, digital construction, building construction, building physics, building material science, geodesy)**
- **Further basics (economics, law, ecology, history of building technology)**
- **Structural engineering (structural analysis and structural design, solid construction/ masonry construction, steel construction, timber construction, geotechnics)**
- **Water sector (water management, hydraulic engineering, residential water management)**
- **Resource management (waste management and contamination)**
- **Transportation, spatial planning (traffic management, public transport systems, road sector)**
- **Management (project management, process management, business management, planning and design management)**

Knowledge, skills and expertise are listed here in order to define the areas of competence in concrete terms. These are intended to serve only as a guideline as to which subjects should be included in the courses. There is no claim to completeness, nor is a full implementation expected in every case. The respective selection and priority settings is left to the specific design of the degree programme.

FUNDAMENTALS OF ENGINEERING			
	Knowledge	**Proficiency**	**Skills**
Mathematics	• Vector algebra, matrices, systems of linear equations • Analytical geometry • Elementary functions and their properties Differential and Integral Calculus • Differential equations - Descriptive geometry - Variational calculus	• Apply techniques, methods and procedures for task categories • Solve mathematical problems	• Think and argue logically • Understand and apply symbolic notations • Reproduce mathematical modelling • Independently select techniques, methods and procedures and apply them efficiently to solve the problem • Verify the results
Technical Mechanics of Elastic Bodies	Tactical basic information: • Forces, moments and their composition or breakdown • Equilibrium of structures (mathematical and graphical) • Static modelling • Method of sections • Support reactions and internal forces of statically determined systems, differential equation of internal forces and deformations Fundamentals of strength theory: • Practical cross-sections, centre of gravity, area moments • Stresses, distortions, material laws • Rates of work	• Distinguish statically determined systems (including joint systems) from kinematic and statically indeterminate systems • Calculate support reactions and internal forces of statically determined systems • Display shear lines for internal forces • for flat, statically determined systems, calculate the stresses for bending, normal force and shear forcen	• Take responsibility to determine the states of stress and independently assess the state of equilibrium of simple statically certain systems (including joint constructions) • Design and evaluate simple supporting structures

Computational Engineering	• How a higher-level programming language works • Techniques used for data exchange via the network • Construction-specific application software for various fields of civil engineering • Computer algebra systems and their applications • Algorithms and data structures • Object-oriented programming • Data security	• Select and implement construction- specific application software for standard tasks • Clearly describe boundary conditions • Recognise calculation and measurement tasks and implement them using digital programming • Implement algorithms in a higher programming language • Solve engineering tasks with the support of a spreadsheet calculation • Use computer algebra systems to solve problems	• Independently prepare construction engineering tasks for the application of computer programs using appropriate software • Use and operate software interfaces • Verify the results of computer-aided calculations and present them in an understandable way
Digital Construction	Basic information: • Information, knowledge and data management • Digital Technology • Tracking systems for machines and tools - CAD programs • Software • Robotics in civil engineering • Principles and Application of Building Information Modeling (BIM) • Artificial Intelligence / Big Data	• Select and implement hardware and software • Process data electronically	• Independently apply current digital technologies • Evaluate and implement digital technologies in planning and execution processes

	Knowledge	Proficiency	Skills
Building Construction	• Technical representation • Introduction to the technical regulations • Structural and finishing works • Principles of constructional fire protection • Constructive fire protection: protection goals, progress of fire, fire behaviour of building materials and components	• develop simple building structures and represent them graphically • Implement technical representation conventions • develop spatial sense	• Independently evaluate simple structural details and a simple overall construction
Building Physics	• Physical principles • Structural thermal insulation objectives: environmental and climate impacts, comfort and hygiene • Fundamentals of thermodynamics, interior climate, damp protection and building and room acoustics	• Apply structural-physical methods • Understand structural-physical relationships • Perform energetic balancing • Establish noise level calculations • Assign building material properties • Calculate component properties • Apply methods of structural-physical evaluation and construction assessment	• Devise structural-physical requirements for the constructions works • Provide evidence in the areas of energy-saving and hygienic thermal insulation, airtightness and room climate • Assess elementary room acoustics, building acoustics and protection against external noise

Building Material Science	• Fundamentals of construction chemistry • Raw materials and manufacturing processes of the most important mineral, metallic and organic building materials • Essential mechanical, physical and chemical properties of building materials and building material composites • Building material properties with regard to structure, strength, deformation, humidity and temperature behaviour • Relevant requirements and testing standards	• Assess the basic suitability of building materials for specific construction tasks • Apply relevant requirements and testing standards • Identify processes that lead to damage of building materials as well as the resulting structural damage.	• Answer questions specific to building materials within the context of the design and construction of buildings as well as their durability • Take any measures necessary regarding the building materials during the construction works
Geodesy	• Principles of surveying: units of measurement, reference and coordinate systems • Various methods and instruments for location, height and 3D measurement • Quality measures for surveying works • Importance of construction tolerances in surveying works • Princiles of Geoinformation Systems	• Separate location and height measurement as well as 3D surveying • Interpreting and producing maps and drawings • Use geoinformation systems for spatial data modelling and analysis and for the generation of digital drawings and landscape models. • Carry out area determination / area calculation, volume calculation and quantity determination • Use existing survey documents and other geo-basic and geo-technical information in a professional manner	• Consider the role of geodesy in the construction process • Use various surveying instruments and the appropriate methods of measurement, staking out and monitoring of the building objects • Assessing the quality of digital 1D/2D and 3D surveying measurements • Evaluate space-time modeling and interpretation of digital 1D/2D and 3D data • Carry out, award and approve surveying tasks within the construction industry

FURTHER FUNDAMENTALS			
	Knowledge	**Proficiency**	**Skills**
Economics	Business principles: • Principles regarding forms of enterprise / legal forms under private-law enterprises • Forms of entrepreneurial deployment in the construction industry • Fundamentals of Business Administration Economics	• Identify the opportunities and risks of different types of companies / legal entities • Recognise the opportunities and dangers of different forms of entrepreneurial deployment	• Understand the business and economic structures as well as the interrelationships
Law	• Introduction of civil law • Introduction of public law • Basic knowledge of public building law (use of land for construction purposes, construction of public transport routes)	• Identify legal sources	• Understand fundamental legal and systematic interrelations relating to the construction industry
Ecology	• Introduction to an ecological understanding • Introduction to the basic principles of environmental protection • Fundamentals of ecological construction	• Observe the basic requirements of environmental protection	• Understand the fundamental ecological relationships
History of Building Technology	• Historical development of construction techniques and construction engineering • Typical construction methods in building construction and civil engineering • Essential properties of historical building materials • -Landmark structures and engineering personalities	• Identify and historically classify historical building and supporting structures, construction methods and materials • Identify typical characteristics of historical buildings and structures as well as their specific options and problems.	• Record and classify historical building structures as a basis for reconstruction works to existing buildings • Recognize one's own profession and its social significance as the result of a historical development proces

STRUCTURAL ENGINEERING			
Structural Analysis and Structural Design	Line of reasoning and working methods for the determination of force and deformation variables of structures as a basis for safe and economical dimensioning: • Modelling, idealisation of structures • Static and indefinite structures • Principles of energy • Force sizing method and displacement sizing method • Introduction to computer-aided structural analysis • Dependencies between structure, action- reaction, materials, safety concept in the dimensioning • Lines of influence	• Select suitable load-bearing systems for the respective construction task • Abstract the static model • Apply manual calculation method to determine internal forces and deformations • Determine system sizes using framework programs • Determine the maximum system response for structures with variable loads	• Responsibly and independently design and assess the structures and load transfers • Calculate internal forces and deformations of statically determined and indefinite structures • Critically question the IT-results by means of simple control and estimate calculations
Solid Structures / Masonry Construction	• Material properties of concrete, reinforcing steel and brickwork • Fundamentals of structural idealization • solid structures • specific safety factors and determination of internal forces Structural behavior of reinforced concrete and masonry: • Limit states, bearing capacity, serviceability and durability • Reinforcement and structural design of standard components	• Apply modelling methods and determine design of internal forces for bending, normal and shear forces • Apply design methods and aids for reinforced concrete and masonry • Verify ultimate limit state, serviceability limit state and durability limit state for standard structures • Read the structural works, formwork and reinforcement drawings and generate own standard components drawing	• design, construct and dimension simple solid components made of masonry and reinforced concrete in accordance with the materials used • assess the load-bearing behaviour, ensure stability • Limit deformation in accordance with common standard designs • Critically scrutinise the data results • Accompany and supervise the manufacture of solid structures

	Knowledge	Proficiency	Skills
	• Representation of execution drawings, masonry drawings, formwork and reinforcement drawings • Knowledge of the typical components and construction of solid structures and their specific load-bearing and deformation behaviour as well as their modelling, including prefabricated construction elements.		
Steel Construction	• Material properties of Steel, corrosion protection, fire protection • Safety concepts of steel construction Principles of: • Load safety and stability of rod-shaped components and their connections • Serviceability including fatigue strength of rod-shaped components • Stability phenomena of steel construction • Composite construction • Structural design of steel components and their connections, spatial stabilisation of steel structures	• Design and dimensions of simple steel structures and connections in accordance with applied standards • Detect beams and columns at risk of instability • Prove structural safety and fitness for use	• Responsible and independent design for specific steel structures • Design and dimensions of simple structures and their connections • Detect components at risk of instability • Critically scrutinise the data results

Timber Construction	• Material properties of wood and derived timber products • Wood protection and fire protection • Timber construction-specific securities • Methods of fixing • Fundamentals of the load-bearing capacity and serviceability of simple beam structures • Timber panel construction - load-bearing behaviour	• Design and dimensions of simple load-bearing structures including stabilization • Design and dimensions of joints • Wooden panel dimensions in multi-storey buildings • Prepare overview and execution drawings	• Responsibly and independently design, construct and measure simple wooden structures • Critically scrutinise the data results
Geotechnics	• Soil types, soil groups and soil classes - Types of foundations and supporting structures/scaffolding • Building pit • anchoring • Properties of slopes and embankments • Measures to improve the subsoil and dewatering Safety concepts according to Eurocode fundamentals of soil mechanics: • Basic equations of soil mechanics, total and effective stresses • Influences of groundwater • Calculation of earth pressure • Strength properties and deformation properties • Compaction and Consolidation • Equilibrium limit states • Basic calculations in soil mechanics	• Determine soil condition and properties • Determine stresses and deformations • Determine buoyancy, permeability and capillarity action of water in the soil • Carry out field and laboratory tests • Develop a subsoil model • Design and calculate shallow and deep foundations • Design and calculate supporting structures and excavation pits, slopes and embankments, subsoil improvements and dewatering • Provide evidence of stability and suitability for use	• Take into account the characteristics of the foundation soil in planning and execution • Independently design, plan and calculate geotechnical structures • Critically scrutinise the data results

HYDRAULIC ENGINEERING			
	Knowledge	**Proficiency**	**Skills**
Water Management	Basic information: • Hydrology and water management • The study of water • Water ecology and water maintenance • Flow and sediment hydraulics • Guidelines and laws concerning water management and environmental protection	Basic calculations for: • Water cycle, water balance • Hydrometry, hydrological statistics and • flow dynamics Execute: Apply basic concepts of water rights, flood protection and flood risk management	• Identify and observe relationships between hydrological processes, water management requirements and solutions to problems using ecologically compatible hydraulic engineering measures.
Water Engineering	• Fundamentals of constructive hydraulic engineering • Overview of essential building typologies in constructive hydraulic engineering and the essential impacts as well as load conditions in hydraulic engineering works Mechanics of liquid media: • Hydrostatic and hydrodynamic fundamentals • Basic information regarding pipe hydraulics, channel hydraulics and groundwater hydraulics	• Design near-natural waterways • Apply the principles of the Water Withdrawal Directive • Distinguish between crossing structures and water bed structures • Determine hydrostatic loads in the form of pressures and forces for any surfaces • Determination of buoyancy and proof of stability for floating bodies • Apply balancing of hydraulic mass, force and energy • Use pipe hydraulics for dimensioning pipelines • Use stationary channel hydraulics to demonstrate hydraulic performance • Dimension and hydraulically verify simple installations in water	• Design and dimensions for the planning and execution of simple hydraulic engineering measures • Work independently on simple hydraulic problems

Residential Water Management	Principles of water extraction: • Water availability, quality, demand, rainwater utilisation and water pollution control • Legal framework conditions • Determination of water demand, water extraction, water promotion, • Water treatment, water storage, water distribution Basics of wastewater technology: • Waste water types, quantities and characteristics • Local drainage systems and structures • Renovation of sewers and buildings • Concepts for rainwater management, waste water reduction and waste water prevention • Process for treating waste water and sludge	• Develop concepts for the listed subject areas • Understand and apply associated design rules • Plan, dimension and rehabilitate water supply and wastewater technology systems	• Understand the interdisciplinary and ecological tasks of urban water management and its procedures as the cornerstone of environmental technology • Participate in the planning, construction, operation and refurbishment of water supply and wastewater technology facilities

RESOURCE MANAGEMENT			
	Knowledge	**Proficiency**	**Skills**
Waste Management and Contamination	Waste management: • Legal basis, environmental compatibility of plants (EIA) • Nature, quantity, composition and properties of waste • Collection and transportation of waste • Waste prevention • Waste recovery, recycling • Waste disposal: Landfill technology, physical-chemical, biological and thermal recycling and hazardous waste disposal Contaminated sites and soil protection: • Legal basis • Recording and evaluation of contaminated sites as well as rehabilitation • Precautionary soil and groundwater protection	• Develop concepts for the listed subject areas • Understand and apply associated design rules • Plan and dimension waste management plants and concepts for the remediation of contaminated sites and soil protection	• Understand the interdisciplinary and ecological tasks of recycling management, waste disposal and treatment of contaminated sites as part of environmental protection • Participate in the planning, construction and operation of an environmental recycling economy

TRANSPORTATION, SPATIAL PLANNING			
Traffic Management	• Basic knowledge and working methods of transport planning in urban development and spatial planning • Legal foundations in environmental and general building law as well as in sectoral planning law • Ensuring mobility in urban and rural areas through different transport systems, networks and facilities • Methods of traffic survey and evaluation • Working steps in traffic planning as a basis for planning methods • Methodology of traffic planning for the determination of current and future traffic loads • Effects of transport e.g. emissions • Specialist designs for individual types of traffic as well as for congestion reduction and traffic avoidance	• Independently develop and plan the implementation of problem analyses and specific solution concepts for the standard transport planning tasks • Functional and environmentally sound development of infrastructure measures in the road and rail network • Create proposals for the dimensioning and design works	• Collaborate in urban and spatial planning and coordinate with other specialist areas • Discuss and communicate planning objectives with other specialists • jointly develop integrative planning objectives in an interdisciplinary specialist context
Public Transport Systems	• Basic knowledge and working methods of planning, designing, building and operating public transport systems • Line networks and planning of public transport services • Organisation of rail transport • Basic principles of vehicle dynamics, line determination and routing on the ground plan and layout, design of the track cross-section • Structure of the railway formation and structural requirements for building materials and components	• Develop and implement problem analyses and specific solution concepts for the standard tasks in the planning of public transport systems • Functional and environmentally sound development of infrastructure measures in the rail network • Create proposals for dimensioning and design, and calculate the performance characteristics of the operation	• jointly develop integrative planning objectives in an interdisciplinary specialist context • Discuss and communicate planning objectives with other specialists

	Knowledge	Proficiency	Skills
	• Switches and crossings • Railway construction buildings • Construction technology • Safety and operating technology • Safety and design of level crossings • Railway operation and timetable design for freight and passenger transport • Planning of railway stations and stops • Connections with other means of transport		
Road Sector	Basic knowledge and working methods of road design, construction and operation: • Legal and functional formation of the road network, road administration structure • Principles of driving dynamics and driving geometry • Environmental impact assessment in road planning • Road line and routing on layout and contour plans, design of road cross section - Planning and design of at-grade and non-controlled intersection forms	• Develop and implement problem analyses and specific solution concepts for the standard tasks of road design, construction and operation. • Functional and environmentally sound development of infrastructure measures for road network • Create proposals for the dimensioning and design of traffic routes • Calculate performance characteristics for the operation of the infrastructure system	• Jointly develop integrative planning objectives in an interdisciplinary specialist context • Discuss and communicate design content with other specialists • Developing traffic control systems • Assist in the operation of roads

	• Basic concepts of traffic flow at junctions and in flowing traffic as well as the control of traffic flow. • Fundamentals of road safety • Road pavement structure • Planning and constructional requirements for roads on bridges and in tunnels • Construction technology: production of road pavements • Basic knowledge and working methods for operation and maintenance of roads		
MANAGEMENT			
Project Management	• Principles of project management for construction projects: Project management with regards to organisation, coordination, information, documentation, qualities and quantities, costs and financing, deadlines, capacities and logistics as well as contracts and insurance. • Relevant broad knowledge regarding the interfaces to other parties involved in the construction process • Principles of quality management and risk management	• Structure and organise simple projects, completing them successfully with regard to cost, deadlines and quality, taking into account the legal requirements. For this purpose, select, apply and implement the appropriate instruments for the respective target group (building owner, planner, companies carrying out the structural and finishing work). • Apply digital methods and tools	• Organise smaller interdisciplinary teams to cope with a corporate task • Present complex work results to both specialist and non-specialist audiences and to represent them argumentatively as well as developing them further • Determine project goals independently as well as achieve them in a team context • Identifying conflicting goals and discrepancies and solving them under guidance

	Knowledge	Proficiency	Skills
Process Management	• Basic knowledge of process theory • Construction methods for key processes and their work preparation • Principles of economic efficiency calculations for the selection of construction methods • Construction equipment technologies • Techniques of scheduling, capacity and process planning as well as their control • Basics regarding LEAN Construction • Use of BIM in Process Planning • Basic Principles regarding Site Equipment Planning and Site Logistics • Formwork • Occupational safety and health protection on site • Environmental requirements within construction management processes	• Recognise the suitability of construction methods and develop time and resource planning for basic construction methods • Select suitable construction methods for system-typical trade groups • Plan the basic elements required for the site installation • Create construction schedule, resources, cycle plans and logistics concepts • Select processes, calculate and compare economic efficiency • Create a Risk Assessment for a construction site • Create a site disposal concept • Apply methods for scheduling, capacity determination and process planning • Applying LEAN principles to the schedule • Apply methods to visualize the construction process • Apply digital data and information management, also on the basis of Building Information Modelling (BIM)	• Independently plan and implement simple, basic building projects within a contractual and economic framework • Independently recognise bottlenecks in the construction process • Identify deviations from drawings and disruptions in the construction process and initiate necessary countermeasures • Recognize and report changes to specified works • Independently use digital information technology tools

Business Management	• Principles of construction business management • Process mechanisms of the construction market • Introduction to construction company accounting • Basic principles of cost, performance and profit and loss accounting of construction companies (KLR Bau), • Application of digital methods during the estimation phase	• Apply principles of KLR Bau for simple projects • Perform administrative tasks in finance and accounting • Create a simple estimation • Create a quantity take off and simple construction billing • Recognize contractual obligations from the tender estimationn	• Independently prepare the tender estimation for simple projects • Control the economic implementation of simple projects • Carry out change management
Planning and Design Management	Basic information: • the project planning and the recording of the performance contents/scope of works • the drafting of work contracts for planning services and respective remuneration • the methods and procedures for cost planning and cost determination • the procedures for determining construction area and room contents • Tendering, awarding and billing (AVA) • The development of the bill of quantities on the basis of private building law • The drafting of contracts for planning and construction works • The award procedure for planning of coordination, management, quality management and planning interfaces • BIM management/coordination in implementation planning	• Determine the area of responsibility of the planning offices, in particular for object planning. • Apply methods of cost calculation and area calculation • Preparation of tender documents for selected construction works • Carry out simple profitability calculations • Determine the interfaces of the various planning participants and evaluate the dates (planning the planning works). • Implement inspection criteria for the design quality • Independently participate in standard tasks within the framework of construction planning law • Develop planning in compliance with legal requirements	• Independent implementation of tasks in the planning office • independent compilation of project documents using the regulations and standards for cost planning and for the determination of area and room contents • Draw up technical contract conditions for selected construction works under supervision • Draft planning contracts and construction contracts under supervision, in particular with regard to the technical and general conditions of contract • Assist with the planning processes • legally substantiate integrative planning objectives in an interdisciplinary technical context • Discuss and communicate design objectives with other specialists

ASBau study programme matrix (Annex 2)

Instructions for use with universities:

With the ASBau study programme matrix[8] one can work out the competence profile of the respective study programme or of individual study and specialisation courses and compare this directly with the reference framework recommended by the ASBau for a Bachelor's programme in civil engineering.

This makes it possible to see at a glance how the respective degree programme is oriented and in which areas a special degree programme profile deviating from the reference framework is offered.

The ASBau program matrix consists of fields in which entries can be made (not colored) and fields that are locked (colored).

For easier orientation, the rows of the matrix are marked with numbers 1 to 99 and the columns with the letters A to H. The values already stored in the brightly marked fields have no meaning, they should only serve as an example.

In column B, all compulsory modules of the respective study programme can be entered one after the other. The actual module names of the degree programme are entered in column B and the awarded credit points in column C.

In accordance with the overall structure of the ASBau program matrix, the modules of your program should be assigned to the following main subjects: „Fundamentals of Engineering" (from line 4), „Further Fundamentals" (from line 22), „Structural Engineering" (from line 32), „Hydraulic Engineering" (from line 42), „Resource Management" (from line 52), „Transport Engineering, Spatial Planning" (from line 62), „Construction Management" (from line 72) and „Further Modules for Profile Building" (from line 91).

In columns D to G the share (in percentage) of the four competence aspects („Fundamentals of Engineering", „Design", „Dimensioning" and „Construction Management") taught in the respective module (based on the assessment of the university professor responsible for the module) can be stated.

Column H serves only as a control column. If a compulsory module also addresses aspects other than the four competence aspects (e.g. a foreign language component), column H would show a total value of less than 100 %. The result should not contain more than 100 % per line.

If all modules of the respective degree programme are recorded and proportionately assigned according to the competence aspect, one can see at a glance how the distribution of the competence aspect in the individual key items is summed up. The automatic summation in lines 3, 21, 31, 41, 51, 61, 71 and 90 is prepared for this purpose.

Furthermore, at the bottom of the table (in line 80), the percentages of all compulsory modules appear in relation to the four competence aspects. The sum of the credit points taken into account can be found in field C 80.

The ASBau Reference Framework recommends that at least 135 credit points are required for the procurement of professional qualifications in the sense of a broad-based civil engineering profile. This sum is shown in field C 84. According to ASBau's recommendation, about 40% of the 135 credit points should be in the first competence aspect („Fundamentals of Engineering") and 20% each

in the other three competence aspect („Design“, „Dimensioning“ and „Construction Management“). These references are given in line 84.

For a better conversion into modules and module performance points, the values from line 84 are again shown in absolute values in line 85 on the basis of 135 professional performance points.

A complete civil engineering degree should, however, comprise at least 180 credit points in the Bachelor‘s programme. This value can be found in field C 86.

As a result, you can compare the weighting in the respective degree programme (lines 81 and 82) with the recommendations of the ASBau reference framework (lines 84 to 86).

By way of comparison, the portions (line 83) are also shown in relation to the total number of credit points awarded according to the curriculum (fields C 99 and C 86).

8 Digital at the ASBau home page (www.asbau.org)

	A	B	C	D	E	F	G	H
1	ASBau matrix of degree program and specialization	*name of university*	**Credit points**	Principles of civil engineering	Planning, design	Calculation	Management	checksum = 100%
2	Bachelor degree program civil engineering	Courses regarding to your curriculum	**(CP)**	dimensions of competency				
3	**Principles of civil engineering**		**11,0**	**59%**	**32%**	**5%**	**5%**	**100%**
4	this includes, for example:	e.g. mathematics 1	**6,0**	100%	0%	0%	0%	100%
5	mathematics, applied mechanics of elestaic bodies		**0,0**	0%	0%	0%	0%	0%
6			**0,0**	0%	0%	0%	0%	0%
7	as well as rather subject-specific principles such as:		**0,0**	0%	0%	0%	0%	0%
8		e.g. structural engineering 1	**5,0**	10%	70%	10%	10%	100%
9	engineering informatics, digitalization of construction processes, structural design, construction physics, building materials, geodesy		**0,0**	0%	0%	0%	0%	0%
10			**0,0**	0%	0%	0%	0%	0%
12			**0,0**	0%	0%	0%	0%	0%
13			**0,0**	0%	0%	0%	0%	0%
14			**0,0**	0%	0%	0%	0%	0%
15			**0,0**	0%	0%	0%	0%	0%
16			**0,0**	0%	0%	0%	0%	0%
17			**0,0**	0%	0%	0%	0%	0%
18			**0,0**	0%	0%	0%	0%	0%
21	**Other principles**		**0,0**	**0%**	**0%**	**0%**	**0%**	**0%**
22	this includes, for example:		**0,0**	0%	0%	0%	0%	0%
23	economics, law, ecology, history of construction technology		**0,0**	0%	0%	0%	0%	0%
24			**0,0**	0%	0%	0%	0%	0%
25			**0,0**	0%	0%	0%	0%	0%
26			**0,0**	0%	0%	0%	0%	0%
27			**0,0**	0%	0%	0%	0%	0%
28			**0,0**	0%	0%	0%	0%	0%
31	**Structural engineering**		**0,0**	**0%**	**0%**	**0%**	**0%**	**0%**
32	this includes, for example:		**0,0**	0%	0%	0%	0%	0%
33	planning and design of structural systems, concrete and masonry structures, steel building, structural steel engineering, timber structures, geotechnics		**0,0**	0%	0%	0%	0%	0%
34			**0,0**	0%	0%	0%	0%	0%
35			**0,0**	0%	0%	0%	0%	0%
36			**0,0**	0%	0%	0%	0%	0%
37			**0,0**	0%	0%	0%	0%	0%
38			**0,0**	0%	0%	0%	0%	0%
41	**Hydraulic + water resources engineering**		**0,0**	**0%**	**0%**	**0%**	**0%**	**0%**
42	this includes, for example:		**0,0**	0%	0%	0%	0%	0%
43	urban water and wastewater systems		**0,0**	0%	0%	0%	0%	0%
44			**0,0**	0%	0%	0%	0%	0%
45			**0,0**	0%	0%	0%	0%	0%
46			**0,0**	0%	0%	0%	0%	0%
47			**0,0**	0%	0%	0%	0%	0%
48			**0,0**	0%	0%	0%	0%	0%

	A	B	C	D	E	F	G	H
1	ASBau matrix of degree program and specialization	*name of university*	**Credit points**	Principles of civil engineering	Planning, design	Calculation	Management	checksum = 100%
2	Bachelor degree program civil engineering	Courses regarding to your curriculum	**(CP)**	dimensions of competency				
51	**Resource management**		**0,0**	**0%**	**0%**	**0%**	**0%**	**0%**
52	this includes, for example:		0,0	0%	0%	0%	0%	0%
53	waste management industry,		0,0	0%	0%	0%	0%	0%
54	contaminated land management		0,0	0%	0%	0%	0%	0%
55			0,0	0%	0%	0%	0%	0%
56			0,0	0%	0%	0%	0%	0%
57			0,0	0%	0%	0%	0%	0%
58			0,0	0%	0%	0%	0%	0%
61	**Traffic engineering, spatial planning**		**0,0**	**0%**	**0%**	**0%**	**0%**	**0%**
62	this includes, for example:		0,0	0%	0%	0%	0%	0%
63	urban and regional planning, transportation		0,0	0%	0%	0%	0%	0%
64	planning, teletraffic engineering		0,0	0%	0%	0%	0%	0%
65			0,0	0%	0%	0%	0%	0%
66			0,0	0%	0%	0%	0%	0%
67			0,0	0%	0%	0%	0%	0%
68			0,0	0%	0%	0%	0%	0%
71	**Management**		**0,0**	**0%**	**0%**	**0%**	**0%**	**0%**
72	this includes, for example:		0,0	0%	0%	0%	0%	0%
73	project management, process		0,0	0%	0%	0%	0%	0%
74	management, business management,		0,0	0%	0%	0%	0%	0%
75	planning and desing management		0,0	0%	0%	0%	0%	0%
76			0,0	0%	0%	0%	0%	0%
77			0,0	0%	0%	0%	0%	0%
78			0,0	0%	0%	0%	0%	0%
80	**Total of shares so far**		**11,0**	**59%**	**32%**	**5%**	**5%**	100%
81	corresponds to a share of study of at least 135 credit points:		135	5%	3%	0%	0%	8%
82	this corresponds to the following sums of credit points:		11,0	6,5	3,5	0,5	0,5	
83	shares in percentage in regard to total credit points of the degree program:		11,0	4%	2%	0%	0%	
84	recommended shares in percentage for a six-semester bachelor degree program according to ASBau:		135	40%	20%	20%	20%	
85	this corresponds to a minimum share in credit points of:		135	54	27	27	27	
86	recommended minimum scale of the bachelor degree program in credit points		180					
90	**Additional courses contributing to the profile of the bachelor degree**		**0,0**	**0%**	**0%**	**0%**	**0%**	**0%**
91	this includes, for example:		0,0					0%
92	project-related study performances such as		0,0					0%
93	Bachelor Thesis, Semester Thesis, and		0,0					0%
94	additional interdisciplinary courses		0,0					0%
95			0,0					0%
96			0,0					0%
97			0,0					0%
98			0,0					0%
99	**Total scope of the degree program**		**11,0**	**59%**	**32%**	**5%**	**5%**	100%

ASBau study programme matrix using the example of a university bachelor's programme (Annex 3)

Explanation:

The Muster-Universität Neustadt offers a Bachelor's programme in Civil Engineering, for which - as an example - a fully completed ASBau programme matrix has been created.

All modules of the curriculum have been adopted in the original wording of the module titles. In addition, a number identifier in front of the module name facilitates the assignment according to the respective semester (1 to 6) and consecutive numbering of the modules within the semesters (1 to 6).

The module managers have assigned the proportions of the competence aspects in their modules. For example, the Mechanics I module (line 5) covers 100% of the fundamentals of engineering. The Geodesy module (line 14), on the other hand, teaches 50% of the skills in design and 25% each in dimensioning and construction management.

The ASBau study programme matrix covers a relatively large scope in the basic subjects and in structural engineering. On the other hand, there is a lack of shares in resource management, transport and spatial planning.

The study programme depicted has a total of 156 credit points in the compulsory area (field C 80), of which 48% (65 LP) is attributable to the competence aspect „Fundamentals of Engineering". This is well above the 40% recommended by ASBau (54 LP). To this end, fields D 81 and D 82 can be compared with fields D 84 and D 85.

Also, in the competence aspects „design" and „dimensioning" the proportions of 24% (32.9 LP) and 29% (39.0 LP) respectively are above the values recommended by ASBau (20% and 27 LP)

However, only a share of 14% is achieved in the competence aspect „construction management" (fields H 81 and H 82). This is below the recommended 20 % (field H 84) or lower than the recommended 27 LPs (field H 85).

Those responsible for this Bachelor's programme could justify the deviations by the fact that a focus of competence of the Bachelor's graduates was deliberately set in design and dimensioning. As a rule, university bachelor students also follow a master's programme which could be set to dig even deeper into demanding design and dimensioning procedures. In any case, further general management competencies are acquired, so that sufficient competencies will be available in the fourth competency aspect after the Bachelor's and Master's programmes.

	A	B	C	D	E	F	G	H
1	ASBau matrix of degree program and specialization	*Muster-Universität Neustadt, Bauingenieurwesen Bachelor*	Credit points	Principles of civil engineering	Planning, design	Calculation	Management	checksum = 100%
2	Bachelor degree program civil engineering	Courses regarding to your curriculum	(CP)	Kompetenzdimensionen				
3	**Principles of civil engineering**		**101,0**	**52%**	**21%**	**22%**	**5%**	**100%**
4	this includes, for example:	1.1; 2.1; 3.1 Mathematik I bis III	15	100%	0%	0%	0%	100%
5	mathematics, applied mechanics of elestaic bodies	1.6 Mechanik I	6	100%	0%	0%	0%	100%
6		2.6 Mechanik II	6	100%	0%	0%	0%	100%
7	as well as rather subject-specific principles	1.4 natwiss. Grundlagen Bauchemie	6	100%	0%	0%	0%	100%
8	such as:	2.3 natwiss. Grundlagen Bauphysik	6	100%	0%	0%	0%	100%
9	engineering informatics, digitalization of construction	2.2 Bauinformatik	6	100%	0%	0%	0%	100%
10	processes, structural design, construction physics, building	1.2 Proj. geometr. und techn. Darstellung	6	33%	33%	0%	34%	100%
11	materials, geodesy	1.3 Baukonstruktion	4	0%	50%	50%	0%	100%
12		2.4 Baustoffkunde	3	0%	34%	66%	0%	100%
13		3.4 Bau- und Werkstoffe	3	0%	0%	100%	0%	100%
14		2.5 Geodäsie	4	0%	50%	25%	25%	100%
15		5.3 Projekt konstr. Ingenieurbau	6	0%	33%	33%	34%	100%
16		5.4; 6.1 Bauweisen des konstr. Ingenieurbau I + II	24	0%	50%	50%	0%	100%
17		5.1 Grundlagen der FEM	6	100%	0%	0%	0%	100%
21	**Other principles**		**0,0**	**0%**	**0%**	**0%**	**0%**	**0%**
22	this includes, for example:		0,0	0%	0%	0%	0%	0%
23	economics, law, ecology, history of construction technology		0,0	0%	0%	0%	0%	0%
24			0,0	0%	0%	0%	0%	0%
31	**Structural engineering**		**40,0**	**30%**	**20%**	**40%**	**10%**	**100%**
32	this includes, for example:	3.3; 4.1 Statik I und II	12	50%	0%	50%	0%	100%
33	planning and design of structural systems, concrete and	3.2 Grdl. Konstruktiver Ingenieurbau	4	0%	50%	50%	0%	100%
35	masonry structures, steel building, structural steel	4.2 Einf. Bauweisen des konstr. Ingenieurbau	12	0%	33%	50%	17%	100%
36	engineering, timber structures, geotechnics	4.4 Mech III Bodenmech und Hydromech.	6	100%	0%	0%	0%	100%
37		5.2 Grundbau	6	0%	33%	33%	34%	100%
41	**Hydraulic + water resources engineering**		**6,0**	**0%**	**66%**	**17%**	**17%**	**100%**
42	this includes, for example:	4.3 Infrastruktur	6	0%	66%	17%	17%	100%
43	urban water and wastewater systems		0,0	0%	0%	0%	0%	0%
44			0,0	0%	0%	0%	0%	0%
51	**Resource management**		**0,0**	**0%**	**0%**	**0%**	**0%**	**0%**
52	this includes, for example:		0,0	0%	0%	0%	0%	0%
53	waste management industry, contaminated land		0,0	0%	0%	0%	0%	0%
61	**Traffic engineering, spatial planning**		**0,0**	**0%**	**0%**	**0%**	**0%**	**0%**
62	this includes, for example:		0,0	0%	0%	0%	0%	0%
63	urban and regional planning, transportation planning,		0,0	0%	0%	0%	0%	0%
64	teletraffic engineering		0,0	0%	0%	0%	0%	0%
67			0,0	0%	0%	0%	0%	0%
71	**BaumanagementManagement**		**9,0**	**0%**	**0%**	**0%**	**100%**	**100%**
72	this includes, for example:	3.5 Baubetrieb	6	0%	0%	0%	100%	100%
73	project management, process management, business	1.5 Einführung in die BWL	3	0%	0%	0%	100%	100%
75	management, planning and desing management		0,0	0%	0%	0%	0%	0%
76			0,0	0%	0%	0%	0%	0%
80	**Total of shares so far**		**156,0**	**42%**	**21%**	**25%**	**12%**	100%
81	corresponds to a share of study of at least 135 credit points:		135	48%	24%	29%	14%	116%
82	this corresponds to the following sums of credit points:		156,0	65,0	32,9	39,0	19,2	
83	shares in percentage in regard to total credit points of the degree program:		180,0	36%	18%	22%	11%	
84	recommended shares in percentage for a six-semester bachelor degree program according to ASBau:		135	40%	20%	20%	20%	
85	this corresponds to a minimum share in credit points of:		135	54	27	27	27	
86	recommended minimum scale of the bachelor degree program in credit points		180					
90	**Additional courses contributing to the profile of the bachelor degree**		**24,0**	**0%**	**0%**	**0%**	**0%**	**0%**
91	this includes, for example:	6.5 Bachelorarbeit	12					0%
92	project-related study performances such as Bachelor Thesis,	3.6 Wahlmodul	6					0%
93	Semester Thesis, and additional interdisciplinary courses	6.4 Wahlmodul	6					0%
94			0,0					0%
95			0,0					0%
96			0,0					0%
99	**Total scope of the degree program**		**180,0**	**36%**	**18%**	**22%**	**11%**	87%

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