SEMESTER SYLLABUS

SEMESTER 4
MULTI-STOREY RESIDENTIAL BUILDING OVER THREE STOREYS

Bachelor's Degree Programme in Architectural Technology and Construction Management
VIA University College
Valid from August 2020

CONTENTS

WELCOME TO SEMESTER 4

You are about to embark on your fourth semester, which is part of the learning environment we call 'Professionalization', and is the last semester but one to be primarily teacher-led. You should consider whether there are any areas in which you need to make a special effort to improve your skills before you choose your study pathway, work on the local programme elements, do your Bachelor's project and, ultimately, venture out into the labour market.

This fourth semester comprises one National subject element and two local programme elements.
The National subject element deals with 'Multi-Storey Building over 3 Storeys'. You will work on an interdisciplinary project in which you and your group will learn about the special requirements associated with the phases of building construction.

The semester's National subject element carries 15 ECTS credits and includes the following subject areas:
- Communication and Collaboration 5 ECTS credits
- Production 5 ECTS credits
- Structural Design 5 ECTS credits

In the two local programme elements, you will work on elective topics. You must describe a specific issue within one or more building industry problems that you will investigate and propose one or more solutions to.

The semester's local programme elements carry 15 ECTS credits and include the following elements:
- Local Program Element – Problem-based Research Design and Introduction to the Theory of Science for the Construction Industry (PRD), worth 10 ECTS credits
- the local programme element – Specialization Element (SE), worth 5 ECTS credits

The choice of local programme elements gives you considerable scope to target your programme towards the work you want to do in future.

The semester timetable will be reviewed at the beginning of the semester. The indicative timetable will then be available on Itslearning.

In the course of this semester, you must decide which pathway to follow in Semester 5: structural design or construction management.

Student Council
At VIA, there is one combined Student Council per campus, with class representatives from across the programmes. There is also a local Student Council for the Architectural Technology and Construction Management programme, known as the Architectural Technology Student Council. Management at VIA Built Environment in Horsens, Aarhus and Holstebro continually involve their respective local Architectural Technology Student Councils in discussions on the quality assurance and quality development of the programme, including: employer involvement, graduate involvement, final evaluation of teaching, final evaluation of internships in Denmark and abroad, final evaluation of study visits abroad, the learning barometer survey and dropout analysis.

Quality assurance
As a student, you are expected to play an active part in quality assurance procedures on the programme. Among other things, this means that you are expected to take part in the halfway evaluation at the midpoint of each semester and in the final evaluation, which takes place every third time a semester is completed. The halfway evaluation is conducted by a member of teaching staff. The idea of the halfway evaluation is that the information gathered from you can be used to develop and adapt the current course of instruction. The purpose of final evaluation is for the programme team to collect from you information that

can be used to improve the organization and conduct of teaching on the programme with a view to the programme's coherence and progression.

You can access information about quality and evaluation on your study portal. Here you can access results from surveys and quality-procedures etc.

SEMESTER STRUCTURE

The semester is described in the curriculum and in this semester syllabus. You can access the semester syllabus on your study portal and the curriculum here.
The content of the semester project will be described in more detail in the semester case study issued when the project work begins.

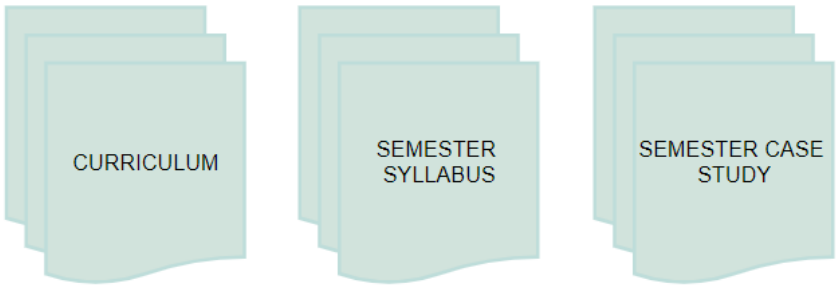

Figure 1: Document hierarchy, Semesters 1-5
Source: Prepared at VIA Built Environment

In the semester's 'Multi-Storey Building over 3 Storeys' national subject element, you will mainly be working on one continuing project. As shown in Figure 2, each subject will be aimed at the project. Theoretical presentations by teaching staff will often be concentrated at the start of the course; later, the teachers will mainly assist with guidance and advice on the project. It is through the process of working to solve the problems set that you, the student, will develop your competency as an Bachelor of Architectural Technology and Construction Management.

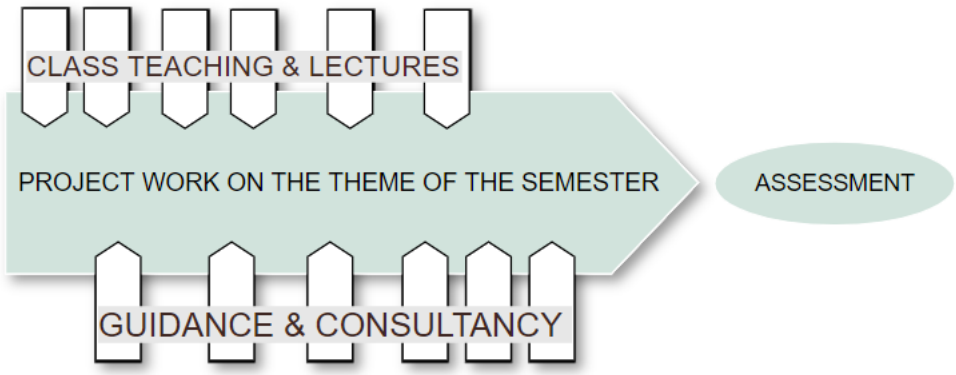

Figure 2: Interdisciplinary project work
Source: Prepared at VIA Built Environment

PROJECT WORK

Students work on an interdisciplinary project throughout the semester. The project work consists partly of assignments to be tackled individually and partly of assignments to be tackled in groups. The reason for working in groups on a specific project is partly that this is a very widely used working style in the building industry, and partly that there is learning value in problem-focused collaboration with other students whose experience and skills are different to yours.
Although students work in groups, it is nevertheless important that you as a student can independently acquire and apply the knowledge you gain from the individual subjects.

TEACHING

Teaching is based on the principles of problem-based learning (PBL), in which the teaching staff act as guides. This form of instruction is combined with academic presentations in the form of classroom/auditorium teaching. Students work on different types of building technology problems and the administration of a building project.
In the course of their day-to-day studies, students are expected to present sketches, provisional drawings and solution proposals for discussion by students and teachers. The Portfolio and study technique are important tools of the programme, to be used to reflect on your own learning.

EXAMINATIONS

As a student, you must take a number of examinations/evaluations in the course of your studies. There is information on this in Chapter 11.0 of the curriculum. The curriculum is available here. General information on examinations is available on your study portal.

STUDY ACTIVITY

Full study activity means that the student spends 825 hours per semester, i.e. approximately 41 hours per week, on study. The study activity model shows how these hours are divided between different teaching and working formats. Not all learning is to be initiated by teaching staff and/or with a member of staff present; this means that you, the student, bear considerable responsibility for your own learning. The programme involves working on professional skills, collaboration and independence in order to equip the student to take on highly responsible professional roles. The student is expected to assume greater independent responsibility semester by semester.

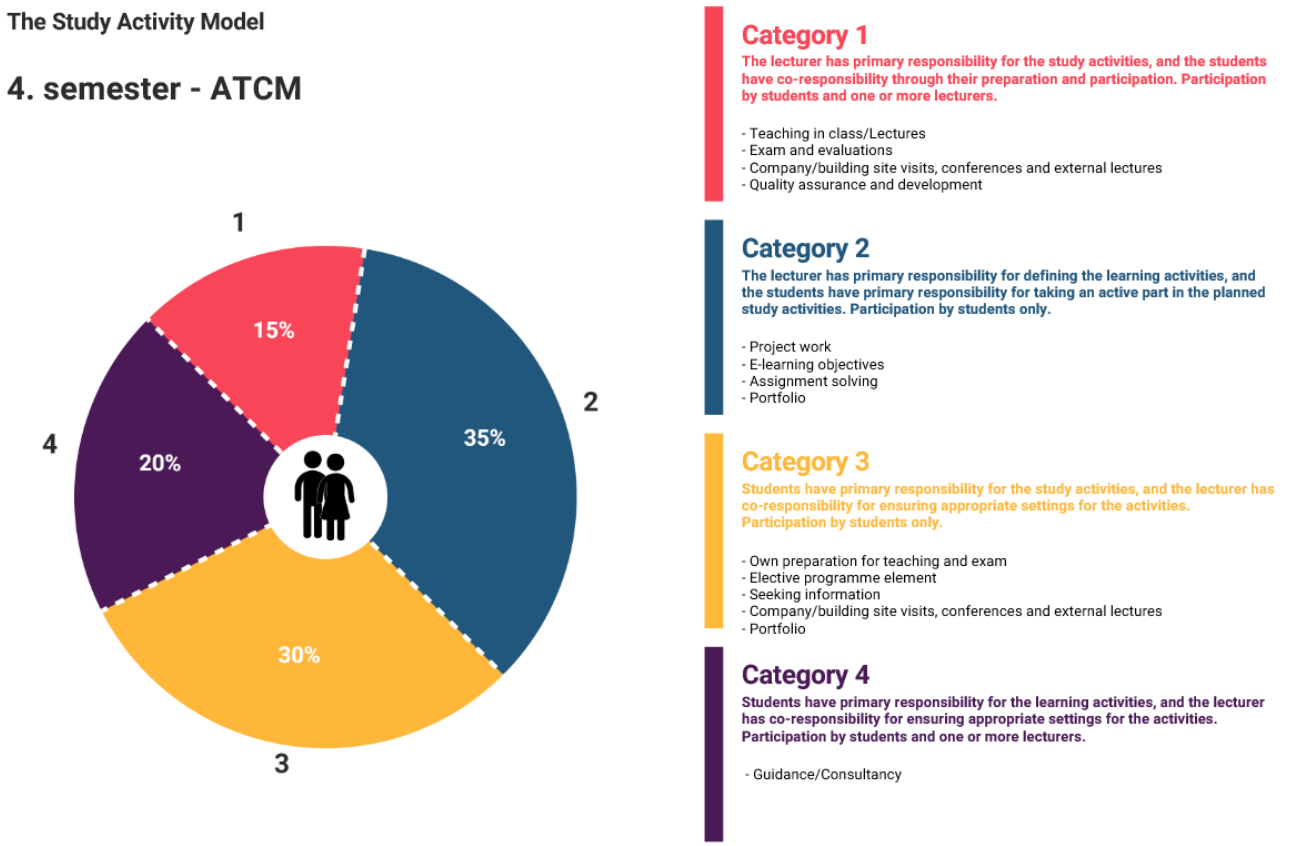

Figure 3: Semester 4 study activity model
Source: Prepared at VIA Built Environment

SUBJECTS

The programme's interdisciplinary learning objectives for Semester 4 are set out in the section of the curriculum on the national subject elements of the programme.

The point of departure for instruction in the individual subjects is the semester's interdisciplinary project. Single-subject teaching covers rules, theories, methods and techniques within each specific professional discipline. The teaching of the individual subjects will also indicate how the content of the subject can be brought to bear on the interdisciplinary work on the semester case study.

The content of the individual subjects is described on the following pages. The content is described at a general explanatory level. The precise teaching topics within the subjects are set out in the teaching schedule, which is available on Itslearning at the beginning of the semester.

Examples of subject-based interpretations of the Semester 4 interdisciplinary learning objectives for the individual subjects are given in Annex 1.
Both separately and together with your project work, the subject-based presentations of the individual subjects will support your attainment of the semester's learning objectives.

Table 2, below, shows the subject distribution of the semester in percentage terms.

Subject	Subject areas	Distribution
Building design (BDS)	Architecture and Building Design (BDS/ABD) Building Construction (BDS/BCN) Materials Science (BDS/MAT)	51%
Structural design (STD)	Structural design (STD)	12%
Building services (BSE)	Building services (BSE)	12%
Building Planning and Management (BPM)	Building Planning and Management (BPM)	13%
Communication (COM)	Communication (COM)	7%
Theory of Science (TS)	Theory of Science (TS)	5%

Table 2: Subjects, subject areas and subject distribution in Semester 4
Source: Prepared at VIA Built Environment

BUILDING DESIGN (BDS)

The Building design subject comprises the Architecture and Building Design, Building Construction and Materials Science elements.
Teaching will be based on the following content:

Architecture and Building Design (ABD)
- architecture and building design in relation to multi-storey residential building over 3 storeys
- study of the theme of multi-storey residential buildings
- study of Danish and international architects, with emphasis on sustainability and industrialization

Building Construction (BCN)
- feasibility study of an existing multi-storey residential building
- reflection on the design brief including quality, site conditions, utilities, building type/architecture, service installations, room requirements and environment
- sketching technique, including freehand drawing, digital tools, building control provisions, analyses, holistic understanding and communication
- structural design technique from a sustainability point of view, including design scrutiny, modular design, legal requirements analysis, the accumulated body of technical knowledge, prefabricated building elements, layout of structures and relevant building techniques
- preparation of design documentation in accordance with the design phases in the description of services
- analogue and digital tools in the design and communication of building works
- visit to company/building site or visit from company

Materials Science (MAT)
- knowledge of masonry, concrete, steel/metal, construction joints, glass and paint
- insight into timber, roofing materials and sheet materials
- material and building element analysis
- environmental considerations around material selection
- material descriptions in the content journal
- material descriptions on drawings linked to a building information model

STRUCTURAL DESIGN (STD)

Teaching will be based on the following content:
- static analysis and building systems
- tabular dimensioning of different element types
- estimation of in-situ concrete structures
- geology and geotechnics
- loads and safety in accordance with standards
- preparation of static documentation

BUILDING SERVICES (BSE)

Teaching will be based on the following content:
- passive and active energy measures, e.g. basic layout on the plot, building envelope optimization, sustainable energy etc.
- indoor climate analyses including acoustics and daylight
- ventilation principles
- layout of service installations and shafts
- electricity: the High Voltage Regulation, positioning of switches etc. (self-study)

- sound theory, sound and acoustics analysis in accordance with Building Regulations and standards requirements
- reverberation time calculation
- building envelope energy framework calculation

BUILDING PLANNING AND MANAGEMENT (BPM)

Teaching will be based on the following content:
- project planning
- fee calculation and time recording
- state-subsidized building, including KPIs
- successive calculation and building calculation, including quantity take-off
- life-cycle costing and life-cycle cost considerations
- network planning
- the content journal
- construction phases and services
- types of award procedure and contract
- general building site layout
- design scrutiny and quality assurance
- the health and safety plan
- tender documents for the subcontractor
- the ICT agreement

COMMUNICATION (COM)

Teaching will be based on the following content:
- communication of a competition design
- information searching in databases
- possible collaboration on an international project
- possible collaboration with international partners

THEORY OF SCIENCE (TS)

Teaching will be based on the following content:
- theory of science and its relevance to the architectural technology profession
- fundamental scientific concepts
- investigation, argumentation and knowledge production summarized in a report
- the 'basic figure' of science and the 'pentagon'
- what is a good problem statement?
- study design
- data collection methods e.g. in the social sciences, humanities and natural sciences
- systematization and interpretation of data
- report writing

LOCAL PROGRAMME ELEMENTS

The local programme elements in Semester 4 are an opportunity for you to work on specific construction technology topics or problems chosen by you within the interdisciplinary project. They will deal with an issue or a topic arising from the semester's national subject element, 'Multi-Storey Building over 3 Storeys'.

The object is for you to enhance your knowledge and competencies in the chosen area and to enhance your methodological and analytical skills and building technology competencies.

The figure below illustrates the respective positions of the SE and PRD in relation to the national subject element.

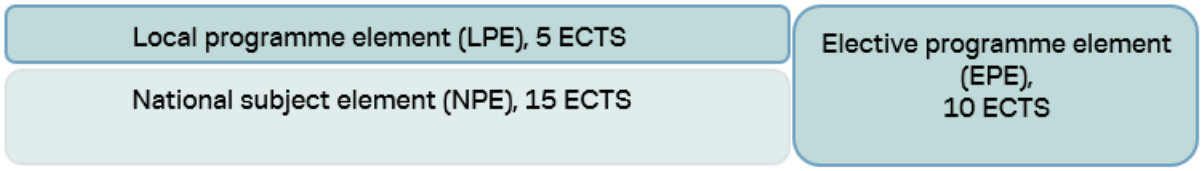

Figure 4: ECTS distribution, Semester 4
Source: curriculum

Problem-based Research Design and Introduction to the Theory of Science for the Construction Industry

In this semester, you must independently write a report based on a topic of your choice within the theme of the semester's national subject element. The report/assignment may be based on your own project documentation. The report is to be prepared following an independent, documented choice and reflection on method and scientific theory. You will be introduced to the work by your supervisors and will be allocated a supervisor. The report is to be submitted on WISEflow as indicated in the semester timetable. The learning objectives and content of the elective are detailed in the institutional part of the curriculum, in Section 9, Local Programme elements (9.2, Problem-based Research Design and Introduction to the Theory og Science for the Construction Industry (4th semester).

Specialization Element

The student must complete a Specialization element (SE) in Semester 4. The student must bring to the Specialization element the knowledge gained from the subject areas of the programme. Figure 4 shows when in the semester the element is taken. The format is self-study, possibly interspersed with individual presentations and facilitative supervision. The learning objectives and content of the Local programme element are detailed in the institutional part of the curriculum, in Chapter 9.5, *Specialization Elements (SEs)*.

The Specialization element runs in parallel with the National subject element and is integrated into the same case study. The knowledge and skills gained will thus be implemented in the National subject element of the semester.

The student chooses one of the following main topics, which will be tailored to the National subject element of the semester:

- **Build 4.0**
- **Sustainable Building**
- **Energy-Efficient Building**

A study design (synopsis) is to be prepared on the chosen main topic. The study design is to be prepared at the start of the national subject element's outline proposal. The study design will then be refined in the project work.

Build 4.0
The 'Build 4.0' Local programme element is the student's opportunity to gain an educational specialization in the tools and methods associated with Build 4.0 within structural design/construction management.

'Build 4.0' is the construction sector's version of the fourth industrial revolution. It means digital technologies, tools and methods that promote optimization in construction through automation. 'Build 4.0' thus encompasses the use of new technology and digitalization in the building and civil engineering sector.

The student will be able to extend his or her knowledge, skills and competencies in sub-elements such as:
- **recording** with digital tools such as scanning and photogrammetry; also data processing;
- **visualization and communication** with digital tools such as Virtual Reality (VR) and Augmented Reality (AR), and digital production technologies such as 3D printing and laser cutting;
- **extended BIM design**, e.g. coordination, structuring, IFC, relevant project platforms, complex 3D building elements and relevant methods associated with other subject areas such as sustainability or renovation;
- **virtual design & construction**: the use of building and site simulation, digital quality assurance and documentation tools etc.;
- **automation, coding and Big Data**, e.g. visual programming, automated construction processes such as robots, and the Internet of Things in operation and maintenance.

Sustainable Building
The 'Sustainable Building' Local programme element is the student's opportunity to gain an educational specialization in sustainable building within structural design/construction management.
The student will gain a deeper understanding of sustainability both as a concept and as regards its importance to each particular building project. Taking a holistic approach, the topic will adopt both a global and a local perspective. Working on the LPE will alert the student to the challenges of the phenomenon from a conversion and development point of view.

The student will be able to extend his or her knowledge, skills and competencies in sub-elements such as:
- the UN Global Goals
- different certification systems
- national, regional and local sustainability strategies
- understanding the historical perspective in Denmark, including earlier focus areas such as energy in the 1970s
- life-cycle assessment/sustainable material selection (LC)
- life-cycle costing/economic sustainability (LCC)
- social sustainability
- the circular economy
- circular building
- circular renovation
- circular design strategies (e.g. design for disassembly)
- circular procurement
- circular/sustainable business models
- sustainable and alternative materials and structures
- sustainable operation and maintenance
- the sustainable building site (energy consumption, waste sorting, recycling etc.)
- legal aspects of sustainability

Energy-Efficient Building

The 'Energy-Efficient Building' Local programme element is the student's opportunity to gain an educational specialization in energy-efficient building within structural design/construction management.
The student will gain a deeper understanding of active and/or passive energy measures both as a concept and as regards their importance to the particular building project.

With the energy requirements of the Building Regulations as a point of departure, the student will be able to extend his or her knowledge, skills and competencies in sub-elements such as:

- energy consumption during building construction
- energy consumption associated with building operation
- lighting technology issues such as daylight and artificial lighting, taking window design and orientation into account
- design of energy solutions and/or energy improvements in the Building Regulations' requirements on energy consumption and energy supply systems
- study of alternative tools used to verify energy needs and energy consumption
- study of how building design affects real energy needs
- estimated calculations on the chosen energy solutions and evaluation of their validity
- alternative heating needs and types
- energy needs for ventilation

ANNEX 1

SUBJECT-BASED INTERPRETATION OF LEARNING OBJECTIVES

This annex presents an indicative interpretation of parts of the Semester 4 learning objectives of the curriculum in relation to the individual subjects. The interpretation may help you gain a concrete understanding of some of what is expected, but it does not give an exhaustive picture of what you must learn during the semester. Indeed, part of what you must learn is interdisciplinary and not amenable to being described within the framework of the individual subjects.

To get a full grasp of what you are expected to learn, you therefore need to read the semester learning objectives in the curriculum. As a student on Semester 4, you have reached a point in your training where you will now be working professionally on your own learning and hence on the pre-requisites for acquiring knowledge, skills and competencies.

Overview of learning objectives supported by instruction in the individual subjects

Building design (BDS)
The Building design subject comprises the Architecture and Building Design, Building Construction and Materials Science elements.

Architecture and Building Design (ABD)
Knowledge
The student shall possess development-based knowledge of:
- and be able to understand the methods and practice of the discipline as they relate to the National subject element of the semester;
- the history and tradition of multi-storey building;
- the industry's focus on sustainability and industrialization;
- sustainable building, including the effect of architecture and design on energy consumption.

Skills
The student shall be able to:
- show proficiency in sketching as a design and layout tool;
- assess and design multi-storey buildings, including sketching and analysing floor layouts encapsulating form, function and architectural qualities.

Building Construction (BCN)
Knowledge
The student shall possess development-based knowledge of:
- and be able to understand and reflect on methods and techniques for planning and designing the sketching and structural design phases in modern multi-storey residential building construction;
- and be able to understand and reflect on complex industrialized building elements and their integration in modern multi-storey residential buildings;
- and be able to understand and reflect on the principles of building physics;
- sustainable, energy-efficient multi-storey residential buildings, including the effect on energy loss of building structures and the design of details;
- analogue and digital tools in the design and communication of building works.

Skills
The student shall be able to:
- show proficiency in work methods for preparing an outline proposal/competition design on the basis of a supplied design brief;

- show proficiency in work methods for preparing a preliminary design including issue identifications, analyses, sketching, digital building information modelling and data collection, taking account of sustainability aspects and of operation and maintenance;
- master complex construction industry problems;
- evaluate and design details from a holistic perspective;
- use sketching and digital building information models to communicate designs.

Materials Science (MAT)
Knowledge
The student shall possess development-based knowledge of:
- and be able to understand the use of materials in relation to the National subject element of the semester, with emphasis on energy-efficient, sustainable and industrialized products and elements;
- matters concerning new building materials;
- and be able to understand the incorporation of materials into structures, their function and performance in relation to use, including relevant buildings;

Skills
The student shall be able to:
- show proficiency in the preparation of material analyses;
- evaluate and document material choices;
- show proficiency in compiling a content journal;
- show proficiency in material descriptions and communicate via a digital information model.

Structural design (STD)
Knowledge
The student shall possess development-based knowledge of:
- how stability is achieved in multi-storey building;
- and be able to understand and reflect on geotechnics and foundation engineering;
- and be able to understand and reflect on table look-up and estimated calculation of industrialized concrete structures;
- in-situ concrete structures.

Skills:
The student shall be able to:
- evaluate, substantiate and communicate the static system;
- evaluate and substantiate all relevant loads;
- evaluate and substantiate the most suitable industrially produced building elements, including consideration of sustainability in relation to installation and production on the basis of the static design;
- apply general geotechnical concepts;
- evaluate issues around the integration of industrialized staircase and balcony elements with the main building;
- evaluate and select relevant property data concerning static requirements in the BIM model;
- carry out collision and consistency checks on drawing extracts.

Building services (BSE)
Examples of learning objectives supported by BSE content:

Knowledge
The student shall possess development-based knowledge of:
- the most important requirements on building services and pathways, and be able to reflect on them;
- the most important building physics requirements, and be able to reflect on them;
- the most important indoor (including atmospheric, acoustic and thermal) climate and daylight requirements;
- the most important energy requirements and how they affect building geometry and design;
- the most important supply cables/pipelines.

Skills
The student shall be able to:

- analyse, lay out and position typical service installations and pathways;
- analyse, dimension and evaluate space requirements for a ventilation system;
- analyse indoor (including atmospheric, acoustic and thermal) climate and daylight requirements;
- analyse energy requirements in connection with energy framework calculation;
- use data on typical supply cables/pipelines.

Building Planning and Management (BPM)
Examples of learning objectives supported by BPM content:

Knowledge
The student shall possess development-based knowledge of:
- requirements, laws and regulations applicable to state-subsidized building and social housing construction;
- and be able to understand types of procurement procedure and contract, and to reflect on the semester's chosen contract type, design and build contracting and relevant award criteria;
- project organization and the roles of the parties in a design and build contract;
- the interaction and relationships between authorities, users, client, design and build contractor, consultant and subcontractors;
- the BIM model's integration options as management tools;
- the quality assurance of structural design work, including scrutiny at phase transition in accordance with the Danish Association of Architectural Firms' guidelines;
- and be able to understand principles of building site layout based on the requirements of the Working Environment Act;
- planning, execution and management methods for engineering works.

Skills
The student shall be able to:
- use systematic data collection to prepare descriptions relating to the case study;
- assess the project budget using parts of the ABC subsidized building form;
- follow up his/her work and the work of the group, and use this as a basis for fee calculation and time recording;
- use and show proficiency in successive calculation in connection with the semester's chosen contract type;
- use and show proficiency in the skills associated with the design of multi-storey buildings within the framework applicable to state-subsidized construction;
- use quantity take-offs from a BIM model for calculations, and use them for building element calculation in the final design phase;
- use and show proficiency in life-cycle costing and life-cycle cost considerations;
- use and show proficiency in network planning and network diagrams for multi-storey residential buildings and put this into a Gantt chart;
- use and show proficiency in skills associated with organizing and planning the construction of a building;
- substantiate and select potential solutions when preparing draft construction site plans;
- communicate the student's own/the consultant's and the design & build contractor's organization and conditions in relation to the overall project organization.

Communication (COM)
Examples of learning objectives supported by COM content

Knowledge
The student shall possess development-based knowledge of:
- and be able to apply and reflect on communication theories and dissemination methods, including digital media.

Skills
The student shall be able to:

- communicate chosen methods and technical solutions to relevant partners;
- analyse and understand communication issues in interdisciplinary collaboration;
- Portfolio.

Theory of Science (TS)
Examples of learning objectives supported by TS content:

Knowledge
The student shall possess knowledge of:
- and be able to understand the role of structural surveys as a fundamental part of the way the building industry operates;
- and be able to understand the most fundamental and relevant concepts in the theory of science.

Skills
The student shall be able to:
- show proficiency in data collection, analyse and describe a specific construction industry topic so that it can be the basis of further technical elaboration;
- use collected data according to scientifically based principles to illuminate a self-chosen construction industry topic or to tackle a specific construction industry task;
- evaluate and substantiate data collection methods;
- communicate reports in the scientific genre using comprehensible written language.