BOUWKUNDE

DEPARTMENT OF THE BUILT ENVIRONMENT

EINDHOVEN UNIVERSITY OF TECHNOLOGY

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REPORT ON THE BACHELOR'S PROGRAMME ARCHITECTURE, URBANISM & BUILDING SCIENCES AND THE MASTER'S PROGRAMME ARCHITECTURE, BUILDING & PLANNING OF EINDHOVEN UNIVERSITY OF TECHNOLOGY

This report takes the NVAO's Assessment Framework for Limited Programme Assessments as a starting point (September 2016).

ADMINISTRATIVE DATA REGARDING THE PROGRAMMES

Bachelor's programme Architecture, Urbanism & Building Sciences

Dutch name of the programme:	B Bouwkunde
International name of the programme:	B Architecture, Urbanism & Building Sciences
CROHO number:	56951
Level of the programme:	bachelor's
Orientation of the programme:	academic
Number of credits:	180 EC
Location(s):	Eindhoven
Mode(s) of study:	full time
Language of instruction:	English
Submission deadline NVAO:	01/05/2019

Master's programme Architecture, Building & Planning

Name of the programme:	M Architecture, Building and Planning
CROHO number:	60434
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	Architectural Urban Design and Engineering Architectural Urban Design and Engineering - qualified to register as an architect Architectural Urban Design and Engineering - qualified to register as an urban designer Architectural Urban Design and Engineering - qualified to register as an architect and urban designer Building Physics and Services Structural Design Urban Systems & Real Estate
Location(s):	Eindhoven
Mode(s) of study:	full time
Language of instruction:	English
Submission deadline NVAO:	01/05/2019

The visit of the assessment panel Bouwkunde to the Department of the Built Environment of Eindhoven University of Technology took place on 28 and 29 November 2018.

ADMINISTRATIVE DATA REGARDING THE INSTITUTION

Name of the institution:	Eindhoven University of Technology
Status of the institution:	publicly funded institution
Result institutional quality assurance assessment:	positive

COMPOSITION OF THE ASSESSMENT PANEL

The NVAO has approved the composition of the panel on 30 July 2018. The panel that assessed the bachelor's programme Architecture, Urbanism & Building Sciences and the master's programme Architecture, Building & Planning consisted of:

- Prof. dr. ir. arch. A. (André) Loeckx, emeritus professor of Architecture and Urbanism at the Faculty of Engineering (Department of Architecture) of KU Leuven (chair);
- Ir. M.E. (Madeleine) Maaskant, director of the Academy of Architecture of the Amsterdam University of the Arts;
- Prof. dr. ir. L. (Luc) Taerwe, emeritus professor in Structural Engineering, pro dean of the Faculty of Engineering and Architecture of Ghent University;
- Prof. dr. W.G.M. (Willem) Salet, emeritus professor Urban and Regional Planning at the University of Amsterdam;
- Ir. J. J. W. (Jorien) Cousijn, Alumnus Master's programme Architecture, Urbanism and Building Sciences at Delft University of Technology (student member);

The panel was supported by Dr. M.J. (Marijn) Hollestelle, who acted as secretary.

WORKING METHOD OF THE ASSESSMENT PANEL

The site visit to the bachelor's programme Architecture, Urbanism & Building Sciences and the master's programme Architecture, Building & Planning at the Department of the Built Environment of Eindhoven University of Technology was part of the cluster assessment Bouwkunde. Between 26 and 30 November 2018 the panel assessed 6 programmes at two universities. The following universities participated in this cluster assessment: Delft University of Technology and Eindhoven University of Technology.

On behalf of the participating universities, quality assurance agency QANU was responsible for logistical support, panel guidance and the production of the report. P. (Peter) Hildering, MSc., was project coordinator for QANU. Dr. M.J. (Marijn) Hollestelle acted as secretary in the cluster assessment.

During the site visit at Eindhoven University of Technology, the panel was supported by Dr. M.J. (Marijn) Hollestelle, a certified NVAO secretary.

Panel members
The members of the assessment panel were selected based on their expertise, availability and independence. The panel consisted of the following members:

- Prof. dr. ir. arch. A. (André) Loeckx, emeritus professor of Architecture and Urbanism at the Faculty of Engineering (Department of Architecture) of KU Leuven (chair);
- Ir. M.E. (Madeleine) Maaskant, director of the Academy of Architecture of the Amsterdam University of the Arts;
- Prof. dr. ir. L. (Luc) Taerwe, emeritus professor in Structural Engineering, pro dean of the Faculty of Engineering and Architecture of Ghent University;
- Prof. dr. W.G.M. (Willem) Salet, emeritus professor Urban and Regional Planning at the University of Amsterdam;

- Ir. J. J. W. (Jorien) Cousijn, Alumnus Master's programme Architecture, Urbanism and Building Sciences at Delft University of Technology (student member);
- C. (Claudia) Graafland, Master's student Architecture, Building and Planning at Eindhoven University of Technology (student member).

The assessment panel to the Department of the Built Environment of Eindhoven University of Technology consisted of the following members:
- Prof. dr. ir. arch. A. (André) Loeckx (chair);
- Ir. M.E. (Madeleine) Maaskant;
- Prof. dr. ir. L. (Luc) Taerwe;
- Prof. dr. W.G.M. (Willem) Salet;
- J.W. (Jorien) Cousijn (student member).

Preparation
On 10 September 2018, the panel chair was briefed by QANU on his role, the assessment framework, the working method, and the planning of site visits and reports. A preparatory panel meeting was organised on 25 November 2018. During this meeting, the panel members received instruction on the use of the assessment framework. The panel also discussed their working method and the planning of the site visits and reports.

The project coordinator composed a schedule for the site visit in consultation with the Faculty. Prior to the site visit, the Faculty selected representative partners for the various interviews. See Appendix 4 for the final schedule.

Before the site visit to Eindhoven University of Technology, QANU received the self-evaluation reports of the programmes and sent these to the panel. A thesis selection was made by the panel's chair and the project coordinator. The selection existed of 15 theses and their assessment forms for the programmes, based on a provided list of graduates between January 2017 – July 2018. A variety of topics and tracks and a diversity of examiners were included in the selection. The project coordinator and panel chair assured that the distribution of grades in the selection matched the distribution of grades of all available theses.

After studying the self-evaluation report, theses and assessment forms, the panel members formulated their preliminary findings. The secretary collected all initial questions and remarks and distributed these amongst all panel members.

At the start of the site visit, the panel discussed its initial findings on the self-evaluation reports and the theses, as well as the division of tasks during the site visit.

Site visit
The site visit to Eindhoven University of Technology took place on 28 and 29 November 2018. Before the site visit, the panel studied the additional documents provided by the programmes. An overview of these materials can be found in Appendix 5. The panel conducted interviews with representatives of the programmes: students and staff members, the programme's management, alumni and representatives of the Board of Examiners.

The panel used the final part of the site visit to discuss its findings in an internal meeting. Afterwards, the panel chair publicly presented the panel's preliminary findings and general observations.

Consistency and calibration
The consistency of assessment within the cluster was ensured by the panel, that (except the student members) consisted of the same panel members for both site visits at Delft and Eindhoven University of Technology. Also, the coordinator was present at the start of all site visits as well as the panel discussion leading to the preliminary findings at the site visits of Delft University of Technology and Eindhoven University of Technology.

Report
After the site visit, the secretary wrote a draft report based on the panel's findings and submitted it to the project coordinator for peer assessment. Subsequently, the secretary sent the report to the panel. After processing the panel members' feedback, the project coordinator sent the draft report(s) to the Faculty in order to have it/these checked for factual irregularities. The project coordinator discussed the ensuing comments with the panel's chair and changes were implemented accordingly. The report was then finalised and sent to the Faculty and University Board.

Definition of judgements standards
In accordance with the NVAO's Assessment framework for limited programme assessments, the panel used the following definitions for the assessment of both the standards and the programme as a whole.

Generic quality
The quality that, in an international perspective, may reasonably be expected from a higher education Associate Degree, Bachelor's or Master's programme.

Unsatisfactory
The programme does not meet the generic quality standard and shows shortcomings with respect to multiple aspects of the standard.

Satisfactory
The programme meets the generic quality standard across its entire spectrum.

After deliberation, the programme management of the programmes within the Bouwkunde cluster (Delft and Eindhoven University of Technology), together with the panel Bouwkunde, decided to use the judgements 'Unsatisfactory' and 'Satisfactory' for the assessment of the standards, and to abstain from the judgements 'good' and 'excellent' for the assessment of the standards.

SUMMARY JUDGEMENT

Bachelor's programme Architecture, Urbanism & Building Sciences

Intended learning outcomes
The panel established that the ILOs of the programme are adequate in terms of level and orientation. They are profoundly formulated and geared towards the expectations of the professional field. The programme has a clear profile within the field of the built environment. The goals and aims are well-suited to produce competent experts of the built environment. The strong integration of research and design orientation in all parts of the AUBS programme is a remarkably strong asset. The programme makes a coherent choice to use a multidisciplinary approach towards the field of the built environment, treating associated disciplines such as architecture and urbanism in a multidisciplinary way rather than as autonomous disciplines.

Teaching-learning environment
The panel concludes that the programme has adequately translated its intended learning outcomes into a coherent curriculum. The programme uses diverse teaching methods such as lectures, work groups, and projects, suited to the learning objectives from the different courses. The combination of group work and individual work is balanced, and prepares students for their work in a future professional setting. The teaching staff is well-qualified, and also includes teachers with professional experience. They are very involved with the students, although the panel is worried about their workload and recommends that the programme management keep investigating methods to reduce this. Students are guided well during their studies and are able to shape the programme to their preferences. They experienced the programme as challenging, but manageable. The facilities of the programme are adequate, although the panel advises the programme management to closely monitor their availability with regard to the influx of new students.

The bachelor's programme is coherent and has a broad basis as well as the opportunity for specialization in the four profiles. The combination of a broad foundation with a deepening elective is a positive aspect in the panel's opinion, and the interdisciplinary focus on theory and reality, architecture and technology, gives a clear and ambitious perspective to the programme. The panel advises the programme management to investigate how terminology and skills in relation to the Dutch professional field could be incorporated in the current English language programme.

With regard to the multidisciplinary focus of the curriculum of the programme, the panel recommends to ensure that a sufficient presence is guaranteed for disciplinary components, including theory, history and criticism of the separate disciplines of architecture and urbanism. The panel acknowledges and supports the fact that reflective and disciplinary elements about architecture and urbanism are already present in several programme components. Nevertheless the panel recommends to expand, gather, contextualize and debate these elements in specialized courses, seminars, assignments, partly compulsory, mostly on elective base. Also, the panel recommends to stress the importance of reflective and disciplinary investigation in the framing of the thesis. In addition, the panel recommends the programme to strengthen the attention paid to design by enlarging the scope and objectives of design which at present have a dominant technological framing, including for instance to aesthetics, stylistics and typology. The panel stresses that these recommendations are a matter of readjustment; they are not meant as an appeal to reduce the design-and-technology vocation of the programme but, on the contrary, to broaden the vocation of technology by emphasizing its cultural and societal impact.

Assessment
The programme makes use of an elaborate assessment policy and framework, including a coherent and well-designed set of criteria, rubrics and forms that are in line with the intended learning outcomes, enhance transparency and reliability, and guarantee personal feedback to the large number of students. The assessment methods in use are versatile and fit the goals of the respective courses. The programme has a solid system in place for assessing the bachelor's theses. The

assessment forms for the theses are sufficient to transparently assess the qualities as defined by the ILO's. The panel thinks that written feedback, that synthesizes the comments that are merely orally given by tutors and examiners, could not only be beneficial to further clarify the grade awarded but also help to evaluate the student's achievement in terms of content, concepts, and choices and to situate these in a broader context of challenges and transitions in technology and design. The Board of Examiners is operating actively and adequately to safeguard that the assessment remains at a high level.

Realized learning outcomes
Based on the quality of the theses and the interviews with alumni, the panel concluded that graduates of the bachelor's programme AUBS master the intended learning outcomes and, after completing their master's programme, are sufficiently skilled to work in the field of the built environment, in both an academic and professional setting. The bachelor's theses are of a high level technically, but could be improved in terms of design and in their reference to the discipline of architecture and urbanism. The panel recommends that the programme consider to aim higher in these two aspects in order to deliver more balanced professionals and a wider range of future researchers and academics, however without weakening the technological DNA of the programmes.

Master's programme Architecture, Building & Planning

Intended learning outcomes
The panel established that the ILOs of the programme are adequate in terms of level and orientation. They are profoundly formulated and geared towards the expectations of the professional field. The programme has a clear profile within the field of the built environment. The goals and aims are well-suited to produce competent experts of the built environment. The strong integration of research and design orientation in all parts of the ABP programme is a remarkably strong asset. The programme makes a coherent choice to use a multidisciplinary approach towards the field of the built environment, treating associated disciplines such as architecture and urbanism in a multidisciplinary way rather than as autonomous disciplines.

Teaching-learning environment
The panel concludes that the programme has adequately translated its intended learning outcomes into a coherent curriculum. The programme uses diverse teaching methods such as lectures, work groups, and projects, suited to the learning objectives from the different courses. The combination of group work and individual work is balanced, and prepares students for their work in a future professional setting. The teaching staff is well-qualified, and also includes teachers with professional experience. They are very involved with the students, although the panel is worried about their workload and recommends that the programme management keep investigating methods to reduce this. Students are guided well during their studies and are able to shape the programme to their preferences. They experienced the programme as challenging, but manageable. The facilities of the programme are adequate, although the panel advises the programme management to closely monitor their availability with regard to the influx of new students.

The choice to shape the programme with four main specializations, with the possibility to choose specialisation electives, is a strong design and also establishes a strong connection with the bachelor's programme AUBS. The programme has 'register specializations' which constitute a necessary condition for registration as an architect, urban designer or both in the Dutch Register of Architects. Students are adequately prepared for their future field of employment through an internship and career preparation events.

With regard to the multidisciplinary focus of the curriculum of the programme, the panel recommends to ensure that a sufficient presence is guaranteed for disciplinary components, including theory, history and criticism of the separate disciplines of architecture and urbanism. The panel acknowledges and supports the fact that reflective and disciplinary elements about architecture and

urbanism are already present in several programme components. Nevertheless the panel recommends to expand, gather, contextualize and debate these elements in specialized courses, seminars, assignments, partly compulsory, mostly on elective base. Also, the panel recommends to stress the importance of reflective and disciplinary investigation in the framing of the thesis. In addition, the panel recommends the programme to strengthen the attention paid to design by enlarging the scope and objectives of design which at present have a dominant technological framing, including for instance aesthetics, stylistics and typology. The panel stresses that these recommendations are a matter of readjustment; they are not meant as an appeal to reduce the design-and-technology vocation of the programme but, on the contrary, to broaden the vocation of technology by emphasizing its cultural and societal impact.

Assessment
The programme makes use of an elaborate assessment policy and framework, including a coherent and well-designed set of criteria, rubrics and forms that are in line with the intended learning outcomes, enhance transparency and reliability, and guarantee personal feedback to the large number of students. The assessment methods in use are versatile and fit the goals of the respective courses. The programme has a solid system in place for assessing the master's theses. The assessment forms for the theses are sufficient to transparently assess the qualities as defined by the ILO's. The panel thinks that written feedback, that synthesizes the comments that are merely orally given by tutors and examiners, could not only be beneficial to further clarify the grade awarded but also help to evaluate the student's achievement in terms of content, concepts, and choices and to situate these in a broader context of challenges and transitions in technology and design. The Board of Examiners is operating actively and adequately to safeguard that the assessment remains at a high level.

Realized learning outcomes
Based on the quality of the theses and the interviews with alumni, the panel concluded that graduates of the bachelor's programme AUBS and the master's programme ABP master the intended learning outcomes and are sufficiently skilled to work in the field of the built environment, in both an academic and professional setting. Both the bachelor's and master's theses are of a high level technically, but could be improved in terms of design and in their reference to the discipline of architecture and urbanism. The panel recommends that the programmes consider to aim higher in these two aspects in order to deliver more balanced professionals and a wider range of future researchers and academics, however without weakening the technological DNA of the programmes.

After deliberation, the programme management of the programmes within the Bouwkunde cluster (Delft and Eindhoven University of Technology), together with the panel Bouwkunde, decided to use the judgements 'Unsatisfactory' and 'Satisfactory' for the assessment of the standards, and to abstain from the judgements 'good' and 'excellent'. As a result, the panel assesses the standards from the Assessment framework for limited programme assessments in the following way:

Bachelor's programme Architecture, Urbanism & Building Sciences

Standard 1: Intended learning outcomes	satisfactory
Standard 2: Teaching-learning environment	satisfactory
Standard 3: Assessment	satisfactory
Standard 4: Achieved learning outcomes	satisfactory
General conclusion	satisfactory

Master's programme Architecture, Building & Planning

Standard 1: Intended learning outcomes	satisfactory
Standard 2: Teaching-learning environment	satisfactory
Standard 3: Assessment	satisfactory
Standard 4: Achieved learning outcomes	satisfactory
General conclusion	satisfactory

The chair, Prof. dr. ir. arch. A. (André) Loeckx, and the secretary, Dr. M.J. (Marijn) Hollestelle, of the panel hereby declare that all panel members have studied this report and that they agree with the judgements laid down in the report. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: 24 April 2019

DESCRIPTION OF THE STANDARDS FROM THE ASSESSMENT FRAMEWORK FOR LIMITED PROGRAMME ASSESSMENTS

Standard 1: Intended learning outcomes
The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

Findings
The bachelor's programme in Architecture, Urbanism and Building Sciences (AUBS) and the master's programme in Architecture, Building and Planning (ABP) at Eindhoven University of Technology (TU/e) are offered by the Department of the Built Environment. The department also offers a master's programme Construction Management & Engineering, which is assessed elsewhere. The department is primarily oriented towards the technology of building and technological solutions that contribute to the cultural dimension of the built environment. The undergraduate programmes of TU/e are organised in the TU/e Bachelor College (since 2012), and the graduate programmes are organised in the TU/e Graduate School (since 2015).

The start of the Bachelor College at TU/e in 2012 was accompanied by a redesign of all educational programmes. In the new structure, students are able to choose how to construct their programme, either going in depth or broadening their knowledge. The *bachelor's programme AUBS* (180 EC) is designed to educate so-called T-shaped engineers, who have a broad basis combined with in-depth knowledge in the field of Architecture, Urbanism and Building Sciences. They are mainly involved in analysis and are expected to be able to address research and design questions of low complexity. The broad base is anchored in the integration of different knowledge domains, which allows them to understand the multidisciplinary nature of the built environment. Graduates have the capacity to apply this instrumentation and knowledge in a professional approach to solve problems – design and research based – and to communicate solutions. Students can choose a profile in line with their individual preferences, when aiming to prepare for connected specialisations in the master's programme ABP (or the master's programme Construction Management & Engineering): Building Physics & Services (BPS), Structural Design (SD), Architectural Urban Design and Engineering (AUDE), and Urban Systems & Real Estate (USRE).

The *master's programme ABP* (120 EC) aims to raise the student's bachelor's level, which includes the capability of doing research, to an expert level under the guidance of a scientific staff member. Its graduates are able to design and carry out design and research projects independently to an expert level. The programme is focused on the scientific education of the students, allowing them to become a specialist in one of the domain-specific disciplines - Building Physics & Services (BPS), Structural Design (SD), Architectural Urban Design and Engineering (AUDE), and Urban Systems & Real Estate (USRE) - while at the same time acquiring substantial knowledge of the other domain-specific disciplines. Upon completion of the master's programme ABP, the graduates are able to work and think independently at an academic master's level as engineers, designers and researchers. They can pursue a professional or academic career and have the capacity to conduct research and design independently to solve complex (societal) problems while taking other disciplines into account. They also have the learning and academic skills required to enrol in a PhD programme.

The panel is positive about the mission and goals of both programmes. The bachelor's programme shows a clear focus on educating engineers with a broad basis combined with in-depth knowledge in the field of Architecture, Urbanism and Building Sciences. The master's programme is focused on educating students to design and carry out design and research projects independently at an expert level, becoming a specialist in one of the domain-specific disciplines - Building Physics & Services (BPS), Structural Design (SD), Architectural Urban Design and Engineering (AUDE), and Urban Systems & Real Estate (USRE) - while at the same time acquiring substantial knowledge of the other domain-specific disciplines. Based on interviews with students and alumni, the panel concluded that this focus is widely recognized and shared.

The programme has good ties with the professional field, and uses them to align its goals with the expectations of potential employers of graduates. In reviewing the self-evaluation document and speaking with management and teachers, the panel concluded that the programme aims to educate engineers in the field of the built environment with a broad multidisciplinary background in the bachelor and a specialisation in the master. The choice for a research and design orientation, as well as the ratio of theory to practice, is very convincing. The strong integration of research and design orientation in all parts of the AUBS and ABP programmes is a remarkably strong asset according to the panel, including in international comparison.

Intended learning outcomes
The goals of the bachelor's programme AUBS and master's programme ABP are summarized in intended learning outcomes (ILOs), comprised of criteria covering knowledge, skills, and academic attitude, which are listed in Appendix 2. The panel studied their level, orientation and content. It valued the distinction made in the ILOs between design, research and science in the disciplines acknowledged by the programmes. It concluded that the ILOs are clearly linked to the Dublin descriptors. This was demonstrated in an overview presented to the panel in which the goals of each of the programmes are shown to be linked with the 4TU Criteria for Academic Bachelor's and Master's Curricula (the Meyers criteria), which cover the Dublin descriptors. As a result, for the bachelor's programme AUBS, the bachelor's level and academic orientation are adequately visible in the ILOs, and for the master's programme ABP, the master's level and academic orientation are adequately visible. The ILOs are clearly described and constitute a solid link with the research and design content of the field of the built environment.

The panel understands that in the intended learning outcomes formulated by both programmes, architecture and urbanism are considered as practices of research and design that contribute towards grasping the multidisciplinary nature of the built environment and solve its problems, practices that intend to be in line with the expectations of the academic and the professional field. This is a coherent choice whereby consequently less attention can be spend on architecture and urbanism as an autonomous discipline with its own history, theories, criticism, paradigms, cases, personalities, practices, modes of research, and with an extended literature covering that discipline.

The panel observed that the ILOs tie in with the level and orientation of the programmes; they are geared to the expectations of the professional field, the discipline (as acknowledged by the programmes), and international requirements. Specific learning outcomes of the programme tie in with the European standards for architects.

Considerations
The panel established that the ILOs of the programmes are adequate in terms of level and orientation. They are profoundly formulated and geared towards the expectations of the professional field. The programmes each have a clear profile within the field of the built environment. Their goals and aims are well-suited to produce competent experts of the built environment. The strong integration of research and design orientation in all parts of the AUBS and ABP programmes is a remarkably strong asset. The programmes make a coherent choice to use a multidisciplinary approach towards the field of the built environment, treating associated disciplines such as architecture and urbanism in an multidisciplinary way rather than as autonomous disciplines.

Conclusion
Bachelor's programme Architecture, Urbanism & Building Sciences: the panel assesses Standard 1 as 'satisfactory'.

Master's programme Architecture, Building & Planning: the panel assesses Standard 1 as 'satisfactory'.

Standard 2: Teaching-learning environment
The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Findings

Curriculum of the bachelor's programme AUBS
The bachelor's programme AUBS is an English-language programme consisting of 180 EC, and comprises a propaedeutic phase (60 EC) and a post-propaedeutic phase (120 EC). Each year is worth a total of 60 EC, comprising obligatory basic and major study components as well as electives. The program concludes with a bachelor's graduation project known as the Bachelor's End Project (BEP).

The bachelor's programmes within the Bachelor College all have the same structure, consisting of four main components: major (90 EC); basic courses (30 EC); User, Society and Enterprise courses (USE, 15 EC); and electives (45 EC). All Bachelor College programmes share a number of topics/skills in the form of the university-wide basic courses (30 EC that underpin the Eindhoven engineering profile). All bachelor's students take five courses (5 EC each), each focusing on generic engineering competencies: Calculus variant A, Applied Physical Sciences, Data Analytics for Engineers, Engineering Design, and a course providing a basis for the USE package and positioning the engineering profession in a societal context, including ethical issues. The remaining 5 EC are assigned to Professional Skills (communication, planning and organizing, reflection, teamwork and dealing with information), which are embedded in various courses over three years. In order to pass these courses, students need to obtain a pass score for professional skills. This presents students with a sufficient basis in academic and engineering skills according to the panel.

The Major (90 EC) represents the field the student would like to work in as an engineer. It is designed to provide a broad basis as an AUBS engineer on the one hand, and a specialization in one profile on the other which best meets the student's personal interests and capacities. The broad basis is provided by mandatory courses (35 EC) covering topics of the B-, A- and U-profiles. The B-profile consists of the project lines Building Physics & Services (BPS) and Structural Design (SD). The A-profile is the Architectural Urban Design and Engineering (AUDE) project line, and the U-profile consists of the project line Urban Systems & Real Estate (USRE). In year two, the students choose one of the three profiles (project line of 55 EC, including the BEP). The projects in year three focus on integration. Students with different profiles are mixed in multidisciplinary design teams and work on an integral design assignment. The programme is concluded with a BEP (10 EC) within the chosen project line. When reading the self-evaluation report and speaking with students and teachers, the panel ascertained a clear profile of the bachelor's programme with coherence between the four profiles. In the third year, the programme creates a horizontal connection between the profiles when students mix in a multidisciplinary project. Vertically, the panel sees a good connection between the bachelor's programme and, for instance, the master's programme ABP.

The panel values the presence of electives in a programme that is set up to provide a foundation for further studies and specialisation. This enables students to adapt the programme to their individual preferences and to start acquiring some more in-depth knowledge and skills with respect to their proposed future specialization, although some students indicate that not all combinations are possible due to scheduling conflicts. To sustain coherence and depth within the electives for all courses in the programme, TU/e has developed 'elective packages' of coherent learning lines of three courses, and a level classification. The courses are classified as introductory (level 1), in-depth (level 2) or advanced (level 3). The panel is convinced that this ensures coherence of the electives with respect to the student's proposed profile. For bachelor students, various Honours tracks have been launched (30 EC on top of the regular program), addressing major societal and scientific questions and challenges. They get the chance to work together with students from other departments, to meet inspiring coaches, to explore state-of-the art knowledge on topics such as sustainability, and to meet with people from industry. They have the choice to dive into their own discipline or explore other ones.

In reading the self-evaluation report and speaking with teachers and students, the panel perceived a programme with a very broad curriculum that enables students to become familiar with different disciplines within the built environment. Technology is integrated in all aspects of the programme. This broad set-up, together with the electives in years two and three to deepen their knowledge, enables students to explore their interests and study preference, and builds understanding for fields other than their specialisation. Alumni indicated that this part of their training has been a valuable asset in their professional career. The combination of broad foundation with an elective deepening (also with the possibility to follow parts of other TU/e programmes, outside the built environment) truly yields T-shaped engineers and makes for a good connection with the master's programme ABP. According to the panel, the focus on a broad development is a positive aspect, and the interdisciplinary focus on theory and reality, architecture and technology gives a clear and ambitious perspective to the programme.

The bachelor's AUBS programme clearly articulates a focus upon design, building and technology, whereby also design is strongly oriented towards technology. While an extensive set of university-wide basic courses underpins the Eindhoven engineering profile, courses uncovering the discipline of architecture and urbanism (theory, history, criticism) remain rather limited. This choice fits well within the mission of the Technical University and the ILOs of the AUBS bachelor programme but bears the risk to weaken the contribution of that discipline to the interdisciplinary approach targeted by the AUBS programme.

When studying the curriculum and speaking with students and teaching staff, the panel observed that the attention to the discipline of architecture and urbanism could be strengthened within the programme in comparison to the other specializations. This is for instance supported by remarks in the self-evaluation report, in which the professional field suggested that more attention to the history of architecture is needed. The panel recommends that the programme management ensure that a sufficient amount of architectural theory and criticism as well as architectural and urban history is retained as an essential and foundational part of the programme. It views the ways architecture and urbanism deal with the built environment to be essential for all students, including those in other specializations than architecture.

The panel also feels that design could be addressed more prominently within the programme. Most BEPs and master's theses displayed a focus on engineering aspects, or on design-for-engineering aspects, rather than on broad-spectrum design aspects (see standard 4). The panel believes that a sufficient presence of all aspects of design, including for instance aesthetics, stylistics and typology, is essential for a programme in the field of the built environment, even when that programme is tuned towards engineering and technology. Moreover the panel recommends to stress the importance of reflective and disciplinary investigation in the preparation of the bachelor's end project.

At the same time, the panel realizes that this focus on engineering and technology in the bachelor's programme is partly the result of the mandatory set of university-wide basic courses of the Bachelor College, which, together with a dominant part of the major courses, constitute a substantial part of the early curriculum. This choice makes it rather difficult for the programme to realize a fair amount of courses and programme components in the remainder of the curriculum that would strengthen the presence and scope of design and that would valorise the discipline of architecture and urbanism by programme components such as theory, history and criticism. Therefore the panel recommends to investigate ways and means to strengthen the attention paid to design aspects and to the discipline of architecture and urbanism in the programme, both in electives and in the compulsory part of the programme. The panel realizes that such recommendation touches upon university-wide policies and is therefore partly outside of both the span of this programme assessment and the responsibility of the programme management. It therefore makes a request to the university management to reflect on this situation, and consider a custom-made solution for this programme in regard to the compulsory courses as to give the programme the room required for its non-engineering components of design, architecture and urbanism. At the same time the panel stresses that this would be a matter

of readjustment and does not reduce the design-and-technology vocation of the programme. On the contrary, it would broaden the vocation of technology by emphasizing its cultural and societal impact.

Since 2015, the language of instruction in the bachelor's programme is English as part of its internationalization process. Not all students are fully satisfied with this. Some indicated to the panel that they would like the programme management to reconsider the switch to English because they are missing the use of – and skills in – Dutch terminology which they think they will need in their future career. The panel understands these concerns, as a majority of them will find employment in the predominantly Dutch built environment. It recommends that the programme discuss this issue, and investigate options to give students the opportunity to get familiar with the Dutch terminology and associated skills as part of the programme.

Students indicated to the panel that they are pleased with the current ratio of Dutch and non-Dutch students (2/3 vs 1/3) within the programme, as well as with the diversity of nationalities. The programme management (and the TU/e as a whole) are conscious that the English bachelor's programme is very attractive to foreign students and are thinking about ways to keep a functional ratio to profit from the international classroom without losing the Dutch nature of the programme. The panel is pleased that the programme is aware of this and thinks the current Dutch/non-Dutch student ratio and the diversity of nationalities is fitting for this programme.

Curriculum of the master's programme ABP
The master's programme ABP is an English-language programme consisting of 120 EC. The core courses form the basis of a master student's personalized study program focusing on one of the four main specializations within the programme: Building Physics & Services (BPS), Structural Design (SD), Architectural Urban Design and Engineering (AUDE), and Urban Systems & Real Estate (USRE). Students follow the core courses of their specialization in their first year, ranging from 15 to 55 EC. They also choose specialization electives providing in-depth knowledge. Free electives complete the course programme. These free electives can be followed within the university's Graduate School but also at other local and international universities. In the second year of the programme, students can choose an optional internship alongside electives, and complete their curriculum with a graduation project resulting in a master's thesis (45 EC). The panel concluded that the core courses, specialization electives and free electives adequately reflect the programme's intended learning outcomes, and prepare students to successfully complete their graduation project. The core courses of each specialization are related to each other and present a coherent curriculum, which is further safeguarded by the Board of Examiners, which checks individual study programmes for coherence.

The master's programme ABP offers the possibility of internships (including international ones), which provide students with the opportunity to orient themselves in professional fields or at a partner university abroad. The internship is a recent addition to the programme, which is commends by the panel, as alumni of the APB master felt the previous absence of an internship as a gap in the programme. The students were pleased with this opportunity, but some found the room offered within the free electives for internships and/or international experiences rather limited. The panel was pleased to learn that other career preparation components were recently added to the programme, such as coaching and career orientationand MyFuture, to prepare students for their future field of employment.

Within the AUDE specialization, the programme has three so-called 'register specializations'. They constitute a necessary condition for registration as an architect, urban designer or both in the Dutch Register of Architects. It is also possible to obtain additional master's certificates. Excellent students can follow the TU/e Honours Academy, which offers 20 EC on top of the master's programme ABP programme, focussing either on 'excellence for science', 'excellence for society' or 'excellence for industry'.

For the master's programme ABP, the panel repeats the comment made at the bachelor's programme AUBS concerning the scope and objectives of design. The focus on engineering aspects, or on design-

for-engineering aspects, could be broadened towards design aspects such as typology, stylistics and aesthetics. The panel believes that keeping a broad-spectrum view on design, is essential for a master's programme in the field of the built environment, even when that programme is tuned towards engineering and technology.

The panel observed that the programme has reflective courses that deal with the discipline of architecture and urbanism, such as architectural history or architecture and philosophy, but they are relatively few in number. As mentioned already in the discussion concerning the bachelor's programme, the professional field also stressed that more focus could be placed on courses like architectural history. In speaking with teachers and students, the panel learned that already many elements uncovering the discipline of architecture and urbanism are found throughout the courses. For instance, the course on concrete opens with the history of the material. Although the panel values that aspects of theory, history and criticism penetrate the whole programme, it recommends investigating possibilities to make reflective and disciplinary elements more recognizable, more situated within their paradigmatic and historical context and gathered in appropriate courses. Moreover the panel recommends to stress the importance of reflective and disciplinary investigation in the framing of the master's graduation project or thesis.

Teaching methods
In studying the programme and talking to students and teachers, the panel perceived an adequate diversity in different types of education (lectures, work groups, projects), fitting the learning objectives of the different courses. Lectures consist of problem-oriented design and research assignments. The combination of group work and individual work is balanced, and prepares students for their work in a future professional setting.

Feasibility
At the start of either one of the programmes, students are assigned a staff member as study coach. In the bachelor's programme, student are also assigned a student mentor, a fellow student from an earlier cohort to guide them during their studies. In speaking with students and teachers, the panel affirmed that students are encouraged to play an active part in their own learning process. Students indicated that they experience great freedom to select electives, and can shape their own programme and learning trajectory. The study coach and student mentor help them in choosing their programme.

Students involved in the Educational Committee experienced that their voice is heard by the programme management, and they felt involved in the design of the programme. With regard to the workload, they experienced both programmes as 'challenging'. Part of this can be attributed to the nature of the project work: work can always be improved and is never finished. So while students experienced the workload as high, they always confirmed that it is not excessive. This workload is also not limited to the programmes alone, but is rather a characteristics of the field of the built environment (especially architecture) in general.

Teaching staff
The panel spoke with a teaching staff that is passionate about the teaching and involved in shaping the two programmes. Over half of the lecturers have a UTQ qualification, and this proportion is rising. The hiring policy of the department searches for teachers who are strong in both teaching and research and/or design.

The students are very pleased with the teachers. Many teachers have professional experience, and the students found that this contributes to their knowledge: they are often able to enrich the courses with insights from practice. The teaching staff is very much concerned with helping students, and the students experienced a pleasant atmosphere in the studios. The panel appreciated that the students value the contributions of their teachers.

The panel learned from the student chapter in the self-evaluation report and the student interviews during the site visit that not all teachers are comfortable with teaching in English, most prominently

in the bachelor's programme. According to the students, the proficiency in English has improved among teachers during the last three years, but some teachers still struggle and are not always able to formulate precisely what they mean. Teachers acknowledged in speaking with the panel that the level of the discourse is sometimes a bit lower than it would be if conducted in Dutch. According to TU/e policy, all teachers should master the English language at least to the C1 level, but the programme management mentioned to the panel that they learned from student surveys that C1 does not always guarantee student satisfaction. The management is taking action to improve this, and the panel would like to encourage it to keep doing so.

In the interviews during the site visit, the students unanimously indicated their concern about the workload of teachers in the department. Although they are in general very satisfied with the quality of the teaching, the course material and the efforts teachers make to provide good feedback, they noted that their teachers sometimes have too little time to read student assignments really well, and that they sometimes are not able to make time to address students when they have a problem. Some of the recent changes in the programme have added to their workload, such as the launch of the English bachelor's, for which they had to develop English language course materials. The management and teachers acknowledged the high workload. The programme management is aware of this and is investigating options to improve the situation. For instance, the BE department is involved in a TU/e pilot project that aims to encourage and support lecturers to work with digital assessment, diminishing the workload for correcting exams for the growing student population. The programme management also suggested that blended learning could reduce the workload. The panel has mixed experience with these types of teaching methods in relation to workload, and suggested that the programme management investigate this further before implementing it, while also investigating other options to reduce the workload of the teaching staff.

Facilities
The Vertigo building houses the bachelor's programme AUBS and master's programme ABP. In the building students can use a workshop for visualizing designs in three dimensions. Different high-end facilities are available, such as a laboratory for structural engineering and a 3D concrete printing facility used in research. The panel saw that the workshop utilizes advanced techniques and is adequately equipped to address all regular student needs. Students indicated their worries, however, about the number of students and the capacity of the building, most prominently the availability of work tables and the accessibility of the machines in the workshop, especially after a large influx of bachelor students in the previous year. They described the current situation as manageable, but as having reached its limits. The panel acknowledged this and recommends that the programme carefully monitor the availability of student facilities in relation to student numbers.

Considerations
The panel concludes that both programmes have adequately translated their intended learning outcomes into coherent curricula. The programmes use diverse teaching methods such as lectures, work groups, and projects, suited to the learning objectives from the different courses. The combination of group work and individual work is balanced, and prepares students for their work in a future professional setting. The teaching staff is well-qualified, and also includes teachers with professional experience. They are very involved with the students, although the panel is worried about their workload and recommends that the programme management keep investigating methods to reduce this. Students are guided well during their studies and are able to shape the programme to their preferences. They experienced the programmes as challenging, but manageable. The facilities of the programme are adequate, although the panel advises the programme management to closely monitor their availability with regard to the influx of new students.

With regard to the multidisciplinary focus of the curriculum of both programmes, the panel recommends to ensures that a sufficient presence is guaranteed for disciplinary components of the programme, including theory, history and criticism of the separate disciplines of architecture and urbanism. The panel acknowledges and supports the fact that reflective and disciplinary elements about architecture and urbanism are already present in several programme components in both

programmes. Nevertheless the panel recommends to expand, gather, contextualize and debate these elements in specialized courses, seminars, assignments, partly compulsory, mostly on elective base. Also, the panel recommends to stress the importance of reflective and disciplinary investigation in the framing of the theses of both programmes. In addition, the panel recommends both programmes to strengthen the attention paid to design by enlarging the scope and objectives of design which at present have a dominant technological framing, including for instance aesthetics, stylistics and typology. The panel stresses that these recommendations are a matter of readjustment; they are not meant as an appeal to reduce the design-and-technology vocation of the programme but, on the contrary, to broaden the vocation of technology by emphasizing its cultural and societal impact.

Bachelor's programme AUBS
The bachelor's programme is coherent and has a broad basis as well as the opportunity for specialization in the four profiles. The combination of a broad foundation with a deepening elective is a positive aspect in the panel's opinion, and the interdisciplinary focus on theory and reality, architecture and technology, gives a clear and ambitious perspective to the programme. The panel advises the programme management to investigate how terminology and skills in relation to the Dutch professional field could be incorporated in the current English language programme.

Master's programme ABP
The choice to shape the programme with four main specializations, with the possibility to choose specialisation electives, is a strong design and also establishes a strong connection with the bachelor's programme AUBS. The programme has 'register specializations' which constitute a necessary condition for registration as an architect, urban designer or both in the Dutch Register of Architects. Students are adequately prepared for their future field of employment through an internship and career preparation events.

Conclusion
Bachelor's programme Architecture, Urbanism & Building Sciences: the panel assesses Standard 2 as 'satisfactory'

Master's programme Architecture, Building & Planning: the panel assesses Standard 2 as 'satisfactory'

Standard 3: Student assessment
The programme has an adequate system of student assessment in place.

Findings
To give shape to their assessment policy, the Department of the Built Environment uses the 'Assessment Policy Department of the Built Environment' ('Toetsbeleid Faculteit Bouwkunde 2015') for both the bachelor's and master's programmes, which is derived from the TU/e assessment policy "Assessment Framework" ('Toetskader TU/e 2014'). The departmental policy describes the instruments, procedures and criteria for written and oral exams and individual projects, including graduation projects, and quality assurance of examinations. The panel appreciates that the programme can build on elaborate and feasible assessment documentation.

The philosophy of assessing students is based on a combination of both individual performance and group work, and on a combination of both formative and summative assessment. Care is taken to use assessment methods that are in line with the course designs and integrated with the key issues of student learning. The assessment methods used for the bachelor's programme AUBS and the master's programme ABP are written exams, projects (model, drawings, report), assignments, presentation, oral exams, peer reviews and portfolios. The panel studied an overview of the course work in relation to the assessment methods used, and concluded that the programme uses a versatile balance of different assessment methods, also with respect to formative and summative assessments.

Assessment of the Bachelor's End Project
The bachelor's programme AUBS is concluded with a final project, or Bachelor's End Project (BEP). This individual project takes one semester to complete and accounts for 10 EC. Students should demonstrate that they are individually capable (under supervision) of accomplishing a design and/or research assignment in the field of AUBS. The topics of the BEP are rooted in the three profiles and oriented to the connected specializations in the ABP program. The assessment of the end project is based on the quality of the content and the product, the competences the student has demonstrated during the process, and the quality of the presentation (both written and oral) and discussion during the defence. The project is assessed by at least two qualified examiners. The panel is impressed by the guideline in place for the assessment of the BEP. It studied a number of assessment forms accompanying the end project. It concluded that this form is sufficient to transparently establish the achievements of the end project in accordance with the ILOs. It also observed that written feedback is frequently missing in the assessment of end projects, and advises the programme to enforce the inclusion of this to provide students with a formalized written feedback on their work that they can come back to later. Often good feedback is given in an oral and ad rather ad hoc way by teachers and tutors in the course of the work process or during presentations of the work, A well written feedback would synthesize such orally given feedback, evaluate the work in academic and professional terms, relate it to the ILOs and situate in within the broader context of challenges and transitions faced by the built environment.

Assessment of the master's programme ABP graduation project
The master's programme ABP is concluded with a graduation project, an individually written master's thesis. Students investigate a problem related to the built environment (analysis) and also create a solution (or product) for it. They show they are capable of integrating disciplinary knowledge and skills that they have acquired during the master's program, and that they are able to apply this knowledge to real-world (business) problems. The panel appreciates the 'real-world' focus and the professional orientation of the graduation project. At the same time the panel encourages the programme to reach beyond current practice and business-as-usual, in line with the TU's technological and societal mission and in line with the drive towards innovation one can read in different ILOs and that is certainly present in several graduation projects.

The assessment of the quality of a graduation project is performed by a Graduation Committee, consisting of at least three members. One of the members should not be affiliated with the track and acts as an independent (second) assessor. The chair of the Graduation Committee must be a Full or Associate Professor whose field of competence encompasses the subject of the graduation project. All members of the Graduation Committee carry equal weight in the assessment.

To complete their graduation project, students deliver a thesis report, give a presentation, and defend their thesis in front of the Graduation Committee. The defence is a public event. The final assessment is based on the quality of the content and the product, the competences the student has demonstrated during the process of the graduation project and the quality of the presentation (both written and oral) and discussion at the defence. The quality of the final assessment is checked by one of the members of the Examination Committee. The panel is positive about the graduation committee, the guideline in place for the process of initiating the graduation project and assessing it, and the assessment form in use. Presenting and discussing it with the committee will make for a weighted assessment. The panel studied a number of assessment forms accompanying the thesis. It concluded that this form is sufficient to transparently establish the qualities of the graduation project in accordance with the ILOs.

The panel observed that written feedback is frequently missing on the assessment forms, and advises the programme to enforce the inclusion of this to provide students with a formalized written feedback on their work that they can come back to later and that might offer them cues for their further academic or professional career. Often good feedback is given in an oral and more fragmented way by mentors and assessors in the course of the work process or during defence of the graduation work, However, a well-written feedback would synthesize the main academic and professional

achievements of the graduation project in relation to the programme's ILOs and situate all this within the broader context of challenges and transitions faced by the built environment, challenges and transitions to be dealt with by technology and design.

Board of Examiners (BoE)
The Board of Examiners ensures that the correct procedures, guidelines and criteria of assessment are followed as laid down in the Program and Examination Regulations of the AUBS and ABP programs and in the TU/e Examination Regulations of the Department of the Built Environment. In addition, the BoE receives individual requests from students and makes decisions on a case-by-case basis. It must also approve the composition of the Graduation Committees. It regularly investigates the quality of assessments and master's theses. It has biannual meetings with the Departmental Board to discuss issues and reports to the Dean annually. This consists of an overview of its tasks and the way they were carried out in the past year.

In 2014, all learning objectives as well as the intended learning process and the assignments of all courses and projects were redesigned by using appropriate instructional set-ups and forms of assessment that are aligned. Assessment criteria were reviewed and adjusted as necessary, enhancing the reliability and validity of exams. In 2018, a new rubric was approved by the BoE, categorizing the assessment criteria (based on the program's learning outcomes) in the process, product and presentation for both the bachelor's and master's graduation projects. For most projects (including all graduation projects), rubrics have been adopted or are under development. The programme management mentioned that the test blueprints ('Toetsmatrijzen') are used by an increasing number of the teaching staff. The goal of the BoE is to improve their use even further. The panel supports this work in progress and suggests to investigate how not only measurable, formal and procedural criteria can be taken into account but also assessment modes that enable to valuate contents, concepts, choices, reflections, criticisms in a student's work, i.e. aspects that witness a degree of contextual and historical awareness.

The Board actively monitors the quality of the courses, internships and final thesis work. The BoE has installed an Assessment Committee to perform these tasks. Each semester, the Assessment Committee evaluates a selection of courses, bachelor's and master's theses (reports and assessment forms) and internship reports for each program. The BoE decides which member of staff is qualified to examine which course. It also assesses and approves personal study programmes, investigates cases of suspected fraud, and safeguards the relation between the learning objectives of courses, the education methods and the assessment methods. This so-called didactic triangle is checked by the BoE for each course. The Board checks whether every assessment fulfils the criteria of transparency, validity and reliability. The BoE checks if rubrics are used in accordance with the Assessment Policy. The course assessment is evaluated on the basis of the course results. The BoE investigates courses with either very good or very poor results in terms of passing rates. This may lead to advice on the education and assessment methods.

In speaking with the BoE and teachers and students, the panel concluded that the BoE proactively strives to uphold the transparency and measurability of the assessment procedures. Improvement has been made in the use of the criteria, rubrics and assessment forms. The panel is positive about the rubrics in use, which are very useful in guaranteeing transparency and reliability and in providing personal feedback to the large number of students.. The panel encourages the BoE, teachers and students to continue their efforts to improve and refine rubrics, assessment procedures, assessment forms and assessment practices. The Department of the Built Environment recently started implementing *Cirrus*, an online assessment tool. The panel values this as a strengthening of the assessment procedure of the programme, which will minimise the risk of administrative mistakes.

Considerations
The programmes make use of an elaborate assessment policy and framework, including a coherent and well-designed set of criteria, rubrics and forms that are in line with the intended learning outcomes, enhance transparency and reliability, and guarantee personal feedback to the large

number of students The assessment methods in use are versatile and fit the goals of the respective courses. The programmes have a solid system in place for assessing the bachelor's and master's theses. The assessment forms for both the bachelor's and master's theses are sufficient to transparently assess the qualities as defined by the ILO's. The panel thinks that written feedback, that synthesizes the comments that are merely orally given by tutors and examinors, could not only be beneficial to further clarify the grade awarded but also help to evaluate the student's achievement in terms of content, concepts, and choices and to situate these in a broader context of challenges and transitions in technology and design. The Board of Examiners is operating actively and adequately to safeguard that the assessment remains at a high level.

Conclusion
Bachelor's programme Architecture, Urbanism & Building Sciences: the panel assesses Standard 3 as 'satisfactory'.

Master's programme Architecture, Building & Planning: the panel assesses Standard 3 as 'satisfactory'.

Standard 4: Achieved learning outcomes
The programme demonstrates that the intended learning outcomes are achieved.

Findings
To assess the achieved learning outcomes of the programmes, the panel studied a sample of 15 theses for each programme, and interviewed several alumni.

The panel considers the graduation projects for each of the assessed programmes to be of sufficient quality, both in terms of content and structure. The topics are relevant and match the expected level. Graduates have clearly achieved the respective ILOs. Overall, the master's theses and the bachelor's end projects are of a high level. The panel considers the bachelor's theses specifically to be very good in their research orientation. The theses are very good in the area of building technology, but in terms of architecture and design, their level could be improved. The same can be said for most master's theses: they are very good quality in terms of research; the results of these projects are regularly submitted to scientific conferences and published in peer-reviewed journals, but their design aspect could be improved. The panel attributes this to the balance between engineering and design in the curricula of both programmes, which currently leans more towards engineering than design, andthe reduced presence of the discipline of architecture and urbanism, which was discussed under standard 2. The panel thinks that a better presence to the discipline of architecture and urbanism would contribute todeliver more balanced professionals in the built environment and a wider range of potential researchers and future academics. At the same time the panel underlines its admiration and support for the achievements of staff, students and programmes in the fields of technology, scientific research and design-for-technology.

In speaking with the panel, graduates of the master's programme ABP indicated that they feel well prepared for the professional field and have no difficulty finding employment, for instance as project leaders, engineers, architects and policy advisors in architectural firms like OMA, engineering companies like Arcadis, Royal HaskoningDHV, building companies like Ballast Nedam and Heijmans, and governmental agencies like Rijkswaterstaat, housing corporations or the Provincial Development Company (BOM). Of the alumni, 3% enrolled in either a PhD or PDEng programme. Alumni indicated that they feel they have learnt a sufficient amount of knowledge and skills to carry out their current jobs. Graduates mentioned that they obtained a broad basis in the bachelor's programme AUBS, which enabled them to understand and communicate efficiently with colleagues working in different fields of the built environment. Graduates who work as an architect for two years and complete a professional traineeship within that period can register as Architect, Landscape Architect or Urban Designer at the Dutch Register of Architects.

The panel congratulates the programme for these results in terms of alumni's employment opportunities and for their capacities to perform well in the professional field. In the conversations the panel had with the programme's alumni, the alumni showed a drive in their ambitions and early professional performance that is in line with the drive towards innovation visible in the programme's ILOs and the university's technological and societal mission. The panel encourages the programme to keep nurturing this drive and to reach beyond current practice and business-as-usual.

Considerations
Based on the quality of the theses and the interviews with alumni, the panel concluded that graduates of the bachelor's programme AUBS and the master's programme ABP master the intended learning outcomes and are sufficiently skilled to work in the field of the built environment, in both an academic and professional setting. Both the bachelor's and master's theses are of a high level technically, but could be improved in terms of design and in their reference to the discipline of architecture and urbanism. The panel recommends that the programmes consider to aim higher in these two aspects in order to deliver more balanced professionals and a wider range of future researchers and academics, however without weakening the technological DNA of the programmes.

Conclusion
Bachelor's programme Architecture, Urbanism & Building Sciences: the panel assesses Standard 4 as 'satisfactory'.

Master's programme Architecture, Building & Planning: the panel assesses Standard 4 as 'satisfactory'.

GENERAL CONCLUSION

After deliberation, the programme management of the programmes within the Bouwkunde cluster (Delft and Eindhoven University of Technology), together with the panel Bouwkunde, decided to use the judgements 'Unsatisfactory' and 'Satisfactory' for the assessment of the standards, and to abstain from the judgements 'good' and 'excellent'. As a result, the panel assesses Standard 1,2,3 and 4 of the respective programmes as 'satisfactory'.

According to the decision rules of NVAO's Framework for limited programme assessments, the panel assesses the respective programmes as 'satisfactory'.

Conclusion
The panel assesses the *bachelor's programme Architecture, Urbanism & Building Sciences* as 'satisfactory'.

The panel assesses the *master's programme Architecture, Building & Planning* as 'satisfactory'.

APPENDICES

APPENDIX 1: DOMAIN-SPECIFIC FRAMEWORK OF REFERENCE

The domain of the Built Environment programs was set out by the Deans of the Department of the Built Environment of the TU/e and TUD. This was done in preparation for the 2006 educational visitation. The domain specific requirements indicated by this framework are translated into the intended learning outcomes (ILO's) of the programs (Appendix 2). Sources used to draft the DSRF are the Quality Assurance Agency for Higher Education and previous self-assessment reports, as well as the Dublin descriptors, Meijers' criteria for scientific programs and European guidelines for access to the work field.

Strategic choice for bachelor and master
The first important observation within the international field of educational programs of the Built Environment (BE) is the existence of professional- and science-oriented programs, both at bachelor's level. The number of professional Masters offered is relatively large and the number of science-oriented Masters is relatively small. Also, the 'Master of Science' programs show some remarkable differences. Generally speaking, three clusters of programs can be distinguished, which reflect different interpretations of the 'building task':

A. The urban development programs are focused on the research and the development of the urban aspects of the assignment;

B. The architecture programs are focused on the appearance and the meaning of the building; functionality is an important aspect, but the attention paid to technical-scientific consequences of structural design and building physics is marginal;

C. The integral, multidisciplinary programs are simultaneously focused on architecture, urban development, management and engineering.

Both our bachelor's and master's program belong to the latter group. Distinguishing characteristics of both programs are the technical-scientific signature, the strong relation between research and design and the focus on the 'engineers of the future', who are prepared for a professional career in a continuously changing society and work field3. The focal points of the educational programs are founded in the special position the Department of the Built Environment occupies, both from a national and an international perspective. Almost all building related disciplines are brought together under one roof: building physics and services, structural design and engineering, architectural / urban design and engineering, urban planning, real estate, etc. This unique position is expressed in the education and the research conducted within the department. Integration of and cooperation by the disciplines in design and research projects characterize the culture and identity of the department. The bachelor's and master's programs are closely related to the research programs of the department.

Bachelor's program
Our bachelor's program is designed to educate so called T-shaped engineers (broad base combined with in depth knowledge in the field of Architecture, Urbanism and Building Sciences). The broad base is anchored in the integral and multidisciplinary approach of the program. To guarantee the required depth to enter connected specializations in the master's program, students have the opportunity to choose a profile in line with individual interests and capacities.

Master's program
The Master's program of Architecture, Building and Planning comprises four different specializations. These specializations correspond with different professional areas within the field of the built environment. Students can combine courses of these specializations into an individually tailored study program, depending on the student's interests.

Conclusion

The domain of the bachelor's and master's programs has been described. Within this domain, the Department of BE has made strategic choices, giving the programs their distinguishing flavor:

- Focus on width, depth and multidisciplinarity in the AUBS Bachelor program, thereby aligning it to the Master's program ABP;
- Focus on societal topics and professional skills to deliver the 'engineer of the future'. bachelor's and master's programs provide the opportunity to compose individual study trajectories, for instance by combining courses of different specializations.
- At a national level, TU/e endows itself with a technical and multidisciplinary signature by integrating into architecture and urbanism key-elements of civil engineering; building physics and structural design are essential parts of the bachelor's and master's programs.

APPENDIX 2: INTENDED LEARNING OUTCOMES

Bachelor's programme Architecture, Urbanism & Building Sciences (AUBS)
Following the DSRF, with both the requirements set by the professional field and the (scientific) domain, and the objectives of the program as described above, leads to the following learning outcomes shown in Table 1.

Table 1: Intended Learning Outcomes Bachelor AUBS

	Intended Learning Outcomes
a. Knowledge	Bachelor AUBS graduates have basic knowledge of the abovementioned profiles[5] and are familiar with the diversity, versatility and ever-changing character of Architecture, Urbanism and Building Sciences.
b. Skills	Bachelor AUBS graduates are able to: • Design a *simple*,[6] sustainable, product, process or system in the field of AUBS in a cyclical, iterative process that consists of the following steps: o analyzing + interpreting a problem; o making/interpreting of a program of requirements; o developing a concept; o elaborating the concept; o developing an aspect; o testing by the program of requirements.
	Bachelor AUBS graduates are able to: • Conduct research on a *simple*[6] product, process or system in the field of AUBS, according to the empirical cycle, which consists of the following steps: o analyzing + interpreting a problem; o formulating the research objective and the research questions; o making a conceptual model; o developing the research tool; o collecting and analyzing data; o interpreting results; o evaluating.
c. Academic attitude	• Cooperating and communicating o Working together in a multidisciplinary (AUBS) team; o Weighting criteria of their own discipline against criteria of other disciplines within a multidisciplinary (AUBS) team; o Reporting in written form and presenting in oral form and in pictures to client and team members about one's own contribution to: - (multidisciplinary) design in the field of AUBS; - research in the field of AUBS.
	• Method o Work project-based; o Work systematically; o Find, interpret and use existing theories, methods, models and techniques in the field of AUBS; o Fill knowledge gaps by means of studying; o Reasoning, critical reflecting, forming a judgment; o Show professional behavior: be creative, reliable, accurate, perceptive, independent.
	• Context o Work as a link between technology and society from a: - user perspective; - social perspective; - business perspective; - innovation perspective.

[5] Design and research in the field of: Building Physics and Systems (BPS), Structural Design (SD), Architectural Urban Design and Engineering (AUDE), Urban Systems and Real Estate (USRE).
[6] Simple: well-defined, however difficult and science-based.

Master's programme Architecture, Building & Planning (ABP)

Following the DSRF, with both the requirements set by the professional field and the scientific domain and the objectives of the program as described above, leads to the following learning outcomes shown in Table 2.

Table 2: Intended Learning Outcomes ABP

Intended Learning Outcomes
Master's graduates of the program Architecture, Building and Planning...
1. ...are qualified to degree level within the domain of 'science engineering and technology',
2. ...are competent in the relevant domain-specific discipline(s), namely Architecture, Building and Planning,
3. ...are able to conduct research and design independently,
4. ...have the ability and attitude to include other disciplines in their research, where necessary,
5. ...have a scientific approach to complex problems and ideas,
6. ...possess intellectual skills that enable them to reflect critically, reason and form opinions,
7. ...have the ability to communicate the results of their learning, thinking and decision-making processes at an international level,
8. ...are aware of the temporal and social context of science and technology (comprehension and analysis) and can integrate this context in their scientific work,
9. ...in addition to a recognizable domain-specific profile, possess a sufficiently broad basis to be able to work in an interdisciplinary and multidisciplinary context. In this context, multidisciplinary means being focused on other relevant disciplines needed to solve the design or research problem in question,
10. ...have the ability and attitude to seek new potential applications, taking the social context into consideration.

These Intended Learning Outcomes are of a generic nature to suit all specializations within the ABP Master's program. These specializations cover different disciplines of the field of architecture, building and planning and therefore differ in content but share the Intended Learning Outcomes.

APPENDIX 3: OVERVIEW OF THE CURRICULUM

Bachelor's programme Architecture, Urbanism & Building Sciences

BACHELOR COURSES YEAR 1

Basis courses (15 EC)		Orientation	EC
2WAB0	Calculus (variant A)	Basic courses	5
3NAB0	Applied Physical Science conceptual (Variant A)	Basic courses	5
2IAB0	Data analytics for engineers (variant A)	Basic courses	5
0SAB0	USE Basic: Ethics and history of technology (C- A)	Basic courses	5
Major courses (30 EC)			
7N1X0	BAU studio 1 (project)	BAU	10
7P3X0	Statistics of structures	BPSD	5
7U4X0	Realisation Exploitation and Transformation	USRE	5
7X1X0	Architecture and the city	AUDE	5
7S3X0	Building physics and materials	BPSD	5
Electives offered by Department BE (10 EC)			
7N3X0	BAU Studio 2 (project)	BAU	5
7T2X0	Building Technology	AUDE	5

BACHELOR COURSES YEAR 2

Basic courses (5 EC)		Orientation	EC
4WBB0	Engineering design	Basic courses	5
Major courses (35 EC)			5
7PPX0	Dimensioning of structures	BPSD	5
7XWX0	Urbanism and Architecture in context	AUDE	5
7UUX0	Housing and residential real estate	USRE	5
7**4X0	Project 1 BPSD / AUDE / USRE	BPSD / AUDE / USRE	5
7**5X0	Project 2 BPSD / AUDE / USRE	BPSD / AUDE / USRE	5
7**6X0	Project 3 BPSD / AUDE / USRE	BPSD / AUDE / USRE	5
7**7X0	Project 4 BPSD / AUDE / USRE	BPSD / AUDE / USRE	5
Electives 4 courses (20 ECTS)			
Choose 4 Elective courses (coherent packages) or USE courses		choice	4X5

BACHELOR COURSES YEAR 3

Major Courses (20 ECTS)		Orientation	EC
7NN8X0	Multidisciplinary project 1	BPSD / AUDE / USRE	5
7NN9X0	Multidisciplinary project 2	BPSD / AUDE / USRE	5
7S4X0	Building physics and service engineering	BPSD	5
7U9X0	Research and statistics		5
Electives 6 courses (30 ECTS)			
Choose Elective (coherent packages) or USE courses		choice	6x5
Graduation (10 EC)			
7NNX0	Bachelor End Project (BEP)	BPSD / AUDE / USRE	10

Overzicht van electives en USE voor jr 2 en 3, offered by BE		Orientation	EC
7HK30	Physics of light and Light design	BPSD	5
7HK40	Liberation of light (project)	BPSD	5
7P9X0	Concrete and masonry structures	BPSD	5
7SAX0	Sounds good !	BPSD	5
7S0X0	Urban physics: wind, acoustics, insolation, precipitation	BPSD	5
7S5X0	Acoustic awareness	BPSD	5
7S6X0	The science of sound	BPSD	5
7S7X0	Materialization of facades and roofs	BPSD	5
7S8X0	Building services	BPSD	5
7S9X0	Introduction building performance	BPSD	5
0HEUA0	Light and experience	BPSD	5
7P0X0	Steel structures and applied mechanics	BPSD	5
7P7X0	Timber structures and experimental research	BPSD	5
7P8X0	Design of structures	BPSD	5
7T8X0	Architecture and technology	AUDE	5
7T2X0	Building technology	AUDE	5
7X0X0	Research in urbanism and architecture	AUDE	5
7X2X0	Urban case study	AUDE	5
7X3X0	History of European architecture and urbanism	AUDE	5
7X7X0	Geometry and form	AUDE	5
7X8X0	Spatial imagination	AUDE	5
7X9X0	Tectonics and materiality	AUDE	5
7W0X0	Landscape and public space	AUDE	5
7W2X0	Walkscapes	AUDE	5
7W3X0	Mobility and logistics	USRE	5
7W7X0	Urban planning	USRE	5

Master's programme Architecture, Building & Planning

MSC CORE PROGRAM AUDE

Core courses (15 EC)		EC
7QX5M0	Seminar urbanism and architecture	5
7QW5M0	Research in urbanism and architecture	5
7QW6M0	Architectural and urban theory	5
Specialization Electives (30 out of 70 EC)		
7QX1M0	Master project 1 Architecture	10
7QX2M0	Master project 2 Architecture	10
7QW1M0	Master project 1 Urbanism	10
7QW2M0	Master project 2 Urbanism	10
7QX3M0	Architectural Engineering	5
7QQ4M0	Types and methods in architecture	5
7QW3M0	Urban planet	5
7QW9M0	Urban green strategies	5
7NN1M0	Master project Integral design	10
Electives (30 EC)		
Graduation Project (45 EC)		
7X45M0	Graduation project Architecture OR	45
7W45M0	Graduation project Urbanism	45

MSC CORE PROGRAM BPS

Core courses (30 EC)		EC
7S880	Lighting technology	5
7LS3M0	Sustainable buildings/physical aspects of building materials	5
7LS8M0	Architectural acoustics	5
7LS9M0	Heat, air and moisture transfer/CFD 1	5
7LY3M0	Building performance and energy systems simulation	5
7LY4M0	Building services and fire safety	5
7S880	Lighting technology	5

Specialization Electives (30 out of 65 EC)		
7LS1M0	Master project BPS A Research	10
7NN1M0	Master project Integral design	10
7LS4M0	Computational modeling for building physics and systems	2,5
7LY5M0	Intelligent buildings	5
7LS6M0	Heat, air and moisture Transfer/CFD 2	5
7LL7M0	C.S. Lighting technology	5
7LY6M0	Materials panorama: design, functionality, environmental aspects	5
7LY7M0	Techniques in architectural acoustics	5
7LS2M0	Master project BPS B Research	10
7LS0M0	Master project BPS Design	10
Electives (15 EC)		
Graduation Project (45 EC)		
7S45M0	Graduation Project Building Physics and Services	45

MSC CORE PROGRAM SD

Core courses (25 EC)		EC
7KP3M0	Advanced steel and alumium structures	5
7KP4M0	Advanced concrete structures	5
7KP5M0	Advanced timber and lightweight structures	5
7KP6M0	Energy and finite element methods	5
7KP7M0	Stability of structures	5
Specialization Electives (30 out of 62,5 EC)		
7KP1M0	SD Masterproject Research	10
7NN1M0	Masterproject Integral Design	10
7KP2M0	Design project Large span structures	10
7KS2M0	Design Project High rise building	10
7KK1M0	Geotechnics, soil mechanics and seismic structural design	5
7KT1M0	Structural design, capita selecta	5
7KT2M0	Structural design with glass and other materials	5
7KT4M0	Masonry Structures	2,5
7PP3M0	Timber Structures	2,5
7KT7M0	Finite element method, non-linear	2,5
Electives (20 EC)		
Graduation Project (45 EC)		
7K45M0	Graduation Project Structural Design	45

MSC CORE PROGRAM USRE

Core courses (25 EC)		EC
7ZW7M0	Urban research methods	5
7ZW3M0	Urban planning II	5
7ZW4M0	Built environment and smart mobility	5
7ZU3M0	Managing place and property	5
7ZM5M0	Process modeling and information management	5
Specialization Electives (30 out of 85 EC)		
7ZU4M0	Housing systems and strategies	5
7ZU1M0	Project Housing portfolio: assets and risks	10
7ZU6M0	Urban projects and finance	5
7ZU2M0	Project redevelopment of problem areas	10
7ZM1M0	Research and development project	10
7ZW5M0	Smart urban environments	5
7ZW1M0	Big data and experiments for urban analysis/Project	10
7M900	Fundamentals of BIM	5
7ZM7M0	Parametric design	5
7ZM9M0	Systems engineering	2,5
7ZM8M0	Collaborative design	5
7ZM3M0	Case study process modelling	2,5
7U772	Corporate real estate strategy	5
Electives (20 EC)		
Graduation Project (45 EC)		
7Z45M0	Graduation Project Urban Systems and Real Estate	45

MSC CORE PROGRAM: REGISTER PROGRAM ARCHITECTURE

Core courses (55 EC)		EC
7QX5M0	Seminar urbanism and architecture	5
7QW5M0	Research in urbanism and architecture	5
7QW6M0	Architectural and urban theory	5
7QX1M0	Masterproject 1 Architecture	10
7QX2M0	Masterproject 2 Architecture	10
7QX3M0	Architectural engineering	5
7QQ4M0	Types and methods in architecture	5
7QQ1M0	Architectural expression	5
7QQ2M0	Constructing architecture	5

Specialization Electives (5 out of 20 EC)		
7QX6M0	Architecture and philosophy	5
7QW8M0	Heritage, urbanization and global efficiency	5
7QX7M0	Architectural analysis	5
7QX8M0	Urban form	5
Electives (15 EC)		
Graduation Project (45 EC)		
7X45M0	Graduation Project Architecture	45

MSC CORE PROGRAM: REGISTER PROGRAM URBANISM

Core courses (40 EC)		EC
7QX5M0	Seminar urbanism and architecture	5
7QW5M0	Research in urbanism and architecture	5
7QW6M0	Architectural and urban theory	5
7QW1M0	Masterproject 1 Urbanism	10
7QW9M0	Urban green strategies	5
7QW3M0	Urban planet	5
7QW7M0	Theory and practice of the public domain	5
Specialization Electives (20 out of 45 EC)		
7QX9M0	Urban trends OR	5
7ZW3M0	Urban planning 2	5
7QX8M0	Urban form OR	5
7QW8M0	Heritage, urbanization and global efficiency OR	5
7ZW4M0	Built environment and smart mobility	5
7QW2M0	Masterproject 2 Urbanism OR	10
7ZU2M0	Project redevelopment of problem areas	10
Electives (15 EC)		
Graduation Project (45 EC)		
7W45M0	Graduation Project Urbanism	45

APPENDIX 4: PROGRAMME OF THE SITE VISIT

Wednesday 28 November 2018	
10.00 h – 10.15 h	Arrival and welcome of panel
10.15 h – 11.45 h	Internal consultation panel
11.45 h – 12.30 h	Interview Dean and programme management
12.30 h – 13.30 h	Lunch break
13.30 h – 14.00 h	Vertigo Tour
14.00 h – 14.15 h	Break
14.15 h – 15.00 h	Interview students bachelor
15.00 h – 15.45 h	Interview lecturers bachelor
15.45 h – 16.15 h	Break / internal consultation
16.15 h – 17.00 h	Interview students master
17.00 h – 17.30 h	Interview alumni

Thursday 29 November 2018	
09.30 h - 09.45h	Arrival and preparation of the panel
09.45 h - 10.30 h	Interview lecturers master
10.30 h – 11.15 h	Interview Examination Board
11.15 h – 11.45 h	Internal Consultation
11.45 h – 12.30 h	Interview program management
12.30 h – 14.30 h	Lunch break and preparing judgements
14.30 h – 14.45 h	Deliberations to the Department
14.45 h – 15.00 h	Break
15.00 h – 15.45 h	Development dialogue between panel and program management

APPENDIX 5: THESES AND DOCUMENTS STUDIED BY THE PANEL

Prior to the site visit, the panel studied 15 theses of the bachelor's programme Architecture, Urbanism & Building Sciences and 15 theses of the master's programme Architecture, Building & Planning. Information on the selected theses is available from QANU upon request.

During the site visit, the panel studied, among other things, the following documents (partly as hard copies, partly via the institute's electronic learning environment):
-List of improvements, following the advice of the previous external assessment panel
-Major developments until 2017
-TU/e Bachelor College: vision, mission and framework of the programs
-TU/e Graduate School: vision, mission and core values
-Table with relations of intended learning outcomes to Meijers' criteria
-Overview of the research groups involved in the programs
-Content of the Bachelor's program
-Content of the Master's program
-Overview of study methods / teaching methods and contact hours for core courses
-Relationship between the learning outcomes and program contents (Bachelor)
-Relationship between the learning outcomes and program contents (Master)
-Relationship between courses and research
-Examples of contacts with the professional field
-Overview of staff in the AUBS and ABP program
-Assessment methods Bachelor
-Assessment methods Master
-Tracks Master Architecture, Building and Planning 2018-2019
-Register programs Master Architecture, Building and Planning 2018-2019
-Assessment form graduation project ABP
-Assessment form Bachelor End Project AUBS 2018-2019
-Graduation guide AUDE June 2018
-Jaarverslag Examencommissie Bouwkunde 2015-2016/ 2016-2017
-Regulations of the Examination Committee, Department of the Built Environment, TU/e 2018-2019
-Toetskader TU/e, 23-10-2014
-Fraudebeleid TU/e Onderwijs, 9 maart 2015