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supervision and questions**  
School of Architecture and the  
Built Environment

## General syllabus for education at third-cycle level in Transport Science

This regulatory document has been decided by the President (V-2023-0468) pursuant to chapter 6 sections 26-27 of the Higher Education Ordinance. The regulatory document is valid with effect from 21 April 2017 and was last modified on 22 June 2022 (V-2021-0836) and 10 October 2023 (V-2023-0468). The regulatory document regulates the main content of the education, requirements for special qualifications and the other regulations that are needed. The School of Architecture and the Built Environment is responsible for review and questions about the governing document.

### 1 Content of the education

#### 1.1 The name of the subject in Swedish and in English translation

Transportvetenskap

Transport Science

#### 1.2 Subject description

Transport science is an interdisciplinary subject that addresses the human, social, environmental and technological aspects of mobility of both people and goods at a wide range of spatial scales, from local to global transport.

Particular attention is paid to the practical, beneficial and harmful effects of transport activities on sustainable development, such as social well-being, economic activity, safety, health, ecological systems, and the global climate.

Transport Science aims to contribute new knowledge to the planning, design, implementation, operation and evaluation of transport technologies, including their physical layout, operational characteristics, management and integration with new technologies, business models and societal developments.

Transport science covers a range of interdisciplinary sub-topics, such as transport policy and planning, travel behaviour analysis, transport modelling, transport economics, traffic engineering, transport logistics, railway systems, civil engineering, and smart mobility services.

The subject currently consists of two specialisations, Transport Systems and Transport Infrastructure

Admission is by subject and specialisation. A specialisation is required for admission to the subject.

#### 1.3 Specialisations

Transport Systems

The Transport Systems specialisation includes the development and application of methods and models for the analysis, planning, organisation, evaluation, control and design of an intelligent, efficient, safe and sustainable transport system for both passenger and freight transport, and the interaction of this system with societal development in spatial terms as well as otherwise. Key methodological areas include simulation and optimisation of transport systems, modelling of road-user behaviour, financial and econometric modelling, and methods for social, environmental, safety and economic evaluation. The subject is interdisciplinary in nature and requires specialisation in other disciplines depending on the specific area of application.

#### 1.4 Organisation of the education

##### 1.4.1 Activities for fulfilment of outcomes for the education according to the Higher Education Ordinance (HF)

Below are described activities for the doctoral student to fulfil the learning outcomes for third-cycle education according to the Higher Education Ordinance (HF) and KTH's goals. The individual study plan specifies the activities for each individual doctoral student.

##### *Learning outcomes: Knowledge and understanding*

For the Degree of Doctor the doctoral student shall:

- Demonstrate broad knowledge and a systematic understanding of the research field as well as advanced and up-to-date specialist knowledge in a limited area of this field.

This outcome can be achieved by the doctoral student continuously training and developing the ability to identify and justify relevant research questions and the choice of appropriate methods; demonstrating advanced understanding of concepts and principles in traffic and transport, sustainability and policy; undergoing summative assessment in courses and participating in workshops and scientific seminars relevant to the subject and research domain; and completing compulsory courses in the research subject:

- Traffic Flow Theory (course)
- Transport Policy (course)
- Sustainable Mobility (course)
- Transport Modelling (course)
- Discrete Choice Modelling (course)

In addition, the doctoral student must carry out both supervisor-led and independent literature study of the chosen research domain.

- Demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

This outcome can be achieved by the doctoral student continuously training and developing the ability to identify and justify relevant research questions and the choice of appropriate methods; acquiring knowledge and thoroughly and critically reviewing scientific work in their own research domain; employing different methods; and completing compulsory general courses in the philosophy of science:

- Introduction to the Philosophy of Science and Research Methodology (course)

and completing compulsory courses in methodologies central to the research topic:

- Transport Modelling (course)
- Discrete Choice Modelling (course)
- Traffic Flow Theory (course)

In addition, the doctoral student must carry out both supervisor-led and independent literature study of the chosen research area. The individual study plan specifies the activities for each individual doctoral student.

For a Degree of Licentiate, the doctoral student shall:

- Demonstrate knowledge and understanding in the field of research including current specialist knowledge in a limited area of this field as well as specialised knowledge of research methodology in general and the methods of the specific field in particular.

This outcome can be achieved by the doctoral student continuously training and developing their ability to plan and carry out their own research; acquiring knowledge from scientific literature of relevance to the research domain; and completing compulsory courses in methods central to the research subject and the philosophy of science in general:

- Introduction to the Philosophy of Science and Research Methodology (course)
- Sustainable Mobility (course)

and practising different methods; as well as completing courses equivalent to 12 credits in the research subject of central methods:

- Traffic Flow Theory (course)
- Transport Policy (course)
- Transport Modelling (course)
- Discrete Choice Modelling (course)

In addition, the doctoral student must conduct both supervisor-led and independent literature synthesis of the chosen research domain and relevant methods. The individual study plan specifies the activities for each individual doctoral student.

*Learning outcome: Competence and skills*

For the Degree of Doctor the doctoral student shall:

- Demonstrate the capacity for scholarly analysis and synthesis as well as to review and assess new and complex phenomena, issues and situations autonomously and critically.

This outcome can be achieved by completing an independent synthesis of relevant scientific literature with the guidance of the supervision team, confirmed by defending a completed doctoral thesis.

- Demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work.

This outcome can be achieved by independently completing the process of problematising and formulating a scientific question with the guidance of the supervisory team.

This outcome is achieved by the doctoral student: independently planning and carrying out experimental or theoretical studies on a sound and proven scientific basis and with scientific research methodology relevant to the research subject; analysing and critically reviewing his/her own results and compiling these in written form for publication in peer-reviewed international scientific journals or in manuscript form of sufficient quality that they can be considered published in peer-reviewed international scientific journals; confirmed by completion of the research project.

- Demonstrate through a dissertation the ability to make a significant contribution to the formation of knowledge through his or her own research.

The outcome can be achieved by participating in the mid-term and four-fifths seminars where the doctoral student's own research contributions are reviewed. The terms mid-term and four-fifths refers here to the proportion of the completed thesis work.

Completing the thesis work and defending their scientific contribution under public discussion and examination by an external reviewer.

- Demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general.

This outcome can be achieved by participating in a number of scientific and social science activities to disseminate research results and participating in workshops and scientific seminars with a methodological focus relevant to the topic and research domain. Confirmed in the compulsory course

- Scientific Engagement in Transport Science (course)

as well as documented research contributions in the doctoral thesis.

- Demonstrate the ability to identify the need for further knowledge.

This outcome can be achieved by actively presenting one's own research results in the form of scientific publications, and at national and international conferences, seminars or workshops; analysing future developments in the selected research domain and outlining a short-term research agenda in the compulsory course:

- Scientific Engagement in Transport Science (course)

- Demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.

This outcome can be achieved by orally communicating one's own research results and their societal implications, confirmed in the compulsory course:

- Scientific Engagement in Transport Science (course)

For a Degree of Licentiate, the doctoral student shall:

- Demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work.

This outcome can be achieved by completing an independently planned and implemented research project as part of the licentiate thesis under the supervision of the supervisory team.

This outcome is achieved by the doctoral student: independently planning and carrying out experimental or theoretical studies on a sound and proven scientific basis and with scientific research methodology relevant to the research subject; analysing and critically reviewing his/her own results and compiling these in written form for publication in peer-reviewed international scientific journals or in manuscript form of sufficient quality that they can be considered published in peer-reviewed international scientific journals; confirmed by completion of the research project.

- Demonstrate ability in both national and international contexts to present, discuss research, and research findings in speech and writing and in dialogue with the academic community and society in general.

The outcome can be achieved by participating in scientific communication activities, such as international conferences and stakeholder meetings, under the guidance of the supervisory team.

- Demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.

This outcome can be achieved by independently planning and implementing a research project as part of the licentiate thesis under the supervision of the supervisory team.

*Learning outcomes: Judgement and approach*

For the Degree of Doctor the doctoral student shall:

- Demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics.

This outcome can be achieved by completing the course on knowledge in ethics and the legal foundations of research:

- Introduction to Law and Ethics (course)

as well as applying research ethics to research activities and the completion of a doctoral thesis.

- Demonstrate specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

This outcome can be achieved by completing the compulsory course on the definitions of concepts and theories and general problem areas:

- Introduction to the Philosophy of Science and Research Methodology (course)

as well as demonstrating understanding of and responsibility for the significance of the doctoral student's own research in the doctoral thesis.

For a Degree of Licentiate, the doctoral student shall:

- Demonstrate the ability to make assessments of ethical aspects of his or her own research.

This outcome can be achieved by completing the course on knowledge in ethics and the legal foundations of research:

- Introduction to Law and Ethics (course)

as well as applying research ethics to research activities and the completion of a licentiate thesis.

- Demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

This outcome can be achieved by completing the compulsory course on the definitions of concepts and theories and general problem areas:

- Introduction to the Philosophy of Science and Research Methodology (course)

as well as demonstrating understanding of and responsibility for the significance of the doctoral student's own research in the licentiate thesis.

- Demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

This outcome can be achieved by independently planning and implementing a research project as part of the licentiate thesis under the supervision of the supervisory team.

#### *KTH's outcome in sustainable development*

For both the Degree of Licentiate and the Degree of Doctor, the doctoral student shall:

- Demonstrate with knowledge and skills the ability to be able to contribute to sustainable societal development towards an equal, inclusive and climate-neutral society.

For the licentiate degree, the doctoral student should be able to account for the relevance of scientific contributions to sustainable development and to the established sustainability goals, confirmed in the compulsory course:

- Sustainable Mobility (course)

For the doctoral degree, the doctoral student should be able to integrate sustainability theories and set goals in their own research questions and scientific contribution descriptions, with the help of and confirmed by the compulsory courses:

- Transport Policy (course)
- Sustainable Mobility (course)

#### 1.4.2 Compulsory courses

For a doctoral degree

- Scientific Engagement in Transport Science, 3 credits
- Traffic Flow Theory, 7.5 credits
- Discrete Choice Modelling, 4.5 credits

#### 1.4.3 Conditional elective courses

For both the licentiate and doctoral degrees, an introductory course in law and ethics must be completed for the equivalent of 1.5 credits, one of the following two courses:

- Introduction to law and ethics for transport science (1.5 credits) or Introduction to research ethics for doctoral students (1.5 credits).

For both the licentiate and doctoral degrees, courses in philosophy of science and research methodology must be completed for the equivalent of 7.5 credits. This requirement can be fulfilled by any of the options below:

- Philosophy of Science and Research Methodology, Engineering and Natural Sciences, 7.5 credits, or
- A combination of:
  - Introduction to Theory of Science and Research Methodology, for Graduate Students in Technology and Natural Sciences, 4.5 credits, or equivalent, or previously earned credit, as well as
  - Supplementary Course in Theory and Methodology of Science, 3.0 credits

For both the licentiate and doctoral degrees, courses in sustainable mobility must be completed for the equivalent of 3 credits. This can be fulfilled through either a course in sustainable mobility at third-cycle level or Transport and Sustainable Development at second-cycle level.

For a doctoral degree, courses in transport modelling must be completed for the equivalent of 3 credits. This can be fulfilled through either a course in Transport Modelling at third-cycle level or Urban Modelling and Decision Support at second-cycle level.

For the doctoral degree, courses in transport policy must be completed for the equivalent of 4.5 credits. This can be fulfilled through either a course in Transport Policy at third-cycle level or Transport Policy and Evaluation at second-cycle level.

For the licentiate degree, courses corresponding to 12 credits must also be completed:

- Traffic Flow Theory (7.5 credits)
- Transport Policy (third cycle) or Transport Policy and Evaluation (second cycle) (4.5 credits)
- Discrete Choice Modelling (4.5 credits)
- Transport Modelling (third cycle) or Urban Modelling and Decision Support (second cycle) (3 credits)

#### 1.4.4 Recommended courses

The following third-cycle courses are generally recommended:

- FAH3456 Simulation Methods in Econometrics
- FAH3002 Traffic Simulation Modelling and Applications
- Optimisation Methods for Transport Systems
- FDS3102 Writing Scientific Articles
- FSD3901 Integrated Transport System
- FAL3512 Methods in Sustainability Science
- FDD3431 Graduate Course in Machine Learning

In addition, there are the following literature courses:

- FAF3811 Brief Literature Course in Transport Planning
- FAF3812 Literature Course in Transport Planning
- FAH3465 Literature Course in Transport Systems, short course
- FAH3466 Literature Course in Transport Systems
- FAH3467 Literature Course in Transport Systems, long course

The following courses are recommended within the framework of permitted second-cycle courses:

- AH2102 Logistics and Transportation
- AH2026 Railway Traffic - Market and Planning, Basic Course
- AH2029 Railway Signalling System
- AH2173 Public Transport
- DD2421 Machine Learning

#### 1.4.5 Requirements for the degree

##### **Degree of Doctor**

*A Degree of Doctor comprises 240 credits. At least 120 credits must consist of the doctoral thesis*



## Thesis

*Quality requirements and possible other requirements for the thesis.*

The thesis is a compulsory part of the third-cycle programme. This component of the programme aims for students to develop the ability to make independent contributions to research and engage in scientific collaboration, both within and beyond their own subject. The thesis must include new research results that the student has developed, alone or in collaboration with others. The thesis is normally to be written in English. It should normally take the form of a compilation of independently written scientific papers and a specially written summary, but may also in individual cases take the form of a monograph, i.e. a thesis written as a whole. Whether in the form of a compilation thesis or a monograph, it must be equivalent in scope to at least four academic papers publishable in international journals, international conference proceedings or internationally edited books of good quality with peer review. It must be possible to distinguish the doctoral student's individual contribution to any texts with co-authors included in the thesis. The thesis is presented at a four-fifths seminar after four fifths of thesis work is complete. In the case of a compilation thesis, the introductory chapter does not have to be included in the four-fifths seminar.

## Courses

*The doctoral student shall have completed courses of at least 60 credits, of which 45 credits must be at third-cycle level and no more than 10 credits can be at first-cycle level.*

## Degree of Licentiate

*A Degree of Licentiate comprises at least 120 credits. At least 60 credits must consist of the academic paper.*

## Thesis

*Quality requirements and possible other requirements for the licentiate thesis.*

The thesis is a compulsory part of the third-cycle programme. This component of the programme aims for students to develop the ability to make independent contributions to research and engage in scientific collaboration, both within and beyond their own subject. The thesis must include new research results that the student has developed, alone or in collaboration with others. The thesis is normally to be written in English. It should normally take the form of a compilation of independently written scientific papers and a specially written summary, but may also in individual cases take the form of a monograph, i.e., a thesis written as a whole. Whether in the form of a compilation thesis or a monograph, it must be equivalent in scope to at least two academic papers publishable in international journals, international conference proceedings or internationally edited books of good quality with peer review. It must be possible to distinguish the doctoral student's individual contribution to any texts with co-authors included in the thesis.

## Courses

*The doctoral student shall have completed courses of at least 30 credits, of which 15 credits must be at third-cycle level and no more than 10 credits can be at first-cycle level*

### 1.4.6 Other elements in the education to promote and ensure goal fulfilment

Supervisors play a key role in organising, motivating and providing feedback on the studies in general and the thesis in particular. Supervision shall be provided so that the doctoral student has the opportunity to develop their skills towards the applicable intended learning outcomes for the programme, including literature synthesis, scientific inquiry, data collection and

processing, analysis, justification of scientific contributions, and communication in various forms and contexts.

In order for the doctoral student to be assessed as having completed 50 per cent of goal attainment, they must have completed a mid-term seminar after approximately two years of net study time. For a doctoral student who has been admitted as a doctor, the mid-term seminar can be the licentiate seminar.

## **2 Admission to education at third-cycle level (qualification etc.)**

Admission to education at third-cycle level is regulated in Chapter 7, Section 40 of the Higher Education Ordinance and in the admission regulations at KTH. KTH's regulations on specific prerequisites and such abilities in other respects as are needed to assimilate the education in the relevant subject at the doctoral level are set out below.

### **2.1 Specific prerequisites**

In order to be admitted to third-cycle education in Computer Science, the applicant must have knowledge of English equivalent to English 6.

To be admitted to third-cycle courses and study programmes in the subject of Transport Science, specialisation transport systems, the applicant must have earned at least 60 credits at no less than second-cycle level in the subject of transport systems, civil and architectural engineering, urban planning, finance, computer science, applied mathematics or other subjects deemed to be directly relevant to the specialisation in question. These requirements are also considered to be fulfilled by those who have acquired substantially equivalent knowledge through other means.

To be admitted to third-cycle courses and study programmes in the subject of Transport Science, specialisation transport systems, the applicant must have knowledge of English equivalent to English 6.

### **2.2 Assessment criteria for testing the ability to assimilate the education**

The following assessment criteria apply for testing the ability to assimilate the education:

Selection for third-cycle education is based on assessed ability to assimilate such education. The ability assessment is primarily based on having passed courses and programmes that satisfy the entry requirements. Particular consideration is given to the following:

1. Knowledge and skills relevant for thesis work and the subject.  
These can be shown through attached documents and a possible interview
2. Assessed ability to work independently
  - a. ability to formulate and tackle scientific problems
  - b. ability to communicate well in speech and writing
  - c. maturity, judgement and ability to analyse critically and independently

The assessment may be based, for example, on degree projects and discussion of these at a possible interview.

3. Other experience relevant for third-cycle education, e.g. professional experience.  
These can be demonstrated through attached documents and, potentially, an interview.

### 3 The other regulations needed

#### 3.1 Transitional regulations

Doctoral students admitted to the doctoral degree with a specialisation in transport systems under this subject syllabus and who were previously admitted to the general syllabus (decided on 5 April 2017) for the doctoral degree with a specialisation in transport systems must fulfil a course requirement of a total of 12 credits in the courses traffic flow theory, transport policy, sustainable mobility, as well as transport modelling and discrete choice modelling.

When changing from the general syllabus decided on 5 April 2017 to this general syllabus, the course FAH3462 Topics in Transport Science, Part 2 (4.0 credits) fulfils the requirement for Scientific Engagement in Transport Science (3 credits)

However, note that changing syllabi normally requires that the new syllabus can be achieved in time.

Doctoral students admitted under previous subject syllabi can transfer credits from previous syllabi.

Doctoral students admitted to the subject study plan Transport Science, specialisation transport systems (decided on 22 June 2022) who wish to change to this syllabus can exceed the course-credit requirement by 7.5 credits in their licentiate degrees.

## 1 Content of the education

Here sections 1.3 to 3 for the Transport Infrastructure specialisation are repeated.

### 1.3 Specialisations

#### Transport Infrastructure

The Transport Infrastructure specialisation involves the science of roads and railways as technical systems. It is based on basic sciences such as physics, mechanics, chemistry and mathematics, supplemented by engineering subjects such as structural mechanics, fluid mechanics, materials science and solid mechanics. Focus in the public construction sector has traditionally been on new construction, but has now become increasingly focused on sustainable development, finance, and operations and maintenance issues for sustainable and smart transport infrastructure. This is reflected in the research profile of the specialisation.

### 1.4 Organisation of the education

#### 1.4.1 Activities for fulfilment of outcomes for the education according to the Higher Education Ordinance (HF)

Below are described activities for the doctoral student to fulfil the learning outcomes for third-cycle education according to the Higher Education Ordinance (HF) and KTH's goals. The individual study plan specifies the activities for each individual doctoral student.

#### *Learning outcomes: Knowledge and understanding*

For the Degree of Doctor the doctoral student shall:

- Demonstrate broad knowledge and a systematic understanding of the research field as well as advanced and up-to-date specialist knowledge in a limited area of this field.

This outcome can be achieved by the doctoral student continuously training and developing the ability to identify and justify relevant research questions and the choice of appropriate methods; demonstrating advanced understanding of concepts and principles in traffic and transport, sustainability and policy; undergoing summative assessment in courses and participating in workshops and scientific seminars relevant to the subject and research domain; and completing compulsory courses in the research subject:

- Future Transport and Infrastructure Systems (course)

In addition, the doctoral student must carry out both supervisor-led and independent literature study of the chosen research domain.

- Demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

This outcome can be achieved by the doctoral student continuously training and developing the ability to identify and justify relevant research questions and the choice of appropriate methods; acquiring knowledge and thoroughly and critically reviewing scientific work in their own research domain; employing different methods; and completing compulsory general courses in the philosophy of science:

- Introduction to the Philosophy of Science and Research Methodology (course)

and completing compulsory courses in methodologies central to the research topic:

- Advanced Rheology of Bituminous Materials (course)

In addition, the doctoral student must carry out both supervisor-led and independent literature study of the chosen research domain. The individual study plan specifies the activities for each individual doctoral student.

For a Degree of Licentiate, the doctoral student shall:

- Demonstrate knowledge and understanding in the field of research including current specialist knowledge in a limited area of this field as well as specialised knowledge of research methodology in general and the methods of the specific field in particular.

This outcome can be achieved by the doctoral student continuously training and developing their ability to plan and carry out their own research; acquiring knowledge from scientific literature of relevance to the research domain; and completing compulsory courses in philosophy of science in general:

- Introduction to the Philosophy of Science and Research Methodology (course)

and completing the following courses in the research subject and key methodologies:

- Future Transport and Infrastructure Systems (course)
- Advanced Rheology of Bituminous Materials (course)

In addition, the doctoral student must conduct both supervisor-led and independent literature synthesis of the chosen research domain and relevant methods. The individual study plan specifies the activities for each individual doctoral student.

#### *Learning outcome: Competence and skills*

For the Degree of Doctor the doctoral student shall:

- Demonstrate the capacity for scholarly analysis and synthesis as well as to review and assess new and complex phenomena, issues and situations autonomously and critically.

This outcome can be achieved by completing an independent synthesis of relevant scientific literature with the guidance of the supervision team, confirmed by defending a completed doctoral thesis.

- Demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work.

This outcome can be achieved by independently completing the process of problematising and formulating a scientific question with the guidance of the supervisory team, confirmed by completion of the research project.

This outcome can be achieved by the doctoral student: independently planning and carrying out experimental or theoretical studies on a sound and proven scientific basis

and with scientific research methodology relevant to the research subject; analysing and critically reviewing his/her own results and compiling these in written form for publication in peer-reviewed international scientific journals or in manuscript form of sufficient quality that they can be considered published in peer-reviewed international scientific journals; confirmed by completion of the research project.

- Demonstrate through a dissertation the ability to make a significant contribution to the formation of knowledge through his or her own research.

The outcome can be achieved by participating in the mid-term and four-fifths seminars where the doctoral student's own research contributions are reviewed. The terms mid-term and four-fifths refers here to the proportion of the completed thesis work.

This outcome can be achieved by completing the thesis work and defending their scientific contribution under public discussion and examination by an external reviewer.

- Demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general.

This outcome can be achieved by participating in a number of scientific activities to disseminate research results. The individual study plan specifies the activities for each individual doctoral student. Confirmed in the compulsory course:

- Scientific Engagement in Transport Science (course)

as well as documented research contributions in the doctoral thesis.

- Demonstrate the ability to identify the need for further knowledge.

This outcome can be achieved by actively presenting one's own research results in the form of scientific publications, and at national and international conferences, seminars or workshops; analysing future developments in the selected research domain and outlining a short-term research agenda in the compulsory course:

- Scientific Engagement in Transport Science (course)

- Demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.

This outcome can be achieved by orally communicating one's own research results and their societal implications, confirmed in the compulsory course:

- Scientific Engagement in Transport Science (course)

For a Degree of Licentiate, the doctoral student shall:

- Demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work.

This outcome can be achieved by independently planning and implementing a research project as part of the licentiate thesis under the supervision of the supervisory team.

This outcome can be achieved by the doctoral student: independently planning and carrying out experimental or theoretical studies on a sound and proven scientific basis and with scientific research methodology relevant to the research subject; analysing and critically reviewing his/her own results and compiling these in written form for publication in peer-reviewed international scientific journals or in manuscript form of sufficient quality that they can be considered published in peer-reviewed international scientific journals; confirmed by completion of the research project.

- Demonstrate ability in both national and international contexts to present, discuss research, and research findings in speech and writing and in dialogue with the academic community and society in general.

The outcome can be achieved by participating in scientific communication activities, such as international conferences and stakeholder meetings, under the guidance of the supervisory team.

- Demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.

This outcome can be achieved by independently planning and implementing a research project as part of the licentiate thesis under the supervision of the supervisory team.

#### *Learning outcomes: Judgement and approach*

For the Degree of Doctor the doctoral student shall:

- Demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics.

This outcome can be achieved by completing the course on knowledge in ethics and the legal foundations of research:

- Introduction to Law and Ethics (course)

as well as applying research ethics to research activities and the completion of a doctoral thesis.

- Demonstrate specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

This outcome can be achieved by completing the compulsory course on the definitions of concepts and theories and general problem areas:

- Introduction to the Philosophy of Science and Research Methodology (course)

as well as demonstrating understanding of and responsibility for the significance of the doctoral student's own research in the doctoral thesis.

For a Degree of Licentiate, the doctoral student shall:

- Demonstrate the ability to make assessments of ethical aspects of his or her own research.

This outcome can be achieved by completing the course on knowledge in ethics and the legal foundations of research:

- Introduction to Law and Ethics (course)

as well as applying research ethics to research activities and the completion of a licentiate thesis.

- Demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

This outcome can be achieved by completing the compulsory course on the definitions of concepts and theories and general problem areas:

- Introduction to the Philosophy of Science and Research Methodology (course)

as well as demonstrating understanding of and responsibility for the significance of the doctoral student's own research in the licentiate thesis.

- Demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

This outcome can be achieved by independently planning and implementing a research project as part of the licentiate thesis under the supervision of the supervisory team.

#### *KTH's outcome in sustainable development*

For both the Degree of Licentiate and the Degree of Doctor, the doctoral student shall:

- Demonstrate with knowledge and skills the ability to be able to contribute to sustainable societal development towards an equal, inclusive and climate-neutral society.

For the licentiate degree, the doctoral student should be able to account for the relevance of scientific contributions to sustainable development and to established sustainability goals, confirmed in the compulsory course:

- Sustainable Mobility (course)

For the doctoral degree, the doctoral student should be able to integrate sustainability theories and set goals in their own research questions and scientific contribution descriptions, with the help of and confirmed by the compulsory course:

- Future Transport and Infrastructure Systems (course)
- Sustainable Mobility (course)

#### 1.4.2 Compulsory courses

For the licentiate and doctoral degrees

- Advanced Rheology of Bituminous Materials, 7.5 credits (course)
- Future Transport and Infrastructure Systems, 7.5 credits (course)



Additional courses for doctoral degree

- Scientific Engagement in Transport Science, 3 credits (course)

### 1.4.3 Conditional elective courses

For both the licentiate and doctoral degrees, courses in philosophy of science and research methodology must be completed for the equivalent of 7.5 credits. This requirement can be fulfilled by any of the options below.

- Philosophy of Science and Research Methodology, Engineering and Natural Sciences, 7.5 credits, or
- A combination of:
  - Introduction to Theory of Science and Research Methodology, for Graduate Students in Technology and Natural Sciences, 4.5 credits, or equivalent, or previously earned credit, as well as
  - Supplementary Course in Theory and Methodology of Science, 3.0 credits

For both the licentiate and doctoral degrees, an introductory course in law and ethics must be completed for the equivalent of 1.5 credits, one of the following two courses:

- Intro to law and ethics for transport science (1.5 credits) or Intro to research ethics for doctoral students (1.5 credits) (course).

For both the licentiate and doctoral degrees, courses in sustainable mobility must be completed for the equivalent of 3 credits. This can be fulfilled through either a course in sustainable mobility at third-cycle level or Transport and Sustainable Development at second-cycle level.

### 1.4.4 Recommended courses

Courses in the following are recommended within the framework of elective courses:

- Analytical design of road superstructures
- Vehicle/climate and road interaction
- Computerised road design
- Unbound stocks
- Financial and environmental analysis for transport infrastructure
- Asphalt technology
- Advanced mathematics
- Applied statistics
- Applied numerical methods
- Risk analysis
- Scientific writing

### 1.4.5 Requirements for the degree

## Degree of Doctor

***A Degree of Doctor comprises 240 credits. At least 120 credits must consist of the doctoral thesis***

## **Thesis**

***Quality requirements and possible other requirements for the thesis.***

The thesis is a compulsory part of the doctoral programme. This component of the programme aims for students to develop the ability to make independent contributions to research and engage in scientific collaboration, both within and beyond their own subject. The thesis must include new research results that the student has developed, alone or in collaboration with others. The thesis is normally to be written in English. It should normally take the form of a compilation of independently written scientific papers and a specially written summary, but may also in individual cases take the form of a monograph, i.e. a thesis written as a whole. Whether in the form of a compilation thesis or a monograph, it must be equivalent in scope to at least four academic papers publishable in international journals, international conference proceedings or internationally edited books of good quality with peer review. It must be possible to distinguish the doctoral student's individual contribution to any texts with co-authors included in the thesis. The thesis is presented at a four-fifths seminar after four fifths of thesis work is complete. In the case of a compilation thesis, the introductory chapter does not have to be included in the four-fifths seminar.

### **Courses**

*The doctoral student shall have completed courses of at least 60 credits, of which 45 credits must be at third-cycle level and no more than 10 credits can be at first-cycle level.*

## **Degree of Licentiate**

*A Degree of Licentiate comprises at least 120 credits. At least 60 credits must consist of the academic paper.*

### **Thesis**

***Quality requirements and possible other requirements for the licentiate thesis.***

The thesis is a compulsory part of the third-cycle programme. This component of the programme aims for students to develop the ability to make independent contributions to research and engage in scientific collaboration, both within and beyond their own subject. The thesis must include new research results that the student has developed, alone or in collaboration with others. The thesis is normally to be written in English. It should normally take the form of a compilation of independently written scientific papers and a specially written summary, but may also in individual cases take the form of a monograph, i.e. a thesis written as a whole. Whether in the form of a compilation thesis or a monograph, it must be equivalent in scope to at least two academic papers publishable in international journals, international conference proceedings or internationally edited books of good quality with peer review. It must be possible to distinguish the doctoral student's individual contribution to any texts with co-authors included in the thesis.

### **Courses**

*The doctoral student shall have completed courses of at least 30 credits, of which 15 credits must be at third-cycle level and no more than 10 credits can be at first-cycle level*

#### 1.4.6 Other elements in the education to promote and ensure goal fulfilment

Supervisors play a key role in organising, motivating and providing feedback on the studies in general and the thesis in particular. Supervision shall be provided so that the doctoral student has the opportunity to develop their skills towards the applicable intended learning outcomes for the programme, including literature synthesis, scientific inquiry, data collection and processing, analysis, justification of scientific contributions, and communication in various forms and contexts.

## 2 Admission to education at third-cycle level (qualification etc.)

Admission to education at third-cycle level is regulated in Chapter 7, Section 40 of the Higher Education Ordinance and in the admission regulations at KTH. KTH's regulations on specific prerequisites and such abilities in other respects as are needed to assimilate the education in the relevant subject at the doctoral level are set out below.

### 2.1 Specific prerequisites

To be admitted to third-cycle courses and study programmes in the subject of Transport Systems, specialisation transport infrastructure, the applicant must have earned at least 60 credits at no less than second-cycle level in the subject of transport systems, civil and architectural engineering, urban planning, finance, computer science, applied mathematics or other subjects deemed to be directly relevant to the specialisation in question. These requirements are also considered to be fulfilled by those who have acquired substantially equivalent knowledge through other means.

To be admitted to third-cycle courses and study programmes in the subject of Transport Systems, specialisation transport infrastructure, the applicant must have knowledge of English equivalent to English 6.

### 2.2 Assessment criteria for testing the ability to assimilate the education

The following assessment criteria apply for testing the ability to assimilate the education:

Selection for third-cycle education is based on assessed ability to assimilate such education. The ability assessment is primarily based on having passed courses and programmes that satisfy the entry requirements. Particular consideration is given to the following:

4. Knowledge and skills relevant for thesis work and the subject.  
These can be shown through attached documents and a possible interview
5. Assessed ability to work independently
  - a. ability to formulate and tackle scientific problems
  - b. ability to communicate well in speech and writing
  - c. maturity, judgement and ability to analyse critically and independently

The assessment may be based, for example, on degree projects and discussion of these at a possible interview.

6. Other experience relevant for third-cycle education, e.g. professional experience.  
These can be demonstrated through attached documents and, potentially, an interview.

### **3 The other regulations needed**

#### **3.1 Transitional regulations**

When changing from the general syllabus decided on 5 April 2017 to this general syllabus, the course Topics in Transport Science, Part 2 (4.0 credits) fulfils the requirement for Scientific Engagement in Transport Science (3 credits)

However, note that changing syllabi normally requires that the new syllabus can be achieved in time.

Doctoral students admitted under previous subject syllabi can transfer credits from previous syllabi.

Doctoral students admitted to the subject study plan Transport Science, specialisation transport systems (decided on 22 June 2022) who wish to change to this syllabus can exceed the course-credit requirement by 7.5 credits in their licentiate degrees.

## KTH Appendix: Goals for qualification and assessment criteria

Goals according to Appendix 2 of the Degree Ordinance to the Higher Education Ordinance, including requirements specified by KTH with examples of assessment criteria that can determine whether the doctoral student has achieved the goals. *The assessment criteria in the table are examples and developed as a support and inspiration for activity descriptions in part 1.4.*

### Degree of Doctor

Knowledge and understanding	
Intended learning outcomes	Assessment criteria with reference to numbering in eISP
Demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialised knowledge in a limited area of this field.	<p>The outcome has been achieved through the doctoral student having</p> <p><b>A1.1:</b> authored original scientific works where their own contributions are significant and identifiable. The works are of such quality that they have been published, or are expected to be published, in international scientific journals or conferences that apply peer review.</p> <p><b>A1.2:</b> demonstrated both broad and specialised knowledge in the research area by writing a thesis in which the research results were placed and discussed in a broader perspective, and presented a reference list of others' research results that spans the relevant breadth of the research area.</p> <p><b>A1.3:</b> demonstrated, at a seminar, a course or in the thesis or its public defence, a good ability to account for how their own research results relate to the research front within the research area, and justify how their own results advance this.</p> <p><b>A1.4:</b> actively participated in seminar activities where their own results were presented and discussed, as well as asked questions and provided feedback on other students' and researchers' presentations.</p>
Demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.	<p>The outcome has been achieved through the doctoral student having</p> <p><b>A2.1:</b> been examined with an approved result regarding intended learning outcomes in scientific methodology, which may be a course or equivalent learning element at third-cycle level.</p> <p><b>A2.2:</b> described basic theories in scientific theory and correctly applied one or more of these in their own research.</p> <p><b>A2.3:</b> practically applied to the research area appropriate methods and developed the ability to independently perform, interpret and critically examine the results in order to clarify whether the method and its execution were appropriate to obtain credible results that answer the scientific question.</p> <p><b>A2.4:</b> justified their choice of method and execution in relation to the issue and to alternative methods.</p> <p><b>A2.5:</b> described the advantages and disadvantages of different scientific methods used in their own research area, as well as the methods used in the broader definition of the research area</p>

<b>Competence and skills</b>	
<b>Intended learning outcomes</b>	<b>Assessment criteria with reference to numbering in eISP</b>
Demonstrate the capacity for scholarly analysis and synthesis as well as to review and assess new and complex phenomena, issues and situations autonomously and critically.	<p>The outcome has been achieved through the doctoral student having</p> <p><b>B1.1:</b> demonstrated the ability to independently formulate and critically analyse both existing and new complex phenomena.</p> <p><b>B1.2:</b> presented concrete examples of scientific questions and problems of a complex nature from their own research and described how these were tested and how the results were analysed.</p> <p><b>B1.3:</b> described the interpretation of the results and how these were combined with existing knowledge to give rise to a new explanatory model.</p> <p><b>B1.4:</b> in cases where it is applicable, presented concrete examples of results that have given rise to falsification of a hypothesis and revision of the hypothesis.</p>
Demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work.	<p>The goal has been achieved through the doctoral student having</p> <p><b>B2.1:</b> presented examples of independently performed experiments / simulations / tasks that were preceded by detailed time planning.</p> <p><b>B2.2:</b> in cases where it is applicable, presented examples of their own hypotheses that have been tested within the framework of their own research project and described the choice of method and outcome. In cases where the result did not turn out as expected, the research student shall have reported on possible sources of error and what measures were taken to move forward in the project.</p> <p><b>B2.3:</b> presented examples of and described and argued for the choice of methods for individual research tasks.</p> <p><b>B2.4:</b> described how it was ensured that the education could be completed on time and whether there were obstacles to staying within the time frame, as well as what measures were taken and their outcome.</p>
Demonstrate through a dissertation the ability to make a significant contribution to the formation of knowledge through his or her own research.	<p>The goal has been achieved through the doctoral student having</p> <p><b>B3.1:</b> authored original scientific works where their own contributions are significant and identifiable. The works are of such quality that they have been published, or are expected to be published, in international scientific journals or conferences that apply peer review.</p> <p><b>B3.2:</b> authored a thesis, based on the scientific work, of good scientific and linguistic quality that was authoritatively defended and discussed in a public defence of the doctoral thesis and been examined with a pass grade by an independent examining committee.</p>
Demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general.	<p>The goal has been achieved through the doctoral student having</p> <p><b>B4.1:</b> in cases where it is applicable, participated in national and international conferences and presented their own research results in poster form or verbally, as well as participated in scientific discussions with other researchers in the research field.</p> <p><b>B4.2:</b> described how experience from conference or seminar presentations contributed to developing their own ability to</p>

	<p>communicate and defend scientific results, as well as how the presentations were received by other participants and whether valuable information could be obtained that helped their own studies progress.</p> <p><b>B4.3:</b> been examined with a pass grade for intended learning outcomes in communication or presentation technology in a suitable compulsory or optional course at third-cycle level.</p> <p><b>B4.4:</b> described basic concepts, tools and methods in presentation or communication technology, as well as demonstrated the ability to put the knowledge into practice by formulating different types of scientific presentation material of good quality.</p> <p><b>B4.5:</b> presented their research results in a pedagogical way for other students and researchers at academic seminars, for a general audience or for another category of recipients, where the formulation of presentation material and speech was based on pedagogical knowledge adapted to the audience's knowledge level and also answered questions at an adequate level for the audience.</p> <p><b>B4.6:</b> participated in outreach activities related to their own research in order to contribute to the dissemination of knowledge and exchange of knowledge with relevant stakeholder groups such as other universities, companies, authorities, schools etc.</p>
<p>Demonstrate the ability to identify the need for further knowledge.</p>	<p>The outcome has been achieved through the doctoral student having</p> <p><b>B5.1:</b> by means of concrete examples, described how the lack of essential knowledge needed to carry out a task was rectified and how this affected the possibility of carrying out the task. This may involve widely differing tasks and knowledge, with the proviso that the third-cycle students themselves must have realised that knowledge was lacking and handled this with measures relevant to the purpose.</p> <p><b>B5.2:</b> demonstrated insight that the knowledge front in higher education and research is in constant change and development and that definitive answers cannot always be obtained, as well as the ability to determine whether certain knowledge already exists, for example by means of thorough and critical examination of existing scientific literature.</p> <p><b>B5.3:</b> demonstrated the ability to question, evaluate and adapt their perception of their own level of knowledge and ability in relation to the prevailing knowledge front.</p>
<p>Demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.</p>	<p>The outcome has been achieved through the doctoral student having</p> <p><b>B6.1:</b> presented their research results in a pedagogical way for other students and researchers at academic seminars, for a general audience or for another category of recipients, where the formulation of presentation material and speech was based on pedagogical knowledge adapted to the audience's knowledge level and also answered questions at an adequate level for the audience.</p> <p><b>B6.2:</b> participated in outreach activities related to their own research in order to contribute to the dissemination of knowledge and exchange of knowledge with relevant stakeholder groups such as other universities, companies, authorities, schools etc.</p> <p><b>B6.3:</b> actively supervised other students in theoretical and / or practical projects. Third-cycle students should, with examples,</p>

	<p>account for and reflect on various aspects of their own input, for example how the supervision was structured, whether pedagogical methodology was applied, how it was ensured that the person who was supervised understood the instructions etc. Third-cycle students should also reflect on different roles of teachers and students and how personal dynamics and supervision techniques can affect the outcome of learning and interaction.</p> <p><b>B6.4:</b> been examined with a pass grade for intended learning outcomes in teaching and learning in higher education in a suitable compulsory or optional course at third-cycle level. The third-cycle student is thus assumed to be able to describe basic concepts, materials and methods, as well as conditions for teaching and learning in higher education, as well as to analyse, evaluate and develop teaching and learning. Third-cycle student is thus also assumed to be able to show the ability to evaluate and analyse different methods and approaches in higher education and to show the ability to take a student perspective into account.</p> <p><b>B6.5:</b> demonstrated the ability to collaborate and communicate in writing and speech, undertaken tasks and assignments that were planned and completed on time and demonstrated the ability to comply with applicable rules and directives and thereby acquired general knowledge and skills required in different societal functions.</p>
<b>Judgement and approach</b>	
<b>Intended learning outcomes</b>	<b>Assessment criteria with reference to numbering in eISP</b>
<p>Demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics.</p>	<p>The outcome has been achieved through the doctoral student having</p> <p><b>C1.1:</b> demonstrated intellectual integrity in the sense that their own choices and positions have been justified and defended on the basis of independent critical thinking in relation to proven experience and scientific basis.</p> <p><b>C1.2:</b> described how they ensured that their own scientific procedure in theory and practice was carried out in an honest and ethical manner.</p> <p><b>C1.3:</b> reflected on possible existing or hypothetical ethical dilemmas related to their own research area or to scientific research in general, and reported on their own ethically independent stance in the existing or hypothetical situation.</p> <p><b>C1.4:</b> been examined with a pass grade for intended learning outcomes in ethics in a suitable compulsory or optional course at third-cycle level. The research student is thus assumed to be able to describe basic theories in research ethics and relate these to their own approach and research work.</p>
<p>Demonstrate specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used</p>	<p>The outcome has been achieved through the doctoral student having</p> <p><b>C2.1:</b> presented concrete examples of how their own research results, and the research area in general, can contribute new knowledge to the research front in the area and justify its societal relevance.</p> <p><b>C2.2:</b> critically reflected on limitations of their own research results, and the research area in general, in order to contribute to solving</p>



	<p>societally relevant problems, as well as identify possible situations where their own research results can be used in both a positive and negative way.</p> <p><b>C2.3:</b> demonstrated good ability to reflect on how their own research results can contribute to sustainable societal development and can, where relevant, also link these to the prioritised global sustainable development goals.</p> <p><b>C2.4:</b> described how their own actions and approach take into account the concept of sustainability.</p> <p><b>C2.5:</b> been examined with a pass grade for intended learning outcomes in sustainable development in a suitable compulsory or optional course at third-cycle level. The research student is thus assumed to be able to describe basic theories in sustainability and relate these to their own approach and research work.</p>
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## Degree of Licentiate

<b>Knowledge and understanding</b>	
<b>Intended learning outcomes</b>	<b>Assessment criteria with reference to numbering in eISP</b>
<p>Demonstrate knowledge and understanding in the field of research including current specialist knowledge in his or her artistic field as well as specialised knowledge of research methodology in general and the methods of the specific field of research in particular..</p> <p><i>Main differences in relation to the doctoral degree: For the licentiate degree, it is enough to be able to show “knowledge and understanding”, as opposed to “broad and systematic understanding”. Also, “deep up-to-date specialist knowledge” is replaced by “up-to-date specialist knowledge”.</i></p>	<p>The outcome has been achieved through the doctoral student having</p> <p><b>A1.1:</b> authored original scientific works where their own contributions are significant and identifiable. The works are of such quality that they have been published, or are expected to be published, in international scientific journals or conferences that apply peer review.</p> <p><b>A1.2:</b> demonstrated both broad and specialised knowledge in the research area by writing a licentiate thesis in which the research results were placed and discussed in a broader perspective, and presented a reference list of others’ research results that spans the relevant breadth of the research area.</p> <p><b>A1.3:</b> demonstrated, at a seminar, a course or in the licentiate thesis and its public defence, a good ability to account for how their own research results relate to the research front within the research area, and justify how their own results advance this.</p> <p><b>A1.4:</b> actively participated in seminar activities where their own results were presented and discussed, as well as asked questions and provided feedback on other students’ and researchers’ presentations.</p>
<b>Competence and skills</b>	
<b>Intended learning outcomes</b>	<b>Assessment criteria with reference to numbering in eISP</b>
<p>Demonstrate the ability to identify and formulate issues with scholarly precision</p>	<p>The goal has been achieved through the doctoral student having</p>

<p>critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work</p> <p><i>Main differences in relation to the doctoral degree: For the licentiate degree, it is emphasized that this is “limited research work” that will contribute to the development of knowledge, in contrast to the doctoral degree where one must be able to show the ability to “conduct research”.</i></p>	<p><b>B1.1:</b> demonstrated the ability to independently formulate and critically analyse both existing and new complex phenomena.</p> <p><b>B1.2:</b> presented examples of their own questions that were tested within the framework of their own research project, as well as described the choice of method and outcome. In cases where the result did not turn out as expected, the research student shall have reported on possible sources of error and what measures were taken to move forward in the project.</p> <p><b>B1.3:</b> presented examples of independently performed experiments / simulations / tasks that were preceded by detailed time planning.</p> <p><b>B1.4:</b> presented examples of and described and argued for the choice of methods for individual experiments.</p> <p><b>B1.5:</b> described how it was ensured that the education could be completed on time and whether there were obstacles to staying within the time frame, as well as what measures were taken and their outcome.</p>
<p>Demonstrate the ability in both national and international contexts to present and discuss research and research findings in speech and writing and in dialogue with the academic community and society in general.</p> <p><i>Main differences in relation to the doctoral degree: The licentiate degree requires the student to communicate their research “clearly”, as opposed to communicating “with authority”.</i></p>	<p>The goal has been achieved through the doctoral student having</p> <p><b>B2.1:</b> in cases where it is applicable, participated in national and international conferences and presented their own research results in poster form or verbally, as well as participated in scientific discussions with other researchers in the research field.</p> <p><b>B2.2:</b> described how experience from conference or seminar presentations contributed to developing their own ability to communicate and defend scientific results, as well as how the presentations were received by other participants and whether valuable information could be obtained that helped their own studies progress.</p> <p><b>B2.3:</b> been examined with a pass grade for intended learning outcomes in communication or presentation technology in a suitable compulsory or optional course at third-cycle level.</p> <p><b>B2.4:</b> described basic concepts, tools and methods in presentation or communication technology, as well as demonstrated the ability to put the knowledge into practice by formulating different types of scientific presentation material of good quality.</p> <p><b>B2.5:</b> presented their research results in a pedagogical way for other students and researchers at academic seminars, for a general audience or for another category of recipients, where the formulation of presentation material and speech was based on pedagogical knowledge adapted to the audience’s knowledge level and also answered questions at an adequate level for the audience.</p> <p><b>B2.6:</b> participated in outreach activities related to their own research in order to contribute to the dissemination of knowledge and exchange of knowledge with relevant stakeholder groups such as other universities, companies, authorities, schools etc.</p>
<p>Demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity..</p> <p><i>Main differences in relation to the doctoral degree: The doctoral student's future contribution to society through research and</i></p>	<p>The goal has been achieved through the doctoral student having</p> <p><b>B3.1:</b> authored original scientific works where their own contributions are significant and identifiable. The works are of such quality that they have been published, or are expected to be published, in international scientific journals or conferences that apply peer review.</p> <p><b>B3.2:</b> authored a licentiate thesis based on their own studies of good</p>

<p>education is toned down and the focus is on the doctoral student being able to work on activities that require skills in research work but not a doctoral degree.</p>	<p>scientific and linguistic quality that have been defended and discussed at a licentiate seminar and examined and given a pass grade by an independent examiner.</p>
<p><b>Judgement and approach</b></p>	
<p><b>Intended learning outcomes</b></p>	<p><b>Assessment criteria with reference to numbering in eISP</b></p>
<p>Demonstrate the ability to make assessments of ethical aspects of his or her own research.</p> <p><i>Main differences in relation to the doctoral degree: The ability to make ethical research assessments is limited to their own research and not in general.</i></p>	<p>The goal has been achieved through the doctoral student having</p> <p><b>C1.1:</b> demonstrated intellectual integrity in the sense that their own choices and positions have been justified and defended on the basis of independent critical thinking in relation to proven experience and scientific basis.</p> <p><b>C1.2:</b> described how they ensured that their own scientific procedure in theory and practice was carried out in an honest and ethical manner.</p> <p><b>C1.3:</b> reflected on possible existing or hypothetical ethical dilemmas related to their own research area or to scientific research in general, and reported on their own ethically independent stance in the existing or hypothetical situation.</p> <p><b>C1.4:</b> been examined with a pass grade for intended learning outcomes in ethics in a suitable compulsory or optional course at third-cycle level. The research student is thus assumed to be able to describe basic theories in research ethics and relate these to their own approach and research work.</p>
<p>Demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.</p> <p><i>Main differences in relation to the doctoral degree: For the licentiate degree, only “insight” is required, as opposed to “in-depth insight” for the doctoral degree.</i></p>	<p>The goal has been achieved through the doctoral student having</p> <p><b>C2.1:</b> presented concrete examples of how their own research results, and the research area in general, can contribute new knowledge to the research front in the area and justify its societal relevance.</p> <p><b>C2.2:</b> critically reflected on limitations of their own research results, and the research area in general, in order to contribute to solving societally relevant problems, as well as identify possible situations where their own research results can be used in both a positive and negative way.</p> <p><b>C2.3:</b> demonstrated good ability to reflect on how their own research results can contribute to sustainable societal development and can, where relevant, also link these to the prioritised global sustainable development goals.</p> <p><b>C2.4:</b> described how their own actions and approach take into account the concept of sustainability.</p>
<p>Demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.</p> <p><i>Main differences in relation to the doctoral degree: The same requirement to be able to identify the need for additional knowledge with the addition of being able to take responsibility for their own knowledge</i></p>	<p><b>C3.1:</b> by means of concrete examples, described how the lack of essential knowledge needed to carry out a task was rectified and how this affected the possibility of carrying out the task. This may involve widely differing tasks and knowledge, with the proviso that the third-cycle students themselves must have realised that knowledge was lacking and handled this with measures relevant to the purpose.</p> <p><b>C3.2:</b> demonstrated insight that the knowledge front in higher education and research is in constant change and development and</p>

*development, which may be considered to be implied for a doctoral degree.*

that definitive answers cannot always be obtained, as well as the ability to determine whether certain knowledge already exists, for example by means of thorough and critical examination of existing scientific literature.

**C3.3:** demonstrated the ability to question, evaluate and adapt their perception of their own level of knowledge and ability in relation to the prevailing knowledge front.