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Course of Study-Specific Examination Regulations

for the Master's Course of Study

in Transport Engineering and Mobility

at RWTH Aachen University

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Now Issued in Their Sixth Revised Version,

Dated August 19, 2022,

Published as a Complete Version

(Examination Regulations 2019 Version)

Please note: This publication is an English translation. Only the German original of these regulations as published in the Official Announcements of RWTH Aachen University ("Amtliche Bekanntmachungen") is legally binding.

Based on §§ 2 (4) and 64 of the law governing the Universities of the Federal State of North Rhine-Westphalia (or Hochschulgesetz – HG) in the version of the act dated September 16, 2014 (Law and Official Gazette of the State of North Rhine-Westphalia p. 547), most recently amended by Article 1 of the Act concerning the Membership of University Hospitals in the Employers' Association of the State of June 30, 2022 (Law and Official Gazette of the state of North Rhine-Westphalia p. 780b), RWTH Aachen University (RWTH) has issued the following examination regulations:

ISSUED BY DIVISION 1.1 OF DEPARTMENT 1.0 ON BEHALF OF THE RECTOR OF RWTH AACHEN UNIVERSITY
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I. General

§ 1
Scope of Application and Academic Degree

(1) These examination regulations apply to the Transport Engineering and Mobility master's course of study at RWTH. They only apply in conjunction with the currently valid version of the General Examination Regulations (GER), supplementing it with an additional set of course-specific regulations. In cases of doubt, the provisions of the General Examination Regulations take precedence.

(2) Upon successful completion of the master's program, the Faculty of Civil Engineering awards the graduates the academic degree of Master of Science RWTH Aachen University (M. Sc. RWTH).

§ 2
Objectives of the Course of Study and Language Provisions

(1) This master's degree program builds upon the bachelor's degree program in Transport Engineering and Mobility in accordance with § 2 (3) GER.

(2) The overall educational objectives are set out in § 2 (1, 3, and 4) GER. For further information and provisions on the educational objectives of this master's course of study, please refer to Appendix 4 of the present regulations.

(3) The degree program is taught in German and English. In the concentrations according to § 4 (2), courses are offered either predominantly in German or in English:

- Transportation Planning and Infrastructure (predominantly German)
- Roads and Motor Vehicles (mainly German)
- Airports and Aeronautics (mainly German)
- Bahnsystemingenieur (mainly German)
- Railway Systems Engineering (mainly English)

(4) Exams may be taken in German or English, in agreement with the examiner in question.

§ 3
Admission Requirements

(1) An essential requirement for admission is a recognized first university degree according to § 3 (4) GER.

(2) With regard to the academic knowledge and skills applicants have gained according to paragraph 1, they must demonstrate that they now possess the knowledge required to successfully pursue studies in their chosen concentration of the master's degree program in Transport Engineering and Mobility to the extent indicated. This knowledge must be comparable to that taught in the bachelor's degree program in Transport Engineering and Mobility at RWTH.

a) For concentrations in Transportation Planning and Infrastructure, Roads and Motor Vehicles, Airports and Aeronautics, and Railway Systems Engineering:

- Mathematical and statistical foundations totaling 18 CP, distributed as follows:

  - Mathematics at least 14 CP
  - Statistics: at least 2 CP

- Fundamentals in the field of mechanics amounting to 11 CP
- Additional engineering fundamentals totaling 10 CP from at least two of the following areas:
  - Building materials science/materials science
  - Automatic control
  - Geotechnical engineering
  - Environmental management
  - Hydromechanics / Fluid mechanics
  - Thermodynamics / Physics
  - Fundamentals of electrical engineering
- Subject-specific basics amounting to a total of 50 CP, whereby at least 10 CP each must be demonstrated from two of the areas listed below:
  - Transportation: Roads, railroads, airports, transport industry
  - Mechanical engineering: Machine design, vehicle technology, combustion engines, rail vehicle technology, aerospace technology
  - Electrical engineering: Electrical engineering, battery storage technology, electrical machines
  - Construction: Building construction, statics, solid construction, steel construction
  - Spatial planning: Urban and regional planning, transportation planning, urban water management
  - Computer science: Programming languages, database systems.

b) For the Railway Systems Engineering concentration:

- Mathematical and statistical foundations totaling 18 CP, distributed as follows:
  - Mathematics at least 14 CP
  - Statistics: at least 2 CP
- Fundamentals in the field of mechanics amounting to 11 CP
- Fundamentals in the field of electrical engineering in the amount of 5 CP
- Additional engineering fundamentals totaling 10 CP from at least two of the following areas:
  - Building materials science/materials science
  - Automatic control
  - Hydromechanics / Fluid mechanics / Thermodynamics
  - Physics
- Subject-specific fundamentals amounting to a total of 40 CP, whereby at least 10 CP each must be demonstrated from two of the areas listed below:
  - Transportation: Roads, railroads, airports, transport industry
  - Mechanical engineering: Machine design, vehicle technology, combustion engines, rail vehicle technology, aerospace technology
  - Electrical engineering: Electrical engineering, battery storage technology, electrical machines

In addition, all applicants are required to provide evidence of having completed the Graduate Record Examination (GRE) General Test. Applicants who are citizens of a member state of the European Union or of the European Economic Area (EEA) as well as “Bildungsinländerinnen” or “Bildungsinländer”, i.e. non-German citizens who have a German school leaving certificate or university degree are exempt from this rule.

(3) For admission conditional on the completion of additional requirements, § 3 (6) GER applies. Admission to the master’s course of study is not possible if the applicant would have to complete the following additional requirements based on their concentration:

a) For the concentrations in Transportation Planning and Infrastructure, Roads and Motor Vehicles, Airports and Aeronautics as well as Railway Systems Engineering:

- in the area of mathematical-statistical basics, more than 8 CP worth
- in the area of fundamentals of mechanics, more than 9 CP worth
- in the area of further engineering fundamentals, more than 8 CP worth
- in the area of subject-specific basics, more than 15 CP worth
- or if the total amount of additional requirements the applicant would need to complete were to exceed 30 CP.

b) For the Railway Systems Engineering concentration:

- in the area of mathematical-statistical basics, more than 8 CP worth
- in the area of fundamentals of mechanics, more than 9 CP worth
- in the area of further engineering fundamentals, more than 8 CP worth
- in the area of subject-specific basics, more than 8 CP worth
- or if the total amount of additional requirements the applicant would need to complete were to exceed 20 CP.

(4) For this master's degree program, sufficient language proficiency in German – or English – must be demonstrated in accordance with § 3 (7) or § 3 (9) GER in the different concentrations according to § 4 (2):

- Transportation Planning and Infrastructure (proficiency in German according to § 3 (7) GER)
- Roads and Motor Vehicles (proficiency in German according to § 3 (7) GER)
- Airports and Aeronautics (proficiency in German according to § 3 (7) GER)
- Bahnsystemingenieur (proficiency in German according to § 3 (7) GER)
- Railway Systems Engineering (proficiency in English according to § 3 (9) GER).

(5) § 3 (12) GER applies for determining whether the admission requirements are met.

(6) General regulations for the recognition of courses of prior assessments and exams are stipulated in § 13 GER.

§ 4
Standard Period of Study, Curriculum, Credit Points, and Scope of Study

(1) The standard period of study is four semesters (two years) full-time, including preparation of the master’s thesis. The course of study may be commenced in either semester.

(2) The program offers five concentrations: transportation planning and infrastructure, roads and motor vehicles, airports and aeronautics, Bahnsystemingenieur, and railway systems engineering. One of these concentrations must be pursued. Each concentration consists of three groups. The first group is a compulsory area, the second group is a core elective area. Modules from the third group do not necessarily have to be taken.
For successful completion of the degree program, a total of 120 credit points must be acquired. The master's examination is comprised of the following components:

a) Transportation Planning and Infrastructure concentration

Compulsory area (group 1)	45 CP
Core electives (group 2)	At least 28 CP
Elective area (group 3)	Variable (depending on CP attained in the first two groups)
Master's thesis	24 CP
Total	120 CP

b) Roads and Motor Vehicles concentration

Compulsory area (group 1)	43 CP
Core electives (group 2)	At least 28 CP
Elective area (group 3)	Variable (depending on the CP attained in the first two groups)
Master's thesis	24 CP
Total	120 CP

c) Airports and Aeronautics concentration

Compulsory area (group 1)	45 CP
Core electives (group 2)	At least 28 CP
Elective area (group 3)	Variable (depending on the CP attained in the first two groups)
Master's thesis	24 CP
Total	120 CP

d) Bahnsystemingenieur concentration

Compulsory area (group 1)	47 CP
Core electives (group 2)	At least 28 CP
Elective area (group 3)	Variable (depending on the CP attained in the first two groups)
Master's thesis	24 CP
Total	120 CP

e) Railway Systems Engineering

Compulsory area (group 1)	46 CP
Core electives (group 2)	At least 28 CP
Elective area (group 3)	Variable (depending on the CP attained in the first two groups)
Master's thesis	24 CP
Total	120 CP

(3) The degree program comprises between 12 modules and 20 modules, including the master's thesis module. All modules are specified in the module handbook. The assignments and exams to be completed in the individual modules are weighted with CP according to § 4 (4) GER.

§ 5
Obligatory Attendance in Classes

(1) According to § 5 (2) GER, obligatory attendance can only be stipulated in courses of the following type:

1. Tutorials
2. Seminars and introductory seminars ("Proseminare")
3. Colloquia
4. Lab internships
5. Excursions

(2) Classes with obligatory attendance in accordance with paragraph 1 shall be indicated as such in the module handbook.

§ 6
Exams and Exam Deadlines

(1) General regulations on exams and exam periods are stipulated in § 6 GER.

(2) If successful completion of modules, exams, or module components according to § 5 (4) GER is stipulated as a precondition for participation in other exams, this is indicated in the module catalog.

§ 7
Types of Exams

(1) General regulations on types of exams are stipulated in § 7 GER.

(2) The duration of a written exam is as follows:

- At least 60 and a maximum of 90 minutes
  and for the sum of all partial examinations a maximum of 135 minutes if up to 3 CP can be attained
- At least 60 and a maximum of 120 minutes
  and for the sum of all partial examinations a maximum of 180 minutes if 4 to 6 CP can be attained

- At least 60 and a maximum of 270 minutes
  and for the sum of all partial examinations, if any, a maximum of 270 minutes if more than 6 CP can be attained.

(3) The duration of an oral exam is 15 minutes at minimum and 30 minutes at maximum if up to 3 CP are awarded, and 60 minutes at maximum if more than 3 CP are awarded. An oral exam may be carried out as a group exam with up to four candidates.

(4) Term papers range from between 1 and 100 pages at the most. The time students are allowed to work on a term papers should be based on the workload to credit ratio (30 hours per CP).

(5) Research papers range from 1 and maximum of 100 pages. The processing time of a written research paper should be based on the workload to credit ratio (30 hours per CP).

Project portfolios range from 1 and maximum of 100 pages. The processing time of a project portfolio should be based on the workload to credit ratio (30 hours per CP).

(6)

(7) The written version of an oral presentation shall range from 1 to 100 pages. The duration of the presentation shall be at least 10 minutes up to 60 minutes at the most.

(8) For colloquia, the following applies in detail: the duration of the exam is a minimum of 10 and a maximum of 60 minutes.

(9) The following applies to internships in particular: Details of the job-related internship of 8 to 16 weeks are based on the guidelines for the internship (Appendix 3).

(10) The examiner specifies the duration of the exam and, if applicable, other modalities of the exam at the start of the course.

(11) Admission to module exams may be conditional on the successful completion of module components as examination requirements in accordance with § 7 (15) GER. For the relevant modules, this is outlined in the module handbook. At the start of the semester, or by the first session of the course, the instructor shall provide the students with precise criteria online in the CMS regarding opportunities to improve their grades by completing module components, specifically indicating the number and type of tutorials that can be taken for extra credit and the methods of correction and assessment.

§ 8
Assessment and Grading

(1) General regulations for assessing exams and the formation of grades are stipulated in § 10 GER.

(2) If an exam consists of several partial exams, each partial exam must be passed, i.e. be completed with the grade of at least "sufficient" (4.0).

(3) A module has been passed if all partial exams have been passed with a grade of at least "sufficient" (4.0), and all other credit points or module components have been achieved according to the relevant course of study-specific examination regulations.

(4) The overall grade is formed from the grades of the modules and the grade of the master’s thesis in accordance with § 10 (10) GER.

§ 9
Examination Board

The responsible examination board according to § 11 GER is the Transport Engineering and Mobility Master's Examination Board of the Faculty of Civil Engineering.

§ 10
Retaking Exams or Rewriting the Master's Thesis, and the Loss of the Right to Take an Exam

(1) General regulations governing retaking exams or rewriting the master's thesis, and the loss of the right to take exams are stipulated in § 14 GER.

(2) Freely selectable modules of this master's program can be substituted as long as the examination performance of the relevant module has not been assessed as "failed" and this is permitted by the relevant module handbook.

(3) An area (a concentration) of this master's program may be changed once upon application to the responsible examination board, provided that the language skills required for the corresponding concentration according to § 3 (4) are proven.

§ 11
Deregistration, Non-Attendance, Withdrawal, Deception, Non-Compliance

(1) General provisions on deregistration, non-attendance, withdrawal, deception, or non-compliance are stipulated in § 15 GER.

(2) The following applies to deregistering from internships and seminars: deregistering from block courses is possible until one day before the first day of the course.

II. Master's Examination and Master's Thesis

§ 12
Type and Scope of the Master's Examination

(1) The master's examination consists of

1. exams that are to be completed based on the structure of the course of study according to § 4 (2) and detailed in the module handbook, as well as

2. the master's thesis and the master's final colloquium.

(2) The order of courses is based on the curriculum (Appendix 1). The master's thesis can only be registered once the student has attained 60 credit points.

§ 13
Master's Thesis

(1) General provisions for the master's thesis are stipulated in § 17 GER.

(2) Further details regarding the supervision of the master's thesis are outlined in § 17 (2) GER.

(3) The thesis can usually be written in German or English, in agreement with the examiner in question.

(4) The time allotted for completing the master's thesis is usually 6 or 12 months at maximum alongside studies. In justified exceptional cases, the writing time can be extended by a maximum of up to six weeks upon application to the relevant examination board in accordance with § 17 (7) GER. The written work should not exceed 80 pages, excluding appendices.

(5) The candidate presents the results of their master's thesis in a master's final colloquium. § 7 (12) GER in connection with § 7 (8) apply accordingly. The master's final colloquium may be held before the master's thesis is submitted.

(6) The work required for preparing and writing the master's thesis as well as for the colloquium shall correspond to 24 credit points. The master's thesis can only be graded after the master's final colloquium has taken place.

§ 14
Acceptance and Assessment of the Master's Thesis

(1) General provisions on the acceptance and assessment of the master's thesis are stipulated in § 18 GER.

(2) Two copies of the master's thesis must be submitted to the Central Examination Office by the set deadline. Printed, bound copies are to be submitted.

III. Final Provisions

§ 15
Viewing of Examination Records

The viewing of exam documents is carried out in accordance with § 22 GER.

§ 16
Entry into Force, Publication, and Transitional Provisions

(1) These regulations shall enter into force as of the summer semester 2022 and shall be published in the official announcements ("Amtliche Bekanntmachungen") of RWTH.

(2) These regulations apply to all students who are enrolled in the master's course of study in Transport Engineering and Mobility at RWTH.

(3) Credit points obtained on the basis of the examination regulations of September 28, 2017, in their respectively valid versions, shall be transferred to the student records in accordance with

the equivalence list in Annex 2 and count toward the degree requirements as stipulated in these present examination regulations.

Issued on the basis of the resolutions of the Faculty Council of the Faculty of Civil Engineering dated July 18, 2018, December 18, 2019, November 11, 2020, December 16, 2020, December 15, 2021, and June 22, 2022, as well as the emergency resolution of the Dean dated August 22, 2019.

It is pointed out that, in accordance with § 12 (5) NRW HG, any claims regarding a violation of procedural or formal requirements of the regulatory or other autonomous rights of the University may no longer be asserted after one year has elapsed since the official publication of this announcement unless:

1) the announcement has not been properly published,
2) the Rectorate has objected, prior to publication, to the decision of the committee adopting the regulations,
3) the University has been previously notified about the defect of form or of procedure in a complaint, specifying the infringed legal provision and the fact which gives rise to the defect, or
4) the legal consequence of the exclusion of complaints was not pointed out in the public announcement.

On behalf of the Rector
The Chancellor
of RWTH
Aachen University

Aachen,
dated August 19, 2022

sgd. Nettekoven

Manfred Nettekoven

Appendix 1: Curriculum (Valid From Winter Semester 2022/2023)

Schwerpunkt Verkehrsplanung und Infrastruktur

Die Darstellung basiert auf der Annahme, dass das Studium in einem Wintersemester begonnen wird. Wer das Studium in einem Sommersemester beginnt, kann die Veranstaltungen belegen, die laut Plan im 2. (und 4.) Semester vorgesehen sind.

		1. Sem.		2. Sem.		3. Sem.		4. Sem.	
		WiSe		SoSe		WiSe		SoSe	
Modul	**Lehrveranstaltung**	SWS	CP	SWS	CP	SWS	CP	SWS	CP
Schale 1									**45 CP**
Straßenplanung II	Straßenplanung II	5	8			(5)	(8)		
Tunnelplanung und -betrieb	Tunnelplanung	2			8	(2)			(8)
	Tunnelbetrieb			3				(3)	
Verkehrsplanung II	Verkehrsplanung II	5	8			(5)	(8)		
Stadt- und Regionalplanung II	Stadt- und Regionalplanung II (2 Prüfungsleistungen)			5	8			(5)	(8)
Eisenbahnbetriebswissenschaft	Eisenbahnbetriebswissenschaft	3	5			(3)	(5)		
Verkehrswirtschaft II	Betrieb und Management von Schienenpersonenverkehrssystemen			2	8			(2)	(8)
	Betrieb und Management von Schienengüterverkehrssystemen			2				(2)	

Schale 2	**mind. 28 CP**
> Module siehe Curriculum Support sowie Webseite der Fakultät für Bauingenieurwesen	

Schale 3	**Anzahl CP variabel (siehe § 4)**
> Module siehe Curriculum Support sowie Webseite der Fakultät für Bauingenieurwesen	
Die Anzahl der hier erforderlichen CP hängt von den in Schale 2 erzielten CP ab.	

Masterarbeit	**24 CP**
Empfohlen im 4. Semester.	

WiSe = Wintersemester
SoSe = Sommersemester
SWS = Semesterwochenstunden
CP = Credit Points

Gesamt: 120 CP
(Schalen 1 bis 3: (mind.) 96 CP + Masterarbeit 24 CP = 120 CP)

Schwerpunkt Straße und Kraftfahrzeuge

Die Darstellung basiert auf der Annahme, dass das Studium in einem Wintersemester begonnen wird. Wer das Studium in einem Sommersemester beginnt, kann die Veranstaltungen belegen, die laut Plan im 2. (und 4.) Semester vorgesehen sind.

		1. Sem.		2. Sem.		3. Sem.		4. Sem.	
		WiSe		SoSe		WiSe		SoSe	
Modul	**Lehrveranstaltung**	SWS	CP	SWS	CP	SWS	CP	SWS	CP
Schale 1									**43 CP**
Straßenplanung II	Straßenplanung II	5	8			(5)	(8)		
Bautechnik von Verkehrsanlagen II	Bautechnik von Verkehrsanlagen II			5	8			(5)	(8)
Tunnelplanung und -betrieb	Tunnelplanung	2			8	(2)			(8)
	Tunnelbetrieb			3				(3)	
Verkehrsplanung II	Verkehrsplanung II	5	8			(5)	(8)		
Fahrzeugtechnik II - Querdynamik und Vertikaldynamik	Fahrzeugtechnik II - Querdynamik und Vertikaldynamik			4	6			(4)	(6)
Fahrzeugtechnik III - Systeme und Sicherheit	Fahrzeugtechnik III - Systeme und Sicherheit	(3)	(5)			3	5		

Schale 2	**mind. 28 CP**
> Module siehe Curriculum Support sowie Webseite der Fakultät für Bauingenieurwesen	

Schale 3	**Anzahl CP variabel (siehe § 4)**
> Module siehe Curriculum Support sowie Webseite der Fakultät für Bauingenieurwesen	
Die Anzahl der hier erforderlichen CP hängt von den in Schale 2 erzielten CP ab.	

Masterarbeit	**24 CP**
Empfohlen im 4. Semester.	

WiSe = Wintersemester
SoSe = Sommersemester
SWS = Semesterwochenstunden
CP = Credit Points

Gesamt: 120 CP
(Schalen 1 bis 3: (mind.) 96 CP + Masterarbeit 24 CP = 120 CP)

Schwerpunkt Airport und Luftfahrt

Die Darstellung basiert auf der Annahme, dass das Studium in einem Wintersemester begonnen wird. Wer das Studium in einem Sommersemester beginnt, kann die Veranstaltungen belegen, die laut Plan im 2. (und 4.) Semester vorgesehen sind.

		1. Sem.		2. Sem.		3. Sem.		4. Sem.	
		WiSe		SoSe		WiSe		SoSe	
Modul	**Lehrveranstaltung**	SWS	CP	SWS	CP	SWS	CP	SWS	CP
Schale 1									**45 CP**
Bautechnik von Verkehrsanlagen II	Bautechnik von Verkehrsanlagen II			5	8			(5)	(8)
Planung und Betrieb von Flughäfen II	Planung und Auslegung von Flughäfen II	2	5			(2)	(5)		
	Airport Management I	2				(2)			
Environmental Sustainability in Transport Engineering	Environmental Sustainability in Transport Engineering	4	6			(4)	(6)		
Flugführung	Flugführung			(4)	(5)			4	5
Flugdynamik	Flugdynamik			4	5			(4)	(5)
Flugzeugbau II	Flugzeugbau II			4	5			(4)	(5)
Flugzeuglärm	Flugzeuglärm	3	5			(3)	(5)		
Systeme der Luft- und Raumfahrt	Systeme der Luft- und Raumfahrt	4	6			(4)	(6)		

Schale 2 **mind. 28 CP**

> Module siehe Curriculum Support sowie Webseite der Fakultät für Bauingenieurwesen

Schale 3 **Anzahl CP variabel (siehe § 4)**

> Module siehe Curriculum Support sowie Webseite der Fakultät für Bauingenieurwesen

Die Anzahl der hier erforderlichen CP hängt von den in Schale 2 erzielten CP ab.

Masterarbeit **24 CP**

Empfohlen im 4. Semester.

WiSe = Wintersemester
SoSe = Sommersemester
SWS = Semesterwochenstunden
CP = Credit Points

Gesamt: 120 CP
(Schalen 1 bis 3: (mind.) 96 CP + Masterarbeit 24 CP = 120 CP)

Schwerpunkt Bahnsystemingenieur

Die Darstellung basiert auf der Annahme, dass das Studium in einem Wintersemester begonnen wird. Wer das Studium in einem Sommersemester beginnt, kann die Veranstaltungen belegen, die laut Plan im 2. (und 4.) Semester vorgesehen sind.

		1. Sem.		2. Sem.		3. Sem.		4. Sem.	
		WiSe		SoSe		WiSe		SoSe	
Modul	**Lehrveranstaltung**	SWS	CP	SWS	CP	SWS	CP	SWS	CP
Schale 1									**47 CP**
Eisenbahnsicherungstechnik	Eisenbahnsicherungstechnik I	2			7	(2)			(7)
	Eisenbahnsicherungstechnik II			2				(2)	
Eisenbahnbetriebswissenschaft	Eisenbahnbetriebswissenschaft	3	5			(3)	(5)		
Verkehrswirtschaft II	Betrieb und Management von Schienengüterverkehrssystemen			2	8			(2)	(8)
	Betrieb und Management von Schienenpersonenverkehrssystemen			2				(2)	
Schwingungsdynamik von Schienenfahrzeugen	Schwingungsdynamik von Schienenfahrzeugen			4	6			(4)	(6)
Spurführungstechnik	Spurführungstechnik	(4)	(6)			4	6		
Grundlagen Elektrischer Maschinen	Grundlagen Elektrischer Maschinen			3	5			(3)	(5)
Komponenten und Anlagen der Elektrizitätsversorgung	Komponenten und Anlagen der Elektrizitätsversorgung	3	5			(3)	(5)		
Elektrische Bahnantriebe	Elektrische Bahnantriebe	(3)	(5)			3	5		

Schale 2	**mind. 28 CP**
> Module siehe Curriculum Support sowie Webseite der Fakultät für Bauingenieurwesen	

Schale 3	**Anzahl CP variabel (siehe § 4)**
> Module siehe Curriculum Support sowie Webseite der Fakultät für Bauingenieurwesen	
Die Anzahl der hier erforderlichen CP hängt von den in Schale 2 erzielten CP ab.	

Masterarbeit	**24 CP**
Empfohlen im 4. Semester.	

WiSe = Wintersemester
SoSe = Sommersemester
SWS = Semesterwochenstunden
CP = Credit Points

Gesamt: 120 CP
(Schalen 1 bis 3: (mind.) 96 CP + Masterarbeit 24 CP = 120 CP)

Main Emphasis Railway Systems Engineering

The schedule is based on the assumption that the study is started in a winter semester. Students who start their studies in a summer semester can take the courses that are scheduled in the 2nd (and 4th) semester according to the plan.

		1. Sem.		2. Sem.		3. Sem.		4. Sem.	
		WiSe		SoSe		WiSe		SoSe	
Module	**Course**	SWS	CP	SWS	CP	SWS	CP	SWS	CP
Block 1									**46 CP**
Railway Systems	Railway Systems	4	6			(4)	(6)		
Principles of Rail Vehicle Technology	Principles of Rail Vehicle Technology	4	6			(4)	(6)		
Railway Timetabling, Operations and Control Systems	Railway Capacity Management and Operations	1			6	(1)			(6)
	Railway Operations Lab	1				(1)			
	Railway Control Systems			1				(1)	
Track Guiding Technology	Track Guiding Technology	(4)	(6)			4	6		
Rail Vehicle Vibration Dynamics	Rail Vehicle Vibration Dynamics			4	6			(4)	(6)
Mechatronic Systems in Vehicle Engineering	Mechatronic Systems in Vehicle Engineering			4	6			(4)	(6)
Power Electronics - Fundamentals, Topologies and Analysis	Power Electronics – Fundamentals, Topologies and Analysis	3	5			(3)	(5)		
Advanced Electrical Drives	Advanced Electrical Drives			3	5			(3)	(5)

Block 2 **At least 28 CP**

> For modules see Curriculum Support and the website of the Faculty of Civil Engineering.

Block 3 **Number of CP variable (cf.siehe § 4)**

> For modules see Curriculum Support and the website of the Faculty of Civil Engineering.

The number of CP required here depends on the CP achieved in Block 2.

Master's Thesis **24 CP**

Recommended in 4th semester.

WiSe = Winter Term
SoSe = Summer Term
SWS = Contact Hours per Week
CP = Credit Points

Total: 120 CP
(Blocks 1 to 3: (at least) 96 CP + Master's thesis 24 CP = 120 CP)

Appendix 2: Equivalence list

<table>
<tr><th colspan="6">Requirements</th></tr>
<tr><th colspan="3">PO 17</th><th colspan="3">PO 19</th></tr>
<tr><th>Name of the module</th><th>Designation of the courses or the exams</th><th>CP</th><th>Name of the module</th><th>Designation of the courses or the exams</th><th>CP</th></tr>
<tr><td>Urban, regional and transportation planning I</td><td>Urban and Regional Planning I</td><td>3</td><td colspan="3">Recognition upon application to the examination board</td></tr>
<tr><td>Administration and public transport</td><td>Public administration and law</td><td>2</td><td colspan="3">Recognition upon application to the examination board</td></tr>
<tr><td>Spatial development and transport policy / public transport</td><td>Spatial development and transport policy</td><td>2</td><td colspan="3">Recognition upon application to the examination board</td></tr>
<tr><td rowspan="2">Road planning (MoVe)</td><td>Civil engineering of traffic facilities I</td><td>3</td><td rowspan="2">Road design and construction technology of traffic facilities</td><td rowspan="2">Road design and construction technology of traffic facilities</td><td rowspan="2">8</td></tr>
<tr><td>Road design I</td><td>4</td></tr>
<tr><td rowspan="2">Road planning (MoVe)</td><td>Civil engineering of traffic facilities I</td><td rowspan="2">7</td><td rowspan="2">Road design and construction technology of traffic facilities</td><td rowspan="2">Road design and construction technology of traffic facilities</td><td rowspan="2">8</td></tr>
<tr><td>Road design I</td></tr>
<tr><td>Urban, regional and transportation planning I</td><td>Traffic planning I</td><td>3</td><td rowspan="2">Traffic planning and public transport</td><td rowspan="2">Traffic planning and public transport</td><td rowspan="2">5</td></tr>
<tr><td>Administration and public transport</td><td>Public transport organization and transport system management</td><td>2</td></tr>
<tr><td>Materials Science II</td><td>Materials Science II</td><td>4</td><td colspan="3">not applicable</td></tr>
</table>

Appendix 3: Guidelines for Internships

Internship Regulations

Regulations for Confirming and Students Properly Completing the Internship Required of Students as Part of the Master's Course of Study in Transport Engineering and Mobility

Purpose of the Internship

For students to sufficiently understand the content taught in technical lectures and through exercises and to prepare them for their jobs after graduation, it is essential that they receive visual, hands-on instruction on the practical foundations of the chosen profession.

The practical instruction of students enrolled at universities of technology is an essential prerequisite for successful studies and it is also an important part of the curriculum.

During the internship, students should learn how to use the knowledge they have attained so far and they should experience operational and social structures at the internship site.

Internship Position

Students shall search for a suitable internship position on their own.

The internship placement becomes legally binding through an internship contract that must be concluded between the company and the intern. The contract should specify all the rights and obligations of the intern and the company.

Working time lost due to illness must be made up.

In case of absences, interns should ask their training company to extend the contract to allow them to complete the training period they have begun as required. At the end of the work placement, the intern will receive a certificate from the training company stating the duration of training in each department and the number of days absent due to illness and vacation.

Students can obtain information regarding compulsory insurance by contacting their respective health insurance providers.
Insurance coverage for internships abroad is provided by an insurance policy taken out by the intern or the training company.

Internship Duration

The internship is scheduled for 8 to 16 weeks as part of the master's degree program in Transportation Engineering and Mobility.

It is also possible to complete two internships of 8 weeks. In this case, two reports must be prepared and two presentations must be given.

Up to 1.25 CP per week may be counted toward the internship module. Credit is given for sections of 8, 12, and 16 weeks (or 8 weeks twice). If the internship duration deviates from those time periods, only the respective lower time period will be counted.

Supervision of Interns

When students complete their internships, they are supervised at the internship site by a supervisor who provides meaningful tasks according to the internship site's capabilities and in compliance with the internship guidelines. They will teach the interns about the professional subject matter through talks and discussions.

Before starting their internship, students must have a confirmation of supervision by a professor researching and teaching at RWTH in the Transport Engineering and Mobility degree program. Adjunct teaching staff and research assistants may assist with supervision.

The supervising professor provides professional guidance during the internship.

Recognition of the Internship and Issuance of the Overall Certificate of Attendance

Students must prepare a written report for the entire period of the internship.

The report should consist of approximately three typed A4 pages per week spent at the internship site.

The interns must also give a presentation about their completed internship at the chair of the supervising professor.

These two deliverables should be examined by the same person who supervised the topic on the part of RWTH. The written report is to be evaluated in accordance with § 9 (1) MPO and must include a written justification.

The announcement of the pass or fail of the ungraded assignment must be made no later than eight weeks after the respective submission deadline. If this announcement is not made in due time, the examination board is entitled to appoint other examiners. The certificate attesting to the completed internship weeks and the passing grade must be sent to the Central Examination Office by the respective chair.

Appeals against decisions of the supervising professor can be lodged with the examination board.

Appendix 4: Program-Specific Educational Objectives

1. Explanation

The German version of these regulations contains gender-specific terms which apply equally to women and men.

2. Overarching goals of the bachelor's and master's degree programs in Transport Engineering and Mobility

The bachelor's and master's degree programs in Transport Engineering and Mobility are consecutive but independent courses of study.

The bachelor's program in Transport Engineering and Mobility provides students with a broad-based education in the fundamentals of the field. The goal of the program is, in addition to teaching basic knowledge, to enable students to independently solve engineering-specific problems, as well as to teach basic methodological skills, team-oriented work methods, and communication skills. The bachelor's program forms the basis for further in-depth study in the corresponding concentrations in the master's program, representing the focus on a specialized area. In the master's program, the content is more technically detailed and explored more extensively. The goal is to teach the scientific and research-oriented approach to tasks and problems. The competence to act independently and responsibly is also strengthened.

The master's program in Transport Engineering and Mobility is both research and application-oriented. The aim is for students to deepen their knowledge and specialize in a particular field. The consecutive structure, which builds on the corresponding bachelor's degree program, provides an appropriate level of technical depth. The hallmark of the Master of Science degree is the ability to exercise interdisciplinary judgment and creativity at the interface between infrastructure and operational resources based on solid specialized engineering knowledge in preparation for leadership positions in the transport science work environment. Completing a master's degree qualifies the student to enter a doctoral program.
The Transport Engineering and Mobility program concept is based on the master's degree as the standard degree. The bachelor's degree is seen as a gateway, qualifying the graduate for both a job in the field of transportation and offering the opportunity for further qualification in that it fulfills the prerequisite for beginning a master’s degree program.

3. General educational objectives

The consecutive bachelor's and master's degree programs are scientific, research-oriented degree programs that focus on basic principles and methods. By focusing on fundamentals, they enable graduates to work successfully throughout their careers since they do not limit themselves to teaching current content but rather provide theoretically underpinned fundamental concepts and methods that endure beyond current trends.
The course provides students with the subject's basic principles, concepts, and methods of the subject. Upon completion of their studies, students should be able to work on tasks in various fields of application of the subject under different technical, economic, and social conditions. They should be able to apply the concepts and methods learned to future developments.

The academic profile is as follows:

Problem-solving skills:
Graduates should be able to systematically analyze complex tasks and develop and validate solutions. They should be empowered to take appropriate actions necessary to resolve problems as they

arise. Graduates should also be able to tackle complex issues, having learned to use the relevant discipline-specific systems and methods in a goal-oriented manner.

Methodological competence and scientific soundness:
Graduates should understand scientific principles and working methods and be able to apply them to engineering problems; understand engineering problems and ways to solve them using mathematical methods; be able to evaluate reasoning, assumptions, and abstract concepts to form their own judgments and make contributions to solving complex problems; design experiments mathematically and analyze and interpret the results quantitatively after the calculations are performed.

Ability to learn and innovate:
Graduates of the bachelor's and master's programs should be able to independently acquire new knowledge, apply newly learned skills, and perform scientific work under guidance.

Analytical and communication skills:
Graduates should be able to recognize, describe, and communicate engineering problems; analyze engineering issues and formulate solutions; communicate adequately in written and oral English in addition to German.

Interdisciplinarity, ability to work in a team, social behavior:
Graduates should have an understanding of the connections of their own field with other disciplines and be able to describe the implications of this; furthermore, they should be able to participate in interdisciplinary activities, be able to work in teams and respect those who think differently, and be able to work in international teams.

Sense of responsibility, determination, ability to work under pressure:
Graduates should be able to consider uncertainties and limits of knowledge; take responsibility for their own work and its effects; persevere in pursuit of an agreed-upon goal, even in the face of opposition.

The educational objectives listed above are achieved at varying levels for the bachelor's or master's degree. There is a clear difference, particularly with regard to problem-solving and leadership skills. This implies that the nature of the tasks the graduates will face in their professional careers will differ depending on which degree they completed.

4. Educational objectives for the bachelor's degree program in Transport Engineering and Mobility

The competencies and skills of the graduates who have obtained the degree in the bachelor's program in Transport Engineering and Mobility can be characterized as follows:

- Graduates possess fundamental knowledge of engineering, mathematics, and the natural sciences.
- Graduates master the scientific methods of analyzing problems in their basic structure.
- Graduates will have an introductory knowledge of theoretical problem description and mathematical modeling in the field.
- Due to the basic orientation of the training, graduates are very well prepared for lifelong learning and employment in various professional fields.
- The acquired methodological skills allow graduates to successfully work on synthesis problems, especially in the context of complex systems, with a balanced consideration of technical, economic, and social constraints.
- Graduates have become familiar with selected fields of technology as examples and are able to link the acquired engineering fundamentals with applications in the professional field.

- Due to the strongly interdisciplinary education, graduates know different ways of thinking to solve problems and can build bridges between engineering, natural sciences, and other disciplines in their careers.
- Graduates demonstrate a broad engineering education. In addition to a large number of fundamentals of civil engineering, knowledge of mechanical and electrical engineering is also taught. This is complemented by knowledge from other fields, such as economics.

5. Structure of the bachelor's degree program in Transport Engineering and Mobility

The bachelor's program includes a total of 32 modules. In the area of mathematical-scientific and engineering fundamentals, 13 compulsory modules (78 credit points) must be completed, and in the areas of civil engineering, electrical engineering, mechanical engineering and economics, a total of 15 compulsory modules (75 credit points) must be completed. Electives are limited in the bachelor's program and only allow students a choice between various courses in the fifth semester: mechanical engineering subjects in the design of vehicles, water infrastructure and life cycle assessment in civil engineering, the economics subject of Operations Research 1, and another elective. In the sixth semester, the institute’s internship phase (5 credit points) takes place and the bachelor thesis (12 credit points) must be completed.

The large proportion of compulsory modules ensures that all students are provided with all the necessary fundamentals of infrastructure planning and vehicle and aircraft design in the required depth and breadth before choosing a concentration in the master's program.

6. Career prospects of graduates of the bachelor's degree program in Transport Engineering and Mobility on the job market

Bachelor's graduates of the Transport Engineering and Mobility program have a basic knowledge that, in principle, enables them, after familiarization, to pursue practical, application-oriented work in industry and with public authorities and associations, primarily in the field of their concentration, or to enhance their profile in a specific research field under guidance.
The skills of graduates for the labor market include, in particular, the following areas:

- Planning, construction, and operation of traffic routes
- Rural, urban, and regional planning
- Environmental administration
- Construction and design of vehicles and aircraft
- Organization and operation of public transport (public transport companies, transport associations, public transport authority organizations)
- Mobility and traffic management

7. Educational objectives for the master's degree program in Transport Engineering and Mobility

The master's program in Transport Engineering and Mobility provides in-depth knowledge of concepts and methods in specialized fields of the respective discipline. On the one hand, students are offered the opportunity to deepen their understanding of the individual modes of transport (road, rail, aviation) by taking a combined look at infrastructure and vehicles/aircraft and, on the other hand, to explore cross-sectional areas such as infrastructure planning and construction or specifically passenger or freight transport. The overlapping areas provide a comprehensive systems understanding of the parties, processes, and measures involved. In the individual traffic types, due to the increasing spread of sensor technology in the infrastructure as well as the closer coupling of intelligent systems between the vehicles and the infrastructure, the interface between vehicle and infrastructure, as well

as the human behavior connection, is considered in particular. Students will thus be guided in achieving high academic qualifications while gaining a broad systems understanding and independence in these areas.

8. Structure of the master's program in Transport Engineering and Mobility

In the master's program, students can expand their professional knowledge in one of five concentrations:
The Transportation Planning and Infrastructure concentration provides knowledge in planning, design, operation, maintenance, and organization in the areas of roads, tunnels, rail, waterways, and aviation.
In the Roads and Motor Vehicles concentration, the focus is on roads, their traffic control systems, and motor vehicles as a means of transport. Students are concerned with the vehicle technology of passenger and commercial vehicles and the design of road traffic facilities. Due to the increasing use of sensors in vehicles and infrastructure, these fields are growing closer together, so a more robust understanding of the system (similar to the area of rail transport) is required.
In the Airports and Aeronautics concentration, students get to deepen their knowledge of aviation technology and airport management.
The Bahnsystemingenieur concentration is taught predominantly in German and focuses on further developments in the railroad system in the integrated network of infrastructure and vehicles. Students deal with rail vehicles, rail transport systems, and infrastructure developments in rail transport.
The English-language concentration Railway Systems Engineering is intended to appeal in particular to international students. The contents of the program are comparable to those from the German-taught Bahnsystemingenieur concentration.

All master’s concentrations have a three-group structure. The first group contains the core subjects. It thus reflects the profile of the respective concentration. Between 34 CP and 47 CP are to be completed in the first group, depending on the respective concentration. The second group contains the extended core area. At least 28 CP must be completed here. In group 3, again, depending on the focus, a maximum of between 22 CP and 34 CP is to be recognized. These can come from subjects not selected in group 2 or additional subjects in the third group.

An internship may be chosen in group 2 in all concentrations. Between 10 and 20 CP are awarded for the internship depending on its duration (8, 12, or 16 weeks). The master’s thesis (24 credit points) takes place in the fourth semester.

9. Career Prospects of graduates of the master's program in Transport Engineering and Mobility

Graduates of the program have a number of career options open to them. In addition to pursuing an academic career, graduates can also work in consulting and engineering firms, in public administration (federal government, states, municipalities, road construction offices), or with infrastructure operators such as railroads or airports in the context of planning, maintenance, and expansion of infrastructure. In addition, there are many career opportunities in the vehicle industry, transport companies, and associations.

The methodological-scientific training also provides a basis for entering into the research and development of vehicles, drives, traffic management, and control tools, and the facilities required for this, including their environmental effects. Graduates are also well-positioned to help drive the development of the infrastructure as well as maintain it in a way that conserves resources.