

Degree Program Documentation

Master's Program in

Transportation Systems

Part A

TUM School of Engineering and Design
Technical University of Munich

General Information:

- Administrative responsibility: TUM School of Engineering and Design
Professional Profile Mobility Systems Engineering
- Name of degree program: Master's Program in Transportation Systems
- Degree: Master of Science
(M.Sc.)
- Standard duration of study and credits: 4 semesters of enrollment and 120 credit points (CP)
- Form of study: full time
- Admission: Aptitude assessment (EV – Master's)
- Start: Winter semester (WiSe) 2026/2027
- Language(s) of Instruction: English
- Main Location: Munich
- Tuition fees for students from non-EEA countries: Tuition fee for students from Non-EU Countries (6.000 €
per semester)
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1 Degree Program Objectives

1.1 Purpose

The transportation system is an important part of any economy and core element of daily human life. Mobility is not only a human basic need, it is the key factor of any modern society and economy. Nowadays, society and economy are both challenged by the growing demand for mobility, as well as by the ecological and economic impacts of the increasing transportation demand. Phenomena like our globalizing world, as well as pollution and climate change require new strategies in the area of transport planning, traffic control and infrastructure design. Particularly, an efficient, environmentally friendly and safe operation of transportation systems is growing in importance. “Environment” and “sustainable development” are still leading topics on the international agenda. Furthermore, new challenges, like global pandemics, and technological advances, such as the proliferation of e-commerce, change the transportation systems landscape.

Transport and mobility are connected with many social phenomena; they are influenced and also influence social structures and processes (e.g. changes in urban spatial structures). In general, the transportation system must be considered as part of a complex system, if there shall be provided optimal transport conditions for people and goods as well as a good quality of living in urban areas. Consequently, transport planning strategies must consider and include the various interactions between transport, economy, land-use, and the natural environment.

There is a need for experts who know about rail and road design, algorithms of traffic management and control systems, and the planning of public transport networks. But, at the same time, those specialists also require interdisciplinary skills to leverage the potential of new technologies, such as artificial intelligence. The current professional environment and development show that transport engineers must also have skills in economics and project appraisal. Besides, they need knowledge about ecology and the concepts of sustainability, so that they can cope with current and future environmental challenges (e.g. noise emissions, air pollution or land-use and soil sealing). They have to know about travel behavior, so that they are able to consider also social aspects of transport (e.g. social impacts of transport investments, accessibility and reachability).

This program is designed to enhance the classical training program for transport engineers towards an interdisciplinary and system-orientated education, including a shift in focus towards the basic and application research field. Taking all this into account, the Master’s program prepares highly qualified professionals for the dynamically growing market of transport and mobility. Within the Master’s program, transportation is considered with regards to the spectrum of urban fields of action: causes (e.g. land-use, urban structure, utilization structure) and effects (e.g. exhaust and noise, congestion), as well as measures (e.g. integrated land-use and transport management, traffic control). Besides, transport planning is increasingly becoming a design and management task within an overall complex system that comprises passenger and freight transport, as well as all other carriers. A functional high-performing transportation system is a prerequisite for economic development. If transportation is considered as an overall system, it becomes apparent that this sector is immensely important for the economy (e.g. the transportation budget is the largest of the state’s individual budgets). Infrastructure design and construction is substantial and also an integral part of the Master’s Program in Transportation Systems.

1.2 Strategic Significance

In its mission statement, the Technical University of Munich (TUM) is committed to “inspire, promote and develop talents in all their diversity to become responsible, broad-minded individuals.” Shaping the “progress of innovation for people, nature, and society” is also central, along with “sensitivity to social and political issues.”

With its strong international orientation, the Master’s Program in Transportation Systems strengthens the worldwide and diverse positioning of the Technical University of Munich in one of the most relevant academic fields of our modern life, transport and mobility.

Furthermore, strong emphasis is given in responsible planning of transportation infrastructure and systems, so that they can support progress of innovation for people and goods. The “responsibility” aspect is ensured through explicitly considering the environmental and social impacts of the developed solutions. Rigorous methodological approaches are taught, which enable the program graduates to suitably assess and quantify these issues, in order to convincingly support evidence-based policies. This enables the pursuit of seemingly conflicting objectives, such as progress, while respecting nature and humans.

As a result, the program trains transportation professionals that can support the push towards a more just and equitable transportation system. In our rapidly changing world, these unique characteristics of this Master’s program offer a concrete differentiating asset for TUM.

The TS program is embedded in the Professional Profile “Mobility” of the TUM School of Engineering and Design and is linked primarily with the Departments of Mobility Systems Engineering and Civil and Environmental Engineering. It plays a central role in interdisciplinarity combining the knowledge of several chairs and professorships, applying it to an international perspective. The large number of elective courses offered from various TUM Schools highlights this interdisciplinarity and provides considerably added value for the students.

2 Qualification Profile

Graduates of this Master's program possess a wide portfolio of relevant competences, abilities and know-how in the area of transportation systems, and they are capable to effectively apply this knowledge and these skills. The qualification profile meets the requirements of the Qualifications Framework for German Higher Education Qualifications ("Hochschulqualifikationsrahmen" – HQR) from 16th February 2017. For Master's programs, the following four areas of competence have been defined: Knowledge and understanding (1), Usage, application and generation of knowledge (2), Communication and Cooperation (3), and Scientific self-understanding/ professionalism (4).

Knowledge and Understanding

Building on the competences achieved during their Bachelor's program, graduates from the Master's Program in Transportation Systems have deepened or expanded this knowledge during the course of the Master's program. For instance, they have knowledge and a sound understanding of how to plan, design and operate integrated transportation systems, and they are able to define and interpret the particular terminology and concepts of their field of study. TS graduates are able to employ their knowledge and understanding in research or practical applications. Besides, graduates have specialized knowledge in one of the three fields of study: Transportation Infrastructure, Intelligent Transport Systems, or Integrated Mobility Planning. They have the skills to identify, analyze and solve problems related to this field. Besides, graduates know and understand the interrelation between land-use demand, transportation supply, economic growth and the natural environment. They are aware of the importance of accessibility and mobility in the planning and implementation process. Apart from that, graduates understand the important concept of sustainability and the requirement of new planning and management strategies. They are able to evaluate the epistemic correctness of their specialist knowledge in consideration of scientific and methodological approaches and, based on this evaluation, solve practical and scientific problems.

Usage, application and generation of knowledge

On a general level, TS graduates have the ability to develop and optimize solutions for a wide range of different tasks in transportation science and engineering. They are capable to systematically structure engineering tasks, as well as to methodologically work out approaches to deal with different engineering and mathematical problems. Graduates know how to achieve knowledge and competence in special fields of engineering and they can use their theoretical-analytical skills on complex applications. More specifically, TS graduates have the competence to analyze the complex system of contemporary mobility, including aspects of sustainability. They can identify the correlations between transportation infrastructure, transport control, means of transport, as well as transportation of persons or goods. The graduates are able to discern the interrelation between land-use demand, transport supply, economic growth and the natural environment. They know about the importance of accessibility and mobility and consider it in the planning and implementation process. Graduates have sound knowledge of the current methods of processing traffic data as well as of the standard applications and functions for visualization. They know and understand how to plan for an integrated transport system together with the skills to identify, analyze and solve problems related to this field.

TS graduates are all-round experts, competent in analysis methods, transport theories and modelling, as well as project appraisal and planning instruments. Thus, they have the expertise to implement and apply different assessment methods and techniques in a relevant, issue-related way. In addition, they have know-how in traffic control and intelligent transport systems applied in an urban or motorway context. Besides, they are able to use their knowledge and insights gained in the field of transportation to develop new solution strategies for problematic transportation systems as well as for efficient transport engineering and planning. They are capable to overview and to give consideration to relevant economic, social and environmental aspects of transport for sound decision making. TS graduates are familiar with the important concept of sustainable development which requires new planning and management strategies. They know and understand significant sociological, ecological and economic concepts and theories. For instance, graduates can estimate and analyze benefits and costs of infrastructure measurements and modifications. They are also aware of the external costs of transport operations and are able to plan and evaluate transport infrastructure investments. Furthermore, they are trained to consider ecological aspects like noise and vehicle emissions. In this way, they are able to contribute to more efficient and environmental-friendly mobility conditions.

Furthermore, graduates know how to find and absorb the required information and how to evaluate and adapt it to a specific context. They are able to develop relevant research questions, to structure complex theses, and to present their findings in a logical, well-supported and convincing way. Thus, they have profound competence in the use of scientific methods, as well as in the development of solutions for practical problems, based on scientific findings. Graduates from the Master's Program in Transportation Systems are able to design research projects related to current scientific fields of transportation engineering. Besides, they can select appropriate and concrete scientific approaches for their specific research topic and justify these chosen ways of implementing research. TS graduates are able to reflect about different research methods and to select the most suitable method, as well as to justify this selection. Furthermore, they are capable to explain the results of their research, to interpret them critically, and to situate their research results within the current state of the art in research.

Communication and Cooperation

The graduates of the Master's Program in Transportation Systems are able to eloquently deliver well-structured presentations in front of a professional or an academic audience and to discuss their scientific findings with international experts. Besides, they have the expertise to prepare papers about their results and recommendations for scientific publishing. The graduates know how to obtain their goals, how to organize themselves and how to work in an independent and self-consistent way.

TS graduates are aware of the importance of cultural differences and know how to deal with cross-cultural issues in an effective way. They are experienced in working together in multinational and interdisciplinary groups and have also achieved cross-cultural competence and the ability to work efficiently in diverse teams. Thus, graduates are trained to be open-minded, pragmatic, but thorough, analytical and structured, good communicators, and quick thinkers. Graduates are able to act in a responsible way. Thus, they have social and strong communication skills, combined with the ability to handle conflicts in a constructive way.

Apart from that, TS graduates have the ability to enter into dialog with both academics and non-academics from various disciplines and fields. They are able to discuss feasible alternatives for solving discipline-specific and subject-related problems.

Scientific self-understanding / professionalism

Graduates of the Master's Program in Transportation Systems at TUM have developed a professional self-understanding, based on the objectives and standards of professional action in academia, as well as in society. They are able to justify their own professional actions in the field of transportation engineering with theoretical and methodological knowledge and reflect on alternatives. During their studies they have learned to assess their own abilities and to make use of their freedoms of interdisciplinary design and decision-making independently, and to further develop them under supervision. TS graduates recognize situation-specific and extra-situational conditions for professional action and are able to reflect on decisions, also with ethical responsibility. They have learned to critically reflect their professional actions with regard to social expectations and consequences. They are also capable to further develop their professional actions in the field of transportation systems.

3 Target Groups

3.1 Target Audience

The Master's Program in Transportation Systems at the Technical University of Munich (TUM) addresses national and international graduates and junior experts with a strong interest in planning, managing and optimizing transportation systems. With its international focus the program aims not only at attracting the best candidates worldwide, but also at providing knowledge transfer, as well as at fostering the development of the transportation sector in emerging and developing countries. Last, but not least, the program is committed to contribute to the excellent worldwide reputation of "German engineering".

3.2 Prerequisites

Generally, application is open to candidates with a relevant Bachelor's degree in the areas of Transportation Engineering, Civil Engineering, Environmental Engineering, Electrical Engineering, Mechanical Engineering, Computer Sciences, Communications Engineering, Economics, Architecture or other scientific area related to transportation systems.

During an elaborate aptitude assessment, there will be examined if the single applicant has the required engineering skills related to transportation systems (e.g. algorithmic, informatics, programming, computer-aided simulation, communications engineering, sensor technology, bridge construction or engineering mechanics as well as urban development and planning). Applicants should be able to demonstrate that they are open-minded and able to work scientifically respectively principle-based and method-oriented. They should have a scientifically oriented interest in engineering problems from the field of transportation and in the solution of those problems. As applicants and students of this Master's program come from all over the world and graduated from different education systems, it is desirable to possess at least some basic knowledge in transportation science (e.g. transportation planning, traffic engineering and control, transportation infrastructure).

To study this international program, every student has to prove adequate knowledge of the English language. This is usually done by submission of a language test certificate (e.g. TOEFL, IELTS).

3.3 Target Numbers

The Master's Program in Transportation Systems started in the year 2007 with 21 students. In the following years the degree program gained national and international reputation and therefore continuously received a rising number of applications from countries all over the world.

The degree program is designed for a limited number of students in order to provide an optimal Individual learning atmosphere. The optimal number of students is thus approximately 40 students per intake, to also strengthen the ability of students to exchange and interact with lecturers and classmates. Rooms are available in a sufficient number to keep the degree program running. However, the increasing number of applicants and students, see illustration 1, represents a success story, but also a challenge.

The introduction of the fully digital application process at TUM (in 2020 for TS), has caused very high application numbers (2020: 352 applications, 2021: 452 applications, 2022: 628 applications, 2023: 644 applications). However, due to the introduction of tuition fees for non-EU students, there was a decline in the number of applicants in 2024 (290 applications).

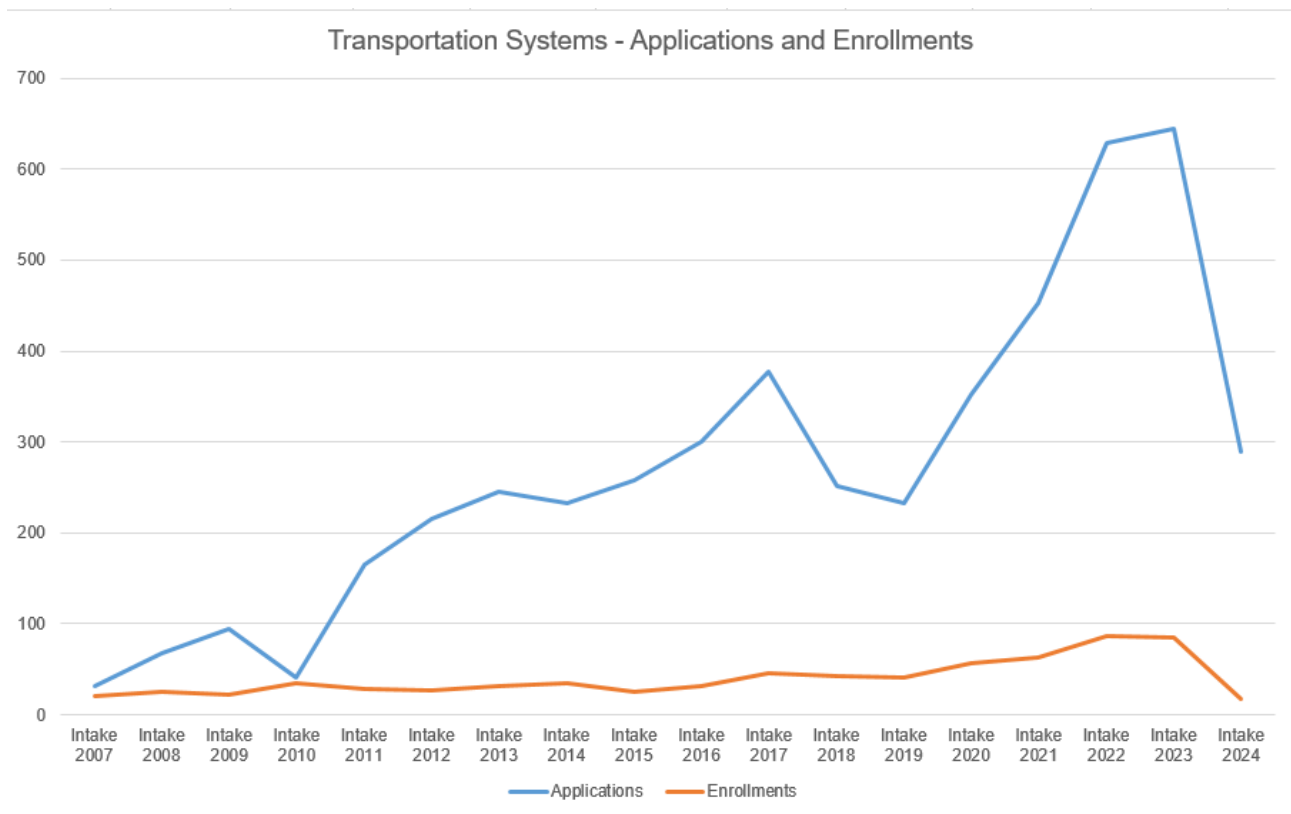


Illustration 1: Development of applications and enrolments since the start of the degree program in 2007 (lower number in 2024 due to the introduction of tuition fees for students outside of the EU)

The Master's Program in Transportation Systems works with a complex and elaborated aptitude assessment; every single application is evaluated individually. The significant difference between the number of applicants and the number of admitted students results from the fact that only applicants meeting the stipulated aptitude criteria are admitted to the degree program. The big majority of applicants and students come from abroad (around 95%). Among all continents, the highest number of applicants and students of the Master's Program in Transportation Systems is from Asia (approx. 2/3). The numbers of applicants and students from Europe, America and Australia are more or less stable since the start of the program in 2007, while we are receiving a steadily increasing number of applications from Africa.

4 Demand Analysis

The need for transportation engineers in Germany is constantly very high – also with regard to the essential importance of transport and mobility for every economy. There are currently around 100,000 engineers working in the German transportation sector (Staufenbiel Institut GmbH, 2020). Already in 2013, the Federal Association of Road Construction and Transportation Engineers (Bundesvereinigung der Straßenbau- und Verkehrsingenieure e.V. – BSVI) stated a great need for transportation engineers and that the future demand will be much higher than the expected number of graduates in this field. Therefore, in Germany almost all graduates of transportation engineering find employment very easily and quickly. Apart from that there is a worldwide demand for well-trained transportation experts, especially in developing and emerging countries, where the majority of the TS students comes from.

Transportation engineers often work for governmental and non-governmental agencies, public transport authorities, or for urban and regional planning departments, but also for the private sector like transportation companies, transportation engineering consultancies, freight and logistic enterprises, the automotive and infrastructure industry or for infrastructure-maintaining companies. The experience of staff at the Department of Mobility Systems Engineering, and from outside TUM (public and private sector), as well as the feedback obtained by students and alumni (e.g. in surveys), show a high demand for highly qualified professionals in the field of transportation engineering all over the world. Feedback from alumni emphasizes the high demand for transportation professionals at the labour market and stressed the importance of the integrated design of this degree program regarding all different aspects of transportation.

The Master's Program in Transportation Systems is a unique feature offering a broad and highly professional education in transport issues. Graduates can e.g. design roads and railways, simulate traffic, apply and design intelligent transport systems, analyse transport data and statistics or consult municipalities in questions regarding transport planning strategies of today and for future demand. Besides, transportation experts also need interdisciplinary knowledge, they need good presentation and writing skills (e.g. working out concepts and present them in front of an audience), They also need good communication skills and must be able to work together in teams, as well as to work individually and independently (Staufenbiel Institut GmbH, 2020).

The “generalist, but specified” education of the TS program has allowed our graduates to easily start their career as transport professionals in Germany, but also in international companies and authorities. The feedback from alumni, as well as from companies and authorities cooperating with the degree program, has supported the general layout of the program as meeting the labour market requests. Therefore, graduates are best qualified for the modern transportation market. However, this Master's degree in Transportation Systems qualifies graduates to apply for admission to doctoral studies/ PhD-course (postgraduate research program). Graduates of the Master's Program in Transportation Systems have the option of undertaking further research or studies in many different research institutions and organizations all over the world. Graduates are able to start a career in many different areas of the transportation sector as well as in Academia.

5 Competition Analysis

5.1 External Competition Analysis

Before the Master's Program in Transportation Systems was set up, a severe and intensive analysis of competitive degree programs in the transportation sector in Germany and worldwide was carried out by the Chair of Traffic Engineering and Control. The results of this non-published analysis showed the necessity to initiate and design and implement a new Master's program specifically designed for today's need of organizing transportation systems globally. It was found that there was no degree program for obtaining Bachelor's or Master's degrees in Germany offering an interdisciplinary and internationally designed approach to the transportation. The Master's Program in Transportation Systems at the Technical University of Munich is a unique feature. Since its first implementation in the winter semester 2007 it has achieved high reputation in the international transport society. The raising awareness of this program on an international basis is reflected in the continuously high numbers of applicants.

With regard to other German universities, the Master's Program in Transportation Systems at TUM with its holistic and international approach has still not any relevant competitor. Meanwhile, there are several Master's programs in Germany dealing with transportation, but they are usually focused either on the economic perspective with major in logistics and supply chain management or on the mechanical perspective with focus on automotive engineering. Besides, the big majority is offered in the German language. The closest comparable programs are:

- the Master's program "M.Sc. Verkehrsingenieurwesen und Mobilität" (M.Sc. Transport Engineering and Mobility) at the RWTH Aachen University (Language of Instruction: English or German),
- the Master's program "M.Sc. Planung und Betrieb im Verkehrswesen" (M.Sc. Transport Planning and Operation) at the Technical University of Berlin (Language of instruction: German),
- the Master's program "M.Sc. Verkehrsingenieurwesen" (M.Sc. Transportation Engineering) at the Technical University of Braunschweig (Language of instruction: German)
- the Master's program "M.Sc. Verkehrswesen (M.Sc. Traffic and Transport)" offered by the Technical University of Darmstadt (Language of instruction: German),
- the Master's program "M.Sc. Verkehrsingenieurwesen" (M.Sc. Transportation Engineering) at the University of Stuttgart (Language of instruction: German) and
- the Master's program "Infrastructure Planning" at the University of Stuttgart (Language of instruction: English).

All these Master's programs are taught in German, except the program "Infrastructure Planning" at Stuttgart. However, "Infrastructure Planning" has a very integrated approach to planning and considers also topics besides transportation (e.g. energy and water supply, wastewater and solid waste management), while areas like traffic engineering or road and rail construction are not taught. Meanwhile, the program "Verkehrsingenieurwesen und Mobilität" (Transport Engineering and Mobility) at the RWTH Aachen University can be studied in English or German. The focus is on vehicle construction, logistics, transportation infrastructure engineering, urban planning and project management.

Besides these two examples, the other Master's programs listed above have a more holistic approach towards transportation. The main difference between the Master's Program in Transportation Systems at TUM and other competitors in Germany is still the language of

instruction. This might also be one reason for the enormous international attractiveness of the Master's Program in Transportation Systems.

There exist also some universities of applied sciences that offer Master's programs in transportation e.g. FH Zwickau: M.Sc. Road Traffic Engineering, TH Nürnberg: M.Sc. Urbane Mobilität (Urban Mobility), HS Karlsruhe: M.Sc. Verkehrssystemmanagement (M.Sc. Transportation System Management). However, these programs have a clear practice-oriented perspective, and some of them (e.g. at TH Nürnberg) cover only 3 semesters. Thus, the curriculum can only consider few aspects of the whole academic field of transportation science. To conclude, the Master's Program in Transportation Systems at TUM is still an exceptional degree program with its universal approach towards transportation systems and its global Aspiration.

5.2 Internal Competition Analysis

The TUM School of Engineering and Design offers plenty of different Master's programs. The Master's Program in Civil Engineering, as well as the Master's Program in Environmental Engineering, also offer education in transportation science. The Master's Program in Civil Engineering has a quite broad curriculum and students may choose up to two transport related fields of specialization ("Road, Railway and Airfield Construction" and/or "Traffic Engineering and Transport Planning"), but they will have to take two further specializations. Thus, after graduation, students will have achieved a scope of competences in at least four different scientific fields of civil engineering.

Students of the Master's Program in Environmental Engineering can focus on "Sustainable Urban Mobility Planning" and/or "Transportation Engineering and Control" if they are interested in transportation. As the title of the degree program promises, the focus of both specializations is on environmental effects of transportation. The design of both specializations has a clear strategic direction towards sustainable urban and transportation planning, while, in contrast, students of the Master's Program in Transportation Systems also learn about the construction and design of transportation infrastructure (railways, roads, and airports).

Some modules of the TS program are also integrated into the specializations of the two others Master's programs at the department. But, to conclude, it can be underlined that the specialization in both degree programs, civil as well as environmental engineering, represent only some limited aspects of transportation. Therefore, graduates are either civil or environmental engineers, who have also deeper knowledge in transportation. Graduates of the Master's Program in Transportation Systems, in contrast, are transportation engineers. They have comprehensive knowledge in all aspects of transportation.

Hence, the TS program at the Technical University of Munich is a stand-alone degree program without comparable degree programs at the department or university.

6 Program Structure

The Master's Program in Transportation Systems consists of four semesters (24 months) and a minimum of 120 ECTS credits must be achieved. Teaching formats are lectures combined with exercises, as well as seminars. The language of instruction is English; students may also elect modules taught in both German and English. The modular structure of the degree program includes required modules, as well as elective modules. Each semester, the elective modules catalogue is updated to meet the changing demand within the transportation sector. Students are informed about the update prior to semester start. A general overview of the curriculum is given in illustration 1.

Master's Program in Transportation Systems							
Semester	Modules						Credits / Number of exams
1	Travel Behaviour and Environmental Impacts (required) written exam 6 CP	Applied Statistics for Transportation Systems (required) written exam 6 CP	Land-Use and Transport - Strategies and Models (required) written exam 6 CP	Traffic Management (required) written exam 6 CP	Cross-cutting Fundamentals and Methods (required) seminar paper 3 CP	Infrastructure Planning (required) 3 CP	30 / 5
2	Project Appraisal and Planning Processes in Transportation (required) written exam 6 CP	Public Transport Concepts, Planning and Operation (required) written exam 6 CP	Methodological Problem Solving Components for Transportation Engineering (required) written exam 6 CP	Elective (FoS) 1 exam 6 CP	Elective with general educational value 1 exam 3 CP	written exam (6 CP in total) 3 CP	30 / 6
3 Mobility Option	Project Seminar * (required) project work 12 CP		Elective (FoS) 1 exam 6 CP	Elective 1 exam 6 CP	Elective 1 exam 6 CP		30 / 4
4	Masters thesis 30 CP						30 / 1
Key	light grey: required modules dark grey: elective modules black: general education module light blue: elective modules (field of study) dark blue: final thesis * In the case of a study abroad at a partner university of the TUM Munich, the module can be taken remotely						

Illustration 1: Degree chart "M.Sc. Transportation Systems".

During the first study year, students achieve the required general, sound and broad-based background in transportation engineering, but also in several related disciplines like travel behaviour, transport economics or general tools for scientific work within the required ten modules. The relatively high number of required modules is due to the fact that the program addresses applicants with a broad variety of previous study directions. Therefore, the students deepen the theoretical knowledge of the overall concepts of transportation systems within all fields of transportation engineering: transportation planning, traffic engineering and control, as well as transportation infrastructure. The students learn about the most relevant theories, concepts and models. The general competences gained during the first semester also include soft skills, the ability to prepare scientific presentations and to write scientific papers. They are able to familiarize themselves with a transport-related topic, as well as to present and to discuss the topic with an academic audience (within a predetermined time). The compulsory module "Methodological Problem Solving Components for Transportation Engineering" ensures that all students share basic methodological foundations, required for their studies and further careers, including understanding of ethical and data protection considerations when conducting studies involving human participants. This ensures students are prepared to manage participant safety and data privacy in professional research settings. The module enhances critical thinking skills by encouraging students to assess solution feasibility, reliability, and potential impacts on transportation systems.

Students know the basic standards of scientific work and publishing and are able to apply them. In addition, they are aware of the importance of cultural differences, when working together in

multicultural groups, and they are able to deal with those cross-cultural issues in an effective way.

At the end of semester 1, the students decide about their specific specialization area (field of study). There is one information session, where professors present the different fields of study. Consequently, in the second semester, students can start creating their own professional profile and achieve the required engineering competences. Students select one out of three fields of study. They can focus on one specific field of the transportation sector: “Transportation Infrastructure”, “Intelligent Transport Systems” or “Integrated Mobility Planning”. Each area of specialization contains one core module, providing them with deeper understanding of their selected specialization and skills that help them select and make the most out of their elective subjects. Students may choose a further subject from the within their chosen Field of Study and then receive an additional certificate, which can aid in demonstrating their specific profile after graduation, while applying for positions in either academia or industry.

These specialization modules are offered during the second and third semester and they allow the students to steer the program towards their specific academic or professional interests. These modules also allow them to deeper explore their topics of interest, potentially also helping them select an appropriate direction for their Master’s thesis.

The core of the third semester is the project seminar. During this module, students deal with real life problems in transportation project planning and application – usually in cooperation with local authorities and companies. By working on a specific project, students explore scientific research and practical solutions in an experimental environment. In multinational and interdisciplinary groups they work out a survey concept and realize field work. Besides, they analyse and discuss their findings with research staff, experienced practitioners and authorities involved in the respective project. So, they train and demonstrate communication and cooperation skills, not only in working together in academia, but also in non-academia.

Finally, students will write their Master’s thesis on a transportation-related subject, where they implement the gained engineering knowledge and research skills. Frequently, the thesis is done in cooperation with a company or authority, but supervised and evaluated by academic TUM professors. The students have six months to complete the thesis. They can conduct the thesis either in Germany or abroad.

The illustrations 2 to 4 below show a sample degree chart for each field of study, including possible combinations of elective modules which complement the chosen field of study:

Master's Program in Transportation Systems							Credits / Number of exams
Semester	Modules						
1	Travel Behaviour and Environmental Impacts (required) written exam 6 CP	Applied Statistics for Transportation Systems (required) written exam 6 CP	Land-Use and Transport - Strategies and Models (required) written exam 6 CP	Traffic Management (required) written exam 6 CP	Cross-cutting Fundamentals and Methods (required) seminar paper 3 CP	Infrastructure Planning (required) 3 CP	30 / 5
2	Project Appraisal and Planning Processes in Transportation (required) written exam 6 CP	Public Transport Concepts, Planning and Operation (required) written exam 6 CP	Methodological Problem Solving Components for Transportation Engineering (required) written exam 6 CP	Optimization for Transportation Systems (elective) exercise 6 CP	Elective with general educational value 1 exam 3 CP	written exam (6 CP in total) 3 CP	30 / 6
3 Mobility Option	Project Seminar* (required) project work 12 CP		Road and Rail design (FoS I) written exam 6 CP	Rail Traffic Planning and Management (elective) written exam 6 CP	Artificial Intelligence in Traffic Engineering and Control (elective) project work 6 CP		30 / 4
4	Masters thesis 30 CP						30 / 1
Key	light grey: required modules dark grey: elective modules black: general education module light blue: elective modules (field of study) dark blue: final thesis * In the case of a study abroad at a partner university of the TU Munich, the module can be taken remotely						

Illustration 2: Example Field of Study I - Transportation Infrastructure

Master's Program in Transportation Systems							
Semester	Modules						Credits / Number of exams
1	Travel Behaviour and Environmental Impacts (required) written exam 6 CP	Applied Statistics for Transportation Systems (required) written exam 6 CP	Land-Use and Transport - Strategies and Models (required) written exam 6 CP	Traffic Management (required) written exam 6 CP	Cross-cutting Fundamentals and Methods (required) seminar paper 3 CP	Infrastructure Planning (required) 3 CP	30 / 5
2	Project Appraisal and Planning Processes in Transportation (required) written exam 6 CP	Public Transport Concepts, Planning and Operation (required) written exam 6 CP	Methodological Problem Solving Components for Transportation Engineering (required) written exam 6 CP	Intelligent Transport Systems written exam 6 CP	Elective with general educational value 1 exam 3 CP	written exam (6 CP in total) 3 CP	30 / 6
3 Mobility Option	Project Seminar* (required) project work 12 CP		Microscopic Traffic Simulation project work 6 CP	Transportation Economics (elective) project work 6 CP	From Reality to Models Models to Mobility Policy (elective) learning portfolio 6 CP		30 / 4
4	Masters thesis 30 CP						30 / 1
Key	light grey: required modules dark grey: elective modules black: general education module light blue: elective modules (field of study) dark blue: final thesis * In the case of a study abroad at a partner university of the TU Munich, the module can be taken remotely						

Illustration 3: Example Field of Study II - Intelligent Transportation Systems

Master's Program in Transportation Systems							
Semester	Modules						Credits / Number of exams
1	Travel Behaviour and Environmental Impacts (required) written exam 6 CP	Applied Statistics for Transportation Systems (required) written exam 6 CP	Land-Use and Transport - Strategies and Models (required) written exam 6 CP	Traffic Management (required) written exam 6 CP	Cross-cutting Fundamentals and Methods (required) seminar paper 3 CP	Infrastructure Planning (required) 3 CP	30 / 5
2	Project Appraisal and Planning Processes in Transportation (required) written exam 6 CP	Public Transport Concepts, Planning and Operation (required) written exam 6 CP	Methodological Problem Solving Components for Transportation Engineering (required) written exam 6 CP	Integrated Mobility Planning project work 6 CP	Elective with general educational value 1 exam 3 CP	written exam (6 CP in total) 3 CP	30 / 6
3 Mobility Option	Project Seminar* (required) project work 12 CP		Accessibility report 6 CP	Planning for Mobility Justice (elective) seminar paper 6 CP	Discrete Choice Methods for Transportation Systems Analysis (elective) exercise 6 CP		30 / 4
4	Masters thesis 30 CP						30 / 1
Key	light grey: required modules dark grey: elective modules black: general education module light blue: elective modules (field of study) dark blue: final thesis * In the case of a study abroad at a partner university of the TU Munich, the module can be taken remotely						

Illustration 4: Example Field of Study III - Integrated Mobility Planning

The modules of the Master's Program in Transportation Systems take place at the Munich main campus. The courses of all required modules are offered without any time overlap. In accordance with the interdisciplinary approach of the program and to ensure a holistic and well-rounded education, students are able to select modules from different schools of TUM within their elective area. Modules on offer are, for example, from the TUM School of Computation, Information and Technology or the TUM School of Science and Technology. Students are encouraged to broaden their knowledge in the areas of ethics, philosophy, language, and enhance their ability for reflection on the societal, economic, and political impact of their academic field by selecting, for example, modules offered by the Centre for Key Competences at the TUM School of Engineering and Design.

Concerning mobility of students, one of the core elements of the Bologna Process, the Master's Program in Transportation Systems offers plenty of opportunities. However, the clear majority of the TS students already come from all over the world; only approximately five percent of all TS students have German origin. Hence, the Master's program significantly contributes to the internationalization strategy of TUM and the general research location Germany. Thanks to the European Credits Transfer System (ECTS), academic records achieved at universities of countries belonging to the European Higher Education Area (EHEA) can be easily recognized at TUM.

The Master's program is designed for four semesters; therefore, the third semester is best suited for a stay abroad. According to the curriculum, there is only one compulsory module (Project Seminar). In the case of a study abroad at a partner university of the TU Munich the module can be taken remotely, the final project work and the presentation can be submitted digitally. Additionally, modules in the field of Transportation Systems taken at another university during an international exchange can be recognized. Thus students won't be restricted or face prolonging their studies if they wish to study abroad.

Most of the students come from abroad (more than 90%) and explicitly decided to come to Germany and do their Master's studies at TUM. Therefore, there is only little interest in going abroad so far. National students, however, often did their semester exchange already during their Bachelor's program. This usually lasts six semesters and thus exchange programs can be integrated in an easier way – considering the long planning and application process. Therefore, only a few TS students are interested in going abroad. These students often decide to write their Master's thesis at partner universities.

7 Organization and Coordination

Areas of responsibility might be listed as follows:

The following administrative tasks are performed partly by the TUM Center for Study and Teaching (TUM CST) and its administrative units, partly by offices in the schools or departments:

- Student Advising: Student Advising and Information Services (TUM CST)
Email: studium@tum.de
Phone: +49 (0)89 289 22245
Provides information and advising for prospective and current students (via hotline/service desk)
- Departmental Student Advising: Program Coordinator and Academic Advisor
Dipl.-Ing. Katja Schwering
Email: katja.schwering@tum.de
Phone: +49 (0)89 289 23946
- Academic Programs Office Examination Administration and Advising
Christine Göppel
Email: christine.goeppel@tum.de
Phone: +49 (0)89 289 28195, 28577
- Study Abroad Advising/Internationalization:
TUM-wide: TUM Global & Alumni Office
internationalcenter@tum.de
Departmental: International Affairs Delegate
Nadin Klomke, M.A.
Email: n.klomke@tum.de
Phone: +49 (0)89 289 22427
- Gender Equality Officer:
TUM-wide: Dr. Eva Sandmann
Email: sandmann@tum.de
Phone +49 (0)89 289 22335
Departmental: Dr.-Ing. Annette Spengler
Email: annette.spengler@tum.de
Phone: +49 (0)89 289 27102
- Advising – Barrier-Free Education: TUM-wide: Service Office for Disabled and Chronically Ill Students (TUM CST),
Email: Handicap@zv.tum.de
Phone: +49 (0)89 289 22737
Departmental: Dipl.-Ing. Michaela Wenzel
Email: m.wenzel@tum.de
Phone +49 (0)89 289 25261

- Admissions and Enrollment: Admissions and Enrollment (TUM CST)
Email: studium@tum.de
Phone: +49 (0)89 289 22245
Admissions, enrollment, Student Card, leaves of absence, student fees payment, withdrawal
- Aptitude Assessment (EV): Where applicable:
TUM-wide: Admissions and Enrollment (TUM CST)
Departmental: Aptitude Assessment Commission
Prof. Dr. Constantinos Antoniou

Program Coordinator
Dipl.-Ing. Katja Schwering
Email: katja.schwering@tum.de
Phone: +49 (0)89 289 23946
- Semester Fees and Scholarships: Fees and Scholarships (TUM CST),
Email: beitragsmanagement@zv.tum.de
- Examination Office: Graduation Office and Academic Records (TUM CST)
Campus Munich
Graduation documents, notifications of examination results, preliminary degree certificates
- Departmental Examination Office: Christine Göppel
Email: christine.goeppel@tum.de
Phone: +49 (0)89 289 28195, 28577
- Examination Board: Prof. Dr. Constantinos Antoniou (Chair)
Christine Göppel (Secretary)
- Quality Management: TUM-wide: Quality Management (TUM CST),
<https://www.tum.de/studium/tumcst/teams-cst/>
Departmental:

TUM ED:

- Academic Program Director: Prof. Dr. Constantinos Antoniou
Email: c.antoniou@tum.de
- Quality management: Brit Krieger
Email: qualitymanagement@ed.tum.de
- QM circles: Funda Koc
Email: funda.koc@tum.de

Evaluations:

Email: evaluation@ed.tum.de

Module management

Email: modulverwaltung@ed.tum.de

8 Enhancement Measures

The Master's Program in Transportation Systems is designed to meet the needs of the modern transportation market in a globalized world, which are no longer covered by the traditional education as German civil engineer with some specialization in transportation. It was set-up with a clear international perspective and attitude, as well as a focus on interdisciplinarity, a Master's program that deals with transportation in its complexity. The program was meant to produce transportation specialists with "traditional" skills in construction and design of transportation infrastructure, but also with broad know-how in modern traffic engineering and control, as well as transportation mobility planning strategies. Besides, graduates should also have interdisciplinary skills (e.g. knowledge about economic interrelations and environmental interdependencies, land management and land-use, or latest developments in automotive engineering, like autonomous vehicles or electro-mobility) to successfully deal with the challenges of modern and sustainable mobility. Consequently, the program is designed to enhance the classical training program for transportation engineers towards an interdisciplinary and system orientated education, with a stronger focus on the basic and application research field.

Over the years, there have been several changes and updates of the study regulations (in 2009, 2011, 2013, 2016 and 2021).

In 2020 the degree program was revised and the following enhancements measures took place: A special aspect of the degree program, the required internship had to be cancelled, due to complicated regulations, affecting its duration. In 2013, the internship had to be limited to only 150 hours in total. For companies and authorities, internships of such short duration are not attractive. Therefore, the professors of the focus area "Mobility and Transportation Systems" at the former TUM department BGU decided to cancel the required internship within the Master's program. However, students are still encouraged to perform internships on voluntary basis. Apart from that, during the project seminar in the 3rd semester, students research in teams on a case study based on a real application and present and discuss their proposals with scientific supervisors, but also with external project partners (companies and authorities). Thus, they gain at least some insight into their future everyday professional life. With "Public Transport Concepts, Planning & Operation", a required module has been introduced that is explicitly dedicated to public transportation. Before, this subject has received less attention and was only part of other modules. The module underlines the high importance of public transportation, especially in cities and large urban areas. This topic will therefore be strengthened.

Because of repeatedly expressed wishes of students regarding "free electives", so-called "Individual electives" have been introduced. Students of the Master's Program in Transportation Systems can achieve up to 6 credits through extra-curricular modules, also from other departments, that are relevant to the field of transportation engineering (e.g. algorithms, programming, urban planning, automotive engineering). With the study regulations in 2020, another elective with general educational value has been added to the curriculum. Within this elective, students can achieve 3 credits with language courses or soft skills seminars (e.g. rhetoric or leadership) that are not relevant for the actual subject of the degree program, but broaden the students' general knowledge and deepens self-competence. Considering that Transportation Systems is a Master's program, there are still many required modules in the first study year. There must be noted that most of the students are international (around 95%) with very diverse academic backgrounds. Thus, the program must ensure a common foundation, before students can choose electives according to their individual interests. Nevertheless, all former required elective modules have been changed to electives.

For several years, the focus in the aptitude assessment has been on graduates from civil or transportation engineering programs. In 2016, there have been approaches to open the degree program also to graduates from other engineering or planning degree programs to strengthen the interdisciplinary ambition of the degree program. Therefore, the required subject-related

qualifications have been modified accordingly. In 2020 and 2025, these required qualifications have been again revised to ease access to the Master's program for applicants with other academic backgrounds, besides civil or transportation engineering. In his or her motivation letter every applicant can demonstrate that he or she has general knowledge about the program and its structure, but also already some basic knowledge about scientific questions and latest developments in the field of transportation engineering. The applicants can prove that they are able to reflect their own competences and skills required for the degree program and they can underline this with relevant arguments and examples. To still ensure the continued quality of the incoming classes, the GRE or GATE test should be taken before applying for the program by applicants from China, Bangladesh, India, Iran or Pakistan. For all other applicants the test is recommended.

In the most recent update, in 2025, the Fields of Study were strengthened at the request of the students. Students complete 6 credits in the compulsory area and 6 credits in the elective area. For a better understanding and overview which modules fit into each Field of study, the elective catalogue will be clustered accordingly. In addition, the new compulsory module "Methodological Problem Solving Components for Transportation Engineering" is being integrated into the curriculum beginning in WS 2026/2027, to ensure that all students share basic methodological foundations, required for their studies and further careers. It is noted that this is also introduced in response to requests by the students.

To conclude, the Master's program in Transportation Systems has developed over the years – based on changing requirements by the national and Bavarian regulations within the Bologna process, but also on regular talks between students and program administration, as well as with external experts. This permanent exchange's nature is both institutional (regular, established quality circles), as well as informal (occasional meetings with students, alumni, and representatives from industry and authorities).