

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information		
Name	Ruben Vos	
Student number	4465512	
Studio		
Name / Theme	Complex Projects – Bodies Buildings Berlin	
Main mentor	Olindo Caso	Architecture Complex Projects
Second mentor	Jan Van de Voort	Architectural Engineering + Technology
Third mentor	Martin Grech	Architecture Complex Projects
Argumentation of choice of the studio	<p>My choice of this Complex Projects (CP) Graduation studio is based on intrinsic fascination for public buildings, particularly train stations. As both a designer and a daily end-user, I bring a unique perspective to the table. With an academic background in civil engineering and architecture, combined with over two years of industry experience in urban design and planning, the train station design is a perfect opportunity for integrating these knowledge domains. For context, the station one of 9 public types that the CP studio offered.</p> <p>The studio's analytical and critical approach in solving complex design problems and finding abstract and tangible design responses truly appeals to me. In today's architecture industry, the ability to provide a compelling narrative, arguments and data-driven proof to clients and stakeholders is crucial, and this studio prioritizes this skill.</p> <p>The studio offers the right balance of teachers with industry experience and academic insights, providing a well-rounded understanding of the architectural field. While the primary focus is on the building itself, the studio's design approach considers its intricate relationship with the city, in this case Berlin, and its end-users. This holistic approach matches with my vision for architecture. I also want to become part of the exploration how the building typologies adapt to changing human and urban conditions as I personally also try to push for innovation.</p>	

Graduation project	
Title of the graduation project	Rush Hour <i>Future digital and transport node in Berlin Westhafen</i>
Goal	
Location:	Berlin Westhafen Station, Moabit, Berlin
The posed problem	<p>The posed problem revolves around the critical issues faced during rush hour at train stations, especially in metropolitan cities such as Berlin. Around 8 am on weekdays millions of individuals commute from home to work, school, or business appointments. Stations have to efficiently facilitate this substantial flow of people within a limited time span. Any delay in this process results in platform overcrowding, creating safety risks and creating negative passenger experiences.</p> <p>At current times, Deutsche Bahn, the German Railway Operator and Provider is in a performance crisis. Decades of neglected infrastructure and insufficient funding have led to outdated systems, frequent delays (with one-third of DB German trains delayed in 2022), and overcrowded stations. This situation is further intensified by certain stations being underused due to the greater attractiveness of car traffic and misalignment between rail and land-use planning.</p> <p>Amidst rapid urbanization (e.g. 60,000 p/year influx in Berlin), energy and climate transition, and technological disruptions, the German Ministry of Transport and Planning has committed a record amount of 40 billion euros to modernize the German Railway infrastructure into a Digital Rail. This underscores the urgency of the situation. Digitalization emerges as a key strategy in achieving efficient transportation of people and goods. Data is seen as a way to make operational aspects more effective and enhance the user experience. The urgency is highlighted by Deutsche Bahn's ambitious goal of doubling passenger numbers, replacing 5 million car trips, and eliminating 1/6 of domestic flights by 2050.</p> <p>The big challenge lies in aligning infrastructure investments with broader urban visions, including urban development and energy infra development. Effectively addressing these problems requires a strategic and innovative approach to transform the current state of railway systems and stations in Germany.</p>

research questions and	<p>The main question this project is trying to answer is:</p> <p><i>How will data impact the design of a train station for rush hour?</i></p> <p>Overarching BBB Studio Sub-question:</p> <p><i>1.How much of the train station design is specific vs. generic?</i></p> <p>Body Sub-question:</p> <p><i>2.How will data impact the user experience at the train station during rush hour?</i></p> <p>Building Sub-question:</p> <p><i>3.How will data impact efficiency of transport at the train station during rush hour?</i></p> <p>Berlin Sub-question:</p> <p><i>4. How will data impact the train station area development?</i></p>
design assignment in which these result.	<p>Deutsche Bahn train station with integrated data centre. A digital and transport node as the urban anchor for sustainable development of Berlin Westhafen into a future innovation district.</p> <p>Through extensive research into station building typology and future trends, it is evident that data will be the digital backbone of train stations. Data-driven automated processes, involving autonomous vehicles and hyper-efficient logistics, will enhance flow efficiency, save time, and increase the station's capacity during rush hours. For end-users, this translates to improved time value through real-time information access and digital services, such as digital makerspaces. The hypothesis is that a data centre will be integral to the station's functionality, ensuring reliable, fast, and secure data access. Digitalization will impact the station's program on both operational and transport aspects, as well as on the city and human aspects.</p> <p>A well-functioning station relies on 5 key criteria, both operational and soft. On the operational side, efficient transport systems, robust digital infrastructure, and sufficient energy resources are essential, especially during mobility rush hours. On the soft side, the station must enhance user experience and serve as an urban anchor, promoting mixed-use urban development within its 1km walking distance catchment area. The balance between place (urban development) and node (transport) values is critical. Users seek positive experiences, including high comfort, services, and ease of wayfinding, to make train journeys more attractive than the</p>

carbon and/or space intensive alternative modes (car and plane), aligning with ambitious climate goals.

Station sizing is context and site-dependent. For instance Berlin Hauptbahnhof, being centrally located, is the largest in Berlin with over 350,000 p/day. The chosen site, Berlin Westhafen, positioned between a future tech area and the city center, primarily caters to tech workers and students. After benchmarking, studying Berlin's mobility system, and considering development plans, a forecast of 100,000 passengers per day by 2050 suggests a need for 100,000 m² of space based on the programmatic benchmarking study. Digitalization and site-specific requirements lead to additional programs, including autonomous mass transit, data center space, battery storage, makerspace, and office space for digital and tech companies.

In summary, the proposed station in Berlin Westhafen will function as an efficient digital and transport node, serving as the urban anchor for sustainable development. Representing a public icon of digital innovation, it will be highly energy-efficient, acting as a digital gateway for people moving in and out of the city center of Berlin.

Process

Method description

To address the main question, "How will data impact the design for a train station during rush hour?" the research is structured into three key categories: program, client, and site. The exploration of these categories is iterative, without a strict order, and answers will be presented in the design brief at the P2 stage, with ongoing research continuing into the next design phase.

Program Research:

Program research involves benchmarking and a literature study to understand the balance between generic and specific aspects of a station, focusing on core functionality versus complementary functionality. The research hypothesis considers data as the digital backbone and energy as an essential resource. A framework with five main domains (three operational and two soft) has been developed, offering criteria for assessing existing case-study train stations and projecting objectives for new or redeveloped stations. Analysis of a station database, comprising 16 case studies (incl. Vienna Hbf, Rotterdam CS, Berlin Hbf), informed the creation of a program bar and additional elements resulting from digitalization and site-specific contexts. For instance, spatial dimensions for key spaces such as platform, entrance hall and data centre have been identified but also overall program requirements with GFA's for accommodating an estimated 100,000 passengers per day.

Client Research:

Client research looked into Deutsche Bahn as the core client and relevant stakeholders, including Berlin, rush hour passengers, and Siemens. Ambitions from each stakeholder are synthesized into a unified project ambition: a "future digital and transport node as the urban anchor in Berlin." A stakeholder is assigned to each studio domain (Building, Body, Berlin) to cover a holistic spectrum of ambitions.

Specific client ambitions, such as Deutsche Bahn's aim to double passenger numbers and Siemens' role as a tech partner to accelerate digital innovation, are highlighted.

Site Research:

Site research begins with formulating site selection criteria, aligning with the station and data center typologies, and project ambitions. The preferred site, Westhafen, undergoes analysis on both Berlin and district scales to understand future passenger flows and specific requirements. Opportunity and constraint analysis results in concrete site-specific ambitions and spatial guidelines. Key site-specific details such as station role as an urban gateway are identified.

After completing program, client, and site research, massing studies were done to develop a preferred massing option that aligns with combined site, program, and client requirements. The preferred massing serves as the starting point for the design phase after P2.

Literature and general practical references

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Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

The rush hour project seeks to push the boundaries of the today's standards of train stations, responding to the societal shift into the digital era and changing urban conditions. It aims to integrate Bodies, Building, and Berlin, aligning with the topic of the complex projects studio. The digitization lens is introduced by the studio itself (not a personal choice), aligning with the future trends in railways and emphasizing a strong focus on data. This exploration serves to understand the impact of digitalization on the built environment, with the intentional strong presence of the concept. It included the strong statement that data is the digital backbone of future railway and cannot function independently. The studio, similar to the master program and track prepares students into architects who play an active role in society. It demands a balance of being a generalist and a specialist, requiring awareness of societal trends and the ability to respond through architectural design in terms of program, form, materialization, and articulation. The station design process begins with a comprehensive understanding of the context and a broader urban vision. While architecture traditionally revolves around the building itself, the studio also emphasizes its relationship with the city. The multifaceted nature of a station design requires a deep understanding of other disciplines urban planning, transport planning, management and building engineering.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

Innovation stands central in this graduation project, implementing an academic approach with a station database and methodology that can be useful for fellow academics, including future students, and professionals for diverse research and design projects. The train station, as a part of many people's daily life, holds a pivotal role in people's experience and shaping society. Frustrations related to delays, overcrowding, and the associated feelings of anxiety or boredom are universally

recognized. This project aims to highlight that the station is more than a transfer machine; it plays a vital urban role and a place where people can pleasantly stay. The increasing standards to human comfort aligns with the railway's effort to compete with carbon and space-intensive alternatives like cars and air travel. Benchmarking of renowned existing train stations and assessing the impact of data on traditional typologies, the project acknowledges the digital future. The project contributes to closing a substantial knowledge gap in the built environment compared to other industries. The recent addition of an AI department to the TU Delft faculty of architecture marks the relevance of digitalization within our discipline.