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	Steven ter Schure
Student number	5483794

Studio		
Name / Theme	Complex Projects, Bodies and Buildings	
Main mentor	Marija Mateljan	Architecture and Digital Culture, and a teacher in the Complex Projects graduation lab at TU Delft
Second mentor	[Appointed before P2 by studio coordinator]	[Academic field involved]
Argumentation of choice of the studio	During my studies, I was fascinated by how architecture can be used as a tool to respond to the needs of a city and its users. Creating a considered integrated design should be seen as a starting point to develop our ideas where the design question has to be answered precisely. The choice of the studio is based on my personal interest in the complexity of building design. Designing large-scale buildings that not only serve a specific program but can also contribute to the user and the city. I believe designing in this way would help create a more integrated urban environment. In my previous design studios, I had the opportunity to design several multifunctional public buildings. In these designs, I always looked for a connection between the user and the building and how this could contribute to an even stronger connection. However, I always found that my design could be improved in this area. Within this studio, I want to explore how future developments can contribute to this connection and how all building components can be fully integrated into the design.	

Graduation project	
Graduation project	
Title of the graduation project	Car free Berlin
	A park and ride train station that encourages motorists to use green mobility to get to Berlin's city centre.
Goal	
Location:	Berlin Jungfernheide station, Max-Dohrn-Str. 5, Charlottenburg-Wilmersdorf, Berlin
The posed problem,	Berlin has one of the best public transport networks in the world. However, the city's existing transportation network mainly focuses on transporting people in and around Berlin and inner-city commuting. As a result, on a daily bases, 400.000 thousand people commute in and out of the city by car, causing congestion in the entire metropolitan area of Berlin.

Existing solutions, such as P+R stations in the city, have been established to facilitate the car user. But these P+R stations are mainly built in Berlin's suburbs or far away from interstate highways. Also, the public transport network from these stations is too slow to reach the inner city faster than the car. This mainly concerns the distance these stations are positioned from the city centre and the number of stops and speed at which the train will travel. The number of parking spaces at these P+R stations ranges from 20 to 400, with an average of 40 available parking spaces, which makes these stations far from able to reduce the number of cars in the city.

Commuters' preference for mobility is likely to stay the same because it is influenced by various factors such as economic wealth and level of education. This makes encouraging green mobility in a train station difficult. Nowadays, however, stations are mostly slow transfer stations with separate car parks. Because the station cannot accommodate quick transfers, it discourages motorists from using public transportation.

The P+R stations are the first fundamental problem that needs to be solved to make Berlin less dependent on exclusively private motorised vehicles. On the other hand, many parking spaces in the city centre allow people to park their cars next to their work or home, making it too attractive to travel to the city by car. The buildings and infrastructure to facilitate the motorised vehicles in Berlin occupy a lot of space. For example, if Berlin reduced 7% of its private cars, it would free up 8.2 km2 of accessible public space. |

	Removing these buildings will discourage users from parking their vehicles in the city.

On the other hand, stations in the suburbs or on the outskirts of the city suffer from a significant effect on fluctuations in station usage. After working hours or on weekends, these stations are used less for P+R stations in particular. This has a substantial impact because these buildings can accommodate 10,000 cars, which is most of the station, leaving this entire area unused. This is mainly due to the monotonous design of the stations that focuses only on the mobility user and is unable to scale or respond to the off-peak hours of the station. |
| research questions and | The main question this project is trying to answer is:
How can implementing automation technologies in architecture influence the users' experience by fluctuating the rhythm of space and space use?

Sub questions:
1. How can a park and ride station encourage motorist to leave their car behind and use public transport?
2. How can automation technologies be implemented in a train station to serve the users personal daily routine?
3. How can automation technologies fluctuate the rhythm of space and space use to inhibit the stations off peak hours?
4. How can a park and ride station adapt to current and future automation and digitization developments? |
| design assignment in which these result.

[This should be formulated in such a way that the graduation project can answer these questions.
The definition of the problem has to be significant to a clearly defined area of research and design.] | Through research, it became clear that the main challenge is to design transportation hub which encourages commuters to leave their car outside the city when commuting towards Berlin. In Berlin today, the car reigns supreme, parking is plentiful, and the main highway serves as the city's main artery. When the car loses its dominant position, people are forced to use other modes of transportation to reach their final destination.

The establishment of new transportation hubs for Berlin should deal with this distribution of cars around the metropolitan area. These hubs should serve the user as quickly as possible and allow seamless transfers. The location of these hubs is determined by their place in the city's public transportation and main road networks. |

	Introducing a new master plan shows possible sites for building these new hubs.
	The second challenge in designing this hub is based on the functionality and programmatic layout of the building. The train station is left empty and unused during working hours or at night. Therefore the mobility hub of the future should address this issue to accommodate several programmes within the building to serve commuters during peak hours and Berlin during off hours. Datadriven technologies can be implemented to fluctuate building programs, therefore its use.
	Dealing with the notion that driving to the city centre can only be accomplished by leaving them at a mobility hub. It integrates these new structures into the daily lives and routines of people who are commuting towards the city. Suppose the building knows who is coming when and how it can adjust programs for its users. Multiuse of parking spaces, for example, can be the first starting point for innovative programming of the building because this takes up the most space.
	Within this framework, the goal is to design a train station that can be driven by its users instead of being a monotonous structure. With the further growth of these hubs, the train station of the future will become part of a daily routine for many people and serve them in the most appropriate way possible due to the application of a data driven technologies.

Process

Method description

In order to answer the research question. The questions will be divided into three categories: programme, site, and client. Each of these topics will be investigated in an integral process until the end of P2. As a result, the issues and information they provide will be constantly updated in response to new information obtained during the research phase.

The programmatic research will be done according to benchmarking of existing projects, literature research into train stations and the analysis of flows through building history. Analysing and benchmarking of case studies will be done to get an insight into the main project layout and to establish a wide variety of relations schemes to get a feeling of how station planning is done in stations nowadays. The program benchmarking is based on the study of several case studies chosen based on their park and ride availability, a position as a high mobility network in/for the city and programmatic layout to serve the mobility user. The buildings analysed in this

research are: Koge Nord Station, Fly-over Ghent, Berlin Hauptbahnhof, Berlin zoologischer Garten, Berlin Pankow- Heinersdorf and Arnhem Centraal

On the other hand, the literature research will provide a framework for actual station planning. Giving insights into factual data design for train stations. This data provides a framework in which station design is mainly based on the number of station users. This research also provides a critical space analysis establishing key spaces for train stations and displaying the most restricted areas for train station design. As a result, programmatic research is based on objective analysis and factual proof by literature. However, this data is set on existing stations. It should be considered as a basis for the design and can still adapt other means of programmatic elements gained from analysing case studies and site and client research.

During the course, a seminar is given, which provides insight into flows in architecture. These flows are analysed mainly in train stations, airports and hospitals. Through analysis, these types of buildings and predecessors will provide a framework for the development of flows. This analysis will be adapted into the programmatic circulation space of the project and give further insight into future possibilities for the flows in buildings.

The site research will be split into two parts. The first consists of finding a site for the project, and the second will research site possibilities. Finding a building site in the city of Berlin will be done according to research into the main infrastructure network, train and P+R station distribution and existing parking availability of the city. This research will include mapping and data analysis to map potential side locations. Also, group research into the environment theme will be conducted to eliminate site locations unrelated to the group theme. For this part, a group vision will be established based on literature research into the vision of Berlin. This vision is then translated to specific site criteria, which create boundaries for possible site locations. Both maps will be overlayed to create the divined site locations.

The second part of the site analysis contains actual on-site research. This research will be done through fieldwork, mapping and literature research on the development strategy of the specific site. This research will be done to get an insight into site possibilities and to create a framework in which the new train station can be established to develop a programmatic connection with its close surroundings.

Researching the client for the project will be done according to defining target groups and analysing stakeholders who can serve these target groups. This will be done by analysing the previously mentioned train stations on their users and program to give an insight into how train stations serve their users. On the other hand, possible site locations will be analysed on their surrounding programmes, user patterns and stakeholder research. Furthermore, the Deutsche Bahn and BVG will be contacted to give insight into the usage patterns of stations.

At last automation technologies and their impact on architecture will be explored. Research on this topic will provide insight into how automation technologies can be beneficial for their implementation in train stations. This will be done by analysing

several examples of a digital twin in smart cities. Providing that data to create a personalised experience for everyone living in these cities. This research will provide insight into how automation technologies can influence the user experience and also encourage the use of specific elements of the building they visit.

Literature and general practical preference

A. Wagner. *Discover Berlin By Sustainable Transport*. Berlin , Germany: Deutsche Gesellschaft für Internationale Zusammenarbeit, 2014.

Anna Minton. *The Privatisation of Public Space*. London, United Kingdom: The Royal Institution of Chartered Surveyors, 2006.

Baggen, J.H, Hans van Ham, and A.J van Binsbergen. *Het Transportsysteem*. Delft, The Netherlands: Delft Academic Press/VSSD, 2019.

Bertolini, Luca, and Tejo Spit. *Cities on Rails: The Redevelopment of Railway Station Areas*. New York, NY: Lightning Source UK Ltd., 2010.

Boer, Hans de, Boomen Tijs van den, Paul Chorus, Jutta Hinterleitner, and D'Laine Camp. *Onder Weg!: Vijftien Ontwerpen Voor Transit Oriented Development (TOD) Aan De Zaancorridor*. Amsterdam, The Netherlands: BNAonderzoek, 2014.

Bruinsma, Frank. *Railway Development: Impacts on Urban Dynamics*. Heidelberg, Germany: Physica-Verlag, 2011.

Bureau Spoorbouwmeester, ProRail en NS Stations. *Hartelijk Welkom, Samenwerken Aan Een Prettige Ontvangst in De Stationsomgeving*. Utrecht, The Netherlands: Bureau Spoorbouwmeester, 2017.

Civic Architects, The Cloud Collective. *Het Openluchtstation, De Nieuwe Opgave: Het Vitale En Comfortabele Ontvangstdomein*. Utrecht, The Netherlands: Bureau Spoorbouwmeester, 2018.

Curtis, Carey, John L. Renne, and Luca Bertolini. *Transit Oriented Development: Making It Happen*. London, United Kingdom: Routledge, 2016.

Dewar, Anthony, Frank Anatole, and Trevor Wilson. *Station Design Guidance Design Manual*. London, United Kingdom: Network Rail, 2021.

Dingeste, A, and M de Boer. "Landschap Als Organisatiestructuur." *Cement*, 2008, 24–33.

Donselaar, P.M Wortelboer-van, P. Jorritsma, and Johan Visser. *Regie Op Knooppunten*. Den Haag, The Netherlands: Kennisinstituut voor Mobiliteitsbeleid, 2012.

Ersoy, Aksel, John Bryson, and Ellen Van Bueren. "Unlocking Values through Infrastructure Interdependencies." *Infrastructure Asset Management* 7, no. 2 (2020): 134–43. https://doi.org/10.1680/jinam.18.00029.

Follmer, Robbert. *Mobility in Germany*. Bonn, Germany: Bundesministerium für Verkehr und digitale Infrastruktur, 2019.

Greene, M, J Reyes, and A Castro. "Degrees of Sustainable Location of Railway Stations: Integrating Space Syntax and Node Place Value Model on Railway Stations in the Province of North Holland's Strategic Plan for 2010-2040," 2012.

Guigon, Marc. *Railway Stations Boosting the City*. Paris, France: International Union of Railways (UIC), 2019.

Haque, A M, S Rezaei, C Brakewood, and A Khojandi. "A Literature Review on Park-and-Rides." *The Journal of Transport and Land Use* 14, no. 1 (October 1, 2021): 1039–60.

Het ministerie van Infrastructuur en Waterstaat. *Contouren Toekomstbeeld OV 2040*. Den Haag, The Netherlands: Het ministerie van Infrastructuur en Waterstaat, 2019.

International Association of Public Transport. *Design Excellence for Public Transport Excellence*. Brussel, Belgie: UITP, 2015.

Julies Menge. *Berlin´s Urban Transportation Development Plan 2025 - Sustainable Mobility*. Berlin, Germany: Senate Department for Urban Development and the Environment of the State of Berlin, 2014.

K, de Lange. *Ontwikkelagenda Toekomstbeeld OV, Nu Instappen Naar 2040*. Den Haag, The Netherlands: Het ministerie van Infrastructuur en Waterstaat, 2021.

M, Loos, E, Luiten. *Het Nieuwe Stationskwartier, Ruimtelijke Kwaliteit Op Het Grensvlak Van Knooppunt En Stad*. Utrecht, The Netherlands: Bureau Spoorbouwmeester, 2019.

M. van Hagen, M. Exel. *De Reiziger Centraal, De Reiziger Kiest De Weg Van De Minste Weerstand*. Utrecht, The Netherlands: Bureau Spoorbouwmeester, 2012.

Mark van Hagen, Menno de Bruyn. *Typisch NS Elk Station Zijn Eigen Rol*. Utrecht, The Netherlands: NS Productmanagement, 2002.

Mecanoo architecture, Pro Rail, Springtime, Bureau Spoorbouwmeester. *Journey to the Future A Passenger Experience*. Utrecht, The Netherlands: Bureau Spoorbouwmeester, 2019.

P. Schaap. *Het Stationsconcept, Visie En Toepassing*. Utrecht, The Netherlands: Bureau Spoorbouwmeester, 2012.

Paul Gerretsen, Miriam Ram, Karishma Asarpota, Rien van de Wall, Jurgen de Haan. *Model Informatieprofiel Knooppunten*. Rotterdam, The Netherlands: Vereniging Delta Metrapool, 2019.

Petit, Max. *Spatial Integration of Newly Developed Train Stations in Mid-Sized Cities in the Netherlands*. Wageningen, The Netherlands: Wageningen University and Research, 2022.

Pro Rail. *Public Transport in 2040 Outlines of a Vision for the Future*. The Hague, The Netherlands: Ministry of Infrastructure and Water Management, 2019.

Rode, Philipp, Christian Hoffmann, Jens Kandt, Duncan Smith, and Andreas Graff. *Towards New Urban Mobility The Case of London and Berlin*. London, Untied Kingdom: London School of Economics and Political Science, 2015.

Senate Department for Urban Development and the Environment. *Berlin Strategy, Urban Development Concept Berlin 2030*. Berlin, Germany: Senate Department for Urban Development and the Environment, 2015.

Siikonen, Marja-Liisa. *People Flow in Buildings*. Hoboken, NJ: Wiley-Blackwell, 2022.

Spoorbeeld. *Aandachtspuntenlijst Duurzame Stations*. Utrecht, The Netherlands: Bureau Spoorbouwmeester, 2019.

Thomas, Ren, and Bertolini Luca. *Transit-Oriented Development: Learning from International Case Studies*. Cham, Switzerland: Palgrave Macmillan, 2020.

Tork, Hossam Amir Mohammed. *The Development Of Train Stations' Design*. Cairo, Egypt: Ain Shams University, 2010.

Triggianese, M, and R Cavallo. "The Station of the Future Amsterdam's Stations in Transition." *OverHolland – Architectonische studies voor de Hollandse stad* 12, no. 20 (2019): 39–60.

Triggianese, M, and Y Soylev. *Inclusive Stations*. Delft, The Netherlands: Unspecified, 2021.

Triggianese, M. "European High Speed Railway, Understanding Design Contractions For Long-Term Urban Architecture Strategy," 2014.

Triggianese, Manuela, and Fabrizia Berlingieri. "Intermodal Nodes for the European Metropolis: Amsterdam Zuidas as Eurandstad's Gate." *Advanced Engineering Forum* 11 (2014): 220–26. https://doi.org/10.4028/www.scientific.net/aef.11.220.

Triggianese, Manuela, Olindo Caso, and Yagiz Soylev. *Living Stations: The Design of Metro Stations in the (East Flank) Metropolitan Areas of Rotterdam*. Delft, The Netherlands: TU Delft, BK Bouwkunde, 2021.

Triggianese, Manuela, R. Cavallo, Nacima Baron, and Joran Kuijper. *Stations as Nodes: Exploring the Role of Stations in Future Metropolitan Areas from a French and Dutch Perspective*. Delft, The Netherlands: TU DElft Open, 2019.

Van Acker, Maarten, and Manuela Triggianese. "The Spatial Impact of Train Stations on Small and Medium-Sized European Cities and Their Contemporary Urban Design Challenges." *Journal of Urban Design* 26, no. 1 (2020): 38–58. https://doi.org/10.1080/13574809.2020.1814133.

Zijlstra, Toon, Thomas Vanoutrive, and Ann Verhetsel. "A Meta-Analysis of the Effectiveness of Park-and-Ride Facilities." *European Journal of Transport and Infrastructure Research*, no. 15(4) (September 2015): 597–612. https://doi.org/10.18757/ejtir.2015.15.4.3099.

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)?

   ?

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

   When looking at cities in the 21st century, most European cities deal with the space cars take up in their city centers. With the view towards the future, almost 7 out of 10 people will live in cities. If these cities are still dominated mainly by cars people will have no room in the city. Therefore many cities are coming up with strategies to move vehicles out of the city, such as environmental zone and removing car parks from the city center.

   The shifting approach towards cars in the city shows the relevance of a project. Exist sting approach to this problem mainly focus on banning cars from the city itself without giving a solution to the car problem itself. This approach primarily focuses on the existing rail infrastructure network of a country. But then still shift the problem from the inner city to the metropolitan area, which gets cramped up with cars.

Designing a well-functioning transportation hub that focuses primarily on cars is something we are seeing emerge slowly in our urban planning. On the other hand, countries such as the Netherlands are increasingly utilizing the concept of the P+R station. However, the design of the hub is still subject to significant change. A good design proposal is relevant not only for the city of Berlin but also for new transportation hubs emerging all over Europe to make cities green, healthy, future proof and less car dominant.