

# 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](mailto: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	<b>Thomas Brandt</b>
Student number	<b>4837649</b>

Studio		
Name / Theme	Complex projects   Bodies & Building Berlin	
Main mentor	Olindo Caso	Architecture
Second mentor	Jan van der Voort	AE+T
Third mentor	Martin Grech	
Argumentation of choice of the studio	The studio offers an opportunity to set up and develop a complex design assignment. This appealed to me because the versatility and dynamics in complex buildings can lead to unique design solutions. The development of the scale of a large building also seemed interesting to me to challenge myself with as a graduation project.	

Graduation project	
Title of the graduation project	<b>Berliner L-Bahn</b>
Goal	
Location:	Berlin
The posed problem,	In Berlin, the result of Germany's reputation as an evolved car developer can be recognized in the street scene and urban network. The city is dominated by cars, the urban structure is clearly designed for this (Bernhardt, 2020). This high use of cars causes congestion and also has adverse effects on air quality (Jonson et al., 2017). The city's own

ambition is to put an end to the car-centric ideology. The municipality wants to ensure a more environmentally friendly city by making better use of resources and being conscious about energy use. The ambition is to significantly improve air quality by reducing car use. Simultaneously, the goal is to give the development of public transport a higher priority by ensuring that a reliable and sustainable network functions efficiently. The aim is to make this accessible to everyone (Menge et al., 2014). However, this does not appear to be an easy challenge. The research by Reckien et al. (2007) has shown that the current city structure is designed in such a way that CO2 emissions by car commuters will not decrease quickly in Berlin. This travel behaviour has also been studied by Beige (2012), it can be seen that within all districts of Berlin the majority moves to or from the central districts. It is striking that the car alternative in the city has not yet managed to connect all neighbourhoods with a fast alternative.

In summary, excessive car use is self-evident in Berlin, with the negative consequence that excessive amounts of exhaust fumes are emitted and thus

	<p>cause poor air quality. Due to congestion, one has the alternative to travel by public transport. However, this involves long travel times, which means that switching is not encouraged.</p>
research questions and	<p>In order to transform the aforementioned problems into an architectural challenge, The focus is put on three main topics: mobility, innovation and digitalization. In the future, people will move much more towards urban areas (Ritchie, 2023). The development of a new type of infrastructure is therefore essential to keep up with urban growth and to be ready for unexpected situations with regard to the future. Since today's infrastructure all run into the problem of leaving little room to expand for future growth. Mobility by air still offers every opportunity for this. A new means of transport that residents of Berlin can use are electric passenger and delivery drones. The advantage of drone use is that the carbon footprint of their alternative services are enormously reduced. Travel and delivery times also become faster and more reliable. In order to continue to provide a healthy and liveable city with reliable mobility, there must be enough alternative means of travel available in the future. The</p>

	<p>challenge is to connect all modes of transport while allowing them to operate autonomously. Thus arising the following research question:</p> <p><i>"How can a new mode of air transportation be designed to facilitate the increasing demand in transportation of people and good?"</i></p>
<p>design assignment in which these result.</p>	<p>The architecture of transportation is recognized by the contemporary lifestyle of humans. For the studio and the future of infrastructure architecture this legacy needs to be properly examined, respected and continued. This new form of urban infrastructure will be part a mixed-use building where passengers can check in and fly from and to another drone station. The network in which these, from now on to be called vertiports, will exist is expected to grow considerably in the coming century to accommodate the decline in car use. The expected increase in demand requires the design to include a modular approach, where a terminal can easily expand or down-scale in the future. In addition, the design will include a warehouse for postal services, where packages and mail can be sent through the city via drones. The location of this drone hub is next to the Hauptbahnhof-</p>

station on the unused plot of land adjacent to the tunnel box where the tracks go underground. The area around and over the train tracks can be used to design platforms. Due to the extent of the tracks, the project has a good chance of expansion in the future.

**Process**

**Method description**

The program of this new building typology, the vertiport, will be investigated by looking at case studies. Characteristic elements of the buildings are measured in surface area and benchmarked next to each other in order to make a statement about an average percentage of the total surface area that the vertiport will need in terms of these spaces. Because the vertiport as a typology does not exist, small airports will be considered. The flow of people and overflow of spaces is comparable. One enters a central hall, passes a number of access procedure areas and leaves the building via a terminal. The research will examine 5 small airports and 2 general aviation airports. Besides this research will be held on existing warehouse designs to examine how a delivery hub can design most efficiently. The case studies for the research into the program were chosen based on the size and passenger numbers on the one hand and the extent to which it is located close to Berlin on the other. To get a broad picture of the scope within which a vertiport can be derived, it is important that the study included a selection of buildings with a varied daily passenger number. This is also to take into account any growth or shrinkage for a modular typology. A range of 23,000 to 230 daily passengers is used for this benchmarking.

The vertiport will be a new infrastructure that will be connected to the existing public transport network. In essence, it is a service for the residents of the city. To find out which clients are interested in such a service, it will be necessary to look at which

parties can benefit from a collaboration with air mobility by looking carefully at the scenarios and finding out via sources which parties are interested in an investment in the part of the network.

The site is determined by three specific requirements. The first is Free Airspace. It is necessary that there is enough maneuvering space for an air mobility vehicle to be able to take off and land. Sufficient air space around the vertiport is therefore important (Schweiger & Preis, 2022). The second requirement is that it must be built as close as possible to an existing S-bahn station. The connection to the existing network is essential for an effective contribution (Brunelli et al., 2023). The last requirement is the space for future growth. The typology must be able to expand due to an increase in demand. When searching for a suitable location, possible growth space for the terminals must be taken into account.

## Literature and general practical references

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## Reflection

### 1.

Within the studio complex projects the given theme is digitalization in this graduation project. A new typology is therefor being designed around the development of autonomously controlled vehicles. Developing a new building typology is a complex challenge in itself because there are no existing examples of it and therefore complexity must be predicted.

The master track architecture is looking for innovative solutions for modern problems surrounding the built environment. Th graduation project is an approach to a sustainable solution to an urban problem. The vertiport is an answer to the search for innovation by developing a building concept using scientifically researched information. This research allows more sustainable and cleaner alternatives to be applied in cities.

### 2.

The prototypes of autonomously flying drones are progressing rapidly. It is not unlikely that this means of transportation will be widely used in the near future, especially in larger modern cities. Surrounding this development, it is necessary to think and research into what the architecture around it should look like. It is important that essential elements are included in a conceptual design so that in practice, when the time comes for this new mode of transport to be used publicly and/or commercially, one is prepared for the construction of such a typology.