

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	Rik Sijbrandij
Student number	5227313

Studio		
Name / Theme	Complex Projects / Beirut studio	
Main mentor	Hrvoje Smidihen	Architecture
Second mentor	Eline Blom	Architecture
Argumentation of choice of the studio	<p>The complex projects studio focuses on projects that are complicated, practical, and realistic, with room for personal interests to be explored. This appeals to me because it allows me to obtain tangible and practical information and knowledge while also addressing my personal curiosity in safety, health, and functionality. Furthermore, the knowledge acquired can be applied directly in the professional field later on.</p> <p>In addition, I have never worked with a context outside the Netherlands before and this studio offered the opportunity to work with a context completely unknown to me, namely: Beirut, Lebanon. Giving the graduation process an extra layer of depth.</p>	

Graduation project	
Title of the graduation project	Architecture and emergency response. (Emergency Station)
Goal	
Location:	Beirut, Lebanon
The posed problem,	In an ideal safe city, everyone has sufficient access to rapid emergency services (police, fire brigade and ambulance) that work together integrally and efficiently. In Beirut, however, there is a lack of capacity in emergency services and mutual coordination to respond in time to all emergencies due to the various crises that have hit the city. Unfortunately, as

	<p>a result of these crises, emergency situations are becoming more common. As a consequence, citizens in need do not receive timely and/or insufficient help, making the city significantly less safe. In addition, tensions between residents, protesters and the police are increasing. By accommodating the emergency services in one overarching building, an attempt is made to improve the (perceived) safety situation in Beirut.</p>
research questions and	<p><i>Research question:</i></p> <p>How can security concerns in crisis-stricken Beirut be generated architecturally in a building typology that unifies the emergency services and contributes to the safety of the city?</p> <p><i>Sub-questions:</i></p> <ol style="list-style-type: none"> 1. What layers of the urban fabric are important in the choice of the site of the emergency station and how do they play a role in shaping this site and the building? 2. What architectural design strategies can be used to make a building as safe as possible, without reducing its approachability to the public? <ol style="list-style-type: none"> 2.1 How can architectural design strategies be used to make a building as safe as possible? 2.2 How can architectural design promote the approachability of a building to the public? 3. How can the emergency services in the emergency station be organized in such a way that mutual cooperation is promoted?

design assignment in which these result.	The research will result in a design brief.
<p>The research questions lead to a variety of design strategies which will be utilized in MSc4, which can be summarized as follows:</p> <p>The project should be designed in a favorable location in Beirut so that it contributes positively to the complex environment as much as possible. This means that it is easily accessible to the public, but that it is in a location where emergency services can reach other parts of the city quickly as well. Furthermore, the building should be designed as safely as possible without compromising the approachability of the building. This influences, among other things, the building shape, construction, materialization, configuration and detailing. As a result, the damage caused by (terrorist/other) explosions will be minimized. However, security interventions will be architecturally integrated into the building so that visitors will not be deterred. (for example, high fences with barbed wire deter visitors and are not integrated into the architecture). In addition, the building must stimulate mutual interaction and coordination between the various services, without sacrificing functionality.</p>	
Process	
Method description	
<p>The research can generally be divided into two parts related to safety, namely the internal safety of the site and the building that are improved through architectural interventions and the external safety improvements of the urban environment, because of architectural and urban planning interventions. In other words, how do architectural interventions contribute to the concrete and tangible safety of the users of a building? And how can a building design (and environment) improve the safety of the people that use the surrounding urban fabric as effective as possible. For the purpose of comprehensibility, the terms '<i>safety through design</i>' and '<i>design for safety</i>' are used. In conjunction, the sub-questions can therefore be divided into these two categories, which can be seen in the research diagram (see figure 1).</p>	

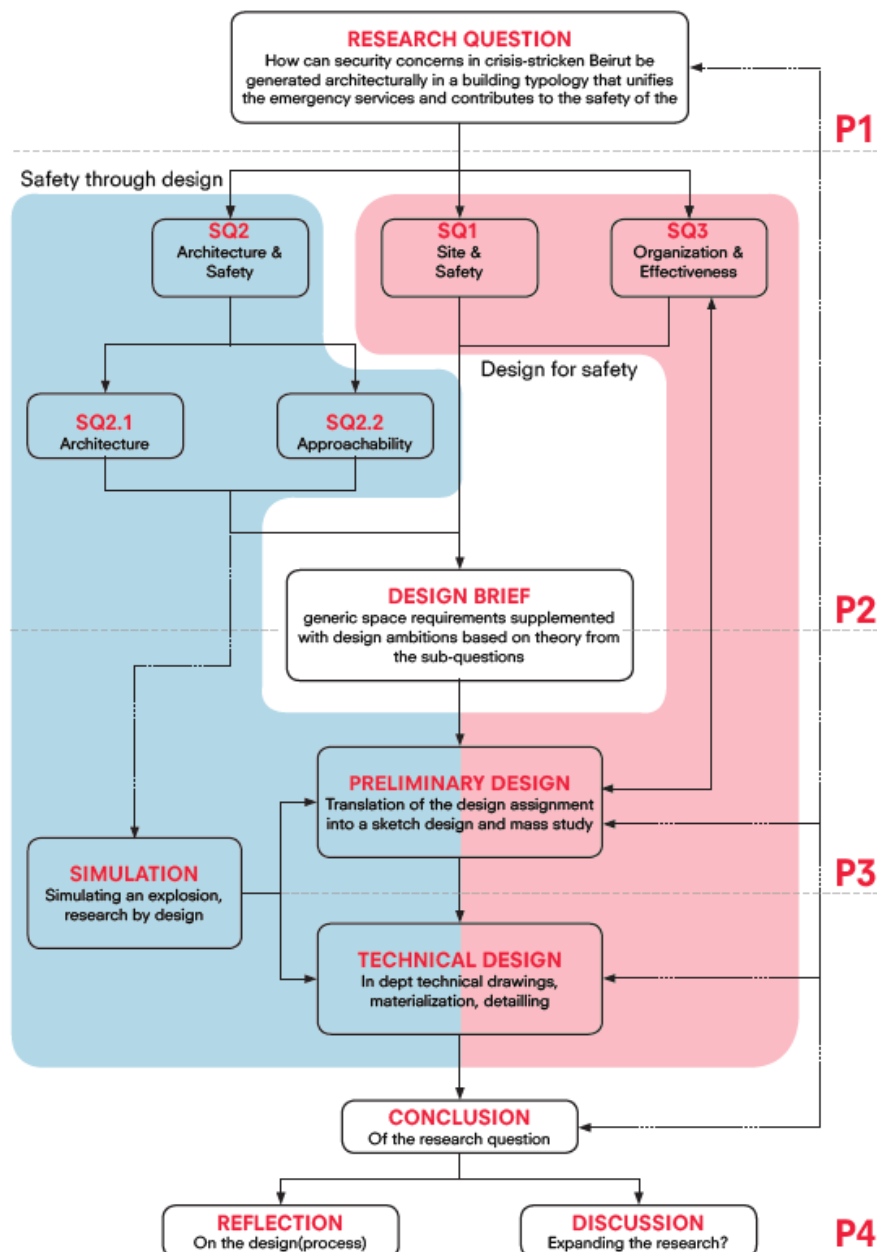


Figure 1: Research structure and general planning (own diagram).

The methods used to answer the sub-questions are discussed in chronological order.

Sub-question 1:

First of all, a precedent study will be used to investigate which aspects in the urban fabric are important for an effective and successful emergency station, focussing on subjects such as accessibility and visibility. To start, the response times of the emergency services according to the location of the project were mapped in order to determine how fast they can reach various important points and areas in the city (including other students their projects). Then, with the acquired knowledge, the urban fabric of Beirut was analysed by means of a targeted plan analysis and a site visit. After the site visit, a logical and argued project location could be designated for the graduation project. Subsequently, the influence of the surrounding urban fabric of the

chosen project location on the layout of the plot and the building shape will be examined. By means of a combination of typological and morphological research (e.g. site analysis, traffic studies, urban massing, etc.), appropriate conditions are set for the urban development, design of the building plot and the building form itself, while keeping Beirut's building regulations in mind.

Sub-question 2:

Additionally, the research on the scale of the building and the environment is further expanded by means of literature research on architectural interventions that can improve the safety of the building (e.g. building form, materials, configuration, etc.). For this, the book 'Primer for Design of Commercial Buildings to Mitigate Terrorist Attacks' by U.S. Department of Homeland Security and Federal Emergency Management Agency (2013) used as a base information. Obviously, this information will be expanded upon through several different sources on architecture and security. Moreover, reference projects are cited and analyzed to study how existing architectural projects integrate safety measures into the design of the building and the immediate surroundings. Simulations of the impact of explosions on the building will be conducted at a further developed stage of design (MSc4). Besides proper security, the building should still feel welcoming to the residents. For this, a precedent study is being conducted into the approachability of buildings as well, in which the research of Kalayci and Bilir (2016) will be used as a guideline. Reference projects are listed and evaluated here as well to see how existing architectural projects accomplish this. With the results of both studies in mind, in MSc4 the emergency station will be designed in a way that is both safe and approachable.

Sub-question 3:

Finally, through literature research it is examined how the three different emergency services, ambulance, police and fire brigade, have developed over the years in Beirut and how they currently operate. The following studies and reports are cited for this purpose: the study of El- Jardali et al. (2017) into Lebanese medical emergency services, the report of the Internal Security Forces (2021) into the history of the police department and the research of Mohsen et al. (2020) into Civil Defense (fire brigade). Subsequently, after the program has been defined, the users of the building are mapped out. All users are then linked to the various rooms they use during a working day, creating a relationship diagram. After this, the spaces are connected by means of a space syntax so that users with the appropriate professions (ambulance personnel, police officers and firefighters) meet each other at the right times in the right spaces. In this way an attempt is made to improve the cohesion between the professions and to increase interaction at appropriate times. By means of a narrative sensory mapping, the daily experiences of the different users of the building are used to create a narrative. Lastly, by combining the different services into one building, the response times of these services in case of emergencies are equalized (the vehicles leave the same place at the same time and therefore are more likely to arrive at the same time), which improves the overall coordination and emergency assistance provided.

Literature and general practical preference

The broader theories and practices related to security/safety are understood in two distinct parts, namely: *Concrete and proven security architectural measures* and *perceived security*. *Concrete and proven architectural security measures* to improve the safety of the users of a building are explained in detail in the report 'Primer for Design of Commercial Buildings to Mitigate Terrorist Attacks' of the U.S. Department of Homeland Security and Federal Emergency Management Agency (2013). The report cites an explosion as the primary hazard to a building and how it can be accounted for in the design. Due to the civil unrest and the terrorist threat in Beirut, an explosion is seen as the main danger for the building that will be designed in the graduation project. Furthermore, the *perceived safety* is studied as well, this does not concern physical safety, but the sense of safety. To this end, the prospect-refuge theory developed by Appleton (1996) and related to architecture by Hildebrand (1999) is used, which looks at the influence of architectural elements (e.g. natural lighting, configuration of volumes, sightlines etc.) that have a strong influence on the user's perception of a space.

As mentioned, the research of Kalayci and Bilir (2016) is used to gather information about how to make a government building more approachable. In this source the approachability of police stations is discussed, this reflects well with the project as the police station part of the emergency station is the only publicly accessible part of the building.

For both the studies on security and accessibility, various reference projects (precedents) are analyzed on how these aspects are integrated into the architecture. This is done in order to create a database with design options that can be used during MSc4 to design the building as safe and approachable as possible.

For the environment in which the project will be designed, different methodologies are used that can be categorized under architectural morphology and typology. Through this research, architectural and urban planning requirements will also be set for the project that is to be designed in Msc4 in the form of a design brief. Furthermore, the experience of the different users is mapped through sensory mapping (phenomenology) used in combination with space syntax to investigate how mutual cohesion and coordination can be stimulated.

Reflection

This research examines how a relatively new and modern building type, the emergency station (one overarching building with police, fire brigade and ambulance), can work effectively and add to safety in the building type's unknown context that is Beirut, a relevant context due to the safety problems that the city faces as a result of the various crises it has endured. It provides insights into how a building can contribute to the redevelopment of a city (part) after crises, an exploration of a new building type that can contribute to security. Therefore, the study touches on one of the most fundamental human needs, namely safety, a tangible and relevant topic that is also related to architecture and the built environment. Conclusions from the research can be used as a design tool for the graduation project, but the design also acts as an important resource and tool for the research.

In addition, the context of Beirut is a very complex environment, which means that the project automatically falls into the scope of the graduation studio, complex projects. Together with six other projects, an attempt is made to revitalize the urban fabric of an area with a diameter of 2 kilometres in which the emergency station plays an important role.

Furthermore, the findings from the research, although tested and focused on Beirut's context, are more widely applicable. There are several cities around the world experiencing, or at risk of experiencing, crises for which the research may be relevant. In fact, the research can be relevant for any city where there are safety concerns, both at a building level or in the broader context. Security can come under pressure in various ways, such as terrorism, crises and war, but also milder phenomena such as demonstrations that have gotten out of hand, other political unrest or crime. These are problems not specific to Beirut, but occurring worldwide, even in relatively safe cities. In addition, by improving the perceived safety of users and people who pass a building, a more pleasant experience can be made.

Social/Practical relevance

The knowledge gained in the field of architectural security without losing approachability can be used in buildings that have safety risks, such as government buildings, banks and buildings with a political function, but also commercial and non-commercial public buildings where many people gather. Moreover, the research into improving the functioning between building users, especially ambulance personnel, police officers and firefighters, can be used to further develop the building type and make it more effective in combating safety issues.

Scientific relevance

Through the graduation project, the manual of the United States Department of Homeland Security and the Federal Emergency Management Agency (2013) and Appleton's (1996) prospect-refuge theory, architecturally adapted by Hildebrand (1999) are tested and consolidated. This enables the study to add to comprehension of architecture's role in safety, both internally and in terms of what it can provide to its surroundings. At the same time, research into the location and its environment and the organization of the building itself can contribute to the performance and efficiency of the building. All in all, a relatively new building type (emergency station) is designed in a context unknown to the building, based on existing theories and data about safety, approachability, organization and scope (response times). Through design and analysis this provides new information that can aid in the development/optimization of the building type as well as a better understanding of it.

Appendix

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