RESPONDING TO EMERGENCY

Research plan

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RESEARCH PLAN

01

Architecture and Emergency Response

The relationship between safety and architecture in crisis-stricken Beirut.

04-08-2020 | Disaster strikes

It's August 4 when Lebanon's capital, Beirut, is hit by one of the largest non-nuclear explosions the world has ever seen (Rincon, 2020). Unfortunately, this explosion that damaged and/or demolished more than half of the city (Fakih, 2021) is not the first crisis it has to deal with. Several catastrophes have already plagued Lebanon and its capital during the last century such as (civil) wars, financial, health and other crises and a corrupt government (Center for Disaster Philantrophy, 2021).

However, Beirut is not the first or the last city dealing with these types of problems. There are multiple cities around the world that are dealing with different disasters or are at risk of being struck by them, be it natural (see figure 1) or man-made. This research investigates how architecture can make a positive contribution to cities that regularly have to deal with emergency situations. In order to improve the lives of people living in areas affected by these emergency situations, it is being investigated whether an emergency station can be successfully implemented in the context of crisis-stricken Beirut. This emergency station will consist of an ambulance post, police station and a fire station combined into one overarching building.

Beirut's security concerns

This paragraph gives an insight in the problems each emergency service (healthcare, law enforcement and fire brigade) encounters in the context of Beirut. Subsequently, these problems will be related to architectural topics that can be addressed, leading to the problem statement of this research.

First of all, the health system in Beirut has been severely damaged by the explosion, limiting the care that can be provided to those in need (Meyers, 2020). Additionally, due to the financial crisis, there is little money in the country to rehabilitate hospitals. Furthermore, the country is struggling with a medicine crisis, which could cause several people to die from minor health complications that could normally be resolved with medicine (Devi, 2020). On top of that, countries worldwide are currently battling the COVID-19 pandemic and Lebanon is no exception (McCaffrey, 2021). These are all reasons why there is a strain on the healthcare system in Beirut, so serious health complications are best prevented or treated early. Nonetheless, response time to emergencies in Beirut is slow due to the lack of departure points for ambulances, congestion in the city and a general lack of staff (El Itani et al., 2019). However, the healthcare sector is not the only emergency service where the pressure is mounting.

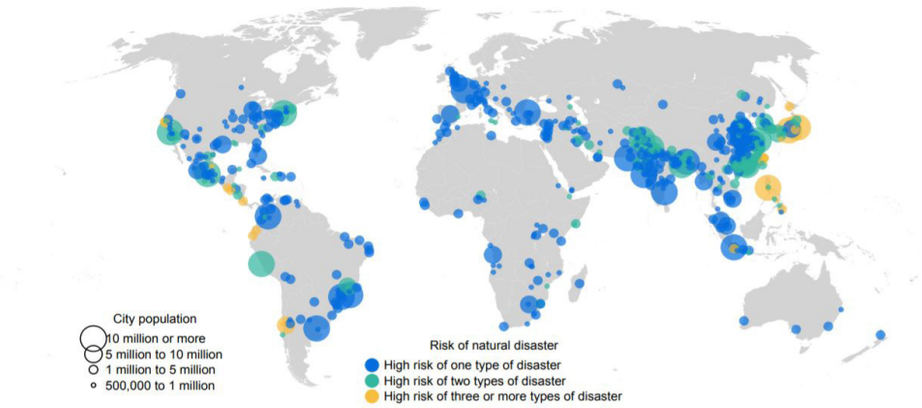


Fig. 1: Cities with a high risk of natural disaster (United Nations, Department of Economic and Social Affairs, 2018)

Secondly, there is an increase in the usage and mistrust of the Lebanese police, the Internal Security Forces (ISF). Since the explosion hit the port of Beirut, crime rates in Beirut have risen significantly (see figure 2). As a result of public unrest due to the financial and fuel crisis, among other things, there have been several incidents. These include explosions and shootings that have killed several people and police officers (Reuters, 2021). Moreover, this public unrest and mistrust in the government has led to many protests that regularly turn violent. These protesters clash with the police due to the lack of confidence they have in the ISF, significantly less than in the army for example (Geha, 2015). This is a consequence of the strong ties that the ISF has with politicians, a majority of citizens would like to see less political interference within the security forces (Geha, 2015). The closed and secured appearance of the police stations in Beirut (see figure 3) don't help the relations with the citizens.

Crime	2019	2020	Percentage Increase/Decrease
Total car thefts	514	1094	+ 112.8%
Total car robberies	44	89	+ 102.2%
Pickpocketing	678	503	– 25.8%
Aggravated robberies	1610	2534	+ 57.3%
Robberies without taking cars	247	610	+ 146.9%
Murders	100	183	+ 38%

Fig. 2: Increase in crime rates (شيباني , 2021)

Thirdly, there are problems within the fire brigade of Beirut, the Civil Defense. As with the ambulance services, the efficiency of the emergency response is limited by the slow response time of the fire brigades' services as well. The congestion that Beirut has also plays a role here, but there are also other causes, namely uncertainty in authority and poor coordination (Anderson, 1969). For example, the Civil Defense should take the leading role in the event of disasters, but their authority is often questioned by other agencies, because of their large base of volunteers (Anderson, 1969). Subsequently, this leads to poor overall coordination in dealing with these emergency situations and slower response times as a consequence.

When these issues are linked to approachable architectural topics, they become design challenges. The problem that arises in healthcare and the fire department, which can be researched architecturally, is the response time, as it is linked to the location and infrastructure (traffic flows & congestion) in the city. In addition, research into the security, approachability and identity of the building is important to the ISF. Due to the conflicts with the population and the terrorist threat in Beirut, the building and the site must be safe, without discouraging citizens from using the police station. Moreover, the coordination challenge facing the Civil Defense can be explored by studying how the services can work together integrally in one overarching building.

Fig. 3: Tayouneh Police Station in Beirut

Problem statement

In an ideal safe city, everyone has sufficient access to rapid emergency services 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 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. By accommodating the emergency services in one overarching building, an attempt is made to improve the safety situation in Beirut.

Research question

How can security concerns in crisis-stricken Beirut be architecturally generated in a building typology that unifies the emergency services and contributes to the safety of the city?

Sub-questions

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?

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

Theoretical framework

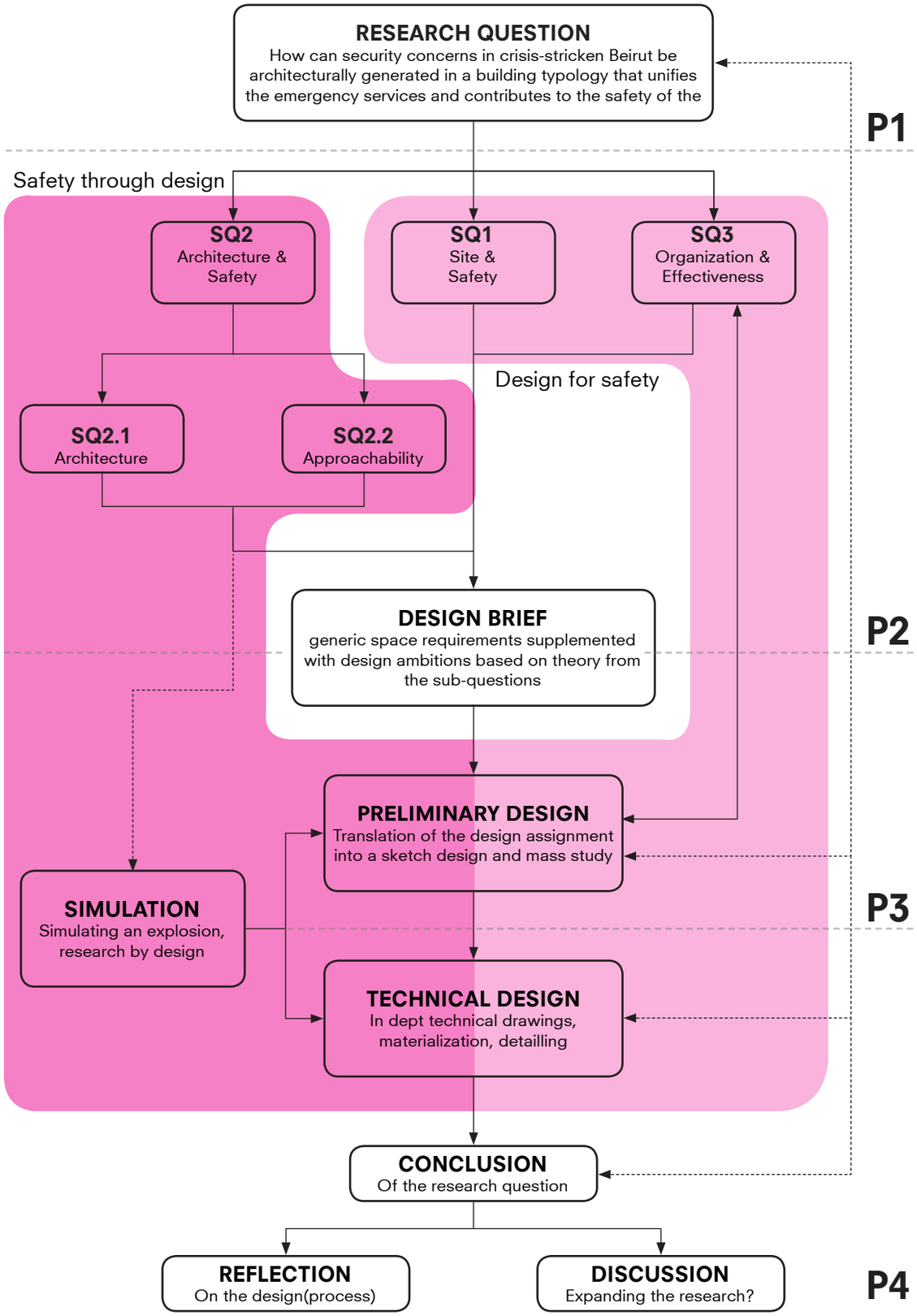
The research can generally be divided into two parts related to safety, namely the *internal* safety of the site and the building that are improved through architectural interventions and the *external* safety improvements of the urban environment, because of architectural and urban planning interventions. 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 'safety through design' and 'design for safety' are used

In conjunction, the sub-questions posed in the previous chapter can therefore be divided into these two categories, which can be seen in the research diagram (see figure 4).

The broader theories and practices related to security are understood in two distinct parts, namely: Concrete and proven security measures and perceived security. Concrete and proven 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 as well.

Furthermore, the perceived safety is also looked at, this does not concern physical safety, but the sense of safety. Furthermore, the perceived safety is also looked at, this does not concern physical safety, but the feeling 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 elements such as natural lighting, configuration of volumes, sightlines etc. has a strong influence on the user's perception of a space.

The academic research for this graduation project will be conducted using a range of different methods. For instance, precedent studies (including references), a simulation, and a mapping of user experiences will be utilized. Furthermore, the conducted research will serve to substantiate and help arguing design choices and will also play an important role in drawing up the design brief. However, the research is also tested in the context of the suburbs of Beirut through the design of the emergency station, so it is a constant interaction and reflection between research and design.



Methodology

As mentioned, the research consists of one overarching theme, safety. This is further subdivided into the two self-defined sub-themes ‘safety through design’ and ‘design for safety’. The research approach of the research sub-questions, including the methods used, is now discussed in chronological order.

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, such as visibility and accessibility. Then, with the acquired knowledge, the urban fabric of Beirut has been analysed by means of a targeted plan analysis and a site visit. Afterwards, a logical and argued project location could be designated for the emergency station (see figure 5). So this part of the research has already been done. 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, appropriate conditions are set for the urban development and the building form, while keeping Beirut’s building regulations according to Mohsen et al. (2020) in mind.

Additionally, the research on the scale of the building and the environment is further expanded by means of literature research on architectural vinterventions that can improve the safety of the building. 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. Simulations of the impact of explosions on the building will be conducted at a further developed stage of design (MSc4). Furthermore, the building should still feel welcoming to the residents, despite good security. For this, a precedent study is also being conducted into the approachability of buildings, in which the research of Kalayci and Bilir (2016) will be used as a guideline. 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.

Fig. 5: Aerial of the project location (own picture)

Finally, it is examined how the three different emergency services, ambulance, police and fire brigade, in Beirut have developed over the years and how they currently work in order to gain basic knowledge into the current situation. 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. 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 this way an attempt is made to improve the cohesion between the professions and to increase the interaction. Also, fewer square meters are used in this way because spaces are combined. By means of a narrative sensory mapping, the experiences that the different users have when using the building are used to create a narrative. Furthermore, the garages are placed next to each other so that if several emergency services have to turn out at the same time, they can manoeuvre through traffic together.

Conclusion

In conclusion, this research examines how a modern building typology, the emergency station, can work effectively and add to safety in the previously unknown context of 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. 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.

Furthermore, the findings from the research, although tested and focused on Beirut’s context, are more widely applicable. As made clear in the introduction, 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.

While security issues in Beirut are an extreme example, building security in any city is important. 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.

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 typology and make it more effective in combating safety issues.

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