

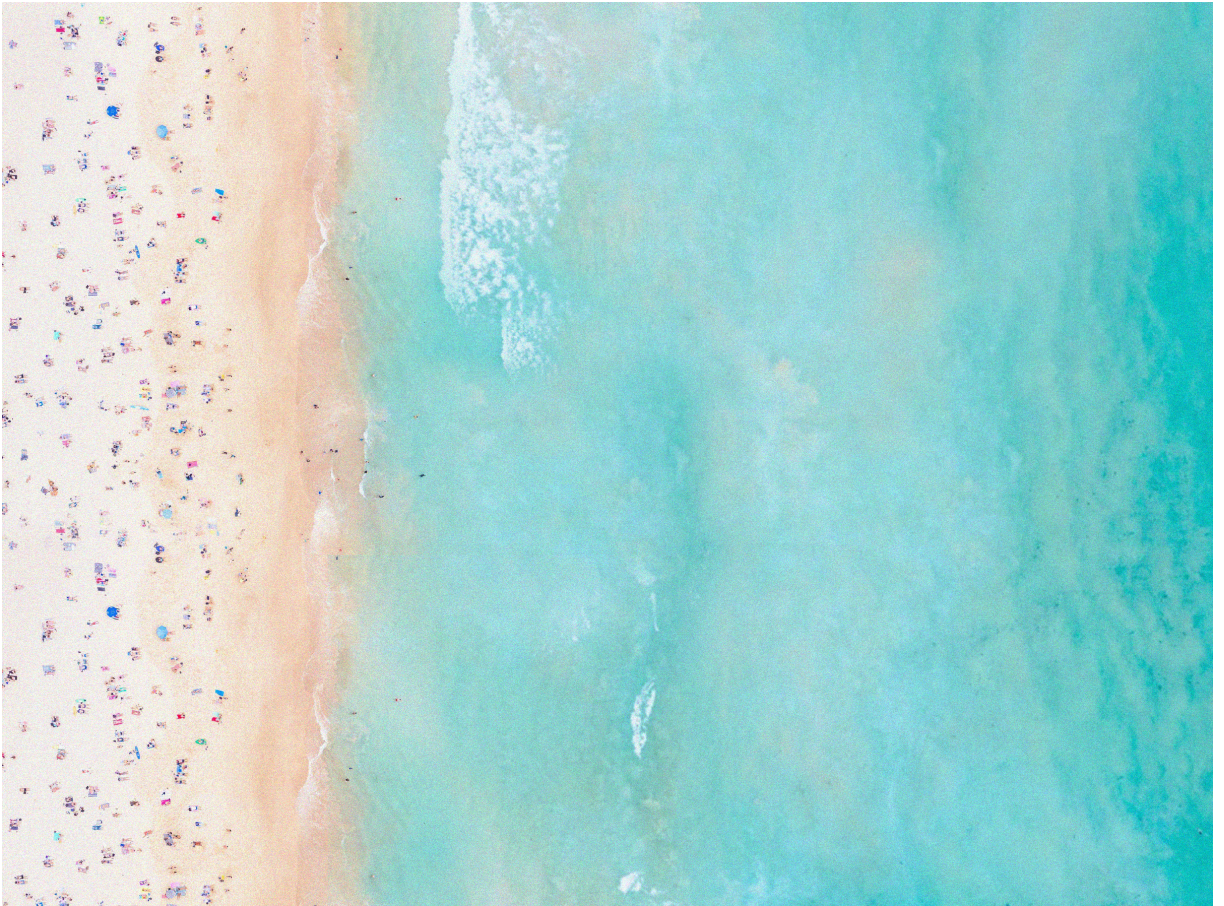
Beirut Ferry Service

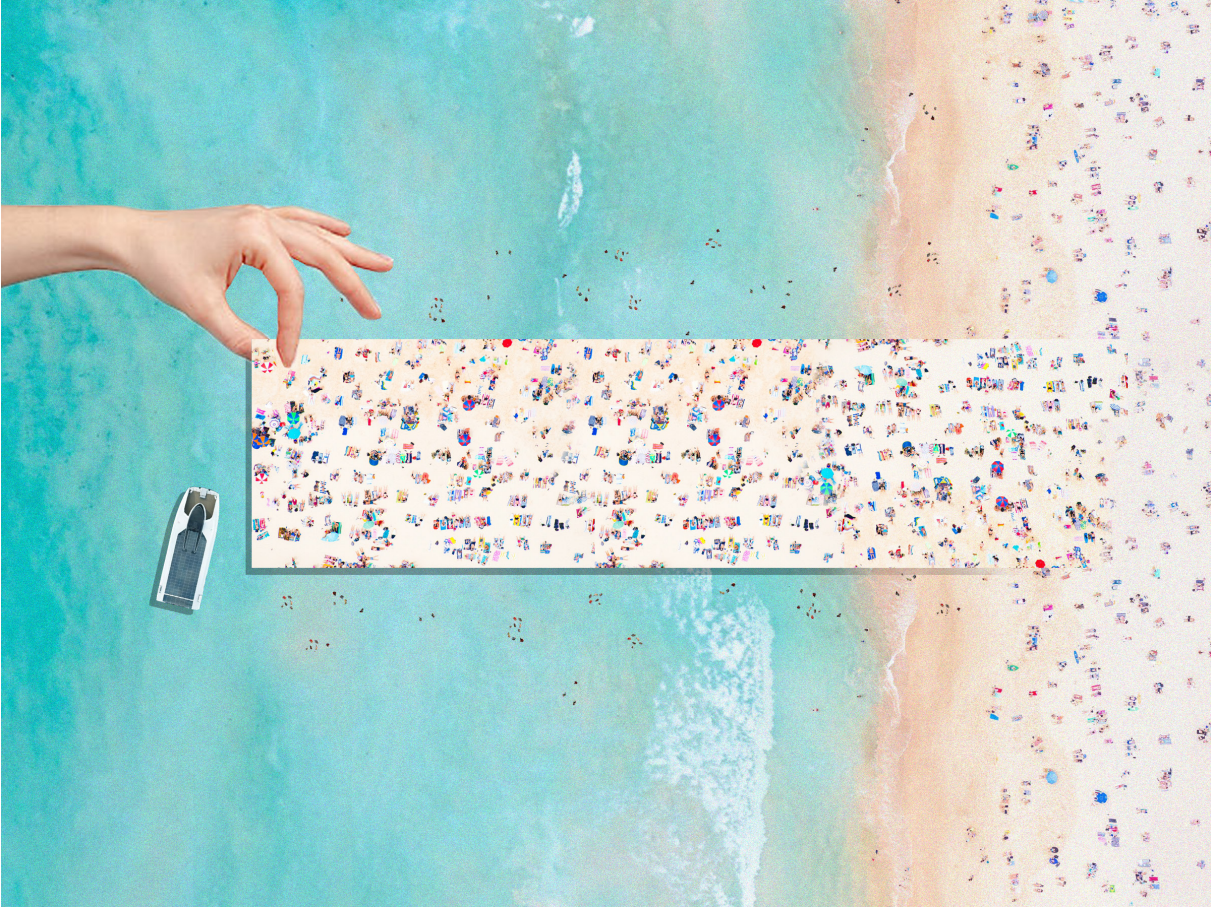
Article P2

Koen Meijman

Complex Projects

Beirut Studio





Content

Introduction

Mobility Crisis	5
History of Public Transport in Beirut	5
Beirut's Favourite Transport	5

Problem Statement & Research Question

(Im)mobility	7
Public Transport	8
Towards the Coast	8
A Ferry Service	8
Ramlet al-Baida	9
Research Question	9

Theoretical Framework

Mobility	10
Public Transport	10
Historical Framework	10

Methodology & Research Methods

Methodology	11
Research Methods	12

Relevance

Societal Relevance	13
--------------------	----

Design Brief

14

Conclusion Research & Design Brief

20

Bibliography

22



Figure 1. Worn out buses in Beirut.



Figure 2. Car centred mobility.

Introduction

Mobility Crisis

Beirut is a port city in Lebanon on the Mediterranean Sea with a troubled past and present. Years of Civil War and armed conflicts left the sectarian country with many challenges. The explosion last year in the port only exacerbated these issues. Since then the country spiralled down into a political and economical crisis on top of a refugee, energy, and health crises, both a pandemic and extreme air pollution.

Besides these crises one could argue that Beirut is also facing a mobility crisis. The car centred mobility system is falling apart, bringing along many challenges. Within this graduation project mobility within Beirut and the arising from it around it will be researched, in order to propose a possible intervention that challenges the current model and address its issues.

History of Public Transport in Beirut

In the past Beirut had various modes of public transport: train lines connecting Beirut to Damascus and Byblos, a tramway measuring twelve kilometres at its peak, and a bus network connecting the coast with the mountains. Unfortunately years of Civil War and political failure completely destroyed these public transport networks (fig. 1) leaving a void.¹

Parallel to the disappearing of public transport networks, two informal transport hubs on each side of the Green Line, the demarcation line between fighting parties during the Civil War, emerged and filled this void.² From these two nodes (Cola Intersection and Dora Roundabout) shared taxis and minivans departed to all parts of the city. In the absence of a reliable public transport system they became the only alternative to public transport, although being unreliable, chaotic and unsafe. Fights, over who takes which ride, frequently erupt between bus drivers and controlled and influenced by political forces such as Hezbollah and the Amal Movement.

Beirut's Favourite Transport

Simultaneously to the development of these informal hubs, the sale of cars skyrocketed. Over 40 years the amount of cars more than tripled from 600.000 to 2.000.000 registered cars.³ Almost 9 out of 10 Lebanese own a car, placing Lebanon on the 25th place of highest car ownership in the world.⁴ In comparison: Dubai has 'just' 550 cars per 1.000 citizens.⁵ By owning a private car many citizens hoped to secure themselves a reliable mode of transport. As a result of the car centred mobility there are as many cars as family members in most families (fig. 2).

1. Nora Niasari, "Under the Bridge," Mas Context, accessed 22 September 2021, <https://www.mascontext.com/issues/10-conflict-summer-11/under-the-bridge/>.

2. Nora Niasari, "Under the Bridge."

3. "Lebanon's car culture questioned in crisis," France24, last modified October 2021, <https://www.france24.com/en/live-news/20211020-lebanon-s-car-culture-questioned-in-crisis>.

4. "Lebanon Among Top 25 Countries with Highest Car Ownership," The961, published February 2019, <https://www.the961.com/lebanon-among-top-25-countries-with-highest-car-ownership/>.

5. "Lebanon Among Top 25 Countries with Highest Car Ownership,"



Figure 3. Citizens waiting for fuel.



Figure 4. Sidewalk double parking.

Problem Statement & Research Question

(Im)mobility

The car centred mobility model that overcame Beirut brings along many challenges. Nowadays the promise of secure transport by owning a car seems shattered. A series of challenges, arising from the car favoured mobility model, will be elaborated upon below.

Arguably the main challenge is congestion, caused by the sheer amount of cars. This is partly caused by the increase of cars, lack of ring road, but mostly due to the car occupancy that dropped from 8,2 person per car to 1,2.⁶ As a result gridlocks are a recurring problem with more than 600.000 cars entering Greater Beirut Area daily.⁷ According to some economist this leads to a loss of productive time costing Beirut approximately 8% of its GDP = \$3.000.000.000!⁸

Secondly, the car centred model takes a huge toll on public health. Due to particle matter emitted by cars, air pollution is exceeding WHO limits twice.⁹ Furthermore noise pollution caused by frequent honking creates additional stress and nuisance, not to speak of the 500 lives that are lost and leave 6.000 people that get injured annually due to traffic accidents.¹⁰

Additionally fuel dependence is a big issue. Car centred mobility brings certain risks to a country that relies mostly on imported fossil energy. Today Lebanon is unable to purchase its energy needs due to the sharply dwindling Lebanese Pound. Combined with a high usage of private generators, disaster is bound to happen. Now and then fuel shortage occur paralysing Beirut. People sometimes have to queue up to a day (fig. 3) to refill their gas

tank partially and in some events the army has to be mobilised to prevent fights.¹¹ Besides immobility and inconvenient for car owners, it also pressures other services that depend on a continuous fuel supply.

Furthermore, the abundance of so many cars in Beirut's dense urban fabric has consequences on public space, as all these cars need to park somewhere. Without an overarching idea how to address this issue people tend to take matters in their own hands by double parking or parking on the sidewalks (fig. 4), appropriating already scarce public space.

Lastly, long commuting times force people to rent or buy more expensive homes closer to their work to cut travel time.

In the light of these challenges it becomes clear that the current car centred system is not resilient at all and therefore very unsustainable. If Beirut wants to move forward the car centred transport model needs to be challenged. Last years many voices called for a public transport network, since this is the most efficient manner of moving many people. Since, however, neither the government nor private actors have done anything meaningful to solve the problems. In this context this graduation project will explore a possible implementation of a public transport system to address Beirut's mobility issues.

6. Samar Kadi, "Traffic congestion adds to Lebanon's many woes," The Arab Weekly, published December 2016, <https://thearabweekly.com/traffic-congestion-adds-lebanons-many-woes>.

7. Kadi, "Traffic congestion adds to Lebanon's many woes."

8. Kadi, "Traffic congestion adds to Lebanon's many woes."

9. "Beirut Air Pollution Causes Allergies and Illness," Antra, Published 2020, <https://www.anera.org/stories/beirut-air-pollution-causes-allergies-illness/>.

10. Kadi, "Traffic congestion adds to Lebanon's many woes."

11. "Lebanese troops deploy at gas stations after bank chief halts fuel subsidies," France24, last modified August 2021, <https://www.france24.com/en/middle-east/20210814-lebanese-troops-deploy-at-gas-stations-after-bank-chief-halts-fuel-subsidies>.

Public Transport

Since public transport is the more efficient than private mobility, the answer probably lies here. In the case of a congested city like Beirut, it is important that a new mode of transport does not fuel the above mentioned challenges. In addition the political unstable environment should be taken into consideration as a factor that determines the success of a public transport service. Subsequently alternatives public transport systems will be assessed.

In Beirut's congested urban fabric a bus or tram network seems unfeasible. They perform best when making use of dedicated lanes, but in Beirut this would simply take up too much already scarce space, leading to more congestion. Even without dedicated lanes a bus or tram service is not reliable in a city where gridlocks are so frequent.

Alternatively a metro system, or even a cable car network, could work as they do not add to and operate independently from the congestion. However, high initial investment costs and maintenance costs make them very unlikely to be developed in a country going through one of the worst economic crisis in history. On top such an effort requires a lot of collaboration on multiple levels which is difficult within in Lebanon's corrupt and unstable political environment.

Perhaps a more personal model such as cycling is an alternative. People already started cycling to escape the fuel crisis. In addition the government announced and encouraged citizens to use a bike sharing service.¹² Although sustainable and healthy it will probably not address the mobility challenges adequately. Dangerous and chaotic traffic conditions (partly caused by not functioning traffic lights due to fuel shortages), the topography (up to +100 meters high difference) and the warm Mediterranean climate do not work in its favour.

Towards the Coast

Now that most common land-based modes of transport do not adequately address Beirut's mobility challenges, a different medium for travel should be explored: water. Beirut has twelve kilometres of coast line (fig. 5) and it is arguably its most valuable asset. Dotted with small beaches, caves and spectacular rock formations, it offers spectacular cliff side views over the Mediterranean Sea. Could this be the last frontier that brings salvation to Beirut's mobility challenges?

This graduation project will explore how a ferry service could be integrated into Beirut's urban fabric and address its mobility issues.

A Ferry Service

The idea of water based transport system to solve Beirut's mobility issue has been mentioned by Dr. Khaled A. Taki in 2017, who wanted to create a water taxi service.¹³ The government was to review the proposal but since nothing has happened.

In Beirut's context a ferry service has a lot of benefits compared to the above mentioned modes of public transport. First of all, the infrastructure (seawater) is already there, cannot be destroyed and requires no maintenance. The are the ferries itself, as existing marinas can be used in the beginning to dock. Later additional stops can be made. Therefore initial investment costs are low compared to alternatives such as a light rail or metro. Furthermore it does not add to the congestion problems inside the city and also consumes no public space.

The service could connect the whole coast of the Greater Beirut Area, from the airport in the south to the port in the north. Later on it can extend perhaps to Jounieh as many people travel to Beirut from there. To be successful the service has to operate at rates competitive to the taxis and minivans departing from the Cola Intersection and Dora Roundabout.

Ramlet al-Baida

During this graduation project a design brief for one specific ferry port, located in the group site, will be developed and later it will be designed. The chosen site for this port lays just south of Ramlet al-Baida, Beirut's last public beach. Like the rest of Beirut's coast Ramlet al-Baida remains, albeit public, relatively under-utilised. Poor accessibility in combination with sewage spillages into the sea prevent it from being used optimally. Because the site is located on the beach, the water is very shallow and a ferry type with a low under keel clearance is needed. However, still a pier construction is needed for the boats to dock.

Research Question

Within the context of Beirut's mobility challenges and the chosen site the implementation of a ferry service and one ferry port will be explored. This research serves to answer the following research question:

“How to create a public ferry service, that addresses mobility challenges which arise from congestion, in a coastal city as Beirut?”



Figure 5. Beirut's coastline.

12. Farah-Silvana Kanaan, “Cycling culture gains ground in Lebanon as fuel runs dry,” Aljazeera, published June 2021, <https://www.aljazeera.com/news/2021/6/24/cycling-culture-gains-ground-in-lebanon-amid-fuel-shortages>.

13. “A Beirut Water Taxi System May Become A Thing In Lebanon,” The961, published March 2017, <https://www.the961.com/beirut-water-taxi-lebanon/>.

Theoretical Framework

The theoretical and historical framework in which the research will operate is explained in this section. Additionally frequently returning concepts are elaborated upon. These concepts include: mobility and public transport.

Mobility

In The Cambridge Dictionary mobility is described as follows: 'The ability to move freely or be easily moved.'¹⁴ This definition will be used during the research process when talking about mobility.

Public Transport

Public Transport has the following description in The Cambridge Dictionary: 'A system of vehicles such as buses and trains that operate at regular times on fixed routes and are used by the public.'¹⁵ Here too, this definition will be used during the research.

Historical Framework

The historical framework in which the research operates is limited to the last 100 years. Before this era not many mobility related developments found place in Beirut, since it was a small town. Within this timespan significant development were made that were influential for Beirut's current state of affairs.

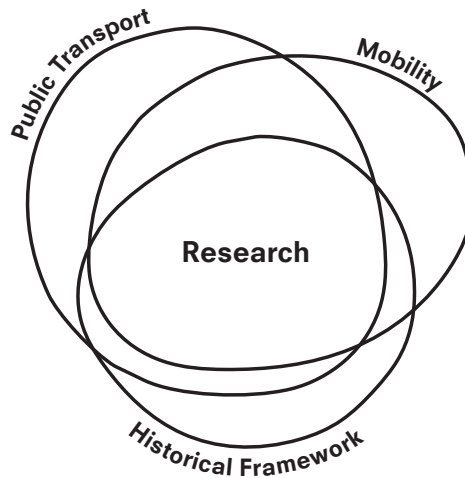


Figure 6. Theoretical Framework visualised.

14. "Meaning of public transport in English," Cambridge Dictionary, accessed October 2021, <https://dictionary.cambridge.org/dictionary/english/public-transport>.

15. "Meaning of mobility in English," Cambridge Dictionary, accessed October 2021, <https://dictionary.cambridge.org/dictionary/english/mobility>.

Methodology & Research Methods

In this section the methodology and research methods that are used during this graduation project are elaborated upon. By creating a clear understanding of the methodology and methods, flaws and biases can be detected, ultimately leading to a better body of research. The aim of the research is to be able to formulate a clear problem statement and research question, and later on answer this research question.

Methodology

The Complex Projects graduation studio exist of both group work and individual work.

Therefore multiple topics are researched parallel to each other with different research methods. The goal of the group work is to create a vision explaining how we think the site, located in a suburb, should develop over the next decades. The individual projects are located within the group site and are part of this vision.

To create a site vision research needs to be done with the group into the following: Beirut's suburbs and the group site. Individually the following topics have to be researched to create a problem statement and answer it: mobility in Beirut, project definition, site and program. Each topic has a different nature and therefore different research methods will be used, explained below.

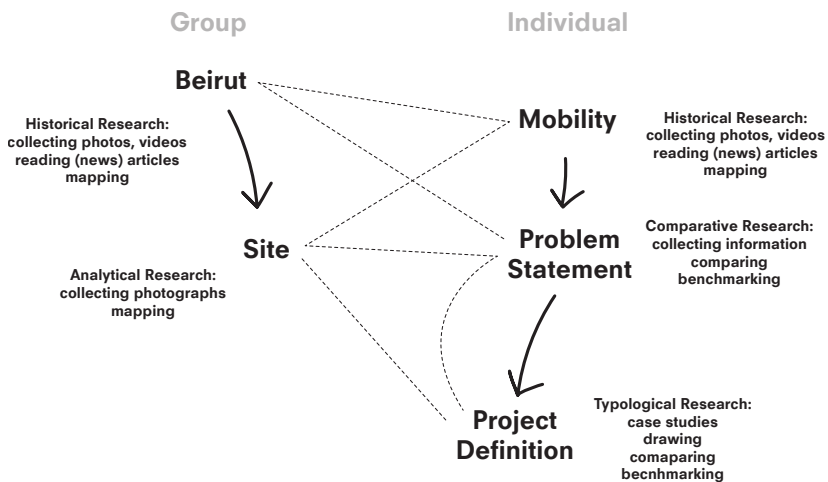


Figure 7. Methodology and Research Methods.

Research Methods

A good understanding of Beirut, and more specifically the suburbs, and its historical and current political, economic, social and spatial context, is required to create a site vision. Historical research encompassing mapping, collecting photos and videos and reading (news) articles, will be done to get a clear overview of the context. Subsequently concluding drawings and mappings showing characteristics and potential of Beirut's suburbs will be made. These provide material to answer the following questions: What are spatial challenges in Beirut? Which spatial developments impact the suburbs? Which suburb has the most potential?

The previous research directly influences the location of the group site as it is used to assess different options. When the site is chosen it needs to be researched in further detail. Historical research encompasses the same methods as mentioned above (mapping, collecting photos and videos and reading (news) articles). This body of research aims to get a clear understanding of the site so that the following questions can be answered: What are the characteristics of the site? What is the potential of the site? And how can they be used to create a resilient strategy for the future?

Parallel to the site research, mobility in Beirut is researched individually. To come up with a problem statement the state of affairs and history of mobility has to be known. Historical research, spanning the last 100 years, into the past and present of Beirut's (public) transport methods will be done. This research consists of collecting (news) articles, photos, maps and videos. With this information drawings, mappings and a descriptive article will be made that give a clear understanding so the following questions can be answered: How has mobility in Beirut developed over the last 100 years? What is the current state of affair of Beirut's mobility? What issues and challenges arise from the current situation?

The project definition, or design brief, describes what kind of intervention could potentially address the problem statement. Research into different interventions that address the problem statement is needed.

Different forms of public transport will be explored through typological and comparative research. Information and facts about the capacity and specifics of transport modes are collected in order to compare and assess which mode addresses the problem statement the best. Questions related to this are: What modes of public transport are available? Which mode of public transport address Beirut's challenges most adequately? The answers to these questions eventually leads into a building type that will be developed further in the graduation project.

Parallel to the project definition, individual research into the group site will be executed, so that a suitable location for the individual project can be chosen. The site will be researched through mapping, collecting photos and videos and making concluding drawings of these findings, so that the following questions can be answered: What are the specifics of the site? Which location would be the most suitable for the architectural project?

Lastly the program, deriving from the project definition, is researched. To formulate the design brief it is necessary to know the programmatic requirements, such as program relations and square meters. Typological research consisting of case studies, with examples from all over the world, will be done. Comparative drawings and diagrams will be made to benchmarking the program. With this research, a proper assessment can be made of what a ferry port exists of, to inform the design brief.

Relevance

Societal Relevance

The topic of this graduation project, mobility in Beirut, and in specific addressing the challenges arising from a car centred transport, has societal benefits for Beirut but also for other coastal cities that face similar challenges.

The mobility crisis in Beirut creates challenges on a country scale as well as an individual scale. The current car based transport model deprives citizens from productive time, in turn decreasing the GDP significantly. Public health is affected by pollution and also takes its toll on the GDP as more people get ill and more sick days occur.¹⁶

On an individual level the fuel crisis makes transport unaccessible for the underprivileged. In addition personal health is threatened by air pollution and stress caused by the traffic conditions. If Beirut's mobility issues are addressed transport could become more inclusive and social welfare could increase.

Another societal benefit for Beirut can be connecting various otherwise segregated areas. Since Beirut is a very segregated and sectarian society, citizens do not often meet each other and mix. A public transport system can allow these areas to be connected and offers a common ground for the various groups of citizens to coincidentally meet.

Furthermore Beirut is facing problems with its housing market. People are unable to live close to their work due to high prices. A public transport system could connect otherwise far off areas with lower housing prices.

Besides being relevant for Beirut, the project has relevance to other cities surrounded by or adjacent to large bodies of water. The strategy of coping with congestion challenges through water based public transport illustrates an alternative for other cities facing these issues. Furthermore the integration of the ferry service and ferry port into Beirut's urban fabric can be an inspiration or strategy for other places too.

16. Bibi-Aisha Wadvalla, "Air pollution threatens health in Beirut," *Nature Middle East*, published May 2011, <https://www.natureasia.com/en/nmiddleeast/article/10.1038/nmiddleeast.2011.60>.

Design Brief

Introduction

Since Beirut has no public transport, mobility is centred around the use of private cars. Car culture has created many challenges in Beirut, such as congestion and making mobility unaffordable. To offer a more efficient and inclusive alternative to car based mobility, a ferry service, targeted at pedestrians, cyclist and electric scooters, is initiated. Boarding the ferries will be free of charge, therefore making mobility more inclusive (because of better access to jobs, education, culture, family, etc.)

The service covers and connects more than 12 kilometre of Beirut's coastline, spanning from the airport to the northern port area. To realise this network several terminals, of which the majority is already existing, are needed. One of the few to be constructed terminals, and the subject of this design brief, is located in the suburbs on Beirut's last public beach: Ramlet al-Baida.

Initial Ambitions

The initial ambition of this project is to create a ferry terminal on Ramlet al-Baida beach. Due to the specific location of this project, namely the beach, a pier is needed for the ferries to dock due to the shallow water. At the moment the beach is polluted by sewage spillages and therefore under utilised by most citizens. Additional leisure program (swimming pool, nightclub, marina, restaurant, cafe) on the pier creates economic potential and acts as an incentive to clean up the water and beach and to maintain it.

Client and Users

The main client and user of the project is the Railway and Public Transportation Authority, abbreviated OCFTC (Office des Chemins de Fer et des Transports en Commun). OCFTC covers the initial investment costs (design costs, construction costs) and is the owner of the building once the project is constructed. To fund the project the government can, for example, reallocated \pm 4% of the \$3.0 billion

that is spend on fuel subsidy annually. This results in \$100.000.000 dollar (similar to the price to construct the St. Petersburg Pier in Florida) to design and construct the pier.

The OCFTC runs the ferry service and leases parts of the building to private companies that exploit the nightclub, marina and restaurant, stalls at the entrance square and the café. Maintenance of the pier is covered by the rent they pay. The public swimming pool is exploited by the Beirut Municipality and is free of charge.

Urban Ambitions

Several urban ambitions inform the design of the project. The first is to make Ramlet al-Baida, as well as the rest of the coast more accessible by means of a free ferry service. This is in line with Environment Law No. 444 that says that 'free and open access to the seashore is a right of every Lebanese citizen.' On a smaller scale the building should give back more public space than its footprint consumes on the land. This is achieved twofold: by a pier structure that extends Ramlet al-Baida's public space into the sea, and by minimising the footprint of the project on the land. This is important because public space is very scarce in Beirut. Furthermore the building should be easily accessible through multiple entries. Lastly, the building should offer various relationships with the sea so that users experience the water in different ways.

Program Ambitions

Traveling through Beirut is an annoyance at the moment, and the project aims to offer an alternative in which traveling becomes fun. Traveling with ferry is already more comfortable than by car but the experience of users in the building should be similarly comfortable. Therefore clear and easy way finding from the entrance to the waiting area is key. In regards to the atmosphere of the project is is important that the 'terminal

sheds its utilitarian character and become an attraction' like OMA aimed to achieve with the Zeebrugge Terminal project.

A wide range of program that attracts different users of different ages and backgrounds is included in the building. Beirutis live very segregated and therefore it is important that the building accommodates different spaces where visitors can accidentally meet and interact within each other. The programmatic mix consists of a ferry terminal (attracting various visitors from 06.00h - 24.00h), a public swimming pool (attracting families, young people and elderly during daylight), a nightclub (attracting a mainly young crowd from 23.00h - 06.00h), a marina and restaurant (attracting affluent citizens), and a café at the end of the pier. These different programs are stitched together by a public promenade. Views and access from and to other program should be as open and easy as possible.

The public swimming pool has 5 different baths that accommodate different types of use: an Olympic pool, a diving pool, a play pool, a lounge pool, and a baby pool. The deck of the swimming pool should be in close proximity to the café. An aim is to use seawater in all the pools except for the baby pool. In the building several modes of mobility are combined: cars enter the parking garage and are parked inside, bicycles and electric scooters ride over a bicycle lane to the ferry terminal and can park there or go to the staging area to board the ferry.

Building Ambitions

An architectural ambition is that the building is easily identifiable as one building. This helps creating a specific identity so that the building is easily distinguishable and recognisable as the pier on the Ramlet al-Baida.

The structure of the project should be easily transformable to accommodate a change of use over time. Simultaneously the building

should have a structure that can be extended so that a future growth in program can be accommodated. This together with high sustainability standards makes the project sustainable.

Because the project is partly located in the sea appropriate, durable materials are required. This means that materials that are used need to withstand the corrosive salty sea water and harsh winds.

Inside the building the way finding has to be as natural as possible, making travelling towards and from the ferry terminal as easy as possible. This means that orientation spaces are needed both at the start and the end of the flow through the building. This will be ensured by an entrance square and a sunset square at the end of the pier.

Building size

The GFA of the building is 21.170 square meter.

Site

As mentioned earlier the site of the project is located on the beach. The site consists of two plots, a piece of Public Maritime Domain and a part sea. The reason that the site is located on the beach and sea is of course so that ferries can dock at the ferry terminal. With positioning the site the other ferry terminal were taken into account so that they are not too close to each other. The site is also chosen due to its good connection with other modes of public transport (such as buses and the future metro line). Close proximity to a roundabout that leads to Cola Intersection (an important transport node where many buses depart and the metro is located), the city centre and the airport ensures this. Furthermore the site has a close proximity to the main beach activities and another plus is the relatively flat topography.

bicycle lane to the bicycle parking or bicycle staging area, located in the ferry terminal. Cars, buses and taxi's and arrive at the entrance square from either the north (from the covered highway, coming from the city centre) or south-east (from the roundabout, coming from Cola, the city centre or the airport). Cars arriving at the entrance square enter the automated parking garage or park at the kiss and ride together with buses and taxi's to pick up or drop off passengers.

Immediate Surroundings and Qualities

The immediate surroundings consist of Ramlet al-Baida beach to the north, the corniche highway to the east, Eden Bay resort to the south and the Mediterranean Sea to the west. As mentioned above an important site qualities is its good connection to infrastructure. Other site qualities are spectacular views on the sea, the city centre and the mountains. The site enjoys daily sunsets at the end of the day since the beach is located on the west.

Site Approach and Circulation

The approach to the site and the building is separated into several flows: pedestrian; bicycle and electric scooters; and vehicles (car, bus, taxi). Pedestrians have access to the building from the beach both from the north and south. A second pedestrian entrance is located at the entrance square next to the corniche highway. Bicycles enter the building from the entrance square located on the corniche highway and connected to the new boulevard that runs along the beachfront. From the entrance square bicyclist ride through the building with over a dedicated



Figure 8. Site seen from south.



Figure 9. Site seen from North.

Urban Rules

Urban rules dictate a FAR of maximum 1.0, a height limit of maximum 15 meter above the corniche highway and a maximum site coverage of 30%. To minimise the impact of the building on the area and the beach (an ambition mentioned above) these rules should be followed. Furthermore it is important that views from the corniche road onto the sea are protected as much as possible. Partly building underground on the land is therefore recommended.

Feasibility Study & Optimal Volume

To explore the feasibility of the site and discover what the optimal volume for the site is, various volumes have been studied. From the volume study an optimal volume emerged, namely: a low volume, either a plane or a classic pier shape, that protects views on the sea.

Basic Program

The program is divided into two categories: mobility and leisure. The mobility program includes a ferry terminal with a waiting area for 500 passengers, with bicycle parking (for 300 bicycles) and an automated parking garage for 300 cars. The leisure program consists of a pier, including a public swimming pool with 5 pools, a nightclub for 2.000 visitors with 2 rooms, a marina for 32 boats with a restaurant for 100 visitors, and a café for 150 visitors. This program is connected by a promenade that starts at the land with an entrance square and ends in the sea at the sunset square. The kiss and ride and the car parking are located on the land next to the entrance square.

Reference Research & Program Benchmark

The size of the program comes forth from several case studies that have been done to understand the programmatic requirements. This consists of research into (pedestrian) ferry terminals, swimming pools, nightclubs and piers. The case studies have been compared to find an average program and a logic regarding the amount of square meters.

The above mentioned program and the program bar below are informed by this.

Program Relations

The project exists roughly out of three parts. An entrance square at the land/beach, connected to the stalls (information and food), automatic car parking and kiss and ride. A middle part, mostly located on the water, containing the promenade that connects to the swimming pool, nightclub, marina and restaurant, and the ferry terminal. And lastly, an end square (called sunset square) with a cafe on the water. Relations between the program should be maximised so that it is easy to go from the pool to the nightclub to the ferry terminal, etc. This is also to ensure that visitors are (visually) exposed to program they otherwise might not use.

Spatial Requirements

Different spatial requirements inform the dimensions of the program. The size of the automated car parking is determined by the dimensions of a car. The length of the ferry dock is determined by the size of (bigger) ferries that are potentially used in the future. These ferries are 50 meter long and move approximately 500-600 passengers. To accommodate two of these ferries a ferry dock of approximately 125 meter is needed, or a ferry dock of 75 meter that can be accessed on both sides. This length makes it possible to use (more) smaller ferries as well.

Program Bar

On the right is the program bar containing the square meters and percentages.

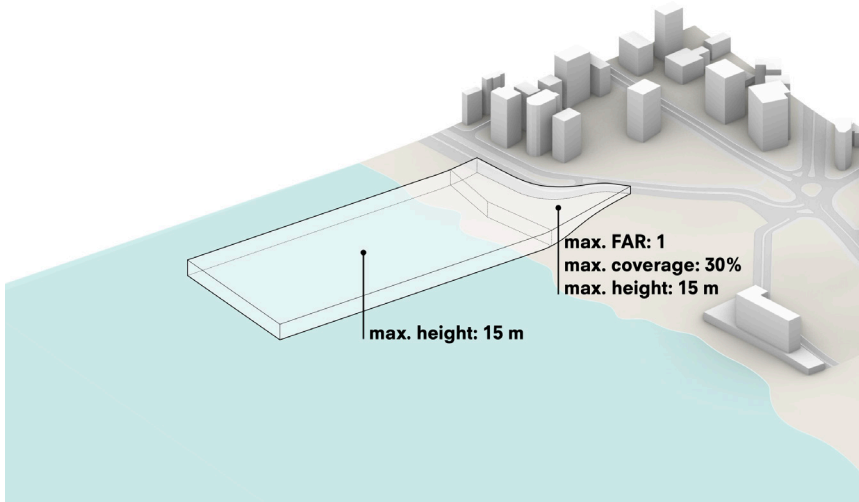


Figure 10. Urban rules.

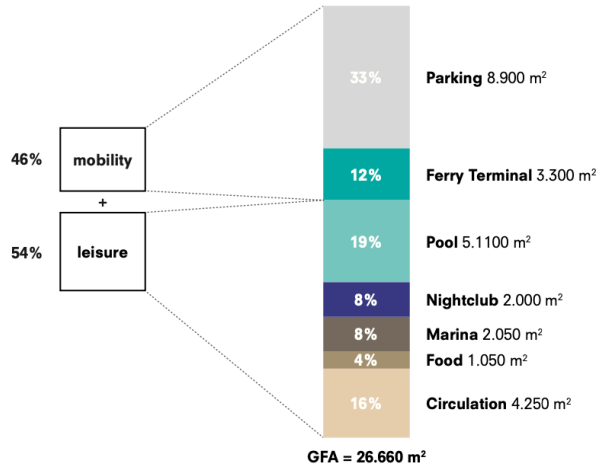
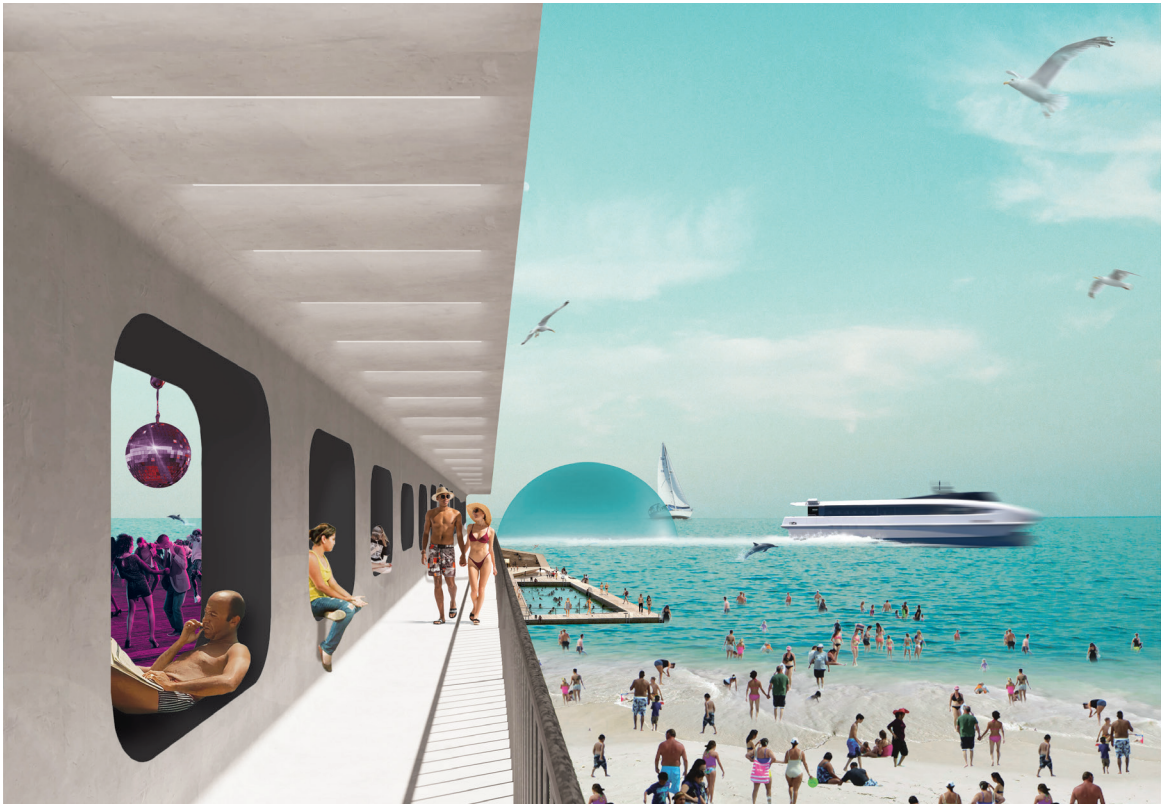


Figure 11. Program bar.

Conclusion Research & Design Brief

The research into mobility pointed out that Beirut needs public transport to solve its mobility issues. It also showed that mobility model that operate on land are not feasible because of congestion and density. Consequently a ferry service along more than 12 kilometre of coastline is chose as transport mode. There are a few big advantages: the main infrastructure (water) and ports (existing marinas) are already there; the water needs no maintenance, (a high cost for public transport); the network is flexible and can easily adapt to changing demands; it operates independent from the congestion on the land.

Each ferry terminal in the network has a different location and therefore exists in a different context. This context is derived from passenger flows, surrounding program and topography and determines the character of each ferry terminal. The design brief is about a ferry terminal on the beach. To create a contextual ferry terminal and enhance the character of the site, beach or leisure program is incorporated into the ferry terminal. This way the ferry terminal is transformed from a purely infrastructural place, into a leisure attractor.



Bibliography

"A Beirut Water Taxi System May Become A Thing In Lebanon." The961. published March 2017. <https://www.the961.com/beirut-water-taxi-lebanon/>.

"Beirut Air Pollution Causes Allergies and Illness." Antra. Published 2020. <https://www.anera.org/stories/beirut-air-pollution-causes-allergies-illness/>.

Kadi, Samar. "Traffic congestion adds to Lebanon's many woes." The Arab Weekly. published December 2016. <https://the arabweekly.com/traffic-congestion-adds-lebanons-many-woes>.

Kanaan, Farah-Silvana. "Cycling culture gains ground in Lebanon as fuel runs dry." Aljazeera. published June 2021. <https://www.aljazeera.com/news/2021/6/24/cycling-culture-gains-ground-in-lebanon-amid-fuel-shortages>.

"Lebanon Among Top 25 Countries with Highest Car Ownership." The961. published February 2019. <https://www.the961.com/lebanon-among-top-25-countries-with-highest-car-ownership/>.

"Lebanon's car culture questioned in crisis." France24. last modified October 2021. <https://www.france24.com/en/live-news/20211020-lebanon-s-car-culture-questioned-in-crisis>.

"Lebanese troops deploy at gas stations after bank chief halts fuel subsidies." France24. last modified August 2021. <https://www.france24.com/en/middle-east/20210814-lebanese-troops-deploy-at-gas-stations-after-bank-chief-halts-fuel-subsidies>.

"Meaning of mobility in English." Cambridge Dictionary. accessed October 2021. <https://dictionary.cambridge.org/dictionary/english/mobility>.

"Meaning of public transport in English." Cambridge Dictionary. accessed October 2021. <https://dictionary.cambridge.org/dictionary/english/public-transport>.

Niasari, Nora. "Under the Bridge." Mas Context. accessed 22 September 2021. <https://www.mascontext.com/issues/10-conflict-summer-11/under-the-bridge/>.

Wadvalla, Bibi-Aisha. "Air pollution threatens health in Beirut." Nature Middle East. published May 2011. <https://www.natureasia.com/en/middleeast/article/10.1038/nmiddleeast.2011.60>.

List of Figures

Cover Image. Gotthardt, Alexxa. View of the Beirut coastline. 2015. Photograph. Artsy. <https://www.artsy.net/article/artsy-editorial-navigating-beirut-s-fast-expanding-art-landscape>.

Fig. 1. Brophy, Zak. Buses bought to die. 2013. Photograph. Executive Magazine. <https://www.executive-magazine.com/economics-policy/lebanon-buses-transportation>.

Fig. 2. Abdallah, Issam. Vehicles are stuck in a traffic jam. 2021. Photograph. Reuters. <https://www.reuters.com/article/lebanon-crisis-int-idUSKBN2B123B>.

Fig. 3. Chalhoub, Ibrahim. Vehicles queue up for fuel near Qalamun, Lebanon, on July 1 amid severe fuel shortages. 2021. Photograph. The Washington Post. https://www.washingtonpost.com/world/middle_east/lebanon-economic-energy-crisis/2021/07/04/b8367752-d8fe-11eb-8c87-ad6f27918c78_story.html.

Fig. 4. Sharro, Karl. In Beirut we do our best to make sure the sidewalks are comfortable for cars. Lebanon in one image. 2014. Photograph. Twitter. <https://twitter.com/karlremarks/status/530358268506677248>.

Fig. 5. Hassoun, J. View for Beirut , capital of Lebanon from an airplane. 2010. Photograph. Wikipedia. <https://en.wikipedia.org/wiki/Lebanon#/media/File:Beirutpic.jpg>.

Fig. 6. Meijman, Koen. Theoretical Framework visualised. 2021. PDF.

Fig. 7. Meijman, Koen. Methodology and Research Methods. 2021. PDF.