Graduation Plan

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Studio

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Nowadays, you cannot think of architecture as simply a form object. The changing climate forces us to think differently about the design of buildings. Which materials to use and where to acquire them. How the design will respond to future changes and how the building system can respond to that. Where the opportunities lie to innovate with new materials and the application in the building process. And also, how we can design better with the tools that are there within the cosntext to come to more sustainable solutions. I think these are currently the most important questions within the field of architecture and the Architectural Engineering studio is the best place to learn more about these aspects.

Graduation Project

Reintroducing Tropicality to St. Maarten

A residential typology rooted in the soil of the past

Hope Estate, Sint Maarten

Objective

The main objective is to design climate adaptive residential typology to fit the climate of Sint Maarten while still providing safety during hurricanes. A aspect of St. Maarten's climate are the hurricanes that reach the island every other year on average. This has consequences for the built environment of the island. Most recent buildings that are constructed on the island are based on the 'Build Back Stronger' principle which seems like a durable solution with regards to hurricane protection and it often is. Yet, it is a unsustainable solution regarding social interaction, material use (often concrete is used in poured or block form) and energy use. Hurricanes bring along destruction which scars the island (physically but also emotionally) which leads to the use of stronger and heavier materials such as concrete as the main building material. Additionally these homes are build with few openings which minimizes costs and risks, but results in a high energy consumption due to cooling needs inside the home. Therefore, the challange and objective of my project is to design a residential typology which has a certain degree of resilience against hurricanes to ensure minimal destruction. Additionally a high degree of thermal comfort during the other 99% of the time when there is no hurricane danger.

Overall design question

How can a passive climate design approach be combined with a hurricane design strategy to enhance the design of a residential typology on Sint Maarten to improve the overall climatic sustainability?

Thematic Research Question

How can a passive climate design strategy be developed which deals with the constraints posed by hurricane resilient design to provide sustainable design solutions?

Method description

Research

Literature Study - With the literature study the objective is to gain information about the climate of Sint Maarten in the first place. Then, the research is focussed on passive design strategies which can be applied in Sint Maarten's climate. Additionally to standard climatic aspects, there is also the aspect of hurricanes on the island. Research on how to design buildings in a hurricane region is going to give additional strategies on how to design on the island of Sint Maarten.

Reference study - The reference study can reveal different approaches to the passive climate design solutions which come forward from the literature. These references are used to complement the literature study. The projects will be judged by their relevance regarding the design principles. Every project is analysed on its applied passive design strategy.

Design

Climate - The objective is to design a climatically appropriate housing project for St. Maarten. Every design decision will therefore need to be assessed on its climatic appropriateness. This runs through all design scales, from urban plan to that smallest building element detail. Currently, there are certain softwares that aid the decision making process, but if necessary this testing can also be done by model making for example.

The hurricane resiliency strategy for the project will need to be determined. How resilient are certain zones within the building and how can the occupants protect themselves when a hurricane hits the island. Also this needs to be considered on all design scales.

Culture - The inhabitants of St. Maarten are characteristically very excentric in their personality. The currently built environment does not respond well to their character. Incorporating socio-cultural aspects within the project will form the anchor which improves the social sustainability of the project.

Climatic sustainability- Referring to the challanges the island faces with regards to the use of resources. The design proposes a solution to minimize pressure on the sewage system and minimize water usage, eliminate organic waste streams to produce resources and relieve pressure on the waste treatment system in place and lastly the ambition of the island to make use of renewable energy.

Literature and general practical preference

Sint Maarten

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Reflection

Research and relationship with design

The first semester of the graduation studio, Msc. 3, revolves mostly around thematic research (80%) but also partly around design (20%). The end of this semester is marked by a formal presentation where the research results are presented and translated into a conceptual design. In my experience, this methodological line of inquiry works well when the project is already defined to a certain extent, meaning that the research is done with a certain goal and implementation in mind. The mistake that I made within the first Msc. 3 semester was that I was doing research to find the goal and purpose of a project on St. Maarten without having a implementation in mind. This was perhaps the danger when choosing a context which has no graduation precedents within the TU Delft to find a focus and relevance. The first semester was therefore a real struggle and resulted in a 'no go' for the 'P2' formal presentation. With the start of the second Msc. 3 semester I had a much clearer goal in mind and the project was defined from the outset. It was then easier to find a relevant research topic to give the project a strong base from where the design can commence. The way that the Intecture studio methodical line of inquiry is intended to function in the design process.

My research focused on climate adaptive building in the Tropical Savannah Climate of St. Maarten. This research gave me a thorough understanding of most aspects regarding the climate and which design strategies can be used to deal with those. The motivation to do research on this topic originated from observations made on the field trip to St. Maarten. The expectations of what the build environment would look like were very different from what was encountered on the island. Having lived on a tropical island in the South of the Caribbean, which does not deal with hurricanes, it was still quiet chocking to see the state of some neighborhoods and buildings. For most people we spoke with, the previous hurricane 'Irma' was still on their mind and holds some emotional drama within them. Hoping that the next one will occur far in the future. That collective traumatic memory is understandably visible in the way that buildings are currently build on the island. The newer buildings are 1 to 2 story's high, made with a concrete cast-in-situ frame with concrete block infill. Often a compact volume with few and small window openings. Climatically controlled with air conditioning units hanging from the façade.

I became fascinated with these observations and therefore decided to find out how a residential typology could be designed that accounts for safety during hurricanes and passively provides a comfortable living environment that responds to the climate. Therefore my research focused, on the one hand, on passive design principles related to the Tropical Savannah Climate and on the other the variables which can be used to design for a better hurricane resistance. The approach that was taken to research climate adaptive design principles started with a clear definition of the climate on St. Maarten. This includes all aspects such as temperature range, monthly precipitation, humidity, wind direction and speed and the sun path. The next step was to explore climate design principles suited for tropical environments and categorize them in urban -and building design principles. Every chapter contains a section explaining the design principle, how and if it can be applied in St. Maarten and, when relevant, a reference project that showcases the principle in a similar climate. Next to these principles I enclosed a section in the research about hurricane design. In the process of designing a building, a certain strategy should be chosen to deal with hurricane conditions. Within most projects that I have analyzed, buildings are designed to be hurricane resistant. If these principles are taken into account in a early stage, some creative examples emerge such as the Walker Guest House designed by Paul Rudolph. This home has movable panels incorporated in the façade that can be moved manually and have a double function. Once opened they adapt to the climate by providing shaded areas around the house. Once closed they form a protective layer in case a hurricane passes by. Another form of hurricane design is to not resist the wind but let it enter the building to prevent pressure from building up on the facades of the house.

Combining all of these different design principles which are specifically applicable for the climate of St. Maarten could be a practical tool for architects on the island and in similar climates around the world. This type of research is not often executed in this way, and maybe it should be to have consensus on what does and does not work in particular climates. Most of the literature that I found and used are either very detailed and specific on a certain design principle or very broad and general. The intent was to make a detailed and at the same time practical catalogue which can be used on the go. Perhaps it is a good idea to scale the catalogue down to fewer pages and just show a summary of the principles for it to be transferable and applicable in the professional field. There is a lot of additional information present which could be a distraction in professional practices where speed and efficiency is key.

Nevertheless, the results from the research show clearly which climate adaptive design principles and which hurricane design principles can be applied in St. Maarten's climate. They form the starting points for the eventual design and helped to understand the framework for a climatically appropriate way of building on the island.

Relevance

The essence of my project is about bringing tropicality back to the island in the form of a residential typology based on climate, culture and sustainability. I discovered that the architectural theoretical movement of Critical Regionalism relates very well to the philosophy of the Architectural Engineering graduation studio. Critical Regionalism originally started as a response to the International architecture style and was led by theorists like Kenneth Frampton, Alexander Tzonis and Liane Lefaivre. This approach to architecture strives towards design that takes its context into account by looking at the characteristics of the place it is situated in (Regionalism). But important to note is that is does not go against the principles of the International style but strives to find a balance between the local characteristics and the contemporary advances in building technology (Critical). Within my project I incorporate climatic and socio-cultural aspects of the context to solve problems that are currently present. From urban scale to details and material choices I aim to make innovations within the existing building culture of St. Maarten. Integrating technology into architecture (Intecture) to come to smarter solutions for complex problems within a context.

In my view it is essential for places such as St. Maarten that have a colonial history and have been dependent on other countries for their prosperity, to not lose sight of appropriate local architecture principles. Being vulnerable to aspects of globalization, design and planning can and has taken a specific route that does not match the place. With my project it is demonstrated that a climatically appropriate design can be made with already available materials on the island. It would be practically impossible to build buildings solely with locally produced materials, therefore I take the approach to combine imported materials with local materials that are ready available such as earth. Promoting innovations with familiar materials might have the effect that it can catch on more easily as opposed to introducing a completely new material. Also providing a alternative way of processing these materials to have improved properties can provide job opportunities to the island. Realizing that the impact of a design can have the potential to enhance many aspects of the life in a certain place is one of the things that I think is great about architecture and about this graduation studio. This is also why it is fun to dive into a context, absorb a lot of information about it and try to improve the life there.

I have started my masters education in the Building Technology track but was missing the (more) complex problem solving aspects of architectural questions in the build environment. Switching into the Architecture master track and choosing to graduate within Architectural Engineering I quickly noticed that I had yet to discover what kind of a designer (and eventually architect) I wanted to become. Looking back, I remember the design subjects that were given in the bachelor of architecture were not so much focused on the theory and thought processes that go into the design of a certain period and style. The masters track of architecture focusses more on that and starting my graduation year I still had to develop this aspect in my design process. Having this

technical background I have the tendency to dive very deep into the matter at hand. This was also the case with the research I did in the first semester while this is not necessary on all fronts. I think that this is the part of architecture that I have thought to be difficult. When have you learned enough about a topic that it can be implemented into a project. A architect is of course first and foremost the designer of spaces but designing entails and influences many subjects. At this point I can say that this graduation period has thought me a lot about the way that I approach a project and the philosophy that I incorporate into this approach. Moving forward I aim to develop my approach and philosophy further and expand the my base of knowledge about the many subjects that live within the professional field of architecture