AN ADAPTIVE VISION

Door: R.J.M. Pruim 4418670

AR3AE015 - Architectural Engineering: Intecture (2017-2018 Q1) Reflection Paper Delft University of Technology 25-05-2018

CONTENT

I Introduction

- II The theme of the graduation studio
- III The methodological approach of research
- IV The implementation of research into the design

V The relationship between the project and the wider social context and dilemmas I encountered

I INTRODUCTION

This reflection paper is part of the studio Architectural Engineering: Intecture (AE). In this studio I found it interesting how the technical engineering and architecture came together. The studios approach started with a technical fascination which progressed into how this is implemented into the design. I started with the fascination of adaptive facades that react to the climate as well as to the people. This was the main focus during the research and design part of my graduation project. In this reflection paper I reflect on the different design approaches and decisions I made concerning my graduation project and design.

II THE THEME OF THE GRADUATION STUDIO

There are three different themes (Make, Flow and Stock) in the graduation studio where a student can choose from, for their graduation project. My graduation will fall under the theme: "Make". You could argue that my project also could be "Stock", because I chose an existing building to be part of my design. But in the context of our studio I view "Stock" more as buildings that deal with every construction element of the building, for example: walk up flats. I will mainly focus on the remaining structure of the building.

The theme Make is about new production methods and systems for existing and new applications (AE journal 2017). The approach fits perfectly with my thoughts about creating and researching a new facade which can contribute to existing and new buildings.

III THE METHODOLOGICAL APPROACH OF RESEARCH

To come up with a good and framed topic for the research was actually the first part of my research. I read different articles and studies related to my personal fascination. I quickly came to the topic of "adaptive facade" and how they can improve the energy consumption and comfort needs of the user. My fascination of adaptivity clearly is a very broad topic and many literature and research papers are written. And the variation of it is enormous. And I learned also that still many entities and specialized companies and research companies are working on it. So I had to adapt my ambition too, and scoped my research to something I could implement in my design. My thoughts where that an adaptive facade should be used 24 hours, the same as the climate conditions around us. Therefore I narrowed it down to a hotel function in the Dutch environment. The goal of the research was to provide sufficient starting points and guidelines for designing a facade in the Dutch environment.

I started my research with a quantitative approach (Figure 1). For instance, by comparing the angle of the sun and the outside temperature I wanted to calculate the thickness of the insulation. The goal was to research an optimal adaptive facade by comparing the data I acquired. I realized that this was something too practical and difficult to accomplish. Many companies are specialized in these calculations. Also I wanted to use the facade in an architectural way in my design.

So I took a step back and I made a more qualitative approach (Figure 2). This approach is more about how and what the facade should do, with respect to temporary conditions. It was however still important to think about the thickness of insulation and outside temperature. But more on a broader level, where the exact data can be calculated at a later time by specialized companies.

The research part is very strong and creates a basis with starting points and guidelines for the design part.

SUNSHINE HOURS



Figure 1. Quantitative approach



FULLY OPEN

144



OPEN A WINDOW



SECOND SKIN

Figure 2. Qualitative approach

FULLY CLOSED



LAYER INSULATION



SEATING SURFACE

GLOBAL RADIATION (J/CM²)





PARTLY OPEN / CLOSED



LAYER SUN SHADING



LARGE ELEMENTS COLLECTIVE TEMP.



MULTIPLE LAYERS



LAYER THERMAL MASS



SMALL ELEMENTS INDIVIDUAL TEMP.

IV THE IMPLEMENTATION OF RESEARCH INTO THE DESIGN

The second part of my graduation project is focused on the design part. Here the engineering and architectural parts come together. The engineering part is the research, where it gives me technical insight and as a result, I became an expert on this specific topic. I really enjoyed during this part to understand the technics and other engineerings aspects of adaptive facades, and how to implement them in my design. To learn about the mechanics, steering and moving all the elements, like the motor, gearboxes, gearracks is very interesting. For the architectural part it is important to use and implement the research in the design and not to forget the architectural elements, like form and expression. A pitfall can be to focus too much on the research. So I find it important to keep the research and architectural in a synergy until the final design (Figure 3).

However, this doesn't mean the starting points and guidelines are fixed. These can change over time. For example, I first wanted to create a facade form that can be used for every orientation, but later I created multiple facade forms. This came as a result of the output of the design options whose difference in facade strengthened my overall idea. So the starting points and design are a circular process which should be compared constantly. The drawing program Revit helped me with this process. I started very early to use the 3D option and that gave me an early and good insight and visibility of my project. And with this early start I could easier see the problems and opportunities of my design. At the end, the related design drawings, the front views, cross-sections and fragments were much easier established than I expected.

In my design I learned that I need and I prefer to work in a very rational way. I used a small booklet in which I step by step wrote down my thoughts, my assumptions, my ideas, simple diagrams, simple icones, etc (Figure 4). Every time when a decision was needed, I checked this booklet in order to see if the decision was still compliant with my targets and assumptions. It helped me a lot to make the decisions in this project. And for sure I will keep using this simple but very effective tool in my future projects. The sustainable part of using the buildings of the site, is also an important factor on the approach of the design part. Just like in the graduation studio: Heritage, an evaluation of the value of the existing building is an important factor. This is something which my tutors noticed, and I did not take into account at my P2. I learned that by studying the existing building and surroundings gives more depth to the architectural design of the building, such as the expression of the building, where you can distinguish the old and new structure.

This out of the box thinking, which was stimulated by the tutors, led to a literal twist in the structure of the building. Where regardless of the extra work, due to the complete changes of drawings, circulation, and structure, the twist is worth it. The twist gives more depth for the architectural expression as well as connecting to the research paper.

Also the expression of the adaptive facade was a challenge. The starting points (Figure 5) shows that the facade elements have infinite possibilities. This was part of my goal, to create a facade expression that changes all the time. It was not always easy to show a complete view of all the possibilities of my adaptive facades, and to show the total picture of the building. The different perspectives of the facades are not easy to sketch so I needed the computer programs to get the pictures and views. This was very time consuming, and when I got the result, and I had to conclude to change parts of my design, the time consuming part started again...! But during this project I became more and more experienced and was able to accelerate this part.



Figure 3. Synergy between research and design



Figure 4. Diagram about the adaptive facade options



Figure 5. Starting points about the expression of the facade

V THE RELATIONSHIP BETWEEN THE PROJECT AND THE WIDER SOCIAL CONTEXT AND DILEMMAS I ENCOUNTERED

What are the visions about the development of the context? How will it affect and contribute my building? And how will my building affect the development of the rest of the buildings? These questions about the redeveloping of the urban area are an important part of the graduation project in general. It depends on the students approach and their kind of research as to whether or not the context is a part of the research and design project. For example if the student looks at how recycling can be used in a neighborhood, the context is an important part of the research and design. This is in contradiction with a student's project where an approach of making a modular system is been researched and designed. Here the context is actually insignificant at first and can be chosen at a later time.

In the case of my project, the wider social context is an important part of my graduation project. Despite the significance of the surroundings of the building I didn't study the context at the beginning of my project. First, I focused on the research of adaptive facade and later on the implementation of a building. I did an analysis of the urban area (Marine terrain), the implementation of the whole building and the influence on the neighborhood and surrounding buildings (Figure 6).

The redesign of my surroundings (Marine terrain) was in the first stage of redeveloping. Many companies and inhabitants are interested in the area. Economics, history, leisure and living are important factors for the different entities. For the inhabitants of Amsterdam the area is close to the city, which can be perfect for dwelling and to connect with people. This is also economically interesting for the investors. For the municipality the area has also great potential for trial and error and everything is possible with regards to design. On the other hand, it's an unknown and very desirable place. These leads to a paradox conflict of the development of the site (Figure 7). To get control on the area and not to be fixed on one master plan, the municipality developed guidelines which are focused on vision and ambition. I took these different vision and ambition guidelines into account that resulted into my vision for the Marine terrain. By redeveloping,

activating, innovating and connecting (Figure 8) the building and Marine terrain, it becomes an attractive and futuristic neighborhood.

To activate the neighborhood I created a building with multiple functions and that is used 24/7. A hotel fits this description. However the Marine terrain is located close to the city centre of Amsterdam, which has a hotel building restriction in place. For me this was not a reason to make the existing building into a something other than a hotel. Especially because a hotel is the optimal program for a building where you can implement an adaptive facade for multiple functions. I chose to make a slight change of the program, where I made long stay hotel rooms instead of normal hotel rooms. However this hotel building restriction is a dilemma that I will have to realize when it could/should be built.

The same applies for the structure report which has to be made. The report should be made to see the strength, lifespan and economical value of the existing structure. In my design I made assumptions about these elements of the structure. But in practice the results could be completely different. Although it was a challenge to redesign an existing building, and the result is satisfying me, I might next time start design a complete new building in stead of using an existing construction. My research focused on a new innovative and adaptive facade, which functionally can have more possibilities when built on new construction. That's why I twisted the top of the building compared to the existing part. Building a new tower on top of an existing construction which the strength is not clear to measure or calculate, is not an easy task.

Overall it was an exciting project with all the challenges and complexities. I really enjoyed working on it.

VISION



LOW-RISE

Figure 6. Analysis of the building and their context



Figure 7. Paradox between the different entities



Activator for marineterrein Extending building



Adaptive facade



Relation function and climate-dynamic and diversity Connection to the water, city centre, East, Piet hein kade

REDEVELOPING

Analogical form

exsisting structure

ACTIVATING

INNOVATING

CONNECTING

Figure 8. Concept on what to do with the wider social context.