Architectural Engineering: The Circular Hub

Reflection paper, Mauric Bohle 4135288

THE GOAL

The main goal of this graduation project is the adaptation of the Circular Economy principle in the built environment. And more specifically in the Amstel III area.

THE PROCESS

The process to reach this goal at the P4 presentation consists of three main parts:

1. Upcycle Amstel (sep 2018 - nov 2018)

In the first part the book "Upcycle Amstel" was written together with the four other students in the studio and supervised by visiting professor Kasper Jensen from GXN/3XN. In this book we researched the circular potential of the Area of Amstel III. This included a research to the principles of a Circular Economy in Europe, The Netherlands and Amsterdam; a research into the current stakeholders in this area and a case study into the Hullenbergweg 3, a building in the Amstel III area. The book was concluded with our five main drivers to create a circular economy.

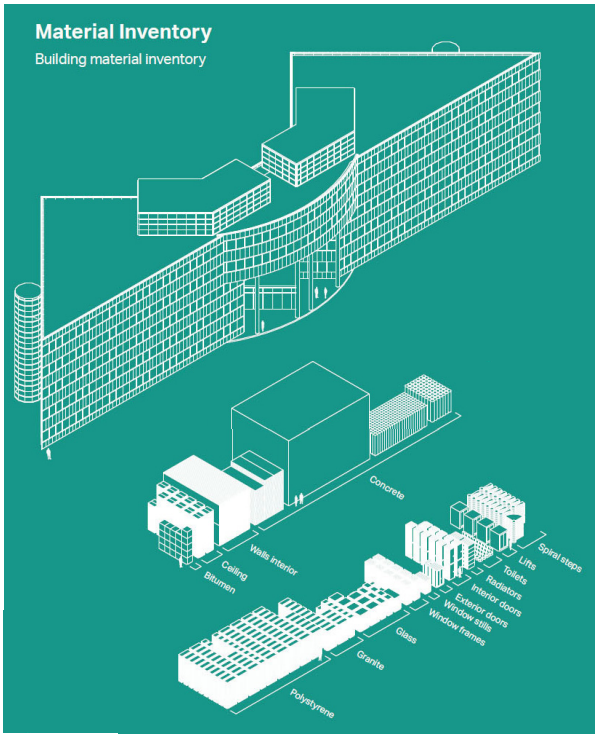

Image 1: Material Inventory of the Hullenbergweg 1

2. The material potential for Design for Disassembly. (nov 2018 - dec 2018)

The second part consists of the writing of the research paper under supervision of Peter Luscuere. In this paper the re-use potential of the Hessenbergweg 8, a building in Amstel III that will soon be demolished, was researched. The building was dissected into the raw building materials and these building materials were rated on their re-use, re-cycling and waste value. In addition to this the hessenbergweg 8 was also virtually reconstructed according to current renovation principles and the circular design principle of the circle house by GXN. These three concepts were compared on their re-use, recycling and wasting value for each of the main building materials. In this comparison the Energy Consumption, CO2 equivalent and water usage were compared. Although it has a higher impact on construction, it is significantly better over time (multiple building cycles) and shows the clear potential for the design for disassembly.

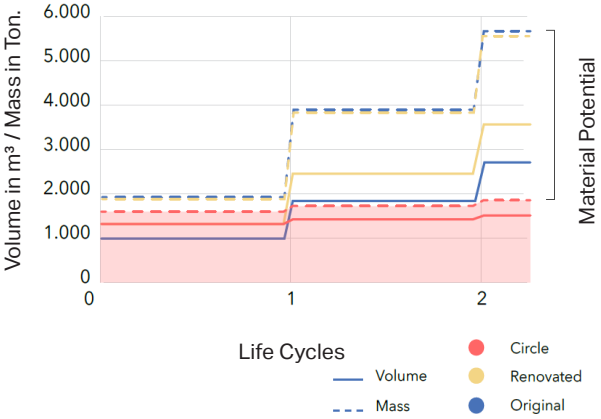

Image 2: The re-use and re-cycle potential.

3. The Circular Hub. (dec 2018 - May 2019)

The third part consists of the actual design based on the previous research. This will be completed with the P4 and P5 under the supervision of Mauro Parravicini and Engbert van der Zaag. This design project consists of the transformation of a low-rise office building, constructed from circular

materials into a high-rise mixed-use building from re-using the same components. This new building houses residential units and a public function to show the possibilities of function-change. This means that this design shows the possibilities of a building to adapt to the fast-changing neighborhood without the generation of waste. In addition to the re-used components a new section was added in front of the building according to the same design principles, but in a different material (wood as opposed to concrete) to accomodate more freedom in the design as the material is also recyclable and allows for the creation of a public forum and auditorium. In the design process various Design for Disassembly Techniques were researched to create a mechanically deconstructable load bearing construction. These principles were also applied to the prefab facade system to allow for irregular compositions of the facade to maximize the relation to the interior.

APPROACH
In my attempt to implement a circular economy though a design into the Amstel III area with the main focus on Design for Disassembly I found out a few things that didn't work an a few things that did.

What did work.
First of all, it was possible to design a building and make it functional according to these principles. It also appeared to be a working technique to keep concrete in the building sector, which is good as it is one of the best materials for acoustic and thermal comfort. It is also necessary as changing to complete timber constructions is not feasible because of the amount of deforestation that will be required for the production of timber. What also worked was the randomness and variety that is still possible in facade design as often standard components result in just square elements. This project also showed the potential for hybrid structures: a building that is largely made from reusable parts but uses materials with a lower re-use potential, but perfectly recycle values, for the non-standard project-specific functions like large halls, atriums pools etc.

What didn't work
It is a lot harder to make a pretty building with a fitting function on a very strict main grid. This was also mentioned before in the hybrid structures. Every component that does not adhere to this grid is essential a special part and loses its reuse value. This makes it a great solution for large scale projects, not so much for smaller buildings. Secondly, the mechanical connections are a great substitution for the cast-in-situ connections we normally use in concrete building. But these connections are also a lot weaker and this makes it hard to create spans or to attach facades to a building in front of columns.

The reflection upon the feedback.
I think the main critique this project was to stick firmly to one story and use all the way through the project. Part of this, as I am dealing with saved amounts of materials and elements, it meant I had to be very precise in this. Also in terms of telling a story and bringing this in a clear way there was some improvement needed. I hope this will be sufficient in the final presentation as it did get some extra attention. Also, I should take some more time to explain things as I tend to rush through everything in an incomprehensible speed. In earlier feedback it was important to stick more to the outcome of the research paper, this was mainly the reason why I failed my P2 presentation. I think I have restored the link to the research paper by using the exact same building volume, location and elements.

Towards the P5
In the final weeks before the P5 I want to spend time on making some atmospheric images that display the new architectural style that comes with circular construction methods. Two physical models will be made to display the construction principle and to show the project in its location. If there is time I would also like to invest some more time into the interior of the building.

Learned from the work.
The adaptation of a Circular Economy is the future and this project gave me a great insight into the way a circular economy works, the stakeholders that are involved, but also all the hurdles that have to be taken to come to a conclusive and clear design. I still think it is the future and I can't wait to further explore this topic in my career.