

Reflection | Design for Disassembly in a Circular Economy

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Comments and thoughts reflecting back on this Building Technology graduation project are shared on the following aspects:

Research and design

The graduation project's followed methodology started with acquiring a solid background through literature review on two main pillars: Circular Economy and Design for Disassembly. This was fundamental in order to set the guidelines for the design that followed. The design focused on the case study of EWI façade and the implementation of the pilot project "Integrated Façades as Product-Service Systems".

The nature of this graduation required more emphasis to be given on the research process than on the actual design. Since Design for Disassembly is a relatively new field for the built environment, with few to none applied examples, there had to be a long continuous research not only in theoretical literature but also in a number of practically involved industries. Even during the design phase, research kept going through communication with the involved industries and exploration of materials and elements that are not traditionally used in the facade components.

As this graduation can be perceived as a starting point to a dialogue between designers and suppliers of facade components, regarding the future of the industry in the Circular Economy, the design was kept at a primary level and the proposals serve only as suggestions. However, the evaluation of the existing designs is based on criteria set during the literature research, which also serve as general guidelines for the optimization proposals.

The theme of the graduation lab and the subject

Within the Master track of Building Technology students are offered the chance of graduating within three themes: Structural design, Climate design and Façade design. All three themes are strongly linked to sustainability.

This graduation project is clearly focused on Façade design as it studies façade components and the relations between themselves and their elements. The specific topic of Design for Disassembly as a means to make façades and their components more suitable for Circular Economy, underlines the graduation thesis' relation to the broader context of sustainability. By introducing Design for Disassembly as a design strategy for façades, a reduction is achieved in the waste stream of the construction industry. Also, embodied and production energy can be reduced as components can be reused and their lifetime can be elongated.

The specific case study of the EWI building and IFPSS pilot project lies within the general effort of the studio to propose more sustainable ways of building façades. Leasing façades as product-service systems can be a powerful business-model within Circular economy and this graduation project studies the technical aspect of that.

At this point it should be mentioned that already from the literature review it became clear that the graduation project would be closely related to product development, as this industry is far more developed in the direction of Design for Disassembly than the building industry. As a result, the outcome of this study is not conventional architectural design as it would perhaps be expected in the Building Technology graduation lab.

The methodical line of approach of the graduation

The Building Technology studio suggests a sequence of literature review, design and evaluation organized in a time-frame of five (5) P assessments. Given the special circumstances of this graduation, where an existing design was taken as a starting point, the graduation started with literature review and then moved to analysis and evaluation of the aforementioned design. This analysis involves a practical approach where actual disassembly of the components takes place and is documented in order to highlight each component's strengths and weaknesses.

The methodology chosen tries to connect data collected from theoretical literature review to existing practical examples, in order to come up with new improved designs. Contrary to the usual case where the designer can start from a blank paper, the chosen methodology imposes the difficulty of starting with an existing design. This can however work in favour of the designer as it sets certain guidelines and gives a more realistic understanding of how façade components work.

The project and the wider social context

This graduation project is part of a greater research conducted by TU Delft with the topic of "Integrated Façades as a Product Service System" which studies the implementation of Circular Economy in the construction industry via a leasing business-model. Design for Disassembly comes to enhance this concept by proposing ways of reclaiming components and materials, moving from the business-model to the technical aspect of the matter.

It can be concluded, from feedback given by industries' representatives, that up to now there has been little to none interest on behalf of the companies to adjust to the Circular Economy model, simply because there has been no demand from the market yet. However, as resources become scarcer and the society in general moves towards more sustainable behaviours, the demand for reclaiming materials will inevitably present itself.

Companies within the construction sector should see this as an opportunity to become more sustainable while at the same time increasing their profits. By maintaining ownership of their products and reclaiming their materials, companies can save from their materials cost, reuse the same components more than once (where applicable) and elongate their products lifetime and last but not least gain valuable informational value on their products as they can monitor their performance throughout the products' lifetime and learn from it. This graduation project comes to serve this purpose by studying the possibilities of Design for Disassembly within this concept and enabling the reclaiming and reusing process for the companies.

Also, this graduation sheds some light on a few materials commonly used in the construction sector and provides a better understanding of the complicated relationships that define these materials' flows from their starting point to their ending point. In this way awareness is raised on the scarcity of certain materials and the benefits that can be gained by limiting their transportation, from an energy point of view but also from an informational point of view for future developments in waste management.

Other comments

Time is always an issue and this graduation project has demonstrated how much work is there to be done in a field that has not yet been fully explored. Many limitations were set in this thesis such as the study of only three (3) components, or the exploration of only three (3) materials. Clearly, the same process can and should be followed for many more components and materials.

The study had started with the idea of exploring disassembly scenarios and relocation of the components from one building to another. But as I was diving into research I realized that in order to do that a strong understanding had to be gained on the way these components were built - an understanding to the point of knowing where the last screw of each component goes. This was a quite time consuming process yet it provided valuable insight in the components themselves and revealed the lack of information. Although not as exciting from a design point of view, it certainly felt more substantial as it's a step that could not be omitted. This graduation project had been very educating and enlightening as it provided me the chance to get an insight in the real construction industry and learn about what is the industry really concerned about (or not). Literature suggests that in theory this strategy would not only be feasible but also profitable for the companies involved. Unfortunately there are not many implemented examples to actually evaluate the real profits of this strategy. This graduation began with the goal of proving that the theory can be validated, but one thing that should always be kept in mind is the fact that there is always a gap between theoretical studies and industry implementation.