REFLECTION

Sustainability and Service Life of Curtain Walls

Stick and unitised system for short-term and long-term use in curtain walls

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The purpose of the thesis is to discover the most sustainable curtain wall system between the stick and unitised and indicate how long it should last. The methodology includes literature study and meetings with the facade construction companies ‘Alcoa’ and ‘Rollecate’. The literature provided all information about the facade design, the material properties and the current construction techniques as well as a background research on the environmental impact of the facades. At the same time, the companies provided me with information about the facade construction in practice, which was extremely helpful in order to understand how the systems work and whether there is any contradiction with the literature or not.

PLANNING

For the implementation of the goal, I first researched the sector of industrial design, which gave me inputs about the assembly and disassembly techniques (reversible/irreversible connections) and the role of serviceability in circular economy. The ability to easily service and recycle any broken part or the complete product at the end of its life contributes significantly at the elimination of its overall environmental impact.

There is a lot to be learnt from the product design and the knowledge I acquired though my research helped me to take decisions for my design proposal as far as it concerns the material selection, the maintenance during the service life and the end-of-life of the curtain wall. In the meanwhile, the final distinction of the different possible life spans arose through my research on facade design and its complete life cycle, focusing more on the stage of refurbishment which determines whether the product’s life will be extended or not.

PROCESS

For the analysis of the service life of the curtain wall, in order to find out which is the best duration in terms of sustainability, two scenarios are examined. The one is short-term (15 years) and the other long-term (60 years). Both are evaluated in terms of embodied energy and CO2 emissions; parameters that represent their total environmental impact during their materialisation and operation. The results are then compared so as to answer the first research question “How long should a curtain wall live to have minimum environmental impact?”. The design of the details and the material selection is optimised to achieve the most sustainable result in each case. However, the changes are quite small due to the production lines from the companies and the already developed performance and detailing of the system. At the same time, the stick and the unitised system are compared to answer the second research question “Does stick or unitised curtain wall provide the most sustainable materialisation and service life?".
All in all, the comparisons implemented are:

1. **Comparison between the two SHORT-TERM scenarios of STICK systems**
   - 15 years service life
     Stick system_ tear down the whole system & recycle / Stick system_ replace the outer part & keep the structure

2. **Comparison between the short-term and long-term scenarios of the STICK system**
   - 60 years / 15 years
     Stick system_ 60 years / Stick system_ tear down the whole system & recycle
   - 60 years / 15 years
     Stick system_ 60 years / Stick system_ replace the outer part & keep the structure

3. **Comparison between the two SHORT-TERM scenarios of UNITISED systems**
   - 15 years service life
     Unitised system_15 years (reusing structure) / Unitised system_15 years (recycling the whole system)

4. **Comparison between the short-term and long-term scenarios of the UNITISED system**
   - 60 years / 15 years
     Unitised system_60 years / Unitised system_15years (reusing structure)
   - 60 years / 15 years
     Unitised system_60 years / Unitised system_15years (recycling the whole system)

5. **Comparison between STICK and UNITISED systems**
   - 15 years
     Unitised / Stick system_ tear down the whole system & recycle
   - 15 years
     Unitised / Stick system_ replace the outer part & keep the structure
   - 60 years
     Unitised / Stick system

6. **Comparison between the BEST results from overall evaluation**
   - Unitised_60 years / Stick system_ replace the outer part & keep the structure

* The comparisons between the unitised and stick systems make use of double glazing, while between the 15 and 60 years scenarios of the stick facade both double and triple are examined and compared.

**PRODUCT**

The final product is the conclusion of the whole research and the outcome of the evaluations. So, I found out that the stick system is more sustainable than the unitised and it should be designed to last 15 years approximately. After this span, the outer part of the facade will be replaced by new parts, while keeping the aluminium structure.

However, more research has to be done on this topic by taking into account not only the materials, but also all the actions from the whole life cycle (manufacture, transport, storage, assembly, operation, disassembly).
REFLECTION/COMMENTS

My thesis started with a different topic and went through different phases until it resulted in having the form it has now. At first it was focusing on the disassembly and the ability to repair the facades; then, the focus point became wider including all different challenges of the facade construction during its complete life cycle; and finally, now, it is constructed upon finding the most sustainable curtain wall scenario.

All this process was very helpful because I acquired a lot of valuable knowledge. However, I could have gained time to go deeper in my final approach by focusing earlier on this perspective of analysis. It would be interesting to take into consideration more parameters during the evaluations and come in contact with companies considering the whole life cycle of the facade so I could calculate also the labour, the transport, etc. Yet, the results are representative of the current condition of curtain walls and are enough to have the right conclusions in matters of sustainability.