# 9.0 Reflection

## 9.1 Motivation

This graduation project has started with my interest in working with a renowned company, to gain experience in practical work and working with professionals in my field of interest. My personal interest lays in technical aspects and knowledge of new and innovative technologies in architectural and urban design, combined with a focus on sustainable design. This can be in detail, but also on macro scale concepts.

The choice to work with Scheldebouw, came from their interest in a specific subject, namely a graduation research on the structural bonding of glazing in unitized curtain wall facades. This would give me the possibility to work on a specific part in building technology. A specific subject means a more in dept research which I prefered. This to gain experience in mastering a specific subject in a practical environment. The subject of adhesives and sealants is an interesting subject, where the right detail might not be the most important aspect. More important aspects with structural bonding might be the right process, procedures and in that way the assurance of quality. This is accompanied by concerns like time, money and image, which are practical aspects that are currently generally missing in the education program.

## 9.2 Challenges

During the course of this research several challenges have been faced:

- Since the topic of structural bonding is a quite specific topic it was relatively demanding to obtain all general knowledge on this topic. Yet, it would not be possible to design, discuss and improve the current process without the total understanding of all relations, reasons and ideas behind every aspect that is involved in this process. Therefore, I more or less started at zero with this research. To not influence the result, little to no information about the process has been given directly to me.

  I needed to collect this information by self-study, interviewing and practival experience from being at Scheldebouw. In this, the distance was also a challenge. Both locations of Scheldebouw, Middelburg and Heerlen, required a long commuter time of respectively 3 and 4 hours. Because of this it was a bigger challenge to achieve the level of understanding and experience that was needed, but this has partly been solved by staying in a hotel near one of the locations for a period of time.

- It was also a challenge to understand and work with external factors that can not be easily influenced, like a supplier of a specific product. Because of the practical approach it becomes a challenge to decide what is a good approach. The best technical solution might not be the most feasible solution because of warranty issues and current relations. Yet, this might still be the best solution if this external factor can be influenced and/or changed.

- During the process of working on this research it was a challenge to plan the work. Because of the start at zero, during the process more and more knowledge was achieved. This caused the ultimate goal and result to change. Therefore, later in the process it became easier to plan and work because the end-result became more clear.

## 9.3 **Relevance and significance of the research**

The value of the this graduation project mainly lies in improving an existing facade system, which is a benefit for the company Scheldebouw. Though, it should be viewed in a wider angle, where there is research in safety regulations, quality assurance and manufacturability. This all is connected to the durability of the product, which is a very relevant topic these days.

In the scientific framework it is interesting to see how in the described process practical possibilities and regulations do not always line up in an efficient way. This might be because of outdated regulations and new developments. Scientific research on this will increase understanding in the misconception between regulations and practice.

Also the process analysis gave general significant knowledge on influences from quality assurance, time, money, production and the actual product.

This research relates with the topic: *Design vs. Development.* Which is a relevant and important topic in almost every industry. This was also the topic of last annual Facade Conference in 2013, held in Detmold, Germany. At this conference was stated there is an ongoing debate between designers and engineers, whether our worldwide innovation comes from artistic aims or from technical possibilities.

This conference was a negotiation between the different positions, like architects, engineers, research institutions and other companies, to start a dialogue about how to improve the innovation process for façades.

In the end, the conclusion was that both design and development are important and have to be considered. Yet, a dialogue between these parties would increase the efficiency of this process of harmony between design and development.

This thesis clearly shows the significance of available technologies that fit the clients needs.


**Figure 9.1** - Facade Conferance Cover: Design vs. Development (Pottgiesser Eds., 2013)

## 9.4 **Approach versus result**

As stated in the challenges, the the topic of structural bonding is a quite specific topic. Therefore it was relatively demanding to obtain all general knowledge and understandment of the total process, prior to be able to improve this process.

Already in the graduation plan the approach/ method this was taken into consideration. The approach contained background literature study, interviews and discussions with the people at Scheldebouw, working in production and quality assurance and evaluation of concepts and ideas by consulting experts in the industry.

This obtainance of understandment, knowledge and practical experience took a considerate amount of time for this research. Yet, also this total overview of process and the reasons behind this process should be seen as a result. Without this, the proposal of an improvement, which is in this case the final product, would not be possible.

As said, at the start of this process planning was a challenge. The project started at zero and more and more knowledge was achieved. Hereby, the direction in research and the ultimate goal could change during obtainance of this knowledge. This is visualized in figure 2.

After obtaining enough information to form a goal it became possible to exactly plan to the final result, which is symbolized by the large ‘round-up‘ arrow. This is the process of processing all obtained information from the done research into the end result.

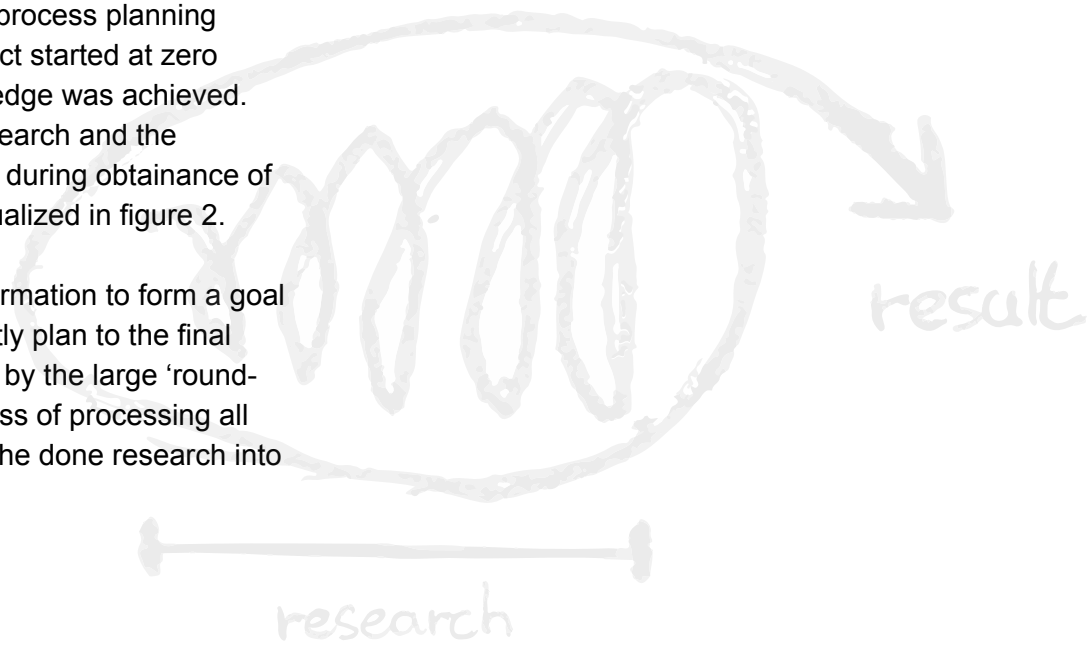


**Figure 9.2** - Sketch process diagram (own ill.)

## 9.5 Further research suggestions

**Prototype**
Next step in research would be the start of a pilot project. This could be by using a prototype. Suggested improvements need to be practically put to test by a physical 1:1 prototype, as test project that will show the performance of this new concept. Together with this, arrangements can be made with 3M as the tape supplier. Together they need to bring this concept to a feasible solution.


**Figure 9.3** - Possible partners in research (Various)

**Permasteelisa research**
The Permasteelisa Group should use its position as an umbrella organisation to conduct research on the actual amount of failures, what kind of failures and costs as a result of these failures. In this way it will be possible to declare extra costs and/or procedures feasible or infeasible. On this moment this information is not available.

**Sika**
If the implementation of the VHB tape appears to be unachievable by means of warranty and/or other factors, further research should be by Sika. As the supplier of structural sealant they should supply the client with a practical solution for their clients. The solution they have now is working, but they could do research on other types of bonding that are less riskfull, like a tape or a one component bonding, and therefore need less extensive procedures. Another option could be an easier way to assure the quality of the mixed 2-part silicone.

**Toggle glazing**
Further research should be conducted on toggle glazing. For this thesis toggle glazing was not an option because it would not improve the process of structural bonding: it would exclude it.

Therefore, this option would not be an answer to this research. Yet, this option should be further researched, because it might be a better option if the implementation in a half-frame system is found to be a feasible option.

Advantages would be:

- No structural bonding, which means less procedures for safeguarding the quality
- Relatively simple replacement

Disadvantages are among others: extra parts and probably a more complex assembly and point loads on the glazing. Yet, it would be interesting and possibly rewarding to conduct further research on this concept.