Reflection

This reflection focuses the aspects of the social context of the design, as well as on the relationship between the research and the subsequently aimed design as an outcome of the research process. The first part explains the purpose of the design and what it adds to existing applications involving glass. This is followed by the second part, which describes the initially planned steps to achieve the result and what has changed during the progress itself with their corresponding argumentation, mentioning the reason of the choices made.

The Design in the Social Context

With the architectural preferences shifting towards more transparent, open plan designs in our day, glass gains additional importance as a building material. It is not only regarded as a means of admitting daylight into the interior, but is also utilised to add character to the building. This was accelerated, or even made possible by the development of research and production techniques. Thanks to this development, technology has come to a point, where glass can be produced in various types and shapes. These include the relatively new type of glass, namely ultra-thin glass. While this product is nowadays commonly in use in the electronics industry, it is almost non-existent in architecture. One of the main reasons for this is the lack of demand in the market due to many factors such as high costs and therefore also the lack of interest in research, which again prevents its cost from declining. However, this product shows a large potential for use in architecture, provided that sufficient interest is shown in the development. When compared to glass with regular thickness, along with some disadvantages, it also shows many advantages. To name a few, these include the lowered use of raw materials, reduced weight of units containing this type of glass due to its lower thickness, its higher flexibility, allowing for unique types of use, the higher impact resistance of its surface and its excellent optical quality.

This thesis aimed to address some of the existing concerns regarding the use of this product in architecture and to bring it one step closer to realisation by presenting ideas that may inspire future researchers and by analysing the extent of its potential through numerical calculations and possible detail designs.

Initially Planned Approach and Changes During Process

The main focus of the research is divided into one aspect in each part; *a) the structural part of the research will focus on the structural behaviour of the laminated thin glass panels with respect to various parameters such as glass thickness, PVB thickness and PVB type under the controlled bending load as well as the wind load, b) the façade focus will be on the water- and airtightness aspect of the proposed kinetic façade element in the closed condition*. The focuses have not changed since the definition of the research framework and remained to be the main focus points of the research. However, the single steps of the research approach and methodology were subjected to small changes during the course of the research.

The initially planned approaches and the changes made to those later on are discussed in the following section.

a) structural behaviour of laminated thin glass

Initially, it was planned to test possible combinations of glass thickness, PVB thickness and PVB types via numerical analysis. To validate the results of the numerical analysis, one or more physical experiments would be carried out. During the research phase, the physical experiment aiming to validate the numerical results was cancelled. The reason therefore is the normally large number of required physical experiments for an expedient validation. This was not possible due to the limited timeframe and in order to prevent the scope to be widened. Instead of preparing a physical experiment specifically for this research, previously performed physical experiments were modelled using the same software and the experimental results were compared to the numerical results to monitor the deviation. For safety purposes, it was made sure that the numerical results remained on the conservative side depicting higher stresses at certain bending points than the ones measured during the physical experiment.

b) water- airtightness

Initially, it was planned to focus on one of the three potential solutions for the water- and airtightness aspect starting from the P2. Upon consideration of the mentor team, it was decided to further investigate the possibilities of all three proposals and make a final decision until P3, after which the selected proposal would be further elaborated. To conclude, which of the options is the most suitable one, the feasibility of the kinetic mechanism, material capacities, and the simplicity of the details were questioned. As planned in the beginning, the method for this step was to draw conceptual details and experiment with similar materials as those planned to be used in each proposal. Another method to investigate the feasibility was to build smaller scale mock-ups of each proposal. This was however later reduced to only one mock-up of the proposal with the biggest potential, since the other two did not seem to be practicable enough to be realized. Also initially, the option of testing the water- and airtightness of the mock-up was considered, was however later dropped, since an establishment to test this aspect requires very accurate laboratory conditions and a thorough expertise in testing in this particular field for reasonable results.

Also initially, the approaches for structural and façade were planned to be separated, so that at first the focus would be solely on the structural part, which would also play a decisive role in the selection of the most suitable design proposal. Even though, the order was roughly kept, it shifted more towards an approach, where the two focuses of structural and façade would go more hand-in-hand and the final outcome would be drawn from the results of both separately.

Apart from these points, the methodology defined in the research framework was maintained throughout the research process. Hence, research and design went hand in hand from the beginning, with the design purpose influencing the focus points of the research and the results of the research that has been done defining the shape of the final design.