Design Plan

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Studio
Name of studio: Architectural Engineering + Technology, The Seismic Studio
Teachers: Annebregje Snijders (Design), Engbert van der Zaag (Building Technology), Martijn Stellingwerff (Research)

Argumentations of choosing the studio
To my opinion the separation between architecture and structure is too big. I believe in an integrated approach, in which the designer or the firm should work as an architect and as a structural designer. I have a preference for the seismic area in Groningen and lightweight earthquake proof structures.

Title
A lightweight structural expansion that supports a by earthquakes threatened building and simultaneously adds new living and working space in the seismic area of Groningen.

Problem Statement
The earnings of the Dutch government are partly dependent on the gas exploration in Groningen. These gas drillings cause pressure differences in the earth crust. These differences result in sudden earth layer shifts. Earthquakes are followed by these sudden shifts. These disruptions of the soil cause a lot of damage to the existing buildings and heritage in this seismic area. This forms a social, structural and financial problem. Without these gas drillings the government cannot afford for example the current retirement of the elderly, but the people living in the seismic area are upset and angry, because they have lost their homes. Most of the damaged heritage has been provisionally reinforced. Beams and structures are running through and around the homes and make the places unlivable. I think an answer lies in providing an external structural support for the buildings which can also function as an expansion for the building. A high performance lightweight structure could give back the trust to the Groningers and provide their houses with a high quality expansion.

Objective
Creating a more permanent reinforcement and protection for the by earthquakes threatened heritage in the seismic region in Groningen by creating a high quality, lightweight and structural expansion that is present in modern Europe. An expansion that prevents the gross damage in earthquakes threatened heritage in Groningen, so that people could live there like they used to. It is impossible to prevent all the damage, but it should be possible to prevent most of the damage. That way the only damage is easily repairable. When the gas drillings are over it should be able to remove the expansion without leaving much damage. This way the rural area of Groningen can have his original feeling back. Using contemporary materials and style, the expansion will be an own addition and not a continuation of the old style. This way the heritage and the solution will get extra attention. If this approach works, it could form a possibility for other by earthquakes threatened areas. The goal is to make homes home again.
According to these goals the expansion should meet the following requirements:
- It should protect heritage.
- High-grade, preventive solution.
- Functional usable expansion.
- It should prevent gross damage by earthquakes to the building.
- A sub-terrain visible solution.
- An expansion which could also have parts inside.
- Use of strong and light contemporary materials (to prevent a much increased mass and thus an increased earthquake severity).
- The expansion should fill up the asymmetric points, making the building more symmetric and should limit the horizontal torsion forces in an earthquake.) When possible
- Be a solution for the coming 50 years.
- Should limit the amount of damage caused by mounting on the original building.
- The expansion can be demounted without leave coarse damage.
- The expansion is not a continuation of the architectural style of the heritage. Through the use of a contemporary material and style the expansion will form an separate addition.
- Case show for making heritage earthquake proof, for example the seismic area in Italy.
- Give trust back to the Groningers.

Overall design question
How could a structural, aesthetical, contemporary and socially acceptable high grade lightweight structural expansion be designed, that supports a by earthquake damaged heritage building in Groningen, prevents gross earthquake damage and simultaneously adds new living and working space?

Thematic research question
1. How can we find out what makes home for the inhabitants for the depopulating seismic area of Groningen? (Position Paper)
   This paper is being used as a strengthening addition to the general story.

2. What are the suitability and applicability of plastic composites as an earthquake proof building material when looking at the structural and architectural features? (Research Paper)
   Content:
   - Introduction to the plastic typology and classification as a building material
   - What happens to a building when an earthquake happens?
   - What damages do earthquakes cause in Groningen?
   - Why a plastic composite considering the ductility, density and strength?
   - How can a plastic composite be turned into an appropriate building material?
   - Conclusion
Building selection
Town hall Berlage in Usquert:

<table>
<thead>
<tr>
<th>Plus</th>
<th>Minus</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real icon, worth it and empty</td>
<td>Maybe a to protected listed building, it is a museum as well</td>
<td>Hard to get plans? (answer is pending at the moment)</td>
</tr>
<tr>
<td>No curves, only edges</td>
<td>Complex building</td>
<td>Maybe hard to model and test the earthquakes on it?</td>
</tr>
<tr>
<td>A lot of windows and bigger spaces</td>
<td>On the edge of the earthquake zone.</td>
<td></td>
</tr>
<tr>
<td>Good location and close to the Eemshaven</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Preliminary design
The giant Tesla battery factory will bring 6000 jobs in the automotive sector. Regio Eemsmond is the Dutch favourite region and makes a good chance, while it has a lot of space, good transportation, the near Eemshaven, green energy and sufficient technical education in the area. Next to factory space, they need offices, diner & housing. It is my idea to use one of the less-used heritage buildings and add office and diner space to it in the expansion. Also by applying a limited transformation of the old building.

Rooms inside and outside will be offices, eating spaces, a foyer and presentation area. The exact sizes and amount will be more clear after receiving the plans.
Planning

Present to P1 (22-09 – 25-10)
- An area analysis: morphological and historical.
- Making an overview of the threatened building stock of the desired location.
- Studying the phenomenon ‘Earthquake’.
- Studying seismic design.
- Formulating design and thesis goals.
- Investigating the possibilities of earthquake proof structures.
- Researching the application of plastics in structures and architecture.
- Studying the architectural, strength and ductile properties of plastics.

P1 to P2 (25.10 – 17.01/25.01)
- Finishing the area analysis.
- Finishing the threatened building catalogue and the final selection of the desired object.
- Analysing the effect of earthquake on different buildings and find out why it has been damaged.
- Continuing studying and calculating earthquakes and their effect on structures.
- Making small experiments with earthquake proof reinforcing structures.
- Specify the research on the different types of high performance plastic composites.
- Write the position paper about what makes homes home for the Groningers.
- Finishing the research report (deadline after the P2, probably the next week) on plastics, their architectural and structural properties and their possible application on heritage in Groningen.
- Making a preliminary design.

P2 to P3 (25.01 – mid April)
- Analyses specific heritage.
- Really starting the design starting from the preliminary ideas in the P2.
  - Floor plans (draft).
  - Sections (elaborated).
  - Facades (draft).
- Continuing the research on the effect of an earthquake on a specified building.
  - Research (continuous).
- Modelling the effect of an earthquake.
  - 3D-model (computer model) for testing the earthquakes on the building.
- Continuing the investigation on the processing of the building parts made of plastic composites.
  - Details (1:20/1:10/1:5) draft
- Making scale models.
  - Scale (1:1/1:2/1:5) test model from a polymer composite.
  - Scale (1:10/1:20) test model façade + expansion connected.

Let us say we have 10 or 11 weeks till the P3, the amount of stars show the importance.

<table>
<thead>
<tr>
<th>Product</th>
<th>Requisite time (till P3)</th>
<th>Importance (till P3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis</td>
<td>1 week (holiday week)</td>
<td>*** (first thing)</td>
</tr>
<tr>
<td>Floor plans</td>
<td>1 week</td>
<td>**</td>
</tr>
<tr>
<td>Sections</td>
<td>1 week</td>
<td>***</td>
</tr>
<tr>
<td>Draft Facades</td>
<td>1 week</td>
<td>**</td>
</tr>
<tr>
<td>Research</td>
<td>Continuous throughout the designing process</td>
<td>***</td>
</tr>
<tr>
<td>Laser cut model (1:200)</td>
<td>2 weeks (first two weeks)</td>
<td>***</td>
</tr>
<tr>
<td>Draft details (1:20/1:10/1:5)</td>
<td>2 weeks</td>
<td>***</td>
</tr>
<tr>
<td>Test model polymer composite</td>
<td>1/2 weeks</td>
<td>*</td>
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As visible, time management is of importance. Therefore the draft sections, the 3D-model, the draft details and of course the overall research will be given priority. Of course the other products (two stars) will not be neglected. It would be nice if the 1 star product can be looked at, but it is optional at this stage.

P3 to P4 (mid April – mid June)

For these products no requisite time or importance is given. This is while it is still too far ahead in the future. After the P2 and throughout the process until the P3 it will be clear, through evaluating by the tutors, which products and processes should be given priority. These products give a rough ideal situation for the P4 presentation.
- Continuing and improving on the design.
  - Floor plans
  - Sections
  - Facades
  - Impressions (sketched and rendered)
- Continuing and improving on the model.
  - 3D-model for renders and laser printing
- Making scale models.
  - Scale (1:1/1:2/1:5) finished model from the chosen material (polymer composite)
  - Scale (1:10/1:20) finished model façade + expansion (connection)
  - Scale (1:100/1:200/1:500) situation model
- Finishing research.

P4 to P5 (mid April – mid June)

- Finishing and improving all products for the final presentation.
- Adding things suggested at the P4 presentation.

New planning, after the P3 I’ve changed my future design steps. I have elaborated on this in my reflection.

Relevance

In the studio of Architectural Engineering + Technology I want to make an aesthetically and socially acceptable structural addition for the threatened heritage in Groningen in order to protect it and prevent further damage. A lot of the housing and heritage in the seismic region in Groningen has been damaged by the recent earthquakes, caused by the sudden earth layer shifts following the gas drillings of the state. A lot of buildings there are being reckoned as being uninhabitable and have been reinforced by temporary structures to prevent further decay. This poses a factor for the depopulation of the area. The whole political debate about these drillings concerns the financial and social welfare of the state and residents as well. That’s why it makes sense to me to find a good solution for the problem. I believe if we give the people a high grade solution for their threatened heritage that they will feel respected again and have a place to live again. Through the use of contemporary materials and architectural style I want to create a new face for the area, without impairing the old heritage. While the earthquakes will last for only 50 years, due to the limited gas drillings, the expansion should be deconstructable without leaving gross damage. An easy, light, qualitative, strong and appropriate looking expansion could therefore from a solution. When this solution proves to be good it might be applied on heritage in other seismic areas, like the by earthquakes threatened areas in Italy.