

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Personal information	
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Studio	
Name / Theme	Architectural Engineering Graduation Studio 16
Teachers / tutors	Pierre Jennen, Anne Sniijders, Pieter Stoutjesdijk
Argumentation of choice of the studio	<p>In 2011 I started as a student in Delft, because I wanted to change the world. Because I have always been a creative person and because I have the ideology of creating a more 'sustainable' world, I chose to study at the faculty of Architecture.</p> <p>In the bachelor of architecture I learned many different things and I discovered which part of architecture interests me the most. I really enjoyed the projects focusing on engineering, sustainability and the detailing of buildings. This is why I chose the Archineering studio as minor. I enjoyed this so much that I decided to graduate in the studio of Architectural Engineering.</p> <p>For me, this studio does not just give me the opportunity to work as an architect, but also gives me the opportunity to understand the more technical and climatological part of the building and to innovate with existing and not yet existing materials and systems.</p>

Graduation project	
Title of the graduation project	Lifespan proof, energy- and CO ₂ -neutral residential buildings in Vrieheide <i>Renovation with renewable materials</i>
Goal	
Location:	Vrieheide, Heerlen (IBA Parkstad)
The posed problem,	<p>Parkstad is a part of Limburg containing eight municipalities. There are several problems known for this region. For example, the population shrinkage of the area, the low quality of the rental housing stock and personal estates and the changing population. Families leave the area, and the population of elderly grows (Rigo Research en Advies, 2012, pp. 8, 22).</p> <p>This is why IBA (Internationale Bau Ausstellung) decided to develop a strategy to restructure this area (IBA Parkstad, n.d.). The aim of the restructuring of IBA Parkstad is to increase the quality of the built environment. The existing environment has to cope with a lot of vacancy, and because of the change in population many buildings do not adjust to the users anymore (Rigo Research en Advies, 2012, pp. 8, 22).</p> <p>The restructuring of the area gives also opportunities on</p>

	<p>sustainability. On this point, IBA Parkstad’s focus is on lowering the housing costs and on environmental aspects: the ambitions of IBA Parkstad are energy saving in the built environment and the re-use of materials from demolished buildings (Rigo Research en Advies, 2012, p. 12). This leads us to more global problems.</p> <p>For the Netherlands, the goal is to reduce the amount of carbon dioxide with 80 per cent by the year of 2050 relative to the year 1990 (Hellinga, 2010, p. 5). This can be achieved by using renewable energy sources, but this can also be achieved by lowering the amount of energy that is needed. New buildings are already made mostly self-sustaining and energy neutral. For the existing building stock this is not the case.</p> <p style="padding-left: 40px;">A large part of this existing housing stock is from the 1960s. This is because there was a shortage of residential buildings after the Second World War. To build new homes fast, systematically building methods were used (Hoogendijk, 2012). Unfortunately, the houses that were produced in this period are very poorly insulated. Therefore, the energy costs of these houses are very high.</p> <p style="padding-left: 40px;">To lower the energy costs of existing post war buildings, many of them are renovated. Unfortunately, the materials that are used to make and renovate buildings make them mostly only sustainable by their final energy consumption. The materials that are used – such as steel and concrete - do still have a large impact on the environment and leave a huge carbon footprint (Bribián, Capilla, & Usón, 2011, p. 1139). Except for wood, which is the only traditional used (building) material with a negative carbon footprint (Houtinfo.nl, 2016; Sikkema & Nabuurs, 1995, p. 155).</p>
research questions and	<p>Because a solution is sought for a large number of houses, a modular system is being devised. This leads to the question: “How can modular built post-war residential buildings be made energy- and CO₂-neutral with the use of renewable materials and be made into houses for life?”</p>
design assignment in which these result.	<p>The aim of this graduation project is to improve the existing building stock in Vrieheide with renewable materials and wooden, prefab façades to make them energy neutral and to remodel them into houses that are lifespan proof homes.</p>
Process	
Method description	
<p><i>Design</i> - In the first part, with the knowledge of earlier researches (from the previously written paper ‘Renewable, prefab, wooden façade elements for post-war residential buildings in the Netherlands’), a façade system will be designed. This will be done by sketching and by modelling (by computer and by hand). The results of every model will be compared to the established requirements. The results of this</p>	

research will be a design catalogue. This will contain different wooden elements for the façade that can be mass-produced and added to the existing stock.

Secondly, an architectural design will be made for the renovation of the post-war residential buildings in Vrieheide. For the flats and terraced houses, different housing types/options (for different phases of life) will be designed. To do this, conceptual models will be made with help of sketches and modelling. When the design is further advanced, technical drawings will be made with CAD programs to make the design explicit.

User analysis – A users analysis will be done with online research articles and books from the library. The focus of this study is on understanding what is needed to make houses for life (levensloopbestendige woningen).

Literature and general practical preference

Hoogendijk, S. (2012). *Energiereducerende installatietechnieken voor seriematige woningbouw uit de jaren '60 en '70 ende waardering daarvandoor bewoners*. (Master), Technical University of Delft, Delft.

Herzog, T., Natterer, J., Schweitzer, R., Volz, M., & Winter, W. (2004). *Timber construction manual*. Berlin: Birkhäuser Architectuur.

Kullberg, J., & Ras, M. (2004). *Met zorg gekozen? Woonvoorkeuren en woningmarktgedrag van ouderen en mensen met lichamelijke beperkingen*. Den Haag: Ministry van VROM & Sociaal Cultureel Planbureau.

Reflection

Relevance

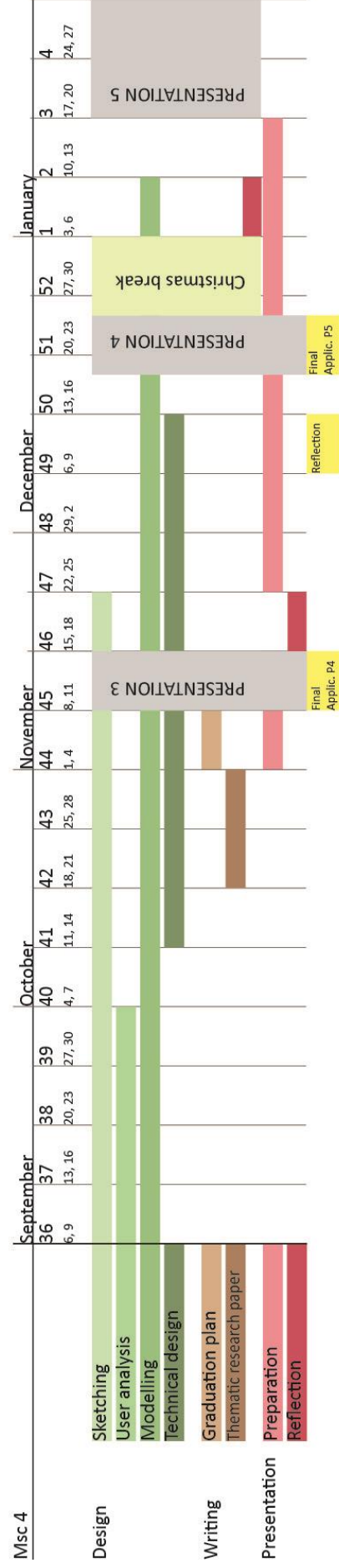
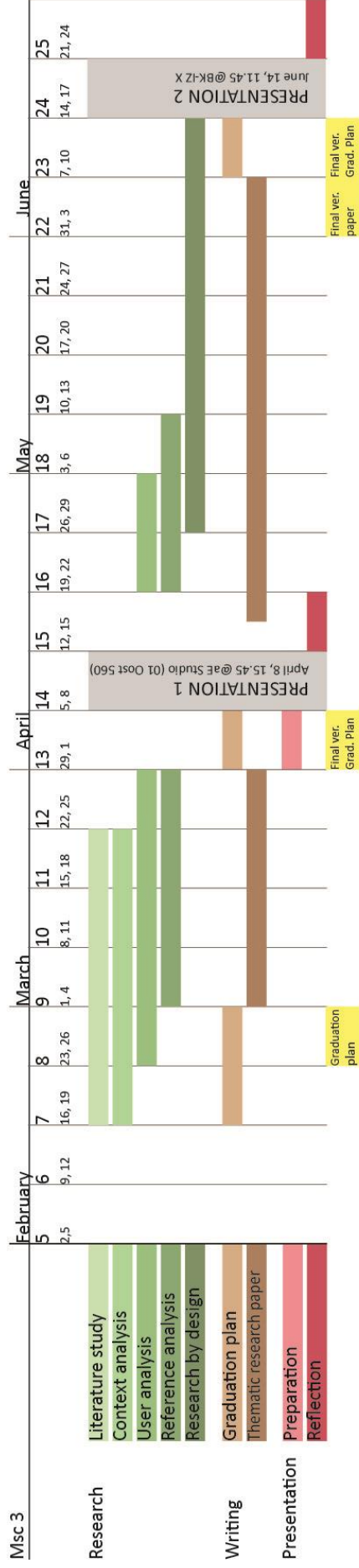
This project focusses on buildings in Vrieheide from the 60s, but the kind of buildings that can be found here, can be found in many other places in the Netherlands. The way that this design makes these buildings energy / CO₂ neutral is thereby not only interesting for locations in Parkstad, but can be seen as a more general approach for the renovation of these kinds of buildings.

Another problem in Parkstad is the growth of the amount of elderly. This problem does also address to other locations in the Netherlands, because the whole Dutch society is becoming more 'grey'. The houses for life make it able for people to live not only in their house with their family, but also when they grow old or get disabled.

The value of this graduation project can be found in the larger environmental framework too. The problem of the amount of CO₂ in the atmosphere is a general, worldwide problem. Furthermore, the use of renewable materials such as wood is not only a way to lower the impact of the carbon dioxide emissions of buildings materials in Vrieheide, but everywhere.

Time planning

See the next page for the planning.



References

Used references for this plan:

- Bribián, I. Z., Capilla, A. V., & Usón, A. A. (2011). Life cycle assessment of building materials: Comparative analysis of energy and environmental impacts and evaluation of the eco-efficiency improvement potential. *Building and Environment*, 46(5), 1133-1140.
- Hellinga, C. (2010). De energievoorziening van Nederland: Vandaag (en morgen?): TU Delft.
- Hoogendijk, S. (2012). *Energiereducerende installatietechnieken voor seriematige woningbouw uit de jaren '60 en '70 ende waardering daarvandoor bewoners*. (Master), Technical University of Delft, Delft.
- Houtinfo.nl. (2016). CO2 FOOTPRINT van hout. from Centrum Hout
- IBA Parkstad. (n.d.). Wat is IBA Parkstad? Retrieved March 1, 2016, from <http://www.iba-parkstad.nl/nl/organisatie/wat-iba-parkstad>
- Rigo Research en Advies. (2012). Regionale woonstrategie 2012 - 2020: Kiezen voor Parkstad. Heerlen: Stadsregio Parkstad Limburg.
- Sikkema, R., & Nabuurs, G. J. (1995). Forest and forest products: the challenge for a better carbon balance. *LIFE-CYCLE ANALYSIS*, 173.