

RESEARCH PLAN BRENT BURM

Architectural Engineering Graduation Studio

Content Research Plan

Studio

Name of studio: *Architectural Engineering*

Design tutor: *Thomas Offermans*

Research tutor: *Pieter Soutjesdijk*

Argumentations of choice of the studio: *I chose Architectural Engineering Studio because of its freedom in the technical design approach. I can combine the architecture “stock” with the technology “make”, which I am fascinated about. The focus on the more practical side of engineering within architecture makes it a perfect studio for me.*

Title of Graduation Project

Rebirth of the church

Keywords

Remountable, timber-construction, monumental architecture, repurpose, reuse, wood joints, modular, permit procedure

General Problem Statement

Nowadays, we think more about the reusability of buildings than we did 60 years ago. We must consider climate change, material scarcity, building industry pollution, economics, and many more things while designing. Even though it is important to consider the consequences of our new buildings, we must also be careful with our current real estate. At the moment we are transforming old offices, schools, and other buildings into housing, according to CBS (centraal bureau voor de statistiek) in 2022 9565 houses were created by transforming old vacant buildings. In the Netherlands, there are not only just vacant buildings like offices and schools but also monuments like churches. According to the RCE (Rijksdienst voor cultureel Erfgoed), there are 7110 churches, synagogues, mosques, and temples. 1530 of these buildings have already got a new function instead of the religious function they once had. This research concludes that not only in the Netherlands but also in the neighbouring countries many churches become vacant in the coming years, as expected by 2030 1700 churches will become vacant in the Netherlands. In metropolitan areas, such as Amsterdam, The Hague and Rotterdam multiple solutions would fit these vacant churches due to the large amount of people living in these areas, but a region where this is not the case is Zeeuws-Vlaanderen. In this area of 875,80 square kilometers live around 105.499 people (Eurostat, 2019) and it is often described as ‘land on its own’ because of its location between the border of Belgium and the surrounding water of the Westerschelde. In a research done by ZB | Planbureau was concluded that the support for facilities is decreasing and becoming more

and more inaccessible (van der Wouw, 2017). Furthermore, in the last 10 years, many churches have become vacant in this region and went for sale with no potential intention of reusing it. Especially in small villages, it is hard to find the right developer to do something with the vacant building. In 2016, omroep Zeeland reported that from 2003 till 2013 the churchgoers of the Dioceses of Breda had been halved. In those 10 years, 27 churches closed their doors and till this day many more churches are becoming vacant. Also, the amount of churchgoers is decreasing. In 2022 43% of the population of people 15 years and older counted themselves as a philosophical group and 12% regularly visited a service. In 2019 this was 46 and 14 per cent (Houben, 2023). Even though they once were the middle point of a village or city they nowadays are just barely used old buildings collecting dust. Regardless of the status of the construction, things like monumental status, spiritual value, costs, building properties etcetera scare society from doing anything with these vacant buildings (Lancellotta et al, 2022). Moreover, the amount of regulations and procedures does not help ease the process in general (Woudt, C, 2003). And we also have to think about the consequences of material choice on the environment. All in all, we have to consider a modular building method, that would shorten the procedures and would form a financially attractive solution. In terms of environment, material properties and construction wood would be the ideal material (Pajchrowski et al., 2013). So, is it possible to repurpose churches with a remountable wooden infill without harming the architecture and construction of the church?

Overall Design Objective

Having grown up in the region of Zeeuws-Vlaanderen, there has been a recent observation that many churches are becoming vacant, often without any thoughtful intention for reuse or repurposing. Looking more into this subject, it became clear this is something that is happening almost everywhere in the Netherlands, but also in the neighbouring countries (Ministerie van Onderwijs, Cultuur en Wetenschap, 2021). The objective of the design is to look into the possibility of making a completely remountable timber construction that is self-supporting and does not have to be connected with the existing construction of the church. By creating something reversible, the architecture of the original building will be preserved, and time in procedures will be shortened. Furthermore, the elements should fit through the doors of the churches without removing any parts of the original building. In the last decade, many churches have become vacant and in the coming years, many more will become vacant. Many of which have a monumental status and while we want to preserve the outside of the church it is important to preserve the inside as well. By making something completely remountable and self-supporting every decision can be undone without harming the structure as it is. The objective is to think about creating a modular system that can be fitted within a church, that is known for overall different measurements and walls that are most of the time slightly tilted. These modular systems need to be adjustable for different public functions, such as an indoor market, workspaces, community centre etcetera. The choice of functions goes hand in hand with the spiritual value and perpetual clause of churches, but it goes also in line with the flexibility of the modular system. With these modular systems,

temporary functions can be created while keeping financial costs in mind. More importantly, this should shorten the procedure of reusing monumental buildings without constantly discussing the decisions with different stakeholders. Moreover, these systems need to be lightweight, small enough to fit through a door and detached from the structure of the church. How these modular systems are made, transported, stored and assembled will be an important factor in terms of time, finance and feasibility. This so-called production process will be different for every location, but will be of great importance to make repurposing churches financially possible. In this way, churches can be preserved completely and can serve once again as a landmark within a city or village. Moreover, it should give a financially attractive solution to vacant buildings so that more people see the potential in repurposing monumental buildings. Even though, this objective may be very specific for one building type it will in the end be possible to fit in many other churches and other types of buildings.

Overall design question / design hypothesis

How can we repurpose vacant churches with remountable modular wooden structures to create new social public functions for the habitants of Zeeuws-Vlaanderen?

Reflection on the relevance

At first glance, the project is quite specific, but from a generic point of view, everything that will be designed for this typical context can be done everywhere. Not only in this region, but almost everywhere in the Netherlands churches become vacant more frequently (Ministerie van Onderwijs, Cultuur en Wetenschap, 2021). The reason for the choice of this region is because of its interesting location, but also of the difficulty in finding the right function for the vacant church (van der Wouw, 2017). Furthermore, the irregular shapes of the structure of the building are an important part of the design. Solving problems for these types of buildings will make it possible to solve them for other monuments or buildings with the same properties. Also, with the current climate change and recognition of using environmentally friendly materials, wood would be the best solution regarding material properties and use of the material (Kaufmann et al., 2018), it also is used as a reference to the first wooden-built churches. (Pajchrowski et al., 2013). By applying a modular system that is remountable, it gives the focus on a design that can be reused. Researching this topic will help provide more information for designers, developers and builders. The research part is mainly based on creating these typical structures, while the design helps solve the problem for a typical context for example. How these elements come together in a different context, should not form a problem for the design of the wooden structure. All in all is the relevance of the design objective giving an possibility in reusing churches and in the end other monumental buildings in a different way, while preserving the building.

Thematic Research Objective

The main objective of this thematic research is to look into the possibility of creating a modular and remountable timber construction. The most important part is defining this modular system. What parts of the construction form the modularity and what needs to be

customizable to be adjusted for different functions? Furthermore, what type of wood should be used and what is the perfect connection in this situation? This modular system can be used as a temporary solution for the vacant churches or churches that will become vacant, to repurpose the building a different way. The objective of this modular system is to be fitted within a church, while preserving the building and without using mechanical connections between the timber and the existing construction. Therefore, this timber system or infill should be lightweight, detached from the original building, modular and remountable. In this way a financial attractive solution can be created, not only because of the choice in materials, but also because the permit procedures can be shortened or not even needed because of the temporary function. Moreover, the remountability of the system gives a possibility to reuse buildings without harming any of the original architecture. So, in this case the main objective will be looking into which type of wooden building system such as on-site-built technique, CLT system, surface unit system, post and beam system as a modular infill would suit as best. The best ideal system will be decided on possibility in production, transport and assembly. Building and location properties are important factors in this process to make design decisions. The infill itself should be able to fit in all types of churches and therefore a modular system is needed that can be adapted on the outside of the infill to fill up the space between the existing building and the newly added infill.

Thematic Research Question(s) / thematic research hypothesis

How can a modular wooden building system be developed with adaptable elements to create customizable, remountable, multistory spaces within vacant churches?

SubQ: How does the building process affect the physical context in terms of production, transport and assembly?

SubQ: Which of the existing wooden building elements would be the most optimal as a modular infill to fit within vacant churches?

SubQ: What are the technical requirements of the system concerning the various functions it is designed to accommodate?

Reflection on the relevance

Within the coming years, almost 1700 churches will become vacant, and the majority of these buildings will probably have a monumental status (Ministerie van Onderwijs, Cultuur en Wetenschap, 2022). Normally, creating something new in these kinds of buildings would mean that changes will be made to the building. This thematic research will look into modular timber construction that is detached, multistory and remountable by hand and only uses wooden joints that can be built within a building. In other words, this research answers the question of what to do with vacant churches without harming the original building and architecture. Simultaneously, the use of wood as a construction material, the remountability

of the infill and the modularity of the system form an answer to a sustainable design. The church in itself forms the challenge of dealing with different sizes and lengths. Even though, the design and research in itself are quite specific it will in the end form a more generic conclusion and hopefully solution for the reuse of monumental buildings for builders, designers and developers.

Thematic Research Methodology

For this thematic research, various methods will be applied. The main question *“How can a modular wooden building system be developed with adaptable standard elements to create customizable, remountable, multistory spaces within vacant churches?”* Will be answered through the three sub-questions with the methodology of research by design, meaning how are the elements of the building system developed from different existing elements. For my first sub-question *“How does the building process affect the physical context in terms of production, transport and assembly?”* the used methodologies will be a literature study and research by design. To answer how these infills will be produced, transported, stored and assembled. It will be a combination of the three methodologies, looking into regulations on how the design will made and constructed. Furthermore, for my second sub-question *“Which of the existing wooden building systems would be the most optimal as a modular infill to fit within vacant churches?”*, the method of research by design will also be implied, but mainly a case study analysis will be conducted on three churches from different architectural periods. The analysis will mainly be a geometrical analysis, to get an answer of what will be the criteria for the modular system. Would there be a general size that would fit all three of these churches? The buildings will be analysed on door size, indoor heights, lengths, widths, distance between columns and construction materials. The analysis of these churches will provide both a generalized understanding of the criteria for modular wooden infill in terms of its properties and an indication of the specific church where the design will be implemented. The three churches are the St.-Willibrordus Basiliek in Hulst (15th century), Onze-Lieve-Vrouw-Hemelvaartkerk in Philippine (1954) and the Maria Hemelvaartkerk in Graauw (1855). The choice for these churches, has firstly to do with the region, they are all located in Zeeuws-Vlaanderen. Secondly, all of these churches are Roman Catholic churches. Thirdly, the buildings are all from a very different period. Lastly, only the basilica is still in use, while the other two churches are for sale and vacant. This sub-question will be addressed through the application of a literature study method to gain deeper insights into various modular systems and their properties. Moreover, for my third sub-question *“What are the technical requirements of the system concerning the various functions it is designed to accommodate?”* similar to the other sub-questions, this one will employ the method of research by design.

Expected results of thematic research and design implementation

By addressing the question *“How can a modular wooden building system be developed with adaptable standard elements to create customizable, remountable, multistory spaces within*

vacant churches?", insights will be gained regarding the criteria for this building system, its implementation in a church setting, and the design process. The deliverables of this research will consist of a modular wooden building system developed from existing systems, with consideration given to the construction process. While production, transport, storage, and assembly may vary depending on location, the core infill system will remain generic, adaptable to various sites, and customizable to suit specific needs. The outcome of this research will involve applying the infill system to one of the three churches under study. With an understanding of the system's potential, greater focus can be placed on designing the infill within the church, allowing for both practical functionality and aesthetic appeal. Each sub-question will provide measurable results: the first will define the criteria, the second will identify existing solutions and their relevance to the project's needs, and the third will explore how combining existing systems can result in a more effective solution for repurposing vacant churches. The third sub-question, "*What are the technical requirements of the system concerning the various functions it is designed to accommodate?*" will help creating a modular system that is adaptable to various functions and not only to accommodate one specific function.

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