

Preservation through Adaptation

Design research focused on developing a redesign approach for adaptive use of vacant churches from a Zero Waste perspective



van Biezen (n.d.), Modified using Photoshop

Heritage & Architecture | Revitalising Heritage | Zero Waste Church
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Research Plan

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Introduction | Why

This research plan provides insight into the *why, what and how* of the individual research that will be conducted within the graduation studio Revitalising Heritage: Zero Waste Church for the Master Architecture, Urbanism and Building Sciences program at TU Delft.

According to The Heritage Council (n.d.), Heritage covers that which has been preserved from the past, allowing it to be valued in the present and maintained for future generations. Under the following thought, the Zero Waste Church studio has been set up:

“HA [Heritage & Architecture] wants to strengthen the connection between the fields of adaptive reuse and sustainability.”

(dos Santos Gonçalves & Heritage & Architecture LAB, 2022).

In doing so, HA provides an environment for research into not only preserving cultural value but also how heritage can serve as a sustainability tactic and make heritage more sustainable in general.

Personally, this appeals to me. I find the preservation of a distinctive building through a redesign with an appropriate new function fascinating. As a result, a building is not lost and is given a second chance. Within the studio, the aspect of ‘Zero Waste’ is interesting as this is a contemporary concept in the design and production sector, although little of it has been achieved on this topic yet (Rana Mahanta et al., 2021). Zero Waste is defined as:

“Zero waste is the conservation of all resources utilizing responsible production, consumption, reuse and recovery of products, packaging and materials without burning, and with no discharges to land, water, or air that threaten the environment or human health”

(Zero Waste Europe, 2022).

The combination of examining and redesigning cultural heritage such as a church from a Zero Waste point of view, as elaborated in following the problem statement, is a thing I find extremely interesting and contemporary to explore in an integrated manner. Heritage and Zero Waste are both topics I find interesting but have not worked with before. It, therefore, motivates me to learn more about them and deal with them during my graduation process. The graduation involves individually conducting integrated design research on a formulated main research question, in which results are generated from research and design. These results are verified against each other for factual accuracy after which conclusions can be made on sub-questions. Ultimately, this process leads to an answer to the predetermined main research question, consisting of a written explanation combined with drawings of redesign scenarios of the chosen case study.

The case study concerns the St Barbara Church designed by Piet van Genk and constructed in 1886 in the city centre of Culemborg, the Netherlands. Some analyses of this church will be carried out as a group and will provide insights for individual research.

Problem Statement | Why

Currently, the phenomenon of secularisation is well underway in the Netherlands. Nationwide research by CBS (2020) shows that in 2019, 54% of the Dutch were non-believers. In 2014, this number was already 47.5%. With that, the number of Roman Catholics declined from 25.4% to 20.1% over the 2014-2019 period, while the number of believers in Islam, Protestants, and other religious groups remained nearly the same. This survey also shows that only 14% of Roman Catholics (R.C.) attend church regularly in 2019. The Trouw church survey (Fijter, 2021), describes because of the Corona crisis, donations to the church have declined drastically. Because of the combination of these events, parishes are forced even to

sell some of their property as there is no budget to maintain all of them. It is therefore expected that a total of 1.700 churches will become vacant by 2030. In particular, this number will largely consist of R.C. Churches, as that is where the vacancy rate is currently increasing the most. 1.530 (mostly churches) of the 7.110 religious' buildings in the Netherlands have been repurposed with a new function and a furthermore of 295 were in transition last year (Hannema, 2021). The number of repurposed churches along with the amount of upcoming vacant churches demonstrated the change occurring within the Netherlands. PhD student Herman Wesselink said: *"We are better off repurposing churches than demolishing them, although the latter cannot be ruled out."* (Reformatisch Dagblad, 2018). His research shows that in the period from 1800-1970, 6,000 churches were built of which 1,000 have already been demolished. In particular, neo-gothic R.C. churches and several Protestant churches have been demolished in the past 50 years. According to Wesselink, has repurposing significantly increased in recent times since society wants to preserve more heritage and treat buildings more sustainably (Reformatisch Dagblad, 2018).

Churches are a part of the history of the village or town in which they are located and are part of the identity of these places and therefore give meaning to the living environment. When a church must close, there is an emotional process for nearby residents as it affects the memories of the church and its function as a landmark in the built environment (Rijksdienst voor het Cultureel Erfgoed, 2011).

According to the European Parliament (2022), the EU produced a combined 2.5 billion tonnes of waste in 2016, most of which (36.4%) came from the construction sector alone. The EU wants to drastically reduce waste production by encouraging waste prevention and recycling as much as possible. If this is not possible, it is possible to switch to recycling or using waste to produce energy. Waste prevention is a transitional process for the upcoming circular economy of 2050. According to the central government of the Netherlands, the circular economy is defined as:

"The circular economy contributes to four societal challenges, which include CO₂ reduction, biodiversity, improvement of air, water and soil quality, and security of supply of resources."

(Het Ministerie van Infrastructuur en Waterstaat, 2021).

Producing and consuming sustainably is at the core of the circular economy (Zero Waste Europe, 2022). The EU has included in the Green Deal, Europe's agenda for sustainable growth, to have a circular economy across Europe by 2050. By 2030, the economy should already be 50% circular. This includes the goal of producing less waste and focusing circular use of raw materials in the manufacturing and construction industries European Commission (n.d.).

The increase in the vacancy of churches because of secularisation is an urgent problem for R.C. churches in particular. Since society considers it increasingly important to preserve cultural history and many churches are still standing through repurposing, these historical buildings will continue to exist and be preserved for the future. In this regard, preserving churches is in line with the EU's Green Deal, as it leads to the process of reusing and waste reduction.

This creates an opportunity to explore the extent to which it is possible to redesign churches without waste (Zero Waste), in which the dilemma between preserving heritage aspects and maintaining usability for future needs of the repurposed space will be the main factor.

Relevance | Why

This design research focuses on developing a Zero Waste redesign approach for vacant churches for adaptive use. By giving a redesign of adaptive features the lifespan of a building will significantly increase since the space will be able to change to the requirements of the user (Open Building. co, 2021). By implementing this, churches will evolve from single religious use to multifunctional use and be able to adapt to new functions over time. This will increase the lifespan of former vacant churches since they will not become waste and by doing so the heritage values of it will be able to be preserved for the future. For this research, the R.C. St. Barbara is used to design and evaluate the approach. This church will become vacant shortly due to the decrease in church attendees (Schaik, 2020) and no specific function has yet been determined for it. This makes it ideal to transform it into an adaptive multifunctional space since it will be able to accommodate a diversity of functions.



R.C. St Barbara church, Culemborg. Own image.

The redesign will consist of several interventions on the existing structure using adaptive construction methods and materials from the perspective of Zero Waste based on research. By doing so the dilemma between preserving heritage aspects and adaptive usability will be the main factor.

Research Questions | What

The research will be conducted on the following main question:

How can a vacant church be redesigned in a way that it can accommodate different demands for use now and in the future through a Zero Waste approach?

The answer to the main question is investigated through research on the following sub-questions:

- 1: What does a Zero Waste future mean within the building sector?*
- 2: How is circularity implemented in new buildings?*
- 3: How is circularity implemented in repurposed churches?*
- 4: How can the percentage of Zero Waste within a church redesign for adaptive use be maximized?*

Theoretical Framework | What

The first sub-question explores what the implementation of Zero Waste means in general for the design and construction sector, based on pre-selected literature. The vision 'Cradle to Cradle' (2007) and 'The Upcycle' (2013) both by chemist Michael Braungart and architect William McDonough, consists of the image in which we only produce innovatively by keeping materials in technical and biological cycles. The vision 'Material Matters', in which the consumer is not an owner but a user of materials, by Architect Thomas Rau and economist Sabine Oberhuber (2016), is likewise a view on the use of materials in the building sector. The view of Socrates Schouten, an expert on sustainability and economy, on why the circular economy is important to fundamentally change the consumption, production and growth within the economy (Schouten, 2016). These views, together with the approach to the design of 'Ecodesign' (Doorselaer & Bois, 2018), are combined into an overview, the *"Zero Waste Framework"* (my approach). This Zero Waste framework will provide the design research with a viewpoint on what will be used to objectively analyse case studies and objectively make design decisions. This framework is supplemented with insights from the lecture and visitation of the Zero-Waste interior design of NN HQ by Fokkema & Partners, the studio Workshop on Circularity, literature of the government on the circular economy and the reuse of heritage buildings as a tactic of maintaining materials and a sustainable approach as a whole.

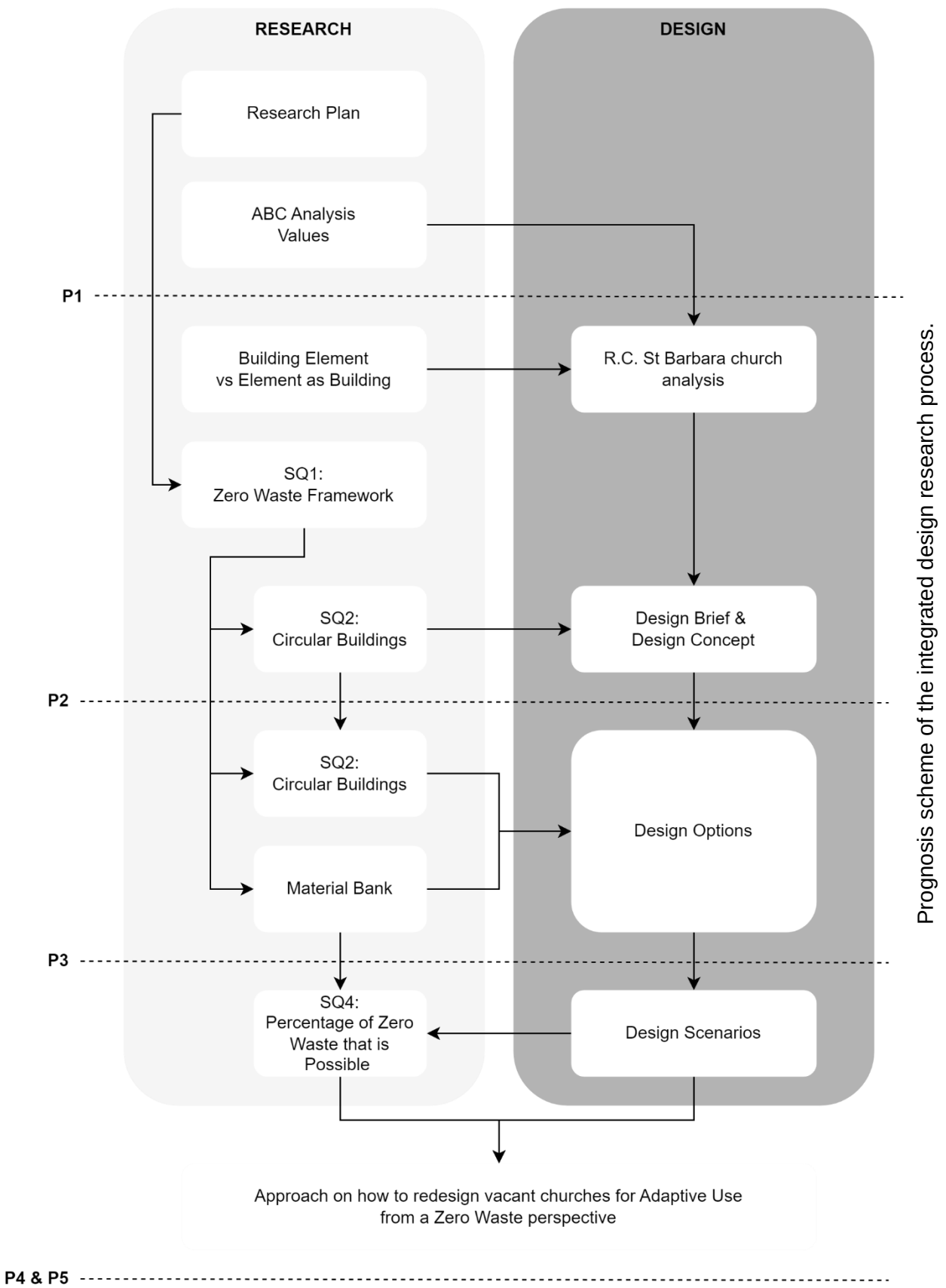
For the following two sub-questions, six predetermined case studies will be analysed on adaptive usability and then their approach to circulatory of material use and construction methods. These topics are first studied by analysing three case studies of repurposed churches that accommodate multiple different functions followed by the analysis of three new buildings that are built with circularity in mind. Only case studies based in the Netherlands are deliberately chosen, given their conformity with the St. Barbara church on economic, social, and political conditions in terms of regulation and their location concerning the climate within the Netherlands.

The results of these sub-questions will be analysed and evaluated by designing three options for a redesign, a *low-impact option*, a *moderate-impact option* and a *large-impact option* of modification on the R.C. St. Barbara church. By making strategic choices between preserving heritage and adapting the church for usability, the amount of use of existing and new materials, and construction methods all based on the Zero Waste perspective, research will follow in an adaptive redesign of the church. This design will be evaluated through *scenarios* on possible functions that the redesign can accommodate.

Finally, in the last sub-question, the redesign is evaluated in terms of Zero Waste using the Madaster software, to determine the percentage to what extent Zero Waste is ultimately possible within the redesign of St Barbara Church. This software creates an overview of the amount of circularity of the materials used in the 3D design model and the impact these materials have on climate based on their CO₂ emissions (Madaster, 2022).

Methodology | How

The research, consists of a continuous process of understanding, analysing, testing, evaluating, and implementing. A diagram of the process between research and design is shown on the next page.



SQ 1: What does a zero-waste future mean within the building sector?

Method: Theoretical research.

Analyses of preselected literature will lead to a Zero Waste Framework, which will be the foundation to objectively conduct the case study analysis and the design process. The meaning of Zero Waste for the design and building sector is clarified through this research and by the lecture and visitation of the Zero-Waste interior design of NN HQ by Fokkema & Partners and during the studio Workshop on Circularity, by taking notes, making photos, and asking questions.

Preselected Literature:

- *De circulaire economie: waarom productie, consumptie en groei fundamenteel anders moeten*, by Schouten, (2016);
- *Cradle to Cradle* by Braungart & McDonough, (2007);
- *The Upcycle* by Braungart & McDonough, (2013);
- *Material Matters* by Rau & Oberhuber (2016);
- *Ecodesign: Ontwerpen voor een duurzame en circulaire economie* by Doorselaer & Bois (2018).

SQ 2: How is circularity implemented in new buildings?

Method: Case Studies.

Analyses of case studies of new buildings will provide an overview of circular features in the field of usability, adaptability, construction methods, material use and preservation of heritage aspects. For this analysis drawings, photos, and documentation on material usage will be used. The overview will be used to evaluate if these results are suitable for the redesign of the R.C. St. Barbara church through design. Which will result in scenarios of the redesign of the R.C. St. Barbara and what the implications are in terms of Zero Waste of these scenarios.

If certain important issues are not clear from the analyses, the method: **Interviews** will be used to ask a relevant stakeholder to clarify these issues.

Preselected newly build buildings:

- The Green House, Utrecht by cepezed;
Restaurant & meeting space.
- Triodos Bank HQ, Driebergen-Rijsenburg by RAU;
Offices.
- Floating Office Rotterdam, by Powerhouse Company.
Offices.

SQ 3: How is circularity implemented in repurposed churches?

Method: Case Studies.

Analyses based on the insights of sub-question 2 will provide an overview of circular features in the field of usability, adaptability, construction methods, material use and preservation of heritage aspects. For this analysis drawings, photos, and documentation on material usage will be used and compared with the results of sub-question 2. The overview will be used to evaluate if these results are suitable for the redesign of the R.C. St. Barbara church through

design. Which will result in scenarios of the redesign of the R.C. St. Barbara and what the implications are in terms of Zero Waste of these scenarios.

If certain important issues are not clear from the analyses, the method: **Interviews** will be used to ask a relevant stakeholder to clarify these issues.

Preselected repurposed churches:

- Repurposed Laurentius church, Weesp by Stork & Albrecht, architecten en bouwadviseurs;
Apartments, offices, yoga studio, hotel room & beer brewery.
- Hotel Heavens, Hoorn by TPAHG Architecten;
Hotel & restaurant.
- Repurposed Baumann church, Rotterdam by HOYT.
Apartments, café, and store.

SQ 4: How can the percentage of Zero Waste be maximised within a redesign of a church?

The redesign of the R.C. St. Barbara church is evaluated for the use of Zero Waste on the topic of material usage with the Madaster software. Through the three scenarios, each consisting of drawings, the amount of Zero Waste will be clarified using drawings and graphs. Which will end with an overview of to what extent Zero Waste is possible in the redesign.

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