Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Adriaan Bon
Student number	5231426

Studio		
Name / Theme	Heritage & Architecture: Zero Waste Church	
First mentor	Catherine Visser	Architecture (Heritage & Arch.)
Second mentor	Silvia Naldini	Building Technology
Trird mentor	Wido Quist	Research (Hertiage & Tech.)
Argumentation of choice of the studio	Under the following vision, the Heritage & Architecture: Zero Waste Church studio has been set up: "HA 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 preserving cultural value, how preserving 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, like a church, through a redesign with an appropriate new program fascinating. As a result, a building and its values are not lost and are given a second life. Within the studio, the 'Zero Waste' aspect of a church redesign find I interesting as this is a contemporary concept in the design and production sector, like reusing existing materials without disposing of them. The combination of redesigning heritage and preserving the existing through a Zero Waste approach intrigued me to choose this studio, as I expect that it requires innovative thinking for methods of preserving heritage and adding a new program that corresponds to the upcoming circular economy of 2050. This will challenge me to research innovative methods and verify them using my research and my redesign.	

Graduation project	
Title of the graduation project	The Preservation of a Church through Adaptation
Goal	
Location:	Markt 50, Culemborg, Netherlands
The posed problem,	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. The decrease in attendance at Roman Catholic (R.C.) churches has an impact on the number of churches in the Netherlands. Parishes are forced to sell some of their property as there is no budget to maintain all their churches. 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 decline in attendance is currently increasing the most (Hannema, 2021).. 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 (Rijksdienst voor het Cultureel Erfgoed, 2011). Especially in Culemborg, where the R.C. St. Barbarakerk will become vacant while it is a significant part of the R.C. history and the city centre. The Suitbertusparochie wants to continue using the church, it's just that the maintenance costs are too high and the attendance is too low for use of the whole church (Schaik, 2020). Because of this, a part of the heritage of Culemborg is under threat to be sold off or demolished to make space for high-end apartments at the prominent location in the heart of the city, as mentioned by the caretaker of the church. The ca 1.100m2 of the R.C. St. Barbarakerk is currently only used for ≥80 church attendees only 10 times a month, which isn't very functional. A new program at this location could be a solution to preserve the church, but by implementing adaptive features in the redesign of the church, will lead to a space that can adapt to future needs. This will significantly increase the lifespan of the building since the space will be able to change to the

	requirements of the user (Open Building. co, 2021). By implementing this, the church will evolve from single religious use to multifunctional use and be able to adapt to new functions over time. This will further increase its lifespan, it will not become waste and by doing so the heritage values of it will be able to be preserved for the future. The question is, how will this be possible and what will it look like?
research questions and	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?
design assignment in which these result.	The aim of my graduation is to design a proposal for the preservation of the R.C. St. Barbarakerk in which the space can adapt for future needs like one apartment can be split up into smaller ones or two hotel rooms or office space can adapt to become a restaurant. This will demand a facade and internal partitions that meet the requirements of these different functions, like dimensioning, daylight etcetera. Secondly, materials from the church need to be reused as much as possible (Zero Waste) and new materials need to be able to meet circular requirements. The research will be conducted on understanding the context, the circular requirements, the use of new materials and the reuse of existing materials and the requirements to make an adaptive space for multiple programs possible.

	The redesign will consist of several interventions on the existing church using adaptive construction methods and materials from the perspective of Zero Waste based on the research. The redesign will have a program existing of multiple functions which relate to each other. By doing so the dilemma between preserving heritage aspects, adaptive usability and circularity will be the main factor. The adaptability of the redesign will be made visible in two scenarios of the redesign, which will consist of variations on the program and its layout. In the end, the redesign will be asses using the Madaster software, in which the 3D model will be analyzed to determine the amount of reusability of the newly added elements to the church. This will result in a graph that will visualize the percentage of Zero Waste possibility of the church redesign.

Process

Method description

Through the research and design phase, the relationship between heritage preservation, useability and circularity will be essential for making decisions and will be used to asses choices.

Collective research is conducted to understand the cultural heritage of the R.C. St. Barbarakerk in relation to its location, surroundings, origin and the elements of which it consists. subsequently, the materials of these elements have been inventoried to gain an understanding of the overall materials which must be taken into account for the redesign. This is done by analyzing literature of the church and Culemborg, visiting the church twice and speaking to the caretaker and by analyzing the drawings to model the church digitally.

Research will be conducted on understanding circularity requirements for using materials in the redesign. Analyses of preselected literature will lead to a framework on circularity, reuse and Zero Waste. This combined with knowledge gained from the lecture on Zero Waste within the NN and the Circularity Workshop will be the foundation to objectively analyze the case studies.

The case studies will be three newly built 'circular buildings' and three redesigned multifunctional churches done in the past years within the Netherlands. Only case studies based in the Netherlands are deliberately chosen, given their conformity with the St. Barbarakerk on economic, social, and political conditions in terms of regulation and their location concerning the climate within the Netherlands. The materials in the layers: skin, structure, services and space plan of these buildings will be assessed in a matrix to determine the circularity of these case studies which

consists of lifespan, adaptability, remountability and climate impact. All these criteria are measurable and verifiable, what will be the foundation to determine the circularity of the used elements. Circularity is categorized using the R strategies based on the Circularity Workshop. The climate impact will be calculated with the GPR software, to which I have gained access to from Dr. Joana dos Santos Gonçalves. This will lead to an overview of construction methods and materials which are and which aren't suitable for the church redesign.

The functionality and the requirements of programs of the six case studies will be researched and used to design the program layout for the church redesign, which will have implications for the heritage aspects of the church. This layout will be designed using the materials and construction methods based on the literature and matrices of the six case studies.

The eventual church redesign will host a program that is suitable for the location and its surroundings. The program will be able to be changed by using adaptable construction methods for internal partitions in the space. The materials used for this will contain reused materials from the church and new circular materials from a Zero Waste perspective. The result will be next to a design, a statement that a redesigned church will be able to be preserved even after the redesign and its 50 years of use, by being adaptable for future needs. In short, a method of preserving a church and its usability.

To clarify the amount of Zero Waste of the redesign, Madaster and GPR software will be used, in which the 3D model will be analyzed to determine the amount of reusability of the newly added elements to the church. This will result in a graph that will visualize the percentage of Zero Waste possibility of the church redesign.

Literature and general practical preference

Gonçalves, J., Mateus, R., Silvestre, J. D., & Roders, A. P. (2020). Contributions to a Revised Definition of Sustainable Conservation. Heritage and the Sustainable Development Goals, (January). TU Delft.

Het ministerie van Infrastructuur en Waterstaat. (2021, October). Uitvoeringsprogramma Circulaire Economie 2021-2023. In Rijksoverheid. Retrieved October 12, 2022, from https://www.rijksoverheid.nl/onderwerpen/circulaire-economie/documenten/rapporten/2021/10/18/uitvoeringsprogramma-circulaire-economie

Hislop, M. (n.d.). De bouw van kerken en kathedralen: Geïllustreerd overzicht van de constructie van middeleeuwse bouwwerken.

Kalk, E. (n.d.). Nieuw leven voor meer gebouwen: hergebruik kan sneller en beter (1st ed.).

Lugt, P. (2017, October). Booming Bamboo: the (re)discovery of a sustainable material with endless possibilities. Material District.

Lugt, P., & Harsta, A. (2020, September). Tomorrow's Timber: Towards the next building revolution. Material District.

Madaster. (2022, September 24). Het platform Madaster | Registreer materialen en producten. Madaster. https://madaster.nl/platform/

McNamara, D. R. (2011). How to Read Churches: A Crash Course in Ecclesiastical Architecture. Amsterdam University Press.

Rana Mahanta, N., Samuel, A. K., & Sachan, D. (2021). Emerging Trends to Approaching Zero Waste [.Pdf]. Elsevier. https://doi.org/10.1016/B978-0-323-85403-0.00014-1

Rau, T., & Oberhuber, S. (2016, December). Material matters: hoe wij onze relatie met de aarde kunnen veranderen (1st ed.). Bertram + de Leeuw Uitgevers Bv.

Schouten, S. (2016). De circulaire economie: waarom productie, consumptie en groei fundamenteel anders moeten (1st ed.). Leesmagazijn.

United Nations. (2015). Transforming our world: the 2030 Agenda for Sustainable

Development. A/RES/70/1.

Vandenbroucke, K. (2020, July). Mag dit weg: Methodiek voor herbestemming (1st ed.). Macmillan Publishers.

Sources mentioned in The posed problem:

Centraal Bureau voor de Statistiek. (2020, December 18). Meerderheid Nederlandse bevolking behoort niet tot religieuze groep. Centraal Bureau Voor De Statistiek. Retrieved October 23, 2022, from https://www.cbs.nl/nl-nl/nieuws/2020/51/meerderheid-nederlandse-bevolking-behoort-niet-tot-religieuze-groep

Gemeente Culemborg. (2022). Horeca Culemborg Praktisch handboek.In Culemborg (Versie 1.1). Retrieved November 9, 2022, fromhttps://www.culemborg.nl/file/21765/download

Hannema, K. (2021, January 14). De herbestemming van leegstaande kerken: van ultieme pauzeplek tot multifunctionele ruïne. De Volkskrant. https://www.volkskrant.nl/cultuur-media/de-herbestemming-van-leegstaande-kerken-van-ultieme-pauzeplek-tot-multifunctionele-ruine~bcd559a6/

Open Building. co. (2021). Manifesto. Open Building. Retrieved October 3, 2022, from https://www.openbuilding.co/manifesto

Rijksdienst voor het Cultureel Erfgoed. (2011, January 1). Een Toekomst Voor Kerken: Handreiking voor het herbestemmen van vrijkomende kerkgebouwen. In Cultureel Erfgoed. Retrieved October 7, 2022, from https://www.cultureelerfgoed.nl/publicaties/publicaties/2011/01/01/een-toekomst-voor-kerken-een-handreiking-voor-het-herbestemmen-van-vrijkomende-kerkgebouwen#:~:text=hier%3A%20Home%20Publicaties-,Een%20toekomst%20voor%20kerken%3B%20een%20handreiking%20voor%20het%20herbestemmen%20van,monumentale%20karakter%20aan%20te%20tasten

Schaik, B. (2020, July 27). Binnen twee jaar is deze kerk in Culemborg (mét achterstallig onderhoud) te koop. gelderlander.nl. Retrieved October 1, 2022, from https://www.gelderlander.nl/culemborg/binnen-twee-jaar-is-deze-kerk-in-culemborg-met-achterstallig-onderhoud-te-koop~a3f7a8b2/

van der Waal, J., de Kroon, T., & Kusters, D. (2022). Samen aan de slag, bestuursakkoord 2022-2026. In Culemborg. Gemeente Culemborg. Retrieved November 9, 2022, from https://www.culemborg.nl/file/25416/download

Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

My approach to the relationship between heritage preservation, useability and circularity which will be essential for making decisions and will be used to asses

choices, largely relates to the Heritage, Architecture and Technology core. The aim of my graduation design research is strongly connected to the 'Zero Waste' topic of the studio since my approach is to reuse as much of the existing materials of the church. This will not only preserve the materials and the appearance of the church but also preserve the initial design by the architect and the manufacturing and craft. Only circular materials will be used next to the existing amount. Secondly, the implementation of an adaptable layout of the space will lead to no waste of the space in general since it will be able to adapt to the future needs of users which significantly increases the lifespan of the church even further. In the end, the materials of the church and the function both will be circular, since they are able to stay in the loop of usage Because of this, my research will contribute to the vision of HA.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework?

The result of my graduation design research will visualize how a church can be redesigned into a new multifunctional space in which cultural heritage is preserved, the usability of the space is increased and how materials from a Zero Waste perspective can be applied as much as possible. How the space will be able to adapt to future needs and, will by this, be able to be preserved in a Zero Waste manner will be made clear in drawings of the design and of possible scenarios of it. The design will consist of applied materials and construction methods that make this adaptability possible. In short, my research contributes to the image of how a church can be redesigned in the era of the circular economy in the year 2050 and how it will be able to be preserved through its adaptable program: preservation through adaptation.