# RETHINKING THE DANISH MEDIEVAL VILLAGE CHURCH

MASTER THESIS 2025

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# ABSTRACT

This thesis aims to rethink the Danish medieval village church and investigate the possibilities of adaptive reuse to secure their future use. There is a present issue that lies within a declining use of the rural village churches. At the same time, there is a rising interest in initiating more diverse use of the medieval village churches. However, the medieval churches are under strict conservation legislations that prevents physical changes, as they are a significant part of the Danish cultural heritage.

This raised the research question of the thesis: *How can a Danish medieval village church adapt to embrace contemporary and future needs to ensure its relevance in modern rural society, where active conservation strategies can accommodate more diverse use while respecting its historical and religious significance and character?*

Through a thorough architectural and cultural analysis of the Danish medieval church's history and the building typology, the basilica, a *framework for the possibilities of adaptations to medieval village churches* are developed. This is created based on the methodology of Rob Roggema's *Research by Design*, and sub methods *Framework for the Field of Opportunities* in relation to the medieval village church by Maj Bjerre Dalsgaard, Søren Vadstrup's *Analysis and Value Assesment of Buildings*, and Johannes Exner's *Four Keys*.

A design proposal of an adaptation of a medieval village church, is created through a chosen case, Borum Church. This aims to show, how a general framework and design principles can be conducted on a specific case. This thesis design case present, how adapting the medieval church based on the basilica typology enables opportunities for new use and physical changes. An adaptation of the church can be done while respecting its special character, heterotopia and historical value. However, as the medieval church, in general, is a protected building, this thesis attempts to respect the conservation with active conservation strategies to ensure its place and function in future society.

Ill. 1: Borum Cementry. Private photo.

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# INTRODUCTION

The Danish society is historically a rural country, but over the last century there have been a shift in the distribution of the population as the result of urbanisation. Only 18 percent of the Danish population live in rural societies with under 1000 inhabitants (Danmarks Statistik, 2023). The population has gone from mainly living in rural areas to now living in the bigger cities. This shift has had its effect on the rural villages and the medieval village churches located in these villages. The churches are a part of the Danish national cultural heritage and are therefore protected by law.

The parishes and their councils are solely responsible for the maintenance of the churches and with a budget they must keep it intact. In some rural villages these churches might be the last place for people to gather. However, it is a challenge to keep them going as the demographics and demands of the community are much narrower in the countryside (Dalsgaard, 2021). Even if there are other gathering places, there is still a demand for the village churches to adapt to more contemporary needs and functions.

If the churches where to close, it will have a drastic effect on the communal life of these rural societies. It will also leave a significant impact on Danish cultural heritage. With approximately 2400 churches in Denmark and around 2/3 of them being medieval churches in the countryside, is it important to secure these historical buildings and keep them in use as they are an important part of Danish cultural history.

This thesis will be investigating a theoretical framework that focuses on working both culturally and tectonically with historical buildings and exploring the potential for adaptation of the church building as a typology. The thesis is based on the research knowledge from Maj Bjerre Dalsgaard's PhD dissertation: *The Medieval Village Church – architecture, perspectives and transformation*[1] (Dalsgaard, 2021).

The focus of the thesis is to rethink and adapt a specific medieval church with intention to secure its future as cultural heritage and as an active building in the rural community, introducring functions without compromising the exsisting functioning church. The theories and methods will be applied to a medieval village church in Borum, Aarhus, where the vision is to investigate the position and possibilities of adapting the Danish medieval churches to fit a contemporary society, to protect their future status and use.

1 *Den Middelalderlige Landsbykirke - arkitektur, perspektiver og transformation.*

Research Question

**How can a Danish medieval village church adapt to embrace contemporary and future needs to ensure its relevance in modern rural society, where active conservation strategies can accommodate more diverse use while respecting its historical and religious significance and character?**

# METHODOLOGICAL FRAMEWORK

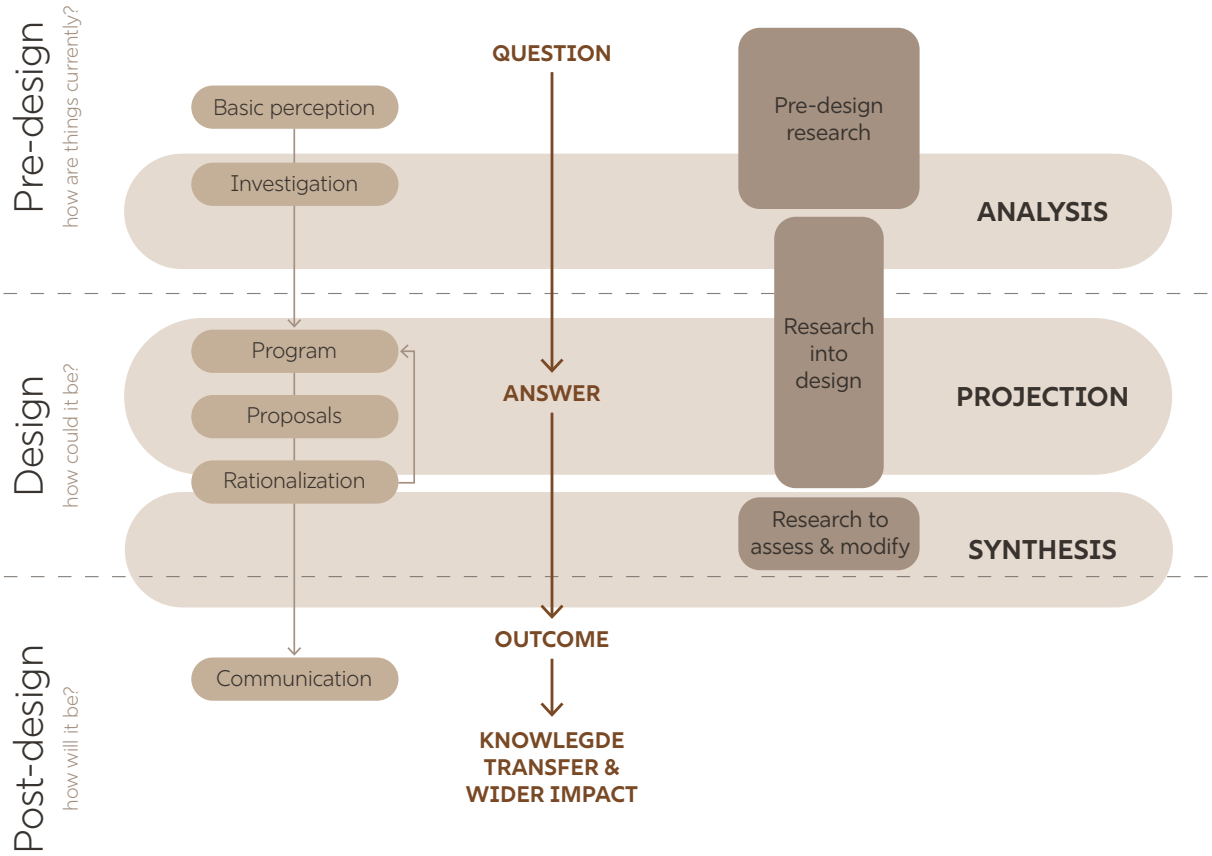
## Research by Design

The project's purpose is to rethink an existing cultural-historical building: the Danish medieval village church. This requires an interdisciplinary approach that integrates historical, spatial, technical, and social dimensions into a holistic design solution. Following Aalborg University's Problem Based Learning (PBL) methodology (Aalborg University, 2025), the thesis combines architectural and engineering perspectives with a problem-based approach.

In line with the PBL approach, this thesis applies *Research by Design* (Roggema, 2017) as the methodological framework to explore how spacial design can respond to the challenges and potentials of the Danish medieval village church. According to Roggema, *Research by Design* is a methodology that uses the design process as a tool to investigate spatial solutions to complex problems while producing new insights of value to a wider audience. The methodology is particularly suitable in situations with no straightforward solution, and with cultural, physical, and societal complexity which is the case with historic churches in a contemporary context. (Roggema, 2017)

Roggema reviewed various definitions of *Research by Design* and developed a unified model. He has divided it in three overlapping phases: pre-design, design, and post-design. Within each phase, researching and designing are interwoven to generate both new knowledge and design solutions to the initial problem. He synthesises multiple existing terms and integrates these in a summarising figure. (Roggema, 2017)

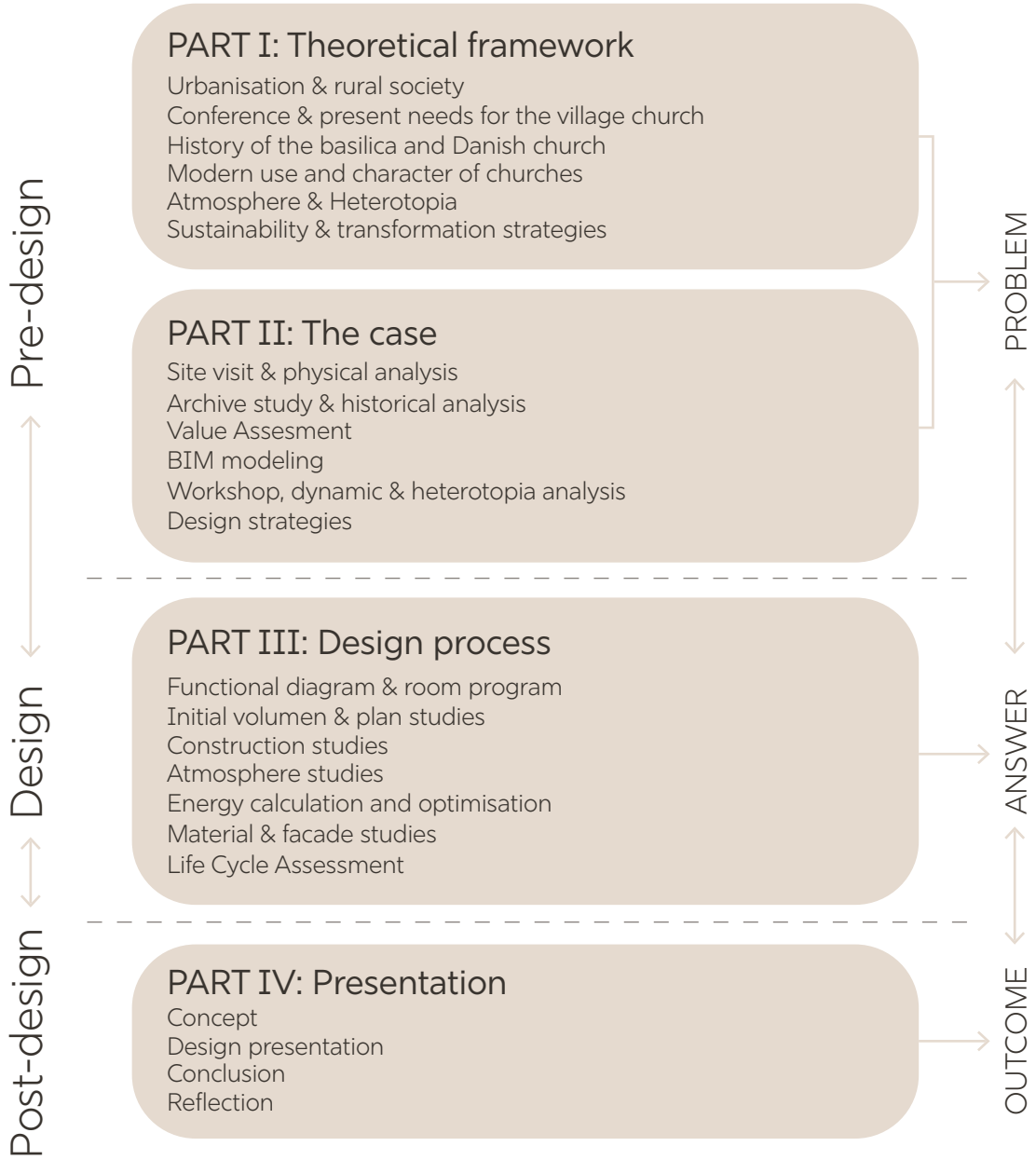
To ensure a successful research process and outcome, Roggema stresses the importance of beginning the project with a challenge, encouraging participants to develop innovative design solutions, and not follow the three phases in a continuous order but allow the process to be iterative. (Roggema, 2017)




Ill. 2: Research by Design Methodology. Own illustration based on (Roggema, 2017 p. 8)

## Methodology applied to the thesis

The design process of the thesis has been iterative and explorative. But to provide overview, the thesis is divided into *Research by Design*'s three phases (Roggema, 2017); pre-design, design, and post-design. The content of each phase is:




Ill. 3: The process of the theis. Own illustration based on the Research by Design Methodology (Roggema, 2017).

# SUB METHODS

## Framework for Field of Possiblities

This thesis builds upon the research conducted by architect Maj Bjerre Dalsgaard in her dissertation *The medieval village church – architecture, perspectives and transformation.*[1] (Dalsgaard, 2021).

Dalsgaard has researched the topic of medieval village churches with the intention of gaining knowledge, formulating strategies, and defining a field of possibilities for transformation of churches that can contribute to future development of the medieval village churches. The main conclusion is the necessity of a process model to guide transformation processes of medieval village churches. The primary outcome of her research is the development of the *Framework for the Field of Opportunities*, which is intendent to be applied individually to each church and its surrounding village. (Dalsgaard, 2021)

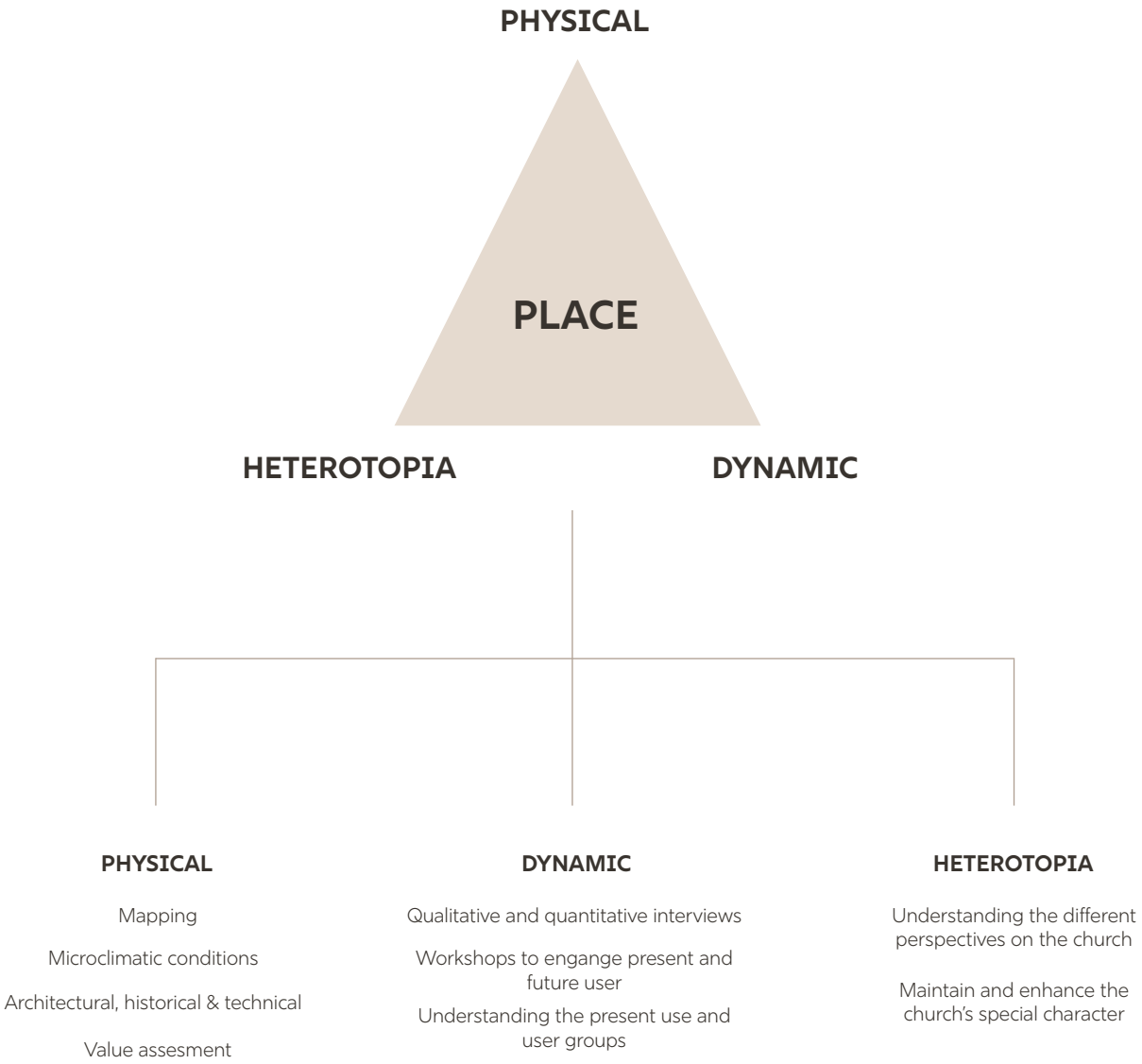
Dalsgaard's framework is based on the spatial theoretical tripartition by the human geographer Edward Relph, one of the first to determine that space and place can be investigated (Dalsgaard, 2021). Building on Relph's definition, Dalsgaard has developed her methodological framework, applicable to the transformation process of each individual church. It contains three parameters:

**Physical**
Involves gaining knowledge on the specific church's architectural and historical development through analysis of the church and mapping of the surroundings. It also includes value assessment of the church's architecture and inventory, as well as identifying sensitive areas within the building or its context. (Dalsgaard, 2021)

**Dynamic**
This parameter focuses on a more detailed analysis of the specific church and parish's social capabilities such as the resources, potentials, network, activities, and user groups. It explores the church's current social role and its position within the local community. (Dalsgaard, 2021)

**Heterotopia**
The final parameter is the concept of heterotopia, originally defined by French philosopher Michel Foucault to describe spaces that exists outside of the norms of everyday society (Foucault, 1967). In this context, it involves gaining knowledge and respecting the different perspectives and views on the church. When transforming a church, one need to ensure the church's heterotopic characteristics and qualities as a place that deviates from everyday space. (Dalsgaard, 2021)

*1 Den Middelalderlige Landsbykirke - arkitektur, perspektiver og transformation.*




Ill. 4: Own illustration based on illustration by Maj Bjerre Dalsgaard (Dalsgaard, 2021 p. 313).

This thesis applies the dissertation's methodological framework and its strategies during the analysis and initial design phases. The analyses and investigations result in a design proposal for the adaptation of a specific medieval village church to remain relevant in its rural society.

# Analysis and Value Assessment of buildings

The restoration architect, researcher, and lecturer Søren Vadstrup is the author and illustrator of numerous books and research projects about maintenance, renovation, and transformation of historic buildings (*Om Søren Vadstrup*, 2025). In his research project from 2018, Vadstrup has developed a method for analyzing and assessing the value of buildings, settlements, and urban spaces worth of preservation (Vadstrup, 2018). Subsequently, he has published serval shorter guides on how to analyse and value assess buildings, settlements/cities/urban spaces, harbours and villages respectively (*By- og bygnings-undersøgelser*, 2025).

In the guide *Analysis and Value Assessment of BUILDINGS and their surroundings*[1] (Vadstrup, 2022), Vadstrup presents the method succinctly. The method can be used to carry out a site-specific restoration or transformation of an existing building with cultural heritage that is worth preserving. (Vadstrup, 2018) Firstly, he identifies three key rules for restoring or transforming existing historic buildings as: **1.** Adapted to the place, **2.** Choice of materials, and **3.** Authenticity, atmosphere and soul.

The purpose of the Analysis and Value Assessment Method is to gain knowledge, an overview and sympathetic insights in: **why** the building is special, **where** its most significant architectural and technical strengths and weaknesses lies, **what** the underlying conservation values are, and **how** the building should be treated to maintain or restore the underlying conservation values and the site-specific character. (Vadstrup, 2018)

The method is divided into five parts as seen in the box on the right. The analysis must be conducted on site at the assessed building following the chronological order from part 1 to part 5. Part 1-3 should be objective, free from personal opinions, and built upon each other to provide a more comprehensive understanding of the building. Part 4 is the concluding section where the architect can offer professional recommendations for the building based on the preceding analysis and value assessment. Part 5 outlines principles for all interventions in historic buildings defined by Vadstrup. Additional principles can be added if neccessary. The analysis and value assessment result in a report that follows the structure of the method.

In this thesis, Vadstrup's method and analytical procedure serve as the foundation for the analysis of an existing church and its surrounding society. Likewise, the presentation of the analysis follows the structure of the five parts in the method.

1 *Analyse- og Værdisætning af BYGNINGER og deres omgivelser*

**1: IDENTIFICATION**

**2: ANALYSIS**

**Historical analysis:** Architectural and building antiquarian analysis, Cultural historical analysis and Intangible assets

**Technical analysis:** Technical condition, Energy condition, Durability and Sustainability

**Architectural analysis:** The body, Interiors and Surroundings of the building

**3: VALUE ASSESMENT**

**4: RECOMMENDATIONS**

**Repair:** Inalienable structures, spaces and building elements that should be preserved, maintained and repaired

**Subtraction:** Unsightly structures, spaces and building elements that can be removed

**Reconstruction:** Removed or replaced structures, spaces and building elements that can be reconstructed

**Transformation:** Structures, spaces and building elements that can be transformed

**Addition:** New structures, spaces and building elements that can be added

**5: GOALS AND PRINCIPLES FOR ALL INTERVENTIONS**

1. All interventions, small or large, must be based on a methodical analysis and valuation.

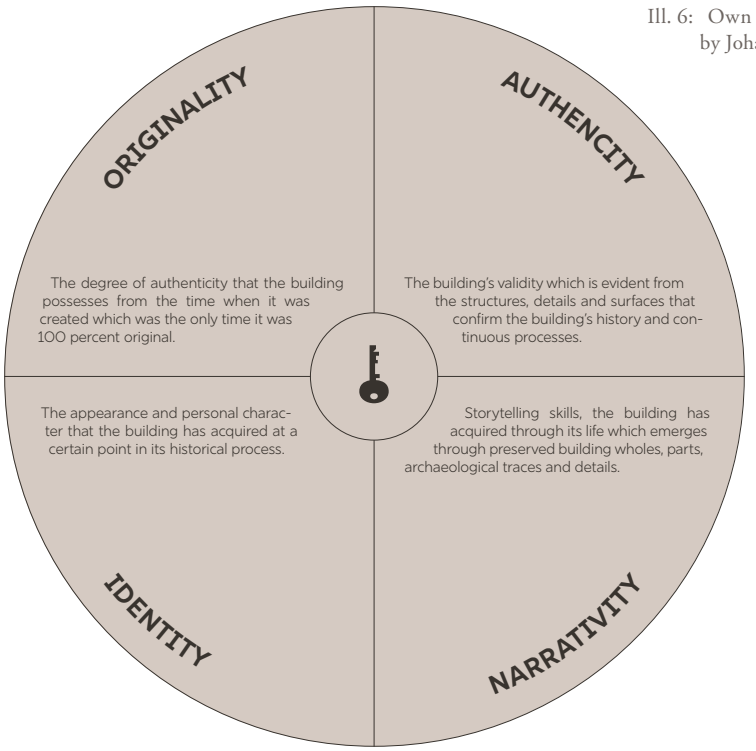
2. Preserve as much as possible of the original materials, elements and structures.

3. New materials and elements must respect and harmonize with the existing ones.

4. Use the classic building materials, constructions and craftsmanship methods that suit the house.

5. Preserve or recreate the architectural integrity of the building – both overall, in detail and in relation to the surroundings.

Ill. 5: Own illustration of *Analysis and Value Assessment* by Søren Vadstrup (Vadstrup, 2018)




Ill. 6: Own illustration of *The four keys* by Johannes Exner (Exner, 2007)

# The Four Keys

In the article *The historical building's life and death*[1], the architect Johannes Exner explains his methodology for value assessment of buildings as *The Four Keys*. It consists of four aspects defined as: Originality, Authenticity, Identity and Narrativity of a building. The keys can be used to analyse and assess an existing historical building and as an evaluation tool after a restoration or other intervention, to assess the historical value of the building after interventions. (Exner, 2007)

He presents the problem of different people's perspective of the same building. Where people will have different subjective opinions of the building and will settle for that. The keys are objective tools that can be a method to make a more precise perception of the building's historical values. The keys appeal to a greater understanding, immersion, and respect for the historical buildings. (Exner, 2007)

Exner points out the **originality** of a building as the materials used when it was built. The originality is always in situ, meaning in its original placement, and it is the only thing which documents the building's actual originality. If the materials have been moved or replaced by a reproduction, the buildings originality has been compromised. It is almost impossible to avoid an exchange in the originality because of use, tear, and maintenance of the building, why it is important to maintain the original substance to ensure the originality and authenticity. (Exner, 2007)

Exner explains the **authenticity** as the importance of keeping historic traces in a building. The authenticity of a building lies in visible architectural elements, details, facades, and the building archeology. The details of historical wear in the building are also proof of the buildings age and historical value. It is important not to make an old building look like a new one or a reconstruction. (Exner, 2007)

Exner explains that the **identity** of a building is its appearance. A historic building most likely has changed identity several times. A buildings appearance can change and have changed with a shift in ownership or a change in the buildings use. Exner points out that it is the architect's great responsibility, when making new additions to historical buildings, to make changes with sensibility to the original substance. (Exner, 2007)

**Narrativity** refers to the building having its own narrative value or readability. The building itself tells a story based on its elements and authenticity, and it becomes a narrator of its own story that the people actively can react to, and in that way engage in the building's history. (Exner, 2007)

In this thesis, Exner's method of *The Four Keys* is used as a value assesment tool to supplement Vadstrup's method of analysing and value assessment of a specific church.

1 *Den historiske bygnings væren på liv og død*

Pre-design

# PART I

Ill. 7: Borum Church. Private photo.

# Theoretical framework

# URBANISATION AND RURAL SOCIETY

The focus of the thesis being village churches located in rural societies, makes it necessary to understand the moving patterns in the population from when the first Christian churches was built to modern times. Therefore, the following part describes the urbanisation in Denmark and the challenges and opportunities of the present rural societies in relation to the National Church.

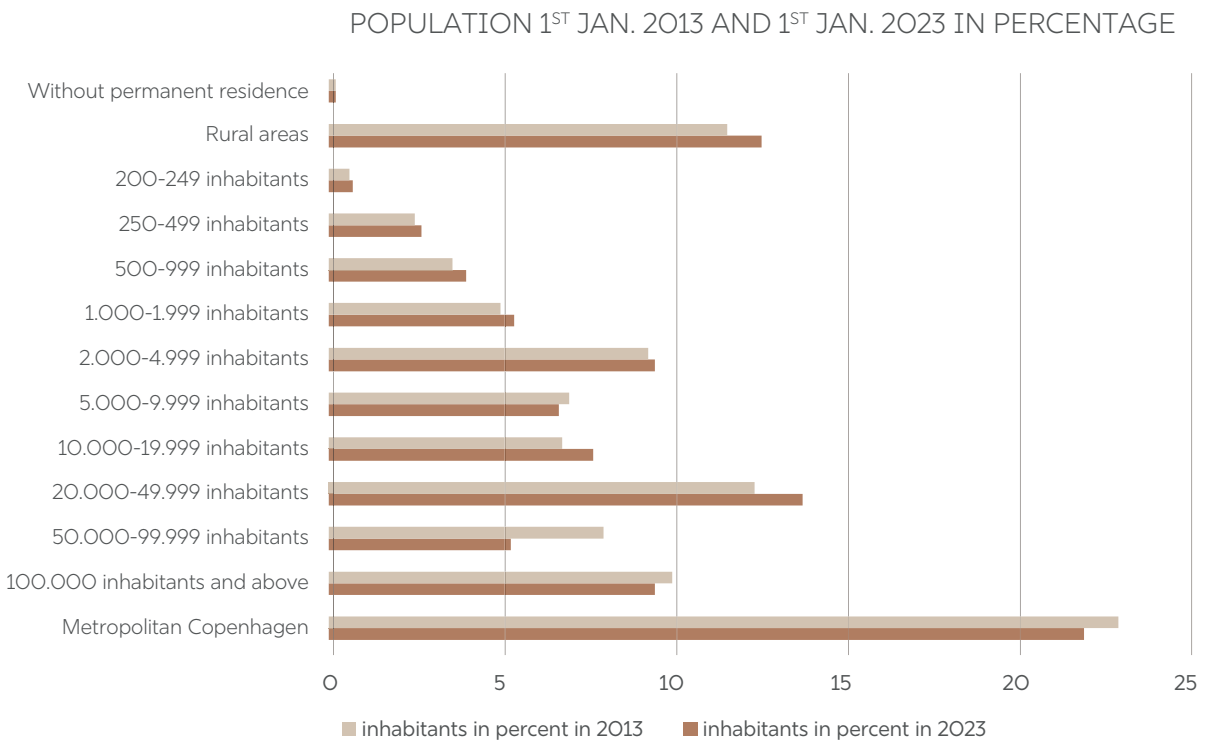
**Urbanisation**

The urbanisation in Denmark meant that people migrated from the rural areas to the cities. In 1814 only 20% of the Danish citizens where living in the bigger cities. This number rose to 49% in 1914. The increasing population growth, from 800,000 in 1800 to 2.7 million people in 1910, caused a surplus of people in rural areas who were unable to find work. At the same time, new inventions such as the automobile and steam power had a major impact on society, turning it from an agricultural to an industrial society. The infrastructure network: roads, railways, ports, and communication inventions such as the telegraph and post made migration to the cities and new businesses possible. (Jørgensen, 2020)

In rural areas, agriculture, and animal production remain the primary vocation and source of income. The demand for more production increases as the population grows and new crops and animal production are introduced. Production continues to evolve and become more efficient with new inventions and technologies. (Jørgensen, 2020)

In industrial society, people are replaced by machines in the primary sector. This changes the function of rural villages. Society becomes centralised. People living in rural areas now commute to work and educational institutions in cities. (Gaarden, 2022) In the 1960s, society again evolved to become a service and knowledge society (Johansen, 2024).

From 1914 to 2021, the Danish population increased from 3,27 to 5,84 million people. Some of the most recent statistics from 2023 on where people live indicate that 23% live in the capital, around 30% live in cities with over 20 000 inhabitants and around 29% live in towns between 1000 and 20 000 inhabitants. Only around 7% of the Danish population live in small villages with less than 1000 inhabitants and around 12% live in rural areas. (Danmarks Statistik, 2023)




Ill. 8: Population of 1st jan. 2013 and 1st jan. 2023 in percentage. Own illustration based on data from (Danmarks Statistik, 2023).

**Rural Society**

Rural areas face several problems as the population in these areas declines. Schools, shops, and leisure facilities close or have no basis to start due to few inhabitants, and workplaces are moving to the cities. (Alstrup, 2020) This results in less community and meeting places for the residents living in rural areas (Kirkefondet, 2016), which forces people to commute to larger cities for everyday errands, creating less attachment to local places and people (Garden, 2022).

On the other hand, multiple studies show that that life satisfaction and subjective well-being is in general higher for people living in rural areas than in urban areas (the 5 largest cities in Denmark) (Sørensen, 2024) (Johansen et al., 2023). Sørensen states that economic differences do not have a significant impact on the feeling of life satisfaction. Instead, the social connections and access to nature in rural areas have a large impact. (Sørensen, 2024) Likewise, in rural areas people feel a lower level of experienced stress and a higher level of feeling of meaning of life. The only significant higher score for subjective well-being in urban areas was the possibilities for spare time activities. (Johansen et al., 2023)

Another positive impact on individuals' quality of life in rural areas is people's participation in civil society. In rural areas, voluntary organisations are more important for inclusion than in cities. The following three points summarise why it is rewarding for people to participate in voluntary organisations:

- To contribute to creating activities for others, so that it is also possible to have a diverse leisure life in a rural setting.
- To contribute to civil society.
- To be a part of the 'struggle' that makes it possible to continue to run a civil society in rural areas despite urbanisation.

(Johansen et al., 2023)

**"Rural communities that build places together for sustained community well-being and quality of life are competent and energetic, reaching out to wider society in relational built structures. They are aware of local amenities in the form of heritage and nature; they look for place-based solutions to problems caused by general urban–rural development and centralisation policies; they are able to develop large, complex spatial innovation projects. While the general development of peripheral rural areas does not seem to be at a turning point, and general rural policies demonstrate little efficiency, these community-driven projects give hope for the future of communities in Denmark's rural periphery."**

(Johansen et al., 2023 pp. 154-155)

Johansen et al. also states that in smaller villages in rural areas "... meeting places are important for the quality of life in rural areas" (Johansen et al., 2023 pp. 459-460). They characterise different types of meetings as: meetings with different people (known and unknown) and meetings with nature. These meeting places are important both psychologically and socially for the individual and the society. (Johansen et al., 2023)

Therefore, it is meaningful to preserve and enhance the quality and quantity of meeting places, especially leisure activities. This increases the possibility of social interactions in rural areas, which can improve life satisfaction for the population. At the same time, the affiliation for places in rural areas can preserve important cultural and architectural historical sites.

- Include the inhabitants in participatory processes to enhance their involvement and afflation.
- Preserve and enhance the quality and quantity of meeting places in rural areas.
- Provide more and better leisure activities in the rural areas.

# THE CHURCH'S ROLE IN CONTEMPORARY SOCIETY

In the years 1100 to 1200, when the majority of churches in Denmark was built, 80% of the Danish population were living in rural areas (Gaarden, 2022). In 2014, 54% of the Danish National Churches were located in the 2180 rural parishes and only 13% of the population were living in rural parishes (Rasmussen & Thomsen, 2015). Traditionally, many smaller villages arose from places with a church (Gaarden, 2022). The church was the main meeting place where there have not been markets (Kirkefondet, 2016). However, urbanisation and the changes in contemporary society has left many medieval village churches as a historical building instead of an active meeting places in the rural villages. Today it is the oldest, most significant and beautiful building in most villages and rural landscapes. (Dalsgaard in Jørgensen et al., 2021)

The percentage of members of the National Church of Denmark has declined from around 90% of the population in 1990 to around 70% in 2025. For people of Danish origin, the percentage of members is 83% in 2025. In general, the percentage of members is higher in rural parishes[1]. (*Folkekirkens medlemstal*, 2025) One of the reasons for that, is that many people with other denominations lives in the cities (*Religiøsitet og forholdet til folkekirken 2020*, 2023).

*1 Parishes with under 1000 inhabitants in the largest village of the parish (Rasmussen & Thomsen, 2015)*

The rural parishes are located in all parts of Denmark with the exception of very few in the dioceses of Helsingør and Copenhagen (Rasmussen, & Thomsen, 2015).

The churches' economy are based on the church tax which is determined in each municipality. On average, the church tax for all tax payers in 2025 is 0,64% and 0,87% for church tax payers (Skatteministeriet, 2024). Even though the membership percentance is higher in rural parishes, the few parishioners compared to urban parishes provide less basis for church tax and consequently a poorer economy for the rural parishes (By-, Land-, og Kirkeministeriet, 2025). This creates problems for parish councils in being able to financially handle maintenance, operation and organise activities for the church. It creates an economic imbalance between the rich urban parishes and the poor rural parishes. (Gaarden, 2022)

Although the percentage of members of the Danish National Church are declining, a survey made in 2025 states that 64% of the Danish population believe that the National Church is important or very important for society. In the same survey, 71% of the Danish population have been in contact with the National Church during 2024, around 78% of members and 51% of non-members of the national church. People have also stated how they have used the church during 2024 (*Folket og Folkekirken 2025*, 2025)

| The population's contact with the National Church | 2024 |
|---|---|
| Baptism, confirmation, wedding, funeral | 45% |
| Visit to the cemetery other than for a funeral | 30% |
| Christmas service | 17% |
| Concerts, lectures or other cultural events | 16% |
| Visiting the church for a quiet moment outside of a church service or concert | 9% |
| Sunday service | 11% |
| Activities for children, young people or the elderly | 6% |
| Other forms of church service, e.g. night church, meditation service, or special service | 6% |
| Choir in the church, adult, youth and/or children's choir | 6% |
| Voluntary church work, e.g. as part of the parish council or as a helper at events arranged by the church | 2% |
| Personal conversation with a priest or other employee at the church | 3% |
| Other | 3% |
| Have not been in contact with the national church in the last 12 months | 29% |

Ill. 9: The population's contact with the National Church in 2024. Own illustration based on (*Folket og Folkekirken 2025*, 2025).

**68% of the Danish population believe that the Danish National Church plays a positive role in the local area.**

(*Folket og Folkekirken 2025*, 2025)

Churches located in rural areas tend to have a larger affiliation for the citizens than in urban areas, because the citizens in rural areas have a personal bond to 'their church'. And there is a higher feeling of community in the churches located in rural areas. (Gaarden, 2022) One of the main opinions in the rural areas is that the churches should be preserved and used by the residents (Rasmussen & Thomsen, 2015). The churches have several potentials and possible responsibilities to remain present and contribute to modern rural society:

Firstly, a potential to contribute to the social life, quality of life, and well-being for the citizens by expanding the use of the church. It has resources to offer the rural society, mainly the church building itself as a meeting place or place for the individual. If the priest, parish council and other local organisations collaborate, it enhances the social life and community feeling in the rural villages and the church becomes more present in modern society. (Alstrup, 2020)

Secondly, the churches have a special character, atmosphere and history unlike any other architecture in Denmark. They have a significant role in the Danish landscape and society, that is essential to preserve. (Exner in Jørgensen et al., 2021) The churches in rural areas are unique resources to enhance the social life and well-being of the citizens in the rural areas and villages (Dalsgaard in Jørgensen et al., 2021).

The churches in rural areas are unique resources to enhance the social life and well-being of the citizens in the rural areas and villages (Dalsgaard in Jørgensen et al., 2021). But the churches need to evolve with modern society's development and demands if churches should be able to utilise their unrealised potential to remain present and contribute to modern rural society.

Ill. 10: Possible future use of the church. Own illustration based on Appendix 02 & Appendix 03.

# FUTURE ROLE OF THE VILLAGE CHURCH

A national conference with the theme 'The future role of the village church' was held on March 6th, 2025. Around 350 people with an interest in the church's future role in rural villages participated in the conference. Multiple lectures, debates, and workshops were held by many prominent people with relation to the Danish National Church.

Maj Bjerre Dalsgaard held a workshop with the headline: *How do we open the door to the church space for more use in the future?*[1] with the focus on what it is acceptable to do in a functioning church. Random groups of different participants discussed possible future activities and functions. All ideas were written on a poster. In the end, all posters were collected and the proposals for new activities or functions were discussed in plenum. (Appendix 02)

1 *Hvordan åbner vi døren til kirkens rum for mere brug i fremtiden?*

At the workshop and conference, there was a broad consensus that the village church need to evolve with the modern rural society. The church needs to collaborate with other local organisations to utilise the unfolded potential in the historical building often located in the center of the rural villages.

Some of the ideas that the majority of people agreed on as acceptable activities or functions in an active church room are seen on page 20.

- Collaboration between the church and other organisations in rural areas to enhance the quality of life for the citizens.
- Utilise the church's potential of enhancing social life and well-being for the citizens in the rural areas by evolving with modern society by offering more activities and rethinking the church room.

Ill. 11: National conference. Photo by: Rikke Lykkebo (Norddahl og co, 2025). Appendix 09, email B.

*FIRST DANISH CHRISTIAN CHURCH, RIBE*
*Approx. 860*

*ROSKILDE CATHEDRAL*
*1200 - 1280*

***REFORMATION***

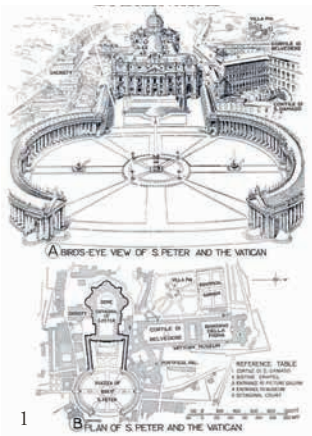
***ROMAN CATHOLICISM IN DENMARK***
*965*

***LUTHERAN PROTESTANTISM IN DENMARK***
*1536*

**0** **500** **1000** **1200** **1500** **1600**

ANTIQUITY VIKING AGE ROMANESQUE GOTHIC RENAISSANCE

*Approx. 300*
*FIRST CHRISTIAN CHURCH: BASILICA OF SAINT PETER, ROME*




*965 - 1100*
*JELLING CHURCH*

*1170 - 1200*
*VIBORG CATHEDRAL*

*1619*
*THE HOLMEN CHURCH*

Ill. 12: Timeline of the history of Christanity and churches in Denmark. Own illustration with pictures attributions in illustration list.

*FREDERIK'S CHURCH*
*(THE MARBLE CHURCH)*
*1749 - 1894*

*GRUNDTVIG'S CHURCH*
*1921 - 1940*

*ISLEV CHURCH*
*1970*

***'THE DANISH NATIONAL CHURCH'***

***CHURCH TAX***
*1920*

***THE CONSTITUTION OF DENMARK***
*1849*

**1700** **1800** **1900** **1950** **2000** **AD**

BAROQUE ROCOCO CLASSICISM HISTORICISM MODERNISM POST-MODERNISM

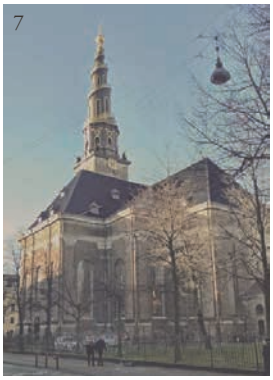
*1912*
***PARISH COUNSILS MANGE FINANCES AND CHURCH BUILDINGS***

*1771*
***FIRST PRESERVATIONAL ACT IN DENMARK***

*1918*
***THE BUILDING CONSERVATION ACT***

*2024*
*HØJVANGEN CHURCH*

*1682 - 1752*
*CHURCH OF OUR SAVIOUR, COPENHAGEN*




*1976*
*BAGSVÆRD CHURCH*

# THE BASILICA

**"The basilica is an architectural form designed to bring the worshipper to the sanctuary, the Christian equivalent of the "holy of holies", not immediately upon entering the building, but after a significant journey."**

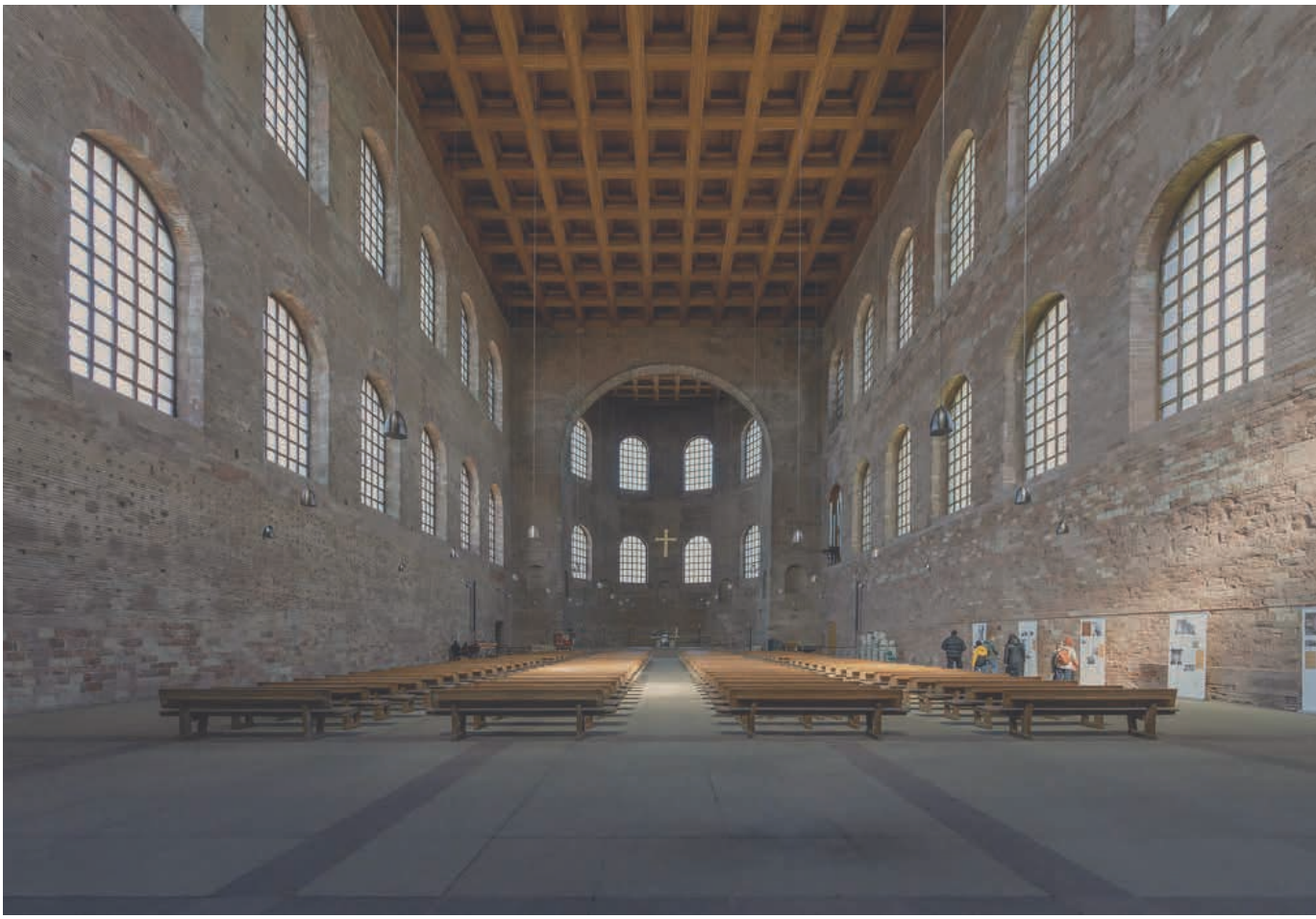
(Kilde, 2008, p. 48)

The typology of the Danish village church is deeply rooted in early Christian architectural traditions, particularly the basilica. The early Christian basilica served as a foundational typology for ecclesiastical architecture, establishing spatial hierarchies that reinforced liturgical practices. However, before the basilica became the foundational structure for Christian churches, it was in fact not a sacred, religious building. Instead, it was a public building type with various different purposes. (Kilde, 2008)

The term basilica originates from the Roman era and was used for buildings, which structures contained large halls where public gatherings, markets, and legal proceedings took place. It is a term used for the function of the building; it was therefore also used for a variety of building types. However, they were often a particular building type: an oblong or rectangular building with a semicircular apse that contains a platform where speaker or emperors stood. (Kilde, 2008)

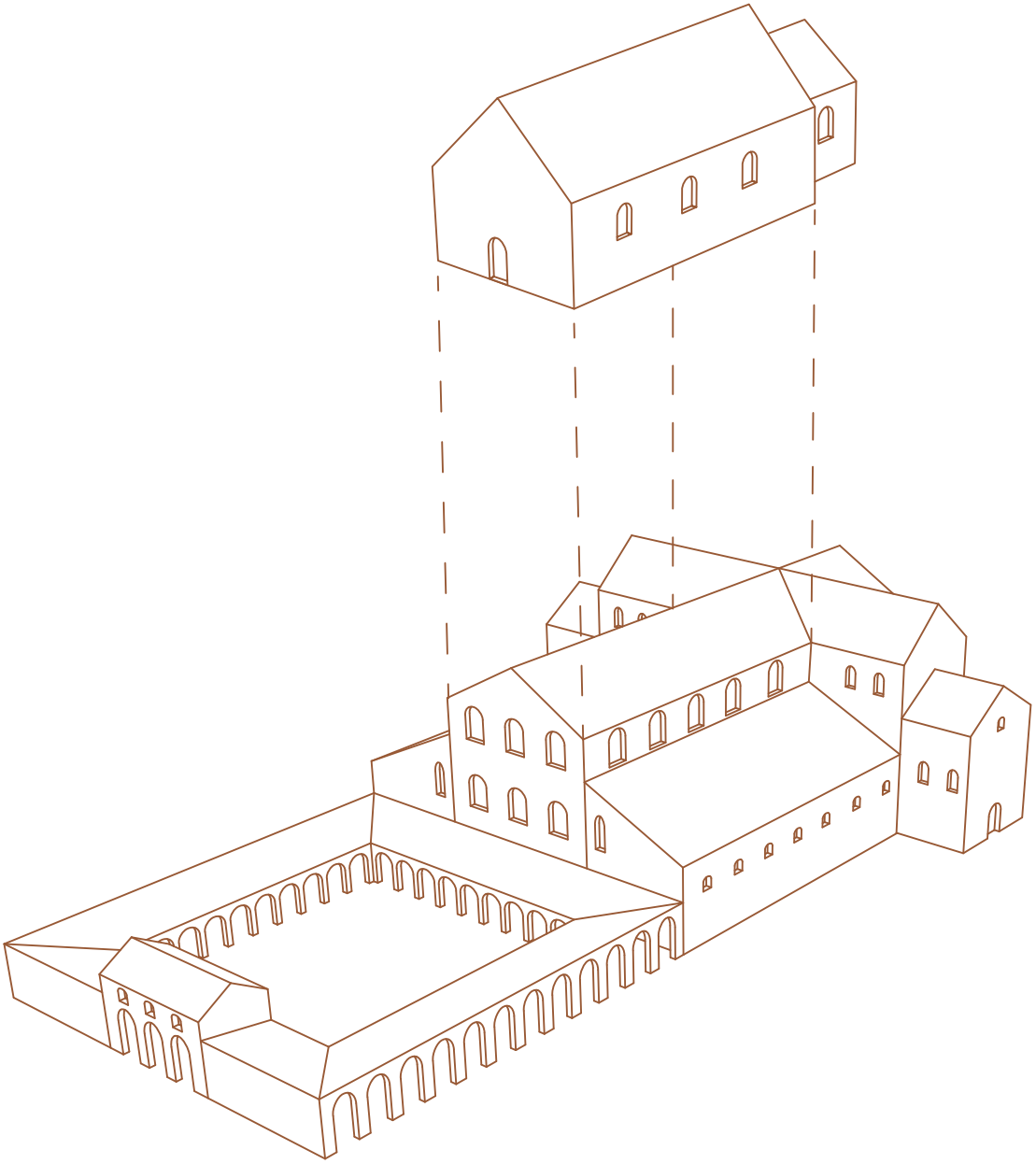
The basilica can be defined as a typology. It has recognisable characteristics that can be found on almost all Christian churches. The building type known as a basilica is characterised by its rectangular plan, which was constructed to signal the imperial and religious significance of these buildings (Kilde, 2008). They were made to stand out in the city with their character and symbolism. The basilica of Constantin in Trier, Germany (Ill. 14 & 15), is an example of an early Christian basilica. It deviates from the more classic basilica structures and has no columns but consists of an open room, where everything happens within the same walls.

It is a typology where the strengths are the spatial capacity and the flexibility in adapting the space if needed. The building structure allows for expansion, to be altered and widened. Combined with the fact that a basilica originally is not sacred, it can be argued that as a building type it can be altered within the typology.

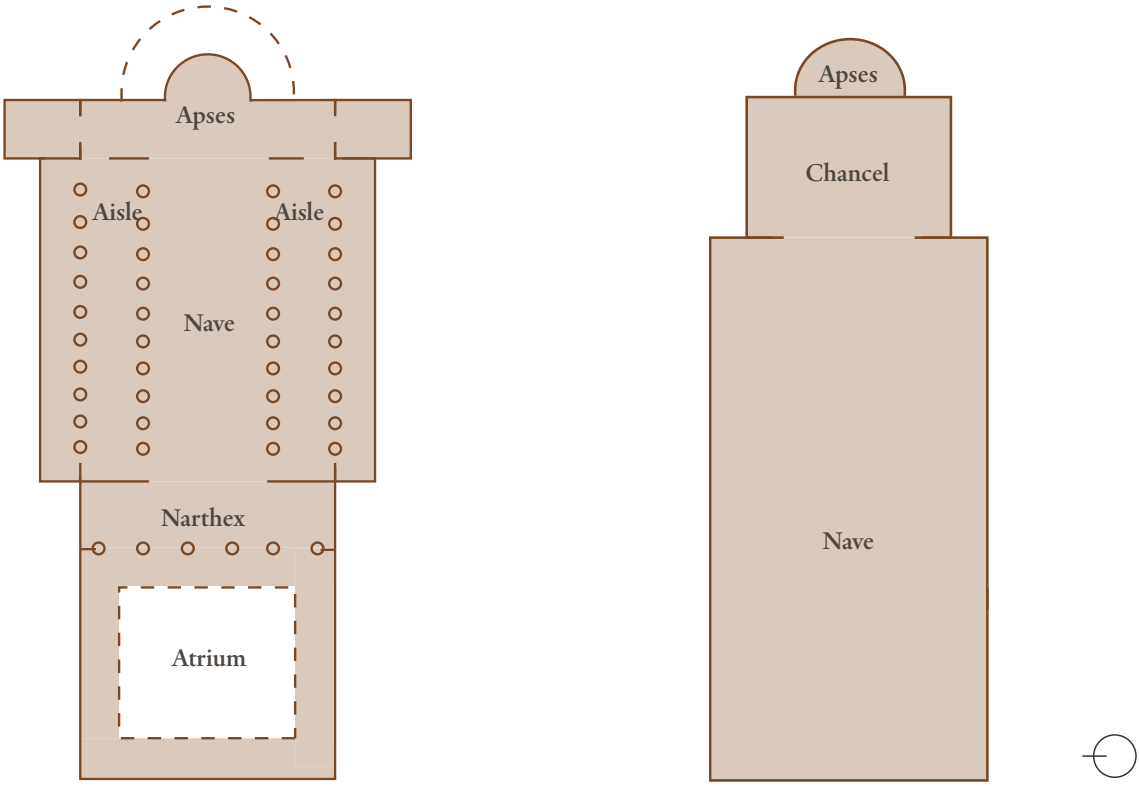


Ill. 13: Basilica of Constantin, Trier. Photo by bvi4092. CC BY-NC-SA 2.0.

Ill. 14: Basilica of Constantin, Trier. Photo by Steven Zucker. CC BY-NC-SA 2.0.



Ill. 15: The basilica and the Danish village church. Own illustration.




Ill. 16: Comparison of the basilica plan and a simple Danish village church plan. Own illustration based on (Kilde, 2008).

## The Christian Basilica

Recognised by a rectangular building shape, the basilica is oriented on a centre line from the entrance to the narthex, through the nave up to the apse (Ill. 17). The focal point of the building is the apse, containing a platform, which is oriented east, giving the building and east to west orientation. On each side of the nave are aisles formed by columns, that supports the ceiling, often wooden, although basilica churches are known to have vaulted ceilings. With a space which can easily be altered to the needs, it can be widened by adding more aisles on the sides of the nave or even extending the length of the nave. The apse is the place of the alter, but if necessary additional apses can be added to extend the sanctuary space. (Kilde, 2008)

When early Christians adapted the basilica for worship, they retained its axial layout, which naturally guided congregational movement towards the altar. The high nave, often clerestoried to allow natural light, created a sense of grandeur, while the side aisles provided circulation space. Over time, modifications as transepts and vaulted ceilings enriched the basilica form, but its core principles, emphasising axiality, processional movement, and the separation of sacred and secular space remained central to church architecture. (Norberg-Schulz, 1980) Additionally, the basilica became an important model for church buildings, as it reflected both the religious and symbolic aspects of the liturgy (Johannsen et al., 1985).

As shown on the illustrations 16, there is a clear connection between the Danish medieval village church and the ancient Roman basilica. The Danish church is a simplified version of the basilica, with the nave, chancel, and porch.

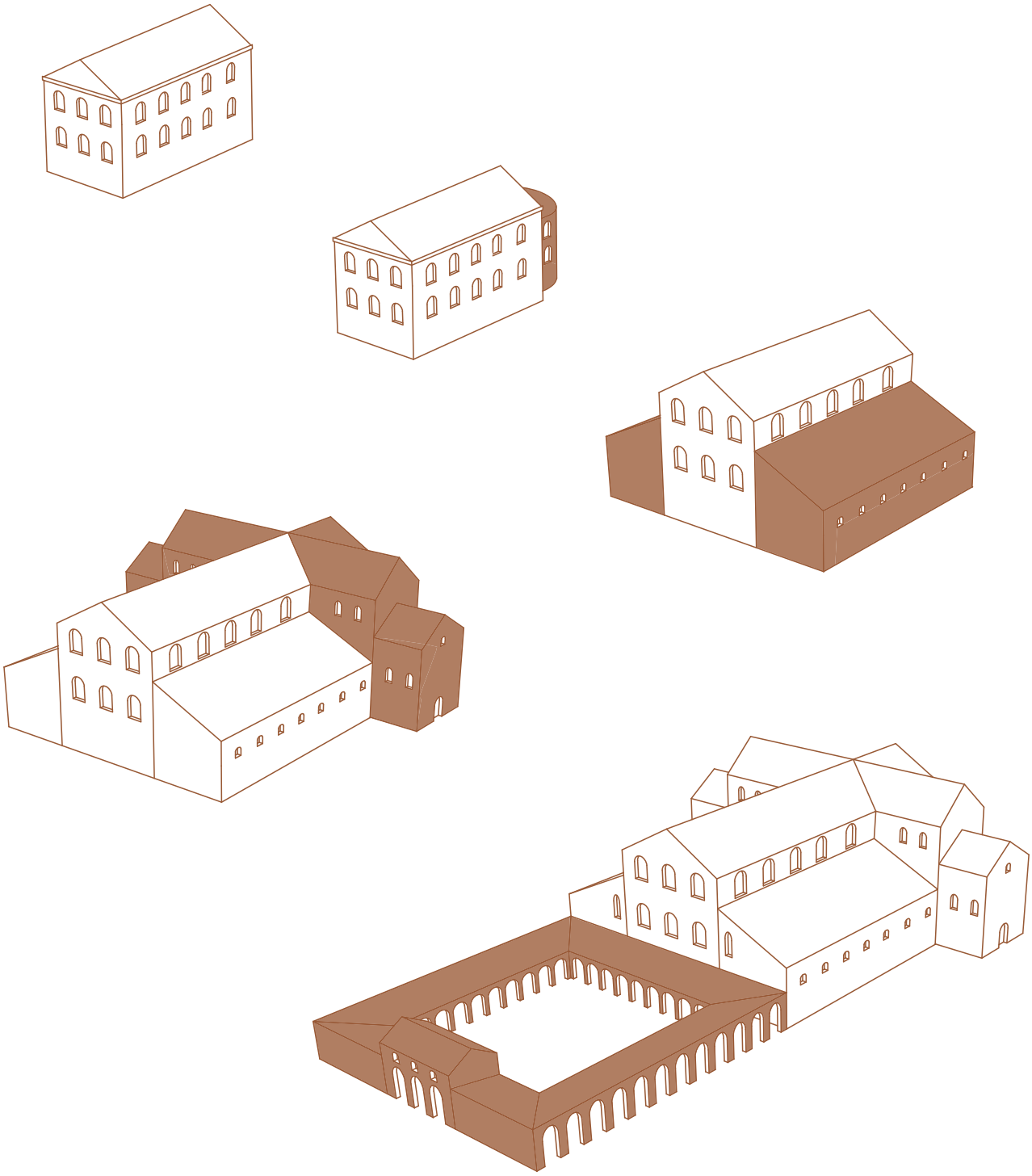
With the knowledge of the basilica typology and its flexibility, it is possible to transfer that to the medieval village churches, and it allows many possibilities for adaptation and transformation, that does not deviate from the typology.

”THE CHURCH ROOM IS A **SECULAR SPACE**, A VERY **ORDINARY** BRICK BUILDING.

IT IS **NOT A SANCTUARY**.”

(Søgaard, Jannie I., 2009)

# Typological extensions



Ill. 17: The typological extension to the basilica Own illustrations.

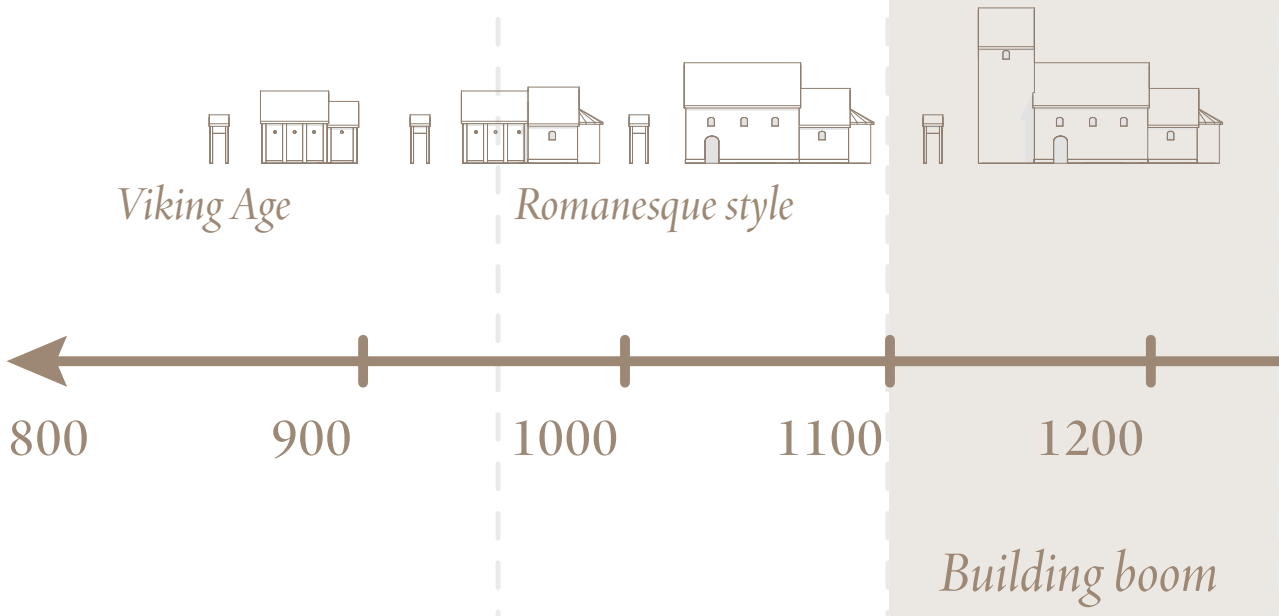
- Danish medieval village churches can be adapted and transformed based on the principles of the basilica typology.

# HISTORY OF DANISH VILLAGE CHURCHES

To work with the transformation of Danish village churches, it is essential to understand their historical development, as architectural structures and social institutions. Since the Middle Ages, these churches have undergone continuous changes, shaped by theological shifts, cultural movements and practical needs. Medieval churches bear witness to an architectural and social dynamic, from the Romanesque stone churches to Gothic modifications, functional changes of the Reformation and later restorations. Each era has left its mark, making the churches today consist immaterial layers. This development demonstrates that churches have never been static monuments but rather living buildings that adapt to the needs of their time.

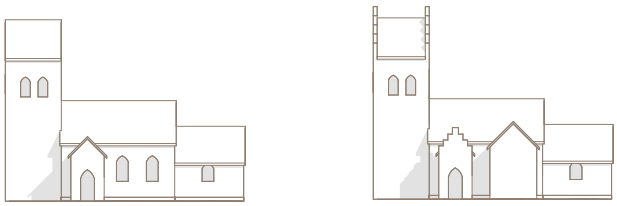
## Catholicism

*The church as a social authority*



Protestantism

*Kingdom*



*Gothic*

1300 1400 1500 1600 1700 1800

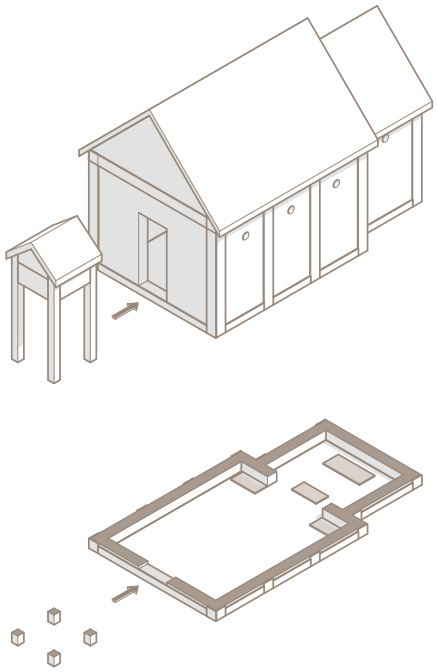
Ill. 18: Timeline of the history of Danish Churches.
Own illustration based on (Dalsgaard, 2021 p. 92-93).

# 800 - 950
## The first churches in Denmark

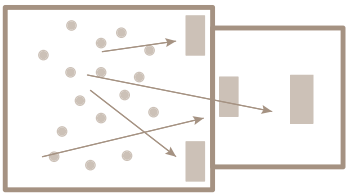
The first churches was introduced in Denmark as a shift in the national religion happened. Christianity, in the form of Catholicism, was introduced to Denmark around the year 830 (Kjær & Grinder-Hansen, 1988). The early churches primarily served Christian merchants travelling from other parts of Europe, where Christianity was already more established.

The churches were built of wood, typically featured a nave and a chancel, and likely included a bell tower nearby (Johannsen et al., 1985). Archeological evidence suggests that the first churches were constructed from oak with saddle roofs covered in wooden shingles, planks, or thatch (Kjær & Grinder-Hansen, 1988).

Their interiors likely featured either flat beam ceilings or exposed roof trusses. Unlike modern churches, they did not have a fixed seating arrangement oriented towards a single altar. Instead, multiple altars were used, and the congregation stood or sat on the floor during mass which was conducted in Latin. The chancel, as in later churches, held a special status as the holiest space, accessible only to the priest. (Kjær & Grinder-Hansen, 1988)



Ill. 19: Own illustrations of the first churches in Denmark

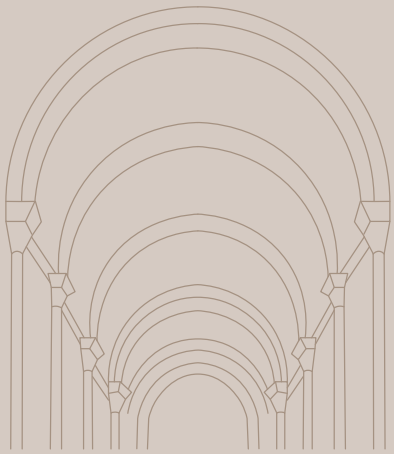


Ill. 20: Own illustration based on (Dalsgaard, 2021 p. 85).

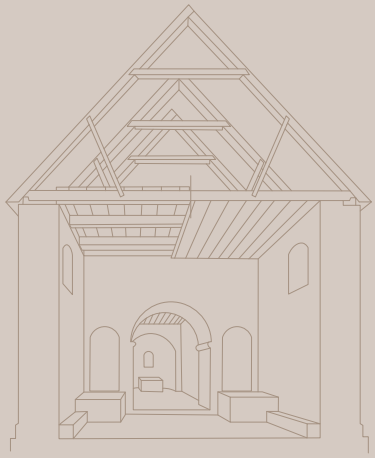
Ill. 21: Reconstruction of wooden church at Moesgård museum. Private photo.

Ill. 22: Reconstruction of wooden church at Moesgård museum. Private photo.

# Romanesque architecture



Ill. 23: Romanesque architecture. Own illustration based on (Mansbridge, 1967, p. 64).



Ill. 24: Princple section of traditional church in Denmark. Own illustration based on (Jørgensen & Johannsen 1979 fig. 2, s. 10).

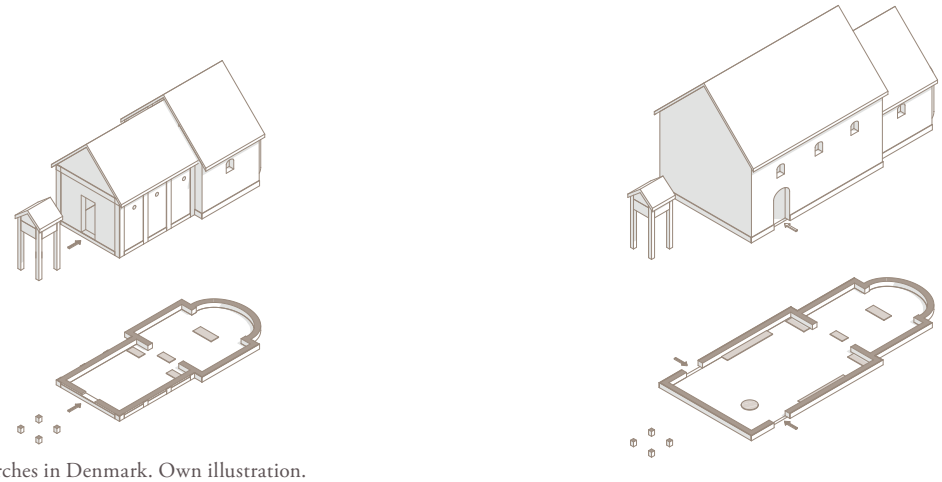
**Structural principles and aesthetic characteristics**
The earliest Danish village churches were constructed in the Romanesque style, reflecting the widespread influence of this architectural movement across medieval Europe. Romanesque architecture is characterised by massive masonry walls, rounded arches, barrel vaults, and small window openings. These features created a sense of solidity and permanence, with the architecture emphasising tectonic stability through thick walls and heavy buttresses. (Kilde, 2008) The semicircular arch, a defining element of Romanesque design, efficiently distributed structural loads, enabling the construction of substantial stone buildingsv (Johannsen et al., 1985).

**Geometric principles and spatial configuration**
Romanesque architecture relied heavily on geometric clarity, symmetry and proportional systems, often derived from simple modular grids. The use of the semicircular arch and barrel vault dictated a spatial rhythm that was repetitive and hierarchical. The nave, typically covered by a continuous barrel vault, was supported by thick walls and closely spaced columns, creating a series of bays that structured the interior space. The articulation of these bays established a rhythmic progression, reinforcing the processional function of the church. (Norberg-Schulz, 1980) The tectonic logic of Romanesque buildings resulted in compact, enclosed interiors with limited verticality. The heavy stone vaults necessitated thick supporting walls, restricting the inclusion of large openings. Consequently, Romanesque churches had a fortress-like quality, with their small, deeply set windows allowing only minimal light penetration, contributing to a dim and introspective atmosphere. (Kilde, 2008)

**Materiality and craftsmanship**
Material choices played a crucial role in the development of Romanesque churches. In Denmark, locally available fieldstone and limestone were the primary construction materials, giving these churches a robust and monolithic appearance. Due to the difficulty of working with stone, some churches retained wooden elements in their roofing structures. Romanesque masons employed precise stone-cutting techniques, using simple tools as chisels and mallets. (Norberg-Schulz, 1980) Some Danish village churches exhibit a hybridisation of Romanesque and early Gothic elements, reflecting the slow architectural transition that took place across Europe. (Johannsen et al., 1985)

- When adapting or transforming a Romanesque style church, it is important to understand and respect the building tradition with symmetry and proportional systems.

# 950 - 1100
## The Establishment of Christianity in Denmark



Ill. 25: First churches in Denmark. Own illustration.

Danish church architecture was primarily influenced by German and English styles but adapted to local materials and traditions. The dominant Romanesque style featured rounded arches, thick walls, and small windows positioned high in the structure to allow only minimal light. (Christiansen, 1965)

Many of the first churches were private chapels built by local by craftsmen moveing between regions, creating both a national architectural style and distinct local variations depending on available materials (Christiansen, 1965). In this period, wooden churches were systematically replaced with stone structures. In some cases, stone chancels were added first, with the wooden nave being replaced later when resources allowed. ( Johannsen et al., 1985)

Churches were built using local materials such as limestone, granite, and fieldstones, often combined to create unique regional expressions. On Zealand, churches were whitewashed for a uniform look, while in Jutland, fieldstones were shaped into ashlars and left exposed. (Kjær & Grinder-Hansen, 1988)

Ill. 26: Lodbjerg Church. Photo by Hans Jørn Storgaard Andersen, CC BY-SA 3.0 Unported.

Ill. 27: Whitewashed. Private photo.

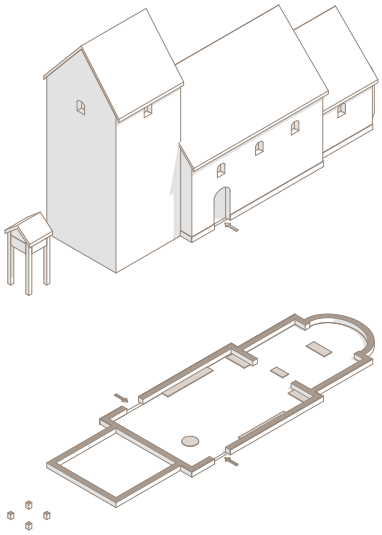
Ill. 28: Granite ashlar. Private photo.

# 1100 - 1250
## The Rise of Romanesque Churches in Denmark

In 1104, the establishment of a diocese in Lund marked a significant step in Denmark's full Christianisation. This led to a building boom in church construction, in the period up to 1250 witnessing the highest number of church buildings in the country. (Christiansen, 1965)

The church had gender-specific entrances, with men entering from the south and women from the north. Inside, men and women typically stayed on separate sides.

The baptismal font could be positioned near the entrance or in the centre of the nave, allowing baptisms for those entering the church.



Ill. 29: Romanesque churches in Denmark. Own illustration.

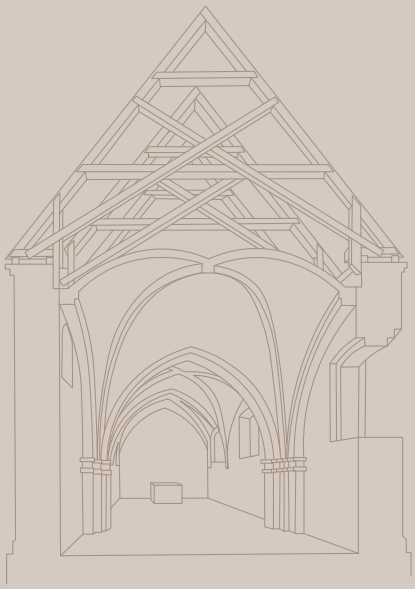
Ill. 30: Aidt Church. Photo by Bococo. CC BY-SA 3.0.

Romanesque west towers became more common during this period, as a symbolic of power, while the bells still typically were placed in separate bell towers outside the church. The bells marked the daily rhythms of life, calling the community to prayer and serving as signals for emergencies such as fires, dangers, or deaths in the parish. (Kjær & Grinder-Hansen, 1988)

By 1160, the introduction of brick kilns led to the use of brick in church construction. Church layouts became more standardised, with rectangular naves and square or polygonal chancels oriented towards the east. Windows were typically placed on the north and south sides, with the east side often featuring a single window or an apse. (Kjær & Grinder-Hansen, 1988)

# Gothic architecture

Ill. 31: Gothic architecture. Own illustration based on (Mansbridge, 1967, p. 65).



Ill. 32: Princple section of gothic church in Denmark. Own illustration based on (Jørgensen & Johannsen, 1979 fig. 3, s. 12).

**Innovations in structural systems**
The transition from Romanesque to Gothic architecture introduced a fundamental shift in ecclesiastical design, transforming the spatial and aesthetic experience of church interiors. Gothic architecture is defined by pointed arches, ribbed vaults, and buttresses. These innovations allowed for greater height, larger windows, and more intricate spatial compositions (Norberg-Schulz, 1980). The pointed arch, unlike the semicircular Romanesque arch, distributed structural forces more efficiently, enabling taller and more slender buildings (Kilde, 2008).

**Geometric principles and spatial configuration**
Gothic architecture was fundamentally driven by the pursuit of verticality and openness, achieved through advanced geometric principles. The pointed arch, a defining element of Gothic construction, allowed for varying proportions in structural spans, reducing lateral thrust and enabling the construction of soaring vaults. The ribbed vaulting system, which replaced the continuous barrel vaults of Romanesque churches, introduced a modular framework in which intersecting ribs transferred loads to designated support points. This innovation does not only facilitated greater structural efficiency but also enabled more complex spatial arrangements (Norberg-Schulz, 1980). The use of the buttress further contributed to the opening up of interior space. By transferring the lateral forces of the high vaults to external supports, walls could be made thinner and perforated with expansive stained-glass windows. This shift allowed for the dissolution of the heavy Romanesque enclosure, creating interiors that felt light, airy, and infused with divine illumination. (Kilde, 2008)

**Materiality and craftsmanship**
Gothic builders developed sophisticated masonry techniques to accommodate the new structural demands. Stonecutters worked with precisely measured templates to produce complex ribbed vaults. The increased demand for decorative elements, as tracery windows and sculptural details, also required skilled artisans proficient in fine carving techniques. (Norberg-Schulz, 1980) Advances in mortar technology, including the use of hydraulic lime, allowed for more durable and resilient masonry joints, further enhancing structural integrity ( Johannsen et al., 1985).

- When adapting or transforming a Gothic style church, it is important to understand and respect the building tradition with verticality, pointed arches and openess.

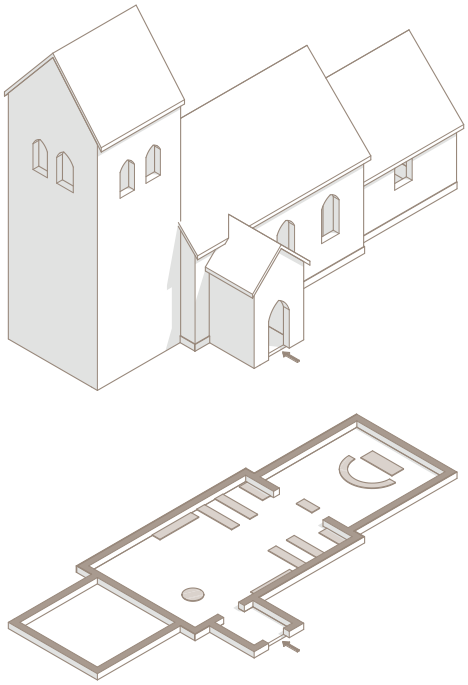
# 1250 - 1400
## The Introduction of Gothic Architecture

Gothic architecture made its way to Denmark around 1250. By this time, Denmark had already experienced a building boom in church construction during the 11th and 12th centuries. As a result, there was less demand for new churches, and few were built entirely in Gothic style (Grinder-Hansen, 1999). Instead of constructing new churches, Gothic architecture predominantly influenced expansions and modifications to existing Romanesque churches.

In the gothic period, additions as west towers and porches were added while many of the women doors were bricked up. These modifications were carried out gradually, depending on the parish's resources and needs. Some churches with existing Romanesque west towers raised them in the Gothic style, often with a Romanesque ashlar base and a Gothic brick upper section. (Kjær & Grinder-Hansen, 1988)

As populations grew, many churches became overcrowded, leading to extensions, as lengthening the nave or removing Romanesque apses to expand both the nave and chancel.

It became more common to supplement with fixed pews at the eastern end of the church for the parish's prominent members (Grinder-Hansen, 1999).



Ill. 33: Gothic churches in Denmark. Own illustration.

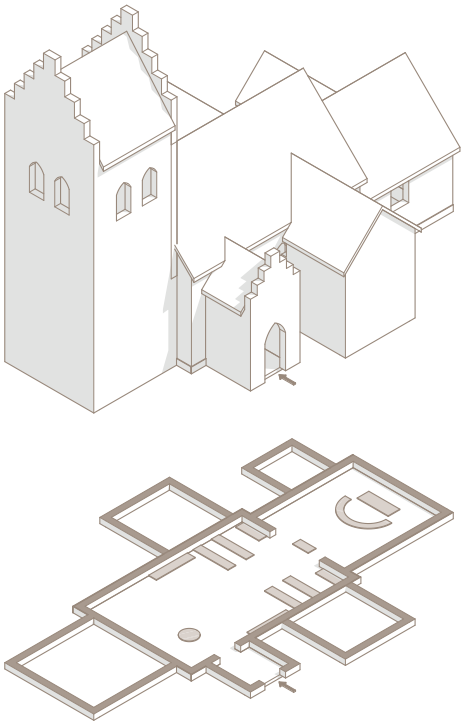
Ill. 35: Sanderum Church. Private photo.

Ill. 34: Lyngby Church. Private photo.

The large, pointed windows brought divine light into the churches. The structural improvements allowed for a brighter and more spacious interior, enhancing the church's aesthetic appeal (Kjær & Grinder-Hansen, 1988).

Gothic architecture introduced new construction techniques that allowed for vaulted ceilings, which were often adorned with colourful frescoes in the chancel. This was particularly beneficial for fire safety, as vaulted ceilings are more fire-resistant than timber ceilings. (Kjær & Grinder-Hansen, 1988)

# 1400 - 1500
## Late Medieval Church Modifications



Ill. 39: Late medieval church modifications. Own illustration.

Changes in church practices led to a larger portion of the congregation attending services. As the congregations grew, the need for expanded church buildings arose in many areas. Churches continued to be extended by lengthening the nave, and it became common to add side buildings. In some instances, side aisles were added to provide more space for the congregation, in others, these extensions were chapels with side altars. (Kjær & Grinder-Hansen, 1988)

The side aisles and chapels were often built in brick which had become the most widely used building material at the time. However, it was common to find a few stones from the church's original construction incorporated into these additions, reflecting a rational reuse of building materials. (Kjær & Grinder-Hansen, 1988)

To the north, sacristies were constructed. Initially, these rooms were used to store church silver and relics, but they later became spaces for the clergy as well. (Kjær & Grinder-Hansen, 1988)

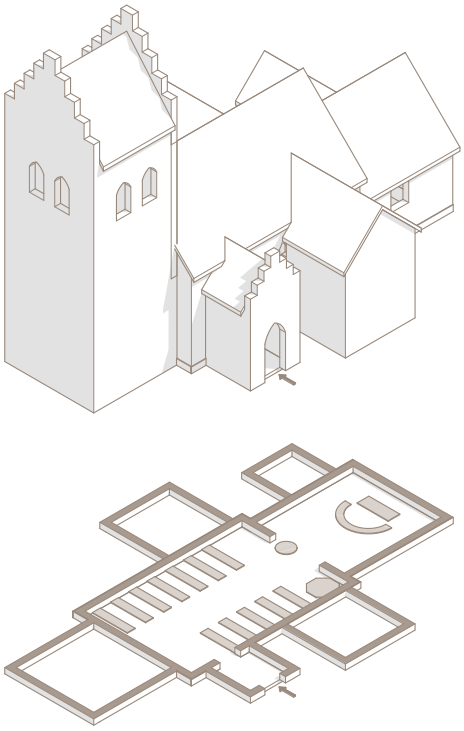
Distinctive gable designs, such as the crow-stepped gables, became characteristic of this era. Many porches were built with cambered gables, and in some cases, they were added to the nave, chancel, and tower as well. (Kjær & Grinder-Hansen, 1988)

Ill. 40: Jerslev Church. Photo by Tomasz Sienicki, 2009. CC-By-3.0.

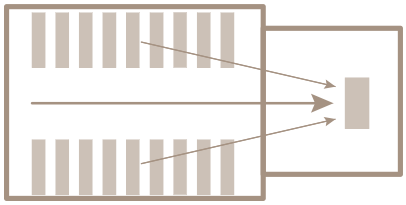
# 1500 - 1600
## The Reformation Century – The Lutheran Era

A rising dissatisfaction with the Catholic Church's power in the late Middle Ages intensified in the 1500s, leading to the Reformation in 1536. When Christian III introduced Lutheran Protestantism, the Church's landholdings were transferred to the king, effectively removing it as a political and economic power. The Danish Church became a royal institution, with the king as its supreme authority. (Kjær & Grinder-Hansen, 1989)

Lutheranism rejected the Catholic hierarchy, emphasising direct access to God through scripture rather than clergy. The word became sacred rather than the physical church and priest. Churches, previously seen as sacred spaces, were now primarily places for preaching. This shift made many churches redundant, leading to widespread demolitions. (Johannsen et al., 1985)



Ill. 41: Reformation century church modifications. Own illustration.



Ill. 42: Own illustration based on (Dalsgaard, 2021 p. 85).

Churches were divided into two distinct areas: the nave, where sermons were performed, and the chancel which remained reserved for the priest (Johannsen et al., 1985). By the late 1500s, fixed pews became common, reinforcing the focus on a single altar in contrast to Catholicism's multiple side altars (Kjær & Grinder-Hansen, 1989).

Ill. 43: Groslunde Church. CC0-1.0.

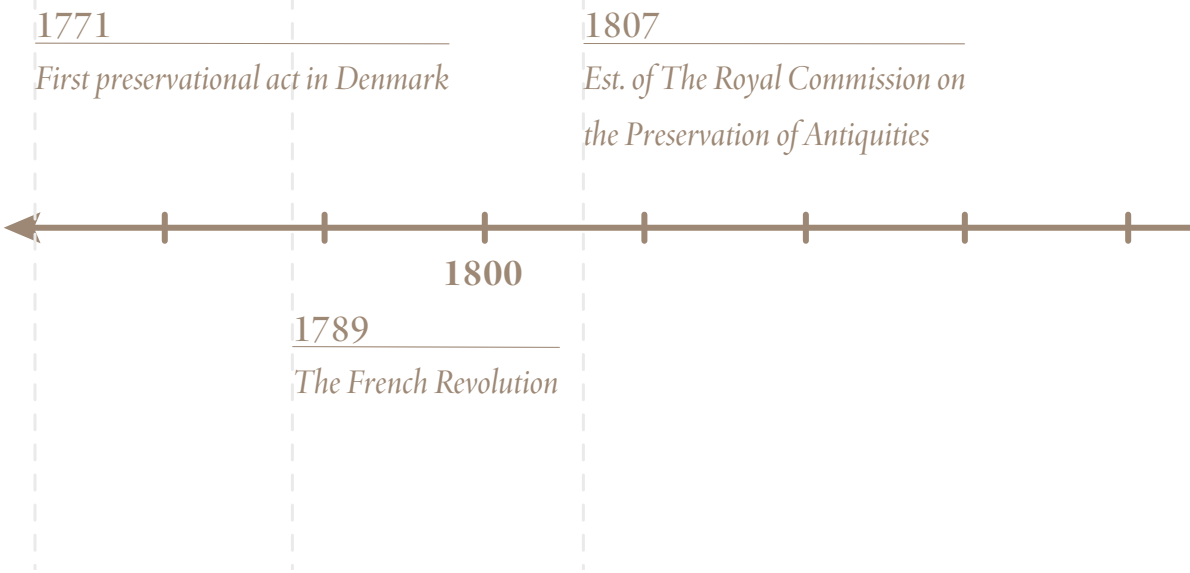
Ill. 44: Østbirk Church. Photo by Nils Jepsen. CC BY-SA 3.0.

Ill. 45: Borum chancel. Private photo.

Instead of constructing new churches, existing buildings were adapted. The most notable change was the increased importance of the sermon. To accommodate this, pulpits were installed, often elevated and placed near a south window for lighting. In many cases, remnants of old side altars were repurposed as pulpit bases. (Grinder-Hansen, 1999)

Congregational singing was introduced as part of worship, leading to the publication of Danish hymnals. While organs were installed in wealthier churches, most rural congregations relied on the parish clerk to lead singing. (Grinder-Hansen, 1999)

Baptismal fonts were moved from their traditional western placement to the chancel or near it, aligning with Lutheran liturgical practices. Despite these relocations, most medieval baptismal fonts were preserved, and many remain in use today. (Johannsen & Smidt, 1981)




# Danish conservation history

In modern society there is a sensitive relation to old and historical buildings, especially if they are a part of the nation's cultural heritage. In Denmark, historical buildings are protected by the Building Conservation Act (Retsinformation, 2018). These buildings are not only protected by law but also protected by people's interest in their historical and cultural value to society.

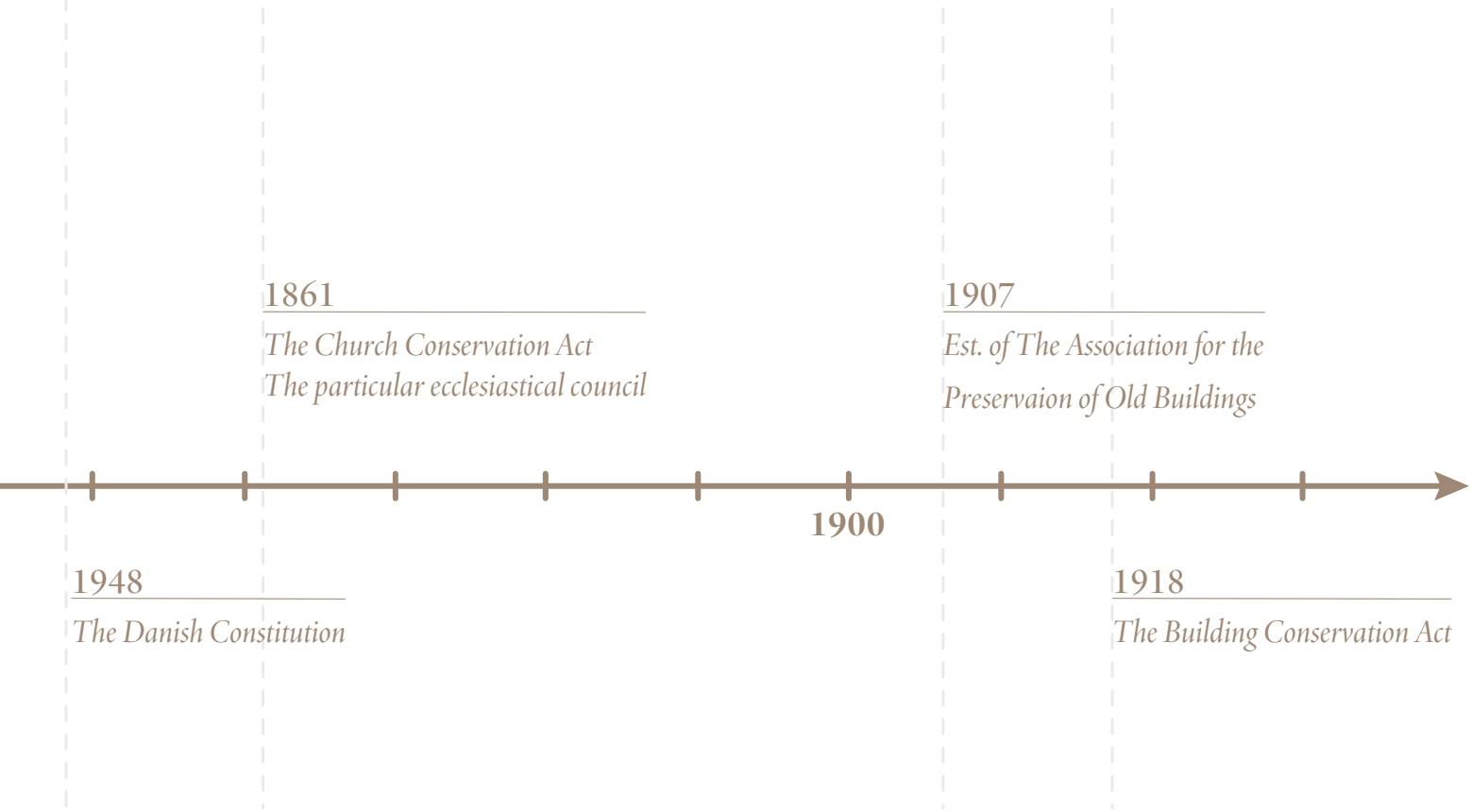
This has not always been the case. To understand the reason why there is such a passionate view on building conservation today, we must understand the historical context. Historically, buildings have not always been appreciated and not much was done to keep them as their originals. Many buildings have been torn down through history, until the 17th and 18th centuries, where the idea of protecting historic buildings and monuments had a breakthrough. The development of the societies and people becoming more enlightened in the 1700s, had its remarks on built cultural heritage. (Bendsen & Morgen, 2018) As societies and people became more enlightened they also became more aware of each nations characteristic and national identities. This was the beginning of cultural heritage preservation.

Throughout the 1800s, where national romanticism in Denmark broke through, meant that building and monument conservation became a political agenda. Significant political changes in 1848 and 1864 led to more awareness of national identity and heritage. One of the reasons for the first church conservation law in 1961, was the work and research by the art historian Niels Lauritz Høyens (1798-1870). He shined light on the importance of Danish architectural history and to gain knowledge of the Danish building culture as the antique building culture. Building and monument conservation became more important in order to maintain the national identity, and the first general building conservation law was signed in 1918. (Bendsen & Morgen, 2018)

**A New Legal Framework**

In 1849, Denmark's Constitution was signed, introducing a new legal structure for the church. The term "the Danish National Church" was established, although the state continued to oversee church affairs. Despite the introduction of religious freedom, former state church members were automatically transferred to the new national church. (Kjær & Grinder-Hansen, 1989)

Although the church was now officially a national church, its relationship with the state and monarchy remained closely linked. In 1903, churches gained the option to buy out private owners and become self-governing, which most did. From 1849, churches were allowed to establish parish councils, though these initially had little influence. In 1912, the management of church buildings and finances was transferred to the parish councils, which continue to oversee them today. (Kjær & Grinder-Hansen, 1989)




Ill. 46: Timeline of the Danish conservation history. Own illustration.

As stated previously, the Danish churches have since their origin developed and changed through history, until the 19th century. In 1807, *The Royal commission on the Preservation of Antiquities* was established. They were to focus on historical preservation, where one of the main agendas was to preserve the remains of churches and other public buildings from the Middle Ages (Bendsen & Morgen, 2018, p. 27). Since then, Danish Medieval churches have barely been changed or transformed due to strict regulations.

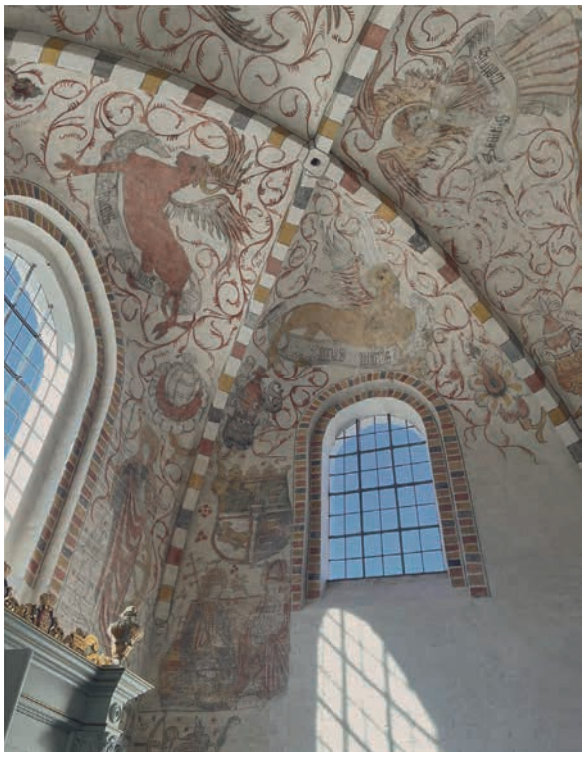
Over time, legislation has secured the church's cultural and historical value. In 1922, a new church law was enacted, eliminating the requirement for restoration to an original state. Instead, a system was introduced whereby five royal Danish building inspectors advise parish councils on architecture, while the National Museum provides guidance on historical preservation. This advisory system remains in place today. (Kjær & Grinder-Hansen, 1989)

**Churches built before 1536**

A church from the Middle Ages, built before the Reformation in 1536, will automatically be listed under the Danish Building Conservation Act, if it is no longer in use for ecclesiastical purposes. If the church is still in use, it is under the church law. When a church is listed, it will continue to be under the parish council's responsibility. However, they must follow the legislation of the Building Conservation Act, when they need maintaining or changing anything. (Ministeriet for Ligestilling og Kirke, 2013)

**Churches built after 1536**

The churches built after the Reformation in 1536 are under different rules, and when they are no longer in ecclesiastical use, they are not automatically listed under the Danish Building Conservation Act. Though they still fall under the category as buildings with significant architectural and cultural value. All buildings and landscape architectural works, churches included, can be listed regardless of their age, when they have extraordinary value or are under special conditions. If a church is shut down, it will undergo the same procedure as other buildings with submission of preservation proposals for the Special Building Inspectorate. (Ministeriet for Ligestilling og Kirke, 2013)



Ill. 47: Budolfi Cathedral, Aalborg. Private photo.

# Danish National Churches

The conservation acts are to protect medieval churches and historical buildings with a significant architectural, cultural-historical and environmental values (Retsinformation, 2018). Not only are the churches under strict regulations, but there is a difference in how protected they are which is determined by their age. In Denmark, around 2/3 of the 2400 churches date back to the Middle Ages. All medieval churches are covered by the act on the church buildings and cemeteries of the Danish National Church (Retsinformation, 2016).

**Use of Danish National Churches**

It is decided by law that the management and use of the Danish National Churches is restricted for ecclesiastical purposes (Retsinformation, 2014). Therefore, it is decided that the churches cannot be used for strictly cultural purposes.

With the parish council's consent, the church spaces can be used for other ecclesiastical purposes than church service. It is not allowed to use the churches for civil purposes such as civil funerals and civil weddings (Ministeriet for Ligestilling og Kirke, 2013). The churches can therefore be used for other things beside church services if approved ahead by the bishop, and does not compromise the character of the church space.

**The Church Buildings and Cemeteries**

Besides the act that dictates, how the Danish National Churches can be used, there is a act that rules physical legislations of the church buildings and their cemeteries (Retsinformation, 2016). If a church is older than 100 years and needs any changes or renovations, it must be approved by the diocesan authority. Every year there is statutory review of the medieval churches and their cemeteries. Maintaining and renovating the medieval churches are a high priority to protect Denmark's cultural heritage (Ministeriet for Ligestilling og Kirke, 2013).

This maintenance is equal on all churches, including the ones that are not being used regularly which is very costly for many parishes. It can be economically difficult to maintain the church in small parishes, resulting in a merge of parishes to secure funding and avoid closing a church.

- The act on use of Churches allows for other functions to take place in the churches.
- Having the conservation legislation in mind, but the thesis' position is critical towards it.

## The Announcement of the Act on the Administration and Use of the Churches of the Danish National Church, etc.

*The Church's Religious Use of the Churches*

*§ 5. The church may be used by the parish council or with its consent for other religious purposes than worship services and religious ceremonies. However, for holding church concerts, staging church plays, and similar activities, permission from the bishop is also required if a minority of the parish council demands it.*

*Subsection 2. The parish council may, with the bishop's permission, make the church available for non-religious purposes. It is a condition for the bishop's permission that the intended purpose does not contradict the character of the church space.*

(Retsinformation, 2014)

## The Announcement of the Act on the Church Buildings and Cemeteries of the Danish National Church.

*§ 1. The purpose of this Act is:*

*1. To ensure that the church buildings of the Danish National Church provide the best possible setting for the congregation's worship services, church activities, and other religious functions,*

*2. To ensure that there is sufficient space for burials in the churchyards of the Danish National Church and that they function as dignified and well-maintained burial sites, and*

*3. To ensure that the cultural values associated with church buildings and churchyards are not degraded.*

(Retsinformation, 2016)

# THE LITURGICAL CHURCH SPACE

The church space is not merely a neutral setting for the sunday service, but an active participant in the liturgical action. Through movement, spatial arrangement, and the staging of key architectural elements such as the altar, baptismal font, pulpit, and organ, create a ritualised environment. Theology and ecclesiastical practice become physically and sensorially present. The Sunday service is structured as a progression through space and time, where both priest and congregation move according to carefully choreographed patterns, and where the axis, orientation, and direction of the space play a decisive role. (Brinth, 2007)

The service begins with the priest entering from the porch and moving along the central aisle, following the longitudinal axis, towards the altar, which is traditionally located at the eastern end of the church. This journey symbolises the transition from the secular to the sacred. The eastward movement of the priest reflects the traditional Christian orientation towards the resurrection and light. The altar forms the liturgical and architectural centre, symbolising the presence of Christ. From here, the priest leads the opening prayer and later conducts the communion rite, standing at the altar, facing the congregation. This spatial and bodily orientation is essential to the relationship between priest and congregation, reinforcing the ideas of fellowship and mediation. (Brinth, 2007)

Following the reading of scripture, the priest moves to the pulpit, which in most Danish churches is located in the south-eastern corner of the nave. The pulpit is raised and in a visually prominent position, providing both acoustic reach and symbolic authority. From this vantage, the Gospel is proclaimed, and the movement from altar to pulpit and back again establishes a liturgical rhythm, in which word and sacrament are interwoven through the structure of the architecture. (Brinth, 2007)

According to Johannes Exner, the church space should be configured so that it "opens itself to the actions that are to take place" and does not simply function as a monumental backdrop (Exner, 1993). The space must make the rituals visible and accessible. In practice, it means that architectural decisions as the height of the pulpit, the placement of the altar, and the acoustics must support the content of the liturgy.

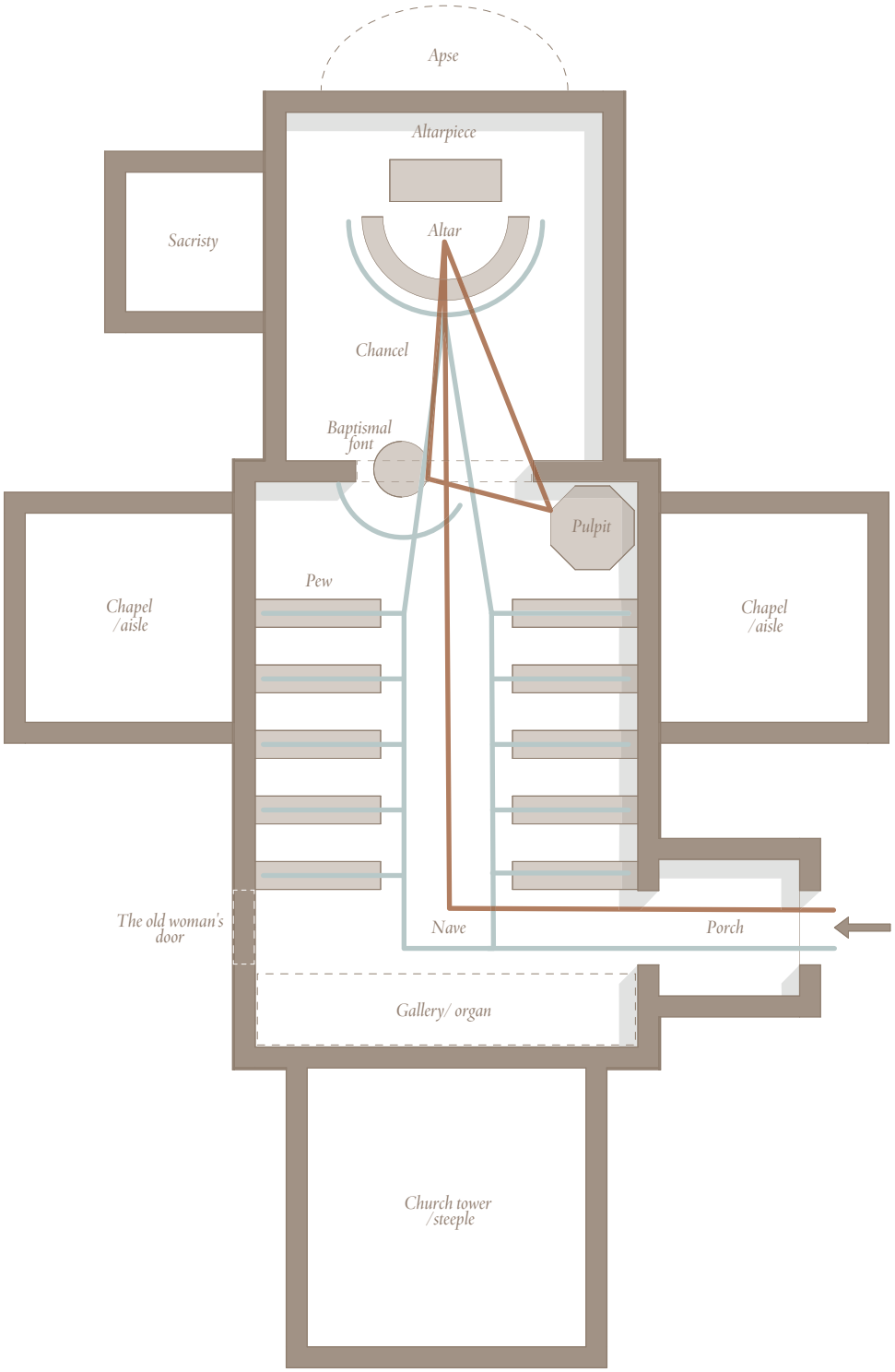
The baptismal font is now typically located between the nave and the chancel, often near the altar and thus centrally placed along the church's longitudinal axis. This position underlines the importance of baptism as an integrated part of congregational life and the liturgy as a whole. Traditionally, the baptismal font was placed in the western end of the nave to symbolis the entry from the world into the church. The contemporary location closer to the altar reflects a theological understanding of baptism as the beginning of life in communion with Christ and the congregation. From this position, children and adults are baptised in a ritual where the priest and the baptismal family gather around the font in visible proximity to the altar. This physical and liturgical integration of baptism into the church's central spatiality strengthens both its theological weight and its visibility to the congregation. (Brinth, 2007)

The movement of the congregation is more limited but nevertheless of architectural importance. During the sunday service, the congregation stands and sits in rhythm with the liturgy, creating a collective, embodied participation in the ritual. The most significant movement takes place during communion, when members of the congregation move in small groups along the central aisle to the altar or communion rail. This temporary activation of the church's longitudinal axis transforms the space into a processional sequence and highlights the altar as a destination and focal point. The room thus becomes not static, but temporarily transformed by liturgical practice. (Brinth, 2007)

In light of this, architect Juhani Pallasmaa emphasises that the role of architecture is not merely to serve as a backdrop for activity but to anchor it in bodily and sensory experience. He argues that architecture should be understood as an "extension of the body", where materials, orientations, and spatial transitions define human experience (Pallasmaa, 2005). The liturgical space of the National Church is a place where the body moves in a defined pattern and where atmosphere is created through light, materiality, and acoustics. The space becomes a co-creator of the ritual's intensity and meaning.

Thus, the church interior during the sunday service becomes a choreographed space, where liturgical actions, theological meanings, and architectural structures are interwoven. The longitudinal axis of the church, the movement of the priest, the positioning of the altar and pulpit, and the congregation's participation in communion and baptism together form a rhythmic and sensuous whole. (Brinth, 2007) It is precisely this integration of movement, space, and significance that Exner refers to as the "usable space"; a space in which architecture serves the action and thereby comes to life.

- Adaptations and transformations must not compromise the ability to perform church services and other religious cermonies.




Movement of the preist during sunday service

Movement of the congregation during sunday service

Ill. 48: Plan of a Danish Medieval church with preist and congregation movement during sunday service. Own illustration.

Ill. 49: Our Saviour's Church, Aalborg. Private photo.

# MODERN USE AND CHARACTER OF CHURCH SPACES

The use of church spaces has changed over time in response to theological, cultural, and societal developments. From the purely liturgical function in the Middle Ages to today's multi-purpose approach, both the character and interior of church spaces have been adapted to meet new needs. Today, many Danish churches face questions about, how they can remain relevant, through adaptations of existing church spaces or extensions that accommodate modern use.

**From medieval sacredness to modern flexibility**
Medieval churches were strictly liturgical spaces, characterised by an axial orientation towards the altar and a clear division of roles between clergy and congregation (Dalsgaard, 2021). According to Johannes Exner, church architecture was designed to reinforce a hierarchical structure where the altar functioned as the absolute center, both spatially and theologically (Exner, 1993). The Reformation in 1536 altered this dynamic, bringing the pulpit and congregational participation into greater prominence which influenced the organization of the space. (Kjær & Grinder-Hansen, 1989)

Today, this fixed hierarchical church space is undergoing changes. Some Danish churches have adopted more flexible furnishing solutions, replacing pews with movable chairs, allowing for different arrangements depending on the activity. This has led to a combination of sacred and secular use, where the church space is no longer reserved solely for worship services but can also be used for concerts, art exhibitions, and community gatherings. (Kreiner-Møller, 2022)

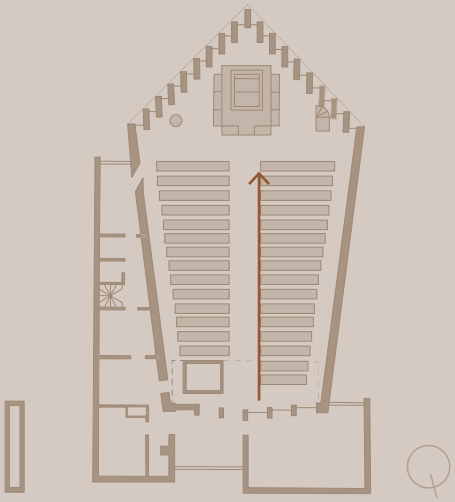
**Exner's reflections on church spaces**
Johannes Exner was one of the most influential church architects in Denmark in the 20th century. His research and design practice had a significant impact on the development of church architecture. Exner's approach was characterised by a thorough theoretical reflection on church spaces, their theological significance, and how they could adapt to serve both liturgical and modern societal needs. The foundation for Exner's philosophy was that one cannot work with church spaces without understanding them in the context of historical, theological, and architectural traditions, as well as reflecting on the church's role in the society. (Jensen, 2012)

**The relationship between clergy and congregation**
A central theme in Exner's architectural studies was the relationship between clergy and congregation in church spaces, a theme he addressed through the concept of *circumstantes* – 'those who stand around'. This refers to how the congregation is positioned in relation to the clergy in the church. In medieval churches, the priest's position is isolated from the congregation, making the priest's actions visually and physically separate. Exner saw this separation as problematic, as it hindered a sense of community in worship. He believed that church spaces should support a sense of fellowship, where the placement of the clergy and congregation was integrated into a more open space. (Exner, 1993)

- The church room should adapt to enhance the relationship between clergy and congregation.
- Flexible furnishing allows for sacred and secular use of the church room.

# From traditional to innovative church architecture

**Sct. Clemens Church** (1969)
Exner's first independent church building in Randers was constructed at a time when church architecture was still strongly influenced by traditional spatial arrangements. Before embarking on a study tour, that would drastically change his perspective on what a church could be, Exner designed Sct. Clemens Church with a classic axial orientation towards the altar. Pews arranged in fixed rows reinforced a more hierarchical spatial understanding. (Jensen, 2012)



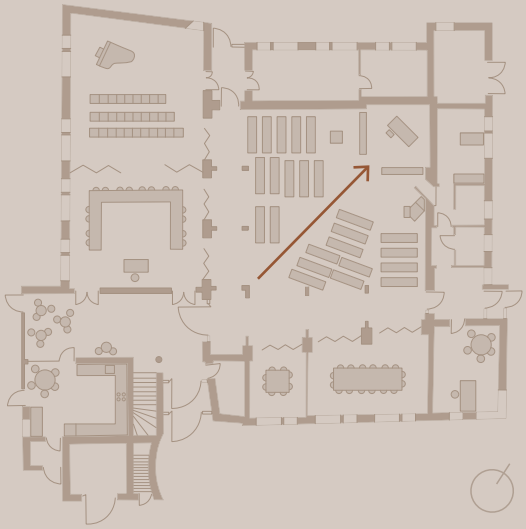
Ill. 50: Plan, Sct. Clemens Church. Own illustration based on (Jensen, 2012 p. 56).

Ill. 51: Sct. Clemens Church. Photo by Mia Kiørboe.

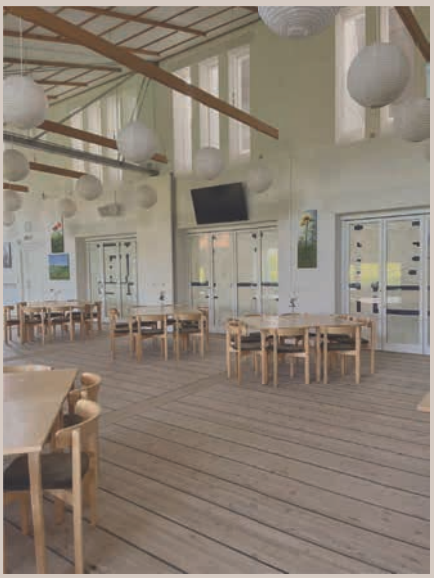
**Skæring Church (1983)**
Exner's design for Skæring Church demonstrates his evolving ideas about, how church spaces must be dynamic and adaptable to the changing needs of society. Unlike earlier churches, Skæring Church breaks with traditional structures. Here, the space is open and flexible, without the physical and symbolic barriers that previously separated clergy and congregation. This development in Exner's architectural thinking reflects a desire to dissolve the boundary between the sacred and the secular.

Originally, another church was planned in the old Skæring area, but local opposition argued that a community center would be more beneficial than a new church, a place robust enough for local youth to repair their mopeds. Inspired by this, Exner conceived the idea of combining a raw church space with these community needs, designing a church room built of concrete clad with brick on the exterior. The church consists of a centrally placed cubic worship space, surrounded by a low four-winged structure with offices, meeting rooms, and a parish hall connected to the church entrance. The altar aisle runs diagonally through the space, with colonnades on either side linking the church space to the adjoining rooms. (Jensen, 2012)

Skæring Church creates a space where clergy and congregation gather around the altar. The church exemplifies how architecture can support both sacred and secular purposes with a focus on interaction. This demonstrate how the role of the church in the society has evolved to include practical functions as a community center. The church serves as a cultural and social hub for the local community, independent of faith, continuing Exner's vision of the church as an inclusive space for fellowship, not only for believers but for society as a whole.



Ill. 52: Plan, Skæring Church. Own illustration based on (Jensen, 2012 p. 305).



Ill. 53: Skæring Church. Private Photos.

# Richard Sennett

The sociological theories of Richard Sennett offer valuable perspectives on how church spaces can be developed to support community and social interaction. In *The Spaces of Democracy*, Sennett argues that architecture should facilitate openness and interaction rather than isolation and rigid structures (Sennett, 1998). This perspective is particularly relevant for church architecture, where the challenge often is to balance the need for a sacred space with the desire for accessibility and multifunctionality.

Sennett describes, how public spaces function as arenas for social life, but also how they can exclude and limit participation. Applied to church architecture, this raises the question of whether a space invites community or enforces hierarchical divisions between clergy and congregation, or between insiders and visitors. (Sennett, 2008)

**From static to dynamic church spaces**
According to Sennett, flexibility and diversity are key characteristics of a well-functioning public space. Traditionally, church interiors have been highly coded by liturgical conventions, but today, there is an increasing tendency for churches to be transformed to support various forms of gathering, both religious and secular. This includes replacing fixed pews with movable chairs, creating community spaces adjacent to the church, or integrating new functions such as cafés or cultural venues. (Hancock, 2019)

Sennett's ideas can help explain why some transformed churches feel more inviting than others. If a space is too rigid, it can feel exclusionary. At the same time, he points out that a space without clear structure can loose its function as a meaningful gathering place. The challenge is to find a balance between openness to variation while maintaining a sense of identity and a framework for communal practices. (Sennett, 2008)

- Flexibility and diversity are important for a well-functioning public space.
- Rigid spaces can feel exclusionary.
- Spaces without a clear structure can loose its function as a meaningfull meeting place.

**Transformation of existing churches**
Alongside the construction of new, modern churches, the transformation of existing church buildings has gained attention. Many Danish National Churches face challenges with declining congregations and the need for new functions. Adapting existing church buildings can help enhancing the relevance in contemporary society while preserving their historical and architectural value.

**Village churches**
In *Some thoughts about our village churches and the restoration of Terslev Church*[1] (Exner, 1980), Johannes Exner reflects on how Danish village churches form a collective cultural heritage and still evolved differently over time. He describes them as an architectural family, where each church shares fundamental features, such as Romanesque or Gothic construction, masonry details, and church towers, but also possesses a unique character. Over the centuries, they have been altered and adapted through renovations, new interior elements, and changing usage patterns. These modifications reflect theological currents, societal needs, and local craftsmanship traditions, making each church unique while still part of a larger whole. (Exner, 1980)

Exner emphasised that the restoration and further development of village churches must be based on an understanding of their historical evolution. He warned against restoration practices that attempt to freeze churches in a single historical period, as they have never been static structures. He argued that changes should be legible, allowing new additions to exist in dialogue with existing structures without falsifying or erasing historical traces.

At the same time, Exner pointed out that churches are not merely architectural monuments but also living spaces that must continue to serve their local communities. Many village churches today face the challenge of remaining relevant, as traditional church attendance declines and new needs emerge. He believed that they must be able to accommodate modern functions while respecting their historical identity and architectural uniqueness. (Exner, 1980)

*1 Nogle tanker om vore landsbykirker og restaureringen af Terslev Kirke*

**Architectural adaptations and social role of the church in modern society**
New churches vary in size and design. Unlike previous construction periods, there are no common stylistic or functional patterns in contemporary church architecture. Notably, nearly all modern church spaces are designed as processional churches, meaning longitudinal churches. The analytical reflections of the Exner couple regarding a church space that gathers around the altar have thus been abandoned. Such design may be perceived as too informal for a church setting. And in Denmark's multireligious society, there is a greater need for churches that unmistakably resemble churches, where the sacred aspect is emphasized over the desire for an intimate and communal worship experience. (Kreiner-Møller, 2022) This aligns with Sennett's theory which suggests that structure is integral to a church's identity. Another possible explanation is that, despite Exner's analytical work, designing churches in this familiar way is simply the easiest choice.

Many recent churches have been built as church centers, featuring a dedicated worship space with rooms for use throughout the week. However, there are examples of churches designed with a single, multifunctional space, which may indicate a paradigm shift. (Kreiner-Møller, 2022)

# Reconfiguring churches

The transformation or redesign of churches involves a meeting between the old and the new, presenting a challenge in balancing heritage preservation with contemporary functional needs. Achieving harmony between existing and new elements is not an easy architectural task; it requires deep insight and professional expertise. (Kreiner-Møller, 2022)

**Ansgar Church**

Ansgar Church in Hedehusene was originally built in 1921, with a tower added in 1940. It follows a traditional design with a whitewashed facade and a red gabled roof. The church interior is rectangular, following the conventional processional church layout with a western entrance and tower, a central nave, and an eastern chancel and altar. Before its transformation, the church was dark, with brown-stained plywood furnishings.

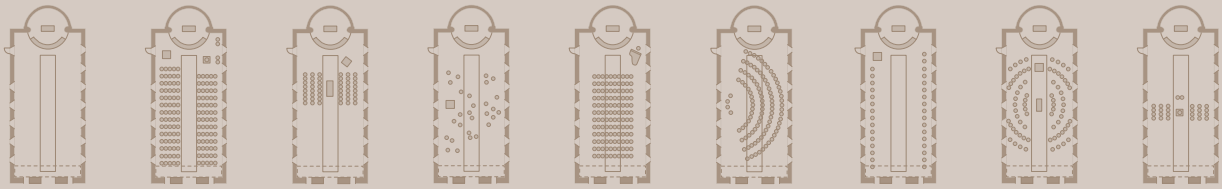
In 2002, the parish council sought changes to the church space to accommodate new forms of worship. The diocese approved alterations to everything except a painted arch behind the altar, likely because the church's relatively recent construction gave it lower heritage protection than medieval churches.

The transformation, carried out by the architectural firm NOVA5, included both structural interventions and new furnishings. The small, high-placed windows were extended downward, and their number was doubled. All surfaces, except for the painted arch, were renovated, including a new natural stone floor in Öland tiles. All furnishings were removed, and a new lighting system was installed, allowing for varied illumination and flexible room arrangements.

A key goal of the project was to maximize flexibility. All furniture, except for the altar in the chancel, is movable. The fixed pews were replaced with lightweight, stackable chairs, upholstered in fabric to help regulate acoustics. The chairs can be removed entirely if an open floor space is needed. The center aisle is marked by floor-mounted candlesticks which can also be relocated to the church's perimeter. Additionally, both the baptismal font and pulpit are movable.

Ill. 54: Ansgarskirken, Photographer: Jens Kinkel (Danmarks Kirker, 2025).

However, storage limitations pose challenges when the chairs need to be removed, as the church does only have a small storage area near the entrance. Additionally, the church staff's resources limit how frequently the space can be rearranged, as moving hundreds of chairs and floor-mounted candlesticks is time-consuming. Despite these challenges, the architects largely succeeded in creating a more flexible worship space that met the parish council's desires. According to the parish priest, Frances Ida Benzon, the improved lighting is highly appreciated, and alternative seating arrangements are used at least twice a week. The church staff and parish council are overall satisfied with the transformation, although public opinion remains divided. Many appreciate the changes, while others feel that without pews, the church no longer looks like a proper church. (Kreiner-Møller, 2022)



Ill. 55: Various rearrangings of the church space in Ansgar Church, hedehusene. Own illustration based on (Kreiner-Møller, 2022 p. 185).

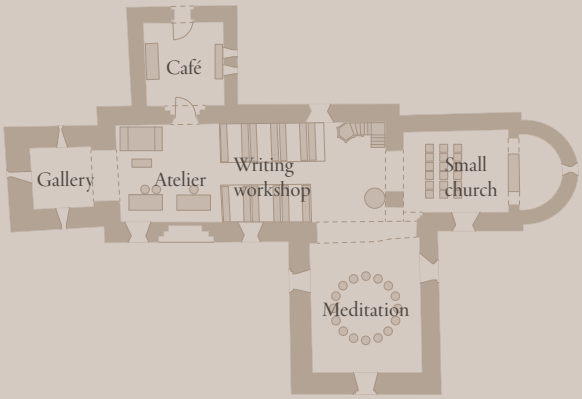
**Rybjerg Church**

Rybjerg Church was built around 1100 in the Romanesque style, featuring a nave, porch, chancel, apse, and tower. Inside, the tower room and chapel are open to the nave, creating a connection between spaces of different character. With a transformation project designed by Anna Mette Exner's architectural studio, it is among the five selected churches in the idea catalogue *The Village Church as an Asset* [1](Kirkefondet, 2016). The idea catalogue aims to inspire parish councils and local communities on how medieval churches can be used in new ways while still serving as a place for worship and religious ceremonies. The project serves as inspiration but has not been realised.

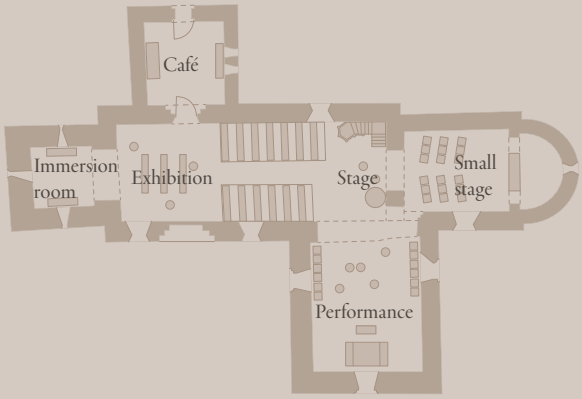
The project proposes two variations for an adaptation of the church to accommondate a cultural production church where people can express themselves creatively, individually and in community. Visitors should be able to participate in events and longer programmes, either as active participants or as spectators. The church's new use is intended to appeal to a wider audience, incorporating both non-religious cultural events and religious services. (Kirkefondet, 2016)

The project proposes, among other things, the partial removal of pews in the nave to create an active meeting place, workshop area, and exhibition space with greater flexibility. The open area in front of the triumphal arch can be used as a stage. In the chapel, a heated timber flooring is proposed, making it suitable for physical activities such as meditation, yoga, dance, and more. The kneeler is planned to be removed from the chancel which could then be used for smaller services. (Kirkefondet, 2016)

1 *Landsbykirken som et aktiv*




Ill. 56: Rybjerg church example 1. Own illustration based on (Kirkefondet, 2016 p. 45)




Ill. 57: Rybjerg church example 2. Own illustration based on (Kirkefondet, 2016 p. 45)

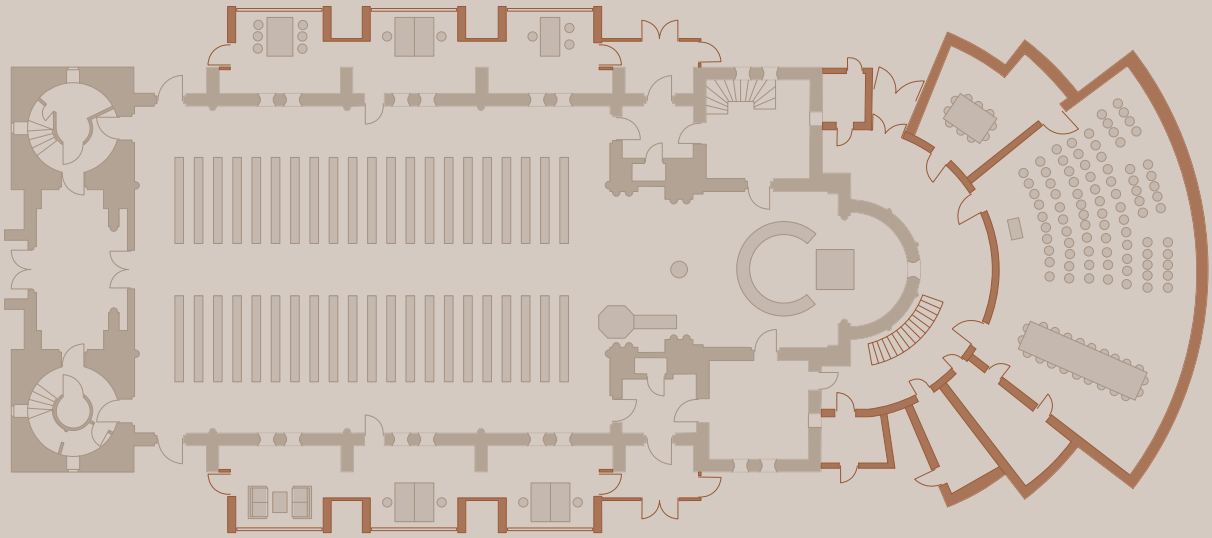
**Functional needs**

- Wooden floor with heating in the side chapel.
- Storage furniture for tools, equipment, and materials.
- Storage for chairs and tables.
- Movable screens for changing, theatre, and more.
- Hand wash basin for various creative activities.

**Points of attention**

- The heating system is being modified, including underfloor heating in the chapel.
- The brick floor is being supplemented.
- The kneeler and some seating are being removed.
- Installing water will involve physical interventions in the building.

(Kirkefondet, 2016, p. 45)



Ill. 58: Plan, Sct. Pauls Church. Own illustration based on (E+N) & (Jensen, 2012).

# Extentions to Sct. Paul's church

Between 1974 and 1978, Sct. Paul's Church in Aarhus was expanded with a parish center built as an extension of the church's chancel. The church is located in the heart of Aarhus and cannot be considered a village church, yet the way its extension was designed is interesting, as it exemplifies how additional space can be integrated in a modern manner while respecting an older church.

The church has a semicircular chancel, which Exner chose to build upon by designing a fan-shaped extension consisting of nine low gabled structures extending outward. Five central structures form a large parish hall, and two shorter structures on each side house offices and meeting rooms. Each unit has two narrow vertical openings and windows in the gable ends, where light is filtered through steel grilles. Between the chancel and the new parish hall, a glass-covered space has been created, functioning as an entrance area for the parish center, a distribution space, and a link between the church and the extension which is built at the church's basement level.

The relationship between old and new is resolved with strong material continuity and a related architectural language, yet the distinction between old and new remains clear. Viewed from the outside, the fan-shaped extension appears as a cohesive addition to the church. Over time, the extension will naturally integrate into its surroundings through the patina of its brickwork and copper roofing. The curved arrangement of small building volumes with interlinked gabled roofs reference the small side chapels, traditionally added to old churches. From the outside, this motif suggests a series of independent cells, while the interior presents as a continuous space.

The extension is a modern intervention that respects the original church architecture while introducing new functions making the church more user-friendly and open to the community. Exner's design includes meeting and teaching spaces, as well as a more accessible entrance area. This demonstrates how a historic church can be developed without losing its architectural and theological integrity. The extension is designed with a discreet yet modern aesthetic, where the use of brick and filtered light creates a harmonious dialogue between old and new. ( Jensen, 2012)

Later, the church had a more extensive renovation of the interior to create a more flexible church space while maintaining the church's original character. The goal of the renovation was to introduce new functions without compromising the historical value of the church. The new extension includes multifunctional spaces that can be used for both religious and cultural purposes, as well as improved accessibility for different user groups. This transformation makes the church more open and user-friendly for a broader audience, highlighting how modern architecture can revitalize historic church buildings by integrating new elements that support socially relevant activities. (E+N, 2024)

Ill. 59: Sct. Clemen's Church, Aarhus. Private photo.

Ill. 60: Sct. Clemen's Church, Aarhus. Private photo.

Ill. 61: Photo borrowed from E+N.

Ill. 62: Photo borrowed from E+N.

Ill. 63: Photo borrowed from E+N.

Ill. 64: Photo borrowed from E+N.

# Transformation of St. James Church

An example of extended use of the church space is the St. James's Church in West Hampstead, London. It is a church that has been adapted to accommodate a post-office, café and play-area without compromising the ability to host church services Sunday morning. (The Sherriff Centre, 2025)

With different services and events throughout the week, ensuring that the church has become a gathering place providing different activities for young and old. Various activities are targeted children and babies, while other events are for young people and adults, for example an evening bar or music events. The post-office was integrated in the church room when the former post-office in the area closed. The former vicar saw it as an opportunity to use the church's space in a wider scale. (The Sherriff Centre, 2025)

Ultimately, the addition of new secular functions and activities in the church room result in an increased use of the space. The have even experienced that the participation in church services have risen. The motivation for this, may be due to people creating a bond with the place resulting in a less awe for attending services. (The Sherriff Centre, 2025)

Ill. 65: St. James Church, West Hampstead, London, England. Photographer: John Salmon (Geograph, 2014) CC-BY-SA2.0.

# Partial conclusion

Considering Exner's and Sennett's theories, the transformation of village churches can be understood as a balance between preservation and renewal. Sennett emphasises the importance of the church maintaining its character, meaning that changes to the church interior or structure must be carried out with great care to avoid compromising its historical and architectural integrity, as well as people's perception of what a church is. Radical interventions, as reorganising the church's axial structure or removing essential architectural elements, can weaken the sacred atmosphere and its identity. At the same time, he points out that renewal is necessary to meet the evolving needs of society, and that changes should preserve community cohesion and the character of the space.

Similarly to Sennett, Exner argues that the character of church buildings can be preserved even when new functions are added. He emphasises that the church has historically been a dynamic structure, changing in response to societal needs, and that it is a misinterpretation to think that it should be frozen in time. For village churches, this means that the flexibility of the church interior becomes a key factor in the transformation. Flexible solutions as modular or movable furniture can accommodate various functions without compromising its sacred and unifying character. Like so, the church can remain a place for spiritual gathering while adapting to the changing needs of society, including secular use.

Regarding the need for new functions, extensions can be a relevant solution. Exner stresses the importance of ensuring that expansions respect the church's historical tradition while emphasising that they can add new spaces and functions without weakening the church's original character. It is essential that extensions build on the church's traditional design language and materials while providing space for a modern expression that harmonises with the existing structure. This could involve using traditional materials in new and relevant forms that give the church new life and make it more robust for future needs.

These approaches can both strengthen the church's relevance and simultaneously preserve its character, which is an important balance in Exner's and Sennett's theories.

- Renewal is neccessary for the church to remain present in modern society.
- Adaptations should not compromise the church's character.
- Flexibility is a key factor for adapting churches to include modern, secular use.
- Extensions with new functions can be relevant to enhance the use of the church without compromising its original character.

# ATMOSPHERE

Churches possess a particular atmosphere. A sense of stillness, seriousness, and presence that sets them apart from everyday environments. In the Danish Protestant tradition, as previously noted, the building itself is not sacred, but the proclaimed word is. Nevertheless, the atmosphere of the space contributes to the experience of something beyond the ordinary, and something we perceive as sacred. Through spatial qualities and architectural design, a sense of reflection, attentiveness and presence emerges. It becomes a space for the practice of faith and spiritual reflection.

## Heterotopia

To get a better understanding of the church's character, the sense of place within a church and its role in society, the term heterotopia is used. Heterotopia is a term defined by the French philosopher, Michel Foucault, in his article "Of Other Spaces" (Foucault, 1967). It is a definition of space used to describe "other spaces", as a counter concept and in relation to utopias. Utopias are spaces with no real place but a representation of society in a perfected form, and is fundamentally unreal spaces. Every culture and civilisation most likely have real, exsisting places, formed by the founding of societies, which are something like counter-sites and somehow act like utopias within the real places. They are formed by the specific society's culture and are places outside of all other places. These real spaces outside of other spaces, that culturally act as utopias but at the same time behaves as a contrast, is what Foucault defines as heterotopias. Foucault describes heterotopias through six principles.

***First principle:*** Heterotopias are constituted in every single culture in the world, in varied forms.

***Second principle***: Each heterotopia has a precise and determined function within a society, however in accordance with the society that surrounds it, it can also have different functions and change over time.

***Third principle:*** A heterotopia has the ability contain multiple and opposing spaces within a single real place.

***Fourth principle***: Heterotopias can function as small time pockets and exist when people break with traditional time and everyday life. They can accumulate eternity or exist outside of time.

***Fifth principle***: Heterotopic places which presuppose a system of openness and closure, that both isolates them and makes them accessible. This can be through a specific ritual or compulsory way of entry.

***Sixth principle***: The heterotopia either creates a space of illusion which emphasises the illusory nature of reality or in contrast another real space, that is so perfect, meticulous, and well-ordered being be the opposite of our everyday spaces.

## The Magic of the Real[1]

| | |
|---|---|
| 1 The Body of Architecture | 7 Tension between Interior and Exterior |
| 2 Material Compatibility | 8 Levels of Intimacy |
| 3 The Sound of a Space | 9 The Light on Things |
| 4 The Temperature of Space | 10 Architecture as Sourroundings |
| 5 Surrounding Objects | 11 Coherence |
| 6 Between Composure and Seduction | 12 The Beautiful Form |

Through the years, multiple architects have tried to explain with their own terminology, how they see the connection between architecture, phenomenology, atmosphere, and senses. To understand a church's heterotopia it makes sense to get an understanding of the place's genius loci and have a tools to understand the atmosphere as well.

In ***Genius Loci***, Christian Norberg-Schulz emphasises the importance of "the spirit of the place" - "Genius Loci" as a essential part of atmospheres in architecture. The medieval church is not just a building and a room like any other, it has a deep history and a special connection to the sourrounding landscape. The materials and construction methods in the heavy walls of stone, the lighting, and spatial indentity create and support the atmosphere of calmness, reflection, and spirituality. (Norberg-Schulz, 1980)

In addition to Heterotopia and Genius Loci, theory on ***Atmospheres***, by Peter Zumthor can contribute to the understanding of the special character of church spaces. He argues that the materials inherent characteristicas have a central role in the perception of architecture. (Zumthor, 2006) His book *Atmospheres* evolves around the term 'The Magic of the Real', describing the 9 and additional 3 "answers" to what he sees as characteristics for a place's atmosphere, life, form, materials etc. (Vadstrup, 2022)

Following Norberg-Schulz and Zumthor's terminology, the medieval Danish village church has a special spirit of place (Genius Loci) and atmosphere. There are common characteristicas in all of these churches that have roots in the basilica, but each church has its own atmosphere and spirit of place.

When transforming the medieval church, it is essential to identify and analyse the sensural qualities and atmospheres present in the specific church today. New materials and spacial interventions should respect and enhance the present atmosphere rather than weaken it. Therefore, it is essential to work carefully with the materials, lighting, and acoustics when transforming a church to remain true to its original character – its Genius Loci. (Vadstrup, 2022)

To gain a perspective of what the heterotopia and special atmosphere are in a medieval church, the following section of this thesis will further investigate, with the contribution of Zumthor's 12 answers, what makes the church's special character and sacred atmosphere.

1 For a more elaborate explenation of Zumthor's answers, see Appendix 07.

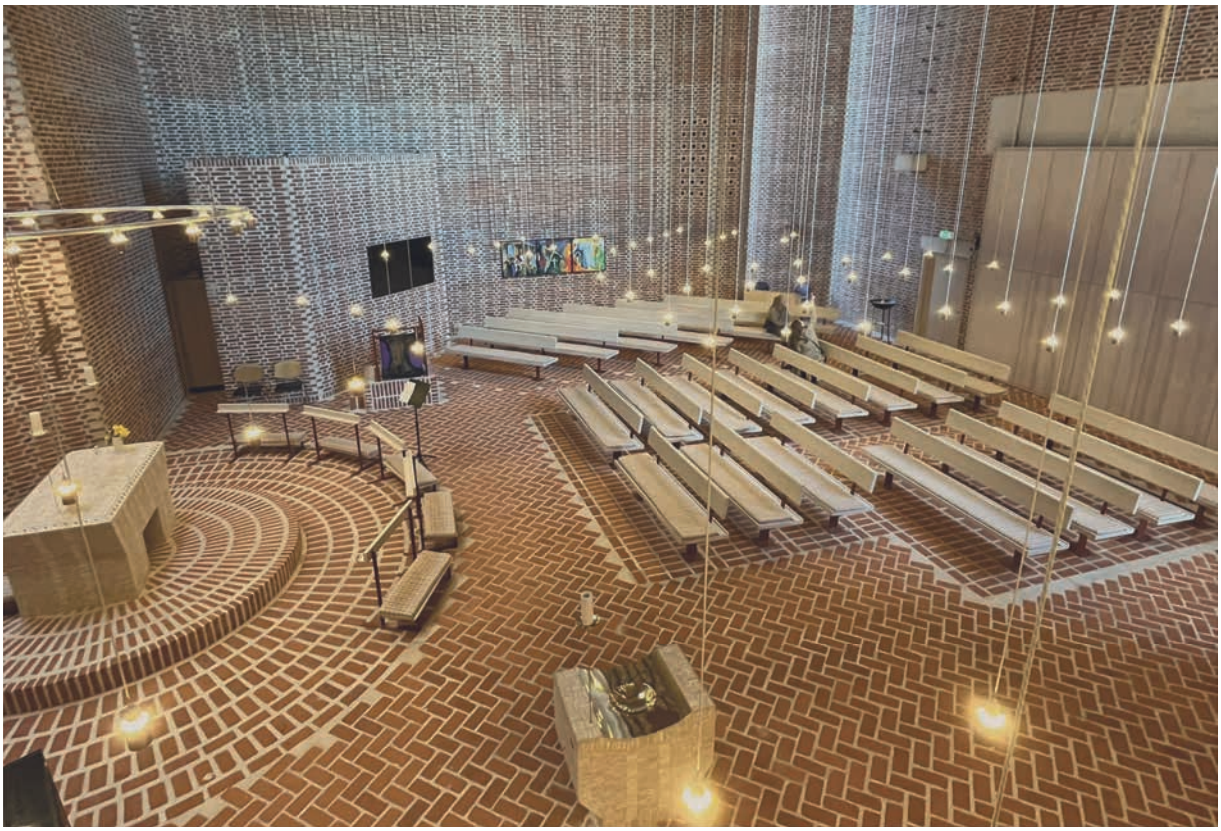
Ill. 66: Nibe Church. Private photo.

# The sacred atmosphere

**Scale and intimacy**
The spatial scale of church interiors balance between the monumental and the intimate. The tall ceiling creates a sense of vertical movement and solemnity, pointing beyond daily life towards something greater. Elements as a lowered vaults or low-hanging lighting that forms a visual ceiling below the actual roof help preserve closeness and enhance intimacy. Details as the baptismal font, pulpit, and other ornamentation are scaled in relation to the human body. This creates layers of intimacy, from the communal and shared in the nave to the more inward and personal in specific areas.

**Spatial orientation**
A clear orientation towards a central point of focus, typically the altar or pulpit, gives the room a spiritual centre. This provides order, guides physical movement and gaze, and gathers the attention of those present. The focal point may be placed at the end of a traditional longitudinal nave, or as a centralised space, as seen in Exner's later church designs.

Ill. 67: Vokslev Church. The altar is traditionally placed at the end of the church's linear axis from the entrance. The pulpit is placed in the center of the church at the junction between the nave and aisle. Private photo.



Ill. 68: Nørre Uttrup Church. A central altar that benches, furnishings, and pattern in the flooring are directed towards. The room has tall ceilings but a human scale is made by low-hanging lamps. Private photo.

**Transition and enclosure**

The transition from the secular to the spiritual occurs as one passes through the porch or into the nave. This movement often includes a shift from a lower to a higher space. Exner emphasises that spatial dramaturgy is essential to the experience of this transition. A clear sequence and defined framing provide direction and support the structure of the liturgy. (Jensen, 2012) Ideally, the first thing one sees when entering the nave is the altar. The church interior is a place to forget everyday life and enter a state of reflection. Therefore, it is often beneficial if the windows do not allow direct views of daily activity, but instead offer glimpses of the sky or nature.

**Materiality**

Tactile surfaces, honest materials, textures, and colours bring depth to the space. Coarse lime plaster, bricks, worn stone floors, and patinated wood all contribute to a sense of continuity and history. Pallasmaa (2005) emphasises, how such materials activate the senses and make the space bodily and present. A consistent use of materials and colours from floor to ceiling reinforces a unified spatial expression. When the visual elements are in harmony, they promote a sense of calmness and coherence.

Ill. 69: Nørre Uttrup Church. The transition from from a low room into the tall church room. Walls and floor in rough brickwork with wide unwashed mortar. Private photo.

Ill. 70: Vokslev Church. Whitewashed walls, robust stone floors and wooden furnishings, painted in cheerful colors that harmonize with the church's other ornamentation and frescoes. Private photo.

Ill. 71: Margrete Church, Aalborg. Private photo.

Ill. 72: Gug Church, Aalborg. Private photo.

*"A good church space therefore contains something ineffable in it or opens up to the ineffable. What this consists of is difficult to explain, but it primarily has to do with light, the space's relationship to light, the space's way of receiving the light from outside, of passing on the light inside the space. Light has to do with life. Light was the first thing God created. Light is a divine material, capable of more than anything else on earth. In a good church space, the light touches the keys of our sensitivity, opens the mind's receptivity, transports and carries you, so that you at once float around the space, out of the space, beyond the space, in the sphere of space, the space of heaven, while at the same time your feet are standing on the stone floor and your eye on the surface of the wall tells you where you are. The light connects you with heaven and earthly existence."*

(Exner, 1993, p. 28)

### Natural light and shadow

Light are perhaps the most powerful atmospheric element. In older churches, it is filtered through small windows and appears concentrated and gentle, almost ritual in character. It is not evenly distributed but appears in specific places as the altar, baptismal font or along the walls. This creates zones of quietness and enhancement.

In older churches, this often occurs through the careful interplay between room and openings. In newer churches, light is used more deliberately as an atmospheric tool. Slanting light may not target specific objects but instead creates subtle effects of light and shadow on walls, floors and ceilings. This lighting can highlight the volume and texture of the room, and creates a dynamic mood that changes throughout the day.

Light in newer churches can also be used to establish rhythm by illuminating specific areas at certain moments. This may include the altar during communion or the pulpit during sermons. This use of light and shadow enhances the liturgical actions and supports the space's spiritual function. Unlike older churches, where light may be more static and natural, modern churches are more flexible and often create varied atmospheres depending on time of day and use. This flexibility allows architects to shape the emotional experience of the space in a more targeted way.

### Artificial lighting

Artificial lighting plays a vital role in shaping the atmosphere and enhancing the spiritual expression of the space. It is especially effective when used to emphasise architectural or liturgical elements. Johannes Exner describes how a 'lowered ceiling of light' can create a unique and reflective atmosphere. By concentrating light above the congregation, it forms a lighted dome within the larger volume of the church room. This immaterial ceiling helps define an inner, liturgical space that is more human in scale (Exner, 1958).

Ill. 73: Nibe church. Light enters through windows and openings, that guides movement. Contrast between light and dark zones. Private photo.

Ill. 74: Nørre Uttrup Church. Natural light falls on walls and highlights important elements such as the altar. Artificial lighting creates warm, intimate spaces within the room. Private photo.

**Symbolism and iconography**

Although Protestant churches are often simple in layout, symbolism plays a crucial role. The crucifix, altarpiece, pulpit, and other visual elements like paintings and sculptures define the spiritual meaning of the room. In older churches, these are often integrated into the architecture through ornamentation and decoration. In newer churches, symbolism may appear more abstract, expressed through simplified forms or lighting.

It is relevant that the symbolism, regardless of its form, is of a character that makes it recognisable as Christian elements. The symbolism contributes to the perception of the space as a church space. Detailed ornamentation, as frescoes, does have an advantage, as it allows the church's visitors to immerse themselves in the details of the Christian narrative being presented, and through this forget time and place for a moment.

Ill. 75: Nibe Church. Private photo.

Ill. 76: Vokslev Church crucifix. Private photo.

Ill. 77: Vokslev Church ship. Private photo.

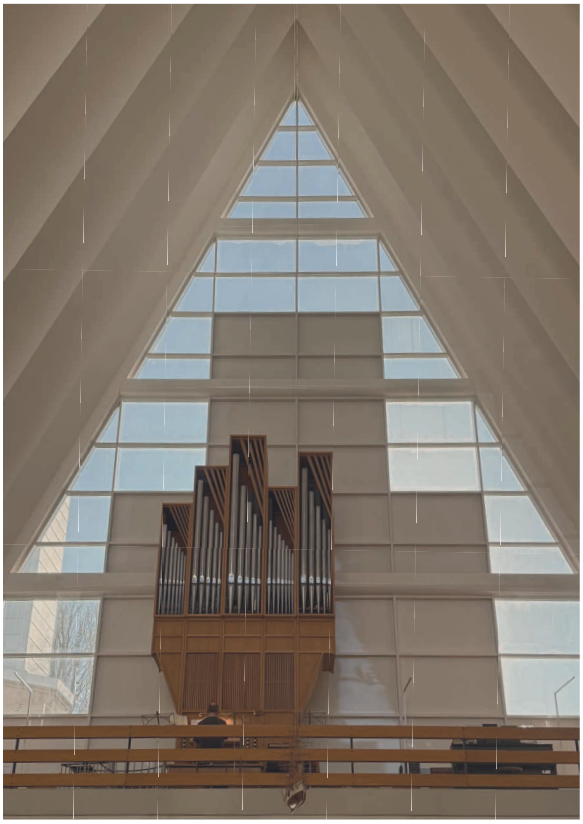
Ill. 78: Skalborg Church. Cruciform ornamentation in the masonry. Private photo.

**Sound and silence**
The acoustic of a church is essential to the perceived atmosphere. Stone floors, vaulted ceilings, and large open volumes create reverberation that enhances speech, song, and silence. When a voice resonates or silence becomes audible, the gravity and stillness of the space are intensified. The contrast with everyday environments makes it clear that one has entered a very different place, that evokes calmness and attentiveness.

**Temperature and physical conditions**
The physical conditions of the space, cold, warmth, and airflow influence the experience of the churches. The cool air in older churches can elevate the sense of seriousness and make one aware of one's body. A comfortably heated space, on the other hand, may foster a sense of peace and presence.

**Associations and expectations**
We all carry certain expectations of what a church should be. These are shaped by cultural traditions and personal experience. They influence how we perceive the space the moment we enter. We associate churches with silence, respect and a slower rhythm. A long room with pews on each side and an altar at the end immediately evokes these associations, even before we consciously register specific features.

A church that departs from traditional forms may challenge these expectations and result in a more ambiguous or distant experience. In such cases, architecture must work more consciously to establish a reflective atmosphere. It needs to compensate for the absence of familiar shapes and rituals that we intuitively associate with a spiritual space. If executed with care and precision, this type of room can be even better, because they can satisfy asmospheric situations that the traditional form cannot.



Ill. 79: Margrete Church, Aalborg. Private photo.

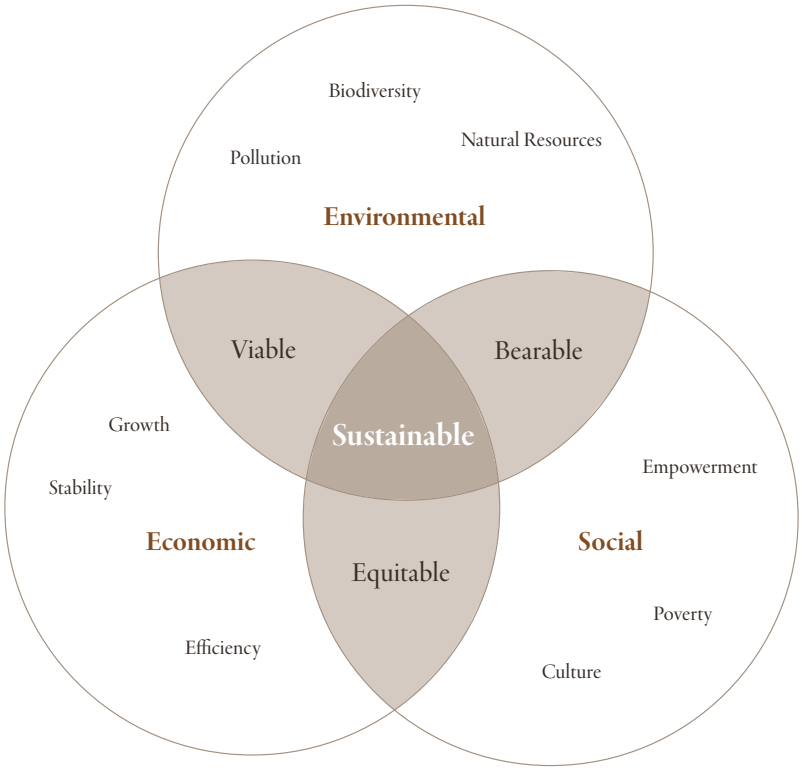
- When transforming exsisting churches the sacral atmosphere and the place's Genius Loci should be preserved and possibily enhanced.
- Enhance the heterotopic characteristics of the churches as "other spaces" in contrast to everyday spaces.

# SUSTAINABILITY
## in regard to medieval village churches

In 1987, World Commission on Environment and Development, 1987 defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." (World Commission on Environment and Development, 1987). In present times, it has become crucial to consider sustainability in every field, especially in the construction industry. In Denmark, the construction industry stands for around 30% of the total CO2-emission (Teknologisk Institut, 2023) and around 40% of all waste (Videncenter for Cirkulær Økonomi i Byggeriet, 2025).

The three pillars of sustainability: Environmental, Social and Economic sustainability are a guideline for sustainable development. These three aspects can be used to influence global sustainability goals, creating a holistic sustainable development. (World Commission on Environment and Development, 1987)

In this thesis, sustainability is the foundation for the problem, process and answer. There is a need for sustainable solutions, environmentally, economically, and socially. The need for the medieval churches to adapt to present and future needs demand a change in the physical environment. This intervention must be designed carefully to enhance the economic and social conditions with a reduced environmental impact. Rethinking the design process is the first solution for a holistic sustainable development.




Ill. 80: Three pillars of sustainability. Own illustration.

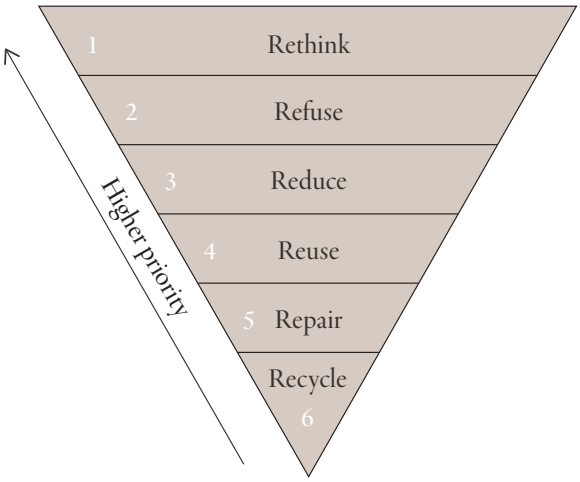
# Rethink the process

Historically, the construction industry has used a linear model for the use of resources. The process has been 1: producing, 2: using and 3: throw away. This results in a high consumption of resources and amount of waste resulting in much emission of greenhouse gases. To avoid this in the future, we need to use circular economy strategies in the construction industry. Total circular economy is impossible, as there will always be a wear of the materials that will decrease in use over time. So the goal is to slow down the waste production and prolong the lifetime of existing materials. (Videncenter for Cirkulær Økonomi i Byggeriet, 2025)

To lower the environmental impact, the construction industry need to rethink the design and building process striving for circularity. A prioritised list of 6 R's is set as a guideline to minimise the carbon footprint and promote circularity. These can be applied in design processes as well in everyday life. The 6 R's are derived from the concept of the three pillars of sustainability and the need for circularity in the society. (Sustainability Success, 2024)

**"Circular construction is about building so that neither precious resources are lost along the way, nor when a building or part of a building has once in the future served its purpose."**

(Videncenter for Cirkulær Økonomi i Byggeriet, 2025)




Ill. 81: The 6 R's. Own illustration based on (Sustainability Success, 2024)

**Rethink;** the process and consider the impact of your decisions. E.g. start with the available materials & design for disassembly.

**Refuse;** overconsumption and to design non-sustainable eg. Use new or non bio-based materials.

**Reduce;** the new things, mineral materials, energy and design compact

**Reuse;** materials, building elements, structures and buildings that has potential and give it a new purpose.

**Repair;** what is possible instead of replacing.

**Recycle;** the material for new purposes if nothing above is possible.

(Sustainability Success, 2024)

# Design for Disassembly

The principle "Design for Disassembly" (DfD) is one of the most important building principles to prevent and reduce material waste in the building industry. By designing the details of a building for future disassembly, it is possible to reuse or recycle the materials which reduce the amount of material waste. (Teknologisk Institut, 2019) Aditionally, Johannes Exner argues that reversible interventions have several advantages when it comes to interventions on historical buildings because it is possible to preserve as much as the original substance and elements as possible. The principle of reversibility ensures that changes made can be undone in the future. (Exner, 2007)

In the handbook by Teknologisk Institut (Teknologisk Institut, 2019) 27 guidelines for DfD are set. Multiple of them are overlapping, why 11 themes are described as following:

The effect of using the principles for design for disassembly compared to using upcycled materials in a building depends on the type of evaluation. The reusing and recycling strategy results in lower GWP when using the LCA method from the EN standards. The standards does not credit for future (potential) reuse of the material as the principle of DfD facilitate. (Rasmussen et al., 2019)

When designing according to the design for disassembly principles, the materials with the highest contribute to the module D (potential for reuse, recycle and recovery beyond the building) must be the ones to focus on. Additionally, focus should be on the materials with short lifetime (and many replacements) as these has the highest potential for environmental savings (CO2). (Rasmussen et al., 2019)

| THEMES | GUIDELINES |
|---|---|
| **Recycled materials** | 1. "Use recycled or recyclable materials" |
| **Simplify** | 2. "Minimise the number of different types of materials<br>7. "Minimise the number of different types of components"<br>17. "Use a minimal number of joints"<br>18. "Use a minimal number of different types of joints" |
| **Avoid toxic and hazardous substances** | 3. "Avoid toxic and dangerous materials" |
| **Same material** | 4: "Make parts that cannot be separated from the same material"<br>5: "Avoid surface treatments of materials" |
| **Identify and retain information** | 6: "Identify material types"<br>21: "Provide identification of component type"<br>27: "Maintain information about components and materials." |
| **Assemblies must be reusable** | 8: "Use mechanical, not chemical, joints"<br>19: "Design joints and components to withstand repeated use" |
| **Avoid special designs** | 9: "Use open construction systems"<br>11: "Design for use of common tools – avoid special factories"<br>23: "Use prefabrication and mass production" |
| **Modular design and standards** | 10: "Use modular design"<br>22: "Build structures and building layouts with dimensional and modular coordination" |
| **Allow parallel disassembly** | 12: "Separate load-bearing structures from cladding"<br>20: "Allow parallel separation" |
| **Easy access to assemblies** | 13: "Provide access to all parts and assembly"<br>25: "Identify assembly points" |
| **Handling components** | 14: "Adjust the size of components for handling"<br>15: "Provide means for handling and placement"<br>16: "Ensure reasonable tolerances for assembly and disassembly"<br>24: "Use lightweight materials and components"<br>26: "Provide spare parts and stock on site for disassembly" |

Ill. 82: Themes and guidelines for Design for Disassembly (Teknologisk Institut, 2019 Table 5, p. 2)

# TRANSFORMATION STRATEGIES

When working with transformation of a historical building, there are various things to consider. Adaptive reuse is a strategy where existing spaces is being reused for other purpose than the original function (Wong, 2016). The intention is to utilise the potential of space to facilitate other functions than its original purpose. Different strategies can be used to transform or adapt an existing structure to new purposes.

**Passive vs Active Monument Conservation**

Maj Bjerre Dalsgaard is in her dissertation discussing and reflecting on: *How the possibilities for future transformation of village churches can be defined?*[1] (Dalsgaard, 2021, p. 311). Dalsgaard introduces the notions passive and active monument conservation. Since the church conservation act was established in the 1800s, **passive monument conservation** has been the strategy to preserve the medieval village churches. The purpose has been to preserve their significance in the countryside as well as their cultural and historical values. As Dalsgaard enhances, the village churches have always been an active part of society and the parishes. They have developed physically following the needs of the religion and society. So, even though passive monument conservation ensures that physical historic values are preserved, it puts the churches in a box for which they were not meant for. To prevent medieval village churches from becoming passive monuments, as Dalsgaard mentions; *historic artefacts for people to observe*, it is necessary to examine the churches with a more active strategy: **active monument conservation.** (Dalsgaard, 2021) It is not uncommon for larger city churches, to be transform into a new function. This way it secures the historic building to exist in a more modern context and therefore shows other possibilities than ecclesiastical use.

Active strategies in this sense can therefore be changing interior to accommodate a more modern approach to the way a church space is experienced. Additionally, not to be afraid to make interventions in the church building for it to allow more activity. When adding new value to a building and the local society, while at the same time protected the original value, it is possible to protect the church as an active part of the village.

*1 Hvordan kan mulighedsfeltet for fremtidig transformation af landsbykirke blive defineret?*

**Five methods on architectural transformation**

In the process of transformation, can different approaches be applied for adapting the old building to accommodate the new. The architect Nicolai Bo Andersen describes five methods on architectural transformation, each introducting different strategies for interventions in a transformation project. (Andersen, 2015)

Not one strategy fits all, when it comes to transformation projects. Every project must be adapted to its own valuation and existing conditions. The intention is to continue the architectural understanding and development to secure a more active building culture (Andersen, 2015). Using more proactive methods as these can support an active monument conservation to secure the future of historical buildings that are in risk of not being used to full capacity in near future.

The five methods: *Subtraction – Reconstruction – Reparation – Refurbishment – Addition* (Andersen, 2015).

**Subtraction**: structures, spaces and elements get removed either because they are unoriginal substance, or to make way for new spatial or visual connections.

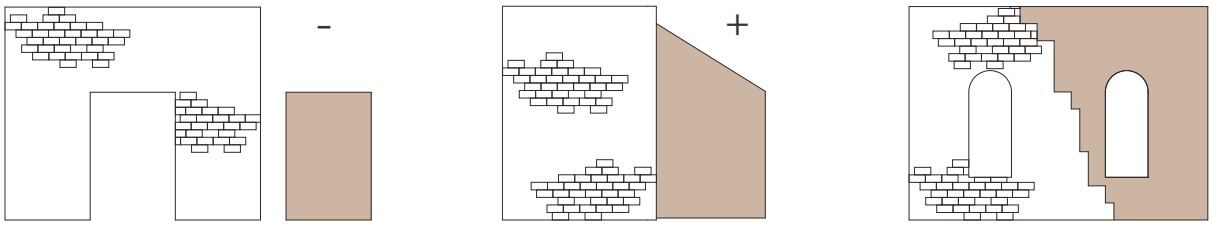
**Reconstruction**: rebuilding the damaged or replaced structures, spaces or elements.

**Repairation**: maintenance or reparation of the structures, spaces or elements that have suffered damage or a visible reparation in architectonical style.

**Refurbishment**: structures, spaces and elements that get reconstructed or transformed with the intention of adapting to a new function or a demand to optimize energy efficiency.

**Addition**: new structures, spaces and elements, that gets added in close relation to the surrounding context.

- Focus on active monument conservation and adapting historical buildings
- Including strategies for transformation of existing buildings




Ill. 83: Transformation strategies. Own illustration based on (Andersen, 2015).

# On Altering Architecture

Fred Scott's theory *On Altering Architecture* reflects on different aspects of transformation and alterations on architecture with perspectives on the physical structure and the cultural context. Scott emphasises that any type of work on a building is an alteration, even when it is restorative work or conservation. In any case an understanding of the host building and its spatial context is required. The same goes for the temporal context, to understand the needs and values of the society. (Scott, 2008)

Architecture is in a constant state of evolving and buildings and spaces are continuously altered over time. The change either physically or by adapting to new functions or needs. Scott emphasises how buildings are designed with the expectation of change and therefore is it necessary to include this thought process, of future alterations, from the beginning of the design process.

Scott explores the identity and spirits of old buildings, as there is a balance of preserving the original structure and identity while adapting to a new purpose or function. Here Scott shares the art critique, John Ruskin's view on restoration, and he has a strong opinion on alterations of architecture. Ruskin believes that restoration is the most total destruction that a building can suffer. "[...], that spirit which is given only by the hand and eye of the workman, can never be recalled." (Scott, 2008, p. 49). He states that when a building is being restored it loses the original spirit of the workman, and it will be given a new spirit, through the new alterations, and therefore it will then be a new building. Simply the original spirit cannot be summoned and commanded to other hands. (Scott, 2008)

> "Old churches are and will continue to be required to absorb changes; what is important is that these changes are both well conceived and well carried out, and not regrettable."
>
> (Scott, 2008, p. 51)

This is where Scott believes it is a necessary and natural thing for a building to be altered and getting a new spirit through time and evolving with society, for the building to stay relevant and still be a part of it. When societal and cultural values and needs change so does a building. This goes for both contemporary buildings as well as historical buildings. (Scott, 2008)

Scott argues that architecture must be understood as a dynamic thing, which is deeply tied to the social context in which it exists.

# Restorations and Reconstructions

David Chipperfield offers his view on restoration and reconstruction, in an essay that reflects on the process of balancing historical preservation and contemporary interventions (Chipperfield, 2016). He writes about the complexity of adapting old historic buildings to a modern society, and how it must be avoided that cities turn into museums and instead have the old buildings interacting with the built environment and contribute to society.

Chipperfield emphasis that including heritage as something not only from a distant past but also as something closer to the present, it can contribute to and create a stronger dialogue in relation to a fundamental architectural issue: the architectures meaning to society. (Chipperfield, 2016)

"Architecture as an isolated individual act is something which endangers our cities." (Chipperfield, 2016, p. 23)

He reasons that buildings must be actively included in their context and give back to society, otherwise they will distance themselves from it. He emphasises that architects often see buildings as more than an object, its role is more like a contributor to society and has more to offer than its individual qualities. (Chipperfield, 2016)

Societies have come to realise through time that even though protecting the old buildings also protect their cultural heritage, it is not only because of their age but also because of the impact the architecture has on the broader shape of their built environment. Chipperfield states that a building is not an artefact and therefore cannot be stored away easily. New buildings will often replace old buildings. The only exception to this is view according to Chipperfield is churches. They are the exception to the rule and because of their significant status in society, they should be preserved. (Chipperfield, 2016)

**"[...], the 'feel' of the building is something everyone seems to understand and we are to avoid changing that 'feel' in any way."**

(Chipperfield, 2016)

In a historical perspective, has certain strategies for adapting buildings to the present times, existed. Yet today there is an academic reluctance when it comes to adapting buildings and use the strategies from the past. Chipperfield claims that it used to be possible to re-interpret historic buildings. Instead, now there it is as if there is a common idea that there is only one crucial moment in a building's history and that one specific characteristic must be preserved. Historically have old buildings been adapted and changed drastically, and these changes how now been accepted by society. (Chipperfield, 2016)

There is a tension between preservation and new architecture, and it is difficult to mediate protection and reuse. It is important to have a balance between what to keep and what to change, as the surroundings will be the first to suffer. When changing existing conditions, it will also change many people relations or connection to that specific place. It can be crucial for a building's future what kind of reception the 'new' building gets. Here Chipperfield states that it is a must to not disrupt the integrity of the original building design (Chipperfield, 2016).

# Koldinghus

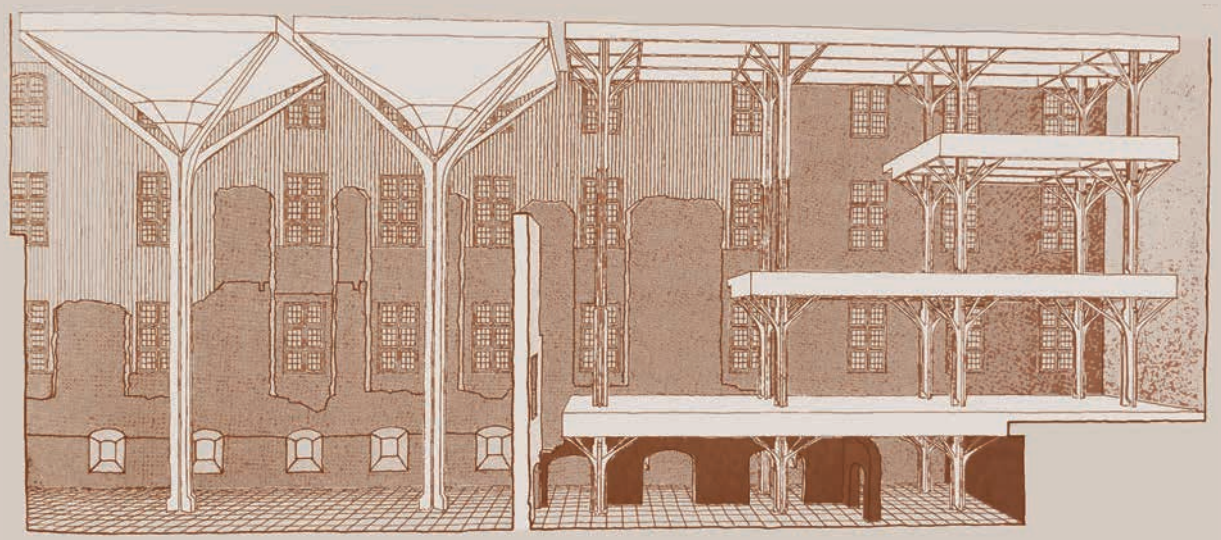
The theoretical foundation opens up for a deeper understanding of how tectonics can be applied to analyse specific architectural works. A prime example of a tectonic approach in contemporary restoration is Koldinghus, a historic ruin in Denmark transformed by Inger and Johannes Exner in the 1980s and 1990s. The project exemplifies how the relationship between structure, construction and tectonics (Sekler, 1965) as well as gesture and principle (Foged & Hvejsel, 2018) can materialise in a built work. The result is a rich interplay between technique and expression.

**Concept: Self-supporting additions as principle**
In line with the tectonic idea that structure and construction carry expressive potential, the Exners developed the restoration of Koldinghus around a clear structural and conceptual principle. All new architectural additions were designed to be self-supporting and independent from the historic masonry. This approach ensured that the old ruin remained legible and intact while allowing new functions to be introduced without compromising its material or symbolic integrity (Jensen, 2012,). The architectural gesture, represented by the light and transparent walkways and timber constructions, was made possible by this structural principle. It demonstrates the balance between technical solution and architectural expression.

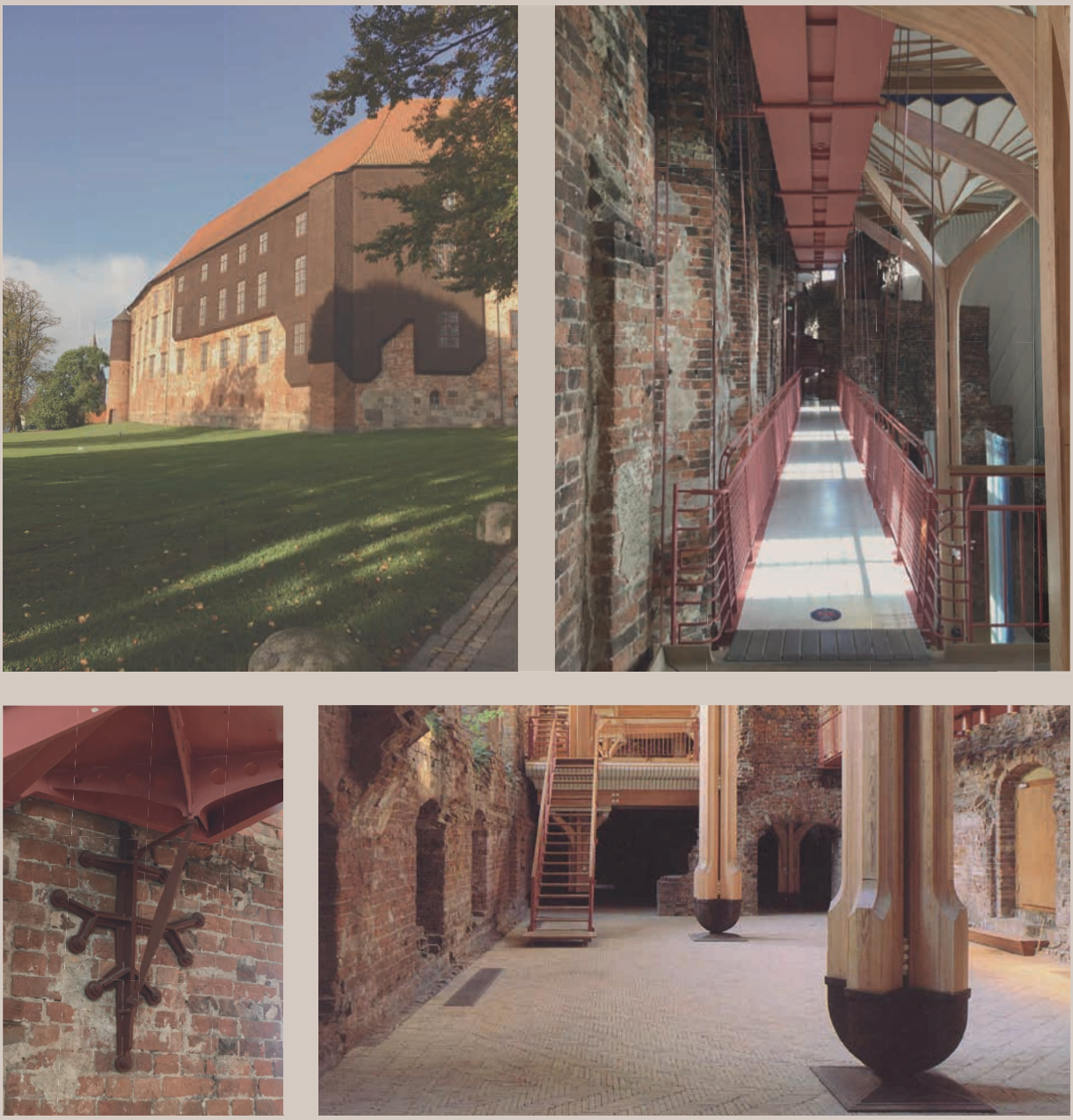
**Meeting of new and old: Contrasts and respectful distance**
The connection between gesture and principle becomes especially evident in the way the new interventions engage with the existing ruin. Rather than imitating or merging with the old structure, the new elements are held at a respectful distance. This is often achieved through narrow physical gaps or recessed joints. The contrast between rough, weathered brick and precisely crafted timber or steel details emphasises the layered history of the building. Here, construction is not only a technical response to stabilise the structure. It also serves as a narrative device that speaks of time, materials and transformation. In tectonic terms, the interventions allow both old and new to coexist while maintaining their individual character (Jensen, 2012).

**Joinery and details: Bespoke fittings**
One of the most remarkable aspects of the restoration lies in the detailing. This is particularly evident in the custom-designed metal fittings and joinery used to connect the new elements. These are carefully adapted to each specific situation and often suspend new floors or staircases just in front of the historic surfaces without making direct contact. According to Thomas Bo Jensen (Jensen, 2012), these fittings are not only technical solutions but also deliberate design gestures. They make the structural logic visible and enhance the tactile experience of the space. These visible connections express how the building is assembled. Construction becomes an integral part of the architecture's aesthetic.

Koldinghus is more than a successful example of adaptive reuse. It is a deeply tectonic project. The careful attention to structural principles, constructive methods and material expression results in architecture that is both technically effective and rich in atmosphere. The Exners' approach reflects Frampton's idea of an expressive constructional culture (Frampton, 1995), where materials and structures are revealed rather than concealed. By using self-supporting additions, crafting detailed transitions and establishing a conscious dialogue between past and present, Koldinghus stands as a built expression of tectonic theory in practice.



Ill. 84: Koldinghus section. Own illustration based (Jensen, 2012 p. 265).

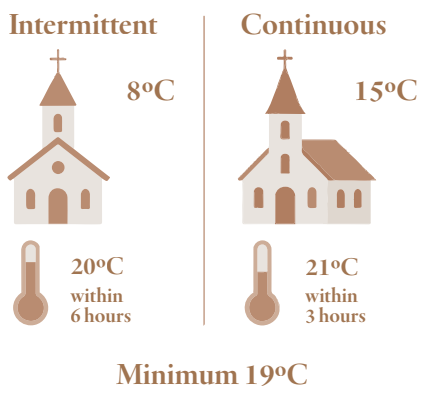


Ill. 85: Koldinghus. Photos borrowed from E+N.

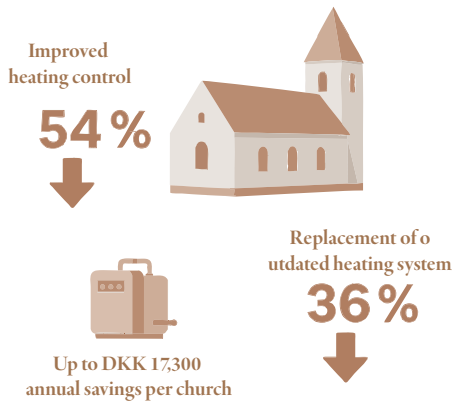
# ENERGY OPTIMISATION & RECOMMENDATIONS

### Balancing Preservation and Energy Efficiency

Energy optimisation in Danish village churches requires a careful balance between preserving cultural heritage and reducing energy consumption. Many medieval churches have remained unheated for centuries, resulting in a stable indoor climate that has been beneficial for the preservation of building elements, and furnishings. However, modern heating systems can introduce temperature fluctuations and moisture problems, which may harm frescoes and masonry. (Creo Arkitekter, 2015)




Ill. 86: Heating recommendations. Own illustration.




Ill. 87: Energy saving potentials. Own illustration.

### Heating Recommendations

A key aspect of energy optimisation involves adjusting heating settings. For churches with intermittent heating, the base temperature should be kept at 8°C, allowing the temperature to rise to 20°C within 6 hours before use. In churches with continuous heating, the base temperature should not exceed 15°C, and the temperature should be able to rise by 6°C within a maximum of 3 hours. (Creo Arkitekter, 2015) For occupational health and safety compliance, temperatures during services and work should be at least 19°C (Menighedsråd, 2022).

### Energy Saving Potentials

Insights from Syddjurs Provsti demonstrate that targeted measures can result in substantial energy savings. Improved heating control alone can reduce energy consumption by an average of 54%, while replacing outdated heating systems can provide an additional 36% reduction. These measures could save up to DKK 17,300 annually per church, with total savings potentially reaching 73%. (Vejborg, 2021)

### Insulation Measures and Moisture Risks

Extensive insulation retrofitting is generally discouraged in medieval churches. The building materials and construction methods differ substantially from those used in modern architecture, making standard solutions unsuitable. For example, installing permanent under-roofs or insulating vaulted ceilings can disturb the building's moisture balance, shift dew points, and block necessary ventilation. This can lead to salt deposits, plaster flaking, and long-term structural damage. Even in non-vaulted churches, insulating flat ceilings can conceal signs of water ingress, rot, or insect activity, allowing damage to develop unnoticed (Creo Arkitekter, 2015).

In addition, insulation typically results in only minor energy savings when compared to the high installation costs. The large spatial volume and short, intermittent heating periods in churches mean that the thermal benefit of roof insulation is limited. It is usually more effective to follow existing heating recommendations and focus on the occupied areas of the church, rather than heating the entire space (Creo Arkitekter, 2015).

### Air Tightness and Window Interventions

When improving energy performance, attention should be paid to sealing air leaks and closing thermal bridges. Secondary glazing, inspired by methods used in other historic buildings, is sometimes proposed. However, medieval churches are fundamentally different, and it is difficult to calculate their heat loss patterns accurately.

In bigger churches with large windows and regular heating, secondary glazing may offer some benefits. Similarly, churches from the past 100 to 150 years with a higher proportion of window area may see improvements. In contrast, medieval village churches usually have small windows and thick, cold walls. In such cases, secondary glazing provides little thermal benefit and is often not economically viable. It may also reduce natural ventilation and contribute to moisture problems. However, from a comfort perspective, it can help reduce cold drafts in winter and improve local conditions for users (Creo Arkitekter, 2015).

### Tailored Approaches and Long-Term Responsibility

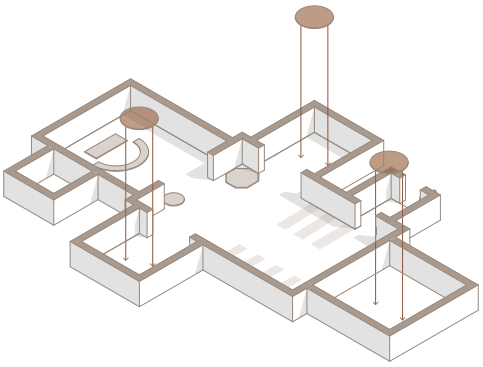
All energy-related measures should be customised for each individual church. While there is increasing interest in $CO_2$-neutral energy sources such as solar panels, geothermal heating, and heat pumps, these technologies must be evaluated not only on technical and environmental grounds but also in relation to their visual and physical impact. They must not compromise the historical or cultural integrity of the building or its surroundings, including churchyards (Creo Arkitekter, 2015).

Church interiors are not as sensitive to temperature as people, but they are vulnerable to fluctuations in humidity. Porous and organic materials absorb and release moisture depending on relative humidity, which can lead to chemical deterioration. If unnoticed, this may cause severe damage to frescoes and historical furnishings, often leading to irreversible loss or very high restoration costs. Maintaining a stable indoor climate is therefore just as important as achieving energy efficiency (Creo Arkitekter, 2015).

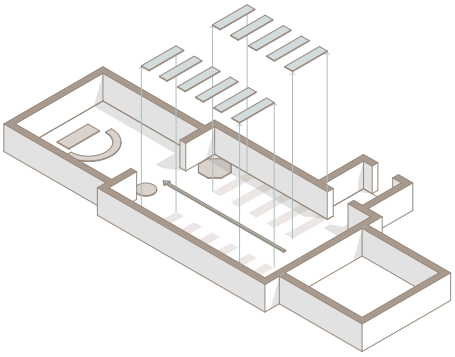
Other energy-saving measures, such as using LED lighting with timers and sensors, and insulating heating pipes, can further enhance energy efficiency without compromising the building's cultural heritage (Creo Arkitekter, 2015).

- The church construction and interios have adapted to the existing indoor climate
- Changes for energy optimisations must not compromise the historical and cultural intergrity

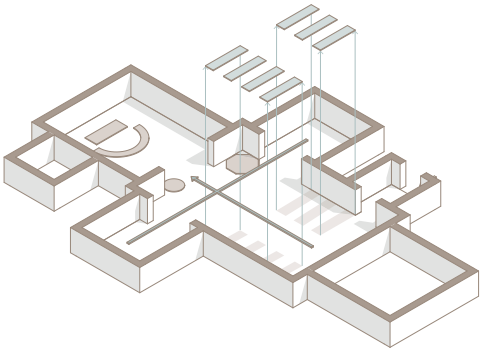
# POTENTIALS FOR ADAPTING THE CHURCHES



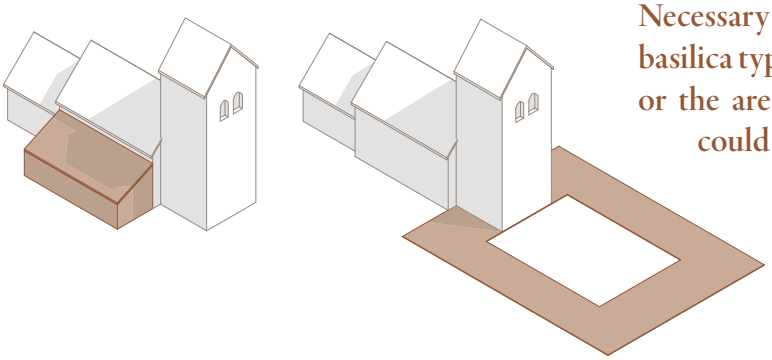
Functions necessary to support a more multifunctional use of the church could potentially be placed in existing extensions.



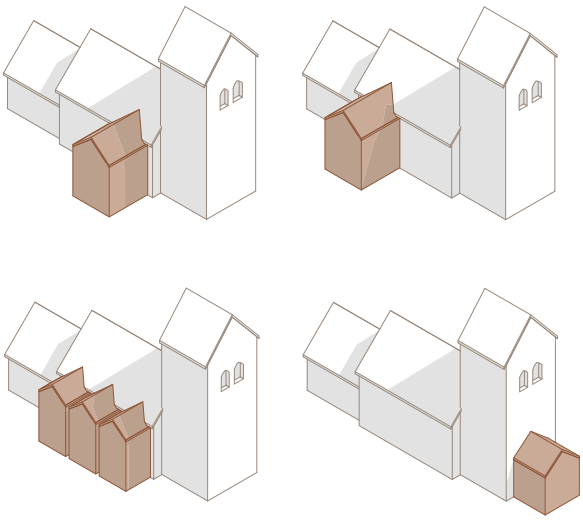
Pews and fixed seating may be removed in favour of more flexible furniture – as long as the church's axial alignment towards the altar and/or the pulpit is preserved.



 Ill. 88: Conluding process for the potentials of adapting churches. Own illustration.

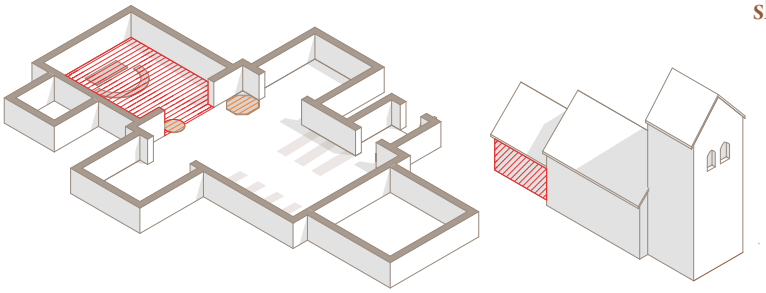


Necessary extensions may, following the basilica typology, be constructed as side aisles or the area of the former atrium courtyard could be explored as a potential site.



Extensions can also be built in line with the church's historical development, characterised by small additions with pitched roofs.

The chancel – as the church's "holiest" space – should remain untouched.



Ill. 89: Conluding process for the potentials of adapting churches. Continued. Own illustration.

# DESIGN PRINCIPLES FOR ALL INTERVENTIONS

## in regard to medieval village churches

Maintain the heterotopia of the church building as a place for both religious and secular purposes

The adapted space must facilitate rural social activities while accommodating the individual user

The intervention must respect and enhance the existing sensory and atmospheric experience of the church

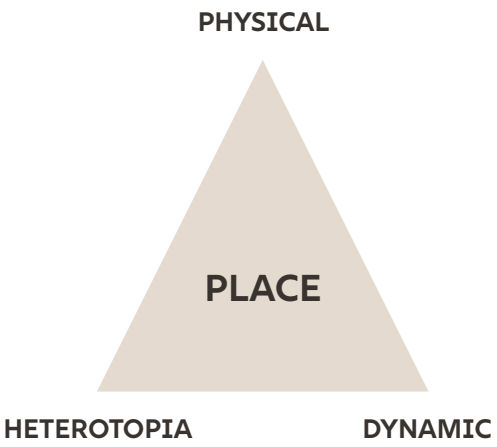
Only subtract materials and elements when it contributes to spatial value and flexibility, and the added must respect, harmonise and differentiate with existing ones on a tectonic level

New construction must comply with BR18 and be optimised in regard to low impact on the environment

Added materials and elements must comply with the principles of Design for Disassembly

All interventions, small or large, must be based on a methodologic analysis and valuation.

# RECOMMENDED TOOLS TO ANALYSE SPECIFIC CHURCHES




## PHYSICAL
based on Søren Vadstrup (p. 14)

**1: Identification**

**2: Analysis**
Historical analysis
Architectural analysis
Technical analysis

**3: Value Assesment**
based on Johannes Exner (p. 15)
Orginality
Authencity
Identity
Narrativity

**4: Recommendations**
based on Nicolai Bo Andersen (p. 77)
Repair
Subtraction
Reconstruction
Transformation
Addition

## DYNAMIC
based on Maj Bjerre Dalsgaard (pp. 12-13)

Qualitative and quantitative interviews
Workshops
Understanding the use and user groups

## HETEROTOPIA
based on Maj Bjerre Dalsgaard (pp. 12-13)

Understanding the different perspectives
Maintain & enhance the special character

**5: Goals and principles for interventions in the specific church**

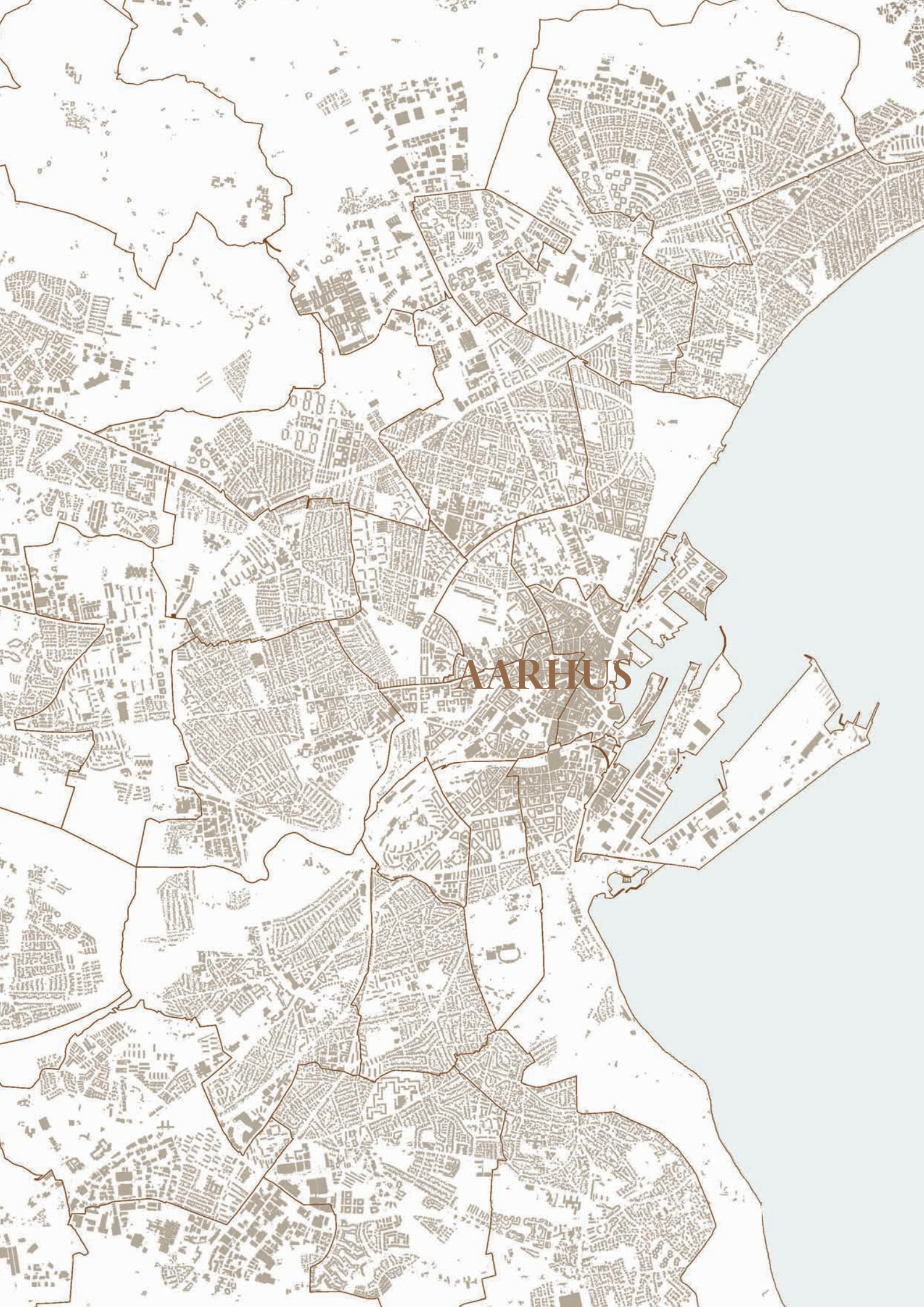
Pre-Design

# PART II

Ill. 90: Borum Church. Private photo.

# The case

Ill. 91: Situational map of Borum and Aarhus showing parish borders and buildings. Own illustration based on maps from Dataforsyningen.


AARHUS

# VISION

Motivated by the ambition to bring new life to the rural community of Borum, this project seeks to gently adapt the local medieval church into a meaningful gathering place. By introducing new functions, the building can support both religious traditions and everyday social needs in a shared and cohesive setting.

The approach aims to balance heritage and contemporary use, continuing the church's historical pattern of physical change in response to evolving societal needs. Additions will express modern building techniques and materials, with a clear focus on sustainability, self-sufficiency, and reversibility.

Architectural interventions will be guided by the church's existing atmosphere and material presence. Additions should form a respectful and clear dialogue with the old, while subtractions must enhance spatial value and flexibility. The goal is to renew the church's role as an active and inclusive part of local life.

Ill. 93: Satellite photo of Borum. Own illustration based on orthophoto from Dataforsyningen.

# BORUM

The case for transformation of a medieval village church is located in the small rural village **Borum**, a village within the borders of Aarhus municipality. With a distance of approximately 15 kilometres to the centre of Aarhus, Borum is located near the many shopping and social activites that Aarhus offers. However, there is no longer any public transportation between Borum and Aarhus. And as many other small rural villages, schools, shopping opportunities and leisure offers have through the years relocated to bigger towns or cities nearby.

There is a rising demand and wish for local offers and meeting places, not just in Borum but many smaller, rural villages in Denmark (Appendix 02). Today, the only public meeting placed in Borum are the common outdoor areas, the community house and the church. Despite that, the inhabitants of Borum have a strong community, and are active in association life and volunteer work. (Appendix 03).

But there is an unrealised potential in the local church to be an everyday meeting place and space for the individual in the village. A place, the inhabitants can use for both religious and secular purposes. A place where otherwise separate worlds can meet and benefit from each other.

In order to rethink the church's role in the society, it is nessesary to gain a broad understanding of the church, its context, and the surrounding social dynamics. Therefore, a thorough analysis will be conducted, following the previous **recommened tools to analyse specific churches** (p. 85) based on the methodologies and transformation strategies by Dalsgaard (2021), Vadstrup (2022), Exner (2007), and Andersen (2015).

# DEMOGRAPHICS

Statistics on the inhabitants in Borum Parish as of 1st January 2025 are from the interactive map of parish statistics in Denmark (Sognestatistikker i kort) (Folkekirkens Uddannelses- og Videnscenter, 2025).

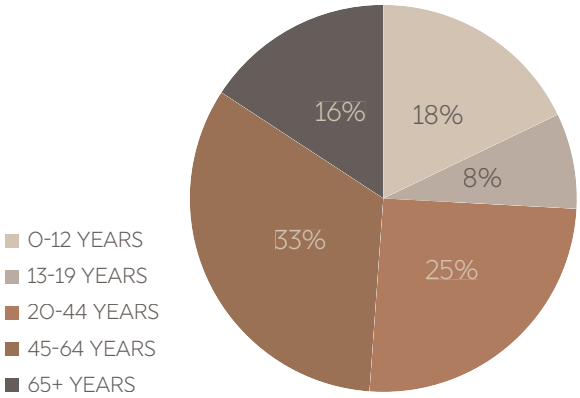
**526**

**INHABITANTS IN BORUM PARISH**

**68,6%**

**IS MEMBER OF THE NATIONAL CHURCH IN BORUM PARISH**

## Inhabitants in Borum Parish, 1ST January 2025




Ill. 94: Inhabitants in Borum Parish, 1st January 2025 based on data from Folkekirkens Uddannelses- og Videnscenter. Own illustration.

## Relocations in Borum Parish, 2024

**39**

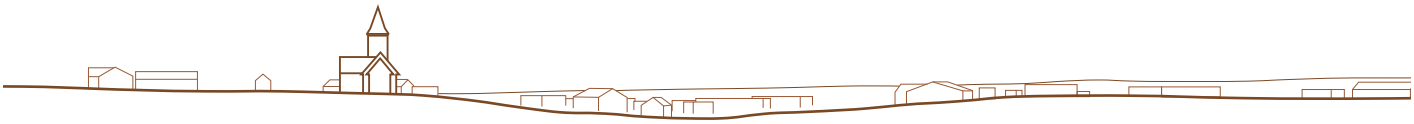
**OUT-MIGRANTS**

**41**

**NEWCOMER**

Ill. 95: Borum. Private photo.

Ill. 96: Situational map of Borum Church. 1:1000. Own illustration based on map from Dataforsyningen.



Ill. 97: Landscape section. 1:2000. Own illustration based on data from Kortgrundlag.

# THE PROJECT SITE

Borum Church
Borum Byvej 4A, 8471 Sabro, Denmark

Borum Parish

Eshøj pastorate
(Fårup-Sabro-Borum-Lyngby)

Aarhus western Deanery

Aarhus Diocese

Romanesque nave and chancel
(approx. year 1050-1275), gothic porch
and church tower (Approx. year 1500)

Cadastre 1u area: 4.231 m²
Church net area: 150 m²

## Views from the site

Ill. 98: The cementry of Borum church. Private photos.

SABRO
SCAN FOR VIDEO
Bommlanderej
Bomm byvej
Stillingvej
02
01
04
03
Langelinie
FRAMLEV

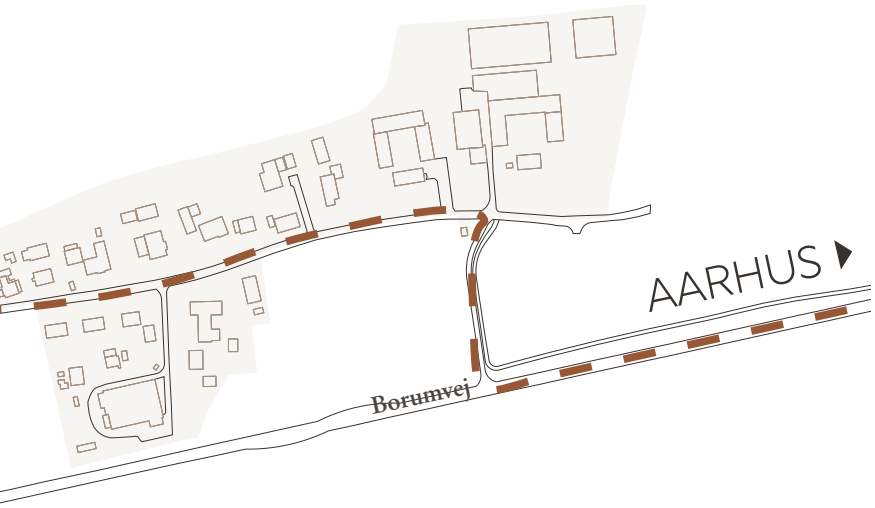
Borum is surrounded by nature and rural landscape, with a small creek passing by the village. The church is placed centrally, on top of a little hill, in the village by the main road Borum Byvej. With other public offers such as the community house, the outdoor area called "Udgangspunktet" [The starting point], and the swap corner, are the church and the surrounding cemetery a central point of Borum.

There are registered walking routes in and around Borum, where some of these paths are passing the church and through the cemetery.

**01 Borum Church**

**02 Community house**

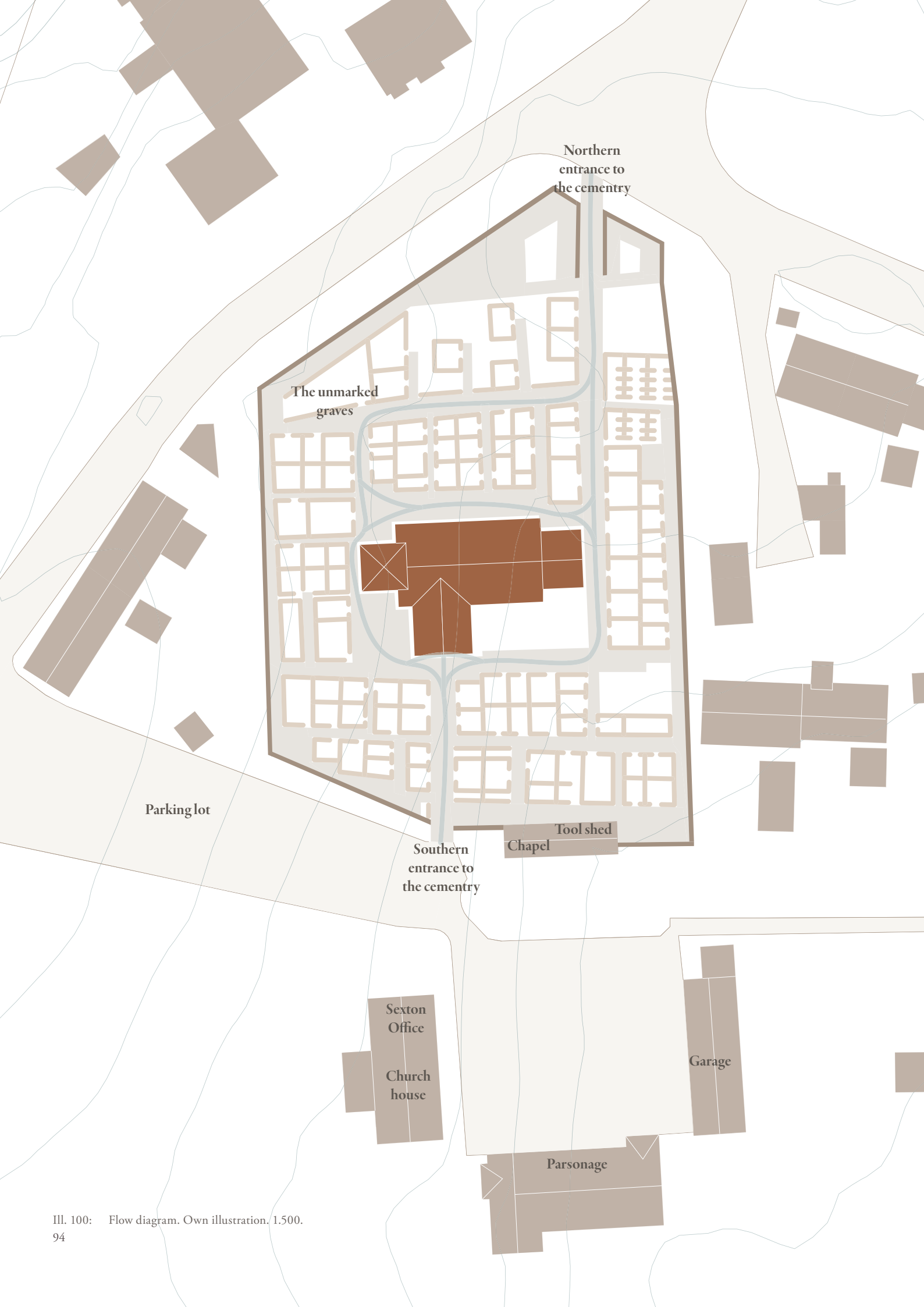
**03 "Udgangspunktet"**




**04 Exchange booth**

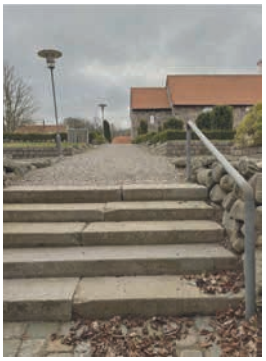
**05 Walking paths**

Ill. 99: Borum. Private photos.

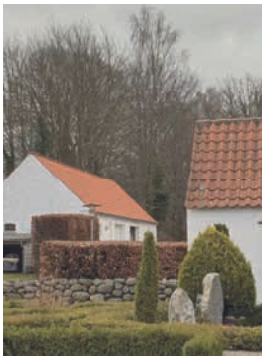



Ill. 100: Flow diagram. Own illustration. 1.500.

Ill. 101: Arrival from parking lot. Southern entrance to cemetery. Private photos.



Ill. 102: Arrival from village. Northern entrance to cemetery. Private photos.



Ill. 103: Southeast part of Borum cemetery. Private photos.

Ill. 104: Northwest part of Borum cementry Private photos.

Ill. 105: Borum church, private photo.

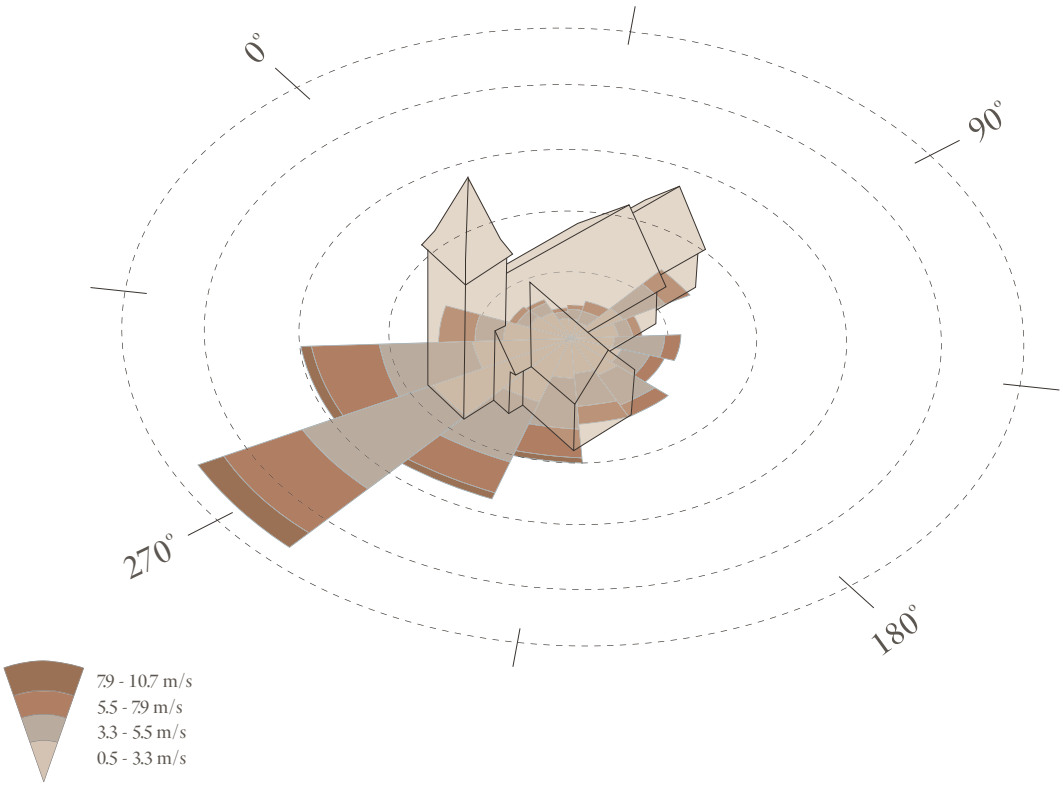
# MICROCLIMATIC CONDITIONS

In Denmark the weather conditions are mild, and with a location such as Borum, that is located deep in the countryside of Jutland, there are no extreme weather conditions to take account of. Though the geographic conditions of Denmark's location equal a few very dark winter months and many daylight hours in summertime.

Medieval village churches are by construction designed with daylight in mind, as they are of the basilica typology, are they oriented by a longitudinal axis going through the nave and then chancel, and thereby always having the chancel towards east (Kilde, 2008). With a symbolic meaning in mind do they have windows in the chancel, allowing the sun to rise behind the minister while the church service is happening. Though this is mostly related to the medieval churches of the basilica typology.

When working with a medieval village church as a typology and a case for transformation the orientation of the building is already determined, however this is where the microclimatic investigations are relevant tools as they clarify the possibilities.

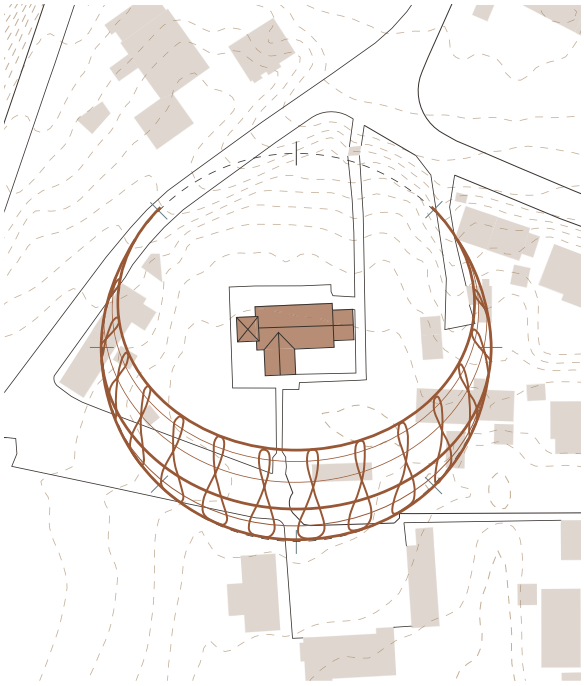
Both wind conditions and sunlight exposure are important factors to consider, as they affect both the outdoor and indoor environments. If a new building volume is added to the existing, these investigations can help determine placement of windows and entrances, as well as be a tool in the design process both wind and sunlight can be used as passive design strategies for indoor environment.




Ill. 106: Annual windrose. Own illustration based on data from CBE Clima Tool (Betti et al., 2023).

**Wind**

Borum church is a very typical village church, which also means that its topographical placement in the countryside, high in the landscape, leaves it open for a lot of wind. The annual wind rose used for wind analysis on the site, is from south of Aarhus as the closest wind data (Betti, 2023) On an annually basis is the wind mostly coming from a western direction with the largest frequency of wind speed being 3.3 – 5.5 m/s and even less wind speed with 1.5 – 3.3 m/s. So, the wind conditions on are mostly on a comfortable level. Though it does reach a frequency of wind speed with 7.9 – 10.7 which is a more uncomfortable level of wind, when staying outside.
When investigating wind conditions on site, it is with passive design strategies in mind. Not much is to be done with the existing building, though if new building volume is added to the church, the wind direction can be utilised for natural ventilation and air change. However, outdoor areas and their conditions are also in consideration, when changing the shape of the church, and it will create new conditions to the wind flow around the church and the cemetery. If the surrounding cemetery is to be a part of the new adapted use of the church, the outdoor wind conditions matter to create thermal comfort.

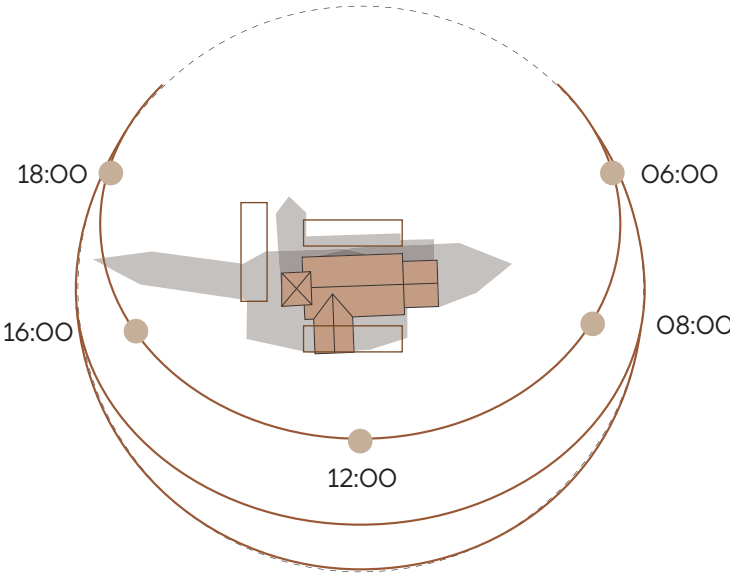


Ill. 107: Spherical sun direction. Own illustration based on data from CBE Clima Tool (Betti et al., 2023).

**Sun & shadow**

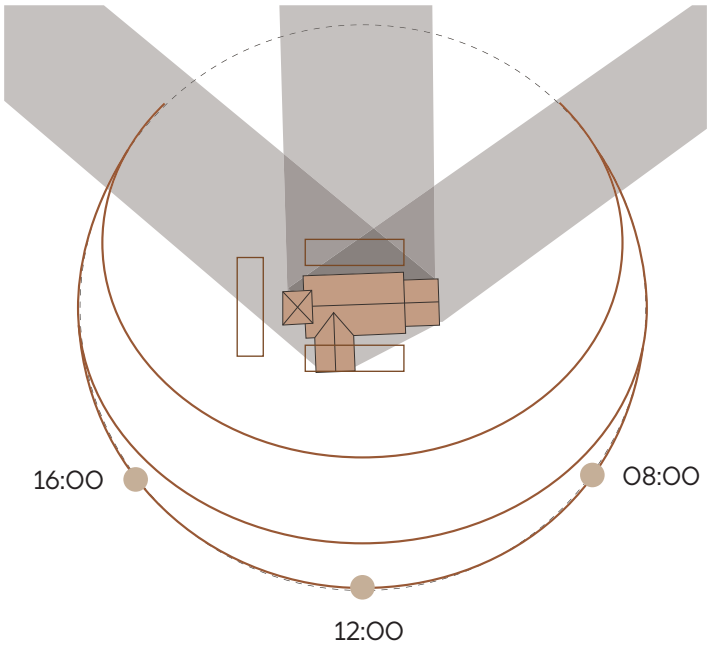
Working with daylight and natural lighting in general is both a historical technique as well as a more contemporary design element when designing churches. It has both atmospheric and religious value in a church, the course of daylight through the day. When doing a sun and shadow analysis for this specific project, it is mostly to investigate how much sunlight reaches on the north side of Borum Church. The medieval village churches are as default always is east to west oriented, however in Denmark the daylight amount varies throughout the year, as seen in summertime there is not much shadow on the north side of the church, and in early morning and late afternoon there is no shadow. On the other side, in the winter the daylight hours are much shorter and shadows longer, which gives less time to utilise the daylight.

This investigation gives an insight to where windows and openings must be placed to work with the light and atmosphere of the spaces. The specific hours on the figures are set for times in the day the future and existing functions for the church where it is in use.




**Summer**

Ill. 108: Shadow analysis. Summer time. Own illustration.




**Winter**

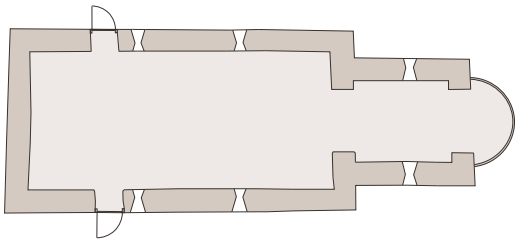
Ill. 109: Shadow analysis. Winter time. Own illustration.

# HISTORICAL ANALYSIS

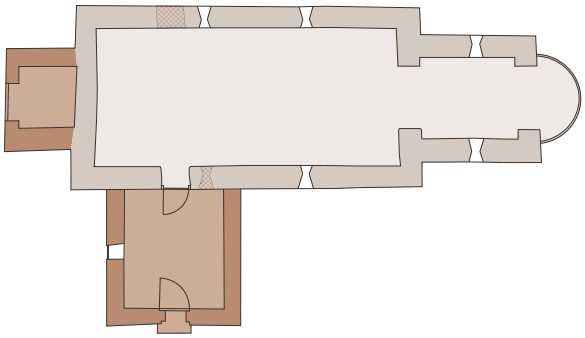
The church of Borum has undergone multiple restorations, changes and additions throughout its history. The evolution of Christianity in Denmark and society's demands have influenced the physical church. The following diagrams and timeline highlights the most significant changes for the church of Borum.

Ill. 110: Borum Church, 1934. Nationalmuseet, Hugo Matthiessen, CC-BY-SA. Appendix 09, Email C.

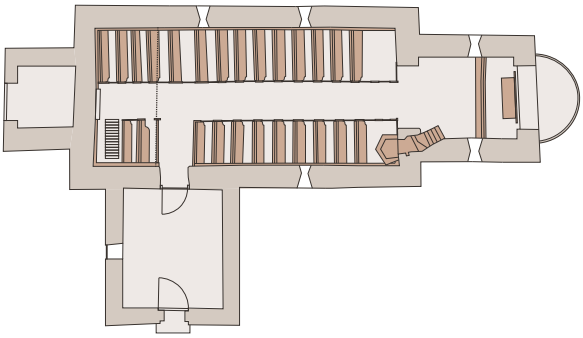
**1050 - 1275:**
Nave, chancel and apsis.
Small romanesque windows.
Northern women's entrance
& southern men's entrance.



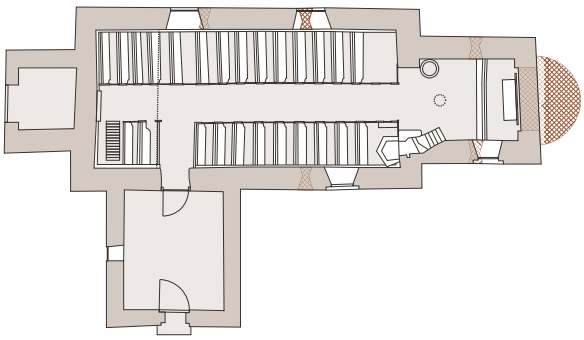
**Approx 1500:**
Added: Church tower and porch.
Subtracted: Women's entrance & window



**After the reformation:**
Added: Pulpit, atler, kneeler and pews.

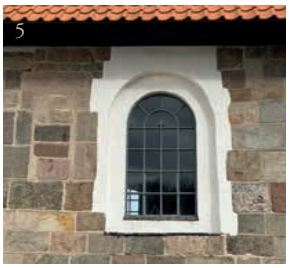


**After the reformation:**
Added: Pulpit, atler, kneeler and pews.



Ill. 111: Physical development of Borum Church. Own illustration based on Nationalmuseet (Appendix 01).

THE PULPIT WAS ADDED AS A GIFT FROM A LOCAL DISTRICT BAILIFF
1604



THE ROMANESQUE WINDOWS WAS RE-PLACES WITH BIGGER GOTIC WINDOWS

REFORMATION

LUTHERAN PROTESTANTISM IN DENMARK
1536

PEWS WAS ADDED
Approx. 1680

ROMAN CATHOLICISM IN DENMARK
965

**1000** **1200** **1500** **1800**

1326
FIRST TIME THE TOWN OF BORUM IS KNOWN. REFERRED TO AS 'BARDHOM'

1594
THE ALTAR PIECE WAS ADDED

1050 - 1275
ORIGINAL ROMANESQUE NAVE AND CHANCEL WAS BUILT

1701
PAINTINGS ON THE PULPIT AND ALTAR PIECE

PORCH AND CHURCH TOWER WAS ADDED IN GOTHIC STYLE

1814
ORIGINAL APSIS ON THE EASTERN FACADE OF THE CHANCEL WAS TORN DOWN DUE TO ITS BAD CONDITION

*1934*

*2025*

*THE CHURCH TOWER LEANED AROUND 30 CM TOWARDS WEST*
*1874*

*A BRICK SHELL WALL WAS ADDED TO THE CHURCH TOWER TO CORRECT THE LEANING TOWER*
*1914*

*THE CHAPEL AT THE EASTERN WALL OF THE CEMENTRY WAS TORN DOWN*
*1980*

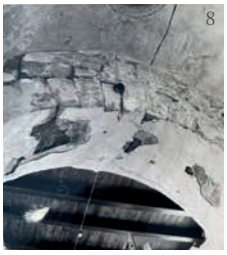
**1900** **1950** **2000** **2025** **AD**

*1915*
*A NEW RED BRICK CLERGY HOUSE REPLACES AN OLD HALF TIMBERING HOUSE*

*2009*
*WOODEN ELEMENTS IN THE NAVE WAS PAINTED IN GREEN, YELLOW, RED, BEIGE AND GREY COLOURS*

*2013*
*RENOVATION OF THE ATTIC AND ROOF*

*1979*
*RENOVATION OF THE CHURCH INTERIOR WALLS, FLOORING AND PAINTING OF WOODEN ELEMENTS*



*1880 - 1910*
*THE CEMENTRY WAS EXPANDED SOUTH, WEST AND NORTH*

Ill. 112: Timeline of the history of Borum Church. Own illustration with pictures attributions in illustration list.

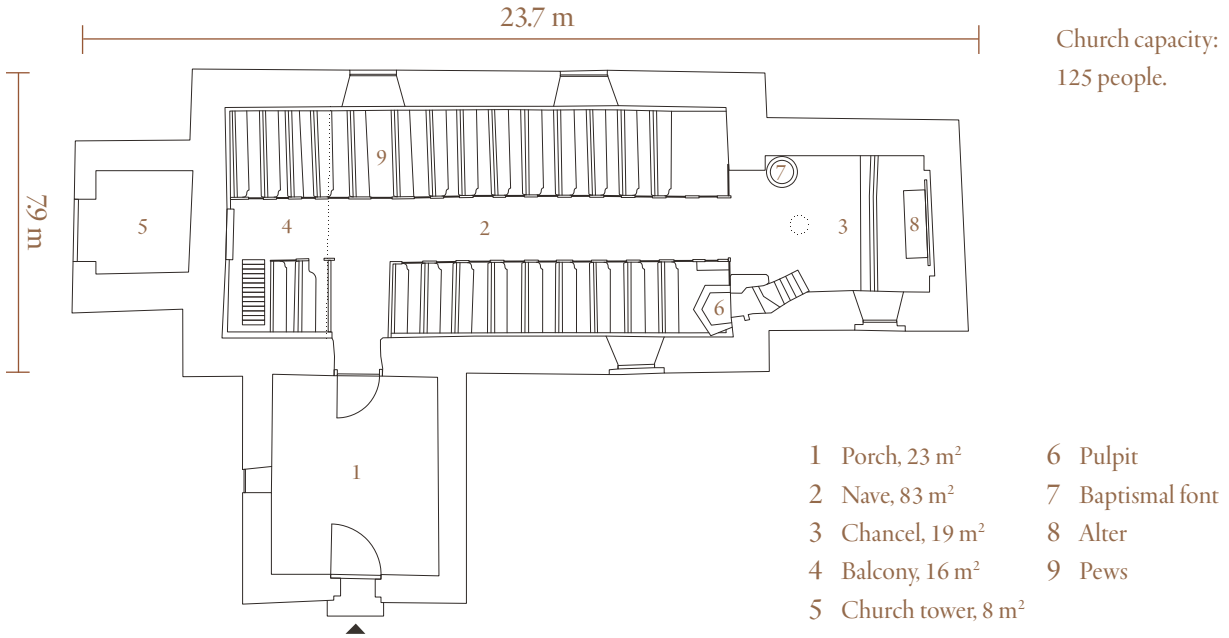
# ARCHITECTURAL ANALYSIS

The wall construction of the nave and chancel are visible ashlar stone, where the tower and porch are made of whitewashed brick and fieldstones. The walls consist of an outer and an inner layer of either ashlar, brick or fieldstones and a middle layer of soil and granite shards from the surrounding ashlar. The outer walls are around 1 meter in depth.

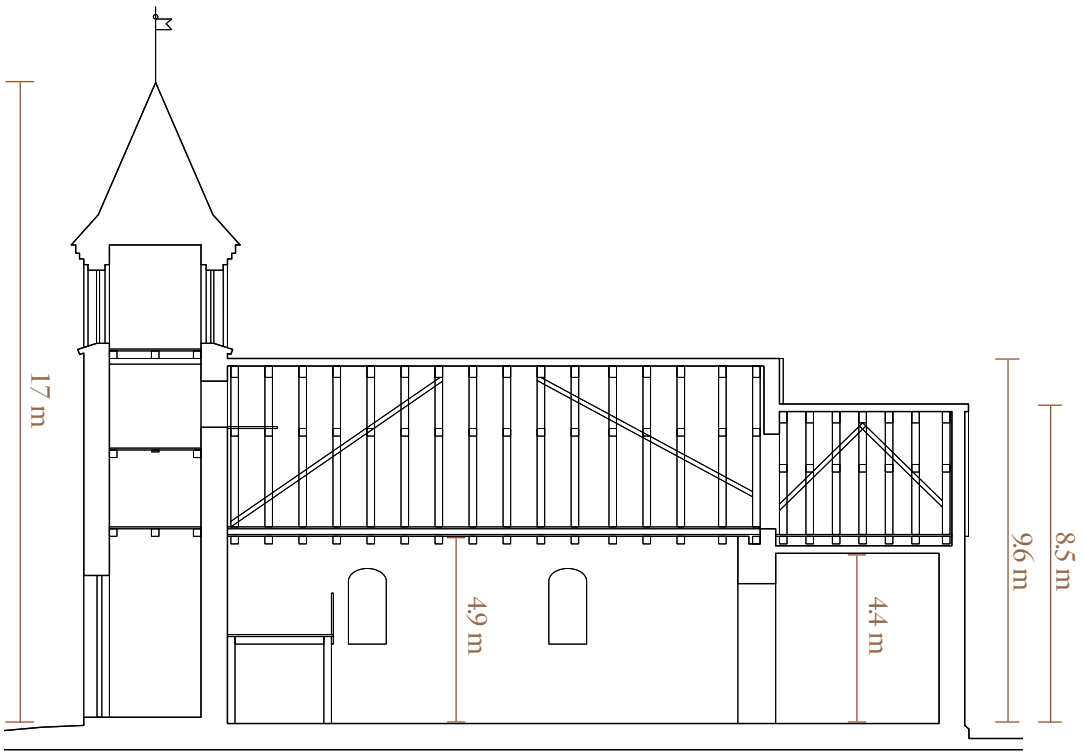
Originally, there was 6 smaller, high placed roman arched windows. 4 in the nave, 2 on the south facade and 2 on the north facade and 2 in the chancel, 1 on the south facade and 1 on the north facade. Three of the six original windows have been walled up whereas three (two on north facade of the nave and one on the south facade of the chancel) have been changed to new bigger windows. The new southeast window in the nave has been made east of the original window placement. The small rectangular window in the west facade of the porch was made around 1850.

Ill. 113: Borum Church exteriors. Private photos.

Ill. 114: Borum Church exterior details. Private photos.




Ill. 115: Plan of Borum Church 1:200. Own illustration based on (Nationalmuseet). Appendix 01.




Ill. 116: Section of Borum Church 1:200. Own illustration based on (Nationalmuseet). Appendix 01.

Ill. 117: Borum Church interior. Private photo.

**Symbolism and staging – the space of the sacred**
The altar, the choir arch, the baptismal font and the axis of the procession form an architectural staging. One moved physically towards the sacred, and space guides the senses through its geometry and structure. Colors, ornamentation and symbols in frescoes and furnishings speak to the visual and narrative, and create a sensory layer of meaning.

The interior of the nave is dominated by the pews, wall panels, gallery and pulpit. Through the restoration in 1976-1976, the organ was built. The pews, wall panels and galley were painted in dark green, red and yellow colors in 2009. But some of the oldest and most valuable interior in the nave is the crucifix (possibly from 1594), the painting of Christ in the Garden of Gethsemane (1857) and the pulpit (1601, painted in 1701).

In the chancel most interior besides the chairs are old and valuable. Essential to mention is the altar table (approx. 1600), alterpiece (1594) with paintings (1701), altar candelstick (1614), chalice (1601), baptismal ewer (approx. 1877), roman baptismal font and baptismal dish (approx. 1550-1775).

Ill. 118: Borum baptismal font. Pivate photo.

Ill. 119: Borum pews and pulpit. Private photos.

Ill. 120: Borum chancel and altar piece. Private photo.

Ill. 121: Borum gallery and organ. Private photo.

Throughout history, many changes have occurred when the new demands from the developing religion of Christianity. Especially after the reformation, many changes occurred in the interiors, e.g. the single altar, pews and pulpit.

**Materiality – tactile and visual surfaces**
The whitewashed surfaces of the walls, the raw boulder foundation, the smooth woodwork and the worn tiles and steps: all of this gives the body a sensual and historical contact with the space. The materials are often sober and close, but with a high materiality and authenticity that speaks to the hands and eyes at the same time.

**Traces of time – patina and use**
Worn doorsteps, crooked benches and old tombstones on the floor create a feeling of the presence of time – many lives have been here before you. It gives an existential depth and a special calm – a place where time is in a way both present and suspended.

Some of the interior changes from the restoration between 1976-1979 involved changing the tiles in the porch and nave from black and white harlequin tiles to red brick tiles, and to bigger tiles in the chancel. Under the pews there is wooden flooring from around 1903 which some placed bends and are in poor condition.

Ill. 122: Borum Church interior. Private photos.

**Sensory and atmospheric values**
The church of Borum, like many other churches, has a special atmosphere and sensory experience that fosters a feeling of presence for the individual. Some of the essential aspects are:

**Light and darkness – the dramaturgy of light**
Small windows and thick walls create a subdued and filtered light, which gives a calm, contemplative atmosphere. Light often plays a role as something almost sacred or guiding – it becomes part of the liturgical and symbolic story of the room. In churches with frescoes, the light is also experienced as changeable when it glides over the colors and ornaments of the walls.

**Sound and acoustics – spatial resonance**
Vaulted ceilings and stone walls provide a long reverberation time, which makes sounds float and amplify – especially singing and organ music. This helps to elevate the experience and create an almost heavenly or sublime sensory impression. The special acoustics can also provide a tangible silence, where even small sounds become significant.

Ill. 123: Borum Church. Private photo.

# TECHNICAL ANALYSIS

The purpose of making a technical analysis of the medieval church is to understand the structural system and building elements as well as the condition thereof. Furthermore, it is important to understand the history of the building materials and the techniques used in the construction. Borum church is an old building and is not built according to modern standards, however it was restored in the late 1970s (Appendix 01). The energy conditions and indoor environment is interesting to analyse to understand the current conditions.

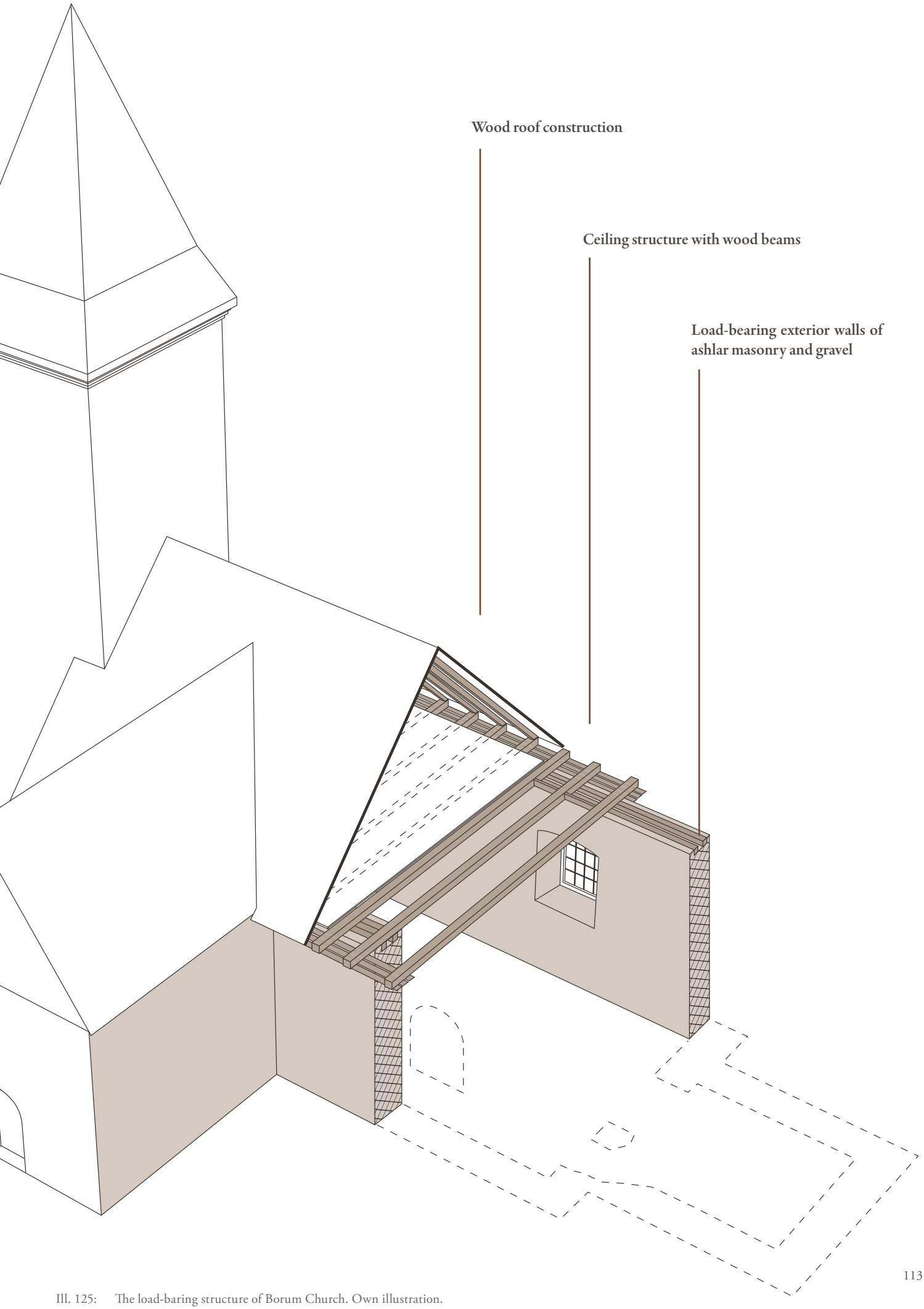
The following analysis will focus on the construction of the church in terms of structural elements and materials, the energy conditions, possible thermal bridges and the indoor environment with the intention of highlighting the daylight and thermal comfort.

Ill. 124: Whitewashed above window in Borum Church. Private photo.

**The church construction**

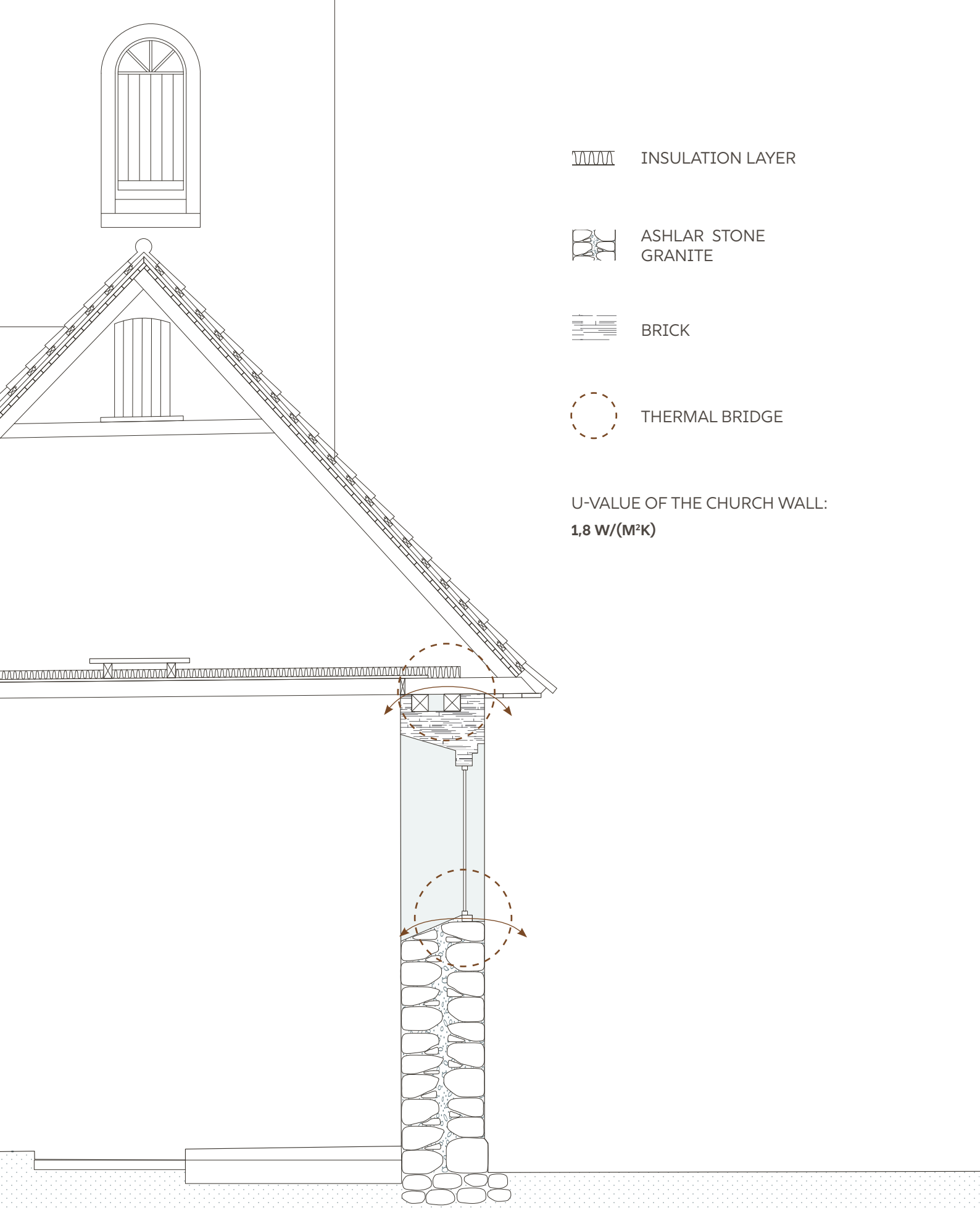
Borum church is, like many medieval village churches, constructed with ashlar stone made of granite stone with the depth of approximately one meter. The structural system consists of load-bearing ashlar stone walls with a Romanesque ceiling structure in wood and a clay tiling on the roof. The exterior walls original form of ashlar stone with carved planar surface areas form a high degree of stability (Brøgger, 1985, p. 26). In the 1970's a thorough restoration and renovation was made on Borum church, therefore the condition of the materials are satisfactory. With this renovation, the roof was changed, and the rafters was repaired. Additionally, insulation was added to the attic floor to improve the indoor conditions of the nave.

Accordingly to historical drawings of Borum church (Appendix 01), the original windows were much smaller than the present ones. This is noticeable as there is a shift in material above the windows, as it was necessary to use bricks to create a segmental arch. This shows that whenever a change has been made in the original structure, a new material has been introduced. This indicated that changes over time are inevitable, so instead of trying to hide these, they are highligted to remember that the building is not a static element.






Ill. 125: The load-baring structure of Borum Church. Own illustration.




Ill. 126: Detail section of Borum Church. Own illustration based on drawing material from Nationalmuseet (Appendix 01).

## BR18 §278

*"Churches and buildings that are part of a protected ancient monument are exempt from the regulations of §§ 274-282.*

*Subsection 2. Protected buildings are excluded from the regulations of §§ 274-282 if compliance with the energy requirements in §§ 274-282 would be contrary to the architectural, cultural-historical or environmental values of the protected building."*

(Social- og boligstyrelsen, 2025a)

# Thermal Bridges & Energy

This project is investigating the indoor conditions of the existing space. The simple construction of the exterior walls entails limitations to the improvement of indoor environment and the building envelope. When working with an old historical building, post-insulating the building envelope is problematic as the construction and choice of materials limitate the possible interventions if the original substance and design is to be maintained.

Until the mid-1800s, church walls were constructed with a compact stone or brick wall. Later this changed to a cavity wall construction. The box wall is the oldest construction method, consisting of an exterior and interior wall of stone with mortar in between. (Brøgger, 1985)

The building envelope of a Danish medieval village church does not contain insulation materials, resulting in a higher U-value and various places with thermal bridges. This makes the building expensive to heat up. Thermal bridges are a specific part in the construction where the transmission loss is highest and therefore affects the general building envelope. It is either in a collection of two construction elements, a linear thermal bridge, or a part in the construction that creates a point thermal bridge. There are specific demands to primary construction element's U-value and for specific linear thermal bridges. Both point and linear must be calculated into the primary construction elements total U-value. (Wagner, 2018)

**The construction**

The construction of Borum church is assumed based on different drawings from the national archive (Appendix 01) and previous investigations made on Borum church (Brøgger, 1985). The exterior walls of consist of the traditional box wall construction. The natural stone, here granite, is built with mortar inbetween. Small pieces of the ashlar stones, gravel and mortar have been used to fill the cavity between the inner and outer wall ensuring a stabile building envelope (Brøgger, 1985). As shown on the section, there are thermal bridges various places in the wall construction of Borum church. This is difficult to prevent with post-insulation as the possible cavity layer is filled.

**Heat loss**

When the building envelope has transmission loss, it effects the building's energy frame. Borum church is only heated occasionally as it demands a lot of energy, and too expensive to do continuously. Even though the church was renovated in the 1970's it does most likely not meet any building standards, Protected buildings and churches has a dispensation in the Building Regulations (BR18), that they do not need to meet the standards if it will affect the architectural expression of the building (§278 + BR18). On the other hand, it is important to consider the energy use when working with transformation of the church and adapting the space to embrace new functions and more use. However, a new addition to the church will need to meet the standards of BR18.

# VALUE ASSESMENT

## The four keys

### Design approach

- A careful approach that respects the church's original structures.
- Targeted interventions to improve functionality while minimising impact on historical elements.
- The altar and chancel are preserved, as this is the church's most "sacred" space.
- Maintenance of existing surfaces with restoration of furnishing in a more harmonious colour scheme.
- Differentiation between new and old, ensuring modern additions remain clearly distinguishable.

# RECOMMONDATIONS

## Repair, Subtraction, Reconstruction, Transformation, and Addition

### Repair:

- The church is in good conditions, and therefore not in need of reparations at this stage.
- Looking forward, extra attention should be directed to the chancel including the interior as the baptismal font, altar, altarpiece and the pulpit.

### Subtraction:

- The pews or some of them can be removed to improve flexibility.
- Openings can be made in walls to create new connections or improve lighting conditions, as long as this relates to the principles of existing or previous ones.

### Reconstruction:

- The closed northern old women's door can be opened and used as access to the nave.
- The closed northern window in the chancel can be opened to gain more daylight.

### Transformation:

- The church tower can be utilised as accessway to the nave or attic.
- The attic can be insulated and used as a heated space.

### Addition:

- Extensions north of the nave or west of the church tower can be constructed.
- Necessary technical installations can be placed in the church tower or the porch.
- New furniture and artificial lightning can be added.

# THE DYNAMICS

## Parish council

The parish council in Borum consists of 6 members. One chairman, one deputy chairman, one cashier, one churchwarden, the two priests in Eshøj Pastorate, and two alternates. The parish council have the main responsibility for the church in each parish. They are responsible for the administration, finances, activities and hiring employees for the church and cemetery (Retsinformation, 2013). The present parish council in Borum was elected in September 2024 for a 4-year period.

Ill. 127: Borum parish counsel. Own illustration.

## Priests

The two priests, Ghita and Peter, both serve all four churches in Eshøj pastorate. Ghita lives in the parsonage of Borum, while Peter lives in a villa in Sabro. Every other Sunday they shift to host the church service in two of the four churches, making each church have church service every other Sunday. In addition, they plan and participate in various activities in relation to the churches and educating future confirmands.

Ill. 128: Priests of Eshøj pastorate. Own illustration.

## Activities in Borum church

# Every other week

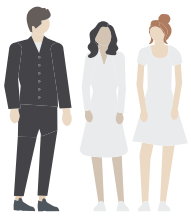
**SUNDAY SERVICE IN BORUM CHURCH**

In Borum Church, there are church service every other Sunday, shifting between the two priests in the pastorate. During Christian holidays, there are more church services and other activities as concerts, lectures and communal dinners or get-togethers in relation to a church service. The activities are often related to the Christian holidays. Some of the activities are targeted to families with children as Saint Lucy's parade and "Blue Hour" (open church for the small children).

## Activities in 2024

**1**
**BAPTISM**

**0**
**CONFIRMATIONS**



**2**
**WEDDINGS**

**2**
**FUNERALS**

Ill. 129: Activities in Borum Church in 2024. Statistics are based on data from Folkekirkens Uddannelses- og Videnscenter.

# Personas in Borum

In order to be able to identify future needs for the specific church and village of Borum, it is essential to understand the people living in the village and their present use of the church. The following personas are a representative description of the persons in Borum and their relation and use of the church.

## PRIEST & SEXTON

This small group of people are hired by the church for maintenance and hosting activities as church services. They are spending the most time in the church and at the cemetery. But they are not necessarily the ones with the strongest relation to the church, as this is their jobs.

## PARISH COUNCIL & CHURCHMENS

These inhabitants in Borum participate in church activities as church services and other activities related to the church. They might do volentary work related to the church and parish. This group of people are not defined by the ages or type of family, but the participation in the church in Borum. Many inhabitants in Borum fit this persona in the Christian holidays while a smaller group of inhabitants uses the church more frequently.

## FAMILIES WITH SMALL CHILDREN

Almost one of the five inhabitants in Borum is 12 years old or below. This indicates that there are many families with small children living in Borum. The children that are in daycare, kindergarten or primary school need to go to other cities, as this is not possible in Borum.

## TEENAGERS

The teenagers in Borum are still living with their parents. Because there are no schools in Borum, they commute to school (Primary, lower secondary or high school) in nearby bigger cities. Lesure activities are also placed in other cities, why they have a smaller connection and everyday life in Borum.

## ADULTS

The majority of the adults in Borum commute to other cities to work, as there are only a small number of physical working places in Borum. Some working adults might work remote, partly or always.

## ELDERLIES

The oldest people in Borum consist of pensioners. Some live with their spouse, other alone. They tend to involve themselves in voluntary work and leisure activities to maintain the social connections and avoid loneliness. This group of inhabitants in Borum are some of the ones spending most of their time in the small village.

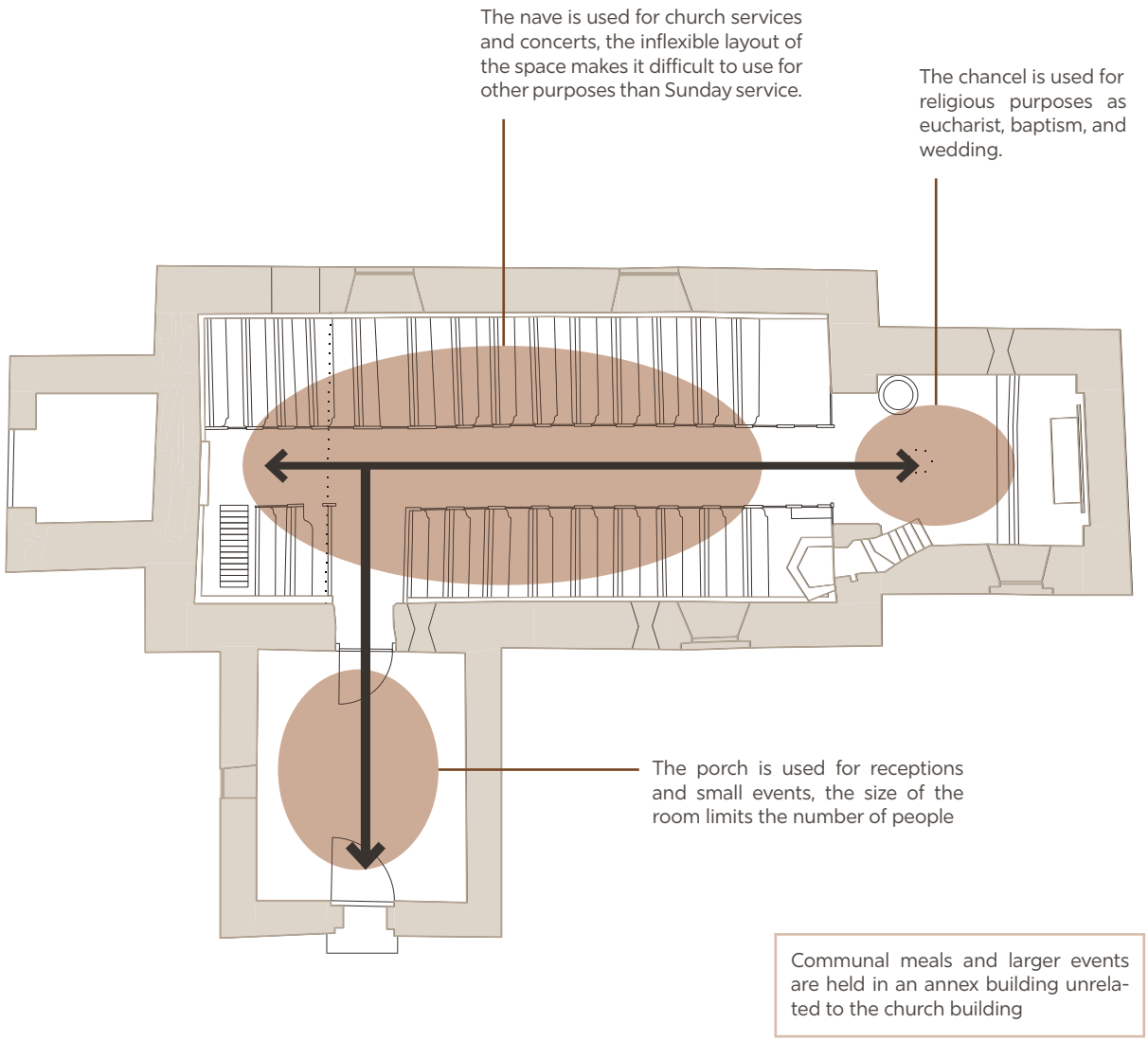
Ill. 130: Personas in Borum. Own illustrations.

# FUNCTIONS

## Functions today

Through a workshop with a little group from the local area around Borum, knowledge of their wishes for the church was gained (Appendix 03). There was a common idea of wanting the church space to become less solemn and more down to earth.

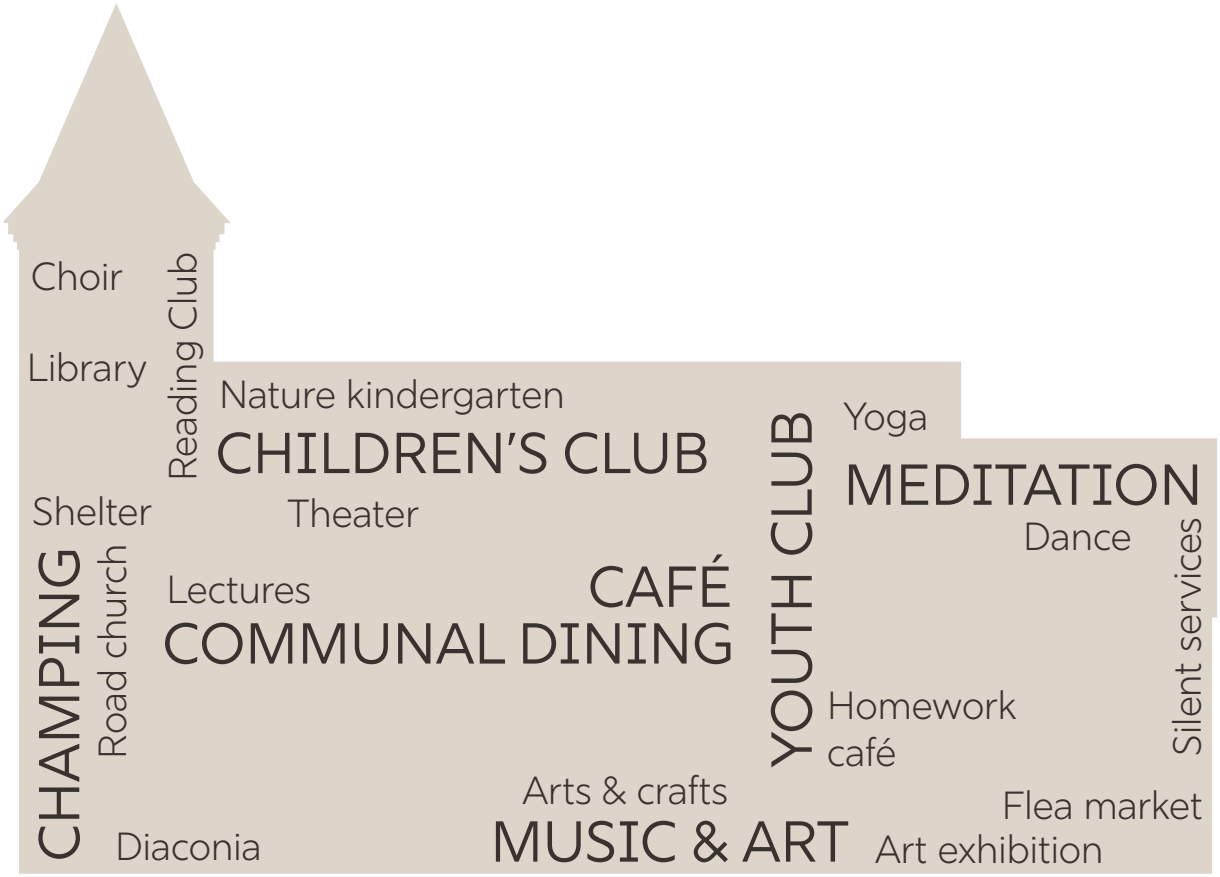
Today the church space is very dictating and does not allow much freedom in use of the space. The nave is constructed with one aisle with two rows of fixes pews on the sides, with one direction to the east oriented alter.




Ill. 131: Illustration of present functions and flow in Borum Church. Own illustrations based on drawing material from Gert Madsen. Nationalmuseet (Appendix 01).

# Possible future functions & activities

The workshop (Appendix 03) contributed with insight to the wishes for what their church in Borum could posibly facilitate in the future. The visions were mostly directed towards functions within the Christian religion, where community and helping others was a significant factor.




Ill. 132: Possible future functions and activities in Borum Church based on workshop. Appendix 03

# THE HETEROTOPIA

As a part of the framework for analysing Borum church is time to investigate the heterotopia of the church space to understand and define its special character. It is the last aspect of the tripartite understanding of place, that will help get a better understanding of Borum church. Dalsgaard has defined the heterotopia of the church space in general through the six principles by Foucault, 1967. (Dalsgaard, 2021).

The church is a well-constituted institution and has a specific role in our society with a specific character and creates different spaces for different situations and needs in society's everyday life. In this analysis the intention is to analyse this specific church to understand its heterotopic characteristics in the rural village of Borum both through Foucault's six principles as well as Dalsgaard's definition on possibilities within the heterotopic aspect, as well as the previous analyses on the physical surroundings and dynamics of Borum church.

The space of Borum church as a heterotopia aligns with general church space, as a place and a building that has a determined and strict role in society. This is where people of Borum attend church services and serves different purposes throughout people's lives. Through a workshop with inhabitant and users of Borum church (Appendix 03), it was clarified, that it is a space the inhabitants of Borum use for different rituals and has different associations with. Some people does only have a relation to it as the village church, but does not use is, where others use for ecclesiastical purposes, some for meditation and some use it for community gatherings.

It is a very centered building and is a space for community meetings. They enjoy using the church spaces for a various purposes, even though the physical environment of the church does not always accommodate the purpose. However, they still prefer to use the church space as the atmosphere and space in general is what embraces the community.

Borum church is a typological medieval village church with the physical frames thereof, but it is always open for people to enter outside of the typical church functions such as church service, weddings and funereal. It is a place as most churches, a space outside of everyday life and places, and a place that is always there no matter what stage of life a person is in.

The understanding of a church space relies on the experience and sense of belonging to the space and place. As determined earlier in the theoretical framework and through the analysis of the physical and dynamic aspects, the heterotopic character of Borum church can be determined as some physical and atmospheric premises. The substantial walls, the limited view to outside, the lighting, the acoustics, and the religious objects leave a lasting impression on the visitor. This and the presence of the history makes you forget the outside and be present in the space. These characteristics must be protected to maintain the church as a heterotopia, an "other space" in the society.

Ill. 133: The heterotopic character of Borum church. Private photos.

# DESIGN PRINCIPLES

## For all interventions

Maintain the heterotopia of the church building as a place for religious purposes, with nessesaty functions such as altar, pulpit and baptismal font

The adapted space must facilitate rural social activities while accommodating the individual user

The intervention must respect and enhance the existing sensory and atmospheric experience of the church

Only subtract materials and elements when it contributes to spatial value and flexibility, and the added must respect, harmonize and differentiate with existing ones on a tectonic level

New construction must comply with BR18 and be optimised in regard to low impact on the environment

Added materials and elements must comply with the principles of Design for Disassembly

All interventions, small or large, must be based on a methodical analysis and valuation

## Specific for Borum church

The nave of the church must be adaptable for a wider range of activities beyond liturgical use, and a more flexible spatial layout is therefore required

Essential functions, along with insulated and heated areas, should be established to expand the church's use to include social events such as communal meals, receptions, and other gatherings, ensuring that the church becomes the primary building

Improved accessibility must be ensured to provide inclusive conditions for all users

The materiality and colour palette of the nave should form a harmonious whole, that creates a calm atmosphere, and improves sacral perception, with particular attention to bringing light into the space

New interventions and additions should be created in continuation of the Romanesque architectural logic, both aesthetically and structurally.

Transitions between the old, coarse materiality and construction methods, and new additions, should be designed to highlight, rather than conceal, the irregular and timeworn qualities of the building

Design

# PART III

Ill. 134: Photo of Borum Church. Private photo.

# Design process

In the following chapter, the design process for the transformation of Borum Church is presented. Following the methodology of *Research by Design*, this part is explores and presents 'what could be'. The focus has been to translate the theoretical insights and analysis of Borum into a physical design proposal. Additionally, the new should not compromize with the heterotopia of the place but add value for the people.

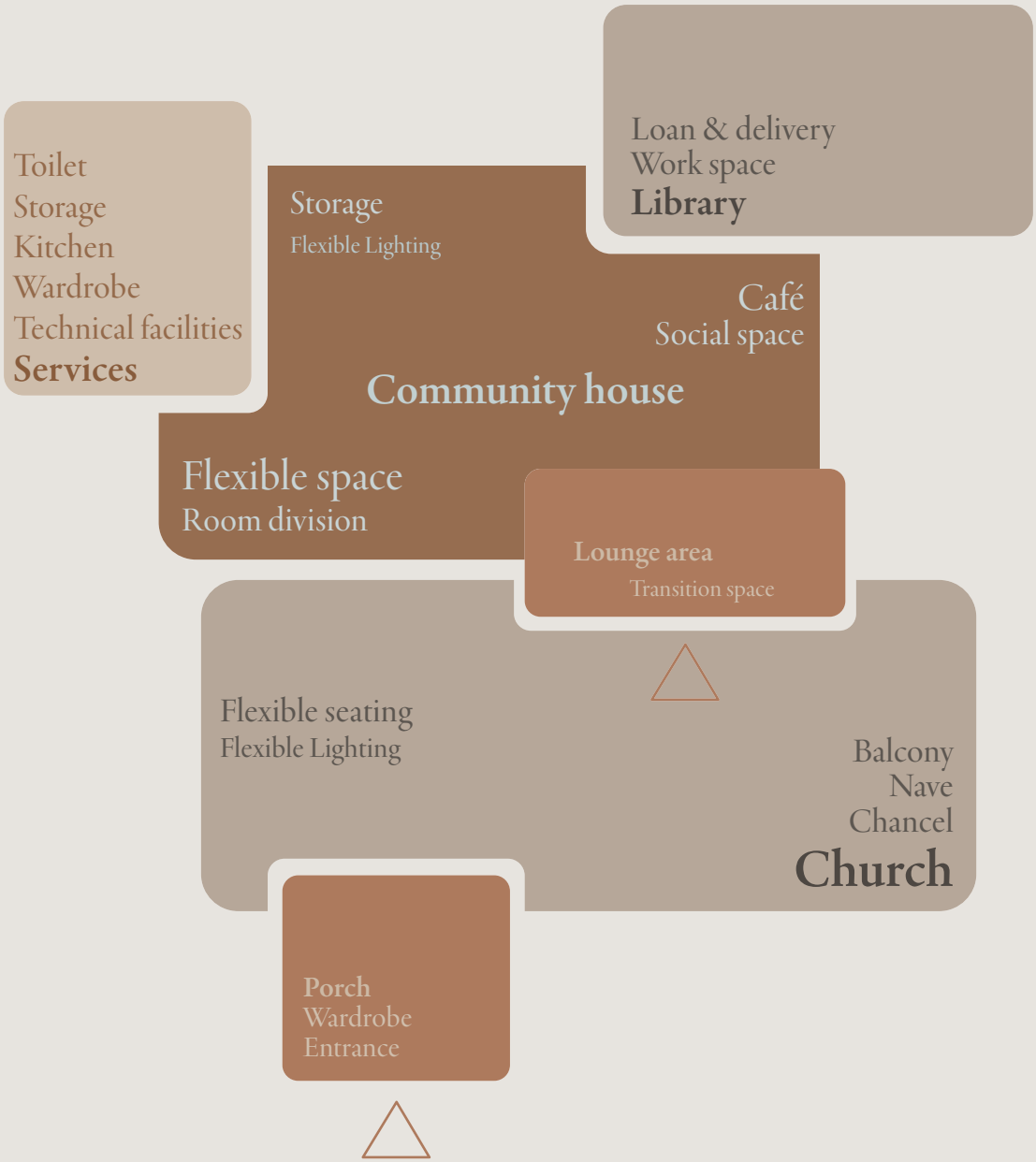
The design process has been iterative, alternating between architectural and technical investigations. To provide overview, it is presented in a more linear format.

The dotted box around some illustrations indicates which ones were further developed after each study.

Ill. 135: Borum Church. Private photo.

# DIAGRAM OF FUNCTIONS

The theory and specific analyses of Borum indicate that there is a need for the church to be more relevant in the society. The church needs to provide more activities for various user groups. For the case of Borum, the following functions can facilitate the wanted activities. The illustration below indicates the various functions and their relation to each other.



# ROOM PROGRAM

The needed functions are distributed in various rooms i the room program below. Furthermore, the tabel decribes serveral parameters for each room as their area, height, need for being heated, people quantity, lights, atmosphere, and religious considerations.

During the design process, the room program is used as a guidance for the project group, to compare and evaluate the various design proposals.

| **Room** | **Net area m²** | **Height m** | **Heated - / +** | **People Qty.** | **Function** |
|---|---|---|---|---|---|
| Porch | 23 | 3 | + | 50 | Main entrance area, space for short term stay, transition from the civic to the sacred. |
| Wardrobe | 5 | 3 | + | - | Store coats and shoes |
| Secondary entrance | 1 | 3 | + | - | Accessible entrance for fire escape |
| Social space | 30 | 4 | + | 20 | Informal and flexible hangout space for everday, social events and after services, with casual seating |
| Nave | 83 | 5 | - | 125 | Sunday services, religious and social gatherings |
| Chancel | 19 | 4 | - | - | Alter, kneeler, baptismal font for preaching & eucharis |
| Balcony | 16 | 3 | - | 10 | Place for organ & singing choir |
| Work /meeting space | 15 | 3 | + | 5 | Work-from-home, homework cafés and meetings |
| Library | 10 | 3 | + | 5 | Book storage & self-service book loaning / delivery station |
| Kitchen | 10 | 3 | + | 5 | Preparing & cooking food, for everyday & bigger events |
| Church tower | 8 | - | - | 1 | Accesway to belltower and church attic |
| Storage | 10 | 2.5 | - | - | Storage of furniture, chairs and tables for events |
| Technical room | 5 | 2.5 | - | - | Area for ventilation & heating system |
| Restroom | 5 | 2.5 | + | 1 | Accessible toilet |

| Relation | Light - Aesthetics | Atmosphere | Religous consideration |
|---|---|---|---|
| Nave | Dim | Enclosed and muted | Adapting to the context, religious or secular |
| Porch / entrance | Practical | - | - |
| Nave and social space | Practical and natural lighting | Welcomming and functional | Should not be visible during religious activities. |
| Easily accessible in the flexible space in the nave | Bright natural lighting | Spacious, warm, civic, and secular | Should not be visible during religious activities. |
| The chancel, balcony, porch, and social space | Bright natural lighting | Sacred, contemplative, and serene | Flexibility - adapt for both religious and secular purposes |
| Nave | Natural lightning & artificial light | Sacred and solemn | Most religious space in the church. |
| Nave and church tower | Dim, but good light at the organ | Majestic and grand | Should be accessible during religious activities |
| Social space, kitchen, and restroom. | Practical, natural lighting and artificial light | Intimate and serene | Should not be visible during religious activities |
| Integrated in the social space | Dim, but flexible reading lights | Comtemplative and secular | Should not be visible during religious activities |
| Social space, storage and technical room | Practical, natural lighting and artificial light | Functional, minimalistic, and warm | Should not be visible during religious activities |
| Nave | Practical, bright artificial lighting | Enclosed, echoing | Important landmark, but not visible from inside the church |
| Nave and social space | Practical | - | - |
| Kitchen and restroom | Practical, no natural light | - | - |
| Kitchen and technical room | Practical | Functional | - |

# INITIAL SKETCHES

Based on the theoretical framework, analyses, functional program and room program, initial sketches have been made to investigate, how the existing building can adapt to feature the new functions. Four different poposals are assessed in terms of functionallity, accessibility, arrival, and heterotopia.

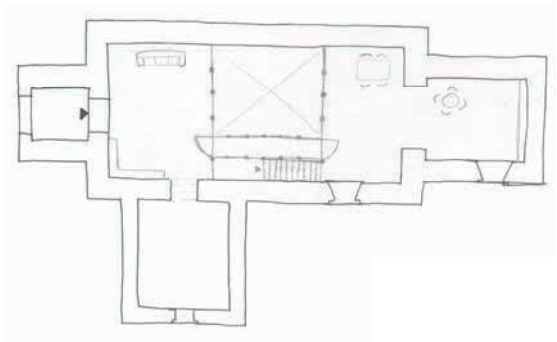
## Changing the existing church

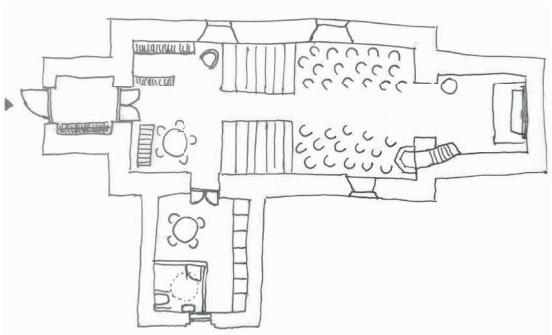
All new functions are placed on the ground floor within the existing church envelope. From a sustainable point of view, this is beneficial. A new entrance is made through the existing church tower, resulting in an arrival from west. The porch entrance are closed off to accommodate the toilet and kitchen. In the nave, multiple pews are removed to make room for the library and a more flexible space near the chancel.

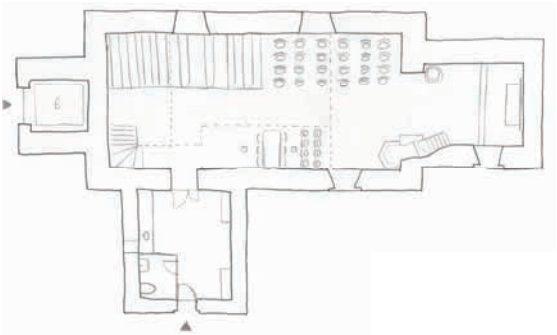
This iteration has multiple problems with the space resulting in the need to change the arrival to be able to change the porch. It is problematic to make the drain and water supply in the porch, and the accessibility from the nave to the porch is poor due to the steps. Additionally, there is no space for storage of furniture.

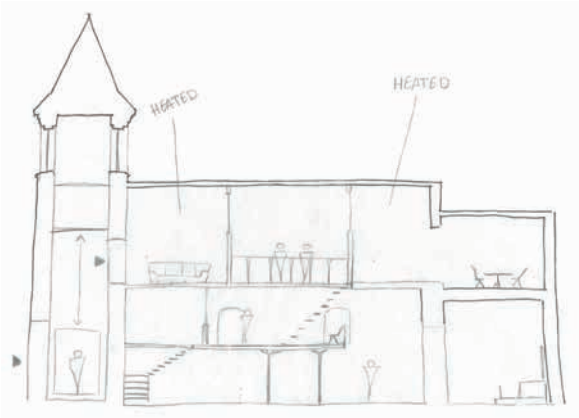
## Utilising the attic

Utilising the attic solves the storage problems but only on the 1st floor, as there is still no room for storage on the groud floor. There are some visual contact between the two levels. However, this solution lacks the physical connection between the religious elements and the new common space, making the two functions difficult to coexist. Accessibility remains an issue, as the exsisting entrance through the porch is still the only access to the nave. An elevator has been installed in the church tower, which is managable but still a challange. Additionally, the new toilet and kitchen facilities are undersized according to the room program.





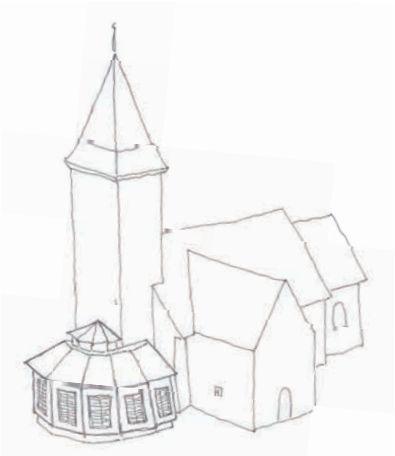


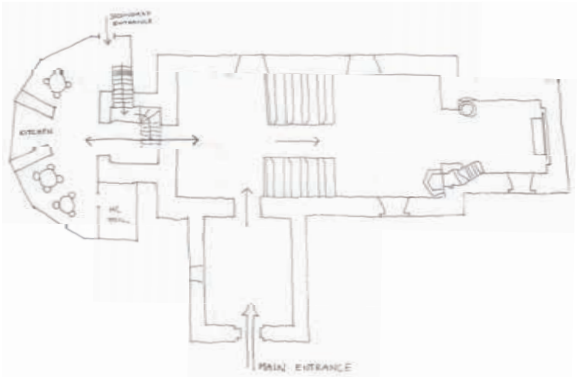


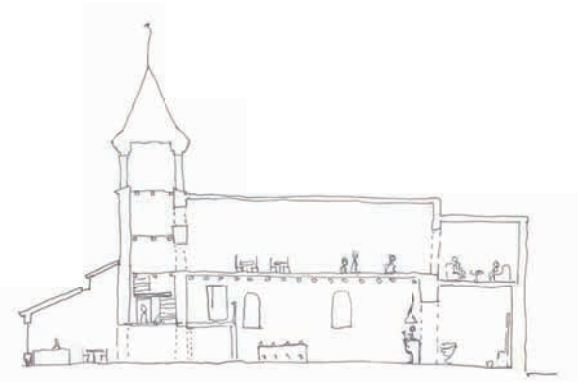

Ill. 136: Initial sketches. Own illustrations.

## Extension west

Making an extension solves the problem with making drainage in the existing building volumen. Here, an secondary entrance facing north solves the problem with accessibility and serves as a fire escape. There is still problems with storage, and the attic is only available by stairs. The common space and kitchen are here in little contact with the religious elements making it difficult to use simultaneously

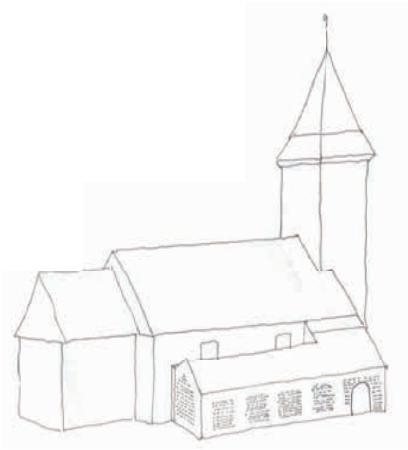


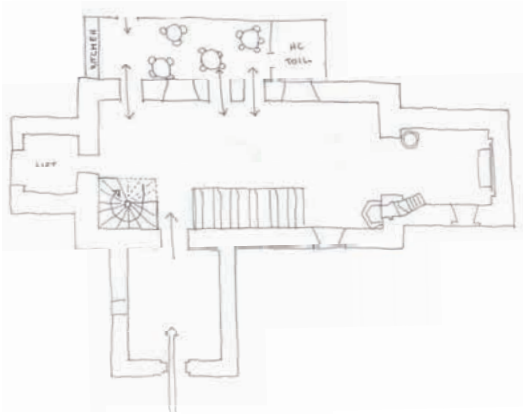


## Extension north

This iteration enables direct contact between the new and exsisting spaces and functions. The exsisting entrance through the porch can be maintained while a new secondary entrance through the extension can facilitate level access for accessibility. The utilisation of the attic is still problematic due to fire regulations needing two stairways as fire escapes.





Ill. 137: Initial sketches. Own illustrations.

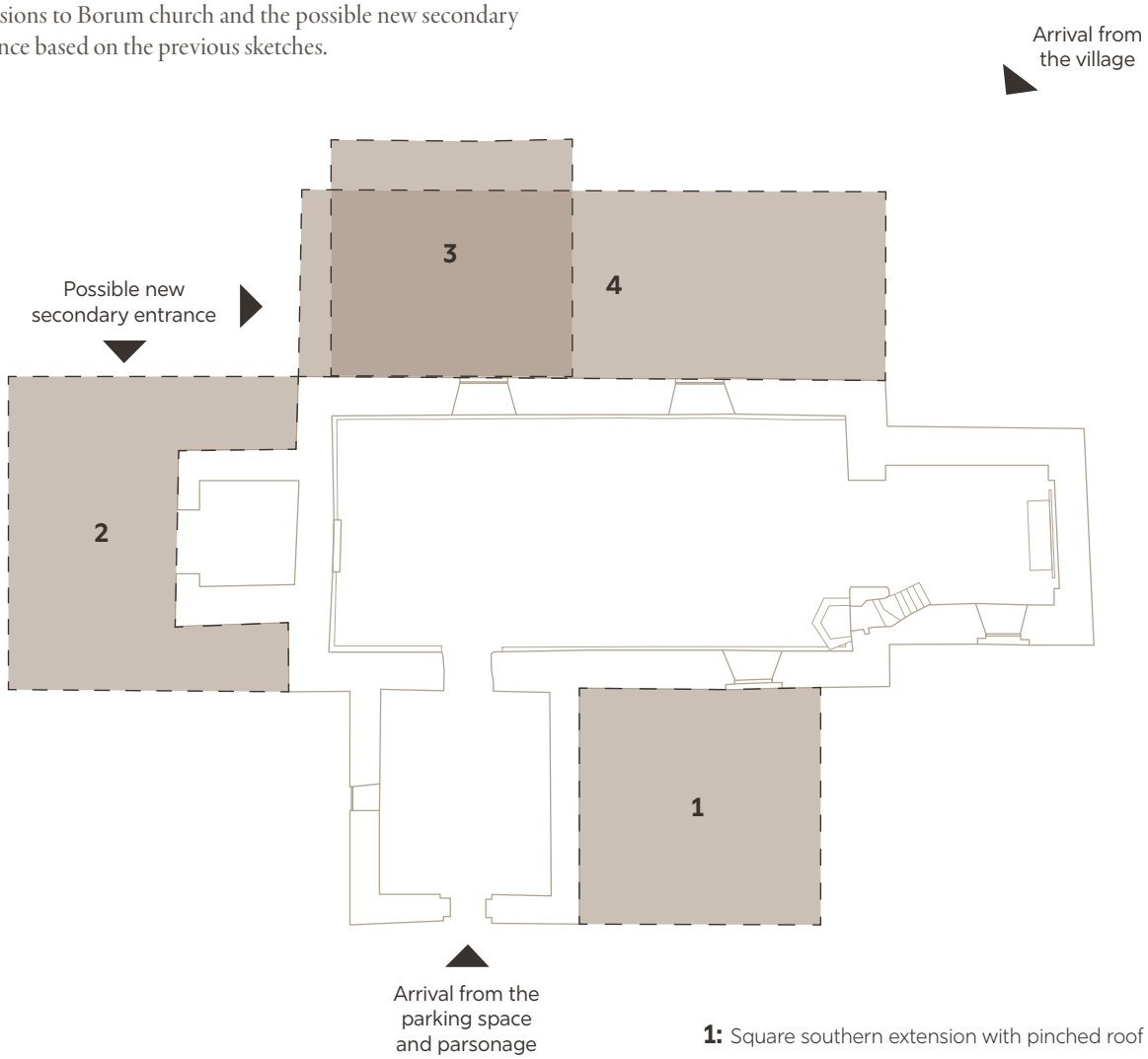
# EXTENSION

## Placements of the extension and arrivals to the church

According to the theoretical framework, certain interior modifications and placement of extensions can be made to the church without disrespecting its history or disrupting the possibility of religous practice.

The illustration below indicates the possible placements of extensions to Borum church and the possible new secondary entrance based on the previous sketches.

The southern extension has only been minimal developed due to the mayor issue of reduced natural lighing in the church if the southern window in the nave were to be blocked.




**1:** Square southern extension with pinched roof

**2:** Circular western extension with either sloped roof or multiple pinched roofs

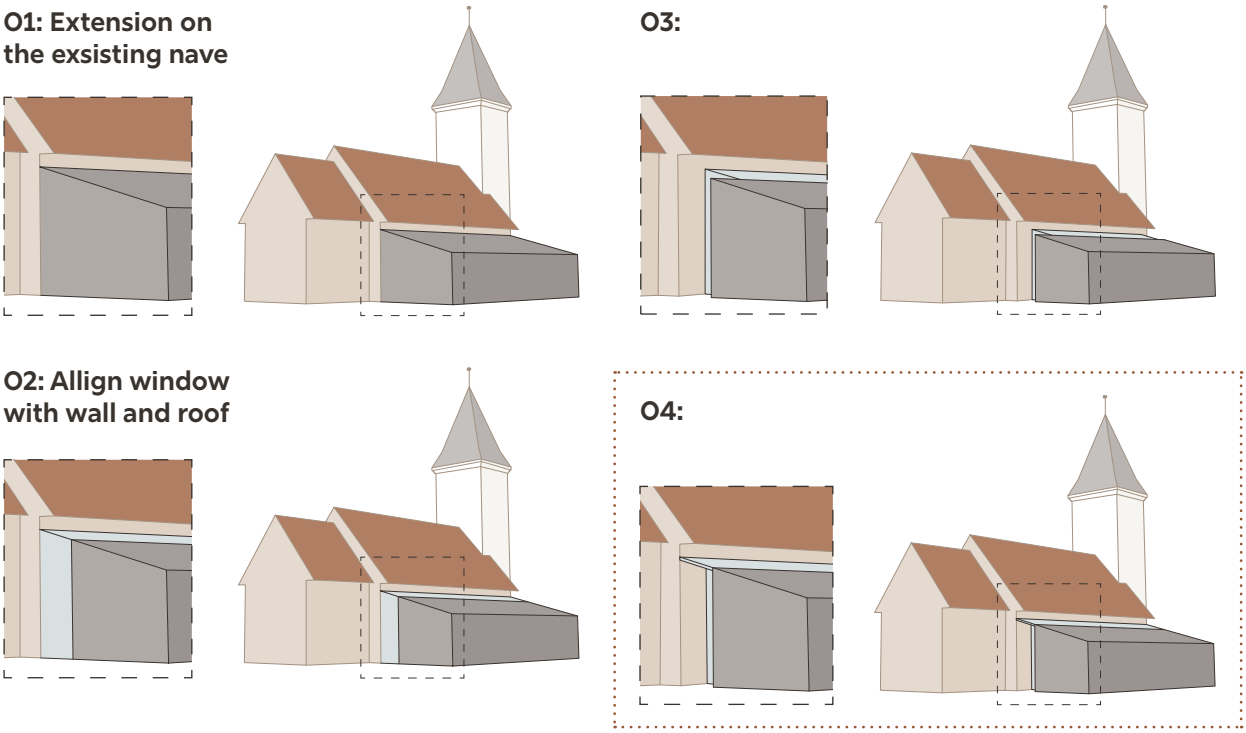
**3:** Square northern extension with pinched roof

**4:** Rectangular northern extension with sloped roof or multiple pinched roofs

Ill. 138: Diagram of possible placements of extensions to Borum Church, following the typology. Own illustration.

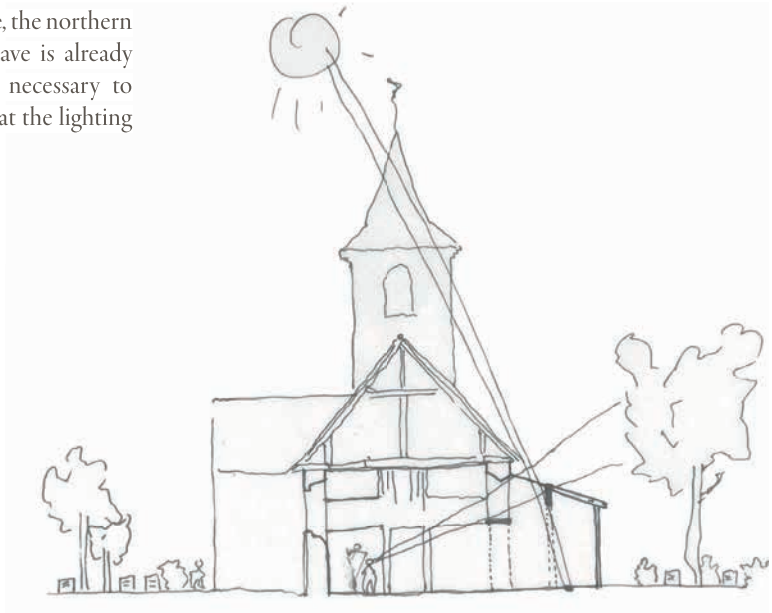
# Connection between exsisting and new

When building an extension to a church, the meeting between the existing and the new is an important detail. Therefore, different versions of a glass assembly are examined.




Ill. 139: Illustrations of the connection between the exsisting nave and new extension

By building an extension to the northern facade, the northern windows in the nave will be covered. The nave is already perceived as a dark space, which makes it necessary to include skylights in the extension, to ensure that the lighting conditions gets optimised.

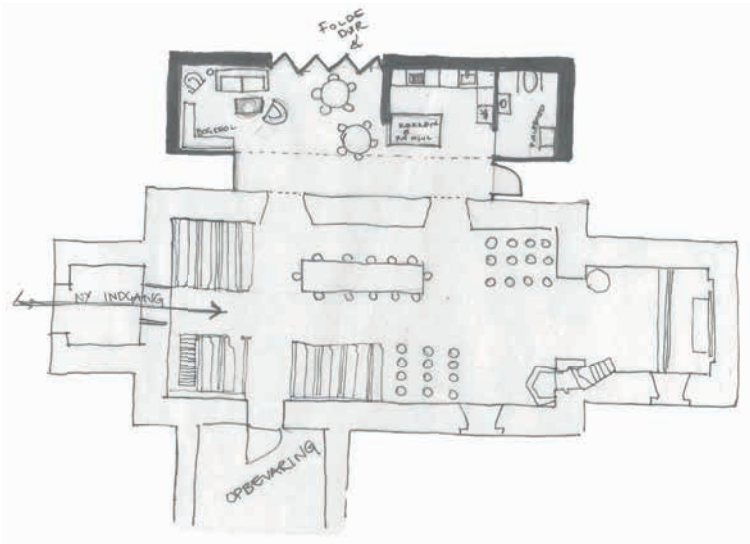


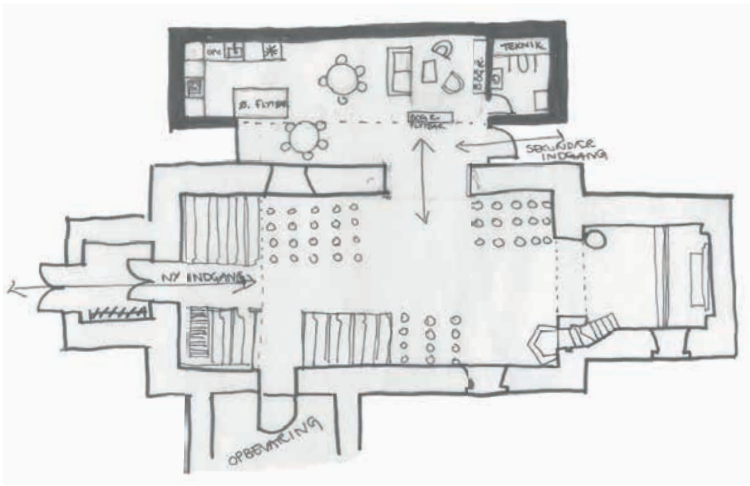
Ill. 140: Sketch section of the exsisting church and extension. Own illustration.

# Plan study

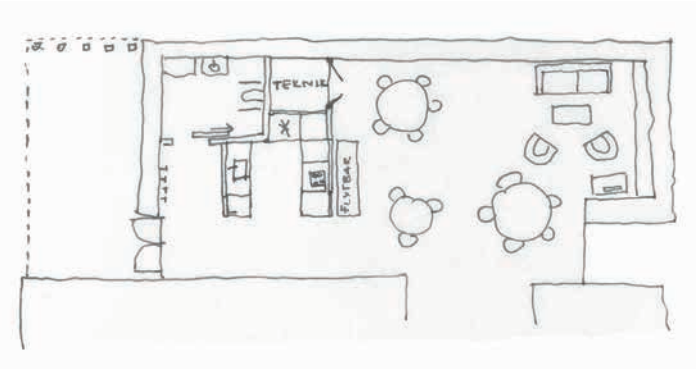
With an extension to the north, different sizes and numbers of openings have been examined in the north facade, with a focus on creating a connection. The main idea is that the room of the nave should function as a large, flexible room, that is heated as needed, while the new extension will contain technical functions, necessary for expanded use, and be continuously heated.

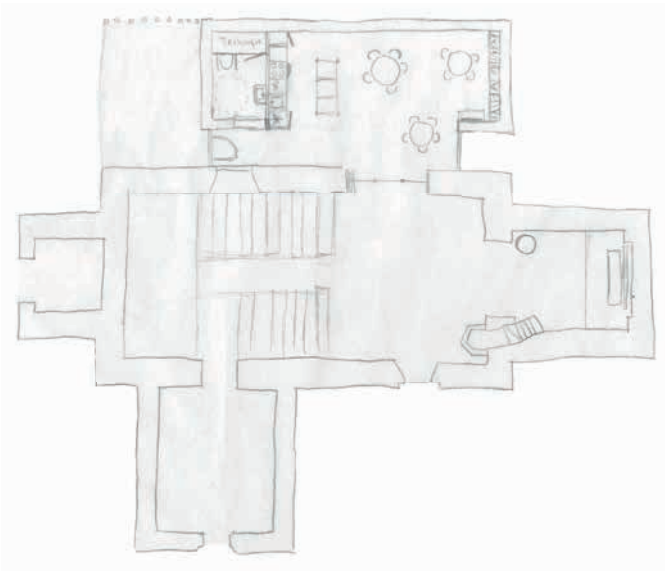
It is essential that the extension, actually should be understood as an expansion of the church, and not a completely new building. On a day-to-day basis, the extension will offer a space that is more comparable to a communal house, while also containing a small self-service library, which significantly expands the functionality of the church building (Appendix 04). The space of the nave should be seen as the Christian room, but the two spaces needs to work together.

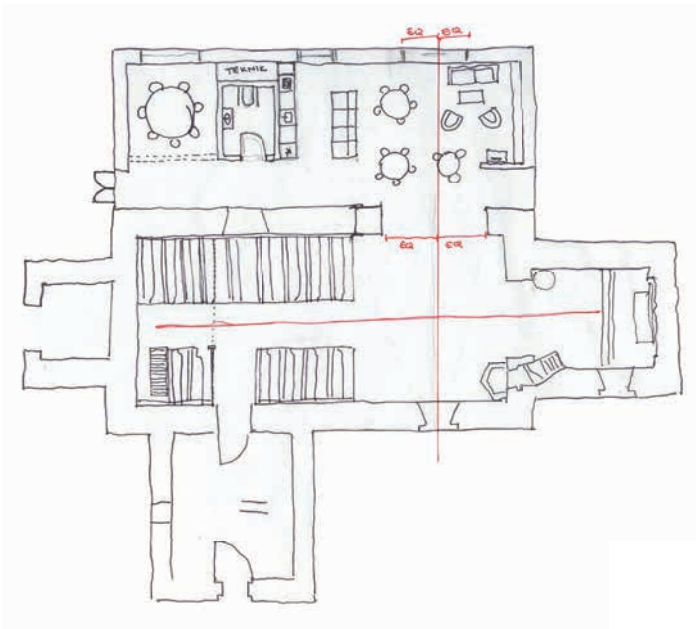



Ill. 141: Plan study of extensions.


TEKNIK
FLYTBAR



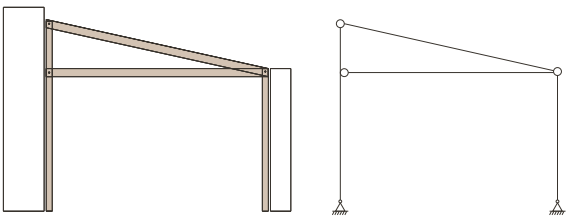

TEKNIK

# Load-bearing construction study

In the process of choosing a construction design for the building extension, there have been made studies on the spatial and visual aspect of a visual timber construction. Different iterations were investigated, and from a functional, tectonic and aesthetic perspective was iteration 5 chosen.
The beam construction functions as the structural system for the roof construction, and through calculations on the utilisation rate for compression and bending (Appendix 06), was the chosen beam a glulam 28h with dimensions of 90 mm x 367 mm.

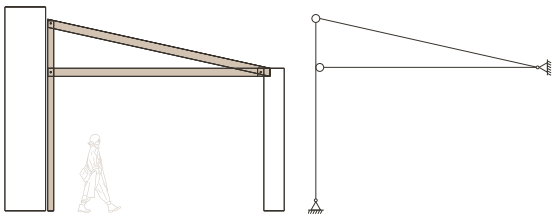
DoF > R: Mechanism
DoF = R: Statically determinate
DoF < R: Statically indetermitate

**01**



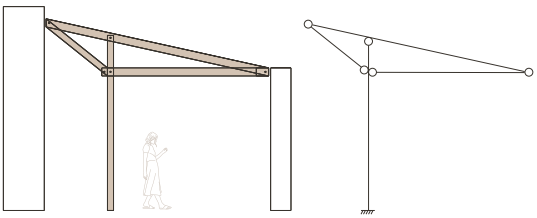
DoF = 12 R = 6 + 6 = 12
**DoF = R**

**04**



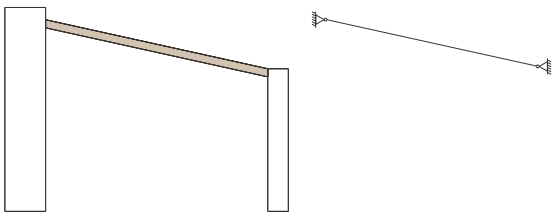
DoF = 9 R = 6 + 4 = 10
**DoF < R**

**02**



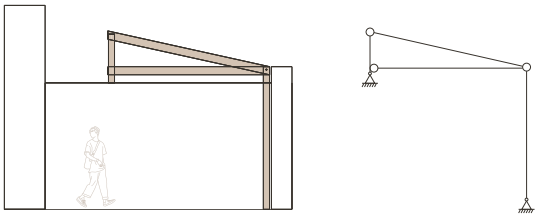
DoF = 12 R = 3 + 10 = 13
**DoF < R**

**05**



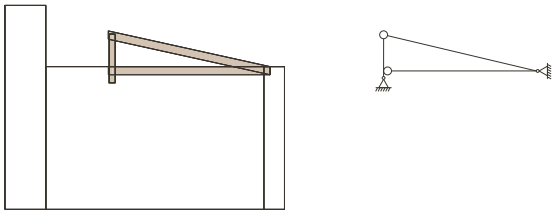
DoF = 3 R = 4 Dimensions:
90 mm x 367mm x 6500mm
**DoF < R**

**03**



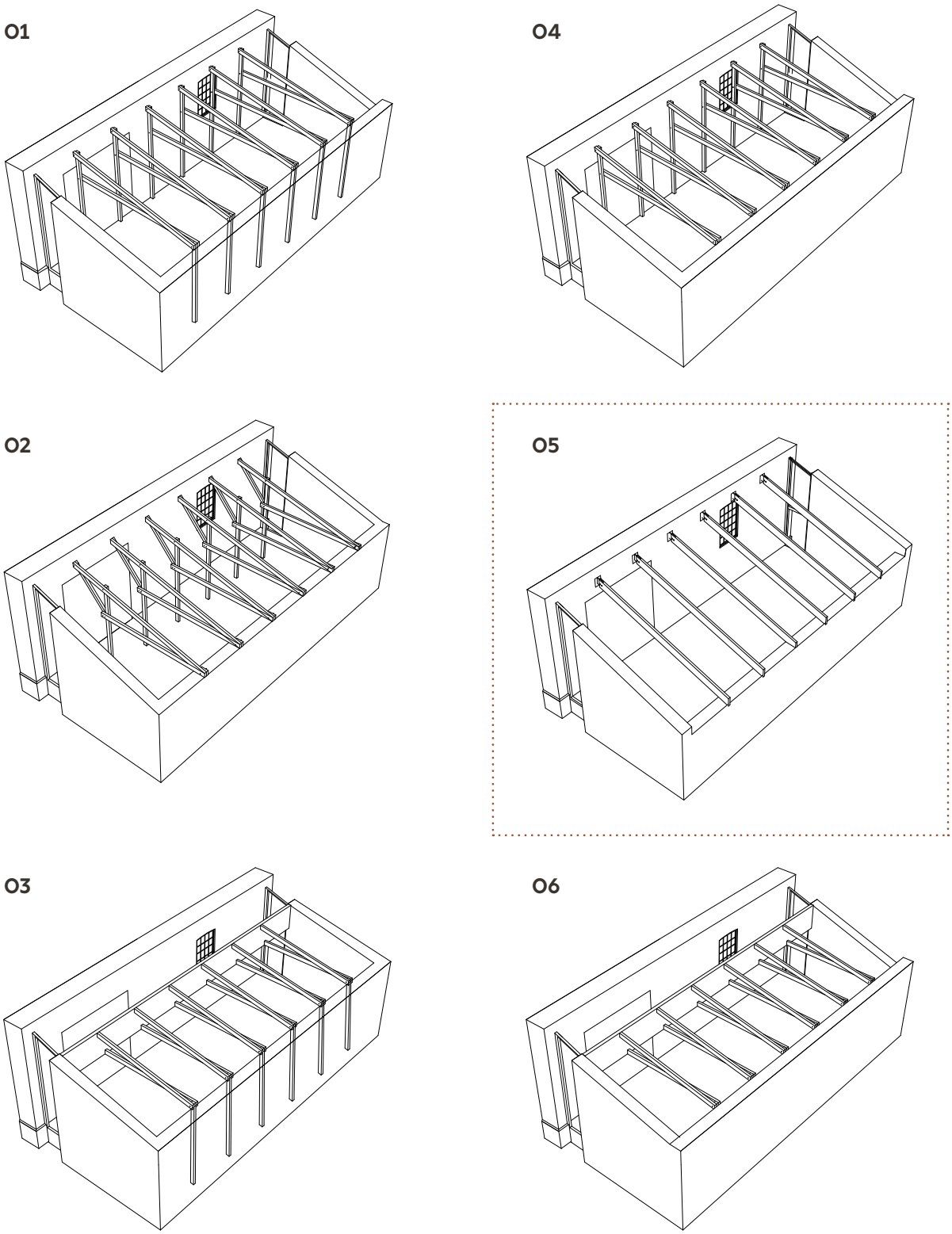
DoF = 12 R = 6 + 6 = 12
**DoF = R**

**06**



DoF = 9 R = 6 + 4 = 10
**DoF < R**

Ill. 142: Technical section of various constructions. Own illustrations.



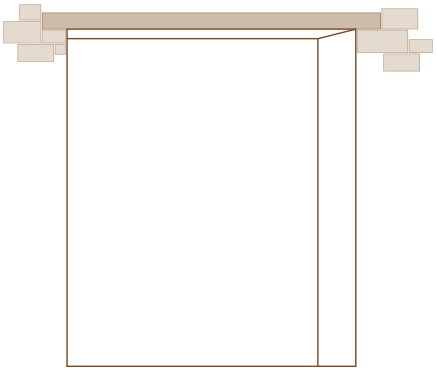

Ill. 143: Model of various constructions. Own illustrations.

# OPENING

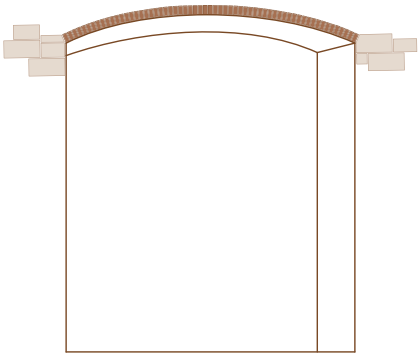
## Form

As it became apparent that an opening was needed to connect the extension with the nave, a study was made on the shape to understand the structural capabilities of different openings. When choosing a segmental arch, it has aesthetical reasons and functional as the arch is structural in its own design.

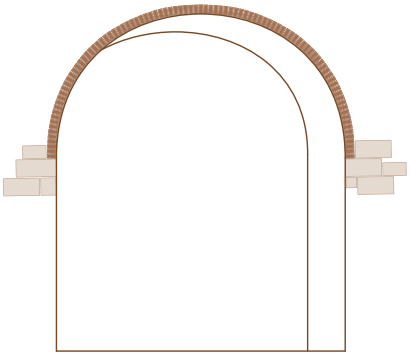
**Rectangular**



**Segmental arch**



**Semicircular arch**

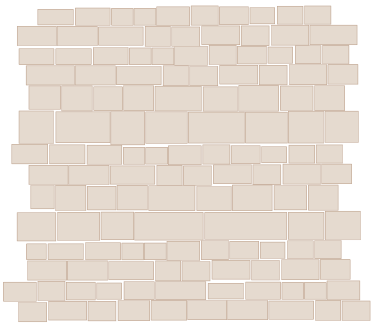


Ill. 144: Various openings. Own illustration.

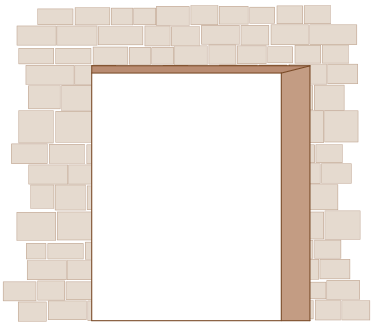
## Making the opening

The technique in how to make the opening has been studied, and in attempt to repeat the existing pattern on the church, where changes have been made, is the idea to remove the ashlar stone one by one.

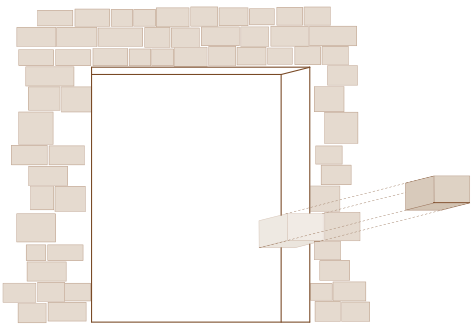
**The existing ashlar wall**



**Cutting the ashlars**



**Removing the ashlars**

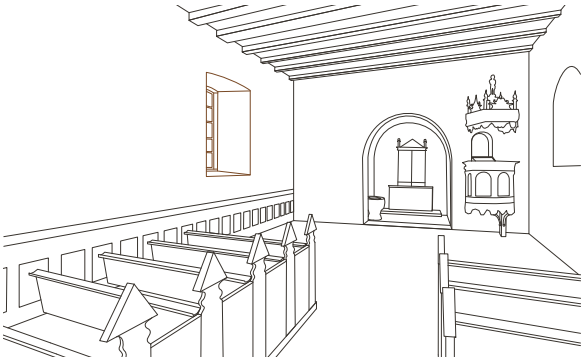


Ill. 145: Methods for constructing the opening. Own illustration.

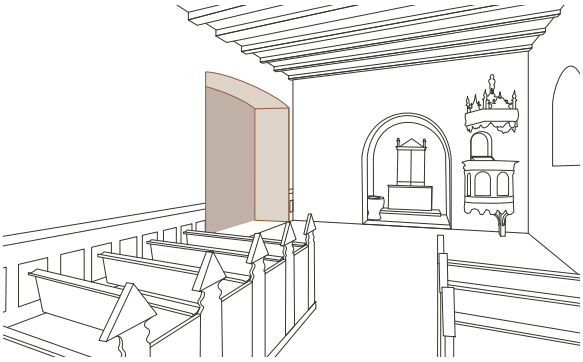
# The opening's impacts in the church room

The existing window opening has a segmental arch and to keep the reference a segmental arch was chosen for the opening's design. However, other shapes of the opening were iterated upon, as well as height and width. All to understand the impact of the new opening in the existing church space and its character. Placement of the opening has also been deliberate to maintain connections the sacred inventory to maintain and enhance the atmosphere in the extended part of the church space.

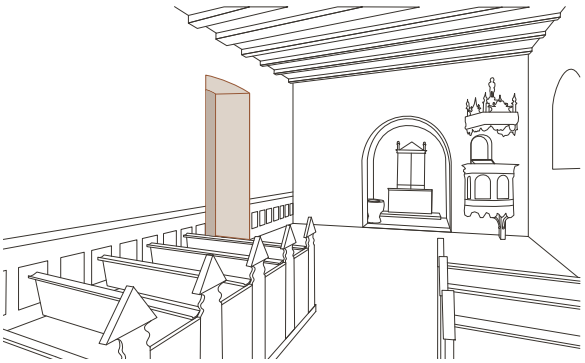
**Exsisting window**



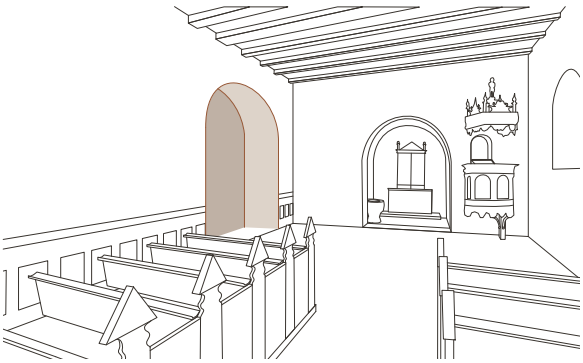
**Approx. 4.5 m segmental arch opening**



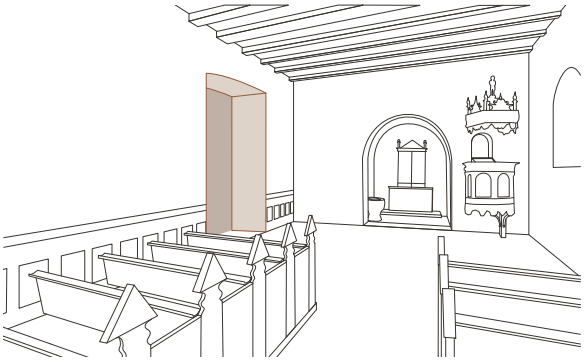
**Segmental arch opening below ex. window**



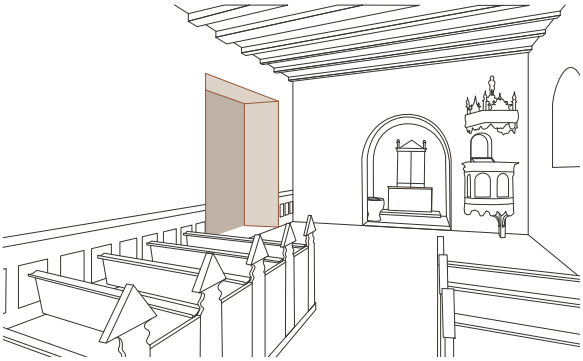
**Semicircular arch opening**



**Approx. 3 m segmental arch opening**



**Rectangular opening**



Ill. 146: Spacial illustrations of various openings.

# ENERGY & HEAT LOSS

To get a building permit for a new building, you need to provide the municipality with an energy frame calculation. When the new building is an extension of an existing building, it is possible to comply with other paragraphs of the building regulations (Social- og boligstyrelsen, 2025c). If the extension does not comply with the energy frame, two other options are possible:

If the total area of external doors and windows in the extension does not exceed 22% of the heated floor area, it is only mandatory to comply with the U-values in §268 (Social- og boligstyrelsen, 2025d).

If the total area of external doors and windows in the extension is exceeding 22% of the heated floor area, it is possible to use the heat loss frame described in §272. The heat loss in the extension must not become greater than if the U-values requirements in §268 (Tabel 2 - Minimum requirements for the building envelope in case of changed use) were met. When calculating the heat loss frame, 50% of the previous heat loss through the part of the exsisting facade that is covered by the extension shall be subtraced from the present heat loss. This means that the net heat loss is less than the present heat loss. Then it is easier to comply with the heat loss frame. (Social- og boligstyrelsen, 2025b; 2025d)

As the total area of the external doors and windows in the extension of the church exceeds 22% of the heated area, the second option, to comply with the heat loss frame, is chosen (Appendix 05).

**Heat loss frame**
**1876.8 W**

**Net heat loss**
**1258.3 W**

**Previous heat loss through covered part of exsisting facade**
**2329.6 W**

**Present heat loss**
**4710.9 W**

**50%**
**1164.8 W**

## U-values & Linelosses

To comply with the heat loss frame (Appendix 05, Max U-values), the following U-values and linelosses for each of the constructions must be below:

New external wall: **0.17 W/m²K**

New roof: **0.2 W/m²K**

New foundation: **0.17 W/m²K**

Windows / external doors w. glass: **1.00 W/m²K**

Foundation: **0.4 W/mK**

Windows and doors: **0.06 W/mK**

Skylights: **0.2 W/mK**

To lower the cost for heating of the extension, the constructions are optimized to meet the U-values to comply with the voluntary building class (ROCKWOOL Danmark A/S, 2025). When making a new heat loss frame calculation with the optimised U-values, a new net heat loss is calculated: The optimisation in U-values saves 23,5% of the annual cost

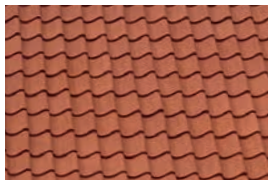
**Net heat loss optimized**
**393.9 W**

**Total saving in new heat loss**
**864.4 W**

# MATERIAL STUDY

In the process of choosing red roof tiles and brick as the materials for the new building addition, different were considered. Whitewashed brick and zinc roof, as they are also common church building materials, and to be found on Borum church as well. Wood cladding and shingles were considered as they are more of a contemporary choice. However, the chosen materials made a coherence with the church.

**Roof materials**



Roof tiles

Zinc roof

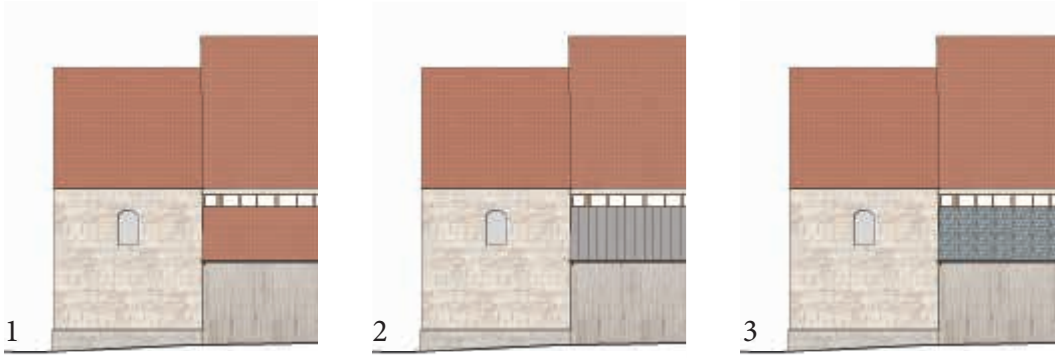
Wood shingles

**Facade materials**

Whitewashed brick

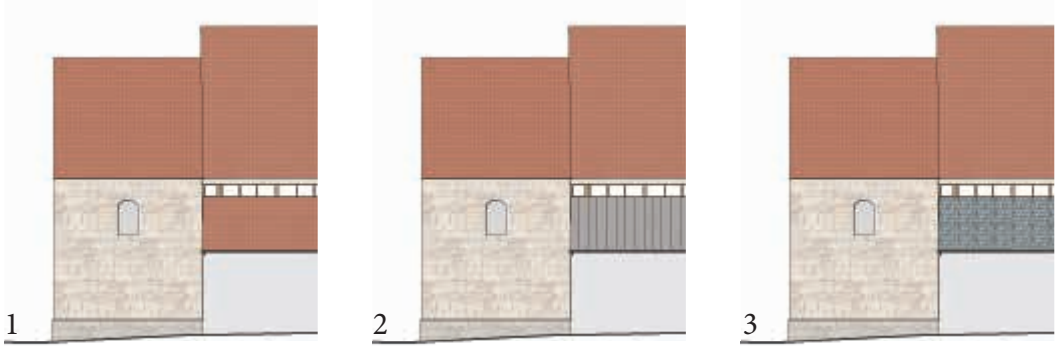
Red brick

Wood cladding



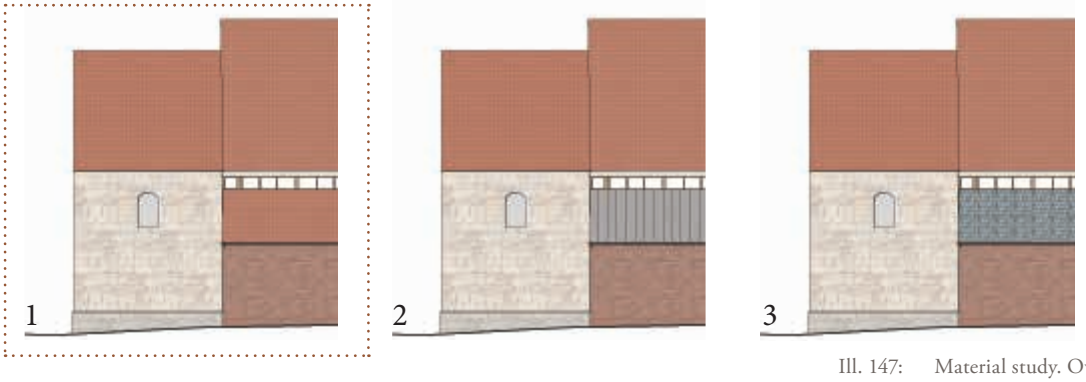

**Wood cladding**

1: Roof tiles
2 : Zinc roof
3: Wood shingles




**Whitewashed Brick**

1: Roof tiles
2: Zinc roof
3: Wood shingles




**Red brick**

1 - Roof tiles
2 - Zinc roof
3 - Wood shingles

Ill. 147: Material study. Own ilustrations. Private photos.

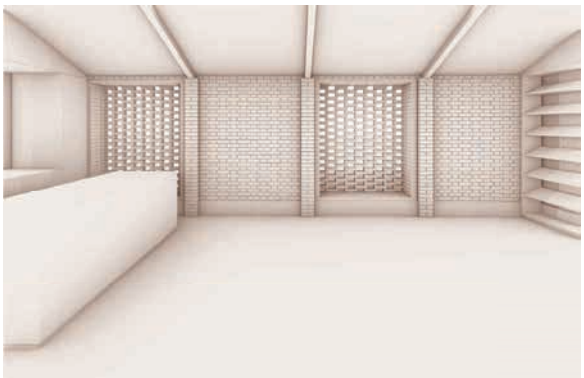
# FACADE STUDY

When the exterior wall is constructed in brick, it is intentionally left exposed to indicate the building's tectonics. A series of studies has been conducted to explore different amount of windows. These are designed as brick perforations, providing a degree of visual filtering between interior and exterior. The windows are essential to ensure access to natural daylight and maintain visual connection to the surroundings.

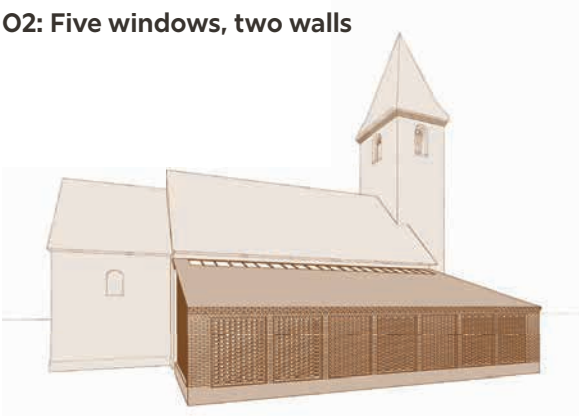
## Exterior facade

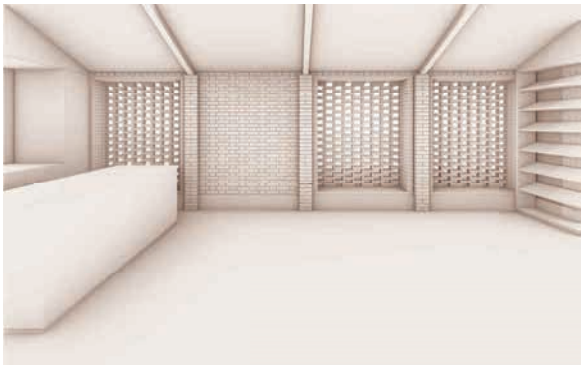
## Interior facade common room

**01: Three windows, four walls**

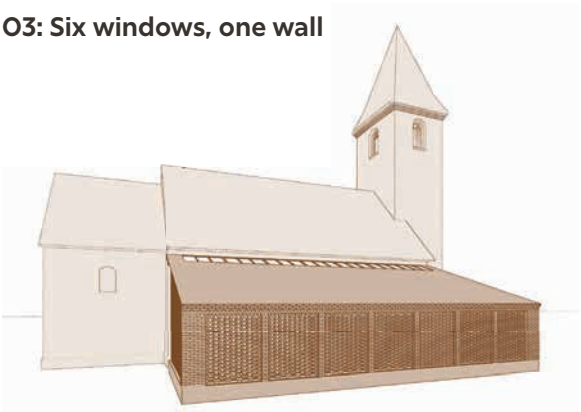


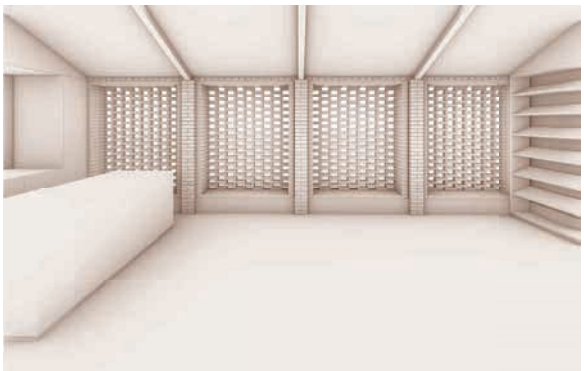
**02: Five windows, two walls**





**03: Six windows, one wall**





Ill. 148: Own ilustrations of facade study.

## Optimisation of U-values & Heat loss frame

For the three iterations of the facade study, the different window and exterior wall area affects the heat loss frame. This has been calculated with the heated floor area of 83,5 $m^2$ for the three iterations. The U-values of the construction have been optimised to meet low emission standards (ROCKWOOL Danmark A/S, 2025). prior to the heat loss frame calculation. Appendix 05)

While the total heat loss through the building envelope is higher in iteration 3 than iteration 1, other factors affect the choice of window area. Such as the natural daylight, a uniform facade, and having a section of masonry for stability. The closed wall section in this case also hides the function behind, as it is the technical room.

**O1:**

Window area 38,4 $m^2$
Windows are 46% of the heated floor area

Heat loss frame: 1890,2 W
Net heat loss: 98,2 W

(Appendix O5, iteration 1)

**O2:**

Window area 45,4 $m^2$
Windows are 54,4% of the heated floor area

Heat loss frame: 1880,7 W
Net heat loss: 295,3 W

(Appendix O5, iteration 2)

**O3:**

Window area 48,9 $m^2$
Windows are 58,6% of the heated floor area

Heat loss frame: 1876,8 W
net heat loss: 393,9 W

(Appendix O5, iteration 3)

# CONSTRUCTION & ENVIRONMENTAL IMPACT STUDY

Various different materials can be used for wall, roof, and slab constructions respectively to comply with the U-values for the low emission building class.

Here, a selection of building materials are assessed in relation to each construction's total thickness and total Global Warming Potential in $kgCO_2$-eq.

## WALL

**55,5 m²**

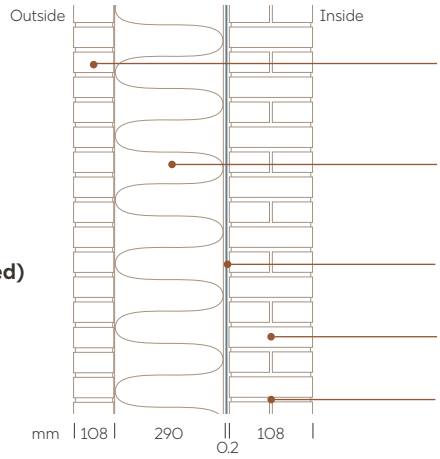
### 01: Mineral wool insulation

**U-value**
0.113 W/m²K

**Total mm**
636 mm

**Total GWP (new)**
5212.7 $kgCO_2$-eq.

**Total GWP (reused)**
204.7 $kgCO_2$-eq.




| Material | GWP |
|---|---|
| 1 layer new red brick, 108 mm | 1669.3 $kgCO_2$-eq |
| 1 layer reused red brick, 108 mm | 0 $kgCO_2$-eq |
| Mineral wool, 290 mm, λ = 0.04 W/(m*K) | 178.9 $kgCO_2$-eq |
| Bitumen membrane, 0.2 mm | |
| 2 layer new red brick, 228 mm | 3338.7 $kgCO_2$-eq |
| 2 layer reused red brick, 228 mm | 0 $kgCO_2$-eq |
| Lime mortar | 25.8 $kgCO_2$-eq |
| Cement mortar, functional | 62.2 $kgCO_2$-eq |

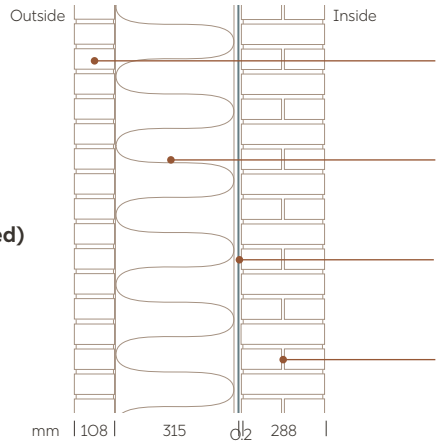
### 02: Hemp insulation

**U-value**
0.116 W/m²K

661 mm

**Total GWP (new)**
5110.2 $kgCO_2$-eq.

**Total GWP (reused)**
102.2 $kgCO_2$-eq.




| | |
|---|---|
| 1 layer new or reused red brick, 108 mm | |
| Hemp, 315 mm, λ = 0,04 W/(m*K) | 76.4 $kgCO_2$-eq |
| Bitumen membrane, 0,2 mm | |
| 2 layer new or reused red brick, 228 mm | |

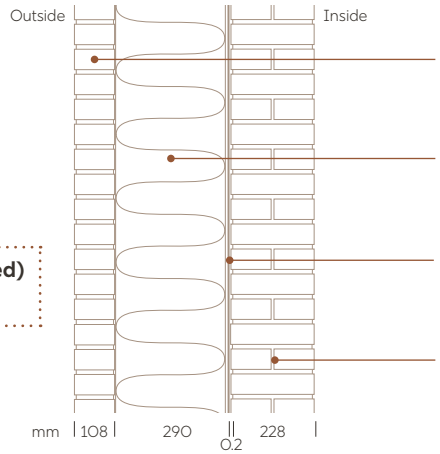
### 03: Wood fiber insulation

**U-value**
0.112 W/m²K

**Total mm**
636 mm

**Total GWP (new)**
5124.9 $kgCO_2$-eq.

**Total GWP (reused)**
116.9 $kgCO_2$-eq.




| | |
|---|---|
| 1 layer new or reused red brick, 108 mm | |
| Wood fiber, 290 mm, λ = 0.038 W/(m*K) | 91.1 $kgCO_2$-eq |
| Bitumen membrane, 0.2 mm | |
| 2 layer new or reused red brick, 228 mm | |

## ROOF

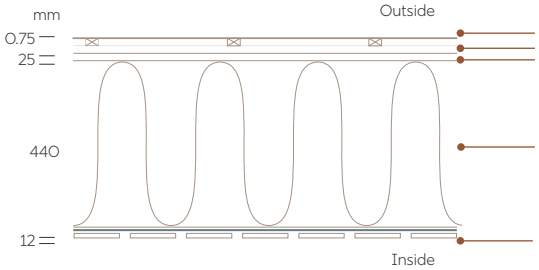
**92,1 m²**

### O1: Zinc

U-value
0.08 W/m²K

**Total mm**
528 mm

**Total GWP**
3674 $kgCO_2$-eq.



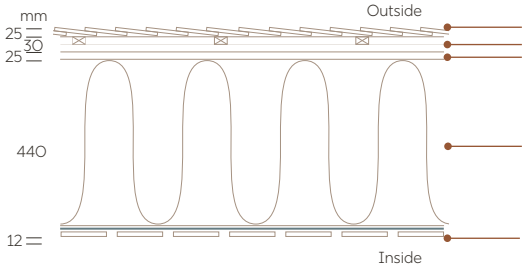

| Material | GWP |
|---|---|
| Zinc, 0.75 mm | 1537 $kgCO_2$-eq |
| Cross battening system, 30 mm | |
| Wind barrier, 25 mm | 60.9 $kgCO_2$-eq |
| Wood fiber, λ = 0.038 W/(m*K) 440 mm | 231.1 $kgCO_2$-eq |
| Acoustic wood ceiling panel, 12 mm | 1845 $kgCO_2$-eq |

### O2: Wooden tiles

U-value
0.08 W/m²K

**Total mm**
552.2 mm

**Total GWP**
3795 $kgCO_2$-eq.




| Material | GWP |
|---|---|
| Wooden tiles, 25 mm | 1658 $kgCO_2$-eq |
| Cross battening system, 30 mm | |
| Wind barrier, 25 mm | |
| Wood fiber, λ = 0.038 W/(m*K) 440 mm | |
| Acoustic wood ceiling panel, 12 mm | |

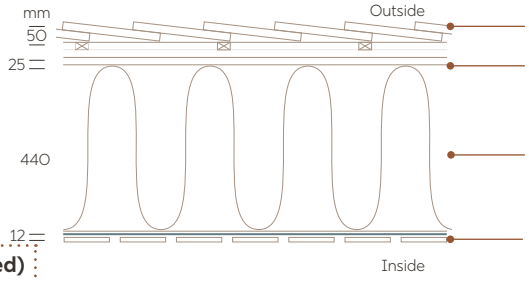
### O3: Roof tiles

U-value
0.08 W/m²K

**Total mm**
577.2 mm

**Total GWP (new)**
3500 $kgCO_2$-eq.

**Total GWP (reused)**
2137 $kgCO_2$-eq.




| Material | GWP |
|---|---|
| New red roof tiles, 50 mm | 1363 $kgCO_2$-eq |
| Reused red roof tiles, 50 mm | 0 $kgCO_2$-eq |
| Wind barrier, 25 mm | |
| Wood fiber, λ = 0.038 W/(m*K) 440 mm | |
| Acoustic wood ceiling panel, 12 mm | |

## SLAB

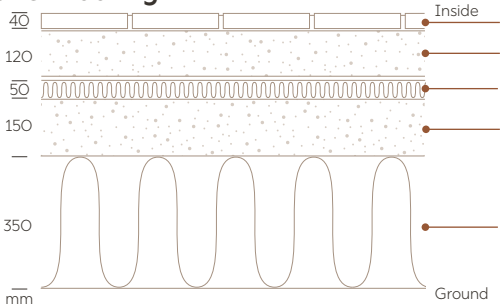
**97.6 m²**

### O1: EPS & new brick flooring

**U-value**
0.097 W/m²K

**Total mm**
636 mm

**Total GWP (new)**
8808.3 $kgCO_2$-eq.



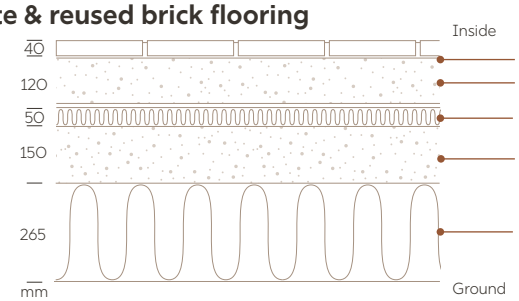

| Material | GWP |
|---|---|
| New Flensborg brick, 40 mm | 921 $kgCO_2$-eq |
| Compression slab with floor heating | 2038 $kgCO_2$-eq |
| Building board, 50 mm | 402,3 $kgCO_2$-eq |
| Concrete, FutureCem, 150 mm | 2757 $kgCO_2$-eq |
| EPS, 350 mm, λ = 0.041 W/(m*K) | 2690 $kgCO_2$-eq |

### O2: EPS Climate & reused brick flooring

**U-value**
0.097 W/m²K

**Total mm**
636 mm

**Total GWP (reused)**
7308.3 $kgCO_2$-eq.




| Material | GWP |
|---|---|
| Reused Flensborg brick, 40 mm | 0 $kgCO_2$-eq |
| Compression slab with floor heating | |
| Building board, 50 mm | |
| Concrete, FutureCem, 150 mm | |
| EPS Climate, 265 mm, λ = 0.031 W/(m*K) | 2111 $kgCO_2$-eq |



Ill. 149: Construction & Environmental impact study. Own illustrations and LCA calculations (Appendix 08).

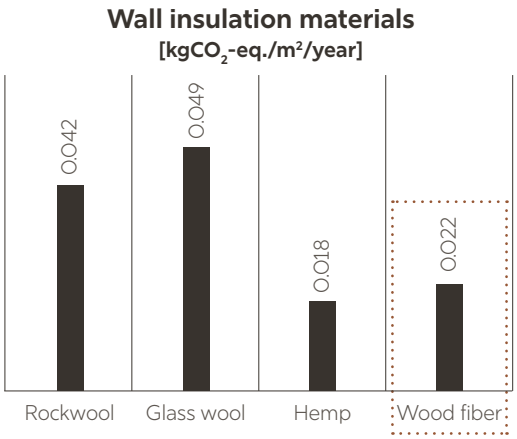
# Life Cycle Assesment results

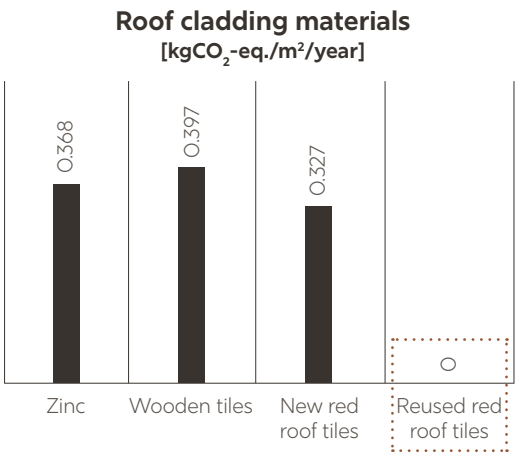
According to §271 in the Building Regulations (BR18), new extensions does not require an energy frame (Social- og boligstyrelsen, 2025c). The lack of an energy frame makes it impossibly to conduct a complete life cycle assessment. Nevertheless, the global warming potential of different materials can be compared to select informed choices.

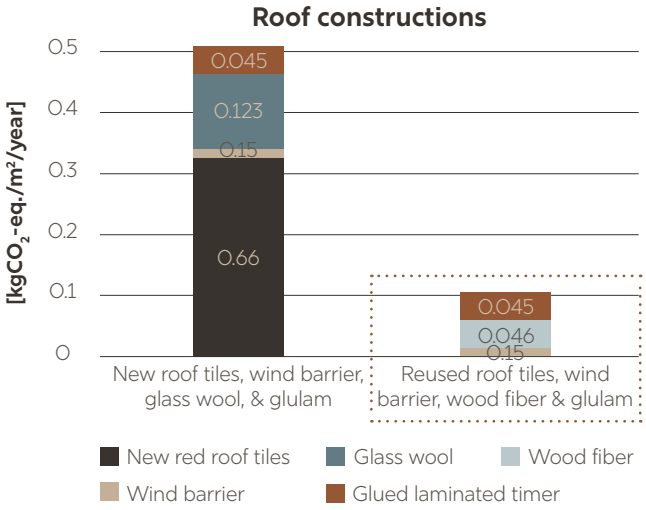
Firstly, variours insulation and roof materials are compared respectivly. Afterwards, different scenarios for roof, exterior wall and slab construction are conducted and compared. Each comparising are between a 'common practice' construction, with the mineral materials, the building industry usually have used. The alternative, optimised constructions do mainly consist of biobased, $CO_2$-reduced or reused materials.

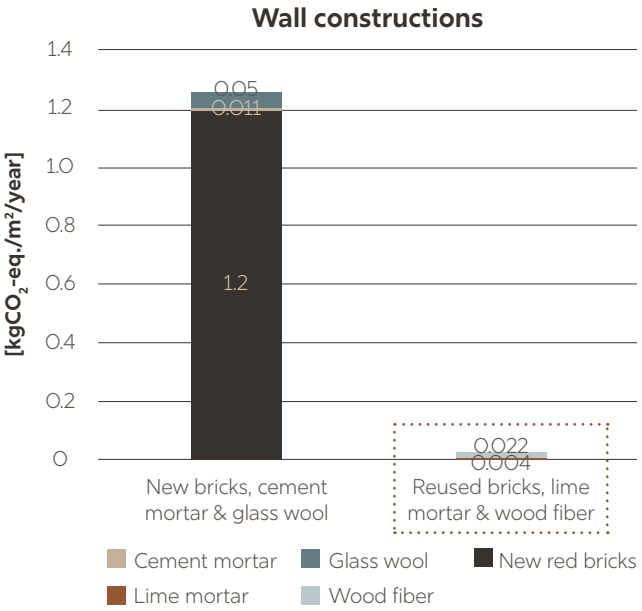
The parameters for the following GWP calculations for the constrtuctions variations are:

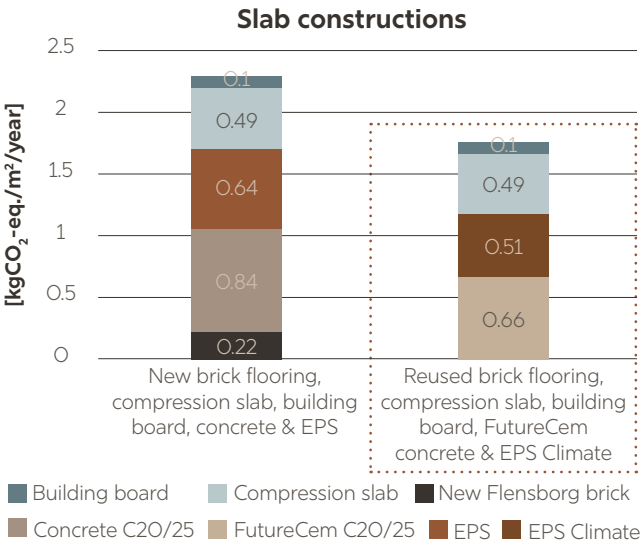
Heated gross floor area: **83,5 m²**
Reference study period: **50 years**



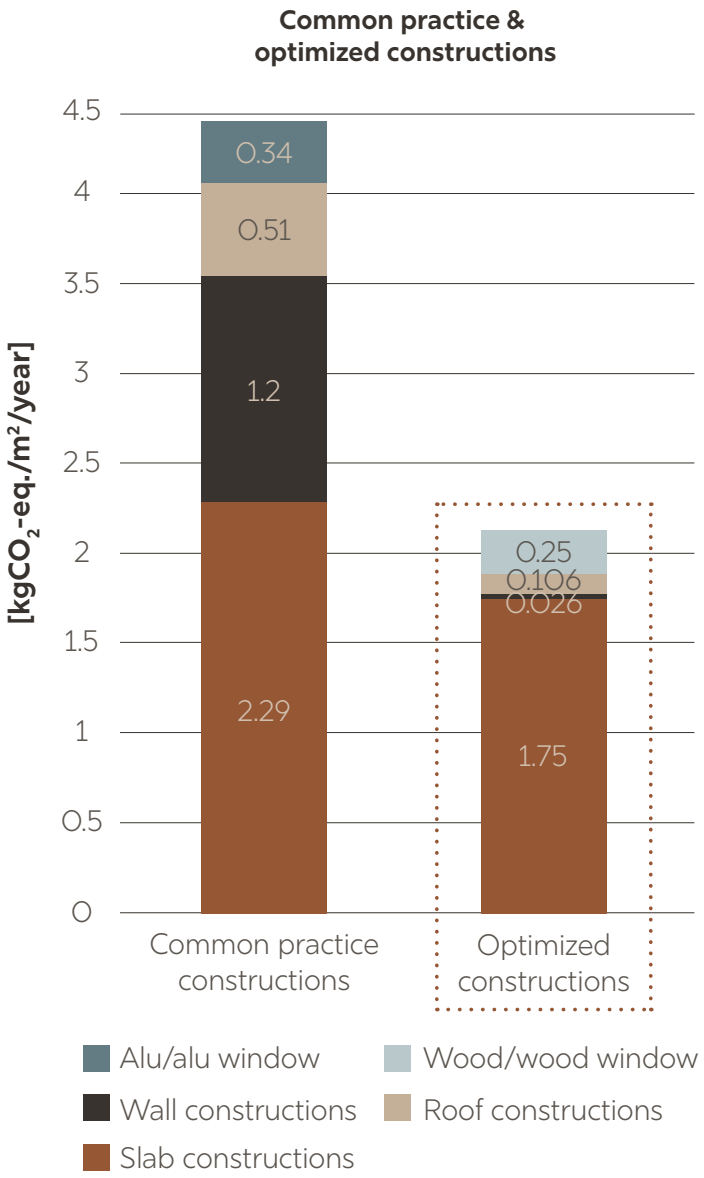




Ill. 150: LCA results illustrated with graphs. Own illustrations and LCA calculations (Appendix 08).




Ill. 151: LCA results. Own illustrations and LCA calculations (Appendix 08).

The study of environmental impact of various building materials results in a comparison between wall insulation materials, roof cladding materials, roof constructions, wall constructions, and slab constructions respectively. (Appendix 08) Ultimately, the 'common practice' and GWP-optimized constructions for each building part is collected and the total compared in the bar chart above (Ill. 148). Here it is clear that the slab construction is the building part with the highest GWP after the optimisation of the constructions.

The optimised constructions result in a total Global Warming Potential reduction of 9412.4 kgCO2-eq. or a reduction of 51.3%.

**Total GWP: common practice**

**18335 $kgCO_2$-eq.**

**Total GWP: optimized**

**8922.7 $kgCO_2$-eq.**

**Total GWP reduction**

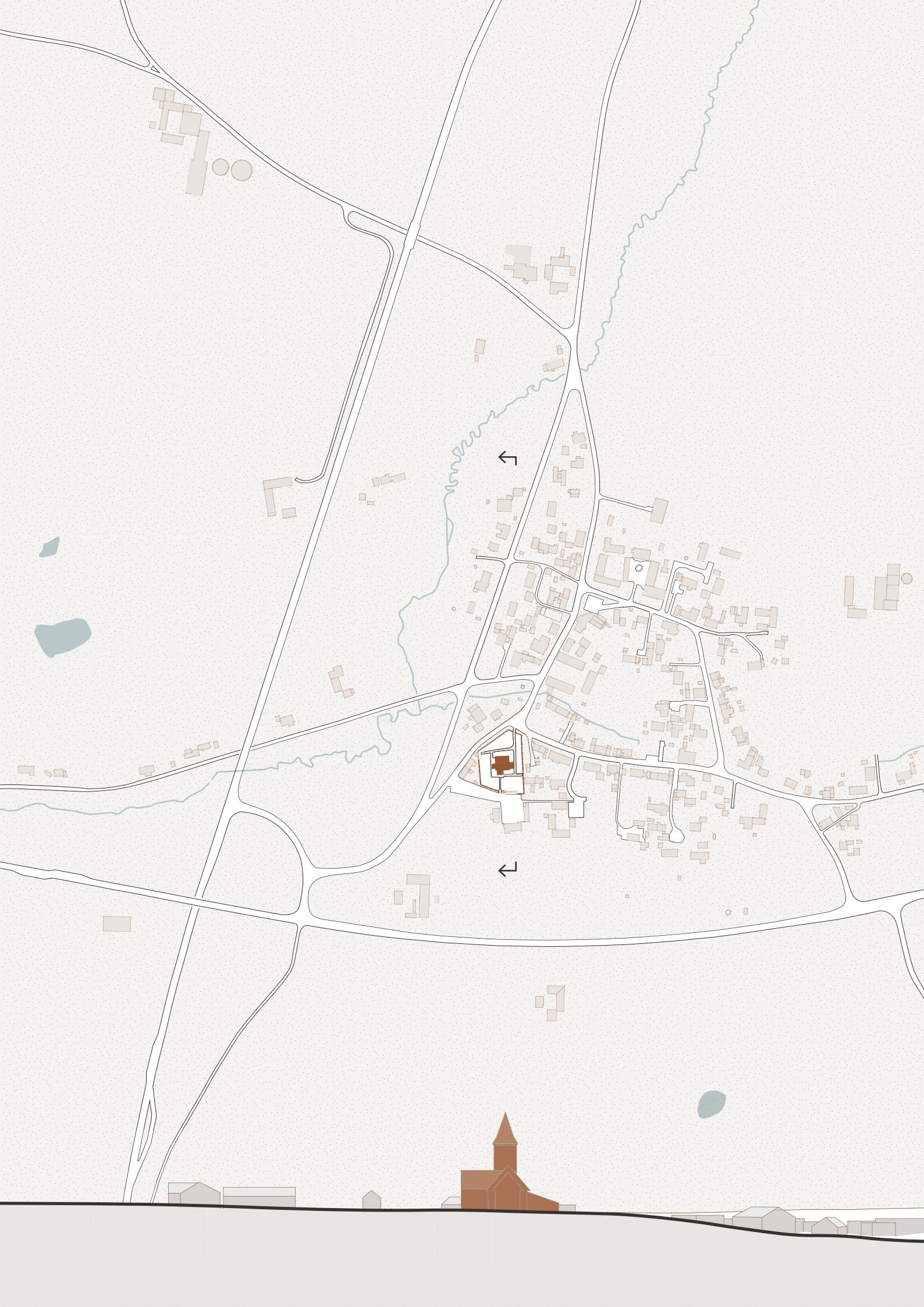
**9412.4 $kgCO_2$-eq.**

**51.3%**

Post-design

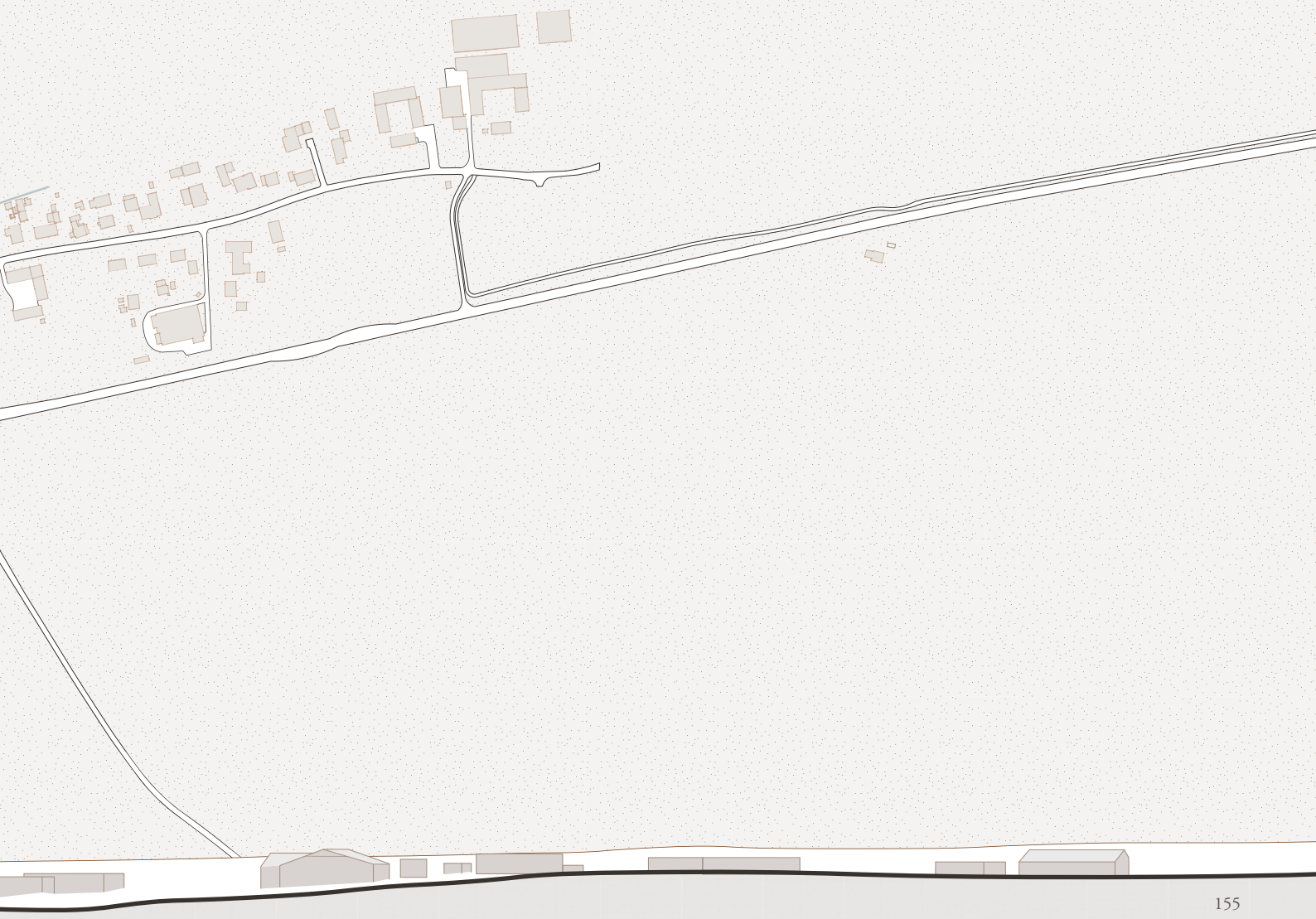
# PART IV

# Presentation



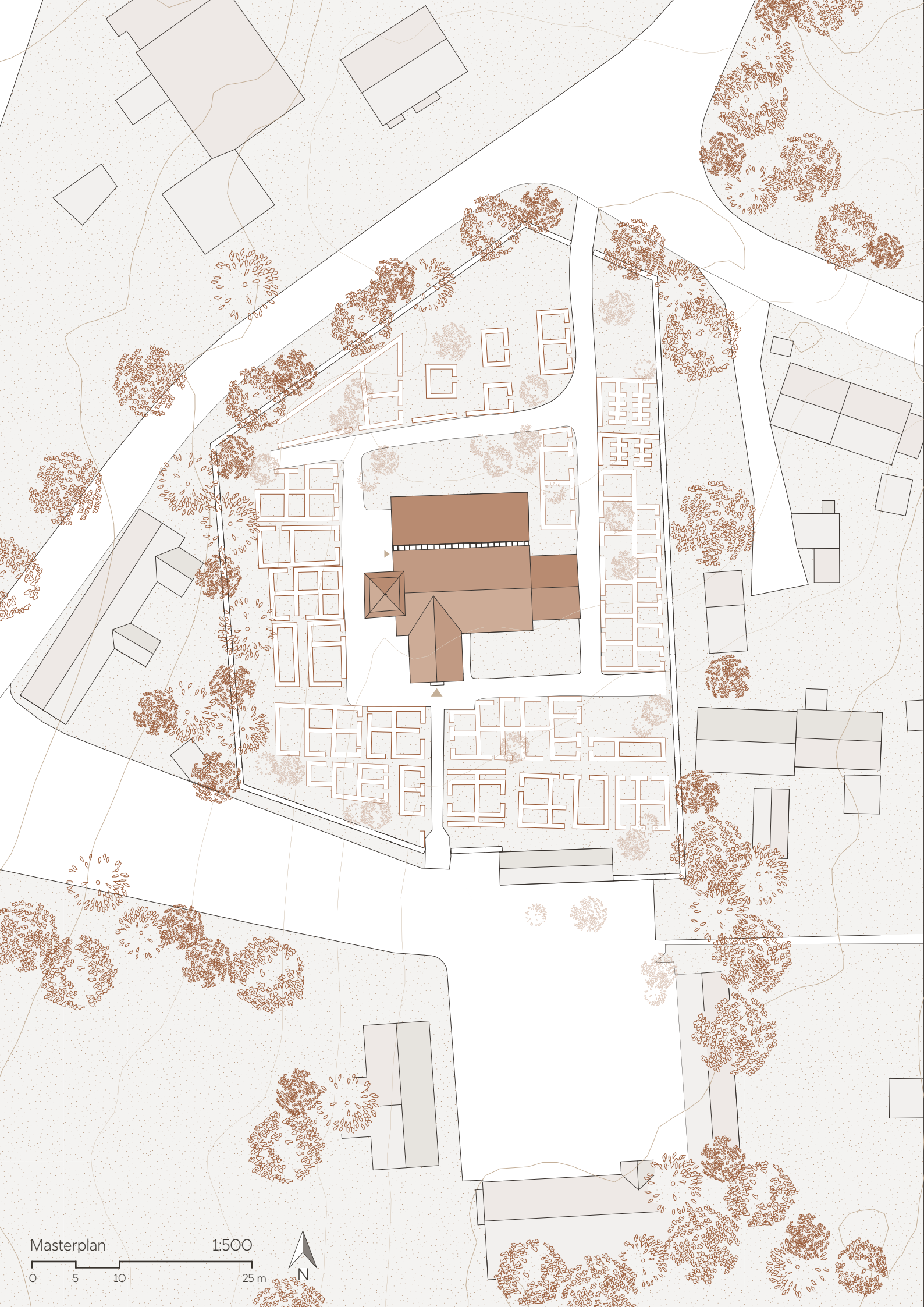
This presentation is the result of this thesis project; to rethink the Danish medieval village churches. Using the village church in Borum, Aarhus, as a design case, the project explores, how a specific church can be adapted to ensure its continued relevance in the rural society. The intention of the peoject have been to secure its future use and role as a heterotopia in Borum, while enhancing its role for a wider user group. In doing so, the project respect medieval church's long history of adapting to societal need.

The proposed transformation of Borum Church involves the subtraction of selected pews in the nave to accommodate spatial flexibility, along with a typological extension of the church to allow additional functions within the building. The modifications and additions are enhancing the use of the place while preserving and respecting the ecclesiastical functions. The adapted Borum Church is a heterotopia, a place outside of the ordinary for the inhabitants of Borum. The extension is north oriented towards the village, reaching out for the community to strengthen its role in the contemporary society.



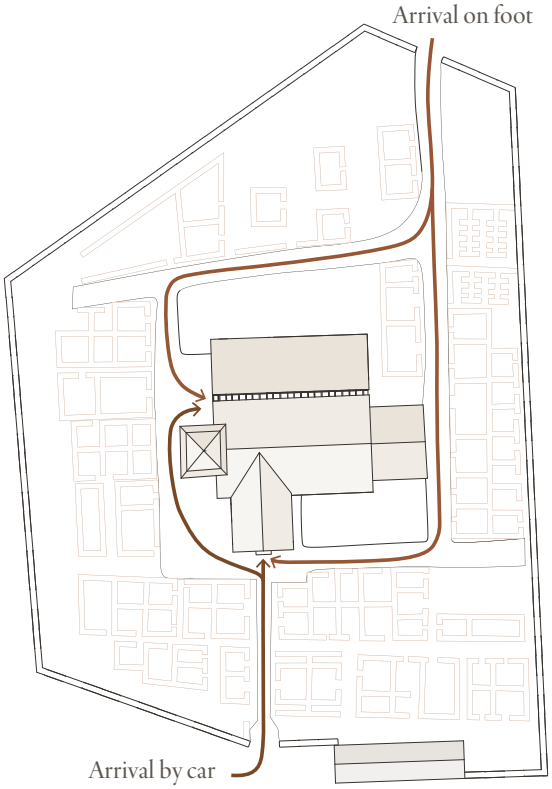
A new typological addtion along the nave's northern facade serves as an exstension of the existing church space. The new facade referes to historical architectureal styles with a conpemporaty expression that is visible from the village. The periforated reused masonry serves as a filter between the interior and exterior.

Ill. 152: Exterior view. Render.

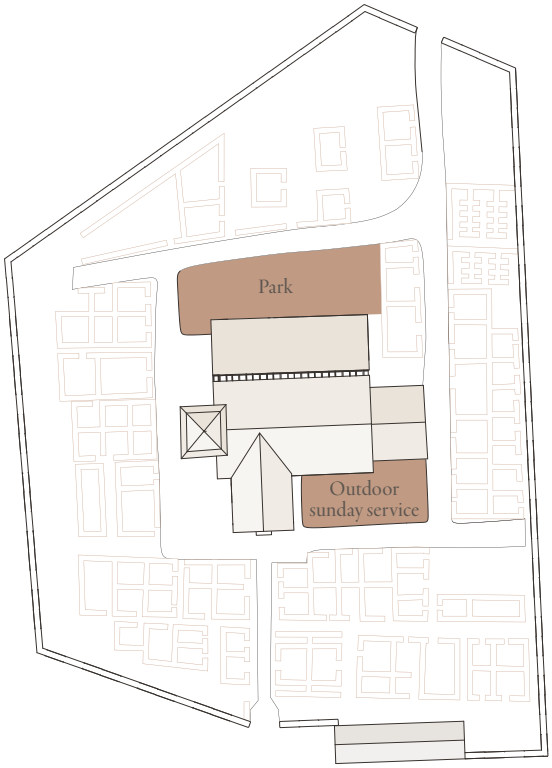

Masterplan
1:500
0
5
10
25 m
N

# THE CHURCHYARD

The declining use of burial places allows for future adaptation of the churchyard. The proposal of the adapted graveyard is a park for the inhabitants of Borum. New paving improves the accessibility for users of the church and passersby. The open areas around the church can accommodate outdoor activities as Sunday service and social activities.




Ill. 153: Flow on the cemetery.



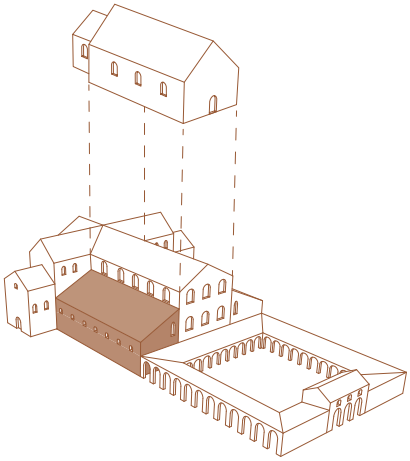

Ill. 154: Space for outdoor activities on the cemetery.

Elevation North 1:200

0 2 5 10 m

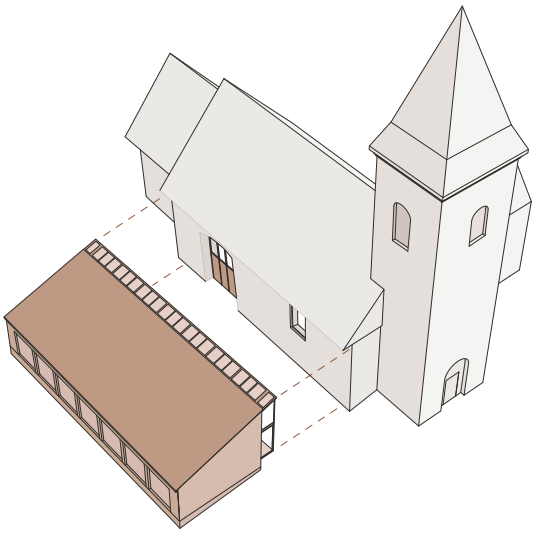
# A BASILICA

The overall design intervention and adaptation of Borum Church is grounded in the basilica typology. The architectural expression of the adaptation draws parallels to the Romanesque style, present in the existing church of Borum. The design proposal both respects and builds upon this historical style, integrating contemporary elements and expression that complements the existing church.



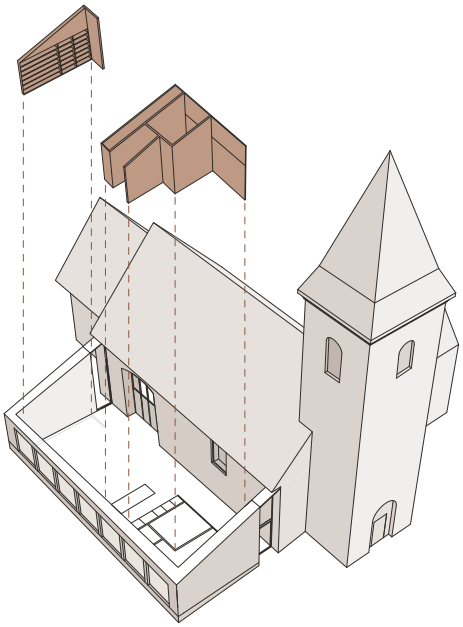
**Addition**

of nothern extension following the basilica typology, to facilitate a variety of functions and provide a thermally insulated space.



**Addition**

of inner walls and interior within the extension, create rooms for various purposes, while enhancing the sense of heaviness and the materiality of the exterior walls.

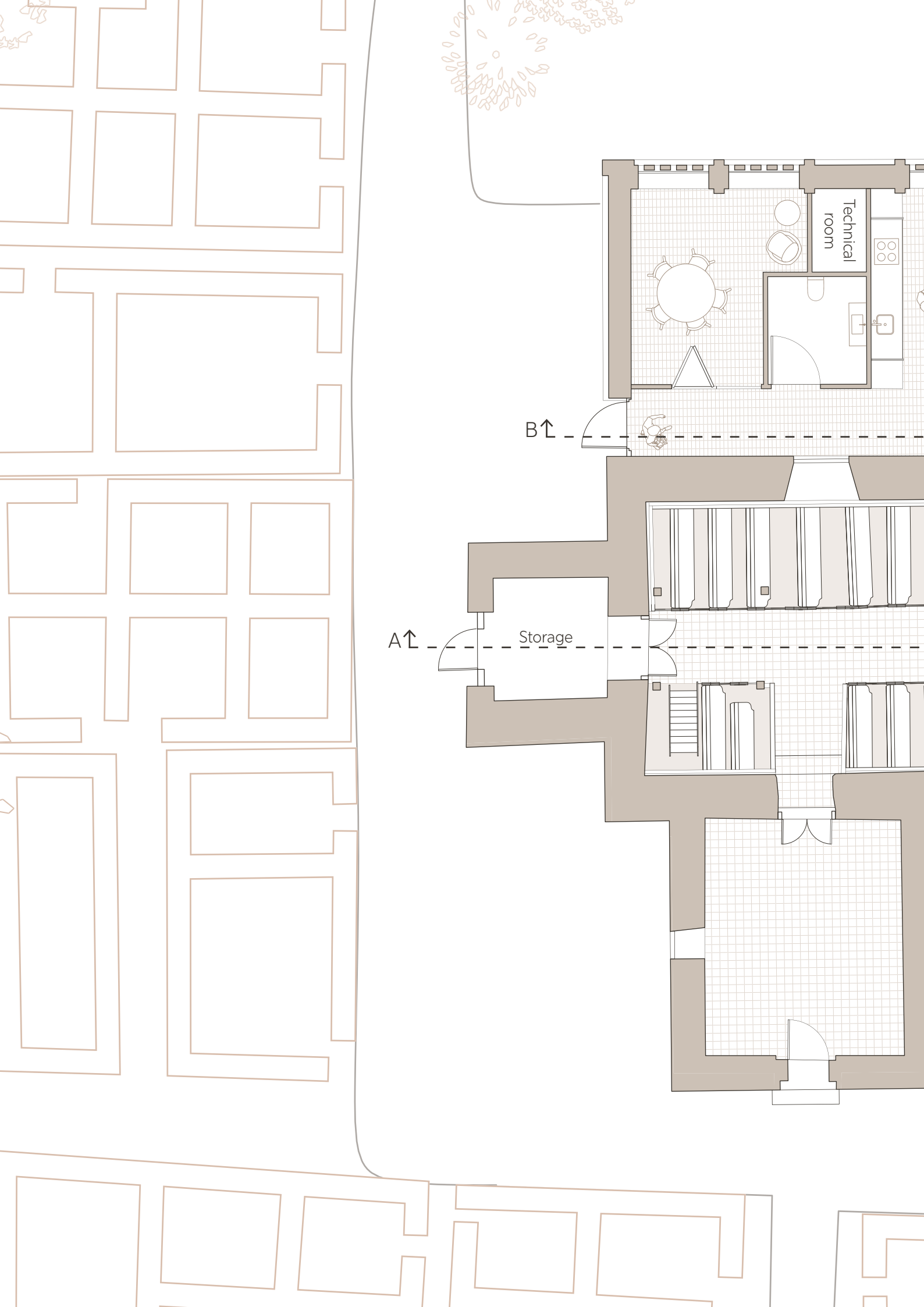


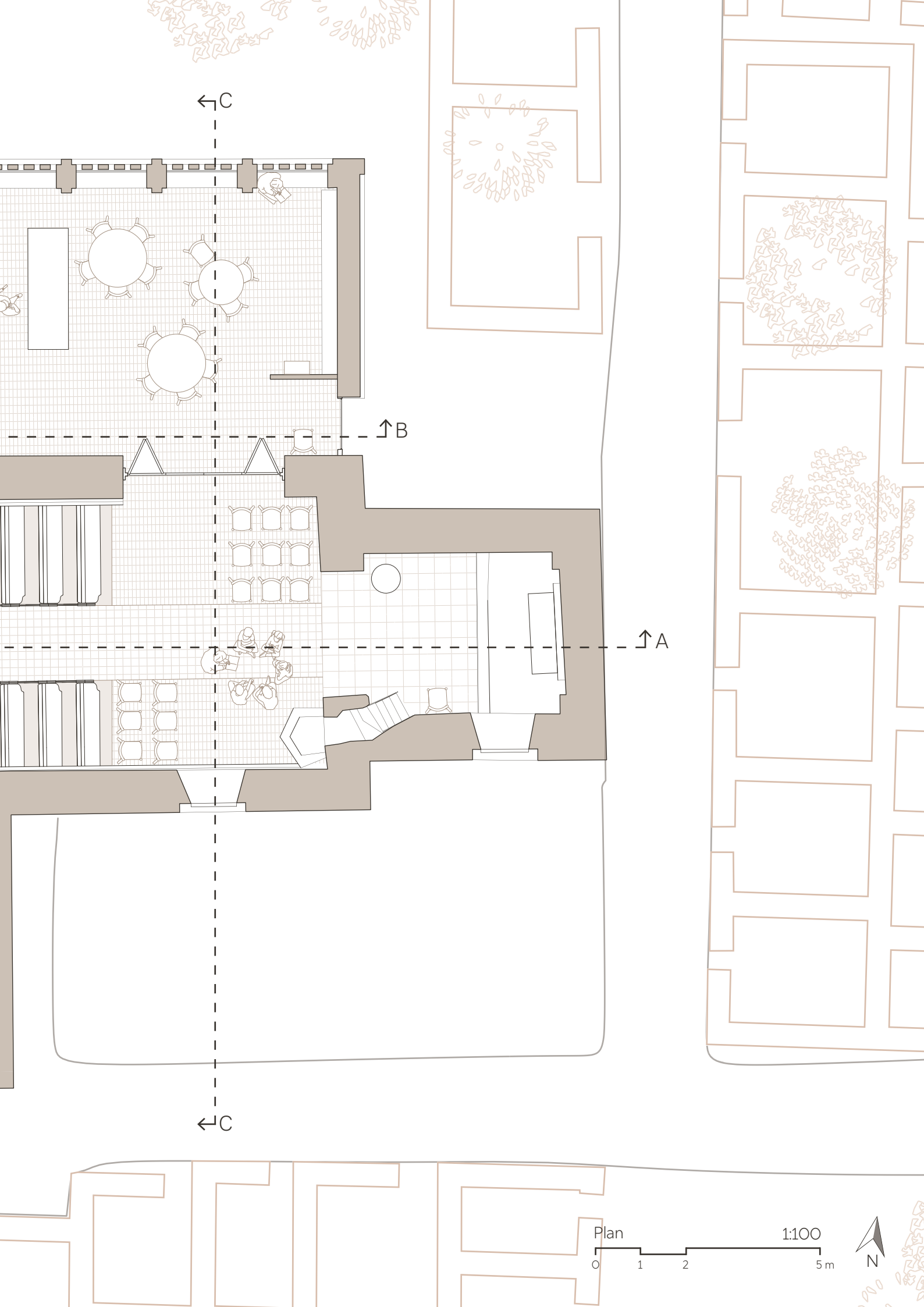
Elevation East 1:200

0 2 5 10 m

Elevation West 1:200

0 2 5 10 m


Technical room
B
A
Storage


C
B
A
C
Plan
1:100
0
1
2
5 m
N

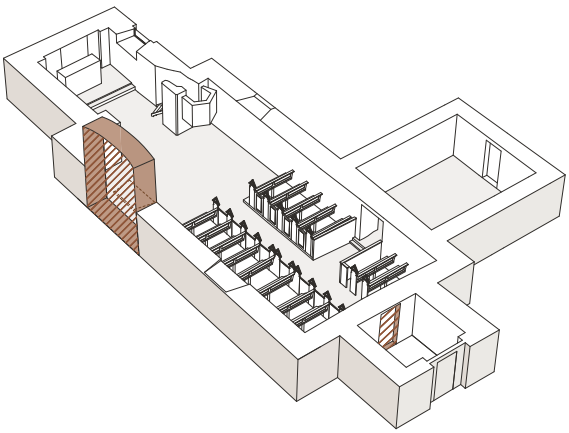
# THE NAVE

As the existing heterotopia of Borum Church lies within, and is connected to, the nave and specific sacred elements, most of the existing interior been preserved to maintain the association of the place. A choice was made to repaint the pews in a more neutral colour scheme to enhance the light and aesthetical harmony.

The existing church space has also been made more flexible and spacious, enabling a wider variety of activities and allowing natural light to fill the room.

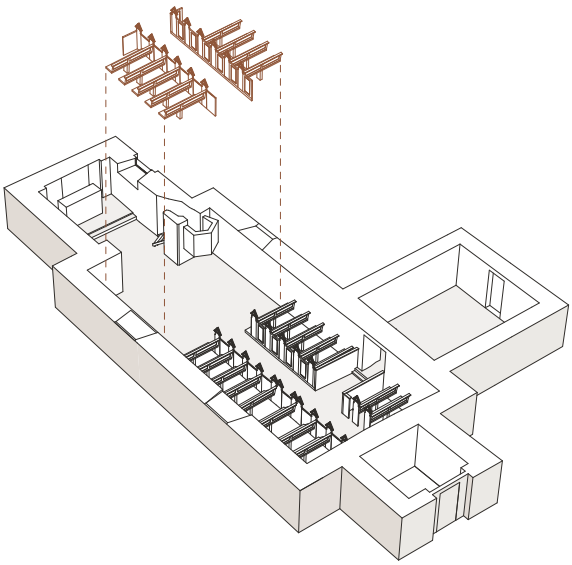
**Subtraction**

of part of the northern exterior wall and wall between the nave and church tower.



**Refurbishment**

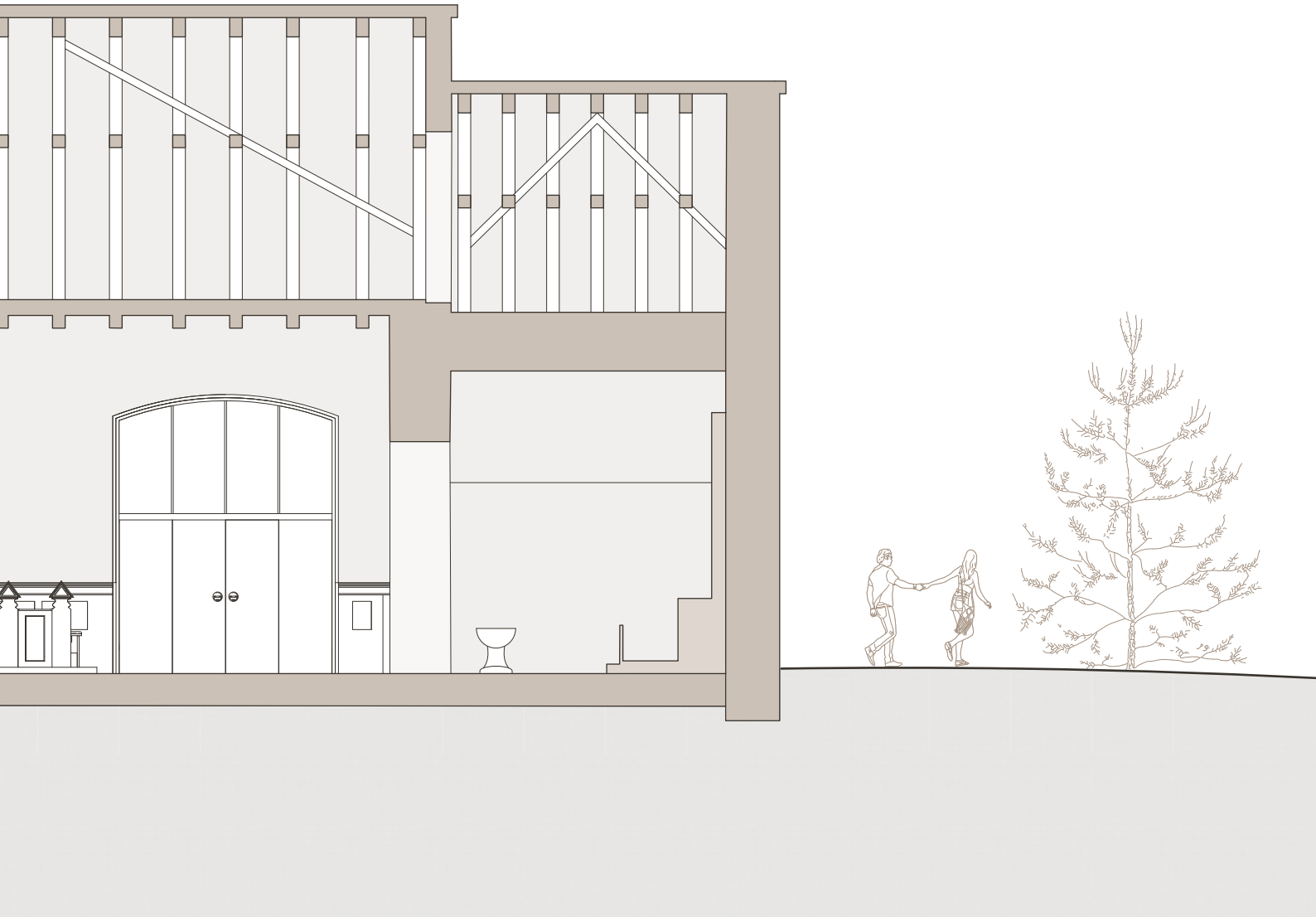
of the nave, subtracting the front pews to get a flexible space. Additionally, repainting the pews in a light and neutral colour sheme.



Ill. 155: Nave view. Render.

Section A-A 1:100

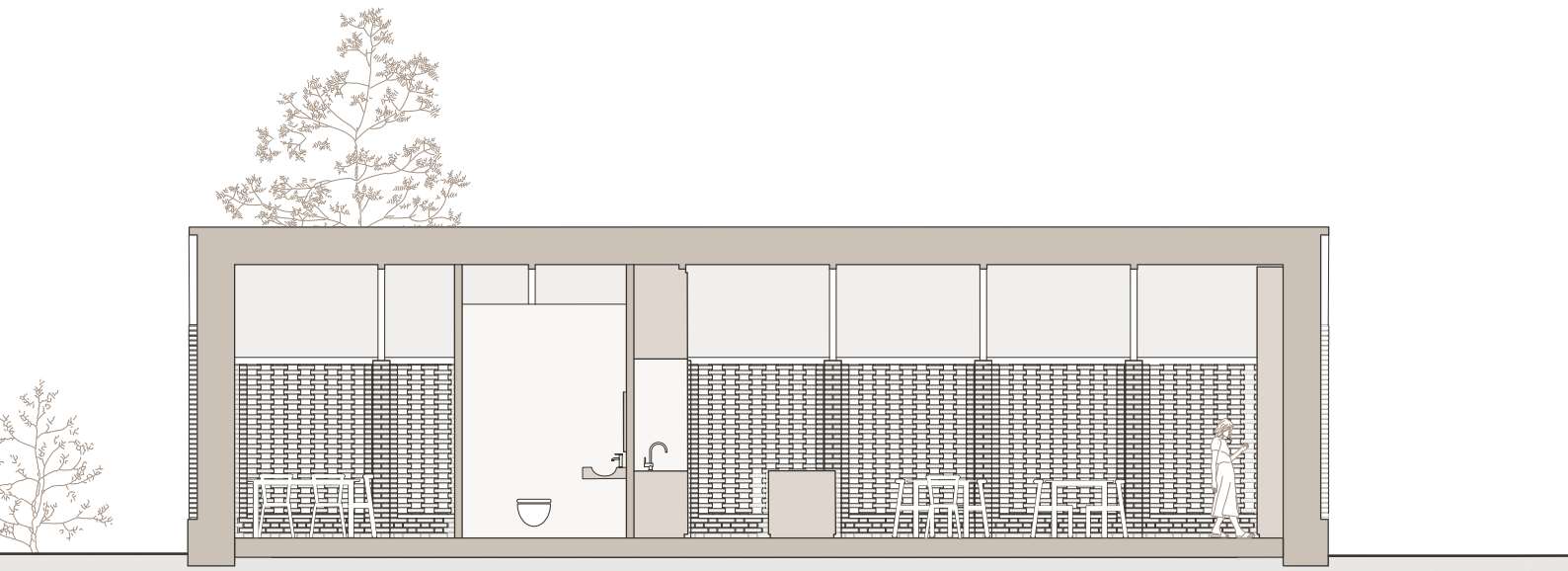
0 1 2 5 m



# TRANSITION BETWEEN SPACES

The connection between the existing church space and the added side nave is established through a large door that allows for different degrees of openness. This enhances the spatial flexibility of the church space and creates a connection to the sacred elements while being in the new extension.

With respect for the existing material substance, the new opening been made with the intention of showing the visible changes. The placement and orientation of the opening introduce a more secular axis in contrast to the church's existing ecclesiastical axis.



Section B-B 1:100

0 1 2 5 m

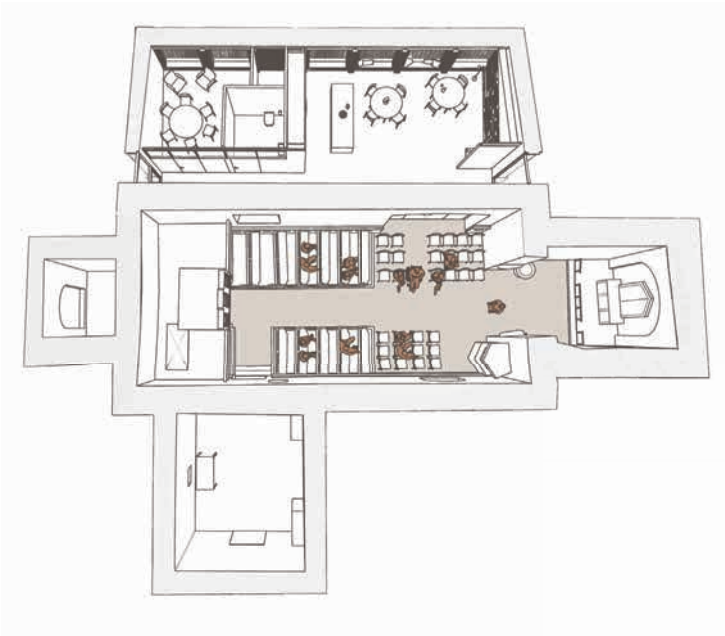
Ill. 156: Extension to nave view. Render.

# FLEXIBLE USE

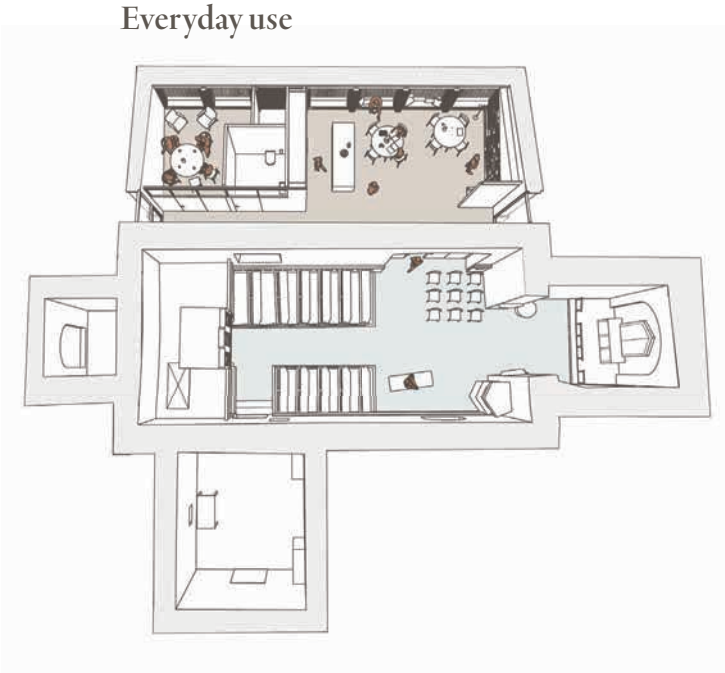
To visualise the intention of use in the transformed church of Borum, four scenarios have been developed. These demonstrate how the space has become more flexible, accommodating various activities, and how the space can adapt for everyday life and special occasions.

While the church remains fully functional for ecclesiastical purposes, everyday or special occasion event can take place in both the extension and the nave. The large opening, with a double-door function, allows for openness or closeness depending on the activity.

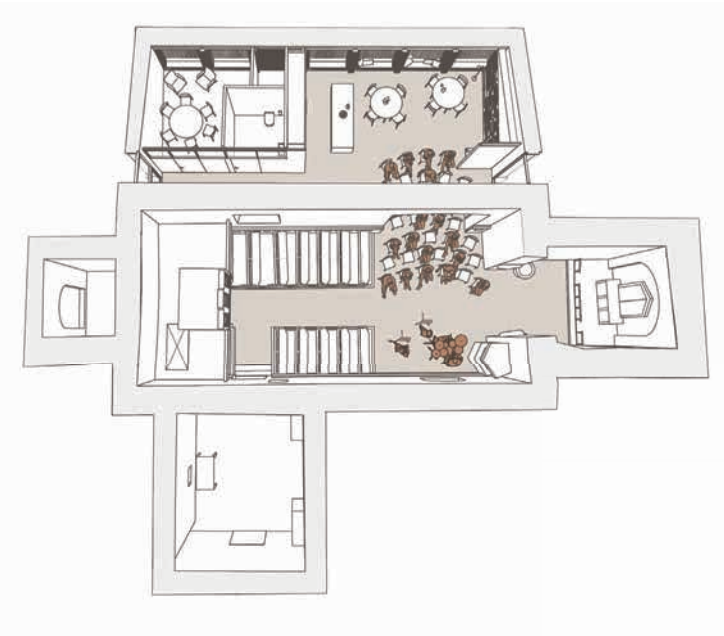
## Sunday service



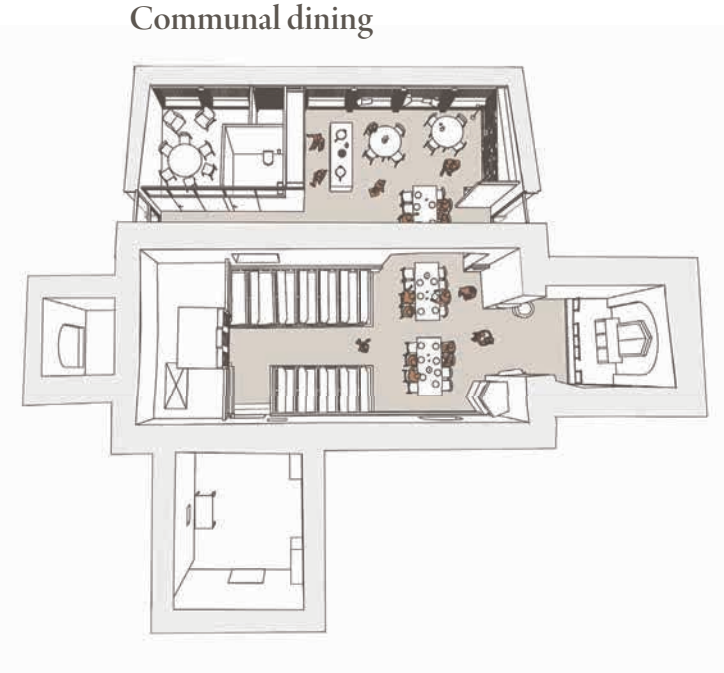
## Everyday use



## Concert



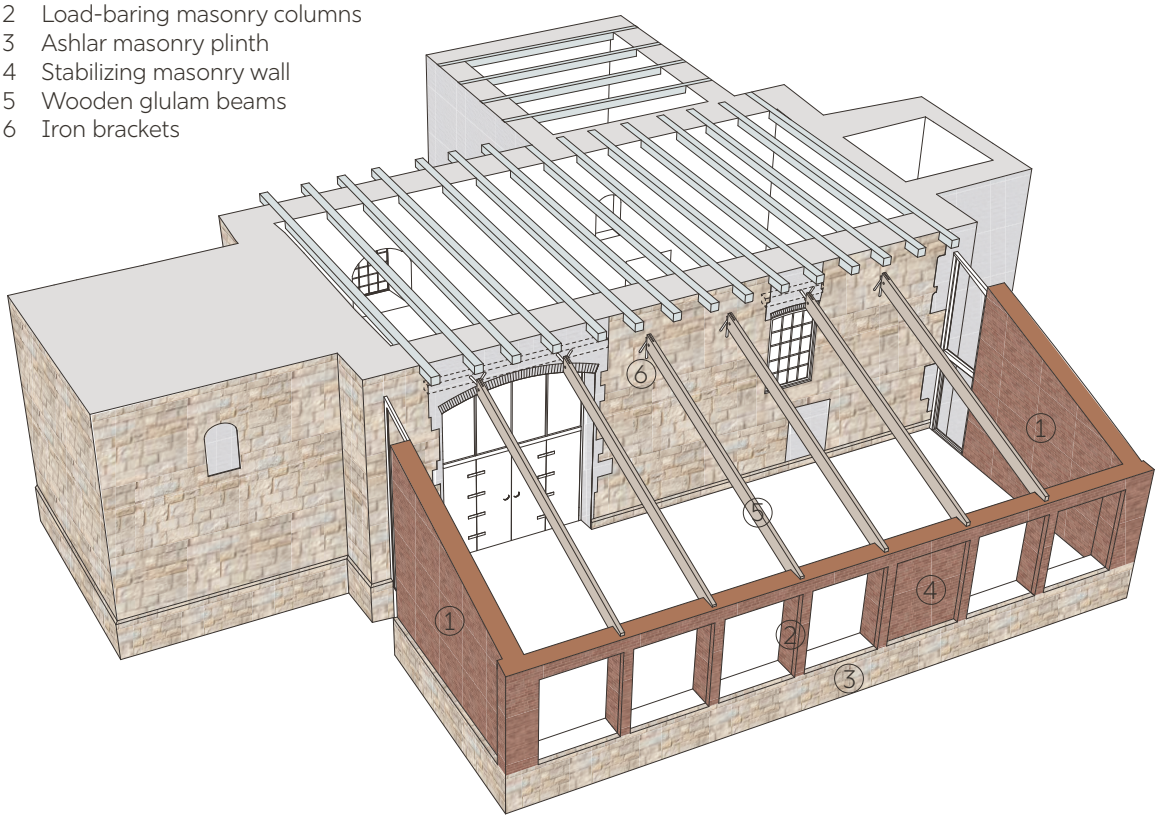
## Communal dining

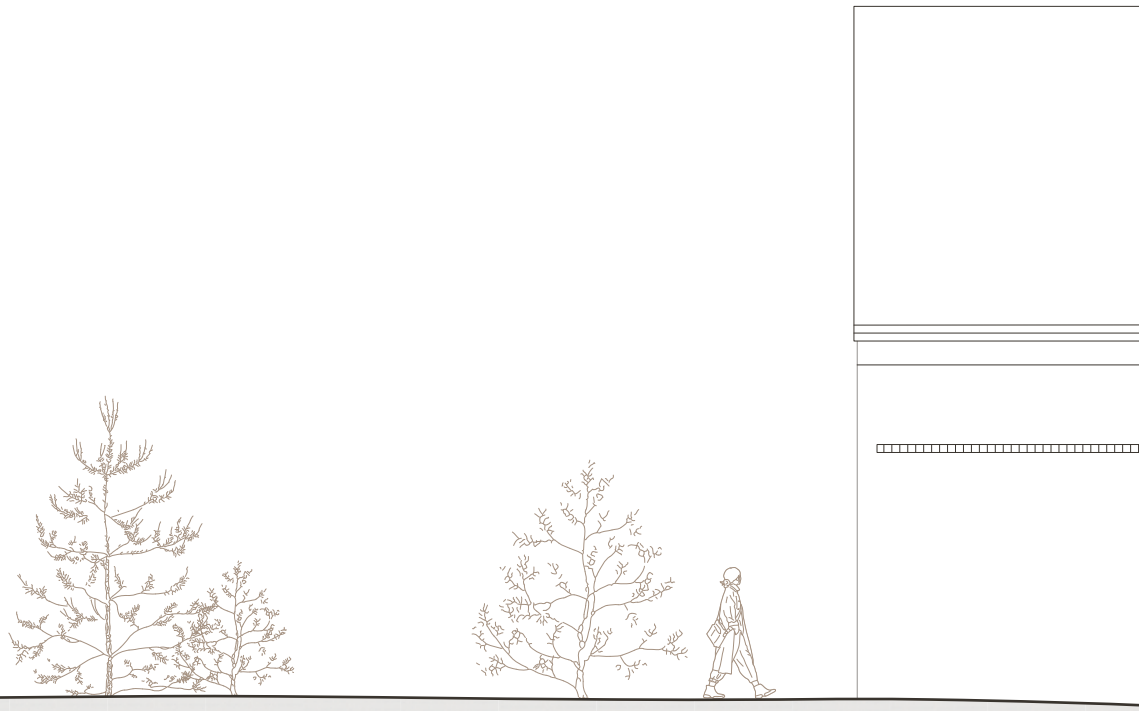


Ill. 157: Common area & library view. Render.

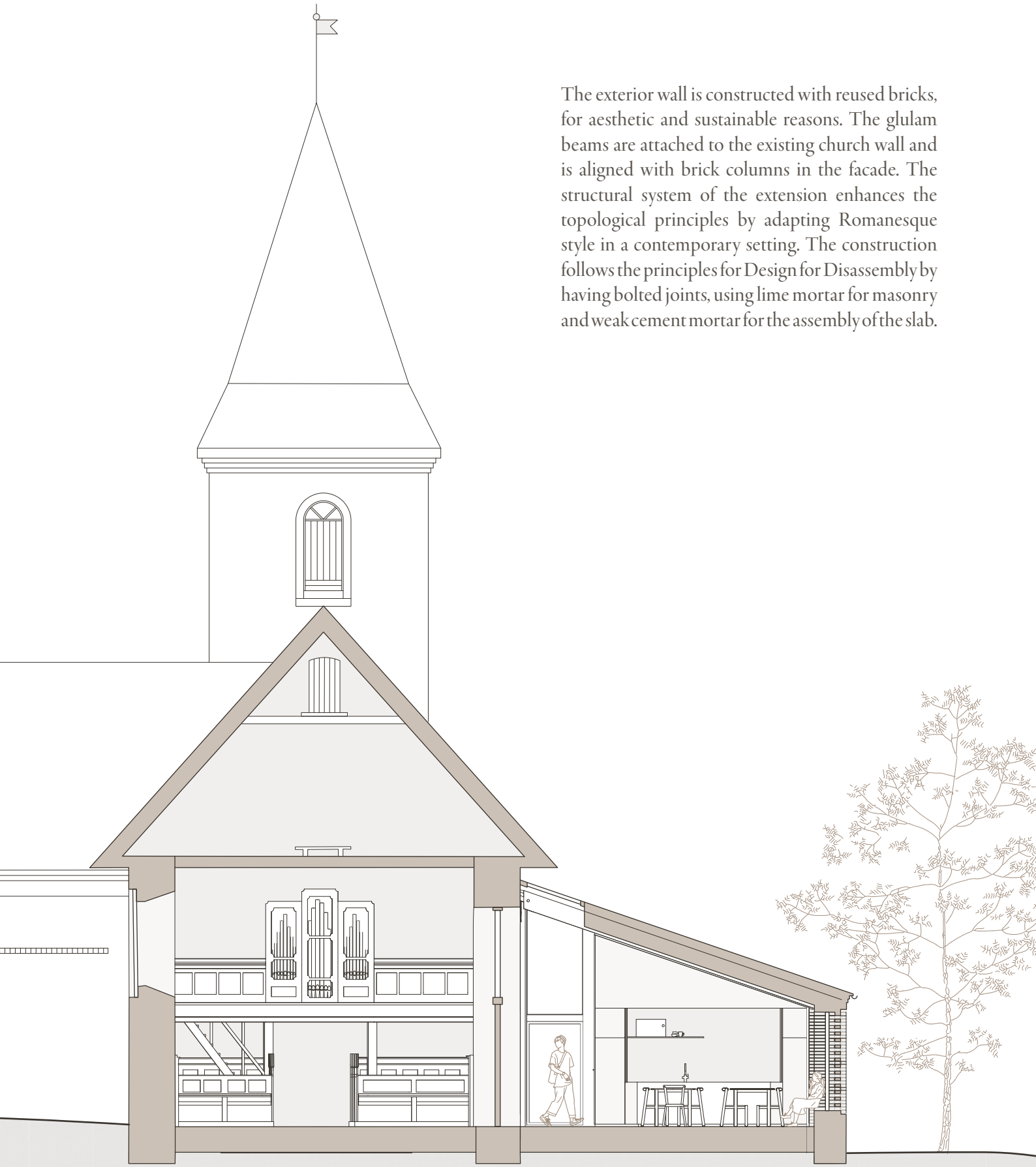
# CONSTRUCTION

1 Load-baring masonry gable
2 Load-baring masonry columns
3 Ashlar masonry plinth
4 Stabilizing masonry wall
5 Wooden glulam beams
6 Iron brackets



The exterior wall is constructed with reused bricks, for aesthetic and sustainable reasons. The glulam beams are attached to the existing church wall and is aligned with brick columns in the facade. The structural system of the extension enhances the topological principles by adapting Romanesque style in a contemporary setting. The construction follows the principles for Design for Disassembly by having bolted joints, using lime mortar for masonry and weak cement mortar for the assembly of the slab.

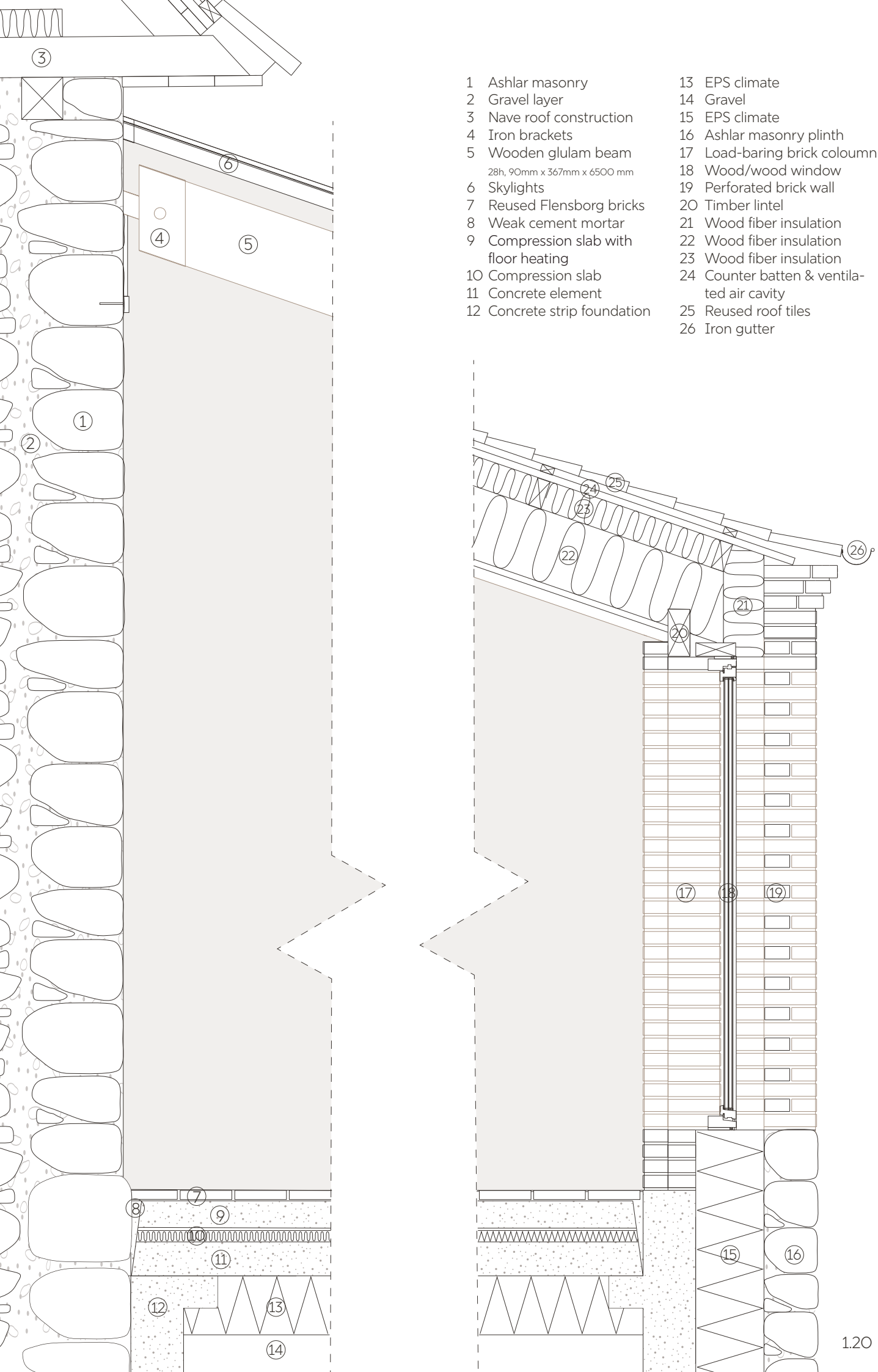


Drawing no. 01

Section C-C 1:100

0 1 2 5 m

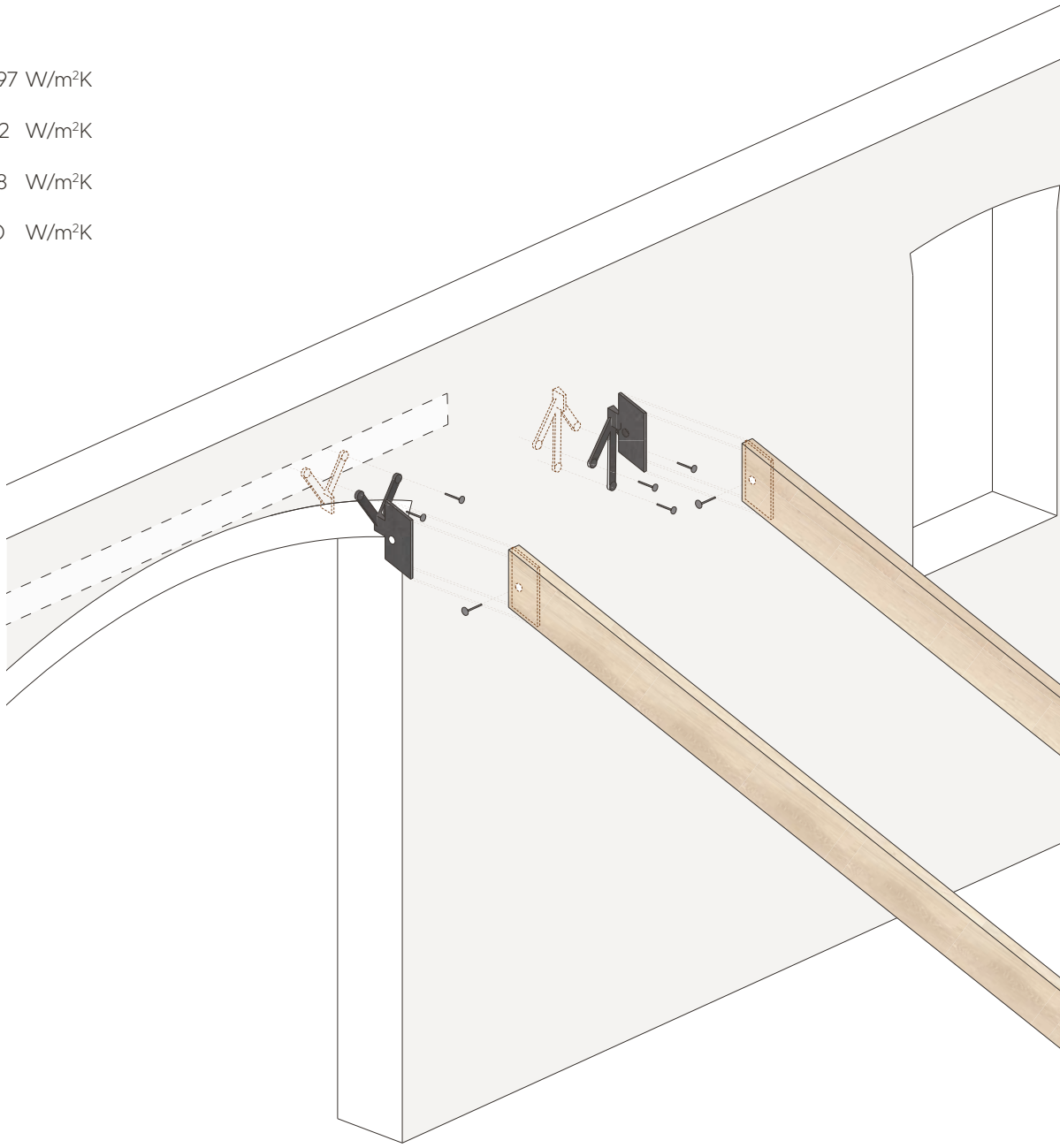
1 Ashlar masonry
2 Gravel layer
3 Nave roof construction
4 Iron brackets
5 Wooden glulam beam
28h, 90mm x 367mm x 6500 mm
6 Skylights
7 Reused Flensborg bricks
8 Weak cement mortar
9 Compression slab with floor heating
10 Compression slab
11 Concrete element
12 Concrete strip foundation
13 EPS climate
14 Gravel
15 EPS climate
16 Ashlar masonry plinth
17 Load-baring brick coloumn
18 Wood/wood window
19 Perforated brick wall
20 Timber lintel
21 Wood fiber insulation
22 Wood fiber insulation
23 Wood fiber insulation
24 Counter batten & ventilated air cavity
25 Reused roof tiles
26 Iron gutter



1.20

**U-values**

| | | |
|---|---|---|
| Roof | 0.097 | W/m²K |
| Wall | 0.112 | W/m²K |
| Slab | 0.08 | W/m²K |
| Windows | 1.00 | W/m²K |



The extension complies with the heat loss frame according to §272 in BR18 (Social- og bolig-styrelsen, 2025c) (Appendix 05). By optimising the U-values and line losses to comply with low emission standards (ROCKWOOL Danmark A/S, 2025), the net heat loss is reduced from 1258.3 W to 393.9 W. The highly insulated extension results in a minimal cost for heating, compensating for the costs of heating the exsisting church.

The constructions have been assessed and optimised in regard to the material's Global Warming Potential. By primaraly selecting biobased, $CO_2$-reduced or reused materials, the total GWP for the extension is reduced by 51.3% compared to 'common practice' constructions. (Appendix 08)

Total GWP:
common practice

**18335 kg$CO_2$-eq.**

Total GWP:
optimised

**8922.7 kg$CO_2$-eq.**

Total GWP reduction

**9412.4 kgCO2-eq.**

**51.3%**

Post-design

# PART IV

# Epilogue

# CONCLUSION

This thesis applies a research-driven approach to address the challenge of ensuring the medieval village church's relevance in contemporary and future rural society. The approach has contributed to a broader perspective and background knowledge that the design process and design proposal is based on. Following the methodology Research by Design by Rob Roggema (2017) has contributed to guiding the project and solving the complex problem of the building type, because it is protected by laws and is social and cultural-historically significant for the society. In the process of rethinking and adapting the medieval village church in Borum, the methodological framework for fields of opportunities by Maj Bjerre Dalsgaard (2021) has been the main driver. The framework has guided the analysis phase to get a thorough understanding of the medieval church as a typology and the specific church of Borum. Understanding the place's special character physically and its heterotopia is essential to be able to adapt and rethink the use of Danish medieval village churches.

The design proposal is site-specific for Borum Church and cannot be used for other churches. But the developed framework: the design principles and recommended tools, can be used as a guidance for analysing and adapting other specific churches. It is necessary to analyse and assess each church individually to conduct specific design principles resulting in a site-specific design proposal.

A thorough analysis of the architectural and cultural history of Danish medieval churches and their origin of the building typology, the basilica, has contributed to an understanding of, how the church as a building typology has and would be able to adapt and evolve. Historically, Danish churches have adapted to religious and societal needs. They have evolved physically by expanding, shrinking, adding, and removing elements to fit the present need. However, heritage legislation introduced during the era of National Romanticism stopped this development. It restricted churches to restoration rather that adaptation. The building- and especially the church conservation acts in Denmark make it almost impossible to make major physical changes to or transformations of medieval churches. This could potentially result in the Danish medieval village churches becoming passive monuments rather than living parts of the local society.

This thesis argues for a re-examination of these laws. Rather than removing protection, the legal framework should be adjusted to enable thoughtful, reversible transformations that reflect contemporary local needs to protect the church's cultural role in the future. It is contradictive to restrict the development of the churches to preservation as cultural monuments. To respect the history of the National Churches, it is necessary to continue its development. Aligning with the Evangelical Lutheran faith, the church building is not sacred; it should evolve according to the religious and societal needs as it has done throughout its history.

The rural medieval village churches have unrealised potential to contribute to the rural communities, outside of religion alone. In alignment with the Evangelical Lutheran faith, which emphasises the sanctity of the word rather than the building, it becomes evident that flexibility in the physical structure does not undermine religious values. Facilitating change can, in fact, reinforce the church's role as a gathering place and spiritual anchor in rural life.

By working with Borum Church as a case for active monument conservation, the design proposal serves as a site-specific answer to the national problem of preserving the medieval village churches as active places in rural areas. The proposal is a refurbishment of the nave interior to accommodate diverse use and a northern extension for the inhabitants to use for both social and individual purposes. The adapted space enhances the heterotopic character of the church as an "other place" in the rural society.

The adaptation of Borum Church provides flexible use to accommodate both religious and civic purposes, ultimately contributing to the well-being of the individual and society. The ecclesiastical axis in the nave is preserved while a new more secular south-north axis through the opening between the nave and extension provides a space for extended use of the church. The removal of the front pews in the nave provide spatial flexibility that facilitates a variety of activities to be held in the church room, making it more valuable in the society.

The design of the added building volume works as an extension of the existing church space. The placement, form, materials, and construction follow the typology of the basilica and the original Romanesque architecture and is therefore not deviating from but co-existing with the existing building structure. The contemporary structure respects the historical style by applying principles as symmetry and proportional systems in the facades, construction and openings. The exterior, re-used masonry walls signals heaviness as a load-bearing structure. The interior walls and elements signals lightness due to its wooden material the detailing. These are more flexible and can be removed if needed. The entire structure is designed with Design for Disassembly in mind and can be removed with little effort, allowing the church to return to the previous state. The possible future removal of the extension will be visible but can be reconstructed following the architectural history of the church.

Originally, the basilica was not a religious and sacred building type. Even today, the churches are not sacred according to the Evangelical Lutheran faith. This argues that the Danish medieval village church which has a long history of developing and adapting, should have possibilities to adapt to contemporary and future society. The declining in use of the rural village churches is a national concern that could be resolved with the adaptation of the churches. This is, of course, with cultural heritage and historical preservation in mind.

# REFLECTION

The process of developing the thesis has been both enlightening and thought-provoking. It began as an investigation into the current state and societal support for medieval village churches in Denmark. Quickly, the thesis evolved into a broader discussion about the role of the church in contemporary society, and how architecture can, and should, serve as a bridge between history and the present. This rise questions about whether the current legislation is still appropriate. Conservation acts play a crucial role in protecting Denmark's cultural heritage, but the question is whether the legislation ensures preservation or causes decay? And whether the legislation should be changed to support living cultural heritage, by reconsidering who and what the churches should be for.

In Borum, conversations with local residents revealed that, while the church still holds symbolic value, symbolism alone is not enough to ensure its continued use. For everyday activities such as choir practice, concerns were raised about the inflexibility of the space, particularly that the fixed pews made it difficult to accommodate the choir during rehearsals. For larger events, the community were using an adjacent parish building. There was clear challenge that people felt more emotionally connected to that space, than to the church itself. Additionally, there was a widespread desire for a place where people could meet, connect, or simply be alone. A calm space to come and go. Integrating these wishes into the design challenged our preconceptions about what a church is, and what it could be. It also underscored how essential architecture is in shaping community life.

In retrospect, we can see that there is untapped potential in user involvement and dialogue with the local population. User involvement yielded great benefits, which could have been better utilized by involving a wider range of the population. Additionally, a closer collaboration where the local population's reactions to the preliminary work could have influenced the project along the way.

In Borum, we worked with a church that had recently undergone extensive restoration and was in relatively good condition. This is not the case for all churches in Denmark, and some are in states of visible disrepair. Before investigating the possibilities for transformation or adaptation, it is therefore crucial to assess each building's physical condition and undertake sensitive preservation work that secures its historic fabric.

The primary focus of the thesis was the church interior and its external expression, but it can be argued that there is just as much work to be done by investigating the potential of the cemetery. Churchyards are often large, park-like spaces in the heart of villages, and the number of new graves is steadily declining. This opens the possibility of parts of these spaces as active public parks. The challenges lie in the fact that the cemetery is a unique space, where like inside the church, it can be difficult to navigate in how to behave. Additionally, churchyards must continue to function for their original purpose, and because burial plots remain protected for many years, any transformation requires long-term landscape planning grounded in careful consideration.

Reflecting on the use of Borum as a case study, we recognise both its strengths and limitations. The method enabled a detailed, site-specific investigation, but limited our ability to generalise. Nonetheless, the study of the case allowed us to identify transferable principles such as adaptability and local dialogue, which could be integrated in future projects. The project has significantly reshaped our understanding of the architect's role in heritage transformation. It is no longer enough to design with historical and architectural knowledge. The architect must also act as a collaborator and engage with legal frameworks, politics, and local communities. As a result, this thesis has been shaped more by research-based argumentation than by the traditional iterative design process (IDP) typically emphasised in the education of Architecture & Design at Aalborg University.

Ill. 158: Borum church tower. Private photo.

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# PART V

# Appendix

| | |
|---|---|
| Project | **Rethinking the Danish Medieval Village Church: Borum church - a case** |
| Department | **Department of Architecture, Design & Media Technology** |
| Semester | **MSc04 Arc** |
| Group | **Group 5** |
| Supervisor | **Lars Brorsson Fich** |
| Technical supervisor | **Jesper Thøger Christensen** |
| Pages | **193** |
| Appendix | **31** |
| Students | |


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AALBORG UNIVERSITET

# THESIS TITLE PAGE

This form must be submitted for all theses written in programs under the Study Board of Architecture and Design, and it should be placed at the beginning of the appendix section of the assignment.

A printed copy of the form must be submitted along with the printed copy of the thesis.

The information given in this form must also be available in PURE.

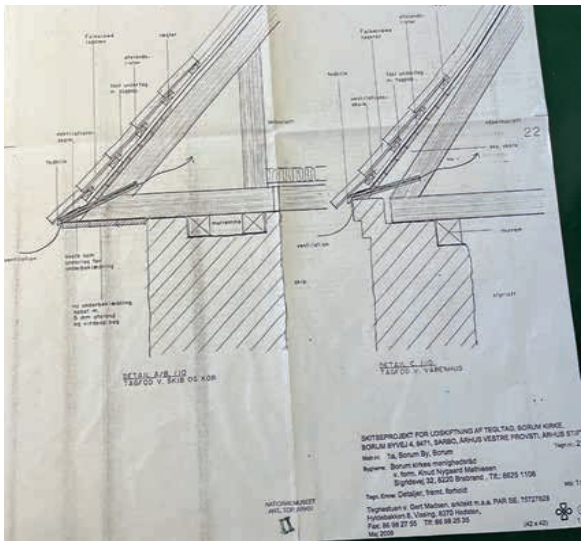
(All fields must be filled out)

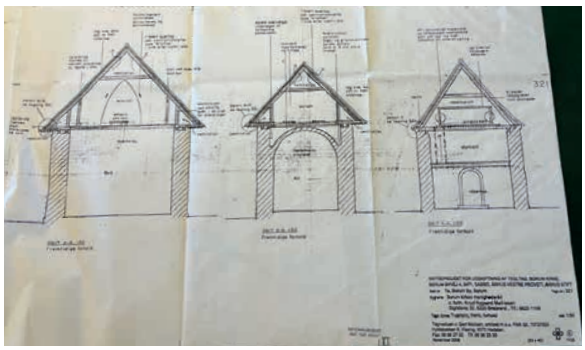
| |
|---|
| **Program:**<br>**Architecture** ☒ **Industrial Design** ☐ **Urban Design** ☐ |
| **This thesis was written by (full name):** |
| **Christine Amalie Revsbech** |
| **Hedda Thorkildsen** |
| **Louise Wolter Uldbjerg** |
| **Title of the thesis:**<br>Rethinking the Danish Medieval Village Church: Borum Church – a case |
| **Supervisor´s name:**<br>**Lars Brorson Fich** |
| **Submission date/year: 2025** |
| **Is the project confidential?**<br>**Yes** ☐ **No** ☒ |
| **External collaboration***<br>**Yes** ☐ **No** ☒ |
| **External collaboration partner (name of company/organization):** |
| **Contact at external collaboration partner (title, name og email):** |

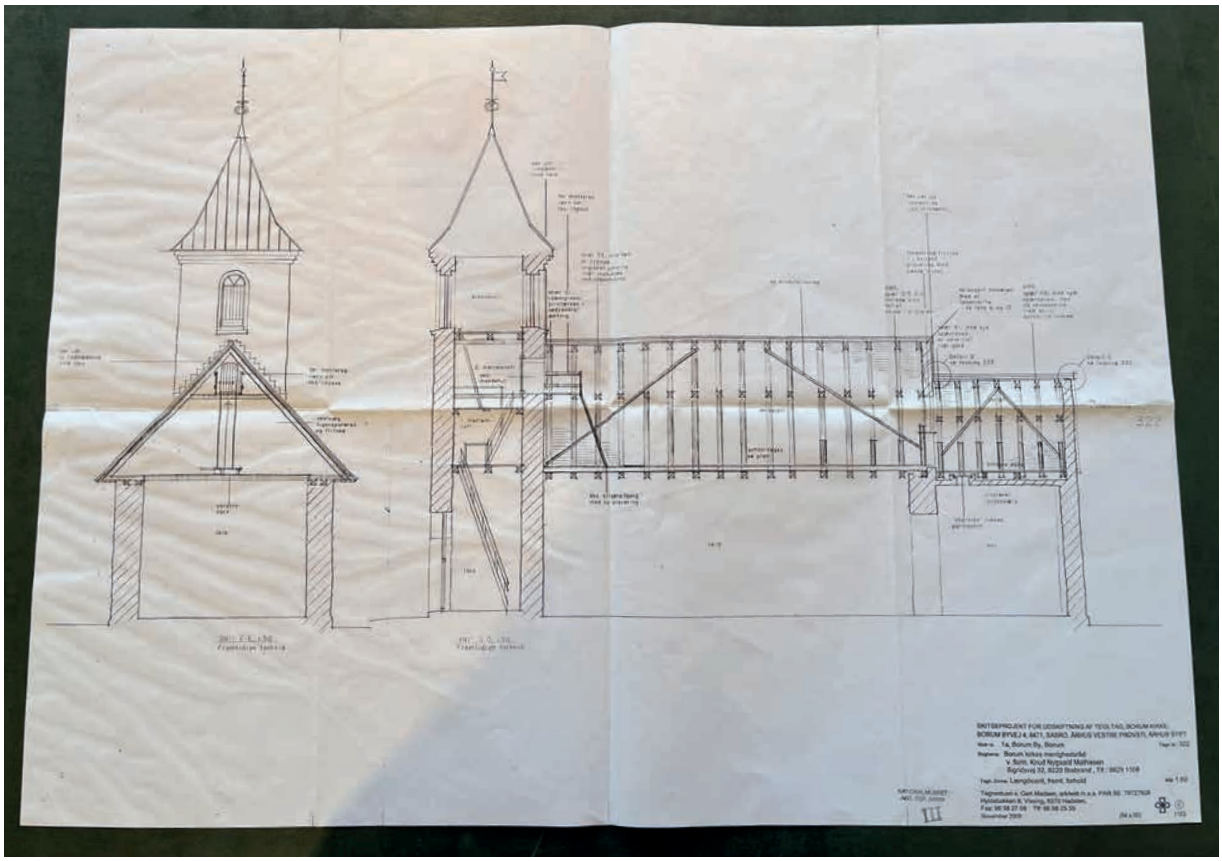
***What is an external collaboration? Read more here.***

# 01 BACKGROUND MATERIAL

## Drawing material of Borum Church by Tegnestuen v. Gert Madsen (Nationalmuseet)







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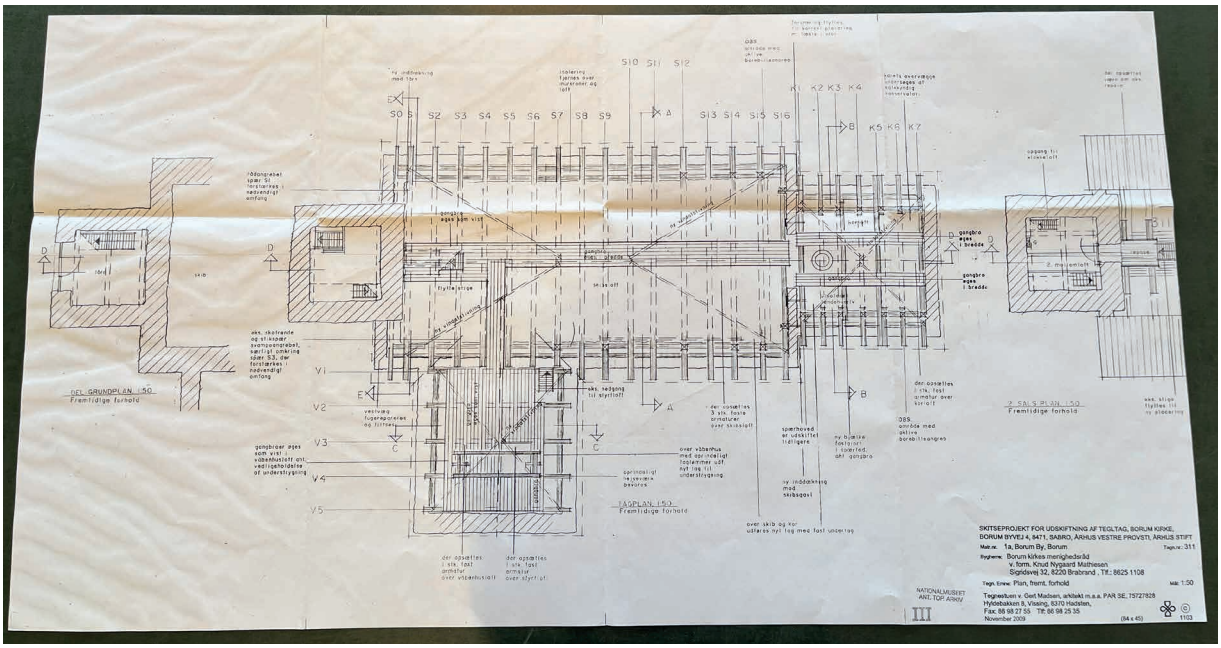


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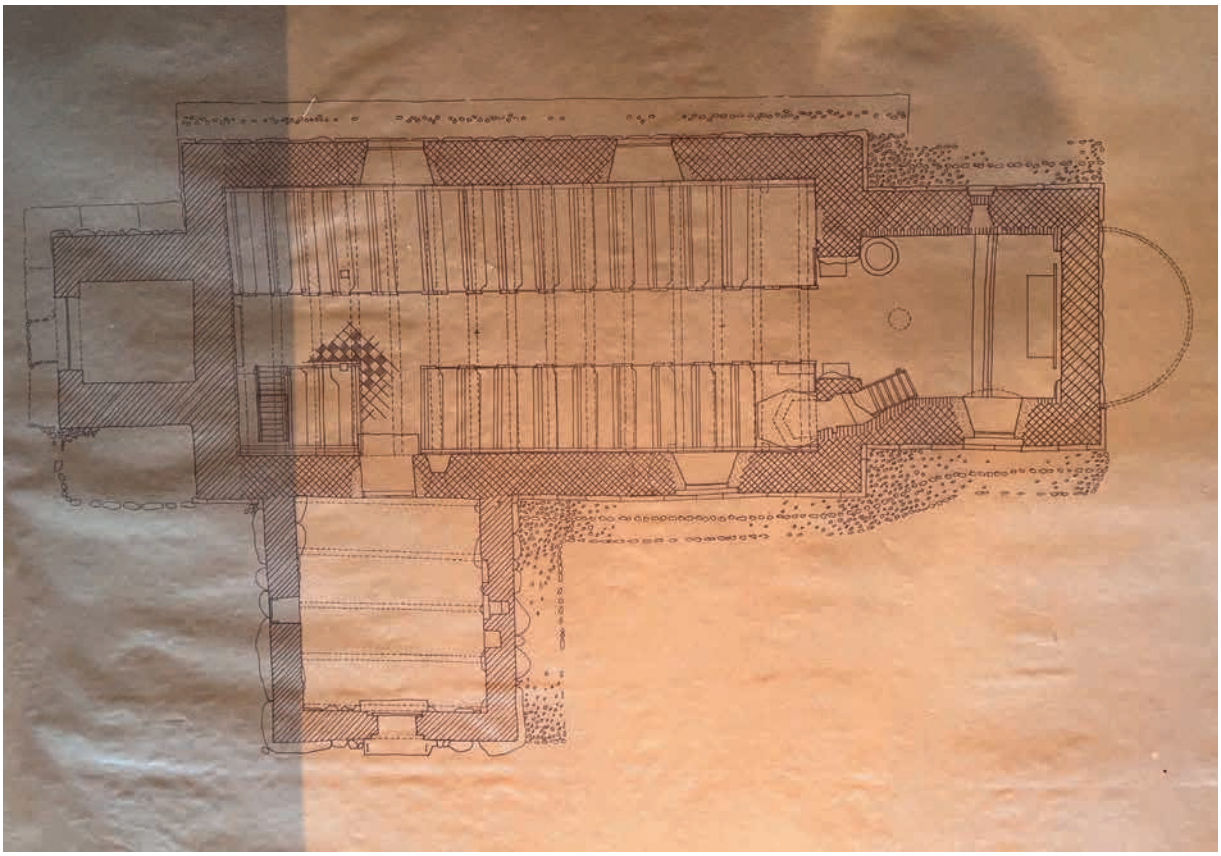

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# 02 NATIONAL CONFERENCE

## Theme: The future role of the village church

A national conference with the theme 'The future role of the village church' was held on the 6th March 2025. The study group and around 350 other people with interest in the church future role participated in the conference. Multiple lectures, debates and workshops was held by many prominent people with relation to the National Church.

Maj Bjerre Dalsgaard held a workshop with the headline: 'How do we open the door to the church space for more use in the future?'[1] with the focus on what it is okay to do in a functioning church. People in random groups discussed the activities and functions. All ideas that they come up with where written on the poster. Whenever one of the ideas for new activities or functions went over the egde for someone, a red circle was put around the idea.

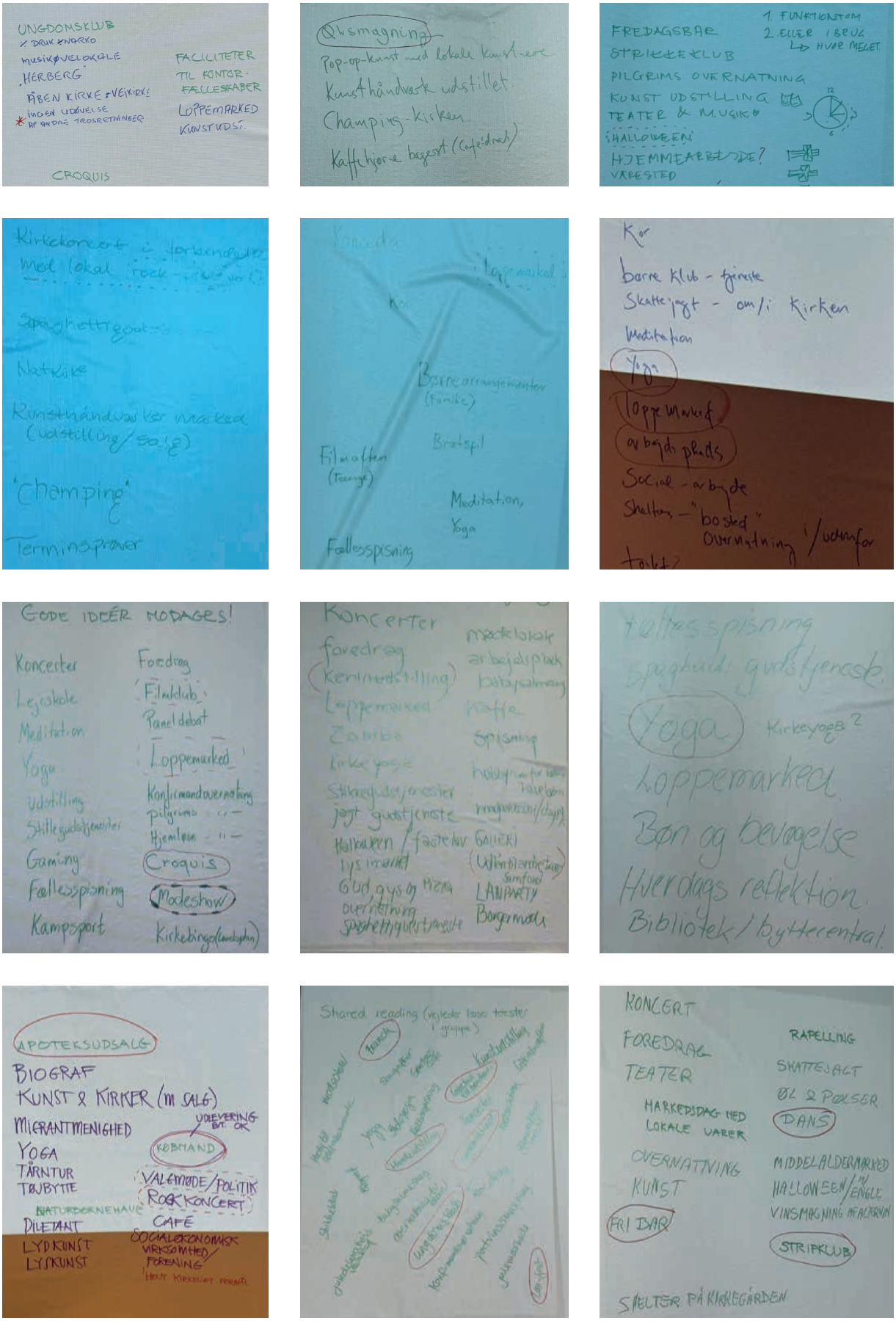
Some of the ideas that the majority of people agreed on as acceptable activities or functions in an active church room are:

- Youth club (without alcohol)
- Gaming / LAN-party
- Office & Meeting facilities
- Art and craft exhibitions
- Flea market & Christmas market
- 'Champing' / possibility to spend the night
- Meditation, Yoga & Dance
- Friday bar / get-togethers
- Theater
- Concerts
- Communal dining
- Cinema / watch movies together
- Library
- Lectures
- Reflection / quiet time
- Creative activites
- Baby hymn
- Confirmation education
- Café & coffee space
- Citizens' meeting

1 *Hvordan åbner vi døren til kirkens rum for mere brug i fremtiden?*

Ill. 162: Photos from national conference. Photographer: Rikke Lykkebo (Norddahl og co, 2025). Appendix 05, email B.

Ill. 163: Photo from national conference. Private photo.




Ill. 164: Posters from workshop at national conference. Private photos.

# 03 WORKSHOP IN BORUM

The purpose of hosting a workshop for the citizens of Borum was to gain knowlegde about the presence and possible future in the village in the relation the the church's role in the village.

All inhabitants in Borum Parish were invited to a workshop, where the participants gave insights in the life and present activities and functions in Borum and future wishes for activities, functions and physical changes of the church.

The participants discussed with eachother and the study groupd, and wrote notes on two posters (1. presence & 2. future). Some of the insights from the workshop are:

## Presence

- A social village with community.
- Many children in the village.
- Primary users of the church: 60-70 years olds in the village.
- Indoor meeting places: The community house, parsonarge, church house, at eachothers houses.
- Outdoor meeting places: "The starting point" ("Udgangspunktet") & "Kringlen".
- Walking routes through the village and surrounding areas. Some routes go through the cementry.
- Present use of the church: Sunday services, choir concert, concerts.
- Present activities in the village:
- Common walking trips, city run, music festival, ladys & gentlemen club, children music, children gymnastics, choir, teather, common dining.

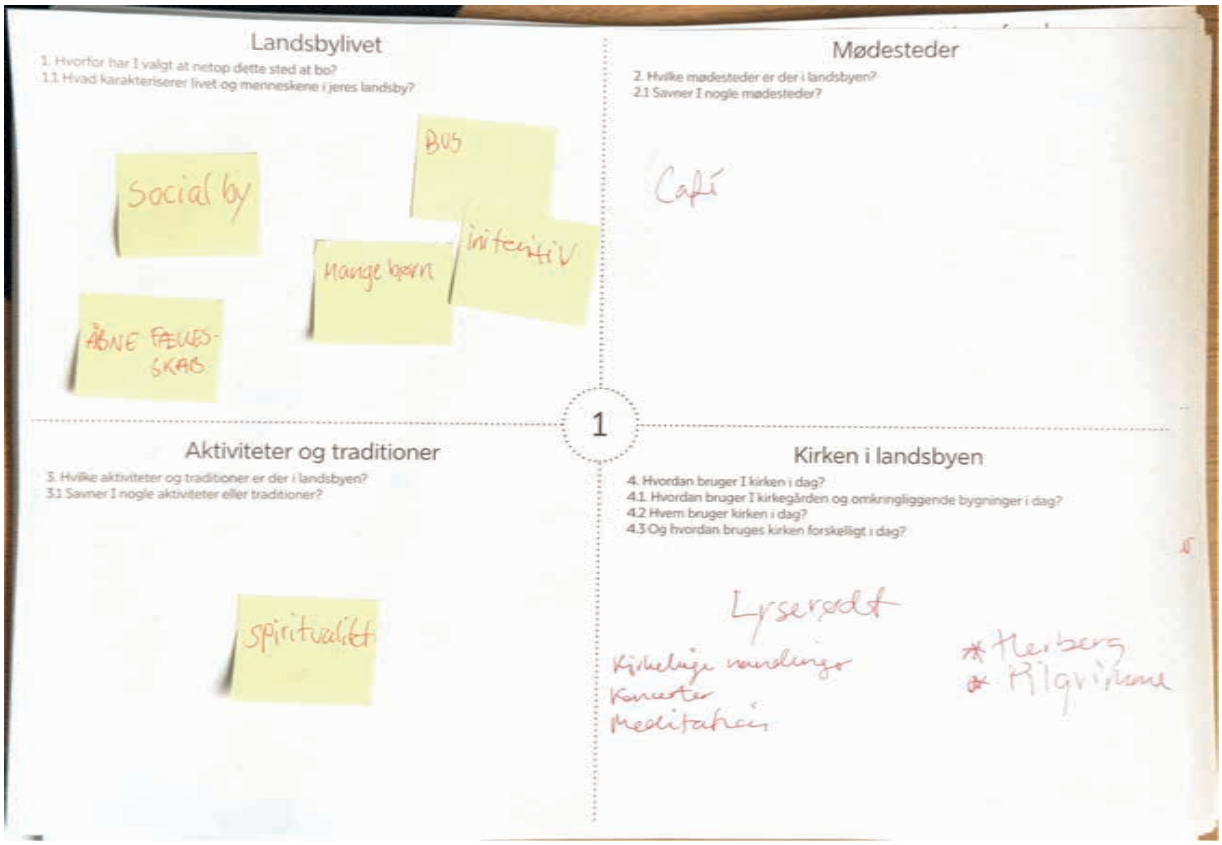
## Future

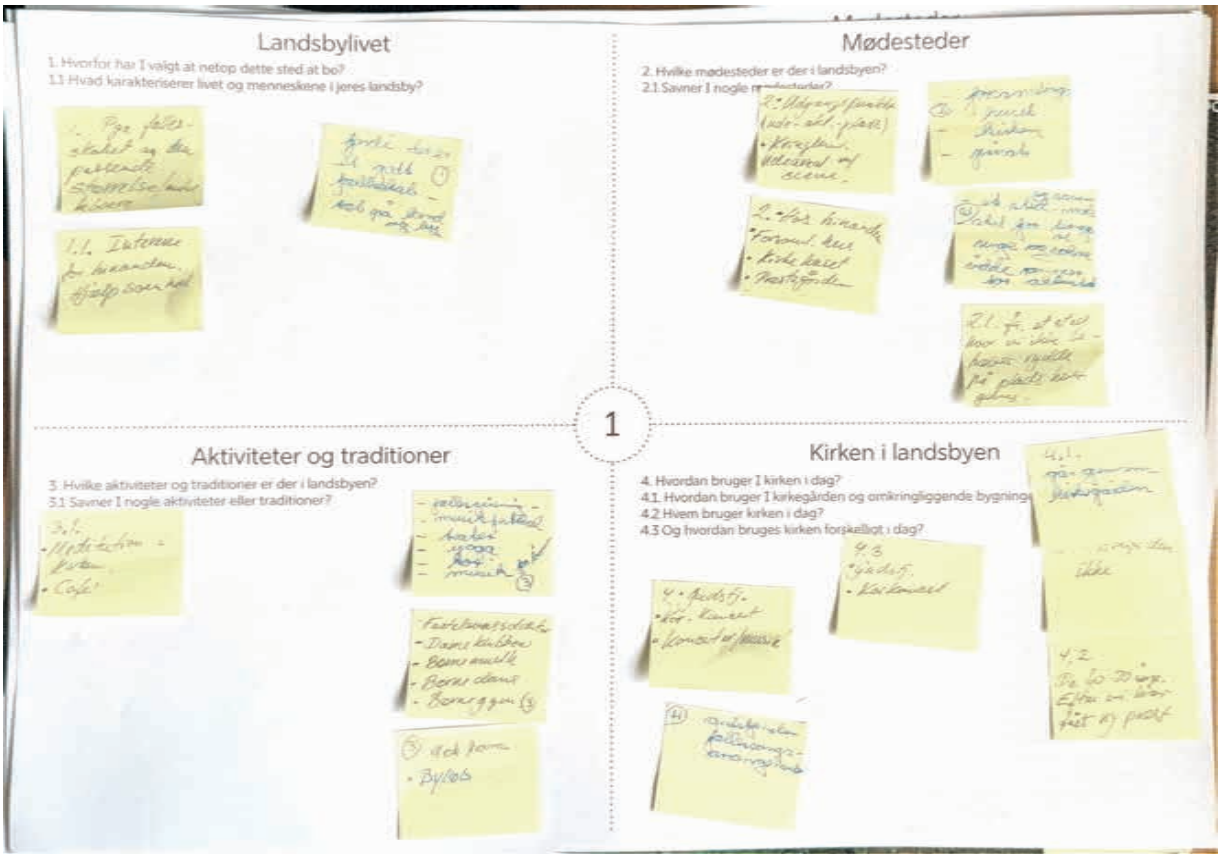
- A meeting place for childring, young people and adults.
- Creative, movement, and social activities.
- Spiritual activities as meditation, reflection, yoga etc.
- The church could be a place to stay for pilgrims / travelers & emergency shelter.
- The church should be a space for rest and calmness.
- A place, where they do not need to put everything away after use.
- Sunday services outside on the cementry.
- Move the preist down on the floor, to make the services less solemn.
- Keep the possibility to have sunday service and concerts in the church.

Physical changes:

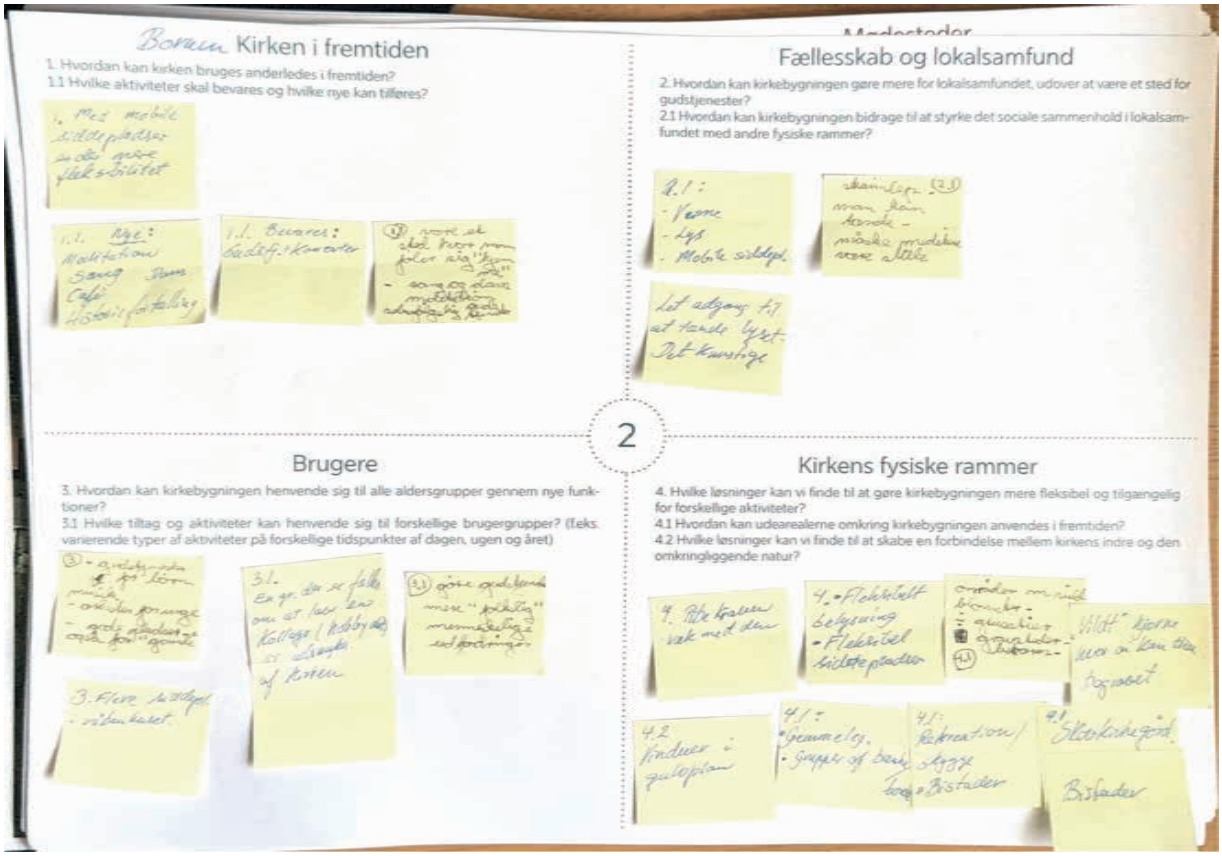
- Lower windows, ability to view outside.
- Flexible lighting & more lighting.
- New colours in the church, more light and "fresh" colours.
- Flexible / mobile seatings in the church.
- Easier access to turn on the artificial lighting.
- Heated areas - be able to use the church in winter.
- Toilet & kitchen to have an open space in everyday life, café & activities as common dining.
- Cementry: "Forrest cementry" / park, more biodiversity, flowers beds, beehives, benches & tables, shelter.

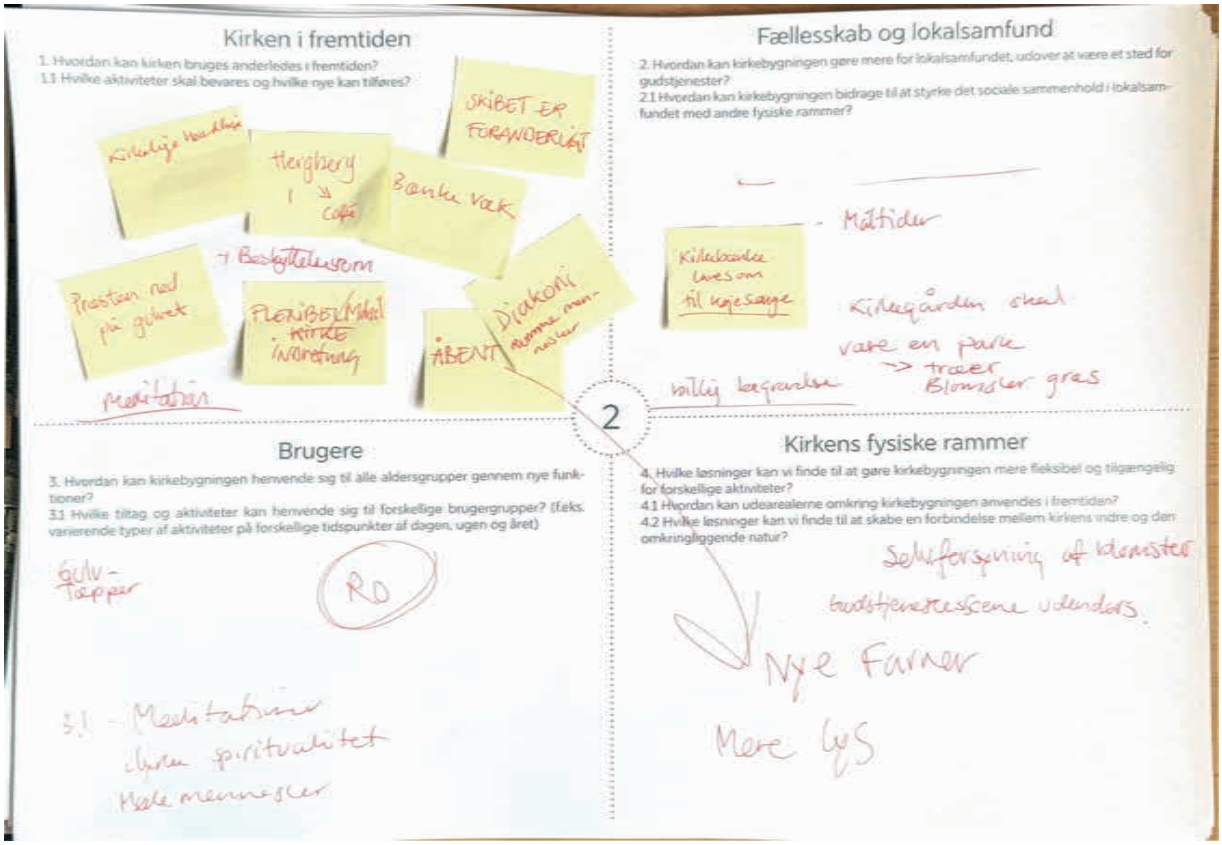
## Presence

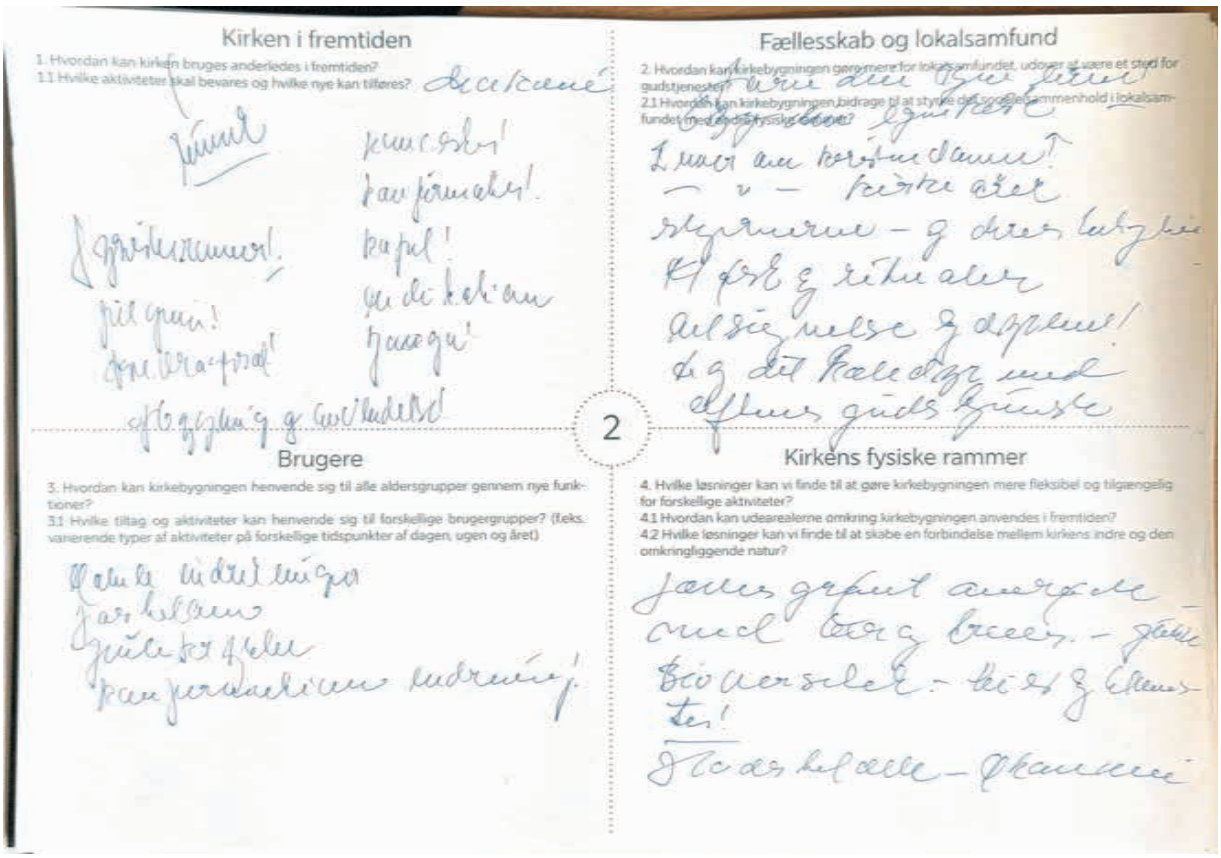

Landsbylivet
1. Hvorfor har I valgt at netop dette sted at bo?
1.1 Hvad karakteriserer livet og menneskene i jeres landsby?
Social by
BUS
initiativ
mange børn
ÅBNE FÆLLES-SKAB
Mødesteder
2. Hvilke mødesteder er der i landsbyen?
2.1 Savner I nogle mødesteder?
Café
1
Aktiviteter og traditioner
3. Hvilke aktiviteter og traditioner er der i landsbyen?
3.1 Savner I nogle aktiviteter eller traditioner?
spiritualitet
Kirken i landsbyen
4. Hvordan bruger I kirken i dag?
4.1. Hvordan bruger I kirkegården og omkringliggende bygninger i dag?
4.2 Hvem bruger kirken i dag?
4.3 Og hvordan bruges kirken forskelligt i dag?
Lyserødt
Kirkelige vandringer
Koncerter
Meditation
Herberg
Pilgrimme


Landsbylivet
1. Hvorfor har I valgt at netop dette sted at bo?
1.1 Hvad karakteriserer livet og menneskene i jeres landsby?
Mødesteder
2. Hvilke mødesteder er der i landsbyen?
2.1 Savner I nogle mødesteder?
1
Aktiviteter og traditioner
3. Hvilke aktiviteter og traditioner er der i landsbyen?
3.1 Savner I nogle aktiviteter eller traditioner?
Kirken i landsbyen
4. Hvordan bruger I kirken i dag?
4.1. Hvordan bruger I kirkegården og omkringliggende bygninger
4.2 Hvem bruger kirken i dag?
4.3 Og hvordan bruges kirken forskelligt i dag?

## Future


Kirken i fremtiden
1. Hvordan kan kirken bruges anderledes i fremtiden?
1.1 Hvilke aktiviteter skal bevares og hvilke nye kan tilføres?
Fællesskab og lokalsamfund
2. Hvordan kan kirkebygningen gøre mere for lokalsamfundet, udover at være et sted for gudstjenester?
2.1 Hvordan kan kirkebygningen bidrage til at styrke det sociale sammenhold i lokalsamfundet med andre fysiske rammer?
2
Brugere
3. Hvordan kan kirkebygningen henvende sig til alle aldersgrupper gennem nye funktioner?
3.1 Hvilke tiltag og aktiviteter kan henvende sig til forskellige brugergrupper? (f.eks. varierende typer af aktiviteter på forskellige tidspunkter af dagen, ugen og året)
Kirkens fysiske rammer
4. Hvilke løsninger kan vi finde til at gøre kirkebygningen mere fleksibel og tilgængelig for forskellige aktiviteter?
4.1 Hvordan kan udearealerne omkring kirkebygningen anvendes i fremtiden?
4.2 Hvilke løsninger kan vi finde til at skabe en forbindelse mellem kirkens indre og den omkringliggende natur?


Kirken i fremtiden
1. Hvordan kan kirken bruges anderledes i fremtiden?
1.1 Hvilke aktiviteter skal bevares og hvilke nye kan tilføres?
SKIBET ER FORANDERLIGT
Fællesskab og lokalsamfund
2. Hvordan kan kirkebygningen gøre mere for lokalsamfundet, udover at være et sted for gudstjenester?
2.1 Hvordan kan kirkebygningen bidrage til at styrke det sociale sammenhold i lokalsamfundet med andre fysiske rammer?
Mødetider
Kirkegården skal være en park
2
Brugere
3. Hvordan kan kirkebygningen henvende sig til alle aldersgrupper gennem nye funktioner?
3.1 Hvilke tiltag og aktiviteter kan henvende sig til forskellige brugergrupper? (f.eks. varierende typer af aktiviteter på forskellige tidspunkter af dagen, ugen og året)
RO
Kirkens fysiske rammer
4. Hvilke løsninger kan vi finde til at gøre kirkebygningen mere fleksibel og tilgængelig for forskellige aktiviteter?
4.1 Hvordan kan udearealerne omkring kirkebygningen anvendes i fremtiden?
4.2 Hvilke løsninger kan vi finde til at skabe en forbindelse mellem kirkens indre og den omkringliggende natur?
Nye Farver
Mere lys



Kirken i fremtiden

1. Hvordan kan kirken bruges anderledes i fremtiden?
1.1 Hvilke aktiviteter skal bevares og hvilke nye kan tilføres?

Fællesskab og lokalsamfund

2. Hvordan kan kirkebygningen gøre mere for lokalsamfundet, udover at være et sted for gudstjenester?
2.1 Hvordan kan kirkebygningen bidrage til at styrke det sociale sammenhold i lokalsamfundet, med dens fysiske rammer?

2

Brugere

3. Hvordan kan kirkebygningen henvende sig til alle aldersgrupper gennem nye funktioner?
3.1 Hvilke tiltag og aktiviteter kan henvende sig til forskellige brugergrupper? (f.eks. varierende typer af aktiviteter på forskellige tidspunkter af dagen, ugen og året)

Kirkens fysiske rammer

4. Hvilke løsninger kan vi finde til at gøre kirkebygningen mere fleksibel og tilgængelig for forskellige aktiviteter?
4.1 Hvordan kan udearealerne omkring kirkebygningen anvendes i fremtiden?
4.2 Hvilke løsninger kan vi finde til at skabe en forbindelse mellem kirkens indre og den omkringliggende natur?

## Quotes from discussion

”The altar and chancel is the most sacred space, the nave is less sacred and more folksy.”

”My relation to the church may be more than attending sunday services.”

”The church should be a place where you feel at home”.

”It will be amazing to dance in the church and feel the joy in that space.”

”It will be amazing to dance in the church and feel the joy in that space.”

"The new is spirituality"

# 04 INTERVIEW ABOUT SELF-SERVICE LIBRARIES

Online interview with Gitte Fisker, Head of Children and Reading Culture at Aalborg Bibliotekerne about self'service libraries in rural, small villages. Transcription of the interview:

**Study group:**
Nå, men du har jo læst vores projekt, men det handler jo om at vi skal lave en transformation af en kirke, og det handler primært om selvbetjente biblioteker. Vi vil gerne have noget mere viden om, hvordan et selvbetjent bibliotek fungerer. Sådan rent både fysisk, men også socialt og hvem der står for det. Vi har skrev et par spørgsmål, så tænkte jeg egentlig bare vi kan tage dem fra en ende af. Det første er, hvordan et selvbetjent bibliotek fungerer sådan generelt i en mindre landsby, både i forhold til bestilling og afhentning af bøger, og hvem der genopfylder og fylder op og så videre. Sådan det helt praktiske, kan man sige.

**Gitte:**
Man kan sige den måde, vi har lavet vores på, så fungerer de jo på mange måder som et almindeligt bibliotek. Altså der er noget personale derude, som laver det der materialehåndtering. Og så har de også en betjent åbningstid, hvor man kan komme og spørge personalet og få vejledning og alle de der sådan klassiske ting, man kan bruge biblioteket til. Og så er der også den udvidet åbningstid, altså der hvor biblioteket er åbent med selvbetjening. Så hos os er det en blanding af den der betjente tid og den selvbetjente tid. Men ellers så er der meget af det der egentlig ligner det almindelige bibliotek, men så er der selvfølgelig nogle forbehold, man gør sig, når der også er åben i en selvbetjent tid.

For eksempel så har vi jo overvejet meget, hvordan skal man kunne finde rundt på biblioteket, når der ikke er nogen at spørge, så vi har forsøgt at gøre det så simpelt som muligt at finde rundt. Der er også noget med at vores borgere, de betjener jo egentlig sig selv. Det gør de også, når der er personale til stede, for eksempel ved at låne og aflevere. Det foregår på nogle automater. Og man sorterer selv bøgerne, når man afleverer dem over på nogle vogne.

Det har vi jo også forsøgt at gøre så nemt som muligt, så man kan finde ud af det selv, fordi den selvbetjente tid er der jo så ikke nogen at spørge, kan man sige.
Vi har både nogle ret store og små biblioteker. Altså alle vores biblioteker har jo faktisk selvbetjent tid, men vores biblioteker ude i de i de små landsbyer, ligesom det i også beskæftiger jer med, der er sådan set ingen forskel på den måde, de er selvbetjent og den måde det er på de større biblioteker. Den eneste forskel, vi har det er, at herinde på hovedbiblioteket er der altid en vagt eller en pedel på arbejde.

**Study group:**
Jeg kan huske fra min folkeskole. Der var nemlig også sådan et selvbetjeningsbibliotek. Der skulle man låse sig ind med et kort hver gang.

**Gitte:**
Ja, det er aflåst dem vi har. Vi har altså som sikkerhed, så har vi dørlås. Men i Aalborg Kommune, har vi valgt at alle, der har et sygesikringsbevis, kan lukke sig ind, også selvom de ikke er registreret i vores lånesystem.

Den kommune jeg selv bor i, der har de valgt, at man kan kun lukke sig ind, hvis man er oprettet i lånesystemet, så man kan sige, at der ligger et yderligere sikkerhedslag på. Og der bliver ens CPR-nummer jo så lagret, hvis man har brug for at gå tilbage og så har vi også altså videoovervågning på alle bibliotekerne som et kriminalitetsforebyggende tiltag, at hvis der sker et eller andet nogen der laver hærværk eller sådan noget, så kan vi gå tilbage og se.

Og så har vi også tænkt meget igen, og det der med indretningen også i forhold til sikkerhed, at der må gerne være altså der kan man sige der. Der har vi jo ikke kunnet gøre det ens på alle vores lokalbiblioteker, fordi arkitekturen jo er forskellig eller rummet er forskellig. Men generelt set, så prøver vi at lave det sådan, at når man kommer ind, så kan man overskue rummet. Det har gjort, at vi har lavet lavere reoler. Nogle steder og forsøgt at nøjes med at have høje reoler ude ved siden. Og også forsøgt ikke at lave sådan nogle kroge. Altså det er jo fint med hyggekroge, men ikke sådan nogle, hvor man kan sidde og putte sig med noget og folk kan blive forskrækket. Sådan forsøge at gøre det til en tryg oplevelse at komme, selvom vi kan jo ikke styre det fuldstændigt når det er et åbent offentligt rum, men vi har forsøgt at gøre nogle tiltag for det.

Man kan sige i biblioteksverdenen, så er reserveringerne vores mælk ligesom supermarkedernes mælk, det alle skal have. Eller sådan er det jo faktisk ikke helt mere, men det var engang. Det er jo nogen der har bestilt en bog på forhånd, som de ved de skal komme og hente, og for en del år tilbage, så havde vi jo egentlig arbejdet med at stille reserveringerne altså langt ned i biblioteket ud fra den tanke om at få dem igennem hele biblioteket for at få det. Det er vi faktisk gået væk fra, så nu står reserveringerne, der hvor man kommer ind. Det er også der, vi har vores selvbetjeningsautomater. Her i Aalborg har vi noget der hedder zone reol, og det er sådan nogle 14 dages lån man ikke kan bestille, så det er tit det nye og det efterspurgte.

Det var faktisk fordi vi lavede nogle undersøgelser, hvor vi fandt ud af, at der er jo egentlig også en del biblioteksbrugere, som om bare lige kommer ned forbi og henter deres reservering. Og dem vil vi selvfølgelig gerne forsøge at inspirere med noget andet. Men nogle gange er det faktisk mere til gene, at man skal igennem et helt bibliotek for at få fat i reserveringer, så det har været sådan lidt en afvejning, så nu har vi faktisk gjort det på den anden måde på alle vores biblioteker.

**Study group:**
Vi har jo gået og tænkt sådan lidt, hvordan vi ville inkorporere sådan et lille landsbybibliotek, eller hvad man kan kalde. Det skal jo placeres i en landsbykirke, hvor der gerne skulle komme flere folk løbende. Og så har vi snakket om, det kan fungere på frivillighed, altså frivillig basis, så der ikke er, at der skal ansættes folk til at stå for den her afdeling eller hvad man kan sige. Men er det realistisk eller?

**Gitte:**
Altså man kan sige det tror jeg faktisk, det er. Jeg bor i en lille landsby. Man har jo tit en følelse af, at man gerne vil bakke op om det lokalsamfund man er i. Så jeg tror sagtens, at man vil kunne lave det ud fra nogle ildsjæle.

Det der selvfølgelig altid er når man arbejder med noget med frivillige. Det er jo det der med at de jo ikke er forpligtet af noget løn eller andet, så der kan der kan være noget ustabilitet i det.

Vi støder jo også nogle gange på nogle slags biblioteksambassadører, ikke hvor nogle steder så bliver aviserne bare lige lagt ude på trappen foran biblioteket, så den første biblioteksgæst, der kommer for at læse aviserne, så tager de den faktisk lige med ind og sætter dem lige på plads. Og det er jo ikke noget vi har bedt nogen om at gøre, det gør de altså selv altså. Så den tankegang tænker jeg sagtens man kan udvide.

Og så er der selvfølgelig også noget med størrelsen af biblioteket. Altså hvor stor en samling af materialer skal der være? Fordi jo større samling, jo mere skal man måske også passe lidt på den eller holde styr på den. Men hvis det drejer sig om nogle reoler med nogle bøger, så er det jo ikke et nødvendigvis et stort arbejde.
Og der tænker jeg også: Vi er jo et stort bibliotekssystem, hvor vi har en flydende materialebestand, så selvom den står i Hals, så når den bliver afleveret, så kan den være den skal sendes til vores filial i Svenstrup. Vi har, at materialerne flyder mellem hinanden. Hvis det er et lille satellitbibliotek man opretter, så der vil nok være mange ting, der kan gøres nemmere, hvis man holder det i en lidt mindre skala end et fuldt udrustet bibliotek.

**Study group:**
Ja, det er også tanken fordi det er jo meget begrænset plads vi har, så det skal være sådan en lille hyggekrog.

**Gitte:**
Vi har en filial bibliotek i Vodskov, hvor det ligger oppe i en idrætshal, hvor er motionscenter og nogle forskellige andre ting i den bygning. Og selvom der er et bibliotek, så har de faktisk en bogbytte reol, hvor det er ud fra en deleøkonomi tanke om, at du kan sætte en bog derop og du kan tage en bog. Og den er der ret godt gang i, også selvom der er et bibliotek lige ved siden af og det er det er nogle frivillige tror jeg, der hjælper med indimellem at smide lidt ud, hvis den vokser sig over hovedet. Men i praksis når så hvis nu, at der så er nogen der bestiller en bog fra sådan et meget lille bibliotek, så bliver det jo kørt derud til et eller andet tidspunkt.

**Study group:**
Hele den rotation, eller hvad man kan sige i bøger, du snakker om, er det hovedbiblioteket der at stå for det, fordi det er en satellit, ligesom du snakker om i Hals?

**Gitte:**
Altså der kunne man jo sagtens forestille sig at der kommer nogle kasser med bøger ud, som er dem der enten er reserveret eller skal sættes op til udlån derude. Og der kunne man jo sagtens forestille sig at have en rotation, fordi det der også kan være faren ved hvis man sætter nogle hylder op med nogle bøger. Det er jo at, hvis det er det samme folk de møder hele tiden, så bliver det nemt en kulisse som bare er der. Det er jo selvfølgelig en god ting at møde bøger i forskellige sammenhæng, men det får ikke nødvendigvis folk til at låne eller læse dem, at de er der. Der skal ligesom også nogle gange noget formidling til eller noget udskiftning i det.
Ja, og så vil jeg jo sige at sådan et mindre bibliotek, som der er tale om her, så ville man jo nok også skulle gå efter at det er noget nyere og populært man måske skulle sætte på hylderne. Fordi så er der størst sandsynlighed for, at der er flest mulige der gerne vil læse.

Men altså, der er selvfølgelig en arbejdsgang i den der proces med, at hvis biblioteket har sørget for, at der kommer en kasse bøger derud, så skal der være nogen, der materialehåndterer det. Der skal være nogen, der pakker det ud og sætter det op. Det er lidt det samme, hvis man kører reserveringsystem. Altså hvis man skal kunne bestille noget ud til den landsbyfilial, så skal der være et reserveringsystem, så man får besked om, at nu kan du komme og hente den og så videre.
Der er selvfølgelig svært at vide om der er nogle frivillige, der vil påtage sig så meget arbejde i det, så det selvfølgelig også noget med, hvad er en for økonomi man har. Men jeg tænker også, man kan løse det med mange ressourcer. Altså, det kan godt være det er dyrt at have en bibliotekar eller en cand. Mag, til den opgave, men det kunne også være at man kunne få en studentermedhjælper eller flexjobber eller et eller andet til at håndtere det så. Eller også så kan det måske løses frivilligt, hvis man har en god frivillig base for det.

Og i den sammenhæng, så kan jeg bare lige nævne, at det er jo sådan noget, som fagforeningerne går en del op i. Det der med, hvornår bruger man det? Nu er det jo fordi jeg er i det offentlige, men hvornår bruger man frivillige og til hvad? De synes det er fint. Vi har frivillige, men det må ikke være nogen der tager arbejde fra, at vi i stedet ville have valgt at ansætte nogle medarbejdere for det.

**Study group:**
Ja, det er klart. Men der er både nogle pensionister og nogle flexjobber, som måske vil have fint nok af at have 2 timer om ugen til at gå der, uden at det så nødvendigvis er fuldstændig frivilligt. Men der behøver ikke at sidde i en fuldtid der det.

**Gitte:**
Ja, lige præcis. Og den der materialehåndteringsdel som igen, jo større samling jo længere tid vil den tage. Men hvis det drejer sig om nogle reoler med måske nogle bestilte bøger og noget andet, man kan låne og inspirere med, så vil det jo ikke være ret lang tid.

Vi har faktisk et. Det kalder vi så ikke et bibliotek, fordi der ikke er formidling, men vi har en afdeling, hvor vi har det på den måde, at der står reserverede bøger og zonebøger, og så kan man komme og låne og aflevere, og så er der lidt børnebøger. Men det er ikke sådan at du kan komme ud og få vejledning af en af en formidler. Og det bliver løst med at 3 x 2 timer om ugen eller sådan cirka. At der er nogen ude at skifte materialerne og pakke reserveringer ud og sådan noget. Så det kan godt lade sig gøre at gøre med forholdsvis få ressourcer.

**Study group:**
Hvor er det henne?

**Gitte:**
Det er i Haraldslund. Det ligger ude sammen med svømmehallen. Der har været bibliotek før, men det er så blevet lukket.
Og altså den der skelnen mellem om vi kalder det bibliotek, det er bare noget internt hos os. Men det er jo fordi, at vi synes for at der skal være en bibliotekar til et bibliotek. Så er der selvfølgelig formidler delen, der ikke er der. Men det fungerer fint. Det bliver brugt i hver fald.

**Study group:**
Vi ved jo i hvert fald at i Borum her, som er den by vi bruger som case, der har der engang været bogbusser. Men de er da ikke særlig meget i brug længere, er de det?

**Gitte:**
Nej, altså der er nogle kommuner i landet, der stadigvæk har, men der er færre og færre af dem. Det er en meget dyr service og den er også meget ufleksibel. Hvis nu man forestiller sig at bogbussen den holder der fra 17-18 ude i en landsby. Hvis dine børn så går til fodbold den dag på det tidspunkt, så kommer du nok ikke og bruger bogbussen, hvis det kun er der, den holder der. Og det var i hvert fald det, vi oplevede her. Det var at benyttelsen den bare faldt og faldt og faldt. Og selvfølgelig var der nogen, der brugte det. Det var jo ikke sådan at folk helt holdt op.

Men vi har faktisk lukket vores her 1. Januar, og så er det blevet erstattet med biblioteksvogne. Det er sådan en mandskabsvogn, der er blevet indrettet til et lille bitte minibibliotek, som så kan rotere mellem byerne og så holder den 2 døgn hvert sted. Som et forsøg på at udvide den tid, den er derude. Men det er jo så også kun 9 byer eller sådan noget, der får besøg af det på den måde, hvor bogbussen jo besøgte lidt flere.

Ja så har vi en lille bogbil, som egentlig kan lidt af det samme. Der kan ikke være ret mange materialer med, men så kan man kan gå ned og hente reserveringen, når den kommer.

Men vores fornemmelse var også lidt, at tiden løb lidt fra den der bogbus. Selvfølgelig var der nogen der elskede den at komme derned i den der bogbus og hente materialerne. Men de faglige spørgsmål til det biblioteksfaglige uddannede personale faldt også. Altså det var meget folk, der kom og hentede reservering og afleverede.

Ja, så kunne det jo være fedt hvis sådan et sted der var lidt mere tilgængeligt. Bare lige for at hente og låne.

Vi har ikke erfaring med det her hos os, men der er nogle kommuner, der for eksempel har en boghylde til at stå hos nogen købmænd eller forsamlingshus. Lidt a la det her. Hvor det bliver gjort tilgængeligt for dem, der ikke længere har et fysisk bibliotek eller bogbus, men stadigvæk så har adgang til.

**Study group:**
Det var meget fint at høre det faktisk. Det er ikke helt urealistisk.

**Gitte:**
Nej, det tænker jeg ikke det er.

**Study group:**
Vi har snakket lidt om det her med indretningen. Der er selvfølgelig nogle elementer, der er vigtige som maskinen hvor man skal låne og udlåne. Og så snakker du om en reol eller en hylde eller noget man ligesom skal sætte de afleverede bøger på. Men hvilke og hvor mange elementer eller hvor meget plads er der behov for?

**Gitte:**
Jeg vil sige, det er lidt svært at komme med et præcist kvadratmeterantal, men sådan en automat der, den kræver lidt mere plads end man tænker fordi man skal jo kunne gå rundt om den og alt efter om der skal være en vogn ved siden af. Hvor hvis nu man også skal kunne aflevere, så skal der være et sted hvor folk de kan lægge bøger.

Men vi har faktisk også en biblioteksapp i Danmark, som man kan bruge. Og her hos os, der kan man låne på den via appen. Og nogle steder har vi også begyndt at eksperimentere med at man kan aflevere på den. Så det var jo også sådan noget, man kunne overveje, som mulighed sådan et sted og så sige det kører rent via appen. Man vil muligvis få skåret nogle få fra ved det, men jeg oplever faktisk, at der er rigtig mange af vores gæster, der godt kan finde ud af at bruge den, også nogle seniorer, fordi den er ret nemt og intuitiv.

Men ellers vil jeg sige, at det er jo det der med at kunne komme omkring automaten og så reolerne. Der er det jo også noget at gøre med, hvordan man vil præsentere bøgerne. Fordi hvis de skal stå med forsiden ud af så kan der jo ikke stå så mange bøger på en hylde. Til gengæld så er det mere inspirerende og spændende at kigge på, men hvis de står ryg mod ryg, sådan traditionelt opstillet, så kan det selvfølgelig være nogle flere.

Så det er sådan lidt svært at sige. Men om der skal 10 reoler eller 2 reoler til det, der tænker jeg, det jo måske også lidt pladsen, der med til at diktere. Hvor meget

kan vi egentlig få ind her?

**Study group:**
Fordi vi havde på et tidspunkt snakket om i forhold til sikkerhed, hvordan man lige kan arbejde med det, uden at man nødvendigvis behøver skulle skanne et kort så snart man kommer ind i kirken. Hvor det måske bliver lidt mærkeligt, hvis det var på den måde.
Men man kunne måske arbejde med, at der måske er et lille område eller altså en lille glasvæg på den ene side der rent faktisk havde bøgerne som man så kunne åbne op til, når man skulle bruge det.

**Gitte:**
Altså nogle af de steder, hvor vi ligger i hus med andre, for eksempel oppe i Vodskov, hvor man godt komme ind i forhallen, og så er det først, når man skal ind til selve biblioteket man skal skanne kortet. Men så er der så altså nogle få gange om året, hvor hallen har lukket, hvor man så godt nok skal validere sig ude ved døren. Men vi har også et andet sted, hvor vi har en filial der ligger sammen med et kulturhus, og der er forskellen at man faktisk ikke skal logge ind, når man kommer. Heller ikke selvom man kommer i en selvbetjent tid. Men det er fordi så har kulturhuset åben og bemandet, og selvom de ikke betjener en i biblioteket, så er der nogle folk i huset. Så der har vi valgt at sige, jamen så er det så et vilkår, der er derude. Der er for eksempel heller ikke åben om søndagen, fordi der er kulturhusmedarbejderen ikke på arbejde. Så kan vi ikke have biblioteket åbent.

Man kan jo sagtens tænke i, hvor meget sikkerhed vil man have? Og igen, så er det måske også forskel på hvor stor samling der er i forhold til, hvad sikkerhedsbehov har man brug for. Vi er også blevet mere modige med årene, vil jeg sige i forhold til når man laver alle de der sikkerhedsting.

Det skal selvfølgelig være trygt og sikkert og overvågningen. Det tænker jeg et must for os, fordi hvis der sker noget, så kan vi dokumentere det. Det er jo ikke os der så skal lave efterforskning, men hvis politiet har brug for at få at vide om noget, så kan vi levere den job.

Det er ikke så lang tid siden vi fik stjålet en Playstation for eksempel. Altså så er det jo meget rart, at vi har overvågning af det, og så kan vi anmelde det.
Men man kan godt overveje det der med hvor sikkert vil man have det? Det kommer også an på om bogsamlingen ikke er stor. Så den afvejning skal man måske gøre. Hvor meget skal man bekoste at sætte alle de der sikkerhedsforanstaltninger op i forhold til, hvad er det egentlig er, vi taler om her? Hvor meget kan man ødelægge eller?

Med og det kommer jo også an på det der med, er der bemanding i kirkerummet, eller hvor det nu skal være? Det var bare lige et input i forhold til det med sikkerhed.

Jeg tror nok, den løsning, vi har valgt med de der biblioteksvogne, er at man ikke skal bippe sig ind, fordi det system der skulle håndtere det bliver alt for tungt at få med i sådan en lille vogn. Men der er så overvågning. Så kan man bare gå ind.
Og så ved vi godt, at så er der måske en risiko for, at det kan være, at der lige pludselig er nogen der laver en masse hærværk der. Det håber vi selvfølgelig ikke. Selvfølgelig kan det ske ude i sådan nogle lokalsamfund, men ellers så er de tit ret gode til at værne om det, der er deres lokale tilbud.

**Study group:**
Jeg synes, vi har fået meget godt og fået svar på det, vi havde brug for. Jeg føler, vi har nok information og viden til at kunne designe det her. Især det med sikkerhed og størrelse, men også det her i forhold til indretningen. Du sagde, det der med gemmesteder, at man godt kan have lave reoler. Jeg tror, vi havde en fornemmelse af at biblioteker altid har højreoler. Det er altid lidt en labyrint man skal finde rundt i.

**Gitte:**
Ja. Det kan da også godt være noget hyggeligt ved, men det er bare sådan sikkerhedsmæssigt, så har vi i hvert fald tænkt at fokusere meget på det der med, hvis du Sådan Det er mere trygt at komme ind i et rum. Hvis du Sådan nogenlunde kan overskue er der, er der noget her der gør mig utryg eller Sådan? Ja.

**Study group:**
Jamen Vi er da megaglade at du lige havde tid til at snakke med det samme.

**Gitte:**
Det er fedt, der er nogen, der ind i mellem laver noget, der handler om biblioteker.

**Study group:**
Ja, det er lidt en anden vinkel.

**Gitte:**
Så tænker jeg, det er fint. Ellers så skriver i, hvis er noget opfølgende I kommer i tanke om. God fornøjelse med projektet.

**Study group:**
Mange tak.

# 05 HEAT LOSS FRAME CALCULATIONS

## Max. U-values & 48.9 m² windows

**Rockwool Energy Design 4.1**

Projektnavn: Borum Kirke tilbygning — Dato: 9-5-2025, side 2 af 4

### Resultater

| | |
|---|---|
| Det faktiske transmissionstab: | 1258,3 W |
| Det normgivende transmissionstab: | 1876,8 W |
| Det faktiske transmissionstab er mindre end eller lig med det normgivende | Overholdt |
| Krav til mindste varmeisolering er opfyldt | Overholdt |
| Bygningen lever op til bygningsreglementets krav | Overholdt |

**Varmetabsramme**

**Beregninger:** Det opvarmede etageareal udgør 83,5 m²
Areal af vinduer, ovenlys og døre udgør 58,6 % af det opvarmede etageareal.
Indetemperatur 20,0 °C

**Konstruktioner og vinduer og døre**

| Navn | Ti (C) | Te (C) | Aktuel bygning Areal (m²) | Aktuel bygning U-værdi (W/m²K) | Aktuel bygning Tab (W) | Normgivende bygning Areal (m²) | Normgivende bygning U-værdi (W/m²K) | Normgivende bygning Tab (W) |
|---|---|---|---|---|---|---|---|---|
| Tag | 20 | -12 | 92,1 | 0,20 | 589,4 | 102,0 | 0,12 | 391,8 |
| Terrændæk | 30 | 10 | 96,7 | 0,20 | 386,8 | 96,7 | 0,10 | 193,4 |
| Ydervæg | 20 | -12 | 55,1 | 0,30 | 529,0 | 75,7 | 0,15 | 363,4 |
| Vinduer nord | 20 | -12 | 21,0 | 1,00 | 672,0 | 7,9 | 1,20 | 302,9 |
| Ovenlysvinduer | 20 | -12 | 15,9 | 1,00 | 508,8 | 6,0 | 1,20 | 229,4 |
| Gavlvinduer | 20 | -12 | 12,0 | 1,00 | 384,0 | 4,5 | 1,20 | 173,1 |

**Kuldebroer**

| Navn | Ti (C) | Te (C) | Aktuel bygning Længde (m) | Aktuel bygning Ψ(psi) (W/mK) | Aktuel bygning Tab (W) | Normgivende bygning Længde (m) | Normgivende bygning Ψ(psi) (W/mK) | Normgivende bygning Tab (W) |
|---|---|---|---|---|---|---|---|---|
| Fundament m. gulvvarme | 30 | -12 | 26,0 | 0,20 | 218,4 | 26,0 | 0,12 | 131,0 |
| Nye ovenlysvinduer | 20 | -12 | 33,0 | 0,20 | 211,2 | 20,2 | 0,1 | 64,7 |
| Nye vinduer | 20 | -12 | 46,0 | 0,06 | 88,3 | 28,2 | 0,03 | 27,1 |

**Eksisterende konstruktioner og vinduer og døre**

| Navn | Ti (C) | Te (C) | Areal (m²) | U-værdi (W/m²K) | Tab (W) |
|---|---|---|---|---|---|
| Eksisterende kirkevæg | 20 | -12 | 61,0 | 1,80 | -1756,6 |
| Eks. vinduer i kirkevæg | 20 | -12 | 4,0 | 5,00 | -320,0 |

**Eksisterende kuldebroer**

| Navn | Ti (C) | Te (C) | Længde (m) | Ψ(psi) (W/mK) | Tab (W) |
|---|---|---|---|---|---|
| Eksisterende vinduer kirke | 20 | -12 | 8,0 | 0,10 | -12,8 |
| Fundament eksisterende kirke | 20 | -12 | 15,0 | 1,00 | -240,0 |

Beregnet med ROCKWOOL Energy Design 4.8.2

I alt — 1258,3 W — 1876,8 W

### Krav til mindste varmeisolering

**Konstruktioner - Tjek af U-værdier**

| Navn | Type | U-værdi (W/m²K) | Maks. U-værdi (W/m²K) | Tjek |
|---|---|---|---|---|
| Tag | Tag | 0,20 | 0,20 | Ja |
| Terrændæk | Gulv mod jord, med gulvvarme | 0,20 | 0,20 | Ja |
| Ydervæg | Ydervæg | 0,30 | 0,30 | Ja |

**Vinduer og ovenlys – Tjek af Eref**

| Navn | Type | Eref (kWh/m²år) | Maks. Eref (kWh/m²år) | Tjek |
|---|---|---|---|---|
| Vinduer nord | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |
| Ovenlysvinduer | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |
| Gavlvinduer | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |

**Kuldebroer – Tjek af Ψ-værdier**

| Navn | Type | Ψ-værdi (W/mK) | Maks. Ψ-værdi (W/mK) | Tjek |
|---|---|---|---|---|
| Fundament m. gulvvarme | Fundamenter 0-2 m's dybde med gulvvarme | 0,20 | 0,20 | Ja |
| Nye ovenlysvinduer | Samlinger mellem tagkonstruktion og ovenlysvinduer | 0,20 | 0,20 | Ja |
| Nye vinduer | Samlinger mellem ydervæg og vinduer/døre | 0,06 | 0,06 | Ja |

## Iteration 1: Optimized U-values & 38.4 m² windows

**Rockwool Energy Design 4.1**

Projektnavn: Borum Kirke tilbygning — Dato: 9-5-2025, side 2 af 4

### Resultater

| | |
|---|---|
| Det faktiske transmissionstab: | 98,2 W |
| Det normgivende transmissionstab: | 1890,2 W |
| Det faktiske transmissionstab er mindre end eller lig med det normgivende | Overholdt |
| Krav til mindste varmeisolering er opfyldt | Overholdt |
| Bygningen lever op til bygningsreglementets krav | Overholdt |

**Varmetabsramme**

**Beregninger:** Det opvarmede etageareal udgør 83,5 m²
Areal af vinduer, ovenlys og døre udgør 46,0 % af det opvarmede etageareal.
Indetemperatur 20,0 °C

**Konstruktioner og vinduer og døre**

| Navn | Ti (C) | Te (C) | Aktuel bygning Areal (m²) | Aktuel bygning U-værdi (W/m²K) | Aktuel bygning Tab (W) | Normgivende bygning Areal (m²) | Normgivende bygning U-værdi (W/m²K) | Normgivende bygning Tab (W) |
|---|---|---|---|---|---|---|---|---|
| Tag | 20 | -12 | 92,1 | 0,06 | 235,8 | 100,4 | 0,12 | 385,5 |
| Terrændæk | 30 | 10 | 96,7 | 0,10 | 193,4 | 96,7 | 0,10 | 193,4 |
| Ydervæg | 20 | -12 | 65,6 | 0,12 | 251,9 | 77,3 | 0,15 | 371,2 |
| Vinduer nord | 20 | -12 | 15,0 | 1,00 | 480,0 | 7,2 | 1,20 | 275,6 |
| Ovenlysvinduer | 20 | -12 | 15,9 | 1,00 | 508,8 | 7,6 | 1,20 | 292,1 |
| Gavlvinduer | 20 | -12 | 7,5 | 1,00 | 240,0 | 3,6 | 1,20 | 137,8 |

**Kuldebroer**

| Navn | Ti (C) | Te (C) | Aktuel bygning Længde (m) | Aktuel bygning Ψ(psi) (W/mK) | Aktuel bygning Tab (W) | Normgivende bygning Længde (m) | Normgivende bygning Ψ(psi) (W/mK) | Normgivende bygning Tab (W) |
|---|---|---|---|---|---|---|---|---|
| Fundament m. gulvvarme | 30 | -12 | 26,0 | 0,20 | 218,4 | 26,0 | 0,12 | 131,0 |
| Nye ovenlysvinduer | 20 | -12 | 33,0 | 0,20 | 211,2 | 22,8 | 0,1 | 73,0 |
| Nye vinduer | 20 | -12 | 46,0 | 0,06 | 88,3 | 31,8 | 0,03 | 30,6 |

**Eksisterende konstruktioner og vinduer og døre**

| Navn | Ti (C) | Te (C) | Areal (m²) | U-værdi (W/m²K) | Tab (W) |
|---|---|---|---|---|---|
| Eksisterende kirkevæg | 20 | -12 | 61,0 | 1,80 | -1756,6 |
| Eks. vinduer i kirkevæg | 20 | -12 | 4,0 | 5,00 | -320,0 |

**Eksisterende kuldebroer**

| Navn | Ti (C) | Te (C) | Længde (m) | Ψ(psi) (W/mK) | Tab (W) |
|---|---|---|---|---|---|
| Eksisterende vinduer kirke | 20 | -12 | 8,0 | 0,10 | -12,8 |
| Fundament eksisterende kirke | 20 | -12 | 15,0 | 1,00 | -240,0 |

Beregnet med ROCKWOOL Energy Design 4.8.2

I alt — 98,2 W — 1890,2 W

### Krav til mindste varmeisolering

**Konstruktioner - Tjek af U-værdier**

| Navn | Type | U-værdi (W/m²K) | Maks. U-værdi (W/m²K) | Tjek |
|---|---|---|---|---|
| Tag | Tag | 0,06 | 0,20 | Ja |
| Terrændæk | Gulv mod jord, med gulvvarme | 0,10 | 0,20 | Ja |
| Ydervæg | Ydervæg | 0,12 | 0,30 | Ja |

**Vinduer og ovenlys – Tjek af Eref**

| Navn | Type | Eref (kWh/m²år) | Maks. Eref (kWh/m²år) | Tjek |
|---|---|---|---|---|
| Vinduer nord | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |
| Ovenlysvinduer | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |
| Gavlvinduer | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |

**Kuldebroer – Tjek af Ψ-værdier**

| Navn | Type | Ψ-værdi (W/mK) | Maks. Ψ-værdi (W/mK) | Tjek |
|---|---|---|---|---|
| Fundament m. gulvvarme | Fundamenter 0-2 m's dybde med gulvvarme | 0,20 | 0,20 | Ja |
| Nye ovenlysvinduer | Samlinger mellem tagkonstruktion og ovenlysvinduer | 0,20 | 0,20 | Ja |
| Nye vinduer | Samlinger mellem ydervæg og vinduer/døre | 0,06 | 0,06 | Ja |

## Iteration 2: Optimized U-values & 45.4 m² windows

**Rockwool Energy Design 4.1**

Projektnavn: Borum Kirke tilbygning — Dato: 9-5-2025, side 2 af 4

### Resultater

| | |
|---|---|
| Det faktiske transmissionstab: | 295,3 W |
| Det normgivende transmissionstab: | 1880,7 W |
| Det faktiske transmissionstab er mindre end eller lig med det normgivende | Overholdt |
| Krav til mindste varmeisolering er opfyldt | Overholdt |
| Bygningen lever op til bygningsreglementets krav | Overholdt |

**Varmetabsramme**

**Beregninger:** Det opvarmede etageareal udger 83,5 m²
Areal af vinduer, ovenlys og døre udger 54,4 % af det opvarmede etageareal.
Indetemperatur 20,0 °C

**Konstruktioner og vinduer og døre**

| Navn | Ti (C) | Te (C) | Aktuel bygning Areal (m²) | Aktuel bygning U-værdi (W/m²K) | Aktuel bygning Tab (W) | Normgivende bygning Areal (m²) | Normgivende bygning U-værdi (W/m²K) | Normgivende bygning Tab (W) |
|---|---|---|---|---|---|---|---|---|
| Tag | 20 | -12 | 92,1 | 0,08 | 235,8 | 101,6 | 0,12 | 390,0 |
| Terrændæk | 30 | 10 | 96,7 | 0,10 | 193,4 | 96,7 | 0,10 | 193,4 |
| Ydervæg | 20 | -12 | 58,6 | 0,12 | 225,0 | 76,2 | 0,15 | 365,6 |
| Vinduer nord | 20 | -12 | 17,5 | 1,00 | 560,0 | 7,1 | 1,20 | 271,9 |
| Ovenlysvinduer | 20 | -12 | 15,9 | 1,00 | 508,8 | 6,4 | 1,20 | 247,0 |
| Gavlvinduer | 20 | -12 | 12,0 | 1,00 | 384,0 | 4,9 | 1,20 | 186,5 |

**Kuldebroer**

| Navn | Ti (C) | Te (C) | Længde (m) | Ψ(psi) (W/mK) | Tab (W) | Længde (m) | Ψ(psi) (W/mK) | Tab (W) |
|---|---|---|---|---|---|---|---|---|
| Fundament m. gulvvarme | 30 | -12 | 26,0 | 0,20 | 218,4 | 26,0 | 0,12 | 131,0 |
| Nye ovenlysvinduer | 20 | -12 | 33,0 | 0,20 | 211,2 | 21,0 | 0,1 | 67,2 |
| Nye vinduer | 20 | -12 | 46,0 | 0,06 | 88,3 | 29,3 | 0,03 | 28,1 |

**Eksisterende konstruktioner og vinduer og døre**

| Navn | Ti (C) | Te (C) | Areal (m²) | U-værdi (W/m²K) | Tab (W) |
|---|---|---|---|---|---|
| Eksisterende kirkevæg | 20 | -12 | 61,0 | 1,80 | -1756,8 |
| Eks. vinduer i kirkevæg | 20 | -12 | 4,0 | 5,00 | -320,0 |

**Eksisterende kuldebroer**

| Navn | Ti (C) | Te (C) | Længde (m) | Ψ(psi) (W/mK) | Tab (W) |
|---|---|---|---|---|---|
| Eksisterende vinduer kirke | 20 | -12 | 8,0 | 0,10 | -12,8 |
| Fundament eksisterende kirke | 20 | -12 | 15,0 | 1,00 | -240,0 |

Beregnet med ROCKWOOL Energy Design 4.8.2

| | | |
|---|---|---|
| I alt | 295,3 W | 1880,7 W |

### Krav til mindste varmeisolering

**Konstruktioner - Tjek af U-værdier**

| Navn | Type | U-værdi (W/m²K) | Maks. U-værdi (W/m²K) | Tjek |
|---|---|---|---|---|
| Tag | Tag | 0,08 | 0,20 | Ja |
| Terrændæk | Gulv mod jord, med gulvvarme | 0,10 | 0,20 | Ja |
| Ydervæg | Ydervæg | 0,12 | 0,30 | Ja |

**Vinduer og ovenlys – Tjek af Eref**

| Navn | Type | Eref (kWh/m²år) | Maks. Eref (kWh/m²år) | Tjek |
|---|---|---|---|---|
| Vinduer nord | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |
| Ovenlysvinduer | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |
| Gavlvinduer | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |

**Kuldebroer – Tjek af Ψ-værdier**

| Navn | Type | Ψ-værdi (W/mK) | Maks. Ψ-værdi (W/mK) | Tjek |
|---|---|---|---|---|
| Fundament m. gulvvarme | Fundamenter 0-2 m's dybde med gulvvarme | 0,20 | 0,20 | Ja |
| Nye ovenlysvinduer | Samlinger mellem tagkonstruktion og ovenlysvinduer | 0,20 | 0,20 | Ja |
| Nye vinduer | Samlinger mellem ydervæg og vinduer/døre | 0,06 | 0,06 | Ja |

## Iteration 3: Optimized U-values & 48.9 m² windows

**Rockwool Energy Design 4.1**

Projektnavn: Borum Kirke tilbygning — Dato: 9-5-2025, side 2 af 4

### Resultater

| | |
|---|---|
| Det faktiske transmissionstab: | 393,9 W |
| Det normgivende transmissionstab: | 1876,8 W |
| Det faktiske transmissionstab er mindre end eller lig med det normgivende | Overholdt |
| Krav til mindste varmeisolering er opfyldt | Overholdt |
| Bygningen lever op til bygningsreglementets krav | Overholdt |

**Varmetabsramme**

**Beregninger:** Det opvarmede etageareal udger 83,5 m²
Areal af vinduer, ovenlys og døre udger 56,6 % af det opvarmede etageareal.
Indetemperatur 20,0 °C

**Konstruktioner og vinduer og døre**

| Navn | Ti (C) | Te (C) | Aktuel bygning Areal (m²) | Aktuel bygning U-værdi (W/m²K) | Aktuel bygning Tab (W) | Normgivende bygning Areal (m²) | Normgivende bygning U-værdi (W/m²K) | Normgivende bygning Tab (W) |
|---|---|---|---|---|---|---|---|---|
| Tag | 20 | -12 | 92,1 | 0,08 | 235,8 | 102,0 | 0,12 | 391,8 |
| Terrændæk | 30 | 10 | 96,7 | 0,10 | 193,4 | 96,7 | 0,10 | 193,4 |
| Ydervæg | 20 | -12 | 55,1 | 0,12 | 211,6 | 75,7 | 0,15 | 363,4 |
| Vinduer nord | 20 | -12 | 21,0 | 1,00 | 672,0 | 7,9 | 1,20 | 302,9 |
| Ovenlysvinduer | 20 | -12 | 15,9 | 1,00 | 508,8 | 6,0 | 1,20 | 229,4 |
| Gavlvinduer | 20 | -12 | 12,0 | 1,00 | 384,0 | 4,5 | 1,20 | 173,1 |

**Kuldebroer**

| Navn | Ti (C) | Te (C) | Længde (m) | Ψ(psi) (W/mK) | Tab (W) | Længde (m) | Ψ(psi) (W/mK) | Tab (W) |
|---|---|---|---|---|---|---|---|---|
| Fundament m. gulvvarme | 30 | -12 | 26,0 | 0,20 | 218,4 | 26,0 | 0,12 | 131,0 |
| Nye ovenlysvinduer | 20 | -12 | 33,0 | 0,20 | 211,2 | 20,2 | 0,1 | 64,7 |
| Nye vinduer | 20 | -12 | 46,0 | 0,06 | 88,3 | 28,2 | 0,03 | 27,1 |

**Eksisterende konstruktioner og vinduer og døre**

| Navn | Ti (C) | Te (C) | Areal (m²) | U-værdi (W/m²K) | Tab (W) |
|---|---|---|---|---|---|
| Eksisterende kirkevæg | 20 | -12 | 61,0 | 1,80 | 1756,8 |
| Eks. vinduer i kirkevæg | 20 | -12 | 4,0 | 5,00 | -320,0 |

**Eksisterende kuldebroer**

| Navn | Ti (C) | Te (C) | Længde (m) | Ψ(psi) (W/mK) | Tab (W) |
|---|---|---|---|---|---|
| Eksisterende vinduer kirke | 20 | -12 | 8,0 | 0,10 | -12,8 |
| Fundament eksisterende kirke | 20 | -12 | 15,0 | 1,00 | 240,0 |

Beregnet med ROCKWOOL Energy Design 4.8.2

| | | |
|---|---|---|
| I alt | 393,9 W | 1876,8 W |

### Krav til mindste varmeisolering

**Konstruktioner - Tjek af U-værdier**

| Navn | Type | U-værdi (W/m²K) | Maks. U-værdi (W/m²K) | Tjek |
|---|---|---|---|---|
| Tag | Tag | 0,08 | 0,20 | Ja |
| Terrændæk | Gulv mod jord, med gulvvarme | 0,10 | 0,20 | Ja |
| Ydervæg | Ydervæg | 0,12 | 0,30 | Ja |

**Vinduer og ovenlys – Tjek af Eref**

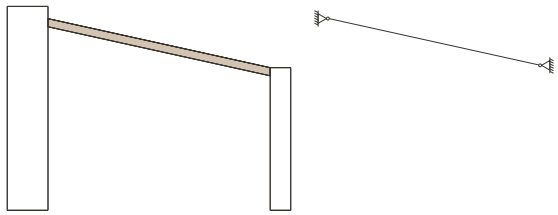
| Navn | Type | Eref (kWh/m²år) | Maks. Eref (kWh/m²år) | Tjek |
|---|---|---|---|---|
| Vinduer nord | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |
| Ovenlysvinduer | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |
| Gavlvinduer | Vinduer og glasydervægge | ERef ≥ -17 | 20 | Ja |

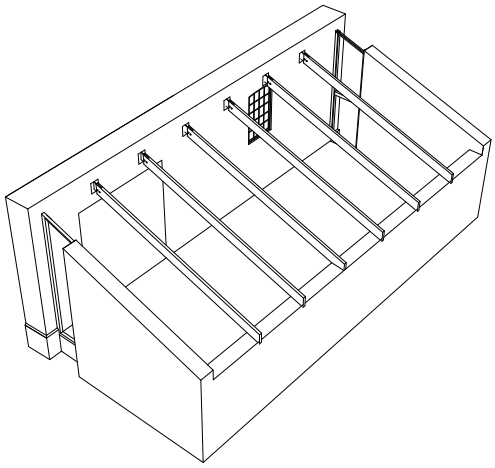
**Kuldebroer – Tjek af Ψ-værdier**

| Navn | Type | Ψ-værdi (W/mK) | Maks. Ψ-værdi (W/mK) | Tjek |
|---|---|---|---|---|
| Fundament m. gulvvarme | Fundamenter 0-2 m's dybde med gulvvarme | 0,20 | 0,20 | Ja |
| Nye ovenlysvinduer | Samlinger mellem tagkonstruktion og ovenlysvinduer | 0,20 | 0,20 | Ja |
| Nye vinduer | Samlinger mellem ydervæg og vinduer/døre | 0,06 | 0,06 | Ja |

# 06 ROOF CONSTRUCTION CALCULATION

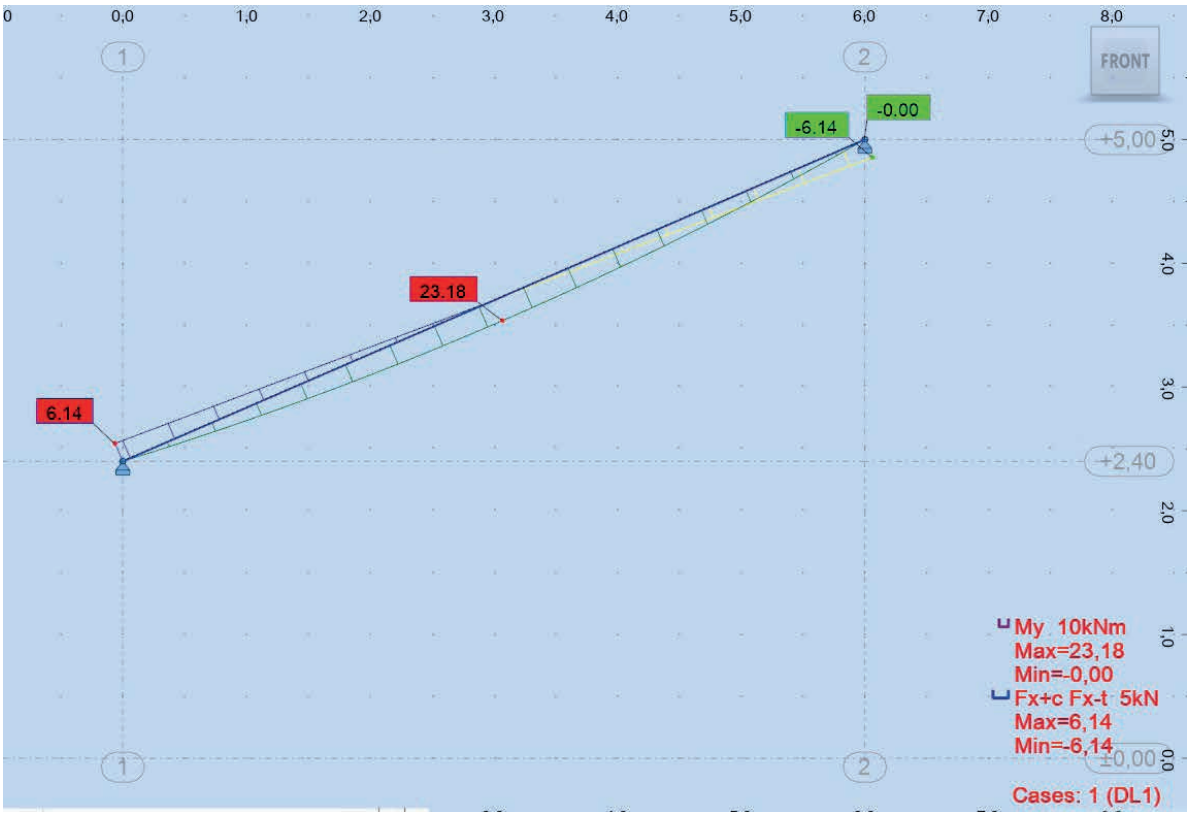
DS/EN 1995 FU:2015. Eurocode 5: Trækonstruktioner, Dansk Standard.
Teknisk Ståbi, 2020, Praxis, Kbh.





Glulam 28h
90mm x 367mm
Utilisation rate 0,9<1

## Autodesk Robot Structural analysis



# Beam dimension

## 1. 90mm x 367mm Beam

### 1.1 Glulam 28h

$f_{c.0.k} := 28\ MPa$ $\quad w := 90\ mm$ $\quad L := 6.5\ m$

$f_{m.k} := 28\ MPa$ $\quad h := 367\ mm$

$E_0 := 12600\ MPa$ $\quad A := w \cdot h = 0.033\ m^2$

$k_{mod} := 0.6$ $\quad$ Normal force: $F_{c.d} := 6 \cdot 10^3\ N$

$\gamma_M := 1.30$ $\quad$ Moment: $M := 23\ kN \cdot m$

Both Normal force and Moment have been found with Autodesk Robot Structural analysis tool.

## 2. Loads

### 2.1 Dead load: $q_d$

Roof dead load: Weight: $\dfrac{m \cdot \frac{kg}{m^3} \cdot 9.81}{1000}$

| | |
|---|---|
| Hemp (insulation): | 0.16 |
| Hunton (windbreak): | 0.06 |
| Rooftiles: | 0.4 |
| Rafters: | 0.15 |
| Wood cladding | 0.10 |

#### 2.1.1 Plane load $\frac{kN}{m^2}$

$$q_1 := 0.16\frac{kN}{m^2} + 0.06\frac{kN}{m^2} + 0.4\frac{kN}{m^2} + 0.15\frac{kN}{m^2} + 0.10\frac{kN}{m^2} = 0.87\frac{kN}{m^2}$$

#### 2.1.2 Linear load $\frac{kN}{m}$

There is a distance of 2 meters between the beams

$$q_d := q_1 \cdot 2\ m = 1.74\frac{kN}{m}$$

### 2.2 Variable Loads: qs + qw

#### 2.2.1 Snow load

Form factor: $\mu := 0.8$

Exposure factor: $C_e := 1.1 \cdot 1.2$

Thermal factor: $C_t := 1$

Characteristic terrain factor: $s_k := 1.0\frac{kN}{m^2}$

Snowload: $s := \mu \cdot C_e \cdot C_t \cdot s_k$

$$q_s := s \cdot 2\ m = 2.112\frac{kN}{m}$$

#### 2.2.2 Wind load

Terrain factor: $k_r := 0.19 \cdot \left(\frac{0.3\ m}{0.05\ m}\right)^{0.07} = 0.215$

Height factor: $z := 0.3\ m$

$z_0 := 0.05\ m$

Base wind speed: $v_b := 24\frac{m}{s}$

Air density: $\rho := 1.25\frac{kg}{m^3}$

Windload: $w := \left(1 + \frac{7}{\ln\left(\frac{z}{z_0}\right)}\right) \cdot \frac{1}{2} \cdot \rho \cdot \left(v_b \cdot k_r \cdot \ln\left(\frac{z}{z_0}\right)\right)^2$

$$q_w := w \cdot 2\ m = 0.526\frac{kN}{m}$$

### 2.3 Total load: qt

$q_t := q_d + q_s + q_w$

$$q_t = 4.378\frac{kN}{m}$$

Created with PTC Mathcad Express. See www.mathcad.com for more information.

## 3. Dimensioning of compression and moment-affected wooden elements

### 3.1 Cross section

$w := 90\ mm$ $\qquad L := 6.5\ m$

$h := 367\ mm$

$A_{ef} := w \cdot h = 0.033\ m^2$

### 3.2 Fracture due to instability + moment

$$\frac{\sigma_{c.d}}{k_{c.y} \cdot f_{c.0.d}} + \frac{\sigma_{m.y.d}}{f_{m.y.d}} \le 1$$

### 3.2.1 The compression is calculated based on the effective area $A_{ef}$: $\sigma_{c.d}$

$\sigma_{c.d} := \frac{F_{c.d}}{A_{ef}}$ $\qquad \sigma_{c.d} = 0.182\ MPa$

### 3.2.2 The factor $k_{c.y}$ $\quad \frac{1}{k_y + \sqrt{k_y^2 - \lambda_{rel.y}^2}}$

The slenderness ratio $\lambda_y$

$i_y := \frac{h}{\sqrt{12}}$ $\qquad \lambda_y := \frac{L}{i_y}$

The relative slenderness ratio $\lambda_{rel.y}$ $\qquad \lambda_{rel.y} := \frac{\lambda_y}{\pi} \cdot \sqrt{\frac{f_{c.0.k}}{E_0}}$

The factor $k_y$

The constant $\beta_c$ for construction wood: $\beta_c := 0.2$

$k_y := 0.5 \cdot \left(1 + \beta_c \cdot (\lambda_{rel.y} - 0.3) + \lambda_{rel.y}^2\right)$

$k_{c.y} := \frac{1}{k_y + \sqrt{k_y^2 - \lambda_{rel.y}^2}} = 0.747$

### 3.2.3 The calculated compressive strength parallel to the fibers is determined $f_{c.0.d}$

$f_{c.0.d} := \frac{f_{c.0.k} \cdot k_{mod}}{\gamma_M}$ $\qquad f_{c.0.d} = 12.923\ MPa$

### 3.2.4 The calculated bending strength is determined $f_{m.y.d} = \frac{(f_{m.k} \cdot k_{mod})}{\gamma_M}$

$f_{m.y.d} := \frac{(f_{m.k} \cdot k_{mod})}{\gamma_M}$

$f_{m.y.d} = 12.923\ MPa$

### 3.2.5 The calculated moment is determined $\sigma_{m.y.d} = \frac{M_{y.d}}{W_y}$

The moment of resistance $\qquad M_{y.d} := \frac{1}{8} \cdot q_t \cdot L^2$ $\qquad M_{y.d} = 23.122\ kN \cdot m$

The arithmetic moment $\qquad W_y := \frac{1}{6} \cdot w \cdot h^2$ $\qquad W_y = 0.002\ m^3$

$\sigma_{m.y.d} := \frac{M}{W_y} = 11.384\ MPa$

To ensure the beam is dimensioned sufficiently the utilisation rate must be $x \le 1$

$$\frac{\sigma_{c.d}}{k_{c.y} \cdot f_{c.0.d}} + \frac{\sigma_{m.y.d}}{f_{m.y.d}} \le 1$$

Compression: $\qquad \frac{\sigma_{c.d}}{k_{c.y} \cdot f_{c.0.d}} = 0.019$

Moment: $\qquad \frac{\sigma_{m.y.d}}{f_{m.y.d}} = 0.881$

$$\frac{\sigma_{c.d}}{k_{c.y} \cdot f_{c.0.d}} + \frac{\sigma_{m.y.d}}{f_{m.y.d}} = 0.9$$

$0.9 \le 1$ $\qquad$ This beam's utilisations rate is below 1, and is the chosen beam for the roof construction.

Created with PTC Mathcad Express. See www.mathcad.com for more information.

# 07 THE MAGIC OF THE REAL

## 1 The Body of Architecture

Architecture is primarily characterized by the fact that it brings together a variety of materials to create spaces. The texture of the materials creates a sensual effect that can be compared to the body's clothes, which can be made of velvet or silk, which gives rise to different emotions and moods.

## 2 Material Compatibility

The materials have great importance for the atmosphere of the place, that they are compatible and form an overall harmony and whole.

## 3 The sound of a Space

The properties of the materials also create different sounds and resonances in the rooms and also in the streets. This also applies to the human use of the building, speech, steps, music, etc. which can be pleasant or unpleasant.

## 4 The Temperature of Space

The materials can feel warm or cold on the body, even through the feet, e.g. wood or metal. This can be real or unreal, but it helps to create comfort or the opposite in the rooms, and thus a certain atmosphere.

## 5 Surrounding Objects

Atmosphere is also created by the things that are in a room and that surround us. If we are surrounded by beautiful objects and details, this gives us greater joy than things that are not beautiful.

## 6 Between Composure and Seduction

When moving around in good rooms, the atmosphere in the house should be able to guide the residents around, so that they have the feeling of being in control of themselves and their own movements.

## 7 Tension between Interior and Exterior

The fact that something surrounds us, walls, floors, ceilings, gives people a feeling of unity and envelopment - no matter whether we are many or alone. Through thresholds, doorways and transitions, an almost imperceptible transition and adjustment from outside to inside occurs.

## 8 Levels of Intimacy

This has to do with proximity and distance, which in the past would have been called scale. But it is just as much about size and dimension. The size of the building in contrast to my own. But also that objects in the building are smaller than me: door handles, locks, hinges. Or also that the interior of a building is not only reflected in the outer shape, but that some walls are thicker or have other shapes.

## 9 The Light on Things

Where and how the light falls, the way the materials reflect the light, where the shadows come or the way the surfaces become matte or shiny, or change depth. Here daylight can move you much more than artificial light.

## 10 Architecture as Sourroundings

The way that a building or multiple buildings interacts with the surroundings of the place – and also the people who live and move in the buildings.

## 11 Coherence

When everything fits together with everything else, so that it is impossible to remove a single thing without destroying the whole. It does this by ensuring that place, use and form must fit together. The form must fit the place. The use must fit the form. And the place must suit the form and use.

## 12 The beautiful Form

Architecture is first and foremost created to be used, so it is not a free art form in that sense. But the materials, the constructions, the body of the buildings, the sounds, the temperature, daylight and surroundings – are not enough. The buildings must also be beautiful and have a beautiful form.

*(Zumthor, 2006 in Vadstrup, 2022)*

# 08 CONSTRUCTION AND LCA CALCULATIONS

## Wall construction - frivillig klasse U-verdi<0,12

*55,1* m2

**Rockwool murbatts 37**

| From inside | Thickness [mm] | kg/m2 | λ | μ |
|---|---|---|---|---|
| Brick 1600 kg/m3 | 228 | | 0,68 | 5/10 |
| Bitumen | 0,2 | | 0,17 | 50000 |
| Mineral wool (rockwool) | 290 | 8,621621622 | 0,037 | 1/2 |
| Brick 1600 kg/m3 | 108 | | 0,68 | 5/10 |
| **Total veggtykkelse:** | **626,2** | | | |
| **U-value:** | **0,113** | | | |

**Knauf Ecobatts Formstykke 37**

| From inside | Thickness [mm] | kg/m2 | λ | μ |
|---|---|---|---|---|
| Brick 1600 kg/m3 | 228 | | 0,68 | 5/10 |
| Bitumen | 0,2 | | 0,17 | 50000 |
| Mineral wool (glass wool) | 290 | 4,35 | 0,037 | 1/2 |
| Brick 1600 kg/m3 | 108 | | 0,68 | 5/10 |
| **Total thickness of wall construction:** | **626,2** | | | |
| **U-value:** | **0,113** | | | |

**Hemp**

| From inside | Thickness [mm] | kg/m2 | λ | μ |
|---|---|---|---|---|
| Brick 1600 kg/m3 | 228 | | 0,68 | 5/10 |
| Bitumen | 0,2 | | 0,17 | 50000 |
| Hemp | 315 | 11,025 | 0,04 | 2,8 |
| Brick 1600 kg/m3 | 108 | | 0,68 | 5/10 |
| **Total thickness of wall construction:** | **651,2** | | | |
| **U-value:** | **0,116** | | | |

**Hemp WITH NEW RED BRICKS**

| From inside | Thickness [mm] | kg/m2 | λ | μ |
|---|---|---|---|---|
| Brick 1600 kg/m3 | 228 | 388,8 | 0,68 | 5/10 |
| Bitumen | 0,2 | | 0,17 | 50000 |
| Hemp | 315 | 11,025 | 0,04 | 2,8 |
| Brick 1800 kg/m3 | 108 | 194,4 | 0,68 | 5/10 |
| **Total thickness of wall construction:** | **651,2** | | | |
| **U-value:** | **0,116** | | | |

**Wood fiber**

| From inside | Thickness [mm] | kg/m2 | λ | μ |
|---|---|---|---|---|
| Brick 1600 kg/m3 | 228 | | 0,68 | 5/10 |
| Bitumen | 0,2 | | 0,17 | 50000 |
| Wood fiber | 290 | 5,51 | 0,038 | 3/5 |
| Brick 1600 kg/m3 | 108 | | 0,68 | 5/10 |
| **Total thickness of wall construction:** | **626,2** | | | |
| **U-value:** | **0,112** | | | |

## LCA

**GWP for den samlede konstruktion**

| | | |
|---|---|---|
| **GWP:** | **174,9 kg CO2-eq.** | **Stone wool (Rockwool murbatts 37)** |
| **GWP:** | **206,6 kg CO2-eq.** | **Glass wool (Knauf Ecobatts Formstykke 37)** |
| **GWP:** | **76,37 kg CO2-eq.** | **Hemp fibre insulation (Ekolution)** |
| **GWP:** | **76,37 kg CO2-eq.** | **Hemp fibre insulation (Ekolution)** |
| **GWP:** | **5008 kg CO2-eq.** | (3 layer brick) |
| **GWP:** | **91,13 kg CO2-eq.** | **Hunton Nativo træfibre insolationsplade** |

## Slab construction - frivillig klasse U-verdi<0,1

***m2***

| From inside | Thickness [mm] | kg/m2 | λ | μ |
|---|---|---|---|---|
| Brick 1600 kg/m3 | 40 | | 0,68 | 5/10 |
| flydespartel m. fjernvarme | 120 | | 2 | 80/130 |
| wedi isoleringsplader | 50 | | 0,035 | |
| concrete | 150 | 3 | 2 | 80/130 |
| EPS S60 | 350 | | 0,041 | 80/130 |
| **Total thickness of slab construction:** | **710** | | | |
| **U-value:** | **0,097** | | | |

| | | | |
|---|---|---|---|
| **GWP (Flensborg tegl 4cm)** | **921 kg CO2-eq.** | | |
| **GWP (Estrich slidlag)** | **2038 kg CO2-eq.** | | |
| **GWP:** | **402,3 kg CO2-eq.** | | |
| **GWP (FutureCem C20/25):** | **2757 kg CO2-eq.** | **GWP (Ikast betc** | **3505 kg CO2-eq.** |
| **GWP:** | **2690 kg CO2-eq.** | | |

***96.7 m2***

| From inside | Thickness [mm] | kg/m2 | λ | μ |
|---|---|---|---|---|
| Brick 1600 kg/m3 | 40 | | 0,68 | 5/10 |
| flydespartel m. fjernvarme | 120 | | 2 | 80/130 |
| wedi isoleringsplader | 50 | | 0,035 | |
| concrete | 150 | | 2 | 80/130 |
| EPS Climate C80 | 265 | | 0,031 | 80/130 |
| **Total thickness of slab construction:** | **625** | | | |
| **U-value:** | **0,097** | | | |

| | | | |
|---|---|---|---|
| **GWP (Flensborg tegl 4cm)** | **921 kg CO2-eq.** | | |
| **GWP (Estrich slidlag)** | **2038 kg CO2-eq.** | | |
| **GWP:** | **402,3 kg CO2-eq.** | | |
| **GWP (FutureCem C20/25):** | **2757 kg CO2-eq.** | **GWP (Ikast betc** | **3505 kg CO2-eq.** |
| **GWP:** | **2111 kg CO2-eq.** | | |

## Load baring construction

| | Thickness [mm] | Density (kg/m3) | | |
|---|---|---|---|---|
| Glulam (Lilleheden) - Limtræ | | 430 | | |
| Construction wood | | 456 | | |

## LCA (kg CO2-eq / m3)

| | | | m3 glulam | |
|---|---|---|---|---|
| **GWP:** | **135 kg CO2-eq. / m3** | **Limtræ (lilleheden)** | 1,39347 | **188,11845 kg CO2-eq.** |
| **GWP:** | **48 kg CO2-eq. / m3** | **Konstruktionstræ fyr & gran (branche EPD)** | | |

| **Bjælker dimensioner** | Tværsnit m | Længde m | Antal |
|---|---|---|---|
| | 0,03573 | 6,5 | 6 |

## Roof construction - frivillig klasse U-verdi<0,08

*92,1 m2*

### Rockwool/ tiles

| From inside | Thickness [mm] | kg/m2 | λ | μ | | | |
|---|---|---|---|---|---|---|---|
| Wood cladding | 12 | | 0,13 | 50 | | | |
| PE foil | 0,2 | | 0,4 | 100000 | | | |
| Mineral wool (glass wool) | 430 | 12,78378378 | 0,037 | 1/2 | GWP: | 512,1 kg CO2-eq. | |
| Hunton | 25 | 6,35 | 0,13 | 5,00 | GWP: | 60,85 kg CO2-eq. | (Hunton vindspærre 25mm) |
| Ventilated air | 50 | | 0,75 | 1 | | | |
| Roof tiles (new) | 50 | 52,5 | | 5/10 | GWP: | 1363 kg CO2-eq. | New red roof tiles (Randers Tegl RT806) |
| **Total thickness of roof construction:** | **567,2** | | | | | **1935,95 kg CO2-eq.** | |
| **U-value:** | **0,08** | | | | | | |

### Hemp/ tiles

| From inside | Thickness [mm] | kg/m2 | λ | μ | | | |
|---|---|---|---|---|---|---|---|
| Wood cladding | 12 | | 0,13 | 50 | | | |
| PE foil | 0,2 | | 0,4 | 100000 | | | |
| Hemp | 475 | 16,625 | 0,04 | 2,8 | GWP: | 192,5 kg CO2-eq. | |
| Hunton | 25 | 6,35 | 0,13 | 5,00 | GWP: | 60,85 kg CO2-eq. | (Hunton vindspærre 25mm) |
| Ventilated air | 50 | | 0,75 | 1 | | | |
| Roof tiles (new) | 50 | 52,5 | | 5/10 | GWP: | 1363 kg CO2-eq. | New red roof tiles (Randers Tegl RT806) |
| **Total thickness of roof construction:** | **612,2** | | | | | **1616,35 kg CO2-eq.** | |
| **U-value:** | **0,079** | | | | | | |

### Wood fiber/ tiles

| From inside | Thickness [mm] | kg/m2 | λ | μ | | | |
|---|---|---|---|---|---|---|---|
| Wood cladding | 12 | | 0,13 | 50 | | | |
| PE foil | 0,2 | | 0,4 | 100000 | | | |
| Wood fiber | 440 | 8,36 | 0,038 | 1/2 | GWP: | 231,1 kg CO2-eq. | |
| Hunton | 25 | 6,35 | 0,13 | 5,00 | GWP: | 60,85 kg CO2-eq. | (Hunton vindspærre 25mm) |
| Ventilated air | 50 | | 0,75 | 1 | | | |
| Roof tiles (new) | 50 | 52,5 | | 5/10 | GWP: | 1363 kg CO2-eq. | New red roof tiles (Randers Tegl RT806) |
| **Total thickness of roof construction:** | **577,2** | | | | | **1654,95 kg CO2-eq.** | |
| **U-value:** | **0,08** | | | | | | |

### Rockwool/ Zinc

| From inside | Thickness [mm] | kg/m2 | λ | μ | | | |
|---|---|---|---|---|---|---|---|
| Wood cladding | 12 | | 0,13 | 50 | | | |
| PE foil | 0,2 | | 0,4 | 100000 | | | |
| Mineral wool (glass wool) | 430 | 8,621621622 | 0,037 | 1/2 | GWP: | 512,1 kg CO2-eq. | |
| Hunton | 25 | 6,35 | 0,13 | 5,00 | GWP: | 60,85 kg CO2-eq. | (Hunton vindspærre 25mm) |
| Ventilated air | 50 | | 0,75 | 1 | | | |
| Zinc | 0,75 | 5,4 | 110 | 750000 | GWP: | 1537 kg CO2-eq. | New zinc tiles (NedZink natural roof) |
| **Total thickness of roof construction:** | **517,95** | | | | | **2109,95 kg CO2-eq.** | |
| **U-value:** | **0,079** | | | | | | |

### Hemp/ Zinc

| From inside | Thickness [mm] | kg/m2 | λ | μ | | | |
|---|---|---|---|---|---|---|---|
| Wood cladding | 12 | | 0,13 | 50 | | | |
| PE foil | 0,2 | | 0,4 | 100000 | | | |
| Hemp | 475 | 16,625 | 0,04 | 2,8 | GWP: | 192,5 kg CO2-eq. | Hemp fibre insulation (Ekolution) |
| Hunton | 25 | 6,35 | 0,13 | 5,00 | GWP: | 60,85 kg CO2-eq. | (Hunton vindspærre 25mm) |
| Ventilated air | 50 | | 0,75 | 1 | | | |
| Zinc | 0,75 | 5,4 | 110 | 750000 | GWP: | 1537 kg CO2-eq. | New zinc tiles (NedZink natural roof) |
| **Total thickness of roof construction:** | **562,95** | | | | | **1790,35 kg CO2-eq.** | |
| **U-value:** | **0,08** | | | | | | |

### Wood fiber/ Zinc

| From inside | Thickness [mm] | kg/m2 | λ | μ | | | |
|---|---|---|---|---|---|---|---|
| Wood cladding | 12 | | 0,13 | 50 | | | |
| PE foil | 0,2 | | 0,4 | 100000 | | | |
| Wood fiber | 440 | 8,36 | 0,038 | 1/2 | GWP: | 231,1 kg CO2-eq. | Hunton Nativo træfibre insolationsplade |
| Hunton | 25 | 6,35 | 0,13 | 5,00 | GWP: | 60,85 kg CO2-eq. | (Hunton vindspærre 25mm) |
| Ventilated air | 50 | | 0,75 | 1 | | | |
| Zinc | 0,75 | 5,4 | 110 | 750000 | GWP: | 1537 kg CO2-eq. | New zinc tiles (NedZink natural roof) |
| **Total thickness of roof construction:** | **527,95** | | | | | **1828,95 kg CO2-eq.** | |
| **U-value:** | **0,08** | | | | | | |

### Hemp/Wooden tiles

| From inside | Thickness [mm] | kg/m2 | λ | μ | | | | |
|---|---|---|---|---|---|---|---|---|
| Wood cladding | 12 | | 0,13 | 50 | | | | |
| PE foil | 0,2 | | 0,4 | 100000 | | | | |
| Hemp | 475 | 16,625 | 0,04 | 2,8 | | | | |
| Hunton | 25 | 6,35 | 0,13 | 5,00 | GWP: | 60,85 kg CO2-eq. | (Hunton vindspærre 25mm) | |
| Ventilated air | 50 | | 0,75 | 1 | | | | |
| Wooden tiles | 25 | 30 | | | GWP: | 1658 kg CO2-eq. | WISA | * RSL = 30 years |
| **Total thickness of roof construction:** | **587,2** | | | | | **1718,85 kg CO2-eq.** | | |
| **U-value:** | **0,079** | | | | | | | |

# kg CO2-eq saving

| | | |
|---|---|---|
| | **Insulation for wall construction** | |
| Rockwool | 174,9 | kg CO2-eq. |
| Glass wool | 206,6 | kg CO2-eq. |
| Hemp | 76,37 | kg CO2-eq. |
| Wood fiber | 91,13 | kg CO2-eq. |
| | | |
| | **Masonry for wall construction** | |
| Red bricks (new) | 5008 | kg CO2-eq. |
| Red bricks (reused) | 0 | kg CO2-eq. |
| Lime mortar (5,1%) | 18,16 | kg CO2-eq. |
| Cement mortar functional | 43,79 | kg CO2-eq. |
| | | |
| | **Insulation in roof construction** | |
| Glass wool | 512,1 | kg CO2-eq. |
| Hemp | 192,5 | kg CO2-eq. |
| Wood fiber | 231,1 | kg CO2-eq. |
| | | |
| | **Roof cladding** | |
| Zinc | 1537 | kg CO2-eq. |
| Wooden tiles | 1658 | kg CO2-eq. |
| Roof tiles (new) | 1363 | kg CO2-eq. |
| Roof tiles (reused) | 0 | kg CO2-eq. |
| Wind barrier (hunton) | 60,85 | kg CO2-eq. |
| Glued laminated timber | 188,1 | kg CO2-eq. |

| | | |
|---|---|---|
| | **Slab & flooring** | |
| Flensborg tegl flooring 4cm | 921 | kg CO2-eq. |
| Sundolitt EPS | 2690 | kg CO2-eq. |
| Sundolitt EPS Climate | 2111 | kg CO2-eq. |
| FutureCem C20/25 | 2757 | kg CO2-eq. |
| Beton (Ikast) C20/25 | 3505 | kg CO2-eq. |
| Wedi isoleringsplade | 402,3 | kg CO2-eq. |
| Estrich slidlag | 2038 | kg CO2-eq. |
| | | |
| | **Windows** | |
| Alu/alu (Velfac Ribo) | 1428 | kg CO2-eq. |
| Wood/wood | 1025 | kg CO2-eq. |
| | | |
| | | |
| **GWP** | **18335,1** | **kg CO2-eq.** |
| **GWP (optimized)** | **8922,7** | **kg CO2-eq.** |
| | | |
| **GWP saved** | **9412,4** | **kg CO2-eq.** |
| **GWP saved in %** | **51,336** | **%** |

# LCA calculations

## Wooden column and beams

Gruppe: Søjler og bjælker

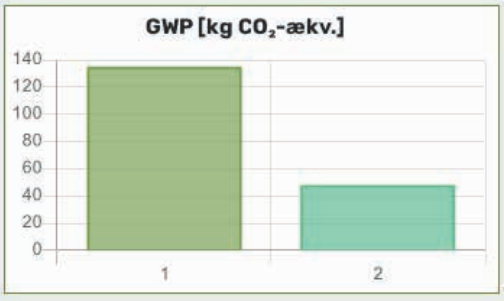
Undergruppe: Andet (søjler og bjælker)

Beskrivelse: Skriv din beskrivelse her...

Medtages i beregningen

### Opbygning

| | Navn | Mængde | Beskrivelse |
|---|---|---|---|
| 1 | Glulam construction | 1 m³ | |
| 2 | Construction timber | 1 m³ | |




## Roof and ceiling

Gruppe: Tage

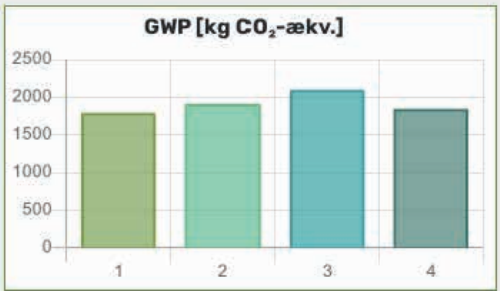
Undergruppe: Tage

Beskrivelse: Skriv din beskrivelse her...

Medtages i beregningen

### Opbygning

| | Navn | Mængde | Beskrivelse |
|---|---|---|---|
| 1 | Zinc roof | 92.1 m² | |
| 2 | Wooden tile roof | 92.1 m² | |
| 3 | Roof tile | 92.1 m² | |
| 4 | Wood ceiling cladding | 80 m² | |




## Slab (EPS & EPS climate)

Mængde: 96,7 m²

Undergruppe: Gulv

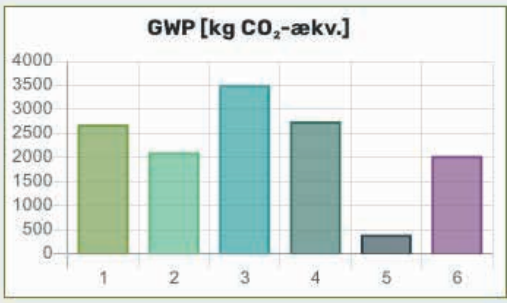
Medtages i beregningen

Beskrivelse: Skriv din beskrivelse her...

Kilde: Bruger

### Opbygning

| | Navn | Mængde | Levetid |
|---|---|---|---|
| 1 | Sundolitt EPS S60 | 5.1576 kg/m² | 80 år |
| 2 | Sundolitt climate EPS | 4.1075 kg/m² | 80 år |
| 3 | Ikast beton C20/C25 | 0.15 m³/m² | 120 år |
| 4 | Futurecem fabriksbeton C20 | 0.15 m³/m² | 120 år |
| 5 | Wedi isolerings plader | 1 m²/m² | 80 år |
| 6 | Uniplan slidlag Estrich beton | 0.12 m³/m² | 80 år |




## Insulating materials for walls

Gruppe: Ydervægge

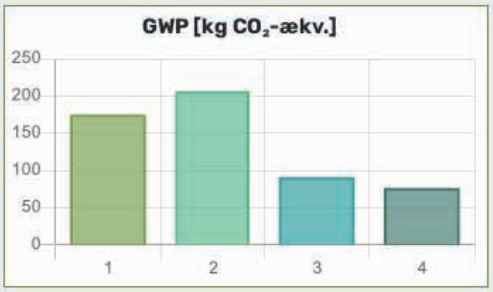
Undergruppe: Ydervægge

Beskrivelse: Skriv din beskrivelse her...

Medtages i beregningen

### Opbygning

| | Navn | Mængde | Beskrivelse |
|---|---|---|---|
| 1 | Wall construction w. rockwool insulation | 551 m² | |
| 2 | Wall construction w. glass wool insulat... | 551 m² | |
| 3 | Wall construction w. wood fibre insulat... | 551 m² | |
| 4 | Wall construction w. hemp fibre insulat... | 551 m² | |



## Wall construction w. hemp fibre in...

Mængde: 55,1 m²

Undergruppe: Ydervægge

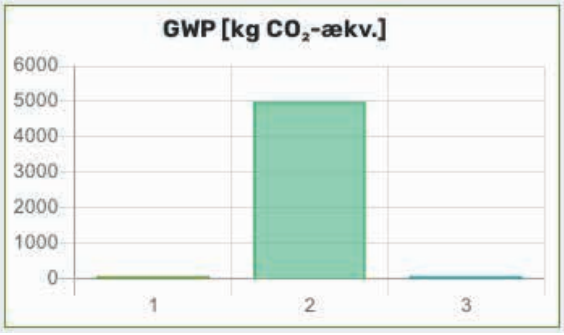
☑ Medtages i beregningen

Beskrivelse: Skriv din beskrivelse her...

Kilde: Bruger

### Opbygning

| | Navn | Mængde | Levetid |
|---|---|---|---|
| 1 | Ekolution® Hemp Fibre Insulation | 11.025 kg/m² | 60 år |
| 2 | Røde mursten uden manganoxid – Helligse Teg... | 583.2 kg/m² | 150 år |
| 3 | Hunton vindtæt 12, 15, 19, 25 mm vindspærre | 255 kg/m² | 60 år |




## Mortar

Gruppe: Ydervægge

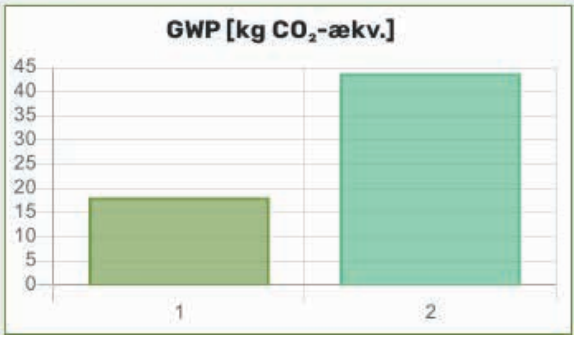
Undergruppe: Ydervægge

Beskrivelse: Skriv din beskrivelse her...

☑ Medtages i beregningen

### Opbygning

| | Navn | Mængde | Beskrivelse |
|---|---|---|---|
| 1 | Lime mortar | 330.6 kg | |
| 2 | Cement mortar | 330.6 kg | |




## VELFAC Ribo Alu & Classic Alu to...

Mængde: 48,9 m²

Undergruppe: Vinduer

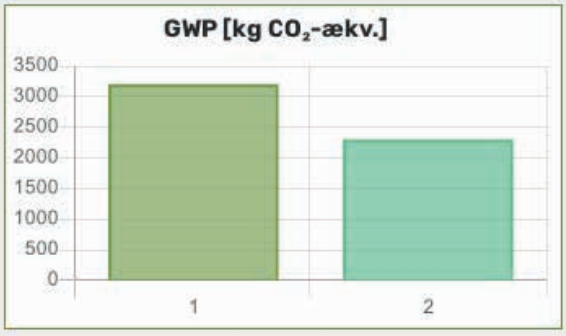
☑ Medtages i beregningen

Beskrivelse: Skriv din beskrivelse her...

Kilde: Bruger

### Opbygning

| | Navn | Mængde | Levetid |
|---|---|---|---|
| 1 | VELFAC Ribo Alu/Classic Alu | 1 kg/m² | 50 år |
| 2 | Vinduer, 3-lags træ vinduer | 1 m²/m² | 50 år |



# Environmental Product Declarations used i LCA calculations

**Insulation**
Rockwool murbatts 37, NEPD-3381-2002
Knauf Formstykker, 37 S-P-10777
Hemp (Ekolution hemp) S-P-10546
Wood fiber (Hunton) NEPD-2287-1041-NO

**Wood**
Glulam (Lilleheden) md-22038-en
Construction wood (Træ.dk c/o Træ- ogMøbelindustrien) md-20002-en

**Roof cladding**
Red roof tiles (Randers Tegl, RT 806) md-22028-en_rev1
Zinc roof (NedZink B.V.) EPD-NED-20200254-IBC1-EN
Wood roof (Træ.dk c/o Træ- ogMøbelindustrien) md-20008-en_rev2

**Acoustic ceiling**
I Wood, md-23091-da_rev1

**Brick**
Red brick (Matzen Tegl: A/S Graasten Teglværk) md-20043-en

**Mortar**
Cement mortar (Vejle Kalk- og mørtelværk), md-23043-da
Lime mortar (Veerst Mørtelværk ApS), md-23034-da

**Slab**
FutureCem C20/25 (Unicon) md-22093-da
Compression slab (Uniplan, Estrich) md-23124-da
Building board (wedi GmbH, structural panel) EPD-WDI-20240309-IBA1-DE

**EPS**
Sundolitt Climate C80, md-24181-en
Sundolitt EPS S60, md-24158-en

**Flooring**
Brick flooring (Egernsund Wienerberger A/S, Helligsø Teglværk) md-22001-en

# 09 PHOTO RIGHTS

## Email A

Outlook

**Re: Tilladelsen til at bruge billeder og information fra hjemmesiden Borum-Lyngby.dk til speciale i arkitektur**

**From** Lokalhistorisk Arkiv for Borum og Lyngby <borumlyngbyarkiv@gmail.com>
**Date** Fri 2025-04-25 16:03
**To** Christine Amalie Revsbech <crevsb20@student.aau.dk>

Hej med jer

I må gerne bruge både billede og tekst.

I kan også få en skriftlig tilladelse til brugen af fotografen. Det er nemlig mig.

Med venlig hilsen

Peter Poulsen
arkivleder
Indbygger i Borum siden 1974

**Lokalhistorisk Arkiv for Borum og Lyngby Sogne**

**www.borum-lyngby.dk**

**Postadresse: Langelinie 69, Borum, 8471 Sabro**

**Besøgsadresse: Lyngbygårdsvej 41, Lyngby, 8220 Brabrand.**

**Åbningstid: Sidste tirsdag i månederne august-juni kl. 13-16**

**Også åbent på andre tidspunkter efter aftale**

**Telefon (arkivleder Peter Poulsen): 2068 8084**

Den fre. 25. apr. 2025 kl. 12.54 skrev Christine Amalie Revsbech <crevsb20@student.aau.dk>:

Hej

Vi er en gruppe fra Arkitektur kandidaten på Aalborg Universitet, der er i gang med at skrive vores speciale omkring gentænkning af middelalderkirken i landsbyen. Vi tager udgangspunkt i Borum og har et samarbejde med præsten Ghita. Vi ønsker at bruge:

Billede af nedrivning af kapellet ved Borum Kirke samt informationerne i opslaget "Kapellet på murens top". Link: https://www.borum-lyngby.dk/?p=1213 & https://www.borum-lyngby.dk/wp-content/uploads/2011/05/Kapel-rives-ned.jpg

Vi henviser selvfølgelig til jeres opslag som kilde for både informationen og brugen af billedet. Som vi forstår, har I ophavsretten til billederne på hjemmesiden, men er der alligevel en kendt fotograf, som skal krediteres for billedet, vil vi meget gerne at dette er afklaret med ham/hende.

Vi ønsker en skriftlig tilladelse til brugen af billedet og informationen i artiklen, da specialet bliver udgivet offentligt.

I er velkommen til at kontakte os ved spørgsmål eller yderligere afklaring. På forhånd tak.

Venlig hilsen
Hedda, Louise og Christine
Kandidaten i Arkitektur, Aalborg Universitet

## Email B

Outlook

**Sv: Billedrettigheder til 2 billeder fra konferencen 'Landsbykirkens fremtidige rolle'**

**From** Rikke Lykkebo Pedersen <rikkelykkebo@outlook.dk>
**Date** Sat 2025-04-26 11:00
**To** Christine Amalie Revsbech <crevsb20@student.aau.dk>

Hej Hedda, Louise og Christine!

Tak for Jeres henvendelse! I har min tilladelse til at bruge billederne i jeres speciale 🙂 Held og lykke!

Bedste hilsner / Best regards

**RIKKE LYKKEBO**
FOTOGRAF / PHOTOGRAPHER

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rikkelykkebo@outlook.dk
https://rikkelykkebo.myportfolio.com/

**Fra:** Christine Amalie Revsbech <crevsb20@student.aau.dk>
**Sendt:** 25. april 2025 13:43
**Til:** rikkelykkebo@outlook.dk <rikkelykkebo@outlook.dk>
**Emne:** Billedrettigheder til 2 billeder fra konferencen 'Landsbykirkens fremtidige rolle'

Hej

Jeg håber, det er den rigtige mail jeg har fat i. Vi snakkede kort sammen i slutningen af konferencen 'Landsbykirkens fremtidige rolle' d. 6/3. Vi er en gruppe fra Aalborg Universitet, kandidaten i arkitektur, som er ved at skrive speciale omkring gentænkning af kirken i landsbyen.

Vi ønsker potentielt at bruge 4 af dine billeder fra konferencen. Det drejer sig om nr. 52, 141, 160 og 164. Jeg har vedhæftet dem i mailen. Da specialet bliver udgivet til offentligheden, vil vi bede om skriftlig tilladelse fra dig til at gengive billederne. Du vil selvfølgelig som fotograf blive krediteret og der vil blive henvist til hjemmesiden kirkenpaalandet.dk, hvor billederne er downloadet fra.

Kontakt os endelig for uddybning, hvis det er nødvendigt. På forhånd tak.

Venlig hilsen
Hedda, Louise og Christine
Aalborg Universitet, Kandidaten i arkitektur

# Email C

**From:** Dánial Magnusson Haraldsen <Danial.Magnusson.Haraldsen@natmus.dk>
**Sent:** 30 April 2025 15:49
**To:** Christine Amalie Revsbech <crevsb20@student.aau.dk>
**Subject:** SV: Tilladelse til brug af billeder og tegningsmateriale fra Borum Kirke til speciale projekt, Arkitektur på Aalborg Universitet

Kære Christine,

Tak for din mail. Det er godt, at I skriver. Jeg kan godt huske, at jeg foreslog jer at sende en liste med illustrationer for at dobbelttjekke eventuelle billedrettigheder.

Jeg kan desværre ikke åbne de billeder, I har vedhæftet. Har I mon mulighed for at vedhæfte dem på anden vis? Det er blot for at se, hvad det er for nogle billeder, hvor fotografs navn ikke er angivet. Jeg kan dog betrygge jer med, at billederne af HM (Hugo Matthiessen) og RS (Robert Smalley) er underlagt en CC-BY-SA licens, hvilket betyder, at I gerne må anvende billeder – sågar til publikation – forudsat at I blot krediterer Nationalmuseet, fotografens navn samt oplyser licenstype. Det kunne være i en billedtekst, der ser således ud: Nationalmuseet, Hugo Matthiessen, CC-BY-SA.

Jeg kan desuden ikke se, at der skulle være noget til hinder for at I gengiver tegningsmaterialet fra Gert Madsen i jeres speciale.

Held og lykke med specialet.

Med venlig hilsen / Best regards

Dánial Magnusson Haraldsen
Studentermedhjælper / Student Assistant

Besøg Nationalmuseets hjemmeside

Oldtid, Middelalder og Renæssance / Prehistory, Middle Ages and Renaissance
Telefon / Phone

Læs om Nationalmuseets behandling af personoplysninger.

**Fra:** Christine Amalie Revsbech <crevsb20@student.aau.dk>
**Sendt:** 25. april 2025 15:36
**Til:** Dánial Magnusson Haraldsen <Danial.Magnusson.Haraldsen@natmus.dk>
**Emne:** Tilladelse til brug af billeder og tegningsmateriale fra Borum Kirke til speciale projekt, Arkitektur på Aalborg Universitet

Hej Danial

Vi var d. 19/2 på besøg hos jer på Antikvarisk-Topografisk Arkiv, hvor du havde fundet materiale frem omkring Borum kirke (8741 Sabro). Vi ønsker at bruge noget af materialet til vores specialeprojekt, som bliver offentligt udgivet. Derfor har vi brug for en **skriftlig tilladelse** til dette.

Det drejer sig om følgende billeder, som bliver medtaget i rapporten:
- Billede af korbuen: Negativ nr. R 72821. Fotograf: RS. År: 1978 IMG_2717.jpeg
- Billede af gulv opgravning: Bygningsarkæologisk udgravning nr.1. Jnr. 65/78 Fot.nr.3. Fotograf Mogens Svanning, 1978 IMG_2700.jpeg
- Billede indvendigt i kirken mod koret: Neg. Nr. 31342. Fotograf: HM. År: 1934 IMG_2721.jpeg
- Billede af kirken og kirkegården fra nord: Nrg. Nr. 31272. Fotograf: HM. År: 1934 IMG_2695.jpeg
- Billede af kirken og kirkegården fra syløst: Neg. nr. 31341. Fotograf: HM. År: 1934 IMG_2693.jpeg
- Billede af præstegården: Neg. Nr. N/A. Fotograf: N/A. År: N/A IMG_2735.jpeg

Desuden følgende tegningsmateriale, der bruges som grundlag til analyser og optegning af kirken i 3D, hvilket skal bruges til præsentationsmateriale til projektet:
- Planer: grundplan, loftsplan og tagplan (eksisterende og nye forhold): Skitseprojekt af Tegnestuen v. Gert Madsen i 2009
  - 20250219_135424830_iOS.jpeg
  - 20250219_135437532_iOS.jpeg
- Snit (eksisterende og nye forhold): Skitseprojekt af Tegnestuen v. Gert Madsen i 2009
  - 20250219_135343203_iOS.jpeg
  - 20250219_135404434_iOS 1.jpeg
- Detaljer af tagfod (eksisterende og nye forhold): Skitseprojekt af Tegnestuen v. Gert Madsen i 2009
  - 20250219_134133201_iOS.jpeg
  - 20250219_134159448_iOS.jpeg
- Grundplan af kirken på transparent papir, måske fra 1983. 20250219_140054329_iOS.jpeg

Kontakt os endelig, hvis du har behov for uddybning. På forhånd tak.

Venlig Hilsen
Hedda, Louise og Christine
Kandidaten i arkitektur, Aalborg Univeristet

Outlook

**SV: Tilladelse til brug af billeder og tegningsmateriale fra Borum Kirke til speciale projekt, Arkitektur på Aalborg Universitet**

**From** Dánial Magnusson Haraldsen <Danial.Magnusson.Haraldsen@natmus.dk>
**Date** Wed 2025-05-14 15:33
**To** Christine Amalie Revsbech <crevsb20@student.aau.dk>

Hej Christine,

Tak for det.

I har hermed tilladelse til at bruge billederne.

Med venlig hilsen / Best regards

Dánial Magnusson Haraldsen
Studentermedhjælper / Student Assistant

Besøg Nationalmuseets hjemmeside

Oldtid, Middelalder og Renæssance / Prehistory, Middle Ages and Renaissance
Telefon / Phone

Læs om Nationalmuseets behandling af personoplysninger.

**Fra:** Christine Amalie Revsbech <crevsb20@student.aau.dk>
**Sendt:** 9. maj 2025 10:22
**Til:** Dánial Magnusson Haraldsen <Danial.Magnusson.Haraldsen@natmus.dk>
**Emne:** Re: Tilladelse til brug af billeder og tegningsmateriale fra Borum Kirke til speciale projekt, Arkitektur på Aalborg Universitet

Hej Dánial

Det lyder godt, tak. Vi krediterer billederne, som du har beskrevet.

Jeg har forsøgt at vedhæfte de to billeder som ikke er af hhv. HM og RS:
- Billede af gulv opgravning: Bygningsarkæologisk udgravning nr.1. Jnr. 65/78 Fot.nr.3. Fotograf Mogens Svanning, 1978
- Billede af præstegården: Neg. Nr. N/A. Fotograf: N/A. År: N/A

Jeg håber du kan se billederne nu, og at du kan verificere, at vi også kan bruge disse.

Med venlig hilsen
Christine

# ACKNOWLEDGEMENT

A special thanks to all participating and guiding the project. A thanks to our supervisors Lars Brorson Fich and Jesper Thøger Christensen for your collaboration and guidance throughout the project period.

To Maj Bjerre Dalsgaard for her PhD dissertation, lecture, and workshop which gave the basis for this master thesis.

To priest Ghita Pflug and the inhabitants of Borum for opening their church for us, letting us to get to know the village, participating in the workshop, and opening their hearts and minds to rethink possible future use and appearance of their church.

A thanks to the National Museum of Denmark for letting us visit the Archive of Antiquarian and Topography to gain knowledge about the history of Borum Church and letting us use drawing material and photos.

The master thesis, as it presents, would not have been the same without your participation and enthusiasm.