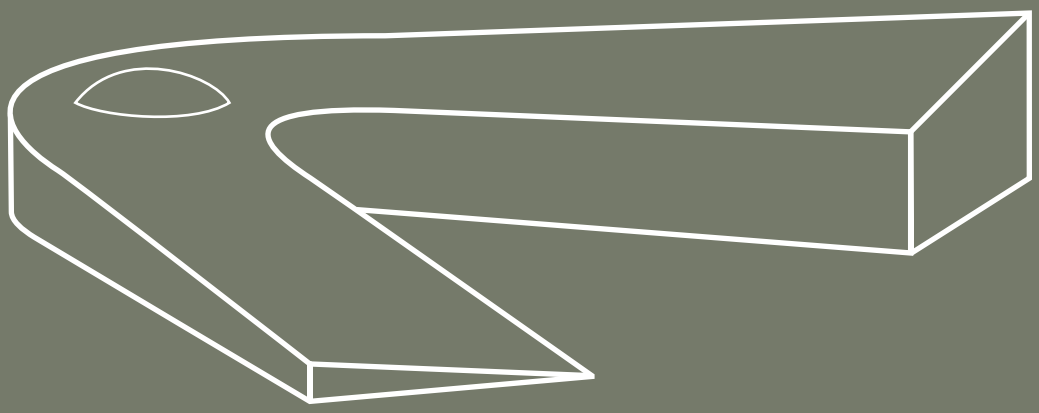

VEJLE LIBRARY & CULTURE HOUSE

PROGRAM & PROCESS

TITLE PAGE

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Project:	Master thesis
University:	Aalborg University
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UNIVERSITY

STUDENT REPORT

PREFACE

This report is part one out of two reports that constitutes the master thesis project of group Ma4-ark10 in spring 2021 of the programme Master of Science in Engineering (Architecture) at Aalborg University. This report presents the analysis and the process behind the design.

This project is made in collaboration with Vejle Bibliotek as they are soon to start up a process of developing the library as a culture house in connection to Vejle Music School and Vejle Culture School. In the collaboration the group will get the insight of new plans for the city and the library, contact to relevant parties of the project, and sparring on the problems in the library as it is today.

The purpose of the report is to produce a proposal for the new building and hopefully inspire the development and evoke a debate between citizens, local planners and politicians on the possibilities, both in the context of urban planning and as part of cultural and social development.

The work intends to show the design process and final proposal for a new library and culture house. The report describes the methodology, demarcation, analyses and conclusions on the design of a new library and culture house.

ABSTRACT

This project proposes a design for a new library and culture house in Vejle developed by group 10, MSc04 Arc, Aalborg University. The foundation of the project is built on learning, social and environmental sustainability. The project aims to support the learning taking place in the building by introducing design principles that enhances different types of learning.
Through analysis of the existing building, site, and context the concept developed and determined that the existing building would not be used in its existing form. Therefore, investigations of reused materials lead to a focus of using low emission materials and reuse of the materials from the existing building.
The final design is following the volunteered sustainability class ensuring good indoor climate and low energy performance of the building.

READING GUIDE

The project work is divided into two reports, a process report and a presentation report. They are intended to be read in the following order; process report first and presentation report thereafter. However some parts are repeated in the presentation report, to make the presentation report to be able to stand alone in case one is only interested in the final design solution and not the process behind it.

This report is the process report, which constitutes the work of the process behind the final design solution. It introduces the project boundaries and the theme it revolves around. Then it presents the analyses conducted to determine a design basis for the project. Finally the process of developing the design is explained.
The project as a whole, meaning both process and presentation, is concluded and reflected upon.

Through the analysis the findings will be gathered in a sub-conclusion at the end of each chapter, concluding how it can be integrated in the design. At the end of the analysis all findings are summarised into design criteria in the Design Basis chapter.

The motivation behind this project was always ‘learning environments’ and how it relates to sustainable architecture. It was therefore decided to limit the scope of the project to these themes, so that there might be more time and energy devoted to this. This means that certain parts have been worked on a mostly conceptual level i.e. the layout and detailing of the offices or the structurural system.

Note: In these reports, the future music- and culture school will be refered to as just “the culture school”.

CONTENT

PROLOGUE

In this chapter the background and motivation for the project is unfolded, setting the scene for the project and explaining the theme, how it relates to the place and how it will be approached in terms of sustainability.

Furthermore the overall methodological approach to the project is described as well as methodologies used through the different phases of the process in the project.

MOTIVATION

LEARNING

The motivation for this project is rooted in learning and how architecture can contribute to this. This topic as main focus inspired an investigation of learning and learning facilities to determine the type of it the project would embrace.

The first thing that comes to mind, might be schools and learning in general is often associated with schools, however there are many different types of learning facilities and ways in how we learn. The school setting as we know it from e.g. primary schools is formal and structured around a mandatory and predetermined learning, and it is limited to a specific period, e.g. from childhood to early adulthood. However we learn throughout our entire lives, whether it is through experiences, hobbies, people or places, these types of learning are more sporadic, informal and sometimes subconscious. So what kind of setting substantiates this life-long learning?

THE LIBRARY

The setting in a library constitutes an informal, voluntary and sometimes subconscious learning, where people can come by their own choice and choose their own topic of interest. This also means the environment, hence the architecture is different from other learning settings as e.g. a school. This spiked an interest in libraries and to look further into how the design can affect learning and invite for it.

Vejle has a need for a new library and is already in the process of starting such a project, it caught our interest as the framework for a learning-foccussed building. As they also wish to integrate the music and culture school in the project, it only contributed to the learning focus to add these voluntary learning facilities to the building. Thus the second focal point is to create a synergy and interplay between these three organisations and make them benefit from each other. The three organisations have expressed a vision and some specific wishes for the new culture house, which is also used in this project as a guideline for what this new building should incorporate. These wishes are described in Appendix 1: Design Brief on page 122.

SUSTAINABILITY

The motivation was further based on sustainability, for a responsible and conscious design for the present and the future.
This implements a focus on environmental sustainability though a life-cycle perspective, more specifically on sustainable materials.
As the Vejle already has a library and the new building is to be at the same site, possibly an extension or an entirely new building, the third focal point is to investigate the materials of the existing library and how these can either be reused or recycled in the new building.

As learning in general and thereby also the library has a significant role in our society and development, it requires a focus on the people and the community in the city. This motivated the fourth focal point on social sustainability, both in terms of providing the settings for learning and in terms of gathering the local community and the surrounding areas to a whole.
The latter also embraces Vejle's wish for the area to be more integrated and attract the local community. This is also part of the District Plan for the area, which is further described in Appendix 2: District Plan on page 123.

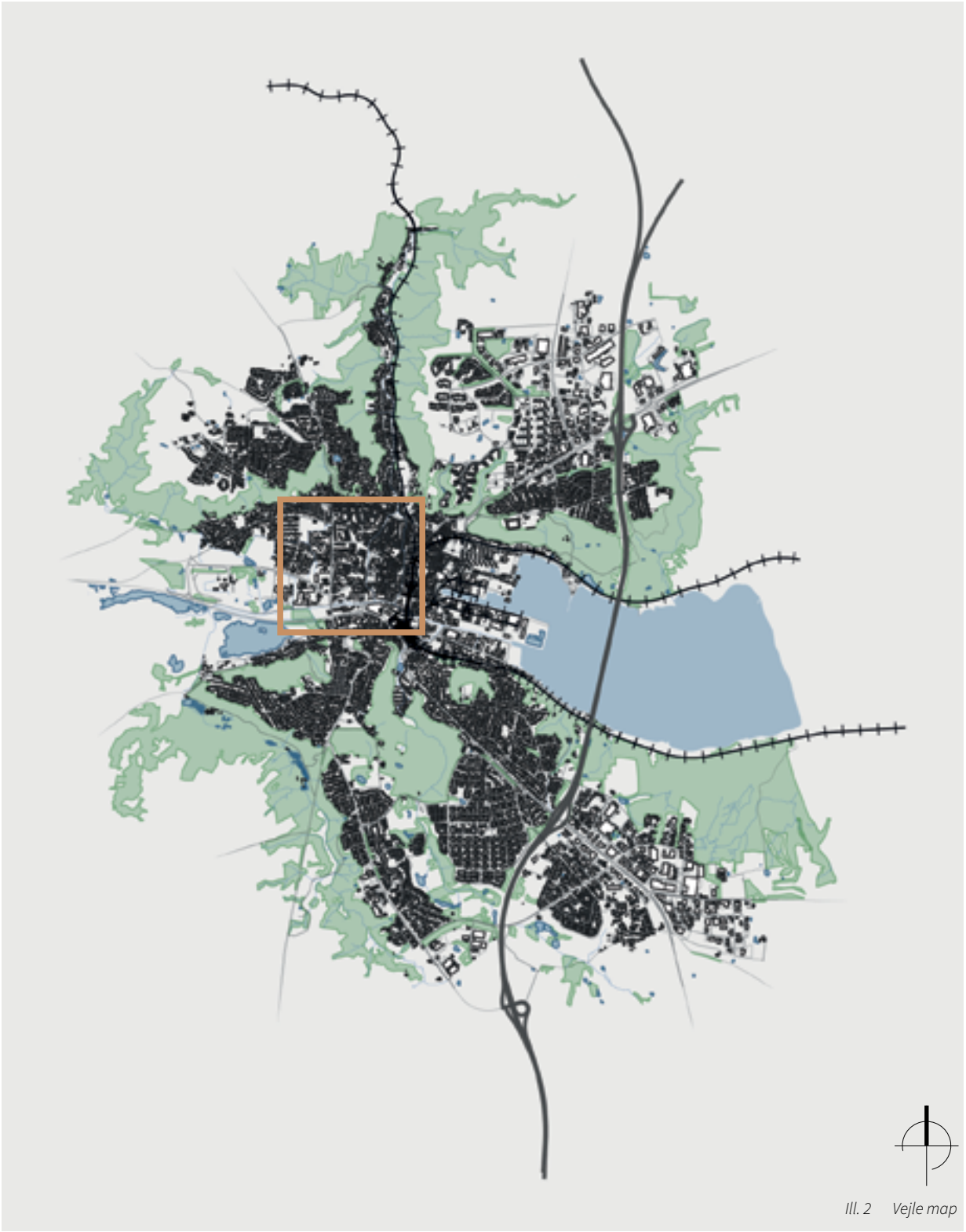
INTRODUCTION

Libraries have existed for thousands of years and have developed ever since. They have always created the framework for knowledge and education. Today the traditional library functions are often combined with other public activities in a hybrid building where they have to operate together and even support each other.

Vejle is a city in southern Jutland in Denmark with an ambition of becoming a cultural and educational acknowledged city and a new library and culture house should promote this. They wish to combine the existing library with the music school and culture school of Vejle and thereby integrate learning and culture. The challenge is to accommodate these three different organisations under one roof and meet all their different needs.

This project embraces the aforementioned topic in relation to cultural development and learning environments, through the design of a new public library and culture house in Vejle. It aims to integrate the various activities and their users and promote the interaction between them to achieve a coherent design. Furthermore the project focuses on the relation to the context and how the building can contribute to the ambition of Vejle.

Ill. 1 Map



Ill. 2 Vejle map

VEJLE

A CITY OF DEVELOPMENT

Vejle means ford (in Danish: vadested) and is placed in the node of Grejs Å, Vejle Å and Vejle Fjord. From the 11th century the city has been in constant development starting as a trade and craft city with great competition from nearby cities. In 1850 Vejle developed to a distinctly industrial town with iron foundries and cotton spinning mills. In the 20th century the food industry as Tulip and the gum factory Dandy took over as the leading companies in the city.

THE CULTURAL CITY

An interesting cultural environment is a strong competitive factor between the cities in the contemporary Denmark. Since the 1990's Vejle has developed as a cultural city starting with Torvehallerne, Musikteatret and Spinderihallerne. The cultural environments are supported including the underground culture and the experimental artists, which mostly is to be found in the old industrial area in western Vejle where the old buildings of De Danske Bomuldsspinderier are transformed for the purpose. The goal for the City Council of Vejle is to stand out strong on the cultural map of Denmark.

THE RESILIENT CITY

The city of Vejle is in constant development; today the ambitions is to be resilient. As a part of the City Council's vision "Vejle with Will" (Vejle med Vilje) Vejle became a part of a global network called 100 Resilient Cities, as the first city in Europe. The aim is to be a municipality of precedence and innovation. In 2016 Vejle Municipality started the project with four strategical focal points: The co-creative city, climate resilience, social resilience, and smart city. Towards 2050 the city of Vejle will make long-term solutions of changing difficulties to new resilient solutions.

On a political level the city is also working with the Sustainable Development Goals (SDG's) from the United Nations.

RESILIENT STRATEGIES

The co-creative city:
The municipality will integrate resilience in the strategies for the city with collaboration across all sectors and departments of the municipality. Furthermore, a cooperation with business and educational institutions will help the city develop from an industrial to a knowledge-based society.

Climate resilience:
The city should be protected from flooding and make the water an innovative element of recreational areas. Furthermore, a progressive conversion for renewable energy, circular economy and sustainable mobility is built upon existence initiatives as a basis for the urban development.

Social resilience:
Strengthen the common mindset and the approach to social resilience throughout
the municipality, in co-creation with citizens and companies for increased cohesion.

Smart City:
Utilize the digital technologies and create a city for resources, learning, and events. A resilient Smart City is also one which is secured against cyber-attacks and ensure that citizens have access to public information and the opportunity to participate in the development of society.

THE INTEGRATED DESIGN PROCESS

The architectural design process is dynamic and ever-changing and therefore it can be hard to define. To be able to get an understanding of it the Integrated Design Process is used to describe it.
The integrated design process (IDP) is the overall methodology used in this project through all phases. It is an iterative process that evaluates every part and step in relation to the initial problem to secure the best possible outcome. It aims to ensure coherent solutions between form, function, construction and sustainability throughout the construction project.

As the design process is complex to describe the integrated design process diagram (*Ill. 3*) is a simplification of the process that can be used to describe the overall idea of the process. The process can roughly be divided into 5 phases: problem, analysis, sketching, synthesis and presentation. The phases represent different elements that are part of the process, however these are not always divided as the diagram illustrates, they often happen simultaneously. Furthermore the progress is not as linear as the diagram shows, as the process is iterative as mentioned before and thereby it goes back and forth between the phases. As more knowledge is acquired, new investigations are required and the problem can develop through the project.

THE FIVE PHASES

Problem
The problem phase is where the basis for the project is defined with a problem definition or the project idea.

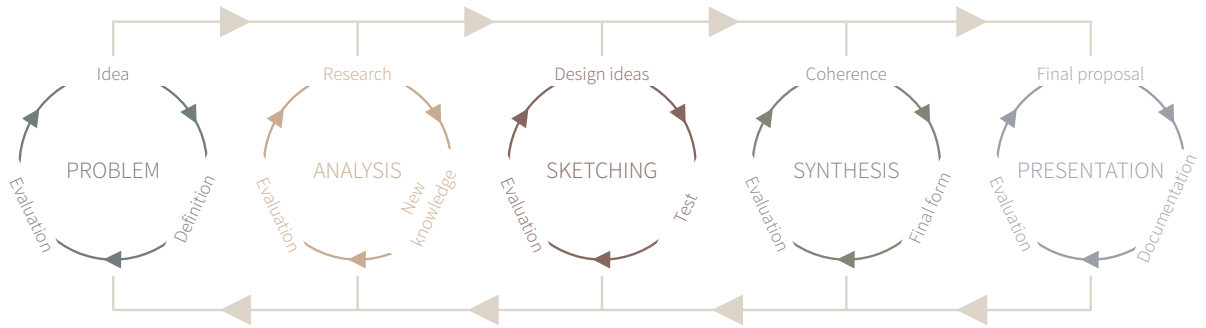
Analysis
The analysis phase investigates all the relevant aspects related to the problem, such as the site, context, theme, users, technical solutions, sustainable strategies, etc.

Sketching
The sketching phase applies the principles from the analysis to design ideas and tests solutions.

Synthesis
The synthesis is where the design is collected into a whole, where the functional, technical and aesthetic creates a coherence.

Presentation
The presentation contains the final proposal of the project, represented through drawings, models and visualisations.

(Knudstrup, 2004)



Ill. 3 IDP diagram

METHODOLOGIES

PHASE	METHOD	DESCRIPTION	HOW WE USE IT	PURPOSE
Analysis	Research / Literature review	Is a method of theory building and obtaining existing knowledge within a topic.	By investigating a specific topic's state-of-the-art, historical background or applicable regulations.	To obtain a knowledge base for understanding of a certain topic.
	Mapping	Is a method for analysing and communicating spatial information of the context.	By studying maps and highlight significant elements on it.	To get an understanding of the context.
	Phenomenological studies	Is a qualitative method of analysing the experience being in or moving through a built environment.	By documenting the (sensory) experience of a specific space or pedestrian route, with pictures.	To determine the experienced atmospheric qualities of the site or getting to and arriving at the site.
	Micro-climate	Is a method for analysing and communicating climatic information of the context.	By performing charts from statistics on the micro-climatic conditions on the site.	To determine possibilities for energy saving, indoor climate, and outdoor spaces.
	SAVE	Is an assessment method of the preservation value of a building.	By registration of character and assessment of conservation values.	To decide whether to build new or renovate the existing building and add an extension.
	Case studies	Is a method for investigating existing solutions.	By studying an example of a similar building or element.	To determine good solutions based on experience from others.
	User interviews	Is a method for analysing a topic and collect information.	By asking open questions about the topic, the interviewed can lead the focus.	To collect data and understand the needs and wishes of the users.
	User questionnaire	Is a method of data collection.	By making a survey of questions to a specific group.	To get an insight of the user's perspective on the building.

Ill. 4 Methodology table

PHASE	METHOD	DESCRIPTION	HOW WE USE IT	PURPOSE
Design Process	Sketching	Is a fast and flexible method of visualisation or representation of ideas.	By exploring and layering ideas and concept with a marker on paper.	To quickly explore and share thoughts and ideas of concept and design.
	Physical models	Is a method for studying, developing and communicating design ideas.	By exploring and testing materials, structural elements, scale, form, etc.	To get an idea of the scale in the context and determine the form or structure of the building.
	3D models	Is a method for investigating, developing and visualising design ideas.	By modelling in a BIM program such as Revit.	To develop and show physical and functional features.
	Daylight simulation	Is a method for analysing the light circumstances in the building.	By investigating how the size and type of windows affect the light inside the building.	To determine design solutions for optimizing daylight in the building.
	LCA	Is an method for assessing the resource consumption and environmental impacts of a material or building element.	By calculating all the climate impacts through it's entire life-cycle: production, construction, operation and end of life.	To reduce the impact by choice of materials and structural solutions.
	Be18	Is a method of investigating energy use.	By calculating energy demands according to building envelope, technical installations and energy source.	To document that a building complies with the energy class.

LEARNING ENVIRONMENTS

As part of the resilience strategy in Vejle, one of the focuses is to be a knowledge-based city. The culture house brings together the library, music school and culture school which means that knowledge-sharing and learning automatically becomes a keystone in the project.

In this chapter the theory of learning is investigated to figure how the knowledge on the field can enrich the project of new culture house. It is essential to understand how we learn to get an understanding of how a building or interior design can enhance learning and education.

LIFELONG LEARNING

Lifelong learning was introduced in the Delors report "The treasure within" by UNESCO in 1996 to set a common goal of learning and ensure the opportunity to develop throughout a lifetime, not least in the third world countries. In the very same rapport, they described four pillars of learning that remains pivotal to the present challenges of education. (Carneiro, 2015)
In Denmark there is a long tradition of learning, and it is secured that everyone gets the opportunity to educate. Starting from the public school, high school and later the choice of education the Danish government support the citizens to have a good educational basis to build their life on.
Lifelong learning is a term with more than one meaning. In this project lifelong learning is the learning throughout life: The skills acquired in school must be developed to remain usable for the rest of life. Personal development, hobbies and work-related development is some of the themes adults often search when they are realizing themselves. (Lotze, n.d.)
According to the Reggio Emilia learning philosophy open ended learning is the anchor to lifelong learning where there is no right or wrong, which allow students to explore and use their imagination while learning. (Open Ended Learning: What, Why, and How, n.d.)
The Reggio Emilia approach is developed in Italy for preschools. They see children as powerful and capable beings who just need to be guided to realize their potential and expand it. Open-ended learning inspires the children to think, wonder, and ask questions which develops a critical thinking to use throughout the lifelong learning. (Valentine, 2006)
The philosophy can be adapted to learning environments adults as well; Especially in workshop areas or meeting spaces as an informal meeting between the users. Here an open-ended learning space can create curiosity and invite to learning. (Migliani, 2020)
According to Amos Blanton, researcher at Interacting Minds Centre at Århus University, the creativity spaces should be playful, informal, and a little messy. He also notes that documentation is very important, therefore the spaces should encompass this in the design. The documenting the process of learning (not just the results) makes the learning visible. Therefore, the learning spaces should have various possibilities of showing the progress e.g., shelves, boards, screens etc. (The Power of Documentation in a Reggio-Inspired Classroom, 2018)

Learning to know
A general knowledge with possibilities of working in depth on subjects of interest. Learning to learn makes it possible to enjoy learning throughout all stages of life.

Learning to be
The development of the personality and be able to handle personal judgment and responsibility. It emerges to be a timeless priority to ensure self-fulfillment as inner journeys to get balanced relations in life.

Learning to do
The bridge of bringing knowledge and skills in action, to acquire not only practical skills, but also handle skills as working in teams.

Learning to live together
To develop empathy for others and get an understanding of interdependence. Develop responsibility and accept the differences of people regardless of gender, ethnicity, religion, wealth etc.

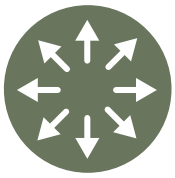
(Carneiro, 2015; Lotze, n.d.)

LEARNING ENVIRONMENTS

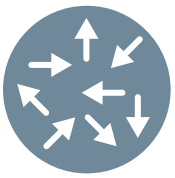
Designing spatial experiences can inspire, motivate, and energize learners and educators. If the physical environment encourages learning it is more likely that people in all ages will take advantages of it and create lifelong learning for themselves whether it is attended or unattended. (Bosch, 2018)
Rosan Bosch has developed a design principle for learning environments divided in six spaces. These design principles can be used in every context of learning e.g., schools, libraries, and exhibitions to support the different kinds of interaction in their learning environments. (Bosch, 2018)

Mountain top
Establish a space for individuals communicate to a group and share knowledge in one direction. The audience will sit on the mountain e.g., formed as stairs. It can be used for presentations, lectures, book readings, theater etc.

Cave
Offers individuals a place for concentration, focus and reflection. It is characterized as small quiet and embracing spaces that not necessarily is isolated. In the cave a non-communicating learning can take place.

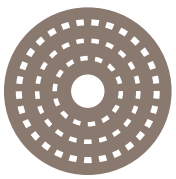


Camp fire
Provides an introvert space for group-based activities where interaction, collaboration and dialogue are in focus. It offers more or less formal situations for knowledge sharing, problem solving and creativity.



Watering hole
Informal spaces with many disturbances that can be places strategically and attracts different users e.g., entrances, hallways, and exhibition areas. It is offering meetings to small talk, new contacts and get distraction.

Hands on
Creative spaces that offer the link between theory and practice for body and brain experiences. It should inspire and motivate by sensory learning experiences that piques curiosity. It can be formed as workshops, studios, or labs.



Movement
Spaces that nudge people to move around as a natural part of the design. The spaces must clearly indicate that they give room for activities with movement and encourage both low intensity and high intensity movement.

(Bosch, 2018)

CASE: OODI LIBRARY

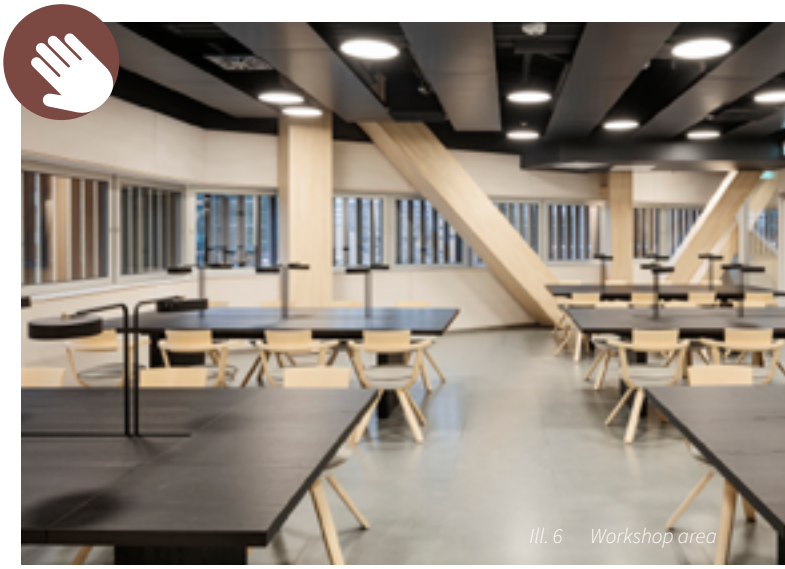
THE LIBRARY AS A SETTING FOR LIFE-LONG LEARNING

This case study focusses on the learning spaces in a library within a cultural building. The case study will reveal an example of how to integrate the six design strategies for learning environments.

Oodi Central Library in Helsinki (*Ill. 5*) consists of almost entirely public spaces and offers the public a wide range of services. The functions of the library are divided into three distinct levels: The ground floor is for active spaces and services, the middle floor is for more specific services as the library room, and the upper floor is more relaxed with space for workshop areas.
On the ground floor there is a café, auditorium, and exhibition facilities. The rooms are flexible so both a movie theatre and a multi-purpose hall can open up and be a part of the lobby. With adaptable rooms they can house both smaller and larger events.
The watering hole is to be fund in the lobby where light furniture encourages to short time stays (*Ill. 7*). (Åvontuura, 2020)

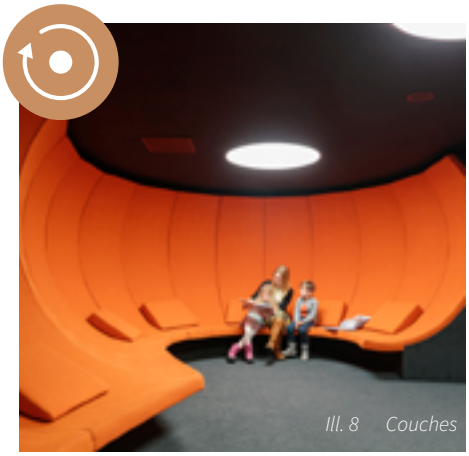
On the middle floor the library area is to be found together with camp-fires (*Ill. 13*) and a mountain top (*Ill. 11*). The area around the stairs on the mountain top is formed as polygons which invites to movement. In the library area there is also caves as single enclosing chairs or the chairs along the windows (*Ill. 10*).
On the top floor meeting rooms and workshop space is placed which gives place for hands on experiences. There is both a workshop area with tables (*Ill. 6*) and one formed as a mountain top (*Ill. 9*) which allows different kinds of maker spaces and living labs. Furthermore the upper floor have rooms for recording studios, photography studio, editing rooms and office spaces (Åvontuura, 2020).

Ill. 5 Oodi Central Library, Helsinki



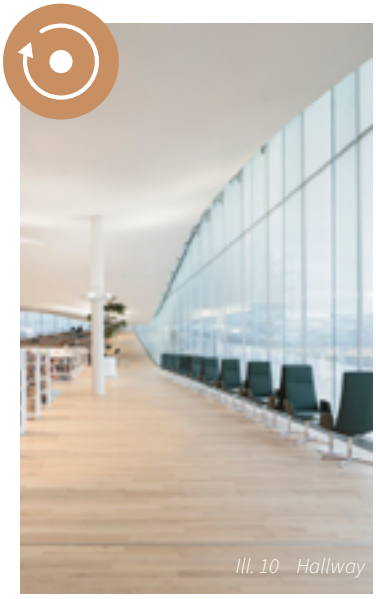
Ill. 6 Workshop area

Ill. 7 Lobby

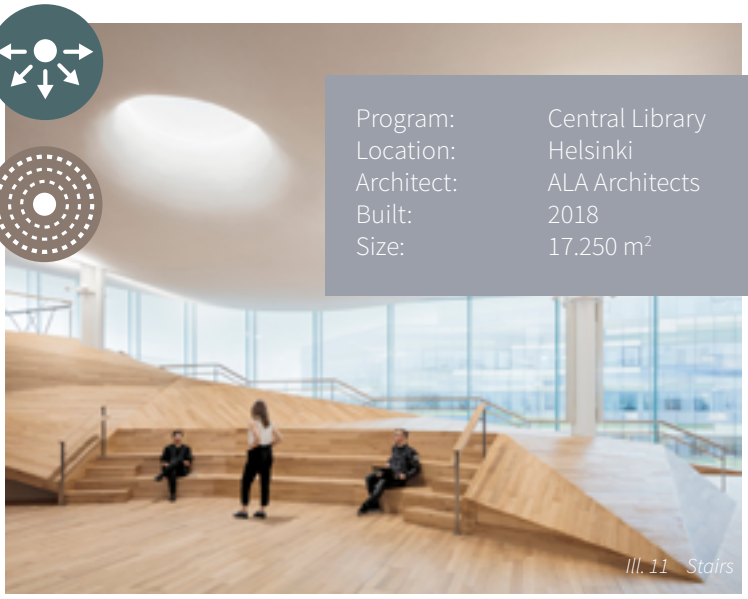


Ill. 8 Couches

Ill. 9 Workshop area/mountain top



Ill. 10 Hallway



Program:	Central Library
Location:	Helsinki
Architect:	ALA Architects
Built:	2018
Size:	17.250 m²

Ill. 11 Stairs

Ill. 12 Couch area

Ill. 13 Sitting area

SUB CONCLUSION

What both the library, the music school and the culture school have in common is learning. Learning is a vital part of being a human being and starts from the day we are born. Learning should follow us for the rest of our lives, and here lifelong learning becomes an important concept.
Lifelong learning allows us to develop throughout our lives either when we face a crisis, we get a new hobby or just by interest.
The four pillars of learning (learning to be, learning to know, learning to do, and learning to live together) is important for this self-development. Open-ended learning from an early stage of life teaches children to think, wonder, and ask questions which is a good foundation for lifelong learning. Open-ended activities can opposite awaken adults that have forgotten how to use their creativity. These activities can also be ice-breakers in the meeting between strangers.
The design strategies of Rosan Bosh and the fundamental thoughts of open-ended learning from Reggio Amelia approach is aimed to integrate in the future culture house of Vejle. Both is operating with spatial variations and as a knowledge based building, learning environments should be an integrated part in the layout and interior design.

USER ANALYSIS

The new library and culture house will combine the library, the music school and the culture school into one unity. The three have very different functions, users and needs that need to be incorporated in the new building.

In this chapter the users from respectively the library, the music school and the culture school are explored and defined, as well as their needs for the future building and their time schedule for usage of the building.

VEJLE BIBLIOTEK

Vejle Bibliotek is the main library of the five libraries and the book bus in the municipality. Furthermore, Vejle is one of the six central libraries of the country covering the southern Jutland and Middelfart Library on Funen. This demands the library to house larger events beside the daily activities that found in a public library. (Vejle med Vilje, 2021)

The library consists of 70 staffs, and there are nearly 1000 visitors at the library of Vejle each day. The visitors are children's families, students, readers, newspaper readers, some interested in music or movies and many more. (Vejle Bibliotekerne, n.d.)

Outside the working hours of the staff the library is available as an 'open library' with self-service. A survey of the visitors on Vejle Bibliotek (Slots- og Kulturstyrelsen, 2016) show that 48% of the users have tried open library, but only 47% of those feels safe staying at the library without staff.

The year around there is a large number of events to be found on the library. They teach and make workshops for the visitors and make the library come to life. Vejle Bibliotek collaborate with the city's other cultural life and are hosting cultural events and meetings. (Vejle Bibliotekerne, n.d.)

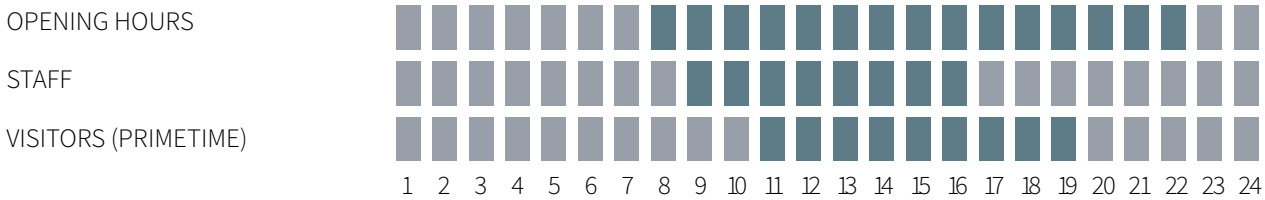
Wishes:
- Vejle Bibliotek wish to have less space for collection and more space for gathering people with fewer shelf meters but easy and quick access.

- In the digital zone and the creativity zone there should be space for people and experiments.

- There should be space for immersion together with places for students and the ones who search knowledge.

- The knowledge should be found on shelves, screens, in workshops and the hall.
Space for waiting, meetings and playgrounds – both for adults and children.

- The learning should happen in both the indoor and the outdoor facilities.



THE LIBRARY IN NUMBERS

GENDER AND AGE

Male	30%
Female	70%

The average age is 54 years, and 39% have children living at home.

EMPLOYMENT

Public	34%
Private	26%
Studying	6%
Umemployed	34%

KIDS

39% have kids living at home

0-2 years	13%
3-7 years	34%
8-12 years	39%
13-16 years	23%
youths 16+	44%

VISITHOURS

Weekday	7-10	3%
	10-13	20%
	13-16	21%
	16-19	36%
	After 19	6%
Saturday	10-13	9%

The remaining opening hours 0-1% uses the library

OPEN LIBRARY

The concept 'open library' is longer opening hours but without staff in the morning and evening.

Open library have made 54% of the visitors that have tried it, use the library more.

MATERIALS

Fiction	85%
Non fiction	71%
Music	38%
Movie	32%
Games	9%
Papers, magazines	42%
Children materials	39%

USE OF THE LIBRARY

Borrow materials	98%
Read	62%
Work	24%
Internet	27%

EVENTS

Events for adults	60%
Events for children	30%
Workshops and learning	27%

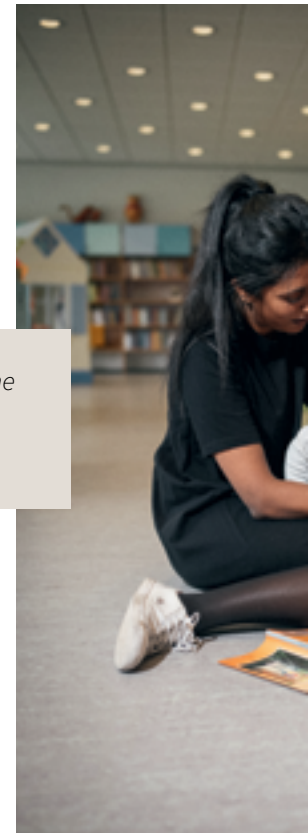
ARRIVAL

Car	47%
Bicycle	31%
Pedestrian	17%
Bus	5%

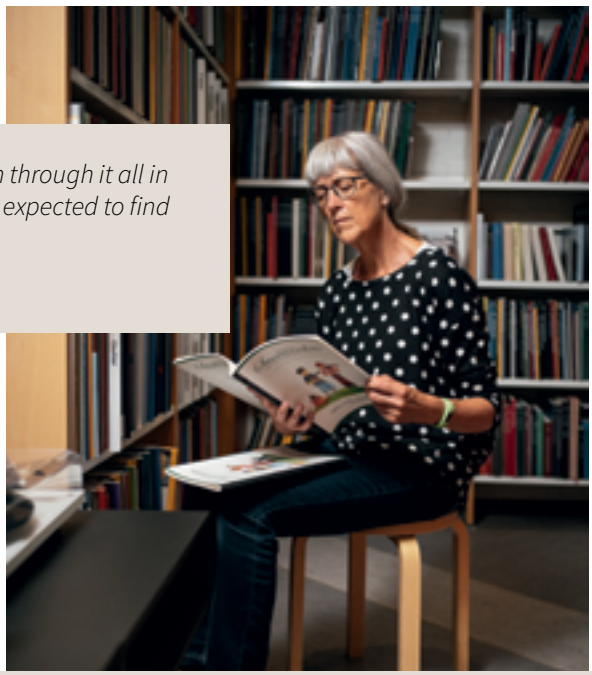
(Slots- og Kulturstyrelsen, 2016; Appendix 7: User survey on page 130)

Pictures & quotes from Jonas Norman's photo exhibition at Vejle Bibliotek:
"To all who carry the stories on" (Norman, 2020).

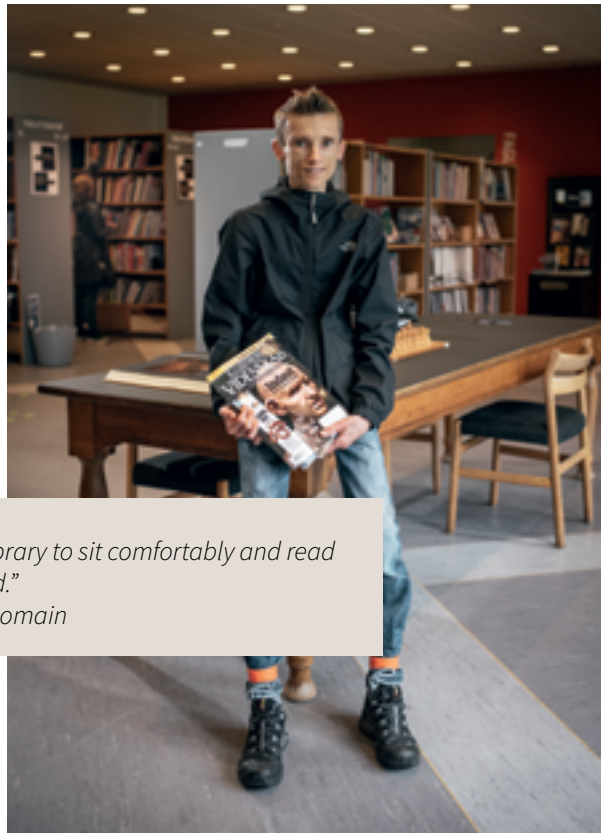
"We live in Denmark where the library scheme is favourable, so the many visits to the library are quite simple to save money."
– Preben Christensen

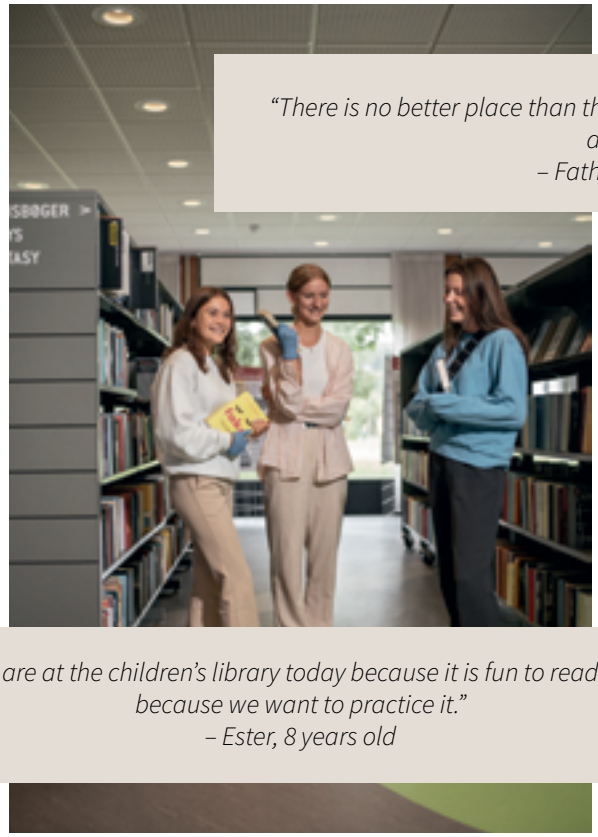


"It is a cosy and quiet place where you can search through it all in peace, and you often find something you had not expected to find and it is very inspiring."
– Music teacher Manny



"There are so many kids and adults who spend all their time on a screen today. Hopefully a day like this will be a memory for Lærke about that books can do something different than an ipad."
– Grandfather Arne





“There is no better place than the library to sit comfortably and read aloud.”
– Father Romain

”We are at the children’s library today because it is fun to read and because we want to practice it.”
– Ester, 8 years old

“The library is a place where everyone can come, without being invited, without needing anything special.”
- Preben Linke

Ill. 14 Vejle Bibliotek users collage

VEJLE CULTURE SCHOOL

TEATHRE AND DRAMA

ART

FILM MAKING

CREATIVE WRITING

CULTURE CLUB

Xeneriet is a culture school in Vejle, which provides experimental performing arts and culture for and made by children and young people between the ages 0 and 25.

The culture school provide education in drama, theatre, arts, film and writer workshops and try to create a creative framework for learning and playing, with a focus on creativity and curiosity. Through this the school provides a sense of community as well as a place for immersion and reflection for the students.

The existing school consists of different rooms for the different classes, workshops and a theatre stage. The stage is available for local performances and can be booked by schools or institutions.

Xeneriet is open from 8.00 where the four administration meets. There are seven teachers who comes early to prepare the lessons for the 200 students the culture school educates. The children arrive after the end of their school day which depends of their grade, but the first lessons starts 15.30.

WISHES
- More stage space
- Lots of storage
- Acoustics
- Blackout drapes

ADMINISTRATION

TEACHERS

STUDENTS

VEJLE MUSIC SCHOOL

Vejle Music School is educating kids and youths from 0-25 years in instrumental knowledge. Vejle Music School is the main school of the five music schools in the municipality. The schools are managed by 5 administration staff and 35 teachers.

There is activity in the music school from 8.30 where the firsts teachers come in and prepare for teaching until 22.00 where the last interaction groups and bands end their rehearsals. Kids in school age will normally go to the music school by the end of the school day – kids from the private school will meet in earlier than kids from the public school. Some kids will also get the possibility to use the facilities in their spare time and lock themselves in with a chip if there is no staff in the building.

The existing music school consist of seven smaller classrooms for single education and smaller groups and two bigger rooms for larger groups. Furthermore, they have a student waiting room, teachers' room, small kitchen, and wardrobe.

STRING INSTRUMENTS

WIND INSTRUMENTS

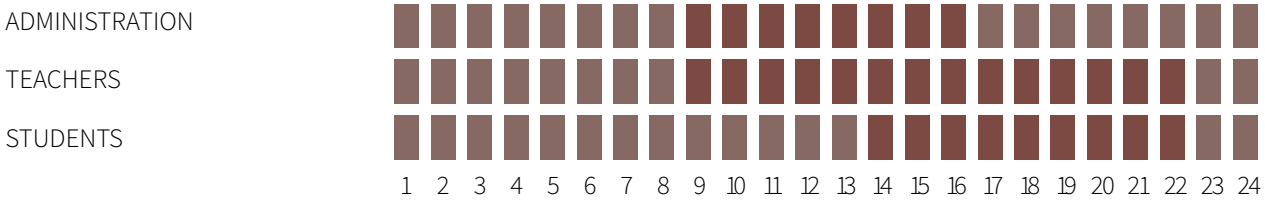
PERSUSSIONS

COMPOSITION

BAND

SONG AND CHOIR

WISHES
- Larger rooms for teaching approximate 8 students.
- Lots of storage connected to teaching rooms.
- Easy access for moving instruments.



USERS NEEDS

With the combination of library, culture school and music school there will be a lot of users in the new culture house of Vejle. This division is made to get an overview of the basic needs of the users in the building. Some of the staff members have same needs and can therefore share spaces, which also could enrich the collaboration between especially the culture and music school, but also the library.
There will also be additional staff for the café, cleaning, and maintenance. A further description is made in the Room Program on page 70.

FAMILIES
LIBRARY VISITORS

To support the relation between children and parents the library should be an informal experience space for learning, playing and inspiration of lending materials.
The family's needs space for strollers, comfortable seating, and inspiring spaces.

LIBRARY STAFF

There are 70 employees at Vejle Library, who needs office spaces shared in smaller groups, a shared break area, coffee area, formal and informal meeting spaces.
The library staff also have tasks to do in the floor of the library and associated areas.

YOUTHS/STUDENTS

LIBRARY VISITORS

The interior should be cosy with room for meetings and relaxation.
It is important with study spaces for groups and individuals. The library should support the co-creation and the "do it yourself"- movement the youths is grown up with.

ADULTS/ELDERLY

LIBRARY VISITORS

This is the largest user group of the libraries, and they share the need of spaces for immersion and inspiration.
Furthermore, the elders read newspapers, seek help for IT, and uses thve library events.

ADMINISTRATIVE STAFF

The administration of the library, culture school and music school have shared working hours, and especially the administration of the culture school and the music school could benefit of sharing office.
The culture school have 5 staff administrative staff members.

CLEANING AND MAINTENANCE STAFF

Cleaning and maintenance of the building is important in order to provide a good experience for the visitors and staff.
Therefore, the cleaning and maintenance staff requires easy access and storage.

LIBRARY

CULTURE SCHOOL

MUSIC SCHOOL

CULTURE AND MUSIC SCHOOL TEACHERS

The teachers of the culture and music school share same needs for facilities: preparation, meetings, and breaks.
Spatially it requires rooms of varying size and interior.

MUSIC STUDENTS

The music students varies from small children accompanied by their parents to young adults and differentiates between a variety of instruments and vocal classes.
However they all have a shared requirement for the classrooms to have suitable acoustics and furthermore to have a space for social interaction, breaks and waiting for classes to start.

THEATRE STUDENTS

The drama students need facilities with blackout drapes, lighting, and acoustics. Furthermore, they need spaces for co-creative corporations and individual lessons.
For performances they use stages as a flexible black box or more informal places.

ART-, CREATIVE WRITING-, AND MOVIE STUDENTS

Though they have different special needs according to the subject, both spatially and equipment-wise, they share the need of having inspiring surroundings matching their specific subject. e.g. writing classes taking place in a space surrounded by books.

STUDENT'S PARENTS

As the students of the culture and music school are younger than 25 years, it is presumed that there will be a lot of parents to bring and pick-up children, and even accompanying their children to the classes

CAFÉ STAFF

The new culture house will have a café offering coffee and food in the building.
Therefore, they also should have easy access to meeting rooms, break spaces, and stages.

MINDS OF LIBRARY VISITORS

This is a phenomenological analysis, based on a questionnaire of the visitors of Vejle Bibliotek (Appendix 7: User survey on page 130), that investigates how the visitors approach learning and what the library means to them.

INSPIRATION

The most used method to seek information in general is to be in nature. Next is the internet or social media. Many of the visitors also seek inspiration through their network e.g., family, friends, colleagues, or other social relations or events.
Additionally sources as newspapers, literature, podcasts, documentaries, travels and experiments are also used to find inspiration in life.

IMMERSION

The majority of the respondents expressed the importance of deep immersion and what is necessary for this. Many mentioned immersion being related to having a good cup of coffee or tea, quietness, and a comfortable seating e.g., a chair, couch or at a table with good lightning.
Furthermore, a view for gazing, a place in the sun or outdoor seating is valued. A few mentions that they need to get their kids activated with something else or that they need a more closed space.

THOUGHTS ON THE LIBRARY

There is a general gratitude of the library system and free sources of knowledge and materials. It is an important place for many people and an oasis of inspiration, immersion, and possibilities. The belonging is strong as some have visited the library since they were children and now come there with their own children or grandchildren. It is a sanctuary for many of the visitors.
The library is also a social meeting place and a workspace with quietness, but still with a pulse. The event create cohesion and knowledge sharing. The families with children appreciate the children's library and events related to it. Here are possibilities to get inspiration, learn to immerse, play, and get a timeout from the daily rush.

SUB CONCLUSION

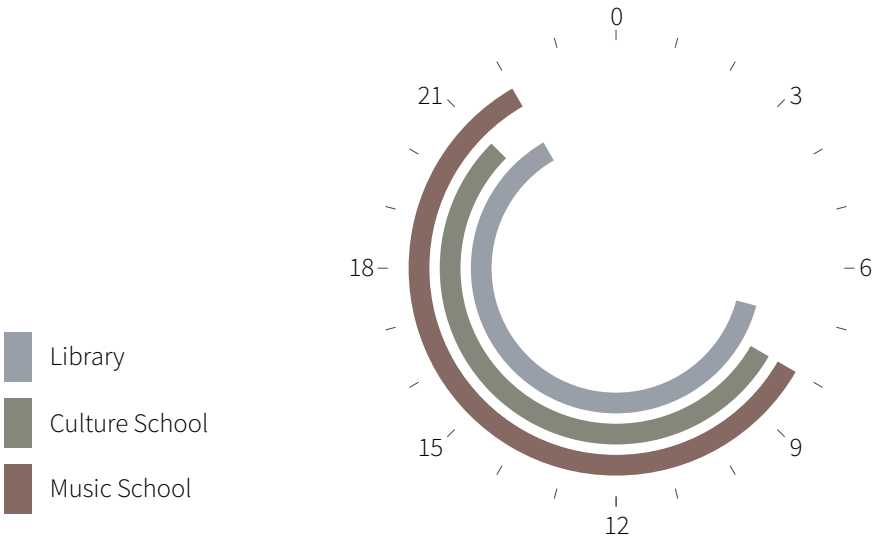
The new culture house in Vejle will consist of three different organisations with multiple user groups in each and thereby different needs of space. Some of the spaces are public and others are more private

By merging the different user groups new synergies could arise. The culture school and music school both have courses that overlap with each other, and therefore the placing of the teachers could add value to both schools. Furthermore, some areas needed for both schools can be shared. The co-creative collaboration could create new networks and a greater synergy for the aggregation of the schools.

The library provides a lot of knowledge that both of the schools can benefit from e.g., nodes, movies, literature etc. Furthermore, different principles of learning environments can be placed within the library, e.g. mountain tops or campfires, which would encourage classes of writing or movie making. This would create more life in the library by distributing the facilities of the different organisations.

The numbers of the library showed that 48% of the users have visited the 'open library', and that it has made 54% of those use the library more. It means that nearly half of the visitors use the library when it is without staff. As a public place it sets some requirements of safety, and in the existing library only 47% of those who have tried 'open library' feels safe.
As the culture school and the music school both have classes to 22.00, which also is the closing time for the 'open library' it will become more life in the building. This could make the library users feel safer when visiting the building without library staff being present.

The new culture house will attract new user groups in addition to the ones already connected to the library. These new user groups are first and foremost the users of the culture school and the music school. Furthermore, the new culture house will most certainly attract new users interested in e.g., the cafe or new possibilities for events, but also simply out of curiosity.



LIBRARY DESIGN

Libraries have changed a lot through the centuries to eventually become the libraries we know today, many of which are complex hybrid buildings combining many different functions.

In this chapter the evolution of libraries is explored with a focus on the societal role of the library, to get an understanding of its relation to the city. Furthermore specific design concepts for successful libraries are examined as well as themed case studies to identify best practice design principles.

THE LIBRARY'S ROLE IN SOCIETY

A TEMPLE OF KNOWLEDGE

The library has always played an important role in our society contributing in our social, cultural and intellectual development. Traditionally it was a place for preserving knowledge as well as for reading and studying, and only for the privileged and literate. It represented power and prestige and the architecture was often monumental, with no visual contact to the interior and often with an enormous staircase to the entrance as the New York Public Library (*Ill. 15*) separating the building from the general public. Throughout history the library has evolved as the society evolved. New types of knowledge material and new technologies emerged. As people became more educated and society increasingly democratic more and more people could use the library, leading to a change in activities available and spatial setting for it. The constant evolving library makes it ever-more complex to define (Hille, 2019).

A LIVING ROOM IN THE CITY

Today new media and mass communication has changed the library significantly, and the material and activities have increased massively leading to a much broader user-group and facilitating a variety of social interaction. Now the library represents a new kind of social centre in the city and is a place available for everyone (Hille, 2019). The library has evolved from being "a temple of knowledge" to "a living room in the city" (Worpole, 2013).

Libraries today are informal and dynamic places where people can meet, read, discuss and explore ideas, a public living room, as the LocHal library in the Netherlands (*Ill. 16*), contributing to cultural development. It is very much dependent on the specific city and site. The social and cultural context of its location determines what the library's role is, what it has to offer and how it can give value to the city. The architecture is often extroverted and open to the surroundings, inviting the city inside, by being a continuation of the urban space and dissolving the border between inside and outside. The entrance is at street level and the facade is transparent to give direct visual contact to the interior, as the Book Mountain in the Netherlands (*Ill. 17*), which appears open and inviting for the visitors and thereby encouraging community use. The floor plans are open, flexible and adaptable to support the differing activities and to accommodate the future (Hille, 2019).

"A city with a great library is a great city" (Worpole, 2013).

A MEETING PLACE

The digital revolution has increased communication and made everything more accessible, but it might also segregate culture, by not exposing people to interests and values that are different from their own. A student, a pensioner and an immigrant would seldom meet and interact with each other, which is necessary for our cultural development.
Many public places are not for everyone, e.g. a church usually only attracts people with an interest in it. Therefore it is crucial for our society and its cultural and social development to have public places that promote multicultural meetings and interactions. The library is one of the places where different people meet each other regardless of age, gender, religion, interests, etc. (Audunson, 2005). Thereby the library still plays a very important and relevant role. For people to engage in the library, it should also be a place they feel a relation to. It should be nice to be in and to look at. It should be a building they are proud of. A place of the citizens (Worpole, 2013).

THE LIBRARY'S ROLE IN VEJLE

The existing library houses different activities and has a variety of different users. It is mainly related to knowledge but also has different other events. It is a place for reading, studying, workshops, performances, courses, etc. and new activities are being tested. The library is generally well visited and the public show interest in its activities. However the building itself is in some ways lacking to express and accommodate this. The facade is somewhat introverted and closed, with no interrelation with the surroundings, e.g. the park and Vejle Å, and it hides the activities inside.

The future library wants to combine library and culture functions and thereby become a vital part of the city. Furthermore the library wants to be resilient to be able to stay a vital part in the future. This correlates well with the library being a living room in the city and a meeting place. It should be inviting and including, providing a place for community by engaging with people and the city. The new library also has an important role of tying the surrounding neighbourhood together, e.g. with the development of New Rosborg the city will be extended to the west, making the library a centre of this new part of the city. This new centre should attract newcomers to the city and provide a place for them to be part of the community. When being a new social centre, accessibility is vital, meaning the library should be connected to the different routes people follow through the city. The library also has a responsibility of preserving the natural qualities, e.g. the park and Vejle Å, which provides opportunities for interaction with nature.

Ill. 15 New York Public Library

Ill. 16 LocHal

Ill. 17 Book Mountain

CASE: DOKK1

THE LIBRARY AS A SOCIAL CENTRE

DOKK1 is the largest public library in Scandinavia and characterizes a new generation of hybrid libraries. It houses many different functions as a library, a culture house and a community centre, which makes it a place for meeting, knowledge and cultural exchange. It is a place for a variety of activities as events, working, hanging out, etc. (SHL, n.d). This case study focusses on how the design promotes the building as a social centre in the city.

CONTEXT AND FORM

The building is placed in the centre of the city and right at the waterfront, where it plays a vital role of tying together the city centre and the transformational harbour front (SHL, n.d). It connects to the surroundings by having access from all directions and by not having a front and back side (*Ill. 18*). The form of the building also reflects the contexts with its twists and turns and the scale of the surrounding building and harbour elements. The facade is equally transparent and inviting from any direction and gives a 360 degree view of the city from inside the building, providing a relation between inside and outside and a continuation of the urban space.

SPATIAL COMPOSITION AND CIRCULATION

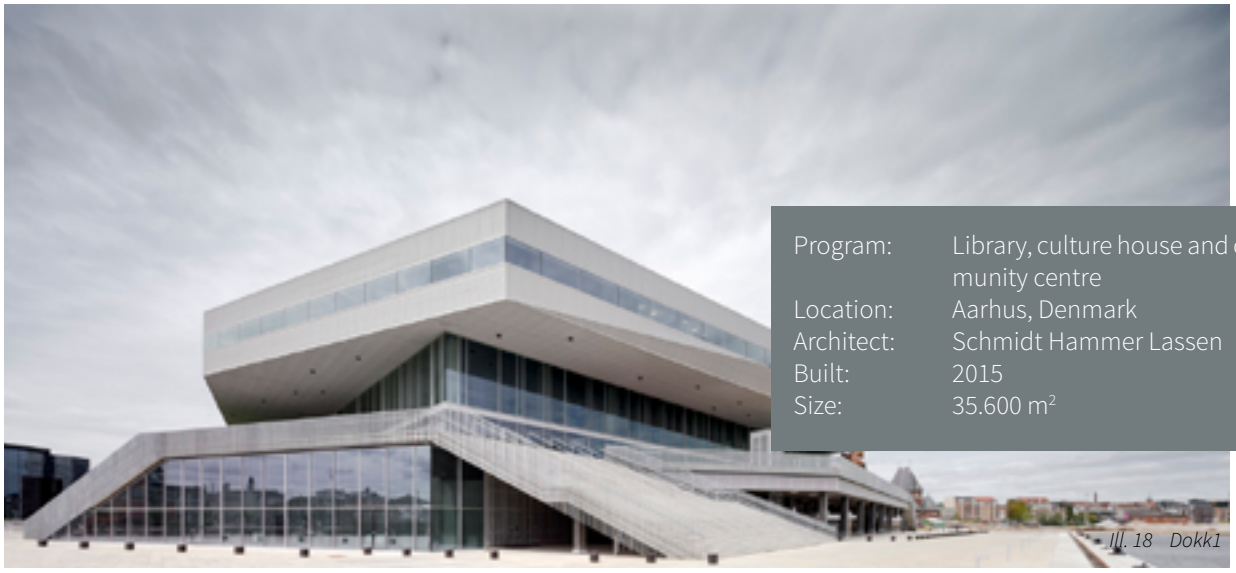
The interior is characterized by an open floor plan (*Ill. 19*), which is flexible, adaptable and provides overview and visual connection between the different functions. Though the different functions are separated in different zones, they are still one unity and can support each other. By exposing people to the different functions it inspires engaging with them. Furthermore it inspires and encourages social interaction between the users and promotes cultural exchange (SHL, n.d).
The layout of the plan promotes a circular movement, as there is not a one way route to follow through the building. From entering the building you immediately have a clear overview of where the different functions are located, and can move in any direction according to the purpose of the visit. The different levels are connected by a large ramp and staircase which also functions as a space for specific activities and can be used for performances and exhibitions (*Ill. 22*).

EXPRESSION AND CHARACTER

Apart from the welcoming expression of the facade, the building is also a landmark with its great size and its distinctive and eye-catching appearance. It attracts attention and more than a million visitors each year (Stiften, 2018), not only users but also as a tourist attraction. It is an icon of the city of Aarhus. Each level is twisted from the previous and has a different form, which gives a dynamic impression that almost seems like the building is rotating. Furthermore this also gives a dynamic and playful experience when moving around the building outside, where each turn provides new discoveries contributing to an interesting urban space (*Ill. 18*).

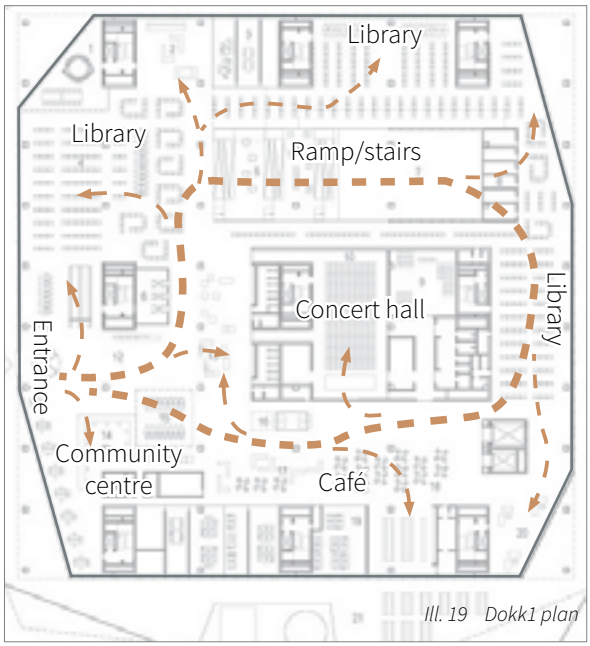
MATERIALITY AND STRUCTURE

The materials used in the building are simple, robust and easy to maintain. The main material is concrete, which is also the load bearing structure. As a contrast to the concrete wood is used on interior surfaces that are in contact with the users (*Ill. 20*) and metal is used for the facade reflecting harbour elements as e.g. shipping cranes (*Ill. 21*) (SHL, n.d).



Program:	Library, culture house and community centre
Location:	Aarhus, Denmark
Architect:	Schmidt Hammer Lassen
Built:	2015
Size:	35.600 m^2

Ill. 18 Dokk1



Ill. 19 Dokk1 plan

Ill. 20 Contrasting materials

Ill. 21 Exterior materials

Ill. 22 The multipurpose ramp

CONCEPTS OF LIBRARY DESIGN

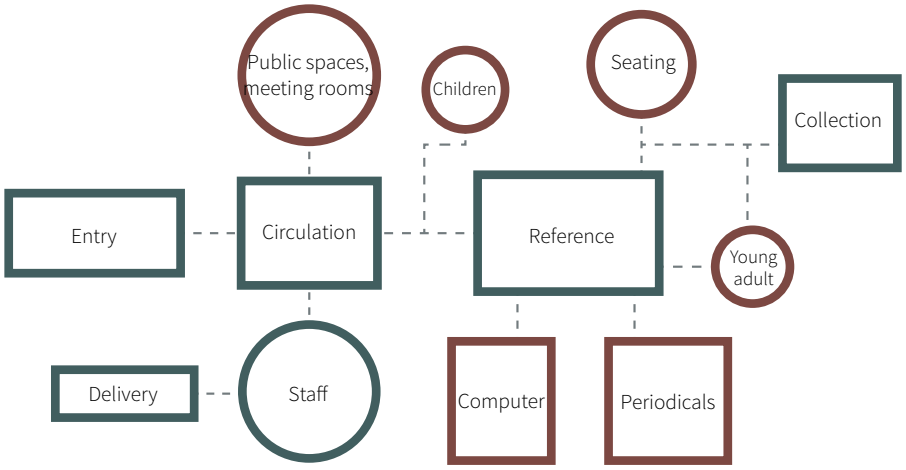
Even though the library is an age-old institution, the fast-increasing improvement of digital technologies meant that many believed that physical books and libraries would very soon be a thing of the past. This proved to be untrue, but the digitalization did impact libraries and how they are designed from that point on. Since information no longer needed to exist on a physical basis in a physical location in the library it did have a big and lasting impact on the library-program. Many established elements were downgraded in importance and some even removed entirely, but the overall relationships between the core functions remained relatively the same.

LAYOUT

The core elements of the modern library are as follows: entrance, circulation, reference/information, staff rooms, collections, and seating. These are universal for all libraries, large or small. Even though much has changed about libraries through the years because of digitalization and automation, these functions have remained roughly the same.

This connection between the core elements and their typical adjacencies described in the illustration are what Liliane Wong describes in "Libraries – A design Guide" as necessary to ensure proper function of the library. She writes: "*[…] They reflect the universal values for the working of the library; efficient movement of materials, clarity of travel for the different users, separations between different user groups, and security for all users and equipment.*" (p. 50, Lushington, Rudorf, and Wong, 2016). Meaning, that when designing a new library, it is best practice adhere to this overall structure of these spaces. This is well-established since there are only minor differences between the daily operations of most libraries.

A core function element has an overall relationship with the library as a whole, and a specific relationship to its immediate neighbours. thus, the resulting adjacencies can affect and does frequently dictate the flow between the core functions.
Adjacencies, in this case, would be other less essential functions in the programme. These functions could be reading rooms, children and young adult services, rare books, maps, newspapers and magazines, and public spaces such as meeting rooms, study rooms, exhibit space or auditoriums. Supporting functions to the library programme could be a theatre or a café.



Ill. 23 Core elements of library design

WAY-FINDING, ORIENTATION, AND SIGNAGE

Orientation and signage in libraries are essential aspects of the building which is often left to the librarians and other staff. This is not determined somewhere or by someone, but because libraries have evolved and change around a lot these last decades, the responsibility has fallen onto these people to adapt the signage in their library themselves. This is of course not ideal since these solutions are often improvised or poorly integrated.

What is ideal is for the routes through the building to be defined from the outset by the architect via the architecture. Moving through a building should – ideally - be intuitive. Way-finding is therefore a product of the architecture and it should help one to navigate the building using more atmospheric clues and rely less on orientation aids (Lushington, Rudorf, and Wong, 2016).

Orientation and signage in a library is much like any other public buildings where the aids have to be addressed to each individual situation. Signage should preferably be moveable and not hinder the user when trying to navigate the library, i.e. the flush rubber mats at the Seattle Central Library.

CHILDREN, TEENS AND YOUNG ADULTS

Since the introduction of the children into the library in 1895 the section for children and young adults has evolved a lot. Today's modern libraries have moved away from the bright primary colours and cut-outs of popular characters and now more towards creating good, universal learning environments for development and learning through current interests, style, contemporary child development theory, education, and community building.

Despite of the growing advances in digital media, the concepts for development of children's spaces focus less on digital and much more on physical learning through experimentation and experiences. This is done by creating a multi-layered space with infinite possibilities of use which stimulates creativity and curiosity. These environments often emphasize this by using playful shapes and deliberate colour strategies to highlight elements integrated in the architecture. (Lushington, Rudorf, and Wong, 2016)

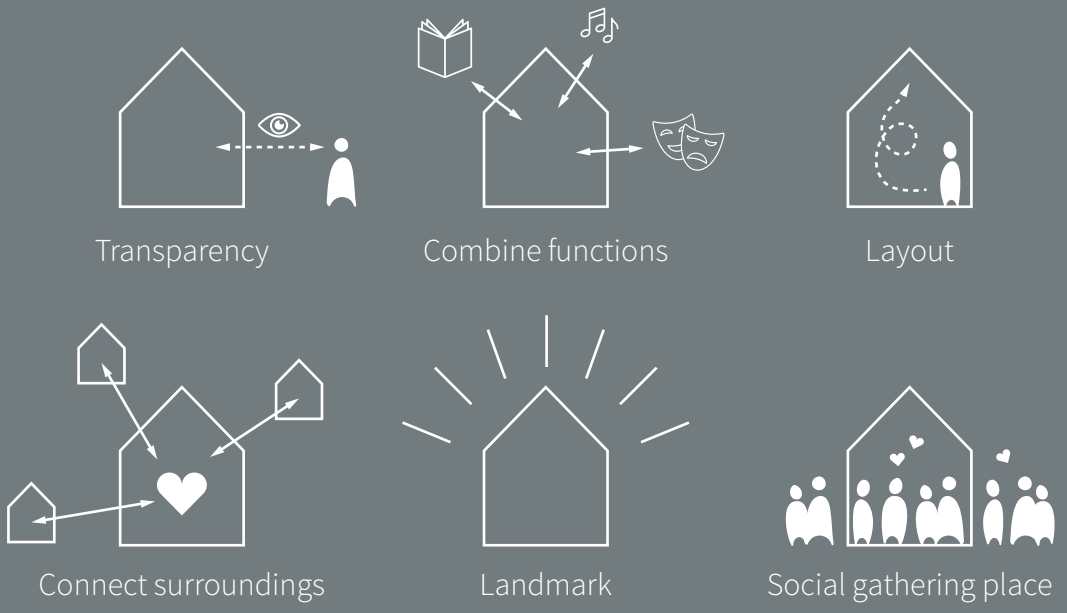
"A children's and young adults library serves as a public square… where they can feel free to choose, explore and know."

Gonzalo Oyarzún, director of the Santiago Public Library, 2008.

SUB CONCLUSION

Since modern libraries are focusing more and more on community and social sustainability, the library in the new building should aim to be a social gathering place in the local area. Therefore, the access, arrival, and entrance into the building should be open, inviting, and welcoming to the users. For this reason, the most public and/or lively spaces should be visible to the users when they pass by the building. To showcase what activities the new library will have to offer and invite the people of Vejle to come and take part in them.
Being a social gathering place, the building should relate to the city and its surroundings but stand out enough that it is easily recognisable and has its own character and presence in the area. The development of the New Rosborg area will bring about new architectural and urban qualities to the area. The new library and culture house has the opportunity to support these qualities and help integrate the new area to the rest of the city.

But what good will a fine shell do if the spaces inside it does not work? The architectural quality and atmosphere of the spaces inside the building are of great importance. They are ultimately what determines if the users will be using the building consistently. For a library to function well, it should ensure efficient movement of materials and clarity of travel by making way-finding intuitive by using the architecture to create orientation clues. Besides housing media, a library is also a place for learning and communities. Sometimes these activities contrast too much, and it is important to separate them from each other to not ruin the experience of other users' activities.



Ill. 24 Library design priciples

SITE ANALYSIS

The location of the project is in the city of Vejle, at the existing site of Vejle Bibliotek. This chapter investigates the specific project site and it's context through a past, present and future perspective. A broader understanding of the context is sought by looking at the past-to-present development and the future goals for the city of Vejle, as well as mapping the present significant elements, to identify the relation between the context and the site. The specific site conditions are analysed both physically and phenomenologically to identify qualities and challenges, and combined with an assessment of the existing building on the site, it is determined whether to keep it or build a new building.

CITY MAPPINGS

The following mappings are limited to the west part of Vejle City, as marked on *Ill. 2*. The theme of these mappings follows the framework from Kevin Lynch's "Image of the city" but is limited to this area and does not focus as much on the social aspect of the city as in Lynch's original method.

POINTS OF INTEREST

The surrounding area around the project site, called Rosborg is mainly populated by private businesses, offices, some residential buildings, and many different education organisations scattered around the area. These range from primary schools and high schools to vocational schools and creative education like the Music school or acting and creative writing at Xeneriet. A few of them are placed very close to the site. The schools and businesses in the area, all have spacious parking arrangements on the ground, creating wide distances between the building. When everyone has left from school or work, these parking lots become empty spaces.

Rosborg has very little to offer regarding shops, restaurants and cafés, or cultural/entertainment buildings. Those that are in the area, lie very close to the shopping district and city centre (except DGI Huset). There are a few public buildings, but except from Sundhedens Hus and the current Library, it is all offices. The public building for Region Syd Danmark, is an interesting brick building, however. Along with that, the Five Sisters (a set of high-rises), and Bryggen (shopping centre), the Rosborg area does house a few interesting pieces of architecture.

Also marked on the illustration, is the area designated for the development of the new area called Ny Rosborg (New Rosborg). Ny Rosborg will be Vejles new, ambitious, district where community, nature and sustainability are the priorities and "Resilience" is the keyword (Vejle Kommune, 2021).

Ill. 25 Mapping Districts, 1:7.500

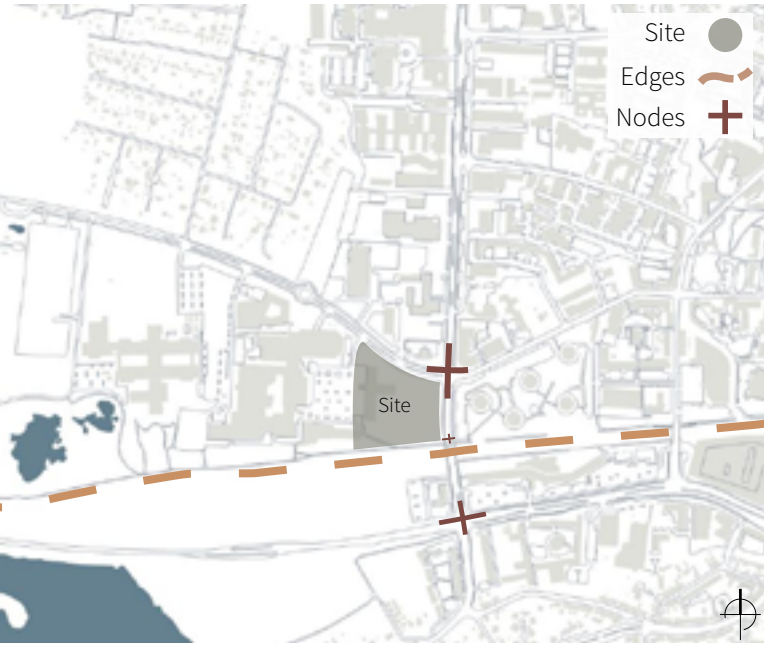
- Culture/Entertainment
- Education
- Public Building
- Shop/Restaurant
- Architectural Landmark
- Residential


Residentia
Vestbyen
Spinderihallerne
// Xeneriet
Syddansk
Erhvervsskole
University College
Vejle
Grocery store
Vejle
Municipality
Allotments
Campus Vejle
Syddansk
Erhvervsskole
Vejle Musikteater
FGU
Restaurant
FGU
Art Museum
Vejle Private School
Ny Rosborg
Sundhedshus
Vejle
Rosborg High School
UCL
Campus
DGI Huset
UCL
SoSu
School
City Centre
Vejle Library
Site
Music School
De Fem Søstre
Bryggen
Region Syddanmark
5 min
Damhaven
School
10 min
Pedersholm
15 min

Ill. 26 Mapping Paths, 1:20.000

PATHS

Two of the biggest roads going through Vejle goes past the project site: “Vestre Engvej” and “Boulevarden” which later turns into “Ribe Landevej”. This provides easy access from the rest of the city and surrounding cities to the Library site for cars, bikes, and public transport by bus. In total, 9 bus routes go by the bus stops next to the library. These roads are sources of heavy traffic around the project site because of their connection from the center to the bigger roads outside of Vejle.
There is also a path next to Vejle Å, leading from the city center to the library site and ends near the recycling station. This is a nice path for pedestrians, except from the lack of a marked crossing at Boulevarden. The current solution is uncomfortable to use because of the heavy traffic on the road.



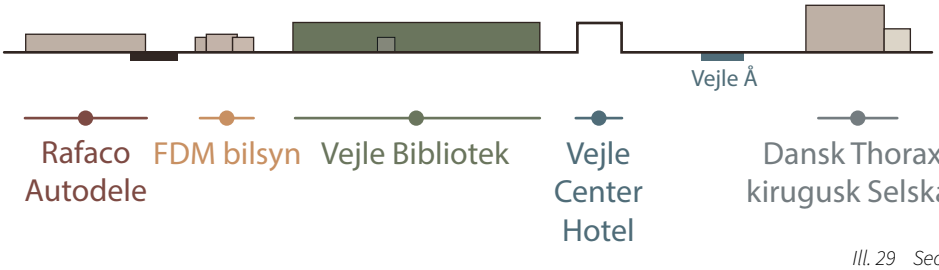
Ill. 27 Mapping Edges, 1:20.000

NODES AND EDGES

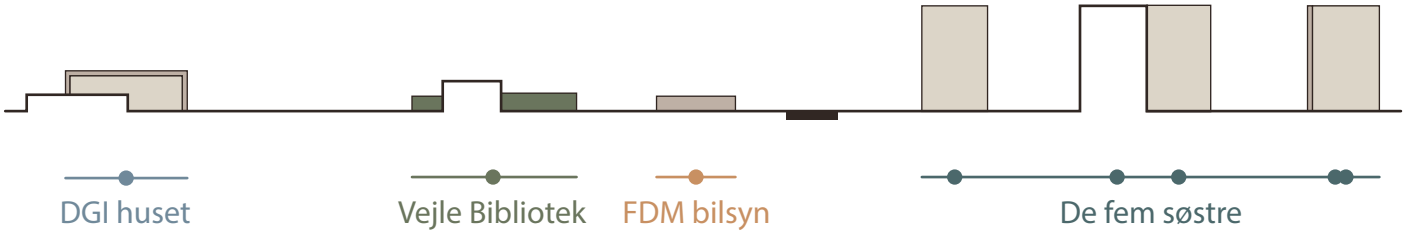
The two big intersections where Boulevarden intersects with Vestre Engvej and Bredstenvej are great causes of dense traffic throughout the day because of the businesses and educations in the Rosborg area and because these roads connect the city centre with the upland.
Since many of the library’s users might arrive by the path along the stream, the intersection between the footpath and Boulevarden also becomes a significant node. Crossing Boulevarden here as a pedestrian is uncomfortable due to the lack of a proper crossing.
The stream, Vejle Å, is the most significant edge near the project site. It runs from the fjord and far into Jutland. It divides and has influenced the shape of Vejle City Centre and attracts people, plants and animals in great numbers.

CONTEXT HEIGHTS

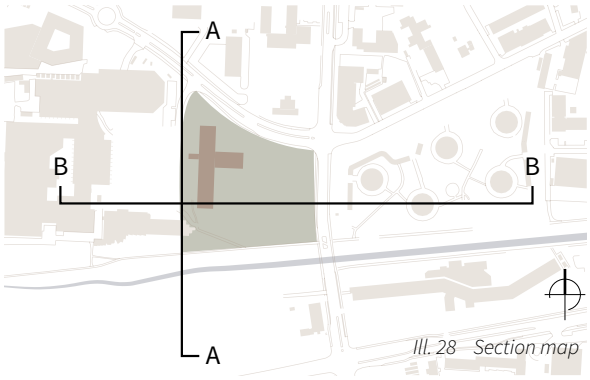
To get an impression of the heights in the context two sections were made.
This can be used to know how the building design will interact with the context in the city perspective.



Ill. 29 Section A-A, 1:3000



Ill. 30 Section B-B, 1:3000



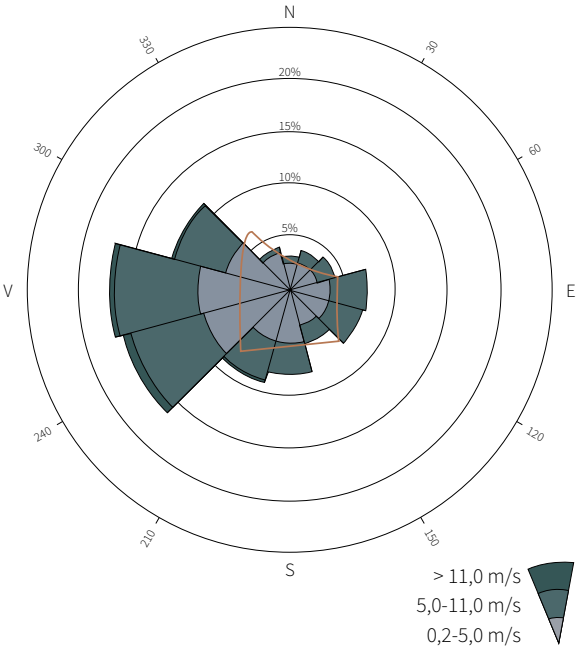
Ill. 28 Section map

The sections show that from north to south the building heights around the site is uniform with only smaller variations.

The section from west to east shows much more spatial variation with different building heights. DGI Huset and the existing library building have building parts in different heights. The residential area, De Fem Søstre, is the tallest in the nearby area.

MICRO CLIMATE

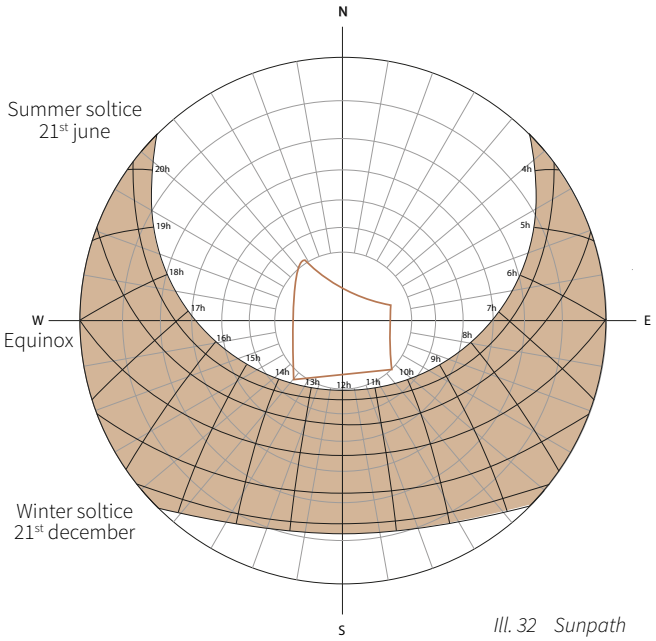
The climatic conditions for the site is investigated to identify challenges and possibilities for the design, according to orientation of the building and outdoor spaces, as well as energy use.



Ill. 31 Windrose illustrating the frequency and strength of winds. Data from Weatherstation Båstrub (DMI, 1999).

WIND

The dominant winddirection is West in Vejle, which is very typical for Denmark. Also typically, the wind rarely blows from a northern direction. This means that the large buildings facing "Willy Sørensens Plads" will help break the winds from west, so it won't be as powerful once it reaches the project site.



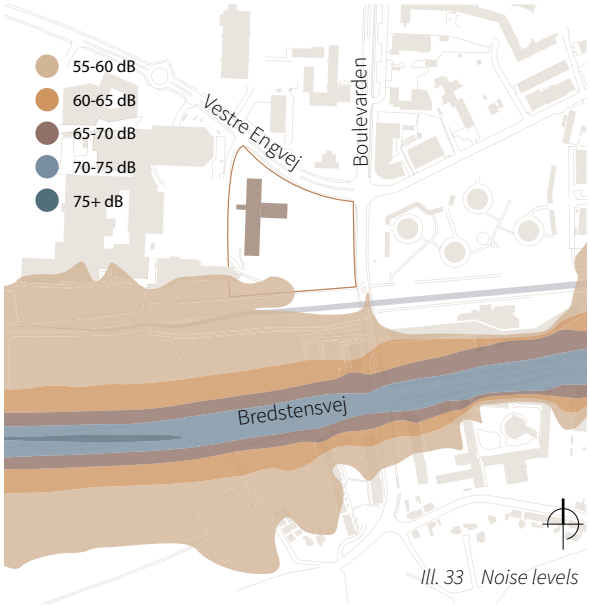
Ill. 32 Sunpath

SUN

To get the extremes and average of the year the analysis is looking at summer solstice, winter solstice and equinox.
Looking at the analysis it is visible that half of the year there will be shadows from the surrounding buildings in the mornings and afternoons (see Appendix 5: Shadows on page 128).
To make some outdoor spaces in the library garden with sun exposure in the winter afternoons, they should be placed in the south-east corner of the site towards the stream.

NOISE

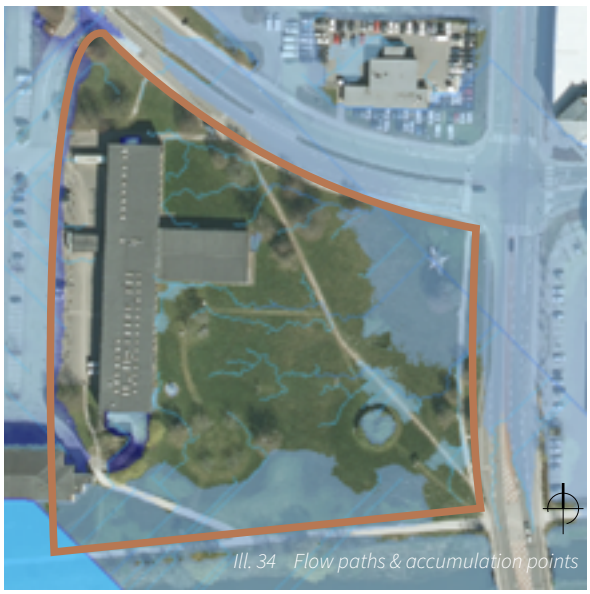
The map (*Ill. 33*) shows the noise load from Bredstensvej near the library during the day. Even though this road is not directly adjacent to the library, there's only a soccer field and the stream Vejle Å in between, which makes the site somewhat affected by the noise. The level of noise load is less than 60 dB and the limit value is 58 dB (Miljøstyrelsen, n.d.). However the noise load is only surveyed for the larger main roads, which means the busy road Boulevarden through the city has not been mapped according to noise. Therefore it has to be taken into account that this road might cause discomfort on the site, at least at outdoor spaces, which will be described later in Sense of Place on page 50.



Ill. 33 Noise levels

FLOODING

Flooding on the site has been investigated for sea-level rise and for extreme rain (Appendix 6: Flooding on page 129). The latter was found to be a problem, since the soil on the site has very poor seepage properties and furthermore the ground-water level is very high at the site. This causes the rain to accumulate on the surface. For the specific site, the terrains formation decides how the water flows and where it accumulates. This can be seen in *Ill. 34*, which shows the water accumulates mostly at the edges of the site (DinGeo, n.d). The existing water flow paths can be used to shape the building and the site to optimise the water handling and slow the flow.


Ill. 34 Flow paths & accumulation points

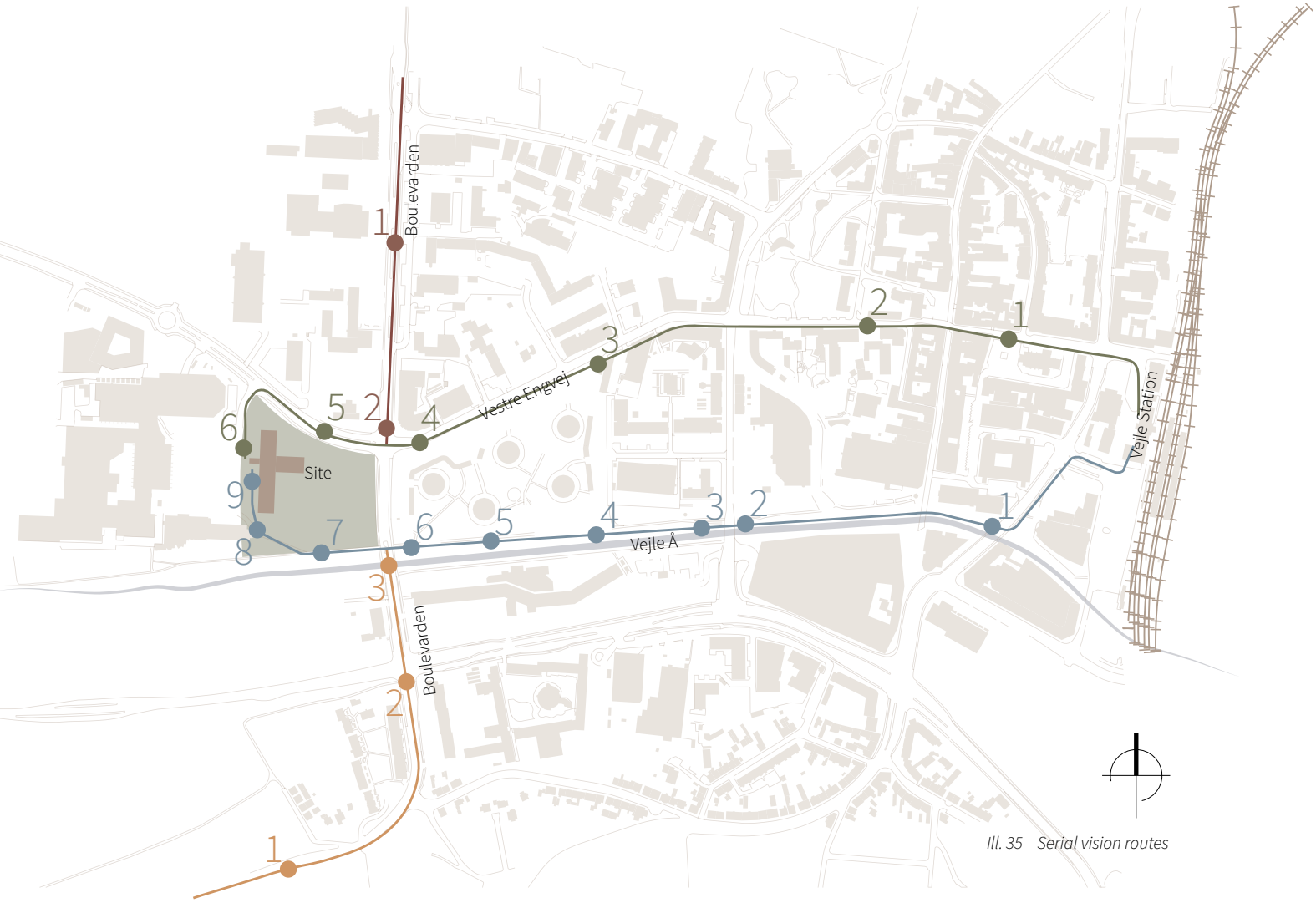
SERIAL VISION

The experience of walking to the library from different parts of the city is investigated to understand the atmospheres and elements that affect the visitors of the library. As mentioned in Paths on page 44 the site is surrounded by large roads and a stream, which also constitutes the main accesses to the site. These are investigated, with a main focus on Vejle Å presented here. The three along the main roads, are explored in Appendix 3: Serial Vision on page 124.

VEJLE Å

The first route is the blue along Vejle Å. This route first follows the stream through the dense urban city, with commercial buildings, busy streets, meeting points and stairs as seating areas by the stream where people can enjoy a sunny day. This part of the path is paved and integrated into the surrounding functions e.g by being an extension of the terraces of the various restaurants and also the seating stairs.

The route then moves to a less dense area, with some apartment buildings, parks and natural landscape with gravel and sand paths. Here one can hear the wind in the trees and birds singing, which feels very calm and relaxing in contrast to the first part of the route. This atmosphere follows the path into the library park, which is described on page 50.



Ill. 35 Serial vision routes

1

Dense urban area, with commercial buildings and meeting and relaxation points.

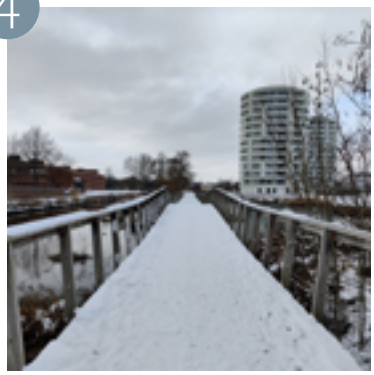
2

Passage way under the road makes the path continuous and uninterrupted.

3

Sculptures follow the path and connects it with library sculptures.

4



A bridge crossing the extended stream at “The 5 Sisters” residential buildings.

5

The path is raised above the water on both sides and first view of the library.

6

Arriving to the library and the park. Stopped by the main road Boulevarden.

7

The path continues along the stream through the library park.

8

Passing through a narrow passage to the “back” of the building and parking area.

9

Arriving at the side of the library entrance.

Ill. 36 Serial vision Vejle Å

SENSE OF PLACE

The character of the site of the library is investigated with a phenomenological approach to understand how the site is experienced. How we perceive a spatial environment affects how we behave and use the space.

THE LIBRARY PARK

The library park is located in front of the library and borders on Vejle Å and the two main roads Vestre Engvej and Boulevarden, which gives two contrasting experiences. When facing the library the atmosphere is calm and relaxed by being in a large, mostly open space where you can breathe and feel like being in nature (*Ill. 37*). It is almost a continuation of the path along the Vejle Å (described in Serial Vision on page 48).

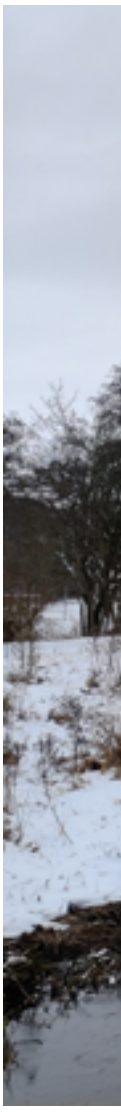
Here you hear the stream calmly moving and the trees swaying in the wind. Mallards and Eurasian coots rocking on the stream. Several tracks in the snow reveal some of the shy visitors of the park, deer and hares among others. Children playing and soft crackles are heard from people walking on the snowy paths through the park and along the stream. The cool wind is tingling on your cheeks.

At the same time a buzzing from behind is present. The more time you stay in the park, the more you notice the buzzing. It is a constant noise and when turning around you see the large main road and all the traffic passing by. It is a large contrast to the idyllic nature experience and it gives a sense of being in a city and close to the pulsating city centre, whereas the nature elements indicate that you are also near the edge of the city.

The natural qualities of the park and relation to the stream should be preserved and incorporated in the design to transform the whole site into one entity.

THE LIBRARY ENTRANCE

The entrance area of the library is located in a shared parking area (*Ill. 38 on page 53*). It feels like a back side or back entrance. The large parking area is surrounded by very large and tall buildings, and gives an enclosed space. The tall buildings block the views and there is no indication of neither the city or the natural qualities of the surroundings. It feels more like a highly functional space serving the different facilities around it, rather than a welcoming space. Cars come and go and people rush into the different buildings.

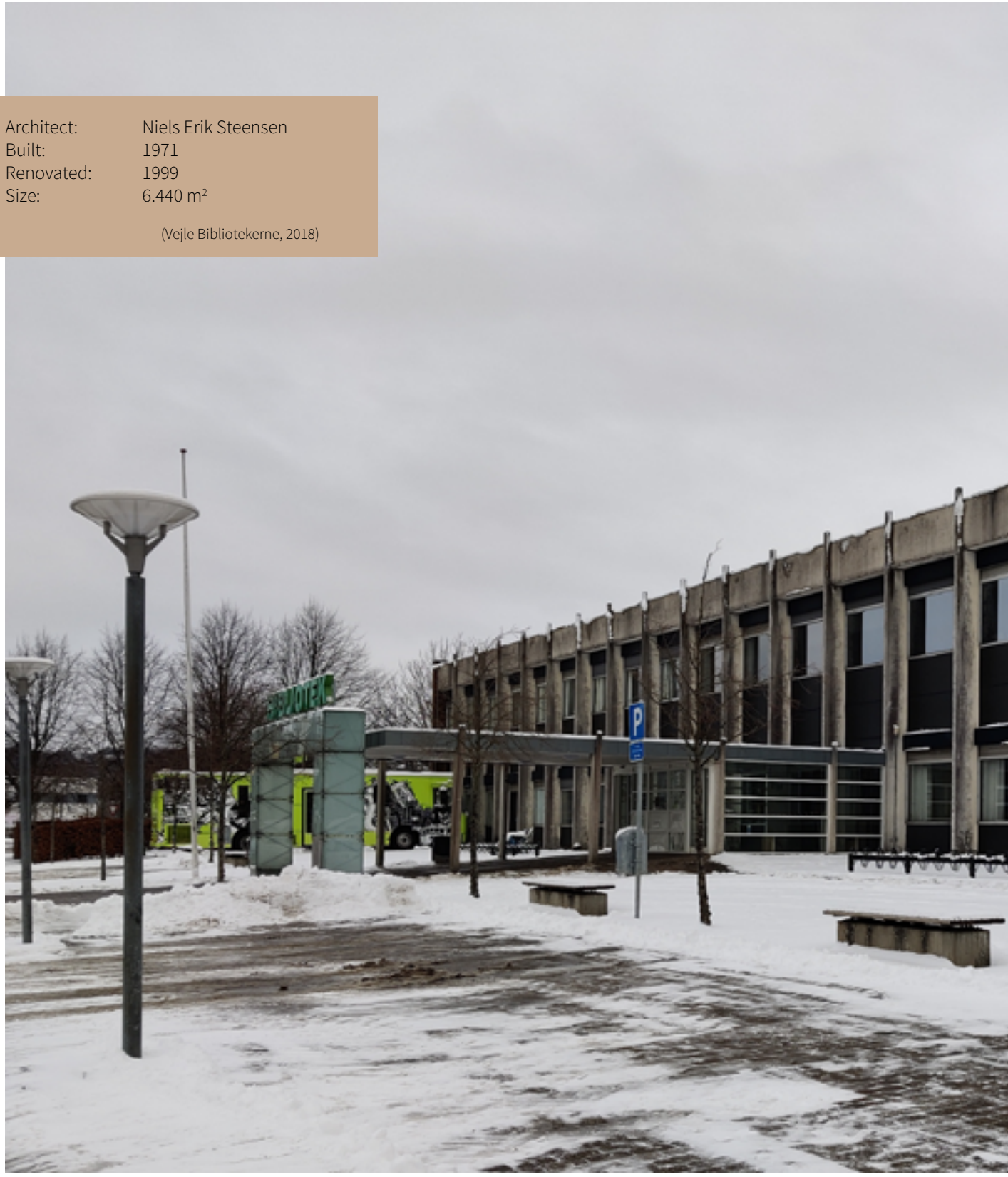


Ill. 37 Sense of place

THE EXISTING LIBRARY BUILDING

Architect:	Niels Erik Steensen
Built:	1971
Renovated:	1999
Size:	6.440 m^2

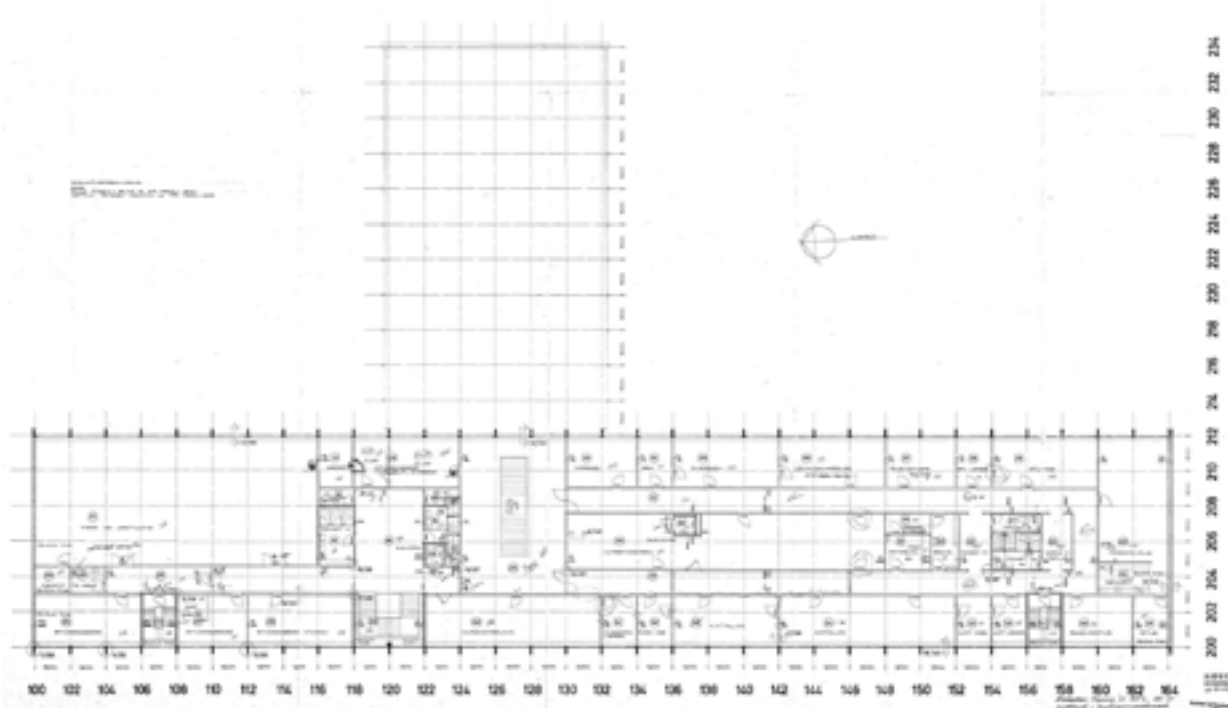
(Vejle Bibliotekerne, 2018)



Ill. 38 Vejle Bibliotek west facade

There are two possibilities for the new library and culture house in Vejle: Either to preserve the existing library building with renovation and extension or to build a completely new house on the existing ground. To figure if the existing library building is worthy of preservation a SAVE analysis (Survey of Architectural Values in the Environment) is made on the building. The SAVE method is used by Ministry of Culture in Denmark to map, register, and assess preservation value of urban environments and buildings. The preservation assessment in SAVE is based on the building's exterior and the interaction with the surroundings. The assessment does not address the building's interior. Under professional circumstances it would have been the municipality to make the preservation assessment based on the analysis and only for buildings build before 1970. (Kulturarv styrelsen, 2011)

The method is interpreted to fit the project by disregarding the forms and instead use the method for the analysis and the assessment characters.



Ill. 39 Vejle Bibliotek floor plan

SAVE ASSESSMENT

The full analysis of the built structures of the context and the library building together with the basis of the assessment can be found in Appendix 4: SAVE Assessment on page 126.

The existing library building has a cultural history value for the built structures on Willy Sørensens Square. The grid is very characteristic for the site as well as the vertical elements in the façades. Therefore, the existing building gets the average preservation value 4, which is given to buildings as by virtue of their architecture and cultural history. Also, the building is also in better conditions than the expectation for lower preservation values.
Looking at the condition of the 50-year-old building it is clear, that the façade materials has served their duty and need to be changed except for the brick walls and the fibre cement boards that could serve some decades more.
The building is traditional for it is time and stands somewhat original on the exterior. The SAVE analysis is only considering the external of building, but the interior layout of the building, which can be seen on *Ill. 39*, with long corridors is outdated for its function as a modern library and culture house. The building is a time capsule of its time, but the experience of the building, both external and internal, is considered more important.

The new culture house has a social role in the society of Vejle of tying together the surrounding neighbourhoods and inviting the users in from more than one façade. The language of the existing building seems more excluding with the long closed façades and caters mostly to the parking lot.

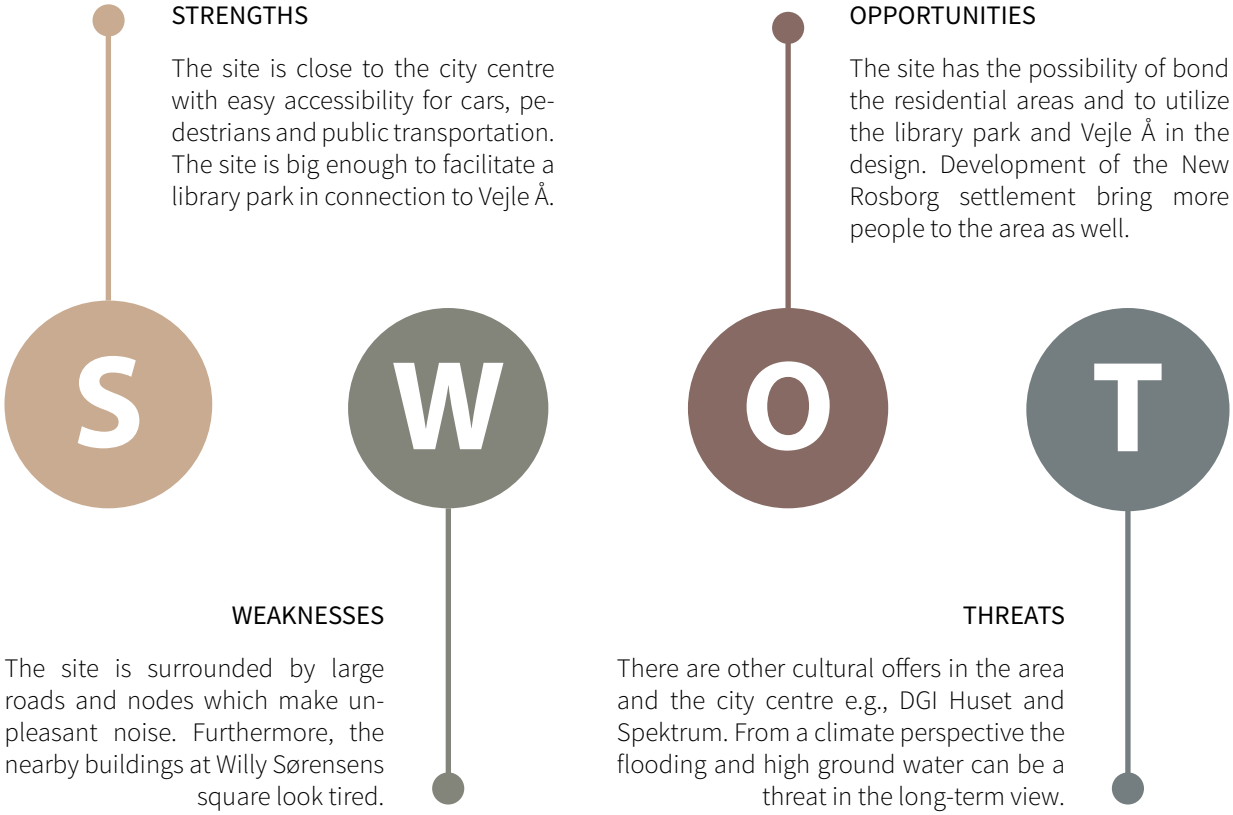
The result of the SAVE analysis and assessment is that the existing building will be an inhibition for the new culture house in Vejle and will therefore not be considered worthy of preservation in this project as it stands today.

SUB CONCLUSION

Vejle city is in development and with the resilience strategy the main focuses from a political perspective are to enhance learning, climate changes and social cohesion which all will be integrated in the project in greater or lesser extent.

The site is accessed through Vestre Engvej, Boulevarden and the path along Vejle Å. When the new area Ny Rosborg is built, the site will have a central location for the nearby residential areas with only 500m to the city centre of Vejle though Vestre Engvej. Therefore, the new building should be inviting from these three main roads to the site, leading people in whether they are arriving on foot, public transport or by car. By that the new building will connect with the nearby areas of the city.
Through the SAVE analysis the old library was assessed for its relation to the nearby built structures and the preservation condition. The materials are old, the building is introverted, and the entrance is not very inviting as it favours people arriving in cars on the back of the building, turning away from the city centre and from the library park. Toward the city the building is completely closed which is not welcoming. Furthermore, the interior layout is very stringent according to functions, but it is also confusing for the visitors according to way-finding. Therefore the assessment is to make a new library in the same site, as it still has some good qualities of the area.

For a better understanding of the site a SWOT analysis is made to capture the findings from this chapter and organize them in the four categories: Strengths, weaknesses, opportunities, and threats. Thereby, they will be easier to manage during the design process.



SUSTAINABILITY

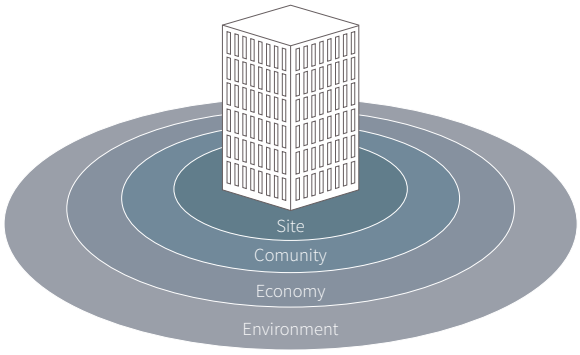
In this chapter the sustainable approach for the project is unfolded, with a main focus on reuse of materials and their life cycle. Additionally the energy class for the building is specified and different passive and active strategies suitable for the building and site is investigated and determined. Furthermore strategies for water handling are analysed to prevent flooding through the design.
The use of the SDG will also be specified with highlighted topics within the social and the environmental aspects.

SUSTAINABLE APPROACH

With sustainability being a focal point in this project, it requires a clarification for the chosen perspective and how it is implemented in the design. Sustainability is a comprehensive matter with no universal definition, however it is often described as the Brundtland Report "Our Common Future" defined it:

"meeting the needs of the present without compromising the ability of future generations to meet their own needs" (UN, 1987).

Sustainability includes many aspects that are categorized into three main themes; environmental, social and economic sustainability. Architecture can affect all of these aspects and should be a catalyst for reaching a sustainable world. Buildings affect their users and their immediate site, but also the context they are in. It can be described as "Architecture's Ripple Effect" illustrated in *Ill. 40*. Just like a water drop falling on a water surface will cause ripples on the water, a building causes ripples in it's context. First the building affects its immediate site creating the first ripple. Once the site is affected, it automatically affects the community it is located it, creating the second ripple. It can e.g. engage with the community to create better social environment or disengage and making the area desolated and create social separation. When the community is affected, it will also affect the economy, creating the third ripple. All of these ripples and the building itself will affect the overall physical environment, e.g. the amount of the harmfull emissions into the atmosphere and the use of renewable or non-renewable materials and energy sources (Bryans, 2017).



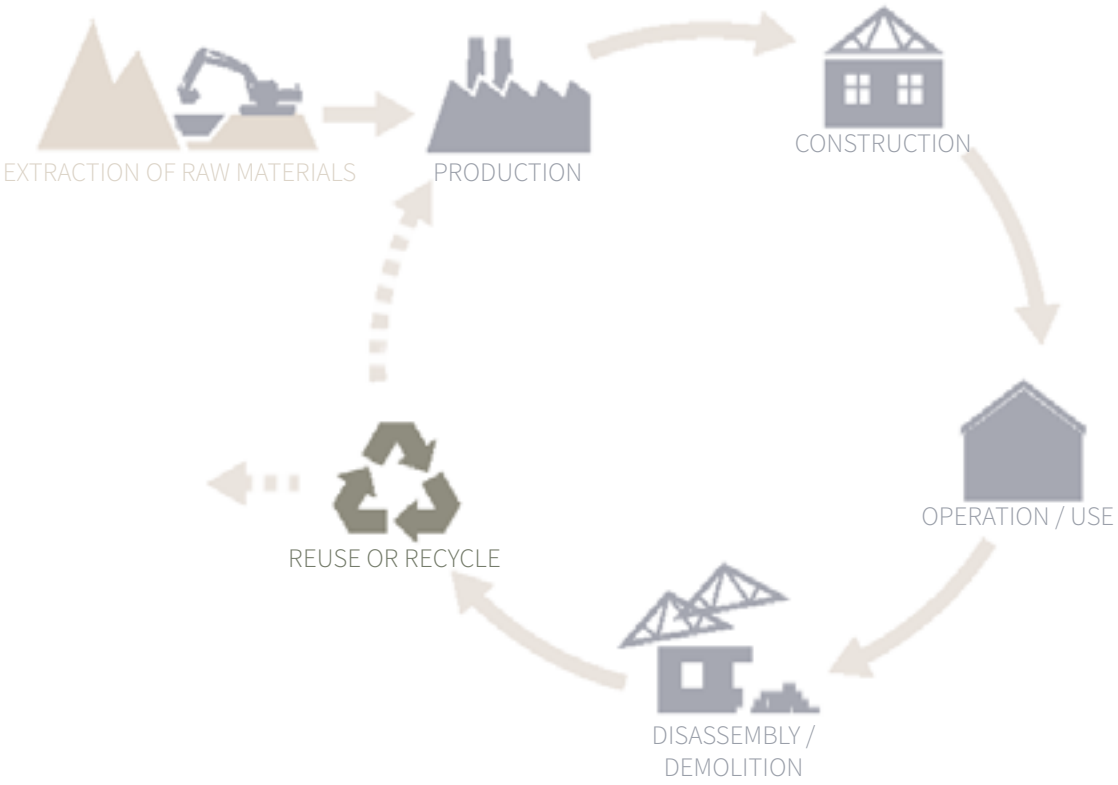
Ill. 40 Architecture's Ripple Effect

The sustainable approach in this project will have a main focus on the social and environmental factors. Vejle is already working with sustainability through a resilience strategy as described on page 11, were climate resilience and social resilience are some of the main factors. The resilience strategy is intended to secure future-proof development of the city. Vejle is also working with the Sustainable Development Goals, which are operating within the themes environmental, social and economic as well (UN, 2015). Both the resilience strategies and the SDG's can be used to base design decisions on.
In this project the social aspect is mainly focussed on promoting learning by integrating learning environments in the design and on gathering the community by designing for social and cultural meeting.
The environmental aspect is focussed on building materials in a life cycle perspective, where materials will be analysed and compared, both new and reused. It will also focus on energy consumption, through the design of building envelope and use of active and passive strategies. Additionally the climate resilience also involves the site-specific problems with water management, which will also be addressed to some extend.

The energy framework for the project will follow the Voluntary Sustainability Class in relation with the Voluntary Low-Energy Class of the Building Regulations.
Building classes are set in place to ensure new buildings are designed to use the least amount of energy for daily operation. The main difference between these classes is the amount of energy a building can require for operation and what parts of the energy requirements are used to calculate the allowance. For example, the Low Energy class from the Danish Building Regulations allow the new Library- and Culture house to require 33 kWh/m2 per year. This includes energy used for heating, ventilation, hot water, cooling, and lighting (Bygningsreglementet 2018, 2020).

Sustainable considerations like material life cycle and environmental impact, resource use during construction, or toxins released by building materials are not included in the current building classes detailed in the Danish BR. The recent addition the Voluntary Sustainability Class is developed to focus on these aspects as an addition to the Low Energy class.
Since this project chooses to put more emphasis on sustainable building materials and life-cycle, we have decided to work with the Voluntary Sustainability Class.

LIFE CYCLE ASSESSMENT



Ill. 41 Life Cycle Assessment diagram

LCA is a tool to analyze the life cycle of materials in a building. This is done though EPDs (Environmental Product Declaration) that revel the environmental impact in the lifetime phases of the materials. The life cycle assessment can be used early in the design phase to make decisions on an informed basis, and later in the process to document the environmental impact of the building.
In this project there will be focus on putting old building materials from the existing library back in the cycle to extend the lifespan.

MATERIALS

REDUCE

In the Save assessment on page 54 it was assessed that the existing library building has a limited preservation value. To reduce the materials needed for the new building it is therefore investigated how the materials from the existing building can be reused in a new building design.

REUSE

In Denmark almost 30% of the total amount of garbage produced comes from the building and construction industry (Høibye, 2015). Therefore, the potential of reusing or recycling some of the materials is huge. From a sustainability point of view this would also benefit the circular economy and save some resources from the embodied energy of materials.

RECYCLE

When handling old material, it is important to know what they consist of to be sure that they are safe and healthy to reuse or recycle. Therefore, it should be considered to do material passports, that would also make it easier to reuse or recycle the materials in the end-of-life in the new building. Such a material passport should consist of a documentation of the quality, identification e.g., an EPD, information on the maintenance, safety, and how to store the materials. (3XN, 2018)

RETHINK

To ensure that the materials in the new building is accessible and easier to change and reuse/recycle they should be designed for disassembly. Securing the connection of materials for easy assembly and disassembly by using screws instead of nails, avoid sealants and instead use easily dissolvable binders and use common fasteners, the building will be easier to handle in the future. (3XN, 2018)

Concrete
- Whole elements can be reused.
- Crushed concrete as aggregate in new concrete.
- Crushed concrete for pavement

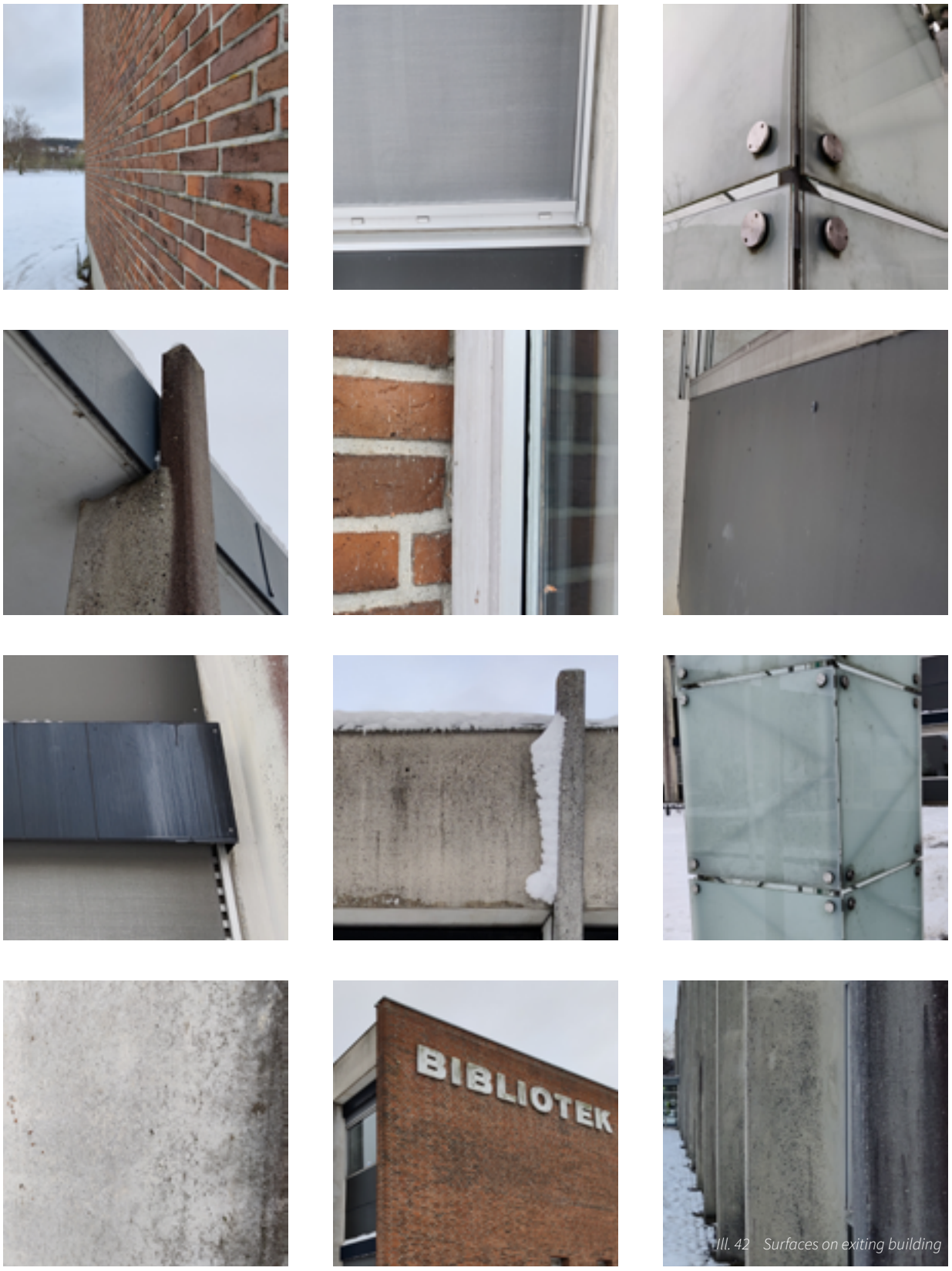
Doors
- Reused in new buildings.

Iron/metal
- Recycled by remelting.

Bricks
- Reused in new buildings.
- Reused as pavement or other landscape solutions.
- Filling material in road construction
- Crushed bricks can replace pumice stone when planting.

Windows
- Glass recycles to glass wool insulation.
- Reused or recycled for new windows.

(Høibye, 2015; VCØB, n.d.)



Ill. 42 Surfaces on exiting building

WATER HANDLING

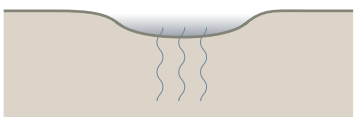
Since flooding is a problem on the site because of the type of soil and the groundwater being close to the surface as stated in Flooding on page 47, different strategies to handle the water are investigated.

Handling of rainwater is mainly focused on permeability and thereby infiltration from surfaces to the soil. When precipitation is high problems with surface water can occur, because the soil can't keep up absorption at the same rate as the rain is pouring. Therefore it is necessary to manage the water.

It can be done by delaying the water as much as possible, e.g. by storing the water in retention areas as ponds or in basins in landscape, where the water then can accumulate and infiltrate the soil slowly (*Ill. 43*). Some retention areas also have the advantage of being able to purify the water. These are called bioretention areas and they filter the water through plants and different layers of material as it infiltrates the soil slowly.
To avoid overflowing streams, lakes or sewers because of rain running too fast into these, the water can be slowed in its way, by forming the landscape and the flow, and thereby creating a longer way for the water to travel (*Ill. 44*). Green areas and green roof also help, as the plants absorb some of the water and by evaporating water through the plants (*Ill. 45*). (Teknologisk, n.d.).

The soil type on the site is freshwater formations, which often have very poor seepage properties. The water can therefore flow on the surface and accumulate in depressions, which increases the risk of flooding. During periods of heavy rainfall, the upper soil layer will have a medium-low hydraulic conductivity of 100 - 125 mm / day in the area. Therefore, even in undeveloped areas, rainwater will remain on the surface and penetrate into the ground only relatively slowly (DinGeo, n.d.). Furthermore, the groundwater level is only 0,4 m, and in periods with massive rain, it is even at surface level (DinGeo, n.d.). When the groundwater level is less than 1 m seepage can be impossible (Aalborg Kommune, 2016).
Therefore infiltration strategies are not very suitable, instead there will be a focus on storing the water or lead it away slowly. The water can be lead to the stream beside the park.

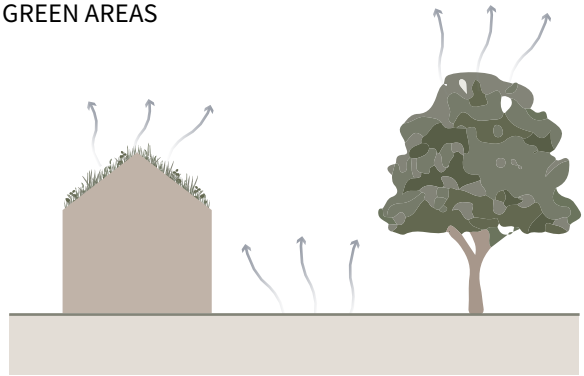
SLOW THE FLOW



Ill. 43 Retention basin

Ill. 44 Slow path

GREEN AREAS



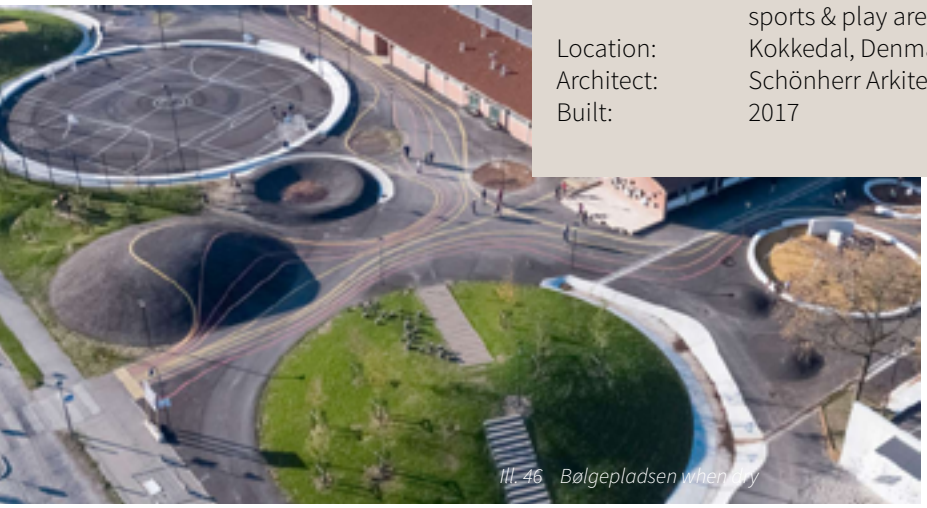
Ill. 45 Evaporation from green areas

CASE: BØLGEPLADSEN

WATER HANDLING THAT PROMOTES THE COMMUNITY

This case study focusses on the water handling solutions of Bølgepladsen.
Kokkedal city had major problems with flooding from excessive precipitation causing the stream through the city to overflow.
Therefore the city started a climate adaptation project for the whole city. It is one of the largest and most complex climate adaptation projects in Denmark. The vision for the project was to turn the problem into an opportunity to create more attractive urban spaces.
Apart from creating spaces for the large amounts of water, the solutions also created many interesting areas for exploring and playing, for the local community to enjoy. Bølgepladsen is one of the new climate adaptation areas in Kokkedal (Realdania, n.d.). This former parking space is now a playground and sports area when dry (*Ill. 46*), and a large water retention area when it raining heavily. A sunken basket area also functions as a water basin and a sunken path turns into a small stream leading to the basin (*Ill. 47*). The depressions and small hills makes the water flow slower and the green areas absorb.
The water flow from the buildings is also slowed by being led through small obstacles in the landscape instead of flowing directly, as e.g. the water steps (*Ill. 48*) slowing the water from the roof and downpipes (DR, 2019).

Program:	Climate adaptation sports & play area
Location:	Kokkedal, Denmark
Architect:	Schönherr Arkitekter
Built:	2017



Ill. 46 Bølgepladsen when dry

Ill. 47 Bølgepladsen when raining

Ill. 48 Water steps

DESIGN BASIS

In this chapter the findings from the analysis is transformed into a comprehensive foundation for the design process.
This includes the problem statement that formulates the what the design aims to solve and vision for the project, as well as gathering demands by setting design criteria for the further process and stating the requirements for the functions and rooms the building needs.

PROBLEM STATEMENT

How can a new culture house promote learning and social interaction to strengthen the community and tie the surrounding areas together in the city of Vejle, while integrating sustainable solutions?

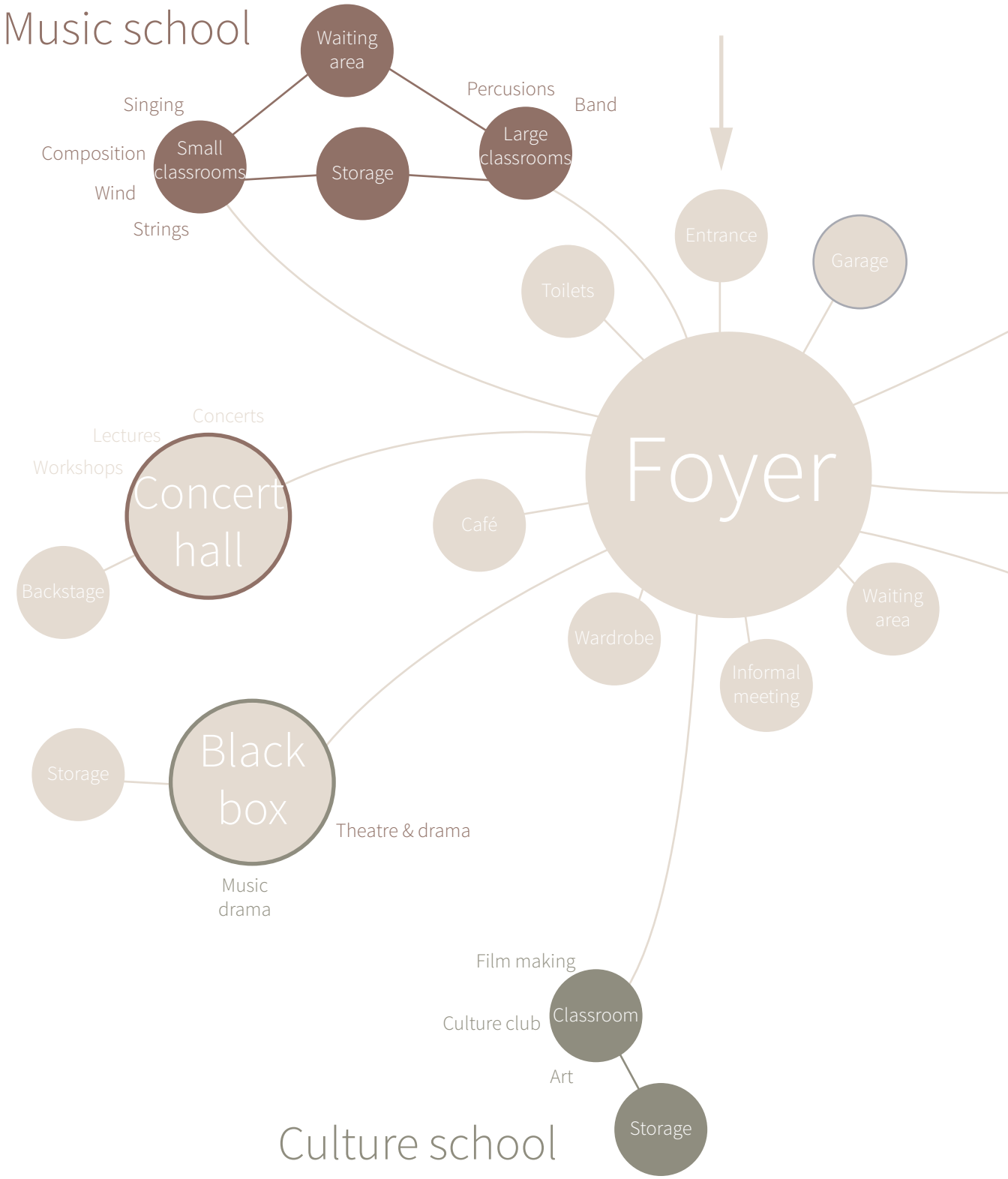
VISION

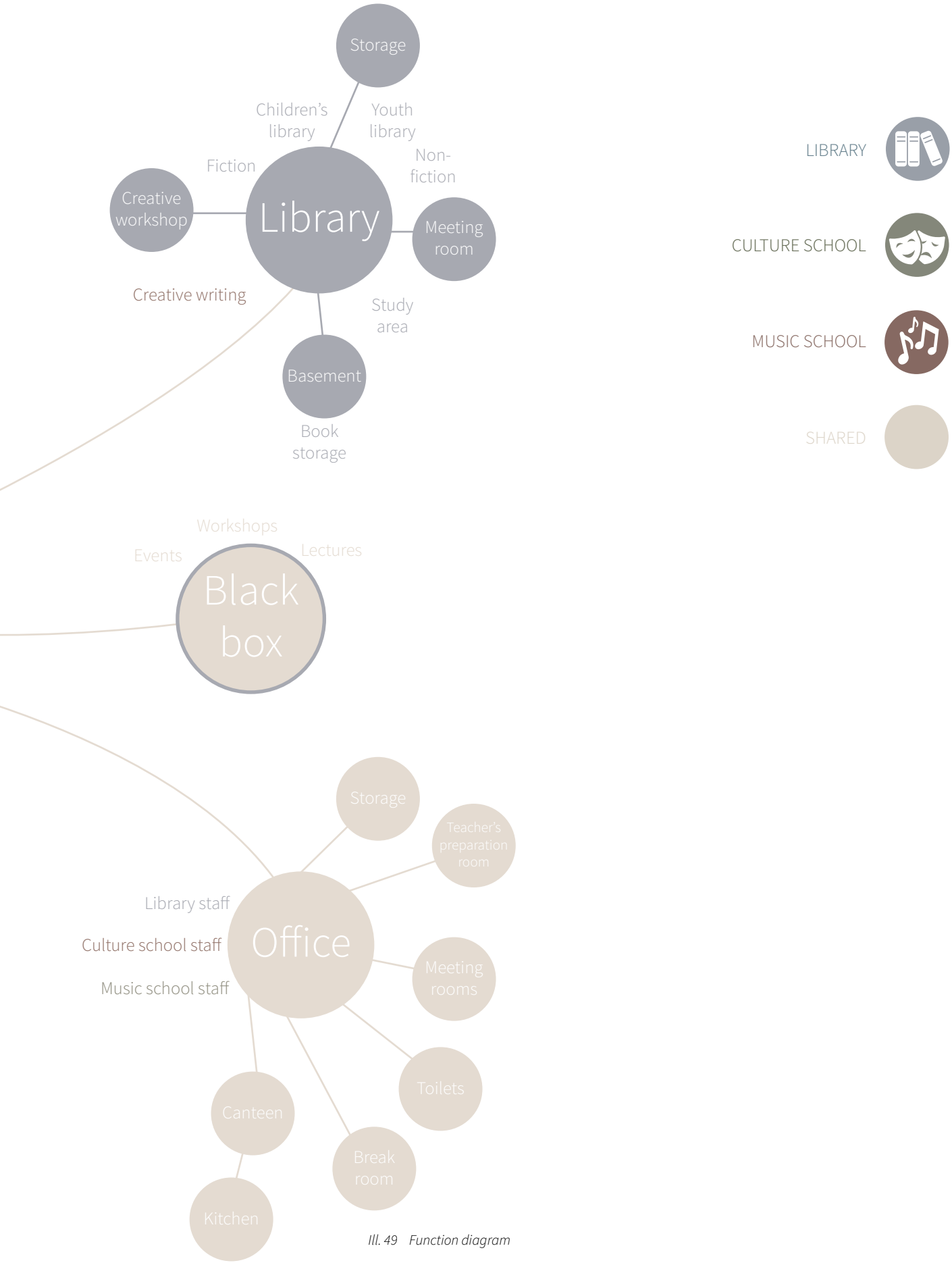
Our vision for the new library and culture house in Vejle is to create a coherence between the three learning and culture organisations: the library, the culture school and music school. By uniting them into one entity the goal is for them to support each other. The aim is to encourage learning through the design and through integrating the various functions of the three organisations for a holistic learning environment.

The goal is also for the design to utilize the differences of the three organisations and the interplay between them to enhance the local community as well as the cultural quality of the city and thereby become a new social centre in Vejle. The aim is to make an inclusive and welcoming building that greets the users at eye-level and is a local gathering place where people can meet and create new experiences with each other and people in their local communities. By facilitating and encouraging meetings we wish to promote cultural diversity and development and to enhance social quality.

Furthermore, the aim is to make a sustainable building, that consciously utilizes the existing conditions and materials on the site combined with low energy solutions and deliberate choices of systems and materials, while also preserving and integrating the surrounding nature qualities.

FUNCTION DIAGRAM





Ill. 49 Function diagram

DESIGN CRITERIA

LEARNING

- The building should integrate design principles for universal learning environments and the design should invite to learning.

COLLABORATION

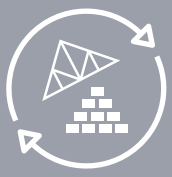
- The building design should encompass multi-functional spaces, that promote collaborations, knowledge and integrates the three organisations: the library, the culture school and the music school.

COMMUNITY

- The design should connect the surrounding areas and promote informal meetings, by being open, inviting and accessible, as a living room in the city, and thereby gather the local community and promote social resilience.

LAYOUT

- The layout of the building should focus on intuitive way-finding and movement through design elements and choice of materials, and having a clear separation between functions and between public and private, both inside and outside.



MATERIALS

- The design should incorporate reuse of materials from the existing library building where it is possible or other sustainable materials.

BUILDING RELATION

- The building should relate to the surrounding buildings and tie the New Rosborg area together with the rest of the city, while also being a landmark and attract attention to lift the atmosphere of the area and create a new identity for it.

NATURE

- The design should relate to the existing nature at the stream Vejle Å and the path along it, and further promote this in the park and the building, as well as the path connection at the road intersection.

OUTDOOR SPACES

- The existing natural qualities of the site and the stream should be preserved and improved, by orientation of spaces according to sun, wind, noise and views.

WATER MANAGEMENT

- The design should integrate water handling, by slowing the water and leading it to the stream, as part of the climate resilience strategy.

BUILDING PERFORMANCE

- The design should follow the Low-Energy Class and the Voluntary Sustainability Class, while also focussing specifically on the acoustics according to the Music School and Culture School functions, as well as daylight for the Library functions.

Ill. 50 Design Criteria

ROOM PROGRAM

	Room	Area	Quantity	Capacity	Total area	Height	Air Change
		m²	Rooms	People	m²	m	m3/h (h-1)
FOYER	Foyer / exhibition	1000	1	500	1000	5,5	0,42
	Café	133	1	30	133	5,5	1,08
	Wardrobe	40	1	2	40	2,5	1,89
	Concert hall	444	1	470	444	10	0,50
	Black box	100	2	120	200	7	0,26
FOYER	Canteen	191	1	100	191	5,5	0,56
	Office	28	19	6	532	3	0,74
	Kitchen	31	1	2	31	3	1,23
	Teachers room	50	1	5	50	6	2,65
	Office supplies	50	1	2	50	3	3,31
	Large meeting room	35	2	9	70	3	0,51
	Small meeting room	24	2	6	48	3	0,53
	Preparation workshop	40	1	5	40	3	1,06
	Teachers preparation room	20	1	5	20	3	0,45
FOYER	Meeting rooms	40	3	10	120	3	0,53
	Classrooms	60	2	18	120	3	0,44
	Recording room	25	1	6	25	3	0,47
	Digi-zone	70	1	22	70	2,5	0,30
	Creative workshop	60	1	13	60	3	0,52
	Media workshop	100	1	26	100	3	0,44
	Library	2600	1	200	2600	5	2,46
	Book sorting robot	90	1	1	90	6	20,42
	Study area	100	2	100	200	2,5	0,11

	Room	Area m^2	Quantity Rooms	Capacity People	Total area m^2	Height m	Air Change m3/h (h-1)
FOYER	Large music classrooms	80	6	11	480	5	1,60
	Small music classrooms	25	18	4	450	3	0,83
	Student's area	85	1	20	85	3,5	0,66
	ArtLab	20	1	5	20	3	0,45
	Arts classroom	20	1	5	20	3	0,45
	Movie classroom	20	1	5	20	3	0,45
FOYER	Storage	25	7	2	175	3,5	1,65
	Niches	20	21	4	420	3,5	0,77
	Stairs & elevators	45	9	10	405	3,5	0,69
	Large seating areas	120	8	30	960	3,5	0,62
	Toilets	2	37	1	74	2,5	0,22
	Toilets - handicap	5	5	1	25	2,5	0,55
	Cleaning room	3	3	1	9	2,5	0,28
	Janitors workshop	40	1	1	40	5,5	7,28
	SUM				11744,7		

DESIGN PROCESS
PHASE 1: IDEATION

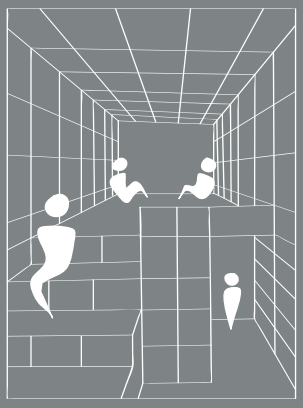
The following three chapters presents the design process of the project. It takes its starting point in the Design Basis from the analysis. The process is iterative and the different elements presented is integrated simultaneously. Therefore the following does not represent a chronological dissemination of the process work, instead it presents an overview of the most important investigations and factors that has been pivotal in the final design.

To explain the process in a more simple way, it is divided into three phases; ideation, developing and detailing. This chapter is the ideation, and presents the work with the concept and ideas behind.

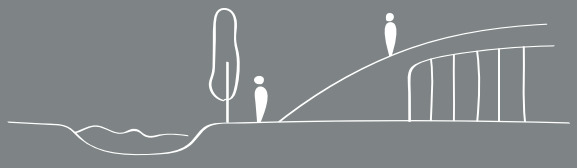
INITIAL IDEA GENERATION

The initial idea generation was based on the findings from the analysis and the design criteria. It shows some of the significant ideas about the form, layout, experience and specific design elements, that has been pivotal for the process and in some way or another also is integrated in the final design.

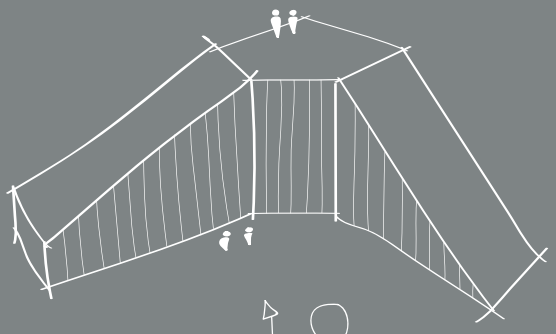
Niches and caves can be integrated in bookcases.

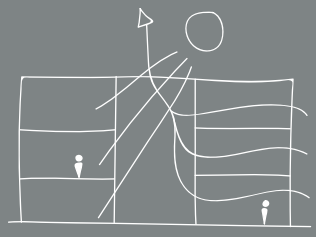


The building is part of the landscape.

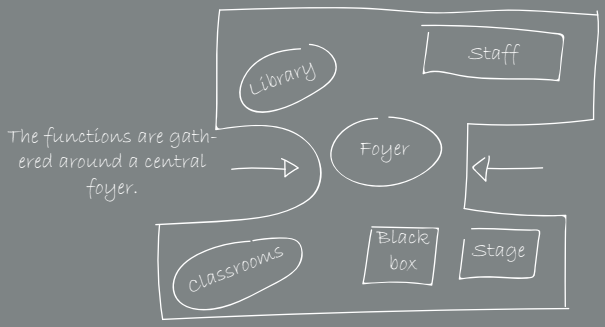


The building embraces the park and creates a protected outdoor space.



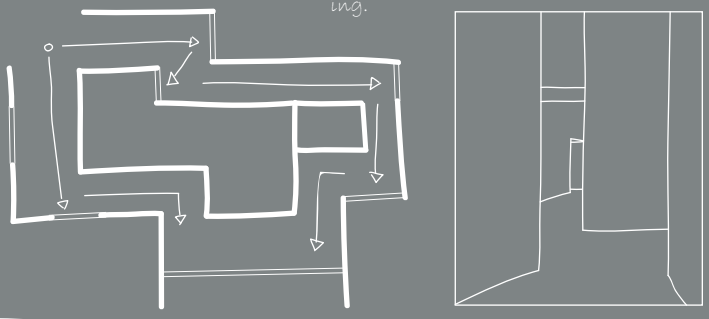


An atrium in the middle of the building for light and ventilation and connects the different floors.

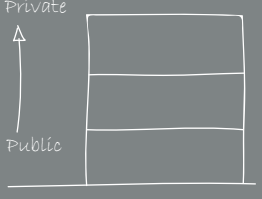


The functions are gathered around a central foyer.

Inviting for meandering and exploring.

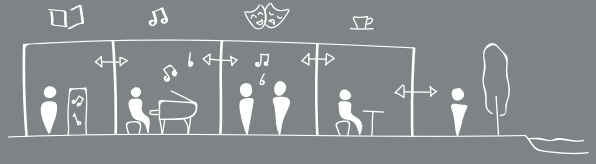


Large glass panel an open up and extend the room outside and be an exhibition window.

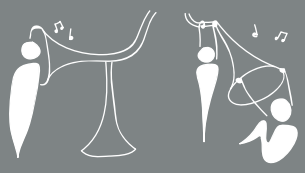


Division of functions.

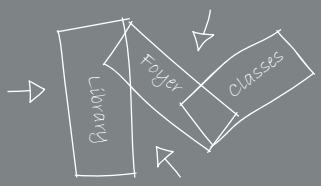
Relation between the functions.

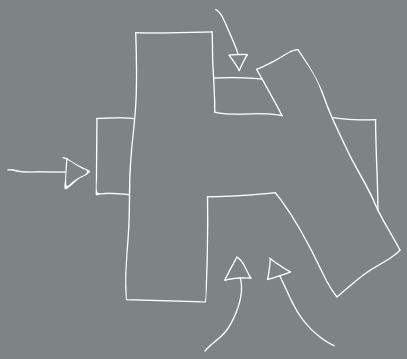


The "trumpet" relates to the music school inside the building and people can interact with it.



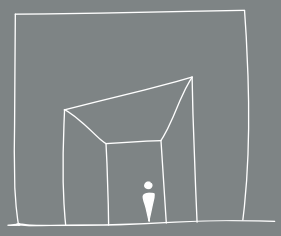
Keeping the existing building and creating several courtyards and entrances.

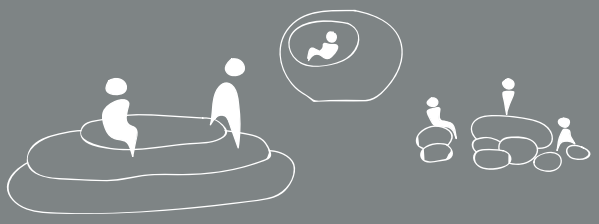




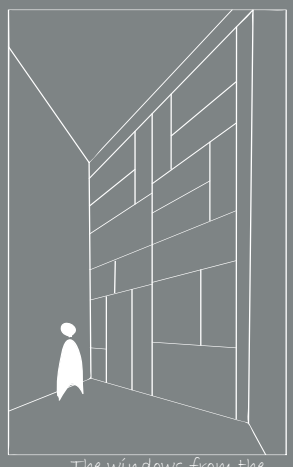
The building opens up towards the stream, leading people in from the path.

Openings that lead people in by shape and materials.



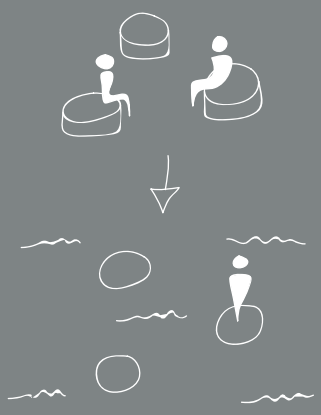


Playful and movable interior invites for learning and exploring.

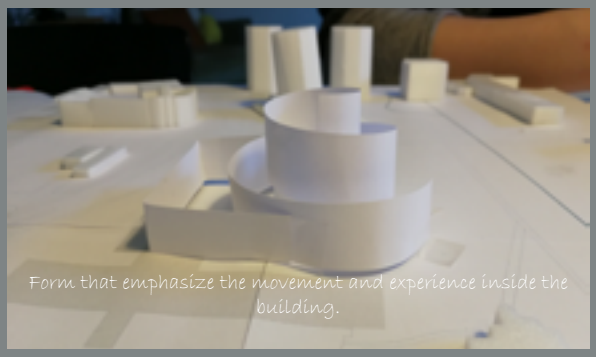


The windows from the existing building can be reused for large view panels.

Elements in the park changes function with the weather.

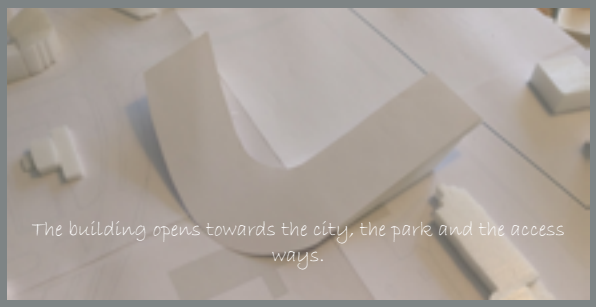


Ill. 51 Idea generation

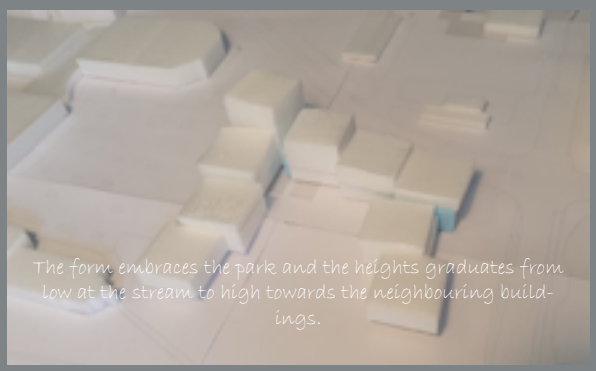


Form that emphasize the movement and experience inside the building.

The roof connects to the landscape and building.



The building opens towards the city, the park and the access ways.



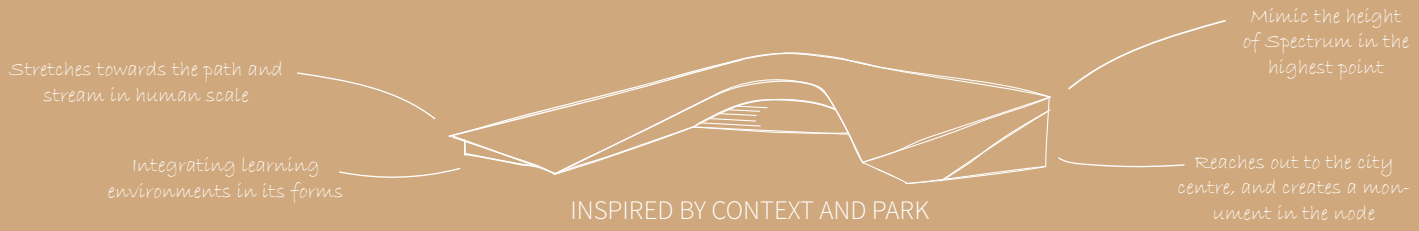
The form embraces the park and the heights graduates from low at the stream to high towards the neighbouring buildings.

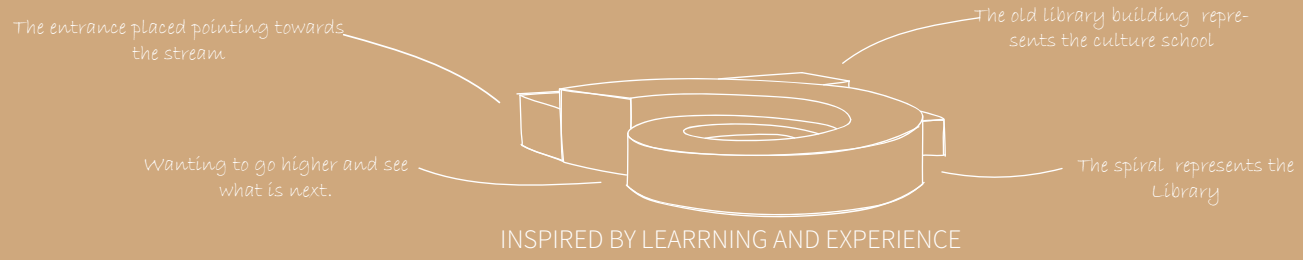
Some functions may be displayed through a transparent or semi-transparent facade.

Ill. 52 Conceptual models

CONCEPTS

After a lot of brainstorm, inspiration, sketching and modelling the design process were started and followed by a lot of iterations. This turned into three very different concepts; one inspired by the context and the park, one inspired by the learning and experiences, and one reflecting the proportions of the old library building. The design criteria were used to validate the concepts and choose between them by giving them a 0 for neutral, - for negative and + for extraordinary aspects of the concepts. The concepts were developed until all of them did not have a minus in any design criteria as they then were seen as more even developed.
Through the analysis and investigation of the concepts, it where clear that the one inspired by the context and park stands out from the others and has most potential compared to the design criteria with no less than 8 pluses.

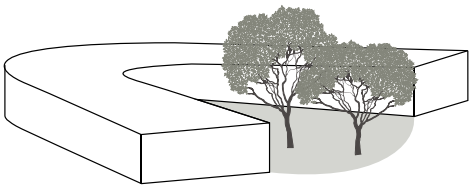




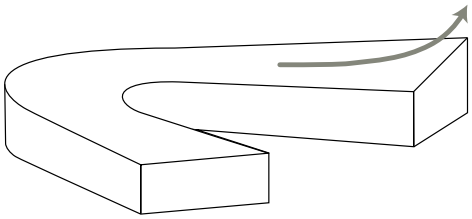
Ill. 53 Three concepts

	INSPIRED BY CONTEXT AND PARK	INSPIRED BY LEARNING AND EXPERIENCE	INSPIRED BY THE PROPORTIONS OF THE OLD LIBRARY BUILDING
LEARNING	+ Green walkable roof which creates a mountain top and watering hole. There can also be created camp-fires.	+ Movement in the interior planning. By floors following the angle of the roof mountain tops and caves can be integrated.	0 Creates an outdoor watering hole towards the park.
COLLABORATION	0 Collaboration between the sections of the building with a visual connection.	+ With the library placed in the spiral an interesting visual connection can appear.	0 A bridge on 1st floor creates a flow between the organisations.
COMMUNITY	+ Embraces the park and arrivals with leading forms. Inviting environments and talks to the scales: human towards the stream and high towards the city.	0 Does not relates to the surroundings. Orientates inwards with the spiral. The entrance stretches towards the path.	+ Creates a open spaces by the entrances towards the park and the road. The building addresses the stream and the city.
LAYOUT	+ An interior flow as 8-flow creates collaborations in the meeting point.	0 The functions is centralised and every function is close to the library.	0 On the 1st floor there is a circular flow by a bridge over the entrance.
MATERIALS	0 Uses the basement of the existing building.	+ Most of the old library building will remain.	+ Utilizes large amount of the old building parts.
BUILDING RELATION	+ Relates to the surrounding buildings and connects the area Ny Rosborg to the city centre. Creates a landmark.	0 The height relates to spectrum, and the spiral relates to De Fem Søstre. More neutral landmark.	0 Relates to itself and the existing library building. Not a landmark, but the facade stands out from the context.
NATURE	+ The green roof makes the building rise from the park and integrates it in the design. Stretches towards the stream.	0 The spiral creates a strong visual connection to the park and stream.	0 The building creates two outdoor areas in the park - the largest one towards the stream.
OUTDOOR SPACES	+ The building hugs the park and shield from road-noice and wind.	0 The spiral creates a non-space around it. The park could be divided as ring in the water.	0 The building opens toward the paths and creates an outdoor area between building and stream.
WATER MANAGEMENT	+ Green roof slowly leads water of the roof. May be used as learning environment.	0 Green facadeelements.	0 Green roof.
BUILDING PERFORMANCE	+ 57,3 kWh/m2/år	0 67,5 kWh/m2/år	0 79,7 kWh/m2/år

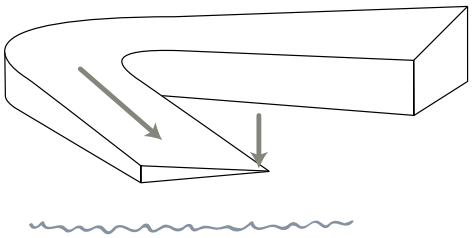
SITE CONCEPT



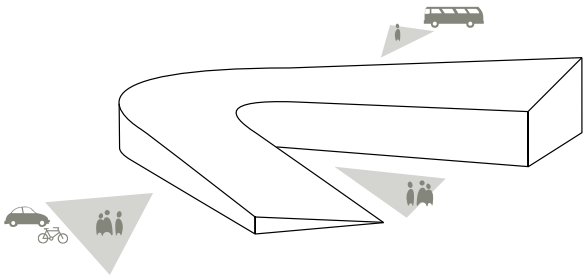
EMBRACING THE PARK



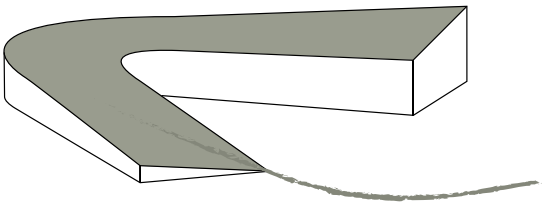
STRETCHED AND LIFTED TOWARDS THE CITY MEETING THE HIGH BUILDING SURROUNDING THE SITE



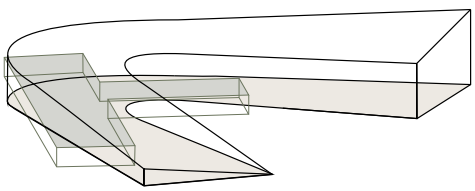
DRAGGED AND PUSHED DOWN TOWARDS THE STREAM AND PATH TO MEET THEM IN A HUMAN SCALE



ENTRANCES TOWARDS PARK, BUS STOP AND PARKING LOT

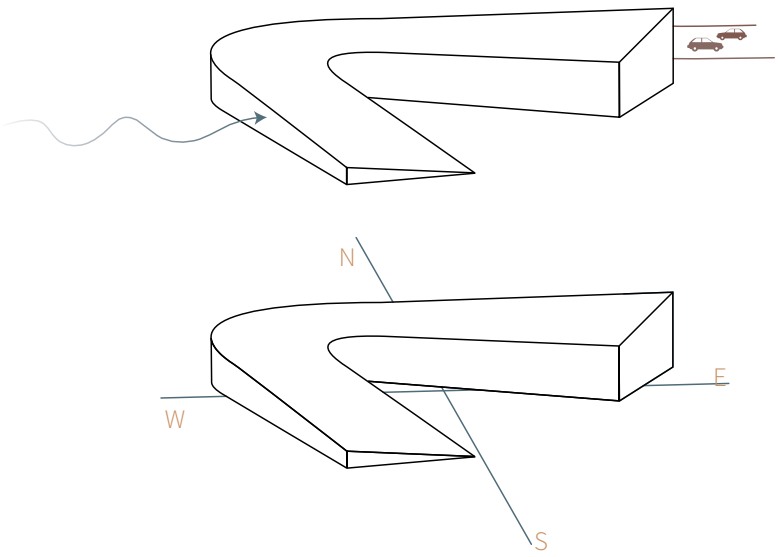


GREEN ROOF MAKING THE PARK INTERACT WITH THE PARK AND INVITING FOR STAYS



THE NEW BUILDING IS PLACED ON TOP OF THE EXISTING BASEMENT TO PRESERVE AND REUSE IT

Ill. 54 Concept part 1

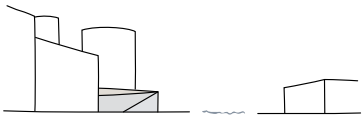


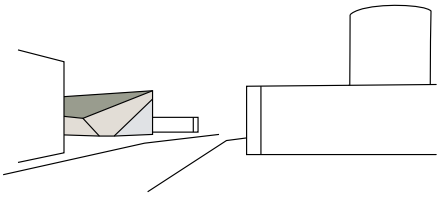
THE BUILDING IS SHIELDING FOR WIND AND NOISE IN THE OUTDOOR SPACE CREATED BY THE BUILDING

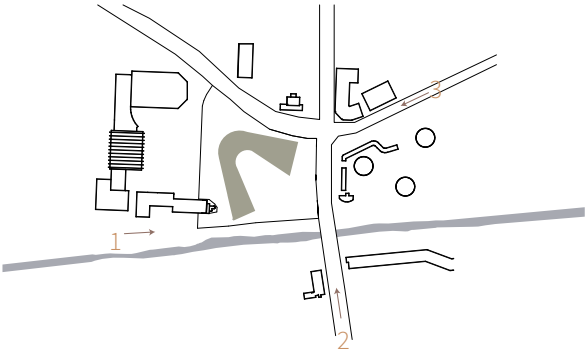
ORIENTATION FOR SUN IN THE OUTDOOR SPACE

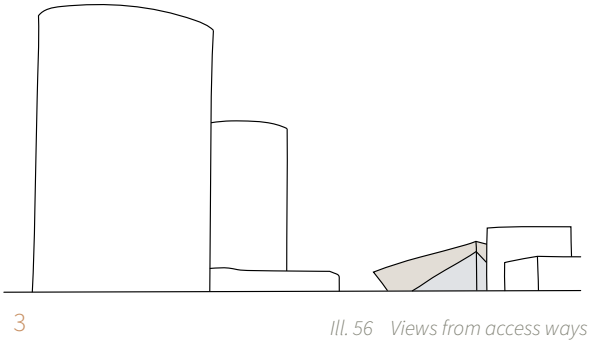
Ill. 55 Concept part 2

Based on the results of site the analyses Serial Vision on page 48 and Sense of Place on page 50 it was revealed that the current library building, and the park related poorly to each other making it an unpleasant city space. Through working with the site and building form, some core themes were developed to create an integrated relationship between the new building and the park. Most of these are founded in the research of the site like the building heights, orientation and placement of masses, and location of entrances. The decision to create a path from the park on top of the new building creates a much more holistic connection between the two and gives the impression of it rising from the landscape.









Ill. 56 Views from access ways

DESIGN PROCESS
PHASE 2: DEVELOPING

This chapter presents the developing of the design through iterations and studies of the form, plans, sections and structural system. It describes the work with the plans of organising the different functions in the building as well as their connections and the flow it creates. At the same time it describes the work with the form in relation to the plan but also in relation to the context and overall aesthetics through scale and hierarchy. Furthermore it presents the development of the roof and atrium also in relation to the flow of the plans and sections.

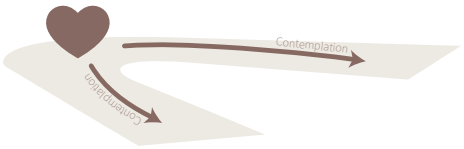
DEVELOPING OF PLANS

The basis for the plan layout out springs from analysis of the organisations and their relation, how the building is going to be used and zoned. The 11744 m^2 should be distributed in a harmonizing way between the users of the building ensuring that they can benefit of each others knowledge.

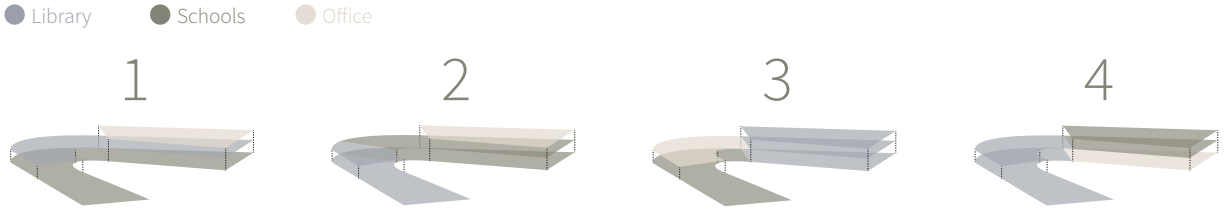
The first themes in the developing of plans where to integrate the functions diagram by investigate different concepts for organisations and core functions.

ENTRANCE
According to the research about the modern library on page 34, it acts like the living room of the city. Therefore, the entrances in the building should be connected and forming a shared space for all users to have formal and informal meetings in open and inviting environments. From the entrance it should be easy to get an overview of the building and easy navigation to move around.

The new building is going be a house of learning for both the library users and the culture school, there for it is important to have room for contemplation which will increase towards the ends (the integration of learning environments will be further described on page 108).



Ill. 57 Comteplation and meetings



Ill. 58 Concept part 1

The organisations have a floor each, this will depend on an vertical connetion.
(Beige floor is offices for both the library and culture school)

The library and culture school is dividing the ground and first floor that would be public. The second floor will be private for the staff of the building.

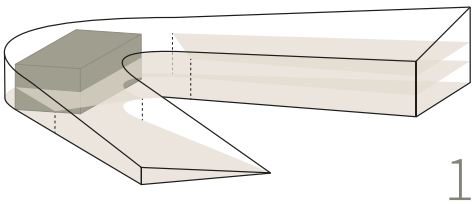
Opposite of option two the library here occupy the high part of the building being more visible towads the node and city centre.

Utilize the eastern facade to stage the culture school. The staff have a close connection to both the library and culture school.

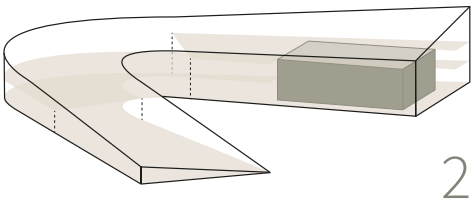
ZONING
The library and culture school have many shared facilities so to utilize that the organisations will be mixed between each other's; the media department of the library should be close to the music classes and the creative writing class should be placed in the library. Thereby there can be created multifunctional spaces for learning and knowledge sharing.

This is an investigation of how to zone the organisations knowing that it most certainly will be more blurred in the final plan layout.
Number one will depend on a vertical connection between the floors to success on bringing the organisations together. At number three the vertical connection has to work to bring the three floors of the library together to a unit. Here there is a strong division between the two building parts. Both number three and four is trying to centralise the staff but in number four it creates a distance between the library and music school.
Number two have mixed floors of library and culture school which makes it easier to support the sharing facilities and learning environments which is why it is the one chosen to work further on.

The building consists of some functions with large areas as the black boxes and culture stage. Together with the café they also have a central role for the movement in the building.



Ill. 59 Stages version 1



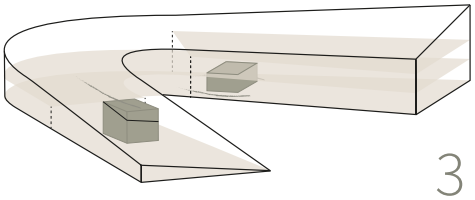
Ill. 60 Stages version 2

CULTURE STAGE

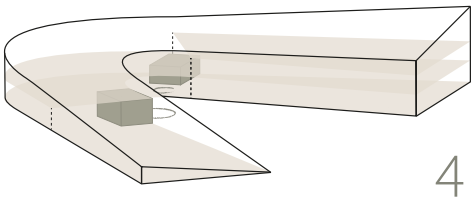
The culture stage is 450 m2 in two floors, so it is a central element in the room planning. It needs to have close connection to the culture school and easy access an outdoor parking space as there is a need of transporting instruments in and out of the stage.

In number one the culture stage is placed towards the parking area for easy access. The stages create a background for the entrance towards the park, but it is also making a clear division between the library and culture school which does not support the idea about mixing functions.

Number two have the culture stage placed in the end of the culture school zone, where it is both close to a facade and to the music classes for transport of instruments. I have a larger distance to the entrances than number one, which is seen as positive for the flow in the building.



Ill. 61 Stages version 3



Ill. 62 Stages version 4

BLACKBOXES

As the culture stage, the black boxes also play an important role for the plan layout.

Number 3 is about how the black boxes can be used for divide rooms and create flow around them and on top of them.

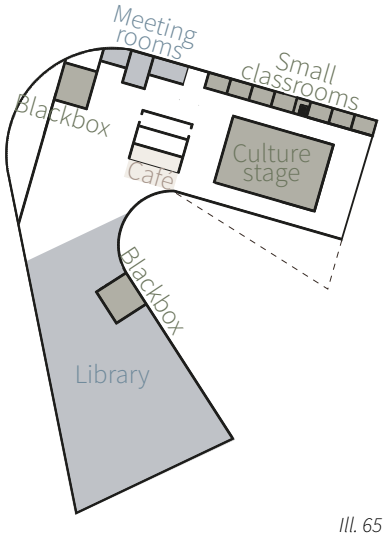
Number 4 is working with the multifunctionality of the stages. One is placed towards the facade to the park; in that way it could be possible to open the facade and make “outdoor” performances. The other one is placed towards a non-space, an indoor square for multipurpose activities, where the stage also is able to open up for adding more area to the stage.

As the building have many users and functions number four is the one going through with as the main concept as it contains more flexibility and still can be used as division in the plan layout.

DEVELOPING OF FORM

Developing the plans with the layout concepts (Developing of Plans on page 82) changed the form of the initial building concept. So, meanwhile developing plans and facade a need for a form study of the building occurred.

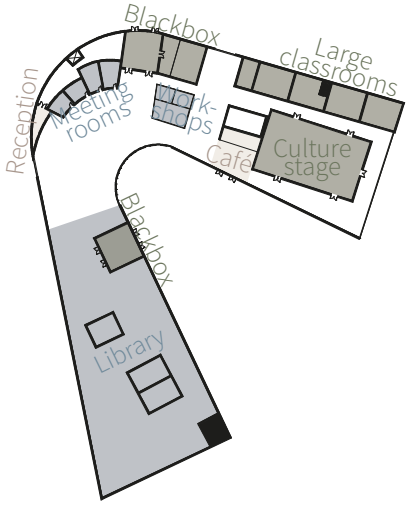
Putting the functions and concepts into the original building concept started to distort the form (see *Ill. 65*). Especially the culture scene needs large space when the area around it is maintained to ensure flow and no dead ends. The opposite site of the building ended up as the form of a trumpet, and the plane got some disharmony to it. Therefore, a form study was made to get the harmony back in the building.



Ill. 65 Form 1

GROUND FLOOR
1:2000

Form one shows the starting point and the asymmetry of the circles forming the arches. Form two have same centrum for the circles which makes the middle of the building narrow. Therefore, form four where the periphery of the small circle is tangent to the centrum of the large circle ensures more space in the middle of the building.
Number 5 points out how the symmetry also is affecting the enclosed outdoor area in a calm way, inviting people into the funnel.
Investigations the contrary of the narrow and wide building parts in form six and seven it is clear that form eight is more harmony between the building parts.
Illustration *Ill. 63* and *Ill. 64* is showing form 11 and 12 placed on the site. Here it is seen that the facade towards east in form 11 is more parallel to the road which create a sharp corner to the inner park area, whereas form number 12 is perpendicular in the opposite corner which makes a more leading for inviting people form the node into the park.

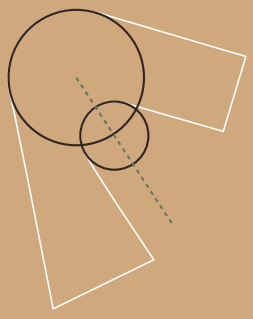


Ill. 66 Plan iteration

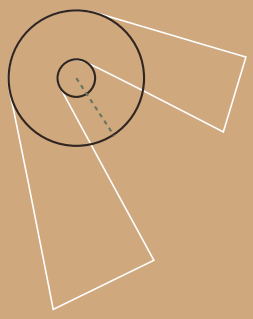
Ill. 63 Form 11

Ill. 64 Form 12

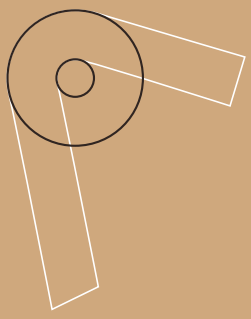
FORM STUDY



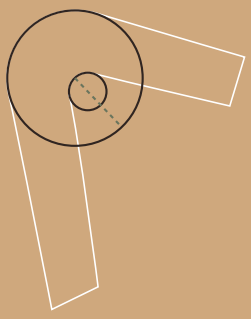
1 Asymmetry of circles



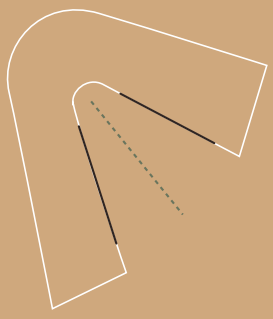
2 Same centrum of circles



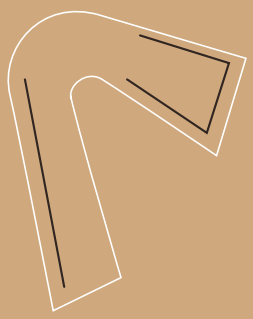
3 Parallel walls



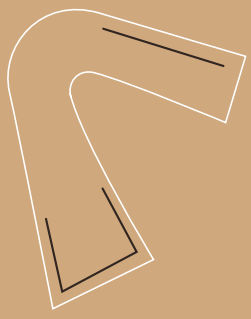
4 Circle periphery crossing radius of big circle



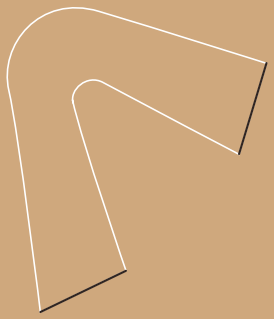
5 Symmetry in the park area



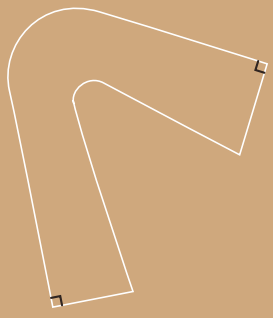
6 Trompet towards north



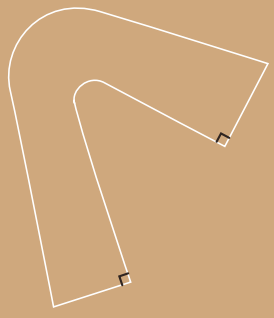
7 Trompet towards south



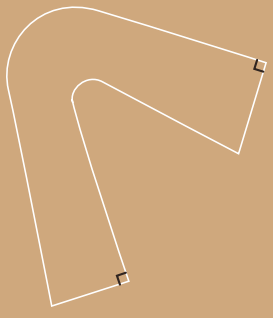
8 Same width in the ends



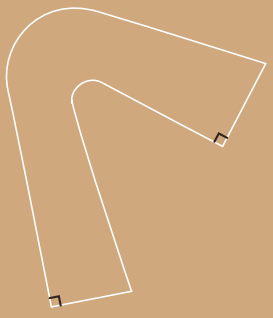
9 Perpendicular corners (outwards)



10 Perpendicular corners (inwards)



11 Perpendicular corners (towards right corners)



12 Perpendicular corners (towards left corners)

Ill. 67 Form development

INITIAL ROOF CONCEPTS

The roof have been developed throughout the hole design process. This page revels roof studies and analysis that where used to investigate the form of the roof. Furthermore, a section study reveled ways to integrate the interior plan layout and learning environments to the roof.

The building form is driven by the context (see Site Concept on page 78) where the roof is a is acting as one of the elements. The main form of the roof haven't changed much from original concept idea to the end result. So during the design process occurred a desire to investigate if it still where the right form for the building design. Therefore, form study of the roof where done and ended by developing another roof design. The initial and the new roof designs were evaluated through discussion based on the involving design criteria.

BUILDING RELATION

Roof one is open towards the park and lifting up to the height of the nearby Spectrum towards the city where also De Fem Søstre is to be found.
Roof two is mostly directed towards the park, as the highest point of the building is moved towards the middle.

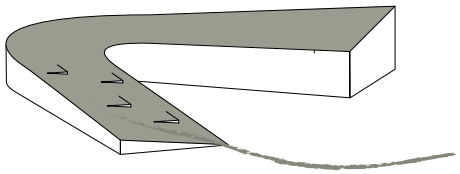
OUTDOOR SPACES

Both roof concepts are integration the park with green roof and waling paths.
Roof two is creating a loop of movement as both ends is going down to the park.

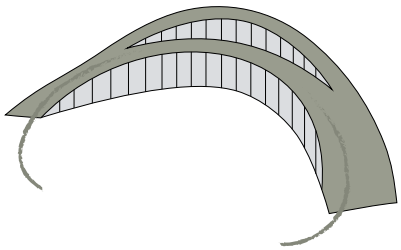
WATER MANAGEMENT

Both roofs are green which means that they slow and absorbs rainwater to reduce the water pressure on site.
Roof one is leading the water down to the stream, whereas roof two is distributing the water to the site.

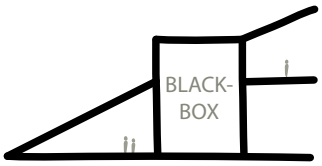
Due to the analysis of the roof design it where chosen to work further on the original roof one ad it relates more to the site.
Besides the window study (see page 98) further iterations on the roof where made to investigate how the roof can interact with the rest of the building.
It where concluded that the roof should function as an extended part of the park with room for experiences and stays. Furthermore, the learning environments watering hole, mountain top, and movement will be integrated (described further on page 108).



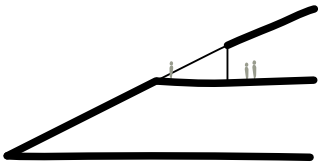
Ill. 68 Roof 1



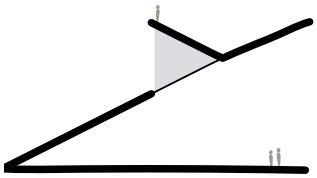
Ill. 69 Roof 2



Letting rooms cut out of the roof and create plateaus



Cutting into the roof creating direct connection from interior floors

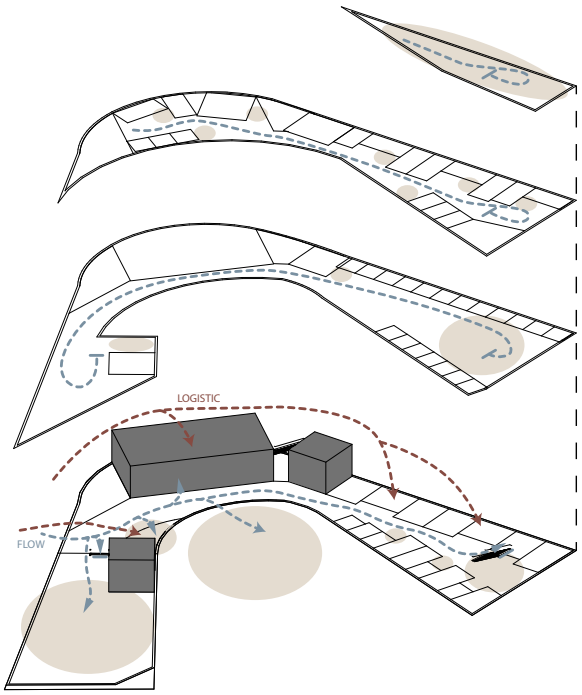


Tipping a roof piece creating a lookout and window on the sides

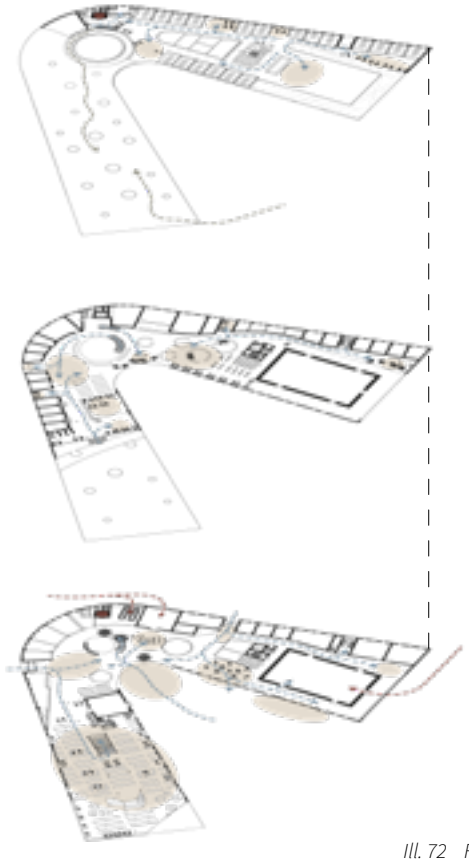
Ill. 70 Roof iterations

FLOW

The flow of the building is essential for a building to success in the long therm and is determined by the relation between functions, stairs, and layout. The flow is investigated in isometric, section and plans as the connection between the floors is important. More investigations about the atrium is to be found on next page.



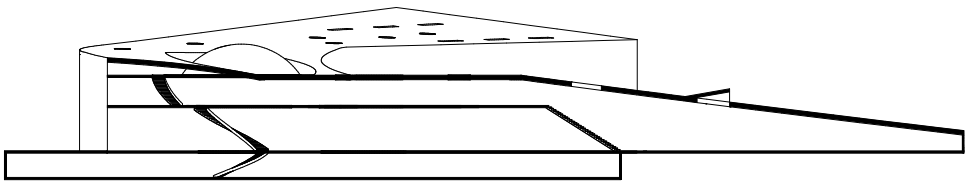
Ill. 71 Flow 1



Ill. 72 Flow 2

FLOW 1
The first plans where the ones with the main stages towards the middle of the building and curved atrium. Here there where a focus on the logistic flow and easy access to the stages.
From the ends of the building there is stairs to first floor with creates a loop flow for the public part of the building. In the building end towards east the stair.

FLOW 2
Further development of the building design, plan layout, and atrium revealed a more detailed flow chart.
By moving the culture stage from the middle to the east end of the building, there is going to be space for a centralized atrium and staircase. The visual connection an atrium creates between floors helping the users navigate in the building.



1:1000

Ill. 73 Flow section of stairs

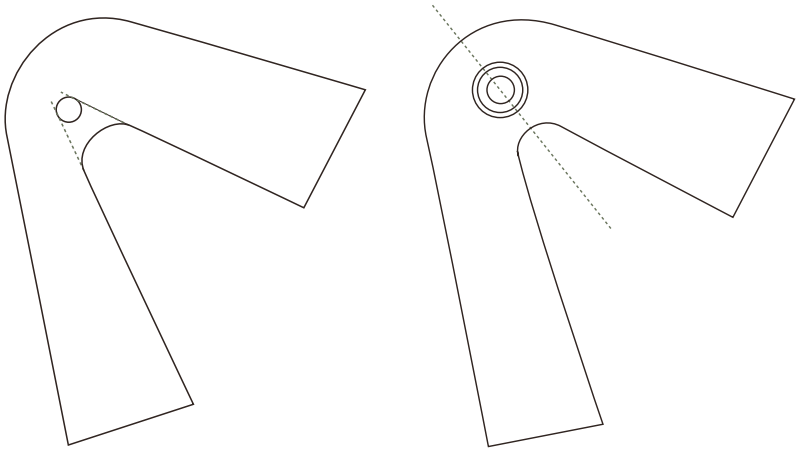
ATRIUM

Through daylight analysis it was evaluated that the middle of the building will be very dark, therefor an atrium was introduced both to ensure good light quality but also to connect the floors vertically. Furthermore, the atrium will be used for stack ventilation to ensure thermal and atmospheric comfort.

CURVED ATRIUM

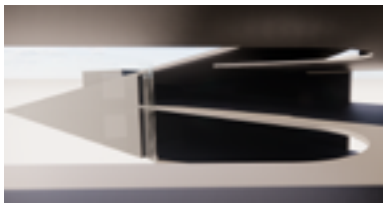
ROUND ATRIUM

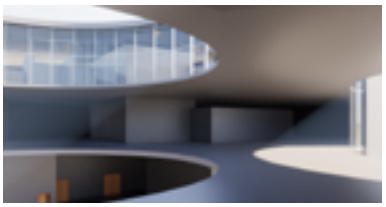
The concept of the elongated atrium was created by maintaining the lines from the inwards facing walls. This creates a large open space between the decks and a focal point in the apex of the curve. This gave a good visual connection between the floors and plenty of daylight.



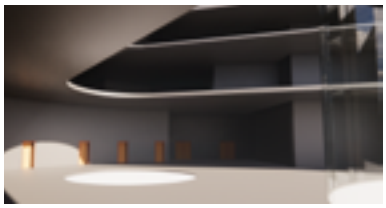
Ill. 74 Atrium concepts

The circular atrium was placed along the same centreline as the inwards and outwards facing curved walls creating a balanced expression in the plan. The circular atrium created an interesting space beneath and around itself and maintained the physical connection between the two “arms” across the 1st floor.



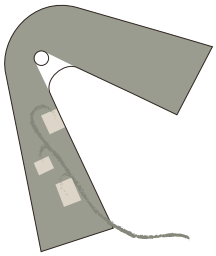
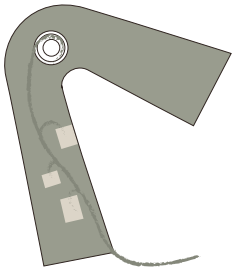
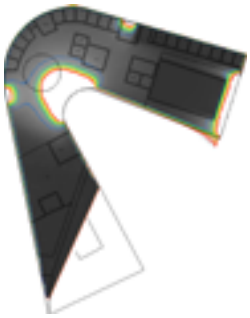
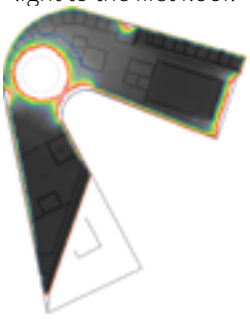


Ill. 75 Atrium visualizations, 1st floor



Ill. 76 Atrium visualizations, ground floor

The review of the two concepts in relation to the design criteria, showed a considerable advantage for the circular atrium. The movement up through the atrium becomes an expression of its form and generates an actual spatial experience. The possibility for a more integrated roof terrace at the top of the footpath on the roof was also an interesting facet of the circular atrium. A particularly attractive aspect of this concept was the unbroken connection around the atrium on the 1st floor between the library and music school, which was more in line with the design criteria. All these reasons were ultimately why the circular atrium was brought on for the final design.

	CURVED ATRIUM	ROUND ATRIUM
LEARNING	**0** Placed at the entrance and in the middle of the building, hence being a watering hole.	**+** It invites for an experience and movement around the atrium. Placed in connection to a watering hole (the entrance and middle of the building)
COLLABORATION	**0** The curved atrium create a division between the two sections of the building on the 1st floor where there is library towards south and music towards north. The curved atrium creates a visual connetion between the sides of the atrium and floors of the building.	**+** On the first floor the round atrium invites to move around. Furthermore, it creates a more direct connections between the two parts of the building.
LAYOUT (INDOOR FLOW)	**0** The curved atrium follows the shape of the building. It limits passage between the two ends to one path.	**+** . Creates a continious flow around the atrium and allows for movement around both directions.
OUTDOOR SPACES (OUTDOOR FLOW)	**0** The curved atrium does only have movement up to the plateus, but it is restricted only to the plateus. 	**+** The circle creates flow on the roof by inviting for movement around the atrium. The staff and other users can have an active break walking around the atrium without having to exit the building completely. 
NATURE	**+** The curved atrium frames a view of the park and stream from every floor.	**0** The round atrium does not provide direct views to nature.
BUILDING PERFORMANCE	**0** The curved atrium directs more light towards the south part of the first floor. 	**0** The round atrium distribute light all the way around it and thereby provide more light to the first floor. 

STRUCTURE

Since the structural system was not one of the focus points in the project, this workshop aimed mostly at investigating how the structural system influences spatial quality and visual expression inside the building. The following investigation examines the relationship between the columns of the structure and the interior spaces which they will inhabit.

To establish a basis for these investigations, a few assumptions were made regarding the loadbearing system and the size of the loads acting upon this system. It was then determined that glue-laminated timber would be the optimal construction material because of its structural properties, lower environmental impact, and lower negative effects on the indoor climate compared to steel or concrete.

VISUAL EXPRESSION

This study will compare different distributions of columns in the library to find out what would fit the room and spaces best. Since attentive material choice is a primary design criteria for this project, it would be desirable for a design option to use less material.

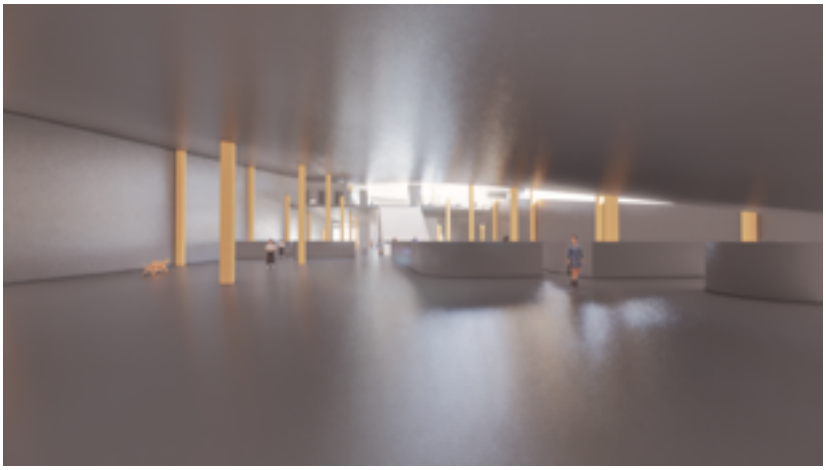
Option 1: Wide middle
The wider option open the middle area up even further and thus, focuses the visual and spatial attention more on this part of the room. Instead of it being the area the users will pass along when moving through the library, it has now also become the figurative “central area”. All other elements in the room seem to revolve around it and respect the space. This would be work well in an area where the aim was to gather people or a big transit area.

Option 2: Even distance
The option with even spacing of the columns was not as interesting as the two others since it did not emphasize a particular part or space in the room. The positioning of the innermost columns does not provide an attractive placement of the corridor area on either side since this would greatly diminish either the inner or outer area. Therefore, this option was not chosen for the final design.

Options 3: Narrow middle
This option place the columns closer to the centre of the room (see ill). Placing the columns close to the middle of the room can help define spaces in that middle corridor which feel denser and more connected. The row of columns on either side also adds depth or guides the user through the room. The wider area along the facades allows for more flexibility when furnishing and designing spaces for the library’s current and future needs. For these reasons, this option was chosen.

STRUCTURAL SYSTEM

The structural system consists of frames spaced roughly 10m apart. The system gains stability in all directions because of the angle and geometry where the two building parts meet to form the atrium.
The columns are dimensioned as 380x380mm gluelam32 in order to carry the loads from two decks and a roof.



Ill. 77 Wide middle, 10m frame distance

Ill. 78 Balanced middle, 10m frame distance

Ill. 79 Narrow middle, 10m frame distance

DESIGN PROCESS
PHASE 3: DETAILING

This chapter is presents the detailing process of the design. It describes the work with the facade detailing, through materials, openings and windows, both in a environmental perspective and in a aesthetic perspective. The development of the windows has been based on investigations the exterior expresseion as well as the interior daylighting conditions. Going from exterior to interior, the chapter also presents the work of integrating learning environments into the plans and the choice of interior materials.

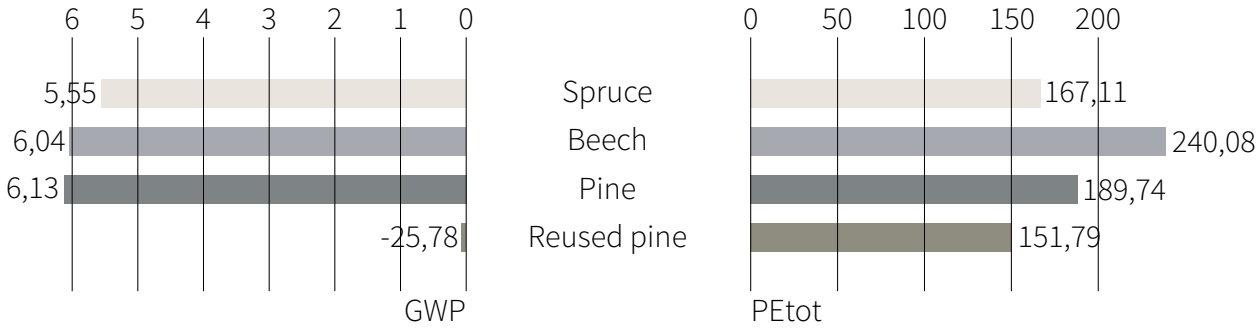
FACADE MATERIAL

To determine the material for the facade various factors were investigated, both sustainability of different materials in a life cycle perspective and the visual expression of them as well as their functionality according to their use.

MATERIAL

As the walls are not the load bearing structure in the building, it is not necessary to have a heavy wall construction. Therefore a light wooden construction and facade material could be a suitable solution. Furthermore wood is a more sustainable material, with a low environmental impact compared to other materials as e.g. bricks, because it stores CO_2.

To determine which type of wood to use, a Life Cycle Assessment (LCA) was performed through which different sorts of wood were compared. The comparison is shown on *Ill. 80* and it shows spruce has the lowest environmental impact of the new wood materials that were investigated. However reused wood has a even lower impact.



Ill. 80 LCA of wood

DIRECTION OF CLADDING

The curved form of the building makes some materials complicated to mount. Horizontal wooden slats are not very suitable for the form, whereas vertical slats naturally follows the curve and even emphasizes the form.
Furthermore the vertical slats relates to the surrounding buildings on Willy Sørensens Square, which all have vertical elements in their façades as described and seen in Appendix 4 on page 126.

Horizontal

Vertical

Ill. 81 Cladding direction

SIZES OF CLADDING

The width of the wooden slats were also investigated as well as the distance between them. In terms of width three different expressions, wide slats, narrow slats or a combination of both. The combination of wide and narrow slats gives a changing appearance through the facade, which creates a more dynamic expression. Both the wide slats and narrow slats is uniform in its expression and seems more calm and organised on the facade.

However the visual expression of the facade depends not only on the cladding, but also other features as e.g. the windows and entrances and should hence be assessed as a whole. Therefore, simultaneously with this investigation of facade materials, windows and entrances were also investigated. This will be elaborated later in Windows on page 98 and entrances on the following page.
Since the building already has a very dynamic form and is intended to have other more expressive features integrated in the facade, it was decided to use only one width.

Ill. 82 Wide cladding

Ill. 84 Narrow cladding

Ill. 83 Cladding combined

FACADE OPENINGS

OPENINGS

To emphasise the functions of the building and to pique the public's interest, it was investigated to display some of the some of the elements inside the building through the facade. By opening up or "lifting" the facade in specific areas it is possible for passers-by and the city in general to get a sneak peek of what is going on inside the building. The idea was to showcase the three main functions the building offers; the library, the cultural functions and the building being a new "living room of the city". From inside these openings connects the building and the users with the context, with visual connection to the surrounding area and the city.

CULTURE

The cultural functions are mainly placed at the north-eastern park of the building, where the gable faces the city. This is the facade that was investigated for the opening. Here the cultural functions will be represented by the culture stage, which is the large concert/event hall in the building. Different opening proposals can be seen on *Ill. 85*. A is only showing part of the box evoking curiosity. However it doesn't fit very well with the plan layout, with having more private functions around the box, since the glass covers the entire width of the gable. B, C and D emphasizes the box by following the sides of it and thereby framing it. C lets the box go all the way to the roof, whereas D completes the frame above the box and further highlights the box. D was therefore chosen.

LIBRARY

The library is mainly placed in the south-western part of the building, stretching its gable towards the stream. The west facade of the library faces the parking lot. To create a better connection to the stream and lead people from the parking lot into the park, the south-west corner "lift its skirts", revealing what is inside. Three openings were investigated see *Ill. 86*. A has the facade is simply lifted from the corner. B has the opening going from floor to ceiling and the facade cladding ends where the opening with glazing starts. C is the same as B, but with a semi-transparent version of the facade cladding covers the upper part of the glazing see *Ill. 86*. The cladding is the same as the rest of the facade, however with distance between the slats to allow light through.

MAIN ENTRANCE

The main entrance faces the park and is placed right in the curve of the building. This is also were the different functions, both vertically and horizontally of the building meets and the users can interact with each other, "the living room of the city". Therefore a large opening was desired to be able to showcase this and furthermore to mark it as the main entrance see A in *Ill. 87*. B has the same glazing as A, but with a semi-transparent part making a smooth transition in the facade. The arch refers to the curved shape of the building and the entrance for a more coherent expression.

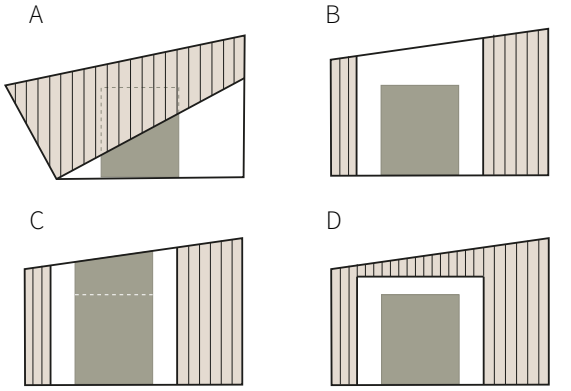
SECONDARY ENTRANCES

As a public building and to create a welcoming atmosphere for the users, the entrances of the building should be easy accessible and visible. They should be inviting and draw people in and at the same time stand out in the facade so there is no doubt in how to enter the building. This let to investigations on different solutions to break up the entrances from the rest of the facade.

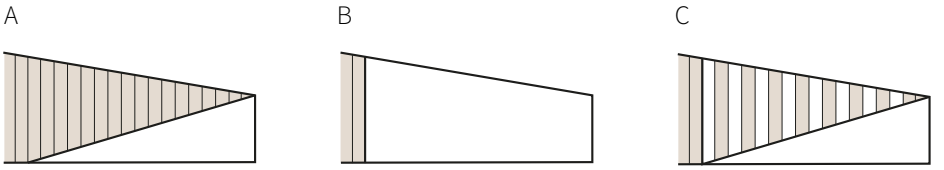
The main entrance already stands out with its placement in the middle of the curved form in direct connection to park and embracing the park. Furthermore it is also where the "living room of the city" is displayed with its large glazed curtain wall, which makes the entrance on display as well.

The secondary entrances were investigated in two different ways, a continuous glazed band from floor to ceiling and a recess into the facade see *Ill. 89*. A creates a clear separation of the facade where the entrances are. B is more vague but still shows the entrance. The recess in C-F creates not only a visual mark of the entrances, but also an experience of entering gradually from outside, to an enclosed entrance and finally inside the building. C gives the experience of entering a large building in a more human scale, whereas D can seems a little intimidating. E relates to the other openings by having the semi-transparent cladding above the entrance. F creates a larger focus on the part above the entrance, than the actual entrance.

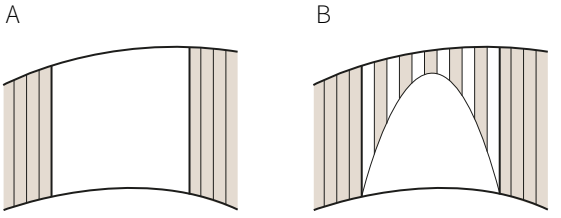
Therefore E was ultimately chosen for the secondary entrances.



Ill. 85 Culture opening

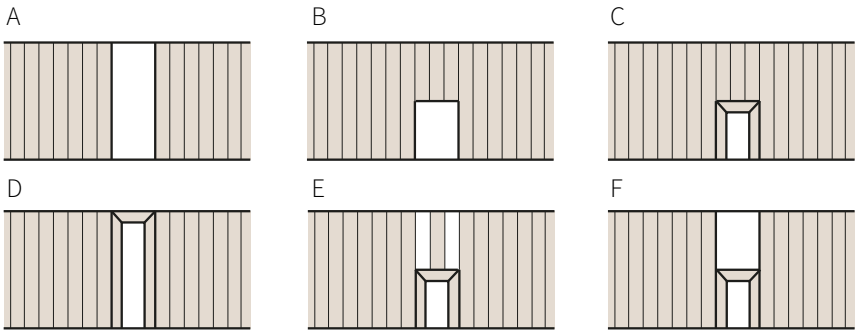


Ill. 86 Library opening



Ill. 87 Main entrance opening

Ill. 88 Transparent facade



Ill. 89 Secondary entrances opening

WINDOWS

To develop the final concept of the windows and openings in the facade we will study the expression of the façades with the different solutions and their daylight performance.

FACADE STUDY

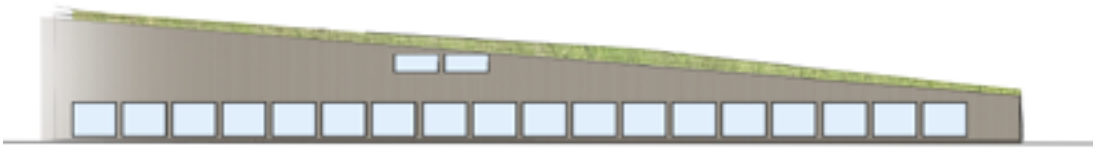
The principles for how the windows are arranged is viewed on the elevation of the west facade of the library. The study will take point in this part since it is one of the key focus areas of the project.
A principle that is attractive in the library area is one that can spread light evenly where needed and provide a view to the outside even above the shelves.
For the building as a whole, it would be desirable that the windows work with and emphasizes the form and shape of the building.

Option 1
Seen on the right page. This option was made to try out windows that would resemble the ones on the old library building. These did not work since it opened the facade too much and would make it uncomfortable to sit near the facade and read.

Option 2
This option was part of the tests to mix slightly square and slender panels to create wider window systems. This was to create a more playful facade, while providing coverage for the users. This option distributes light well but does nothing to emphasize the shape of the building's shape.

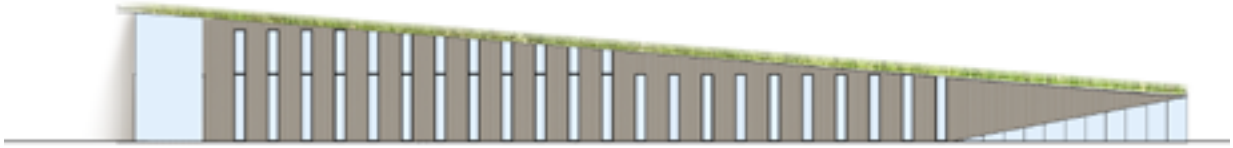
Option 3
Option 3 examines a system of tall and slender windows (1 x 5m) organized in a repetitive rhythm. The tall windows enable the users to peek to the outside over the shelves and the shape and steady repetition of the windows helped accentuate the building's shape. This option was not chosen, however, because it distributed light quite poorly compared to the broader openings. The long vertical elements are an interpretation of some common features shared by the other buildings facing the Willy Sørensens plads and the original library.

Option 4
This is the principle chosen for the building a variation of the repetitious slender windows where the rhythm is broken in places to accommodate the interior spaces, but still accentuates the building's shape. Some of the windows will be placed in a different height (40 cm above the floor) from the others so they can be used as seating. The breaks and bigger openings distributes daylight to create diverse and interesting spaces inside.



Ill. 90 Option 1

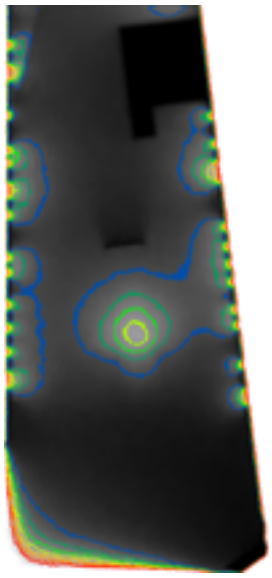
Ill. 91 Option 2



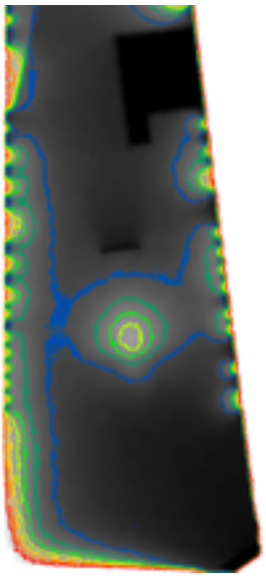
Ill. 92 Option 3

Ill. 93 Option 4

Stage 1: Facades

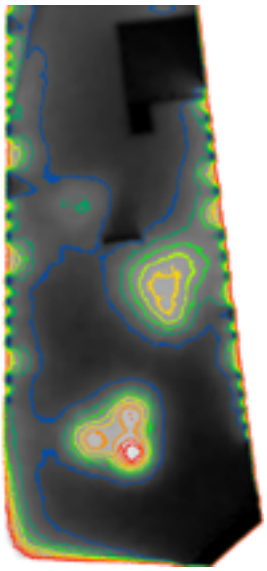


Ill. 94 Facade baseline

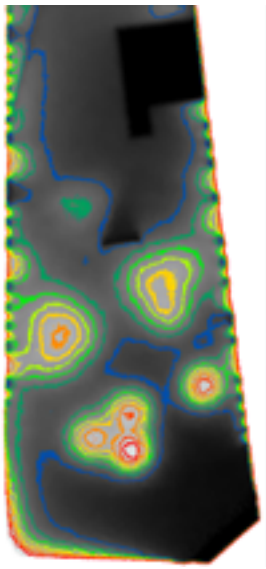


Ill. 95 Facade optimized

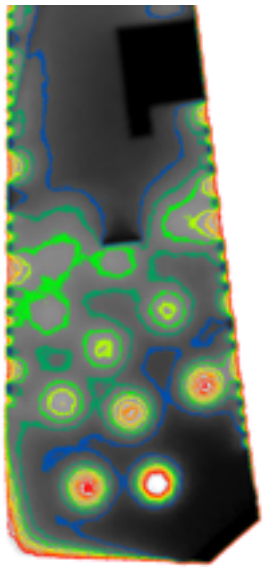
Stage 2: Skylight



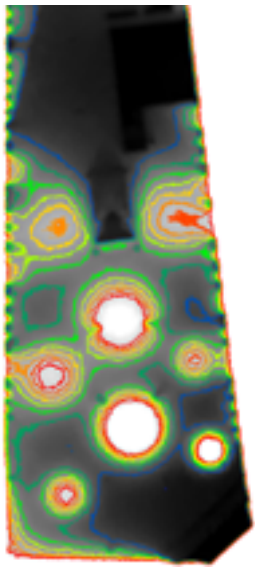
Ill. 96 Arrangement 1



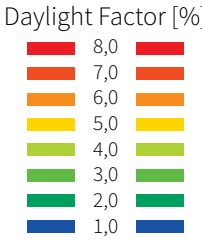
Ill. 97 Arrangement 2



Ill. 98 Arrangement 3



Ill. 99 Arrangement 4



DAYLIGHT OPTIMIZATION

Daylight is a very important element in architecture. It affects the interior spaces as much as people occupying them, the building in general, and its energy performance. The users benefit from adequate amounts of natural light because it improves the quality of the indoor climate, increases health and well-being as well as making visual tasks easier or less straining (FBK, 2020).
According to the BR18 and the FBK, the amount of natural daylight inside a room is considered sufficient if at least half of the relevant floor area receives 300 lux (equivalent to 3% Daylight Factor) or more in at least half of the daylighthours. Where the relevant area is where workstations are located (§379 stk. 2 in Bygningsreglementet 2018). Again, this investigation will take point in the main room of the library unless otherwise stated. The library measures roughly 60m in length from the toilets as well as 25,3m to 33,2m deep.

Library

Because the term of "relevant floor area" is very vague, we have decided to interpret the entire floor area of the library as "relevant floor area" the assumption being that visual tasks are performed everywhere in the library, apart from clearly marked transit areas. In "Libraries - A design manual" by Lushington, Rudorf, and Wong, it is also described that an even distribution of daylight is important in a library, even in the stacks area and reading areas (Lushington, Rudorf, and Wong, 2016).
The daylight optimization was done in two stages: the first was to determine the placement and distribution of windows, and the second investigating the placement and size of skylights.

During the first stage, the development of the library started, so the placement of reading areas was determined alongside these daylight investigations. This was used to define which areas of the facade needed larger openings to accommodate those functions.

Illustrations 1 and 2 show the change in daylight distribution. The size of the windows remained the same since the height causes them to act as clerestories, casting light deeper into the room.In some places, windows were added closer together to form a curtain wall, and the oblique curtain wall meeting the south facade was given a uniform height, but partly covered with lamellas to conserve the expression and act as a shade Ill. 16 LocHal on page 35.

In the next stage different arrangements of skylights were added to increase the daylight in the middle of the room.

The first two arrangements investigate clusters of three circular skylights with Ø=3m. Neither of them managed to bring in enough daylight into the room and were therefore not chosen.

Arrangement 3 use the same number of skylights as no.2, but scattered across the roof instead. This gives a pleasantly even level of daylight in the library but falls short of the 3% DF for half the relevant floor area.

The 4th arrangement mixes openings of varying sizes placed above working areas in the library. The increase in size of the openings, supplies more daylight, but also does it with less window area than the other relevant options. Therefore, this arrangement is chosen for the final design.

Skylights - flat or domed?

An important aspect to a skylight is the shape and angle of the glazing. Typically, flat skylights placed flush with the roof act more as a spotlight and directs light straight into the room depending on the angle of the sun in relation to the skylight. A domed skylight gives a more diffused light and covers a broader area. With the aim to cover a larger area with daylight to rely less on artificial light, the decision was to go with the domed skylights. Another advantage of the domed shape is that rain and snow cannot gather as easily on the window and block the light or otherwise damage the roof (Aluplex, 2018 and Rahman, 2021).

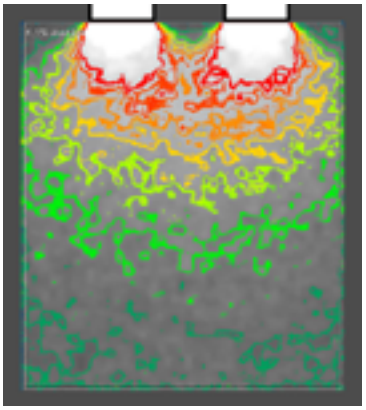
OFFICES

The offices were also investigated to ensure that these would also receive sufficient daylight with the chosen principle as per the regulations from BR18. The investigations are made on a reference north-facing offices from the project measuring 4,8m wide and 5,8m deep.

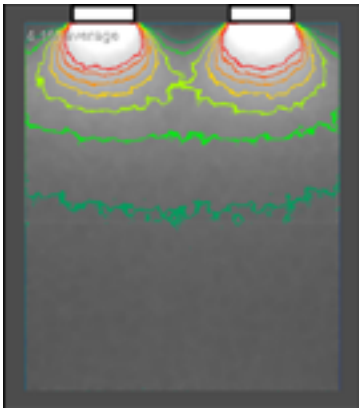
The first iteration shows the result of placing two windows of 1x3,5m. This provided an excessive amount of light reaching an average 4,1% Daylight Factor (DF) for the entire floor area, not half.

The chosen iteration still has two windows, but are downsized to 1x2,5m and 1x2,0m placed by the floor and 0,5m from the floor respectively. This arrangement supplies an average 4,1% DF for half the floor area in the office. A similar arrangement is also used in the smaller music rooms since they differ very little in size.

A 24 hour average temperature calculation has been performed and resulted in a maximum temperature of 25,4°C. Therefore exterior roller blinds are integrated in the facade, which brings the temperature down to 24,9°C. The roller blinds are individually controlled by the users.



Ill. 100 Office baseline



Ill. 102 Office optimized

Ill. 101 Windows, final concept

INTERIOR MATERIALS

The interior materials has been investigated through a comparison of materials, where the visual expression and environmental considerations were taken into account. Furthermore the materials has been evaluated for suitability of their specific use.

WALL

For the interior walls several materials were investigated shown in *Ill. 103-Ill. 106*.

CLAY BOARDS

Clay boards have a positive effect on the indoor environment, as it improves the thermal comfort and balances the moisture. It is also environmental sustainable in terms of production and disposal and can be reused. Is is possible to choose almost any colour for the clay cladding, which creates a variety of possible aesthetic solutions when combining it with other materials. The visual expression of the clay is uniform and calm, while still having tactile qualities. Hence clay is chosen as main wall material. However the boards are not very suitable for curved walls.

Ill. 103 Clay wall

WOODEN SLATS

Wooden slats are also a sustainable solution and locally available. It has a warmth to it, both through the visual expression and tactile qualities. Furthermore it gives the possibility of integrating an acoustic solution, with a sound-absorbing material behind the slats. The wooden slats creates a coherence between inside and outside, by being a continuation of the exterior facade into the interior of the building. The vertical slats is also a good solution for the curved walls inside, as they follow the form. Therefore they were chosen for the curved walls inside.

Ill. 104 Wooden slats wall

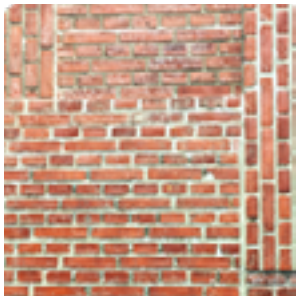
CLT

Cross laminated timber is both durable, strong and sustainable. It can be used for the fire cores, which is why it was chosen for the enclosed staircases. It can also function as way-finding, by making the cores stand out as the only walls with this material.

Ill. 105 CLT wall

REUSED BRICKS

Reused bricks were considered as the existing library building has brick gables. The bricks can be used to highlight some functions and can work as a thermal mass. The culture stage is intended to be displayed through the facade, which could be further emphasized by cladding it with bricks and make it stand out from inside the building as well. Hence it was chosen for this.



Ill. 106 Reused brick wall

FLOORING

The flooring materials examined can be seen in *Ill. 107- Ill. 109*.

Ill. 107 Concrete flooring

Ill. 108 Industrial parquet

Ill. 109 Clay flooring

CONCRETE

Concrete flooring is very durable and easy to maintain which is important in a public building where many people pass through every day, especially in the entrance areas. However it can seem cold depending on the colour and finish. Moreover the production of concrete is not very sustainable, but it has a long lifespan and has a high thermal capacity.
The ground floor has three main entrances and further several other access doors leading directly out to the park. It is where the largest amount of people will pass through during daily use of the building, and it is also where the three stages are placed. This means most events and activities will take place in the ground floor. Therefore is determined that concrete flooring will be suitable for the ground floor. The concrete from the existing library building can be reused for the flooring.

WOOD

Wooden flooring was considered for its sustainable and tactile qualities. As the building strives to become “the living room of the city”, wooden flooring only seems suitable to create a “living room” atmosphere. A very durable and visually interesting wooden flooring is industrial parquet (højkantsparket) made from oak. It was chosen for the first and second floor, that does not have the same high practical demands as the ground floor.

CLAY

Clay flooring was also considered for having many of the same qualities as the wooden flooring, however it is not as durable, and therefore not suitable for a public building with so many users.

CEILING

Materials for the ceiling were investigated see *Ill. 110-Ill. 111*.

WOOD

Wooden slats for the ceiling has the same qualities as wooden slats for the wall and can also be an acoustic solution. However the curved wall are already wood and the flooring on the first and second floor is also wood, so it can be too much with a wooden ceiling also. Furthermore the wooden slats would be problematic to use in the curved part, because the slats would not be able to follow the form of the building, so the direction of the slats would have to be changing all the time.

CLAY

Clay boards as ceiling has the same qualities as clay boards for walls (see previous page). It is also not a problem to mount it in the curved part of the building. The visual expression is calm, which goes good together with the changing wall and flooring. Therefore it was therefore chosen for all ceilings.

Ill. 110 Clay ceiling

Ill. 111 Wooden slats ceiling

GROUND FLOOR

FIRST & SECOND FLOOR

Ill. 112 Materials collage

LIFE CYCLE ASSESSMENT

The life cycle assessment is in this project used as a tool to evaluate materials and be able to take thoughtful decisions on materials for the building. Working from the phrase “reduce, reuse, recycle and rethink” materials from the old library building have been in consideration.

REDUCE
Glass has a heavy impact in the climate impact, therefore it has been investigated how the doubled-glazed windows can be utilized in the new building. They are put together in a two-layered system in the glass wall framing the culture stage. That means that the building envelope towards east is going to consist of 4 layered glass wall.

Ill. 113 Reused windows

REUSE
Bricks can last for many years and need minimal maintenance, which makes them prominent to reuse from old buildings teared down. The masonry from the old library building is constructed with cement joint which makes it impossible to disassemble each brick without ruin them. Instead, the wall will be cut out in larger pieces and but back together in the walls of the culture stage.

Ill. 114 Reused bricks

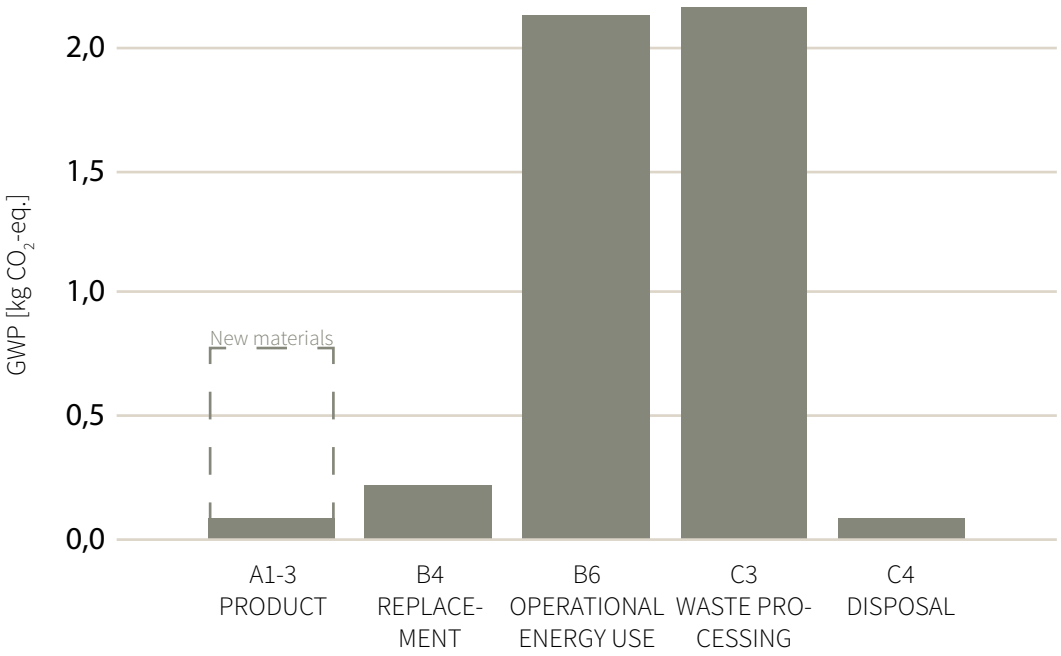
RECYCLE
Concrete can be recycled for stone material in new concrete, which will be used in the foundation and terrain deck of the new building.

Ill. 115 Reused concrete

RETHINK
Design for disassembly will makes it easier to reuse, recycle or replace materials which will have a long-term positive impact on the environment. Furthermore, vernacular materials can be used for to reduce the transportation of building materials. It was found that Vejle Municipality is having a project of restoring the ecosystem in the fjord with eelgrass. Taking in consideration that they in the future could be able to harvest seagrass in the fjord this is chosen as insulation material

Ill. 116 Eelgrass insulation

The table illustrates the climate impact measured in global warming potential (GWP). The total climate impact, GWP, for the new building with reused and recycled materials from the old library building is 4,7 kg CO2eq./m2/year Table ?? shows that by using reused and recycled materials there have been saved 0,7 kg CO2eq./m2/year in a 50 year timespan.



Ill. 117 Table: Life cycle phases

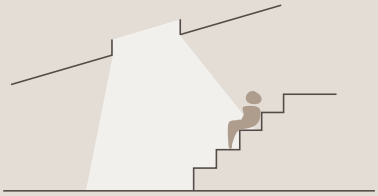
INTEGRATING LEARNING ENVIRONMENTS

Learning environments has been an important part of the development of the plans. With a basis in the Rosan Bosch design principles for learning described in the analysis of Learning Environments on page 17, different zones and spaces were implemented throughout the plan. The intention was from the beginning to have all six learning environments listed in to be present on every floor to promote the learning as much as possible for all it's users.
The development of the learning environments are shown in *Ill. 120* through plans at different stages in the process. The plans shown are the first floor, but the same applies for the other plans. It can be seen placement of the learning environments have changed trough the process and the they have gradually become more integrated.

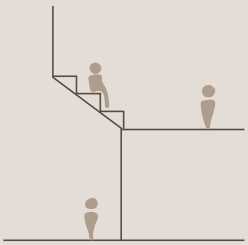
- Mountain top
- Cave
- Camp fire
- Watering hole
- Hands on
- Movement

Ill. 118 Bosch's design principles

Bookshelves are used to create an enclosed space within a large open space, it can either be a cave when one person uses it or a camp-fire when a group of people uses it.



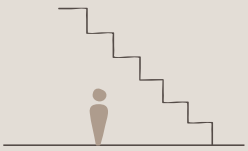
The staircase in the library can be a mountain top where one can communicate to an audience. Skylights can emphasize this by highlighting the "stage". Furthermore it can be a watering hole, connecting the floors and offer informal meetings.



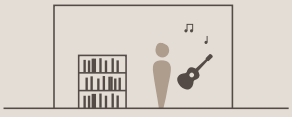
The recessed entrance can create a mountain top on the floor above.

Submerged areas in the children's library can be a cave for individuals to immerse.

In the children's library a landscape of bookshelves invites for movement and can be both a camp-fire and mountain top.

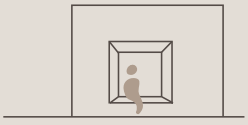


The space under staircases can be a cave, where individuals can sit and immerse themselves.



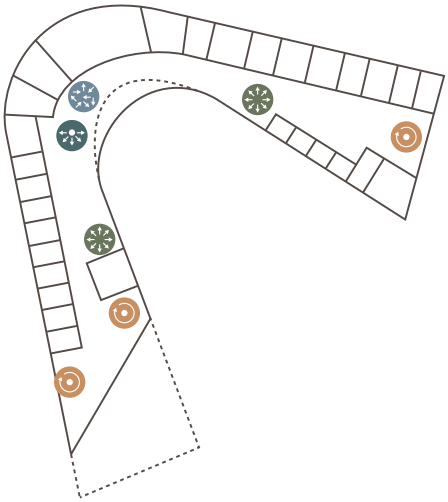
The music and movie library are placed inside an enclosed space and offers hands on experiences.

The black boxes has a higher ceiling than the rest of the ground floor and is therefore emerging through the floor on the first floor, making an elevated camp fire on top of it for the study area.



Niches are integrated in the walls along the classrooms, creating caves to immerse in.

Ill. 119 Learning environments diagram

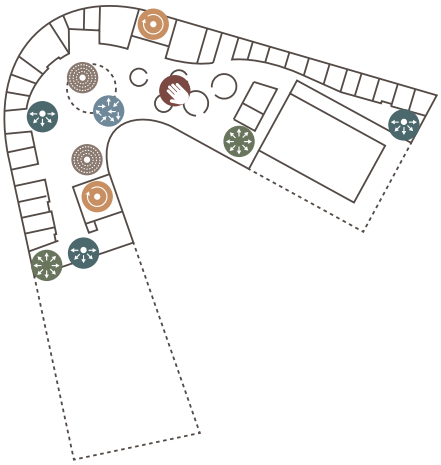


PLACEMENT OF LEARNING ZONES

The initial plans were divided into various zones of different learning environments. The zones were placed in relation to the other functions in the building. In the middle of the building the most social and active zones were placed as watering hole and mountain top. Towards the ends the zones are gradually more focussed on immersion, first with camp fire zones for group based activities and ultimately cave zones at the ends for individual activities. The long straight corridors does not create specific spaces for the different learning principles.

INTEGRATING SPACES FOR LEARNING

As the plans were developed the learning principles were integrated more and more by creating niches and areas between the rooms. The middle of the building was still the most social. The learning principles were distributed and mixed more around the building, to create a more interesting experience and flow, and avoid “dead ends”. Furthermore spaces for immersion were also integrated several places throughout the plan.



DESIGNING THE LEARNING SPACES

The final plans creates a coherence with the learning principles, by integrating specific spaces designed for them. As can be seen on the plan on the left the different learning environments are distributed evenly throughout the first floor plan. Some of the specific spaces designed for the learning principles can be seen in the diagrams in *Ill. 119*.

Ill. 120 Development of learning environments on the first floor

EPILOGUE

This chapter completes the project where the final design and the process is brought to a conclusion and reflected upon.
It sum up the whole project, both the process described in this report and the final design presented in the presentation report.

References and illustration lists are also included in this chapter.

CONCLUSION

The new Vejle Library and culture house is a centre for learning. Learning have been a theme throughout the entire project by investigate lifelong learning and the learning environments of Rosan Bosh. This have been integrated both in the arrangement of the library and culture schools and their relations, but also to create learning environments for both library users, students, and staff.

A site visit and further analyses of the site showed how the existing library is not using the full potential of the library park. Focusing on the park as a place to stay and invite visitors into the building the form became embracing for the paths going through the site. The diverse height in the city context inspired to let the building rise from the park and meet the high buildings towards the city – almost like the learning curve rising from child to adult.

In the indoor environment the daylight quality has been the one with most focus as it is important for the experience of spaces and niches in the building to create interesting learning environments. More technical tool as 24hour average, and BE18 have been used to validate the thermal, atmospheric whereas the acoustic indoor climate has been touched on a conceptual level.

It was assessed that the old library building was not worthy of preservation of architectural quality. Some of the materials have meet their end-of-life phase, but not all. So, with an environmental mindset of sustainability relevant materials where validate on how to reduce environmental impact, reuse in the new building and how to recycle to new purposes. The basement of the old library building where also reused and being integrated as a central part of the existing building due to its preservation value.

The building as a living room in the city became visible in the design criteria community where the focus was to connect the surrounding areas and promote informal meetings, by being open, inviting, and accessible which all have been a part of the layout development.

To promote the way-finding there is a continuously flow in the building that connects functions horizontally and vertically with the stairs as central elements in the building.

The flow of the building has been integrated in both the interior and exterior using the roof as an element as well. The roof is inviting park visitors up with several experiences along the way, the viewpoint, the path through the skylights and the big dome on the top of the atrium. Wise versa the spiral staircase is leading up towards the dome giving the visitors the view from 2nd floor.

REFLECTION

The motivation for this project were rooted in learning and how architecture can contribute to this. The library building provides both informal, voluntary, and sometimes subconscious learning, where people can come by their own choice and choose their own topic of interest. Due to the collaboration with Vejle Municipality the project and the size of it grew to more than we at first expected as their plans for the new library is to merge it with the culture and music school of Vejle. The topic of learning where strengthen by adding schools to the project though their learning is slightly different as it is more teacher-to-student based but as it is leisure-based learning it share some values with the learning in the library.

The building became more multifunctional as the library and culture school shares a lot of functions and are more or less mixed between each other. The multifunctionality of the rooms also means that they should be able to be more basic and easier to clear for other purposes. The size of the project has affected the process the specific classrooms and workshops to be degraded and instead focus on the shared learning spaces and niches. This means that the frames of lifelong learning and open-ended learning have been made and placed strategically. The newt step in the design process of the learning spaces would therefore be to detail them more specific to their uses.

The perspective of learning has changed a lot the last decades, so to understand the new learning methods and figure how to utilize it as a design strategy it resonated into the design process that we had a challenge integrating them in the start. Through the design process there were a clear goal on integrating at least one of them on each floor in the building. But later in the process it where clearer that also the learning environments and belonging spaces where a lot about the final detailing as well. Again, there was more focus on where the learning environments were placed in the shared spaces and due to time, the next move would be to detail more in the staff zone on 2nd floor.

Learning more about the modern library it was found that a library today is about much more than learning and gain knowledge which also put another dimension to the project we were not prepared on. Non the less it where really interesting how the modern library is known as the living room of the city creating connections in the city being a space with social resilience – a place for all to feel welcomed and be able to be a part of the community. The café, different sizes of niches to different sizes of groups har the purpose of having a space that fits different types of clusters or individuals. Social sustainability has had major impact on the project mixing the functions of the library and culture schools, inviting the city in, and let them be a part of the pulse in the building. By integrating the learning environments throughout the building, it has been a wish to nudge, create informal, and sometimes subconscious learning to support lifelong learning and open-ended learning.

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ILLUSTRATIONS

All illustrations are own illustrations unless they are listed here:

Ill. 5 - Ill. 13 Oodi Central Library	**Tuomas Uusheimo** (2018.) *Oodi Central Library.* [image] Available at: https://www.archdaily.com/907675/oodi-helsinki-central-library-ala-architects [Accessed 17 February 2021]
Ill. 14 Vejle Bibliotek users collage	**Norman, J.** (2020) *Til alle dem som bærer historierne videre.* [Photography exibition] Vejle Bibliotek, 16 September – 4 November 2020.
Ill. 15 New York Public Library	**Stephen Yang** (2020.) *New York Public Library.* [image] Available at: https://nypost.com/2020/06/25/new-yorks-public-libraries-to-begin-reopening-july-13/ [Accessed 15 February 2021].
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Ill. 17 Book Mountain	**MVRDV** (n.d.) *Book Mountain.* [image] Available at: https://www.mvrdv.nl/projects/126/book-mountain [Accessed 15 February 2021].
Ill. 18 - Ill. 22 Dokk1	**Adam Mørk** (n.d.) *Dokk1.* [image] Available at: https://www.archdaily.com/644920/dokk1-schmidt-hammer-lassen-architects [Accessed 17 February 2021]
Ill. 34 Flow paths & accumulation points	**DinGeo** (n.d.) *Willy Sørensens Plads 1, 7100 Vejle.* [Online] Available at: https://www.dingeo.dk/adresse/7100-vejle/willy-s%C3%B8rensens-plads-1/ [Accessed 28 February 2021]
Ill. 46 - Ill. 47 Bølgepladsen	**DR** (2019) *Bølgepladsens flow.* [Image] Available at: https://www.dr.dk/drtv/episode/vi-bygger-det-vaek_-klimaforandringer_82914 [Accessed 1 March 2021]
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Ill. 81 Cladding direction	**Pinterest** (n.d.) *Wood cladding.* [image] Available at: https://www.pinterest.dk/akakichen/008-%E6%9D%90%E8%B3%AA/ [Accessed 19 May 2021]
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Ill. 103 Clay wall	**Clayworks** (n.d.) *WHI-07.* [image] Available at: https://clay-works.com/colour/ [Accessed 19 May 2021]
Ill. 104 Wooden slats wall	**Contemporist** (n.d.) *This Home's Modern Interior Design Was Inspired By Japanese Minimalism And Nature.* [image] Available at: https://www.contemporist.com/home-modern-interior-design-inspired-by-japanese-minimalism-and-nature/ [Accessed 19 May 2021]
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Ill. 106 Reused brick wall	**Lendager** (n.d.) *Bricks from abandoned buildings put together.* [image] Available at: https://lendager.com/ [Accessed 19 May 2021]
Ill. 109 Clay flooring	**Clayworks** (n.d.) *GRY-07.* [image] Available at: https://clay-works.com/colour/ [Accessed 19 May 2021]

Ill. 107 Concrete flooring	**Koziel** (n.d.) *Concrete.* [image] Available at: https://www.koziel.fr/en/concrete/5508-light-grey-textured-concrete-wallpaper-3664890004851.html [Accessed 19 May 2021]
Ill. 108 Industrial parquet	**Scandia Floor** (n.d.) *Højkantsparket af Eg.* [image] Available at: https://scandiafloor.dk/produkter/hoejkantsparket/eg.aspx [Accessed 19 May 2021]
Ill. 110 Clay ceiling	**Clayworks** (n.d.) *WHI-05.* [image] Available at: https://clay-works.com/colour/ [Accessed 19 May 2021]
Ill. 111 Wooden slats ceiling	**Contemporist** (n.d.) *This Home's Modern Interior Design Was Inspired By Japanese Minimalism And Nature.* [image] Available at: https://www.contemporist.com/home-modern-interior-design-inspired-by-japanese-minimalism-and-nature/ [Accessed 19 May 2021]
Ill. 113 Reused windows	**Lendager** (n.d.) *Rækkehuse på upcyclede materialer.* [image] Available at: http://www.dagensbyggeri.dk/artikel/96463-raekkehuse-pa-upcyclede-materialer [Accessed 19 May 2021]
Ill. 114 Reused bricks	**Lendager** (n.d.) *Bricks from abandoned buildings put together.* [image] Available at: https://lendager.com/ [Accessed 19 May 2021]
Ill. 115 Reused concrete	**Teknologisk Institut** (n.d.) *Genanvendelse af beton.* [image] Available at: https://www.teknologisk.dk/ydelser/genanvendelse-af-beton/proevning-af-genanvendte-tilslag/40866,3 [Accessed 19 May 2021]
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Ill. 128 Spektrum	**Totalsikring** (n.d.) *Spektrum.* [image] Available at: https://totalsikring.nu/c/referencer/dgi-huset-vejle#gallery-1 [Accessed 15 February 2021].
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APPENDIX

APPENDIX CONTENT

APPENDIX 1: DESIGN BRIEF

The existing library in Vejle needs change as it need renovation and the interior layout and room programming have some troubles. Vejle is in development and there is a political wish for the library to turn into a knowledge-based culture house by adding the music school and the culture school, Xeneriet (the culture school), to the building as well.

The site is located between the city centre, campus and Ny Rosborg and the new building should in its architecture and sustainable approach set the direction for the development of Vejle's new city district.

The new culture house should have inspiring spaces for learning, teaching and dissemination. The synergy of the library, music school and Xeneriet should create a transverse creative environment with knowledge sharing in relation to interdisciplinary teaching, activities and development.

Despite the existing facilities of the three institutions the new culture house should consist of a study area, media workshop, film and listening room and digizone. The establishment of a study area creates an optimal framework for synergy and collaboration with the area's educational institutions and DGI Huset.

Furthermore, two black boxes of 100 m^2 and a culture hall (kulturhussal?) and an atelier should be included for the institutions to share. These should be flexible and multifunctional hosting e.g., concerts, debate and citizen meetings, lectures, theatre and dance.

The culture house should invite to formal and informal meetings. With a common café area, the informal meeting has a space to take place. In the café area, there should be a possibility of outdoor dining in the library park where healthy sustainable food can be served. In addition to attracting the culture house's guests, the café can also function as an independent meeting place.

The outdoor areas should be welcoming and invite you to stay. There should be room for e.g., playing, community singing, reading camp, theatre, dance, music, lectures and debates on warm summer days. The outdoor areas should also create coherence throughout the area and link a new culture house together with the existing functions at Willy Sørensens Plads.

The design of the new culture house and park should also make room for more parking spaces.

(Vejle Kommune, 2020)

APPENDIX 2: DISTRICT PLAN

The project site is included in the “District plan no. 1155 for public area at Vestre Engvej, Vejle” and “District plan no. 142 for more beautiful access roads, facade areas along roads”, which includes following regulations affecting the site.

DISTRICT PLAN NUMBERS

- Max height: 20 m
- Max no. of floors: 5
- Max plot ratio: 90 %
- Max terrain regulation: +/- 0,5 m
- Min. distance to stream: 40 m
- Min. distance to Vestre Engvej: 12 m
- Min. distance to Boulevarden: 15 m
- Min. parking per 2 visitors: 1

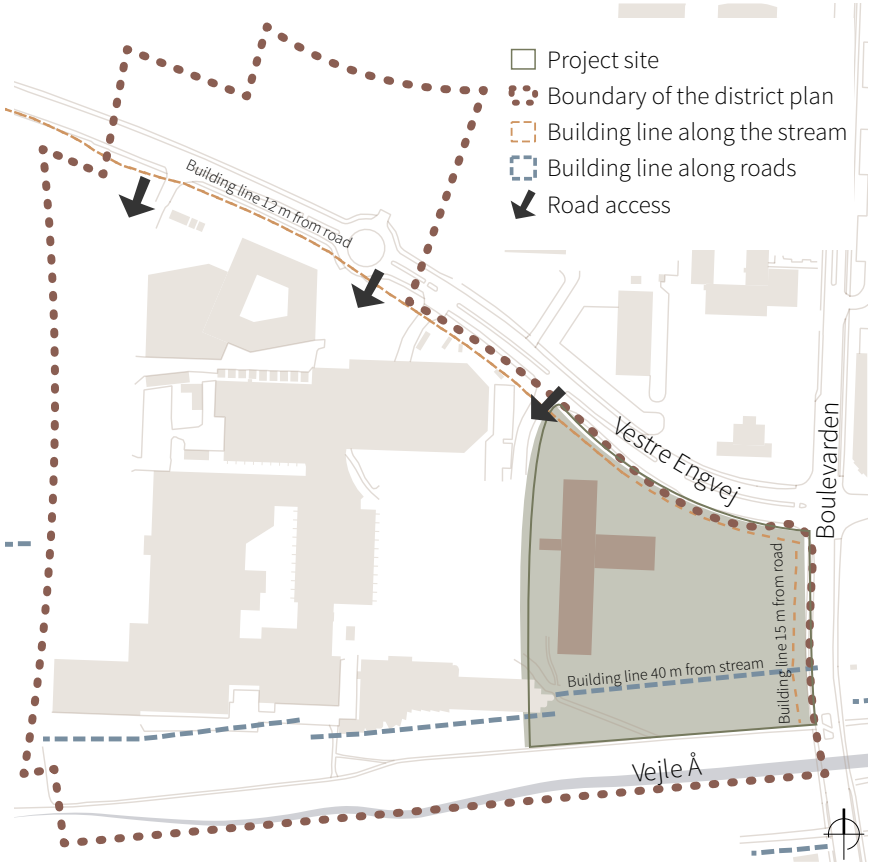
(Vejle Kommune, 2012)

ARCHITECTURE

- The facade should be concrete, brick, natural stone, wood, pre-patinated zinc or glass.
- The facade should have a varying expression.
- Roofs should be flat and of roofing felt, pre-patinated zinc slate or similar, or green roof.

LANDSCAPE

- The natural landscape at Vejle Å and the path along it outside the building line should be preserved and can’t be altered.
- Rain water should be slowed with e.g. LAR solutions.
- There should be a 3 m green belt along Boulevarden (Vejle Kommune, 2012).



Ill. 121 District plan overview

APPENDIX 3: SERIAL VISION

Four routes are investigated (*Ill. 35 on page 48*), with a focus on one along Vejle Å, presented in Serial Vision on page 48.
The three other routes follow the main roads passing the library, Boulevarden and Vestre Engvej. The green route starts at Kirkegade in the dense city centre with narrow streets and with stores, apartments and historical buildings as e.g. churches and the town hall. There are exciting elements to see around each corner and building.
When the route turns into Vestre Engvej the streets get wider and buildings less close and soon the library is visible. The route crosses Boulevarden at a large and busy intersection right in front of the library, then passes the library park and goes around the library building to a large parking area where the main entrance is finally found.

VESTRE ENGVEJ

1

The beginning of the route is in city centre with stores, apartments and historical buildings.

2

Commercial and residential buildings.

3

The city dissolves and opens up towards the landscape, with residential building.

4

Several main roads intersects right in front of the library.

5

Moving along the library park and around the library, to find the entrance.

6

The main entrance at the back side of the library and the parking area.

Ill. 122 Serial vision Vestre Engvej

The last two routes are both along Boulevarden. The red from the north is a straight road with commercial and educational buildings and parking areas giving a monotonous experience. It meets the intersection in front of the library, and turns around the corner and follows the green Vestre Engvej route to the main entrance.
The yellow route from the south starts in a residential area, first single family houses, then apartment complexes and finally it turns into commercial buildings. After crossing the stream it arrives at the library park and follows the blue route to the main entrance. Both the red and yellow routes are very busy and noisy with heavy traffic and very little variation.

BOULEVARDEN FROM THE NORTH

1

Commercial and educational building as well as parking areas.

2

Arriving at the library intersection.

BOULEVARDEN FROM THE SOUTH

1

Residential areas in the hilly landscape. Both single family housing and apartments.

2

Large traffic intersection surrounded by commercial buildings.

3

Arriving at the library park by crossing the stream.

Ill. 123 Serial vision Boulevarden

APPENDIX 4: SAVE ASSESSMENT

Ill. 125 Vejle Bibliotek north facade

BUILT STRUCTURES

Vejle Bibliotek (*Ill. 125*) is placed on Willy Sørensens square, named after an former mayor of the period where the buildings of the square where constructed. Willy Sørensen were a social democratic mayor in 32 years from 1946 to his dead in 1978. (Vejlewiki.dk, n.d.)


Ill. 126 Vejle Center Hotel

On Willy Sørensens square the Vejle Center Hotel is also placed (*Ill. 126*), designed by Jan Utzon and built in 1987. Vejle Bibliotek is built in 1971 and designed by Niels Erik Steensen, who in same period draw the House of Sport, now known as DGI Huset in Vejle (*Ill. 127*). DGI huset is placed on the opposite side of the square that provide parking for the surrounding buildings. (Vejlewiki.dk, n.d.)


Ill. 127 DGI Huset Vejle

The newest addition to Willy Sørensens square is an addition to DGI Huset called Spektrum (*Ill. 128*). Spektrum is an flexible arena that can be transformed for concerts, congresses and fairs built in 2015 and designed by Arkitema Architects. (DGI Huset, n.d.)

Ill. 128 Spektrum

The buildings around the Willy Sørensens square are neatly arranged in a grid where all the buildings are perpendicular to each other. The four buildings have one architectural character in common: vertical lines in the facades.

THE LIBRARY BUILDING

The SAVE assessment of a building consists of both a registration of the building's characterizing building parts and an assessment of the building's conservation values. The method is based on five parameters: Architectural value, cultural-historic value, environmental value, originality, and condition. (Kulturarv styrelsen, 2011)

The existing building's external facade mainly consists of concrete, which is also the load bearing structure. Concrete columns are evenly spread along the facade and constitute the recognisable character of the building (*Ill. 38*).

The columns frame the windows in the facade and dark grey fibre cement boards below and above the windows contrast and highlight the columns. The upper part of the facade is clad with light grey fibre cement boards in the same colour as the columns, which ties the building together, marks the roof and further frames the windows. The windows have aluminium frames and are equipped with grey external solar screens.
The interplay of the light and dark grey materials provides depth to the facade and thereby a dynamic expression. At the same time the grey materials can also appear cold and uninviting. As a contrast to the different grey tones the end gables are red bricks, which brings a little warmth into the facade.

The entrance is emphasized by a colonnade of concrete columns with a low roof clad with zinc. The first part of the colonnade is a steel framed gateway with mat glass panels mounted with bolts of stainless steel. The proportions of the entrance are wide and low which makes it look heavy and oppressive.

From a cultural-historic point of view the building of Vejle Bibliotek exudes the 70's modernism in danish architecture with the closed brick gables, concrete columns and glass divided by the fibre cement boards.
The area of the library building is built within a few years. The masses of the building support the urban environment of Willy Sørensens square as it follows the grid and vertical characteristics of the area.
The building was renovated in 1999 after a fire in the former café, but the originality of the outer expression of the building is still intact.

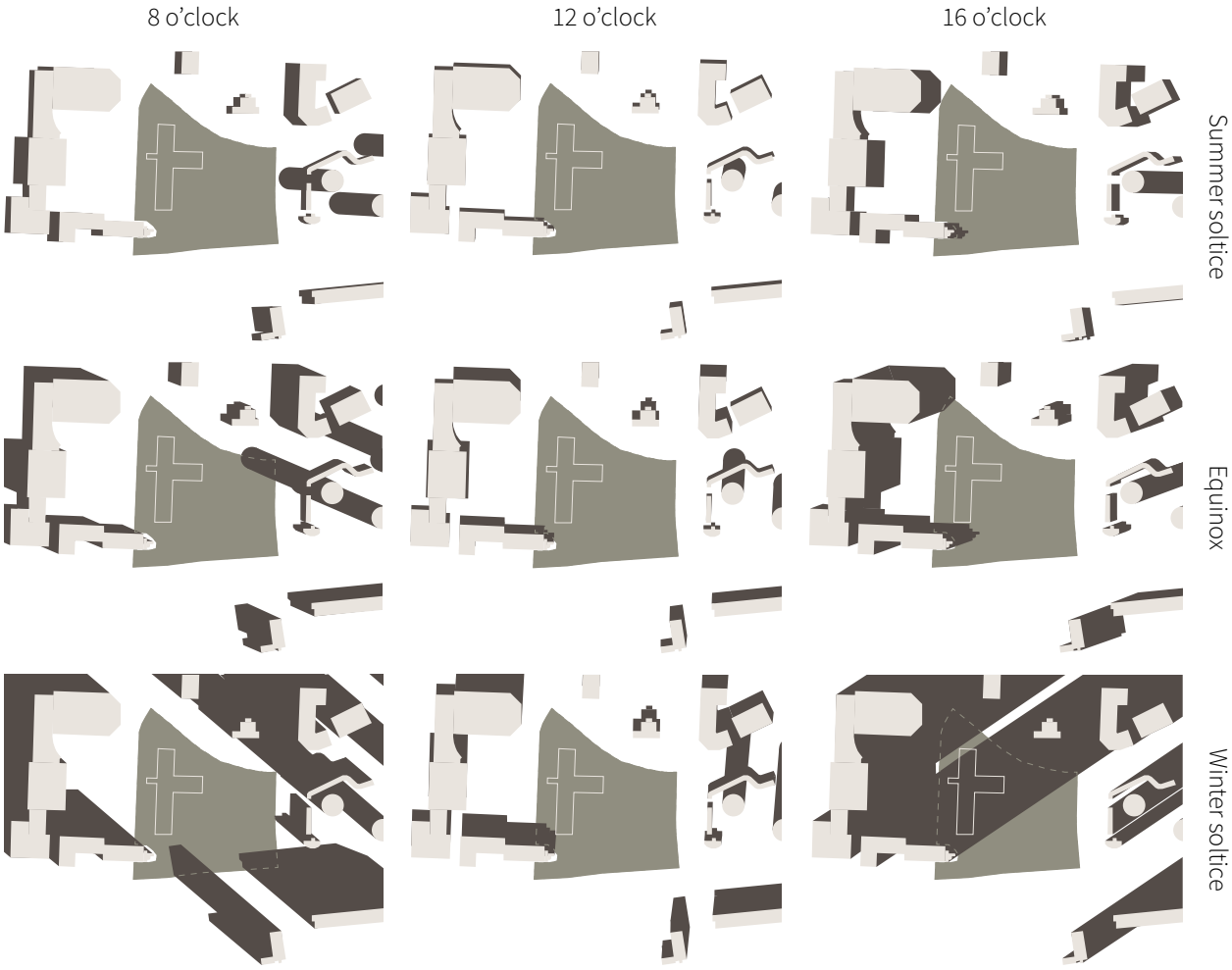
Today the weather and time has taken its toll on the building and especially the concrete looks somewhat worn. As the quality of the concrete is unknown an estimate lifetime of the columns will be 50 years and therefore soon need to be handled (Betonhåndbogen.dk, 2017). Based on the assumption of the fiber cement boards have been renewed in the renovation in 1999, they could last approximate 30 years more as the lifetime is 50 years (Frederiksen and Lindegaard, 2020). The windows have not been renewed, which means they would have to be replaced to renovate for better energy solutions.

SAVE ASSESSMENT

The assessment values for preservation ranges from 1 to 9 where 1 is high preservation value and 9 is low preservation value. Buildings assessed with a value from 1-3 will get on a national map for preserved buildings.
The assessment values 2 to 4 is given to buildings as by virtue of their architecture, cultural history, and are locally prominent examples within their kind, or buildings which, by virtue of their location, are inalienable for the whole.

APPENDIX 5: SHADOWS

For an understanding of the site a sun-shadow analysis is made to give an insight of how the surrounding buildings cast shadows on the site.



Ill. 129 Shadows analysis of site

APPENDIX 6: FLOODING

The library and the park sit on a small raising in the landscape, lifting it up slightly higher from the rest of the area. Therefore, the park can avoid flooding caused by the rising water levels in the stream and the sea, as seen on ill. XX (MiljøGIS, 2007). The rising water levels are a major problem for the surrounding area. Even though the library park is not in immediate danger from rising water levels, the combination of that along with heavy rains should be considered. The table shows the absolute amount from heavy rains of frequency 2, 5, and 10 years and how they might escalate for the next century [mm/day].
Too much rainwater is a big issue because of the dense soil layer on top. Furthermore, the groundwater only lies 0,4m under the surface and will usually rise to the surface during rains (Din Geo).

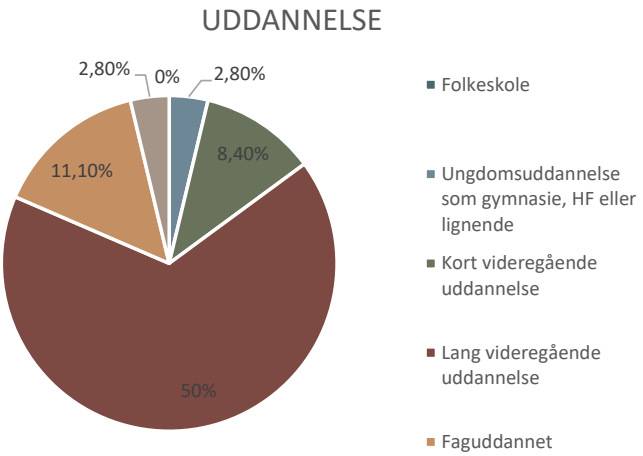
Frequency	2011-2040	2041-2070	2071-2100
2	41,7	43,4	46,2
5	51,1	53	57
10	59	62	66

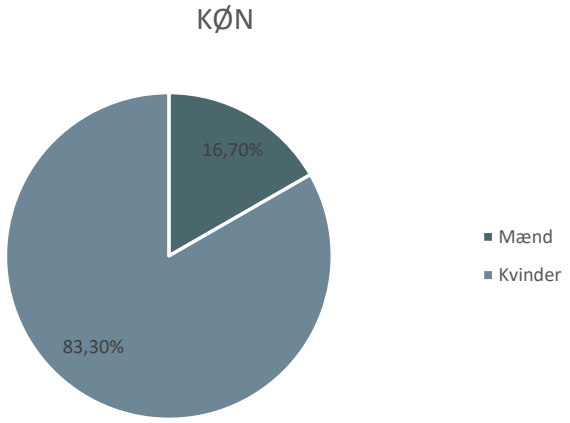
Ill. 130 The amount of water [mm/day] falling in Vejle during 2-year, 5-year, and 10-year rains and how it might escalate the next century (DMI).

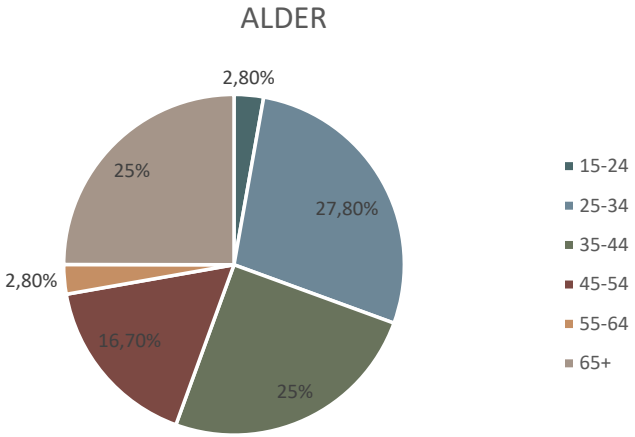
Ill. 131 Map showing waterline after 1 m, 2 m, and 3m rise in watel-evel.

APPENDIX 7: USER SURVEY

To get closer to the visitors of the existing Vejle Bibliotek a survey was send out through the Facebook-page of the library.
This is used in comparison of the survey of the Slots- og Kulturstyrelsen (Slots- og Kulturstyrelsen, 2016) and as a more phenomenological approach to get more in depth with the visitors as it were not possible to do interviews with visitors due to Covid-19.

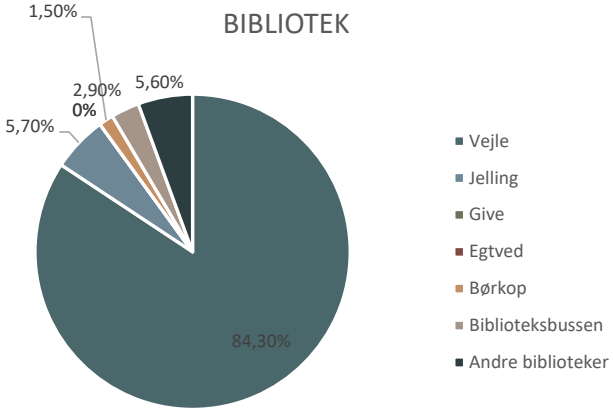


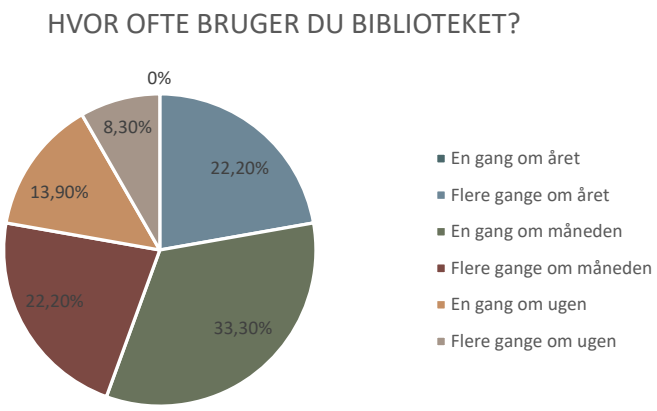


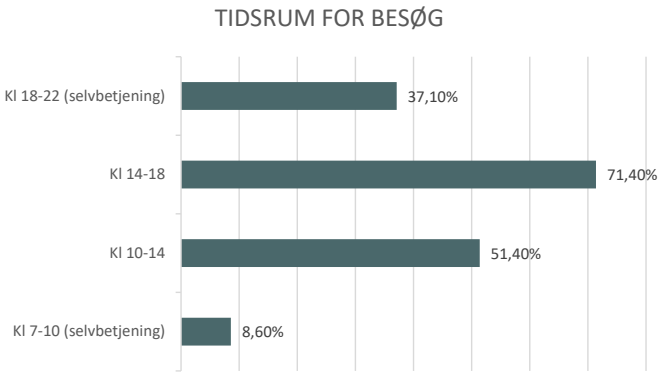


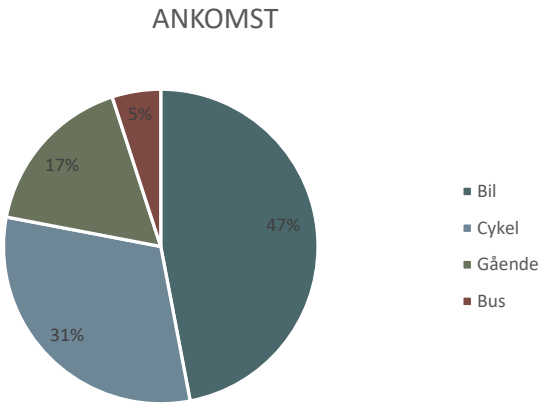
JOBTITEL

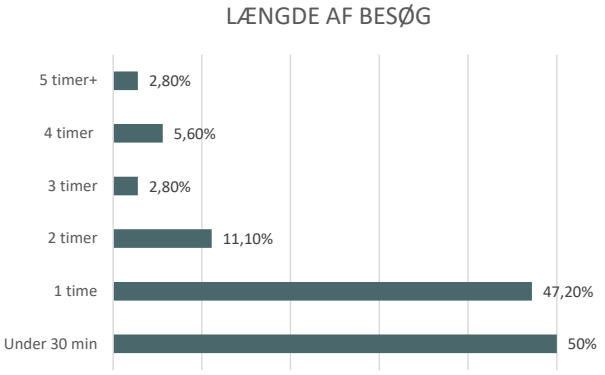
Adjunkt
Bibliotekar
Bioanalytiker
Forfatter
Formidler
Førtidspensionist
Gymnasielærer
Klimakoordinator
Kontorassistent
Leder x2
Lærer x2
Pensionist x3
Pensionist, tidligere bibliotekar
Pensionist, tidligere boghandler
Pensionist med lille selvstændigt firma
Psykolog
Sagsbehandler
Sekretær x2
Senior manager
Studerende, kandidat
Sygeplejerske
Sygeplejerske og Cand.pæd.pæd.psyk

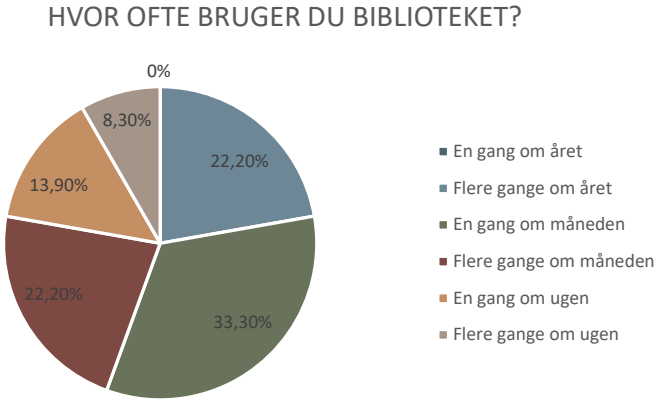

BIBLIOTEK
1,50%
2,90%
0%
5,60%
5,70%
84,30%
Vejle
Jelling
Give
Egtved
Børkop
Biblioteksbussen
Andre biblioteker


HVOR OFTE BRUGER DU BIBLIOTEKET?
0%
8,30%
22,20%
13,90%
22,20%
33,30%
En gang om året
Flere gange om året
En gang om måneden
Flere gange om måneden
En gang om ugen
Flere gange om ugen

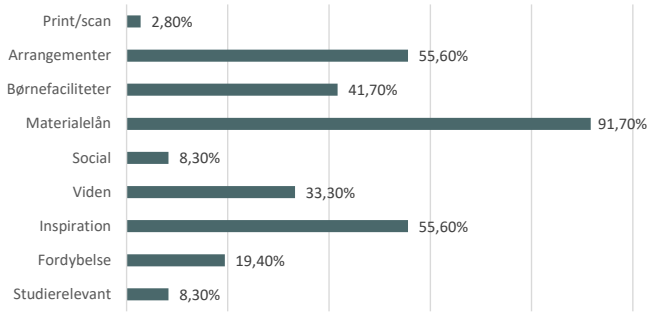

TIDSRUM FOR BESØG
Kl 18-22 (selvbetjening)
37,10%
Kl 14-18
71,40%
Kl 10-14
51,40%
Kl 7-10 (selvbetjening)
8,60%


ANKOMST
5%
17%
47%
31%
Bil
Cykel
Gående
Bus

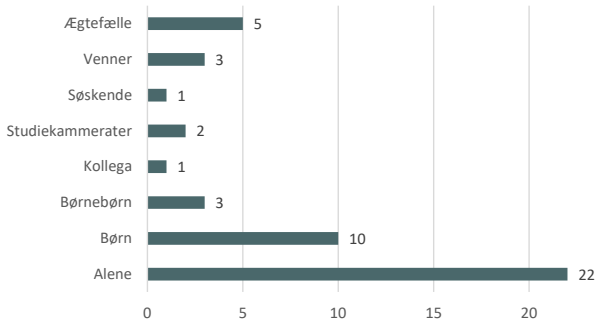

LÆNGDE AF BESØG
5 timer+
2,80%
4 timer
5,60%
3 timer
2,80%
2 timer
11,10%
1 time
47,20%
Under 30 min
50%


HVOR OFTE BRUGER DU BIBLIOTEKET?
0%
8,30%
22,20%
13,90%
22,20%
33,30%
En gang om året
Flere gange om året
En gang om måneden
Flere gange om måneden
En gang om ugen
Flere gange om ugen

HVORFOR KOMMER DU PÅ BIBLIOTEKET?



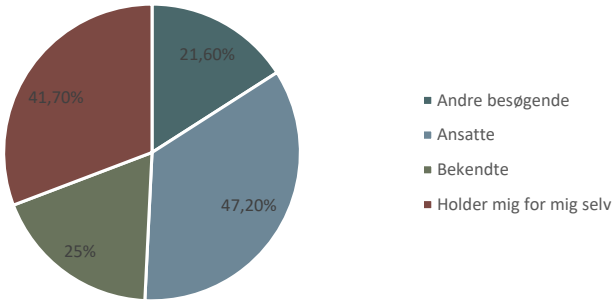
SELSKAB PÅ BIBLIOTEKET



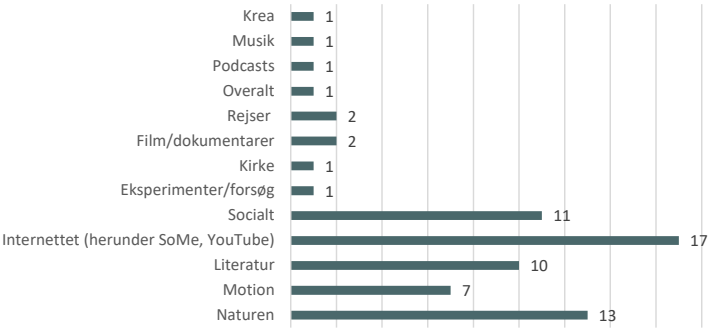
FORSLAG TIL AKTIVITETER

Arrangementer (herunder foredrag, digitale- og børnearrangementer) x12
Brætspilscafé
Bøger op af kælderen
Café (herunder kaffe, mad) x5
Flere siddepladser x2
Interessefællesskaber
Kontofællesskab
Koncerter x2
Krea-workshops
Lyttelounge
Mødested x2
Noget mere eksperimenterende/legende (for voksne).
Studiemiljø x4
Udstillinger
Workshops (herunder krea) x2

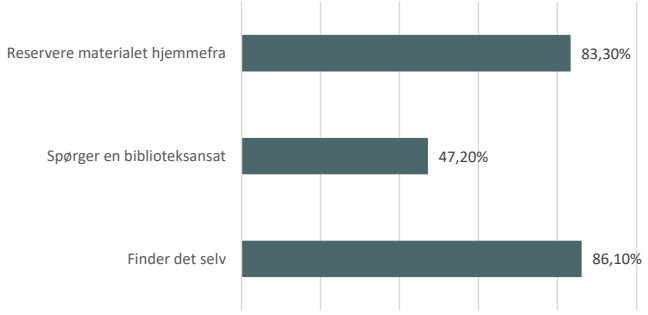
KONTAKT MED ANDRE UNDER BESØGET



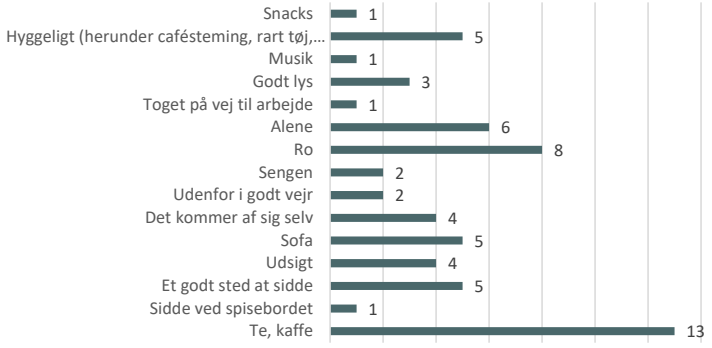
HVOR FINDER DU INSPIRATION I LIVET?



HVORDAN FINDER DU DIT MATERIALE?



RITUALER VED FORDYBELSE



HVAD BETYDER BIBLIOTEKET FOR DIG?

- Demokrati, ligestilling, fordybelse.
- En luksus. Et tegn på velfærdssamfundet. Adgang til inspiration og ressourcer i arbejdet.
- Kulturstation, frirum, inspiration.
- Et offentligt rum, tilgængeligt for alle. Viden, ro, god atmosfære.

- Gratis udlån af bøger.
- Luksus at vi kan læse og lytte alt det vi har lyst til - gratis.
- Mulighed for at læse forskelligt skønlitteratur og at få læst faglitteratur om noget jeg mangler information om.
- Mulighed for at låne bøger, cd mv - og gerne et bredere udbud.
- Et rum hvor jeg har den fantastiske mulighed at låne materialer, søge nyheder mm... gratis.

- Det er et hyggeligt sted hvor man kan finde og låne gode bøger til mine børn. Også til mig selv, men der er ikke meget tid til det med små børn. Hyggelige arrangementer man kan deltage i som familie.

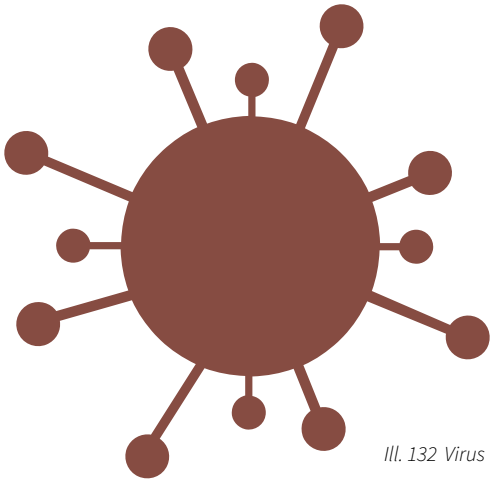
- Gerne ro og inspiration - og "bogshopping" i voksen afdelingen - i børne afdelingen, lidt mere støj, der skal være plads til god leg og finde gode bøger.
- Ro, fordybelse og børnehygge.(vi mangler bare en lille cafe).
- Skullet gerne kunne inspirere og vise nye veje og muligheder.
- Det er et rart sted at komme for at blive inspireret.
- Et sted hvor man kan mødes - finde nye bøger/musik/arrangementer.
- Inspiration og oplevelser.

- Vidensformidling incl litteratur, forfatterarrangementer, læsekredse, og et stort materialeudvalg og bibliotekarer med stor faglighed.
- Udbud af gode arrangementer til særligt børn. Der ud over mulighed for leg og fordybelse i de faciliteter biblioteket tilbyder.
- Central inspirerende kulturinstitution, et kollektivt fællesrum, helt uundværlig. Har brugt. Biblioteker i over 65 år. Mine børnebørn elsker også Vejle Bibliotek. De bor ikke i byen. Har arbejdet som bibliotekar i 45 år på forskellige biblioteker.

- Jeg er tilflytter fra Århus, og der var Dokk1 mit andet arbejdssted. Her er materiale tilgængeligt og der er en ro - og alligevel en puls.
- Sted for jeg kan være produktiv sammen med andre eller alene. Er sted hvor jeg kan bruge printer da jeg ikke selv har en hjemme. Læsning af bøger man ikke selv har råd til at købe.

- En vigtig del af min tilværelse.
- Rigtig meget. Det er et godt tilbud som jeg håber at flere og flere vil benytte sig af.
- Frirum.
- Alt.
- Elsker biblioteker. Det giver mig en ro i sindet.
- Det er vigtigt! Både for mine børn og mig. Det er et sjovt sted, men det kunne godt blive endnu sjovere for børn på Vejle Bibliotek. Biblioteket er et fantastisk sted, hvor læsning og særligt højtlæsning får en særlig plads.
- Det er MIT åndehul, hvor jeg finder viden, chick lit, inspiration, nye input. Jeg har slugt bøger fra biblioteket siden jeg var barn, og læseoplevelsen fra en fysisk bog slår aldrig hverken tablet, internet eller iphone.
- Muligheder, frirum, lighed, ro.

APPENDIX 8: BUILDINGS IN PANDEMICS



Ill. 132 Virus

How can the physical and built environment adapt to reduce the impact of an epidemic or other infectious disease? Naglaa Megahed and Ehad Ghoneim compares Covid-19 pandemic's impact on the security of our built environment to that of a computer virus and how antivirus systems secure our computers. In their article "Antivirus-built environment: Lessons learned from Covid-19 pandemic" they are taking the first, early steps into studying how architecture can help reduce the impact of pandemic-level diseases in the future. They suggest that our buildings should have more layers of security much like an antivirus-software would. The following are some of the measures they propose that relates to public buildings.

HYGIENE

If surfaces are in contact with people and have a possibility of being touched, these are possible sources of infection. Flat/smooth surfaces without crevasses and strict geometries void of ornamentation are easier to clean and sanitize. Hygienic and antibacterial materials like certain plastics or copper are also an option for critically exposed surfaces like handrails, buttons, or doorhandles.

HEALTHY BUILDINGS

Since we are spending more time indoors than ever before, the demands for a higher quality of our indoor climate have never been higher in order to avoid sick buildings and in extension, sick people. Better (natural) ventilation systems are essential to easily change stale air and the particles in it. Other critical design options to ensure good building health are: plenty of light via skylights or large windows, accessibility to fresh air i.e. rooftop terraces, balconies or courtyards.

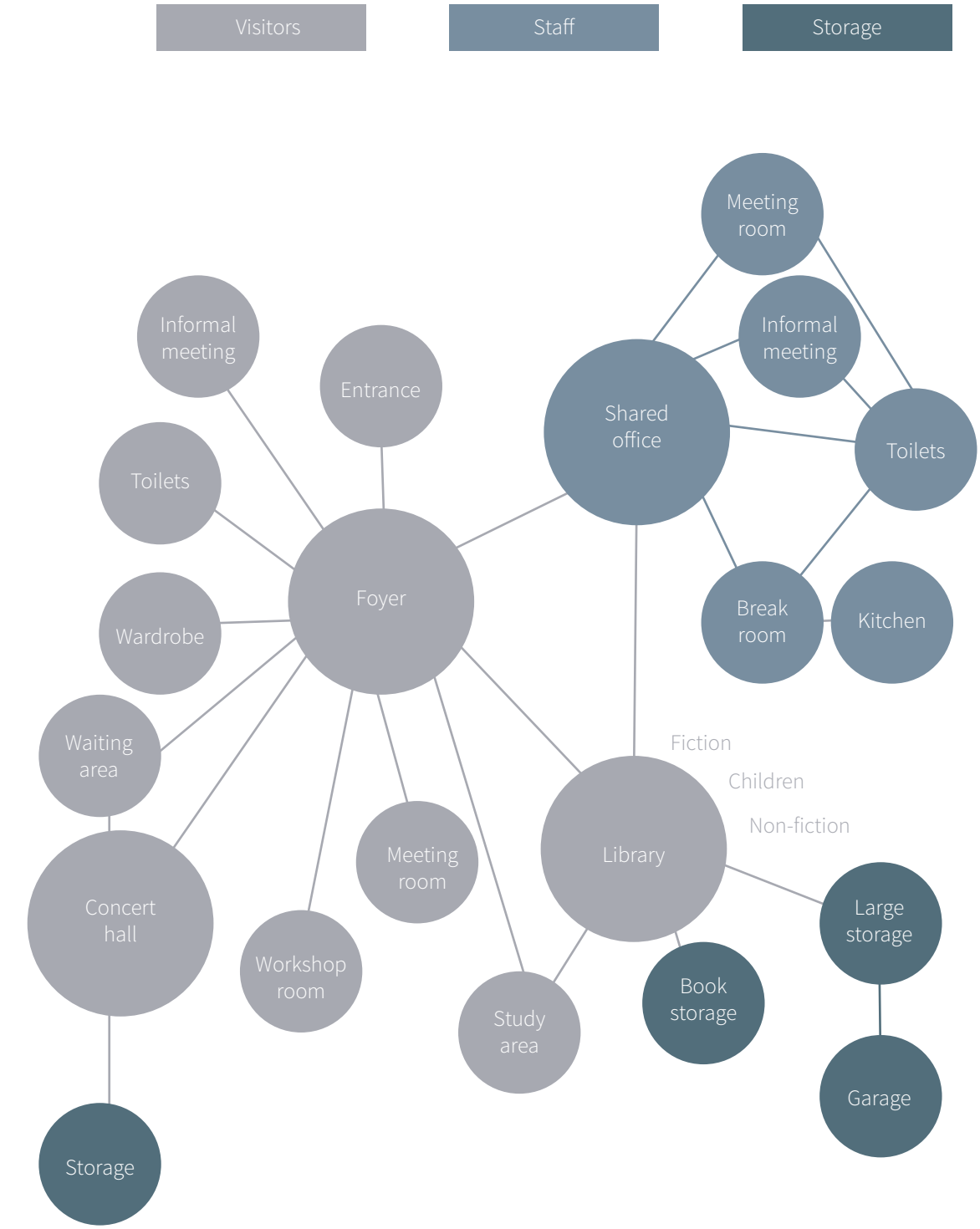
ENTRIES AND EXITS

How and where we enter and exit buildings are an ever more important subject, but in a pandemic scenario where physical distance to other people is critical, the position and number of possible points of entry needs careful consideration. Many older public buildings use the same door/windbreak for entry and exit which is not ideal in this situation.

Though it is not the goal of this project to design a library/culture house with the pandemic in mind, but given this current world situation, we deemed it necessary to at least touch upon the subject of architecture during pandemics.

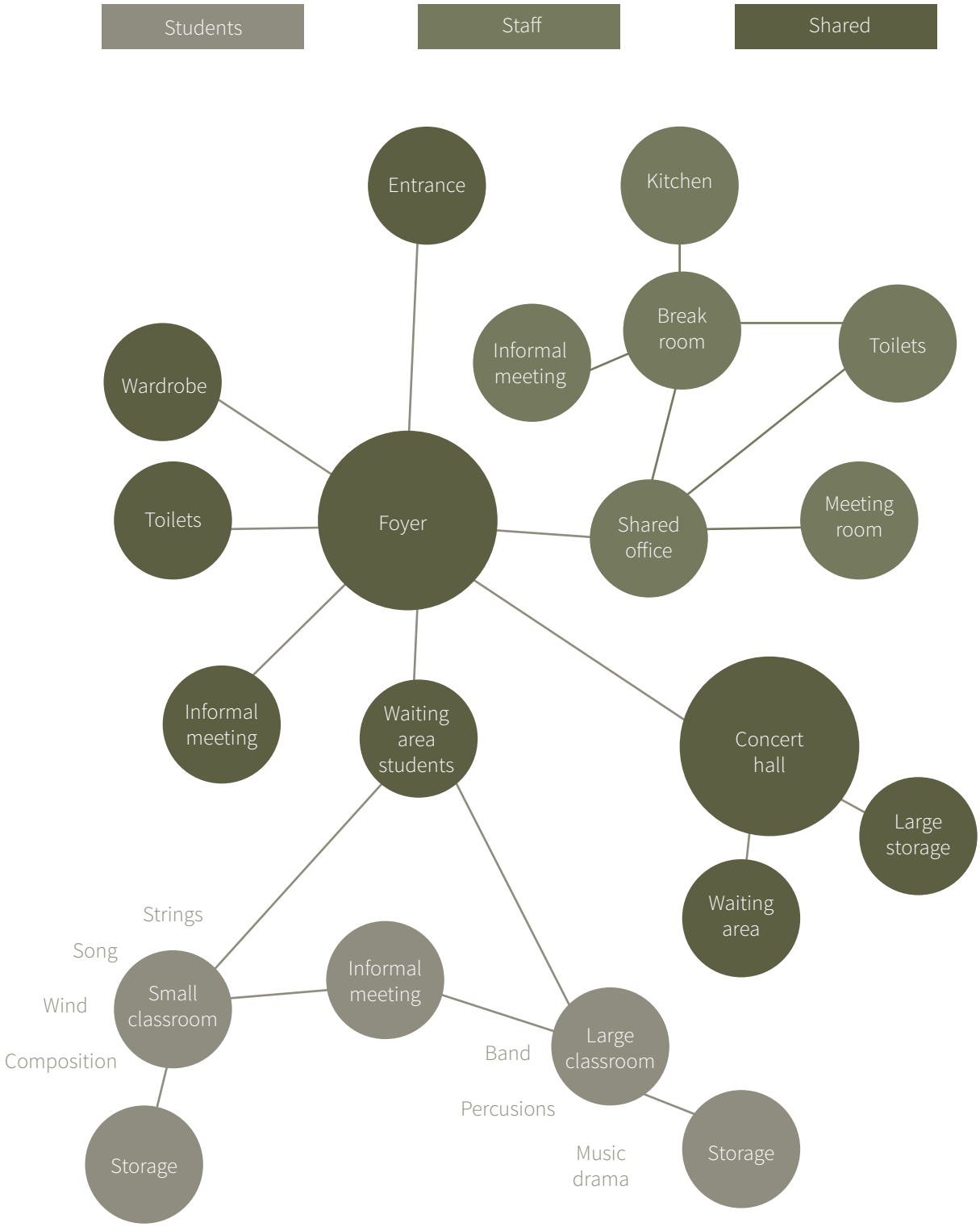
APPENDIX 9: FUNCTION DIAGRAMS

LIBRARY FUNCTION DIAGRAM



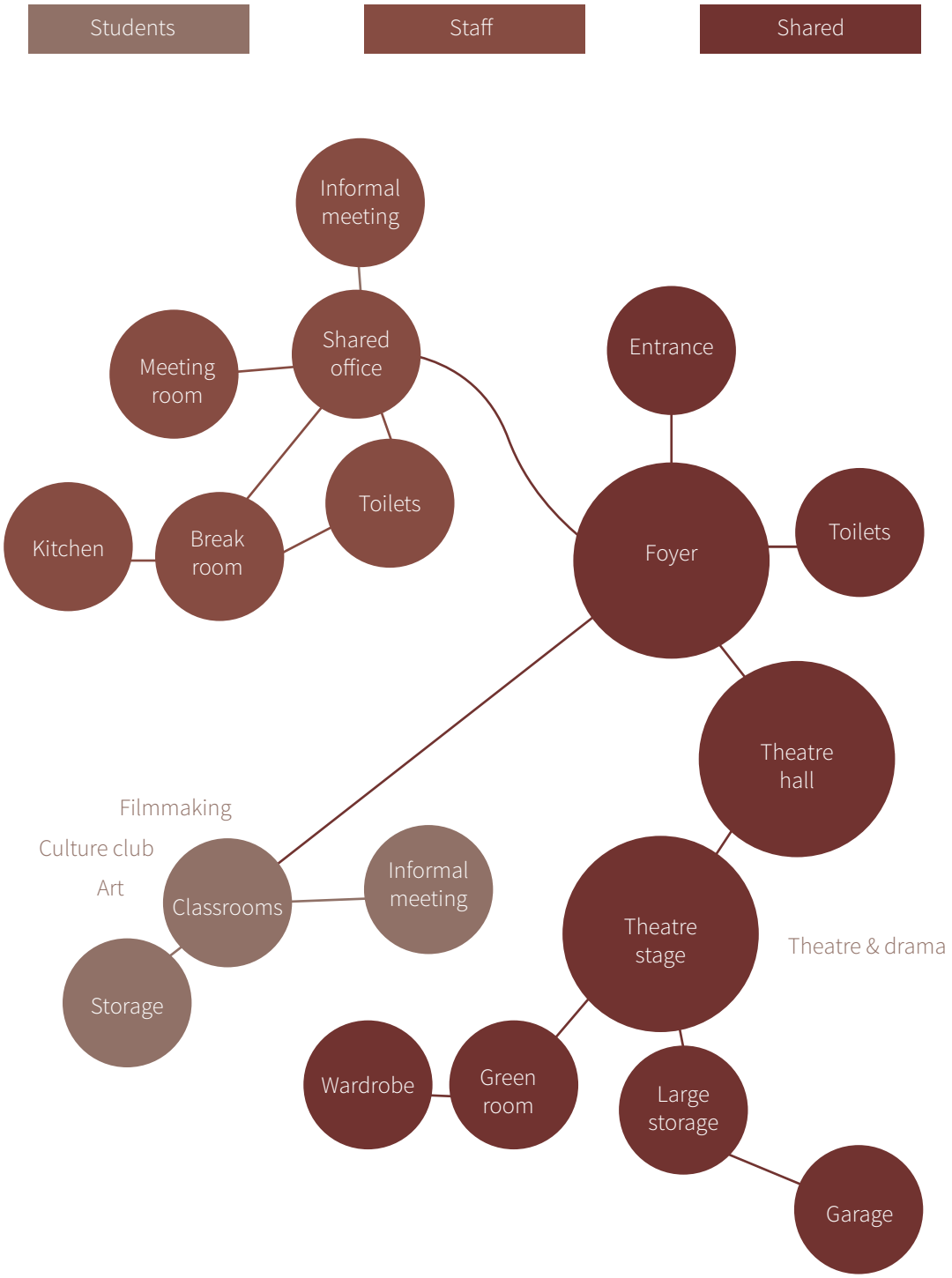
Ill. 133 Library function diagram

MUSIC SCHOOL FUNCTION DIAGRAM

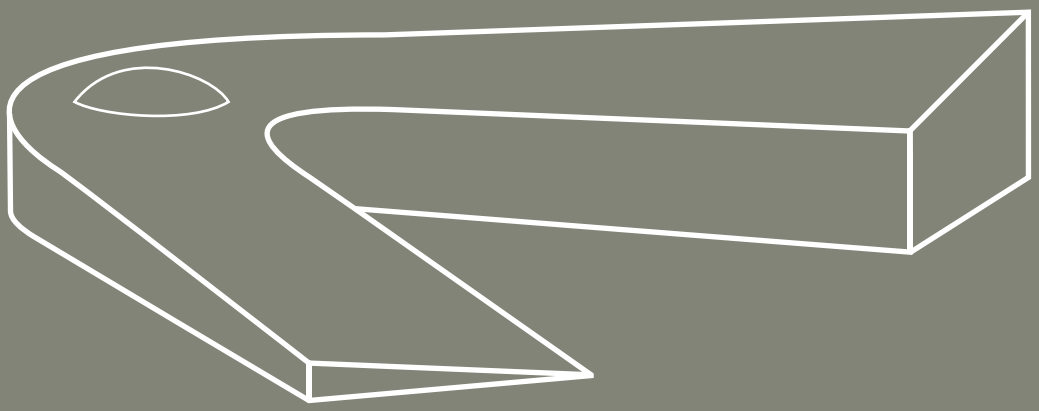


Ill. 134 Music school function diagram

CULTURE SCHOOL FUNCTION DIAGRAM



Ill. 135 Culture school function diagram



VEJLE LIBRARY & CULTURE HOUSE

PRESENTATION

TITLE PAGE

Title:	Vejle Library and Culture House Presentation report
Project:	Master thesis
University:	Aalborg University
Faculty:	Technical Faculty of IT and Design
Department:	Architecture, Design & Media Technology
Programme:	Master of Science in Engineering (Architecture)
Semester:	MSc04
Project period:	02.02.2021 - 27.05.2021
Main supervisor:	Camilla Brunsgaard
Group number:	ma4-ark10
Total page number:	65

Authors:

Carolina G. Walther von Loebenstein

Jacob Hugger Krebs

Lisa Lousdal Thorsted

AALBORG
UNIVERSITY

STUDENT REPORT

PREFACE

This report is part two of two reports that constitutes the master thesis project of group Ma4-ark10 in spring 2021 of the programme Master of Science in Engineering (Architecture) at Aalborg University. This report presents the final design.
The background for the report is the project work of a new library and culture house in the city of Vejle.

This project is made in collaboration with Vejle Bibliotek as they are soon to start up a process of developing the library as a culture house in association Vejle Music School and Vejle Culture School. In the collaboration the group will get the insight of new plans for the city and the library, contact to relevant parties of the project, and sparring on the problems in the library as it is today.
The purpose of the report is to produce a proposal for the new building and hopefully inspire the development and evoke a debate between citizens, local planners and politicians on the possibilities, both in the context of urban planning and as part of cultural and social development.

The work intends to show the design process and final proposal for a new library and culture house. The report describes the methodology, demarcation, analyses and conclusions on the design of a new library and culture house.

ABSTRACT

This project proposes a design for a new library and culture house in Vejle developed by group 10, MSc04 Arc, Aalborg University. The foundation of the project is built on learning, social and environmental sustainability. The project aims to support the learning taking place in the building by introducing design principles that enhances different types of learning.
Through analysis of the existing building, site, and context the concept developed and determined that the existing building would not be used in its existing form. Therefore, investigations of reused materials lead to a focus of using low emission materials and reuse of the materials from the existing building.
The final design is following the volunteered sustainability class ensuring good indoor climate and low energy performance of the building.

READING GUIDE

The project work is divided into two reports, a process report and a presentation report. They are intended to be read in the following order; process report first and presentation report thereafter. However some parts are repeated in the presentation report, to ensure the presentation report is able to stand alone in case one is only interested in the final design solution and not the process behind it.

This report is the presentation report, where the final design solution is presented through plans, sections, elevations and renders. Selected technical details are also presented. For further information on the project and the background for the design and how it was developed, it is recommended to read the process report.

The motivation behind this project was always ‘learning environments’ and how it relates to sustainable architecture. It was therefore decided to limit the scope of the project to these themes, so that there might be more time and energy devoted to this. This means that certain parts have been worked on a mostly conceptual level i.e. the layout and detailing of the offices or the structurural system.

Note: In these reports, the future music- and culture school will be refered to as just “the culture school”.

CONTENT

MOTIVATION

LEARNING

The motivation for this project is rooted in learning and how architecture can contribute to this. This topic as main focus inspired an investigation of learning and learning facilities to determine the type of it the project would embrace.

The first thing that comes to mind, might be schools and learning in general is often associated with schools, however there are many different types of learning facilities and ways in how we learn. The school setting as we know it from e.g. primary schools is formal and structured around a mandatory and predetermined learning, and it is limited to a specific period, e.g. from childhood to early adulthood. However we learn throughout our entire lives, whether it is through experiences, hobbies, people or places, these types of learning are more sporadic, informal and sometimes subconscious. So what kind of setting substantiates this life-long learning?

THE LIBRARY

The setting in a library constitutes an informal, voluntary and sometimes subconscious learning, where people can come by their own choice and choose their own topic of interest. This also means the environment, hence the architecture is different from other learning settings as e.g. a school. This spiked an interest in libraries and to look further into how the design can affect learning and invite for it.

Vejle has a need for a new library and is already in the process of starting such a project, it caught our interest as the framework for a learning-foccussed building. As they also wish to integrate the music and culture school in the project, it only contributed to the learning focus to add these voluntary learning facilities to the building. Thus the second focal point is to create a synergy and interplay between these three organisations and make them benefit from each other. The three organisations have expressed a vision and some specific wishes for the new culture house, which is also used in this project as a guideline for what this new building should incorporate. These wishes are described in the process report.

SUSTAINABILITY

The motivation was further based on sustainability, for a responsible and conscious design for the present and the future.
This implements a focus on environmental sustainability though a life-cycle perspective, more specifically on sustainable materials.
As the Vejle already has a library and the new building is to be at the same site, possibly an extension or an entirely new building, the third focal point is to investigate the materials of the existing library and how these can either be reused or recycled in the new building.

As learning in general and thereby also the library has a significant role in our society and development, it requires a focus on the people and the community in the city. This motivated the fourth focal point on social sustainability, both in terms of providing the settings for learning and in terms of gathering the local community and the surrounding areas to a whole.
The latter also embraces Vejle's wish for the area to be more integrated and attract the local community. This is also part of the District Plan for the area, which is further described in the process report.

INTRODUCTION

Libraries have existed for thousands of years and have developed ever since. They have always created the framework for knowledge and education. Today the traditional library functions are often combined with other public activities in a hybrid building where they have to operate together and even support each other.

Vejle is a city in southern Jutland in Denmark with an ambition of becoming a cultural and educational acknowledged city and a new library and culture house should promote this. They wish to combine the existing library with the music school and culture school of Vejle and thereby integrate learning and culture. The challenge is to accommodate these three different organisations under one roof and meet all their different needs.

This project embraces the aforementioned topic in relation to cultural development and learning environments, through the design of a new public library and culture house in Vejle. It aims to integrate the various activities and their users and promote the interaction between them to achieve a coherent design. Furthermore the project focuses on the relation to the context and how the building can contribute to the ambition of Vejle.

Ill. 1 Map

PROBLEM STATEMENT

How can a new culture house promote learning and social interaction to strengthen the community and tie the surrounding areas together in the city of Vejle, while integrating sustainable solutions?

VISION

Our vision for the new library and culture house in Vejle is to create a coherence between the three learning and culture organisations: the library, the culture school and music school. By uniting them into one entity the goal is for them to support each other. The aim is to encourage learning through the design and through integrating the various functions of the three organisations for a holistic learning environment.

The goal is also for the design to utilize the differences of the three organisations and the interplay between them to enhance the local community as well as the cultural quality of the city and thereby become a new social centre in Vejle. The aim is to make an inclusive and welcoming building that greets the users at eye-level and is a local gathering place where people can meet and create new experiences with each other and people in their local communities. By facilitating and encouraging meetings we wish to promote cultural diversity and development and to enhance social quality.

Furthermore, the aim is to make a sustainable building, that consciously utilizes the existing conditions and materials on the site combined with low energy solutions and deliberate choices of systems and materials, while also preserving and integrating the surrounding nature qualities.

DESIGN CRITERIA

LEARNING

- The building should integrate design principles for universal learning environments and the design should invite to learning.

COLLABORATION

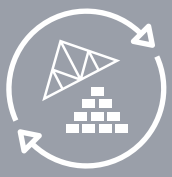
- The building design should encompass multi-functional spaces, that promote collaborations, knowledge and integrates the three organisations: the library, the culture school and the music school.

COMMUNITY

- The design should connect the surrounding areas and promote informal meetings, by being open, inviting and accessible, as a living room in the city, and thereby gather the local community and promote social resilience.

LAYOUT

- The layout of the building should focus on intuitive way-finding and movement through design elements and choice of materials, and having a clear separation between functions and between public and private, both inside and outside.



MATERIALS

- The design should incorporate reuse of materials from the existing library building where it is possible or other sustainable materials.

BUILDING RELATION

- The building should relate to the surrounding buildings and tie the New Rosborg area together with the rest of the city, while also being a landmark and attract attention to lift the atmosphere of the area and create a new identity for it.

NATURE

- The design should relate to the existing nature at the stream Vejle Å and the path along it, and further promote this in the park and the building, as well as the path connection at the road intersection.

OUTDOOR SPACES

- The existing natural qualities of the site and the stream should be preserved and improved, by orientation of spaces according to sun, wind, noise and views.

WATER MANAGEMENT

- The design should integrate water handling, by slowing the water and leading it to the stream, as part of the climate resilience strategy.

BUILDING PERFORMANCE

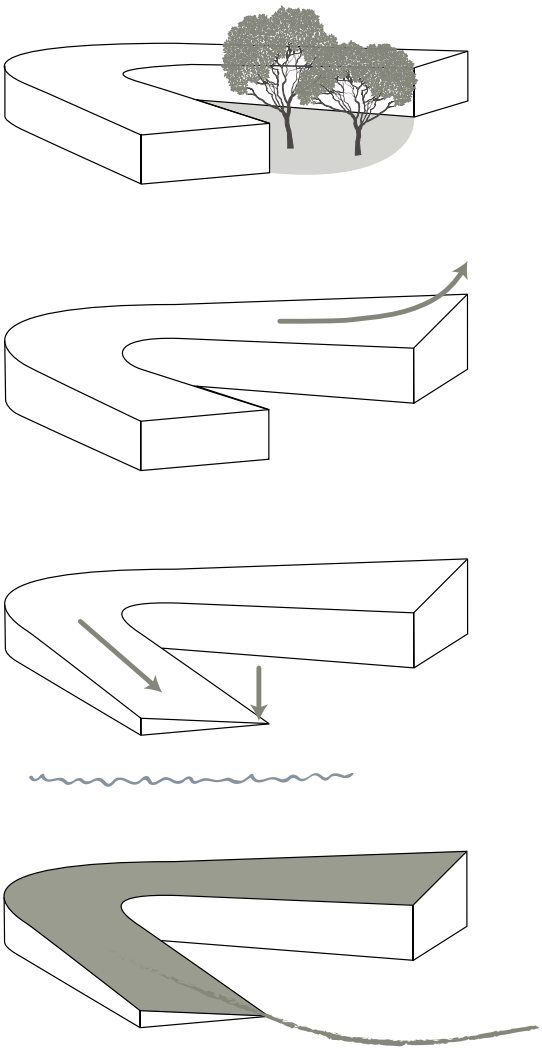
- The design should follow the Low-Energy Class and the Voluntary Sustainability Class, while also focussing specifically on the acoustics according to the Music School and Culture School functions, as well as daylight for the Library functions.

Ill. 2 Design Criteria

MASTER PLAN 1:1000

Ill. 3 Master plan

SITE CONCEPT



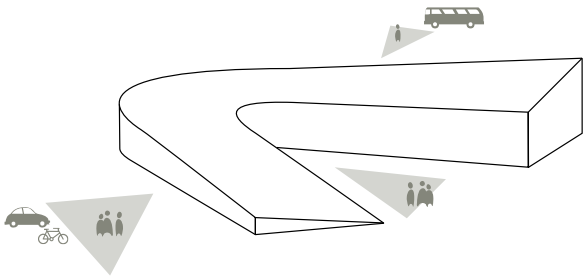
EMBRACING THE PARK

STRETCHED AND LIFTED TOWARDS THE CITY MEETING THE HIGH BUILDING SURROUNDING THE SITE

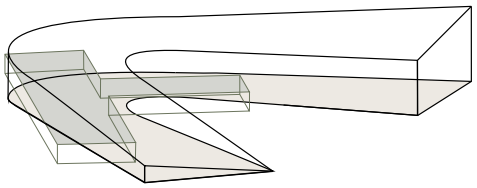
DRAGGED AND PUSHED DOWN TOWARDS THE STREAM AND PATH TO MEET THEM IN A HUMAN SCALE

GREEN ROOF MAKING THE PARK INTERACT WITH THE PARK AND INVITING FOR STAYS

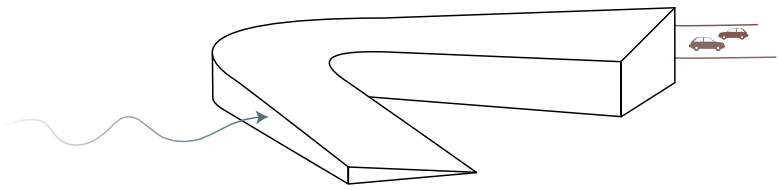
Ill. 4 Concept part 1



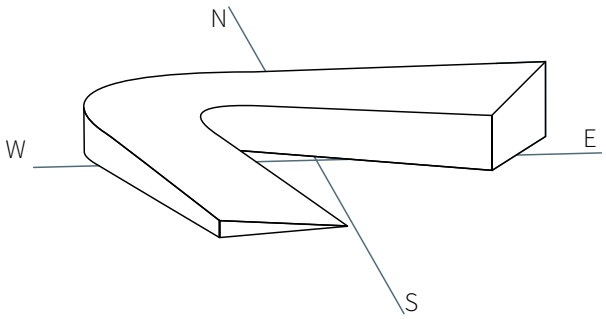
ENTRANCES TOWARDS PARK, BUS STOP AND PARKING LOT



THE NEW BUILDING IS PLACED ON TOP OF THE EXISTING BASEMENT TO PRE-SERVE AND REUSE IT



THE BUILDING IS SHIELDING FOR WIND AND NOISE IN THE OUTDOOR SPACE CREATED BY THE BUILDING

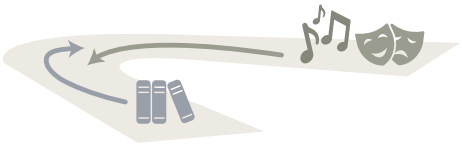


ORIENTATION FOR SUN IN THE OUTDOOR SPACE

Ill. 5 Concept part 2

BUILDING OF LEARNING

Vejle Library and culture house is a building of learning where learning of interest takes place both in the library and the culture school. People come here for inspiration, knowledge and learning new skills which give both young and elderly a good base for lifelong learning. Opposite the learning in educational schools the learning in Vejle Library and culture house is optional and informal – it can even be subconscious.



Ill. 6 Concept of collaboration

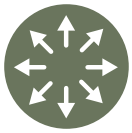
The building is designed based on the learning environments of Rosan Bosch, which is distributed throughout the building and park area strived to have at least one of each environment on each floor of the building.

MOUNTAIN TOP
Knowledge sharing in one direction

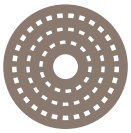
WATERING HOLE
Informal spaces offering new contacts and small talks

CAVE
Individual spaces for focus and reflection

HANDS ON
Practical creative spaces



CAMP FIRE
Group based interactions and collaboration

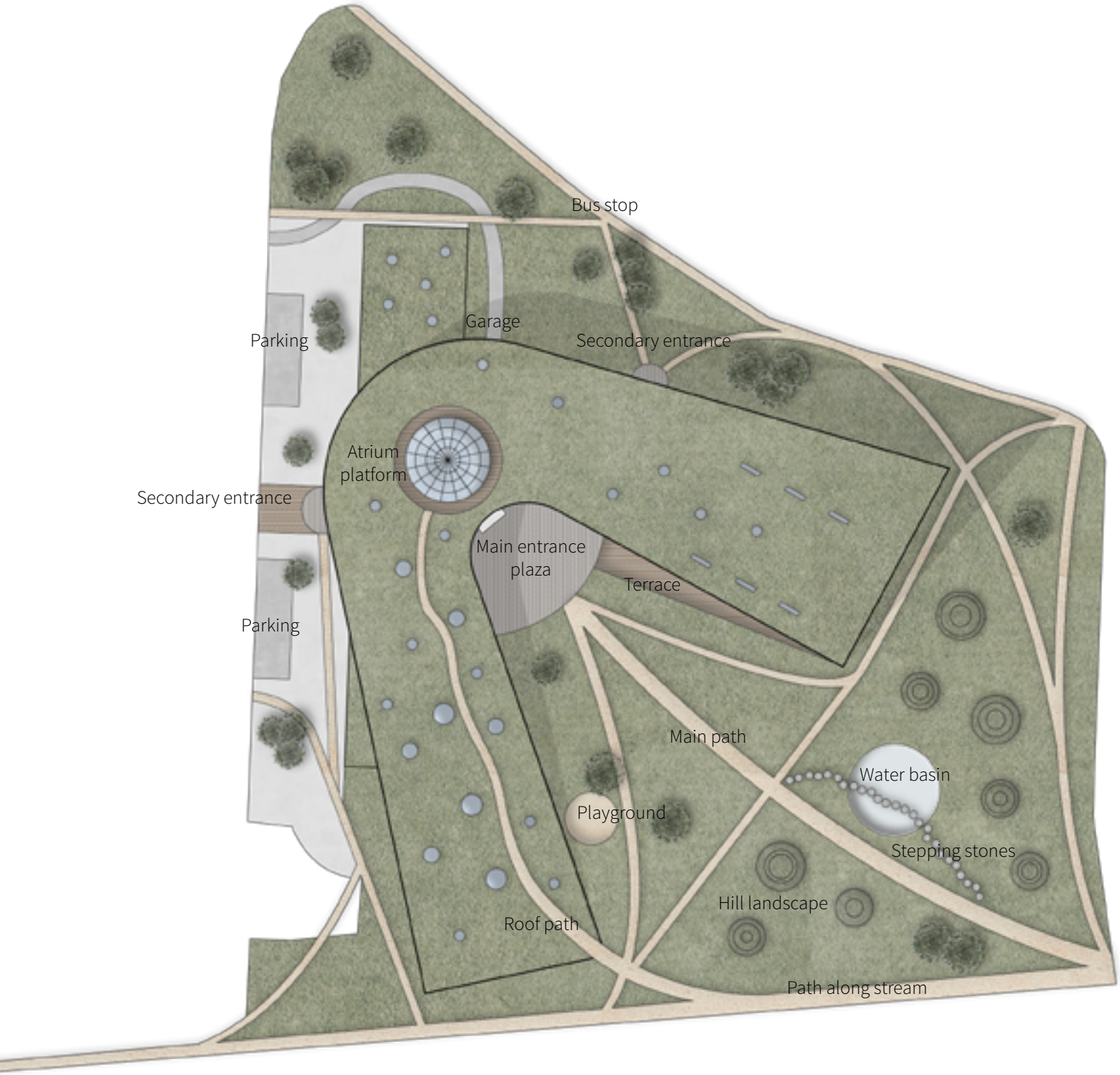


MOVEMENT
Nudging people to be active and move around

Ill. 7 Rosan Bosch learning environments

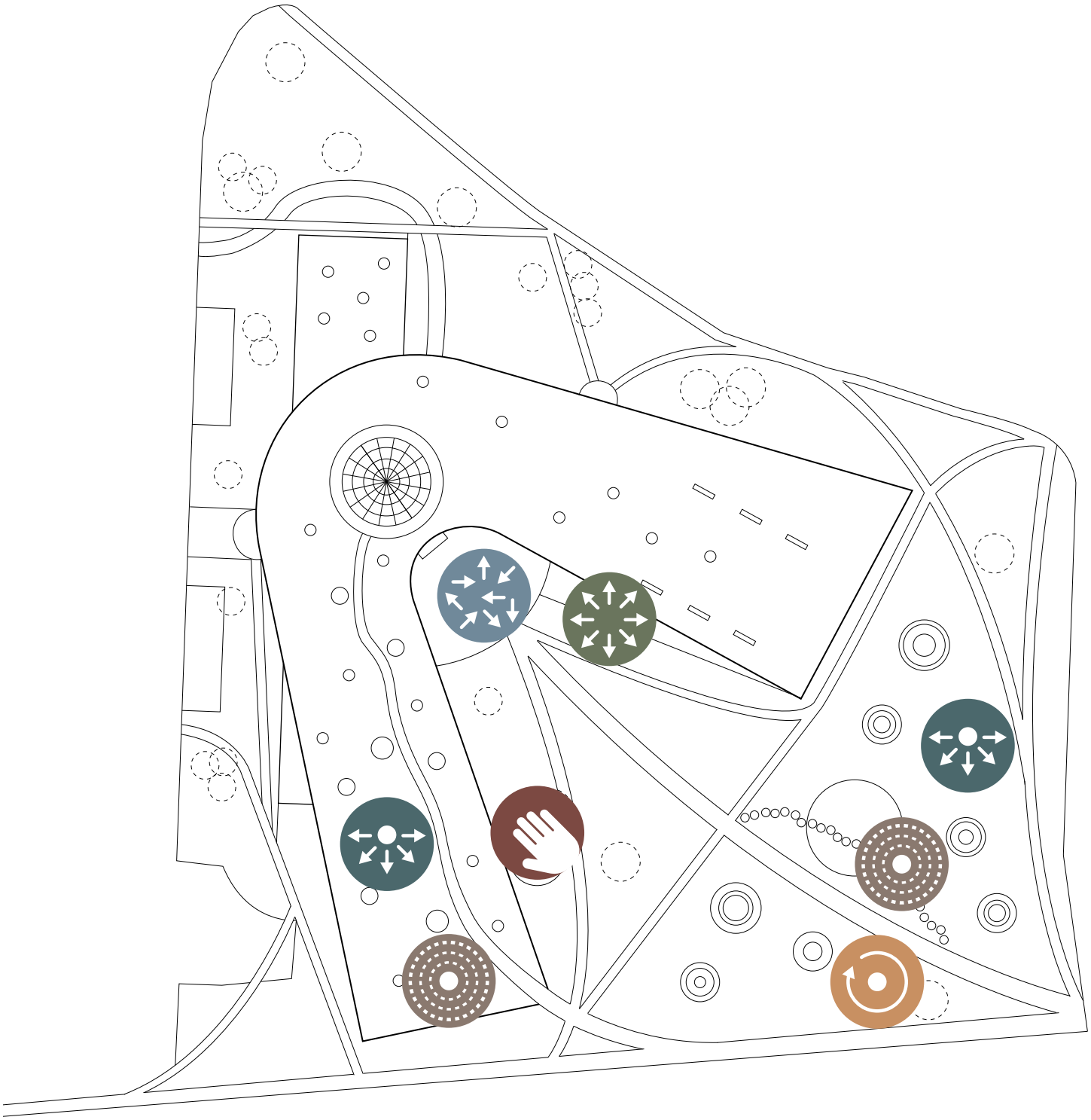
Ill. 8 Cave with view to the park

SITE PLAN 1:1000



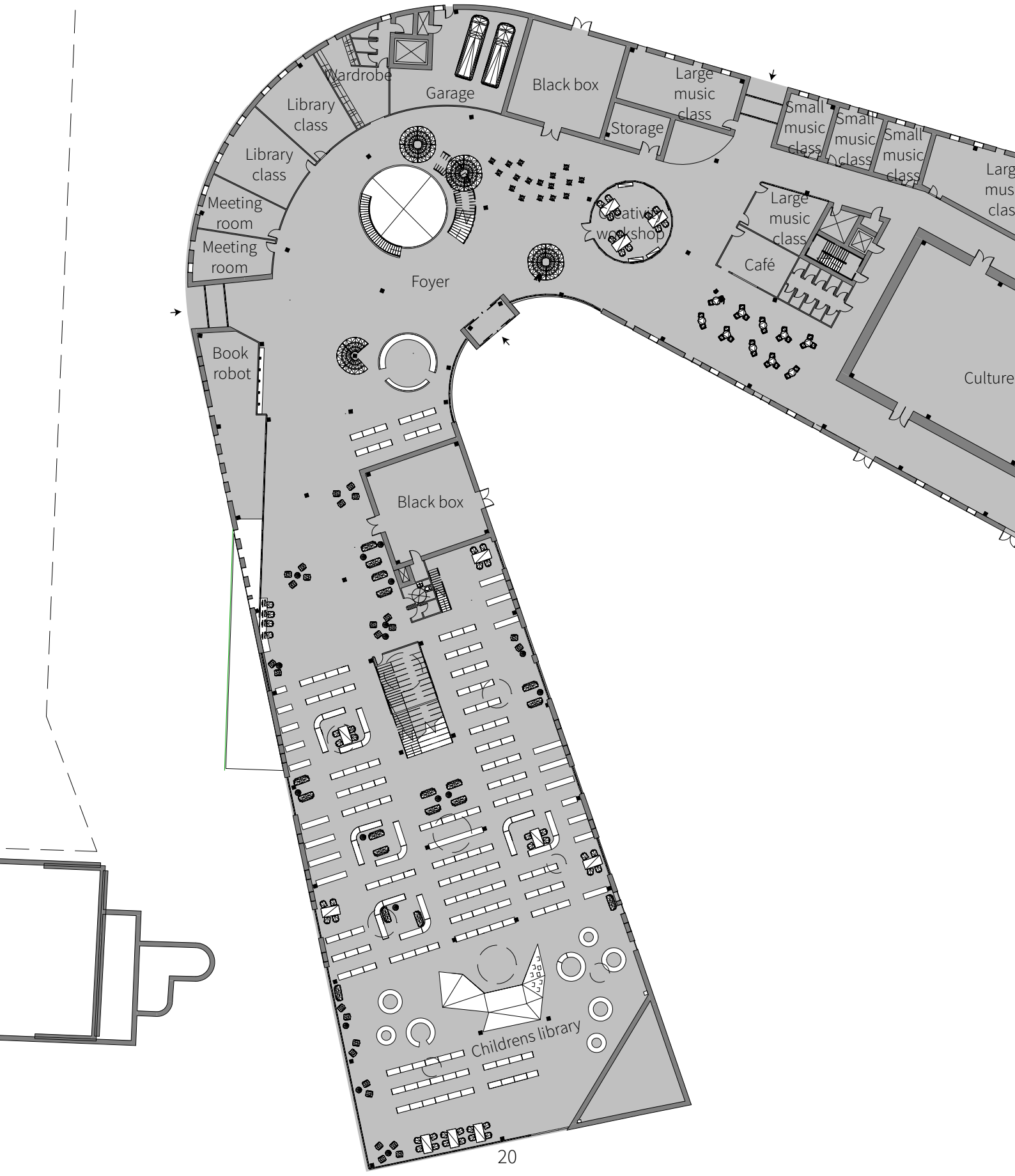
Ill. 9 Site plan

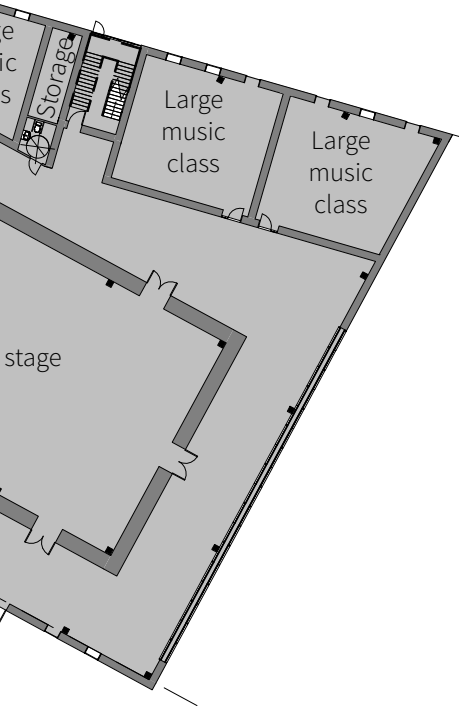
LEARNING ENVIRONMENTS ON SITE



Ill. 10 Outdoor learning environments

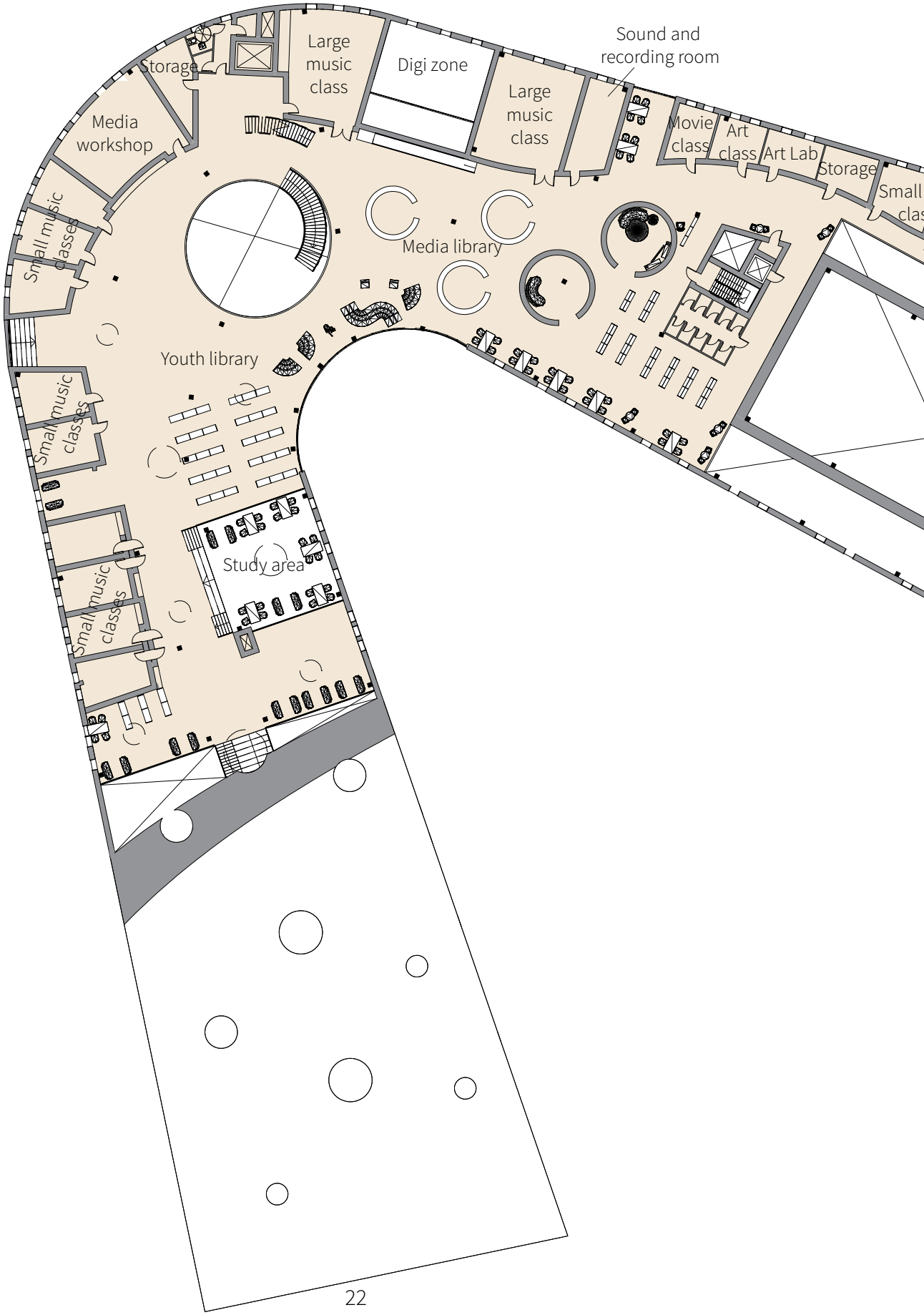
GROUND FLOOR 1:500

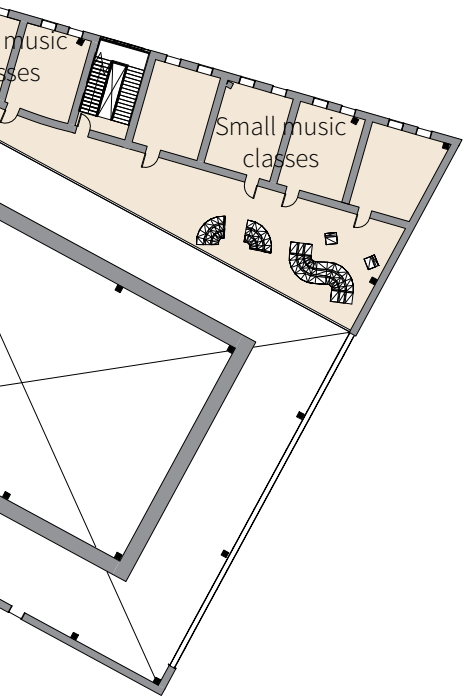




Ill. 11 Ground floor

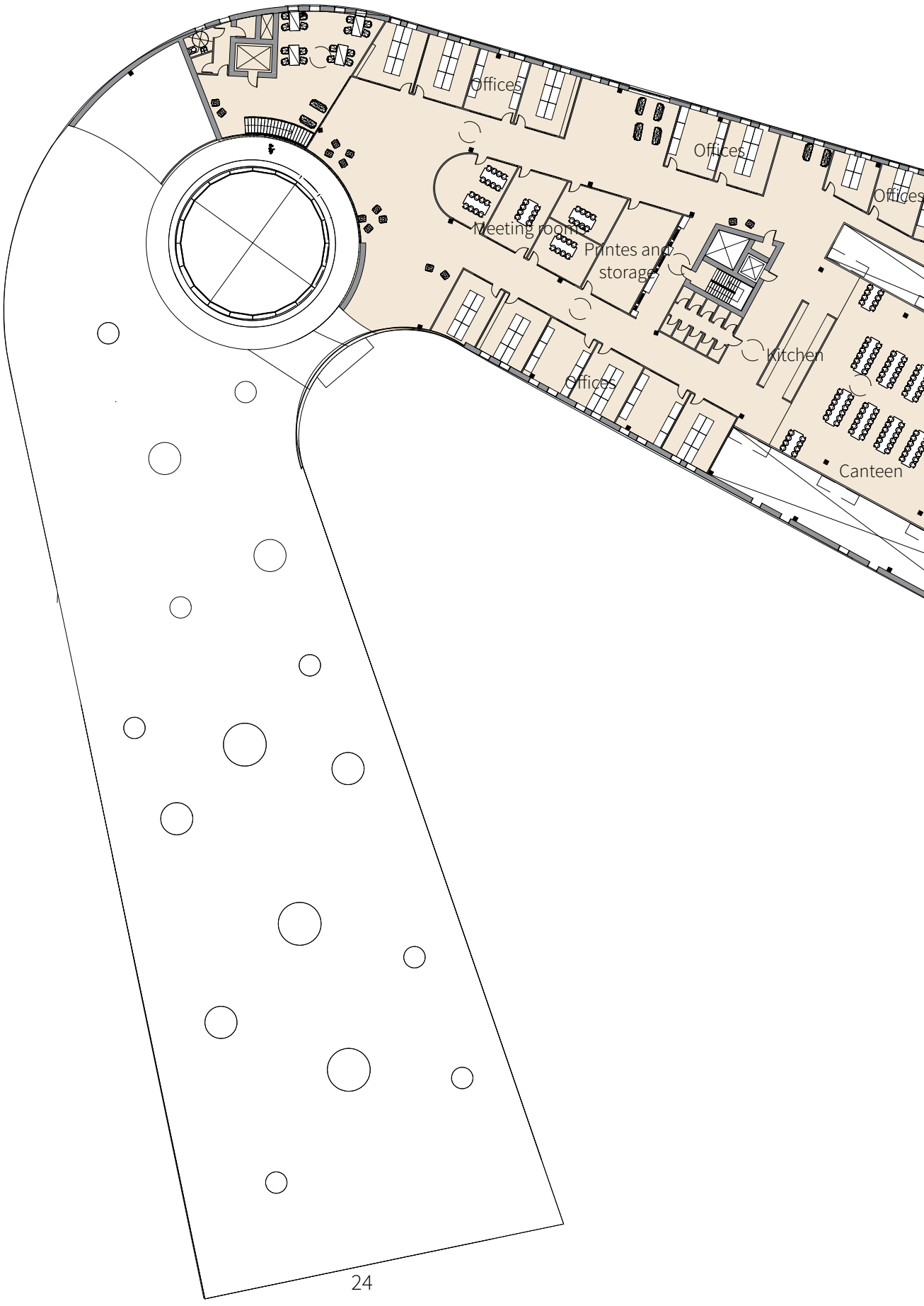
FIRST FLOOR 1:500





Ill. 12 First floor

SECOND FLOOR 1:500

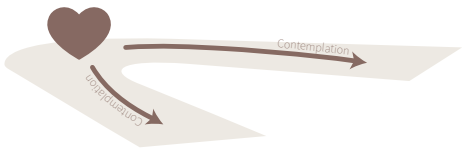


Ill. 13 Second floor

Ill. 14 Park entrance

ENTRANCE

The building embraces the park and catches visitors from the path along the stream welcoming them with open arms. The curved form clad in slabs amplifies the direction towards the entrance inviting people into the building. All entrances lead the users into the middle of the building where the building has its social centre of facilities, i.e. a café, exhibitions, events, and workshops etc. This part of the building is the primary watering hole where everyone will pass entering the building. The informal meeting spaces will attract different users which can connect new contacts between visitors. The busy watering holes in the building is also a place for distraction, which can be used to clear the head while learning. From here the users of the building can navigate towards the ends where contemplation is more in focus.

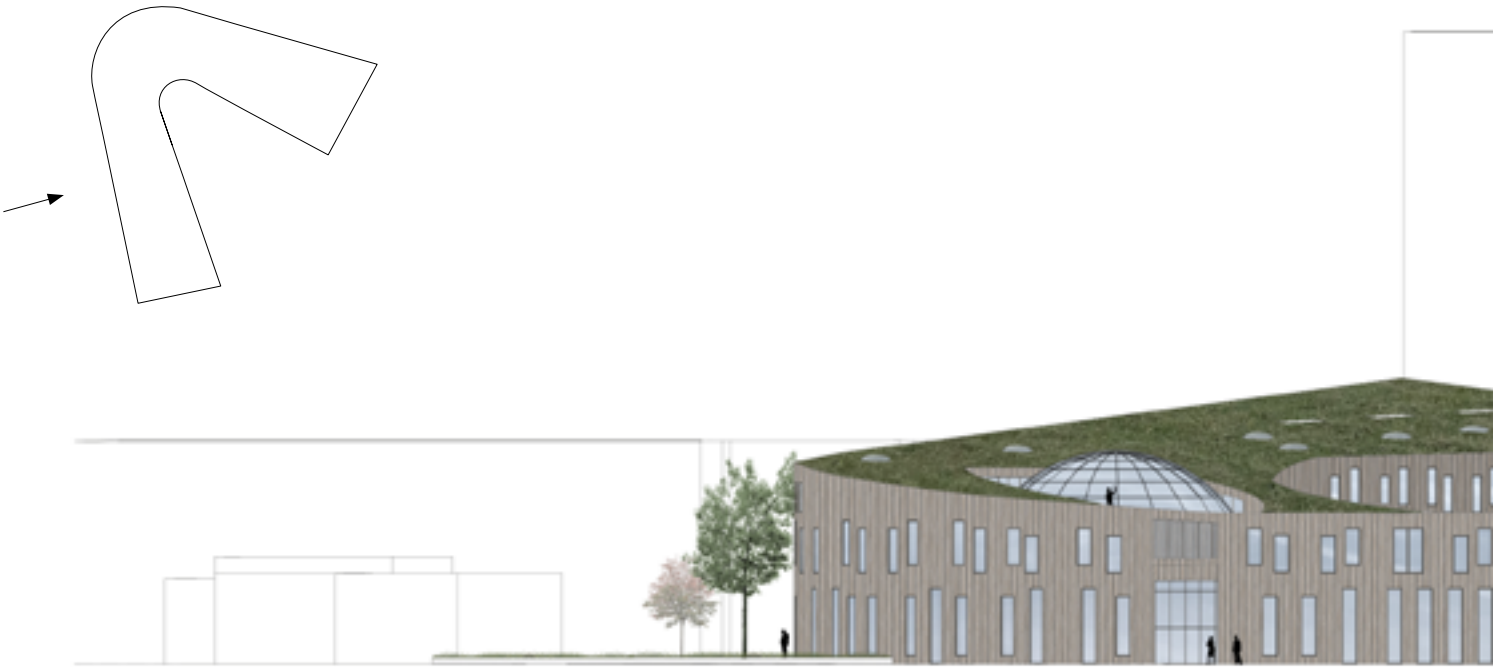


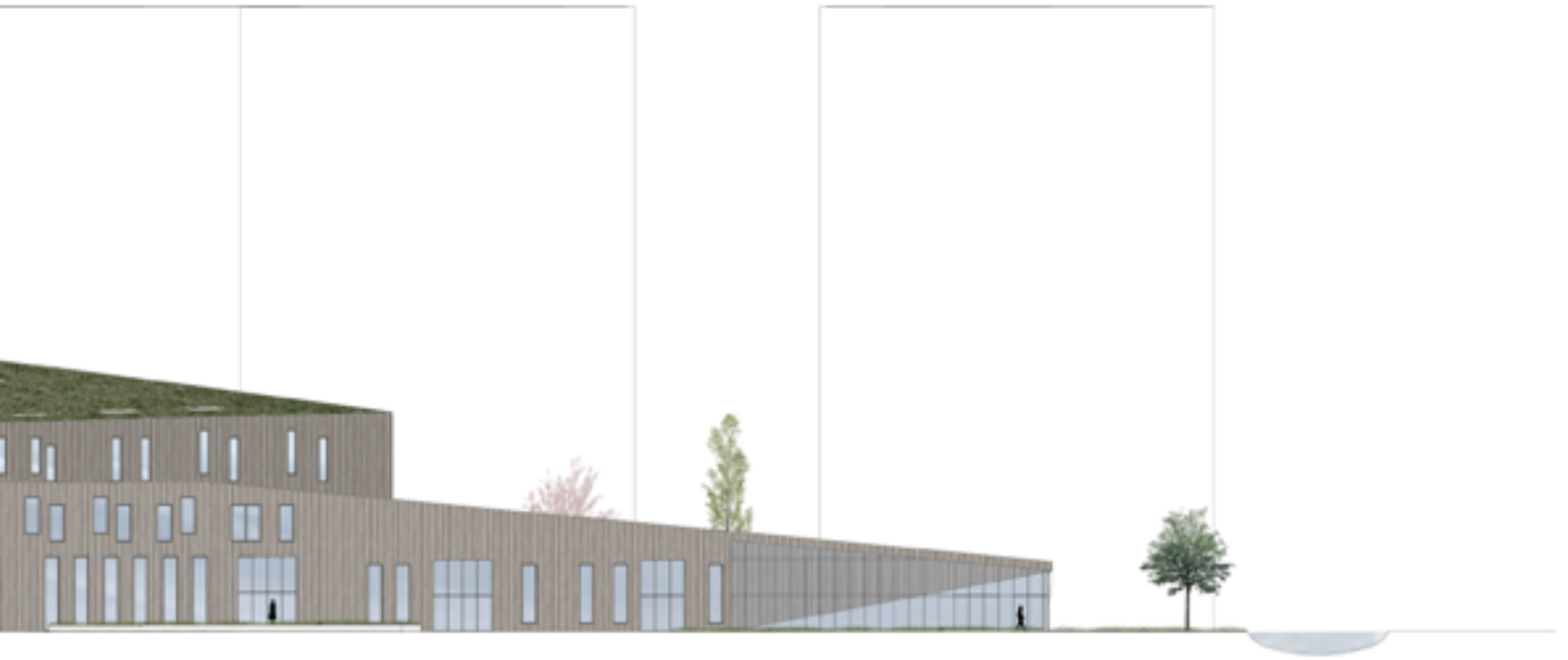
Ill. 15 Concept of contemplation

The Library and culture house have two types of entrances: the primary towards the park and two secondary towards Willy Sørensens Plads and Vestre Engvej at the long façades. Both have horizontal slabs, opposite of the rest of the façades, to mark the entrances. To mark the hierarchy the primary entrance, have a box added to the building as windbreak, whereas the secondary entrances inverts this and “subtracts” a box from the building form.

Ill. 16 Foyer

ELEVATIONS 1:500





Ill. 17 West elevation

Ill. 18 North elevation

Ill. 19 Atrium

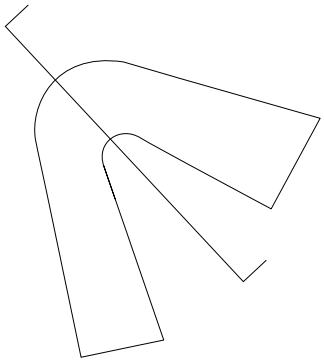
ATRIUM

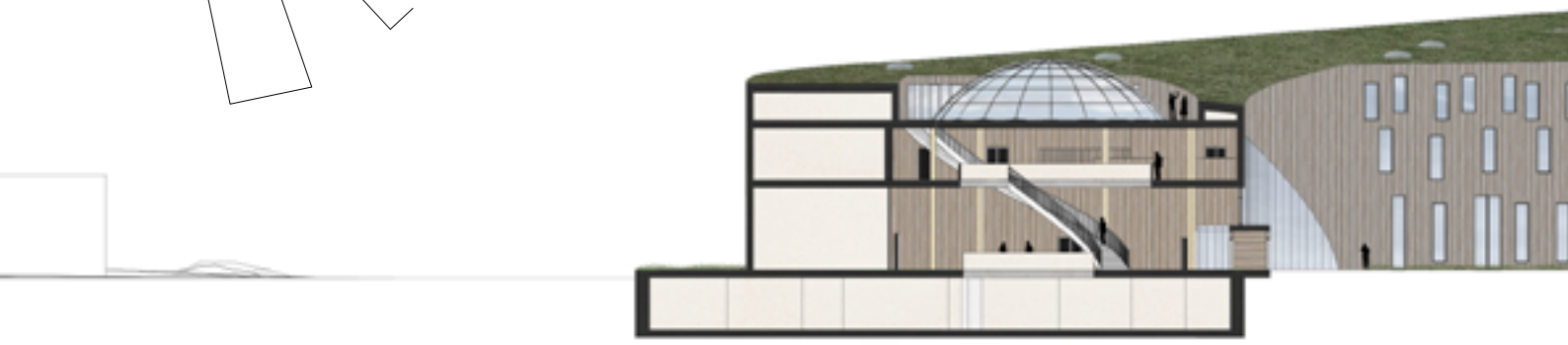
When entering the building the atrium is seen in the middle of the building connecting the floors from basement to the roof. The library and culture school are placed in either end of the building, but come together in the middle, where the atrium provides an instant overview vertically of the building. Therefore, the atrium is also used for way-finding and easy access to the desired functions of the users. Furthermore, the atrium provides daylight to the middle of the building to ensure a good visual indoor climate.

The spiral staircase in the atrium creates movement toward the dome in the roof nudging visitors to move upwards ending on the 2nd floor where it is possible to go out on the roof and walk around the dome for some fresh air and a enjoy the view over the city. It is also possible to move further down the roof to the park and thereby a loop of movement is created.

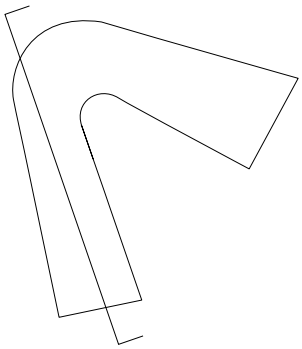
Ill. 20 Roof space

SECTIONS 1:500

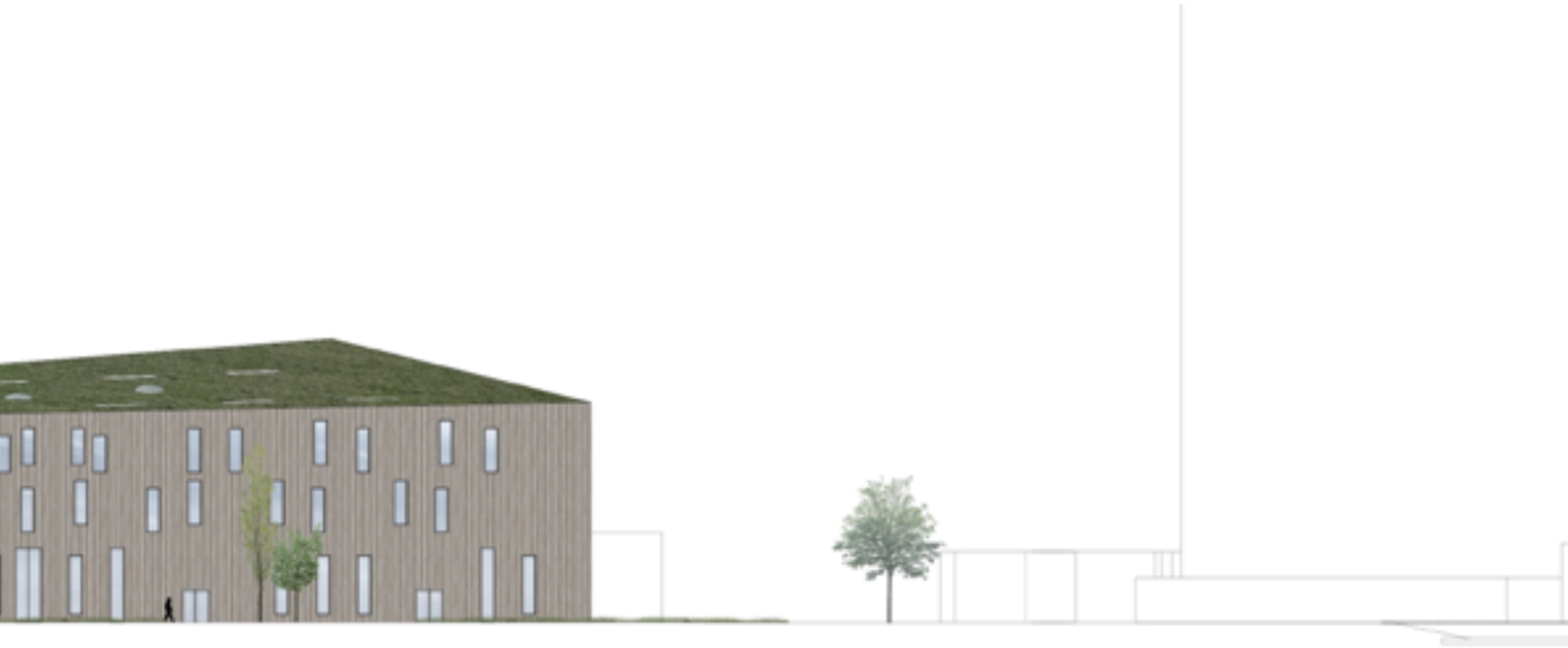


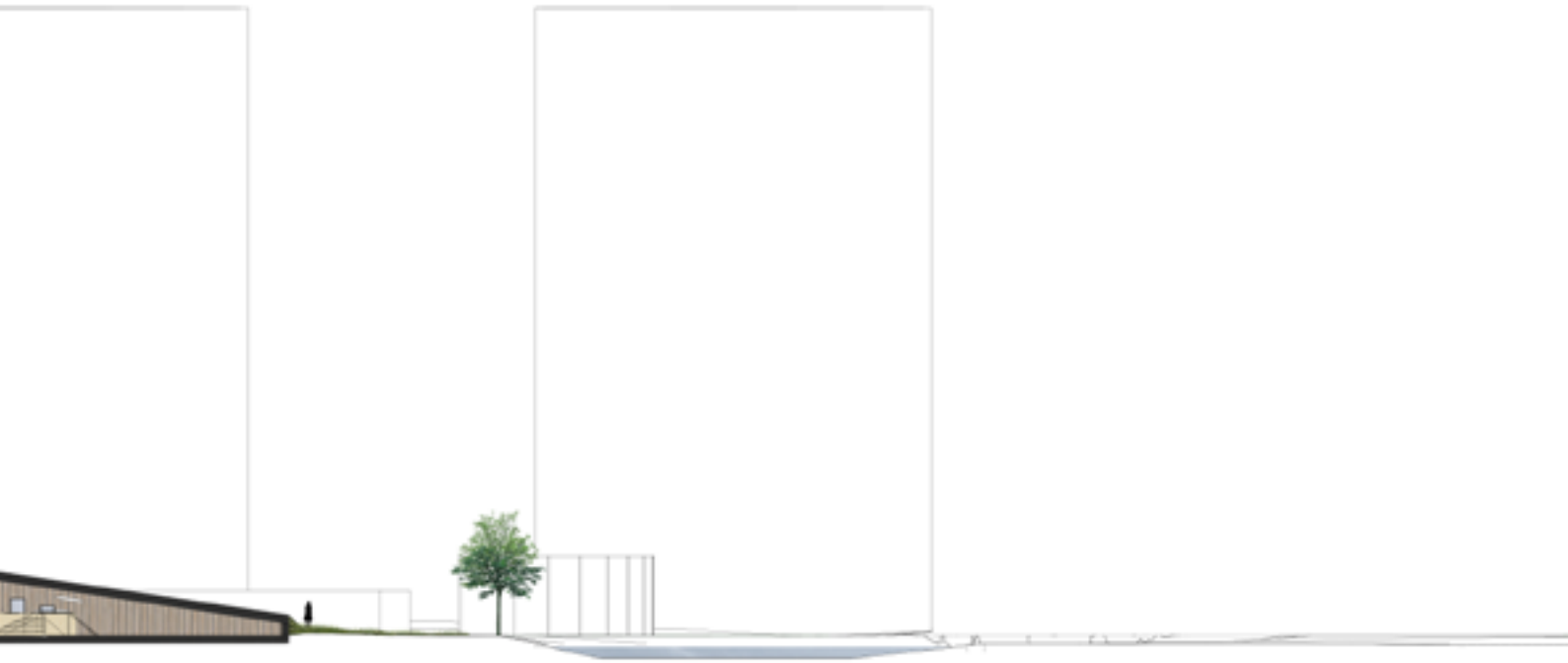


Section through atrium



Section through library





LIBRARY

The library is mainly distributed to the west end of the building where a large staircase connects the ground floor and the 1st floor. From the top of the library stair there is view to the lower floor to help way finding and create a flow through the library part of the building.

The library stair serves multiple uses as it formed as a mountain top with seating for learning as a learning environment, but also for individuals or groups to make stays on. From the library stair there is a rooftop window, which makes it possible to sit on the stair and gaze up on the skies or down on the life in the library.

Ill. 21 Library stair

Ill. 22 Watering hole in the library, ground floor

Ill. 23 Campfires in the library, ground floor

Ill. 25 Library

Ill. 26 Caves in the library, 1st floor

Ill. 27 Overview of the library

MEDIA LIBRARY

The media library, consisting of music, movies, board games, video games, magazines etc., is placed on 1st floor together with the youth library and smaller classrooms for the and culture school. This is to engage the collaboration between the culture school and the library where also users of the library can gain knowledge or experiences from the culture school.

In the media area on the 1st is placed enclosed rooms to explore e.g., movies, music, or instruments. These are hands on experiences that ties together theory and practice. Other workshop areas placed around the building with room for creative and open-ended learning.

Ill. 28 Hands on

Ill. 29 Watering hole with open-ended furnitures, 1st floor

Ill. 30 Mountain top, 1st floor

YOUTH LIBRARY

The culture school is for children from age 0-25, so the classrooms are placed near the youth library and the media area where e.g., the music classes can benefit from the library's collection of sheet music.

The study area consists of camp-fire environments which are spaces for group based activities where interaction, collaboration and dialogue can take place.

Ill. 31 Study area

MATERIALS

BRICKS

The old library building contains of bricks in the load-bearing walls. As the masonry are from 1971 it is most certainly done with cement joints which means the bricks will be hard to teat about.
By cutting the walls into larger parts they can be reconstructed into new wall constructions.

WINDOWS

Looking into the LCA of glass it is shown that it has high embedded energy, therefore the goal is to reuse the large windows of the old library building.
The old windows is constructed with two layers of glass and by putting two of those together will give a glass construction of 4 layers and ad an insulation value to it.

CONCRETE

Tearing down the old library building will generate large amounts of concrete waste. This will be recycled stone-fill in new concrete constructions.
The new building is going to use concrete as the foundation, so here the old concrete can be put to usage.

EELGRASS

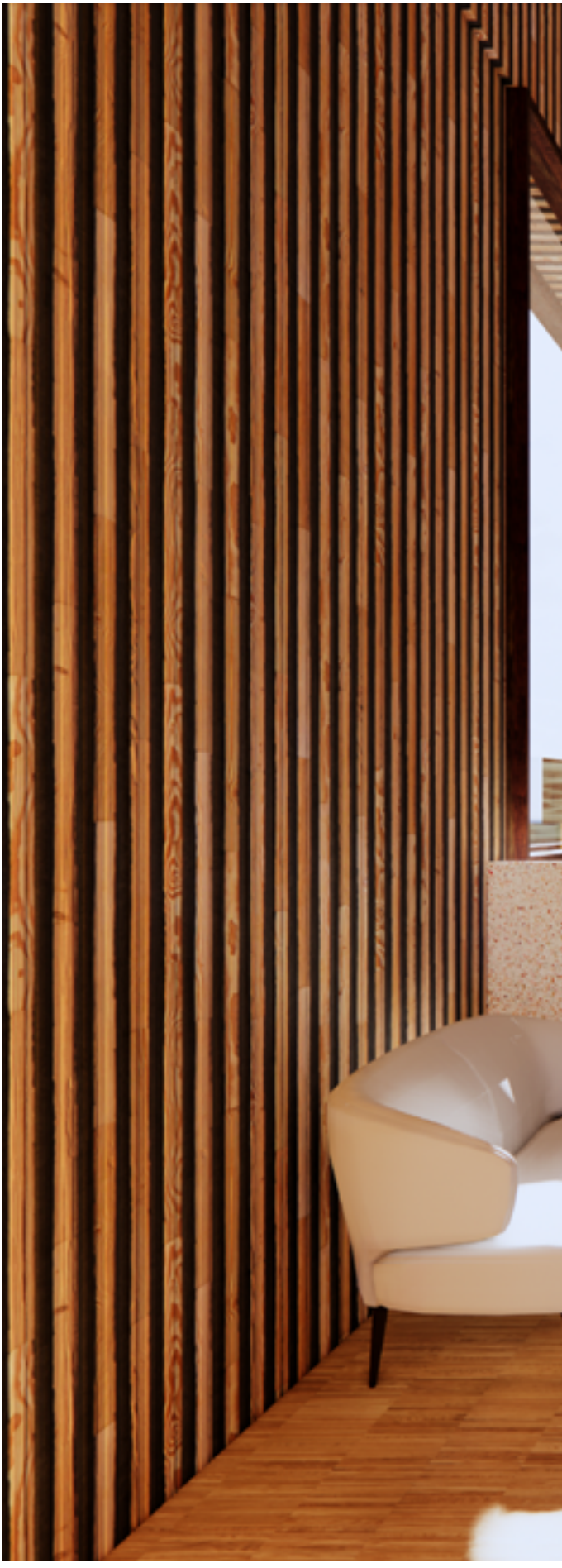
Eelgrass thrives in Vejle Fjord, and the local community is using it to re-establish the underwater ecosystem in the fjord.
When the eelgrass grabs and syncs with the ecosystem and it starts to overgrow, it can be harvested and used for a low environmental impact insulation.

Ill. 32 Culture stage

SHARED OFFICES

The second floor is mainly for staff despite the end towards the middle of the building where the spiral staircase connects with the roof. Like the other floors this one is also shared and mixed between the organisations to support collaboration.

At the offices, the learning environments has also been integrated as they can be translated into a working environment as well. The caves can be used for informal contemplation and seating in a smaller and quiet setting compared to a shared office.

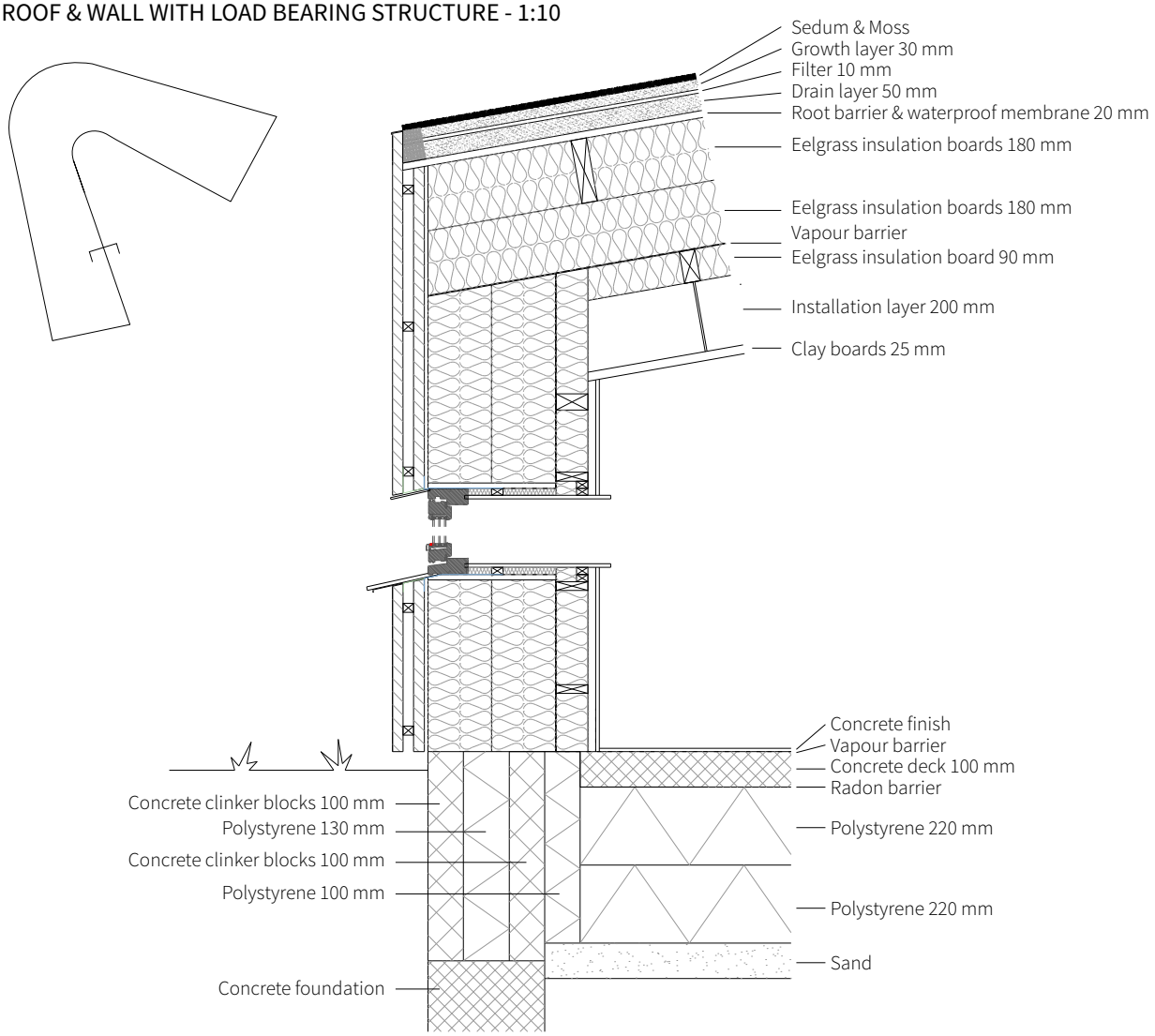


Ill. 34 Office, 2nd floor

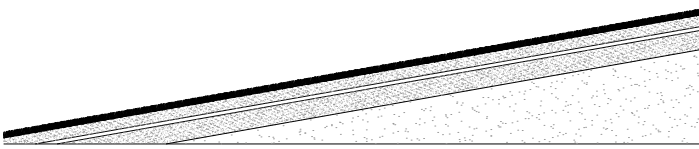
Ill. 35 Canteen, 2nd floor

CONSTRUCTION DETAILS 1:20

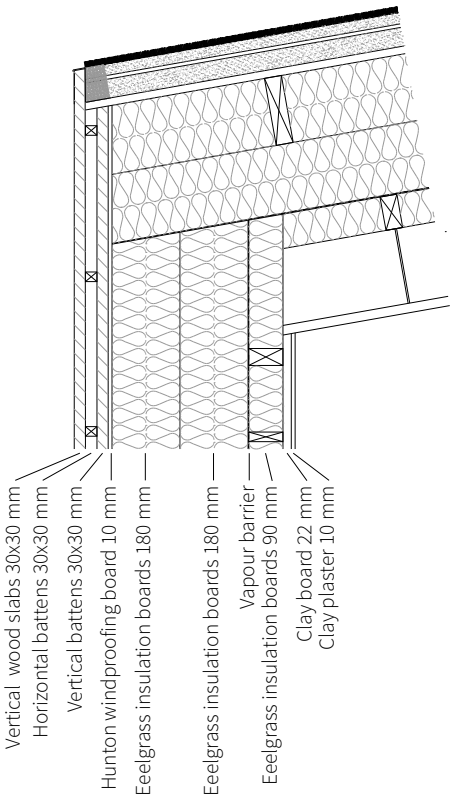
ROOF & WALL WITH LOAD BEARING STRUCTURE - 1:10



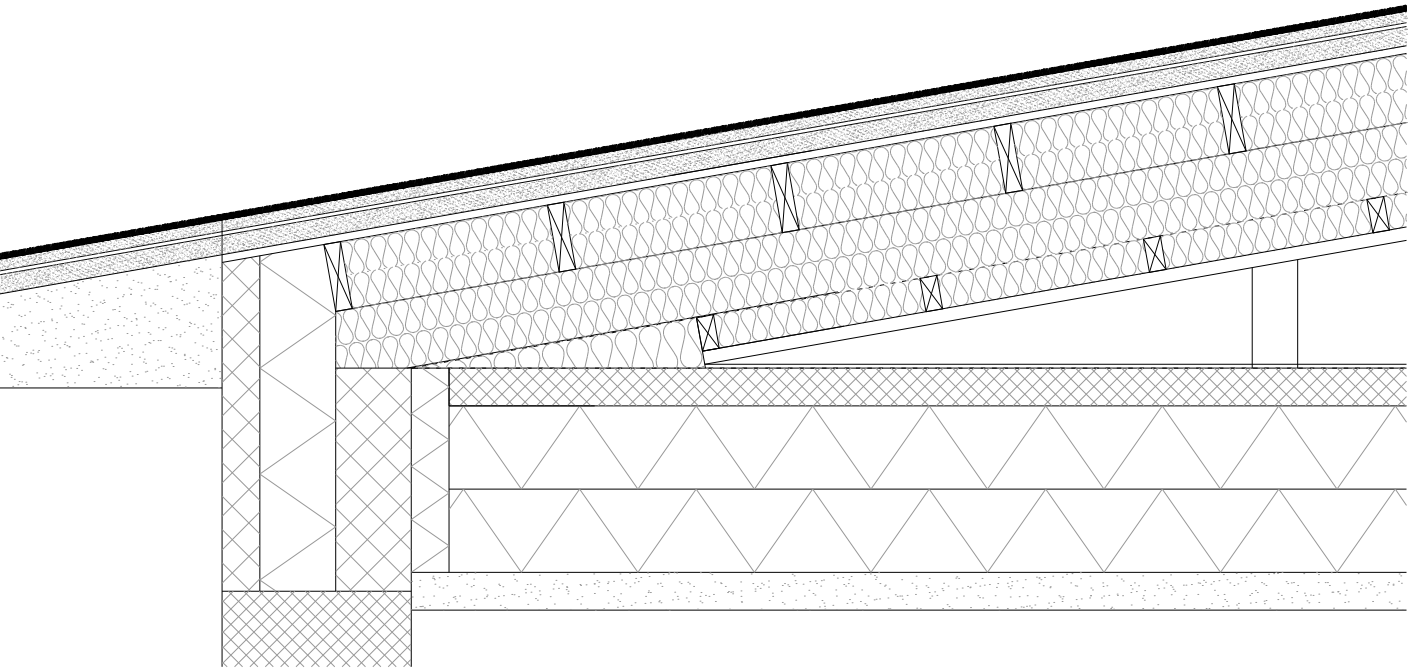
WALL & FOUNDATION - 1:10



ROOF & WALL -1:10



ROOF & FOUNDATION - 1:10

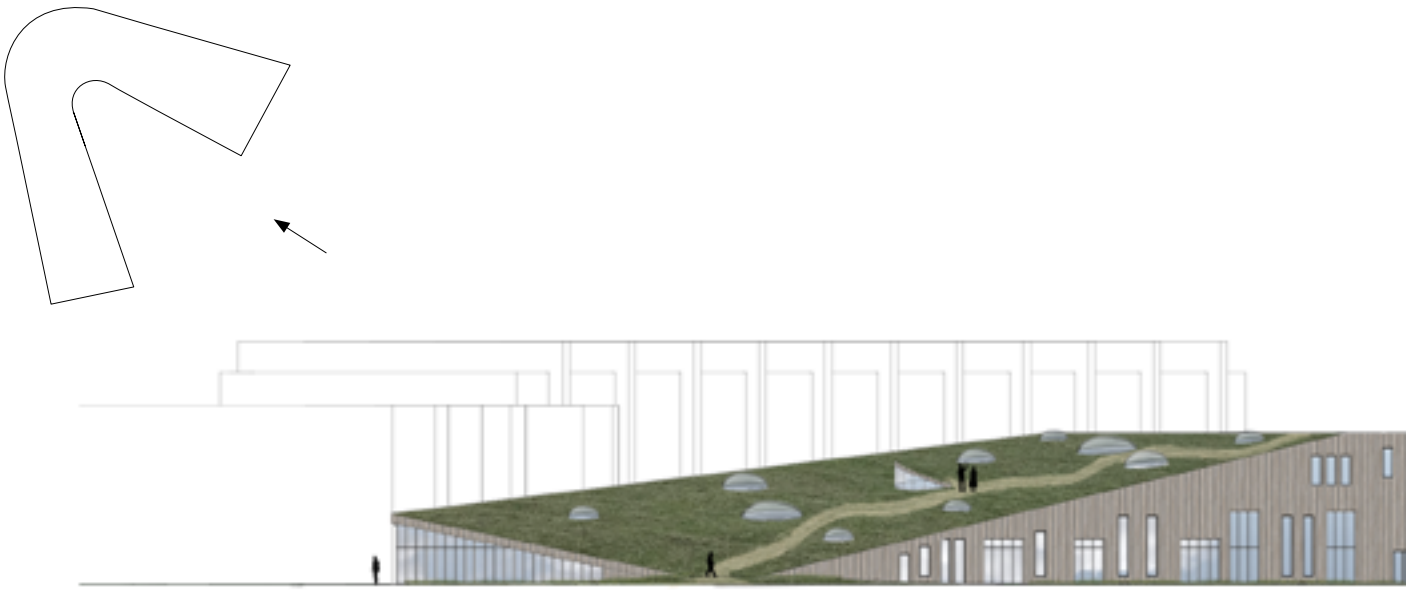


ROOF

The building “rises” visually from the park. The grass continued on the roof makes the fifth façade an active element of the building design. The roof catches the path along the stream continuing the path to the roof creating movement that connects with the interior flow in the atrium. It is possible to walk around the dome creating a view to the staff area, which otherwise is more a private area of the building.

The path on the roof slings between the domed skylights to a viewpoint towards the stream on the middle of the southern part of the building. The domes along the path have different sizes creating a playful expression along the path to the large dome covering the atrium.

The roof can furthermore be utilized as a mountain top on the viewpoint which is a surface angled in the opposite direction than the roof. This creates a more intimate atmosphere as the listeners is looking towards the presenter with the green roof in the background.



East elevation 1:500

ENERGY PERFORMANCE

To assess the energy requirements for the new library and culture house, the final design has been modelled in BE18 for analysis. BE18 calculates on a monthly and yearly basis to determine the yearly energy requirement and other key numbers.

To make the simulation easier to calculate, the model's physical properties like building envelope, interior spaces, internal loads, and systems such as lighting and ventilation are simplified into numeric values. Some of the inputs are estimations and assumptions based on standards and the internal guidance of the software. All the data is processed by the software to create a building model for it to base the simulations.
Results
As seen in the table, the building model's total energy requirement is 46,9 kWh/m2 per year. According to the FBK (Frivillige Bæredygtighedsklasse) and the danish Building Regulations 2018, the requirement for the "Low Energy" energy frame for a public building like this is 46,1 kWh/m2 per year, with the addition of 13,1 kWh/m2 per year (BUILD, n.d.).
The addition to the energy frame can be added when a building meets special circumstances that sets it outside the norm in some ways, either by having high need of light, ventilation, or particularly extended opening hours.

The project does not meet the requirement, probably due to the energy spent on cooling because of excessive heat in rooms. This could be resolved in a few ways, some of which could be to reduce the number of windows and shade more effectively or add more thermal mass to absorb the heat and even out temperatures in the building throughout the day. Another way could be to supply energy via renewable energy sources.

Contribution to energy requirements (kWh/m2 per year)	
Excessive heat in rooms	4,9
Net requirements (kWh/m2 per year)	
Room heating	21,6
Domestic hot water	13,5
Total el. Consumption	12,4

BR18 "Low Energy" Frame	33,0 kWh/m2 per year
Addition to Energy Frame	13,1 kWh/m2 per year
Energy requirement of New Library and Culture House	46,9 kWh/m2 per year

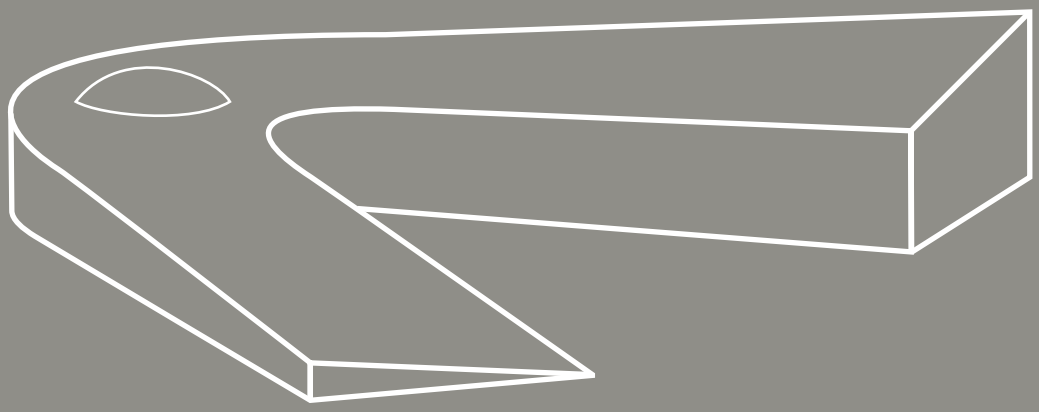
REFERENCES

ILLUSTRATIONS

All illustrations are own illustrations.

SOURCES

BUILD. (n.d.) *SBI Anvisning 213: Bygningers energibehov (1.3.3 Tillæg til energirammen*). [Online] Available at: https://sbi.dk/anvisninger/Pages/213-Bygningers-energibehov-5.aspx#/1-Bygningsreglementets-energibestemmelser [Accessed 24 May 2021]

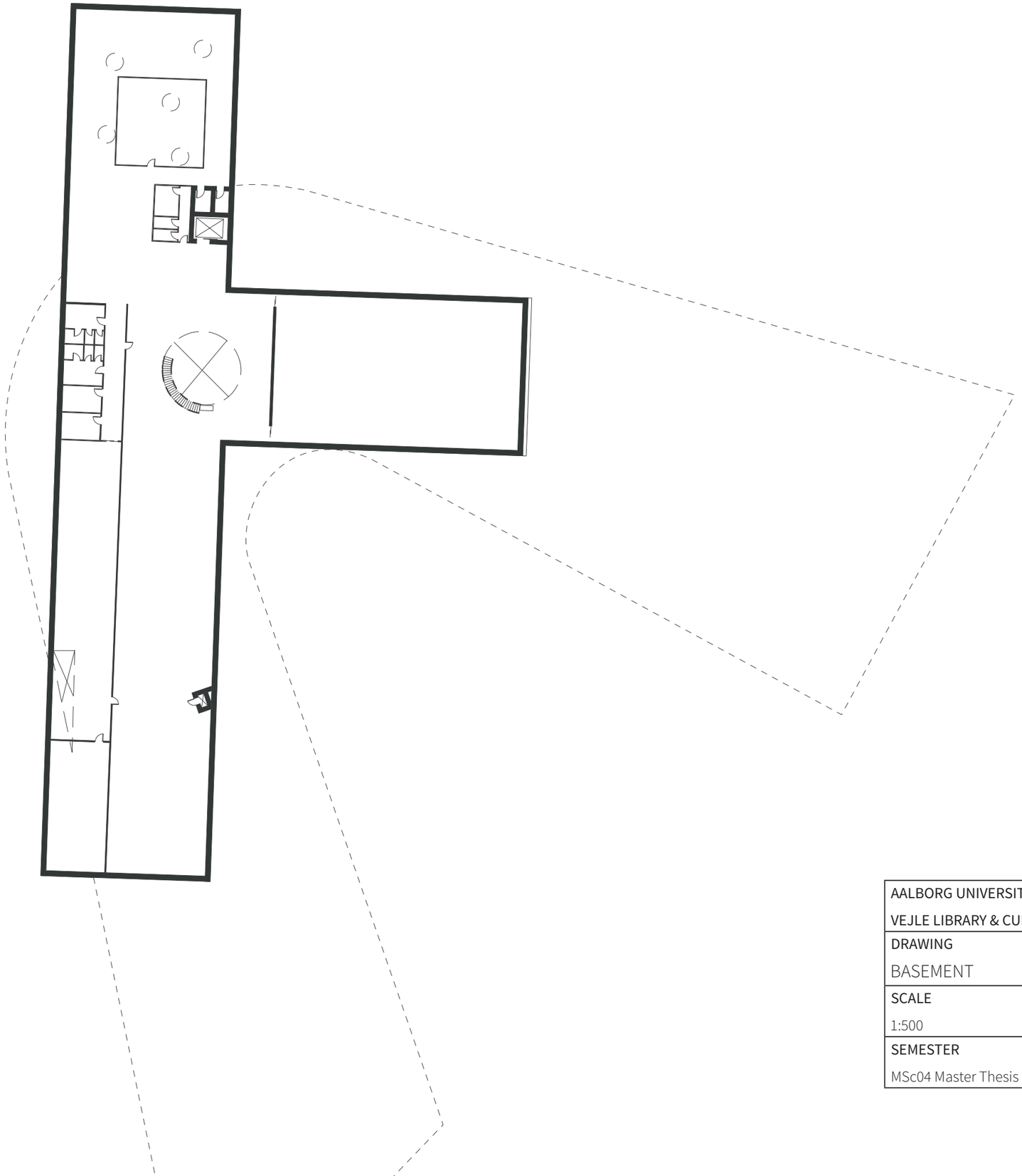


VEJLE LIBRARY & CULTURE HOUSE

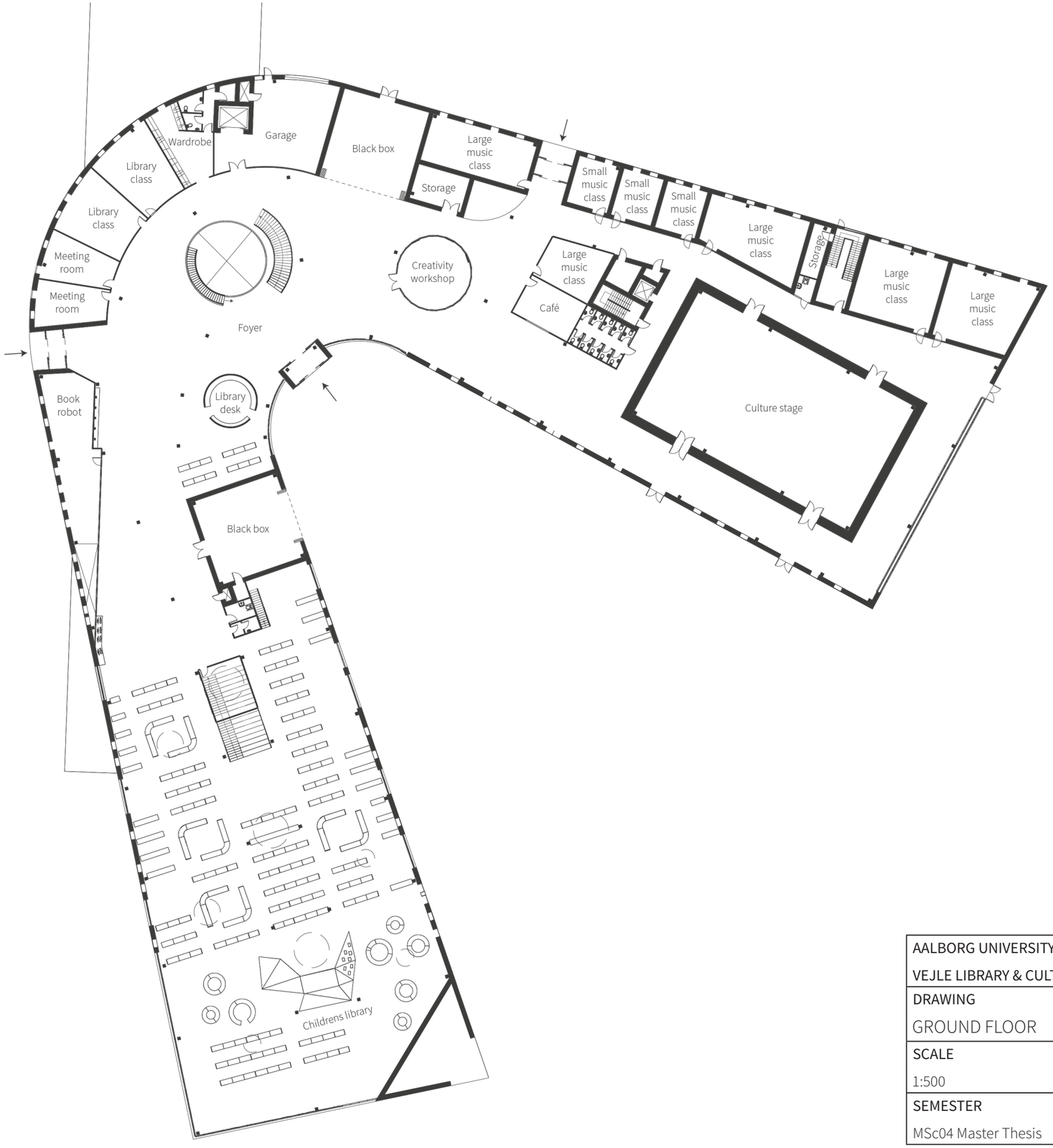
DRAWING FOLDER

CONTENT

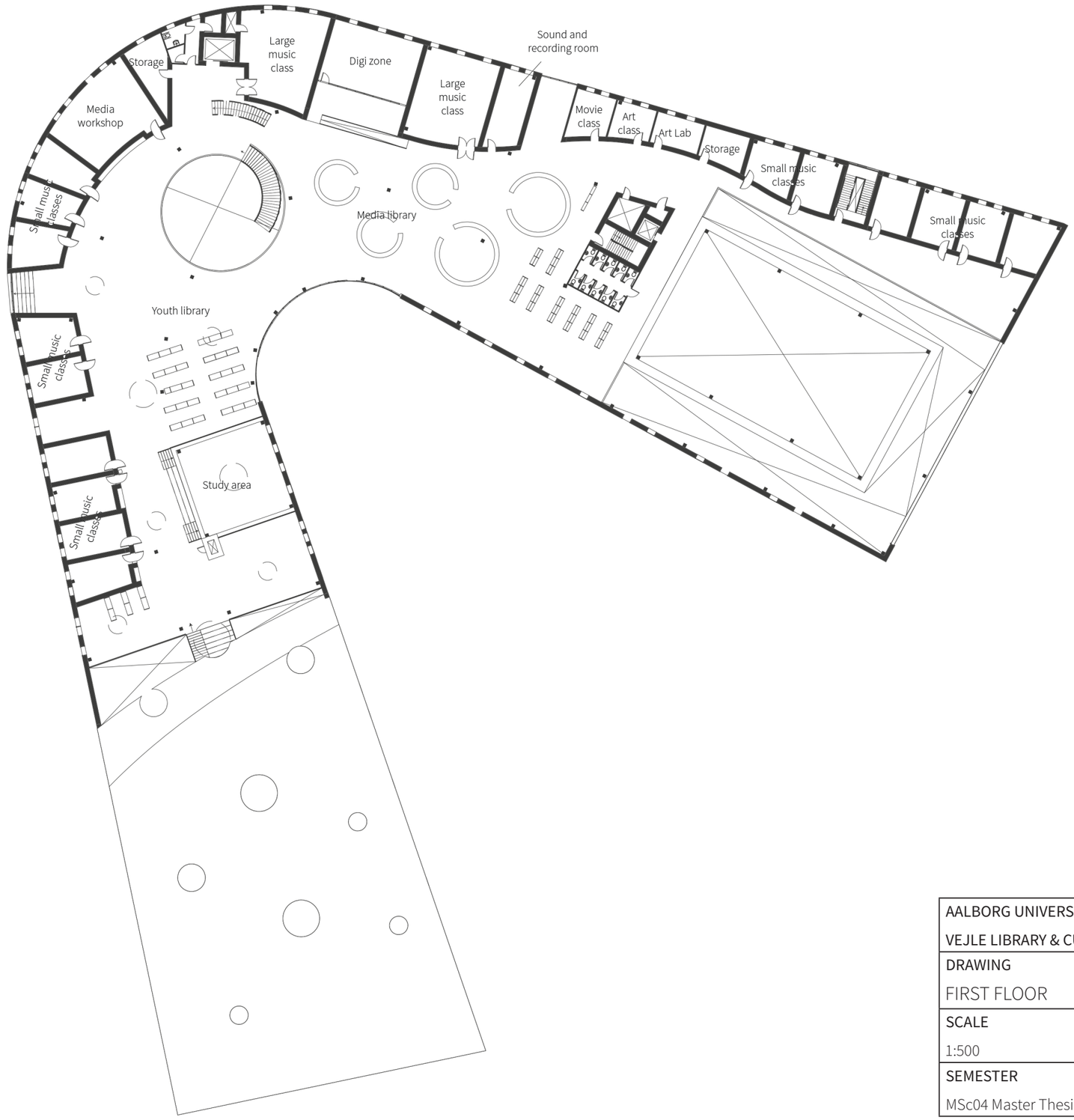
AALBORG UNIVERSITY	
VEJLE LIBRARY & CULTURE HOUSE	
DRAWING MASTER PLAN	NUMBER 1 of 15
SCALE 1:1000	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10



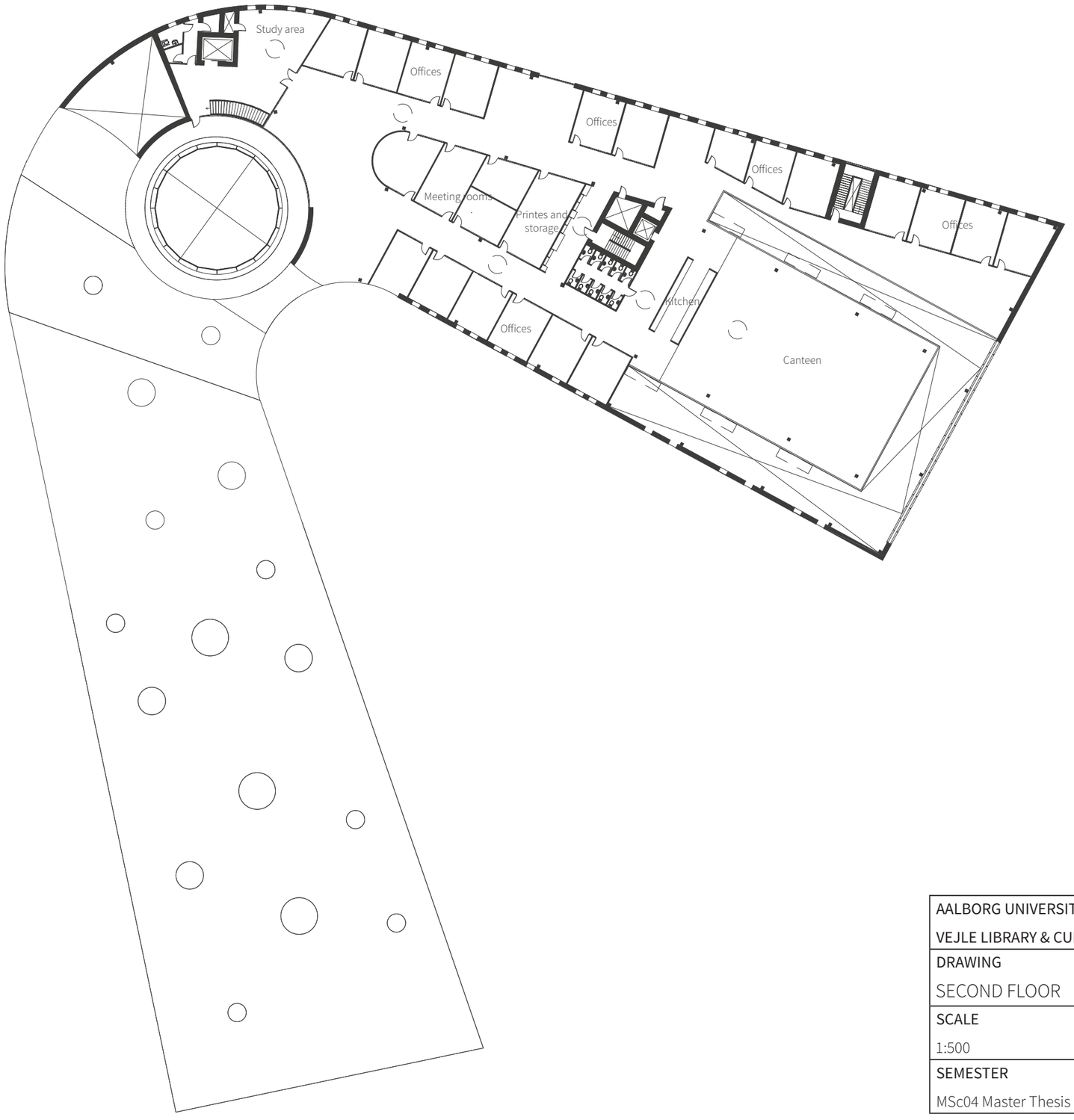
AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING BASEMENT	NUMBER 2 of 15
SCALE 1:500	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10



AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING GROUND FLOOR	NUMBER 3 of 15
SCALE 1:500	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10



AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING FIRST FLOOR	NUMBER 4 of 15
SCALE 1:500	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10



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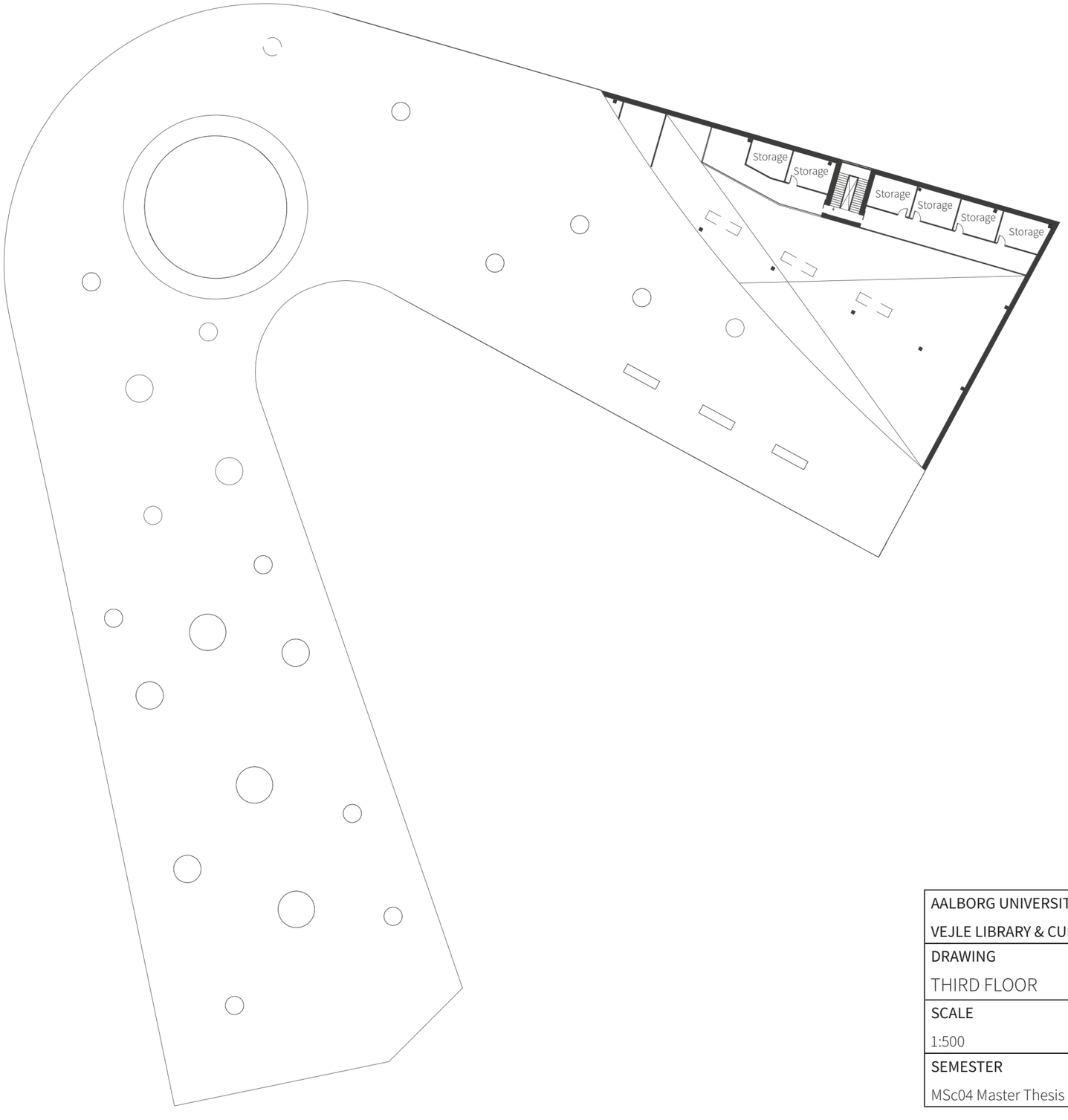
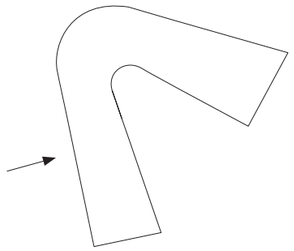
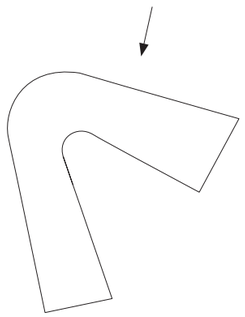
DRAWING SECOND FLOOR	NUMBER 5 of 15
SCALE 1:500	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10



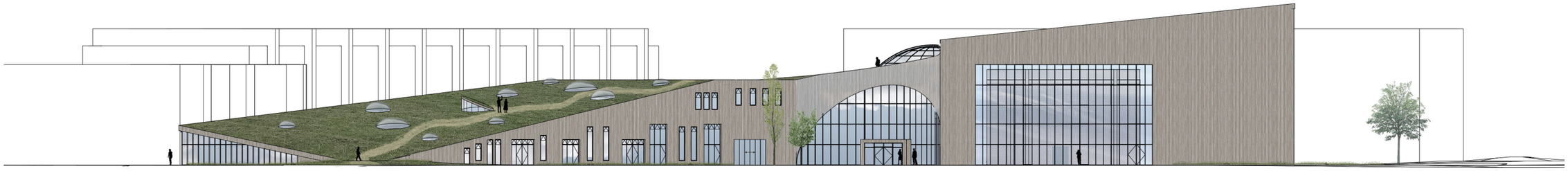
AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING THIRD FLOOR	NUMBER 6 of 15
SCALE 1:500	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10

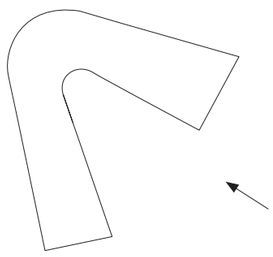


AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING WEST FACADE	NUMBER 7 of 15
SCALE 1:500	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10

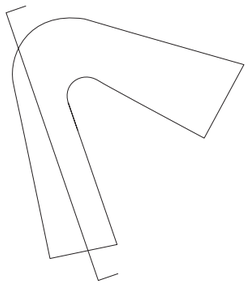


AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING NORTH FACADE	NUMBER 8 of 15
SCALE 1:500	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10

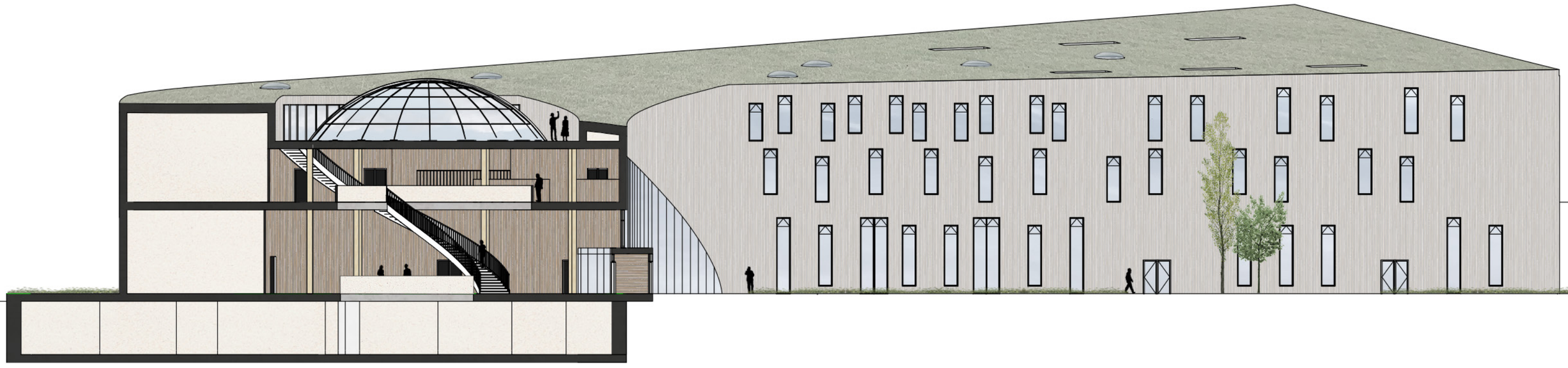


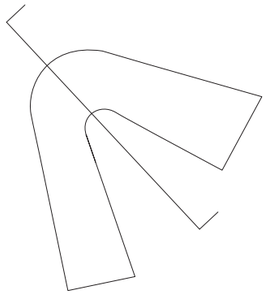


AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING EAST FACADE	NUMBER 9 of 15
SCALE 1:500	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10

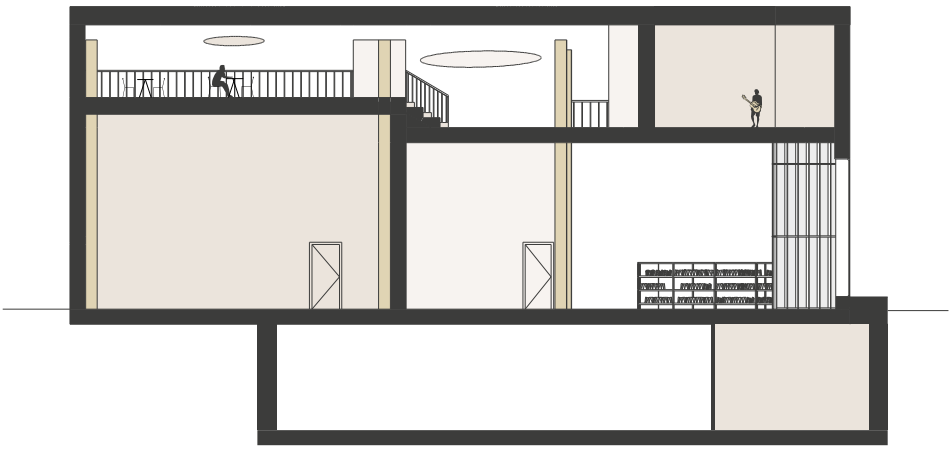


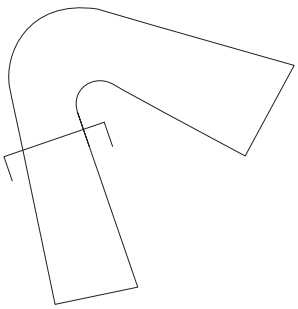
AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING LIBRARY SECTION	NUMBER 10 of 15
SCALE 1:500	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10



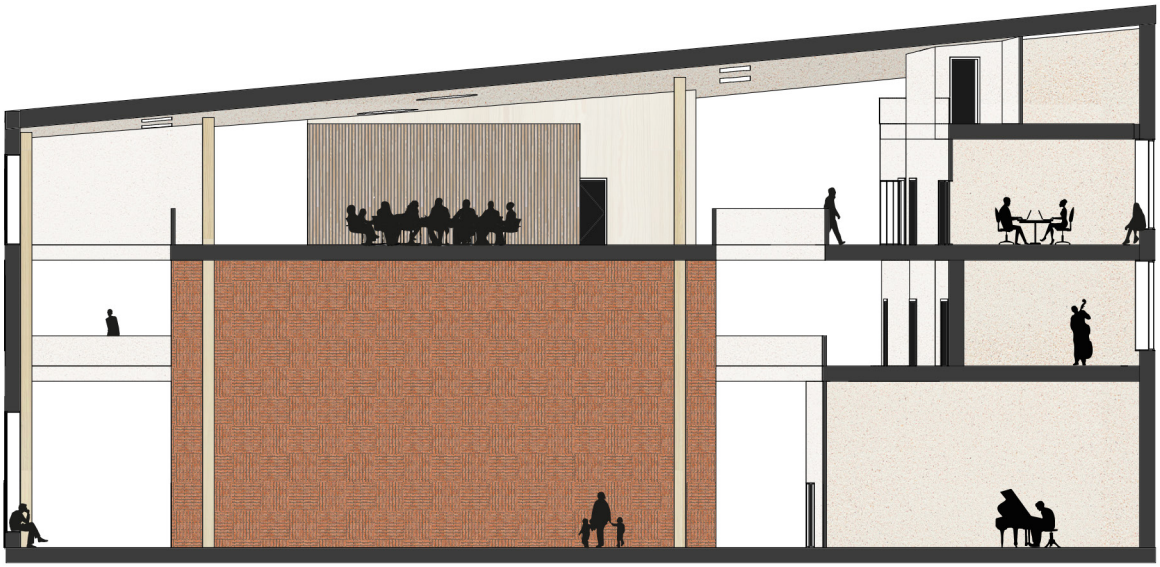


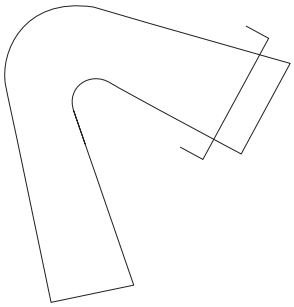
AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING ATRIUM SECTION	NUMBER 11 of 15
SCALE 1:250	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10



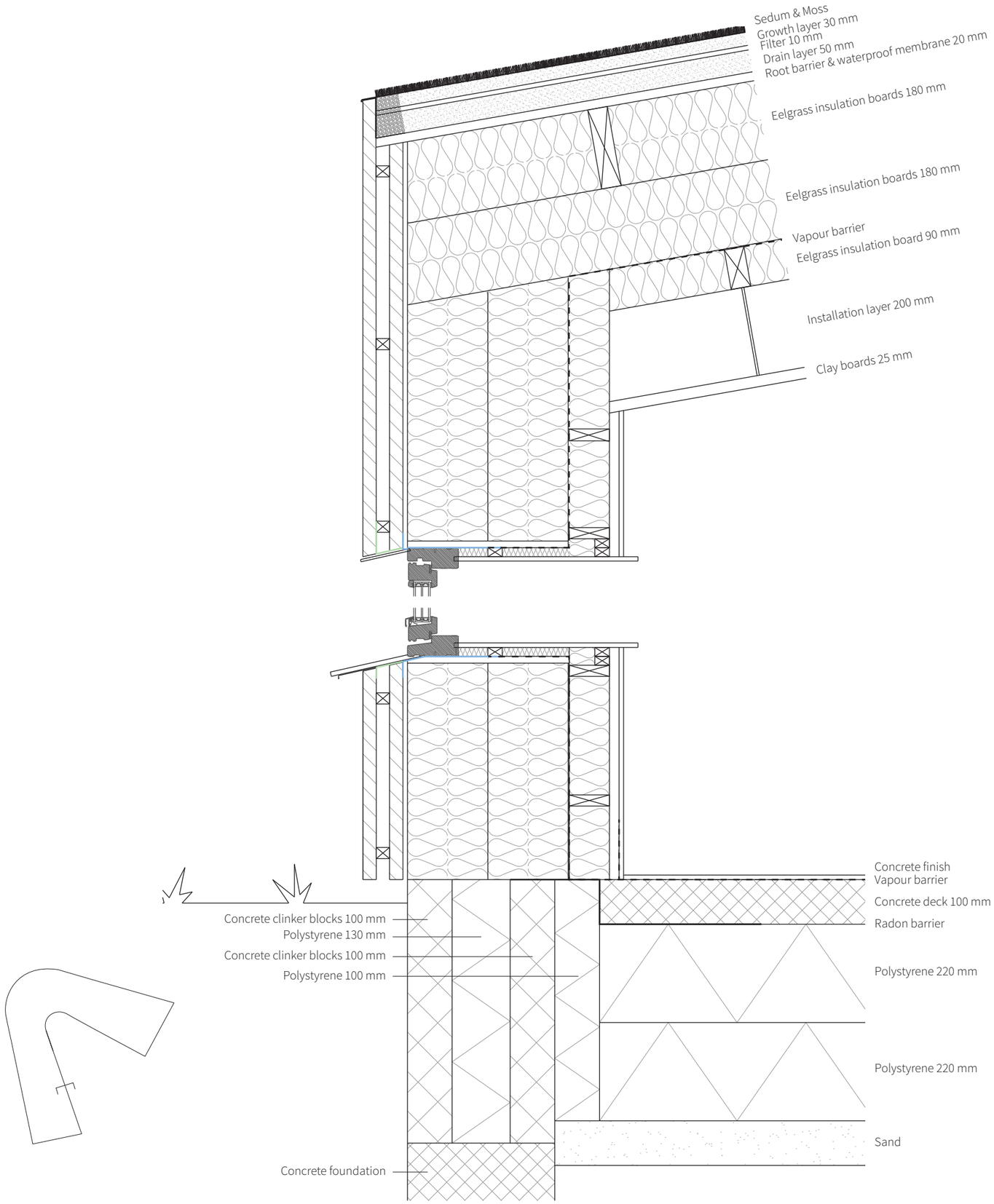


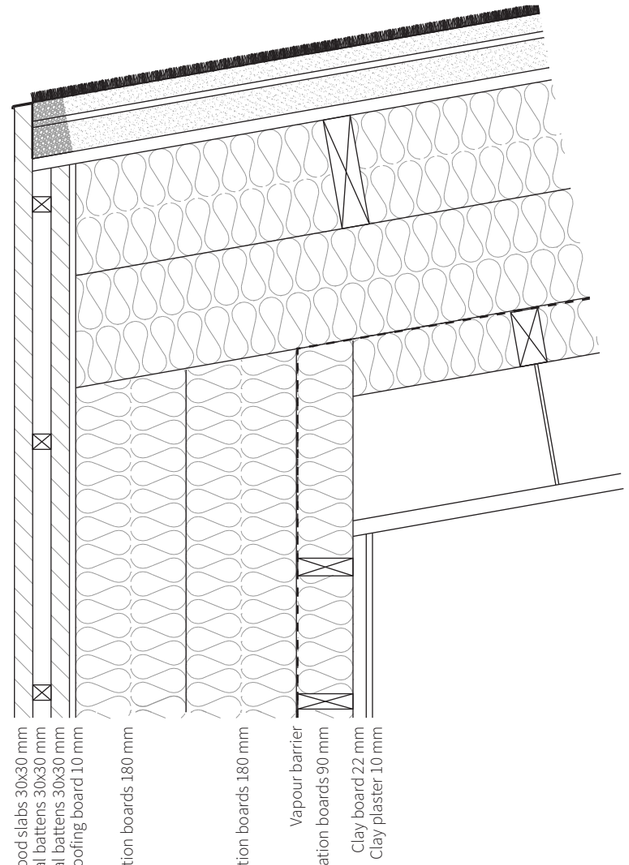
AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING BLACK BOX SECTION	NUMBER 12 of 15
SCALE 1:250	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10



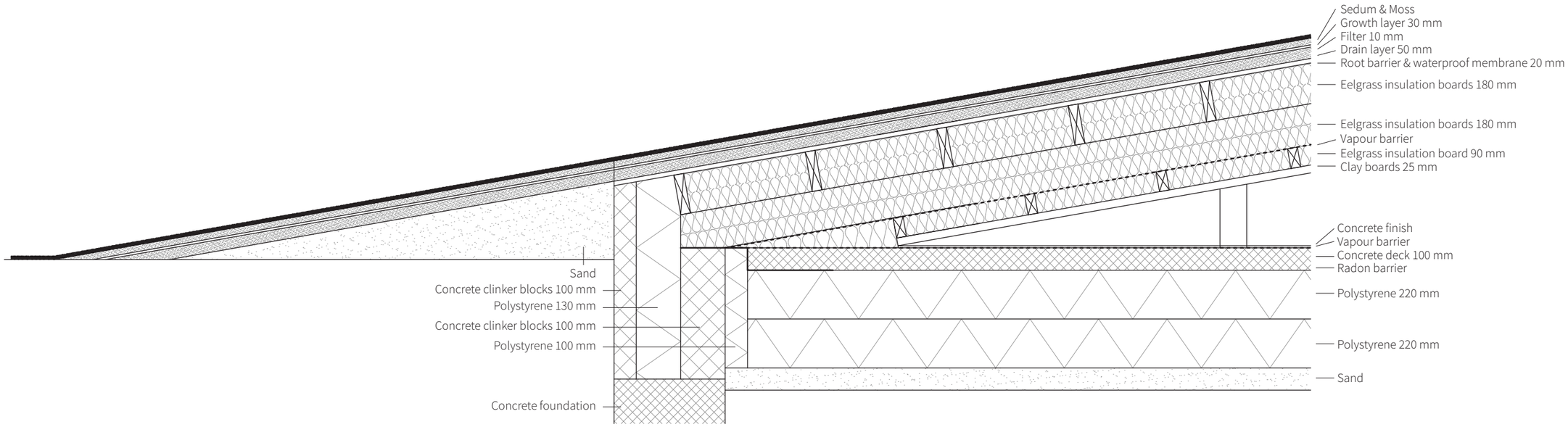


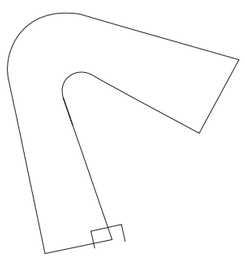
AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING CULTURE STAGE SECTION	NUMBER 13 of 15
SCALE 1:250	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10





AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING ROOF, WALL & FOUNDATION DETAIL	NUMBER 14 of 15
SCALE 1:10	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10





AALBORG UNIVERSITY VEJLE LIBRARY & CULTURE HOUSE	
DRAWING ROOF & FOUNDATION DETAIL	NUMBER 15 of 15
SCALE 1:10	UNIT mm
SEMESTER MSc04 Master Thesis	GROUP ma4-ark10