VoresHjem

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SUMMARY

This project is an architectural design of a children's home, placed in Aalborg in the area of Tornhøj. The aim of this project is to make a children's home where children feel proud of living and where the feeling of home is in focus, giving the children a community.

A place where they have the possibility of having private spaces and be part of the large community at the children's home.

The main focus of the project, has been create a future children's home far from the traditional institutions already existing in Denmark.

The design process is based on the Integrated Design Process and the project of VoresHjem written by Zoomstory for Kerteminde Kommune in June 2012.

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INTRODUCTION

Asking people, what a home is in their eyes, the answer is rarely the same. Though all share a common idea about a permanent place to live, when they describe their own home.

Looking elsewhere to get an answer about what a home is; it was looked up in the dictionary. Here the word "home" is described as following: "The place where one lives permanently, as a member of a family or household." [Denstoredanske.dk, 2013]

But what if one does not have the possibility to live with its family, is it then possible to have a home?

About 5.000 children are living at a children's home in Denmark, that is 0,1% of the Danish population. [egmont-fonden.dk, 2013] A lot of these children do not see the institution as their home.

They have a feeling of being ashamed of the place they live! But it has not always been like this.

Children's homes have not always been institutions in Denmark. The early children's homes before the 1930s looked normally like good-sized villas, placed in between other villas in residential areas, mostly in Copenhagen. A children's home was a home between other homes.

But during the 1930s more focus on the children were introduced, while the children's homes were placed away from the residential areas. [Coninck-Smith, 2011]

The children's homes were being formed into the institutions we know today, far from the ideal of a home, institutions focusing on being working places more than being homes.

It ought to be possible to reverse these institutions and let children's homes become the homes the children deserve. Course all persons deserve a home, most of all vulnerable children.

ill. 001

METHODOLOGY

During this chapter the Integrated Design Process (IDP) will be clarified. The method is used through the project from the beginning to the finished project. It will be introduced in the following text.

The Integrated Design Process

This method, IDP, has been developed at Aalborg University with the purpose to teach students at Architecture and Design how to use their knowledge from both architecture and engineering at the same time. By integrating knowledge from both categories the students have the basis of getting the best possible solutions when designing sustainable buildings. [Hansen and Knudstrup, 2005]

The Integrated Design Process is divided into five different phases: 1. Idea/Problem phase, 2. Analysis phase, 3. Sketching phase, 4. Synthesis phase and 5. Presentation phase.

Following is a short description of the five phases:

1. Idea / Problem

This phase is where the project idea or problem is formulated.

2. Analysis

After formulating the idea or problem, this is being analyzed. All information such as context analysis, requirements, user profiles, plans, environment etc. are collected and form the basis of the problem statement, vision and spatial program.

3. Sketching

In the sketching phase the criteria from the previous phase are used as a basis of the design, where sketches and models are made and examined with an eye to technical, architectural and functional demands.

4. Synthesis

In this forth phase the building design is being optimized and detailed parallel with investigations, calculations and final adjustments.

5. Presentation

The final phase is the presentation. Illustrations, pictures, 3D renderings and models etc. are used to present the final project. [Knudstrup, 2004]

ill. 002

"Issues of global warming and new legislative demands for the energy consumption in buildings have resulted in a need for methods for developing sustainable architecture. At the moment mainstream architects have difficulties achieving sustainable results in their projects. (...)

Therefore there is a need for methods, which enable more holistic sustainable architecture. Within the last five years new methods have emerged in sustainable architecture. Many of these, however, focus on subsections of sustainable architecture, which complicates the implementation of sustainability by mainstream architects. There is therefore still a need for holistic methods in sustainable architecture." [Hansen and Knudstrup, 2005, p. 894]

02

THEORETICAL BACKGROUND

A CHILDREN'S HOME

This chapter is to define the role that a children's home plays in a social perspective, but also to define some of the problems that the children that are placed at a children's home struggles with, this to define the role of the home and the spaces they are living in.

Children's homes are playing a more central part in Denmark than most of the other Nordic countries. Today about 13.000 children in Denmark are placed outside their normal home. [Socialpaedagogen.dk, 2013]

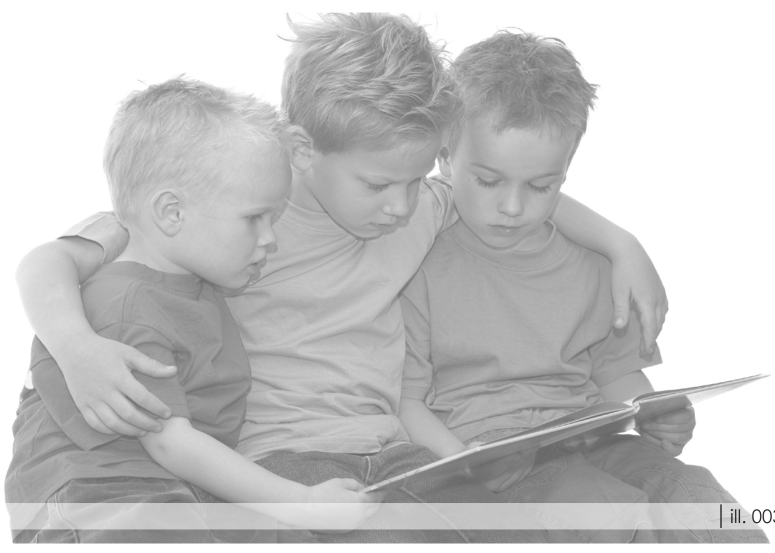
The children that are focused on in this project are children that are normal intelligent, with neither physical nor psychical handicaps. But all of the children have been let down by their parents to a greater or lesser extent. [Socialpaedagogen.dk, 2013]

Many of the children that are placed at a children's home are carrying traumas with them from their childhood, whether it is problems from home or in school, if it is expulsion or harassment. All of the children are in need of making relations during the placement at the children's home, this can help them understand and manage the incidents, that has effected them during their childhood.

Conflicts with the school along with neglect is often one of the most significant causes, when young people are placed outside the home. In many cases these conflicts are the main course for young people being placed at a children's home. The children tells about complicated schooling, marked with shirking, struggles with the teachers, harassment from classmates and expulsion. [Døgninstitutionen, 2011, p 80]

Despite of the neglect placed children are as all other children, they have the same interests and needs, they need a good school and need to learn and play. Therefore many of the children at a children's home have hobbies, such as football, handball, gymnastics etc. this gives them a more "normal" everyday life, that reminds them of a "normal" family life. [Socialpaedagogen.dk, 2013]

"If the children should have a good life, it is important that they are able to face the world and expand their horizons. You do not get broadened its horizons if you never come away from home. It is important that children gain experience of how the world is, so they can live independently and learn to socialize with other people." [Socialpaedagogen.dk, 2013]



ill. 003

USER GROUPS

The users of the children's home "Vores-Hjem" are kids and teenagers that are between 3 and 23 years. Common for all of them are that they have experienced failures and defeat in their families, and therefore by different reasons don't have the possiblity of staying with their parents.

Some of the children have been placed at the children's home as an immediate situation and some of them have been visiting the home along with their parents before they moved in. [VoresHjem.pdf]

In the project of designing a new children's home it is important to differentiate between the children. Therefore the user group have been divided into two groups, the kids between 3-16 years and the teenagers between 14-18/23 years.

The wishes and demands for a new children's home are likewise divided into two cases, that are focusing on the demands and wishes from the different groups.

Kids between 3 and 16 years

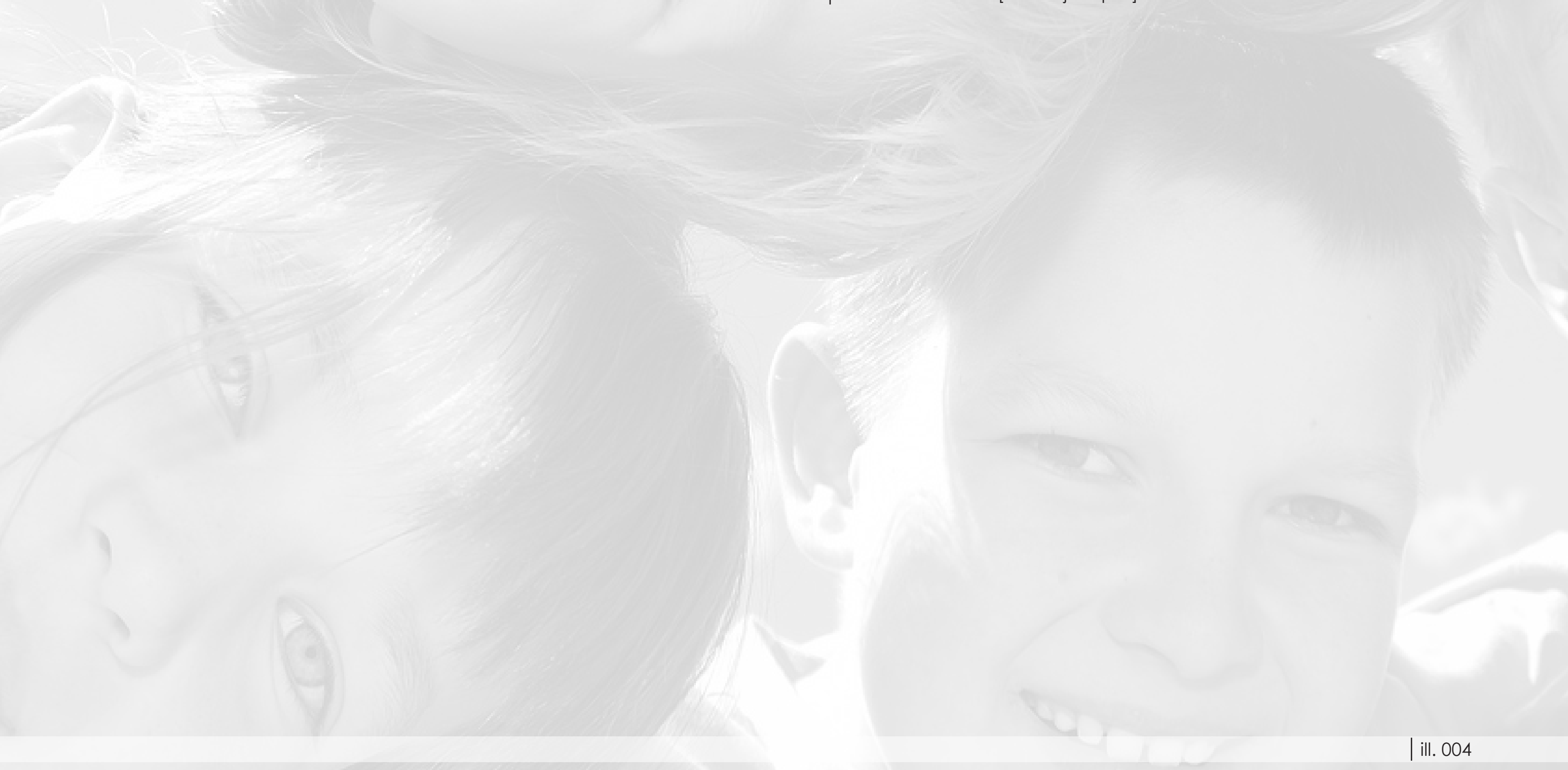
The kids have a larger need of supervision and support in there everyday life, and are thereby having a larger need of being in contact with the pedagouges that are at the children's home.

All of the kids have a large wish of having as much contact to their parents as possible, having them to stay over night, or having space for more private times with the family.[VoresHjem.pdf]

Teenagers between 14 and 18/23years

When children are becoming teenagers, their need of support and supervision are being changed from the help in the everyday life, to support with homework's and other difficulties in their lives.

Most of the teenagers have a wish of living in an apartment instead of a children's home, where they can prepare for a life, where they have to take care of themselves. [VoresHjem.pdf]



| ill. 004

VORESHJEM

This chapter are based on a report that are made for Kerteminde kommune, along with a competition for " A future children's home", the report "VoresHjem" are based on statements from children living in a children's home and are based on their experiences and wishes for a future children's home.

This report will be the point of departure for the design of the children's home "VoresHjem".

The children that are placed at a children's home have normally lots of doubt to the people near them. Therefore it is important that a children's home are giving comfort and are creating a safe environment, where the children have the spaces to develop.

Most of the children have experienced failure and defeat when living with their parents, this means that each of them can be struggling with behavioural, social and physical problems.

That is why they need pedagogical support, treatment and help in their life. Together with the structure and clarity they get at a children's home, the children are being part of a community, where they are being listen to, and are asked for advice, so they are participating actively in there own life.

The children and the teenagers are all having a dream about having "a normal family life", and when they where placed at a children's home that dream disappeared and awere replaced with a wish of living in a comfortable and safe environment, with a homely atmosphere, close to family and friends. [VoresHjem.pdf p. 7]

"Children and teenagers need to be received with warmth, when they move into the children's home. It is of course the human warmth, but also the warmth a building and its interior can exude." [VoresHjem.pdf p. 7]

The children wishes for living in a children's home are a place where they feel at home, a home that makes them proud and a home that gives them space to many different activities and beeing a part of different kinds of communities.

"More home, more pride and more solidarity." [VoresHjem.pdf p. 9]

This is the words, which describe the wishes of living at a children's home.

ill. 005

More Home

Is referring to, that the children and teenagers wants to have a larger influence on the physical environment at the children's home and that they could be part of the appearance of the interior in their own rooms and the areas of the home they use the most. Being part of the home and not just being put into a room.

The children have a need of having influence on their own home, and having their own space, where they decide what things to put where, what colour they want on the walls and which furnitures to have in their rooms. [VoresHjem.pdf p. 10]

"It is an institution and not a home, when it is filled with standard things, which others have decided. Then your home look and feel strange" [VoresHjem.pdf p. 10]

The physical appearance of a home is in the eyes of the children a mix between a villa and a holiday home. Where they can relate to places, where they feel safe and see the ideal of a home, combined with a place to have fun and where all the worries are forgotten for a while. [VoresHjem.pdf p. 11]

The atmosphere in the children's home should reflect an atmosphere of home, where there is a feeling of a safe and cosy house, with a mix of places to be alone and to be part of a community. The home should also be a place where the children can have friends and family to stay.

To sum up the home should be a place where there are focus on the individual child and teenager that gives them space to be themselves, even though they are living many children together. [VoresHjem.pdf p. 12]

More pride

When saying pride the children refer to not being embarrassed, having fewer defeats and not being ashamed of living at a children's home. But where they instead have a place they can be proud of when showing their friends and other persons. The idea of having something that other children would like to have. More pride is included in the dream of living in a normal house that are not stigmatised, but still is quite special.

It is very important for the children to live in a place that are attractive to friends and classmates, they want the home to be a place people wants to visit instead of a place that are looked down on. [VoresHjem.pdf p. 13]

The specific wishes and attractions from the children where a music room, cosy corners, homework places , computer corners, different kinds of animals (horses, rabbits, birds), a cinema, a garage for fixing mopeds or a field for different sport activities.

"It would be easier to have friends over, if there where some cool things, such as a multi-lane or a trampoline. Then friends might come visiting more often" [VoresHjem.pdf p. 14]

The home should, according to the children, be a place where they learn to live alone and together with other children.

More solidarity

"More solidarity are in the children and young peoples optics equal to fewer clashes, conflicts and disturbances. It is a basic condition in the children's lives at the children's home that they live in and alongside a range of differentiated and changing solidarities where constellations of children and adults will change when situations and needs changes, and where chaos, anger and sadness are parts of the daily life." [VoresHjem.pdf p. 16]

The children are very aware of their ability to act among others, and the fact that the possibility of being two or tree people alone in a smaller solidarity gives them a better opportunity to interact with each other. To have spaces that is differentiated according to the way of use and the amount of people in the solidarity.

The children are also very aware of the character of their activities which are very differentiated, therefore there are a wish for a division of rooms with active activities and rooms with quite activities.

All of the children are focusing on the activity of having friends or family visiting, they all mention that it is nice to have space for the possibility of having their family and friends stay over night, in a space where they can have their privacy. They also have a wish of having spaces where they can be active along with friends and family.

The children are very aware of the large community with many children, which they are being a part of. Together they are a "we" that have to function together every day. This can make conflicts and confrontations, but still it is important for the children to have the possibility to mark Christmas, summer parties and so on, in a place where they all can be together, along with there families. [VoresHjem.pdf p. 18]

"I would like a homework space with a table and a few chairs, where we can be alone from the noise of others. I would also like a little playhouse inside the house, where I can sit on my own." [VoresHjem.pdf p. 19]

CASE: VORES HUS BY CEBRA

The future children's home in Kerteminde, are designed by the Danish architects CEBRA, and are also taking point of departure from the report "VoresHjem".

The focus of the project "Vores Hus" was to design an institution that facilitate social interaction, the community and learning activities. Where there are focus on the feeling of "home" and the feeling of being safe.
In this project there has also been a large focus on the architecture as a platform for the children to be creative, do to the uncluttered lines in the architecture.

"The organization of the house ensures a good and fast flow, which gives the adults more time to care and social interact with the children."

[Fremtidens børnehjem.pdf, p 5]

This project is used as an inspiration on how to work with combining architecture and children, and how to make a home for the children living in an institution.

Site plan Vores Hus | ill. 006

Vores Hus from Southwest | ill. 007


Outside area | ill. 008


Common room | ill. 009


Vores Hus from outside | ill. 010

CASE: GÅRDEN, AALBÆK

The 22 years old children's home outside Aalbæk in Nordjylland, located south of the Råbjerg plantation was visited during the project period, to gain an insight into the everyday life at an institution.

The children's home, Gården, is a place for teenagers between 13 and 18 years old, which has been placed in care by choice. The institution has room for eight children at a time. When visiting the children's home eight girls occupied all rooms. It is an institution for both girls and boys, but there had been no boys for a period.

The building, where the children lives is around 275m^2 divided between two floors. It contains eight rooms between 8m^2 and 20m^2, where the children live, a kitchen, a living- and dinning room, three bathrooms, a utility room and an office with a bed for the staff.

Most of the rooms for the children were placed at the first floor, where the children have the possibility to stand outside their rooms and look down in the living room through an opening in the floor. This placement of the rooms at the first floor, have made it possible to create a very compact building, without the feeling of being squeezed when living at the children's home.

In an old restored barn the common facilities, such as an activity room, a music room and a big room for meetings or other social events are placed. It was light and friendly rooms, but the pedagogues said the facilities were rarely used, because it is located in another building.

The pedagogues liked to work at the children's home, but were not satisfied with their own facilities. All pedagogues shared one little room at 8m^2, which were both an office and the place, where the 24-hour pedagogues slept, they didn't have their own bathroom.

The overall view on the children's home is, that the inside of the buildings is very pleasant and well-functioning, apart from the small rooms for the children and the staff facilities. Though the outdoor facilities could need a helping hand.

The well-functioning compact indoor arrangement of the rooms is defiantly something, which will be taken into consideration, when designing the future children's home in Aalborg.

The childrens home to the left and the barn/common facilities to the right | ill. 011

One of the children's room | ill. 013


Common room | ill. 012


Dinning room | ill. 016


Looking down to the dinning room | ill. 015


Music room | ill. 014

SUSTAINABLE ARCHITECTURE

This chapter about sustainable architecture is to define the terms and focus of the project in relation to sustainable architecture, the 2020 requirements and the focus on passive and active initiatives.

"Sustainable architecture is aesthetically satisfying, good and healthy buildings with flexibility over time, possibility of reasonable maintenance, quality in terms of usability and very low environmental impact from energy consumptions and materials"

[groenthus.dk, 15.02.2013]

The development of the Danish building regulations has change drastically during the past 50 years, concerning the energy consumption in building projects. From 1961 when there where no demands of the energy consumption to the 1977, where the demands of u-values where introduced.

These regulations have been increased during the past 25 years to the 2020 requirements that is defined in the building regulation as building class 2020, these requirements is defined for houses, hotels, dormitory etc. to be 20kWh/m^2 pr. year and for offices, schools, institutions etc. to be 25kWh/m^2 pr. year. See table on next page. [Bygningsreglementet.dk]

To reach the demands of the 2020 requirements it is important to focus on other energy resources than fossil fuel, and to minimize the amount of energy used to produce and run the building.

Therefore the focus is to reach the 2020 requirements by focusing on passive- and active energy initiatives.

The initiatives, which will be focused on is:

Passive energy initiatives

- Orientation and landscape
- Building envelope
- Compact building mass
- Solar shading
- U-values
- Natural ventilation
- Daylight optimization
- Thermal mass

(see further describtion in appendix)

Active energy initiatives

- Heating of the building
- Mechanical ventilation
- Solar cells [Lehrskov,2011]

BR10 demands from 24.08.2011	Energy frame: offices, schools, institution etc.	Energy frame: houses, hotels, dormitory etc.
Standard 2010	(71,3 +1650/A) kWh/m^2 pr. year	(52,5 +1650/A) kWh/m^2 pr. year
Standard 2015 Lowenergy building class	(41+1000/A) kWh/m^2 pr. year	(30+1000/A) kWh/m^2 pr. year
Building class 2020	25 kWh/m^2 pr. year	20 kWh/m^2 pr. year
Expected building class 2025 - ZEB(zero energy buildings)	0 kWh/m^2 pr. year	0 kWh/m^2 pr. year

*A is the heated floor area

[Lehrskov,2011] and [www.bygningsreglementet.dk]

Green Lighthouse , CO_2 neutral building | ill. 017

SUSTAINABLE MATERIALS

As an aspect of working with sustainability, the focus on materials is an important aspect to have in mind when designing.

Therefore looking at wood that are being certified by either FSC (Forest Stewardship Council) or PEFC (Programme for the Endorsement of Forest Certification schemes) common for these certifications are that the wood is produced in accordance to beneficial for both nature and the local community. Having the focus that there are not being felled more trees than the forest can reproduce in a natural way. [Stark.dk, 2013]

Also having in mind that materials can be reused or in another way contribute to the production of other material, instead of being thrown away. [C2C, I det byggede miljø.pdf]

The service life of the different materials are playing a large part of choosing the materials that will be used in the children's home, having materials that are not to be changed or maintained in an extended degree.

Materials used should have a certain degree of local in it so that the part of being sustainable are not disappearing in transporting the material over large distances.

The materials should be produced under fair and sustainable conditions [C2C, I det byggede miljø.pdf]

These are the focus points which will worked with when choosing the materials for the children's home, and they are being defined by some of the principles from the cradle to cradle principles. [C2C, I det byggede miljø.pdf]

Solhuset, climate friendly day care centre | ill. 018

Rheinzink House | ill. 019

Home for Life, active house by AART | ill. 020

Comfort House by AART | ill. 021

ATMOSPHERIC ENVIRONMENT

It is important that the atmospheric environment in a building is satisfying. A good air quality is depending on the right ventilation strategy, where the inhabitants and the use of the building have to be considered. All these are important factors when the energy consumption of the building has to be calculated.

Normally natural ventilation is used during the summer period (May-September) where there is a need to cool down the building. Opposite is mechanical ventilation used during the winter period (October-April), where a building in Denmark normally has to be heated up.

A combination between natural ventilation and mechanical ventilation, called hybrid ventilation, is often to prefer when the energy consumption has to be kept down on a yearly basis.

Air Quality

When designing a new building the desired air quality must be discussed and decided. The minimum air change in a new building according to the Building Requirements 2010 is a minimum air supply at 0,3 l/s per m^2. [BR10, 6.3.1.2] But the air quality can also be chosen on the basis of CO_2 concentration and sensory pollution in the air.

If it is chosen not to follow the minimum demands of BR2010, CR1752 has defined three categories A, B and C, where respectively 15%, 20% and 30% are dissatisfied of the experienced air quality. [CR1752]

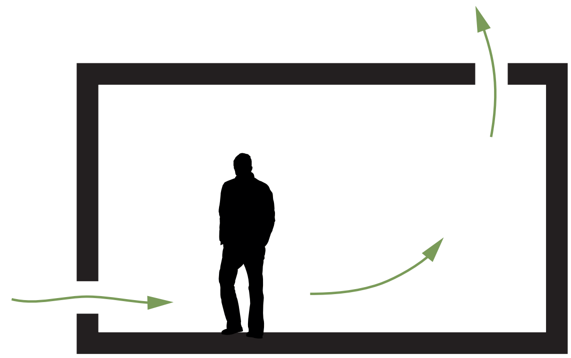
Mechanical ventilation

The most common mechanical ventilation principles are mixing ventilation and displacement ventilation.

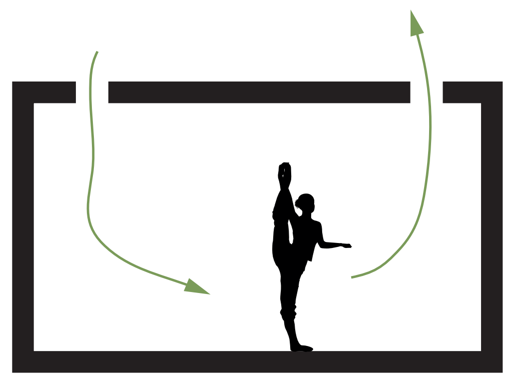
Mixing ventilation function as intake air blowing in to the room in a way, which mix the polluted air and the new fresh air. This makes sure that the air in the room the entire time is gradual replaced. After the air has been mixed it is drawn out of the room.

Using displacement air the intake air is blowing in to the room close to the floor. The intake air is a bit colder than the polluted air in the room, which makes the polluted air rise to the ceiling, where it is drawn out of the room.

To keep the energy consumption as low as possible the outgoing air is used to preheat the new intake air, using heat recovery.



Displacement ventilation | ill. 022



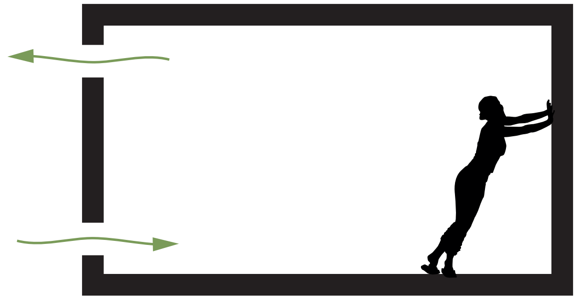
Mixing ventilation | ill. 023

Natural ventilation

There are four ventilation principles when it comes to natural ventilation: Cross ventilation, stack ventilation, single-sided ventilation and a combination between stack and cross ventilation. The four ventilation principles can be used in two different ways, wind pressure and thermal buoyancy.

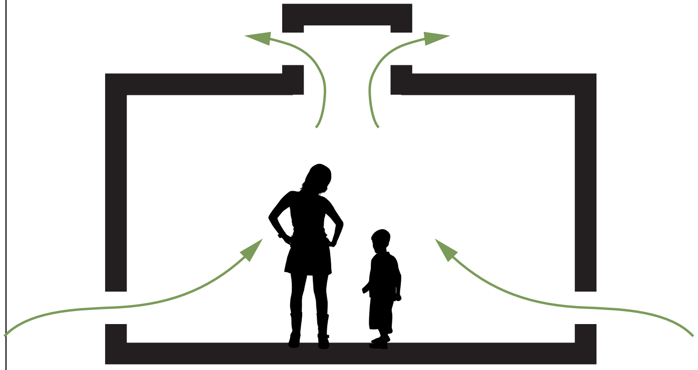
Wind pressure is the air exchange created of differences in air pressure between two or more different zones. The air in the building is changed by means of low pressure and overpressure at each side of the building. [AZEC_11_Modelling of N&HV.pdf, slide 19]

Thermal buoyancy is the air exchange created between different zones because of differences in the air density. It is often created by temperature differences, but differences in moisture content are also an opportunity. [AZEC_11_Modelling of N&HV.pdf, slide 5] [Urban Village.pdf, 2012]



Single-sided ventilation | ill. 024

Cross ventilation | ill. 025



Stack ventilation | ill. 026

LIGHT AND ARCHITECTURE

When talking about architecture, light is a very important factor, with a view to the indoor environment and well-being.

A human's body demands light from the sun to function optimal. Daylight has a positive influence at our mood, immune defence mechanism and circadian rhythm. Most important is that light gives humans the possibility to see, which cannot be done in darkness. [videnomenergi.dk, 2013]

In particular children has a need of light, as 70-80% of all sense impressions pass on through our eyes. Because of this light is the most important communicator compared to humans other senses. Light has also the biggest importance when it comes to the learning process particular reference to comfort, concentration, focus and perception. [SBi 238, p. 4]

Natural and artificial light

Light can be a lot of different nuances, when it comes to both daylight and artificial light. Particularly in Denmark the daylight is very varying in proportion to the time of year. In the summer period the daylight last the most of the day, where the daylight in the winter period is only to be found for a couple of hours each day.

To make matters worse, the intensity and colour of the daylight varies during the day and year. In the summer the sun is standing high at the sky, where the sun in the winter is being low at the sky.

Because of the daylight's very varying light conditions, artificial light is also an important element in the building design. In the winter period where the daylight is scarce, artificial light must take over. But artificial light can also be comfortably furnished, if it is thought and placed optimal in the building.

When creating a new building, it is important to remember, that without darkness there are no light! The lights significance of the experience of a room highly depends of various lighting brightness's in different areas in the room. If it is intended to create a room in the room only by the help of light, e.g. a lamp over a table, then make sure all artificial light in the room can be dimed or turned off, otherwise the light in the "light-room" over the table can't be seen, because there are no contrasts in the light. [SBi 238, p. 5]

Opposite daylight is often wanted in big concentrations to get a well light room without to much darkness. That is why big windows often are to prefer with a view to daylight, but they often create other problems such as glaring from the sun and overheating in the building.

"Light and shadow effects with the same feeling as walking through the forest, its glades and shady spots."
[Lund, 2008]

As read above, the position of the artificial light and place of the windows are very important in the experience of a building. The following part will be describing the implementing of daylight. (see artificial lightning principles in appendix

ill. 027

DAYLIGHT PRINCIPLES

The daylight has a huge impact on a room. As mentioned it varies a lot during the day and year, but it also varies in other ways. Daylight through a window can be influenced by clouds at the sky or reflections from nearby elements e.g. water and other materials from nearby buildings. [AZEC_07e Daylight.pdf]

Optimal use of daylight creates a better indoor environment and huge savings at the use of artificial light. Which will of course affect the energy consumption.

When designing windows for a building it should be considered how they affect the rooms. Should it be one big window or several small windows, should the window be placed low, high or in the middle of the wall? All this depends on the purpose of the window, but common to all, they have to light up the room.

Institutions must have good daylight in the primary rooms, where the children and staff stay most of the time. The 2020 building regulations requires a window area at minimum 15 % of the floor area in the given room. As an alternative to the window area, the daylight factor is satisfaction if this is more than 3 documented trough calculations. [bygningsreglementet.dk]

Different use of daylight

Daylight is used in a lot of different purposes in architecture. The following part will shortly describe a few buildings, where the daylight has a considerable effect.

The Hedmark Museum in Hamar is one of Sverre Fehn's best-known works. Here material history goes hand in hand with modern concrete constructions and big windows. The windows are designed in a way, which let daylight light up the old Storhamar Barn in a dramatic way, which is giving visitors great opportunities to explore the museum with the right feeling. [architecturenorway.no, 2013]

The chapel near Aalborg Sygehus Syd designed by Friis & Moltke is built in a minimalistic character, where white concrete elements together with narrow windows create a lightning that set the mind at rest. [friis-moltke.dk, 2013]

Jørn Utzon's private house Can Lis at Mallorca is a good example of how to use daylight to create effects in a room. The living room in the house has large openings, where from the daylight enters the room. In the corner near the roof a narrow opening allows the daylight to enter, which creates varying sunbeam effects at the wall. [Lund, 2008]

The daylight can of course influence buildings at a lot of other ways, which also must be remembered when designing the children's home.

Can Lis at Mallorca | ill. 029

Hedmark Museum | ill. 030

Chapel by Friis & Moltke | ill. 031

ARCHITECTURAL EXPRESSION

A lot of new houses appearance has been tighten up; architects create houses with a minimalistic architectural expression, where a small detail in the facade makes a huge impact at the facades appearance.

This tendency of tight forms and lines are an expression, which is aimed at during this project. This chapter is going to describe the aesthetic expression, which is wanted for this project, during references to new architecture.

The home is a crucially factor for occupants well being, it is therefore important that the building look like a home and not something else. The purpose of this project is to create a children's home, which should feel and look like a home, not an institution.

Asking people to draw a house it is almost certain that most of them sketch a picture of a house with a pitched roof. This picture of a house with a pitched roof can more or less be seen as a picture of most peoples common understanding of a home and it is therefore worth to research into.

The recent years many architects have used pitched roofs in their design. A good example is Hans Thyge & Claus Hermansen, which has designed a modern house with clear geometrically forms from the idea of the archetypical house. [hansthyge.dk]

It is whished to create a building with a clear and minimalistic expression, but without appearing boring. A building design with small details, which are experienced exciting and dynamic. Like Y House by Beijing Matsubara and Architects, which has a dynamic looking facade just by pushing in the areas around the windows.

The effect where the typology is increased by using the same material for the facades and roof, creating this clear building mass, which really express the tighten and clear lines, is also something which are whished to bring into the project when designing the children's home.

Vitra House by Herzog & de Meuron and MVRDV's coloured houses on Hagen Island is both examples, where facades and roof are one, creating this clear expression of an archetypical house.

It is important to create a children's home where the materials emphasize the building without taking away the focus of its typology. The honesty when using different materials is also important in the architectural expression. The construction should be easily read and not covered up by other materials.

Details should give the building character and create architectural quality. It could be details around the doors and windows, how the light penetrates the building or changes in the facade materials.

Y-house by Beijing Matsubara & Architects | ill. 032

House K by Yoshichika Takagi | ill. 033

Villa Wallin by Erik Andersson Architects | ill. 035

Studio Hans Thyge & Co | ill. 034

Hagen Island by MVRDV | ill. 036

Vitra House by Herzog & de Meuron | ill. 038

Studio Hans Thyge & Co | ill. 037

03

CONTEXT ANALYSIS

CONTEXT

This chapter describe the existing conditions for the area and relevant references to the valid local plan. The chosen site is in the local plan described as area B in the Institution area in Tornhøj.

Aalborg is the biggest city located in the northern part of Denmark. It is located at the south side of the Limfjord, which makes the connection to the water an important part of the infrastructure in Denmark.

In the eastern part of Aalborg is the Tornhøj district located. Tornhøj is one of three districts in Aalborg East, where Smedegård and the University area are the other two.

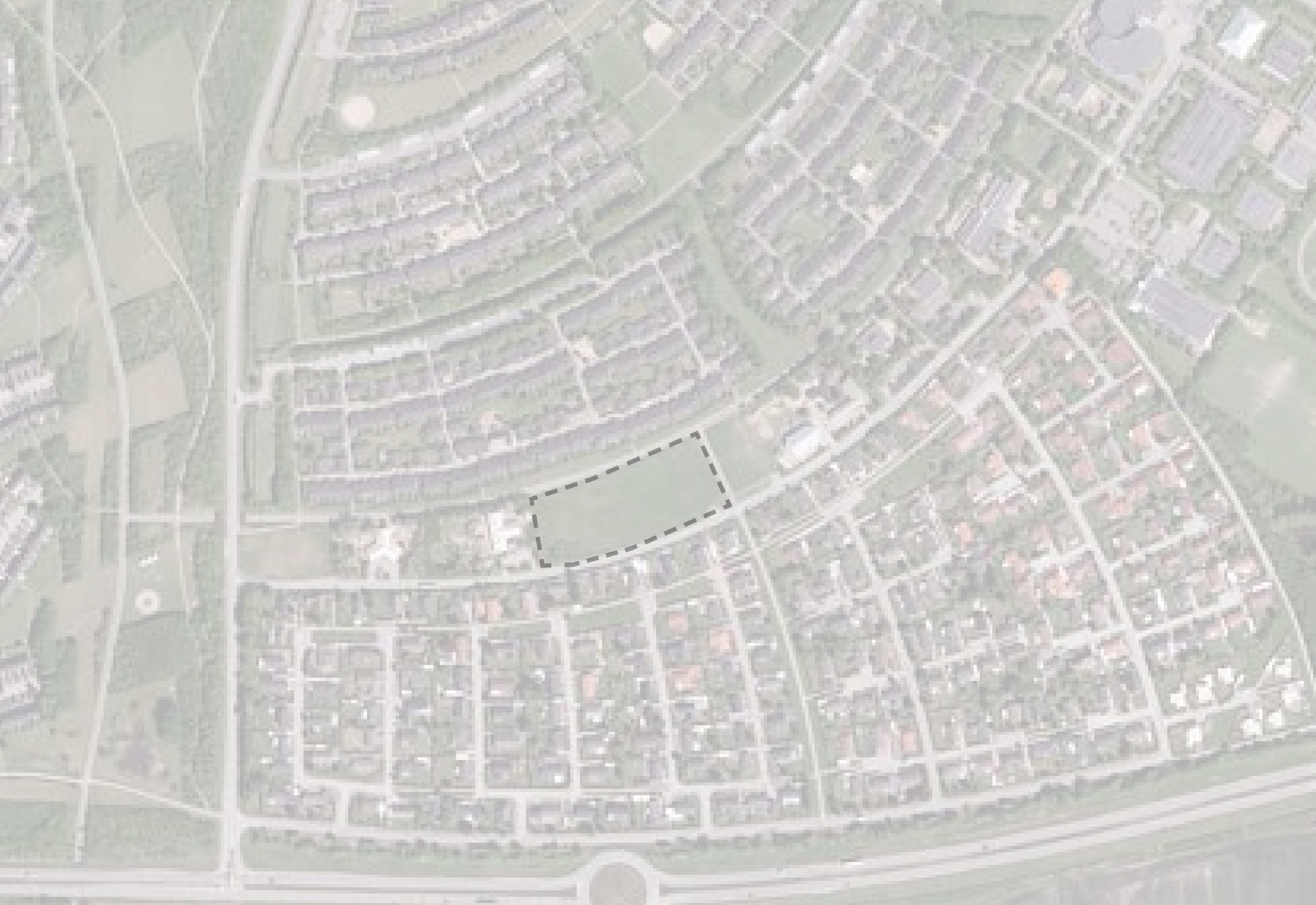
Since the 1970s Tornhøj has been extended with different kinds of houses. These houses are group in typologies 150-200 together. The whole Tornhøj district contains about 1.900 houses.

Existing conditions

Tornhøj are often experienced as a closed and turned inward district, because baffles surround it. The centre of Aalborg East is found close to the Tornhøj Centre and Tornhøj School.

The Tornhøj Centre and Tornhøj School is part of a green institution belt, which cover an area from Humlebakken in the North East in Tornhøj to South West close to Budumvej. [t_520_to.pdf]

ill. 039



Extract from the local plan

From the local plan for the area, the following conditions should be considered.

•The area should be used for houses built for public purposes, institutions for young and elderly people.

•Buildings are only allowed in 2 floors, but the garret can be utilised. The height of the building cannot exceed 15 meter.

•Sport centres can as an exception be built higher.

•A plot ratio at max. 40 %. [Kommunerammeplan.pdf]

•Roads, paths and common outdoor areas, should be designed in connection to the close building estates.

•The building must be built in materials in harmony with the existing buildings in the area. [lokalplan.pdf]

•The green appearance and character of the area should be retained.

•In connection to the institution one parking space per eight children/teenagers and one parking space per eight employees must be laid out.

•Likewise five bike parking places per ten children/teenagers must be laid out, plus one handicap and two minibus parkings.
[bilag F.pdf]

•The area belongs to environment class 1-2, where the building has to be 20 meters from nearest building.
[Bilag A.pdf]

| ill. 040

CONTEXT ANALYSES

The method "The city images" made by Kevin Lynch has been used to analyse the context around the building site to get an insight in the Tornhøj area in Aalborg East, close to the university.

Kevin Lynch said this about the city:

"Looking at cities can give a special pleasure, however commonplace the sight may be. Like piece of architecture, the city is a construction in space, but one of vast scale, a thing perceived only in the course of long spans of time." [Lynch, 1960, p. 1]

To make it able to analyse cities he has lined up five points, which can help understanding an area or the whole city. This is done by analysing the following points; paths, edges, districts, nodes and landmarks.

1. Paths
Paths are lines showing the movement in the city. It could be footpaths, bike paths, streets, canals, railroads etc. People use these paths and observe the city while doing it.

2. Edges
Edges are linear elements that divide the city into different areas. It is barriers in the city and could be high walls, hills and streams etc.

3. Districts
Districts are different sections in the city. Areas with special typologies, larger green areas etc. could be districts.

4. Nodes
Nodes are places where people meet each other. Like crossings between paths, meeting points, street corners and common outdoor spaces.

5. Landmarks
Landmarks are elements such as church towers, buildings, big signs, mountains and the sun etc. It just has to be visible from a distance, to point out a direction that makes it possible for people to orientate in the city. [Lynch, 1960, p. 46-48]

The five different elements have been used to analyse the context around the building site to get impression of the area.

Districts of the area | ill. 041

Division of the area

The area around the building site is very clearly divided into three different districts, as illustrated at ill. 41. The northern district exists of terraced houses, which long line of facades creates an edge to the green district, in where the building site lies.

This green district is an area only for institutions, such as kindergartens, schools and children with special needs. The district is compared to the other two districts in the area, very open with focus on vegetation around the institutions.

The last district at the southern part of the area around the building site has a very clearly edge existing of high hedge. Behind the hedge is a district of single-family houses hidden.

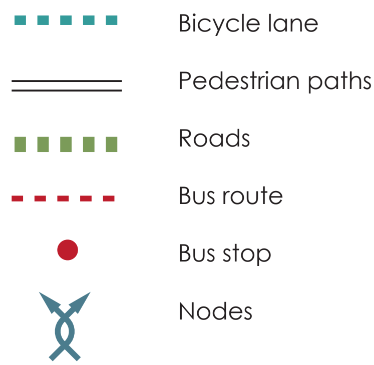
Infrastructure & meeting points

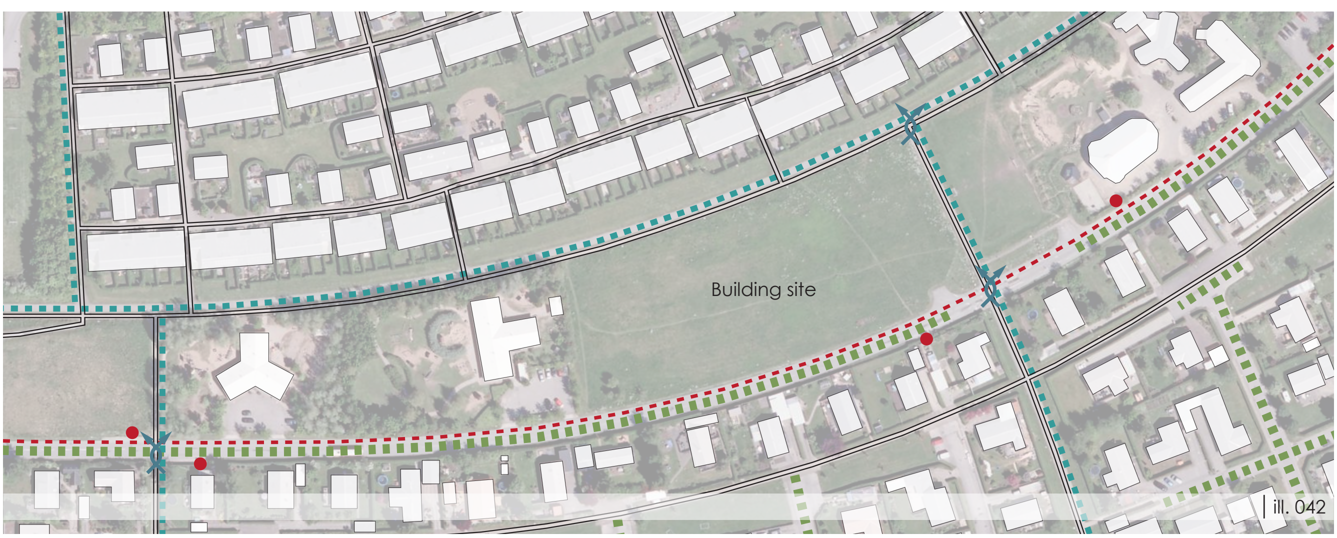
Different paths are going through the area around the site. The area is not marked by lots of heavy traffic, as cars enter the site two places south of the site by a no thoroughfare road, one from east and one from west. Only busses are able to drive all the way though the area. The bus drives from the area directly to the city centre every quarter of an hour.

North of the site is there no heavy traffic, the paths here are only for pedestrians and bicycles, which create a peaceful track along the green district passing by the institutions with children and young people.

Close to the site three nodes are found. Here the different paths cross and creates natural meeting points and common outdoor spaces.

The area does not have any landmarks, since no buildings, signs, nature elements or similar are conspicuous.





ill. 042

THE SITE

This chapter is a mood board, to give an idea of the area around the building site of "VoresHjem".

The building site is located between two characteristic districts in the Tornhøj area, placed between a terraced house area and a single-family housing area that both have their "back" to the building site.

This gives a closed of area between these two districts, and are making it difficult for the area to connect to each other, therefore the paths and nodes are important in this area to find points where there is a connection between the three districts of the area.

The building site is an open site, which has the possibility of being the link between the districts.

ill. 043

ill. 044


ill. 045


ill. 047


ill. 046

VEGETATIONS

The vegetation in the area are low bushes, trees placed in scattered clusters and low vegetation, there are no dominant landmark in the landscape, the vegetation is dominated by the small enclosed gardens that are relating to the housing in the area.

Most of the vegetation is used to close of areas from each other and to create privacy. The common spaces are easy to spot do to the plain grass areas that are used as football fields.

The bushes and trees are marking an edge around the site and are making a screen that separates the areas.

ill. 048

ill. 050

ill. 049


ill. 052


ill. 051


ill. 054


ill. 053

MATERIALS

The materials of the area are typical for the building types, the single-family houses is one or two storey, in bricks and tiles, with a typical garden surrounding the house.

The terraced houses are in concrete elements, with a differentiation in colours, which define the different housing areas.

The choice of material in the green institutional area is also bricks, tiles and concrete elements, which are typical for the area around the site.

ill. 055

ill. 056

ill. 057

ill. 058

ill. 060

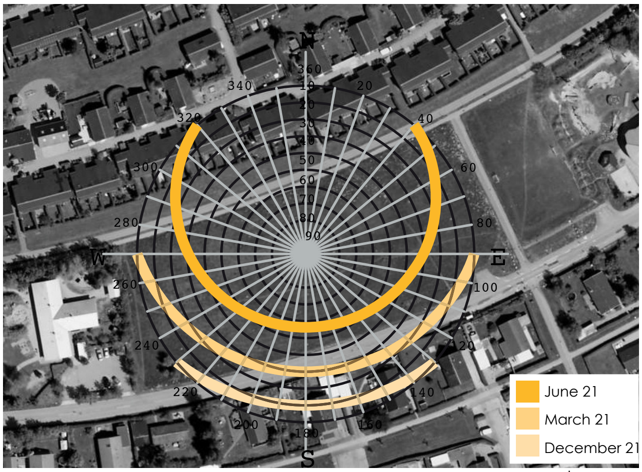
ill. 059

LIGHT/ SHADOW STUDIES

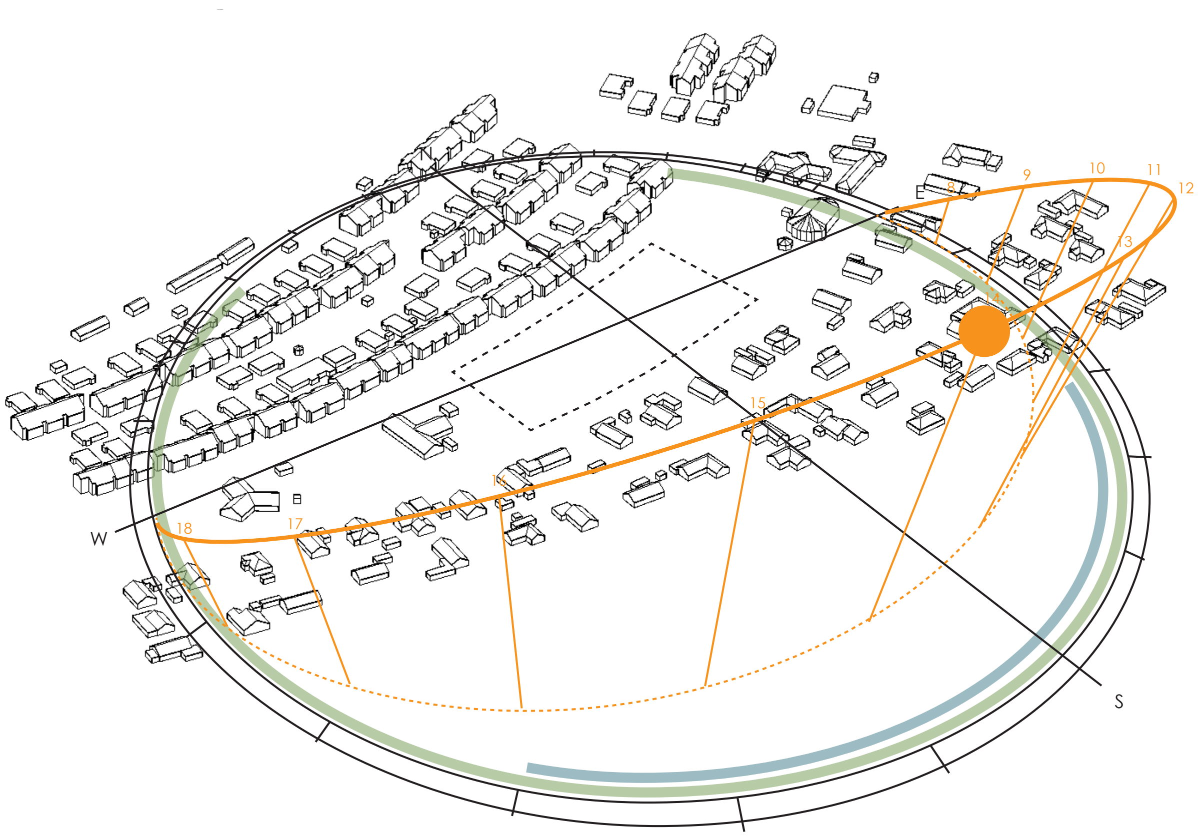
To find out the shadow conditions in the area around the site shadow studies of the area with the program Ecotect have been made to give an idea of how the buildings are casting shadows.

The studies are made in three periods of the year, June 21, March 21 and December 21, to get the variations of the day there are chosen three times of the day to give an idea of the variation during the day.
See appendix for detailed sun studies.

The diagram below, shows the sun path over the site.



| ill. 061

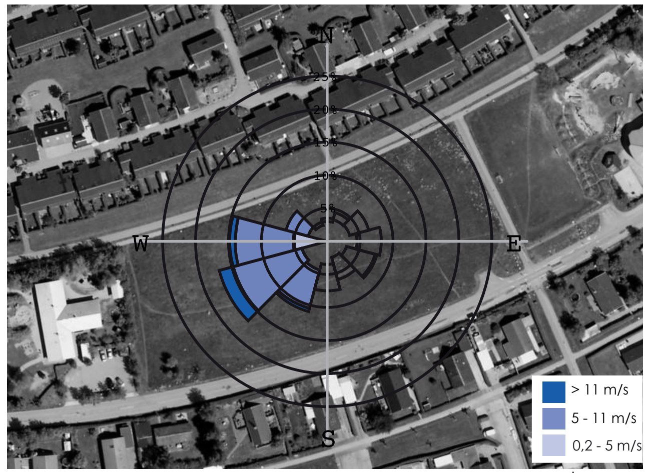


| ill. 062

WIND STUDIES

To find the wind conditions for the site, there are made a wind study to determine how the wind moves in the context of the site. The studies are made in the program Autodesk Vasari Ecotect wind tunnel. The studies are made from the three main wind directions (see wind rose) west, southwest and east.

This study is to see how the built context are influencing the site. Where there are created lee in the area and where the buildings are enhancing the wind.
See appendix for detailed wind studies.



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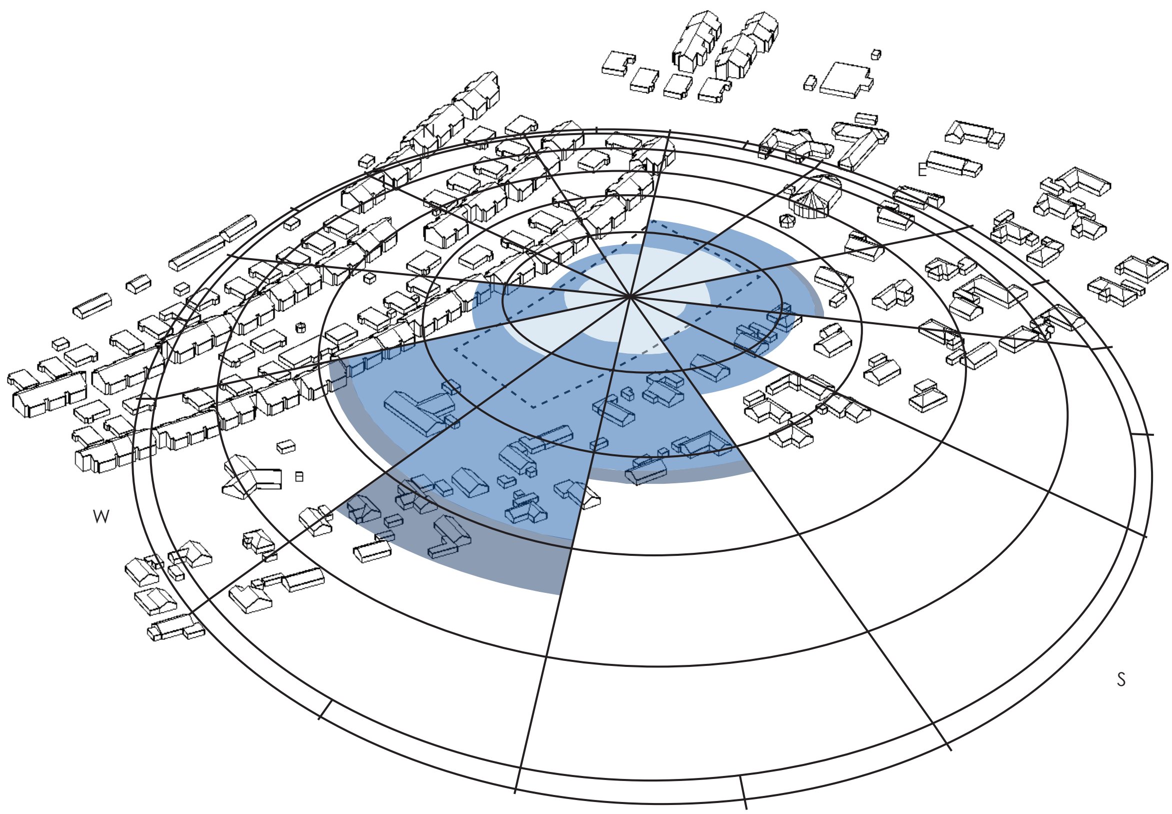


| ill. 064

04

RECAPITULATION

ARCHITECTUAL DESIGN CRITERIA

Children's home
The institution should reinterpret the societies negative pictures and ideas of what a children's home are and how it looks.

The institution must be a home for kids and teenagers, therefore it must appear beautiful, comfortable, cosy, with space for privacy and sociability. It is a wish that each child should have it's own private room, which by appearance is different from the other children's private rooms.

The common living rooms must contain space of different facilities. It must have the possibility to gather all the children together, but there also has to be small corners and cosy recesses, which gives the children the opportunity to be together in smaller groups. Here the children can play, read or feel at home close to the other children and adult staff.

Materials and sustainability
The use of materials should reflect the sustainable aspect of the project having materials that can be reused or recycled, and be produced local, by local materials. The sustainable aspect is also to be aware of the orientation, the building envelope, and the compactness of the building volume.

Light
All primary rooms, such as private rooms, living rooms e.g. must be light up mainly by the use of daylight. The daylight must be dragged into the rooms through windows, giving a minimum daylight factor of 3, to create light up rooms to stay in.
In smaller not primary rooms, such as toilets, depots, e.g. artificial light should be used.

Outdoor areas
The site has a lot of space for outdoor areas, where private outdoor spaces and semi public areas will be created. The outdoor areas have a large significance for the children at the institution. It should be a garden compared to a single-family house gardens, which has space for activities and quiet places. These outdoor spaces should be designed as an integrated part of the institution.

The site is placed between an area with terraced houses and an area with single-family houses that is why solidarity between the site and the two areas are wished created.

TECHNICAL DESIGN CRITERIA

Energy
The goal is to fulfil the requirements of the energy frame for the 2020 building regulations for institutions on 25 kWh/m^2 per year by the use of passive energy initiatives. Because of the childrens home being more a home than an institution, it is chosen to follow the regulation for housing on 20 kWh/m^2.

This will be done by integrating sustainable aspects and energy aspects during the design of the institution.

Indoor environment
As mentioned the daylight factor must be minimum 3 in all primary rooms.

The acoustic in an institution with several children is very important, but it has been chosen to focus on the choice of materials rather than calculations.

BSim will be used to check the thermal environment, to make sure the indoor temperature and CO_2 pollution are satisfying on the basis of CR1752[Cr1752.pdf], where:

- The indoor temperature is allowed to pass 26 degrees in 100 hours and 27 degrees in 25 hours on an annual basis.

- Temp. summer: 25 +/- 2,5 degrees

- Temp. winter: 21 +/- 2,5 degrees

- CO_2 level: maximum 900 ppm in a shorter amount of time [bygningsreglementet.dk,2013]

To make sure the air quality is good enough it has to fulfil the category A standards during the summer period [CR1752], ventilation principles will be adjust to the individual rooms, where some will be selected for calculation on natural ventilation, to make sure the CO_2 concentration is within category A. See appendix

Fire and escape routes
The institution will be designed in a way, where the regulations for escape routes, rescue openings, fire sections and fire cells will be followed. [estb.dk]

Construction
The bearing construction and the design of this is not the focus point of this project. Therefore only the overall bearing construction system will be described, together with architectural details and U-value calculations of the walls, floors and roofs.

PROJECT BRIEF

As mentioned, this project is based on the report "VoresHjem" published by Zoomstory and Kerteminde kommune, which also formed the basis of the project brief "Fremtidens børnehjem" put out for tender in 2012 by Kerteminde kommune. It is the purpose to create a similar project in Aalborg based on the report and inspired by the project brief.

The explanation of the project made by Kerteminde kommune in the following text form the foundation of the project in Aalborg:

"It is the vision to create an innovative type of residential home for children and young persons, which combines the qualities from a traditional and confidently home with new ideas about what a children's home are and what needs it has to fulfill.

The Municipality wishes to create a home with confident conditions, which boost children and young person's possibilities of doing well in their future life.

The future children's home have to be modern and fit the reality it lies in, where the involving of the user, individual consideration and flexibility goes hand in hand with sustainability and administrative large-scale operations." [www.langeskov.dk]

The report encourages a new building with no more corridor space than possible. It should be a building, where the children and young persons feel safe and at home.

The new building should contain facilities for staff, children and young persons. Various shaped rooms and apartments that make them unique and exiting to live in. There should be common kitchens, dinning areas and shared facilities. All this should take part in two departments, one for children and one for young people, where they have room for being them self.

The projects point of departure is this project brief, report and the local plan for the area around the building site. At the same time the awareness of sustainability, environment and energy efficiency are important. [VoresHjem.pdf, 2012], [Kommunerammeplan.pdf]

VISION

The vision of the project is to create a building, where the architectural focus is both on the visual and functional aspects. The children's home are defining the community, where children are having their homes and where they feel save in their everyday life. But the children's home are as much home as a workplace where staff are having needs according to giving the best care for the children at the home.

These challenges being embraced by one building where there are spaces and opportunities for the children to evolve. The building should make a relation to the surrounding nature, and be part of the green path going through the area.

The children's home should be a new way of thinking children's homes, being a home that are not referring to a traditional institution, but also be in front in terms of sustainable architecture and the choice of materials, indoor climate and active energy solutions.

The building "VoresHjem" should be a building where the focus on community, functions and energy are being innovative and creative.

ill. 065

FUNCTIONS

This chapter is to describe the need of rooms and functions in the children's home, and the relation between the rooms.
The functions and relations are based on the report "VoresHjem", where the spatial program is found.

The functions are divided into five groups, the kids section, teenagers section, a flexible section, an administration section and a common section.

The kids section, is where the kids have their rooms, a smaller living room and a kitchen and dinning space that are only for the kids, this section are divided into two sections to make smaller groups among the children.

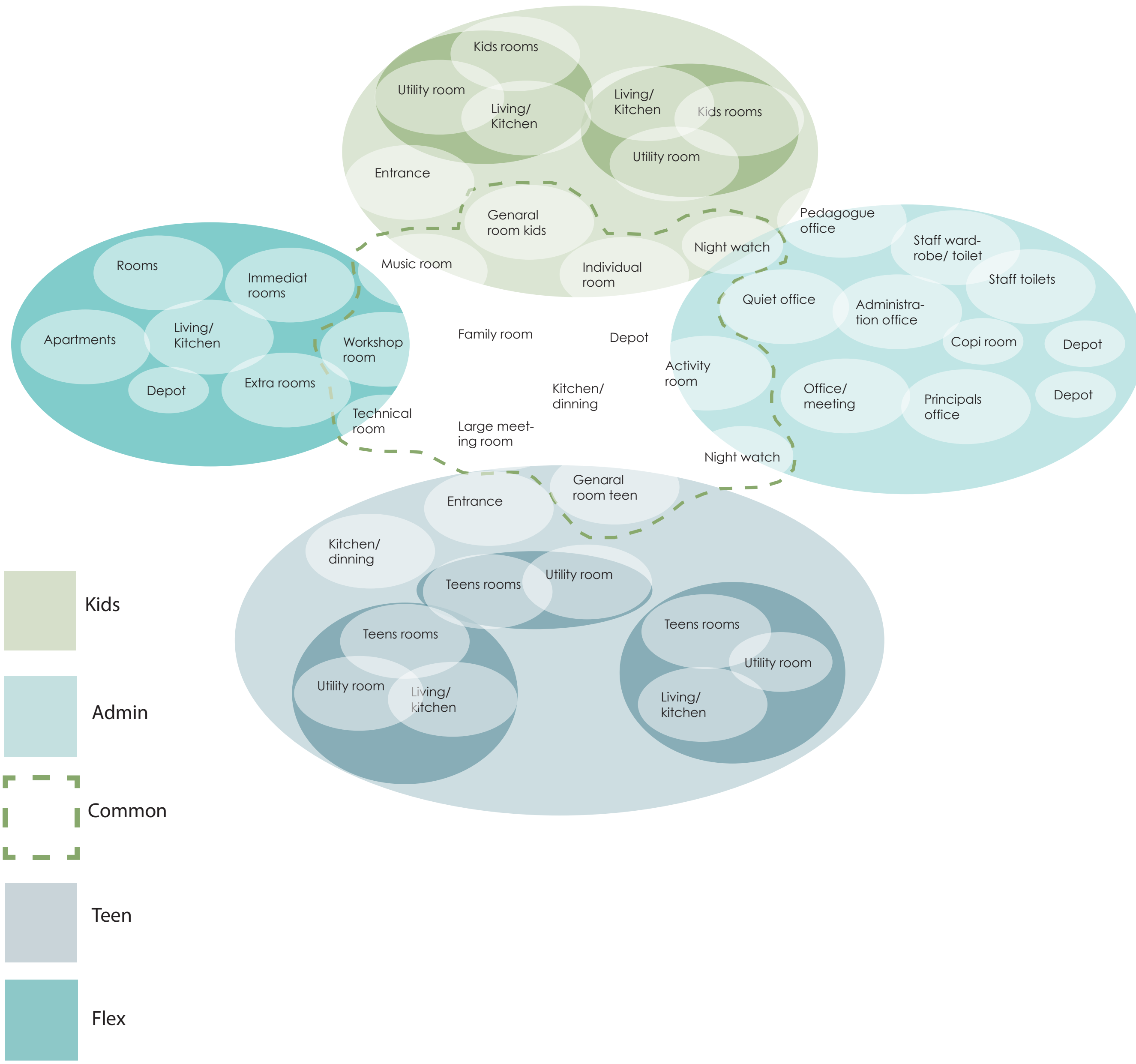
The teenagers section is divided into two sections where the teenagers have three rooms, an entrance and a utility room. As well as a kitchen and dinning/ living area connected to the three rooms. The second section is the apartments where the teenagers have their own kitchen, living room and bathroom. The last section is a larger common space where all the teenagers can eat and be together.

The flex section is for kids and teenagers coming to the children's home for a shorter period of time or are being put here as an acute situation. There are also apartments, for families where the kids living at the children's home can have visitors, and apartments for young moms that are in need of help. In this section there are likewise a common space including kitchen, living and dinning facilities.
The administration section is where the principal has office and where there are spaces for meetings with the children and their parents. This section is where the practical part of the everyday life at the children's home is planed, and where the adults are.

The common section is the large kitchen, living and dinning area where all of the children at the home can be together along with their families and friends. In this section, all the facilities such as, music room, activity room, workshop, family room, meeting rooms etc. are found. This is where the children can do different activities and be together.

In the spatial program are defined the square meters of the different rooms along with the different needs of the specific room.

FUNCTIONS DIAGRAM



| ill. 066

SPATIAL PROGRAM

The spatial program have been provided by CEBRA architects, and are from the project "Vores Hus" from 2012 by Kerteminde Kommune.

For the project VORESHJEM there has been added some rooms and made some adjustments according to room area, etc.

Room specifications	Number	Size	User group	Capacity	Daylight demand	Air change*	Other functions	Situated close to
Teen section 1								
Teen apartment	2	30m²	Teenagers	1-2 pers.	High	A	Bathroom/small kitchen	
Teen apartment utility	1	9m²	Teenagers/Staff	1-2 pers.	Low	C	Washing machine	
Teen common room	1	30m²	Teenagers/Staff	8 -10 pers.	Medium	A		
Teen section 2								
Teen rooms	3	20m²	Teenagers	1-2 pers.	High	A	Bathroom/wardrobe	
Teen living room	1	30m²	Teenagers/Staff	4-6 pers.	Medium	A		
Teen utility	1	7m²	Teenagers/Staff	1-2 pers.	Low	C	Washing machine	
Teen section 3								
Teen rooms	3	20m²	Teenagers	1-2 pers.	High	A	Bathroom/wardrobe	
Teen living room	1	30m²	Teenagers/Staff	4-6 pers.	Medium	A		
Teen utility	1	7m²	Teenagers/Staff	1-2 pers.	Low	C	Washing machine	
Teen Entrance								
Teen Entrance	1	18m²	Teenagers/Staff	4-6 pers.	Medium	A		Teen sections
Kids section 1								
Room K1	2	20m²	Kids	1-2 pers.	High	A	Bathroom/wardrobe	Living/kitchen
Room K2	1	22m²	Kids	1-2 pers.	High	A	Bathroom/wardrobe	Living/kitchen
Room K3	2	24m²	Kids	1-2 pers.	High	A	Bathroom/wardrobe	Living/kitchen
Living/kitchen	1	30m²	Kids/Staff	6 -8 pers.	Medium	A		
Kids utility	1	10m²	Kids/Staff	1-2 pers.	Low	C	Washing machine	
Kids section 2								
Room K1	2	20m²	Kids	1-2 pers.	High	A	Bathroom/wardrobe	Living/kitchen
Room K2	2	22m²	Kids	1-2 pers.	High	A	Bathroom/wardrobe	Living/kitchen
Room K3	1	24m²	Kids	1-2 pers.	High	A	Bathroom/wardrobe	Living/kitchen
Living/kitchen	1	30m²	Kids/Staff	6 -8 pers.	Medium	A		
Kids utility	1	10m²	Kids/Staff	1-2 pers.	Low	C	Washing machine	
Kids Entrance								
Kids Entrance	1	18m²	Kids/Staff	4-6 pers.	Medium	A		Kids sections
Flex section								
Extra room	2	22m²	All	1-2 pers.	High	A	Bathroom/wardrobe	
Immediat room	1	20m²	All	1-2 pers.	High	A	Bathroom/wardrobe	
Flex apartment	1	60m²	All	2-5 pers.	High	A	Bathroom/kitchen/living	
Living/kitchen	1	30m²	All	2-6 pers.	Medium	A		immediat/extra room
Flex entrance	1	18m²	All	1-2 pers.	Medium	A		immediat/extra room

ill. 067

Room specifications	Number	Size	User group	Capacity	Daylight demand	Air change*	Other functions	Situated close to
Common facilities								
Activity room	1	50m²	All	15-25 pers.	Medium/High	A	Projector	
Music room	1	20m²	All	6-8 pers.	Medium	C		
Workshop	2	20m²	All	6 -8 pers.	Low	C		
Individual storrage	8	6m²	Teenagers	1 pers.	Low/non	C		
General storrage	2	20m²	Teenagers/Kids	2-4 pers.	Low/non	C		
Technical	2	35m²	Staff	1-2 pers.	Low/non	C		
Large kitchen/dinning	1	50m²	All	30-40 pers.	High/medium	A	2 stationary mork places	Kitchen depot
Kitchen depot	1	10m²	Staff		Low	C	2 refrigerators/ 2 freezers	
Family room	1	30m²	All	2 pers.	High	A	Bathroom/small kitchen	
Administration								
Large meeting room	1	20m²	All	8-10 pers.	Medium	A		
Decentralt depot	1	10m²	Staff		Low	C		
Pedagogue office	1	13m²	Staff	1-2 pers.	Medium	C	2 work places	
Cleaning depot	1	10m²	Staff		Low	C		
Principal office	1	13m²	Staff	1-3 pers.	Medium	C	1 work space	
Staff wardrobe	1	8m²	Staff	1-2 pers.	Low	C		
Toilet/handicap toilet	4	5m²	All	1 pers.	Low	C		
Copy room	1	10m²	Staff	1-2 pers.	Low/non	C	Copy, printer, fax, archive	
Administration office	1	14m²	Staff	2 pers.	Medium	C	2 work places	
Office/ meeting room	1	16m²	Staff	2-4 pers.	Medium	C	1 work place	
Quiet office/meeting room	1	12m²	Staff	2-4 pers.	Medium	C	1 work place	
Night watch	2	15m²	Staff	1 pers.	Medium	C	Bathroom	

* According to categories in CR1752

The total amount of m² : 1203m2

There will be added common rooms, toilets and passageways e.g to the total amount in the final project.

| ill. 068

05
DESIGN PROCESS

VOLUME STUDIES

This chapter supports the choice of building geometry used in the concept.

Starting out designing the Children's Home some volume studies were made. It is the vision to create a 2020 building and therefore some of the most common shapes have been assessed in proportion to volume, surface area, floor area ratio, energy consumption and indoor arrangement.

All shapes have the same volume of 100m^3 to get comparable results. The building surface area was found to calculate the transmission loss when calculating the energy consumption in the program Month Average.
The floor area ratios were compared to find out how much space the geometry uses at the building site. The indoor arrangements were estimated in preparation to inside living area in the geometry.

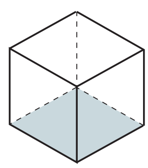
Looking at the results from the six different building geometries it is found that the high box, the cube and the sphere are the most energy saving geometries.

But the sphere is not good when looking at the indoor arrangements and is therefore chosen to do without.
The high box is neighter good because of the item on the local plan, which says the height of the building cannot exceed 15 meter.

The cube, which has a squared floor area ratio, sqared facades and the second smallest surfacearea of all the geometries is choosen as geometry. It is compact and has the possibility of having more than one floor. The possibility for having more cubes next to each other is also an opportunity, since the energy consumption doesn't raise much.

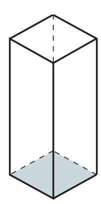
CUBE

Volume: 100 m^3
Surface area: 129,27 m^2
Floor area ratio: 21,53 m^2
Energy consumption: 19,3 kWh/m^2 per year
Indoor arrangement: Good



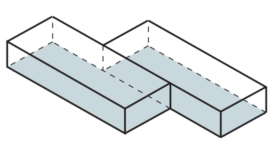
HIGH BOX

Volume: 100 m^3
Surface area: 151,32 m^2
Floor area ratio: 9 m^2
Energy consumption: 18,6 kWh/m^2 per year
Indoor arrangement: Good



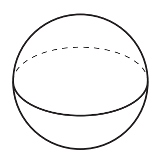
LOW Z-BOX

Volume: 100 m^3
Surface area: 201,32 m^2
Floor area ratio: 66,66 m^2
Energy consumption: 38,3 kWh/m^2 per year
Indoor arrangement: Good



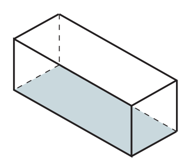
SPHERE

Volume: 100 m^3
Surface area: 104,16 m^2
Floor area ratio: 0 m^2
Energy consumption: 11,3 kWh/m^2 per year
Indoor arrangement: Not good



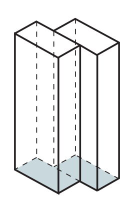
LOW BOX

Volume: 100 m^3
Surface area: 151,32 m^2
Floor area ratio: 33,33 m^2
Energy consumption: 24,6 kWh/m^2 per year
Indoor arrangement: Good



HIGH Z-BOX

Volume: 100 m^3
Surface area: 184,65 m^2
Floor area ratio: 9 m^2
Energy consumption: 22,2 kWh/m^2 per year
Indoor arrangement: Good



| ill. 069

GRID

The choice of building geometry has a square as floor area ratio and it is there fore logical to divide the building site into a grid such the building geometry can be placed in the most optimal location.

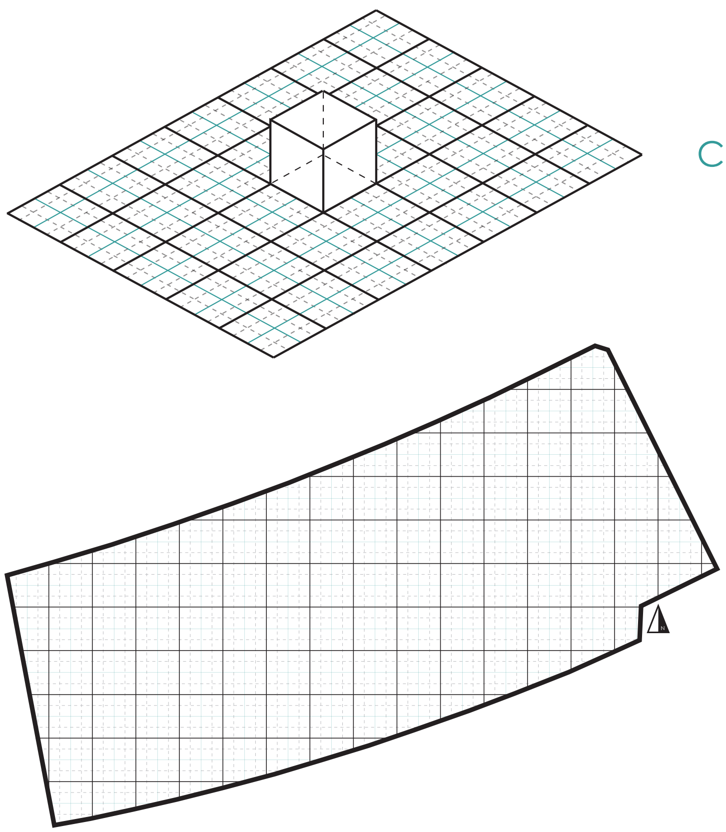
After studying the size of the grid in proportion to the building volume at 8m x 8m and 12m x 12m. The grid at 8m x 8m was to small; the building volumes were not big enough to contain the different facilities, which the children's home needs in a workable solution.

The grid at 12m x 12m was opposite; here the building volumes were a little too big and there was a lot of wasted space between the functions.

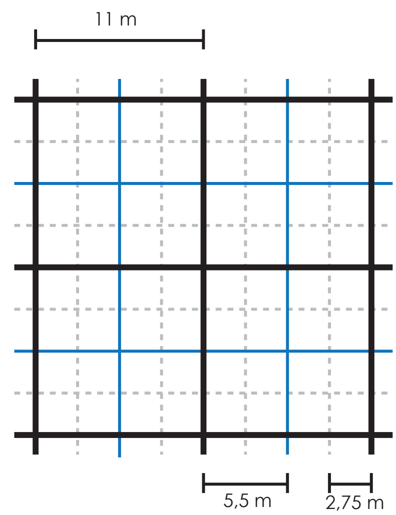
Therefore it was decided to use a grid at 11m x 11m because the building volume could be used to the full. At the same time this size of building volume gives the possibility of getting natural light in to the middle of the volume.

The building volume is according to the building requirements not allowed to be higher than 15m and it is therefore necessary to have more than one building volume.

It is chosen to divide the grid into smaller grids, which makes it possible to move the building volumes more around, with out being separated completely from each other.



Close up grid size



| ill. 070

BUILDING GEOMETRY

This chapter explain the first steps in modelling the children's home and how the building shape has evolved during the design process.

After the size of the grid has been chosen, the buildings different placement is valued, in a way where both the buildings and the site are used optimal.

Starting out he building mass exist of six cubes pushed together. Each cube contains three floors; ground floor, 1^{st} floor and 2^{nd} floor. Together the six cubes contain $1800m^2$.

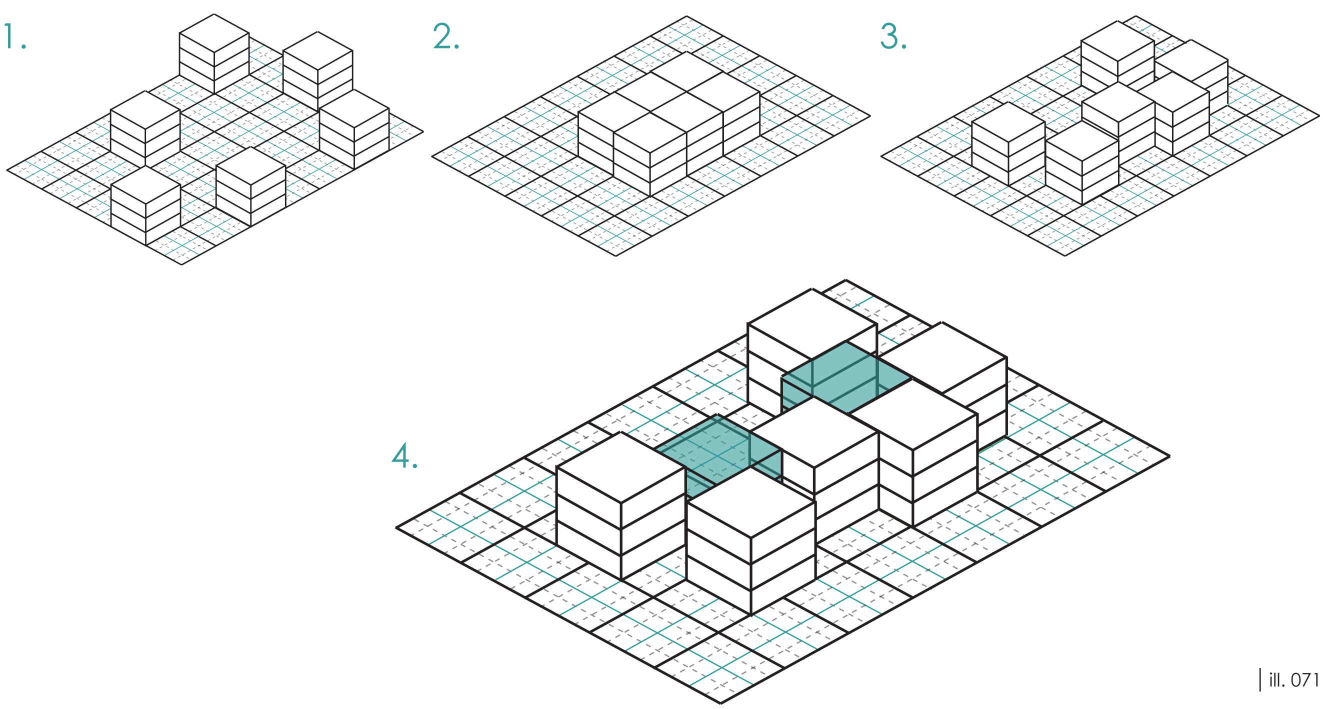
1. The six cubes were first placed randomly in the grid with space between each other. At first this seems logical, because of the varied space created between the buildings. But with more specified eyes this is not a good idea considering the flow in the building, where the staff and children need the possibility to move around in all buildings with out going outside.

2. To create this flow indoor the cubes are instead placed close together, but this gives problems according to daylight in the middle of the building mass, while no outdoor spaces are defined around the building.

3. As a result the cubes are pushed a bit from each other, but making sure they still are in contact with at least one other cube. This helps the problem of getting light into the middle of the cubes. But there are still some problems walking effortlessly around the whole building.

4. Consequently the two new cubes are placed, though they are different and function as two atriums, acting as a link between the other cubes to create a building with a good flow.

Looking at the outdoor spaces between and near the building cubes, this building mass pushed a bit from each other creates rooms and corners, which invite to outdoor stays.



| ill. 071

PLACEMENT ON SITE

This chapter will explain the placement of the building on the site and the functions, which will be placed around the building.

The site is big compared to the building and therefore the building can be placed exactly as wanted. The building has a plot area ratio at 968m2. As the site is 9717m2, the building plot ratio is only roughly 10%.

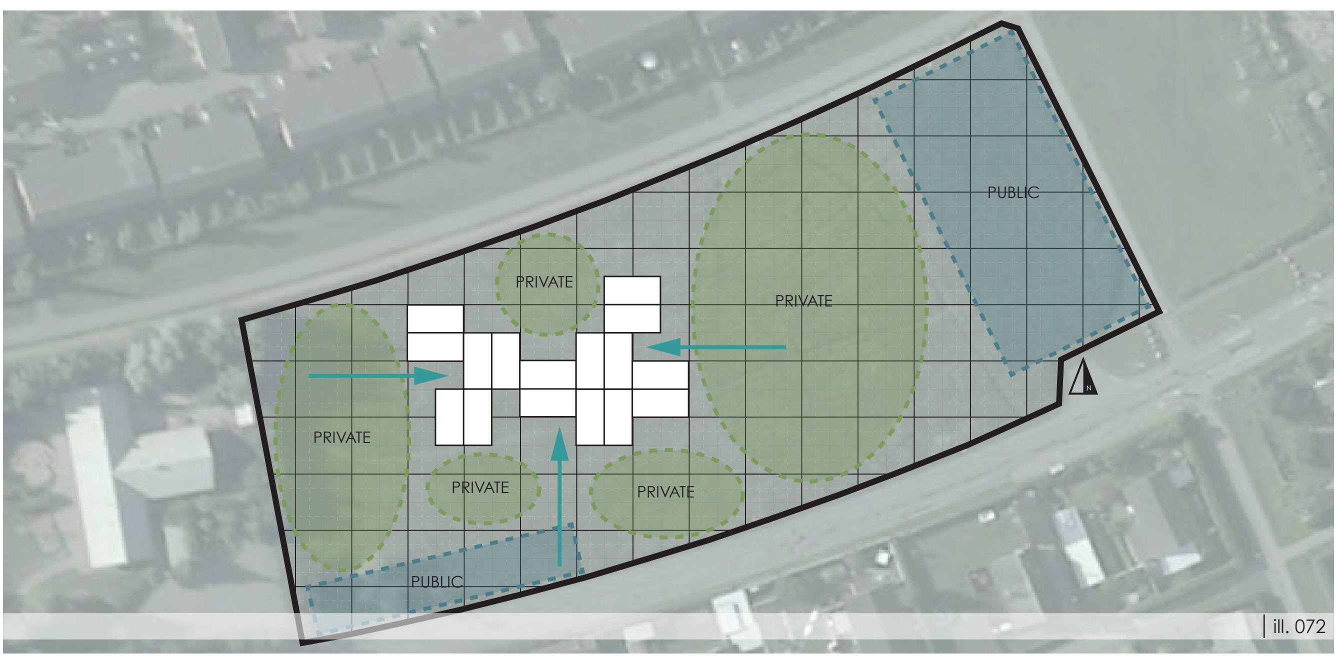
The building is organized on a grid, placed north/south, east/west, which makes the building create a barrier crosswise the site. The building is placed in the middle in the western part of the site. This placement of the building creates a big outdoor space to the west and an even bigger outdoor space to the east. To the north and south of the building is three smaller outdoor spaces created.
Looking at the illustration below, it is seen that the outdoor spaces have been divided into two categories; private outdoor areas and public outdoor areas, likewise the access to the building is showed.

The public outdoor spaces are placed to the east and to the south. The idea behind the public outdoor space to the east is to create an area for all children in the neighborhood, where they can meet and play together. There are no public outdoor areas for children in the neighborhood, which is why it is obvious to create one near the children's home.

The public outdoor space to the south is going to be the parking area for staff and people visiting the children's home.

The private outdoor spaces are surrounding the children's home and are the outdoor areas where the children living at the children's home can relax and play undisturbed from curious eyes. The private outdoor spaces are facing all corners of the world, which gives possibility to choose sunny or shaded areas depending on wishes.

As showed at the illustration there are three entrances to the building. The one from the south is the public entrance to the children's home, where staff and visitors enter. The two access ways from the west and east are the private entrances for respectively the kids and the teenagers.



ill. 072

SITE PLAN

The following pages is to set the mood for the activities happening on the site around the children's home.

ill. 073

ill. 074

ill. 076

ill. 075

ill. 078

ill. 079

ill. 077

ill. 080

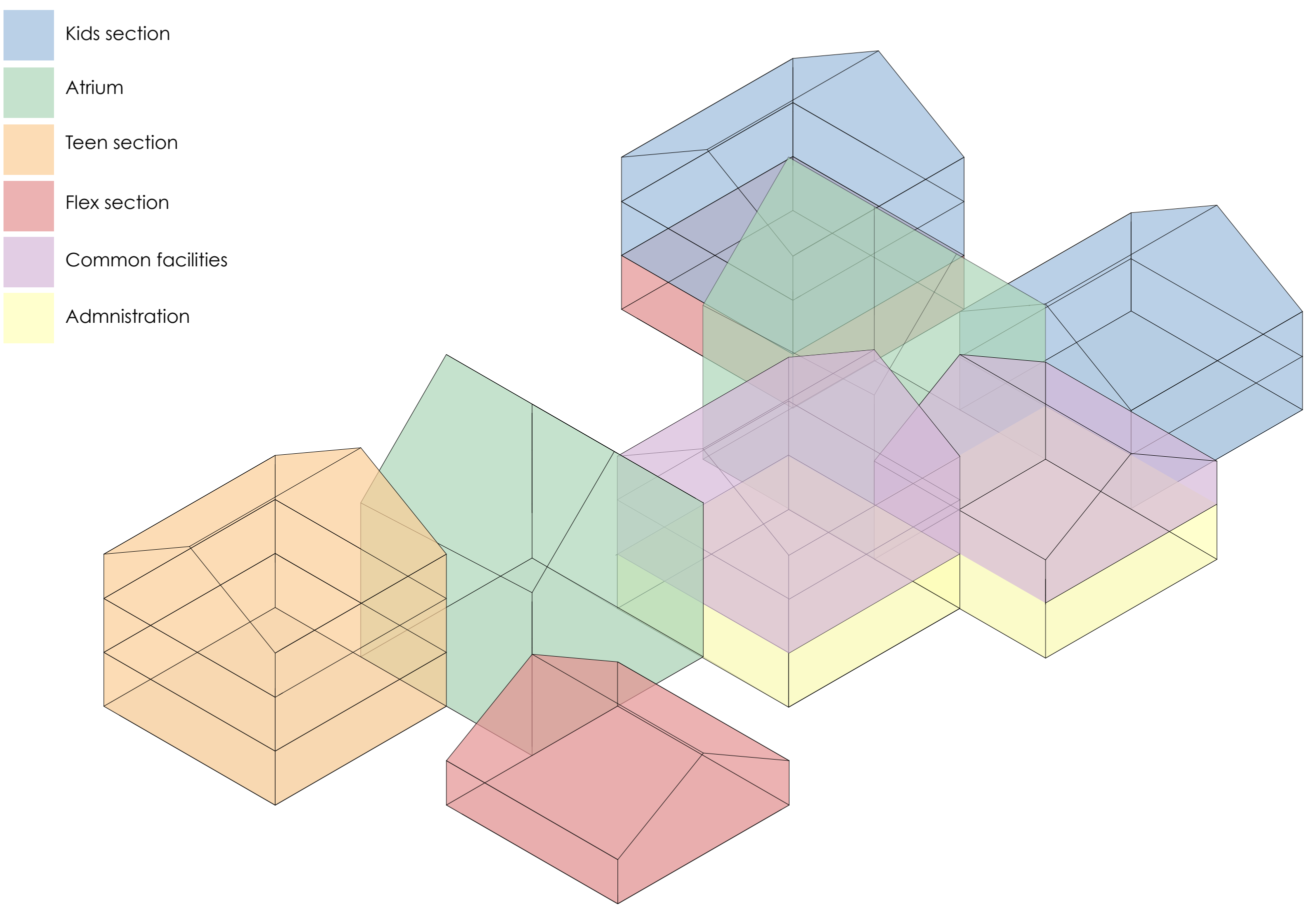
BUILDING ORGANIZATION

According to the spatial program given for the project, the building is divided into an administration part, a teen-, kids- and flex zone and a common part.

To seperate the functions and to create a boundary between the children's spaces and the public spaces of the children's home, the functions is separated into the different houses to give the children a sense of belonging to their own house, and by making a connection between the children living in the same house.

By having the atriums in-between the living units there is a clear line between the children's home and the activities/community. In that way it is possible to have each children's living unit separated and thereby giving them a small community to be a part of, like their own small family.

The administration is separated from the children so that they are not forced to move by the administrational part of the building, but only have to move around between the buildings only by using the common spaces.



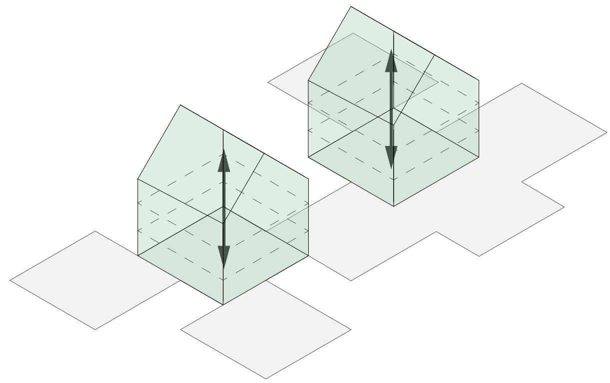
ill. 081

FLOW IN THE BUILDING

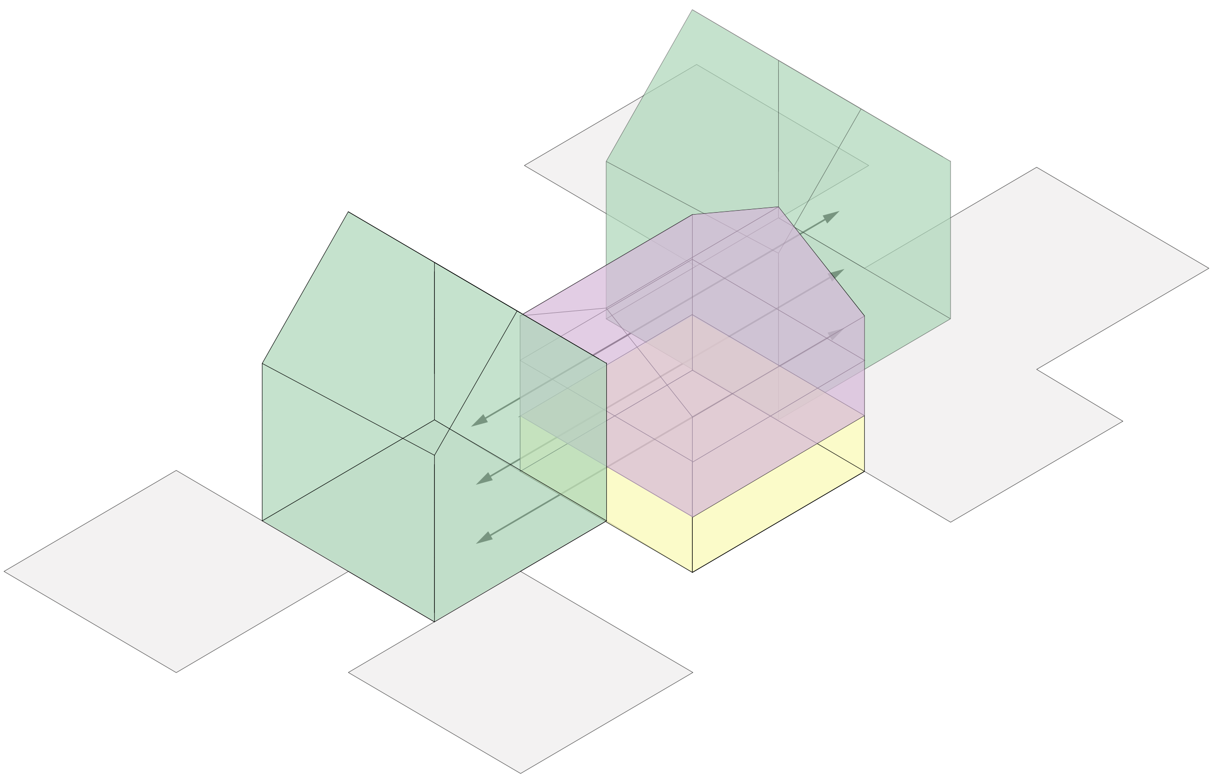
The flow in the atrium is intended for the children and should be seen as a vertical playground and common space where different activities for kids and teenagers living in the children's home can unfold.

This giving them a space for private and common activities, but also being their private entrance, and the distribution to the different living units.

The horizontal flow is the flow between the atriums and through the common space. This flow is to connect the atriums and thereby the different living units of the children's home.



| ill. 082

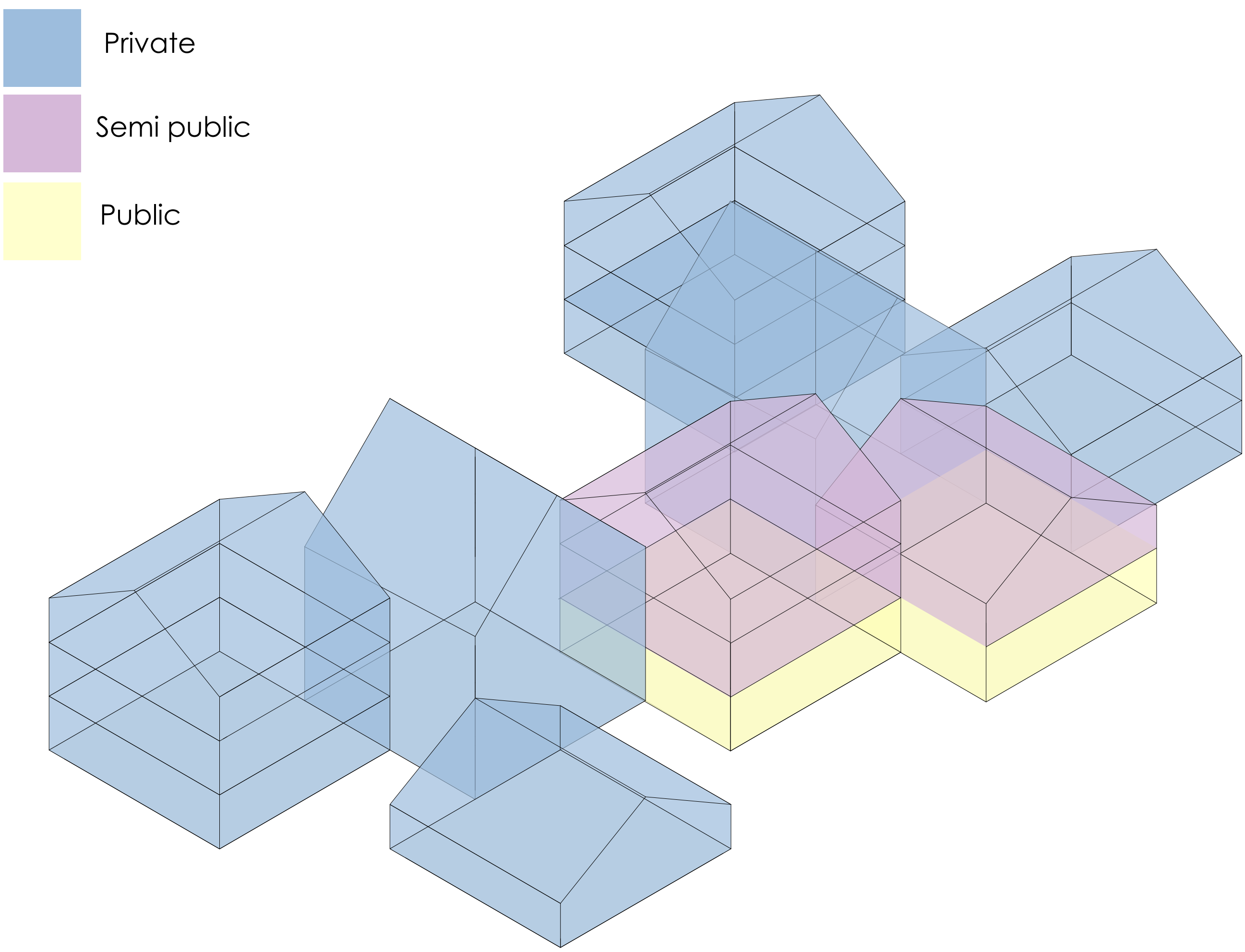


| ill. 083

PRIVATE / PUBLIC

The public area of the children's home are the administration, where people not being part of the home enter the building. Thereby they do not enter directly into the private areas of the home, where the children are living and having their everyday life. Having to separate the official part of the home from the children's everyday life make sure the children do not feel like living at a institution.
The semi public areas are where friends and family come visiting, but are also the common spaces where the children's are gathering and are being part of the large community.

The private areas are the children's own rooms their living unit and the atrium, where they have the possibility of being together with the other children living at the home.



ill. 084

ill. 085

WINDOWS EXPRESSION

When working with a compact building mass, the light is an important factor according to the interior of the building. Therefore this chapter is to document how there has been worked by giving a significant expression to the building, with out making any compromises in terms of energy or the strict building typology, this part of the process was made parallel to the design of the interior and the placement of windows according to the rooms and the use of the rooms.

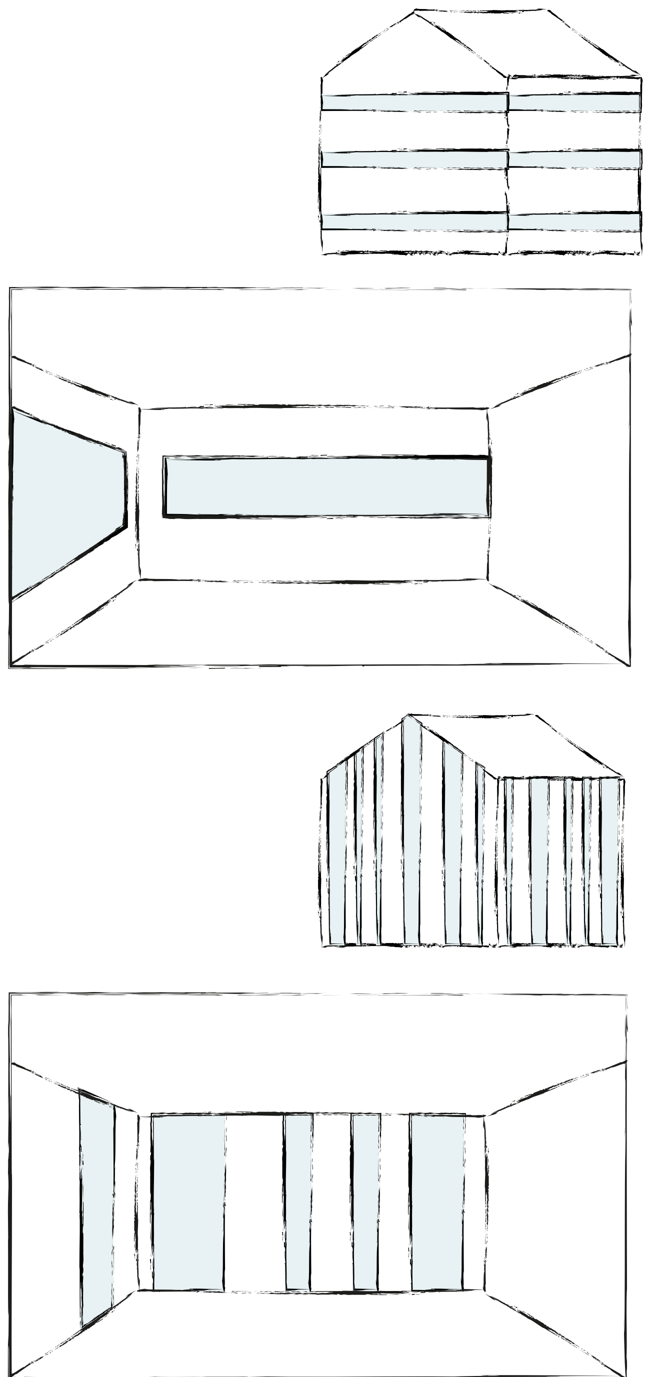
Horizontal lines

Working with horizontal lines in the building facade, the facade is interacting more with the landscape and are making a connection to the ground. The lines are underlining the horizontal of the building and are making the building seem lower than it is. When having the horizontal lines going all the way around the building, there are problems with the internal walls and it will not be possible to have the internal walls going all the way out to the external walls.

When having these horizontal lines at eye level, the rooms will be more exposed because of the large continuous windows through the rooms.

Vertical lines

The vertical lines are opposite the horizontal underlining the height of the building. The windows going from ceiling to floor in the rooms are exposing the privacy of the rooms, and are making the room exposed to the outdoor spaces. Having these vertical lines, the functions of the interior must not interfere with the lines of the windows when having the windows going from ground floor to 2nd, this is not giving a flexible interior plan, and will interfere in the way the different floors can be used.



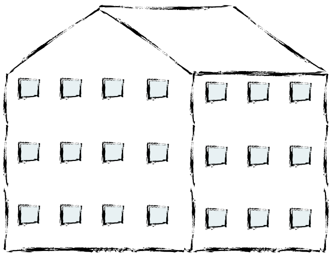
ill. 086

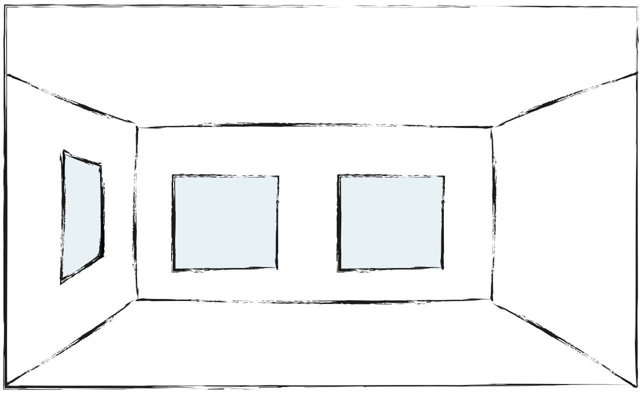
The squared

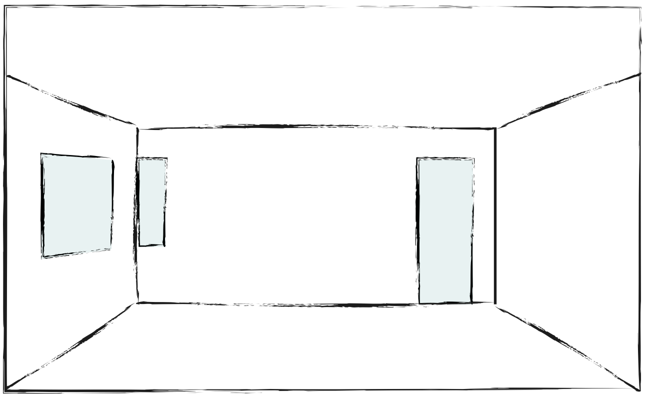
Squared windows placed in a freer pattern on the facade are giving more freedom when working with the interior of the building volume and are making the three floors independent of each other.

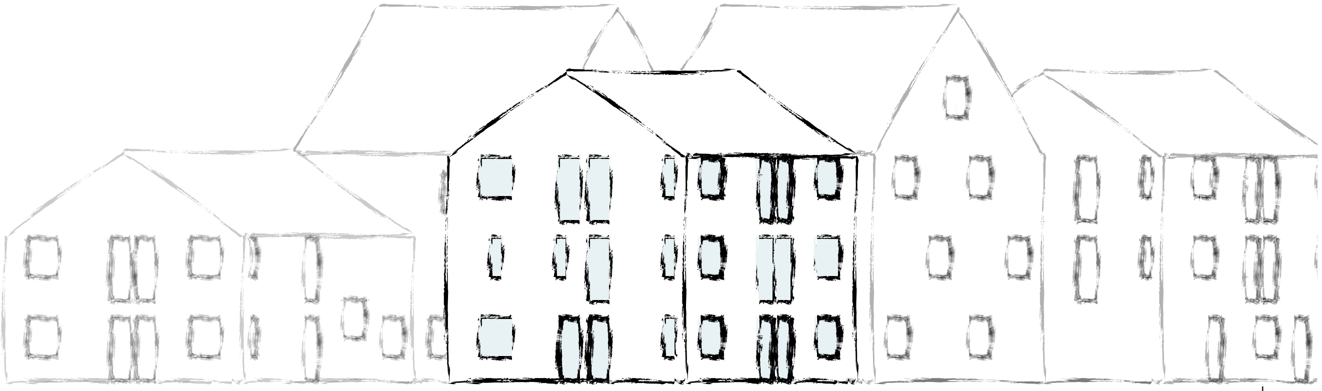
Squares of different sizes

To keep the expression of the typology and to keep the reference to the traditional pitched roofed houses, the squared windows are chosen. Working with windows with different sizes and ways to be placed in the façade. Having these windows of different sizes the freedom of placing them in the façade are getting larger and the windows are only placed where they are needed and are thereby not exposing the privacy of the rooms. The windows are placed having focus on the interior expression the daylight in the rooms and common spaces of the children's home.









| ill. 087

ROOM PLANS

According to the spatial program (see page 52) the children is divided into a kids section and a teenage section each having different need for the rooms and the living room connected to the rooms.

Kids

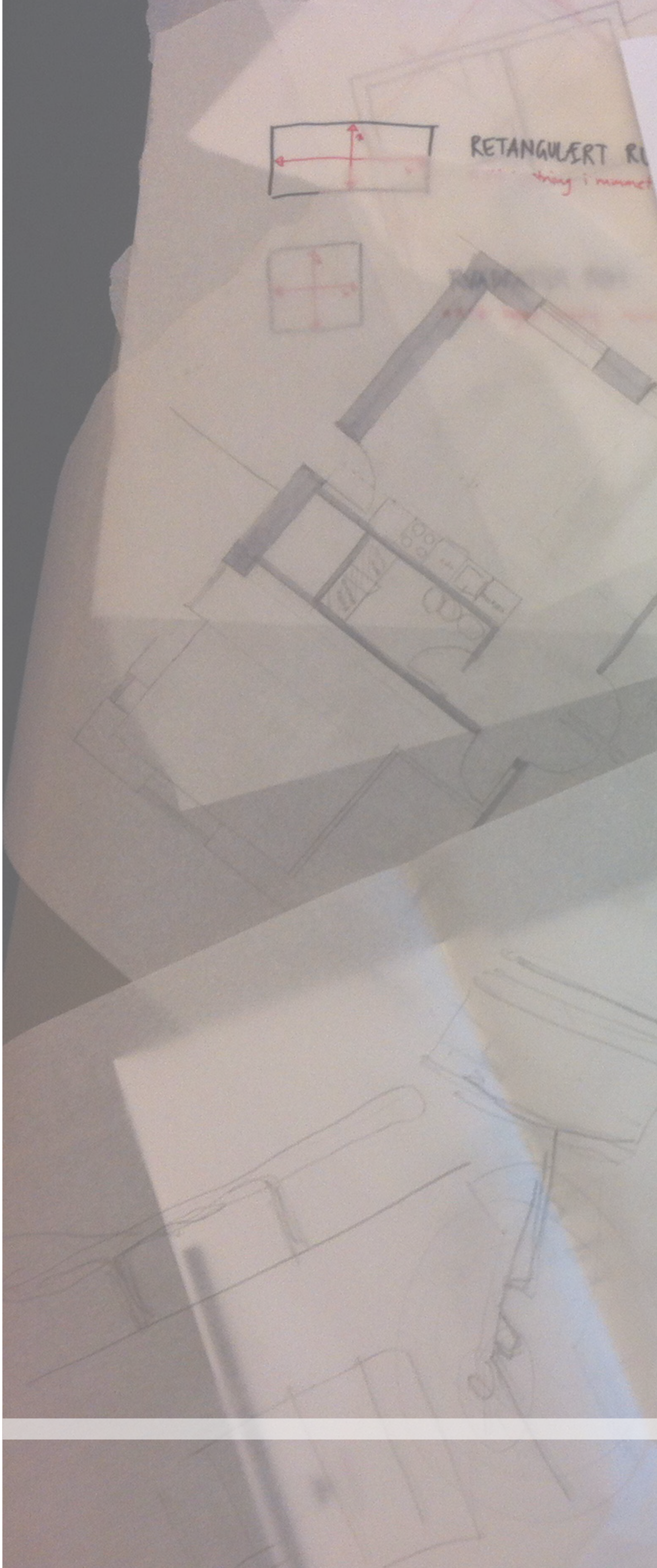
In the kids section there a three different sizes of rooms, to differentiate the rooms and to differentiate the needs of the rooms having the different age groups. Therefore the rooms are $20m^2$, $22m^2$ and $24m^2$, each room are containing a separate bathroom, to keep the privacy for the kids.

Teenagers

In the teen section there is only one size of room of $20m^2$ including a separate bathroom, this are made to have more focus on the common space for the teenagers, where they have the spaces to be together with others, and still have their room as a private space.

Flexibility

To give the children a possibility of decorating and giving a personal touch to their own room, it was important to add flexibility to the rooms so that the children can move their furniture around, have different furnitures than the other children and be able to create their own private room. Therefore the placement of the windows and to minimizing the walking zones was important.



ill. 088

DAYLIGHT IN ROOMS

This chapter is to document, the placement, size and amount of windows that are needed to give a daylight factor above 2 in the children's rooms.

One window, one orientation

Only having one window 1200mm x 1200mm placed in a height of 900mm is giving a dark room where the light do not go deep enough into the room and are therefore not giving the minimum daylight factor of 2. The window is not adding an architectural feature to the room, and it is giving the room a standard expression.

Two windows, one orientation

Two windows with the size of 1200mm x 1200mm are adding more light to the room, but are still not having the daylight factor of 2 in the back of the room. When having light from one direction it is hard to get light to the back of the room, and to add the quality of daylight to the room.

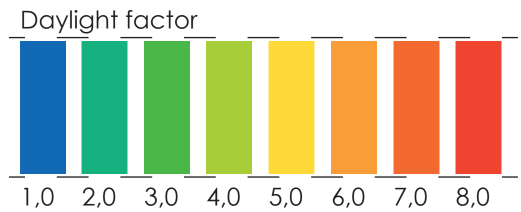
Therefore it was worked with getting light into the room from two orientations to get a better daylight factor.

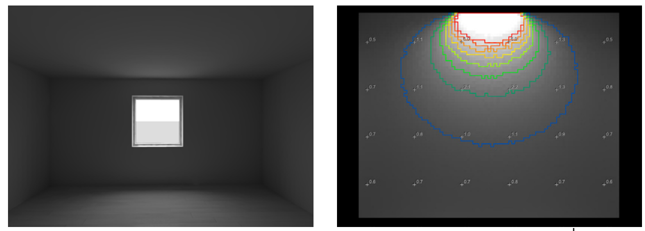
Three windows, two orientations

Having three windows at the same size and height as before, the light are penetrating all the way through the room and are giving a daylight factor above 2 in almost all parts of the room. By having light penetrating from two orientations, the light is getting deeper into the room and is giving a larger differentiation to the room.

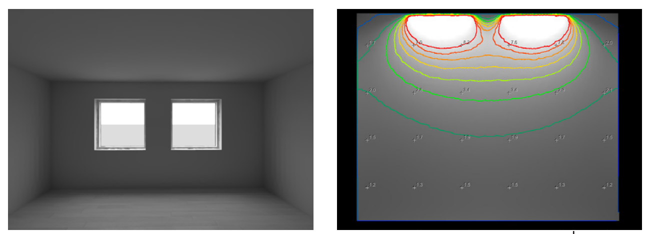
Larger windows, two orientations

By increasing the area of the windows, the daylight factor was also increasing in the back of the room, but having three large windows placed like shown on the illustration, the amount of space for furniture and add flexibility to the interior was removed.

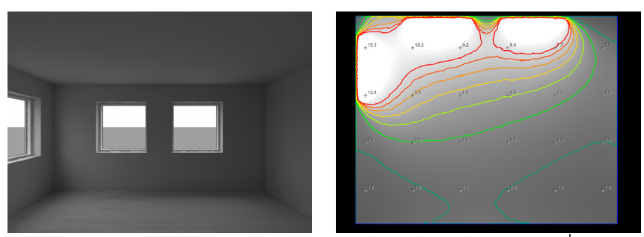




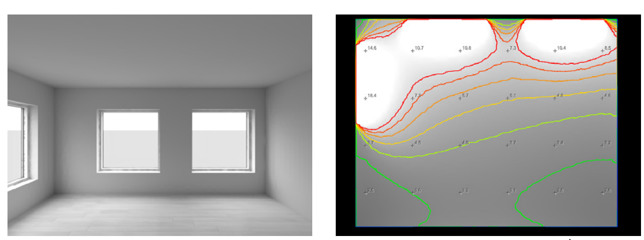
One window, one orientation and daylight factor | ill. 089



Two windows, one orientation and daylight factor | ill. 090



Three windows, two orientations and daylight factor | ill. 091

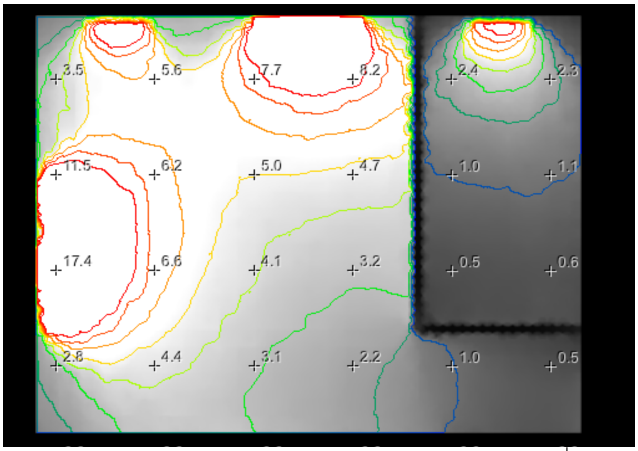


Larger windows, two orientations and daylight factor | ill. 092

Different windows, two orientations

To get the light deep into the room it was chosen to work with light from two orientations. And by having three windows the light is spread in the room. To make a more flexible interior of the room, there have been worked with three different windows. One large squared window. A window looking and being able to open up as a door to get better natural ventilation in the room. The third window is a narrow window, placed to frame the view, so that there can be placed a bed or a desk below the window.

By having the two of the windows in a minimum height of 0,9m it is possible to have a flexible interior. The window that is going from floor to ceiling is placed in the walking zone of the room to give flexibility to the rest of the room.



Daylight factor for different windows, two orientations | ill. 093

Different windows, two orientations | ill. 094

BATHROOM IN ROOMS

The bathroom as an element

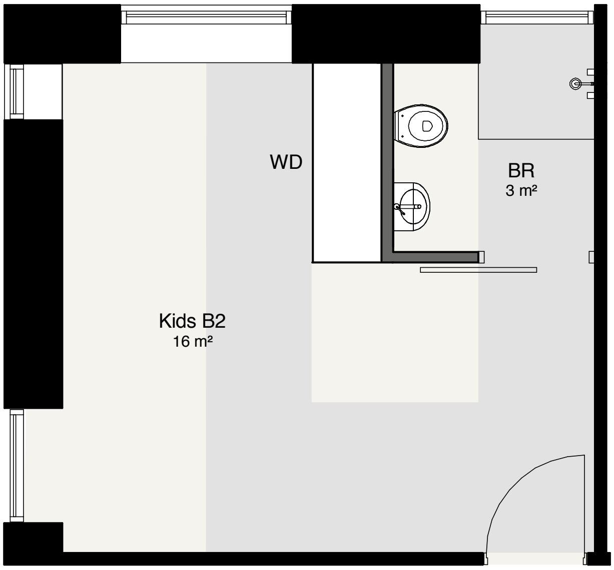
To optimize the space of the room the bathroom and wardrobe area must be reduced. This gives more possibilities for the kids to add their own personal touch to their room.

Therefore the bathroom was minimized to 3m^2 and was made very compact, given that it should only facilitate one person. Having the bathroom and wardrobe as an element in the room, it was worked with combining these to facilities in a very compact space. By having the bathroom closed off and the wardrobe being integrated in the surface of the element it was adding a large walking zone around the element to get the optimal use of the wardrobe. (See ill 95).

To avoid this walking zone in the room, it was worked with having bathroom and wardrobe facing inwards the element to minimize the walking zones in the room (See ill. 96)

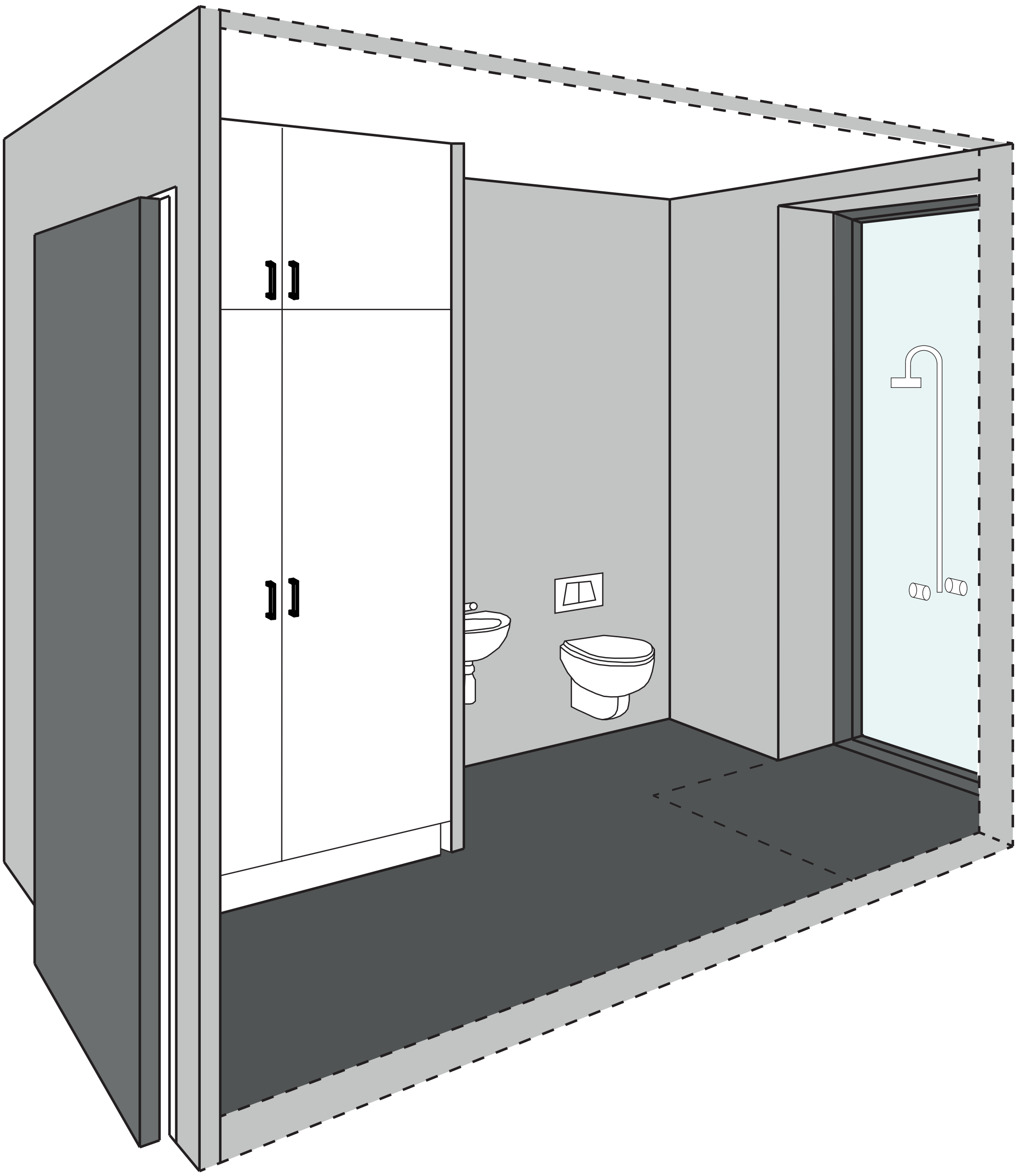
The idea of the bathroom was to give the kids a zone in their room, where they could have their more private stuff kept in the bathroom element and be able to close of, so that the focus could be on the room.

The bathroom/wardrobe is divided from the room with a sliding door, and are having a walking/wardrobe zone open into the bathroom, which gives the feeling of the bathroom being one big room. (See ill. 97)



ill. 095

ill. 096



| ill. 097

LIVING UNITS

Teen living unit

The interior of the teen living units are facilitating three teen rooms with bathroom and a common living facility with kitchen, dining and living spaces, giving the teenagers a private space and creating their "home" and base in the children's home.

The common spaces are only containing the most necessary functions, such as a kitchen, dining space for six people and a small couch and sitting area. This is to give them the experience of having a private space, a semi private space in the unit and a public space outside the unit.

In the interior plan of the unit there as been a focus on giving flexibility to the teenagers in their own rooms so that they can influence what they want in their room and where they want to place it. This is done by having a regular room that are not being affected by the placement of windows and doors.

There has been a focus on making the plan of the rooms as simple and regular as possible to give the teenagers the freedom of making their own private spaces.

ill. 098

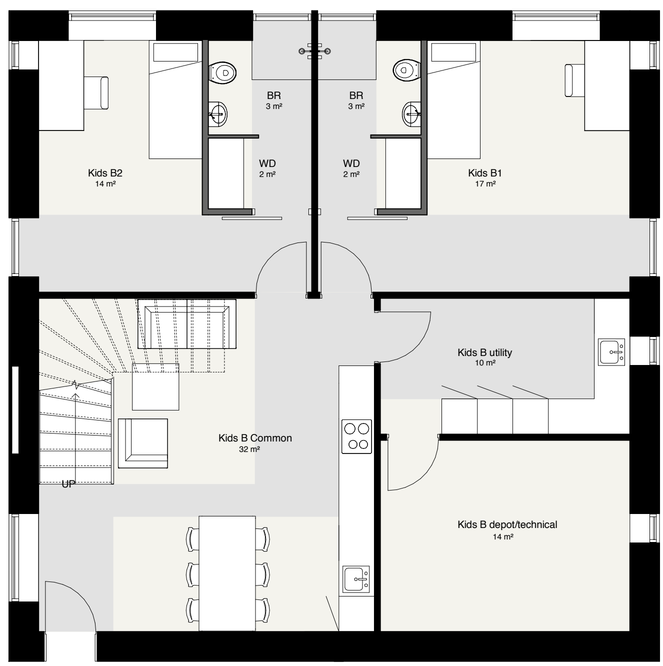
Kids living unit

The interior of the kids living unit are facilitating five kids rooms, having different sizes to facilitate different ages and need of the kids living at the home. As the teen rooms the kids' rooms are also having bathrooms in connection to each room.

The common facilities of the kids' living unit are also containing kitchen, dining and living spaces, but the common spaces are a double high room to make a common core of the unit, and to give a connection from each room to the common space. This is done to enhance the fellowship between the kids.

The interiors of the rooms are like the teen rooms flexible and gives the kids the possibility of creating their own private space.

ill. 099



ill. 100

FACADE EXPRESSION

After chosing the window typologies for the building, there was made a shattered expression having the windows placed according to the rooms and the interior functions.

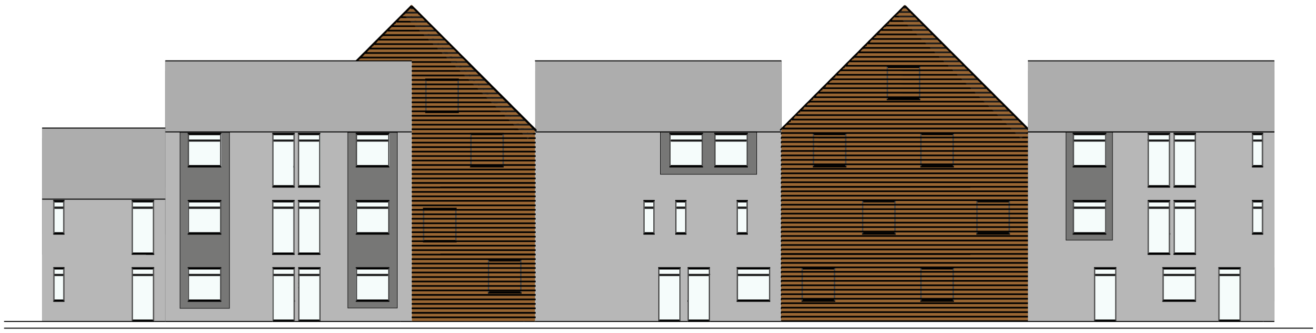
Trying to make a connection between the windows in the facade, there was made an investigation on how to connect the windows with each other.
It was worked with different materials. Having wood making a connection to the atrium and thereby using the wood to mark a change in the facade, either by framing the vertical windows in a vertical frame or by framing the squared windows in a vertical line. It was also tried to have a darker zinc material to frame the windows in the same system.

It was only worked with vertical lines of the building, to underline the height of the volumes and the differentiations of the heights.

It was chosen to keep a simple and clean expression of the volumes and let the windows stand out as cut out openings in the sharp volume. This to keep the expression of the volume and the character of the building typology.

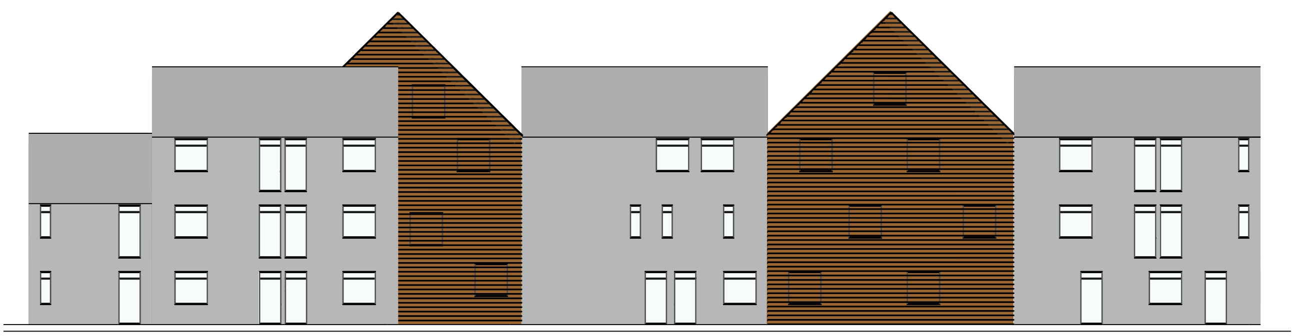
Facade showing the framing of the windows with wood. | ill. 101

Facade showing the framing of the windows with zinc. | ill. 102



Framing of the squared windows, with zinc. | ill. 103

Framing of the squared windows, with wood. | ill. 104



Keeping the clean expression of the building volumes. | ill. 105

EXTERNAL MATERIALS

To get a homogeneous expression of the building typology and to enhance the shape of the pitched roof typology, it was chosen to work with a materials that could work both as a facade material but also as a roof material, therefore wood and zinc was chosen as the materials to work with for the building exterior.


ill. 106


ill. 107


ill. 108


ill. 109

Zinc

The zinc material chosen for the children's home is made by the manufacturer Rheinzink, is being produced in Europe (Germany) and are a 96% reusable material [Rheinzink.dk, 2013] that has a long service life, over 50 years, and are a maintenance-free material that can be used on all surfaces.
The facade system used, is the vertical seamed system, with a seam distance of 500mm to underline the material following the shape of the building.
It was important that the material did not take the focus from the shape of the pitched roof typology, to make the typology stand as this well-known shape of a home.

ill. 110

ill. 112

ill. 111

Wood

To keep underlining the shape of the building volume the wood material was used, as a warm contrast to the cold and sharp zinc cladding. The wood material that is used is Superwood manufactured in Denmark which are being PEFC certified. The wood is made by Nordic produced fir that are being impregnated by a eco-friendly material adding a service life of the wood for up to 30 years. [Superwood.dk, 2013]

The wood can be a maintenance-free material but then it will lose the warmth of the wood and thereby not be the contrast to the zinc material as intended. Therefore the material has a degree of maintenance that it should be painted every three to five years, to keep the colour of the wood.

ill. 113

ill. 115

ill. 114

INTERIOR MATERIALS

Concrete painted

As the bearing construction of the building concrete is used as the load-bearing wall. The concrete wall is being painted as the internal walls of the building. Concrete has a long service life and are a local produced material (Denmark). Having it as the internal walls the material are maintenance-free. The surface of the concrete is a hard, cold material that is having a large durability.

Plaster

There are used plasterboards as ceiling material as a contrast to the hard concrete on the walls. There are not chosen a specific manufacture for the plaster boards, but the criteria's for the material is that it is produced according to the parameters mentioned before: local materials, long service life etc. (see Sustainable materials)

Flooring

The floor that is chosen for the children's home is wooden floors, in most of the rooms. In kitchens, bathrooms and depot rooms, where there are a need of a harder surface tiles are chosen. There are not chosen a specific manufacture for the flooring material, but as mentioned the criteria's from the chapter of Sustainable materials should be fulfilled.

The demands for the wooden floors are that they are giving a warm contrast to the hard concrete and the white surfaces of the rooms. it should add the softness to the room, where the children are spending there private time, maybe sitting on the floors walking around bare footed. The wood floor should have a plain surface making it easier to clean.
The tile surfaces, should be easy to clean and give a contrast to the white surfaces of the walls and ceilings. In the atriums there should not be wooden floors, this to give a contrast to the living units and rooms, to underline the different use of the room. Here dark concrete is used as the floor material

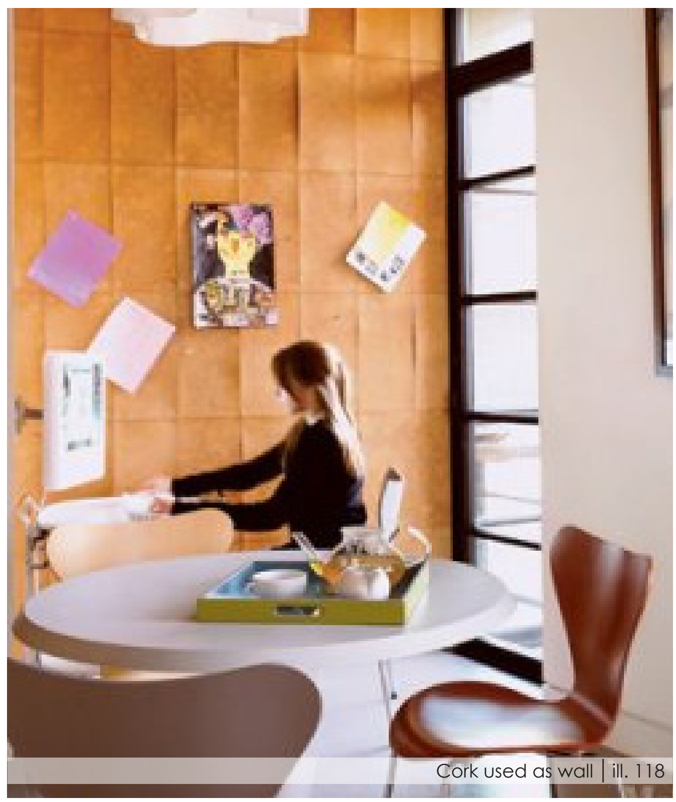
Bathroom element

To underline the bathroom, as an element of the room there is a contrast in materials from the white walls and ceiling and the wooden and tiled floors, it was chosen to work with the material cork. Giving a contrast to the other materials and giving the children a wall they can use as a pin-up board which can be decorate as they pleases, giving them a wall where they can express their creativity. There are not chosen a manufacturer, but it will choose from the parameters in the chapter Sustainable materials.

Concrete floor | ill. 116

Wooden floor | ill. 119

Cork used as wall | ill. 117



Cork used as wall | ill. 118

ATRIUMS

The two atriums are together the heart of the building. It is where the children meet and play or where they hang out together.
The atriums are gathering places where the kids and teenagers can meet, have friends over or find a quiet corner where they can sit and just be alone.

Activities in the atriums

The atriums are divided into a teen atrium and a kids atrium that are each focusing on the needs and wishes for the different age groups.

Teen atrium
The main focus of the teen atrium is the opportunity of having cosy spaces where the teenagers can sit and hang out and be together with friends. Having both open and closed of spaces for being alone, reading and listening to music, but also spaces for semi active activities such as table football, wii- and play station spaces, this giving the teenagers a space in the children's home, where there are a large focus on community and the idea of being part of a community or being in a fellowship.

Kids atrium
In the kids atrium the main focus is on play and being active, therefore the activities are more in a playful setting. Having a sandpit, playhouse and caves, where the children can play, but also to have spaces where they can be alone, listen to music or read.

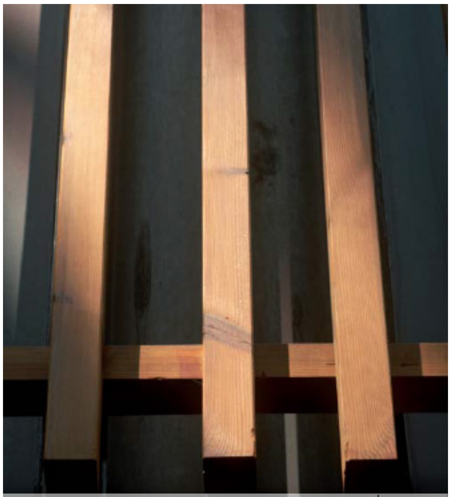
ill. 121

ATRIUM APPEARANCE

ill. 125

ill. 124

ill. 123



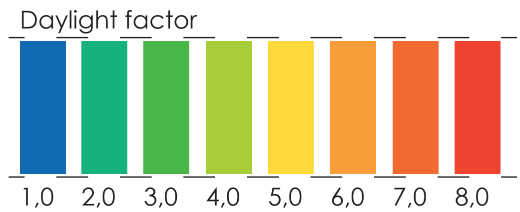
ill. 122

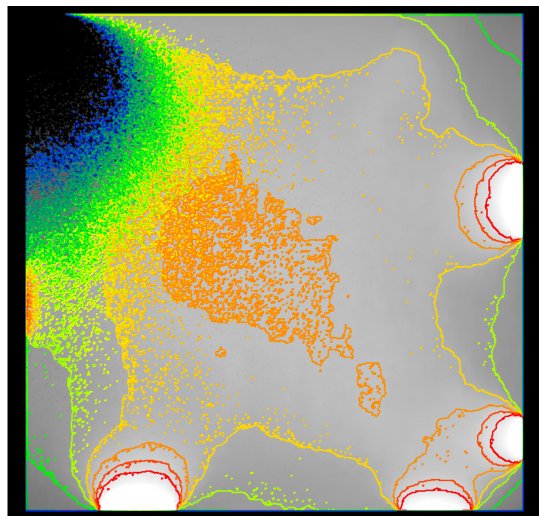
DAYLIGHT IN ATRIUMS

To give a sense of being in a space in-between indoor and outdoor, it was important to get that sense from the daylight and to have a different expression than there is in the living units or outside, to give the feeling of being in-between.

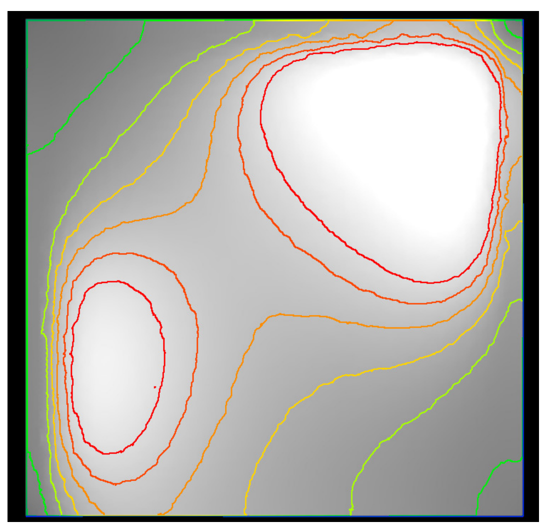
To test out the daylight, the Velux Visualizer was used to get an idea of the daylight factor of the atrium and to compare window sizes and experinces (see ill. 126 and ill. 129.), and to get an idea on how the light was spread into the room. (See ill. 127 and ill. 128)

ill. 126





ill. 128



ill. 127

The windows are placed in a random grid, to get light in from different heights and orientations in the atrium.

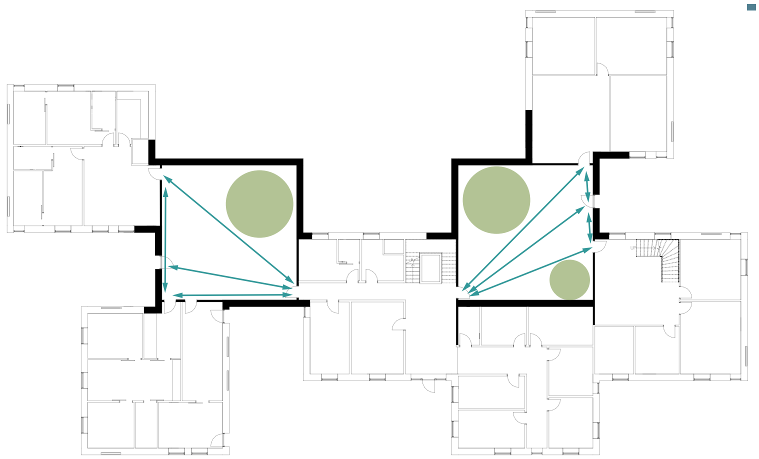
When having this placement of the windows the light differ during the day and are creating a larger contrast between light and dark.

| ill. 129

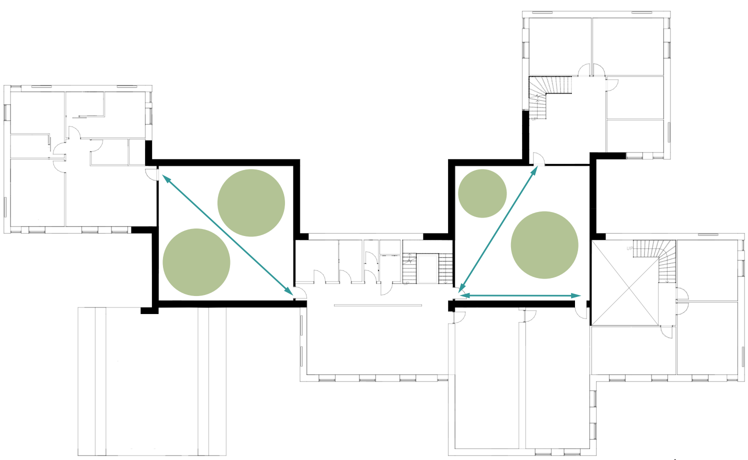
ATRIUM FLOW

Both the atriums are functioning as pathways in the building, but also functioning as an entrance for the different areas of the building.

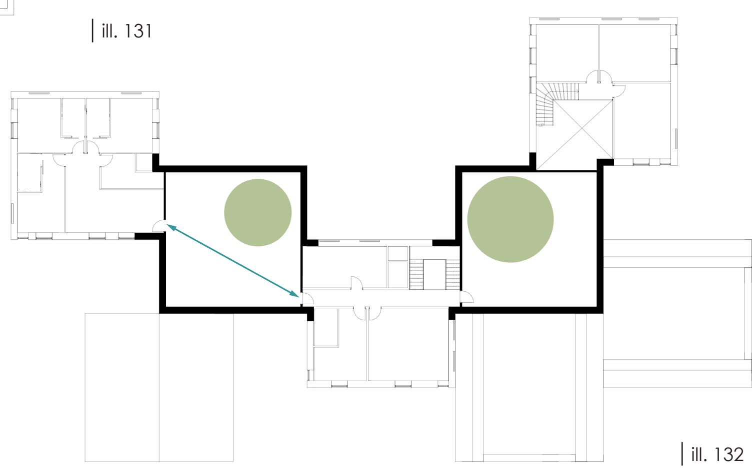
Having the atrium functioning as the pathway of the building the accessibility of the different floors are important to keep a simple flow between the living units, administration and common facilities.



ill. 130



ill. 131

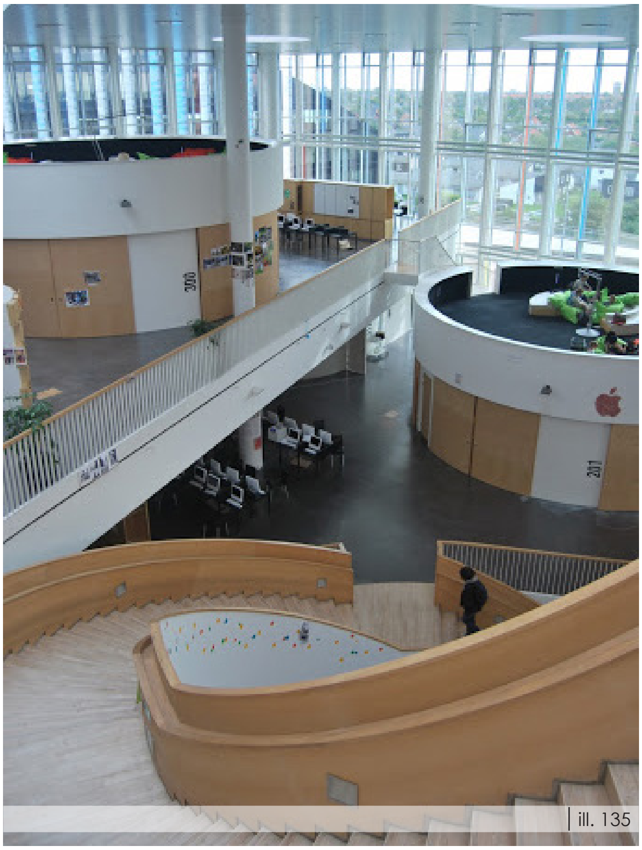


ill. 132

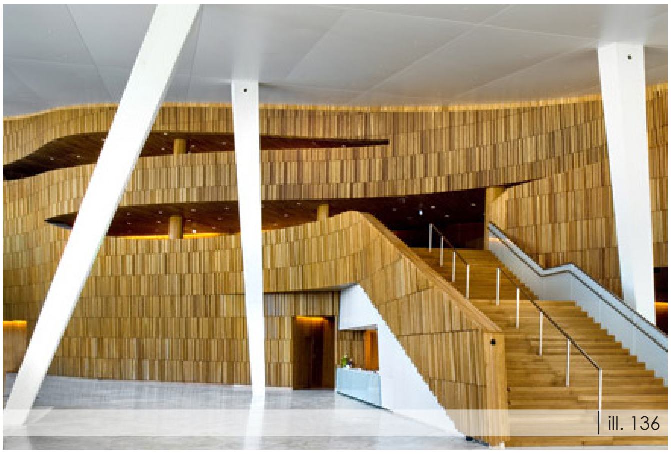
STAIRWAY AS AN ELEMENT

To underline that the atrium has another function than the other houses in the children's home, it was worked with the stair as an element in the room. By having this element to separate the room and to make small-enclosed spaces, giving the feeling and sense of the room is differentiated from the living spaces and rooms, giving another character to the atrium.

The pictures are to underline how this element can be used, and how tit can divide the spaces and add character to the room.



ill. 135



ill. 136

ill. 134

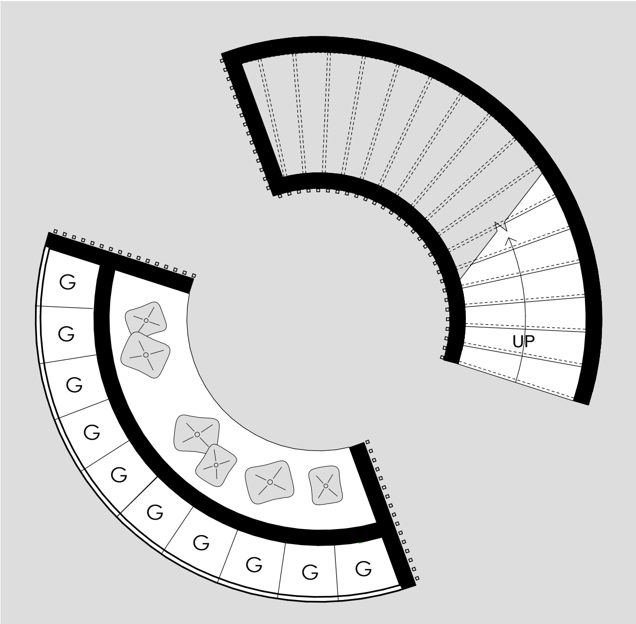
ill. 133

STAIRS IN ATRIUM

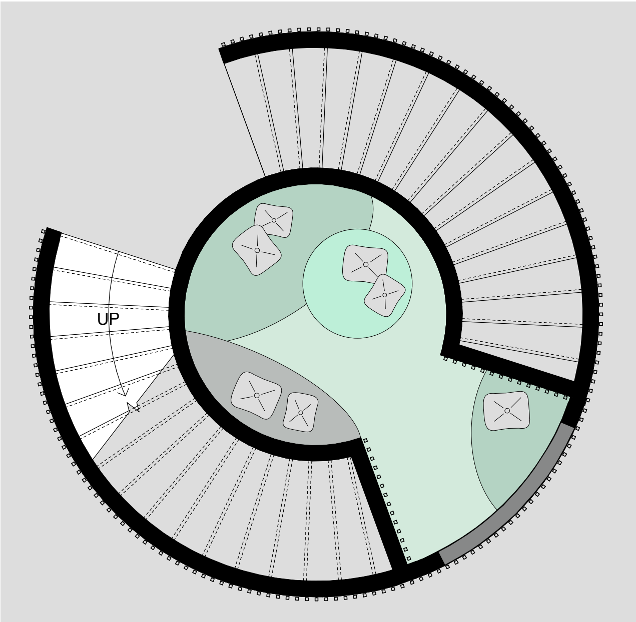
Both atriums have an element standing in the room dividing it and creating smaller areas around the element. The element is containing the stairs to the different levels in the atrium, but is at the same time functioning as an element, where the children can have corners to sit and hang out with their friends. Some parts of the elements are closed of to create caves, where the children can play or make oneself comfortable away from curious eyes. To get to these caves inside the element, the children have to climb through these cracks in the elements, which are different from cave to cave.

The elements are going to be made in wood with lamellas, which creates a contrast to the concrete wall inside the atrium. The round elements with stairs gives a feeling of walking up a tower, which where one of the wishes the children had if they should design the children's home by themselves.

During the design process the elements were evolved from being made in concrete to being made in wood. The illustrations showing the two different plans shows elements made in concrete with wooden lamellas on the outside.



| ill. 137



| ill. 138

ill. 139

06

TECHNICAL DETAILING

CONSTRUCTION

This chapter of the report is going to clarify the basis statistic behind the construction. Because of the size of the building, selected parts will be discussed and detailed, which includes the load bearing principle, building elements and type of building.

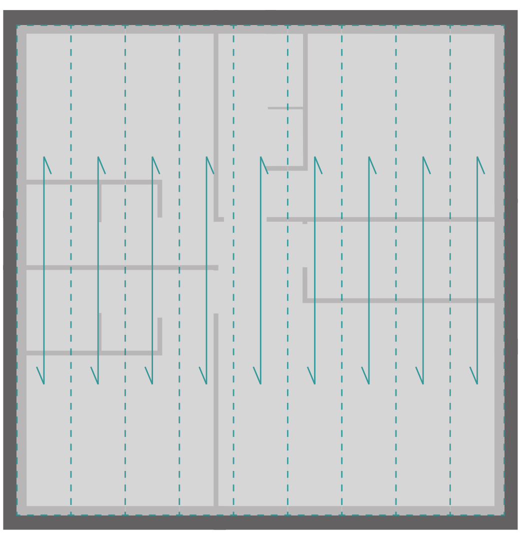
Type of building

The building is constructed with heavy external walls, existing of a heavy inner concrete wall with a lightweight outer leaf.

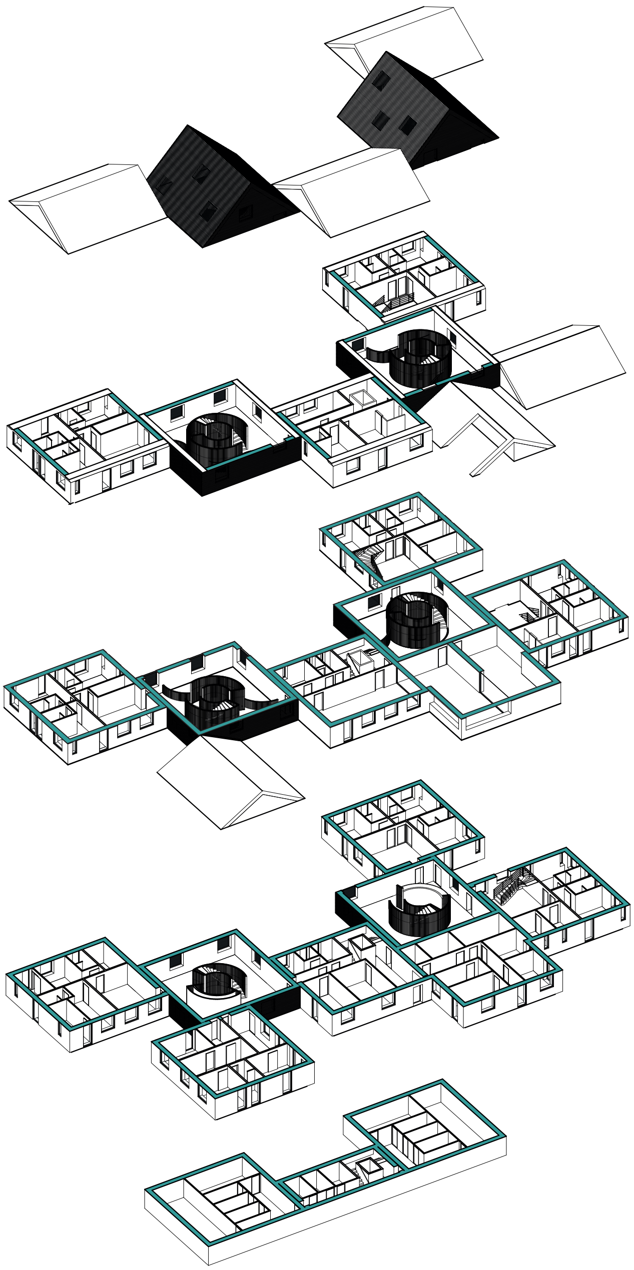
It is chosen to use Spæncom's Spanmax slabs called PX18. The slabs are made in reinforced concrete and have a length at 10,3 meter, a width at 1,2 meter and a height at 0,18 meter.

The load bearing principle

To make sure the building does not collapses, it is important to ensure stability. As seen at the illustration, all external walls are load bearing. The heavy concrete part of the external walls are the bearing elements, which carries the load of the reinforced concrete slabs, however the slabs are also supported by some of the internal walls in the building.
The external walls are creating frames at 10 meters x 10 meters which is seen as enough to create stability to the building, when the slabs are keeping them together.



ill. 140



ill. 141

Building elements

The Danish Building Regulations has set up some rules about transmission losses through building elements. To make sure the external walls, ground deck, roof construction and windows come up to these regulations the transmission coefficients have been calculated and compared to the Danish Building Regulations demands. [Bygningsreglementet.dk, 2013]

Comparison of transmission coefficients

	BR10	Project
Windows	< 1,40	0,87 – 1,03
Ground deck	< 0,10	0,066
Roof construction	< 0,10	0,076
External walls	< 0,15	0,099

The presented transmission coefficients (U-values) have been calculated as the following example. The rest of the calculations are found at the enclosed CD.

Transmission coefficient

The U-values are used when the thermal performance of the building envelope should be found through calculations in Be10.

A useful rule of thumb is that the higher a U-value the worse the thermal performance of the building envelope is. Conversely a low U-value indicates that the materials have a high insulating power. [architecture.com, 2013]

The thermal resistance: $R = d/\lambda$

Where:

R = The thermal resistance for the separate layers in W/m2 K

d = The thickness of the material in m

λ = The thermal conductivity for the material in W/m K

Calculating the U-value: $U = 1/\Sigma(R)$

Where:

U = The measure of heat loss in a building ele ment W/m² K

Σ = The sum of the different materials thermal resistance in a building element

Example of U-value calculation

First the thermal resistance of each material in the wall was calculated:

$R_{zinc} = d/\lambda = 0{,}001\text{m}/116\ \text{W/m K} = 0{,}0000086\text{W/m}^2\ \text{K}$

$R_{laths} = d/\lambda = 0{,}012\text{m}/0{,}13\ \text{W/m K} = 0{,}092\text{W/m}^2\ \text{K}$

$R_{batten} = d/\lambda = 0{,}048\text{m}/0{,}13\ \text{W/m K} = 0{,}369\text{W/m}^2\ \text{K}$

$R_{laths} = d/\lambda = 0{,}012\text{m}/0{,}13\ \text{W/m K} = 0{,}092\text{W/m}^2\ \text{K}$

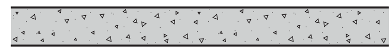
$R_{insulation} = d/\lambda = 0{,}300\text{m}/0{,}032\ \text{W/m K} = 9{,}375\text{W/m}^2\ \text{K}$

$R_{concrete} = d/\lambda = 0{,}150\text{m}/0{,}8\ \text{W/m K} = 0{,}188\text{W/m}^2\ \text{K}$

Then the u-value of the exterior wall is found:

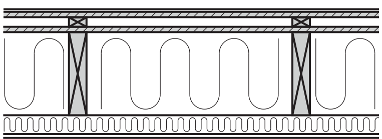
$U_{ext.\ wall} = 1/\Sigma(R) = 1/\ 10{,}116\ \text{W/m}^2\ \text{K} = 0{,}099\ \text{W/m}^2\ \text{K}$

Architectural detailed building elements



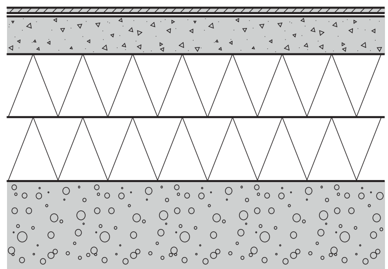
Internal wall

Description	□ [W/(mK)]	[mm]
Concrete		150



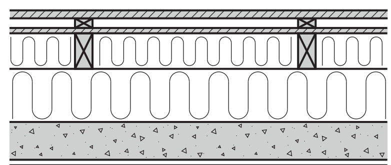
Roof, zinc

Description	□ [W/(mK)]	[mm]
Zinc	116	1
Laths	0,13	12
Batten (48x48)	0,13	48
Laths	0,13	12
Insulation/Rafter	0,032	350
Insulation/Batten	0,032	50
Plaster board (2x13)	0,25	26
Total dimension		499
U-value: 0,076 W/m2 K		



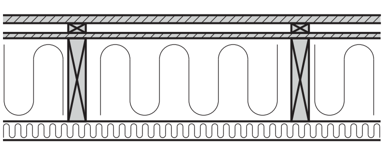
Ground deck

Description	□ [W/(mK)]	[mm]
Wooden floor	0,13	22
Concrete/		
20 mm heat pipes	0,8	50
Reinforced concrete	0,8	180
Sundolit (insulation)	0,034	500
Capillary break layer		150
Total dimension		902
U-value: 0,066 W/m2 K		



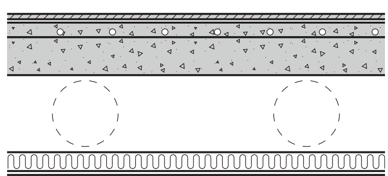
External wall, wood

Description	□ [W/(mK)]	[mm]
Batten	0,13	13
Batten 48 x 48	0,13	48
Laths	0,13	12
Insulation	0,032	300
Concrete	0,8	150
Plaster board	0,25	13
Total dimension		356
U-value: 0,098 W/m2 K		



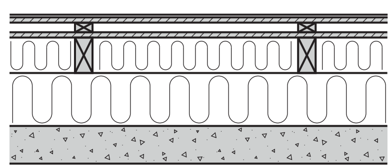
Roof, wood

Description	□ [W/(mK)]	[mm]
Batten	0,13	13
Batten 48 x 48	0,13	48
Laths	0,13	12
Insulation/Rafter	0,032	350
Insulation/Batten	0,032	50
Plaster board (2x13)	0,25	26
Total dimension		499
U-value: 0,076 W/m2 K		



Deck

Description	□ [W/(mK)]	[mm]
Wooden floor	0,13	22
Concrete/		
20 mm heat pipes	0,8	50
Reinforced concrete	0,8	180
Suspended ceiling		300
Insulation/Batten	0.032	50
Plaster board (2x13)	0,25	26
Total dimension		628



External wall, zinc

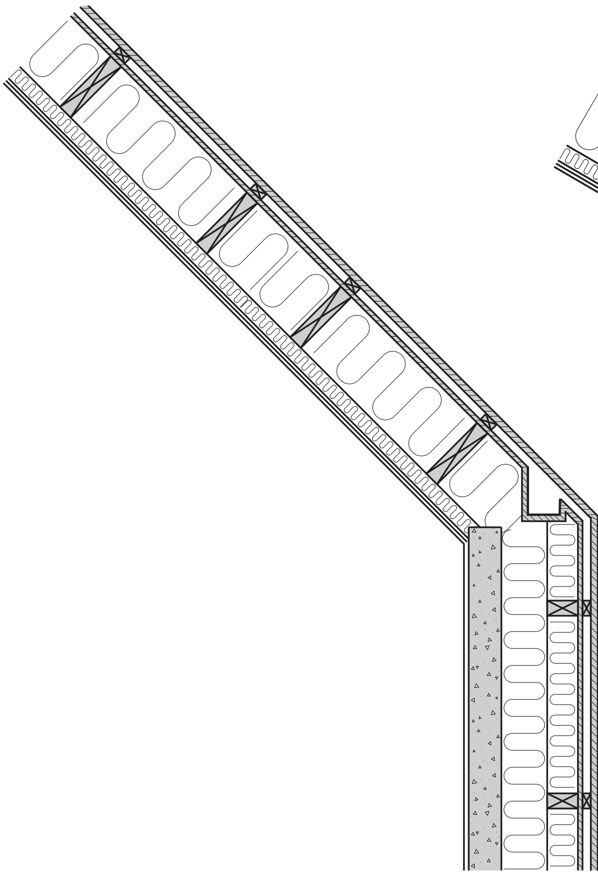
Description	□ [W/(mK)]	[mm]
Zinc	116	1
Laths	0,13	12
Batten 48 x 48	0,13	48
Laths	0,13	12
Insulation	0,032	300
Concrete	0,8	150
Plaster board	0,25	13
Total dimension		356
U-value: 0,098 W/m2 K		

ill. 142

ROOF DETAILING

There was made an architectural detailing on how to place the gutters in the roof of the wooden roof and on the zinc roof.

To underline the sharp shape of the building. Having external gutters would give the building another expression than intended. Therefore there were made a detail on how to place the gutters in the different roof types.



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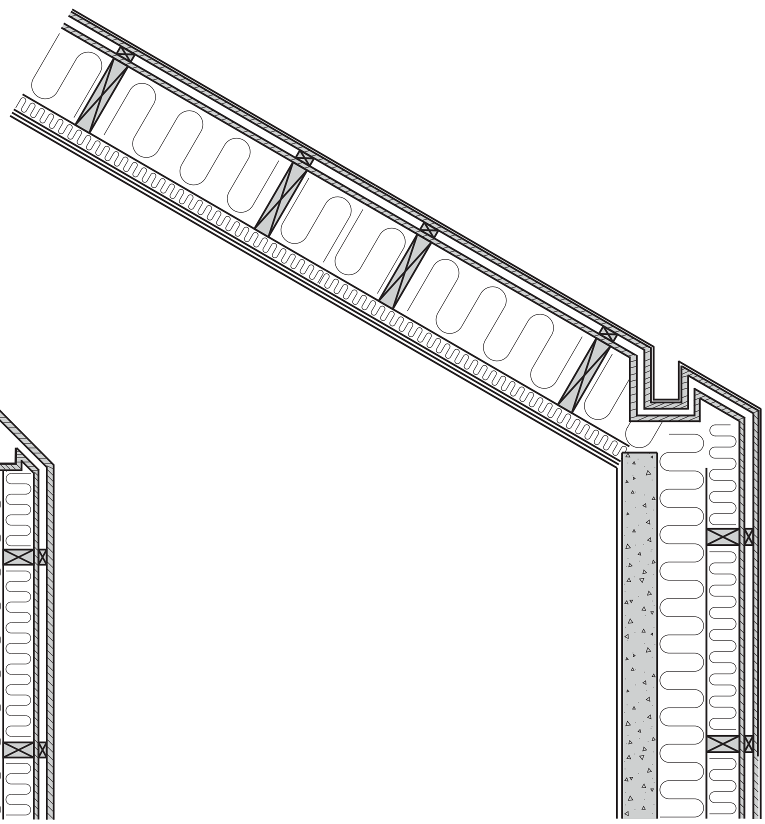


| ill. 144

The wooden roof

To keep the expression of the building the gutters was placed under the wooden lamellas. Making the water run under the wooden lamellas, and thereby protecting the wood from constant contact with the water. The materials that are used under the wooden lamellas are felt roofing. The roof slope of the wooden roof is 45 degrees. See ill. 143

The zinc roof

The zinc material is used to continue from the roof into the gutter and into the facade, the gutter is placed lowest on the roof slope to hide the gutter when looking on the facade. The roof slope of the zinc roofs is 30 degrees. See ill. 144

VENTILATION STRATEGY

The overall ventilation strategy is based on mechanical ventilation supplemented by natural ventilation during the summer period (May-August), which will help avoid overheating in the period.

The purpose by mechanical ventilation is to obtain a good indoor air quality, but at the same time minimize the heat loss from ventilation by using heat recovery.

Air Quality

It is decided to fulfil the minimum air change according to the Building Requirements of 2010, where the air has to be changed by 0,3 l/s pr. m^2 during the heating season (September-April) to keep the energy consumption on a minimum in this period. During the summer period an air quality in category A, where only 15% are dissatisfied according to CR1752 will be aimed at by using natural ventilation as a supplement to the mechanical ventilation.

The air change has been calculated according to BR2010, CO_2 concentration and sensory pollution fulfilling category A.

The sensory pollution is the worst case, which decide the air change to keep a satisfying indoor air quality in the building, fulfilling category A.

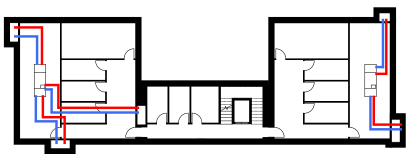
Mechanical ventilation

Mechanical ventilation can be divided into two different kinds of ventilations, mixing ventilation and displacement ventilation. In this case mixing ventilation has been chosen, where the outgoing air is heating up the ingoing air, which will influence the energy consumption in a positive way, because there is used a smaller amount of energy to heat up the ingoing air.

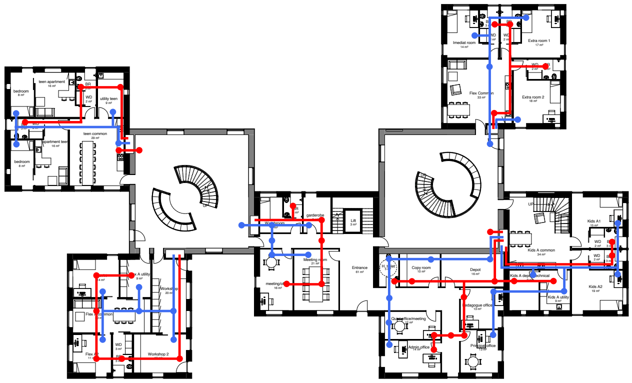
Even though the ingoing air is heated up, it is important to mention, that the mechanical ventilation is not used for heating up the building. The incoming air is not warm enough to heat up the building and there will be a too big energy consumption to heat up a building in this way. Therefore the building is heated up by district heating.

To make sure the mechanical ventilation is not used without any thoughts on the use of the room and therefore is using a lot of energy, the system is created to adjust the air change according to the sensory pollution of the room. When there is no one in the room, the mechanical ventilation is changing the air change to a minimum.

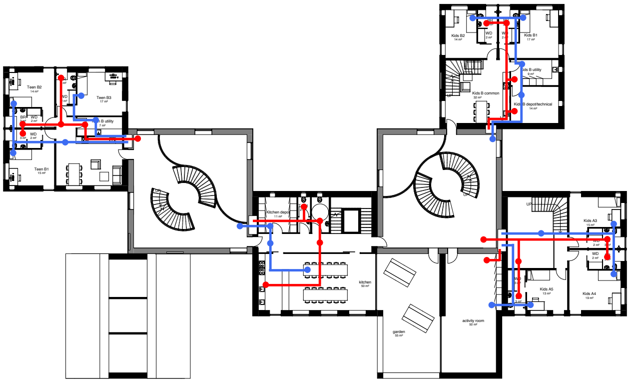
	Area	Volume	Occupants	Air change CO2	Air change BR2010	Air change Sensory pollution
Room	14m^2	35m^3	1	1,18h^{-1}	0,43h^{-1}	3,09h^{-1}
Living room	32m^2	210m^3	6	1,18h^{-1}	0,16h^{-1}	2,10h^{-1}
Atrium	100m^2	1050m^3	10	0,39h^{-1}	0,10h^{-1}	0,88h^{-1}
Average				0,92h^{-1}	0,23h^{-1}	2,02h^{-1}



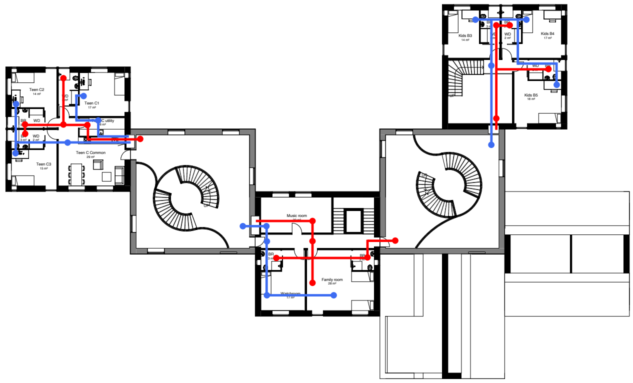
Basement



Groundfloor



1st floor



2nd floor

| ill. 145

Ventilation Aggregate

To make sure the space required for the technical rooms are having the necessary size to contain both the ventilation aggregate and other technical devices the space has been estimated. The basement has two technical rooms at 35m^2 each.

The building has two technical rooms in the basement and is going to have two ventilation aggregates. It is chosen to use an aggregate called Exhausto VEX270-1, which has a capacity on 1300-7500m^3/h. [exhaust.dk]

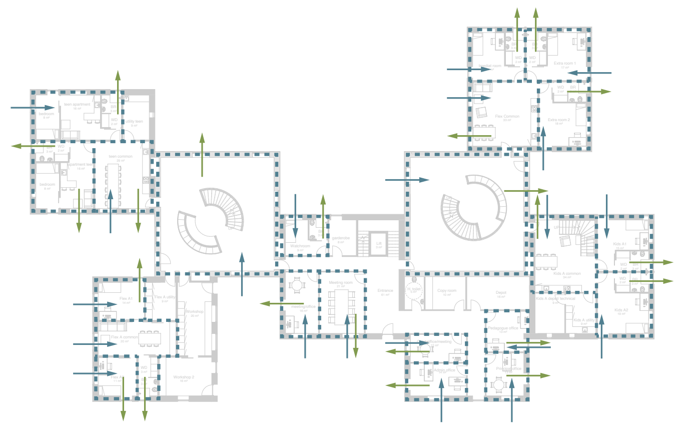
If the basis air change has to be 2,0h^{-1} each aggregate has to be able to change 5825m^3/h. This gives the possibility of reaching a peak performance approximatly 30% higher than the basis air change in the building, which is seen as sufficient.

Natural ventilation

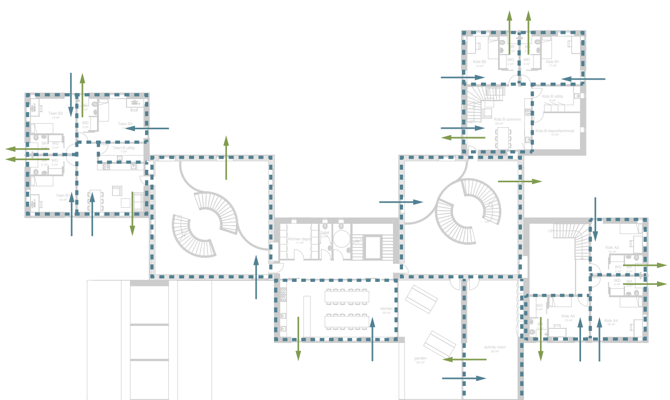
In the summer period (May-September) using natural ventilation minimizes the energy consumption. Natural ventilation is used as a supplement to mechanical ventilation in all possible rooms, except basement, depots, cleaning rooms and utility rooms etc.

In the rooms where the air has to be changed by natural ventilation the principles varies and it is therefore not possible to use the same ventilation principle. The ventilation principles used are respectively single-sided ventilation and cross ventilation. The air is getting into the room through the upper part of the windows, which is mechanically controlled to open to prevent overheating, also when there are no occupants in the room.

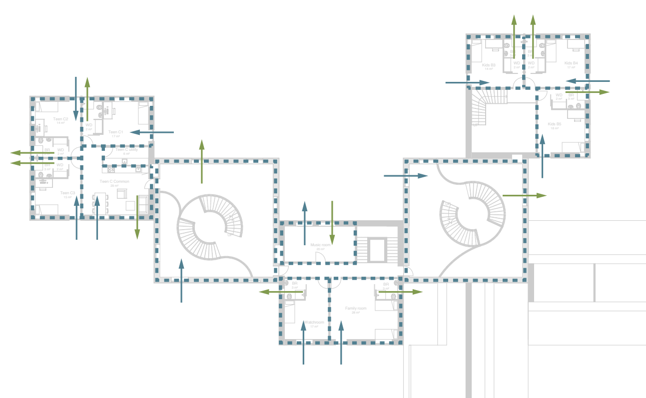
Ventilation aggreate	Exhausto VEX270-1
Height [mm]	1905
Width [mm]	1525
Lenght [mm]	2050
Weight [kg]	734
Capacity [m^3/h]	1300 - 7500
Effect [kW]	6,1
Heat recovery [%]	> 90



Groundfloor



1st floor



2nd floor

| ill. 146

THERMAL ENVIRONMENT

Bsim

Bsim is used to simulate the indoor climate in the teen atrium, to get an idea of the indoor climate, in terms of overheating, air change and CO_2 pollution of the space.

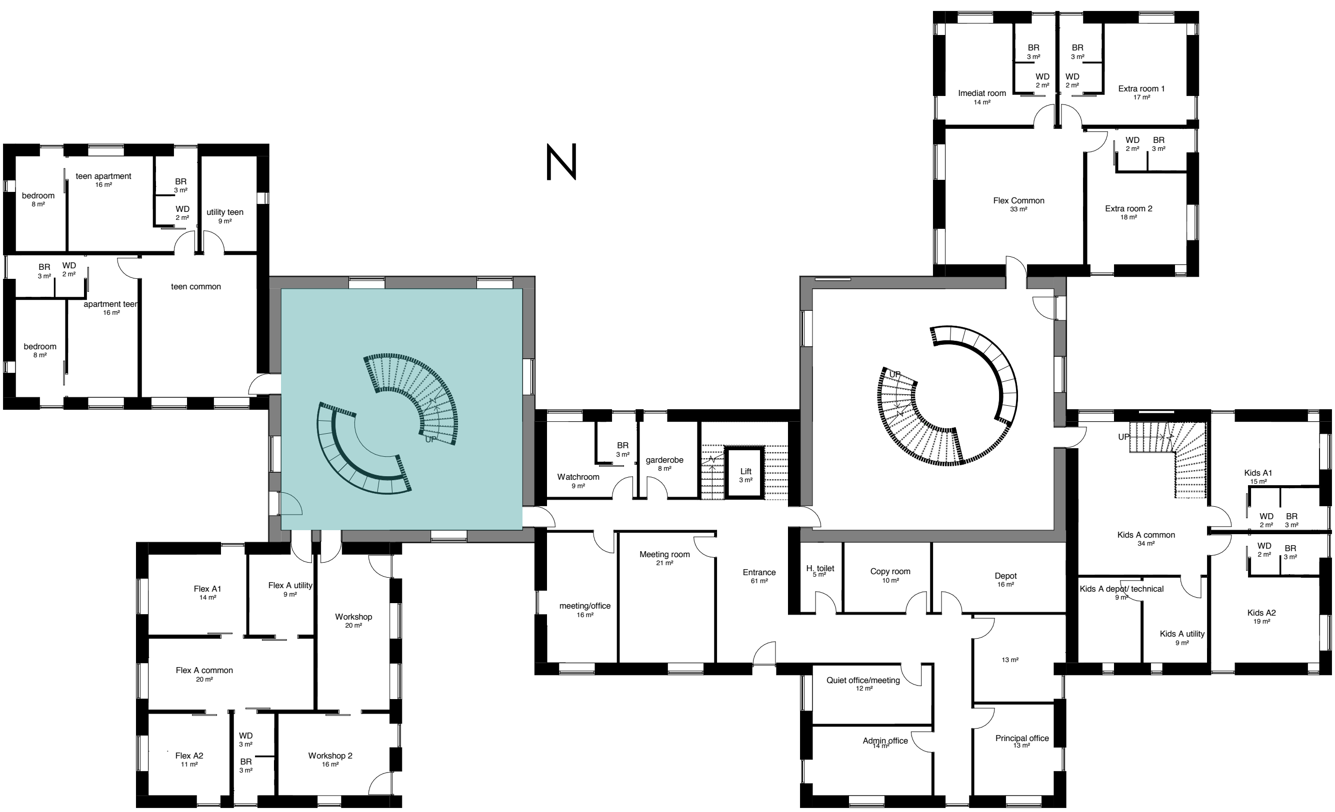
As mentioned in the ventilation strategy chapter, there is used mechanical ventilation during the winter period and in the summer period, it is been supplemented by natural ventilation.

There was a wish of having the minimum temperature of 20°C in the winter period and in the summer period having a higher temperature, following the outdoor temperatures, but still not having more than 100 hours above 26°C and 25 hours above 27°C (CR1752).

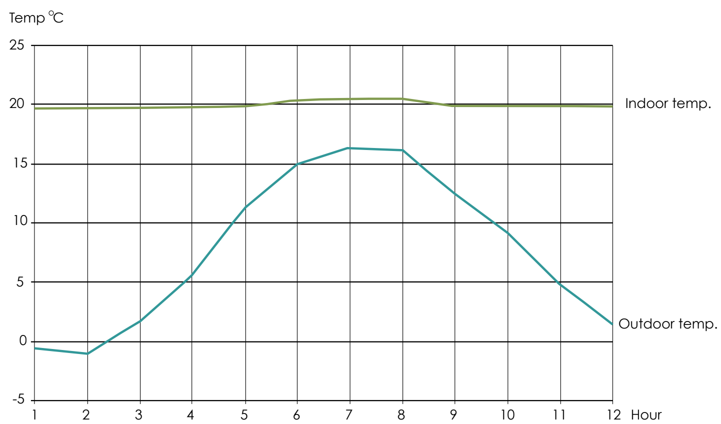
There was build a simplified model of the atrium in the Bsim program, adding windows and orientations, along with materiality to the construction and windows.

The systems added where: heating, infiltration, people load, equipment, ventilation, venting (see appendix for system loads)

There are made annual simulations to see the temperatures indoor and outdoor and a simulation to see the CO_2 pollution over a year.



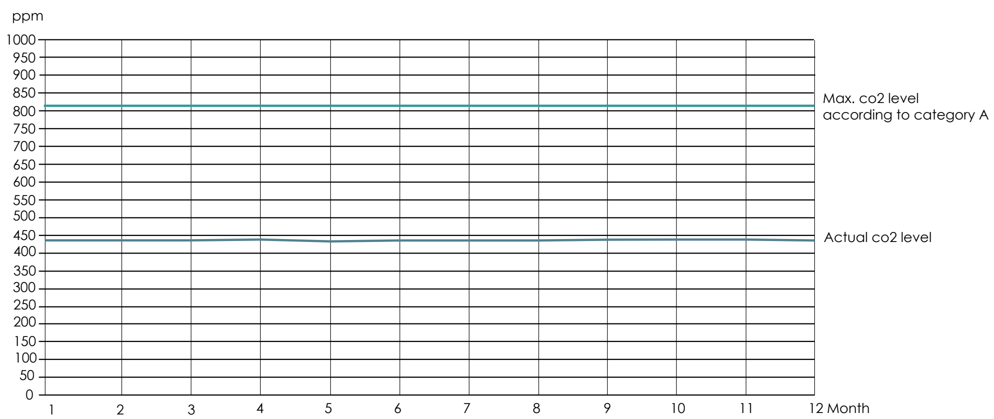
| ill. 147



| ill. 148

Temperatur during the year

The temperatures are showing that there is no over-heating in the atrium at an annual basis. And that there in the months from January to April are a heating need of the building, having the temperature set on 20°C, and again from September to December the building are being heated.



| ill. 149

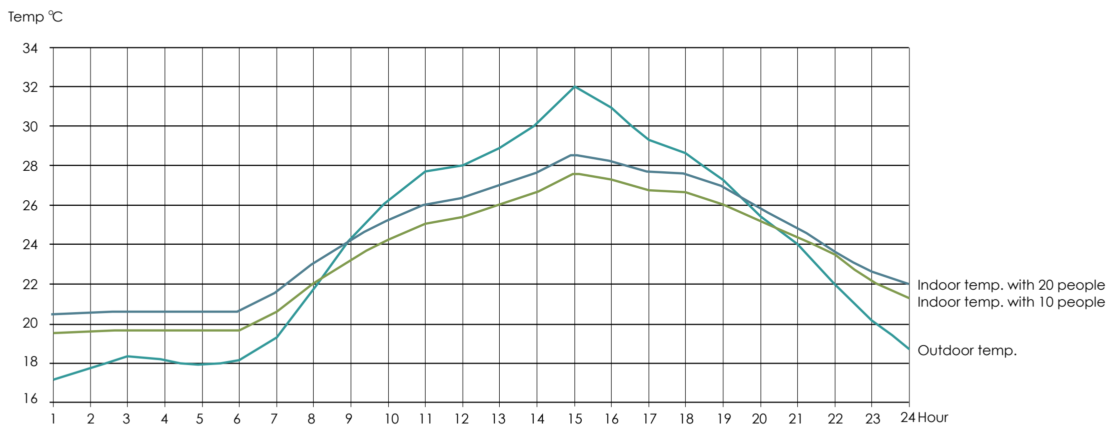
CO_2 level during the year

The CO_2 level is on a low level, being stable over the year, and below the allowed 900ppm that are set from the Building Requirements and also below the 810ppm required from Cr1752 category A, that are the one that are being followed as mentioned in the ventilation strategy.

To see if there are periods of the year where the atrium are having a to high air change, CO_2 level or the temperatures are rising, the hottest day of the year was tested.

The 1st of August was according to Bsim the hottest day in the simulation year. And therefore there was made simulations on air change, CO_2 and temperatures on that day.

There was made a stress test on the same day to get an indication on the impact of having a people load on 10 people to an impact on 20 people. And how it effects the air change, the CO_2 pollution and the temperatures of the atrium during that day.

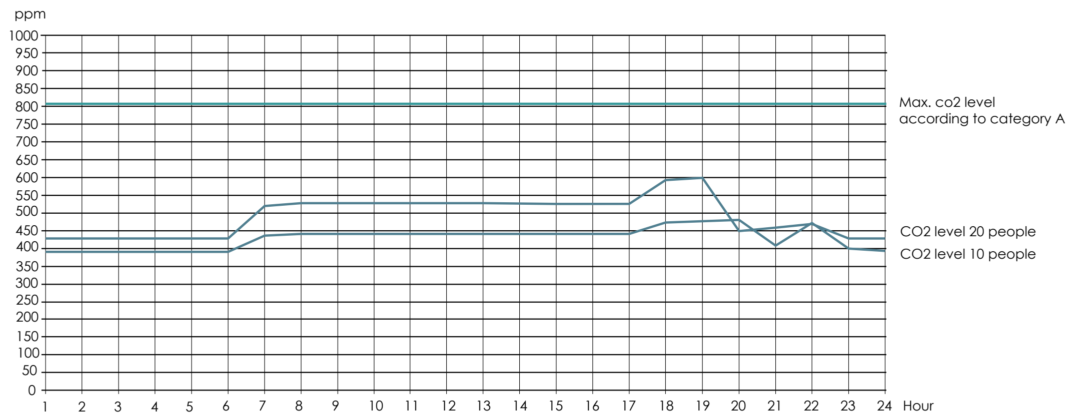


| ill. 150

Temperature warmest day a year

To compare the indoor temperature of the hottest day with having a people load on 10 people and a people load on 20 people, it shows that the indoor temperature is rising when adding more people to the atrium with the same day profile as the 10 people (see system loads on CD).

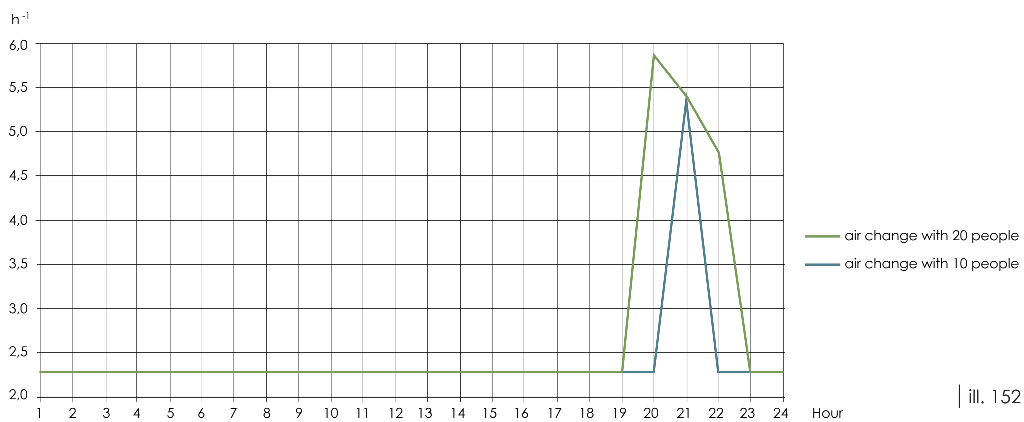
The indoor temperature are in the time when the sun is up below the outdoor temperatures, because of the permanent shutters that are added on all the window of the atrium as a part of the architectural expression of the atrium.



| ill. 151

Co_2 pollution warmest day a year

To test out if the CO_2 pollution are raising above the allowed according to the category A requirements , when adding more people to the room, the CO_2 simulations have been done to compare the pollution of the different people loads of the atrium.
As assumed the ppm rate was raising when adding more people to the atrium, but it is still below the allowed 810ppm.



| ill. 152

Air change warmest day a year

When having a higher pollution rate it would be assumed that the air change rate would increase according to the pollution rate. The air change peaks in the hours where the people load are at a 100% both when having 10 people and 20 people in the atrium. But when having the stress load of 20 people the air change gets higher to ventilate according to the CO_2 pollution.
It can be concluded that there are no overheating or problems with the CO_2 pollution in the atrium used for simulation.

But when adding additional 10 people to the atrium the temperature increases and the CO_2 pollution also increases but it is still being below the allowed 810ppm.

It can be disused if the air change and the demands for CO_2 pollution should be minimized and thereby having a lower category than A in the atrium when we are having a large volume and a low people load in the atrium during the day.

ENERGY OPTIMIZATION

The aim of the project of the children's home was to fulfil the requirement of the Building Regulations of 2020. The program Be10 was used to determine the energy consumption of the building.

As mentioned in the chapter ventilation strategy, it was chosen to follow the minimum requirements of the Building Regulations of 2010 according to air change of the building in the winter period, and to ventilate according to category A (CR1752) in the summer period using natural ventilation.

By using this ventilation strategy the building are fulfilling the requirements and the Be10 are showing that the building are below the demands of 2020 Building Regulations without using any energy producing initiatives.

Building information

Brutto area: 2562m^2
Heat capacity: 120Wh/K m^2
Time of use: 168 hours/week

Heat supply: District heating

Benefit from other sources:

Solar heat:	0,0 Wh/m^2 pr. year
Heat pump:	0,0 Wh/m^2 pr. year
Solar cells:	0,0 Wh/m^2 pr. year
Wind generator:	0,0 Wh/m^2 pr. year

Energy frame 2020	20kWh/m^2 pr. year
Total energy frame:	19,2 Wh/m^2 pr. year

Contribution to the energy need

Heath	20,0 Wh/m^2 pr. year
Electricity for building operation	4,0 Wh/m^2 pr. year
Overheating	0,0 Wh/m^2 pr. year

Netto need

Room heating	5,9 Wh/m^2 pr. year
Domestic hot water	11,3 Wh/m^2 pr. year
Cooling	0,0 Wh/m^2 pr. year

Heat loss from installations

Room heating	2,9 Wh/m^2 pr. year
Domestic hot water	2,1 Wh/m^2 pr. year

Selected Electricity need

Lightning	0,0 Wh/m^2 pr. year
Heating of room	0,0 Wh/m^2 pr. year
Heating of VBV	0,0 Wh/m^2 pr. year
Heat pump	0,0 Wh/m^2 pr. year
Ventilator	3,9 Wh/m^2 pr. year
Pumps	0,1 Wh/m^2 pr. year
Cooling	0,0 Wh/m^2 pr. year
Total electricity use	34,7 Wh/m^2 pr. year

Total heat loss

transmission loss	25,9 kW =10,1 W/m^2
ventilation loss without vgv	36,7 kW =14,3 W/m^2
total loss:	62,6 kW =24,4 W/m^2
ventilation loos including vgv	11,4 kW = 4,5 W/m^2
total loss:	37,3kW = 14,6W/m^2

To get and indication of the category A requirements are a realistic scenario for this building, there was done a second Be10 to show what the energy consumption would be, and what energy producing initiatives there should be integrated to fulfil the requirements of the category A air change.

It can be concluded that the building are fulfilling the

Building information

Brutto area: 2562m^2
Heat capacity: 120Wh/K m^2
Time of use: 168 hours/week

Heat supply: District heating

Benefit from other sources:

Solar heat: 0,0 Wh/m^2 pr. year
Heat pump: 0,0 Wh/m^2 pr. year
Solar cells: 21,5 Wh/m^2 pr. year
Wind generator: 0,0 Wh/m^2 pr. year

demands of the 2020 requirements both having the minimum requirements of the Building Regulations and the category A air change requirements, but having to integrate solar panels when fulfilling the category A requirements.

The decision of having a category A air change quality or ventilating according to the minimum requirements, will be up to a developer to decide, what their demands would be for the children's home.

Energy frame 2020 20kWh/m^2 pr. year

Total energy frame:	20,0Wh/m^2 pr. year

Contribution to the energy need

Heath	36,5 Wh/m^2 pr. year
Electricity for building operation	20,4 Wh/m^2 pr. year
overheating	0,0 Wh/m^2 pr. year

Netto need

Room heating	22,4 Wh/m^2 pr. year
Domestic hot water	11,3 Wh/m^2 pr. year
Cooling	0,0 Wh/m^2 pr. year

Heat loss from installations

Room heating	2,9 Wh/m^2 pr. year
Domestic hot water	2,1 Wh/m^2 pr. year

Selected Electricity need

Lightning	0,0 Wh/m^2 pr. year
Heating of room	0,0 Wh/m^2 pr. year
Heating of VBV	0,0 Wh/m^2 pr. year
Heat pump	0,0 Wh/m^2 pr. year
Ventilator	20,3 Wh/m^2 pr. year
Pumps	0,1 Wh/m^2 pr. year
Cooling	0,0 Wh/m^2 pr. year
Total electricity use	51,1 Wh/m^2 pr. year

Total heat loss

transmission loss	25,9 kW =10,1 W/m^2
ventilation loss without vgv	160,4 kW = 62,6 W/m^2
total loss:	186,3 kW = 72,7 W/m^2
ventilation loos including vgv	30,0 kW = 11,7 W/m^2
total loss:	55,9 kW = 21,8 W/m^2

FIREPROOFING

Application category

Following the Danish building regulations the application category are determined to the category 4 [BR10,5.1.1 Anvendelseskategorier]. The application category are determined for;

"A building for night stay, where the people that are staying in the building have knowledge to the buildings escape routes and are capable of bringing themselves to safety" [BR10,5.1.1 Anvendelseskategorier].

Application category 4 covers; block of flats, youth housing, single-family house, twin-houses, terraced houses, linked houses, cluster housing and holiday homes.

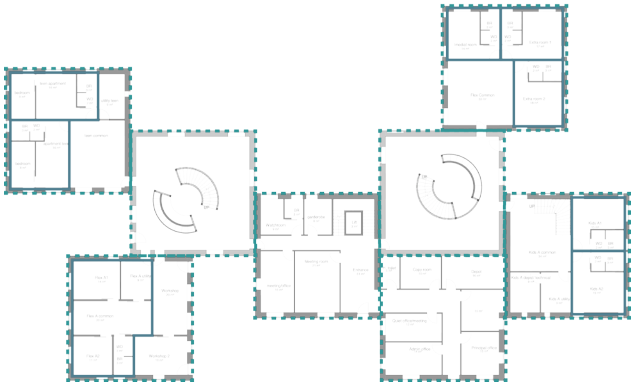
By that definition the children's home are categorised to be an overnight stay, where the users are able to bring themselves to safety and are having knowledge of the building. The building mass can be seen as linked houses.

Fire sections

The children's home is divided into eight fire sections. Illustration 153-155 Shows how the fire sections are divided. The main principle is to have each "house" as a fire section, to separate the living units from each other.

Fire cells

Each fire section is divided into fire cells where the rooms are separated. The illustrations 153-155 is showing the fire cells in the children's home.



Groundfloor | ill. 153

1st floor | ill. 154

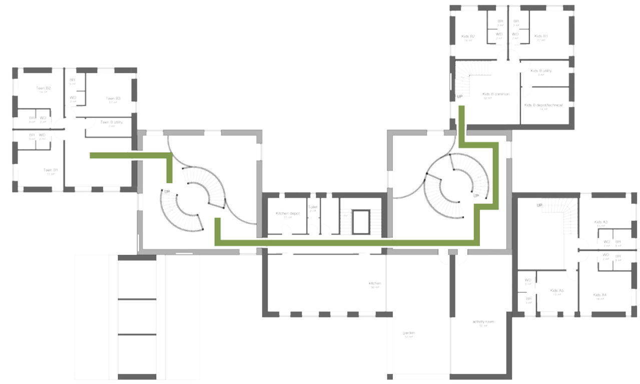
2nd floor | ill. 155

Escape routes and rescue opening

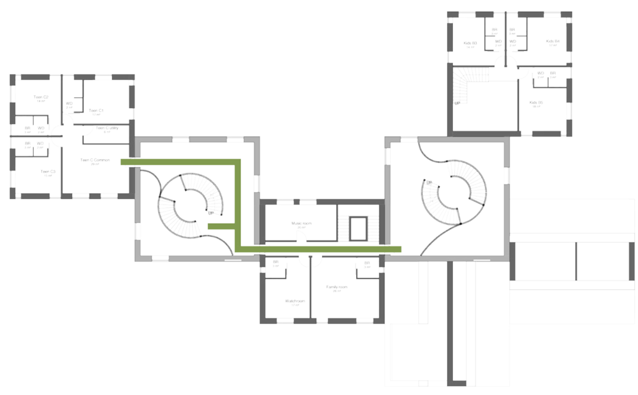
The escape route strategy used in the children's home is presented at the illustrations

In each children's room there are made a rescue opening, following the regulation of 2010 about rescue openings [bygningsreglementet 2010, 5.2 stk. 7, redningsåbninger], where the window going from floor to ceiling is used as a rescue opening.

Groundfloor | ill. 156



1st floor | ill. 157



2nd floor | ill. 158

07

PRESENTATION

INTRODUCTION

On the basis of the design process the results will be presented in this part of the report. The project VoresHjem will be presented from the urban scale with the context and the outdoor areas and move down in scale to the individual children's rooms.

As the atriums are an important part of the children's home, these has been detailed more specific than some of the other common facilities.

Also the living units and the children's rooms are being pointed out to enhance the importance of the private and public spaces of the home.

The private entrance to the teen atrium. Having the teen rooms and living units to the left, and the flex apartment to the right of the entrance.

The outdoor area is a part of the large area to the west of the building, which are the most private part of the outdoor spaces on the site.

ill. 159

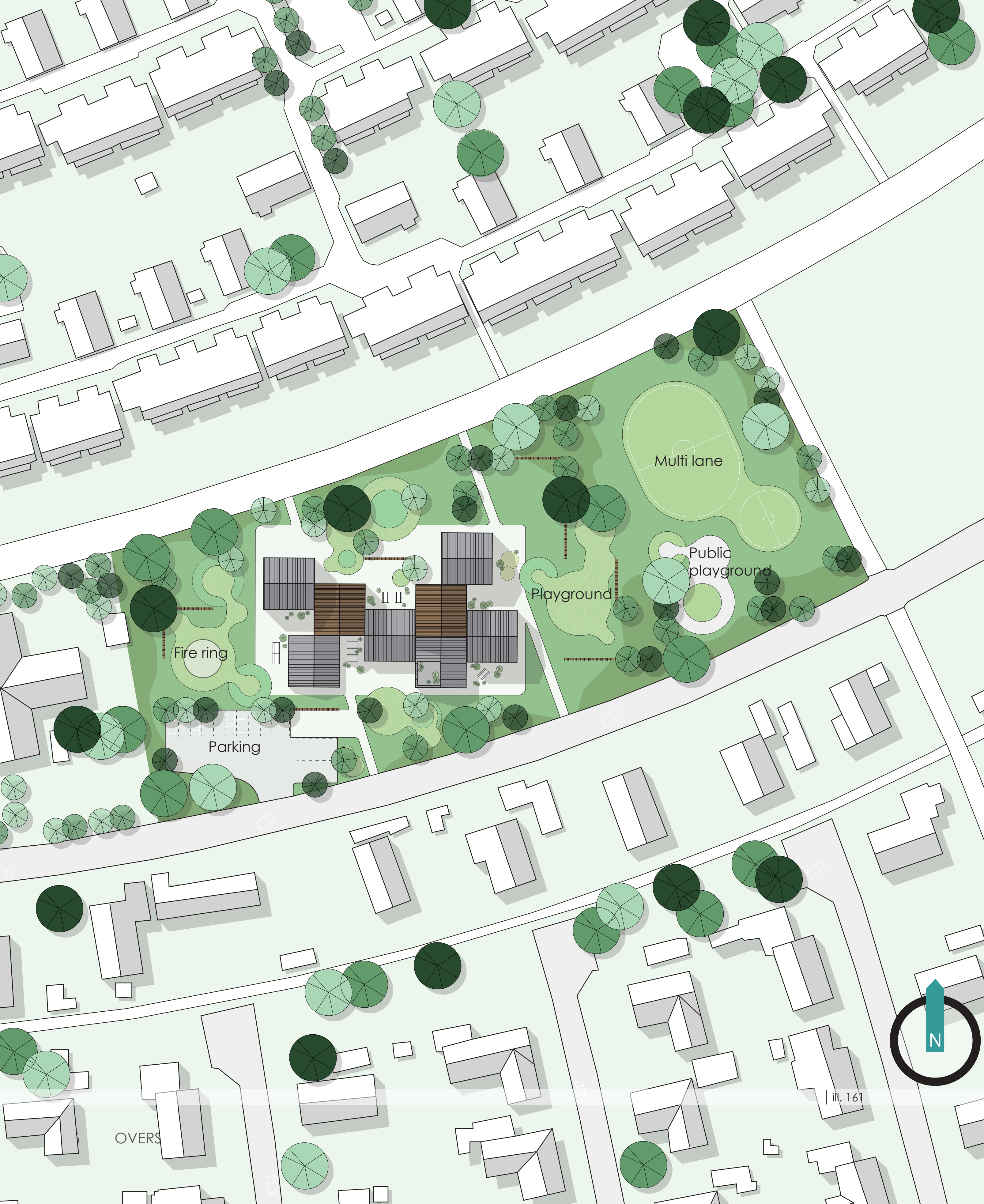
SITE PLAN

As mentioned the site is divided into a private area and a public area to give a social meeting point to the neighbourhood around the children's home.

The private area is placed to the left of the building, where the site are closed of towards the pathway to the north, giving the area a more private character.

To the right the more public part of the site is found, where there are a multi lane, playground and large open areas that are inviting people in when going on the pathways around the site.

ill. 160

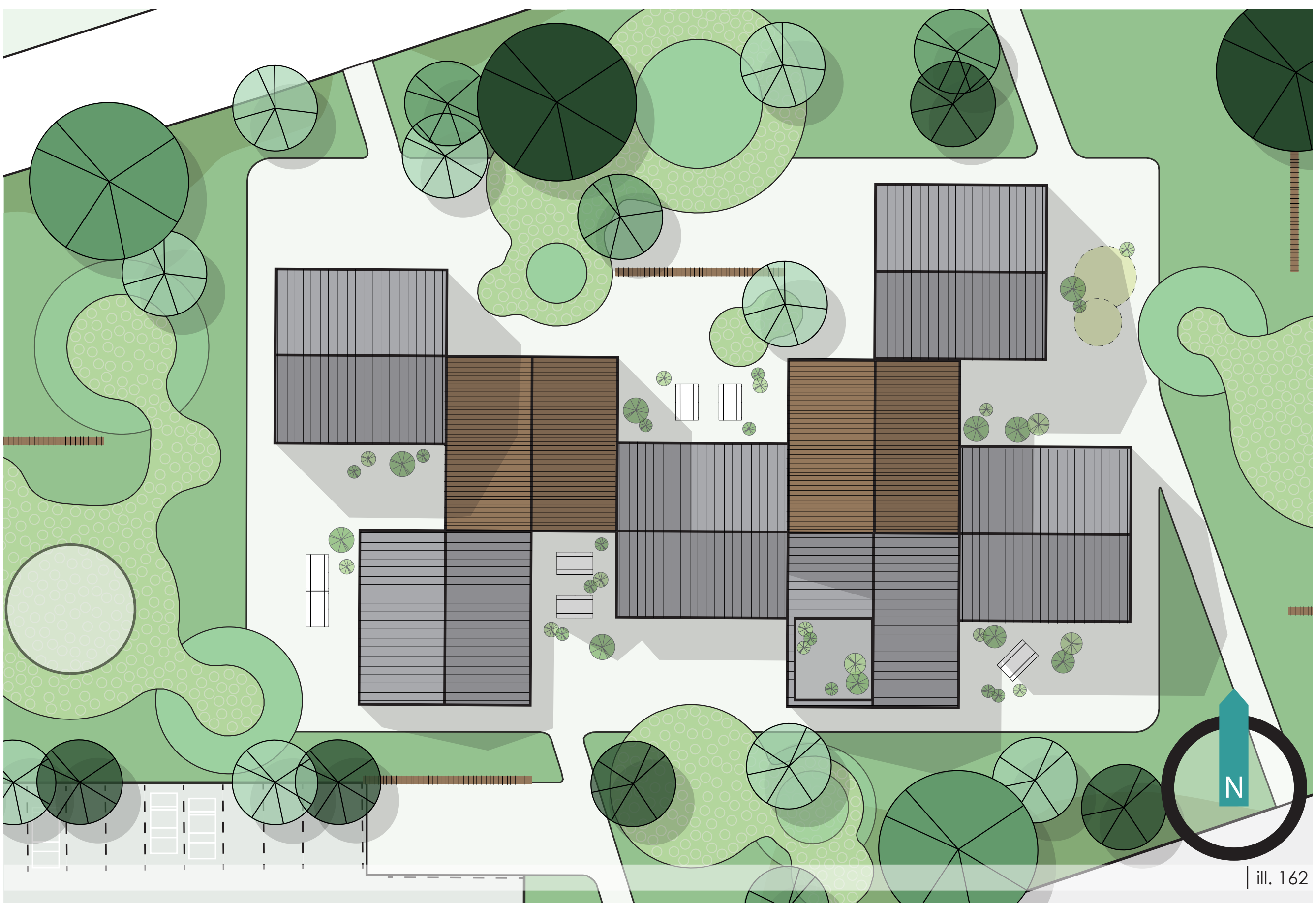

Multi lane
Public playground
Playground
Fire ring
Parking
N

ill. 161

When zooming in on the site, the use of the different areas of the site is becoming visible. There are made "walls" using trees and wooden walls that are referring to the atrium of the children's home, these are made to divide the site into more closed of spaces, by adding these boundaries, which are creating smaller intimate spaces, where the children can play and make caves and so on.

It has been the intention to use the grid when placing the walls and trees to get a controlled expression. All structures such as playgrounds, pathways and flower beds are having a more organic expression, to soften up the grid.

Looking close at the site plan around the building, it is seen that there are made terraces with both private closed of areas and areas where the children can play.



ill. 162

The children's home seen from Southwest, having the different heights of the building volumes, and the terraces in front of the building

ill. 163

FACADES

There a kept a clear an simple expression of the facades, having the contrast between the wood and the zinc facing on the different volumes. The wood facing are on the atriums, to give another character to the volumes and to underline the different use of these volumes both from the outside and the inside. The zinc facing are used on the other building volumes, which are creating a contrast between the warm wood and cold zink materials.

North facade | ill. 164

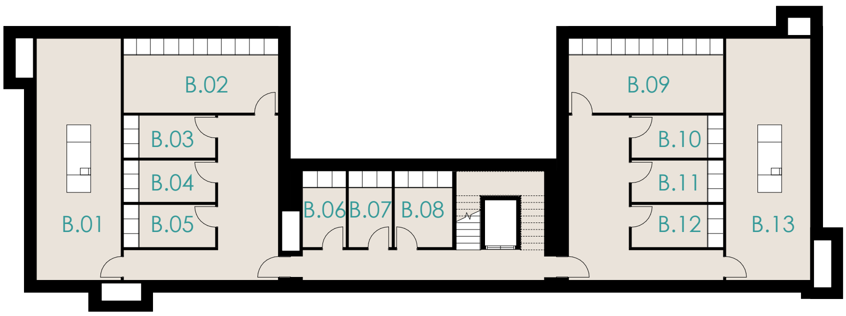
East facade | ill. 165

West facade | ill. 166

South facade | ill. 167

FLOOR PLANS

The plans are presented from the basement to the 3rd floor of the children's home, illustrating the flow and the organisation of the different functions, how they interact among each other, and how the flow are moving up through the atriums and out to the living units and the common facilities.

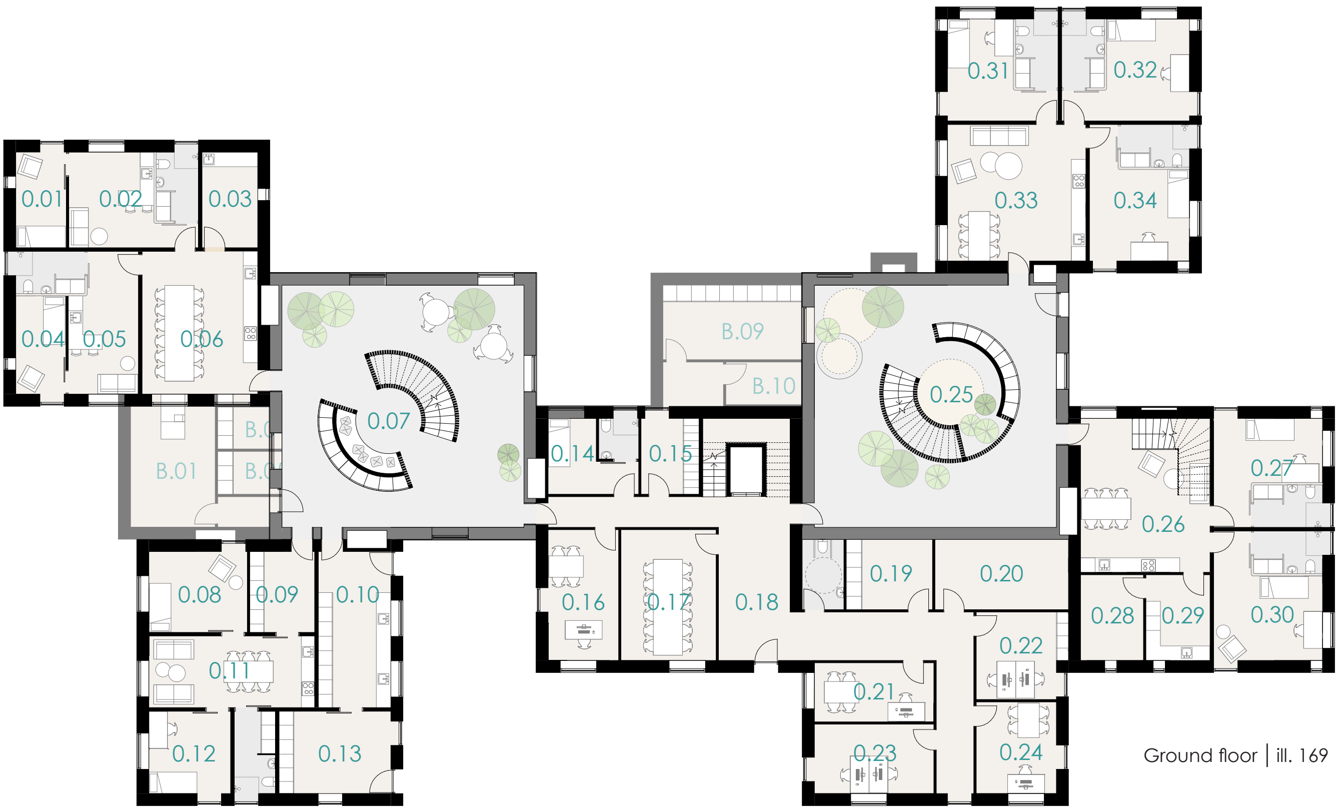


Basement | ill. 168

Basement

The basement is used for storage and technical installations, there was a demand from the spatial program that there should be a large amount of storing facilities for the children. A place to store the things they bring from home and don't use, therefore the storage areas was placed in the basement to keep it from stacking up on the other floors.

B.01 Technical room
B.02 Teen general storage
B.03 Individual storage
B.04 Individual storage
B.05 Individual storage
B.06 Individual storage
B.07 Individual storage
B.08 Cleaning depot
B.09 Kids general storage
B.10 Individual storage
B.11 Individual storage
B.12 Individual storage
B.13 Technical room



Ground floor | ill. 169

Ground floor

When you enters the ground floor you either enter by the common/public entrance or in the two atriums, where the children have their own private entrance to their homes. To the South the administration is placed to keep it away from the everyday life of the children and thereby focusing on home and community, where the children moves around in the home, to keep the feeling of home at not institution. The centre of the ground floor is the atriums that are leading the children from the outdoor spaces into the atrium and further into their living unit and their own room.

0.01 Teen apartment bedroom
0.02 Teen apartment living room
0.03 Teen apartment utility
0.04 Teen apartment bedroom
0.05 Teen apartment living room
0.06 Teen common room
0.07 Teen atrium
0.08 Flex bedroom
0.09 Flex utility/entrance
0.10 Workshop
0.11 Flex living room
0.12 Flex bedroom
0.13 Workshop
0.14 Night watch
0.15 Staff wardrobe
0.16 Small meeting/office
0.17 Large meeting room
0.18 Entrance
0.19 Copy room
0.20 Decentral depot
0.21 Small meeting/office
0.22 Peadagouge office
0.23 Administrations office
0.24 Principal office
0.25 Kids atrium
0.26 Kids living room
0.27 Kids room
0.28 Kids depot
0.29 Kids utility
0.30 Kids room
0.31 Flex immediat room
0.32 Flex immediat room
0.33 Flex living room
0.34 Flex extra room

1st floor | ill. 170

1st floor

On the 1st floor the more common facilities such as common kitchen, activity room and outdoor garden are placed, elevating the common areas of the home away from the ground floor and the public area of the children's home. Giving the children the possibility of moving through the home without passing through the administrational part of the building.

On this floor the atriums are still part of the centre of the building and are the spaces where the community is in focus, but also where the children move up and down between their living unit and the common facilities of the home.

1.01 Teen room
1.02 Teen room
1.03 Teen utility
1.04 Teen room
1.05 Teen living room
1.06 Teen atrium
1.07 Kitchen depot
1.08 Common kitchen
1.09 Kids atrium
1.10 Common garden
1.11 Activity room
1.12 Kids room
1.13 Kids room
1.14 Kids room
1.15 Kids room
1.16 Kids room
1.17 Kids utility
1.18 Kids Living room
1.19 Kids depot

2nd floor | ill. 171

2nd floor

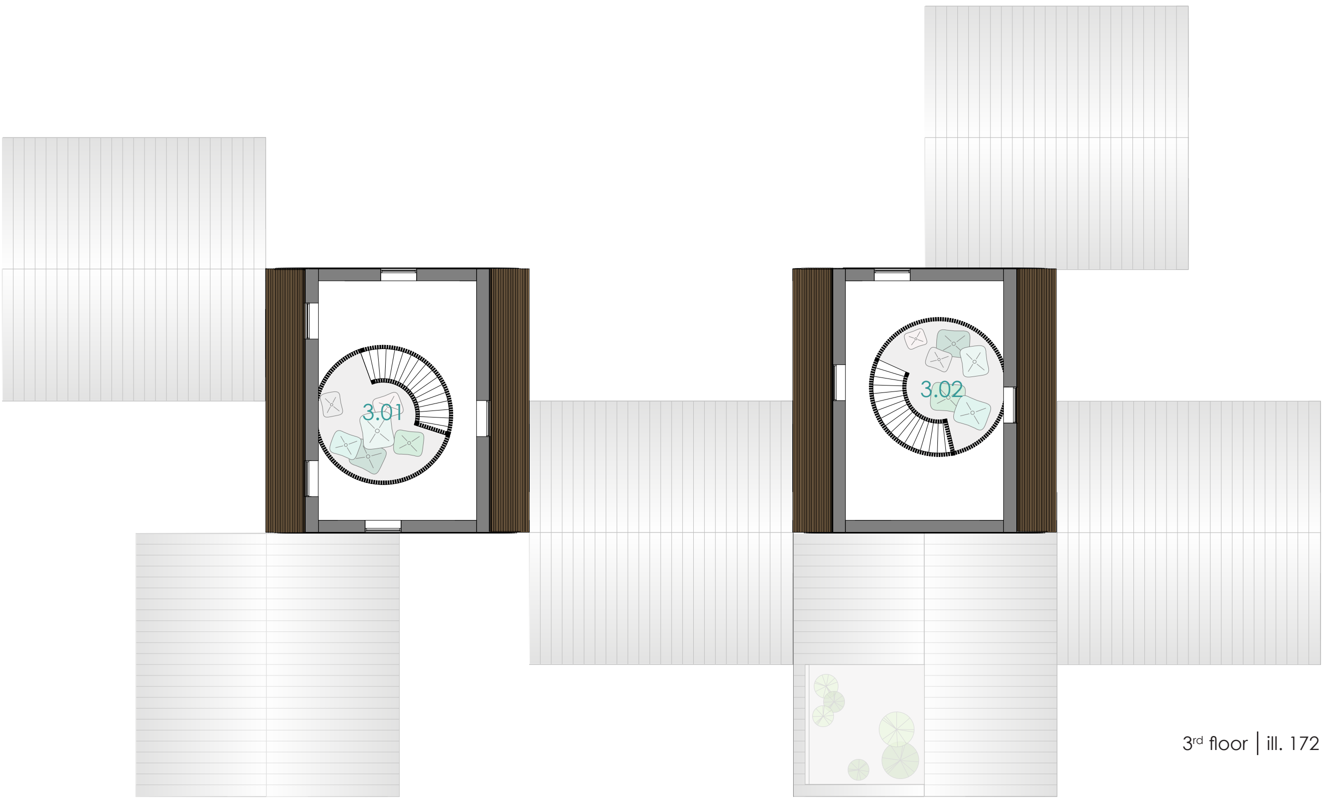
The 2nd floor is where the more quiet part of the common facilities are placed, having the family room where the children can be private with their families and the music room, where they can go to be immersed in music.

On the 2nd floor the atriums are not as much pathways through the building as on the previous floors. This gives the opportunity of having spaces for the children, where they can be more private, but still in the atrium.

2.01 Teen room
2.02 Teen room
2.03 Teen utility
2.04 Teen room
2.05 Teen living room

2.06 Teen atrium
2.07 Music room
2.08 Night watch
2.09 Family room
2.10 Kids atrium

2.11 Kids room
2.12 Kids room
2.13 Kids room



3rd floor | ill. 172

3rd floor

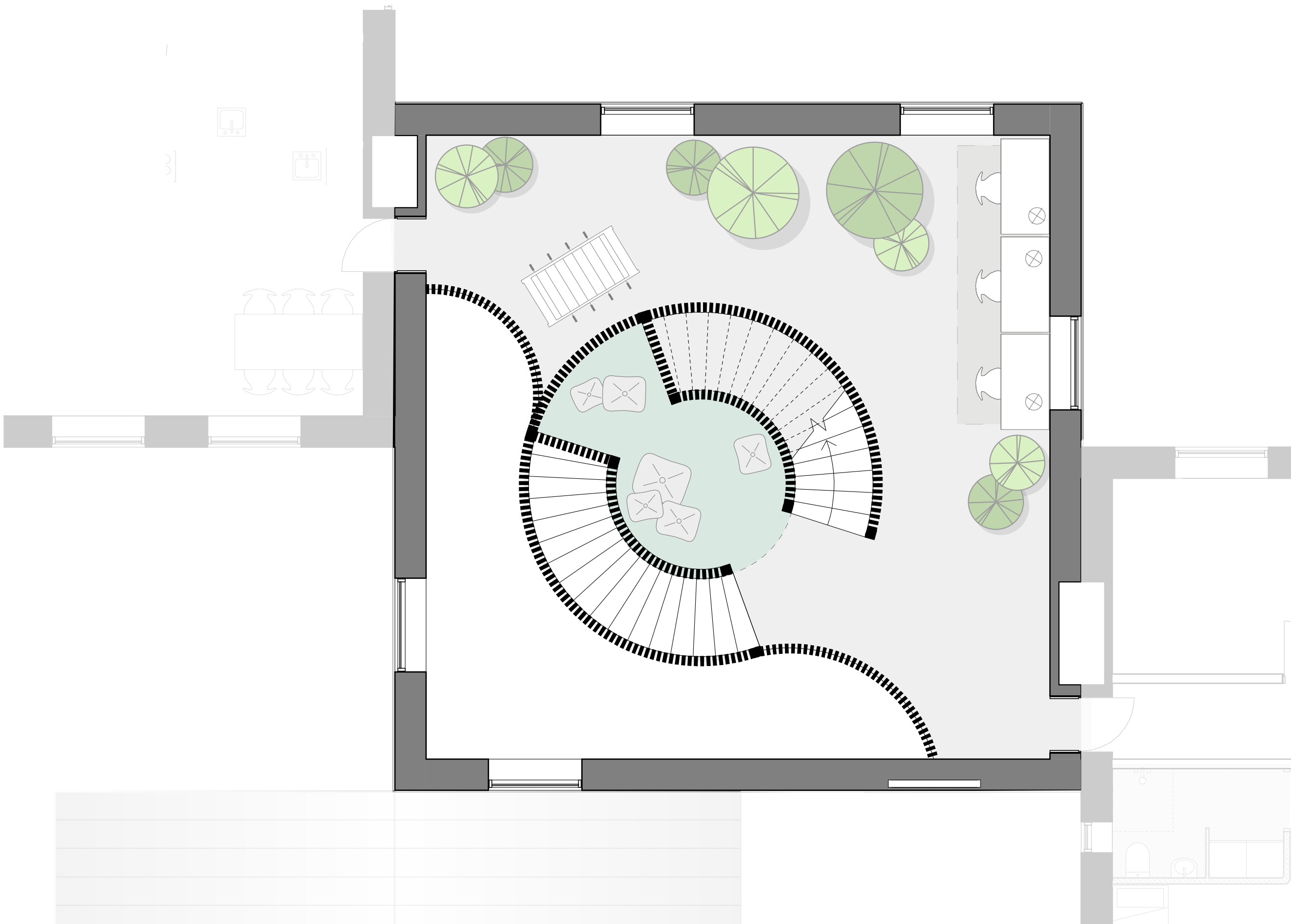
The 3rd floor is only in the atriums and are made as an extension of the stair element, which are becoming a tower where the children can sit and play or look out over the atriums or out over the city.

3.01 Teen atrium
3.02 Kids atrium

ATRIUMS

The atriums are seen as the community part of the children's home, this is where the children meet, play or sit listening to music, when wanting to be part of the community of the home. The atriums are where the activities and common life of the home is played out. The atriums are having caves for private intimate spaces, cosy lounge spaces, homework spaces, sandboxes, playing spaces etc. where the children can be part of the community.

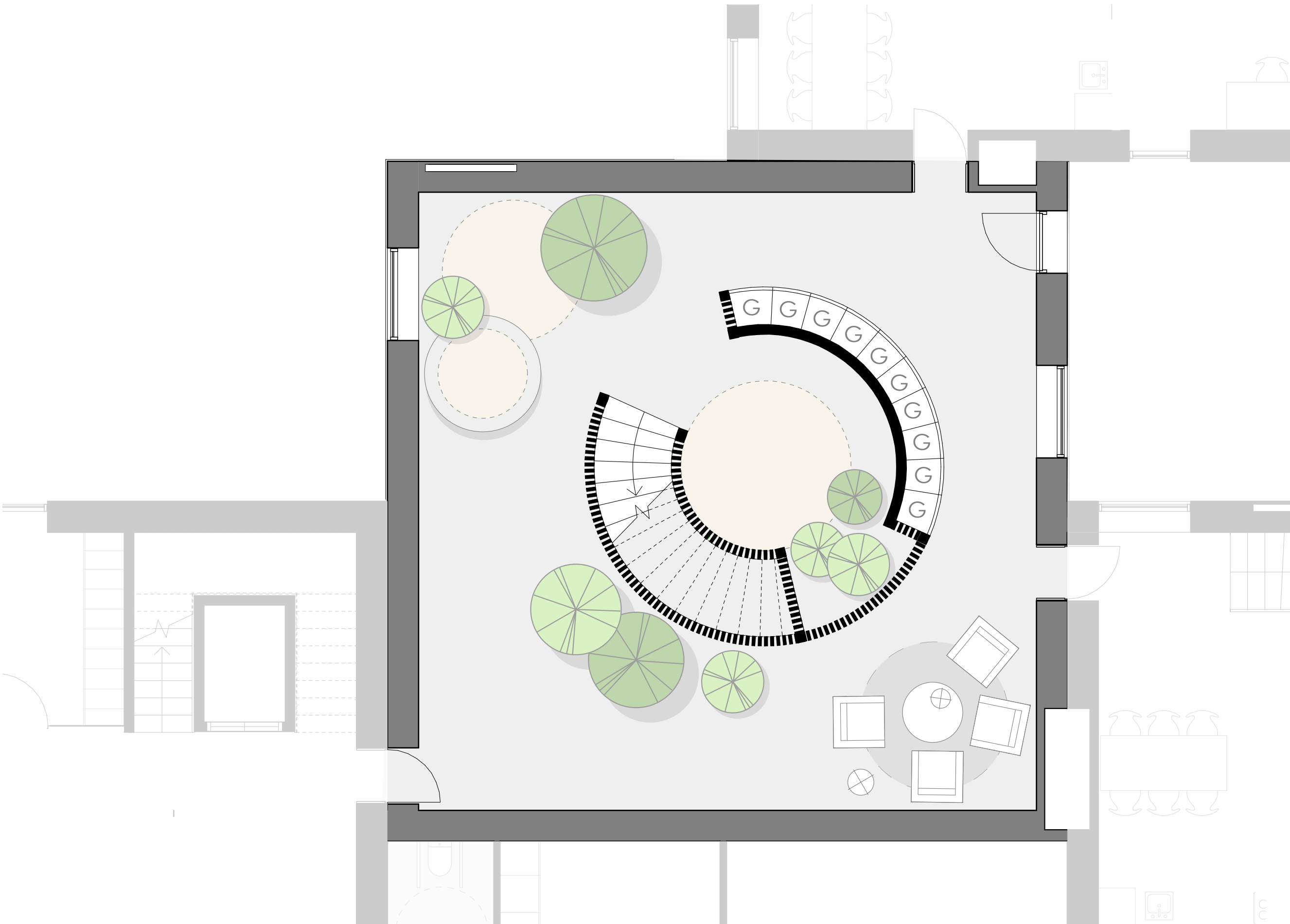
The atriums differ from the other volumes both in the facade expression with the wooden material, but also in the interior, having the stair element to separate the room and to create closed of spaces in the room. Both the choice of materials and greenery differ from the other functions of the home. Giving the atrium a character of having another use than the other volumes.



Teen atrium 2nd floor | ill. 173

The 2nd floor teen atrium has a cozy cave with pillows, which invite the teenagers to stay.

In the northern corner of the atrium is an area for computer playing, where the teenagers can play together.

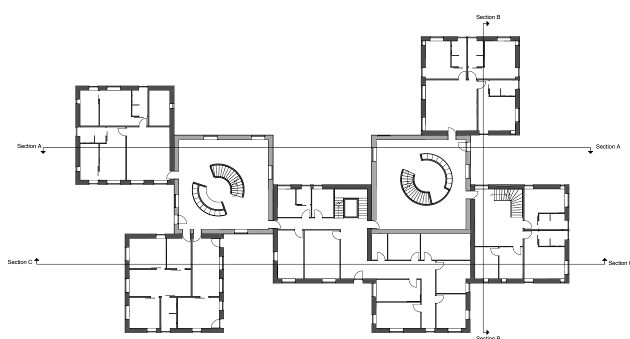


ill. 174

The ground floor kids atrium has a lot of different play areas and sandboxes, giving the children opportunity of choosing the play area they want.
In the corner a cozy lounge area is found, were the children have a video area.

Section A | ill. 176

Section through the atriums and the teen living unit, are giving an idea of the volume of the stair element in the atriums.



| ill. 175

The teen atrium seen from the 2nd floor. This shows the wooden stair element standing as a contrast to the concrete floors and the greenery in the atrium.

ill. 177

TEEN LIVING UNIT

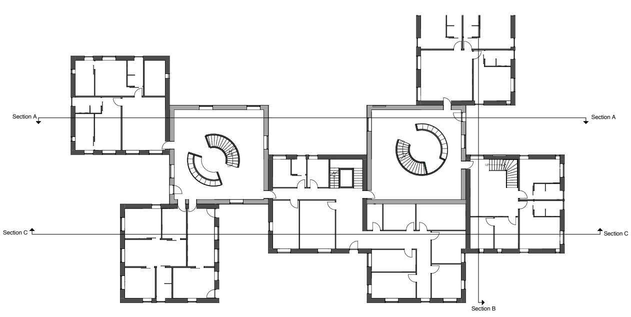
Teen living unit 1st floor | ill. 178

The living unit for the teenagers are facilitating a utility room, a kitchen, dining area and a living area with room for six persons. Three teenagers are living in each teen unit, having their own room and bathroom.

The utility room are providing the teenagers with a space for washing their own cloth. The kitchen are a common kitchen where the teenagers from the living unit are cooking together.

Section B | ill. 180

The section are showing the double height room of the kids living unit and where the ceiling are getting heigher in the rooms and lower abowe the bathrooms and kitchens, where the ventilation is running.

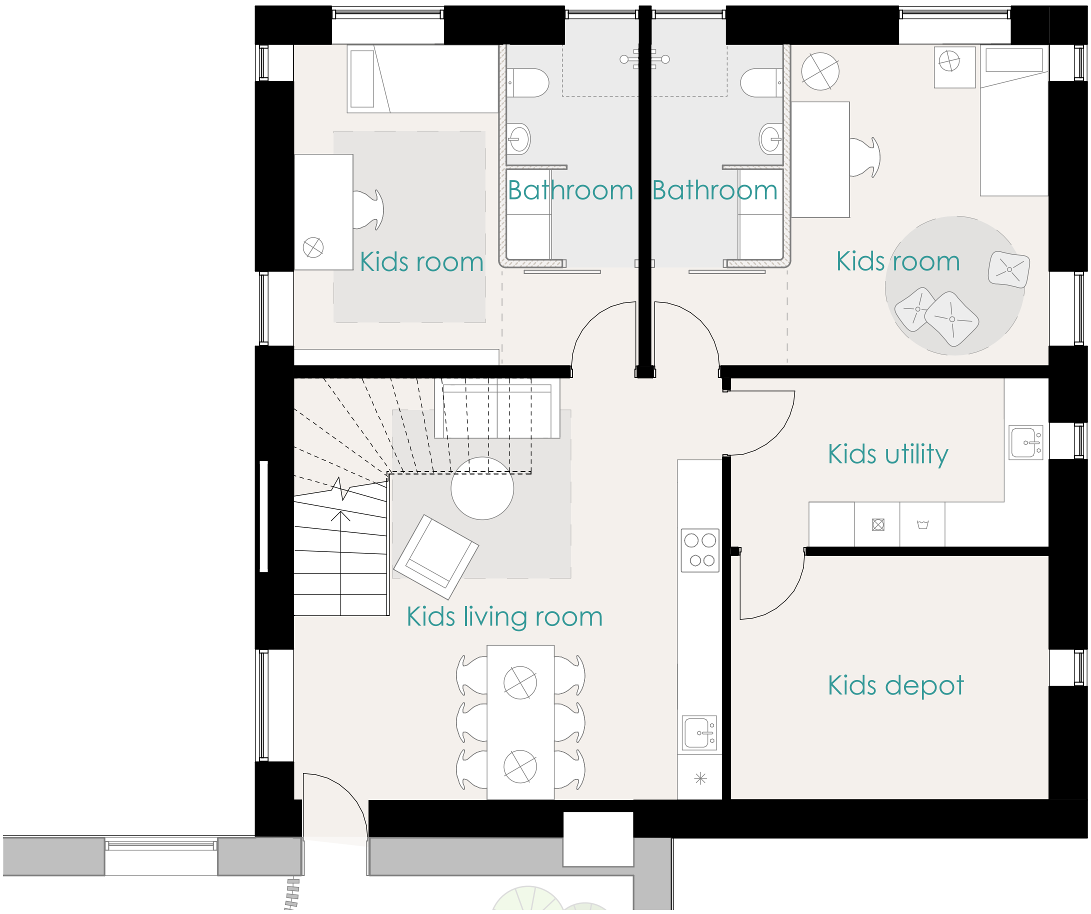


| ill. 179

The kids living unit with the double height room, which create a connection between the rooms on the two floors.

ill. 181

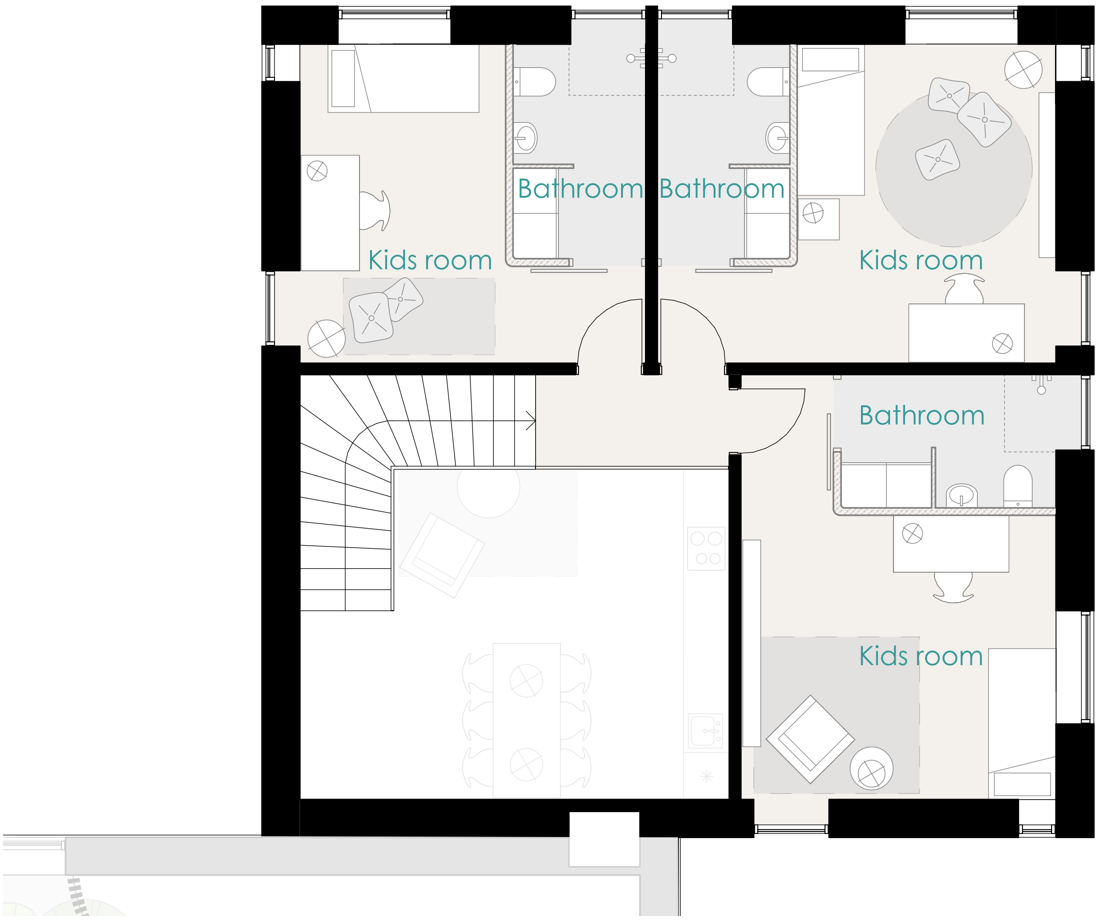
KIDS LIVING UNIT



Kids living unit 2nd floor | ill. 182

In the kids living unitFive kids live together in the kids living unit. They all have their own room and bathroom. The unit also contins a depot, a kitchen, a living/dining area, divided on two floors. The kitchen dining area should facilitate six people, the kids of the living unit and a pedagogue.

The living unit are only facilitating the most necessary functions for the kids, and therefore places for playing are moved to the rooms or to the atriums, this to minimize the area for the living functions in the units and to put focus on the community in the atriums.



Kids living unit 2nd floor | ill. 183

The 2nd storey of the kids living unit contains three rooms for the kids, which are conected to the 1st storey by a stair.

ROOM

Room | ill. 184

The kids rooms are being differentiated in size due to the different needs in the rooms depending on the different age groups. The rooms differ in sizes of 20m^2, 22m^2 and 24m^2 including bathroom and wardrobe.

The teen rooms are 20m^2 and are including bathroom and wardrobe. The rooms are similar in size and differ only in the interior that are chosen by the teenagers to add personality to their own room.

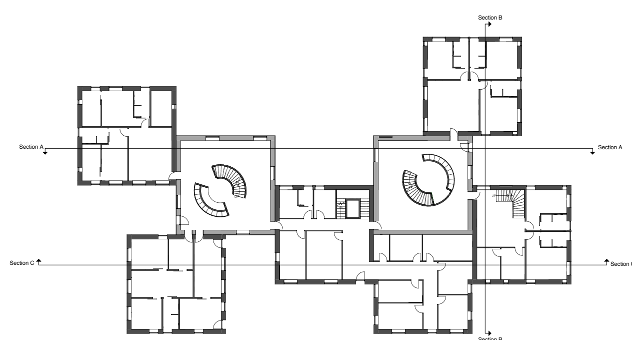
| ill. 185

A kids room, where the bathroom/wardrobe are standing as an element in the room. The element are being covered with cork making the wall easy for the children to decorate in the way they want.

COMMON ROOMS

Section C | ill. 187

On the 1st floor the common areas are placed. To show the connection between the kitchen and the roof garden these renderings and sections where made to get a feeling of the connection between the indoor and outdoor spaces.

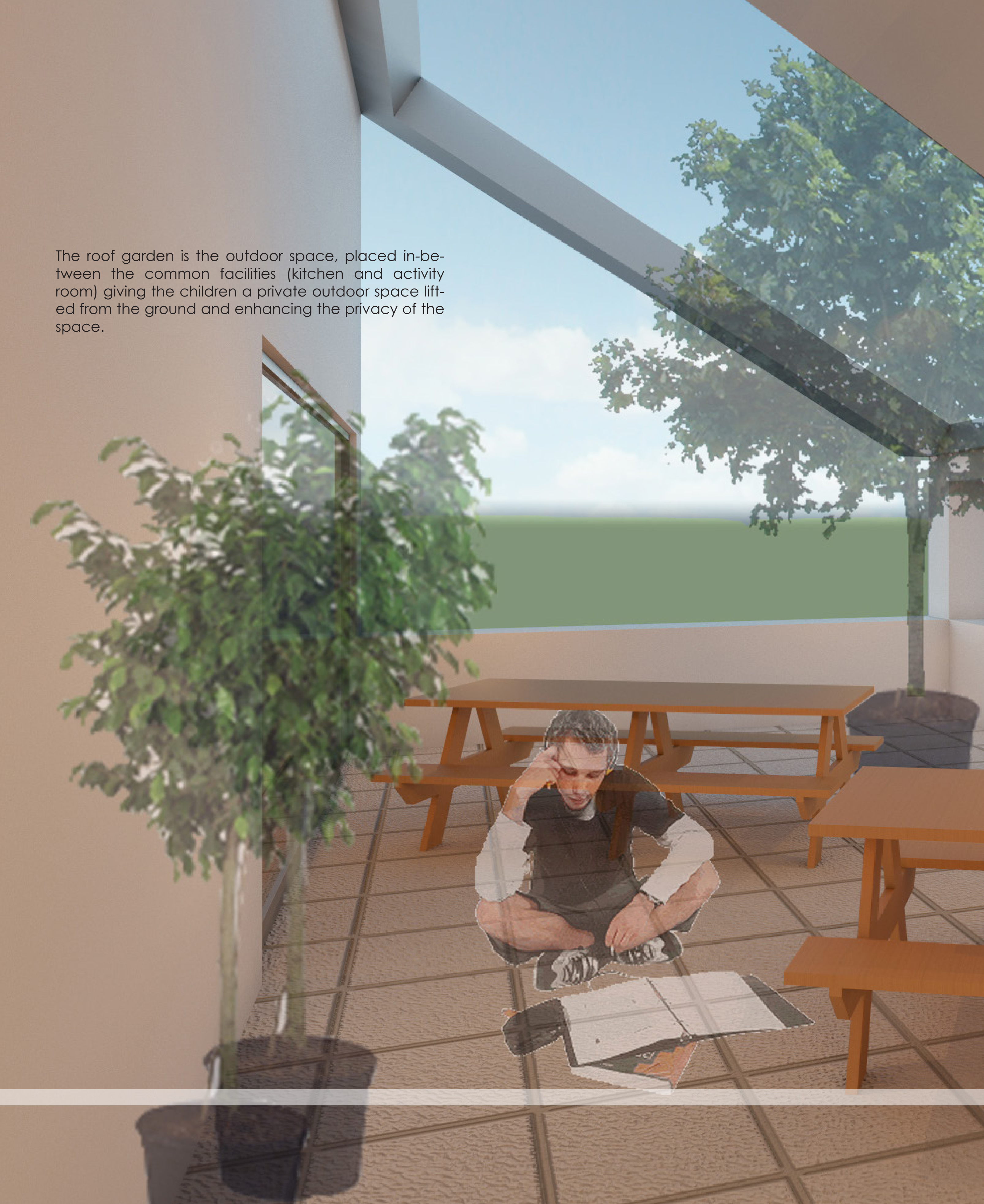


| ill. 186


The common kitchen where the children gather when
there are larger events in the children's home

| ill. 188

The roof garden is the outdoor space, placed in-between the common facilities (kitchen and activity room) giving the children a private outdoor space lifted from the ground and enhancing the privacy of the space.



| ill. 189

08
EPILOGUE

CONCLUSION

It has been a big challenge to rethink an institution for children in all ages, a new and modern version of a children's home during this project. One of the focus points has been to create a building, which both architectural and functional function as a home for children, where they feel at home and not closed of at an institution.
This has been the main focus point parallel to the task of creating a building which appearance should be a group of pitched roof houses combined with passive and active solutions, which could improve the energy consumption with out compromising on this very clear building expression, which should maintain the spirit of row houses and single-family houses combined as one.

The children's home consist of eight pitched roof houses standing close together. The houses vary between one to three storeys, which are divided into administration, apartments, living units, and atriums. The two atriums are important as they connect the whole building. They are both functioning as the in-between areas in the building but at the same time as a place where the children from different living units meet each other. The atriums have areas where the children can play, relax and talk together, both places hidden a bit away from curious eyes and places where it is possible to be visible for other children and staff.
All the other functions except the public administration are placed around the atriums, which creates pathways through the atriums and make sure there are life in the atriums during the whole day.

To make sure the children are feeling at home, they live in living units with up to five children in each. The living units are each designed as a normal Danish home, with a living area, kitchen, rooms, bathrooms, utility room and a depot. It has been a very important aspect to create these living units as close to a normal single-family house, to make sure the children feel at home. It is the idea, that the children in a living unit function as "a family" with children and adults, in this case pedagogues.

Around the children's home are a lot of outdoor areas, where the children from the children's home have private areas with terraces, playgrounds and gardens. The area has a lot of green plantation, such as big trees, bushes and flowerbeds, which also has been a demand of the local plan. The outdoor areas attached to the children's home also contains a public playground and multi lane east of the building, where the children can meet and play with children from the neighbourhood.

Sustainability has been implemented as an important design criteria from the beginning of the project, which find expression in the thick walls, chose of materials and building geometry, which has made it possibly to reach the aim of the building class of 2020 has been accomplished only by using passive solutions if the building follows the demands of the Building Requirements. The children's home has been designed with pitched roofs facing north/south and east/west in an angle, which gives the possibility to place solar cells in the roof if necessary according to the energy consumption. The windows in the building are placed both aesthetic and functionally with thoughts on using the sun for heating up the building during the summer period and to help ventilate the building during the summer period.

The vision about creating a children's home, which fits into the context and has an expression of being a community of small houses and not an institution, using the qualities from single-family houses, traditional residential areas and sustainability, creating a new and modern version of a children's home in Aalborg are from our perspective seen as completed in a susses full building design.

DISCUSSION

It can be discussed if the children's home brings out a change in proportion to traditional institutions. It still contains the normal functions from a traditional children's home, with rooms, living areas and public spaces just added something more.

The private parts in VoresHjem are connected with each other in a direct connection just outside the doors to the living units. Maybe this change from private to semi public are to sudden for the children, which must chose between privacy with their "family" in the living unit or community with other children and staff just outside their door. Living in a single-family house you have a front garden, which separate the private and public. But children often have an other view on private life and this sudden change between being with ones "family" in the living unit and being together with other children and friends in the atrium is maybe precisely what the children wishes.

But does the children's home provide safety and the feeling of being home? One of the wishes the children had for a new children's home where this feeling of belonging somewhere. A home like normally children have with their parents, brothers and sisters. The children on the children's home do not live with their parents any more, some even not with their siblings. It has been a wish to create this safety and feeling of being a family through the architecture, knowing that materials can create a good or unpleasant feeling. The materials used inside the living unit are the same as most modern single-family houses are made of. This creates a living unit that could be confused with a normal house, a living unit with a feeling of being home together with family.

The living units, where the children lives three to five children together divided into age groups where a demand from the Municipality, which has been fulfilled in the project. However normally families often have children in different age groups living together. Maybe it could have been an idea to create the living units in a way, where small kids and teenagers could have lived together and learned from each other.

Each child has its own room and bathroom, which were a demand from the Municipality. The rooms vary in size but not as much in their appearance. The bathroom stands as an element in the room and is covered by cork. This gives the child a possibility to decorate the element as wished. Each child brings their own furniture and is therefore in charge of designing the room. The rooms could also had been different in appearance, colours and furnished before the child moved in, but then the child are forced to live with e.g. green walls when their favourite colour is pink. This is why the child and not an interior designer should design the room.

The building is up to three storeys high, which might estrange the expression from a traditional house with pitched roof. To get a more clear understanding of these building typology the building could consist of a lot of one storey pitched roof houses instead of the eight houses the project ended out with. Could a lot of houses spread out at the site had given a better feeling of belonging to the neighbourhood. This could maybe have been an opportunity, if the flow inside the building was not important and it was accepted that the children and staff should walk outside when going from one unit to another.

The sustainability in this project could have been taken to an even higher level, but instead the needs of the children have been the focus point. Therefore only the atriums have been investigated in BSim. If the time had not been a hindrance more investigations in different parts of the building should have been made.

The Be10 has been made in two different ways. One where the building comes up to the regulations of the building requirement and one where the indoor environment is determining. At the first Be10 the building fulfil the demands of being a 2020 building using under 20 kWh pr. m2. If the indoor environment instead is important the building must add around 500m2 solar cells to fulfil the demands of the 2020 standard. It can be discussed if it is most important that the building fulfil the building requirements or the indoor environment fulfilling category A, where only 15% are dissatisfied with the air quality are more important?

09

APPENDIX

APPENDIX 1 -VENTILATION NEEDS

During this chapter it is calculated if the CO_2 concentration, the demands from BR2010 or the total sensory pollution are the factor, which decide the ventilation needs in the building.

The following calculations are made for a room. The calculations for the total sensory pollution and the CO_2 concentration in the air are all made in the light of Category A, where 15% are dissatisfied. [CR 1752, p. 23, table A.3.3.2]

1. Minimum air change in proportion to the CO_2 concentration:

It is chosen to use a pollution load caused by school children as the children at the children's home can be categorized as such.
The value of the CO2 concentration above the outdoor level is corresponding to category A, to make sure the indoor environment is satisfying for as many as possibly.

The formulas used are:

$$Q_h = \frac{G_h}{C_{h,i} - C_{h,o}}$$ [CR 1752, p. 29, eq. A.3]

$$n = \frac{Q_h}{V_R}$$ [CR 1752, p. 29, eq. A.3]

The CO_2 pollution amount G_h:

$$G_h = q \cdot O = 0{,}019 \frac{m^3}{h} \cdot 1 = 0{,}019 \frac{l}{s}$$

Minimum air change is therefore:

$$Q_h = \frac{G_h}{C_{h,i} - C_{h,o}} \cdot 1000000 = \frac{0{,}019 \frac{l}{s}}{810ppm - 350ppm} \cdot 1000$$

$$n = \frac{Q_h}{V_R} = \frac{41{,}30 \frac{m^3}{h}}{35m^3} = 1{,}18h^{-1}$$

Where:

A_t is the room area (m^2)

V_R is the room volume (m^3)

O is the number of occupants

q is the pollution load caused by occupants (m^3/h) [CR 1752, p. 26, tabel A.6]

G_h is the CO_2 pollution amount (olf)

$C_{c,i}$ is the desired perceived indoor air quality (decipol) [CR 1752, p. 23, table A.5]

$C_{c,o}$ is the perceived outdoor air quality at air intake (decipol) [CR 1752, p. 24]

Q_h is the required ventilation rate for health (m^3/h) [CR 1752, p. 29, equation (A.3)]

V_{air} is the minimum air supply (l/s per m^2) [BR10, 6.3.1.2]

2. Air change in proportion to the Building Requirement 2010:

The minimum air supply used in these calculations are the minimum outdoor air supply according to the building regulations.

Minimum air supply: $V_{air} = \quad > 0{,}3\frac{l/s}{m^2}$ [BR10, 6.3.1.2]

$$n = \frac{V_{air} \cdot 0{,}001 \cdot 3600 \cdot A_t}{V_R} = \frac{0{,}3\frac{l/s}{m^2} \cdot 0{,}001 \cdot 3600 \cdot 14m^2}{35m^3} = 0{,}432h^{-1}$$

3. Minimum air change in proportion to the experienced air quality:

Also here the school children are used, when the value for the sensory pollution load should be found, which in this case are seen as the children at the children's home. The pollution load caused by the building is chosen on the basis of a new low-polluting building.

The required ventilation rate for comfort can be calculated from the equation:

$$Q_c = 10 \cdot 3{,}6 \cdot \frac{G_c}{C_{c,i} - C_{c,o}}$$ [CR 1752, p. 28, eq. A.2]

$$n = \frac{Q_c}{V_R}$$ [CR 1752, p. 28, eq. A.2]

The total sensory pollution load G_c:

$$G_c = q_1 + q_2 = 0{,}1\frac{olf}{m^2} \cdot 14m^2 + 1{,}3olf = 2{,}7olf$$

$$Q_c = 10 \cdot 3{,}6 \cdot \frac{G_c}{C_{c,i} - C_{c,o}} = 10 \cdot 3{,}6 \cdot \frac{2{,}7olf}{1{,}0dp - 0{,}1dp} = 108\frac{m^3}{h}$$

Minimum air change is therefore:

$$n = \frac{Q_h}{V_R} = \frac{108\frac{m^3}{h}}{35m^3} = 3{,}09h^{-1}$$

Where:

q_1 is the sensory pollution for the building (olf/m²)
[CR 1752, p. 28, tabel A.8]

q_2 is pollution load by occupants (olf)
[CR 1752, p. 26, tabel A.6]

$C_{h,i}$ is the CO_2 intake in Category A (ppm)
[CR 1752, p. 23, table A.5]

$C_{h,o}$ is the outdoor concentration of CO_2 (ppm)
[CR 1752, p. 27, table A.9]

G_c is the sensory pollution load (olf)

Q_c is the ventilation rate required for comfort (l/s) [CR 1752, p. 28, eguation A.2]

n is the air change rare for health (h^{-1})
[CR 1752, p. 28, eguation A.2]

4. Choice of air change

Looking at the three calculations of necessary air change according to CO2 concentration, the demands from BR2010 or the total sensory pollution it is seen that the sensory pollution is the worst case. It is therefore necessary to change the air 3,09h-1 to keep a satisfying air quality in the room.

The same calculations listed above have also been made for the living room and atrium in children's home. Equally to the room the sensory pollution were the worst case and is therefore deciding the air change.

	Area	Volume	Occupants	Air change CO2	Air change BR2010	Air change Sensory pollution
Room	$14m^2$	$35m^3$	1	$1{,}18h^{-1}$	$0{,}43h^{-1}$	$3{,}09h^{-1}$
Living room	$32m^2$	$210m^3$	6	$1{,}18h^{-1}$	$0{,}16h^{-1}$	$2{,}10h^{-1}$
Atrium	$100m^2$	$1050m^3$	10	$0{,}39h^{-1}$	$0{,}10h^{-1}$	$0{,}88h^{-1}$
Average				$0{,}92h^{-1}$	$0{,}23h^{-1}$	$2{,}02h^{-1}$

All calculations are found at the enclosed CD.

APPENDIX 2
ARTIFICIAL LIGHTNING PRINCIPLES

A children's home must function all 24 hours a day during a year. In Denmark natural daylight cannot always be used to light up and artificial light has to be used. Therefore artificial light has to be considered early in the design process, to make sure it is integrated and function effective in the building.

This kind of light can both support the furnishing in a room and the architecture, in a way, which creates comfortable surroundings to be in. This is very important in a children's home, where especially the homelike feeling has a major priority.

Different kinds of light

The right lighting can do a lot for a room; it can by itself create feelings and experiences. There exists a lot of different ways to use light, in the following the three main elements in lightning will be described, common light, accent light and decorative light.

Common light
This sort of light is the most well known lighting method. Here the lighting of the surroundings is in focus, which make it possible to orientate in the building.
The light has no direction and are mainly used to light up a room or similar. The light is however good as background light when using other lightning sources, such as accent light and decorative light.

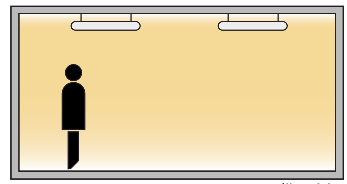
Accent light
This type of light is used to accentuate an item. It could be all from trees, work of art and furniture's to large buildings. The lighting exposure gives e.g. a building more character, as the shadows stand out and creates contrasts. There are no doubt what is in focus, as the lightning often is very directional.

Decorative light
The last of the three types of light is decorative light. This sort of light is used to "give something more" by using extra lighting effects. It can be colours, which underline a special mood. Patterns that gives a certain expression in a room, an item or a building, which can be changed completely.
This type of light can also be used to create an illusion of a sunbeam, coming trough a crack in the ceiling. [erco.com, 2013]

Placing of lighting in the room

Artificial light is experienced very different depending on the placement of the lighting. Whether the lighting should be placed high, middle or low in a room is determined by the use and shape of the room.

High zone lighting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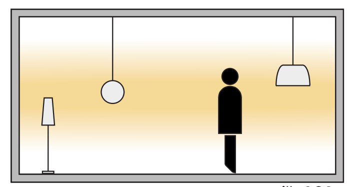
Light placed in a high position in the room is used for rooms with a lot of activity, which need good lighting conditions. Because of the lights distribution from above it creates small shadows. This type of light is particularly suitable as basis light for working at offices, institutions and hospitals e.g.

Middle zone lighting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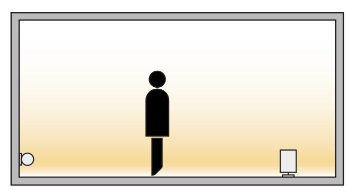
When the light is placed in a middle position in the room, it is often distributed from several different lighting sources, which also creates longer and more varied shadows than lighting from a high position in a room. This type of light is normally lamp's hanging from the ceiling or light from standard lamps. It is often used to create a homelike environment and is often associated with rooms with social activities, such as living rooms.

Low zone lighting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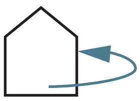
Light distributed from a low position in the room is often creating very long shadows.
It is not good to use for lighting up a room, but instead as leading light. It can be used a night-time, were as little light as possible is wanted e.g. when people need to go around in the dark or are going to sleep. [Patients_light_preferences.pdf]

APPENDIX 3
PASSIVE ENERGY INITIATIVES

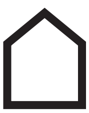
The passive energy initiatives, which will be worked with in the project is described further in this chapter.

Orientation and landscape (context)



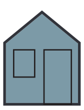
When placing the building on the site the orientation is important, if the use of passive heat gain should be optimal. When looking at passive heat gain the most efficient orientation is having large window areas to the south and to make sure that there are no shadows from other buildings or trees, so when sun is low on the sky the passive heat still can reach the inside of the building. [Isover, 2010, p146]

Building envelope



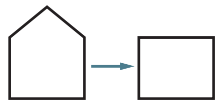
The building envelope is to make sure that the heat from the building mass is not let out through leaks in the construction. Therefore it is important to have more or less the same thickness of insulation throughout the whole construction. A rule is that the insulation layer most not be broken at any time in the building envelope. [Isover, 2010, p 162]

Facades



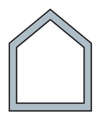
Placement of the windows in the facades can help the passive heat gain in the building and can be a passive factor in heating the building. Window orientated south are adding to the passive heat gain of the building, but can also give the problem of overheating the rooms. [Lehrskov,2011,p19]

Compact building mass



When designing it is important to have in mind that a compact building envelope without any extra corners is the most optimal concerning to the energy use. Having a geometry where the relation between building envelope and building volume is minimized is the most beneficial according to energy consumption. Having for example row housing or blocks of flats it is easier to fulfil the energy demands of the buildings. [Isover, 2010, p150]

U-values and insulation

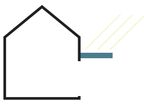


The u-values is defining the materials ability to prevent heat loss from internal to external spaces, having a low U-value is equal to a better insulation power, and thereby reducing the use of energy in the buildings.

The u-value for external walls a normally around 0,10 W/m2 K giving a insulation thickness of 450mm, when having a smaller u-value the walls will give a limited saving in the overall energy use. [Marsh, 2006, p 46]

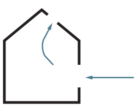
The windows are also an important factor in the energy use of the building. A window frame is loosing more than the glass itself, so by having large windows there is a saving of energy in that aspect. The g-value of the windows is also important when designing buildings fitting to the 2020 requirements, a high g-value is letting in more light and solar energy through the window. These values differentiate do to the different manufactures.

Solar shading



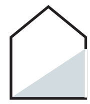
To prevent the passive heat gain, from the openings in the building mass, to overheat the rooms solar shading to south can be a necessity. Solar shading is to prevent the high sun in the summer months to penetrate the windows. Solar shading can be shading on individual windows or shading by balconies over the windows. It is important to have the need of daylight in mind when designing windows and shading. [Lehrskov,2011,p.19]

Natural ventilation



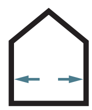
When having wind, sun and shadows of the area mapped in the first step of the design process the ventilation principles, can be part of the design of the building, by using the wind conditions to ventilate the building most of year, this also minimize the energy use of mechanical ventilation.
Or to make a combination of mechanical and natural ventilation, hybrid ventilation that are used in many zero energy building or low energy buildings. [Lehrskov,2011,p. 21]

Daylight optimization and articial light



To minimize the need of artificial light and use of energy the daylight in the rooms are important. Having rooms with a high of min. 2.2m and large windows the need of artificial light is being minimized. By having a focus on daylight factor no less than 3, light in the rooms must often come more than one orientation. This is also improving the light in the building. [Lehrskov,2011,p. 20]

Thermal mass



Looking at thermal storage in buildings, there is a connection between a heavy building mass and its ability to storage heat in the construction. The energy use for heating the building is reduced with materials having a large thermal storage ability. The risk of having overheating in the rooms are also minimized. The energy use for producing materials with large thermal storage is increased compared to materials with smaller thermal storage ability.
[Marsh, 2006, p 40],[Urban Village.pdf, 2012]

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APPENDIX 4 -SUN STUDIES

June 21st

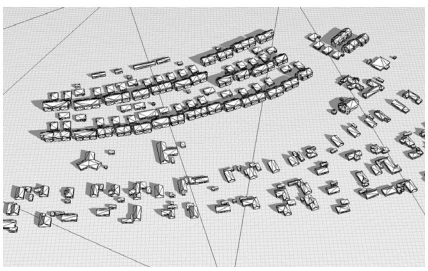
When looking at the shadow studies from June 21st there are no shadows that are interrupting the site when looking at the time of 9am and 12am, but in the time around 6pm the shadows from the surrounding buildings are moving across the site area.
Having that in mind when looking at orientation and daylight for the building mass, and also when placing solar cells and solar panels on the building roof.

March 21st

In March there no shadows at any time of the day that are effecting the site. Therefore this is not taking into the design process when designing the building.

December 21st

The shadows in December are in the period of time around 9am casting long shadows across the site. By looking at these shadow studies of the site in these three periods of the year, it can be concluded that the surrounding buildings are having a influence on the site and that is important to be aware of the shadows of the buildings during the whole year, to avoid times of the day where there are no sunlight in the building, or a period where the solar cells and solar panels are not working.



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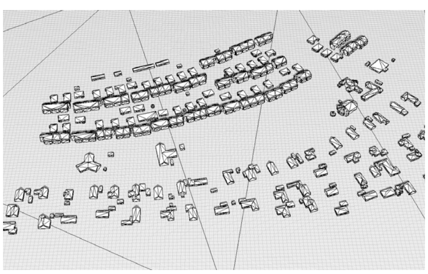

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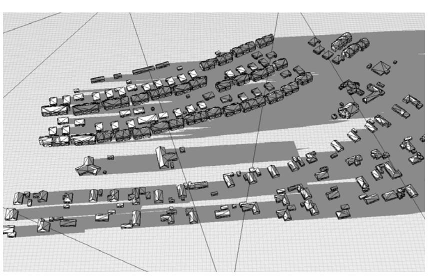
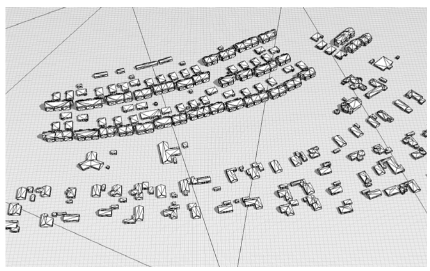


6 pm



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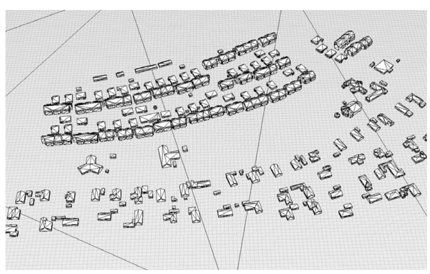

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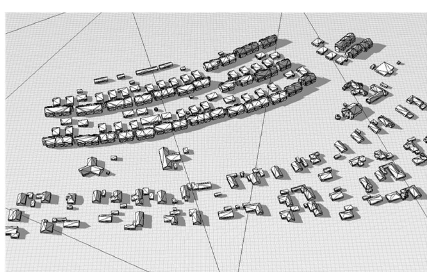

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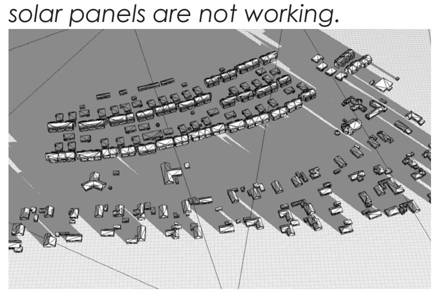

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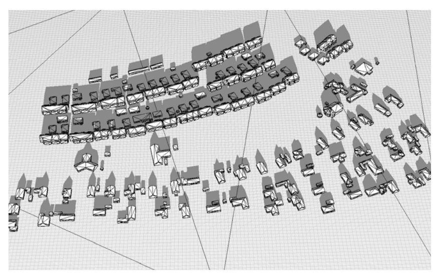

12 am

6 pm

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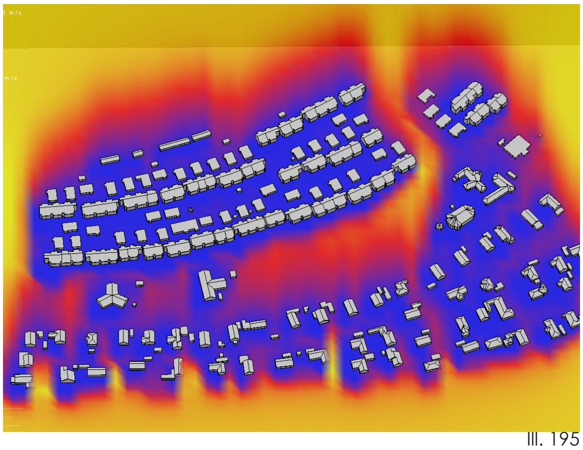
APPENDIX 5 -WIND STUDIES

South

The wind direction south is the most rare wind direction in Denmark, and are therefore not the direction that are focused mostly on.

When the wind is coming from the south the single-family houses are acting as lee to the site. This gives a site where there is hardly any wind.



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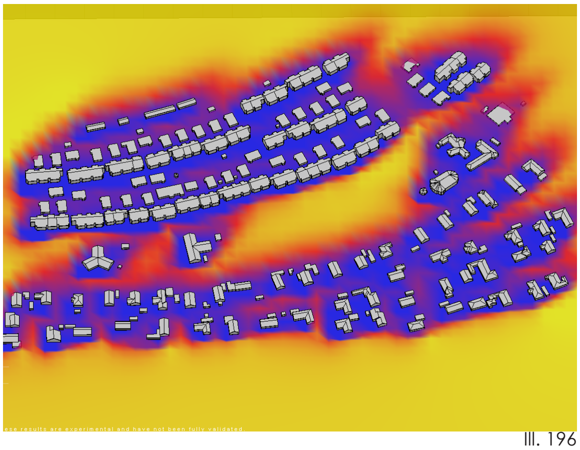
Southwest

The most common wind direction in Aalborg is from southwest, according to this site there are a heavy load of wind, and the area are open and not being in the leeward side of any of the other buildings.

Having that in mind it is important to focus on planting to the southwest to shield the site and the outdoor areas from the wind.



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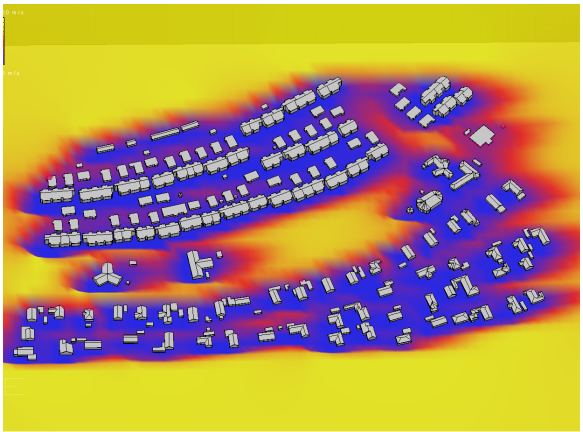
West

When the wind direction are west the site are exposed for wind, and are not being in the leeward side of the building mass neither from north nor south, this gives as also mentioned a heavy wind load from west.

Also according to opening in the building and natural ventilation the wind direction are important to get the most from the natural ventilation, a strategic placement of windows are important. Also to avoid draft in the building the door openings must not be placed in the wind direction.



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