CROSSROADS

[a refugee community centre]

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Aleksandra Przesmycka · Irene Ank Jørgensen · Kristian Bue Jensen

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Authors:	*Aleksandra Przesmycka*
	Irene Ank Jørgensen
	Kristian Bue Jensen
Supervisor:	*Michael Lauring*
Technical supervisor:	*Claus Topp*
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Aleksandra Przesmycka | *Irene Ank Jørgensen* | *Kristian Bue Jensen*

READING GUIDE

The following assembled work presents the design process and final proposal for a refugee community centre situated in Copenhagen, Denmark. The focal point of the design is to create a truly sustainable building in all its aspects; environmental, economic and social. Initially presented is the methodology, which is centred around an integrated and holistic approach to architecture. After this, the framework and motivation for the project is depicted, explaining the need for this type of architecture, as well as the user groups and initial room program. Hereafter, all analysis and case studies made to serve as the basis for the design of the community centre are portrayed. The presentation section includes documentation of the design proposal; presentation drawings, detailing and technical documentation. Following the presentation, the design process is explained, revealing thoughts and choices behind the design. The report is concluded with an epilogue, containing a conclusion, as well as a reflection on the final design proposal and the process. Referencing is registered by the Harvard method and lastly, the appendixes contain calculations and other elaborations on the report.

"What is needed most in architecture today is the very thing that is most needed in life - Integrity. Just as it is in a human being, so integrity is the deepest quality in a building. [...] Stand up for integrity in your building and you stand for integrity not only in the life of those who did the building but socially a reciprocal relationship is inevitable."

F.L. Wright

CONTENT

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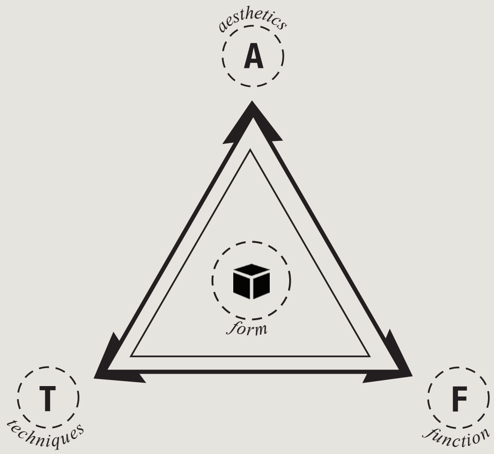
FRAMEWORK

Methodology
Refugees
Sustainability
Designing for humans
Programme

METHODOLOGY

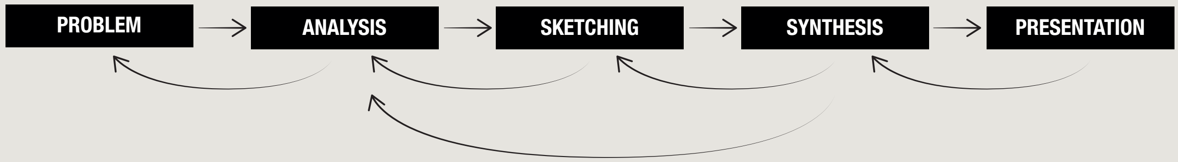


Ill. 1.01: Vitruvian triangle

The development of a refugee community centre needs a holistic approach centred in the unity of both architectural qualities and technical solutions. To ensure this, the Integrated Design Process (IDP), as explained by Mary Ann Knudstrup, and the principles of the Vitruvian Triangle will be implemented in the design process. Hereby the development of a holistic design will derive from an iterative design process. Furthermore, theory from Bryan Lawson, Juhani Pallasmaa, Paolo Sassi and Henning Larsen Architects will create the framework of the project and serve as tools to value information throughout the process. These initiatives will ensure a holistic project consisting of a carefully designed architecture, that revolves around environmental, social and economic sustainability.

The Integrated Design Process is founded on the concept of working with five iterative phases: problem, analysis, sketching, synthesis and presentation, that are constantly reviewed throughout the design process (Ill.1.02). Since the system relies on a constant feedback loop of information, the IDP is far from being linear and ensures that all aspects of the design, including function, aesthetics and technology, are equally integrated in the process already from the beginning. [Knudstrup, 2004]

The preliminary phase of Problem Formulation, orbits around various elements of a given project in order to define the relevant information and eventual problems as a foundation for the project. Secondly, the Analysis Phase investigates a broad spectrum of factors that concerns the project and describes the possible solutions for the problems.



Ill. 1.02: The Integrated Design Process

"According to Vitruvius, the Roman master builder, architecture was the combination of three virtues: utilitas, firmitas and venustas. He forgot humanitas [...] That, I felt, needed changing."

Lucien Kroll

All relevant factors such as, climate, site, context, history, and social, environmental and economic sustainability are examined and concluded in design parameters, that serve as guidelines for the design process.
Thirdly, the Sketching Phase is initiated, where the development of the project starts to visualise by using a variety of digital and analogue tools. All the previous phases serve as catalysts for developing a design concept and eventually further detailing hereof.
Information and knowledge from previous phases are adjoined in the Synthesis Phase. This compilation of material, knowledge and thoughts are synthesised into a clear path for the architecture, thereby serving as the foundation for the last phase of presentation.
Lastly the Presentation Phase, communicates the project through a spectrum of mediums in order to visualise, refine and prepare the final project.

VITRUVIAN TRIANGLE
Firmitas, Utilitas, Venustas, meaning Strength, Utility and Beauty, were developed and presented by the Roman architect and engineer Vitruvius. The three fundamentals of architecture are acknowledged as the foundation of critical architectural values (Ill. 1.01). Firmitas, Utilitas, Venustas cannot be isolated as they only achieve a great impact on the design by coming together as a unity. Recognizing the three interactive factors is the basics of understanding the realm of architecture. [O'Gorman, 1998]
Having Vitruvius principles in mind for this particular, socially involved project, it seems relevant to follow Lucien Kroll's idea of adding the human aspect to the triangle. Humanitas values will be responsible for keeping the social balance in the design and will enhance all the others by adding focus on the human body and feelings. [Graaf, 2016]

REFUGEES

Origins

Ongoing conflicts and acts of violence in Syria, Iraq and other parts of the world are forcing many people to flee their country in fear of persecution. Since many of their neighbouring countries are also in conflict, they are forced to flee to Europe. Many of them are also trying to reunite with family members, who are currently in a European country. Each year, many refugees lose their lives, or watch their beloved perish, in attempt to find safety [UNHCR, 2017]. In 2014 and 2015, Europe experienced a massive peak in refugees seeking asylum, with a total number of 1.2 million refugees. This number decreased substantially in 2016, probably as a result of closing the Balkan-route, which resulted in thousands of refugees stuck on the border of Greece and creation of new more uncertain routes [Bendixen, 2016A]. Illustration 1.04 shows the main routes the refugees used to travel to Europe in 2015, including the now closed Balkan-route.

In practice, the only way to access Denmark is by illegal entry, either with fake papers or completely without. This often requires help of human smugglers, which is expensive and dangerous. Many refugees lose their savings and personal papers, experience violence and are separated from their family on these journeys. Many also die on the way, most by drowning but also from starvation, thirst and disease. It is a paradox, that having the right to seek asylum usually means to break the law and put your life at risk. [Bendixen, 2016B]

Denmark receives two different types of refugees: spontaneous refugees and quota refugees. Spontaneous refugees come by themselves in search of safety and they have to go through a thorough process to be granted asylum. While their application is being processed, they are placed in asylum camps. Quota refugees are individual refugees chosen in collaboration between UNHCR, the Danish Immigration Office and Danish Refugee Aid. Denmark receives a certain number of quota refugees each year. They all obtain a two-year residence permit and are moved directly to the Danish municipalities, without going through the asylum process. [Bendixen, 2016C]

2011	total: 3 806
Afghanistan	906
Iran	462
Syria	429
Serbia	321
Russia	300

2012	total: 6 235
Somalia	919
Syria	822
Afghanistan	577
Serbia	559
Iran	549

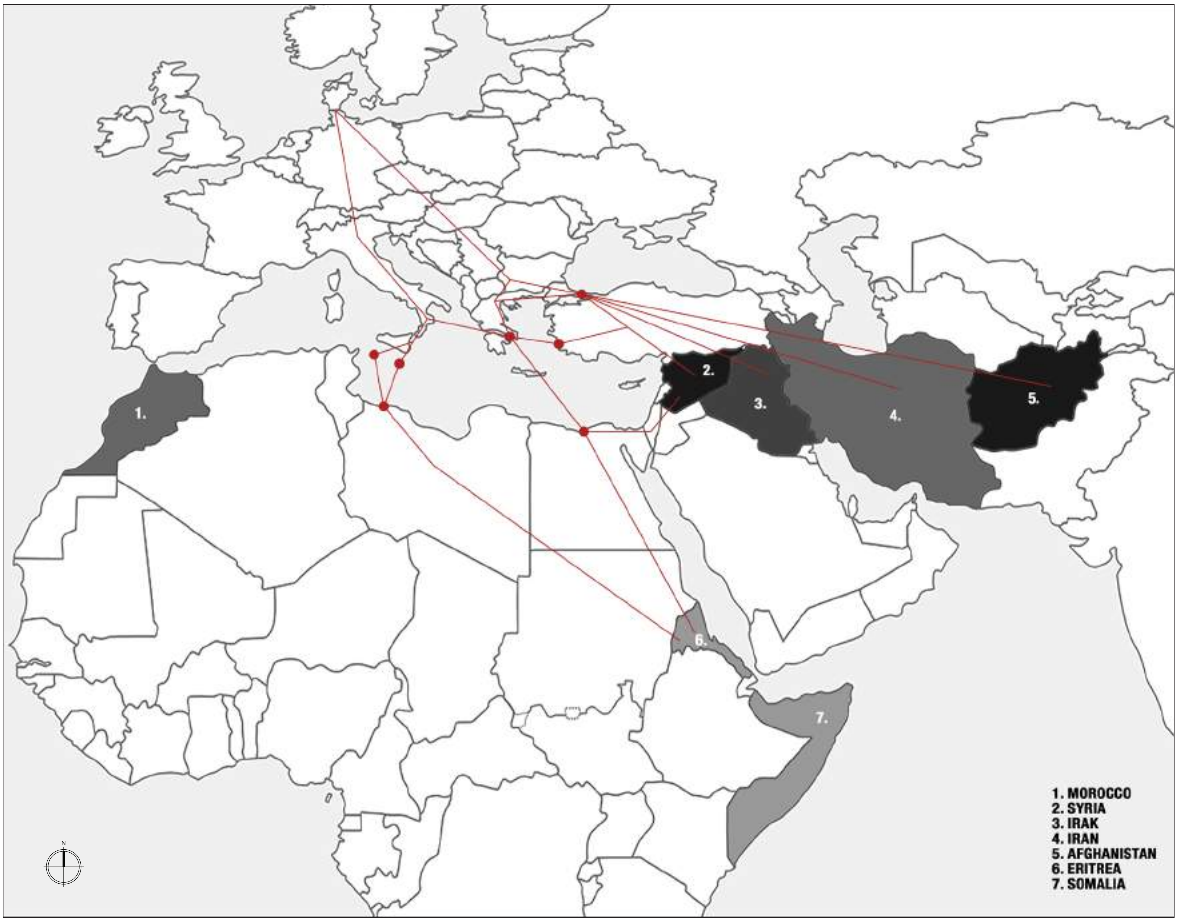
2013	total: 7 557
Syria	1 710
Russia	982
Somalia	965
Serbia	466
Afghanistan	426

2014	total: 14 792
Syria	7 210
Eritrea	2 275
Stateless	1 140
Somalia	700
Russia	520

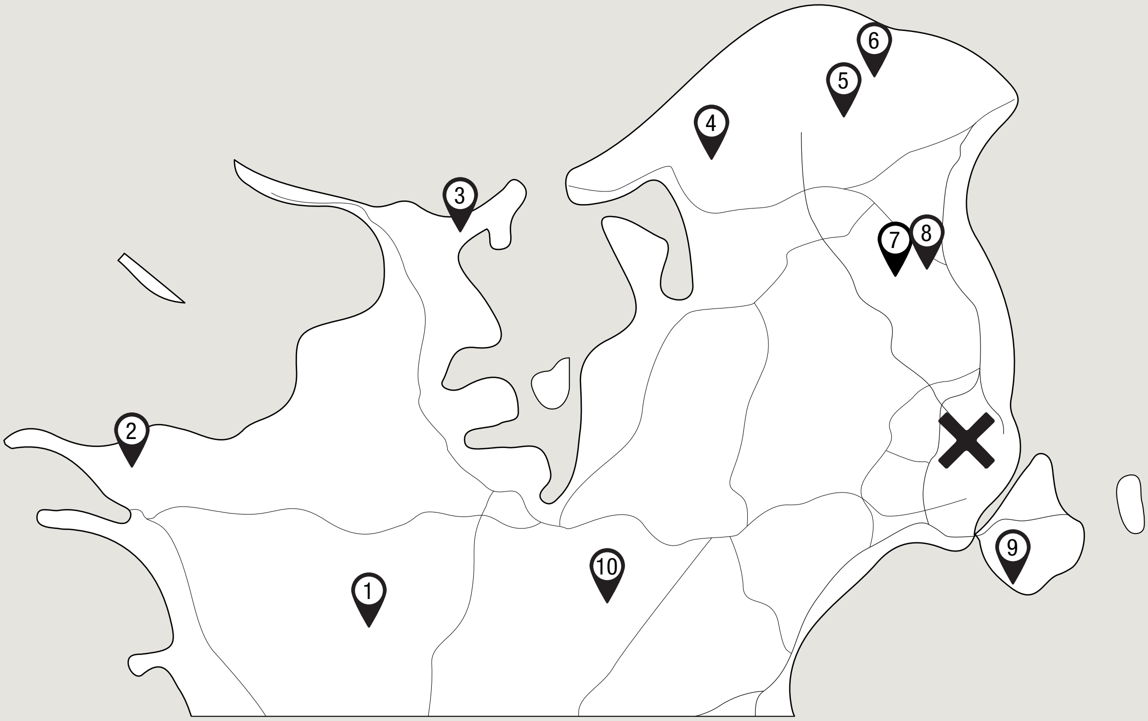
2015	total: 21 316
Syria	8 608
Iran	2 787
Afghanistan	2 331
Eritrea	1 740
Stateless	1 734

2016	total: 6 235
Syria	1 251
Afghanistan	1 122
Others	896
Stateless	488
Irak	449

Ill.1.03: Number of refugees accepted in Denmark from 2011 to 2016



Ill. 1.04: Main routes to Denmark



1	2	3	4	5
DIANALUND	KALUNDBORG	ANNEBERGPARKEN	AUDERØD	GRIBSKOV
CAPACITY **342**	CAPACITY **400**	CAPACITY **120**	CAPACITY **600**	CAPACITY **60**
OPERATED BY	OPERATED BY	OPERATED BY	OPERATED BY	OPERATED BY
CONNECTION TO SITE	CONNECTION TO SITE	CONNECTION TO SITE	CONNECTION TO SITE	CONNECTION TO SITE
1h36m	1h50m	1h30m	1h44m	1h18m

6	7	8	9	10
CENTER ESBØNDERUP	SANDHOLM	SJÆLSMARK	KONGELUNDEN	AVNSTRUP
CAPACITY **336**	CAPACITY **600**	CAPACITY **300**	CAPACITY **110**	CAPACITY **700**
OPERATED BY	OPERATED BY	OPERATED BY	OPERATED BY	OPERATED BY
CONNECTION TO SITE	CONNECTION TO SITE	CONNECTION TO SITE	CONNECTION TO SITE	CONNECTION TO SITE
1h30m	0h53m	0h55m	0h54m	1h28m

ACOOMODATION CENTER · ARRIVAL CENTER · CARE CENTER · WOMEN CENTER · DEPARTURE CENTER · CHRILDREN CENTER

RED CROSS · KRIMINALFORSORGEN · METRO · S-TRAIN · BUS · TRAIN

REFUGEES

Asylum camps

Refugees arriving in Denmark have to go through an asylum procedure in order to determine if they can be granted asylum. First, they must register at Centre Sandholm and hereafter they are placed in an arrival centre while they wait for the initial interview, which can take many months. The interview determines which type of procedure needs to be followed for the particular asylum seeker. After this the management of their application starts and the asylum seeker is then placed in an accommodation centre. While waiting for their case to be processed, the asylum seeker gets some financial support and has the possibility to do internships and receive Danish or English language courses. If they are granted asylum they are moved to a permanent housing solution in one of the Danish municipalities and start a 3-year integration program. If they are denied asylum and resist deportation, they are moved to a departure centre, lose their financial aid and can no longer do internships or language courses [Bendixen, 2016D]. Special centres, as children centres, women centres and care centres, exists to accommodate asylums seekers with particular needs. Illustrations 1.05 shows the asylum centres closest to the project site, as well as the different centres' function and public transport connections to the site.

Asylum seekers living in accommodation camps, waiting for their case to be processed, can end up staying there for a long time, usually between six months and five years. The camps are not designed for this and studies show that the longer people stay in the camps the more their social and professional skills decrease due to the lack of identity and respect. In the camps, only the bodily functions of the inhabitants are respected, but they are not seen as people who can contribute to the society. Refugees can carry traumas from their home countries, but their traumas are only intensified by the life in asylum camps, where they can become isolated and depressed. Being accepted as a part of society is hugely beneficial for the individual being. Having a job and contributing to the community also means self-recognition and the feeling of belonging. But talking about integration starts only when the asylum has been granted, which means that many people are drowning in the bureaucracy and life in the camps. Instead, integration should be a priority as early as possible, as the director of refugee community centre Trampoline House, Morten Goll, has stated: "Integration should start from the day you arrive in the country – it's just common sense!" [Goll, 2017]

It is therefore important to create community centres, that focuses on the needs of the refugees and help them integrate into their new setting.

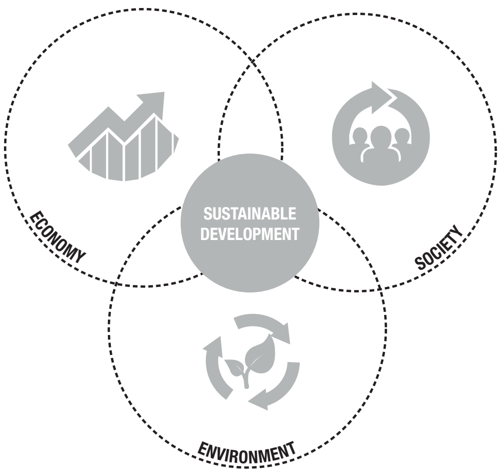
◀ *Ill.1.05: Asylum camps closest to the site*

SUSTAINABILITY

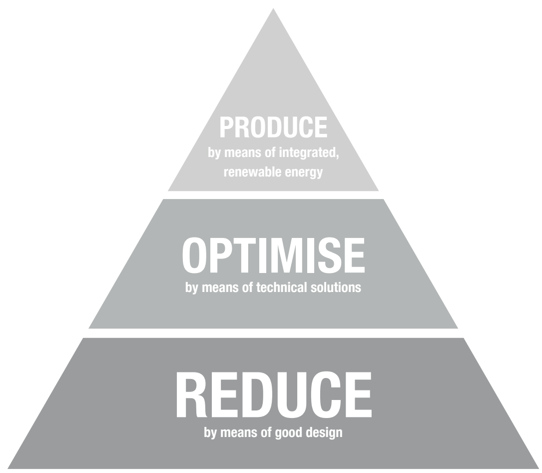
Sustainability can be described as a synergy between three different sustainable qualities: environmental, social and economic. Only when all these three aspects are taken care of, is the building truly sustainable (Ill.1.06).
The world is currently living beyond its means, using resources faster than they can be restored and producing more waste than can be assimilated naturally [Meadows et al., 1992, cited in Sassi, 2006, p. 13]. To achieve a more sustainable society it is therefore essential to become aware of the situation and "tread lightly on the Earth". This also applies to buildings, which should have a small ecological footprint, meaning that the environmental impact associated with their construction, use and end of life should be reduced as much as possible. Although the environmental approach to the construction is very important, sustainability is not merely about architectural strategies, but much more about how people live. Living within an active and safe community, with access to culture, education, work, leisure and time for family and friends proves a potential way of lowering environmental impacts. Vibrant communities have the possibility of replacing material interactions with human interactions. Architecture can contribute in the creation of sustainable communities, that are inclusive and cater to the needs of all individuals, regardless of background and beliefs. Such a community should enhance a feeling of belonging, be attractive, healthy and free of pollution, as well as assisting and informing people about living in a more sustainable way. [Sassi, 2006]
Furthermore, buildings with sustainable qualities have the potential of being an integral part of the community and thus have a long lifespan. With a long life of a building comes its effect on the next many generations. It is therefore important that the buildings can live up to the requirements of the future and in this way also become economically sustainable. [Sassi, 2006]

In the development of a sustainable community centre for refugees, the aim will be to have all three aspects of sustainability as integral parts throughout the design process, thus to create architecture with best possible quality of sustainability. Goals for the building's energy efficiency, thermal and atmospheric environment, as well as daylight conditions will be determined from the beginning, and carried out through an integrated design process. The integration of aesthetical, functional and technical solutions as equal parts of the design process will result in a holistic design, as stated by Kongebro (2012, p. 8): "The key to aesthetic, comfortable and energy-efficient buildings is found in the interaction between architecture and technology."

To guide the design process of a sustainable building the "Integrated Energy Design" scheme, as explained by Kongebro (2012, p. 16-17) is implemented (Ill.1.07). It is illustrated as a three-level pyramid, each representing a way of reducing energy demands.
The first layer and foundation of the pyramid is to reduce. This is most effectively achieved through passive strategies, that only requires an intelligent use of resources. Designing the buildings for passive solutions, such as natural ventilation, passive solar gains, natural daylight and heat



Ill.1.06: Sustainability concept diagram



Ill.1.07: Integrated Energy Design diagram

accumulation, will ensure the effectiveness in the entire lifespan of the building. Passive solutions are therefore the logical foundation of a sustainable building.

The second layer of the pyramid describes optimisation of the building by means of technical installations. Installations, such as mechanical ventilation and heating, are expensive both economically and environmentally, but will however be regained within a fairly short period, due to the reduced operating costs and CO2 emissions.

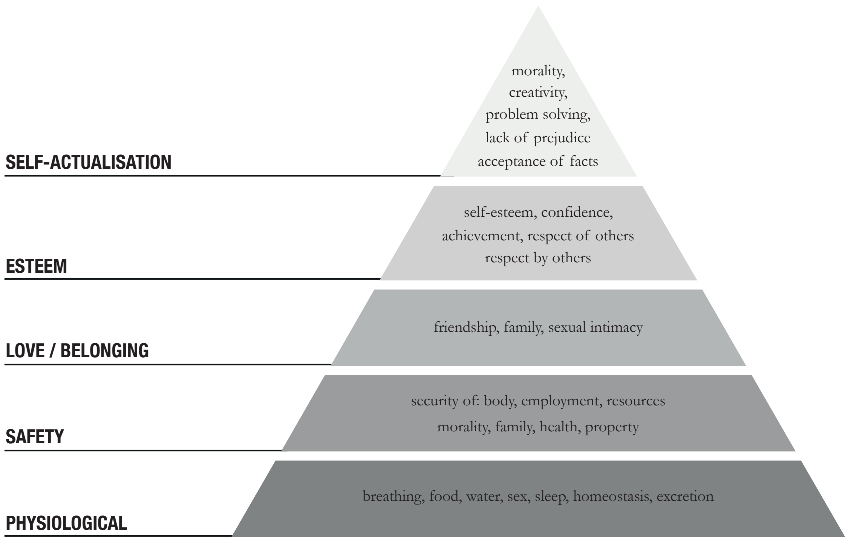
Lastly, the top of the pyramid represents the production of renewable energy. This has a positive effect on the energy balance of the building but is also an expensive implementation with a short lifespan. The need for renewable energy should therefore be reduced as much as possible by a careful, iterative design with a focus on reducing and optimising.

The aim of the community centre is to create a building that is sustainable in all aspects. The community centre should meet the needs of refugees living in asylum camps by giving them a place of belonging, where they can feel welcome and valuable. Integrating the users in the community will give the possibility of educating them in how to live in a more sustainable way, using the building that should be able to enhance knowledge of sustainability. The building's impact on the environment should be reduced as much as possible by meeting the current demands for energy consumption, focussing on local, recyclable and certified materials and only using renewable energy sources. These factors, along with a high level of flexibility ensuring a possible future repurpose, will give the building the potential of a very long lifespan, making it economically sustainable, and ensuring an overall truly sustainable architecture.

DESIGNING FOR HUMANS

Coming to Denmark in search of asylum can be a traumatic experience. Many refugees have lost their home and identity, and maybe even family and friends. When they arrive in Denmark, they are placed in large asylum camps where, even though the facilities might be good, they still feel out of place and without identity. A community centre should give the refugees a sense of belonging and identity. To achieve this, it is essential that such a centre is designed with the human body and psychology in focus.

In order to better understand and design for human needs, Maslow's "hierarchy of needs" is introduced (Ill.1.08). Maslow states that certain human needs are what motivates people to work and live. The pyramid illustrates five layers of different needs, starting with the bottom one, that take precedence on the others. Here are the physiological needs, such as food, water, shelter and sleep. These are the very basic needs that motivate people. When they are fulfilled it is possible to go further up, level by level, to the top of the pyramid [McLeod, 2007]. When a person flees from home and becomes a refugee, the very basic needs as food, water, shelter and finding safety are the main motivation. With the arrival to Denmark these basic needs are fulfilled, but there is still a long way to the top layers of the pyramid of self-esteem and self-actualization. It is therefore very important for the community centre to provide the middle layers of security, love and belonging, and after this set the right frame for the users to be able to reach the top layers of achievement, morality and acceptance.
The complexity of human nature and its interdependent psychology reveals a necessity for a major implication of social sustainability within architecture. Architecture is the art created by humans but also for humans, mainly to give shelter, facilitate every-day life and enable social interactions, but in this particularly delicate and complex theme of social integration, architecture is also there to heal, build trust and help to recover from trauma. In that sense, it seems to be more relevant than ever before to create architecture that understands the human needs and behaviour and actively contributes to a better social integration. Deep understanding of how our body's senses and feelings function can have a great impact on how to deliberately design rooms with a certain atmosphere and influence on the user. Although it is more difficult than it seems to be. According to Bryan Lawson we all fluently talk "the language of space" every single day, but since we are all individual human beings with different perceptions, we sometimes fail to explain our spatial feelings to our fellow humans. Lawson argues that there is no design guide to the perfect design, since the individual's spatial perception and associations toward architecture are never identical. Thus, the designer's desire to create a perfect physical setting pleasing all individuals and collectives is very idealistic, as stated by Steward Brand in "How Buildings Learn", and quoted in Lawson's book "The Language of Space": "All buildings are predictions. All predictions are wrong." [Lawson, 2001]. On the other hand, even though we are all very different in terms of preferences, we are still human beings and some of our overall perceptions can be generalized, categorized and predicted. Referring to Pallasmaa's



Ill.1.08: Maslow's hierarchy of needs

"Eyes of the Skin" there is a big difference in how humans perceive life and space with different senses. The space could be understood and appreciated in many ways involving different senses, but the dominant memory would always be visual while the tactile or acoustic experience remains an unconscious background impression. In the book, the sight is presented as being glorified for ages, yet a very distant and treacherous sense leading to detachment and isolation, whereas touch is the sense of nearness, intimacy and affection. The human body with all its senses is perceived as "the navel of the world" [Pallasmaa, 2015], a general reference for all feelings and experiences, hard drive for different memories and breeding ground for imagination. The body is on the border between our mental inside world and the outside surrounding reality and this special interaction should be reflected in architecture through the senses. "Architecture is the art of reconciliation between ourselves and the world, and this mediation takes place through the senses." [Pallasmaa, 2015, p. 77] It is therefore impossible to neglect the body and its reactions to the surroundings in the design, even though it might differ from individual to individual.

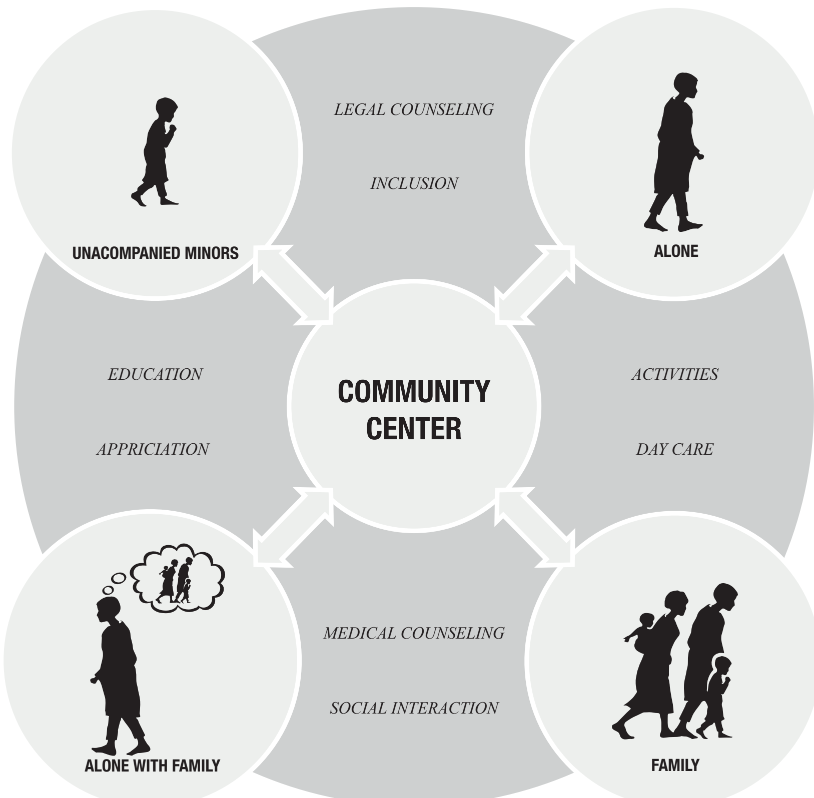
All human related sciences are definitely very subjective, broad and sensitive matters, but there is still some general truths, that we should relate to. Referring to the Maslow's "hierarchy of needs", there are three common factors for all of us, that influence our life and wellbeing: Security, stimulation and identity. The way we perceive reality through the body is more individual yet also important and very powerful in a social design. In regards to social sustainability, a great human project will show aspects of individuality, solidarity and community at once. In a socially engaged design all the above-mentioned qualities and considerations must be present in order to create architecture that equally serves both individual and the collective.

PROGRAMME

User group

The community centre will be designed for asylum seekers living in camps, awaiting the processing of their asylum application. Generally, the user groups will be: Families, people coming alone, people coming alone, but with a family still being in their home country and unaccompanied minors (Ill. 1.09). In 2015, the majority of asylum seekers were men between 20-30 years old. This age group is the biggest for women as well, but generally a lot less women than men applied for asylum. Also in 2015, the majority of asylum seekers came alone, not accompanied by family, but by the end of 2015, the number was closer to 50%. [Udlændingestyrelsen, 2016]
The needs of the users will be somewhat similar, since they are all in the same situation of seeking asylum and living in camps. The overall needs of the users will be to have a place where they can feel included and valuable – a place where they can escape from life in the camps. More specific needs include the possibility of education, such as language classes, medical and legal counselling and spaces to interact socially with others. Furthermore, families will benefit from having day care facilities, so parents will have the opportunity to concentrate on their individual needs.
The needs of the users in the community centre will vary significantly throughout the week or the day, depending on which activities take place at which time. This presents the need for highly flexible spaces, so the community centre can change according to the current functional and social needs.

Besides asylum seekers, the community centre will also be occupied by a number of other users, such as: paid staff members, volunteers and interns and, to a certain degree, the public. Inviting the public in will enhance the asylum seekers' feeling of integration in society and will also inform the public about the current refugee situation and encourage them to help.



Ill.1.09: User groups

		SIZE m2	NO.	TOTAL m2	CAPACITY people	DAYLIGHT	KEYWORD	VENTILATION l/s	COMMENTS
SOCIAL	Reception	30	1	30	3	Medium	Welcoming	32	Info desk, wardrobe
	Common space	200	1	200	100	High	Social	770	
	Kitchen	60	1	60	10	High	Functional	20	
	Exhibition Space	60	1	60	30	Medium	Inspiring	231	Flexible space
EDUCATIONAL	Classroom Big	50	2	100	25	High	Focused	193	Flexible in size
	Classroom Small	25	2	50	15	High	Focused	114	
	Computer Room	30	1	30	10	Medium	Focused	81	
	Personal Care	25	1	25	10	High	Relaxing	79	Hair salon, health counseling
	Daycare	30	1	30	15	Medium	Lively	116	
CREATIVE	Creative	60	1	60	20	Medium	Inspiring	161	Painting, sewing etc.
	Craft	60	1	60	10	Medium	Functional	91	Wood, metals etc.
	Music	40	1	40	15	Medium	Inspiring	119	
	Fitness Room	50	1	50	20	Medium	Active	158	For fitness classes
ADMIN.	Office	40	1	40	8	High	Focused	70	Open office for paid staff
	Counseling Room	8	3	24	2	High	Private	17	
OTHER	Storage	10	4	40	-	Low	-	-	Cleaning articles etc.
	Toilets	15	4	60	4	Low	-	10	Toilet rooms - 4 stalls
	HC Toilets	5	3	15	1	Low	-	10	sBi guide: 101-250 users
	Showers	20	2	40	4	Low	-	15	Shower rooms - 4 showers
	Laundry	15	1	15	-	Low	-	10	
				1029					
OUTDOOR	Green area								Can include public events
	Garden								Herbs, vegetables etc.
	Playground								

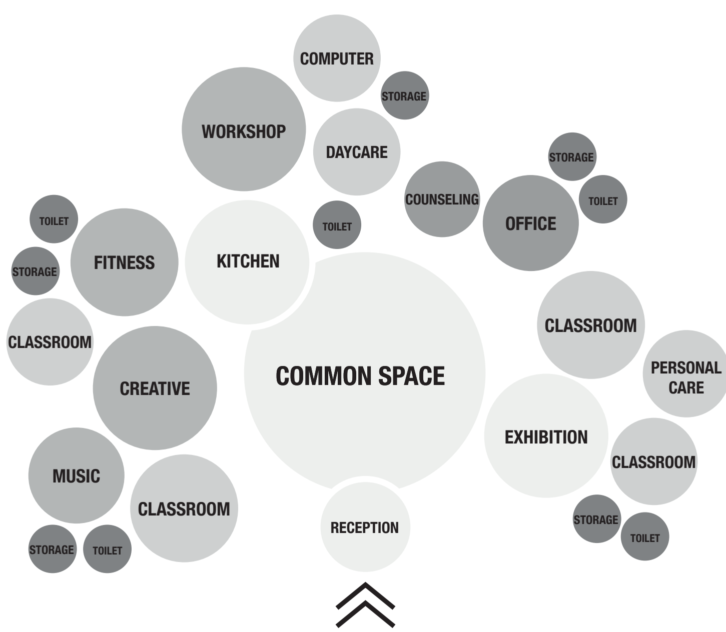
Ill.1.10: Room programme

PROGRAMME

Room Programme

The initial room programme is developed based on a case study of the refugee community centre, Trampoline House, user and site analysis (Ill. 1.10). The scheme describes the capacity in terms of occupants and net-size areas for every function within the community centre. An indication of the desired daylight condition for the functions gives an idea of the need for light and with this the placement of the function within the building. Furthermore, different keywords are used to trigger associations towards the desired atmospheres of the rooms. Initial ventilation requirements are calculated, based upon the standards of DS/EN 15251. Category II, for a very low polluting building, demands a ventilation rate of 0.35 l/s/m2 and additionally a ventilation rate of 7 l/s/person (Table B.3, DSEN_15251, p.37).

The function diagram (Ill. 1.11) shows initial thoughts of a central common space as the foundation for a socially sustainable building, where the users can meet and interact through their use of the building. The rest of the functions are dispersed around the common space and mixed together to enhance the meetings happening in the central space.



Ill.1.11: Function organisation diagram

- 02 -

ANALYSIS

Site
Climate
Case studies
Design parameters

SITE

Site location

The site chosen for the project is located in the north-western part of Copenhagen on the border between the two districts Nørrebro and Bispebjerg (Ill.2.01). According to the Kommuneplan [2015] the Floor Area Ratio (FAR) for the site should be 185%. The close proximity to the city centre, as well as very good connections to public transport make the site an easily accessible and lively place. At the same time, the project site is very well exposed due to the corner placement in an intersection between four of the bigger roads in the area. These possibilities and qualities make the project site optimal for a refugee community centre, since a place that is easy to find and get to by public transport is important to invite people who are completely new in Denmark.

The area is an old working class district and is now known for its diverse multi-ethnic population. The diversity of the area is also being reflected in its vast offer of attractions, such as colourful buildings, parks, nice cafes and shops that also could be a great advantage for the community centre and its users.

Ill.2.01: Site location mapping

Ill.2.02: Site location ▶

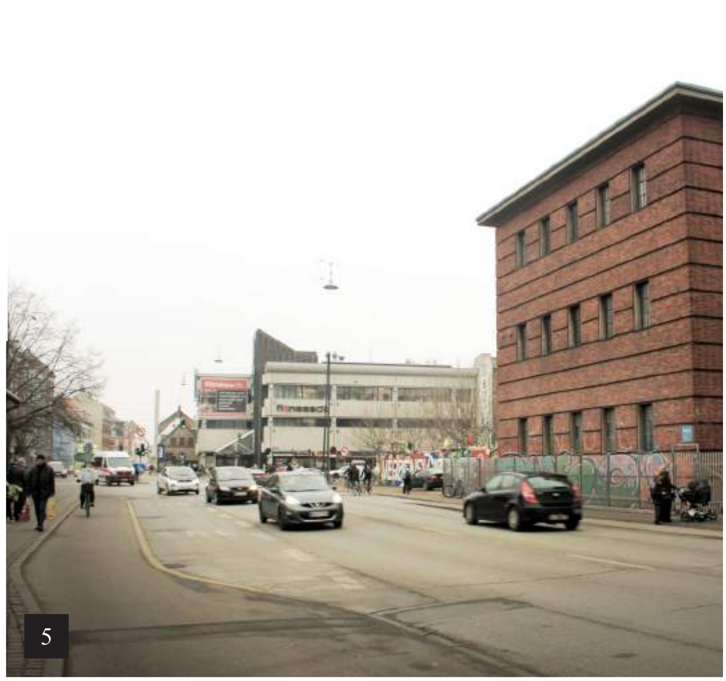

Lygten
Frederikssundvej
Mimersgade
Nørrebrogade
Nordre Fassanvej


1

2


3


4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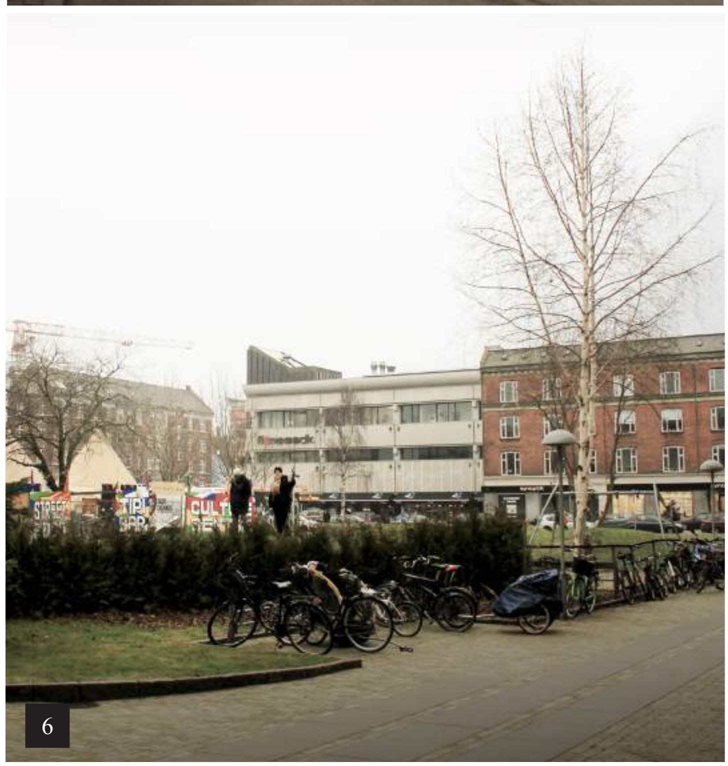
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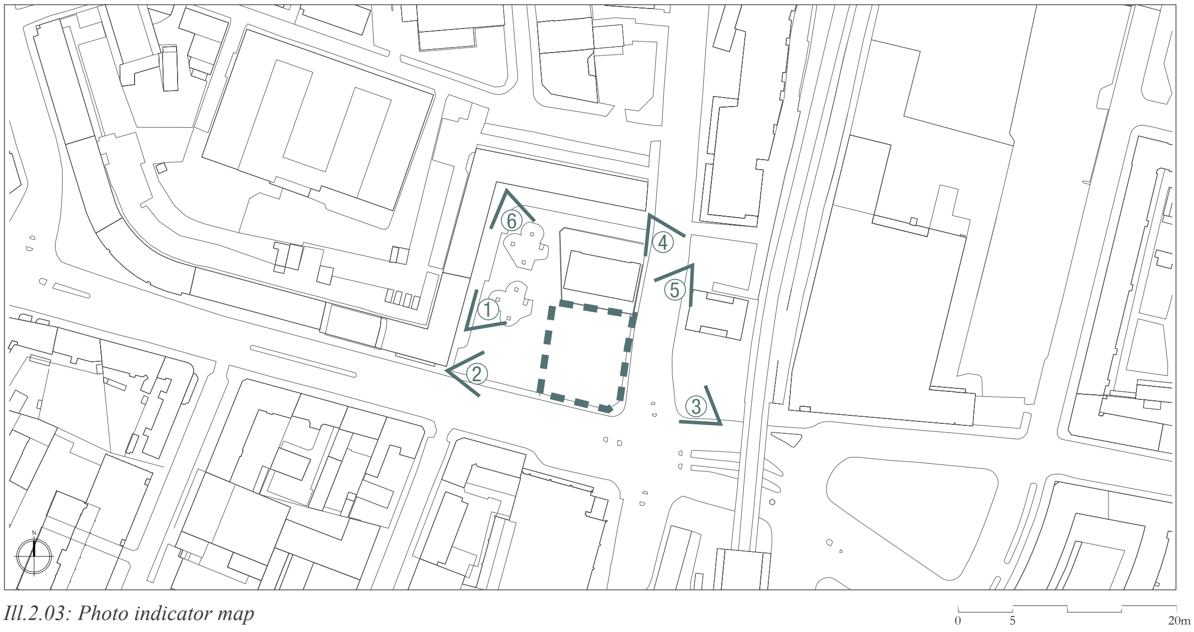
SITE

Context

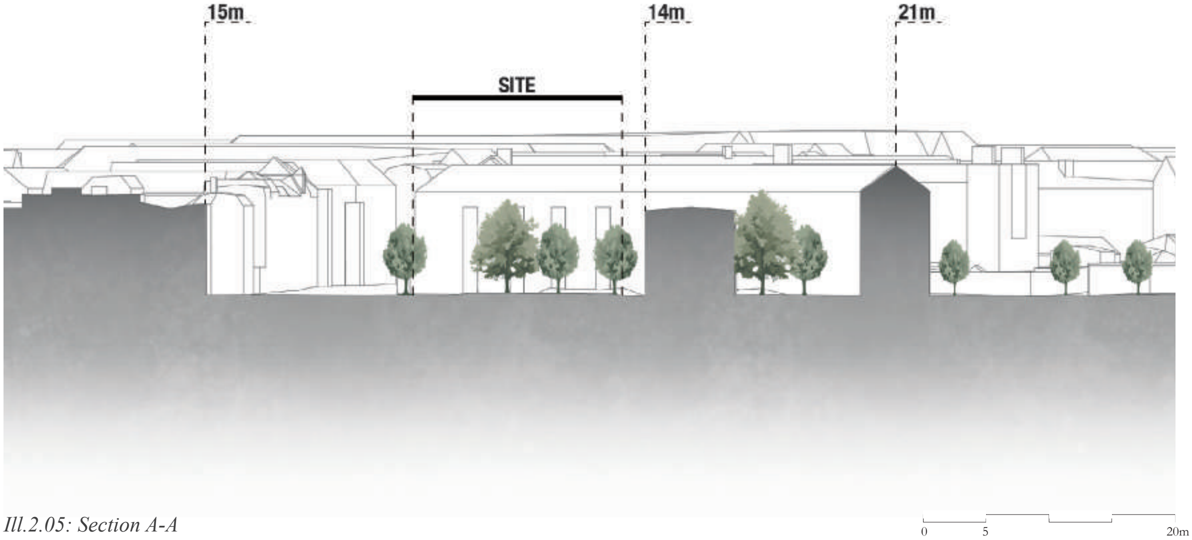
When walking around the site, the atmosphere of the area is quickly perceived. The chosen site is a very loud, lively and high-speed space (image 3) due to the intensity of both hard and soft traffic and special pop-up events, currently a street-food market (image 2). In spite of the very large and open space, it is difficult to stop without being hit by the crowd of pedestrians or bicycles and the only option is to get involved in the pace of the place.
The buildings surrounding the site are of many different identities in terms of time (both modern and traditional), typology (urban blocks and freestanding) and height (3-5 and 1-2 storeys). This gives the community centre the possibility to either add a new, different identity to the space or to relate to some parts of the surroundings.

When designing the community centre, it is relevant to take advantage of the well-exposed, highly frequented and very diverse identity of the place. This can be utilised in the design by, for example, making space for these temporary pop-up events or invite by-passers in to experience the life of the community centre. In this way, the community centre can add to the diversity of the area and be a part of the everyday life of its inhabitants.

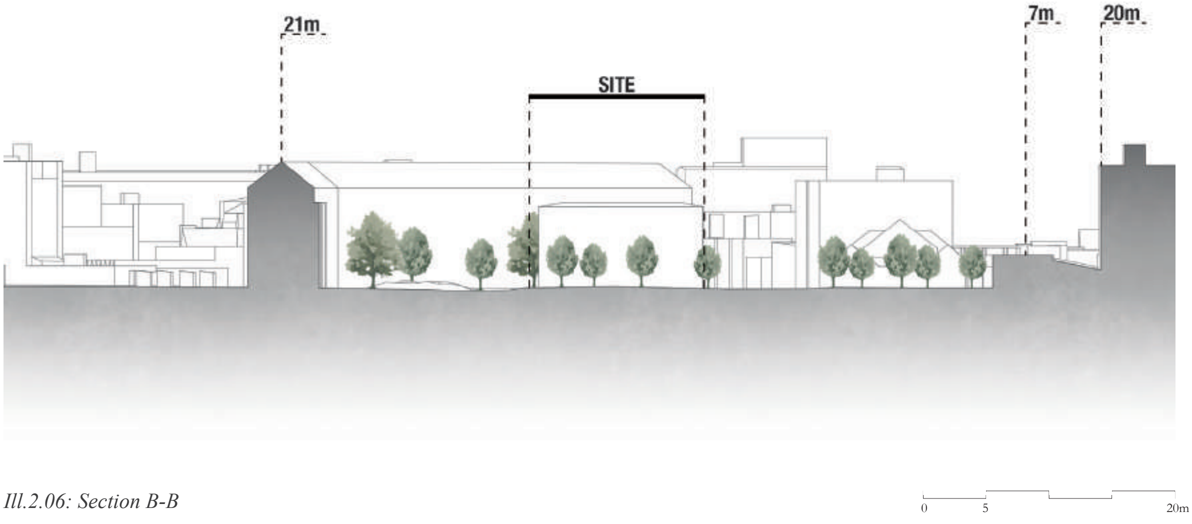


Ill.2.03: Photo indicator map

◀ *Ill.2.04: Site photos collage*



Ill.2.05: Section A-A



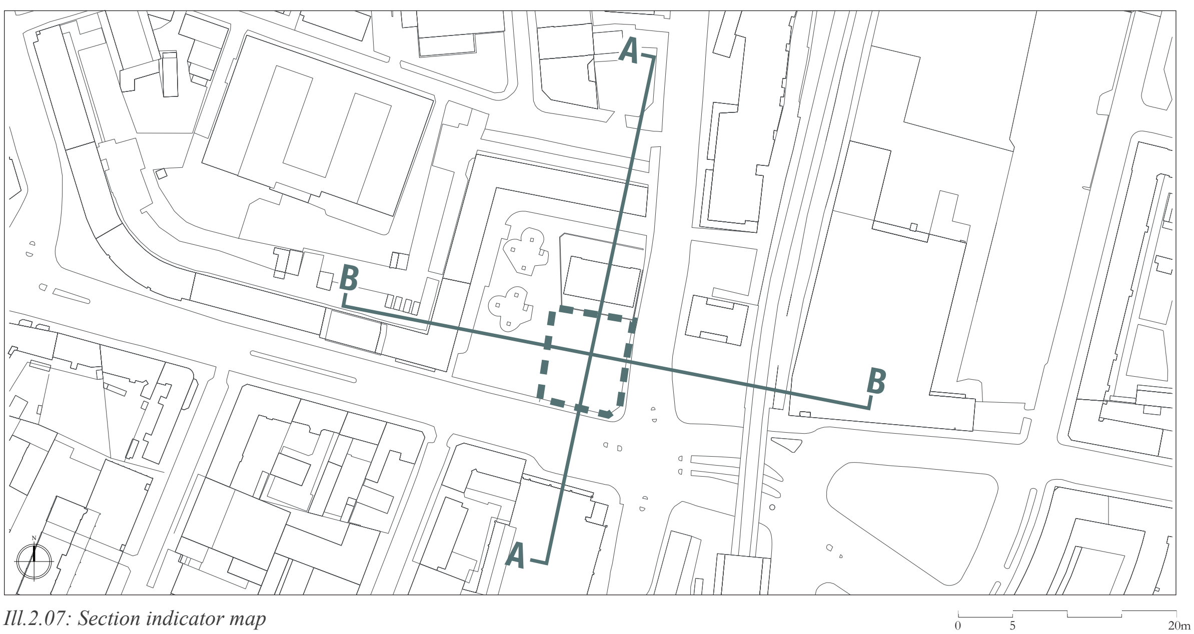
Ill.2.06: Section B-B

SITE

Sections

To achieve a better understanding of the project site and its context, analytical sections of the area are made. Section AA shows the project site and its surroundings in the north-south direction (Ill.2.05). Just north of the site there is a building of 14 metres, while south of the site is quite open because of the large street. Section BB (Ill.2.06) shows that the surroundings in the east-west direction are very open with no buildings immediately next to the site. To the west there is an open green space and a housing block of 21 metres, while the space to the east is a larger street and an open urban plaza, followed by the train tracks with a height of 7 metres.

The sections give an understanding of limits of the size, in terms of what is possible to implement without interfering with the current scale of the area. It also becomes visible what elements are present in the immediate context of the site, as these elements should be considered while making a design for the project site.



Ill.2.07: Section indicator map

SITE

Infrastucture

The project site is located at the intersection of four large streets: Nørrebrogade, Frederikssundsvej, Lygten and Nordre Fasanvej (Ill.2.08). Nørrebrogade and Frederikssundsvej act as the main entrance way from the north-west suburbs and districts of Copenhagen to the city centre. That is the reason why these roads are highly trafficked at all times during the day by cars, buses, bicycles and pedestrians. Nordre Fasanvej runs between Nørrebro Station and Frederiksberg, while Lygten runs north to one of the most trafficked roads in Copenhagen, Tagensvej. These streets are also highly trafficked by both hard and soft traffic.

Along Nordre Fasanvej and Lygten runs the S-train with Nørrebro Station placed in the same intersection as the project site. This is one of the busiest stations of the Circle Line and is currently undergoing renovations to include a metro station, which is expected to make Nørrebro Station the third largest station in Denmark, based on number of passengers [Wikipedia, 2017]. The project site is well served by many different bus lanes for both day and night. Many bus stops in the proximity of just two minutes of walking from the project site create a good connection to Copenhagen city centre and suburbs.

Good access to public transport is an essential quality for the community centre, since the users of the centre mostly will come from the asylum camps, that are placed outside of Copenhagen. It is therefore important that they can easily travel to the site without having access to a car.

The large intersection location provides the project site with both possibilities and challenges. The site is highly frequented by a large variety of people throughout the entire day, which exposes the community centre to a vast amount of users. Because of this, the pace of the surroundings is very fast, which challenges the building to utilise the qualities of its exposure while still creating spaces for the users that are pleasant and distant from the speed and noise of the surroundings.

Ill.2.08: Infrastructure diagram

0 50 200m

SITE

Functions

The area surrounding the project site is characterised by a very high level of functional diversity (Ill.2.09). The area includes dwellings, businesses and recreational spaces as the main functions.
The diversity of the area is also reflected in the diverse services, including many different restaurants, cafes, fast food shops, supermarkets, fitness centres and a shopping centre. Furthermore, many different sport facilities and public outdoor spaces such as parks and urban plazas are placed in close proximity of the project site. Different cultural offers such as concert and theatre venues, conference spaces and market halls are also well represented in the area.
The area has a very multicultural character with many immigrants and ethnic Danes inhabitants. This adds up to a high diversity of the townscape and provides the area with different spaces to practice religion for both Christians and Muslims. Many different educational possibilities, as well as three job centres are also present in the area, which could serve as a support in helping the users of the centre to find work.

Many different possibilities provide the area with very diverse user groups in terms of age, profession and ethnicity, and therefore set a good frame for the placement of a community centre in this area. Since no function is missing in the area, the design of the community centre can include only functions that improve the use of the centre and attract more users.

Ill.2.09: Function diagram

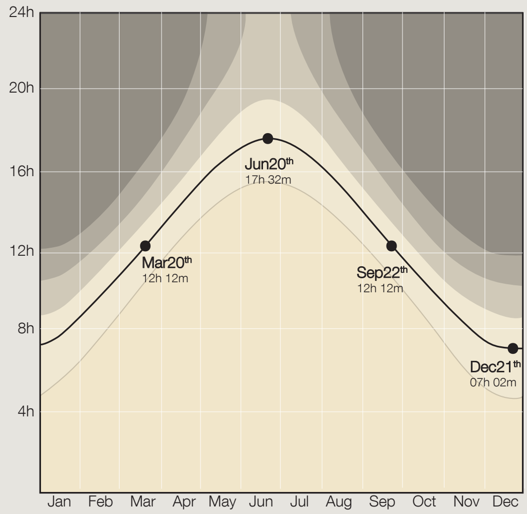
CLIMATE

Sun & Clouds

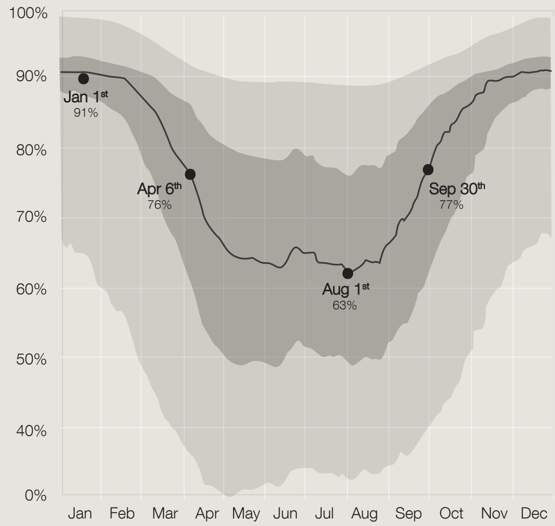
The specific latitudinal location of Copenhagen determines the length of days throughout the year. The longest day of the year is in summer on the 20th of June with around 17,5 hours of daylight, while the shortest day of the year is on the 21st of December, with only around 7 hours of daylight (Ill.2.10) [Weatherspark, n.d.]. This also results in different intensities, angles and directions of the sun throughout the day and the year.
In Denmark, the sky is often very cloudy (Ill.2.11). The average cloud cover in Copenhagen ranges from 63% up to 91%. The clearer part of the year for Copenhagen is in summer (the clearest on the 1st of August) and the cloudier part in winter with its peak on the 1st of January [Weatherspark, n.d.].

Influence of the sun on the project site should be accounted for while considering the indoor environment, utilizing sun for natural heat gain in wintertime and preventing overheating in summer. The sun and clouds are also an important factor in achieving good daylight conditions in the building, where the reflection of light on materials should be considered to minimise the need for artificial lighting.

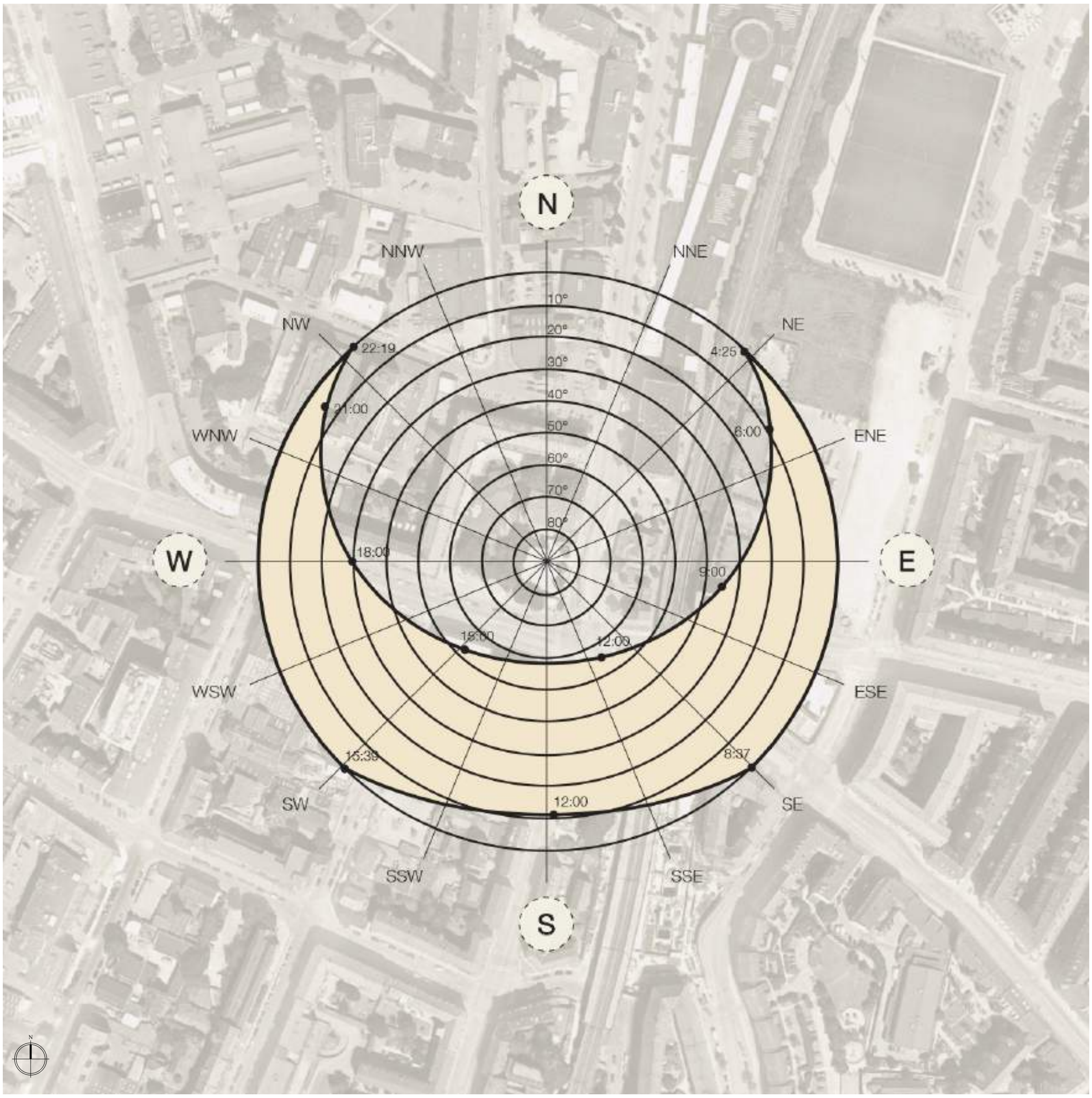
The sun and clouds analysis will also be useful at attaining the optimal placement of photovoltaics. The angle of the sun throughout the day and the year should influence the placement of solar cells and the clouds should be considered when calculating photovoltaics' effectiveness.



Ill.2.10: Sun hours over the year



Ill.2.11: Cloud coverage over the year



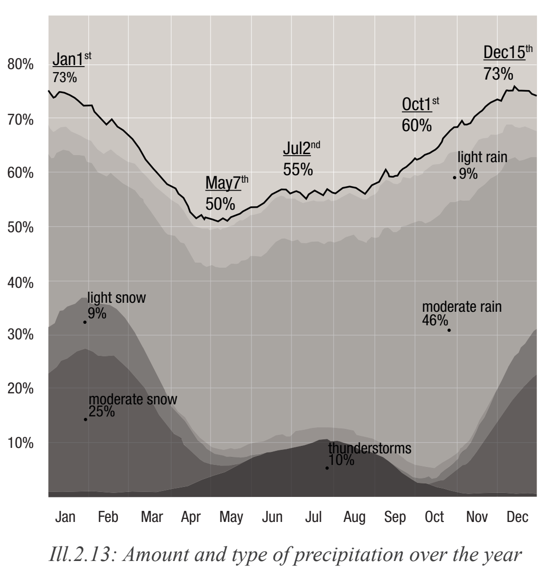
Ill.2.12: Sun diagram

CLIMATE

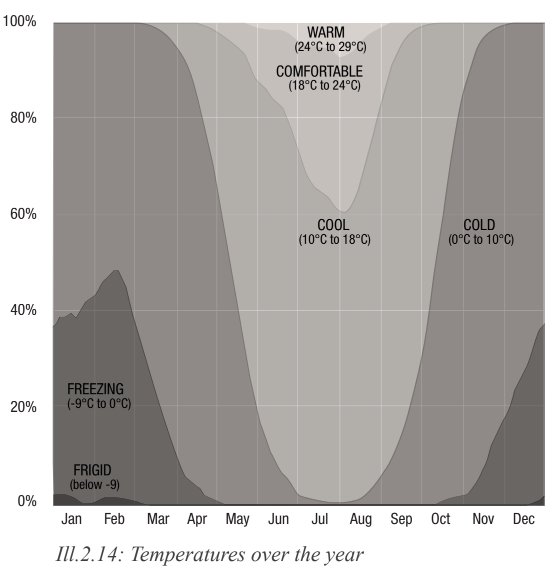
Precipitation & Temperatures

During a typical year, the temperatures vary between -2°C to 21°C in Copenhagen, while rarely above 26°C or below -8°C. Warm season occurs from June 3rd to September 8th, with a daily average high temperature above 18°C. August 2th is the hottest day of the year with an average high and low temperature of 22°C and 14°C. Cold season occurs from November 21th to March 22th, averaging a daily high temperature below 6°C. February 14th is the coldest day of the year with an average low and high temperature of -2°C and 2°C (Ill.2.14). [Weatherspark, n.d.]
Precipitation in Copenhagen vary throughout the year, but generally there is a very high probability of precipitation all year round (Ill.2.13). The probability is at its highest in December and January and lowest in May (occurring 50% of the days). During the typical year, the precipitations most likely to occur is moderate rain, moderate snow and light rain [Weatherspark, n.d.]

Temperatures and precipitations are important factors when designing the community centre, especially concerning the indoor climate. The temperatures effect the need for heating and cooling of the building and the possibilities of using natural ventilation in the building. Also, considerations about the shape of the building will be necessary to avoid accumulation of rainwater and snow on the roof.



Ill.2.13: Amount and type of precipitation over the year

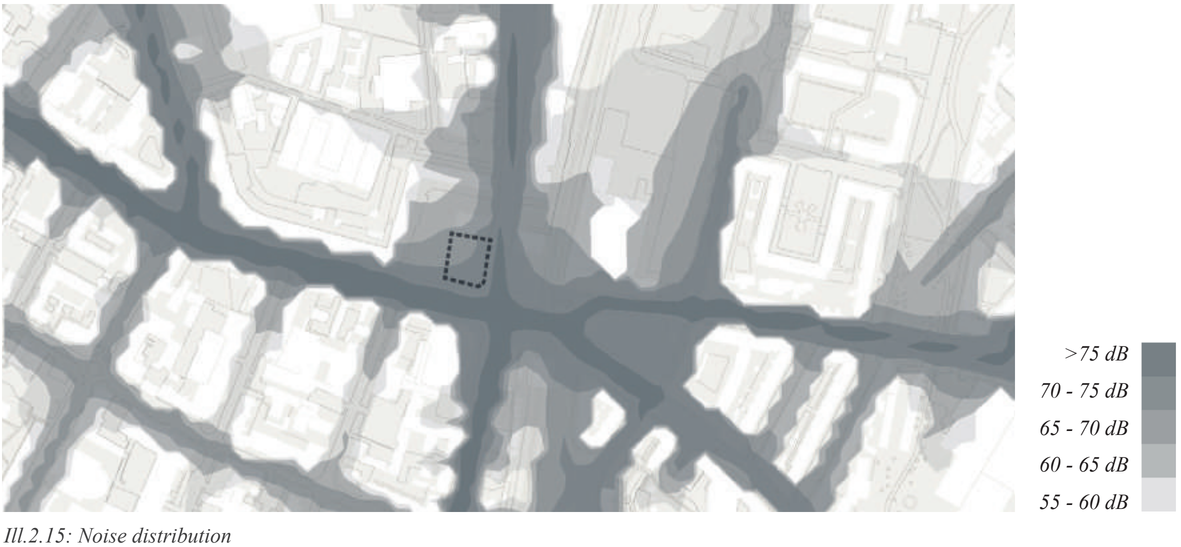


Ill.2.14: Temperatures over the year

Noise

The mapping (Ill.2.15) illustrates the sound intensity on and around the project site at 1.5 metres above the ground, which was the worst-case scenario for this given area. [Miljøstyrelsen, 2012]
In a metropolis like Copenhagen the noise pollution from traffic, trains and the inhabitants themselves have a huge impact on the soundscape. Excessive noise pollution can affect our physical as well as psychological wellbeing, and it is therefore important to be aware of the local noise levels and be able to avoid spaces with too much noise pollution. As the mapping shows, most of the project site has a noise level of 70-75dB, which is in the high end of what is tolerable. As a reference, a sound intensity of 60dB corresponds to a normal conversational voice.

The design of the community centre demands considerations regarding placement of functions and utilisation of materials that can lower the noise pollution, with the objective of creating a pleasant environment in all parts of the centre, inside as well as outside. Especially, the working and teaching spaces of the centre should be considered according to noise pollution.



Ill.2.15: Noise distribution

CLIMATE

Shadows

The study of shadows on the site, made using Google Sketchup, shows how the light and shadow behave on the site for specific peak days and hours throughout the year (Ill.2.16). The sun cast shadows in different ways during the day: morning, noon and afternoon and during the year: spring, summer, autumn and winter. The shadows from surrounding buildings do not affect the site due to relatively low height of the context (3-4 storeys) and proximity of two wide streets and squares. The worst light conditions on the site are in wintertime, when the sun path is low and casts longer shadows.

The shadows study should be taken into consideration when designing attractive outdoor areas connected to the building. Shadows also have an influence on the indoor environment. Well sheltered parts could help cool down the interiors in summer, and exposed parts could be heated up naturally in winter, when there is a high demand for heating.

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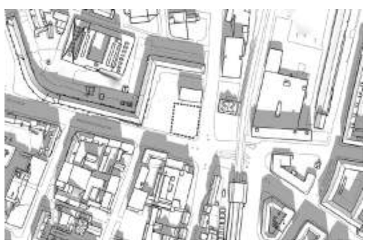

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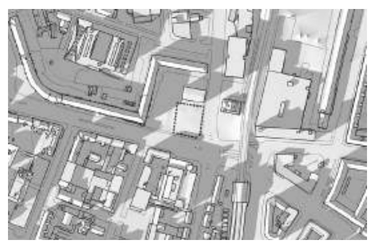

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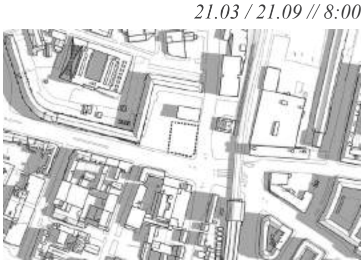

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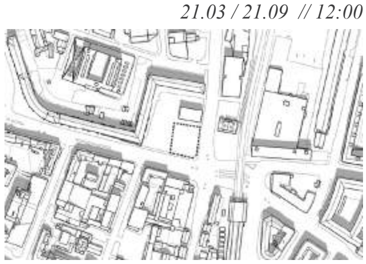

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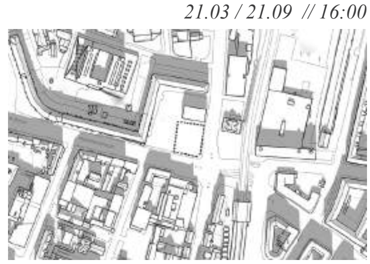

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21.12// 8:00

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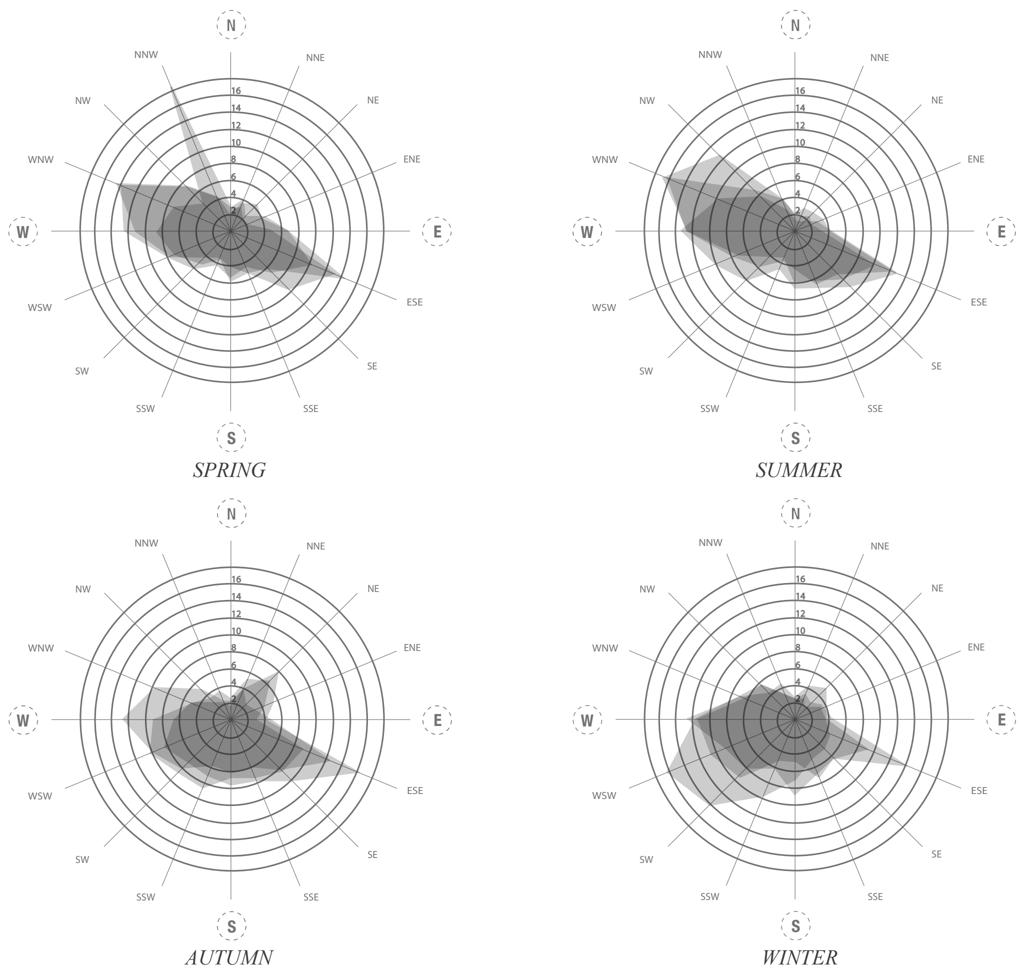
21.12// 16:00

Ill.2.16: Shadows on site

Wind

Wind conditions on the site are important to consider while designing a sustainable building. The direction and velocity of the wind on and around the project site depends on the urban environment with its buildings, green spaces, large streets, etc. The most common directions of the wind throughout the year in Copenhagen are west and southwest (Ill.2.17). The speed of the wind is rather evenly distributed throughout the year. The peak speed of 18m/s is reached in May. The analysis of the wind velocity and directions is important while designing the community centre to achieve effective natural ventilation. Another important aspect to consider is how to shelter from the wind in outdoor spaces surrounding the building.



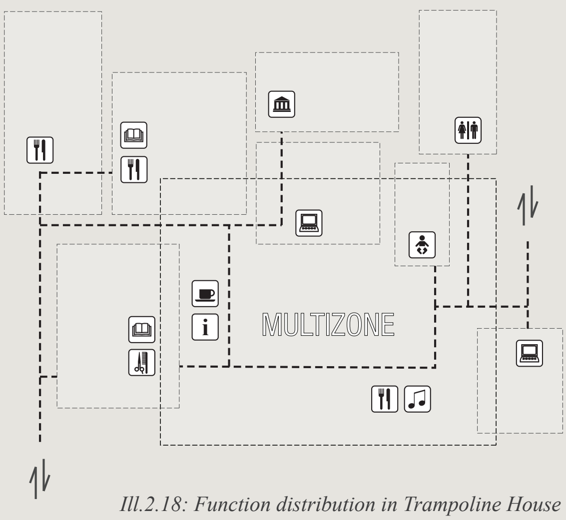
Ill.2.17: Wind directions and intensities throughout the year

CASE STUDY

Trampoline House

Trampoline House is an independent community centre for asylum seekers and refugees that aims to serve as a replacement for a family structure or home for the people living in asylum camps. Their slogan "my house, your house" expresses the very welcoming approach of the community centre while it also underlines its user-involving identity. Trampoline House draws parallels towards the home, by aiding the occupants and making them feel safe while protecting their rights, and in return demanding a contribution to the daily life in the house, which is a necessity in order to make the house function. It can be done in a number of different ways, like giving lectures or creating workshops that others could participate in, cooking dinner, making coffee, cleaning, fixing some parts of the house, etc. At the Trampoline House the interplay between refugees and non-refugees is crucial, therefore all activities offered in the House are carried out by mixed teams of refugees and volunteers. Trampoline House is a place where a vast variety of cultures meet and reconcile and this diverse social structure makes the house attractive for all occupants. Volunteers come to the house to get another perspective on life from people with different backgrounds and to do something good for the society. Refugees and asylum seekers use the house as a free space away from the traumatising reality of the camps, to integrate with nice, helpful people and to feel useful, needed and supported. The interactions and relationships in Trampoline House are very beneficial for both users and the centre. Proving that true social integration can go beyond the settings of cultural and personal differences.

In terms of the functional arrangement, Trampoline House include two classrooms, two kitchens, common multi-zone space, two staff offices, an art gallery, a counselling office and toilets with shower and laundry. The described feeling of the house is enhanced by the size of the place, which is around 550m2, but also by a cosy and flexible temporality and imperfection. Even if the house works well in terms of social and functional facilities, there still is a language barrier encountered in everyday life. A very functional solution for this problem was the use of iconographic information about building equipment or activities.



Ill.2.18: Function distribution in Trampoline House

The case study of Trampoline House is written based on an interview conducted with the Program Coordinator of the house, Tone Olaf Nielsen. For the full interview see Appendix 01.

Ill.2.19: Trampoline House interior - Multizone

For the design of a community centre of this nature it is important to be a place of integration, reconciliation with the reality and being socially accepting. The quality of the Trampoline House lies in the friendly and welcoming atmosphere that makes people kind towards each other and eager to participle in the community life, be emphasising that getting and benefiting adjoins with giving and sharing. The scale of the community centre will be of a different one than Trampoline House, but the ability to build a community, where profit and effort are fused together, is something to be inspired of. The case study of Trampoline House also provides the project with a list of functions and inspiration on how to solve challenges occurring in everyday life at such a community centre.

Ill.2.20: La MéMé - facade

La MéMé project represents a way of working with a close integration of its users. Their influence on the building corresponds to Lawson´s idea of translating "the human language". This particular approach could be reflected in the way the users of the community centre adapt parts of the building according to their needs. The opportunity to present their personas in the architecture could ultimately act as a reconciliation with the architecture.

CASE STUDY

La Mémé

La Maison Médicale (or La MéMé in short) is a student housing project, that was created by Lucien Kroll in the mid 70s in close collaboration with the students, who were the future inhabitants. This was done as a protest against being foisted by the original architect and the university towards traditional commercial architecture, serving every other party than the inhabitants themselves. The students' reaction to the situation was to demand having an influence on the process of the development of their dwellings and hereby they referred to Lucien Kroll [Graaf, 2016]. La MéMé is examined as a case study in terms of estimating the benefits of basing the design process on a substantial amount of user influence.

"An open process becomes the motivation for its form and complexity. This can't be reduced simply to the production of an architectural object or even to an aesthetic, but is if anything the prototype of a radical overturning of architecture. The MéMé would thus be a manifesto- building: recognized as an "icon of democratic architecture" (…)" [Poletti, 2010]

Kroll provides the students with guidelines and makes them work in groups, using mainly models rather than drawings. The fact of being distanced from the institution allows more freedom in the process. The work between Kroll and the students is very intimate and often takes place within Kroll's private residence, embracing the collective as a key feature. At one point the students collectively buy a house with the ambition of renovating it, ripping out the interiors, leaving only the shell standing and then redecorating it according to their needs. Kroll acknowledges this idea and develops it in the concept for La MéMé. By constructing a shell house and allowing the inhabitants to transform it, he creates a different approach to the design, which is described as the mock-house method.

What this building has achieved is considering human influence as the key aspect in the design process and communicating this through architecture, that exhibits a mosaic of personas. The democracy of this architecture is centred around the users and strives towards a social sustainability which is often neglected in the consensus of typical architecture, dictated by an architect. The only critique of the building is that only the first-generation users have an opportunity to entirely adapt their spaces, leaving this "Frankenstein's monster" to the future inhabitants and spectators [Graaf, 2016].

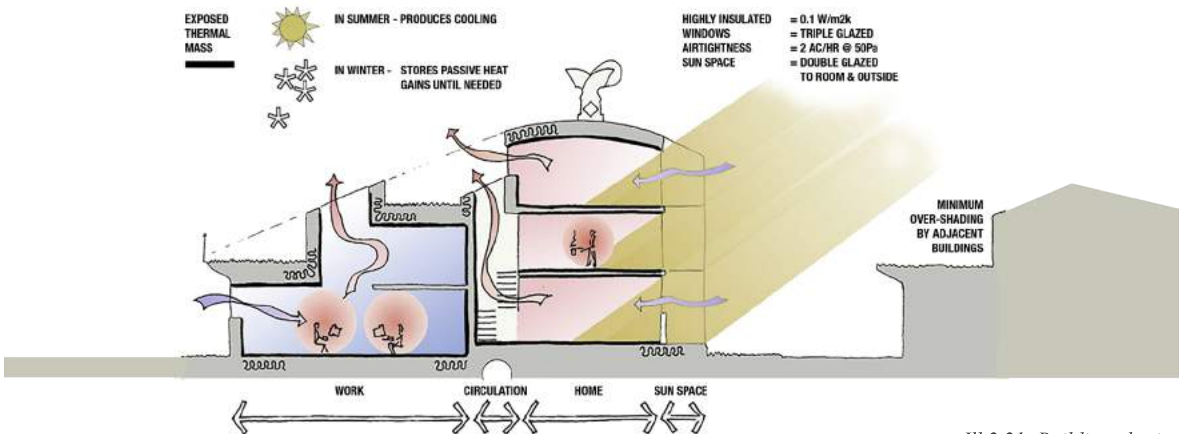
CASE STUDY

BedZED

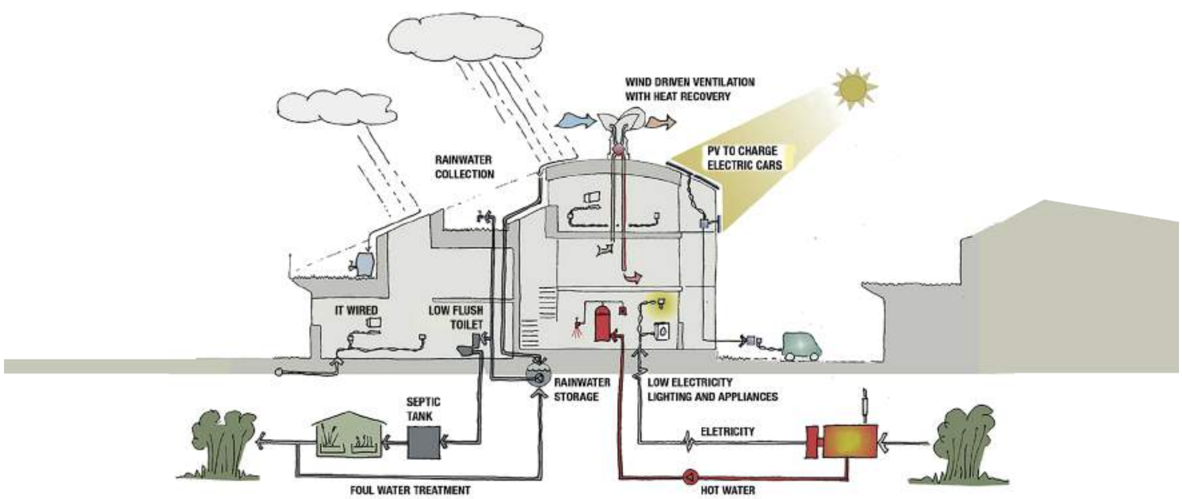
Located in the southern London suburbia, the BedZED complex is the UK's first and largest eco-village. It was completed in 2002, initiated by the environmental organisation BioRegional and designed by Bill Dunster Architects. It is designed and operated with a holistic approach to sustainability and a consideration of the environmental impact of every part of the building. All aspects of the residents' lifestyles relate back to sustainability, in the way that all residents are thoroughly informed of the way they themselves can minimize their carbon footprint. [Danish Architecture Centre, 2014]

BedZED have reached impressive results in terms of lowering the need for heating and cooling, the use of electricity for lighting and appliances and water consumption, merely through careful design and utilisation of passive systems. The first step in achieving these low energy demands is the design of the building physics (Ill.2.21). The functions are orientated according to the utilisation of external heat gain. Working spaces, with high internal gains from appliances and fairly steady gains from people, are placed to the north to minimise solar heat gain. The dwellings, with low internal gains and varying gains from people, are then placed to the south with large glazing areas to maximise solar gains, thus creating zero-heating homes. The building envelope also plays a large role in making zero-heating possible. The thermal mass is exposed to ensure cooling in the summer and storing and release of heat in the winter, as well as airtightness and multiple layers of glazing minimise uncontrolled heat loss through the construction. The materials of the building were sourced within a 55km radius to reduce transport impact, and as many as possible were recycled materials with a recognised environmental standard, as for example FSC certified wood.

Low energy demand is secondly ensured in the design of the building's systems (Ill.2.22). BedZED uses a bio-fuelled combined heat and power system which runs on wood chips, previously used as landfill, from a local waste stream. The natural ventilation system was developed to deliver preheated fresh air and extract polluted air, including heat recovery from the extracted air. The wind cowls on the roofs of the buildings were designed to harness low velocity wind and utilise both positive and negative wind pressure to ensure that the supply air is ducted down into the building and the polluted air extracted from the building. The specific design of the ducts and cowls allows to achieve a certified performance that eliminates the need for ventilation fans, trickle vents, controls and fresh air heating, thus being a completely renewable energy source. Roof surfaces are designed for rainwater collection, which is stored in underground tanks and then used for watering the gardens and flushing the toilets. Surface water runoff is handled using a sustainable drainage system which prevents the surface water from going into the local sewers. Instead the water slowly soaks into the ground, as if there were no buildings upon the site.
Lastly, a few photovoltaics are placed on the south facing roofs and are used only for charging shared electric cars. With this BedZED is not only a carbon-neutral building but also a net exporter of renewable energy. [Twinn, 2003]



Ill.2.21: Building physics



Ill.2.22: Building systems

The BedZED will influence the design of the community centre in the way it maximises the use of passive strategies to minimise the need for active solutions. It will give inspiration to the design process and the general vision for choosing only the most sustainable solutions, using passive systems to lower the energy demand of the building.

DESIGN PARAMETERS

Functional

- The community centre should contain spaces for social interactions and spaces for contemplation
- Some parts of the building should be open to the public, while other parts are only open to the users
- The Floor Area Ratio of the building must not exceed 185%
- The building should be no more than 24 meters tall

Technical

- The building must meet the energy class of 2020, with only passive initiatives
- The community centre must be a Net-ZEB, with the implementation of renewable energy sources
- The indoor climate must meet category II of DS/EN 15251
- The daylight factor must be > 2% on average for all occupational rooms
- The materials should have a low impact on the environment by being recyclable or certified
- The construction should have tectonic qualities and a low impact on the environment

Social

- The architecture must embrace the human body and senses
- Social spaces should be the centre of the building to enhance social interactions
- The building should enable the users to regain identity and a feeling of achievement
- The users should be able to adapt certain parts of the building, according to their needs

Aesthetical

- The aesthetic expression should be open, inviting and embrace the community
- The materials should relate to the human senses and create specific atmospheres
- The community centre should act as a landmark in its surroundings
- The building must inform about integration of refugees in the Danish society
- Sustainability should be a part of the aesthetic expression

- 03 -

PRESENTATION

VISION

The refugee community centre should be a truly sustainable building, consisting of a synthesis of environmental, economic and social aspects. It should provide asylum seekers with a feeling of being a central part of a community and function as a way to escape the life in the camps. The centre will enable its users to strengthen their professional and social skills by setting the right frame for learning and creating a network. Being a part of a community means that receiving something translates into contributing to the community, thereby providing the asylum seekers with the possibility to both accumulate new skills and share their own skills and knowledge with their fellow users in a mutually beneficial manner. The community centre will accommodate many different users of various backgrounds. It should be designed to be suitable for all its users and also, to a certain degree, invite the public to take part in events and thus interact with the users of the centre. The building should be designed with thought on expressing the diversity of users through the aesthetic expresion.

In order to ensure a holistic sustainable design, the technical aspects of the building such as lowering the energy consumption, ensuring a satisfying indoor environment and implementing renewable energy sources should be an integrated part of the design process. The community centre should be designed in a way that informs its users on how to inhabit a sustainable building and also promote sustainable living.

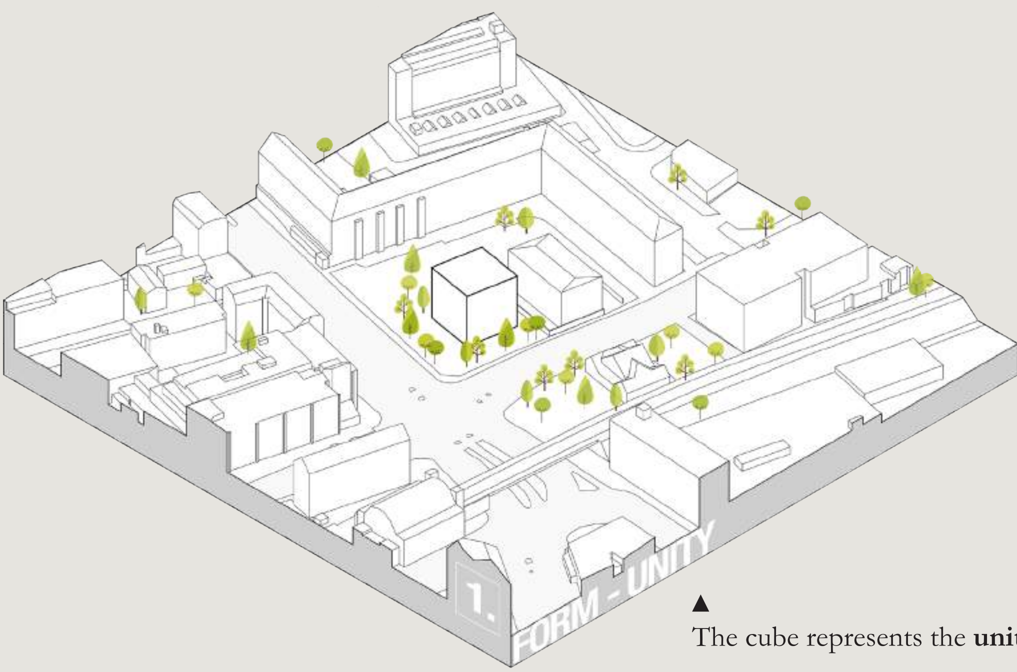
A holistic design of the community centre with focus on welcoming and activating asylum seekers will lead to a better integration of refugees starting already from the day of arrival in Denmark. It should enhance their quality of life and their chances in getting a job or education and help to become an integral part of the society. As a result, the community centre should stand out as a landmark showing how to efficiently integrate refugees in the society.

"It is evident that 'life-enhancing' architecture has to address all the senses simultaneously, and help to fuse our image of self with the experience of the world. The essential mental task of buildings is accommodation and integration."

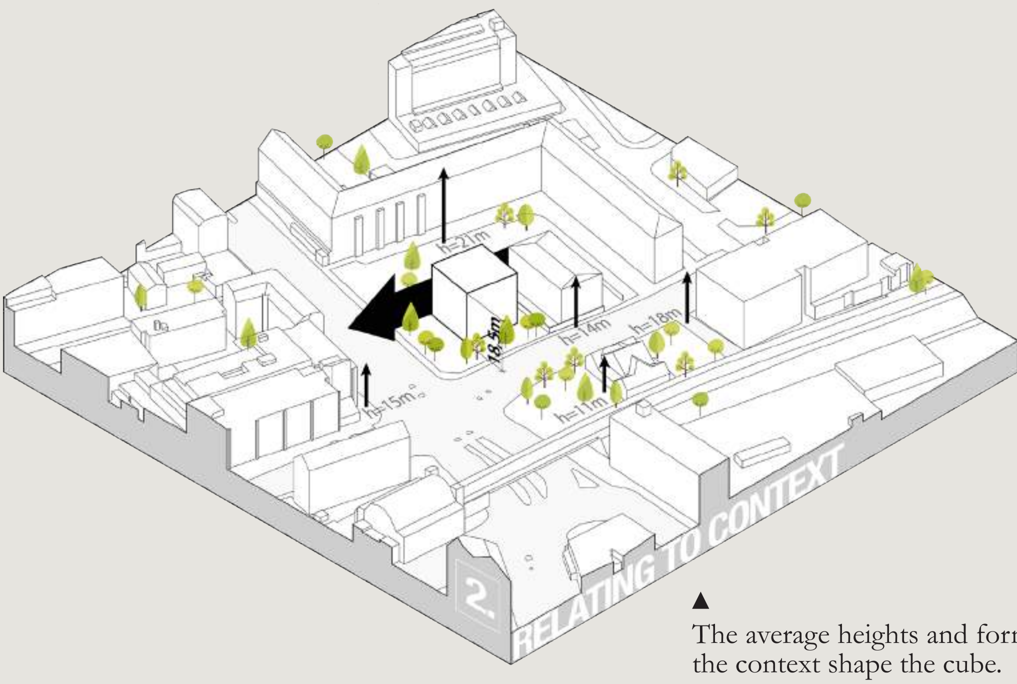
J. Pallasmaa

Ill.3.01: General concept diagram

CONCEPT



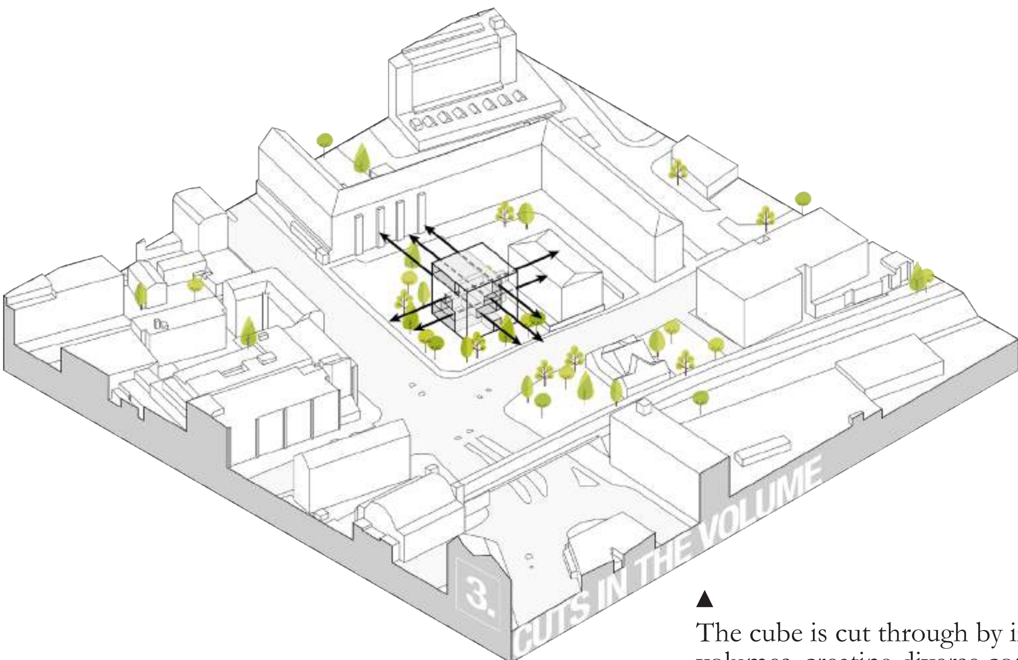
▲
The cube represents the **unity** of its users.



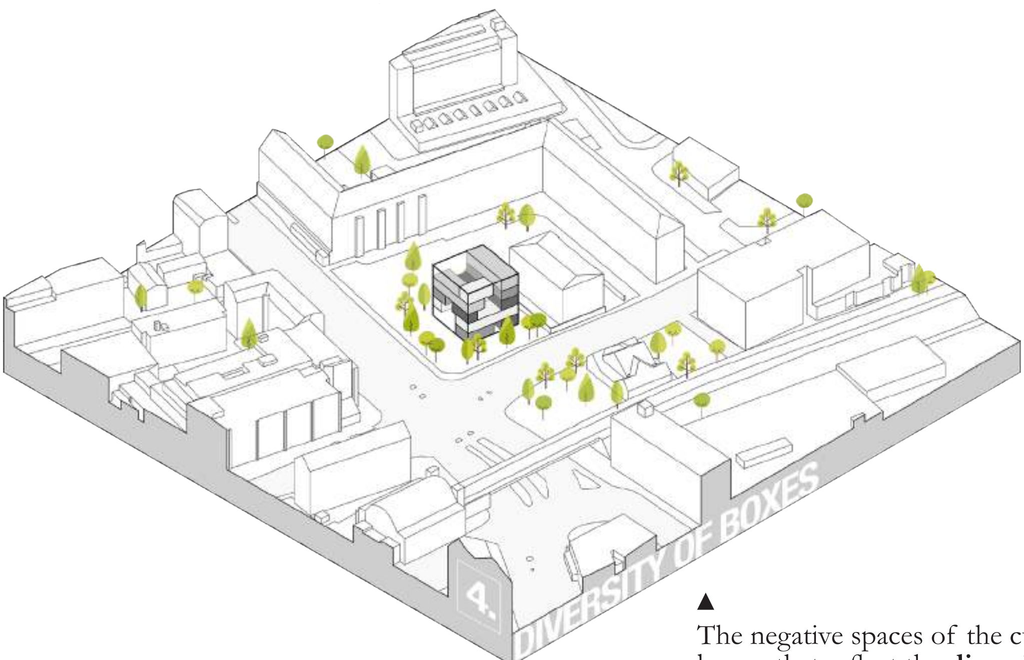
▲
The average heights and form language of the context shape the cube.

Ill.3.02: Concept diagram

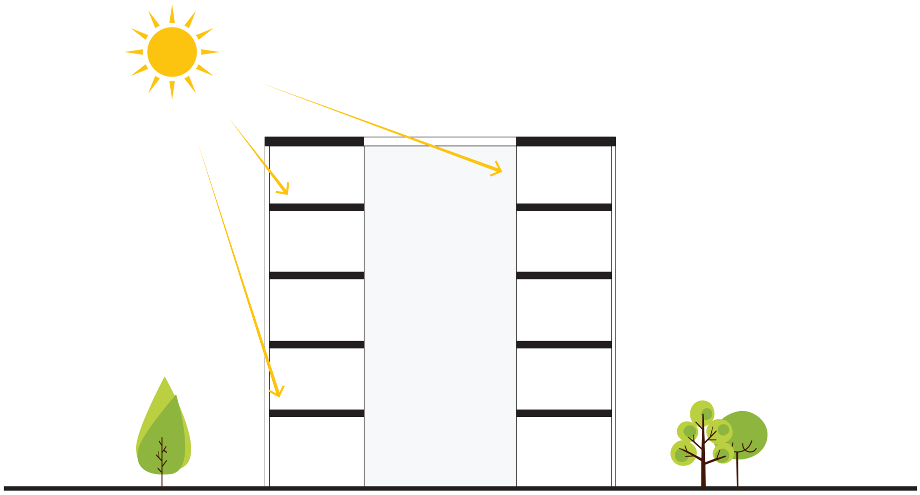
Unity in Diversity



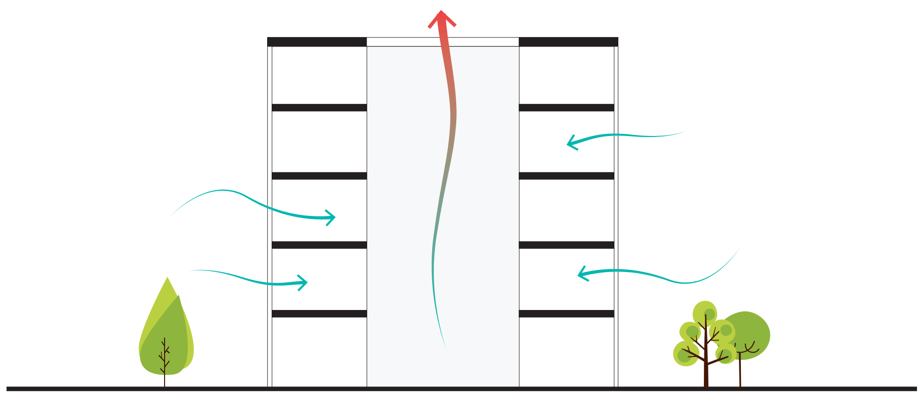
▲
The cube is cut through by intersecting volumes, creating diverse common spaces.



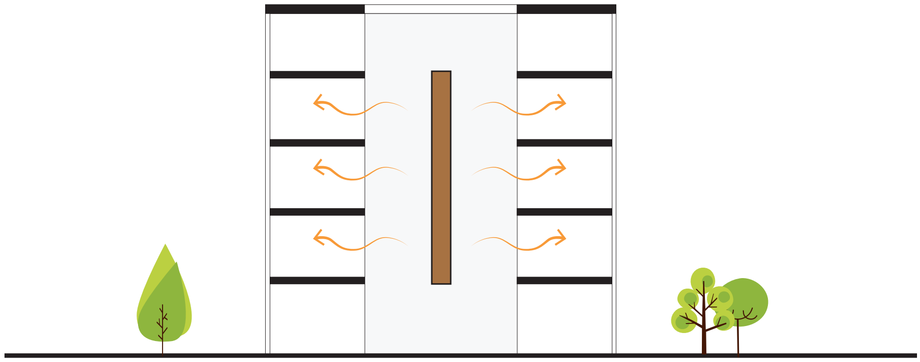
▲
The negative spaces of the cuts creates boxes, that reflect the **diversity** of users.



Ill.3.03: Passive solar gains and daylight



Ill.3.04: Natural ventilation



Ill.3.05: Thermal mass inside the envelope

CONCEPT

Passive Strategies

In order to design a truly sustainable community centre, it is necessary to ensure a good thermal and atmospheric indoor environment, minimise energy and water consumption and the use of materials. This is best achieved through a combination of different passive strategies implemented as fundamental parts of the iterative design process. This will optimise the design of the community centre by reducing the energy demands for ventilation, light and heating with the use of renewable resources. By focussing on the implementation and design of passive strategies the need for active solutions is lowered. Illustrations 3.03-05 show the three fundamental passive strategies, all based on a central atrium within the building.

Daylight conditions are an important factor in achieving a good indoor environment with a pleasant atmosphere, and lowering the demand for artificial lighting. The atrium lets the daylight spread through the functions of the building, and postpone the need for turning on artificial lighting.

Passive solar gains provides the building with heating all year round, that lowers the need for heating in the winter, but can also give problems with overheating in summer. Implementing solar shading could prevent overheating of the rooms in the summer months.

Natural ventilation of the community centre is based on the atrium, ensuring stack and cross ventilation of the open common spaces within the cuts. The natural ventilation is driven by temperature and pressure differences, and the polluted air is extracted from the building through the skylight of the atrium. The boxes surrounding the atrium are also be supplied with natural ventilation by placements to the facades, providing either single-sided or cross ventilation.

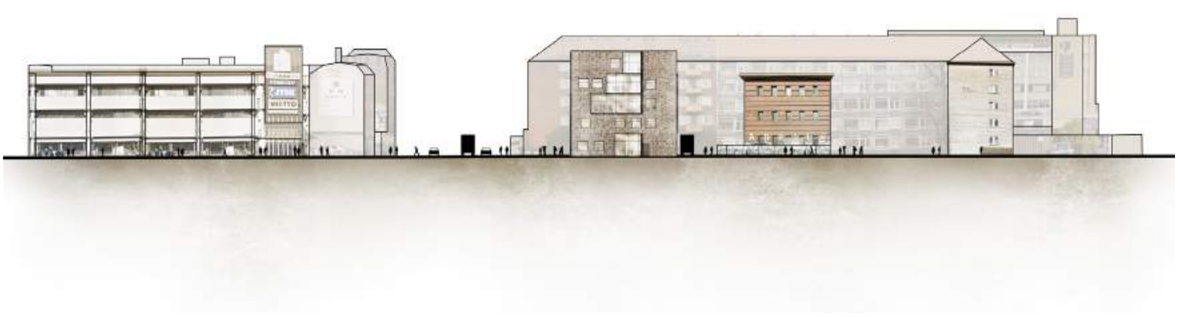
Thermal mass implemented in the building ensures more steady temperatures throughout the day. Construction elements with high heat capacity stores the excess heat accumulated in the building during the day and releases it during the night to prevent large fluctuations in the thermal environment.

All passive strategies are designed to support each other. The central atrium providing good natural ventilation also allows the daylight to enter the central areas of the building, while implemented thermal mass enhances the effectiveness of the natural ventilation and the buildings energy efficiency.


N
0m
5m
20m

SITE PLAN

The site is located on the corner of a busy intersection, functioning as a transit area for numerous cars, bicycles and pedestrians every day (Ill. 3.06). The placement just on the border of the Nørrebro district, a lively area with a high level of diversity, makes the building and the site relate to the special atmosphere of the city. An urban corner site implies a special treatment of outside spaces enhancing the diverse social interactions which would add value to the area.
The urban spaces surrounding the building are designed based on flows in the area. A wide path is cut through the site from north-east to south-west in order to let by-passers cross the site as a shortcut. By inviting people onto the site, the community centre with its lively atmosphere is revealed. The building is transparent in some parts in order to make the purpose of the building visible from the outside and inform about the integration of refugees into Danish society, which can have many positive reciprocal effects.
The second main flow happens from the corner of the site to the entrance of the community centre, making the way of entering clear and accessible for all.
The main function in the ground floor of the community centre is a large dining space. This gives place for the centre to arrange community dinners both for the users and for the people living in Copenhagen. The asylum seekers can get an opportunity to share their cooking traditions with others and form a social network, enabling a better integration into the society. The dining space opens up to the outside by a sliding glass wall to the south, enlarging the space and giving the possibility to sit and eat outside. The outdoor dining area is open to the surroundings and visible when passing by the site, but still slightly protected from the busy life of the street by plant beds and greenery, creating a nice border, where the urban life can happen and be observed.



Ill.3.07: Context elevation, East

◀ *Ill.3.06: Site plan*

ELEVATIONS

Ill.3.08: Visualisation from the intersection

Ill.3.09: South facade

Ill.3.10: East facade

Ill.3.11: North facade

Ill.3.12: West facade

Ill.3.13: Visualisation of the outdoor terrace

MATERIALS

Illustration 3.14 shows the use of different materials in the design of the community centre. Generally, all materials are chosen for their sustainable capabilities and the possibility of a sustainable execution of the building. All materials come from local suppliers to minimise the needs for transportation and hereby the environmental impact of the building.

Wood is the primary material in the building, and is used for the structure and interior walls and floors, where it is protected from the climate conditions. For the structure, glue laminated wood is used, the cladding for the walls is of plywood panels and the flooring consist of wooden boards. The use of wood as the structure derives from its life cycle properties, where it performs better than other suitable materials. Although this statement is only true if the wood comes from sustainable foresting, thus all wood used for the centre is FSC certified. Also, the execution of the structure is of great importance, since poor detailing of wood can affect its ability of being reused. For this reason, the wooden elements are kept as regular as possible, and the number of bolts and joints is minimised.

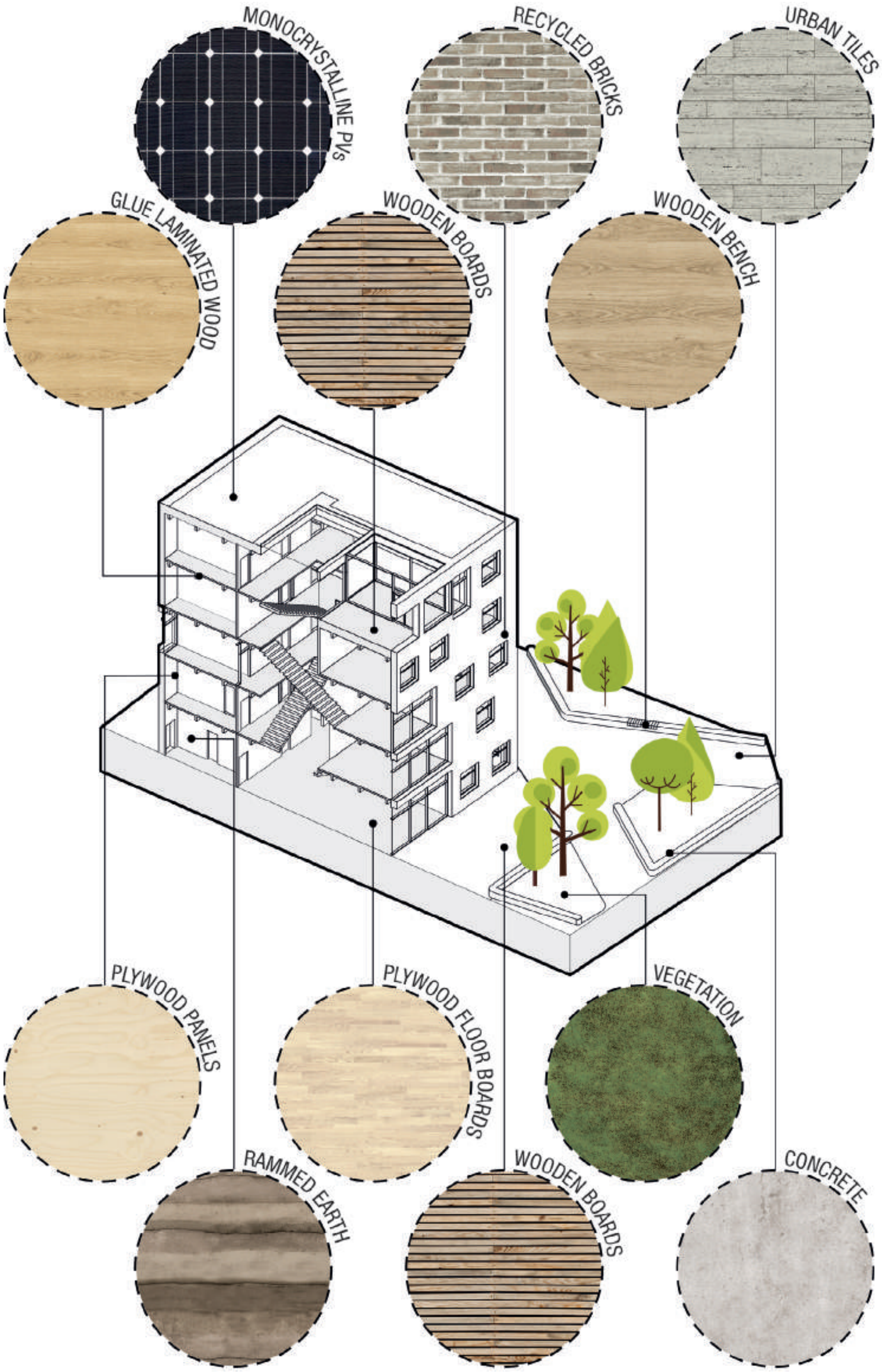
Rammed Earth is in itself immensely sustainable, since no chemicals need to be added in order to use it in constructions. The earth is implemented as a stabilising core and also acts as a separator between the wooden materials and the wet rooms as toilets and showers. To ensure the structural capabilities of the rammed earth, a small amount of cement is mixed with the earth. Rammed earth also has a very high heat capacity, making it ideal for ensuring a good indoor environment. The added thermal mass also serves the natural ventilation in summer months by storing and releasing heat when necessary.

Bricks are implemented as the main element of the facades, both as an aesthetical and sustainable solution. The durability and low maintenance need make the bricks highly suitable for an urban context. The brick facades act as a skin protecting the more delicate wooden structure inside the building. Recycled bricks with chalk joints will be used due to the life cycle capabilities of this type of bricks and guaranteeing the possibility of future reuse.

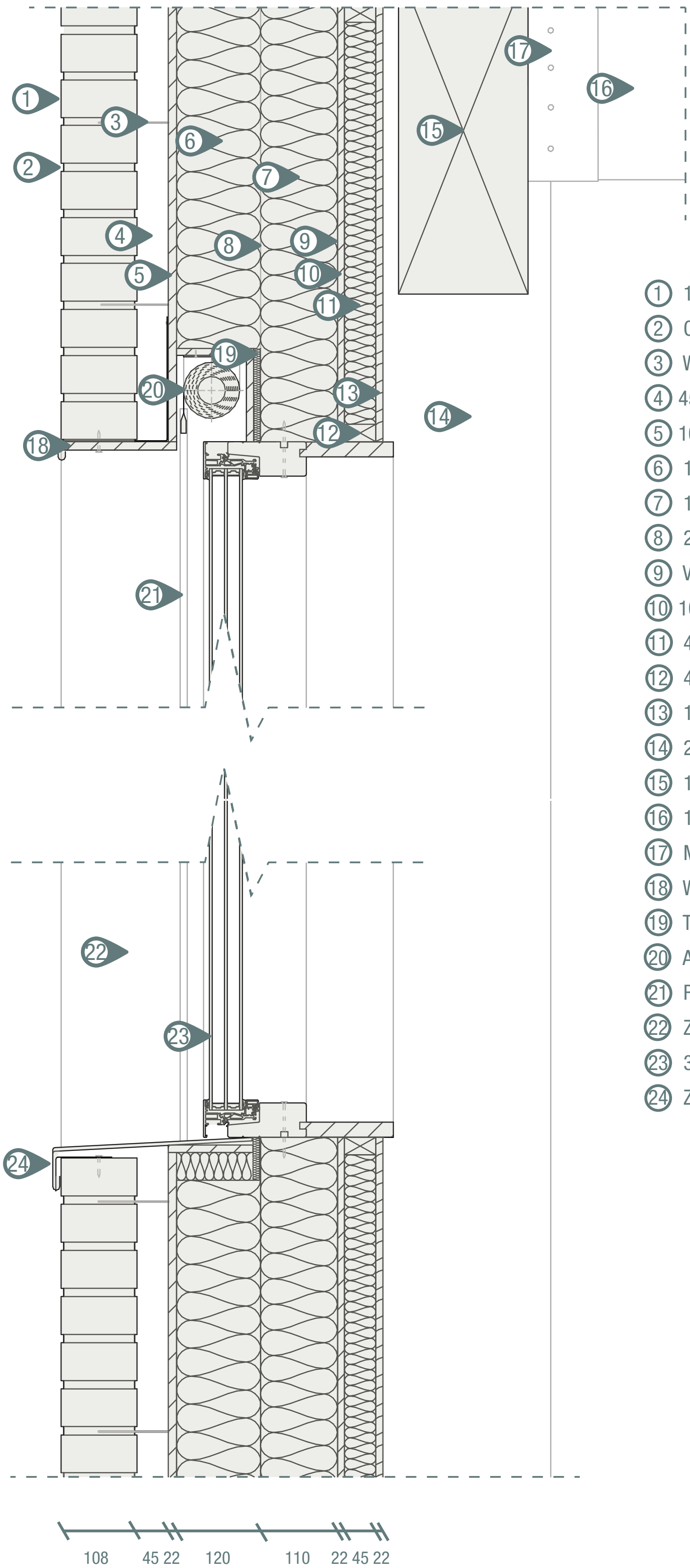
Photovoltaics are fitted on the roof, as this surface is the one that has the greatest exposure to direct sun. The chosen type is monocrystalline due to the high efficiency and subtle black appearance.

Vegetation is placed in plant beds surrounding the building creating a soft, green border between the building and its noisy surroundings. The plant beds are designed for seating and they create attractive niches underneath the trees. Furthermore, the implementation of green spaces eases the sewage system under heavy rain by allowing the absorption of rainwater.

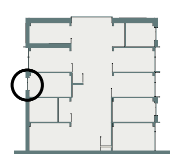
Concrete usage is kept to a minimum, since its life cycle capabilities are not the best, e.g. due to a limitation in reusability. In spite of this, concrete has many advantages, for example for constructing the building's foundation. Also, the plant beds surrounding the building will be cast in concrete, as its robustness and aesthetic expression makes it ideal in an outdoor, urban context.



Ill.3.14: Diagram of materials throughout the building



1. 108mm Grey/Yellow recycled brick
2. Chalk mortar
3. Wall tie
4. 45mm Ventilated air gap
5. 10mm Masterboard
6. 120mm Isover 37 insulation
7. 110mm Isover 37 insulation
8. 230*45mm Plank rafter cc 600
9. Vapor Barrier
10. 10mm Masterboard
11. 45mm Isover 37 insulation
12. 45*25mm Distance battens cc 600
13. 10mm Interior Cladding FSC
14. 250*250mm Loadbearing Column - FSC
15. 185*467mm Beams - FSC
16. 140*333mm Beams - FSC
17. Metal Joist
18. Wooden board
19. Thermal bridge insulation
20. Automatic solar shading screen
21. Rolling shin for solar shading
22. Zink window sill
23. 3 Layer argon glass
24. Zink drip nose



Ill.3.15: Detail of window and solar shading, 1:10

SOLAR SHADING

A good indoor climate relies on steady temperatures, that are pleasant for the occupants. To examine the indoor temperatures, and ensure that the rooms do not become overheated throughout the day, 24-hour average calculations has been made (Appendix 02). The calculations show, that in order to keep the temperatures below the maximum 26C of Category II, it is necessary to implement solar shading. Illustration 3.16 show the two different types of solar shading, that are implemented in the community centre. For the windows in the boxes, manually adjustable blinds are placed on the exterior of the windows. This shading solution is considered one of the most effective and is also highly flexible, to fit the needs of the users. The placement of the blinds in the construction can be seen in illustration 3.15.

In order to enhance the concept of cuts through the volume, the solar shading for these windows are treated differently. The glazing areas in the cuts are shaded by extending the window frame 300mm on the outside to create an overhang. According to the 24-hour average calculations, this solution is not sufficient in avoiding over temperatures in the common spaces. However, since the calculations only take a smaller, defined space of the large open functions into account, it is assumed, that the total size of the spaces, together with the cross and stack ventilation of the atrium, will help to ensure a satisfactory indoor environment. Furthermore, implementation of thermal mass in the atrium will also assist in steadying the temperatures.

Ill.3.16: Visualisation of solar shading principles

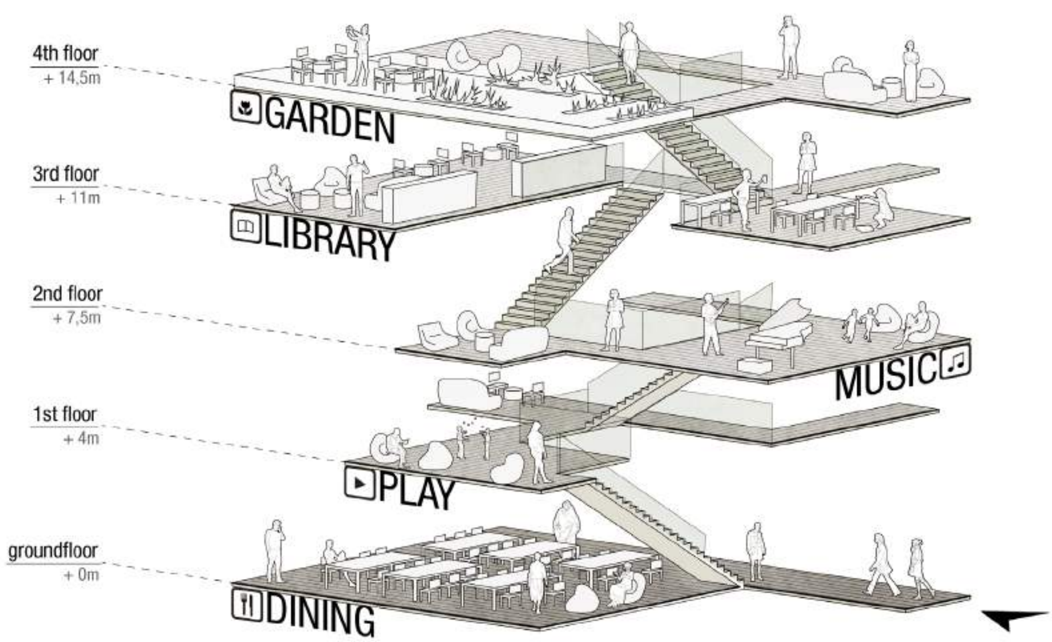
Ill.3.17: Visualisation of the music common space

FUNCTIONS

Diverse Common Spaces

Good social integration happens in spaces that enhance the feeling of community and encourage users to take part in common activities. In order to ensure a quality space for diverse social interactions, the Crossroads community centre proposes a number of common spaces with varying characteristics (Ill. 3.18).
The spaces are arranged vertically, according to the level of noise they produce. Each floor serves a social function, resulting in rooms such as dining room and play area, being located in the lower floors, while the library is being placed higher up in the building. The diversity of common spaces enables different interactions and activities, which suit the needs of a diverse user group. The layout of the stairs joining the levels, is deliberately designed in a way so that people occupying the common spaces are encouraged to interact with each other when moving around the building.

The common spaces are all placed in the cuts thought the volume and are designed as open and transparent, thereby revealing the life of the community centre to the city.



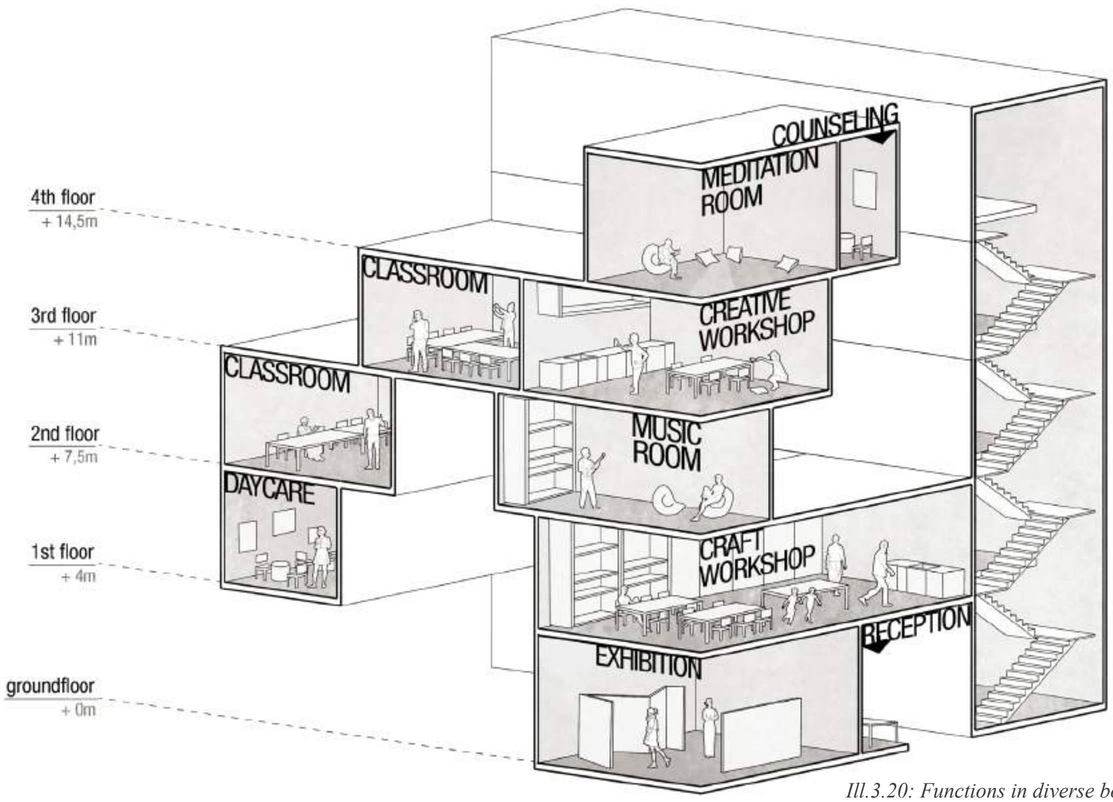
Ill.3.18: Diverse common spaces

Ill.3.19: Diagram of function's placement according to noise level

FUNCTIONS

Functions in Diverse Boxes

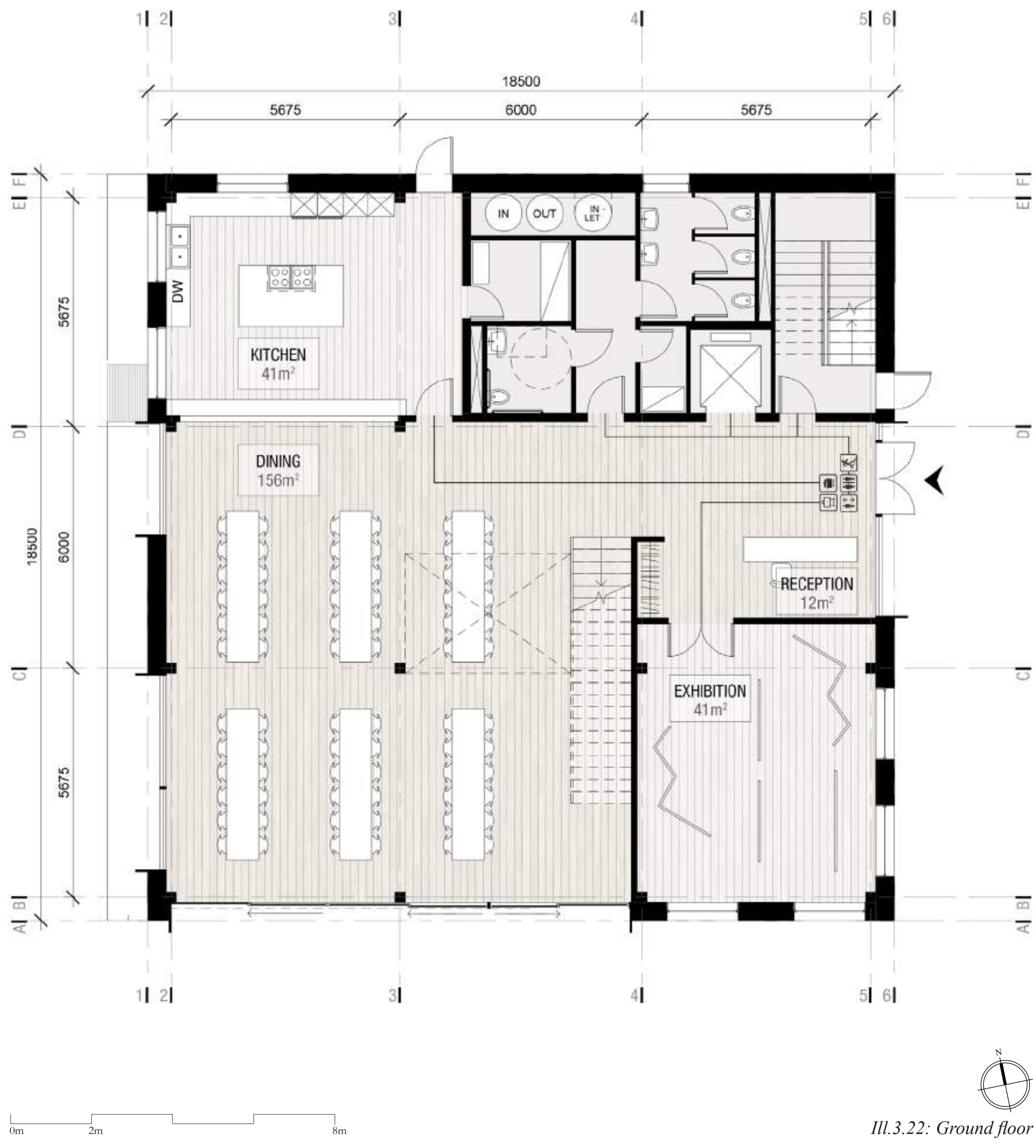
Apart from the common functions, Crossroads also contains some more private functions, such as classrooms, workshops, offices and counseling rooms. These functions require a higher level of privacy and protection from noise (Ill. 3.19). The spaces designed for these functions are placed in defined boxes, created as the negative spaces of the cuts (Ill. 3.20). The diverse functions in the boxes are joined by the common spaces, hence reflecting the diversity of the users and illustrating the path to social integration. The feeling of community joins the users regardless of age, origin or beliefs, in the same way as the common spaces join the diverse functions in the boxes. The overall diversity of functions and users happens within the unity of the cubic volume and is represented on the facades through the use of diverse brick patterns.



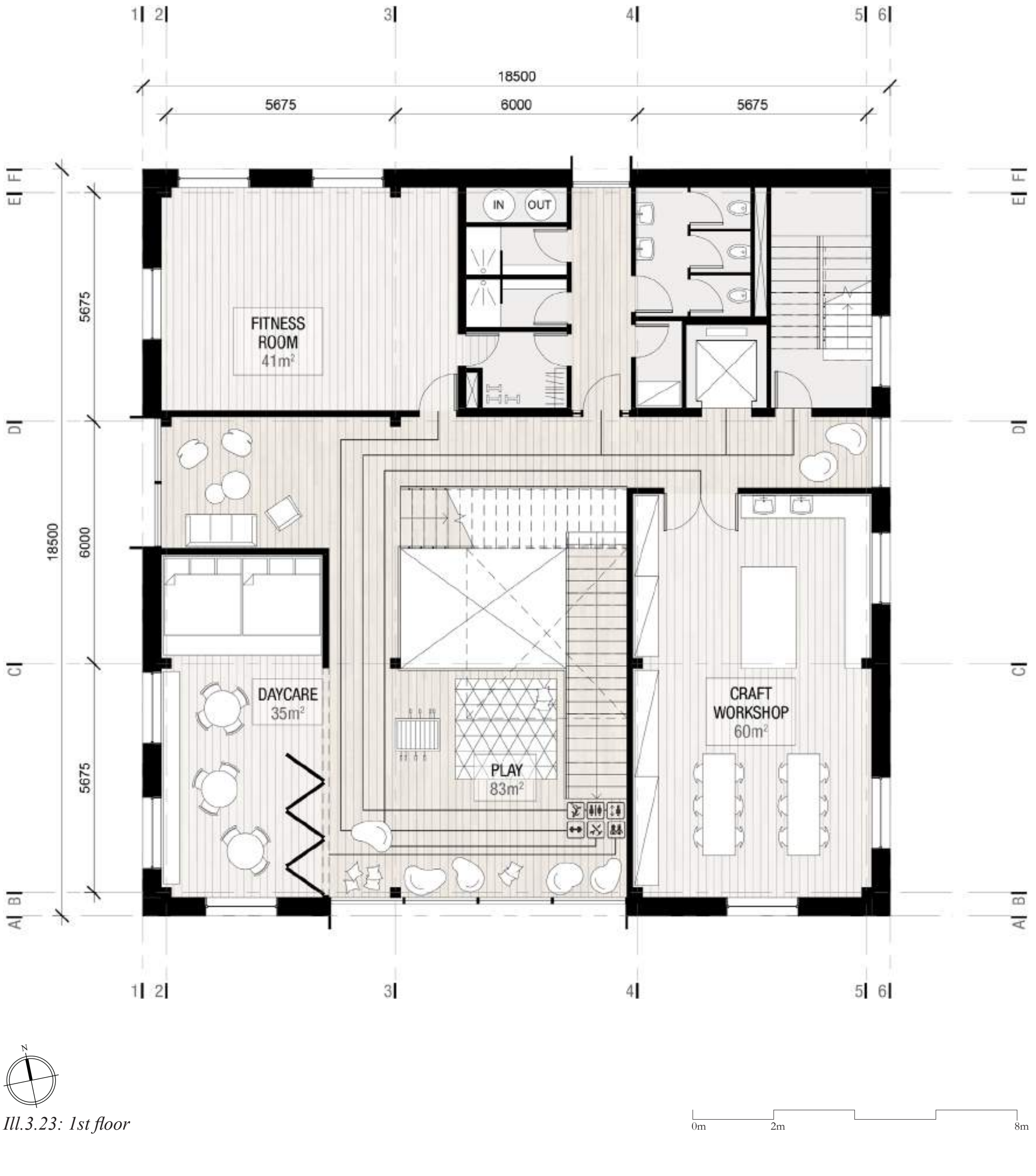
Ill.3.20: Functions in diverse boxes

Ill.3.21: Visualisation of the community dining space

FLOOR PLANS

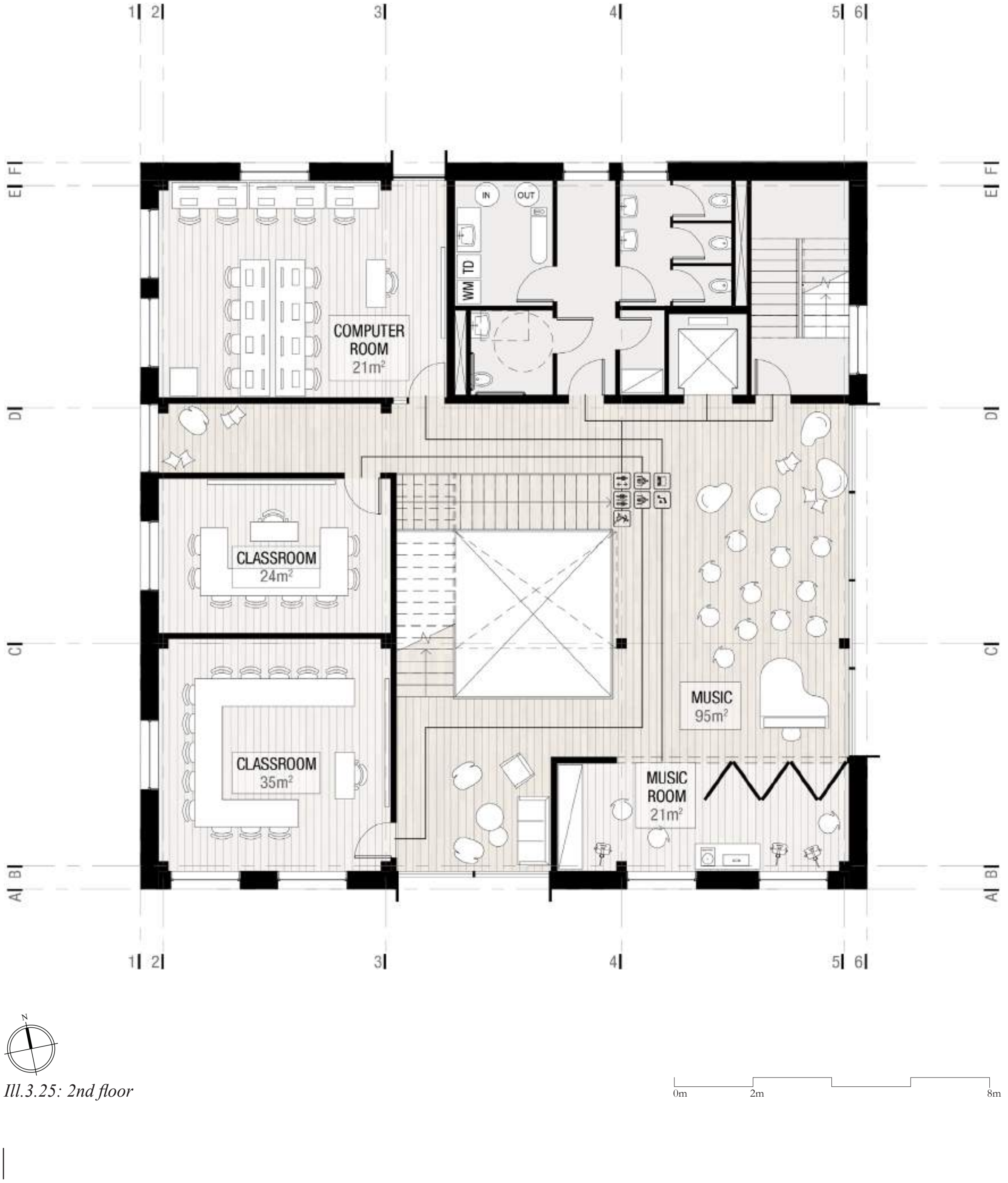


Ill.3.22: Ground floor

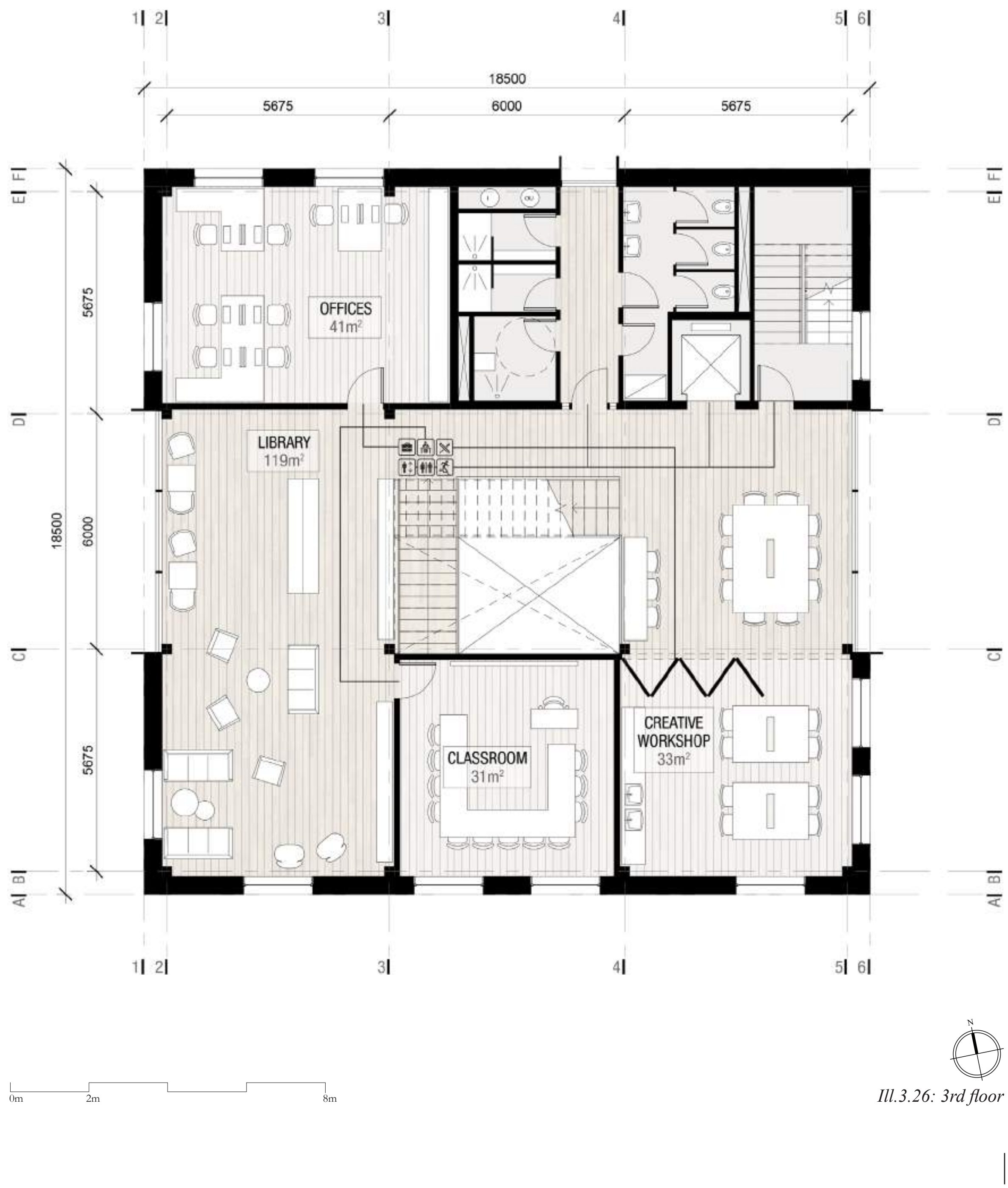


Ill.3.23: 1st floor

Ill.3.24: Visualisation of the craft workshop

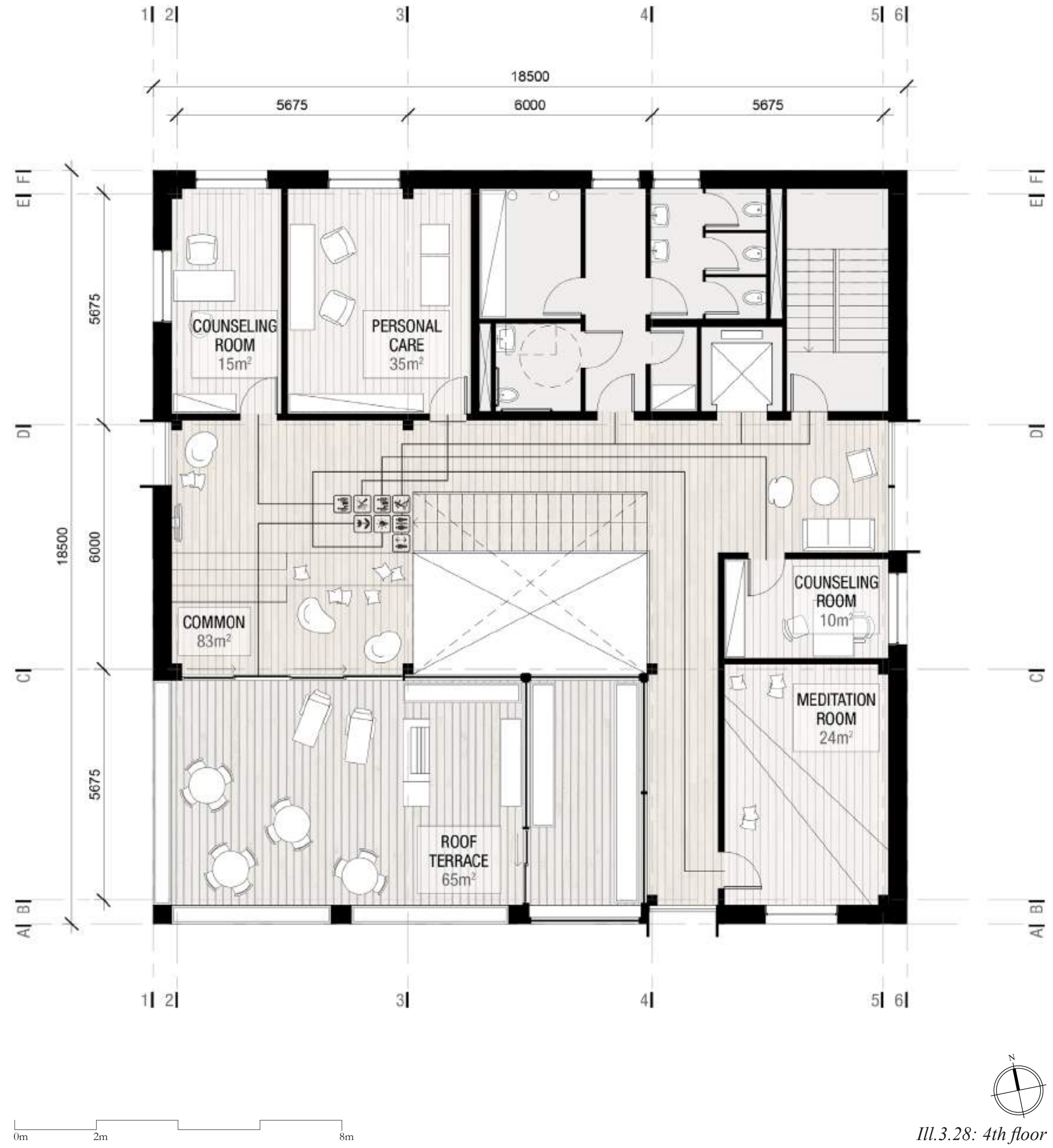


Ill.3.25: 2nd floor



Ill.3.26: 3rd floor

Ill.3.27: Visualisation of the roof terrace and common space



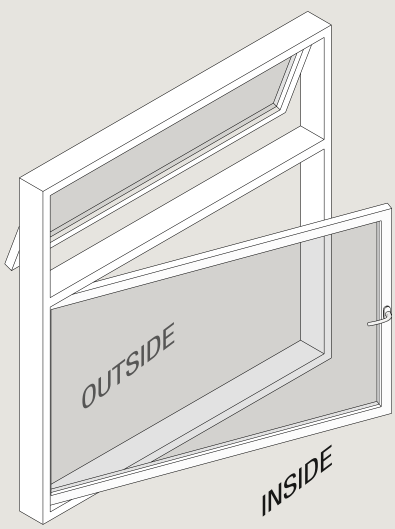
Ill.3.28: 4th floor

VENTILATION

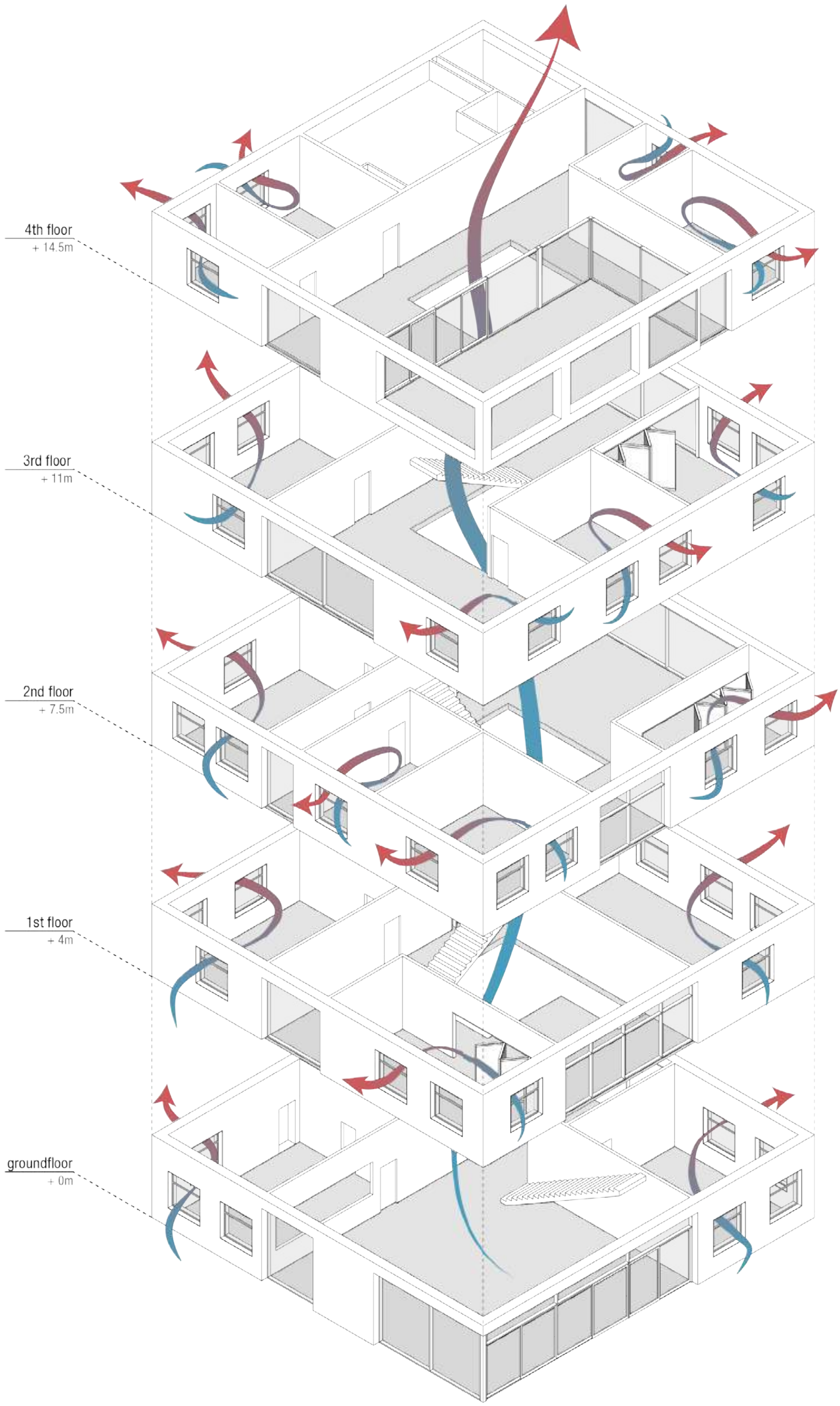
Natural Ventilation

The community centre is designed for natural ventilation during cooling season in order to lower the energy demands of the building as well as improve the thermal and atmospheric indoor environment. Different strategies for natural ventilation have been applied to different parts of the building (Ill. 3.30). The open common spaces, placed within the cuts, are all connected by an atrium with a large sky light with automatic openings, which ensures optimal conditions for stack ventilation. The stack ventilation is combined with cross ventilation through openings in the large glazing areas in the facades to achieve a better natural ventilation of each individual common space.
The boxes with functions are each naturally ventilated on their own with either cross or single-sided ventilation. The majority of the boxes are placed in the corners of the building, which makes cross ventilation possible. A few rooms have only one window, or only windows in one façade, thereby only allowing single-sided natural ventilation.

To ensure efficient natural ventilation of the critical rooms, calculations have been made on the window openings. The windows are designed with a smaller and a bigger openable part (Ill. 3.29). The smaller, top part is controlled automatically with a sensor and open when there is a need for ventilation. The bigger, bottom part is controlled manually, giving the users the possibility to let more air in and also makes it function as a rescue opening in case of fire. The calculations showed that the necessary air change rate of all critical rooms can still be achieved within the maximum opening angle of the automatic top windows.
The calculations can be seen in appendix 04.



Ill.3.29: Design of windows



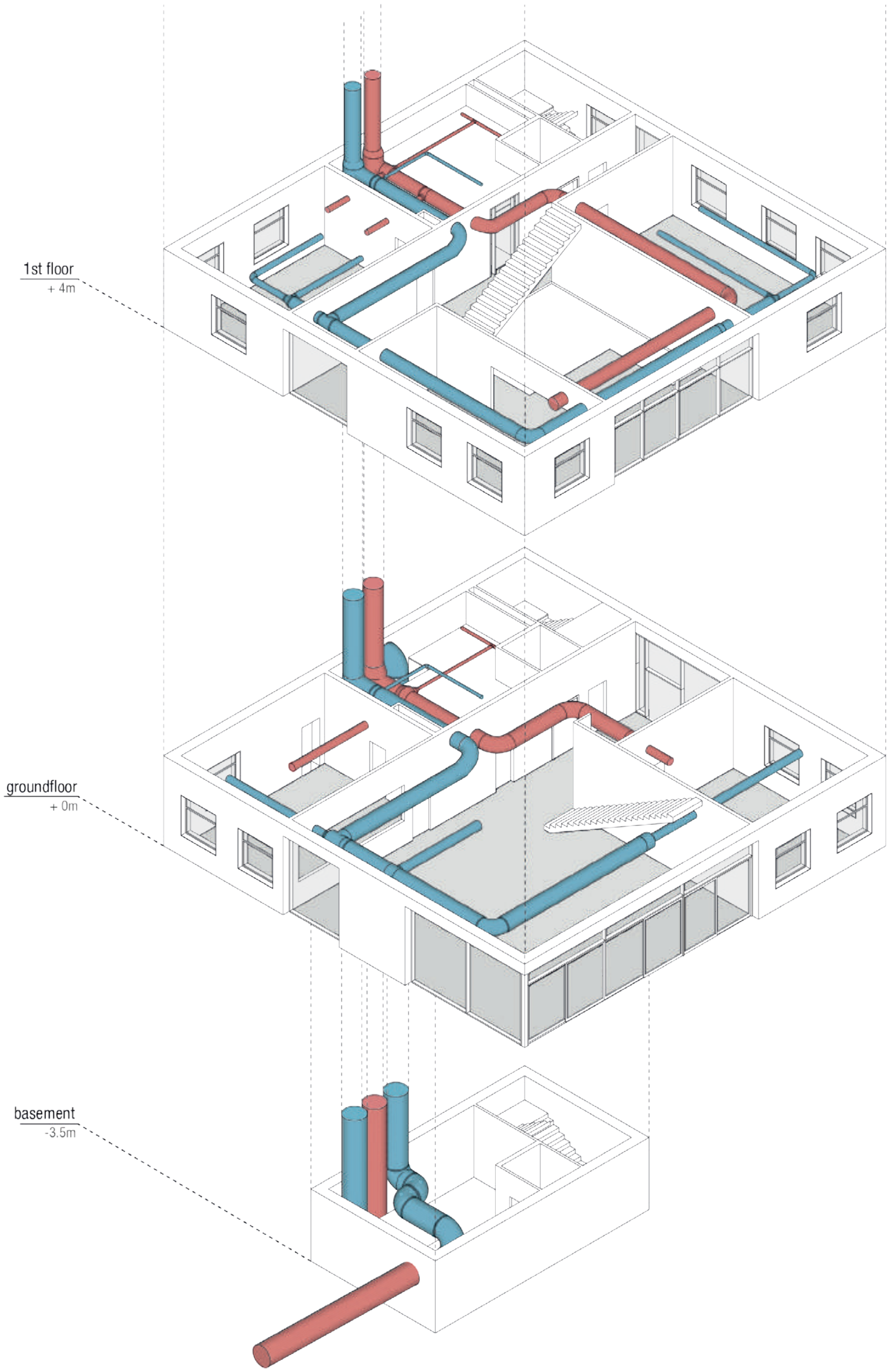
Ill.3.30: Natural ventilation strategy

VENTILATION

Mechanical Ventilation

In addition to the natural ventilation the building is supplied with a mechanical ventilation system to achieve a good indoor environment during the heating season, when the outdoor air is too cold for natural ventilation, and therefore it is potentially more energy efficient to have a mechanical system with heat recovery.
The ventilation aggregate is a Variable Air Volume system and is placed in the basement of the building (Appendix 03).
Intake for the system happens through the northern façade in the ground floor and the outcast runs through the ground under the building and goes out through a grate in the ground on the west side of the building. The VAV system makes it possible to control the air volume for each room individually with thermostats, to accommodate the many different users and their different needs. Since not all rooms are fully occupied at the same time, the size of the aggregate is based on 80% of the total air flow volume, whereas the pipes are dimensioned from the total air flow volume.
The necessary air change rates for each room are calculated for both the pollution of olf and CO2. For the large majority of rooms the olf pollution gives the highest need for ventilation and the system is therefore dimensioned based on this. The calculations can be seen in appendix 05.
Illustration 3.31 shows the pipe system designed for the basement, ground floor and 1st floor. The pipes for the remaining floors will follow the same principle as the one for the 1st floor. The main pipes are placed in a shaft in the north façade. The distribution and connection pipes runs along the ceiling, below the visible construction, throughout the building. A requirement for the pipe system is that the pipes cannot cross each other inside the spaces of the building, since the room height would then be too low. Therefore, the core has a suspended ceiling, giving space for the pipes to cross each other, without the intersections being visible.

The inlet pipes are placed in all occupational rooms with multiple inlets, placed where people are occupying the space. The outlet pipes are placed in all rooms as well, but with fewer outlets than inlets. Some functions, as the kitchen, baths and toilets, have more suction than supply air, which means that a negative pressure is created in the rooms, ensuring the removal of polluted air that always travels from a lesser to a higher polluted area, establishing a suitable indoor environment.



Ill.3.31: Mechanical ventilation system

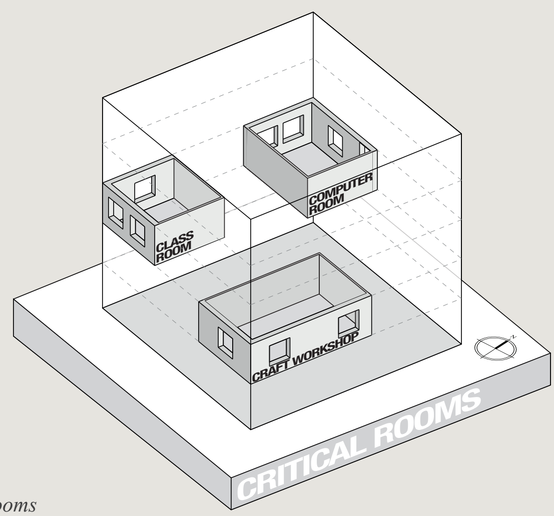
INDOOR ENVIRONMENT

Thermal & Atmospheric

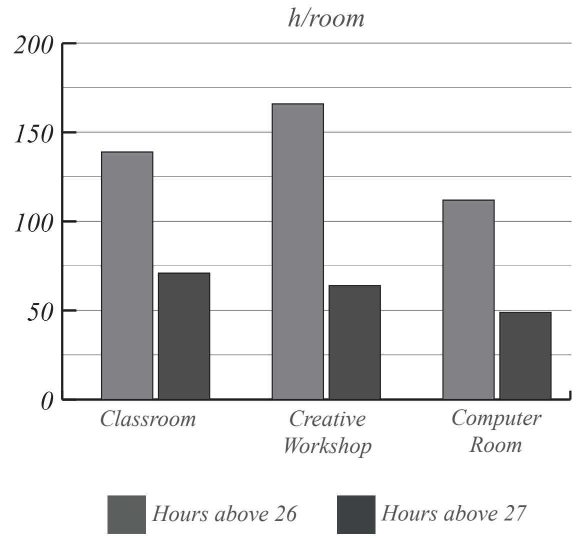
The thermal and atmospheric indoor environment of the building is documented using BSim to calculate the temperatures and CO2 pollution on an hourly basis for three critical rooms. The chosen rooms are: the craft workshop on the 1st floor (South-East), the large class room on the 2nd floor (South-West) and the computer room, also on the 2nd floor (North-West) (Ill. 3.32). They are chosen due to their solar gains, people- and equipment loads, which might cause excessive temperatures and pollution levels. It is assumed, that these rooms will be representative for ensuring the thermal and atmospheric comfort of the entire building. Each of the rooms have cross ventilation during the cooling season and mechanical ventilation with heat recovery during the heating season.

To reach an atmospheric comfort of Category II, the CO2 pollution of the room cannot exceed 500ppm above the 350ppm of the outdoor air (Table B.4, DS/EN 15251, pp.36). Illustration 3.34 shows the CO2 levels of the three critical rooms during the 2nd of August. The CO2 pollution spikes when the rooms are fully occupied. When it starts reaching the maximum, the natural ventilation turns on to remove the pollution of the room.

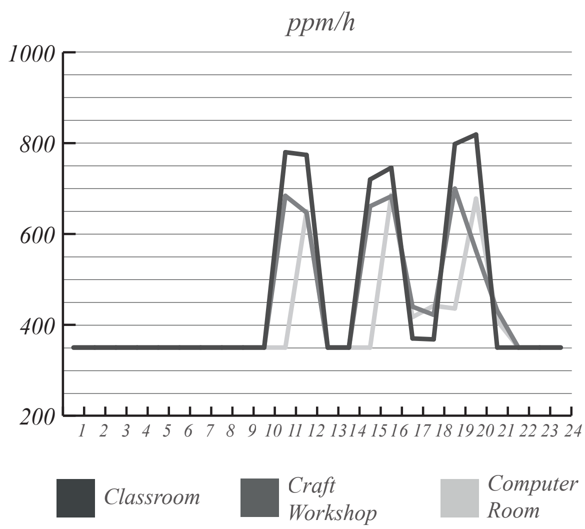
In order to achieve a satisfactory thermal environment in the rooms, the temperatures are calculated. Illustration 3.33 shows the number of hours during a year, when the temperatures of the rooms are above 26°C and 27°C. There are no demands for the allowable number of hours with over temperatures, but the limit is set in collaboration with the building owner. Illustration 3.35 shows the operative temperatures of the three rooms together with the outdoor temperature on the 2nd of August. When using only natural ventilation, the indoor temperature follows the outdoor temperature and because of this, in some cases, it is difficult to keep the operative temperature of the room under the maximum 26C of Category II (Table A.2, DS/EN 15251, pp.26).



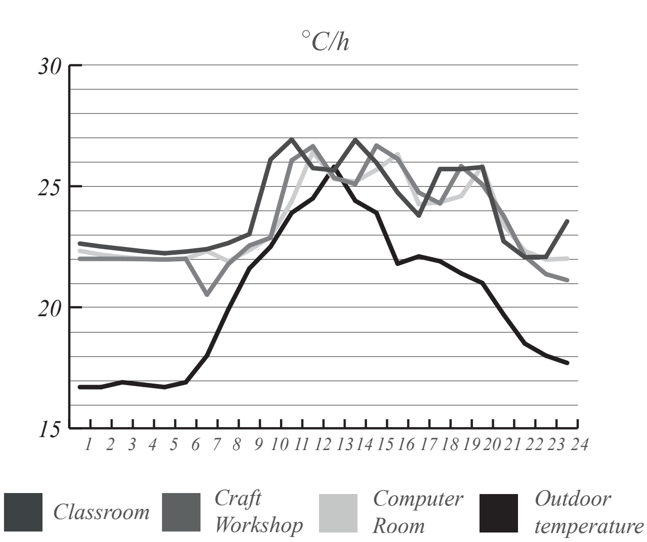
Ill.3.32: Placement of the critical rooms



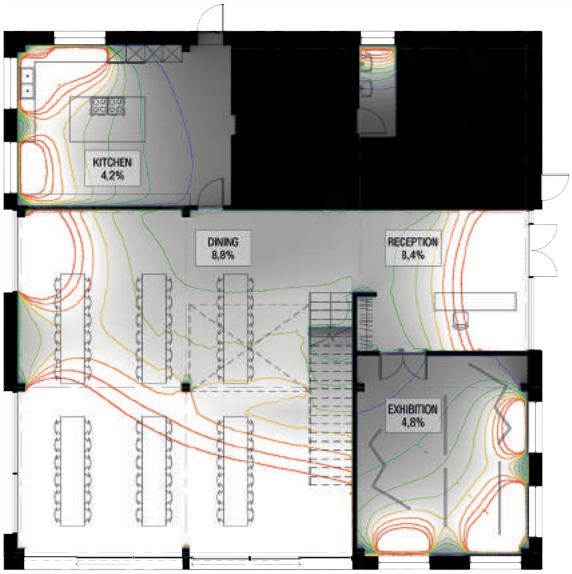
Ill.3.33: Graph of over temperatures



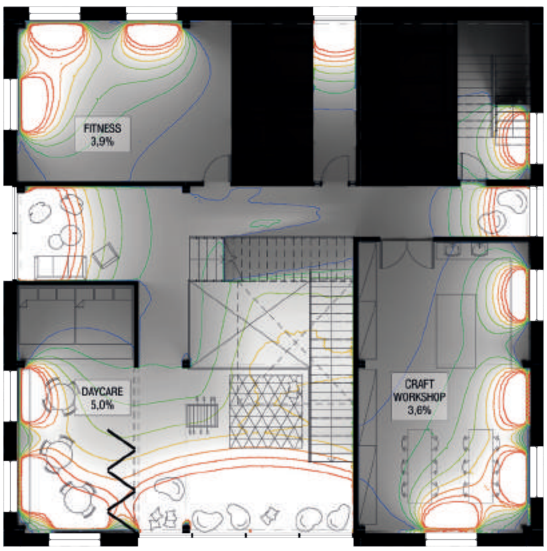
Ill.3.34: Graph of CO2 levels



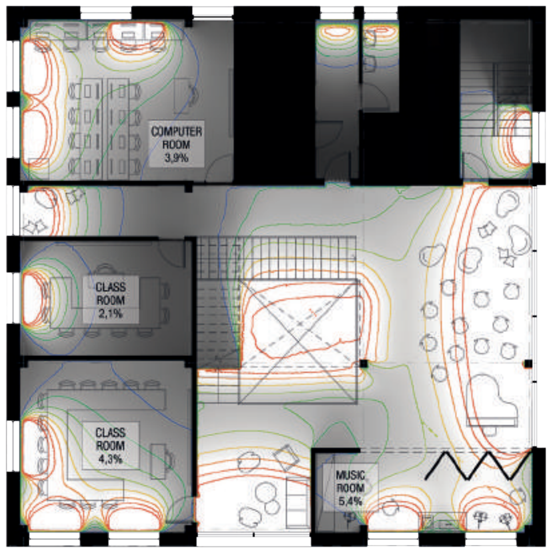
Ill.3.35: Graph of operative temperatures



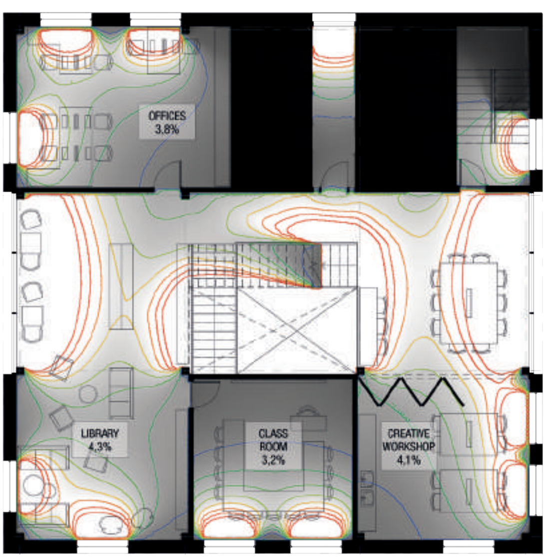
Ill.3.36: Average daylight factors, ground floor



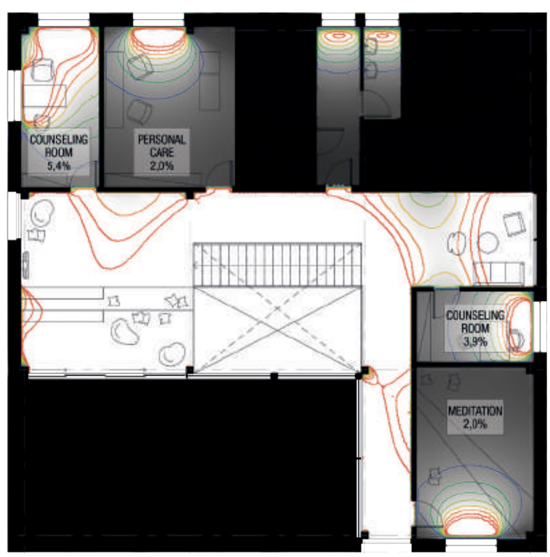
Ill.3.37: Average daylight factors, 1st floor



Ill.3.38: Average daylight factors, 2nd floor



Ill.3.39: Average daylight factors, 3rd floor



Ill.3.40: Average daylight factors, 4th floor

INDOOR ENVIRONMENT

Daylight

The average Daylight Factor of all rooms is documented using Velux Daylight Visualizer. The Daylight Factor is calculated from an overcast sky, and should be a minimum of 2% on average for all rooms (BR15, 6.5.2, Dagslys), although the aim is to have higher values where possible, in order to lower the energy demand for artificial lighting.
Illustrations 3.36-40 show the daylight conditions of the floor plans, all measured 0,8m above floor level. When designing the floor plans, focus was on all rooms being placed to the façades to achieve high values of daylight and thus, a better indoor environment. The blue lines on the plans show where in the rooms the Daylight Factor is 2%

The illustrations show that all rooms meet the minimum of a 2% average, while most rooms exceed this.

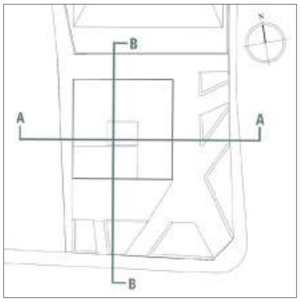
The functions in the core have no windows, since daylight is not necessary in for example storage rooms and showers, but windows are added in the hallway and the front room to the toilets to make these spaces more pleasant.
Only three rooms just meet the minimum daylight factor; class room (2nd floor), personal care (4th floor) and meditation (4th floor). The slightly low average daylight factors are a result of these rooms only having one window, and might cause an increased use of artificial lighting.

SECTIONS

The sections (Ill. 3.41-3.42) show the connections between the floors of the Crossroads community centre. The open atrium extends to the facades by common spaces of different functions, creating "the heart of the building", where life and diversity is experienced. The vertical flow is situated within the atrium, which allows the light to spread through the entire building. The shifted stairs for each level make the users move around the building, creating informal meetings and enhancing the liveliness of the common spaces. Surrounding the open common spaces, the more private functions are placed within boxes, ensuring great settings for functions, such as class rooms, offices and counselling rooms. Since many of the users does not speak either Danish or English, a universal language of icons and lines is implemented on the floors and doors, guiding the users around the building to the different functions.

The stabilising core of rammed earth is visible throughout the building, adding a new texture to the atmosphere and ensures a good indoor environment due to its heat capacity.

Ill.3.41: Section AA

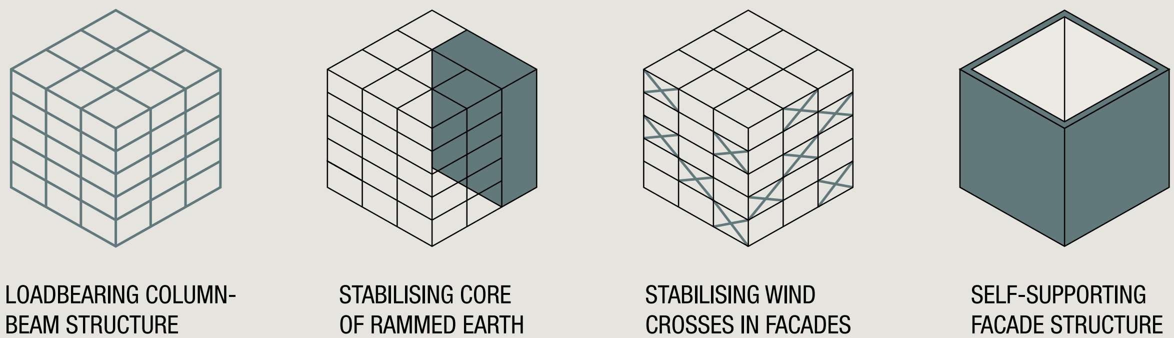


Ill.3.42: Section BB

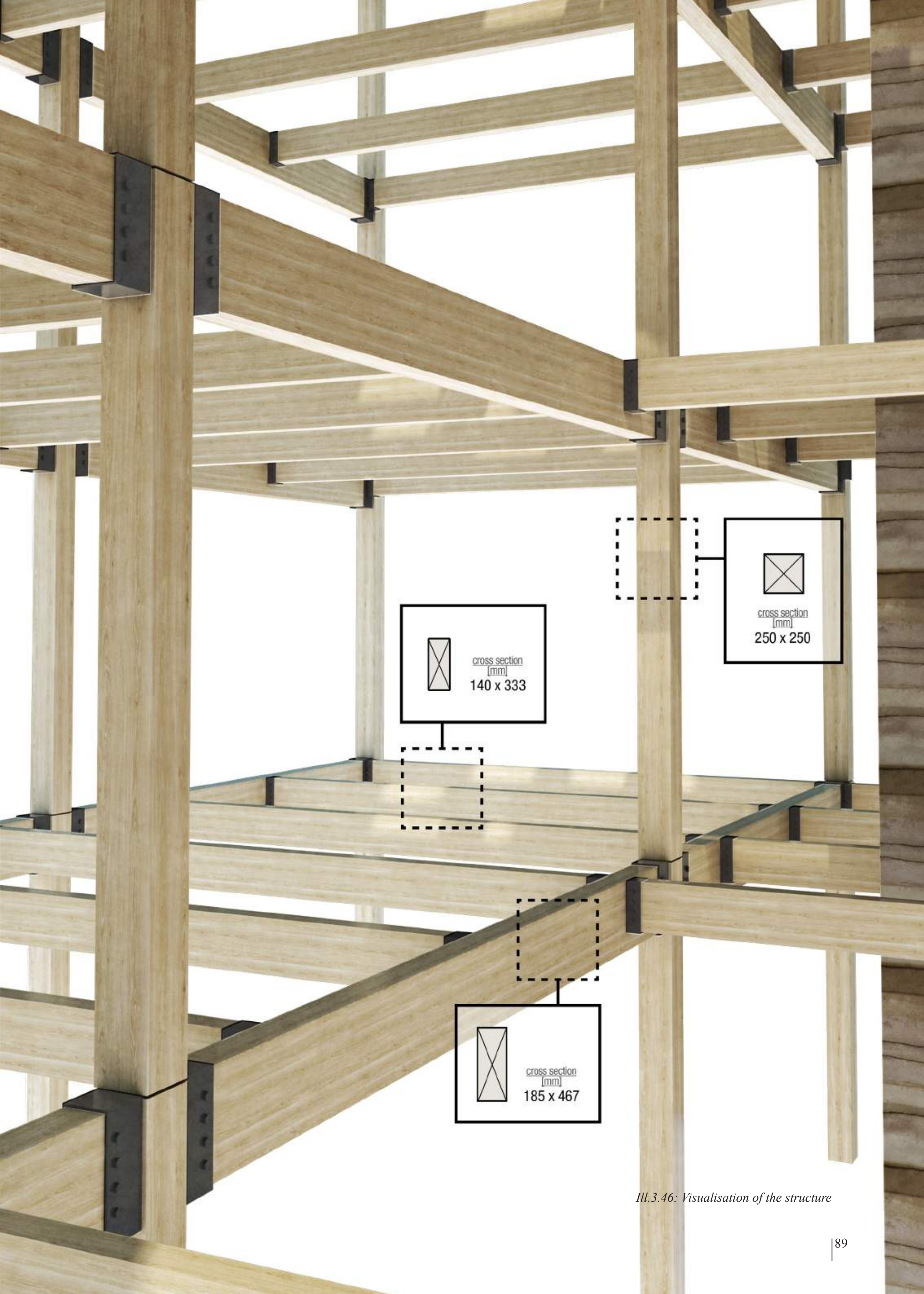
STRUCTURE

The structure of the community centre consists of glue laminated wooden columns and beams, positioned in an orthogonal grid. The wooden structure is a sustainable choice in the sense that its embedded CO2 is very low, compared to other structural materials. The structural elements will be FSC certified wood and provided from a local manufacturer in order to minimise the building's impact on the environment, concerning deforestation and CO2 emissions.
The structural principle, with the columns and beams as the loadbearing elements (Ill. 3.45), eliminates the need for loadbearing walls within the building and adds flexibility for future repurpose of the building. The stabilisation of the structure is ensured by a rammed earth core and wind crosses in the facades. Furthermore, the facades are self-supporting, as wooden constructions cladded with bricks in order to protect the structure from the elements.

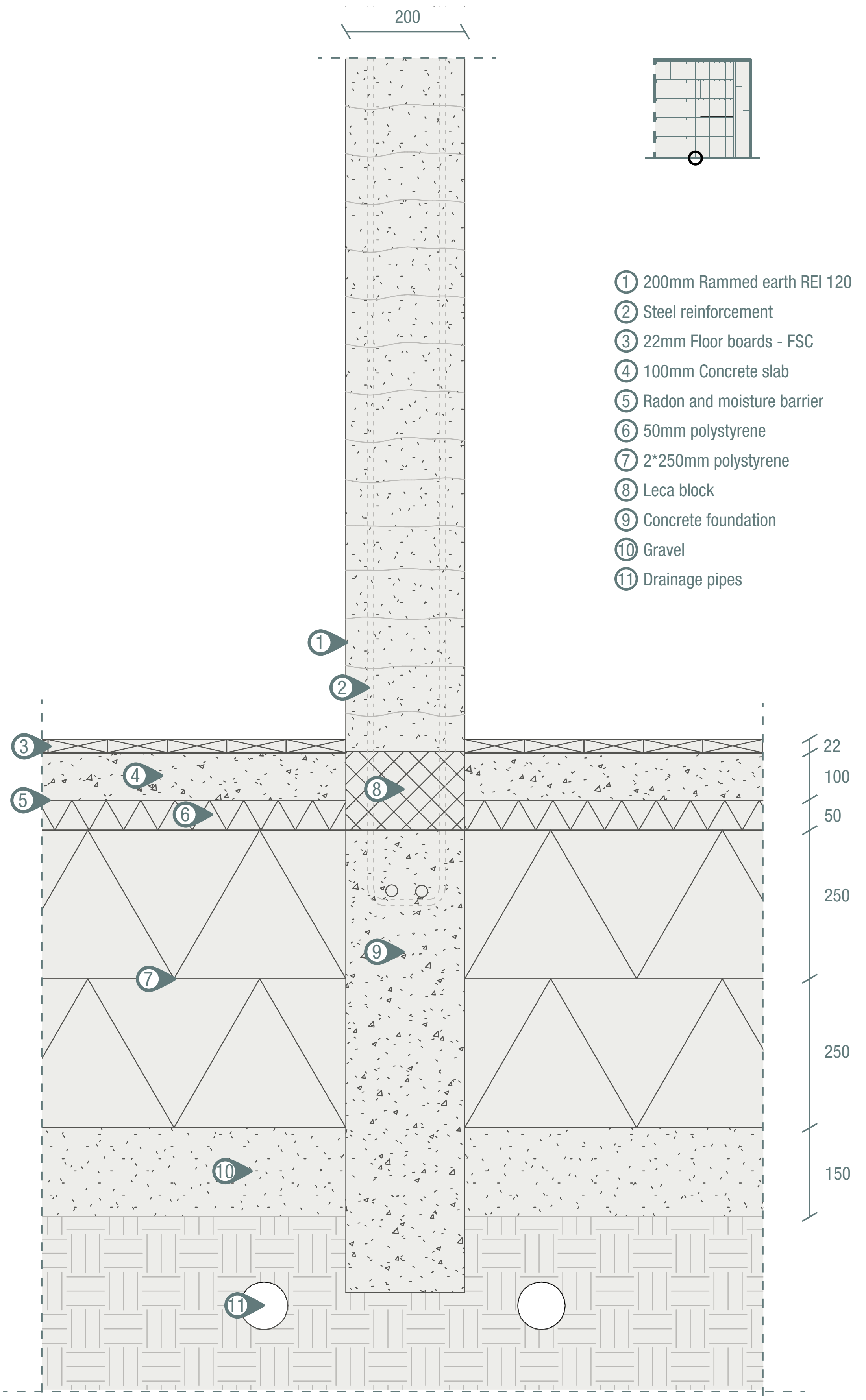
Illustration 4.46 shows the loadbearing structure and how the elements are connected. The smaller beams supporting the floors are joined to larger beams, that are then connected to the columns, ensuring an even distribution of the forces down to the foundation of the building. All joints are black steel brackets, connected to the wooden elements with bolts. The sizes of the three different types of elements are also shown in the illustration, and the calculations of their strength conditions can be seen in appendix 06.



Ill.3.45: Structural principle



Ill.3.46: Visualisation of the structure

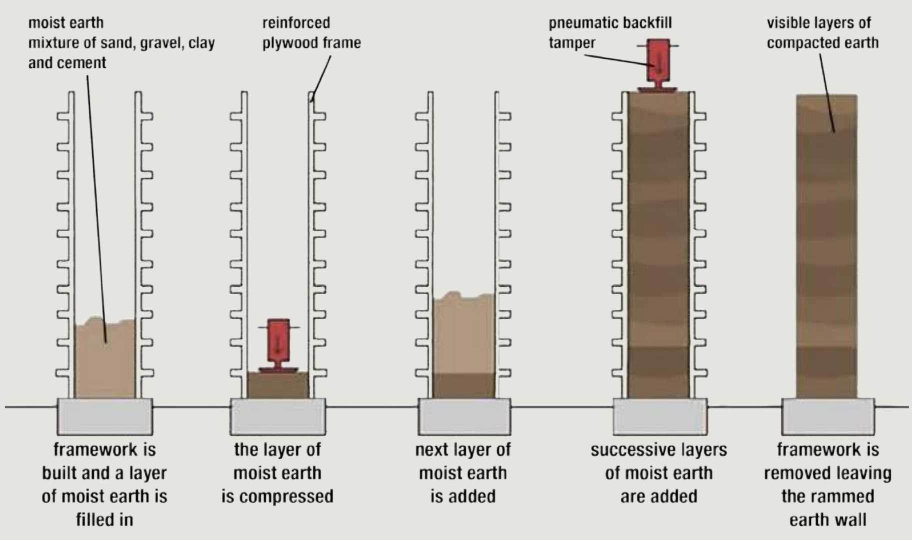


Ill.3.43: Detail of rammed earth wall and foundation, 1:10

THERMAL MASS

Thermal mass is implemented in the community centre as a stabilising core of rammed earth. The earth has a great heat capacity, making it ideal for accumulating heat in the building, thereby assisting towards an improvement of the indoor environment. The rammed earth accumulates heat in the building, coming from solar gains, equipment and people, and stores it throughout the day. When the temperature of the building starts to decrease, the heat is released from the earth, ensuring steady temperatures in the building throughout the day and night. In order to utilise the full capacity of the rammed earth, the functions, that have the highest internal thermal gains, such as kitchen, offices, computer room and fitness are placed directly to the exposed rammed earth core. This ensures a better thermal environment for these critical functions. Furthermore, the core is visible throughout the central common space, adding contrast to the warm and soft tactility of the wood, while increasing the effectiveness of the natural ventilation, which also benefits the energy frame of the building.

The most effective thickness of a rammed earth wall is the first 100mm [Autodesk, n.d.], but since the walls should also act as a stabilising element in the building, the thickness of the wall will be 200mm. Illustration 3.43 shows how the rammed earth wall is constructed on top of the foundation, then reinforced with steel rebar's and cement ensuring its stabilising and loadbearing capabilities. The earth used for the core will be the earth that is excavated from the site during construction and is primarily boulder clay, which gives the core grey and brown shades. The construction method of the core is shown in illustration 3.44, where formwork is raised, earth is filled in and compressed, subsequently leaving an untreated earth wall of compressed layers.



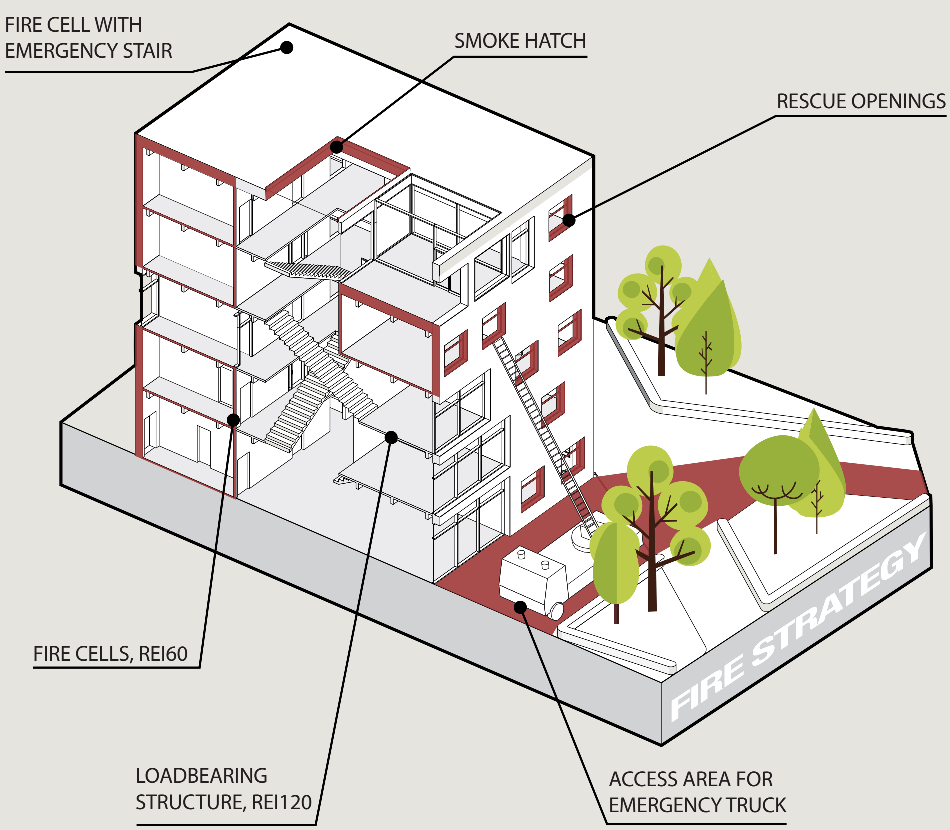
Ill.3.44: The construction process of a rammed earth wall

FIRE STRATEGY

The emergency strategies in case of fire has been taken into consideration during the design of the building to ensure that all exit areas meet the required width and that the building has sufficient escape measures. Illustration 3.47 shows the fire strategy of the building with the different elements designed to make the building safer.

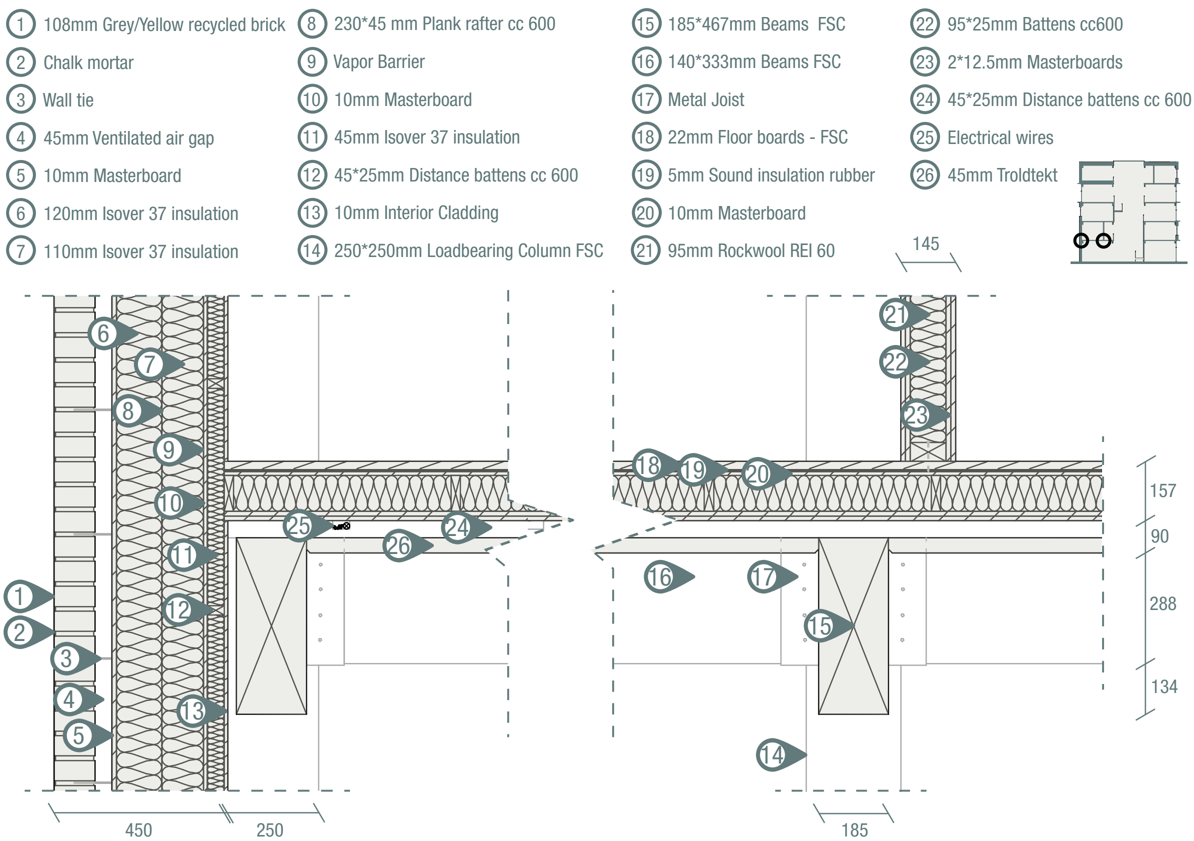
The loadbearing timber structure is fire resistant in itself and is constructed in a way where all cavities are filled with fire resistant insulation, that prevents unnecessary fire expansion in the building. The structure is of the classification REI120, meaning that it can withstand fire for 120 minutes, which is the demand since the building is of the usage category 3 (BR15, 5.1.1, Anvendelseskategorier).

To prevent fire from spreading to the nearby buildings, the community centre has a certain distance to the context, likewise the brick cladding prevents the fire from spreading to the surroundings. The sky light of the atrium



Ill.3.47: Fire strategy diagram

functions as a smoke valve, ensuring deviation of smoke from escape routes. All escape routes have a minimum width of 1.2 metres and are kept clear. The escape routes lead people to the fire escape in the north-eastern corner of the building, going directly to the ground floor and out in open terrain, or to the boxes with functions, which are constructed as individual fire cells.
The fire cells have a fire resistance of REI60 (Ill. 3.48), guaranteeing safety of people until emergency personal can rescue them through the windows, which are all dimensioned as rescue openings.
Technical installations, such as auditory fire warnings, signs and sprinklers are placed throughout the building to enhance the safety measures, and the ventilation is constructed as regulative DS 428 specifies.
These initiatives ensure the safety of the users in various emergency situations by allowing people to escape or be rescued, without risking their wellbeing.



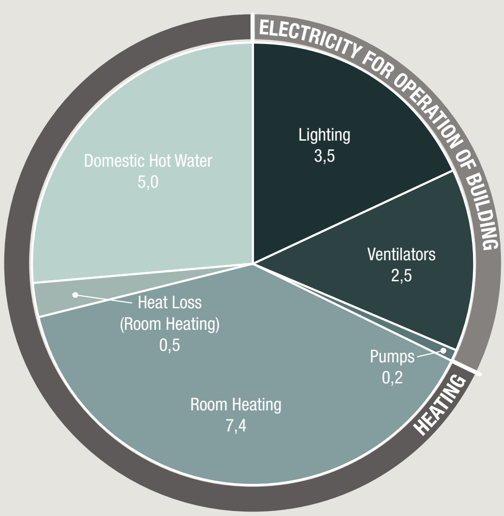
Ill.3.48: Detail of the construction of fire cells, 1:20

ENERGY FRAME

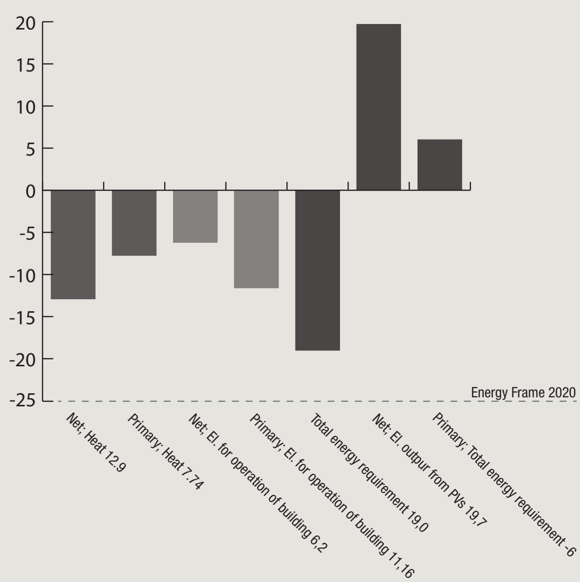
BE15

The aim for the community centre is to reach energy class 2020, with the limit of 25kWh/m2 year for a non-residential building, with only passive initiatives. This is achieved through an integrated design process and iterative assessments of both aesthetic, functional and technical qualities, making the passive strategies of the building an integrated part of the architectural design. The energy frame is documented using BE15.

Illustration 3.49 shows the distribution of energy demands throughout the building. The construction meets the requirements of energy class 2020 with a heat loss of 3,3 W/m2K for the envelope that is below the maximum of 5,7 W/m2K (BR15, 7.2.4.1, Energiforbrug). Building techniques ensure a tight envelope with an infiltration of less than 0,1 l/s m2 in the building. As a means of reaching Net-ZEB status, renewable energy sources are implemented in the form of photovoltaics. The effect of adding photovoltaics is shown in illustration 3.50. The energy output of the photovoltaics covers the annual energy consumption of the building with a small surplus, ensuring future Net-ZEB status, as the efficiency of the photovoltaics reduces over time.



Ill.3.49: Diagram of the distribution of energy demands



Ill.3.50: Graph of the energy frame

Photovoltaics

In order to achieve Net Zero Energy Building status, the building must cover the total energy use of a year by implementation of active strategies. It is decided that the community centre should be a Net Zero Energy Source Building, meaning that the energy use of the building, when accounted for at the source, should be covered by renewable resources. The energy is supplied by monocrystalline photovoltaics, placed horizontally on the roof (Ill. 3.51). The energy use of the building amounts to 19,0 kWh/m2 year and this number is used as the basis for calculating the necessary area of PVs (see appendix 08). The energy produced by the PVs has to be used instantly within the building. This means, that the energy demand for electricity in the building is covered directly by the PVs while the building is in operation, and the excess energy is directed to the grid, allowing the building to receive district heating while still achieving Net-ZEB status.

Ill.3.51: Visualisation of the photovoltaics fitted on the roof

- 04 -

DESIGN PROCESS

Volume
Floor Plans
Facades
Site

VOLUME

Initial Volume Studies

Ill.4.01: Volume study with vertical boxes

Ill.4.02: Volume study with horizontal boxes

VERTICAL BOXES

pros

- relate to the scale of the context
- outdoor spaces on roofs
- niches created around the building

cons

- large envelope area
- volumes shading each other
- does not stand out as a landmark

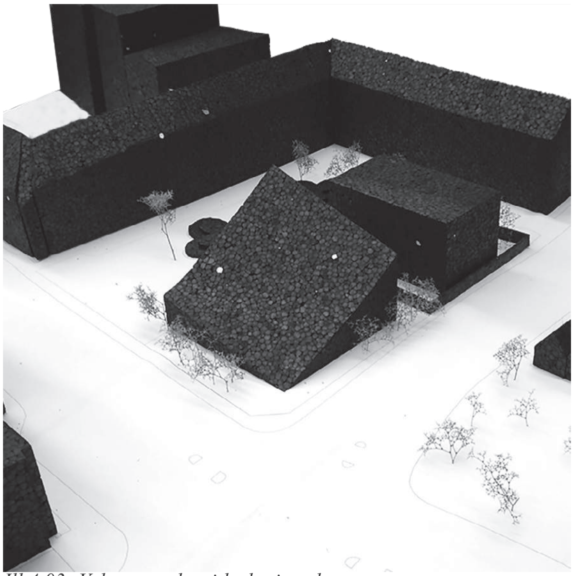
HORIZONTAL BOXES

pros

- relate to the shapes of the context
- niches created within the building
- stands out as a landmark

cons

- large envelope area
- large overhangs (expensive)
- massive/brutal expression



Ill.4.03: Volume study with sloping shape

Ill.4.04: Volume study with circle

SLOPING TOWARDS CORNER

pros
- sympathetic to the corner
- relates to the heights of the context
- efficient envelope area

cons
- useless spaces created in the corners
- no space for urban areas
- does not stand out as a landmark

CIRCLE

pros
- the building does not have a back side
- efficient envelope area
- stands out as a landmark
- embracing shape

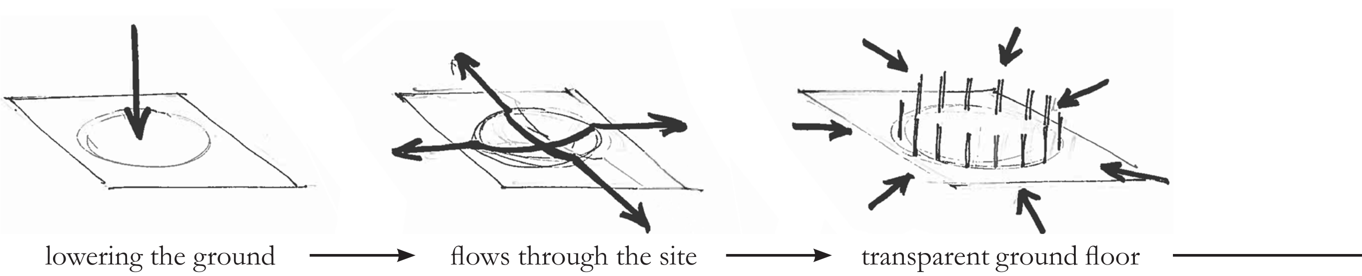
cons
- shape can seem rejecting from outside
- curved interior walls, less flexible

VOLUME

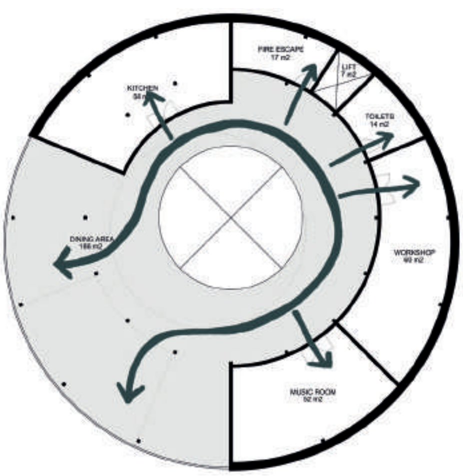
The Circle

From the initial volume study the circular shape is chosen and further developed. The concept includes a central atrium that ensures good daylight conditions and enables natural ventilation in the building (Ill. 4.05). All functions are placed around the atrium making all access happen from the central space (Ill. 4.06). This will make the users of the building meet multiple times throughout their stay in the building. Open common functions, such as a dining space, play area and library, are placed within the atrium, stretching out to the facade, enhancing social interactions and connecting the building to the outside. The opening of the atrium is shifted from floor to floor to create visual connections between the floors (Ill. 4.08).

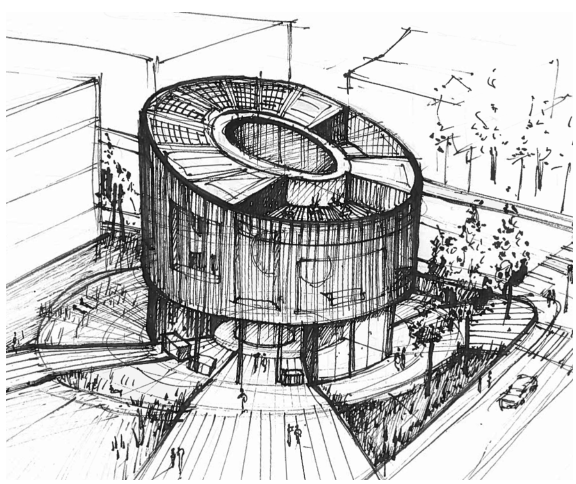
A transparent ground floor invites people into the building and reveals some of the more public functions, such as the exhibition space (Ill. 4.07). Sloping the ground from the edge of the site to the building leads people in and creates urban spaces that are sheltered from the road.



Ill.4.05: Concept for the circle



Ill.4.06: Floor plan for the circle

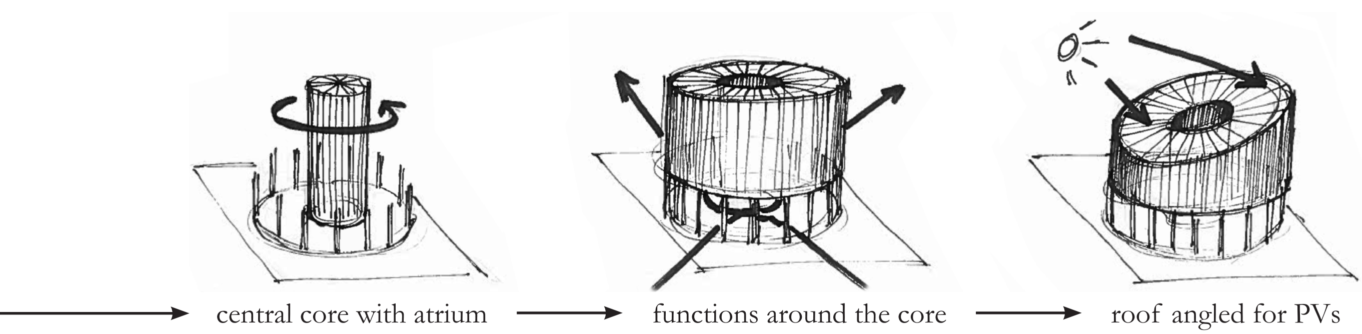


Ill.4.07: Perspective sketch of the concept

The structural principle is a timber structure consisting of columns and beams (Ill. 4.09). Wood is chosen as the structural material because of its low embedded CO2, the wood will derive from sustainable foresting by being FSC certified. Wood is also easy to disassemble and reuse, if the structure is designed accordingly.
The structure is visible throughout the building to save materials for ceilings and to create a tectonic expression, furthermore revealing the technical aspects of the building to the users.

A visible wooden structure also provides the interiors with a warmer and softer expression than a concrete or steel structure.

The wooden structure is an extra light construction in terms of thermal mass. This should be taken into consideration when designing the building to ensure an effective natural ventilation and a good thermal environment in the rooms.




Ill.4.08: Visualisation of the central atrium


Ill.4.09: Structural model

VOLUME

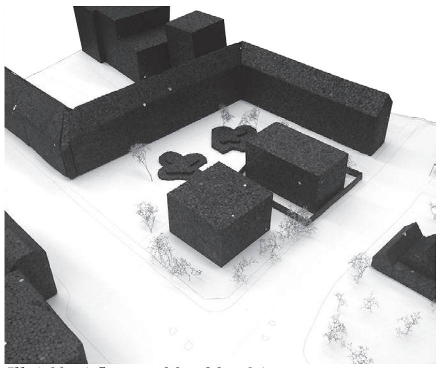
The Cube

The circular shape of the building is reconsidered, since it is found to stand out too much in its context, which is not the intention. Instead, a square shape, relating to the form language of the context, is chosen. A study of the building height is made (Ill. 4.10-13) where the FAR is kept constant, while varying the number of floors and the size of the footprint accordingly.

The cubic volume (Ill. 4.12) is chosen, since it fits the varying heights of the context. The cube is an easily readable shape, which makes the building stand out from its rectangular neighbours, and have a uniform expression.

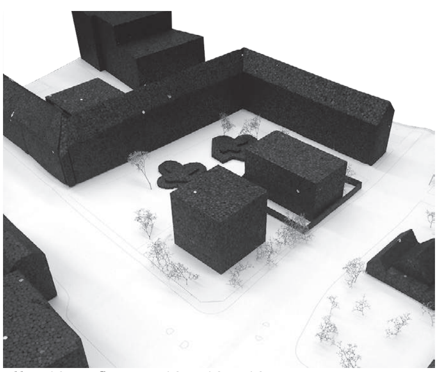
Ill.4.10: 3 floors - 23 x 23 x 10.5m

- little space around the building
- low rise relates to the old station (Lygten)
- horizontal expression



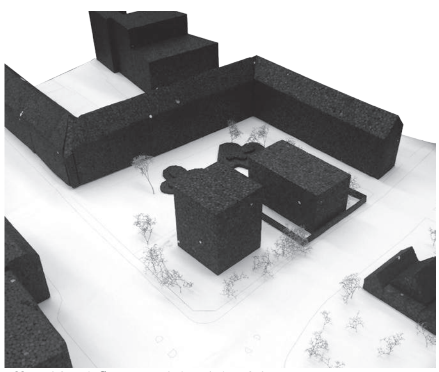
Ill.4.11: 4 floors - 20 x 20 x 14m

- relates only to the building to the north
- unbalanced proportions, somewhere between low-rise and a cube



Ill.4.12: 5 floors - 18 x 18 x 18m

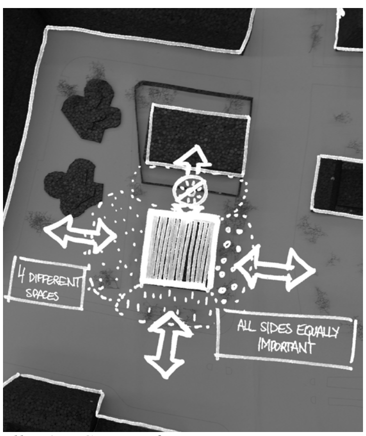
- average height of the context, fits in
- the cube is easily readable
- space for urban areas around the building



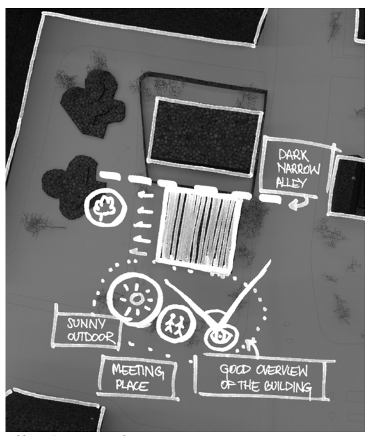
Ill.4.13: 6 floors - 16 x 16 x 21m

- large areas around the building for urban
- expression of a tower, out of human scale
- creates long shadows in the area

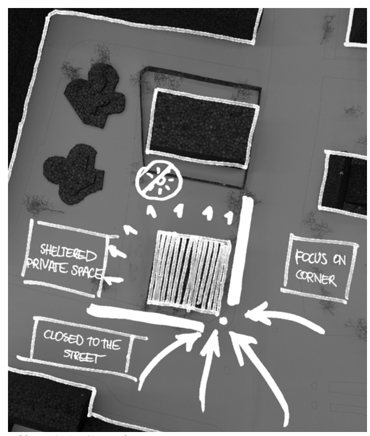
A study of the building placement upon the site is carried out and the possibility and quality of urban spaces around the building are assessed, as well as how the building is perceived when approaching it. Views and light into the interiors are also taken into consideration. The placement in the middle of the western edge of the site is chosen (Ill. 4.18), since it relates to the context by following the lines, giving great overview of the building and the site when approaching. The urban spaces around the building are also of a good size accompanied by good sunlight conditions, while the smaller space to the north is still functional and not too narrow and dark.



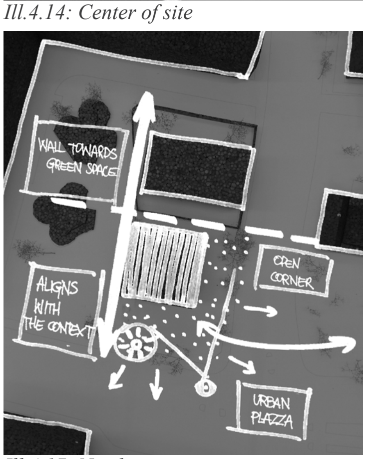
Ill.4.14: Center of site



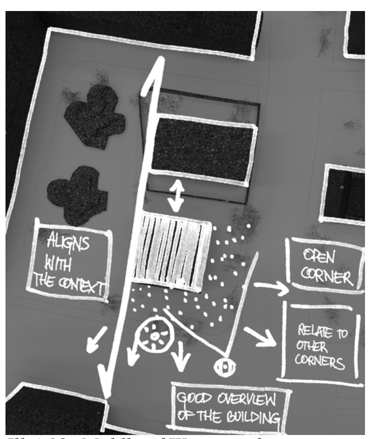
Ill.4.15: North-east corner



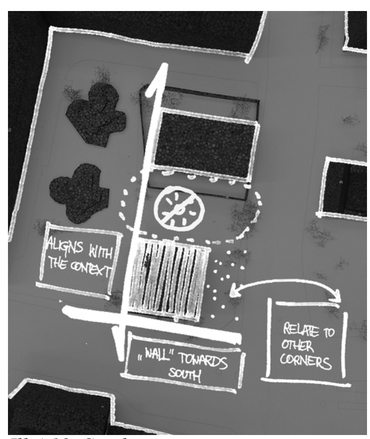
Ill.4.16: South-east corner



Ill.4.17: North-west corner



Ill.4.18: Middle of Western edge

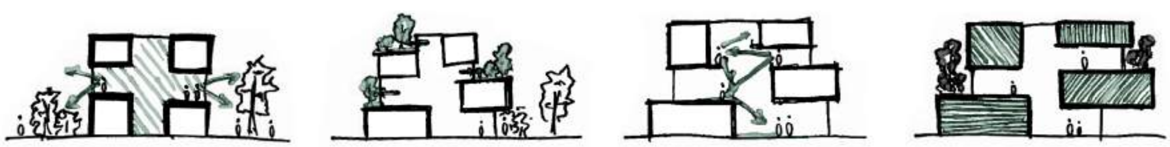


Ill.4.19: South-west corner

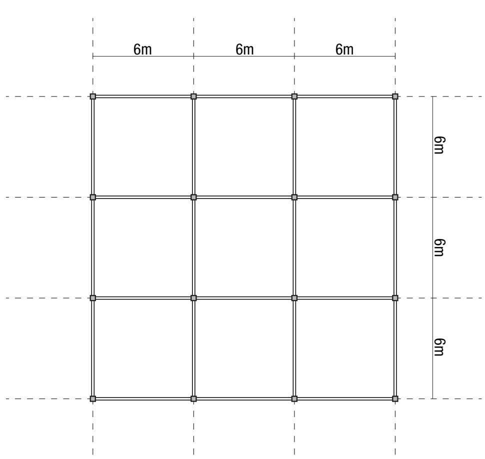
VOLUME

Concept

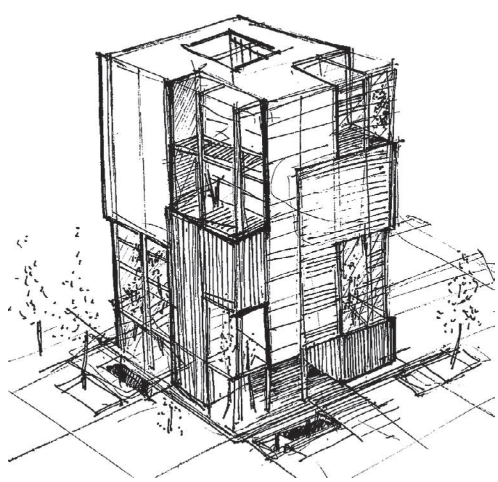
The concept of the vertical connected common space within the atrium from the circular proposal is applied to the cubic shape. Three different ways of translating the concept of "unity in diversity" to form are compared (Ill. 4.23-25). The cube should represent the unity, holding a diversity of expressions, that reflects the diversity of users coming together to support each other. In the solution of shifting boxes (Ill. 4.25), the cube is lost, meaning that the unity is no longer clear. The solution also has problems with PV placement and envelope area.
The other two solutions represent two opposites. The concept of boxes within the cube (Ill. 4.23) is designed with the boxes controlling the shape of the atrium inside, while for the cuts through the cube (Ill. 4.24), the cuts are the controlling aspect defining the atrium as well as common spaces, leaving the boxes with functions as the negative spaces of the cuts. Since the atrium holding the common spaces should be the central part of the building, the concept of cuts through the cube is chosen.
The structural principle from the circular concept is kept, introducing a 6m by 6m grid to control the placement of columns and beams (Ill. 4.21), hence also preserving the layout and togetherness of the circle.



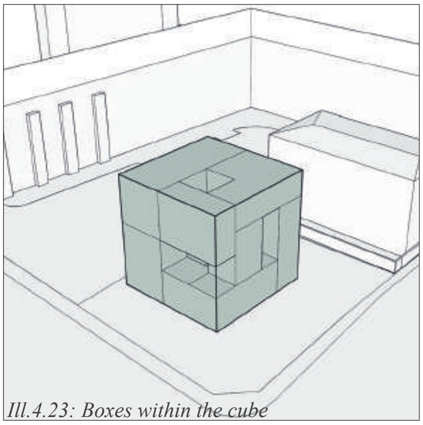
Ill.4.20: Concept sketches



Ill.4.21: Structural grid



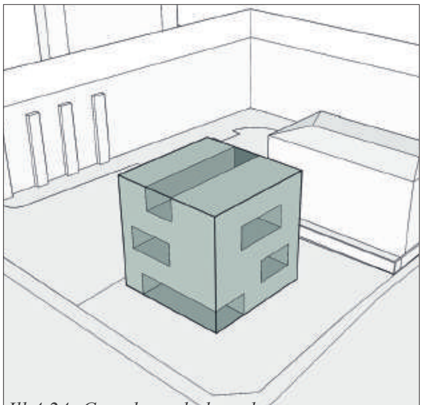
Ill.4.22: Concept sketch



Ill.4.23: Boxes within the cube

BOXES WITHIN THE CUBE

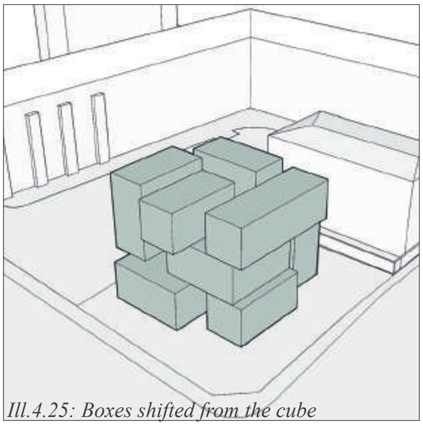
- atrium placed in the negative spaces of boxes.
- diversity is expressed through the mix of boxes.
- focus on the boxes, the atrium follows.
- simplicity in shape, but still expressing diversity in the facades.
- small envelope area.
- photovoltaics can be placed without shadows.



Ill.4.24: Cuts through the cube

CUTS THROUGH THE CUBE

- atrium placed within the cuts.
- diversity is expressed through the openings.
- does not express diversity in the facades.
- focus on the atrium, everything else follows.
- small envelope area.
- photovoltaics can be placed without shadows.
- simplicity in shape



Ill.4.25: Boxes shifted from the cube

BOXES SHIFTED FROM THE CUBE

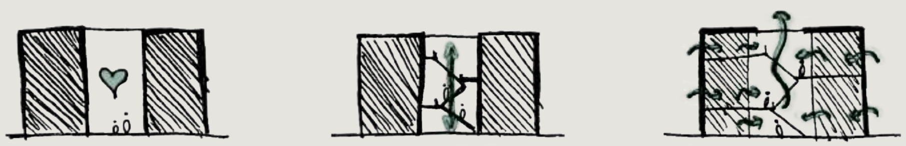
- boxes start as a cube and are shifted out in different directions.
- atrium placed in between the boxes.
- high level of diversity, both outside and inside.
- the expression of the cube (unity) is lost.
- large envelope area.
- photovoltaics in the facades will be shaded by the boxes.
- dynamic expression

FLOOR PLANS

Atrium

The atrium is designed to be the "heart of the building" and create informal meetings between its users (Ill. 4.26). This is achieved by connecting common functions to the atrium and having all access to the rooms from the atrium. In this way, the users have to cross the central spaces when moving around the building allowing them to meet and talk. The functions placed within the atrium are social functions, such as a play area, dining space and library (Ill. 4.28), as introduced in the circular concept. Connections between the functions on different floors enhances the social and lively feeling of the central atrium and common spaces.

The atrium tells a story of the community centre as a sustainable building, by ensuring good daylight conditions on all floors, and a good indoor environment due to an effective natural ventilation strategy of cross- and stack ventilation.

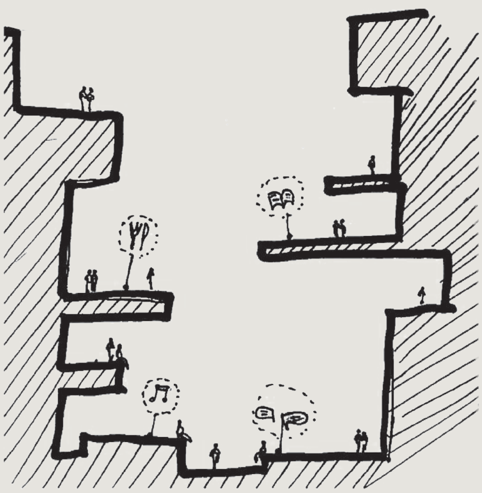


atrium
"heart of the building"
daylight

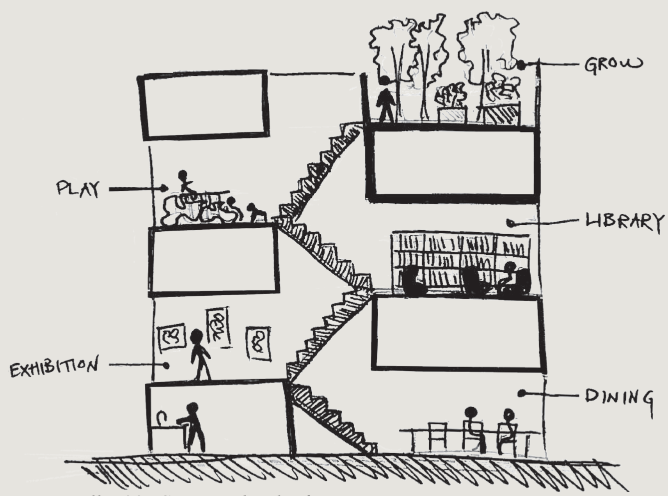
vertical flow
access to functions
creating meetings

natural ventilation
cross- and stack ventilation
good indoor environment

Ill.4.26: Concept for the atrium

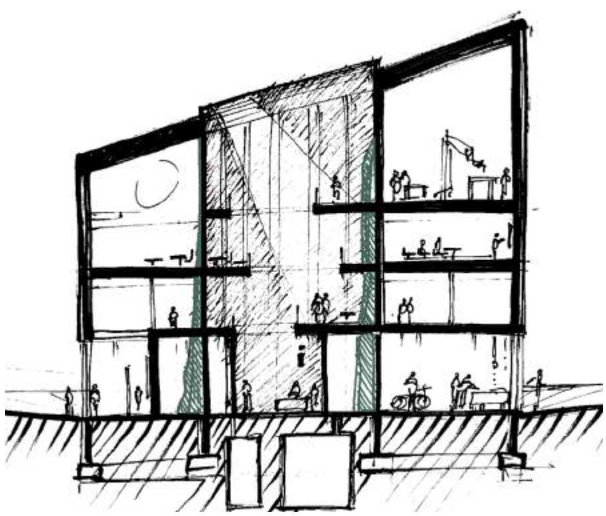


Ill.4.27: Concept sketch of atrium with common spaces

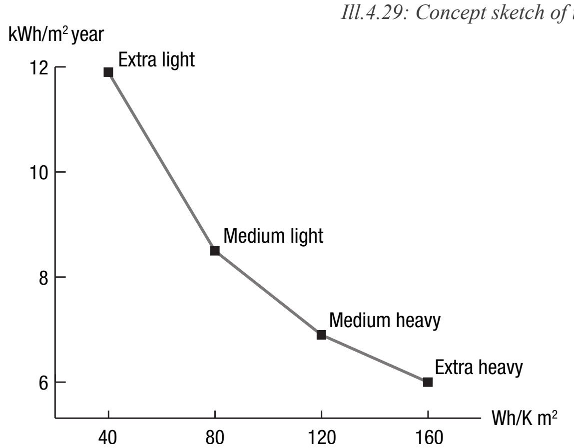


Ill.4.28: Concept sketch of common spaces

A study of introducing thermal mass into the atrium is made. Since a construction with high heat capacity can be a big help in having an effective natural ventilation and a good thermal indoor environment, by storing and releasing heat when necessary.
The study is made using BE15, where the effect, that thermal mass has on the energy consumption of a simplified building, is tested. Illustration 4.30 shows that the biggest change in energy consumption happens when going from an extra light construction to a medium light construction which in this case would mean to implement some elements with high heat capacity inside the building. Because of this, an element of rammed earth is implemented within the atrium. Rammed earth has a high heat capacity and an aesthetic expression that compliments the concept.



Ill.4.29: Concept sketch of thermal mass within the atrium



Heat capacity [Wh/K m²]	40	80	120	160
Net requirement Room heating [kWh/m² year]	11,0	7,7	6,2	5,3
Heat loss from installations [kWh/m² year]	0,9	0,8	0,7	0,7
Total [kWh/m² year]	11,9	8,5	6,9	6,0

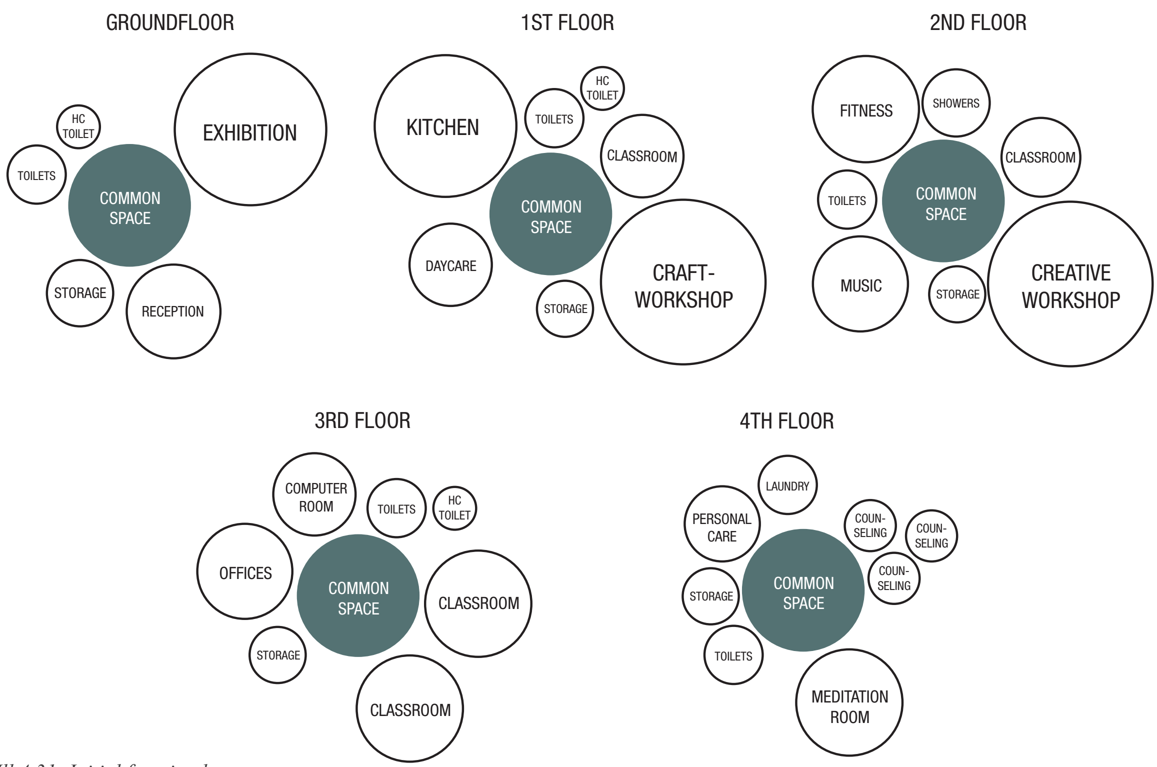
Ill.4.30: Energy consumption for different construction types

FLOOR PLANS

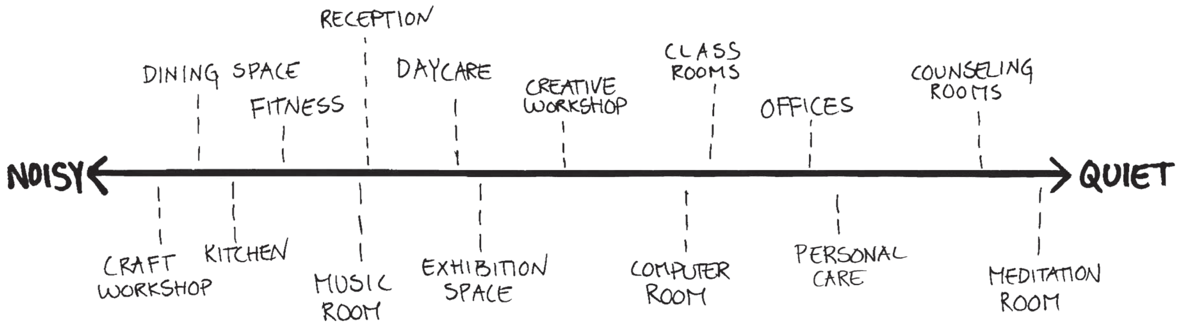
Function Layout

The first step in placing the functions in the building is to look at the need for minimising noise levels and solar gains. Functions such as the dining space, fitness room and day care are very noisy and therefore need to be placed away from the counselling rooms and mediation room, which need more quiet spaces (Ill. 4.32). The functions are placed vertically accordingly from bottom up, going from noisy to quiet.
The offices, computer room and kitchen have high internal heat gains, which means that they are more sensitive to solar heat gains. Due to this they are placed north in the building, while functions with low internal gains are placed to the south to get the heat of the sun in the winter (Ill. 4.33).
Illustration 4.31 shows the initial placement of all functions on five floors with the before mentioned considerations in mind, as well as which functions would benefit from being close to each other.

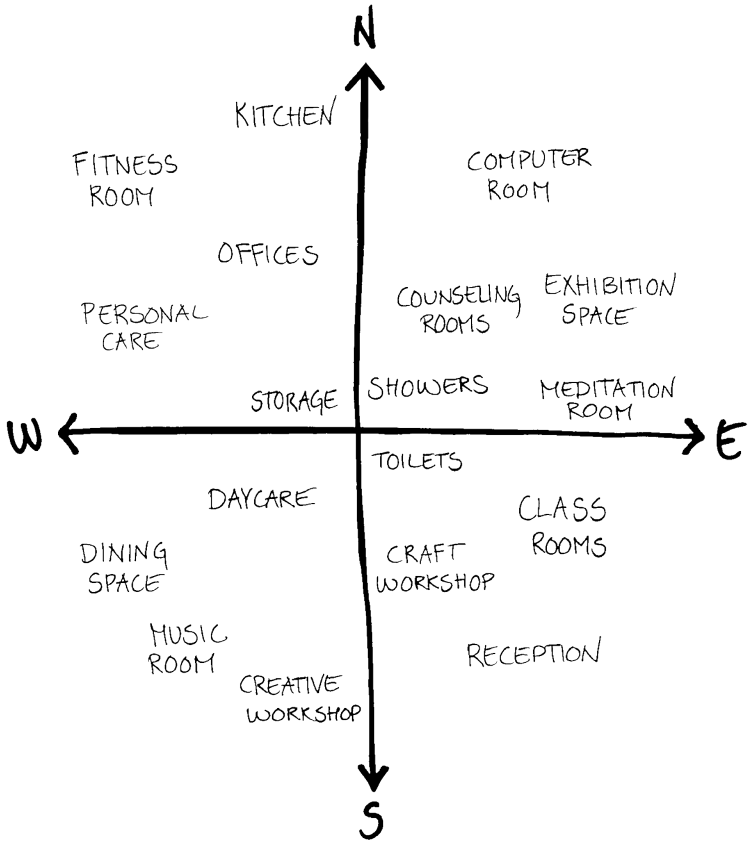
In order to make people move around the building, functions are mixed and distributed on all floors, which makes the central atrium a dynamic space and create possibilities for meetings.



Ill.4.31: Initial function layout



Ill.4.32: Function placement according to noise



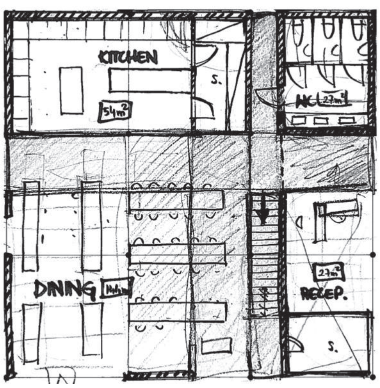
Ill.4.33: Function placement according to heat gains

FLOOR PLANS

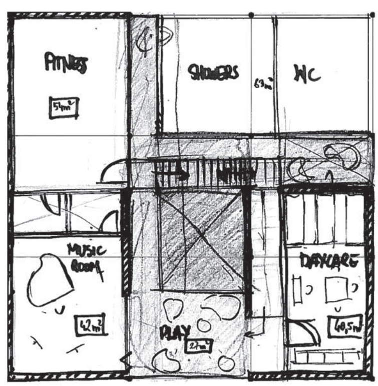
Designing the Plans

When designing the floor plans the atrium with the adjoining common spaces are in focus. Illustrations 4.34-38 show a proposal for the floor plans where each floor has different cuts of varying sizes through the volume. In the bigger cuts the common spaces are placed, and where the cuts intersect the atrium is created. The common spaces are shifting direction from floor to floor creating a new expression for each floor and a diversity of views and connections. The functions are placed in boxes surrounding the atrium according to the studies of noise and solar gains. All functions are placed to the facade, which gives good daylight conditions and the possibility of natural ventilation.

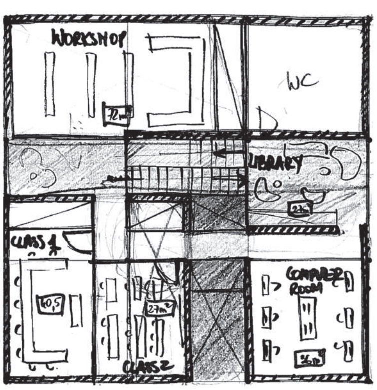
For this proposal, problems occurred with large, unusable hallway spaces around the atrium, as a result of the shifting common spaces and stairs. The shifting opening for the atrium also resulted in the actual area of the atrium, that is open through all floors, becoming quite small. This could cause problems with getting daylight to the lower floors and the effectiveness of the natural ventilation.



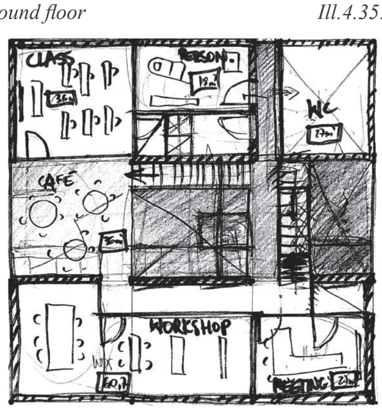
Ill.4.34: Ground floor



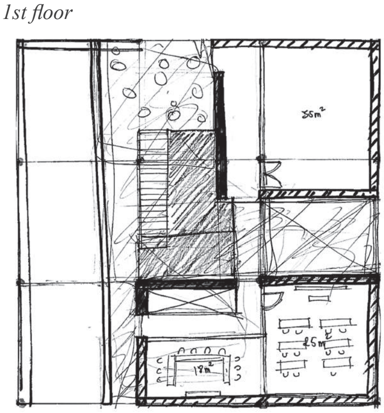
Ill.4.35: 1st floor



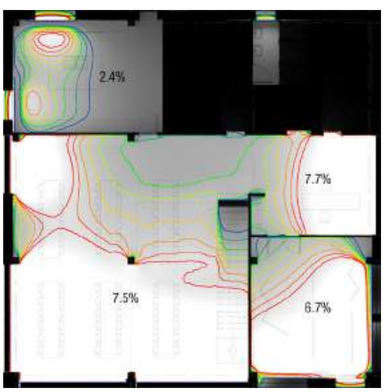
Ill.4.36: 2nd floor



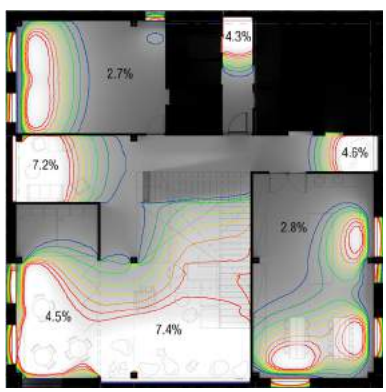
Ill.4.37: 3rd floor


Ill.4.38: 4th floor

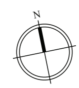
In further development of the floor plans a study of the daylight conditions in all rooms is made (Ill. 4.39-43). Velux Daylight Visualizer is used for rendering the average Daylight Factors for each room, and the aim is to have a minimum of 2% average. All interior surfaces are wood and the glass have a transmittance of 78%. In the north-east corner of the building a stabilizing core is placed with functions, such as toilets, showers, storage, emergency stairs and the lift, which do not require daylight. The windows tested are of varying sizes; 1x1m, 1.5x1.5m and 2x2m, which are placed in the facades according to functions.
The daylight factor study shows, that all the common spaces have great daylight conditions due to the large windows in the facade and the atrium. Generally, all the functions have an average daylight factor above 2%, but a few problems occur with the rooms that only have windows in one facade.
The result of the study is therefore to have windows in two facades in all possible rooms, and to slightly enlarge the size of the windows to get higher average daylight factors in all rooms.

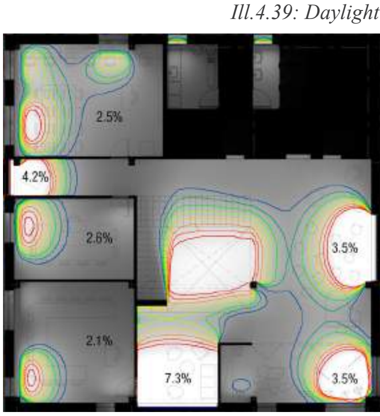


Ill.4.39: Daylight factor, ground floor

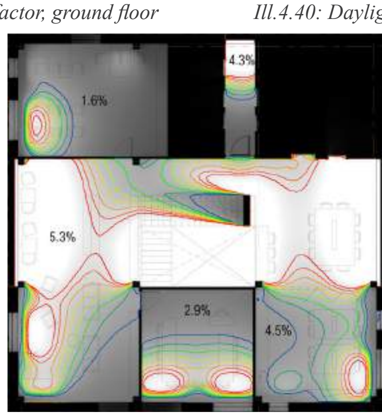


Ill.4.40: Daylight factor, 1st floor

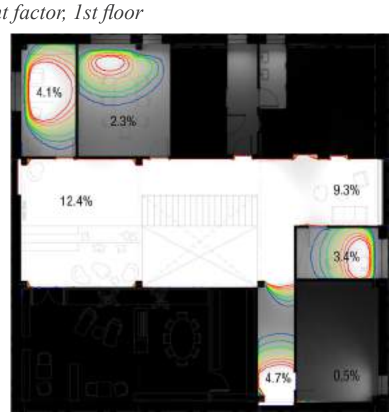




Ill.4.41: Daylight factor, 2nd floor



Ill.4.42: Daylight factor, 3rd floor

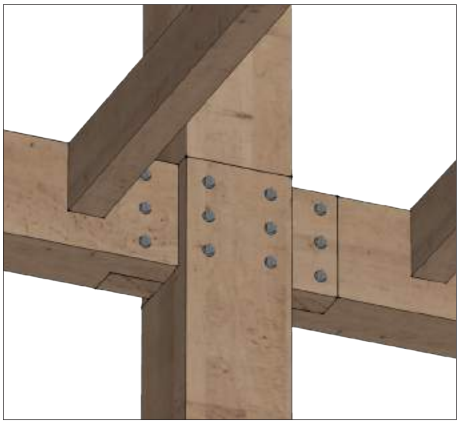


Ill.4.43: Daylight factor, 4th floor

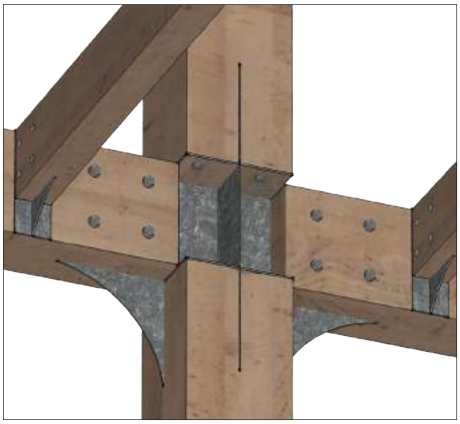
FLOOR PLANS

Detailing

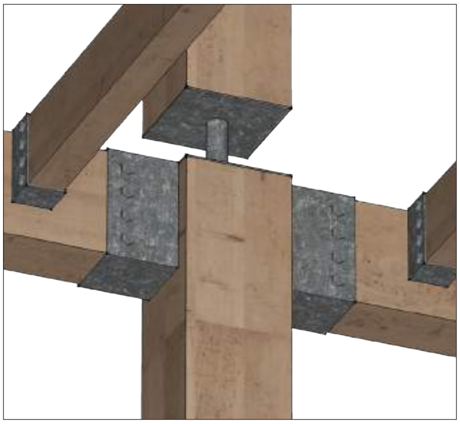
In further detailing of the structure the expression of the joints is examined. Illustration 4.44 shows a timber lap joint, where the structural elements are cut to fit each other and connected only with bolts, hiding the joint and putting focus on the column and beams.
A metal plate joint is made, shaped according to the moment forces in the joints (Ill. 4.45). This puts the joints in focus, but is very dominating and distracts from the light wooden structure.
A hidden metal plate joint puts the central metal pieces, connecting all four construction elements, in focus (Ill. 4.47).
The chosen joint is a metal bracket joint bolted to the columns and supporting the beams (Ill. 4.46). This joint is found to be enhancing the meeting of the column and beams, and showing the hierarchy of forces, without taking focus away from the structure. The joint between the columns will be hidden in the floor construction.



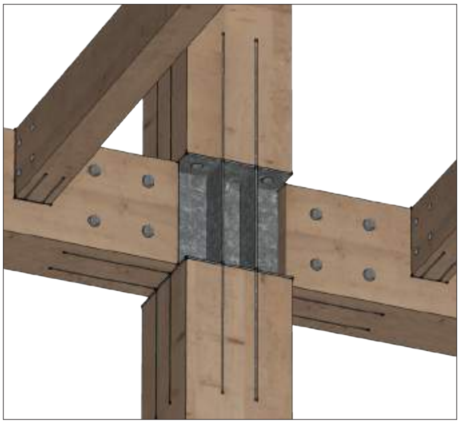
Ill.4.44: Joint detail, timber lap joint



Ill.4.45: Joint detail, metal plates showing forces



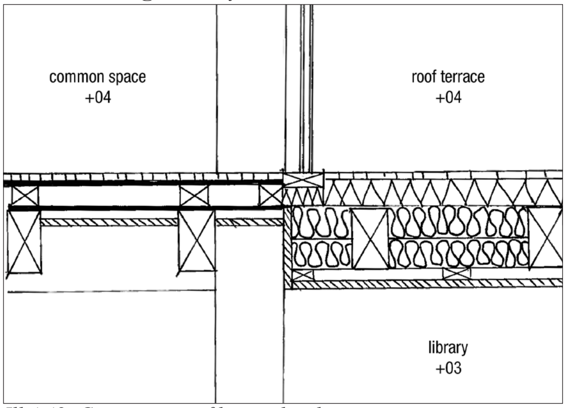
Ill.4.46: Joint detail, metal brackets



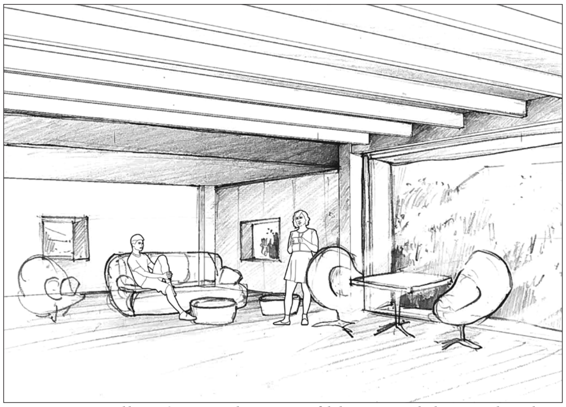
Ill.4.47: Joint detail, hidden metal plates

Implementing a roof terrace on the 4th floor makes it necessary to consider the construction of the floor slab, since it is a part of the building envelope.
Two solutions are made; lowering the ceiling of the floor below or raising the floor of the terrace. Lowering the ceiling effects the space of the library on the 3rd floor, hiding the structure (Ill. 4.48-49). This solution contradicts the concept of a visible structure throughout the building, and could also create problems with the room height for ventilations pipes.
The chosen solution is to raise the level of the terrace to fit the envelope above the structure (Ill. 4.50). The stair necessary to access the terrace is designed as a part of the common space, as a place for seating and socializing (Ill. 4.51). Problems occur with handicap accessibility, and a wheel chair lift will be mounted on the wall to give access to the terrace.

Lowered ceiling on 3rd floor

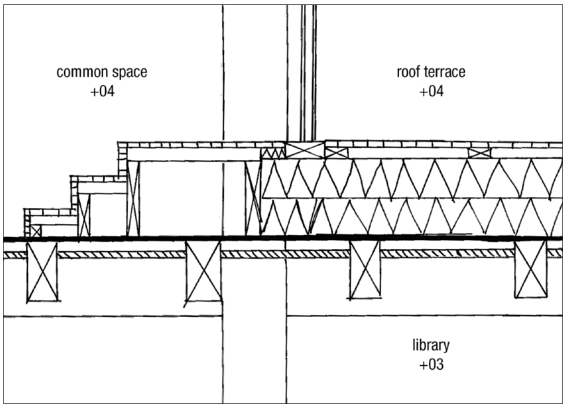


Ill.4.48: Construction of lowered ceiling

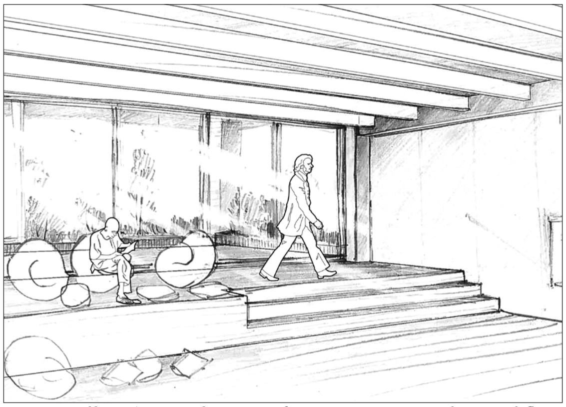


Ill.4.49: Visualization of library with lowered ceiling

Raised floor on 4th floor



Ill.4.50: Construction of raised floor



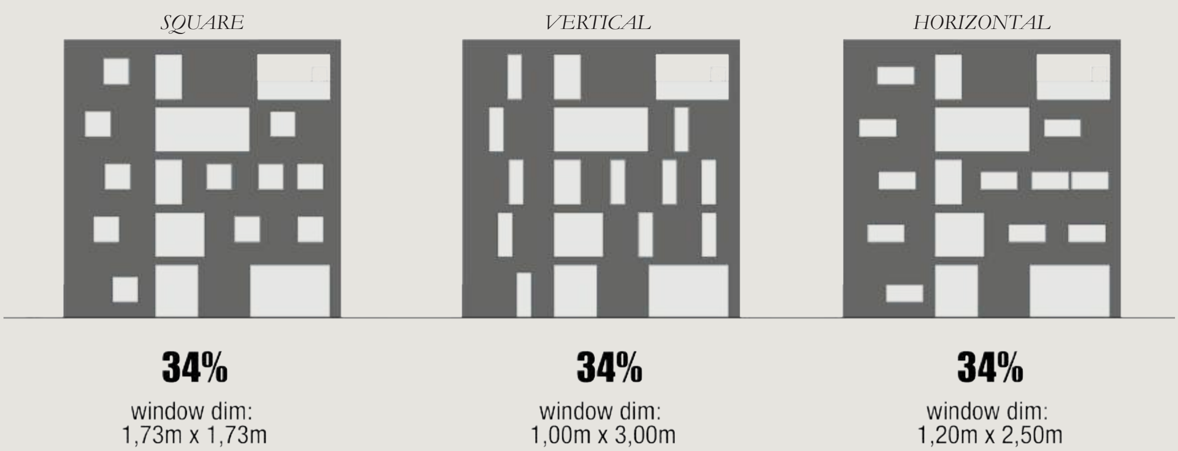
Ill.4.51: Visualization of common space with raised floor

FACADES

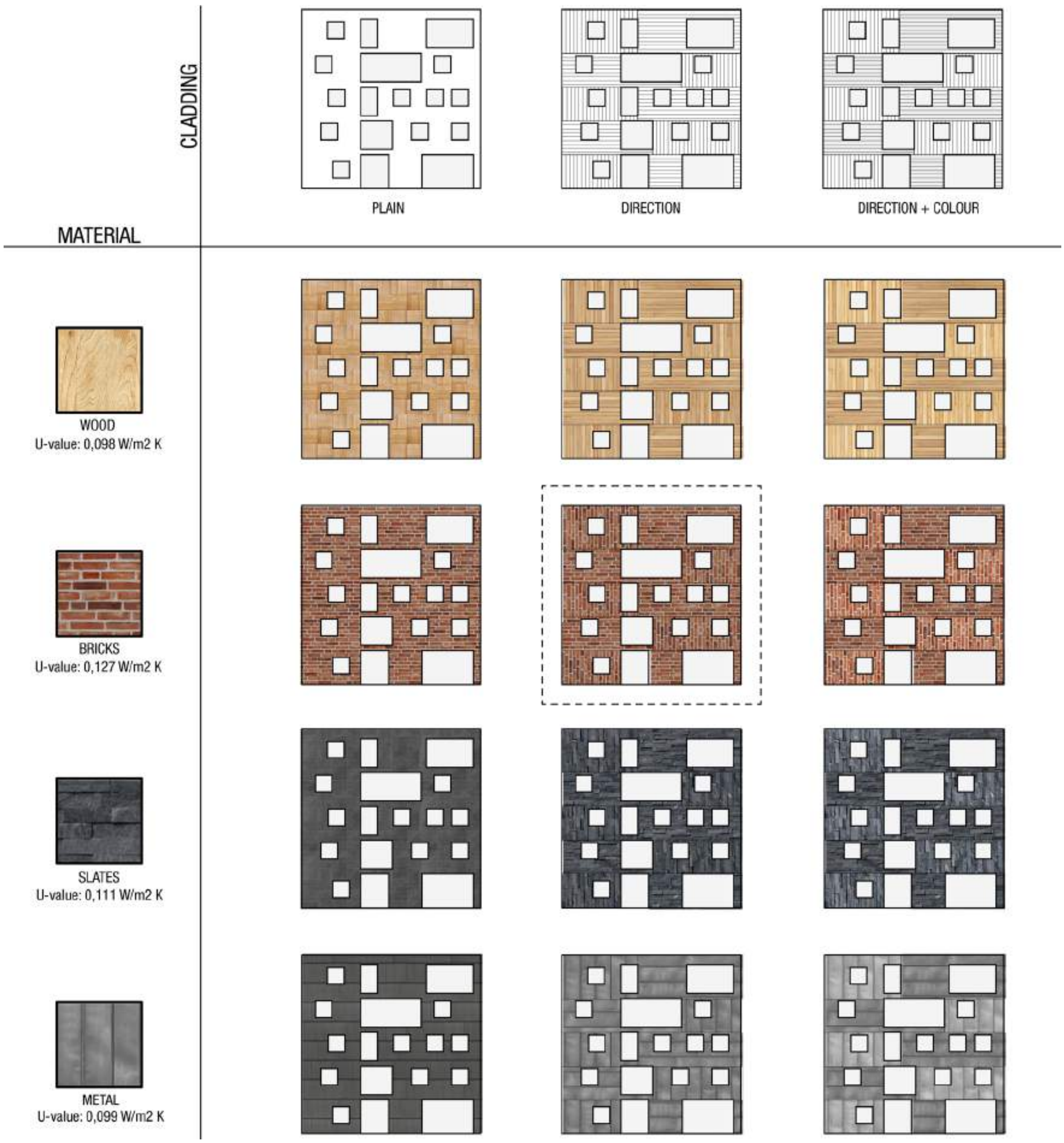
Windows & Cladding

The expression of the facades is studied together with the shape of the windows (Ill. 4.52). Vertical windows enhance the height of the building and relate to the shapes of the cuts, but diminish the focus on the cuts in the facades. They also reduce the flexibility of the floor plans. The horizontal windows can give good daylight conditions along the width of the facade, but the shape does not relate very well to the shapes of the rest of the building. Square windows are therefore chosen, as they give good daylight conditions, keep the floor plans flexible and relate to the shape of the cube. The percentage of windows to the envelope area will affect the energy consumption of the building, so it is important to minimise the total window area, while keeping good daylight conditions and views outside.

The way the facades are cladded also have a big impact on the expression of the building from the outside. Four different materials are tested each with three different layouts (Ill. 4.53). The material chosen is bricks since it relates to the urban expression of the context, and the chosen cladding is of changing directions, expressing diversity in the facades, without having too many different elements, as with the changing of colours.
The walls have different u-values based on which cladding is used. When choosing bricks, which has the highest u-value of the four wall constructions, it is important to be aware of the u-values for the other parts of the envelope and the windows to ensure an efficient envelope and keep the energy consumption of the building as low as possible.



Ill.4.52: Comparison of window expression



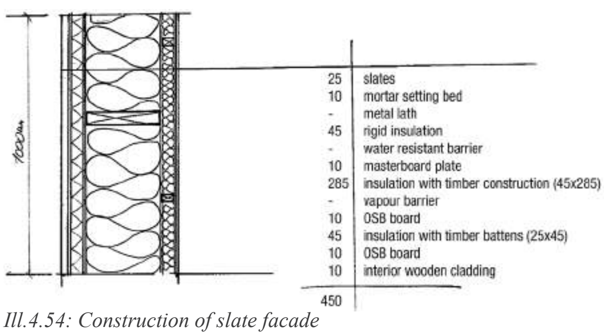
Ill.4.53: Comparison of materials and cladding expression

FACADES

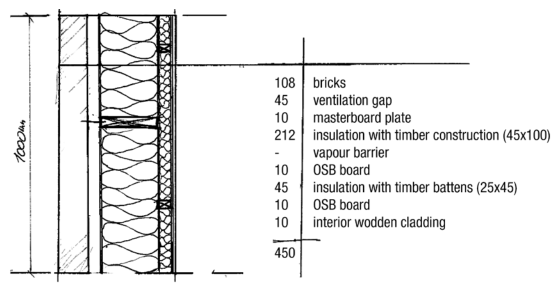
Life Cycle Assessment

As a tool for choosing the material for the facades, a Life Cycle Assessment is made of all four wall constructions. The LCA gives knowledge of the materials' impact on the environment and helps with choosing a more sustainable solution for the facades.
Depending on the cladding material, the construction of the wall differs and thereby its properties (Ill. 4.54-57). One square meter of wall with a constant thickness of 450mm is assessed for all cladding iterations.
Illustration 4.59 shows the comparison of the four wall constructions from the LCA, with the parameters explained in illustration 4.58. The brick facade is always at 100%, while the others are either higher or lower.
When comparing the four solutions, metal and slates are the better solutions according to the LCA, based solely on the combined numbers of the graph. Looking at the parameters, as for example the Global Warming Potential, bricks are the highest, but choosing recycled bricks for the cladding, would presumably make it better than the three other options. This is the case for several of the other parameters. Additionally, bricks has the lowest values when it comes to the use of secondary fuels (Sec) and the depletion potential for non-fossil resources (ADPe).

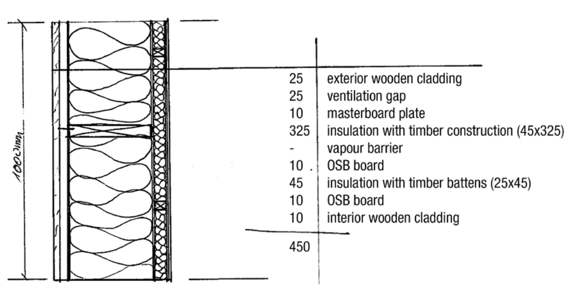
The LCA study therefore supports the choice of bricks for the facade, as long as the bricks are recycled.



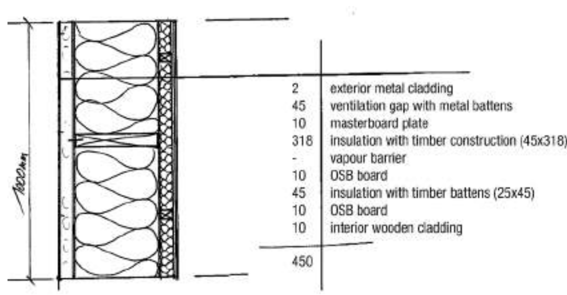
Ill.4.54: Construction of slate facade



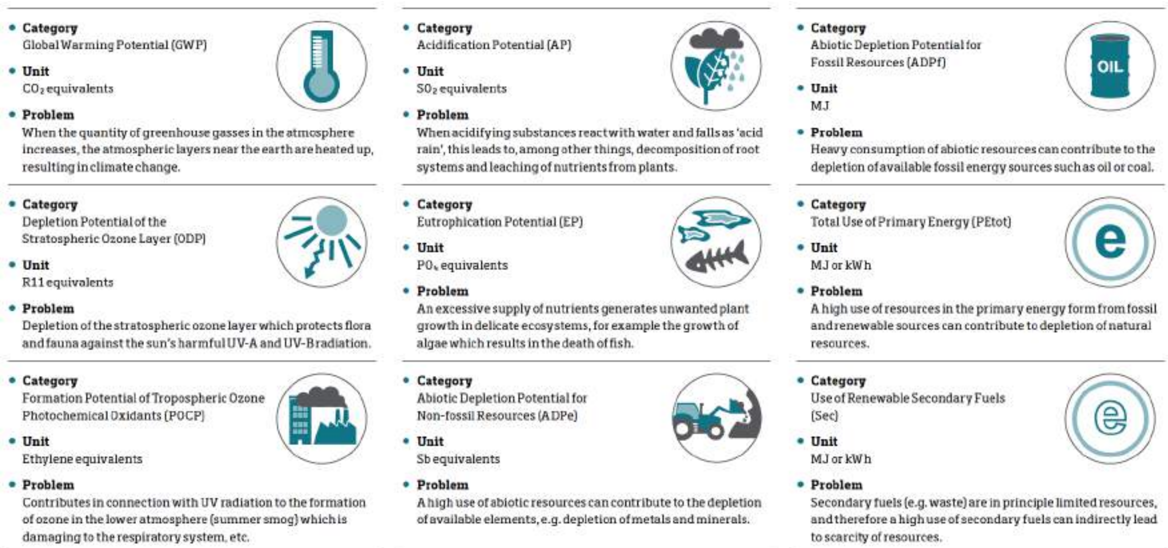
Ill.4.55: Construction of brick facade



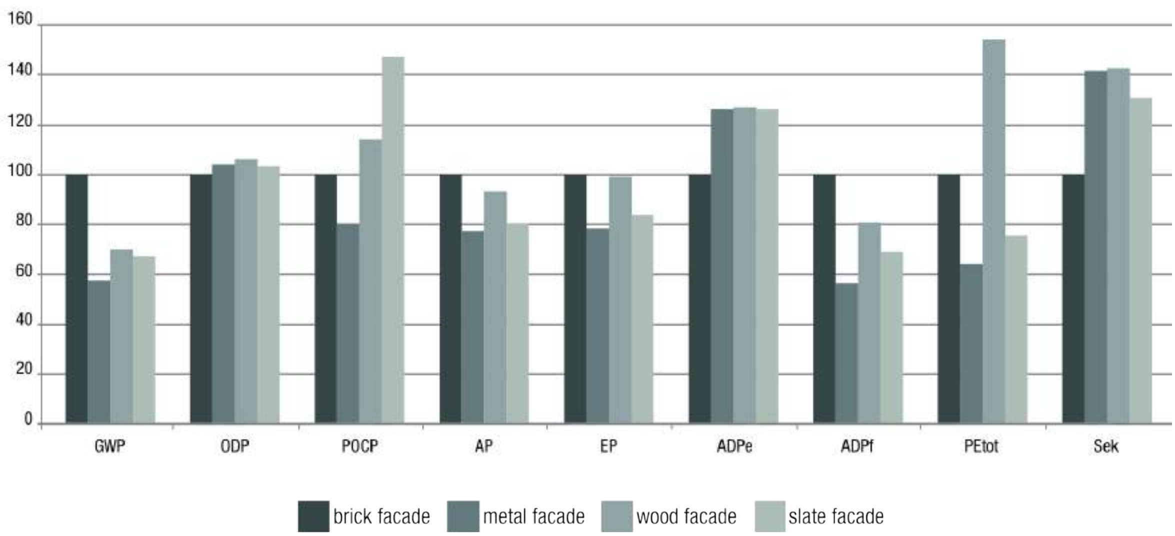
Ill.4.56: Construction of wood facade



Ill.4.57: Construction of metal facade



Ill.4.58: Description of LCA parameters



Ill.4.59: LCA comparison of different exterior walls

FACADES

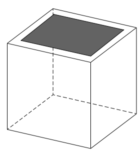
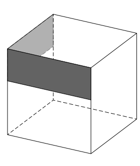
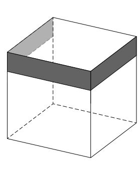
Photovoltaics

In order to become a Net-Zero Energy Building, the energy consumption of the building should be covered by a renewable energy source. Therefore, photovoltaics are implemented in the design of the building and a comparison of the type and placement is made according to the efficiency (Ill. 4.60).
Mono- and poly-crystalline PVs are chosen since they are both more effective and cheaper than the thin-film cells. Mono-crystalline PVs are black, while poly-crystalline can have a variation of colours.

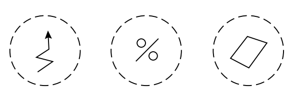
Depending on the choice of PVs and placement, this will affect the expression of the building. The study shows that the smallest number of panels is needed when choosing mono-crystalline placed flat on the roof. They would be even more effective if placed with an angle, but this does not fit well with the expression of the cube.

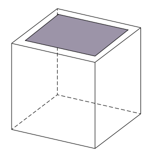
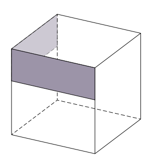
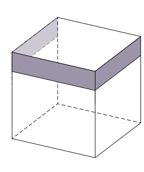
Placing the PVs in the facades could enhance the expression of the building as sustainable architecture, but they would need to be integrated naturally in the design of the facades.

MONO-CRYSTALINE PHOTOVOLTAICS

	surface [m²]	155,20
	no. panels	80
	energy [kWh/year]	39 071,29
	surface [m²]	199,21
	no. panels	103
	energy [kWh/year]	39 160,80
	surface [m²]	207,58
	no. panels	107
	energy [kWh/year]	38 800,44

POLY-CRYSTALINE PHOTOVOLTAICS



	surface [m²]	159,08
	no. panels	82
	energy [kWh/year]	38 898,66
	surface [m²]	203,70
	no. panels	105
	energy [kWh/year]	38 735,63
	surface [m²]	213,40
	no. panels	110
	energy [kWh/year]	38 736,36

Ill.4.60: Comparison of type and placement of PVs

Solar Shading

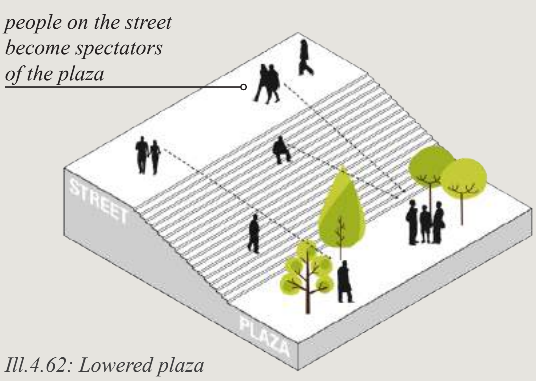
Calculations of the 24-hour average temperatures in some of the critical rooms show that solar shading is necessary in order to avoid overheating in the summer. Three different solar shading systems are compared with the expression it adds to the building (Ill. 4.61).
Sliding panels changes the expression of the facades depending on the need for shading, but takes focus away from the concept of the cuts. PVs could be placed in the panels, but this creates problems with shading of the panels.
A skin covering the entire building with openable folding panels makes the solar shading the main expression of the building, again removing the focus from the cuts. It is also an expensive solution, since it needs a lot of maintenance.
Hidden blinds for the windows in the boxes are chosen, in combination with bigger overhangs for the cuts, enhancing the expression of the cuts as the controlling parts of the building, extending them out of the facades. This choice concludes the PV study, placing mono-crystalline PVs on the roof, to keep focus on the original concept of the cuts.

Ill.4.61: Test of different solar shading systems

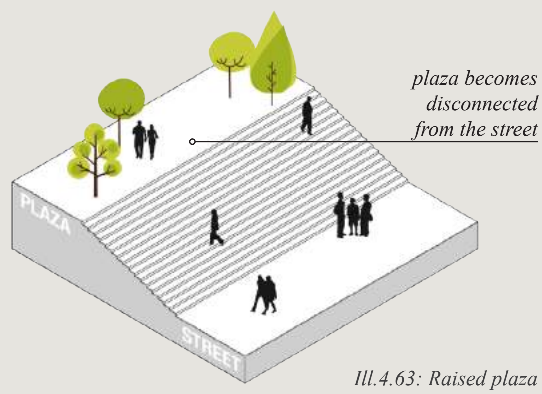
SITE

Studies of Urban Spaces

Studies made by sociologist William H. Whyte are used as inspiration on how to create attractive urban spaces. [Whyte, W., H., 1980]
In his study of plazas, it is visible that raising or lowering a plaza too much can make it disconnected from the life of the street. In a lowered plaza, people in the street become spectators, while the users of the plaza are "the show" to watch (Ill. 4.62). A raised plaza is disconnected from the street by the border of a large stair, dividing the life in the plaza from the life in the street (Ill. 4.63). Whyte's most important point of attractive urban spaces is, that people like to observe people.
This makes the front ledge to a busy street a nice place to sit and observe the life of the city (Ill. 4.65). Adding to this, people prefer to have different options for seating depending on if they are in a group or alone and what kind of activity they are doing (Ill. 4.65).
Seating spaces under trees are the most attractive, since the trees give shelter and create niches, while still keeping the views to the life of the city open (Ill. 4.64).
These studies are implemented in the design of the urban spaces, since the building is placed in a busy, urban area with lots of life to observe.

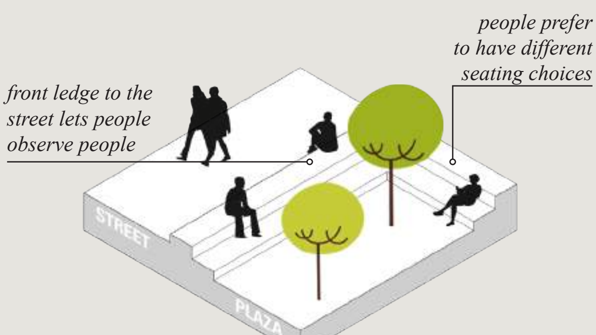


Ill.4.62: Lowered plaza

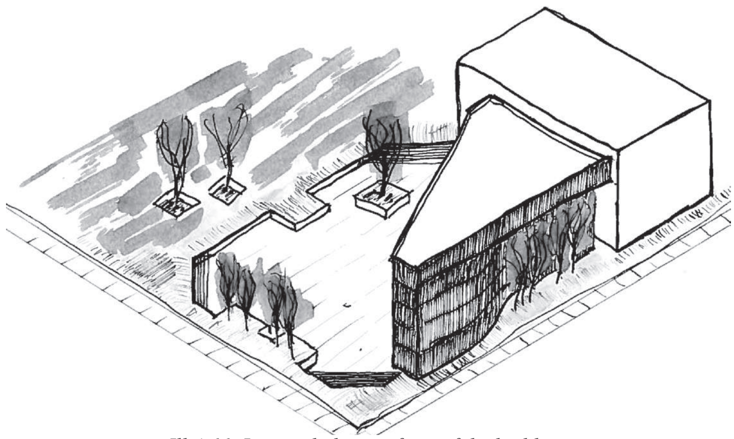


Ill.4.63: Raised plaza

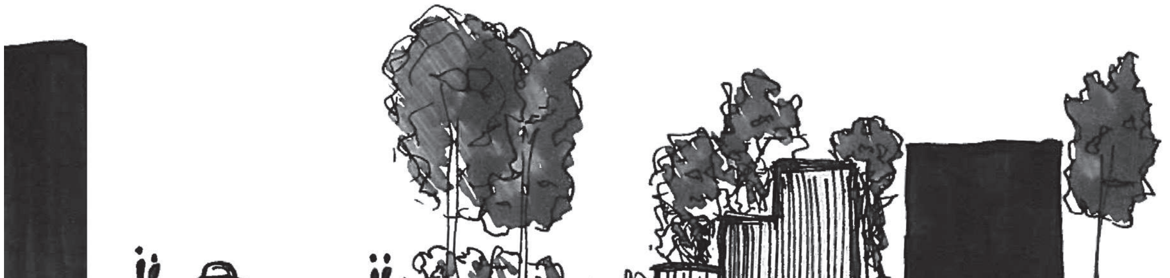
Ill.4.64: Seating under trees



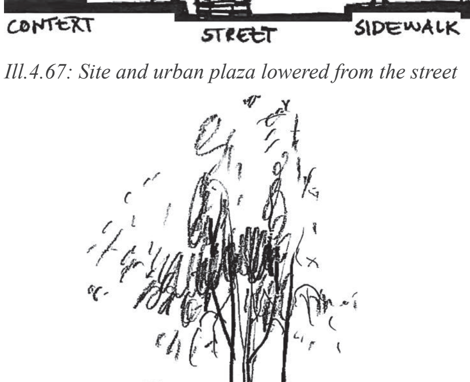
Ill.4.65: Seating choices



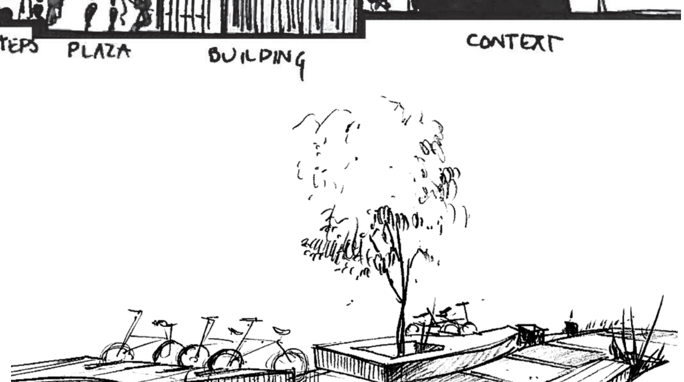
Ill.4.66: Lowered plaza in front of the building



Ill.4.67: Site and urban plaza lowered from the street



Ill.4.68: Seating under trees



Ill.4.69: Seating and bike parking

SITE

Different Levels

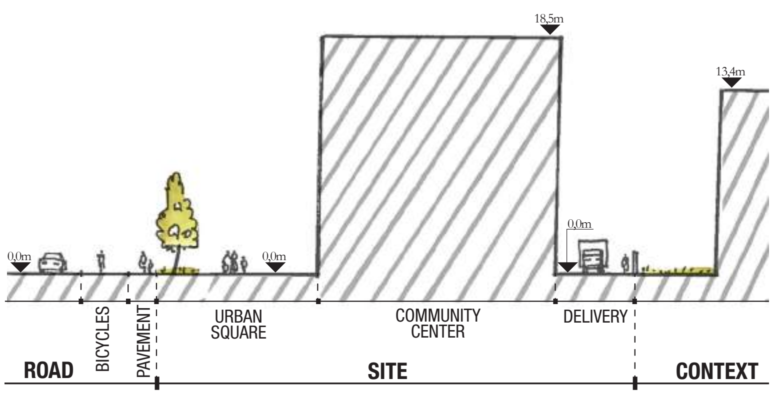
In connection to the studies made on the previous page, different ways of using levels in the urban spaces are tested. The important aspect to assess is accessibility for people and delivery trucks, the connection to the street and the perception of the cube.

When the urban areas are on level with the street, there is no problems with accessibility and delivery (Ill. 4.70). The cube is also clearly perceived and no border is created between the street and the urban spaces. This is a good thing in terms of access and inviting people into the building, but since the streets surrounding the building are very busy, it is an important factor to take this into consideration in order to make the spaces nice to stay in.

Lowering the whole site gives problems with access and delivery (Ill. 4.71), and it is necessary to introduce ramps in the design of urban spaces. The steps leading to the building could be a nice

site on level with street

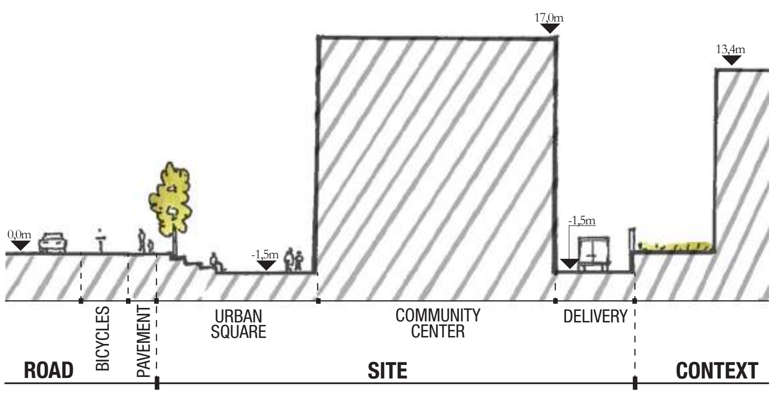
- easy access for everybody
- easy delivery
- no border between the site and the context
- clear perception of the cube



Ill.4.70: Diagram showing site on level with the street

lowered site

- problems with access + delivery
- border created between the site and the context
- seating steps towards the plaza
- cube is only perceived from a distance



Ill.4.71: Diagram showing the site lowered from the street

place to sit, directed to the plaza in front of the building, but they create a border between the site and its context.

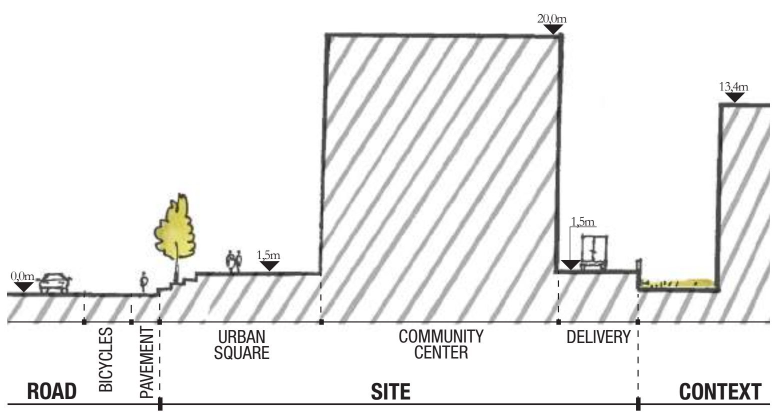
Raising the entire site creates a lot of the same problems as lowering it; accessibility, delivery and a large border to the surroundings (Ill. 4.72). The steps to the site are directed to the street instead, letting people watch the life of the city.

Only lowering the urban plaza on the site, and keeping the rest on level with the street fixes the problems with the delivery (Ill. 4.73). But there are problems with accessibility to the plaza, and the perception of the cube is lost, because of the different heights.

It is decided to keep the site on level with the street in order to have easy access for all. Not creating a border between the site and the context also invites people into the site and the building, which could be an important factor due to the amount of people passing the site every day.

raised site

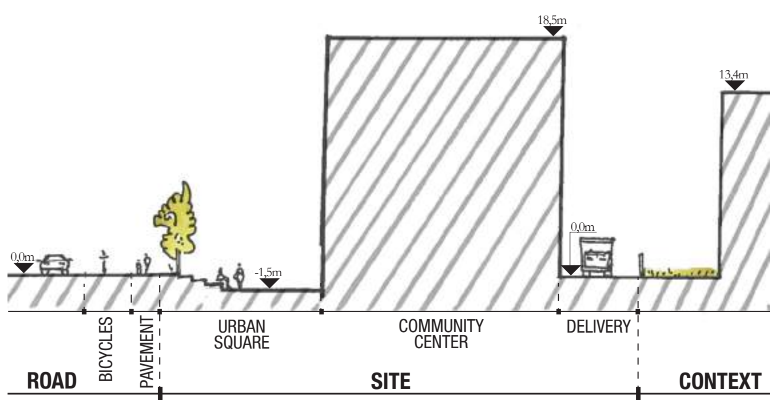
- problems with access + delivery
- border created between the site and the context
- seating steps towards the street
- clear perception of the cube



Ill.4.72: Diagram showing the site raised from the street

site on level with context, lowered plaza

- problems with access
- easy delivery
- border created between the plaza and the context
- seating steps towards the plaza
- unclear perception of the cube



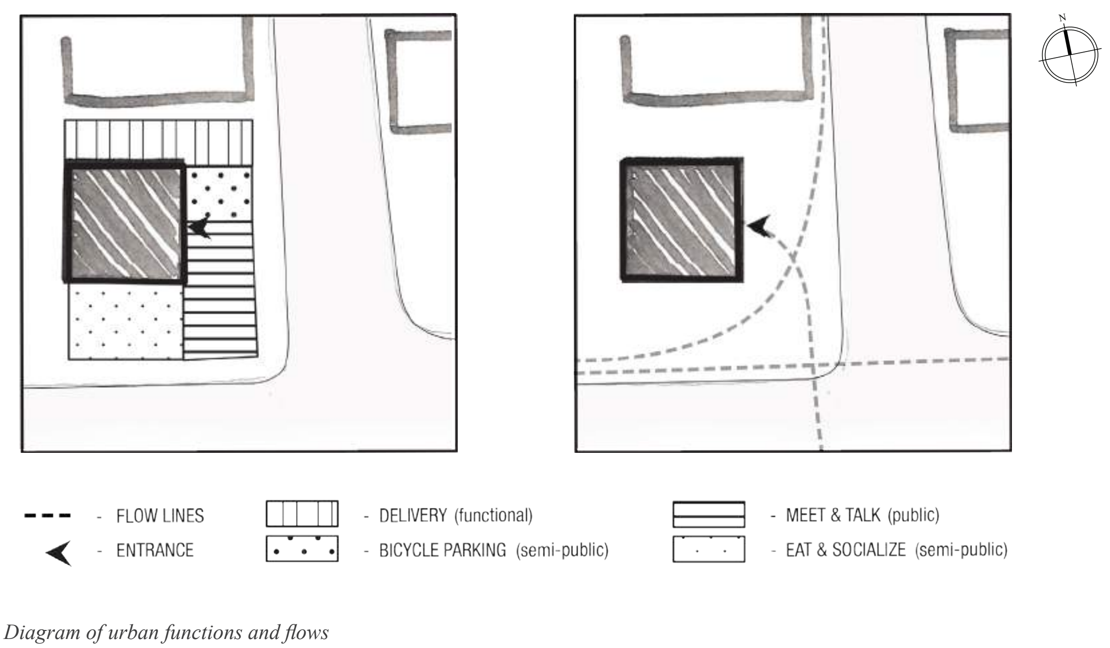
Ill.4.73: Diagram showing site on level with the street, with lowered plaza

SITE

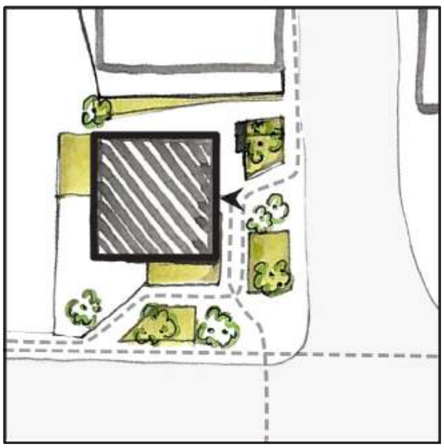
Flows & Shapes

For the design of the urban spaces the site is divided into four different functions; delivery, bicycle parking, "meet and talk" and "eat and socialize". The functions have different levels of privacy (Ill. 4.74) and are placed accordingly. The public "meet and talk" area is placed in the corner of the site, where many people pass by every day. The main flow to the entrance also happens from the corner to enhance the meetings happening here. The functional delivery space is placed to the small, shaded space to the north, bicycle parking to the east next to the entrance, and the "eat and socialize" area as a terrace connected to the building to the south, with good possibility for direct sun. A flow line crossing through the site from southwest to northeast is implemented in order to invite by-passers into the site by giving them a short-cut. The building becomes a part of the everyday life of many people, by letting them get close and connect with the life of the building, hence telling a story about natural integration of refugees in the Danish society.

For the shapes of the urban elements different solutions are sketched (Ill. 4.75). It is chosen to enhance the flow through the site even more by using the shapes of the elements to direct it and make it easier and faster to cross the site. The elements are placed where the existing trees on the site are placed, so that it will not be necessary to take them down.

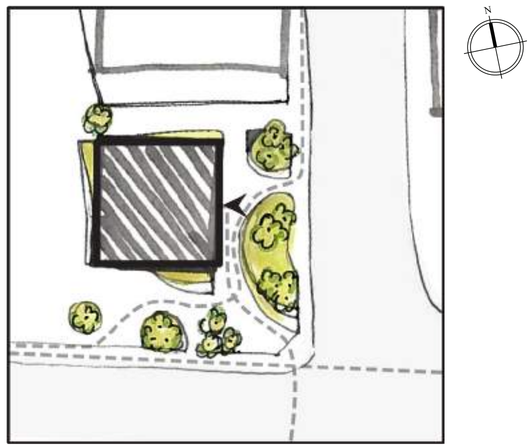


Ill.4.74: Diagram of urban functions and flows



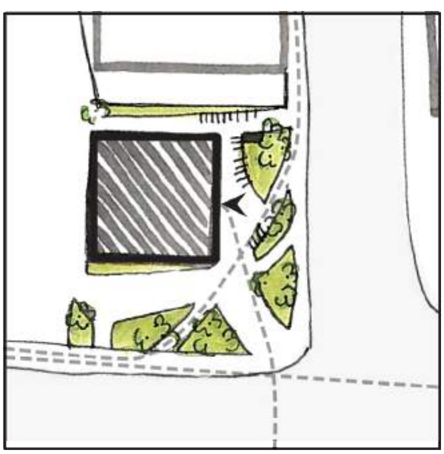
Ill.4.75: Square shapes with diagonals

- flow lines are interrupted
- the speed of the flow is slowed down
- flow lines are enhanced by diagonals
- urban and cube have same form language



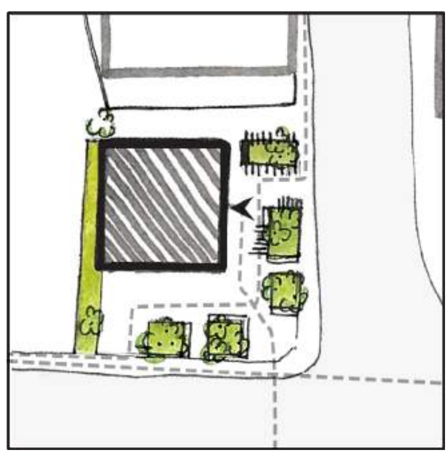
Ill.4.76: Organic shapes

- flow lines are interrupted
- the speed of the flow is slowed down
- rounded shapes are guiding
- urban form language contrasts the cube



Ill.4.77: Shapes following flow lines

- flow lines are clear
- the speed of the flow is faster
- shapes are controlled by the flows
- urban form language contrasts the cube



Ill.4.78: Square shapes

- flow lines are interrupted
- the speed of the flow is slowed down
- flow lines are directed by orthogonal shapes
- urban and cube have same form language

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EPILOGUE

Conclusion
Reflection
References
Illustrations

CONCLUSION

The design proposal for the Crossroads community centre aims to fulfil all goals and thoughts outlined in the initial phase of the project and, as a result, present as a truly sustainable building, including all environmental, economic and social aspects. The community centre enhances the quality of life for refugees coming to Denmark in search of asylum, and tells a story of better integration of refugees into the Danish society.

The location and exposure of the community centre is immensely important for the refugees to be informed about the existence of the centre. The central location in Copenhagen NV, just next to a large node of public transport, Nørrebro Station, makes it easy for the asylum seekers to come to Crossroads from the camps. Being placed on the corner of a large intersection, the community centre is highly exposed to the city, is easily locatable and expresses its purpose, acting as a landmark in its context. The design of urban spaces surrounding the building makes the site a part of the urban context while inviting the public to walk by, stop, sit and look inside the building, revealing the life of the community centre and encouraging to take part in its activities.

As for the concept of the design for the Crossroads community centre, a strong focus is put on relating to the context in order to avoid an unwanted expression of being a stranger in the city. Instead, the centre fits in by relating to the urban context in its use of bricks for the facades and by relating to the lines and form language of the area. In this way, Crossroads is a translation of a better integration of refugees into society, that can be a natural and mutually beneficial achievement. The introduction of the concept of cuts going through a cubic volume and creating diverse boxes as the negative spaces, contributes to an overall expression of diversity. Reflected on the facades, the diversity of users come together in the unity of a cube, expressing the overall social sustainability of the community centre.

When entering the community centre, one is met by a large dining area, giving space for community dinners, bringing together the inhabitants of Copenhagen and the users of the centre. By opening some parts of the building to the public, Crossroads becomes more transparent and gives the users opportunity to interact with other people and thus, informs the public about integration of refugees. The vertical arrangement

of common spaces within the atrium of the community centre creates a lively space, that functions as the heart of the building by giving an opportunity for its users to meet and interact. This is enhanced by the shifting stairs, making the users move around within the building and thus, creating more meetings. A system of icons and lines throughout the building guides the users to the respective functions. Using a universal iconographic language, that is understandable for all cultures, enhances the accessibility of the community centre.
Furthermore, the atrium provides the building with vast amounts of daylight and promotes natural ventilation of the common spaces. Boxes surrounding the atrium give the functions the necessary privacy and appropriate atmosphere for learning and other activities. All functions are placed to the facades, which gives them good conditions of daylight and the possibility of natural ventilation.

By ensuring a good indoor environment in the building using passive strategies, the energy frame for the building is also improved, hereby lowering the impact of the community centre on the environment. The sustainable properties of all environmentally certified or recycled materials used in the community centre, also inform about the environmental impact of the building. All technical solutions implemented in the design, together with a special focus on social aspects, makes the community centre stand out as a great example of sustainable architecture.

Crossroads community centre is a place of social integration, where the lives and paths of people can intersect and support each other, setting the frame for welcoming refugees from the day they arrive in Denmark. The building underlines the importance of all social, environmental and economic aspects of sustainability, and serves as an example of a mutually beneficial integration, expressed through unity in diversity.

REFLECTION

In the process of designing the Crossroads community centre, all technical, functional and aesthetical aspects were evaluated and developed through numerous iterations, according to the methodology of the integrated design process. This approach had a great impact on the design, which resulted in a more holistic as well as realistic project. The initial framework of the project contained a number of functional, technical, aesthetical and social design parameters, that were all considered a focal part of the design, though some aspects were weighted higher than others during the process. The reflection on the design process and proposal for the community centre serves as a summary, reflecting on the choices made during the process and their effect on the final outcome.

One of the initial design parameters were to design the community centre as a landmark in its context. Originally, the building was meant to stand out in its form in order to be easily locatable for the users and to show the special purpose of the building. Through investigations of the look of the design proposal, it was concluded that the more the building stood out in its expression, the more it became a stranger in the city, which was not the intention. The re-evaluation of the idea of a landmark led to the conclusion that the centre needed to be a political statement about the integration of refugees, that through the design of the building as a natural, settled part of the city, is a metaphor for an easy and smooth integration of refugees in society. By this, Crossroads becomes a landmark through its function, informing people about social integration, rather than a landmark in its form and appearance.

In the process of making the building a natural part of its urban context, bricks were chosen for the façade cladding. The hard, urban expression of bricks that fits the context is contrasted with a very soft, warm and welcoming feeling of the wooden interiors, which created a clear transition from outside to inside. The choice of contrasting materials highlights the general concept of fitting in but also provides asylum seekers with the feeling of being welcome and needed in the society. However, cladding the light wooden construction with heavy bricks could be perceived as contradicting. In order to have an awareness on tectonics, it might have been more natural to choose a lighter material for the cladding, that could still have provided the desired expression.

As stated in the design parameters, it has been a goal for the building to express sustainability. This can be achieved in many different ways, but a very clear way to show sustainability could have been to make sustainable initiatives, as photovoltaics, solar shading or natural ventilation, key elements in the aesthetic expression of the building. Studies were made during the process to test different solutions for showing the sustainable elements of the building, but they all were taking focus away from the fundamental concepts and making the building stand out too much in the context. This could be a result of the sustainable initiatives not being a central part of the original concept for the aesthetics, but more as the means to solve functional and technical aspects. At least, this was the case for the solar shading, where calculations of the necessity for shading came quite late in the process, making it problematic to integrate naturally in the aesthetics. Instead, the focus was put on the social sustainability of the building, by expressing the diversity of the community centre's users in the building's identity. Having more technical sustainable strategies as an essential part of the concept could have added a new level to the expression of the building, telling a story, not only about the social sustainability, but also about the awareness of the building's impact on the environment.

In order to enhance the quality of the social sustainability of the project, the importance of "designing for humans" was outlined in the framework. This included the focus on the human body and senses, as a tool for creating spaces for healing and integration of the refugees. The aim was to set different atmospheres for different parts of the community centre relating to different feelings and needs of the users. This consideration was achieved in some ways when thinking of the different functions included in the centre's layout, as well as in the choice of materials, providing different atmospheres. However, designing for the human body and senses finally became more of an underlying thought than an actual design parameter and was not much a defining factor when making choices. Furthermore, all collected information about the user's needs came from second-hand sources and were not elaborated in a close collaboration with actual asylum seekers living in the camps. Doing this could have enriched the project with some motivating inputs on the more genuine feelings and needs of the users. Having used the designing for humans as a focal feature throughout the process could have created an even better, user-customised environment for the refugees to regain identity and start a new chapter of their lives.

In relation to designing for humans, the aspect of user influence was included in the design parameters. This meant that the users should be able to adapt and change the building according to their needs. The user influence aspect was tested through the implementation of flexible solar shading, changing the exterior expression of the building together with the needs of the users. Furthermore, a thought of leaving some parts of the building untreated to allow the users to influence the expression of the spaces was investigated. Again, these design parameters were weighted less than some of the other aspects through the process, resulting in the user influence ideas being less integrated within the design of the community centre. Instead, focus was on a designed expression of user influence, showing the diversity of the users and how they come together to help and support each other within the unity of the community centre. This idea was communicated through the concept by the "unity in diversity" expression.

Considering all these reflections on the aspects of the project that could be further developed, the proposal for the Crossroads community centre presents as a realistic design, with various considerations for social, environmental and economic sustainability, as well as functional, technical and aesthetic qualities. In this way, the holistic design of the Crossroads community centre represents a way to achieve a better integration of refugees arriving in Denmark.

REFERENCES

Andersen, Heiselberg and Aggerholm, 2002, *Naturlig Ventilation i Erhvervsbygninger*. [PDF] Hørsholm: Byg og Byg

Autodesk, n.d., *Thermal Mass. Autodesk.com,* [Online] Available at: <https://sustainabilityworkshop.autodesk.com/buildings/thermal-mass> [Accessed: 11.05.17]

Bendixen, M. C., 2016A. *Meget få nye asylansøgere kommer til Danmark. Refugees.dk*, [Online] Available at: <http://refugees.dk/aktuelt/2016/august/meget-faa-nye-asylansoegere-kommer-til-danmark> [Accessed: 21.02.17]

Bendixen, M. C., 2016B. *Rejsen til Danmark – Ruter, risiko og beløb. Refugees.dk*, [Online] Available at: <http://refugees.dk/fakta/asylproceduren-i-danmark/rejsen-til-danmark-ruter-risiko-og-beloeb/> [Accessed: 25.02.17]

Bendixen, M. C., 2016C. *Asyl og andre former for beskyttelse. Refugees.dk,* [Online] Available at: <http://refugees.dk/fakta/lovgivning-og-definitioner/asyl-og-andre-former-for-beskyttelse/> [Accessed: 25.02.17]

Bendixen, M. C., 2016D. *Asylprocedurens tre faser. Refugees.dk*, [Online] Available at: < http://refugees.dk/fakta/asylproceduren-i-danmark/asylprocedurens-tre-faser/> [Accessed: 25.02.17]

Bygningsreglementet.dk, 2015. *Bygningsreglement 2015* [Online] Available at: <http://bygningsreglementet.dk/forside/0/2> [Accessed: 11.05.17]

Danish Architecture Centre, 2014. *BedZED: Promoting Green Living. DAC&Cities,* [Online] Available at: <http://www.dac.dk/en/dac-cities/sustainable-cities/all-cases/social-city/bedzed-promoting-green-living/> [Accessed: 22.02.17]

Dansk Standard, 2007. *DS/EN 15251:2007 - Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics*, Charlottenlund: Dansk Standard

Dansk Standard, 2010A. *Eurocode 0 - Projekteringsgrundlag for bærende konstruktioner*, Charlottenlund: Dansk Standard

Dansk Standard, 2010B. *Eurocode 1 - Last på bærende konstruktioner*, Charlottenlund: Dansk Standard

Goll, M., 2017. *The problem of asylum camp life and how businesses can benefit, Interviewed by Hursh Joshi.* [Online] SoundCloud, January 19th 2017

Graaf, R., 2016. *Few architects have embraced the idea of user participation; a new movement is needed. The Architectural Review,* [Online] Available at: <https://www.architectural-review.com/rethink/viewpoints/few-architects-have-embraced-the-idea-of-user-participation-a-new-movement-is-needed/10008549.article> [Accessed: 16.02.17]

Hyldgård, et al. 1997, *Grundlæggende Klimateknik og Bygningsfysik*. [PDF] Aalborg: Aalborg Universitet

Jensen, C. and Olsen, K., 2011. *Teknisk Ståbi.* Valby: Nyt Teknisk Forlag

Kongebro, S., ed., 2012. *Design with Knowledge – New research in sustainable building*. Copenhagen: Henning Larsen Architects

Københavns kommune, 2015. *Københavns kommuneplan*. [Online] Available at: <https://kp15.kk.dk/artikel/serviceerhverv-s> [Accessed: 21.02.17]

Knudstrup, M-A., 2004. *Integrated Design Process in Problem-Based Learning*. In: A. Kolmos, F. Fink, L. Krogh, eds., The Aalborg PBL Model: Process, Diversity and Challenges. Aalborg: Aalborg Universitetsforlag. pp. 221-234

Lawson, B., 2001. *The Language of Space*. Oxford, Architectural Press

Madsen, P., 2010. *Statik og Styrkelære*. Copenhagen: Nyt Teknisk Forlag

McLeod, S., 2007. *Maslow's Hierarchy of Needs. SimplyPsychology*, [Online], (Updated 2016). Available at: <http://www.simplypsychology.org/maslow.html> [Accessed: 13.02.17]

Miljøstyrelsen, 2012. *Støjkortlægning*. [Online] Available at: <http://miljoegis.mim.dk/spatialmap?&profile=noise> [Accessed: 16.02.17]

O'Gorman, F., 1998. *ABC of Architecture*, [Online] Available at: <https://www.nytimes.com/books/first/o/ogorman-abc.html> [Accessed: 24.02.17]

Open Society Foundations, n.d. *At home in Europe project.*[pdf] Open Society Foundations. Available at: <https://www.opensocietyfoundations.org/sites/default/files/d-muslims-copenhagen-factsheet-en-20110303.pdf> [Accessed: 20.02.17]

Pallasmaa, J., 2005. *Eyes of the skin.* Chichester, Wiley-Academy

Poletti, R., 2010. *Lucien Kroll: utopia interrupted. Domus,* [Online] Available at: <http://www.domusweb.it/en/architecture/2010/06/30/lucien-kroll-utopia-interrupted.html> [Accessed: 16.02.17]

Sassi, P., 2006. *Strategies for Sustainable Architecture.* Abingdon: Taylor & Francis

Twinn, C., 2003. *BedZED. The Arup Journal 2003 Issue 1*, [Online] Available at: <http://publications.arup.com/publications/t/the_arup_journal/2003/the_arup_journal_2003_issue_1> [Accessed: 22.02.17]

Udlændingestyrelsen, 2016. *Tal og fakta på udlændingeområdet 2015, nyidanmark.dk*, [Online] Available at: <https://www.nyidanmark.dk/NR/rdonlyres/EBDF83E7-B151-4B3B-A87C-CC291B29CF14/0/tal_og_fakta_2015.pdf> [Accessed: 27.02.17]

UNHCR, 2017. *Europe Situation. The UN Refugee Agency*, [Online] Available at: < http://www.unhcr.org/europe-emergency.html> [Accessed: 25.02.17]

Weatherspark, n.d. *Average Weather for Kastrup near Copenhagen.* [Online] Available at: <https://weatherspark.com/averages/28823/Kastrup-near-Copenhagen-Capital-Region-of-Denmark> [Accessed: 13.02.17]

Whyte, W., H., *Social Life of Small Urban Spaces*, 1980. [Documentary] William H. Whyte. United States

Wikipedia, 2017, *Nørrebro Station*, [Online], Available at: <https://da.wikipedia.org/wiki/Nørrebro_Station#Kommende_metrostation> [Accessed: 17.02.17]

ILLUSTRATIONS

All illustrations are own, except for:

Ill.1.03: Information based on: https://www.nyidanmark.dk/NR/rdonlyres/E3C50EA0-BD36-4DDD-9C8D-7AAF44DE1F12/0/seneste_tal_udlaendingeeomraadet.pdf

Ill.2.20: La MéMé facade: https://www.architectural-review.com/pictures/1180xany/8/1/0/3028810_bxl_ucl_meme82_kroll_dia1.jpeg

Ill.2.21: Building physics: http://www.eurotubieuropa.it/english/NL/2014/09/ARUP-Bedzed-Hi.jpg

Ill.2.22: Building systems: http://3.bp.blogspot.com/-6B0ZwJGEad4/ThglcnoVzdI/AAAAAAAAAIc/WCF7TxbAXus/s1600/systems.jpg

Ill.3.44: Construction process of a rammed earth wall: http://www.niftyhomestead.com/wp-content/uploads/igm/d2/rammedearth-1.jpg

Ill.4.58: Description of LCA parameters: Birgisdóttir, H. and Rasmussen, F.N., 2016. Introduction to LCA of Buildings. Copenhagen: Danish Transport and Construction Agency

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APPENDIX

Trampoline House Interview
24 Hour Averages
Basement Floor Plan
Natural Ventilation
Mechanical Ventilation
Structural Calculations
Energy Frame Key Numbers
Photovoltaics Calculations

APPENDIX 01

Trampoline House interview

INTERVIEW WITH PROGRAM COORDINATOR OF TRAMPOLINE HOUSE, TONE OLAF NIELSEN
"WHAT IS THE PHILOSOPHY OF TRAMPOLINE HOUSE?"

(...)
TH: Philosophy number two in the house is that it's a user involving house. Our slogan "My house, your house", so the house is build on the family model, where we're all family members and everybody has equal say in what happens in the house. This is the way to empower people, to provide people with agency, that they don't have in the camps. We don't have any political, social, juridical rights in Denmark as an asylum seeker. You're stripped down to what Giorgio Agamben said, bare life, naked life. In Trampoline House we try to reequip people with these rights, at least within the house. So we have house meeting where you can vote. Our philosophy is to notice everybody, let everybody speak and listen to everybody. People are made invisible and silent in the camp. The family structure, the house, you know, functions a replacement for your identity back home, where you would have house, you would have support with work and your families, you would have colleagues, you would have the state maybe that protected you. Well, that's the problem. People don't. But ideally the state is there to protect your rights. So within Trampoline House, a house as a structure, protects your rights, you have rights here. So when you get praktik at Trampoline House, as an asylum seeker, you are paid in the form of tickets. Asylum seekers are not allowed, according to recent surveys... You can't choose where to live and you can't work when you're an asylum seeker. While in this house you can symbolically work and you can symbolically get the pay of two tickets. And then the House is a house that attracts not only asylum seekers and refugees but also people like me who is interested in to contribute into social change, to change migration and asylum politics. So this is why we have a lot of volunteers in the House who are not refugees. We have at the moment 65 people doing praktik or internship with asylum seeking background or refugee background and we have 70 non-refugee volunteers and we have 10 educational interns. People put in 1-2 days work a week, interns put 25 hours, and then we have 5 paid staff members. And without the staff members I don't think the House would have been able to exist for so long. It's 6 years old. It's long for a community project. It's also very expensive to have 5 staff members and pay 2 tickets per week for 65 interns and pay rent and all this, so a basic economy is important for a project like the Trampoline House. We have an annual budget of 3,5 million, we're not state funded, we're not municipality funded so this is from funds that we fundraise ourselves. We have a full time fundraiser employed, that's all she does, speculating how to get private donations with monthly donors, try not to be too depended upon state funding, (that we apply for of course, because then the state will have a say in how we rent the house and since we don't have a pro-immigration policy government, we don't want the government to do the same what we do.) The interplay between refugees and non-refugees in the House is crucial. All the activities in the House are carried out by a mixed team of refugees and non-refugees. So we have a cleaning team every day, a cooking team every day, dishwashing team, English teachers, Danish teachers, Arabic teachers. We have women's club on Saturdays, we offer legal counseling, integration counseling, job counseling, and all these tests are carried out by people living in asylum centers, people with refugees status and non-refugees. So there are hierarchies in the House definitely in terms of authority, like staff definitely do have more authority. Everybody else in the house, we're the ones with legal, methodological, ideological and economical responsibility. But it's not so it's the asylum seekers cleaning and Danish people teaching, it's a mix. So it's Danish people cleaning the

toilets together with asylum seekers, there's asylum seekers teaching English together with native English speakers, and so forth. And it's this mix that makes people attractive, that makes the house attractive for people. People who are not refugees they come here because they want to meet refugees and do a good thing. And refugees come here because they are living in a what the House would call a very racist structure. M. has described the Danish asylum centers as an architectural manifestation of Danish state racism. Meaning that the camps are designed to keep people outside of society to filter or to select all undesirable people and place them in these camps until the immigration service have decided if they can stay or not. The philosophy in Trampoline House is that the camps should be closed and that the people should be allowed to integrate from the day1, not wait until people get asylum, but start integrating them the moment they arrive. Let people work, go to school, go to the normal doctor, go to the job center, go collect the pocket money at the municipality office, and not let people live in this camp situation, that's the philosophy. Then the house as a physical location functions in a way that we need lots of different rooms because we have lots of different activities and the camps are located far away so people have very long transport time. That directs out opening hours. We could open at 9 o'clock and close at 10 o'clock in the evening but we would not have people coming early morning and late evening because there's not buses to the train to get here and also people have mandatory chores in camps so after 6 years we've learned that people can arrive at around 1 and people leave at around 6. That's our opening hours. So within this very short time slot we have to program a lot of activities. The philosophy is when you enter the Trampoline House as an asylum seeker or refugee in one day you should be able to do to Danish, go to English, speak to the lawyer, speak to the doctor, have coffee with your friends, eat dinner and then go home. You can also choose not to participate in all these activities, but they are there for you offered, so to have so many activities in such a short time span means that we need a lot of space and we have 550m2. We have two classrooms, we have two kitchens, we have shower. A lot of people who live in the streets, they don't have access, they shower here. We have a men's room, we have a women's room, we have two staff offices, we have a big what we call multizone which is a flexible space for all kinds of activities and socializing. We have an art gallery, an exhibition space in here where we show work engaging migration and asylum policies. And then we have a legal counseling office. And.. when you enter the Trampoline House it doesn't look like a Nordic institution, there's no fancy Nordic design furniture. If you go to any state institution in the Nordic region, they are like super designed, this is not. The House is beautiful and it's ugly. It's clean and it's dirty, it's fixed up and falling apart, all at the same time. And this is because we want people to feel that when you arrive, you are the person we've been waiting for. Or you know how to fix the sofa because you are the carpenter from Syria, well great we have three sofas that needs to be fixed.

(pause, someone came)

So my advice number one is finance, lots of space and room for improvement. Let the House be a house in progress at all times. Again this goes back to the philosophy of asylum seekers and refugees not being victims. They were people with full lives, with resources, skills, knowledge, expertise, all that have been stripped off their identity the minute they arrive and they are reduced to this one identity of an asylum seeker or a refugee. So in our philosophy a house should be able to let people employ these skills and knowledge, make themselves feel useful, needed and supported. Than one last comment if you go to the kitchen, for instance, or if you look at some of the cabinets, you'll see that we have like little drawings. Translation in the house is a big issue, right? We try to organize kitchen by writing on the door: knives and forks and stuff. There's like maybe 10% of the people in the House who spoke enough English or read enough English to read that. Ok, so we translated it to Danish and we translated it to Arabic, and then people kept saying: but I only read Kurdish, and I only read ... And in the end you end up having to translate everything into 10, 20 languages, which is not possible. So we made a decision in Trampoline House that the main language spoken is English because people are not allowed to learn Danish when they first arrive and in order to avoid these very long translations it was much easier to just make a drawing of a knife, and a drawing of a fork and then paste in on the drawer. So iconography, symbols, visuality is super important, cause that translates, better than words. And not always. Maps, for instance, are a culturally specific thing, not everybody can read westerns maps.

K: You say that facilities that you have now are sufficient for what you want to do. Do you need more space or differently arranged?

TH: We definitely need more space in the gallery, we could need more office space and we could need more classrooms and workshops spaces.

I: How many people roughly use the House right now?

TH: Right now we have.. yhm. It's easier to calculate in visits because you'll have people that come to the House every day, and you'll have people who come only on Fridays when we have a party. Roughly we have 400 visits per week.

A: Is it only young people coming or you have different social groups: children, elderly people..?

TH: We offer childcare every day. Parents who have children they can't do praktik or participate in activities unless we have childcare. So we have childcare. So there's children, young teenagers, elderly people, retired people from all across the world.

I: The house we are planning to design is gonna be around 2000m2. And we are planning to of course integrate all the functions you have now and make them bigger, so they fit with this. But yeah I think you said that you could need more space....

TH: Why you want it to be big?

I: Actually we chose the site and according to the municipality, there's a rule for the floor area ratio for that site, that is a 185%, which based on the size of the site gives us around 2000m2.

TH: That would be too big for Trampoline House. You would lose this house feeling, right? 2000m2 is not a house. It's a center, yeah. That's another thing that is very important with Trampoline House. I think people take the ownership of the House because it's a house, it has the size of a house because we have imported this family structure as I talked about earlier. And because we are not affiliated with the municipality, we're not affiliated with the state, we're not affiliated with Danish Red Cross, that administrates most of the camps and we are not affiliated with the national police that deports people. So in other words it's super super important in our building to be independent. The municipality of Copenhagen has just opened their own house. It's called the Welcome House, maybe you should go check it out. It's a very different structure. They have a lot of the same activities and facilities, like we do. It's a house for people granted the asylum so refugees in Copenhagen. The theoretical distinction between an asylum seeker and refugee is that as a refugee you are legally acknowledged, as an asylum seeker you have not yet been acknowledged as a refugee and maybe you won't. So Velkomsthuse is only for people who have asylum, residence permit in Denmark. We are the only place directed at asylum seekers when it hasn't been decided yet if they can stay in Denmark or not. And the Velkomsthuse is the Copenhagen municipality project and I think they have problems with credibility and trust exactly because it's a kommune, municipality, project. You have to understand that people they stay in asylum system for years and years. A lot of them come from totalitarian states or dictatorships where there's a mistrust in authorities to begin with. And then they arrive in Denmark, the social miracle of social democracy, they think. And then they realize that this is also not a democratic structure, and that they are kept in camps for years. So people, a lot of them, developed a mistrust to Danish authorities as well. When you do get an asylum, you enter an integration program in the municipality. After that you're not even free. When you leave the camp you have to stay 3 years in the specific municipality and do your integration program. And you cannot choose that, the municipality yourself. So you can risk to, you know, being moved to a place you don't want to go. So you're still not free. And your main contact is the municipality, right? And you get like a social work contract. So to have a house, that's a municipality house, it's just not a good idea. It's much smarter to outsource this to the independent organizations, like Trampoline House, that could act as mediators. We are sort of also acting like a mediator between the Danish Red Cross, we have to stay friends with them, otherwise we can't access people in the camps, the Danish Red Cross camps. But we are also an alternative to Red Cross and it's important for people to know that we are not the Red Cross. So size affiliation I would say are super important for any kind of organization structure.

I: Is it both people who are seeking asylum and people who are already granted asylum that use the house?

TH: Yes, refugees and asylum seekers.

I: Could you see there was a potential for even more people using the house?

TH: Yeah, if we had 3 times as much money and more staff, yeah. But I think it's more realistic to think along the lines of having Trampoline Houses spread all over the country. Now we're the only Trampoline House. The perfect asylum system in our opinion would be to close the asylum centers, as I said, and allow people to live in a community setting. It could be an allotment garden, kolinihave kind of setting, where everybody will get their own little house and a little garden. They would be free to work, to go to the doctor, to go to school, while their case is being processed. And in relation to kolonihave, to the allotment garden, there would be a Trampoline House with staff who could assist people with medical, juridical, social problems. That would be the ideal asylum system. And of course speed the processing. What it is right now, the processing time, is very critical and very long.

K: This allotment garden should it also be like a temporary residence for those who come. Until they find other places to live in Denmark or should it be also permanent. Or how long should they live there?

TH: As long as they want it to. But in the beginning.. I mean. That's the Canadian asylum system, right, where you are just fused in the society from day1, right? You can work, you can choose where to live. And people who have just arrived in a new country, like Canada, I hear that people feel lonely and isolated. So in the beginning upon your arrival you need kind of support structure. But you don't need a prison, you don't need a god damn camp, right? What is amazing about the allotment architecture in my sense is that it's a petit bourgeois kind of principle, right? Everybody has their own little house, everybody has their own little fence and most people who come here to seek asylum they are petit bourgeois, they have a middle class dream just like all of us, they want to send their kids to school, they want a car, they want a house, they want what half the world has. And the allotment garden is this amazing idea of, you know, private ownership combined with

the collectivity of all the other people in that space. So you could have easy access to your neighbors. Much more than if you end up in a public housing project, right?
K: The location of such a place, where you think is ideal?
TH: To be spread out all over the country, in the suburbia and in the big cities. And people should be allowed to choose: am I a city person or am I a country person, am I a suburban person. Lot of people think Copenhagen is too noisy but I know also a lot of people also think that the countryside is too silent. So people are individual, they have individual needs. The allotment gardens are great because they are always in proximity to a big city. They are kind of in between space.
I: I have a question about activities you have here. Is there some activities that you would maybe like to have but don't have space for now? Something you imagine would be great to do?
TH: No, what we need most is money to contribute and money to expand especially our legal counseling program because it's also very important to remember that all people appreciate all the activities that we offer, they appreciate the ability to cook a community dinner for all of us, cook their own food and sit in the sofa and have coffee but what is really in their mind is to get a resolution to their life situation and to be reunited with their families. So legal counseling is the key, is the number one thing that we have to do. Everything is just kind of a bandeau, you know on the wound. I think that a lot of volunteer driven projects misunderstand this and they think that life will be durable for people if we play some ping pong or make a picnic and stuff. But you can do legal counseling and help people understand that you really can cope situation that they are in, making the asylum system transparent for them, if they are not up to it mentally and physically. And that's a degradation happening in the camps. People they grow ill from the camp life. Maybe you're not ready for legal counseling, maybe you need to sit on a couch her for couple of weeks and kind of just get out of four person bedroom that you are staying in, in the camp and just have some peace and quiet and then realize that all this house is full of good people and I can actually relax and trust somebody for the first time. And when that happens, then you're ready to learn and to teach. And you're ready to start the project of fighting for your case.
I: I guess there is also few people who are traumatized from what happened in their home country.
TH: Yeah, lots of studies show that the trauma you get from the camp is bigger than the trauma you endured back home. It's important to remember
I: Is there also psychological counseling here?
TH: No because it's.. that requires very long time spans. You can't offer like, you know, one or two session. Maybe you need two years, we don't have funds for that and we're not trained for it. But we have professional lawyers, who are here in the house once a week.
K: Where do you see the Trampoline House in for example 3 years? Is it still the same house?
TH: Yeah, I think it will pretty much be the same house. It's a platform for recurring activities and it's a platform for special event. So we will have temporary workshops, temporary discussions, and then we have those weekly activities that would repeat and repeat. We like to say in Trampoline House that it would be great if we would not be here in 10 years. Because that would mean that the asylum system have been improved. But for as long as we have the camp structure Trampoline House is needed.
I: Could you imagine a better location for the house?
TH: No. We had another location on Norrebro and it moved to north-western part of Copenhagen because it's more multicultiral and it's easier to access for people in the camps. Lots of buses, S train, Norrebro station, and free parking. It's also important.
I have to get back to work.

Tone Olaf Nielsen. 2017. *Philosophy of Trampoline House*. Interviewed by Aleksandra Przesmycka, Irene Ank Jørgensen and Kristian Bue Jensen. [Personal interview] Copenhagen 01.02.17

APPENDIX 02

24-Hour Average

The 24-hour average temperatures are calculated for selected rooms with and without solar shading. For both class rooms, it is clear that the rooms will have over temperatures without solar shading. The maximum temperature is 26C to obtain an indoor environment of Category II. When adding the solar shading, the temperatures of the rooms are within this limit.

Class Room, 2nd floor - 35 m2 - two windows, South and West

Without solar shading:			With solar shading:		
Choosen month: June	tu =	20 °C	Choosen month: June	tu =	20 °C
If the ventilation air has same temperature as outdoor air:			If the ventilation air has same temperature as outdoor air:		
24-hour average	ti =	23,6 °C	24-hour average	ti =	22,0 °C
Temperature variation	Dti =	8,8 °C	Temperature variation	Dti =	7,1 °C
Max. Temperature	timax =	28,0 °C	Max. Temperature	timax =	25,5 °C

Class Room, 3rd floor - 31 m2 - two windows, South

Without solar shading:			With solar shading:		
Choosen month: June	tu =	20 °C	Choosen month: June	tu =	20 °C
If the ventlation air has same temperature as outdoor air:			If the ventlation air has same temperature as outdoor air:		
24-hour average	ti =	22,9 °C	24-hour average	ti =	21,8 °C
Temperature variation	Dti =	8,1 °C	Temperature variation	Dti =	7,0 °C
Max. Temperature	timax =	26,9 °C	Max. Temperature	timax =	25,3 °C

The common functions within the atrium will, for aesthetical reason, not have blinds, but only larger overhangs. The numbers below show, that the play area will have a maximum temperature that exceeds the limit of Category II. It is assumed, that this will not be the case though, since the calculation does not take the effect of the stack ventilation and thermal mass, and that the rooms are in open connection with a much larger space, into account.

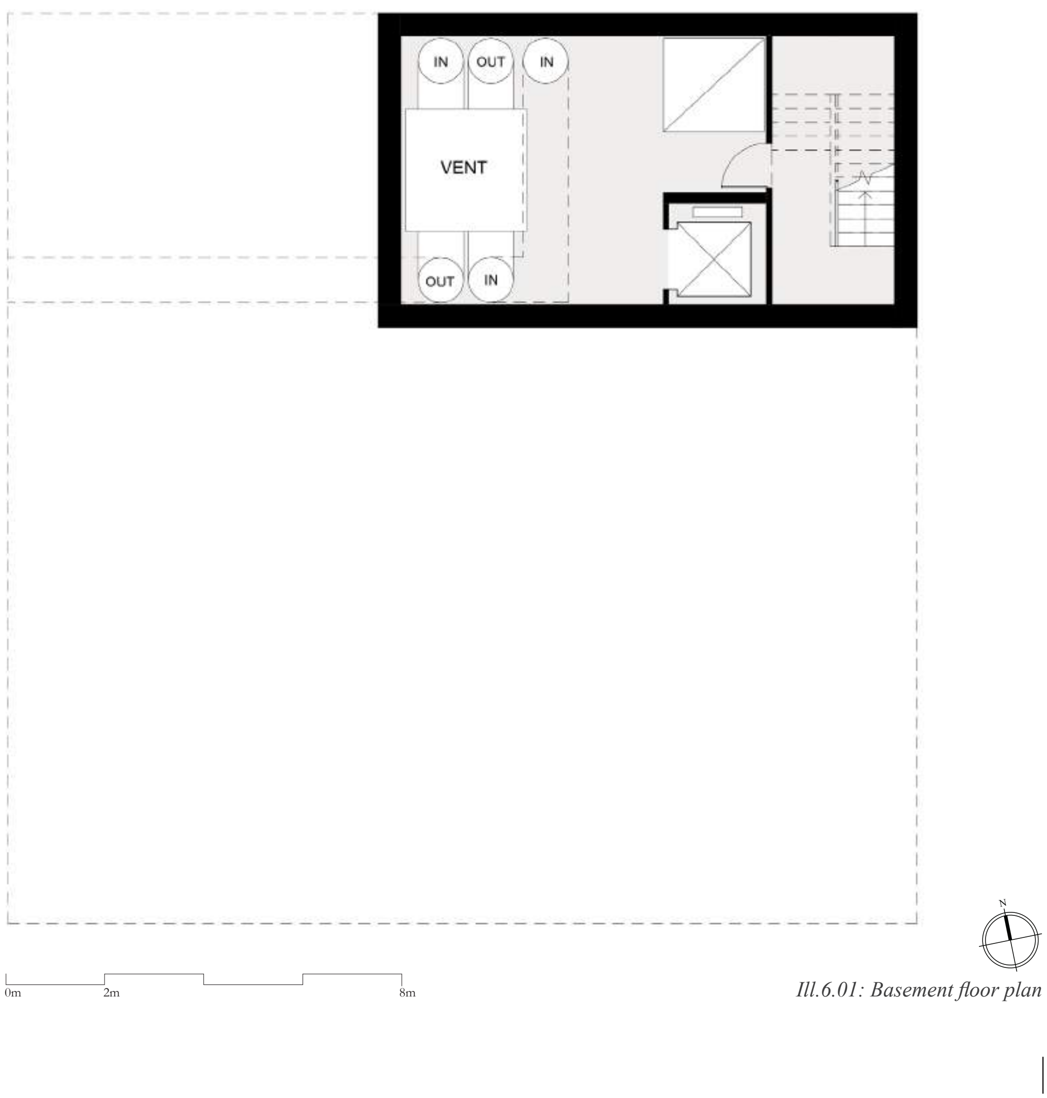
Play Area, 1st floor - 82 m2 - one glass facade, South

Without solar shading		
Choosen month: June	tu =	20 °C
If the ventlation air has same temperature as outdoor air		
24-hour average	ti =	24,0 °C
Temperature variation	Dti =	6,5 °C
Max. Temperature	timax =	27,2 °C

APPENDIX 03

Basement Floor Plan

In order to have enough space for the ventilation system, a small basement is designed (Ill. 6.01). The escape stair and lift from the other floors will continue down giving access to the basement. The ventilation aggregate is dimensioned based on 80% of the total air volume needed, since all rooms will never be fully occupied at the same time. The aggregate is placed to one wall, leaving space for pipes on either side, and space for maintenance in front. In the basement, there will also be space for different pumps and tanks for the operation of the building.



Ill.6.01: Basement floor plan

APPENDIX 04

Natural Ventilation

The natural ventilation is calculated for four critical rooms that all have only single-sided ventilation.
The calculation method used is taken from 'By og Byg Anvisning 202 – Naturlig Ventilation i Erhvervsbygninger', which gives the following expression for the volume flow [Figure 9.8, By og Byg 202, pp. 58]:

$$q_v = A_{eff} v_m$$

q_v: Volume flow [m3/s]
A_{eff}: The effective area [m2]
v_m: Average wind speed [m/s]

The average wind speed is calculated with the following expression [Figure 9.7, By og Byg 202, pp. 58]:

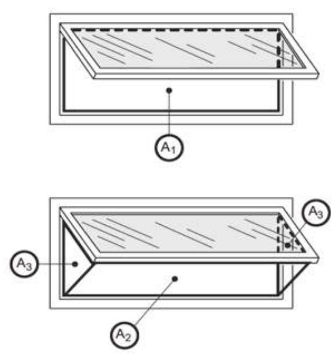
$$v_m = (0{,}001 {v_{10}}^2 + 0{,}0035 h \Delta T + 0{,}01)^{1/2}$$

v_m: Average wind speed [m/s]
${v_{10}}^2$: Reference wind speed [m/s]
h: Height of opening [m]
ΔT: Temperature difference [C]

And the effective area of the opening can be found with the expression [Figure 9.9, By og Byg 202, pp. 58]:

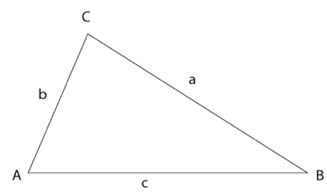
$$\left(\frac{1}{A_{eff}}\right)^2 = \left(\frac{1}{C_{d,1} A_1}\right)^2 + \left(\frac{1}{C_{d,2} A_2 + 2 C_{d,3} A_3}\right)^2$$

A_{eff}: The effective area [m2]
$C_{d,1/2/3}$: Discharge coefficient
A_1: Area of the opening [m2]
A_2: Area of the opening between the window and the bottom frame [m2]
A_3: Area of one of the side triangles [m2]



The three opening areas are calculated using the cosinus relation to calculate the distance c (from the window to the frame) to find the effective area based on the opening angle of the window. In this way, the result of the calculation is the necessary opening angle of the window in order to achieve the required air change rate for olf pollution for each room (appendix 05).
The opening angle can maximum be 45°, since this is approximately equivalent to 100% of the opening area. As long as the necessary air change rate can be achieved with an opening angle under 45°, the room can be ventilated naturally. The calculations on the next page show the opening angle of the windows in the four critical rooms, and it is assumed that when these rooms can be ventilated naturally, it will also be possible to achieve the necessary air change rate in the rest of the rooms with natural ventilation.
The opening angle of each window will be controlled automatically to ensure a sufficient volume flow of air.

Discharge coefficient	0,7	
Wind speed	6	m/s
t_outdoor	12	C
t_indoor	21	C
Opening Height	0,55	m
Opening Width	1,7	m
Max opening angle	45	degrees



$$c^2 = a^2 + b^2 - 2 \cdot a \cdot b \cdot \cos(C)$$

CLASS ROOM (2nd floor)

Room Volume	72,00	m3				c	0,34	m
Number of windows	1							
Opening Angle	36	degrees				A1	0,935	m2
Effective Area	0,46	m2				A2	0,578	m2
Average Wind Flow	0,25	m/s				A3	0,089	m2
Volume Flow	0,12	m3/s						
Total Volume Flow	417,19	m3/h						
Air Change Rate	5,79	h-1	>	5,75	h-1			

CLASS ROOM (3rd floor)

Room Volume	93,00	m3				c	0,11	m
Number of windows	2							
Opening Angle	12	degrees				A1	0,935	m2
Effective Area	0,32	m2				A2	0,195	m2
Average Wind Flow	0,25	m/s				A3	0,031	m2
Volume Flow	0,08	m3/s						
Total Volume Flow	586,58	m3/h						
Air Change Rate	6,31	h-1	>	6,19	h-1			

MEETING ROOM (4th floor)

Room Volume	75,00	m3				c	0,28	m
Number of windows	1							
Opening Angle	29	degrees				A1	0,935	m2
Effective Area	0,43	m2				A2	0,468	m2
Average Wind Flow	0,25	m/s				A3	0,073	m2
Volume Flow	0,11	m3/s						
Total Volume Flow	393,86	m3/h						
Air Change Rate	5,25	h-1	>	5,20	h-1			

MEDITATION ROOM (4th floor)

Room Volume	72,00	m3				c	0,12	m
Number of windows	1							
Opening Angle	13	degrees				A1	0,935	m2
Effective Area	0,33	m2				A2	0,212	m2
Average Wind Flow	0,25	m/s				A3	0,034	m2
Volume Flow	0,08	m3/s						
Total Volume Flow	302,29	m3/h						
Air Change Rate	4,20	h-1	>	4,08	h-1			

APPENDIX 05

Mechanical Ventilation

The following calculations show an example of the ventilation need of the large class room on the 2nd floor. The ventilation need is calculated both for the experienced air quality (olf) and for the CO2 pollution.

OLF [Figure 1.17, GKB, pp. 40]

$$c = c_i + 10\frac{q}{V_L} \Rightarrow V_L = 10\frac{q}{c - c_i}$$

c: Experienced air quality [dp]
c_i: Concentration of supply air [dp]
q: Pollution loads [olf]
V_L: Necessary air flow [L/s]

To achieve an indoor environment of category II, the percentage of dissatisfied should be 20%, which gives an experienced air quality of 1.4 dp [Figure 1.18, GKB, pp. 41]. The concentration of the supply air is between 0.05-0.3 dp [Table 1.7, GKB, pp. 41]. A concentration of 0.2 dp is chosen since the site is located in the centre of Copenhagen.

Pollution loads:
From people: 1 olf/person (Sitting) [Table 1.6, GKB, pp. 40]
From construction: 0,2 olf/m2 (Low pollution buildings) [Table 1.6, GKB, pp. 40]

$$q = 14\ ps * 1\ olf/ps + 35\ m^2 * 0{,}2\ olf/m^2 = 21\ olf$$

$$V_L = 10\frac{21 olf}{1.4dp - 0.2dp} = 175L/s = 6h^{-1}$$

CO2 [Figure 1.14, GKB, pp. 29]

$$c = c_i + \frac{q}{V_L} \Rightarrow V_L = 10^6 * \frac{q}{c - c_i}$$

c: Experienced air quality [ppm]
c_i: Concentration of supply air [ppm]
q: Pollution loads [m3/h]
V_L: Necessary air flow [m3/s]

To achieve category II, the experienced air quality must be a maximum of 500ppm above the outdoor CO2 concentration, which is 350ppm in most of Denmark [Table B.4, DS/EN_15251, pp. 36].

Pollution loads:
From people: 17 * MET [l/h] [Figure 1.19, Danvak, pp. 47]

$$q = 14\ ps * \frac{1{,}2 * 17l/h}{1000l/m3}/ps = 0{,}29\ m3/h$$

$$V_L = 10^6 * \frac{0{,}29m3/h}{850ppm - 350ppm} = 571{,}2m3/h = 5.44h^{-1}$$

Since the necessary air change rate is highest for olf pollution the ventilation system will be dimensioned from these values.

Ventilation rates

GROUND FLOOR	Area [m2]	Volume [m3]	People	q [olf]	Vl [L/s]	V [m3/h]	OLF n [h-1]	q_CO2 [m3/h]	V [m3/h]	CO2 n [h-1]
Dining / Reception (1 MET)	168	588,00	70	103,60	863,33	3108,00	5,29	1,19	2380,00	4,05
Exhibition (1,2 MET)	41	143,50	15	23,20	193,33	696,00	4,85	0,31	612,00	4,26
Kitchen (2 MET)	41	143,50	8	16,20	135,00	486,00	3,39	0,27	544,00	3,79
TOTAL						4290,00				
1ST FLOOR										
Play / Common space (1 MET)	83	249,00	10	26,60	221,67	798,00	3,20	0,17	340,00	1,37
Daycare (1,2 MET)	35	105,00	10	17,00	141,67	510,00	4,86	0,20	408,00	3,89
Craft Workshop (2 MET)	60	180,00	15	27,00	225,00	810,00	4,50	0,51	1020,00	5,67
Fitness (7,5 MET / 11 olf)	41	123,00	15			1230,00	10,00		1230,00	10,00
TOTAL						3348,00				
2ND FLOOR										
Music / Common space (1 MET)	95	285,00	10	29,00	241,67	870,00	3,05	0,17	340,00	1,19
Music room (1,2 MET)	21	63,00	5	9,20	76,67	276,00	4,38	0,10	204,00	3,24
Class room 1 (1,2 MET)	35	105,00	14	21,00	175,00	630,00	6,00	0,29	571,20	5,44
Class room 2 (1,2 MET)	24	72,00	9	13,80	115,00	414,00	5,75	0,18	367,20	5,10
Computer Room (1,2 MET)	45	135,00	15	24,00	200,00	720,00	5,33	0,31	612,00	4,53
TOTAL						2910,00				
3RD FLOOR										
Library / Common space (1 MET)	119	357,00	15	38,80	323,33	1164,00	3,26	0,26	510,00	1,43
Offices (1,2 MET)	41	123,00	8	16,20	135,00	486,00	3,95	0,16	326,40	2,65
Class room (1,2 MET)	31	93,00	13	19,20	160,00	576,00	6,19	0,27	530,40	5,70
Creative Workshop (1,2 MET)	33	99,00	10	16,60	138,33	498,00	5,03	0,20	408,00	4,12
TOTAL						2724,00				
4TH FLOOR										
Common space (1 MET)	83	249,00	10	26,60	221,67	798,00	3,20	0,17	340,00	1,37
Meditation room (1,2 MET)	24	72,00	5	9,80	81,67	294,00	4,08	0,10	204,00	2,83
Meeting room (1,2 MET)	25	75,00	8	13,00	108,33	390,00	5,20	0,16	326,40	4,35
Counseling room 1 (1,2 MET)	15	45,00	2	5,00	41,67	150,00	3,33	0,04	81,60	1,81
Counseling room 2 (1,2 MET)	10	30,00	2	4,00	33,33	120,00	4,00	0,04	81,60	2,72
TOTAL						954,00				

Dimensioning of pipes

		Air speed [m/s]	Volume flow [m3/h]	Volume flow [m3/s]	Pipe area [m2]	Pipe diameter [m]
MAIN PIPES	Ground floor	6	14226,00	3,95	0,66	0,92
	Ground floor - 1. floor	6	9936,00	2,76	0,46	0,77
	1. floor - 2. floor	6	6588,00	1,83	0,31	0,62
	2. floor - 3. floor	6	3678,00	1,02	0,17	0,47
	3. floor - 4. floor	6	954,00	0,27	0,04	0,24
DISTRIBUTION PIPE	Ground floor	4	4290,00	1,19	0,30	0,62
CONNECTION PIPES	- Dining / Reception	2	3108,00	0,86	0,43	0,74
	- Exhibition	2	696,00	0,19	0,10	0,35
	- Kitchen	2	486,00	0,14	0,07	0,29

APPENDIX 06

Structural Calculations

The structural elements of the community centre are dimensioned by calculating their characteristic strength and comparing this to the forces acting on the structure. First, the different loads affecting the structure are calculated: Payloads, wind load, snow load and self-weight.

LOADS

Payload	2,5 kN/m2	Offices - Eurocode 1, table 6.2	$q = payload \times load\ area$
Windload	0,62 kN/m2	Terrain Category 4 (Dense, urban area) - Table from rockwool.dk	
Snowload	0,8 kN/m2	$s = \mu_i C_e C_t s_k$ - Eurocode 1, 5.1	
μ_i	0,8	Shape Factor: Roof angle: 0°≤ a ≤ 30° - Eurocode 1, table 5.2	
C_e	1	Exposure Factor: Normal - Eurocode 1, pp. 50	
C_t	1	Thermal Factor: No high thermal transmittance - Eurocode 1, pp. 51	
s_k	1 kN/m2	Characteristic Terrain Value: National value - DS/EN 1991-1-3 DK NA:2015, pp. 5	

Self Weight: $g = density \times cross\ section\ area \times gravity$

Gravity	9,8 m/s2	
Density	430 kg/m3	GL32h - Teknisk Ståbi, table 7.1

The loadcombination (Ultimate Limit State) is calculated for all the different elements, with the appropriate factors, and the payload as the dominating variable load.

LOADCOMBINATION

ULS - Ultimate Limit State (Eurocode 0, figure 6.10, pp. 35)

$$N = \underbrace{\sum \gamma_{G,j} G_{k,j}}_{permanent\ loads} + \underbrace{\gamma_{Q,1} Q_{k,1}}_{dominating\ variable\ load} + \underbrace{\sum \gamma_{Q,i} \psi_{0,i} Q_{k,i}}_{other\ variable\ loads}$$

$\gamma_{G,j}$	1,1	Unfavourable - Eurocode 0, table A1.2(A)
$\gamma_{Q,1}$	1,5	Unfavourable - Eurocode 0, table A1.2(A)
$\gamma_{Q,i}$	1,5	Unfavourable - Eurocode 0, table A1.2(A)
$\psi_{0,i}$	0,3	Combination with dominating payload - Eurocode 0, table A.1.1

The strength conditions of the beams and columns are calculated with the appropriate factors and should then be bigger than the forces affecting the structural element. The sizes of the cross section of the element is changed, until the characteristic strength of the element is larger than the loads. The element's strength should be as close to the loads as possible in order for the element to be utilised the best and not have wasted material.

The columns are dimensioned from the ones in the ground floor, since they will have the loads of all floors and the other structural elements.

DIMENSIONING OF SMALL BEAMS

SIZES

Width	0,14	m
Height	0,333	m
Load Area	2,16	m
Span	5,815	m

LOADS

g_{beam_small}	0,20	kN/m
$q_{payload}$	5,4	kN/m

LOADCOMBINATION - ULS

N	8,32	kN/m

STRENGTH CONDITION

k_d	0,462		Glue Laminated Wood, Class 1, Payload - Teknisk Ståbi, table 7.2
f_{mk}	32	MPa	GL32h - Teknisk Ståbi, table 7.1
W	2590	mm3	GL, Cross section size (mm) - Teknisk Ståbi, table 7.6
M	35,15	kNm	

13,57	≤	14,78

Strength condition - beams (Statik og Styrkelære, pp. 287):

$$\sigma_{md} = \frac{M}{W} \leq k_d \times f_{mk}$$

σ_{md}	Bending stress	MPa
M	Maximum moment	Nmm
W	Cross section resistance	mm3
k_d	Conversion factor	
f_{mk}	Characteristic strengh	MPa

Maximum moment (Statik og Styrkelære, pp. 289):

$$M = \frac{1}{8} \times q_r \times L^2$$

q_r	Line load on beam	kN/m
L	Span of beam	m

DIMENSIONING OF BIG BEAMS

SIZES

Width	0,185	m
Height	0,467	m
Load Area	5,825	m
Span	5,7	m

LOADS

g_{beam_big}	0,36	kN/m
g_{beam_small}	0,59	kN/m
$q_{payload}$	14,6	kN/m

LOADCOMBINATION - ULS

N	22,89	kN/m

STRENGTH CONDITION

k_d	0,462		Glue Laminated Wood, Class 1, Payload - Teknisk Ståbi, table 7.2
f_{mk}	32	MPa	GL32h - Teknisk Ståbi, table 7.1
W	6720	mm3	GL, Cross section size (mm) - Teknisk Ståbi, table 7.6
M	92,97	kNm	

13,84	≤	14,78

DIMENSIONING OF COLUMN

SIZES

Side length	0,25	m
Height	3,9	m
Load Area	33,93	m2

LOADS

5 x	g_{column}	5,14	kN
5 x	g_{beam_big}	10,38	kN
5 x	g_{beam_small}	17,14	kN
4 x	$q_{payload}$	339,30	kN
1 x	q_{snow}	27,14	kN
1 x	q_{wind}	21,04	kN

LOADCOMBINATION

N (F)	566,54	kN

STRENGTH CONDITION

k_c	0,7		λ_{rel}	0,95	k_{rel}	0,061	GL32h - Teknisk Ståbi, table 7.8 (0,8: kc = 0,8 - 0,95: kc = 0,7)
k_d	0,462				l_s	3900	1 x Length - Teknisk Ståbi, figure 7.6
$f_{c,0,k}$	29	MPa					
A	62500	mm2					

9,06	≤	9,38

Strength condition - columns (Statik og Styrkelære, pp. 282):

$$\sigma_{c,0,d} = \frac{F}{A} \leq k_c \times k_d \times f_{c,0,k}$$

σ_{md}	Compression stress	MPa
F	Calculated load	N
A	Cross section area	mm2
k_c	Column factor	
k_d	Conversion factor	
f_{mk}	Characteristic strength	MPa

Slimness coefficient (Statik og Styrkelære, pp. 282)

$$\lambda_{rel} = \frac{k_{rel} \times l_s}{h}$$

k_{rel}	Factor	
l_s	Effective column length	mm
h	Height of cross section	mm

APPENDIX 07

Energy Frame Key Numbers

Energy frame of 2020 with only passive initiatives:

Energy frame Buildings 2020		
Without supplement	*Supplement for special conditions*	*Total energy frame*
25,0kWh	*0,0kWh*	*25,0kWh*
Total energy requirement		***19,0kWh***

Contribution to energy requirement	
Heat	*12,9*
El. For operation of building	*6,2*
Excessive in rooms	*0,0*

Net requirement	
Room heating	*7,4*
Domestic hot water	*5,0*
Cooling	*0,0*

Selected electricity requirements	
Lighting	*3,5*
Heating of rooms	*0,0*
Heating of DHW	*0,0*
Heat pump	*0,0*
Ventialtion	*2,5*
Pumps	*0,2*
Cooling	*0,0*
Total el. Consumption	*21,8*

Heat loss from installations	
Room heating	*0,5*
Domestic hot water	*0,3*

Output from special sources	
Solar heat	*0,0*
Heat pump	*0,0*
Solar cells	*0,0*
Wind mills	*0,0*

Energy frame of 2020 with implementation of photovoltaics:

Energy frame Buildings 2020		
Without supplement	*Supplement for special conditions*	*Total energy frame*
25,0kWh	*0,0kWh*	*25,0kWh*
Total energy requirement		***-6,0kWh***

Contribution to energy requirement	
Heat	*12,9*
El. For operation of building	*-3,8*
Excessive in rooms	*0,0*

Net requirement	
Room heating	*7,4*
Domestic hot water	*5,0*
Cooling	*0,0*

Selected electricity requirements	
Lighting	*3,5*
Heating of rooms	*0,0*
Heating of DHW	*0,0*
Heat pump	*0,0*
Ventialtion	*2,5*
Pumps	*0,2*
Cooling	*0,0*
Total el. Consumption	*21,8*

Heat loss from installations	
Room heating	*0,5*
Domestic hot water	*0,3*

Output from special sources	
Solar heat	*0,0*
Heat pump	*0,0*
Solar cells	*19,7*
Wind mills	*0,0*

APPENDIX 08

Photovoltaics Calculation

TOTAL ENERGY USE

In order to be a Net Zero Source Energy Building, the direct energy, used in the building, is the basis for the calculation of the necessary amount of energy produced by renewable resources.

$$19{,}0\ kWh/m^2 year * 1547\ m^2 = 29.393\ kWh/year$$

Therefore, we need to supply the building with: 29.393 kWh/year

PHOTOVOLTAICS ASSESSMENT

The energy is supplied by monocrystalline photovoltaics fitted flat on the roof. The following equation is used for calculating the yearly output of the PVs:

$$\text{Yearly output} = C * D * E \qquad \text{where } C = \frac{A * B}{100}$$

A: The total area of panels [m²]
B: Efficiency of the separate module [%], B = 18,4% *for mono-crystalline modules with high efficiency.*
C: Total output of photovoltaics (with direct sunlight)
D: System factor (the temperature, different modules' output, losses through cables etc. are taking into account) D = 0,8 *(building integrated)*
E: Radiation of the sun, depending on its position and angle [kWh/m²] E = 999kWh/m² *(for angle 0° - roof)*

$$\text{Yearly output} = 29.393\ kWh/year$$

$$29.393\ kWh/year = A * 0{,}184 * 0{,}8 * 999 kWh/m^2$$

$$A = 29.393\ kWh/year\ /\ (0{,}184 * 0{,}8 * 999 kWh/m^2) = 199{,}9\ m^2$$

The area of the roof = 221,3 m² > 199,9 m² - meaning that it is possible to place solar cells only on the roof

Solar panels of 0,36 kW_{peak} and 1,96 m * 0,99 m = 1,94 m² is chosen.

Number of panels = 199,9 m² / 1,94 m2
Number of panels = 103,01 ~ 104 panels, with total area of: 104 * 1,94 m2 = 201,8 m²

Total energy produced by solar panels:

$$201{,}8\ m^2 * 0{,}184 * 0{,}8 * 999\ kWh/m^2 = 29.675{,}5\ kWh/year$$

In order to achieve Zero Energy Building status, the energy consumed should be equal to or lower than the energy produced by renewable sources.

$$29.393\ kWh/year \leq 29.675{,}5\ kWh/year$$

Current crisis in parts of the world are forcing people to flee from their home countries and families to come to Denmark in search of a safer life. While waiting for the asylum application to be processed, refugees are placed within asylum camps where their basic needs are met, but the longer they stay the more their identity and sense of purpose is diminished. Therefore, the motivation for this project is to improve quality of life for asylum seekers in Denmark.

The report presents a design proposal for a refugee community centre, located in Copenhagen. The community centre's main purpose is to help asylum seekers to develop social and professional skills, as well as create a network and regain identity and a feeling of safety in a new setting. The centre includes functions as class rooms, workshops and rooms for counselling, together with more social common functions, hence setting the frame for a better social integration.

The focal theme of the project is sustainability in all its aspects: environmental, economic and social. All three aspects are developed through an integrated design process, resulting in a holistic, sustainable architecture. The building has a low impact on the environment, fulfils the energy class of 2020 with only passive initiatives and achieves Net-ZEB status by implementing renewable energy sources. Furthermore, it has a highly satisfactory indoor environment, in terms of thermal and atmospheric air quality and daylight conditions. These technical factors, together with functionality and aesthetics, are the key aspects for developing a design that embraces the well-being of its users, and creates the right settings for a better integration of refugees in Denmark.