Rebuilding Ukraine

A Shift Towards a Sustainable Future

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abstract

This thesis presents the process and result of developing ”A Little Sprout Kindergarten” in Kyiv, Ukraine, within a post-war context. It is developed within the framework of the master’s program in Sustainable Architecture at Aalborg University, focusing on the interdisciplinary collaboration between architecture and engineering.

This collaborative approach is based on the Integrated Design Process (IDP), an iterative methodology. The objective is to address the needs that arise in a post-disaster context and contribute to shaping a new identity for Ukraine through the concept of Building Back Better.

With an emphasis on environmental and social sustainability that addresses the topics; of recycling war debris and creating physical nurturing environments for children to process their trauma. It explores the potential of utilizing recycled concrete to reduce war waste and minimize the environmental impact of extraction and extensive use of natural resources.

The thesis culminates in a design proposal for a kindergarten consisting of three clusters accommodating four groups of 15 children each, along with a main building, an aula as the central space, administrative areas, and an industrial kitchen.
At last, the thesis reflects on the research and design proposal presented.

reading guide

This master thesis is built on the Integrated Design Process method. To convey the iterative process comprehensibly, the thesis is divided into three main parts; program, design process, and presentation. The program (part one) consists of research, theoretical work, and analyses, establishing an essential design process framework. The design process (part two) is a dynamic phase that allows exploration and encourages moving back and forth between the analyzing and design phase. In this part of the thesis, selected design iterations will be presented. Lastly, in the presentation (part three), the final design proposal is presented through visualizations, diagrams, and architectural drawings.

Harvard Referencing system is used as source citation and is cited within the text as (author, year). A reference and illustration list of the work is gathered at the end of the thesis. All illustrations are prepared by the group members unless otherwise noted. Important terms used throughout the thesis are explained to provide a common understanding.

Recycle: Transforming old materials into new ones by reprocessing them as raw materials.

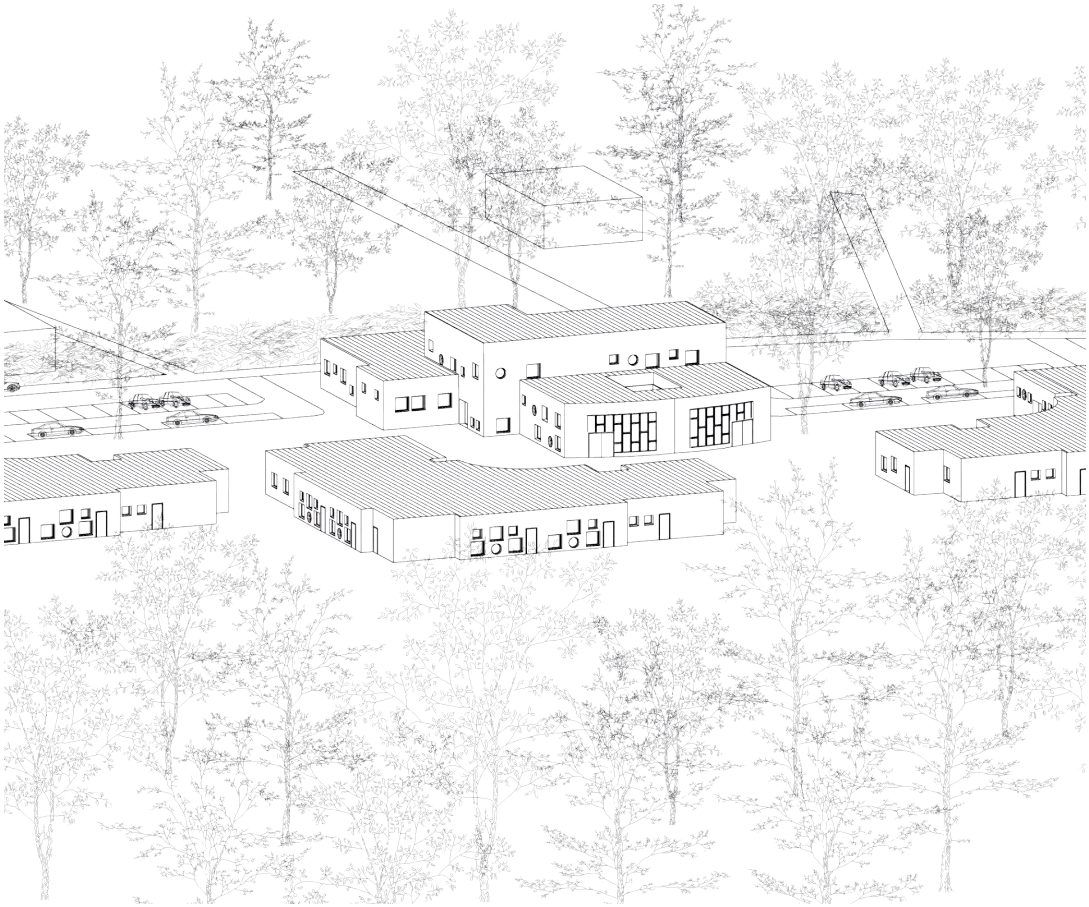
Recycling concrete: Crushing debris concrete and using it as aggregates in producing new concrete.

Postwar Reconstruction: refers to a physical and psychological rebuilding of a country after a war ends.

Build Back Better: This is about going beyond a quick-fix rebuilding of Ukraine and instead prioritizing an enriching and sustainable future for the citizens.

Affordance: These are valuable actions provided for the children by the space.

Group room: refers to the room and the group to which the individual child belongs.



Ill. 1. Design teaser

motivation

Our inspirational source for this master thesis is the "Build Back Green in Ukraine" project by Arkitekter Uden Grænser. This pilot project centers around building a kindergarten in Ukraine with bio-based materials. This project was intriguing as it focuses on current events and relevant worldwide challenges.

War and catastrophic disasters is a recurring issue that is often forgotten in peaceful nations worldwide as we have grown numb to all the negative information we receive daily. The decision to build in a post-disaster context was decided to emphasize creating architecture for those in need of it the most. Allowing us to design architecture essential in current society and tackle problems beyond the norms we meet regularly.

This problem is a challenge unlike any other we have faced during our studies at Aalborg University, allowing us to experiment with a different type of architecture. This thesis also allows us to work with a fascinating user group and creates the possibility of working with the connection between architecture and children.

Ill. 2. Picture of concrete facade blending with nature

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introduction

If architecture aims to improve quality of life, then why are architects often neglecting those who need it the most? Military conflicts and natural disasters are reversing with ease generations of progress. We have recently witnessed war and disasters in Yemen, Ethiopia, Iran, Sahel, and Ukraine. Common for all is that harm and destruction are irreplaceable. It has been over a year since Russia invaded Ukraine in February 2022.

The postwar reconstruction plans have already begun, and a vast amount of scarce resources are needed. The destruction caused by the war is immense, and the recovery of Ukraine involves small-scale and large-scale reconstruction. (WWF,2022). The scars left in Ukraine, both visible and invisible, will take time to heal and a new generation to uphold. Postwar reconstruction efforts tend to focus primarily on physical rebuilding, often neglecting the emotional pain and well-being of the people affected by the war.

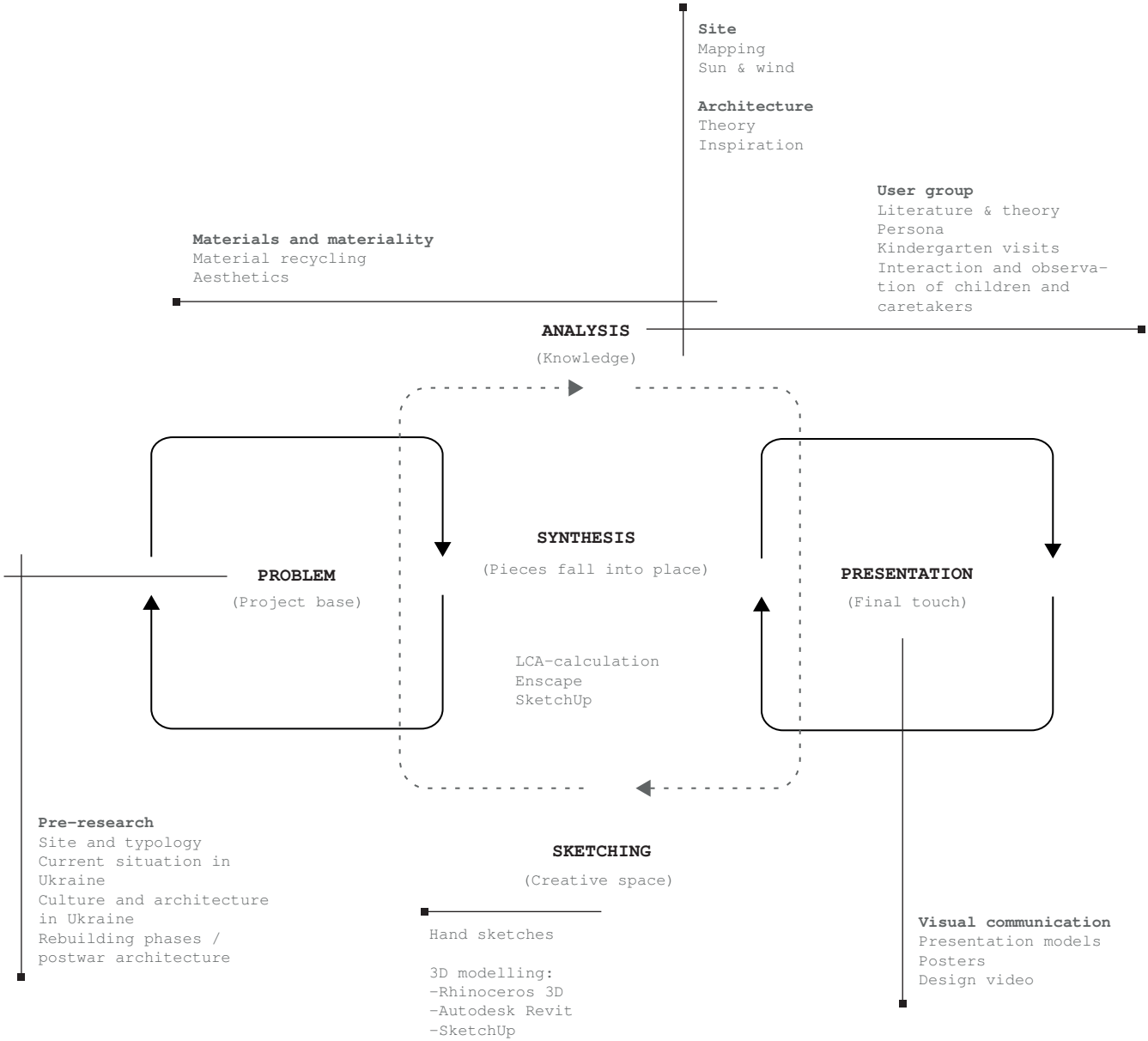
Does a war end when it is declared to be over? Millions of children are growing up only knowing a life of violence and war. Around 230 million of the world's children are today living in high-intensity conflict zones (Red Barnet, 2022). No one is spared when it comes to war. Children, in particular, are susceptible to their environment. Children not directly affected by war are still at risk of exposure to secondary traumatization through parents (Larsen, 2022).

The consequences of war and trauma not only impact the present but can also have lasting effects on the quality of their future. The human brain is malleable. It develops and adapts throughout life, especially in early childhood. Research has demonstrated the significant impact of war and traumatic experiences on children's development and health. Depending on the child and the duration of exposure to a traumatic experience, the effects can appear either transitory or chronic. Early intervention is crucial because it can prevent permanent and irreversible harm. (Ugeskrift for Læger, 2005)

It is uncertain when the war will end, and the consequences may persist long after it does. The aftermath of the war involves more than just establishing physical environments for the future; it must also facilitate a healing process.

The environment can either support or undermine the individual. Architecture cannot heal people, but incredible architecture provides enriching experiences.

> “Children growing up with psychological distress from armed conflict may struggle with their mental, emotional and behavioral health as adults. This can create a destabilizing environment for their own children”
>
> – Wolfe, 2022



Ill. 3. The methodological approach

method

The Integrated Design Process is a method used at Aalborg University, combining architecture and engineering. Integrating aspects such as sustainability, indoor environment, and tectonics in the early stages facilitates a more comprehensive and holistic design approach.

Integrated design is achieved through an iterative process between the following five phases: problem identification, analysis, sketching, synthesis, and presentation. IDP is a crucial method in this thesis to improve the integration between the user's specific needs, architectural qualities, and sustainable strategies. Further, the method allows a variety of tools and methods to be applied in the different phases, improving the process of this thesis. (Knudstrup, 2005)

Literature studies
Literature studies provide an overview of the existing knowledge and research within a particular theme. Essential studies of various subjects such as child development, trauma, post-war consequences, and reconstruction have created parts of a conceptual framework for the design. This method is used throughout all the phases of the IDP.

Site analysis
Site analysis involves a combination of research, data collection, and mapping such as climate, existing structures, infrastructure, and the surrounding context to evaluate the site's characteristics, constraints, and opportunities. The site analysis used in this thesis is all desktop analysis meaning all information regarding the site and the surroundings is acquired through the internet, influencing how the site is perceived. The tools Google Maps and Google Street View have been used throughout the process.

In order to obtain information about the local climate, data for the temperature profile and wind rose is acquired from an EPW weather file that originates from CBE Climate Tool. The registration is situated in the southern part of Kyiv near Demiivka, and the weather file is known as Kyiv KC UKR.

Interview
A field trip to Klepholm kindergarten was arranged to interact with the caretakers and children and observe their environment and the relationship between them. A semi-structured interview was used during the field trip, supported by natural observations. The interview resulted in an informal conversation with the caretakers and leader, allowing qualitative and open-ended responses. Notes from the conversation can be found in appendix 1.

Moodboard / Inspirational pictures
Moodboards and pictures capture the desired mood, style, or aesthetic to inspire the design. It serves to express and communicate design concepts, ideas, and inspirations in a visual format.

Persona
A persona is a fictional character based on gathered knowledge and analysis. This process can be divided into three stages. The first stage is field studies, to collect data of empirical substance with different interview approaches. The second stage is finding data on the user group and combining it with the collected data from the first phase. The third phase is making the persona profile, including name, age, illustration/photo, and text description. (Tvedebrink, 2018)
In order to understand the children's

and caretakers' needs and behaviors, three personas are created to enhance the designed spaces.

Life Cycle Assessment
Life Cycle Assessment (LCA) is a method used to evaluate the environmental impacts of a building throughout its entire life cycle. It considers the various stages, assesses the emissions, and calculates the potential environmental impacts associated with each stage. LCA supports making informed decisions throughout the design process to minimize the environmental footprint and promotes sustainable design solutions. This thesis is primarily using LCA as a tool to understand the impact of conventional solutions compared to recycling.

Daylight simulation
To improve user comfort and utilize natural light, design iterations have been tested through daylight simulations with the tool Velux daylight analysis tool, primarily in the sketching and synthesis phase.

Renders
Renders are images generated from 3D models with materials, textures, and lighting to visualize and communicate architectural ideas. This method was used in the sketching, synthesis, and presentation phase. In the design and synthesis phases, it has been used to visualize and explore different ideas, while in the presentation phase, it is used to visualize the final design.

AI
Adobe Firefly (BETA) is used to create illustrations based on written input. These are in this thesis only used to create specific atmospheres throughout the report.

Ill. 4. The destruction of war

“There is no beginning. There is no end.
There is only change”

- Robert Monroe, n.d.

the impact of war

One year on, the conflict in Ukraine persists, and the damage is physically and psychologically incomprehensible. The destruction of infrastructure, buildings, and public spaces has caused significant damage while also increasing the population's vulnerability to developing mental health issues.

Physical damage

Ukraine has suffered extensive damage to energy, water infrastructure, industrial sites, and buildings (Guillot et al., 2023). Hundreds of thousands of buildings are damaged, including hospitals, religious institutions, cultural facilities, and residential buildings, and more than 3,000 educational institutions, from preschools to universities, are damaged or destroyed (Garver, 2023).

As of April 2, 2023, OHCHR reports that the invasion by Russia has resulted in the deaths of 841 civilians and injured 14,156. (Published by Statista Research Department & 6, 2023). More than eight million Ukrainians have been displaced from their homes and have sought refuge in other cities and countries, and more than 40,000 individuals have sought asylum in Denmark (Operational Data Portal, 2023).

3,000 educational institutions are damaged or destroyed

840 civilians dead

1.500.000 children at risk of critical affected mental health

Psychological scars

The war has far-reaching effects beyond physical damage and economic loss. The conflict significantly impacts the mental health of Ukraine. The more exposure people have to physical and psychological trauma, the more likely they will experience mental health difficulties. The World Vision estimates that over 20% of those who experience trauma will suffer from mental health issues.

Children who have experienced war trauma are especially vulnerable to long-term psychological consequences. The stress and trauma of war can lead to anxiety, depression, PTSD, and other mental health disorders that can persist long into adulthood. The consequence is a country with a large percentage of the workforce suffering from mental disorders. According to World Vision, around 1.5 million Ukrainian children are at risk of having their psychological health critically affected by the conflict over the past year. (Haddad et al., 2022)

Supportive environments

The effects of trauma can linger for years, affecting the child's development and well-being long into adulthood. Trauma does not disappear when the conflict is over. Early intervention is crucial in mitigating the long-term impact of trauma during and after the war. It is essential to provide the child with psychological support and care to help them process their traumatic experiences and build resilience for the future. (Murthy, 2006)

Ukraine's future depends on its children's well-being, and they must receive proper psychological care. This care needs to include both short- and long-term solutions. It is essential that the children are provided with safety, stability, protection, and psychological support daily. Without this, the long-term consequences of the war will continue to impact their lives, and the future of Ukraine will be at risk.

”build back better”

Ukraine has to be rebuilt so it prepares the country for the future while not reconstructing the past. The concept of ”Building Back Better” emphasizes the importance of rebuilding what was lost and improving and creating long-term sustainable solutions.

The concept

”Build Back Better” is a concept that originates in disaster risk reduction and post-disaster recovery and consists of three terms: reconstruction, recovery, and recovery plan, both referring to the long and short-term restoration.

The ”reconstruction” process includes building resilient societies and communities, using sustainable and environmentally friendly materials and techniques, in situations of disasters and crises. The ”recovery” process intends to address pre-existing vulnerabilities, reduce risks, and improve the well-being of the affected population. Lastly, the ”Recovery Plan” establishes a common platform for managing the recovery/ reconstruction nationally. The concept of ”Build Back Better” is a way of rebuilding after a disaster that prioritizes resilience, sustainability, and equity. (United Nations General Assembly, 2016).

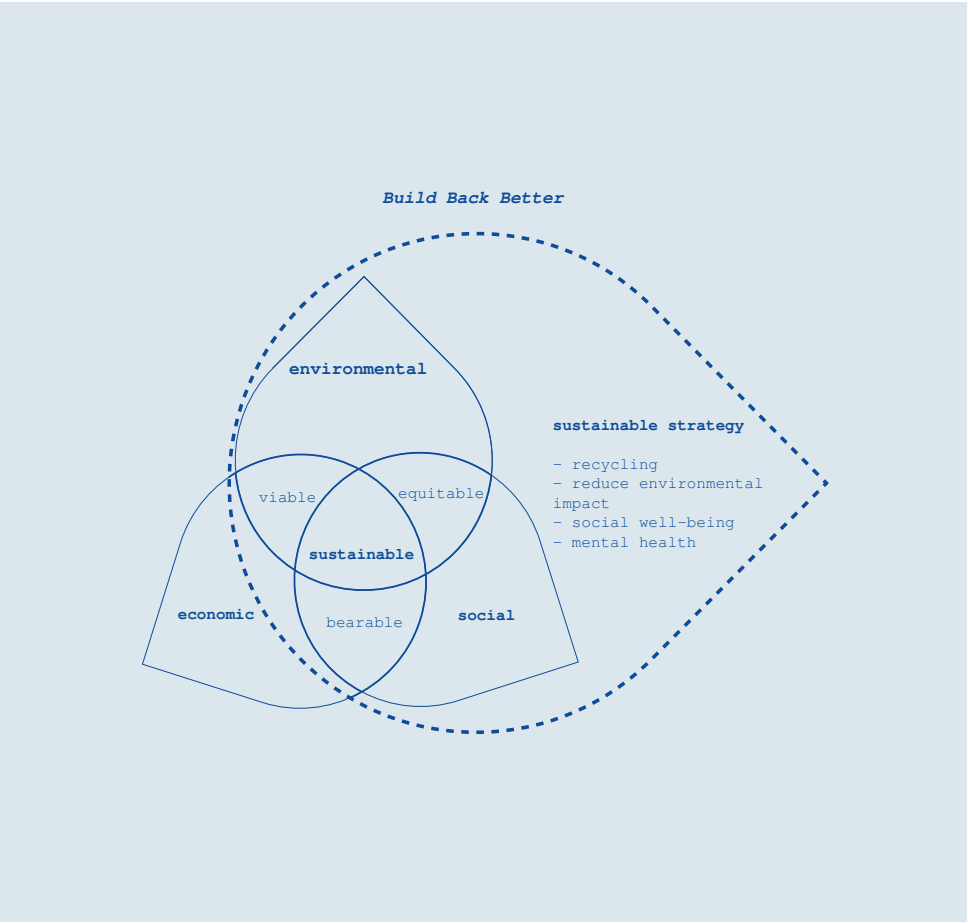
”Build Back Better in Ukraine”

A sustainable reconstruction of Ukraine requires the recovery process to adapt to the ”Build Back Better” approach, which emphasizes a sustainable built environment, green infrastructure, and energy. The plan with the ”Build Back Better” concept is to follow international best practices and standards, including approximation to the EU legislation to effectively address the challenges posed by climate change and other global uncertainties. (Riabokin, 2022)

Sustainability

Sustainability is a broad topic with many different categories and sub-categories. It refers to the capability to meet the needs of the present without compromising the future generations’ possibilities to meet their own needs. A framework for sustainable development is provided by the three pillars of sustainability, which consist of economic, social, and environmental. (Brundtland, 1987)

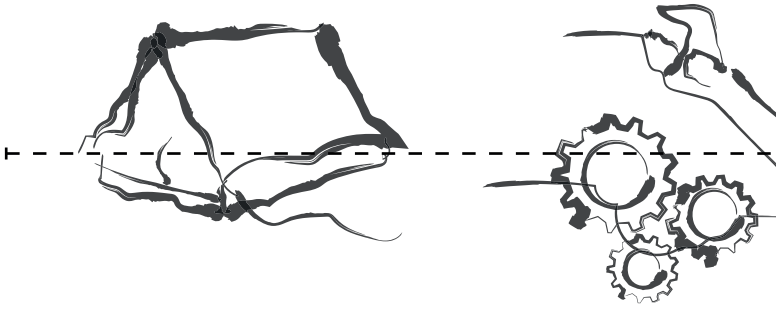
This thesis’s approach to the ”Build Back Better” concept prioritizes social and environmental sustainability while following Danish standards and regulations in the creative process. Given Ukraine’s current situation, the critical aspect of social sustainability is meeting the needs of children and providing necessary care to reduce the long-term impact of the distressing experience through the implementation of well-designed spaces and by providing routines that meet the present and future needs of individual children. Environmental sustainability will be approached with a focus on repurposing waste and using natural resources to reduce the consumption of limited resources.



Ill. 5. This thesis´s approach to ”Build Back Better”

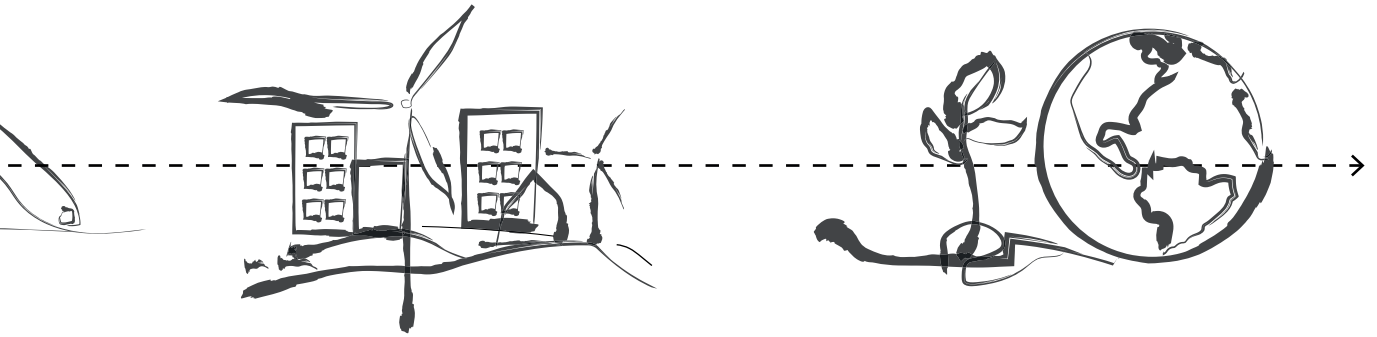
rebuilding phases

The rebuilding phase after a war can be divided into four stages: emergency, restoration, and reconstruction, followed by the development stage.
These processes are not always linear and overlap; each stage's duration depends on the extent of the damage during the war. Ukraine has already begun the restoration of buildings and infrastructure in Kyiv (Mamo, 2023). This kindergarten is identified as a building that would be built around the reconstruction phase, as it is a new building focusing on Building Back Better by prioritizing environmental and social sustainability



Emergency relief
This initial stage occurs during and immediately after the war ends, focusing on ensuring the affected population's basic human needs, such as food, water, shelter, and medical care. These are achieved to stabilize the situation and reduce further loss of life or damage to property. (Sobhaninia & Buckman, 2021)

Restoration phase
Repairing and restoring infrastructure such as roads, bridges, water, electricity, and damaged or destroyed buildings is the focus of the next stage. This stage is critical in bringing back normality to the affected areas and ensuring people have access to essential facilities required for survival. The restoration phase aims to restore the affected areas to their pre-war state. This requires attention to detail to ensure that the restored infrastructure meets safety standards and is sustainable for the future. (Sobhaninia & Buckman, 2021)



Ill. 6. The four rebuilding phases after war

Reconstruction phase

The reconstruction phase is the most extensive and complex as it involves rebuilding the country's infrastructure and physical and economic landscape to a level equal to or better than its pre-war state. The primary purpose of this phase is to construct new buildings, roads, bridges, and other vital infrastructure, including establishing new businesses and industries to create job opportunities and stimulate economic growth. (Sobhaninia & Buckman, 2021)

Development and growth

During this final phase, the focus shifts from short-term reconstruction to long-term development and sustainability. The primary purpose is to create a stable country that can sustain itself, including establishing institutions and systems supporting economic growth and development. (Becker et al., 2022)

“ Today, one of our greatest challenges is to sustain the planet that sustain us”

– Unesco, n.d.

Ill. 7.

recycling war debris

Environmental impact of the war

The accelerated climate change we are currently facing is the consequence of our harmful impact on the environment. The war in Ukraine is burdening the environment and causing even more damage to an already stressed environment. The war itself is releasing significant amounts of emissions. However, the post-war reconstruction following the war is expected to aggravate the situation as vast energy and resources are required. (Rybarczyk, 2022) Advanced technology is making modern warfare more intense, causing long-term environmental impacts. Unfortunately, modern warfare's significant environmental impact is often overlooked (European Union, 2023).

The war in Ukraine is causing the depletion of already scarce resources. Dangerous substances and chemicals from the war are polluting the air, water, and soil leading to significant environmental challenges, which Ukraine will have to face alongside climate change. (WWF – World Wide Fund For Nature, 2022) Even today, the Vietnam War (1955) serves as a reminder of the long-lasting and irreversible destruction that a war can inflict on the environment and human health (Ogoyi, 2022).

Utilize war waste

Rebuilding Ukraine is a complex process that will take many years to complete what took decades to build. The war in Ukraine is generating large amounts of construction and demolition waste. Within a year of the war, the demolition waste in Kyiv alone reached 144.000 tons (Belousova, 2023).

> ”
> It is noted that Kyiv region was the first region to arrange 62 sites for temporary placement of demolition waste. Currently, there are 144,000 tons of war waste at 48 sites”
>
> – (Belousova, 2023)

The demolition waste is stored for future post-war reconstruction, while the dangerous waste is carefully separated. Across Ukraine, there is an estimated around 10-12 million tons of war debris (Belousova, 2023). Sustainable waste management is necessary to avoid the accumulation of waste taking up large land spaces and polluting the environment. Burning waste increases emissions and is neither a sustainable solution. It is vital to consider environment-friendly approaches, such as circular thinking. Recycling enables materials to be utilized for a more extended period. This does not alone reduce the waste generated from the war, but it also reduces the demand for virgin materials.
Nevertheless, how can war debris be utilized more effectively than just for road filling or as energy resources?

Recycling Concrete

The amount of old concrete from destroyed residential buildings and infrastructure in Ukraine is estimated to be around 20–30 million m^3 (Troian et al., 2022). As old concrete is often recycled as aggregates for road filling, there is potential to utilize it more efficiently (Recycling of Concrete, 2021). This thesis explores the potential of transforming war debris into something valuable by recycling old concrete and utilizing it to produce new concrete. The aim is to reduce the use and depletion of scarce resources and promote sustainable waste management.

”

Up to 50 billion tonnes of sand and gravel are mined each year to meet soaring demand from construction and land reclamation – making it the largest extractive industry on the planet. Yet most people have never given it even a passing thought. And nor have most decision makers and river managers.”

– (WWF, 2018)

Ill. 8. Impact of sand mining

Ill. 9. Pollution

Ill. 10. Deforestation

all resources are valuable

Concrete

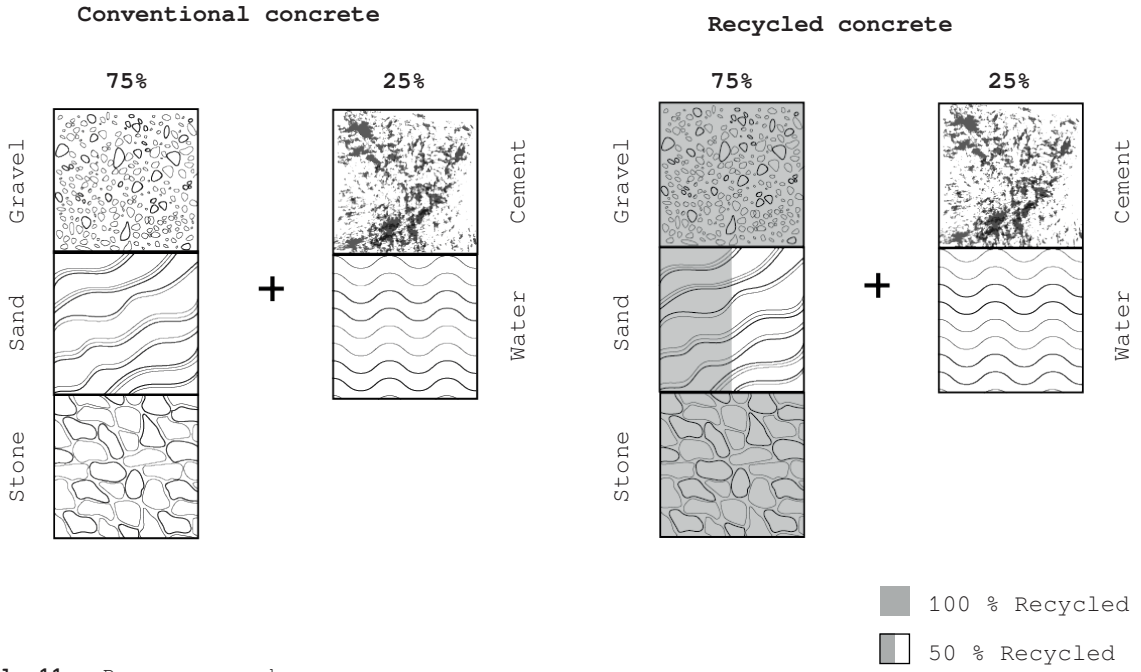
Concrete is a composite material of cement, water, and a mix of aggregates used in architecture as either an exposed or covered material. It went from being perceived as the building material of the future to now a reviled material for its aesthetics and high carbon footprint. (Pasternak, 2022)

Thus, slum reputation concrete is a malleable material allowing versatile expressions and complex structures. Moreover, it is a durable and weather-resistant material with a long lifespan in its usage phase. Environmental challenges arise during its production phase. Concrete production requires a significant amount of energy and generates substantial emissions. The significant carbon footprint is primarily caused by the production of cement, which is alone responsible for 90% of the total carbon footprint of concrete (Pedersen, 2021).

Towards a sustainable transition

Despite these challenges, concrete remains an essential and widely used material in the built environment. Efforts are made to decrease its environmental impact by reducing energy consumption and exploring sustainable alternatives to traditional cement (Krull & Brixen, 2019). To prevent a throw-away culture and encourage sustainable practice, it is essential to address the challenges arising from extensive material use and rethink how we use them. While recycling concrete can only reduce the consumption of natural resources to a certain extent, it is a more responsible use of resources than conventional concrete.

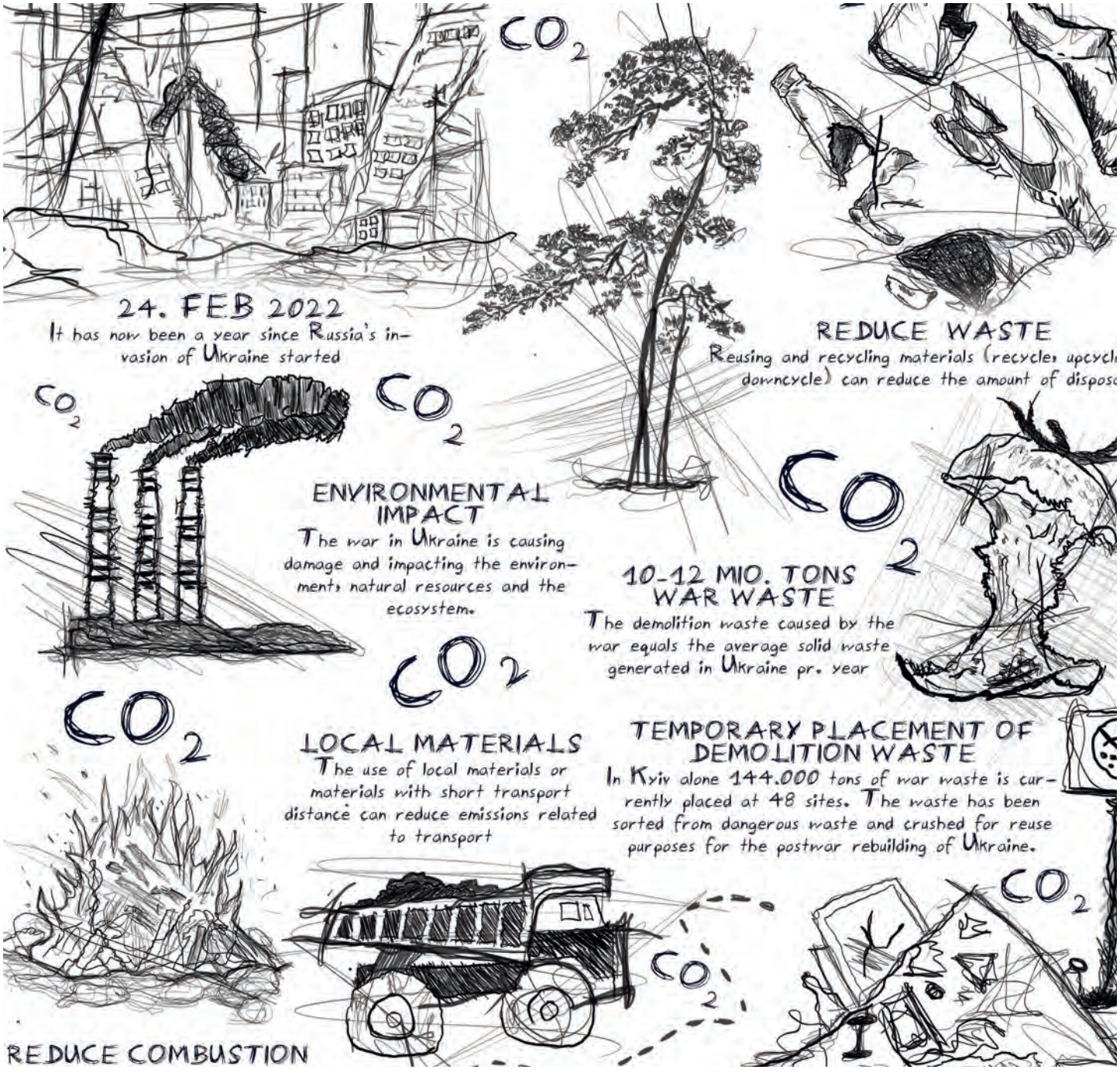
This thesis emphasizes the importance of efficiently utilizing available resources by replacing 100% of the stone fraction and 50% of the sand fraction with recycled concrete (Recycling of concrete, 2021 p. 11). Through LCA-calculation, the thesis investigates the environmental impact of material transport and analyzes the benefits of using local materials.



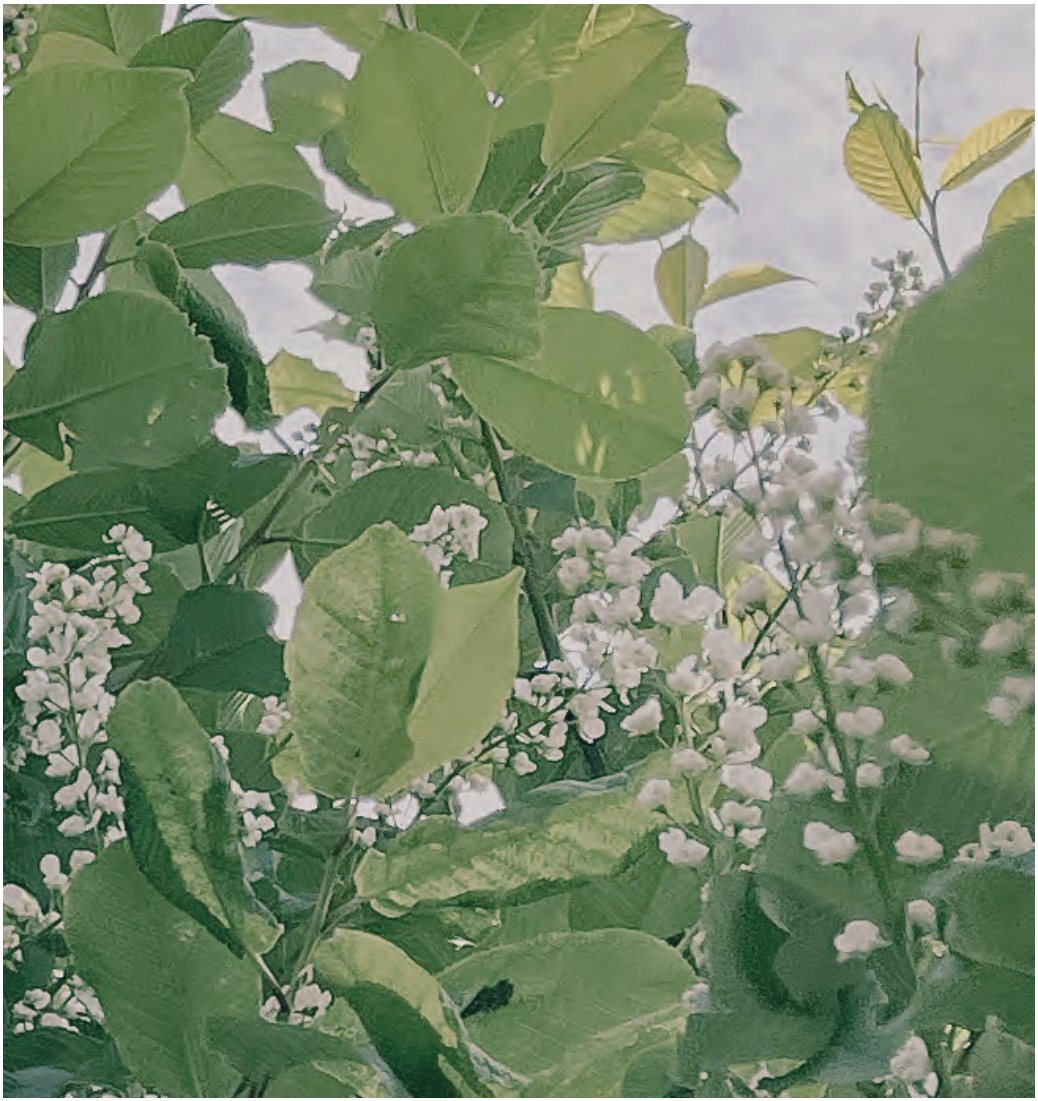
Ill. 11. Resource graph

Integrated thinking

A holistic approach is essential when choosing materials. LCA (Life Cycle Assessment) is a method used to evaluate a material's environmental impact throughout its lifetime (LCA Center, n.d.). It is essential to understand that LCA calculations are solely based on quantitative data. Material's architectural quality and technical properties should not be overshadowed by its environmental impact but should be considered in relation to these. Further, the calculations do not include the harm of extensive use of materials. While wood is a sustainable material, irresponsible use can lead to deforestation and destruction of biodiversity (Pedersen, 2021). Whether a material is renewable or non-renewable, it is essential to consider both valuable resources.



Ill. 12. Mindmap



Ill. 13.

ukrainian architecture

The devastating impact of the war requires an environmentally conscious reconstruction approach, involving the utilization of war waste and debris. Given the significant amount of waste material available, the use of concrete as a building material becomes a particularly intriguing option to explore. The potential of post-war architecture and Ukrainien modernism as a source of inspiration to create architectural principles for the reconstruction.

Diverse and rich architecture

Ukrainian architecture is a unique and diverse style that has evolved over the centuries. It is characterized by a combination of influence from Byzantium, Slavic, and Western European styles, as well as its own distinctive features. The architecture of Ukraine reflects the country's rich and cultural style, and its unique history of political and social changes. From Byzantine cathedrals to ornate Baroque churches to brutal modern structures. (Hybrid Warfare Analytical Group, 2021)

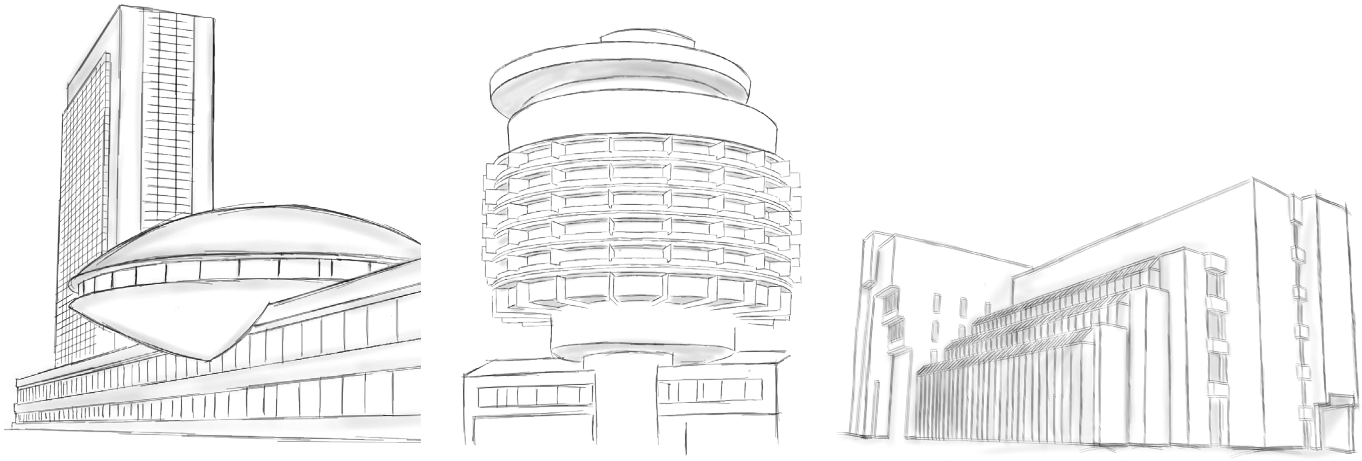
Ukrainian modernism was heavily influenced by Stalinist architecture during the 20th century which is characterized by constructivism and brutality of lines (Hybrid Warfare Analytical Group, 2021). This period is greatly influenced by brutalist architecture including the use of raw concrete, with a focus on mass and texture rather than Ukraines traditional decorative ornamentation. Brutalism is known for its concrete-heavy aesthetics, monolithic structures and lack of decoration, with a focus on the essential function of the building. (Brutalism 2022) Although brutalist architecture is controversial due to its austere and imposing appearance, this style has had a lasting impact on the built environment and has influenced many contemporary architects.

Post-war architecture

Post-war architecture refers to the architectural style that emerged after World War II, particularly in Europe and the United States. The style is characterized by a shift towards functionalism and simplicity, with an emphasis on clean lines, minimal ornamentation, and the use of modern materials such as glass, steel, and concrete were widely used. (Encyclopædia Britannica, nd)

Architectural crossover

Brutalist architecture and post-war architecture share similarities in terms of their design principles and the use of modern materials and an emphasis on clean lines and simple geometric shapes. However, brutalist architecture is often characterized by its rough, textured surfaces and the use of raw, unfinished



Ill. 14. Ukrainian modernism

concrete, while post-war architecture tends to be sleek and polished.
Both architectural styles prioritize functionality and minimalism, with a focus on creating large, efficient buildings that meet the needs of a growing population. Additionally, these styles were born out of a need for reconstruction and rebuilding after periods of devastation. Function and materiality is taken to an extreme by prioritizing it above all else, shaping a style that is either celebrated for its honesty and clarity or criticized for its simplicity and lack of warmth.

A modern interpretation of post-war architectural style based on the principles of Ukrainien modernism, brutalism, post-war architecture, and the rich culture of Ukraine, presents an opportunity to combine old and new. This style embraces the functionalism and simplicity of post-war architecture, the raw and expressive materials of brutalism, and the traditional Ukrainian design elements such as the ornate patterns and colorful expression.

By incorporating these various elements, a style emerges that reflects Ukraine's history, culture, and contemporary needs. This creates an architectural language that celebrates the past while embracing the future.

kindergarten in Ukraine

The customs, educational goals, and standard differences between Ukrainian and Danish kindergartens are noteworthy. In order to design a kindergarten in Ukraine that aligns with their culture, learning objectives, and guidelines, this section will elaborate further on these distinctions.

Ukrainian kindergartens

In Ukraine, there are eight types of preschool institutions; where one is defined as kindergarten:

”Kindergarten (age – 1 to 6(7) years), which ensures development, upbringing, and training of children following the requirements of the Basic component of preschool education.” (Kitsoft, 2017)

In Ukraine, kindergartens aged 3 to 6/7 years are defined as preschool age (Maslo & Kapustain, 2022). From age five, preschool education is mandatory to ensure the child develops basic competencies regarding personality, natural environment, play, society, speech, art, sensory, and cognitive space. (Education system in Ukraine 2022) Furthermore, it requires the law of Ukraine preschools to preserve and strengthen children’s physical, psychological, and spiritual health (Law of Ukraine, 2022). Public kindergartens are open all year round in the time span from 8 am to 7 pm. During the children’s daily stay in the kindergarten, they are offered three daily meals, afternoon snacks, and educational activities, and it is required to take a midday nap between 1:45 pm and 3:15 pm. The Children caretaker ratio is dependent on the children’s age, and when working with kids in the age 3 to 6/7 years, the ratio is one caretaker for up to 20 children. (Maslo & Kapustain, 2022)

Better spaces

Studies have shown that the kindergarten’s size and the quality of care that is provided affects the children’s well-being, learning, and development. The following points are recommended to ensure a physically comfortable and stimulating environment promoting diversity and inclusivity: (Kragh-Müller & Ringsmose, 2015)

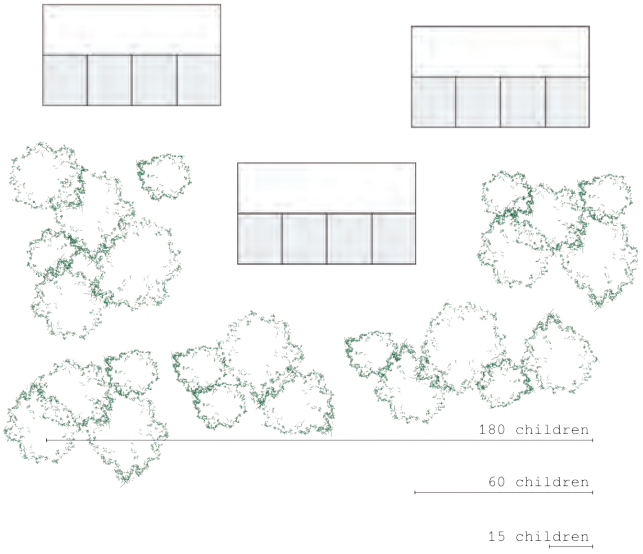
Building layout:

- Less than a 100 children in a kindergarten or it should be physically separated.

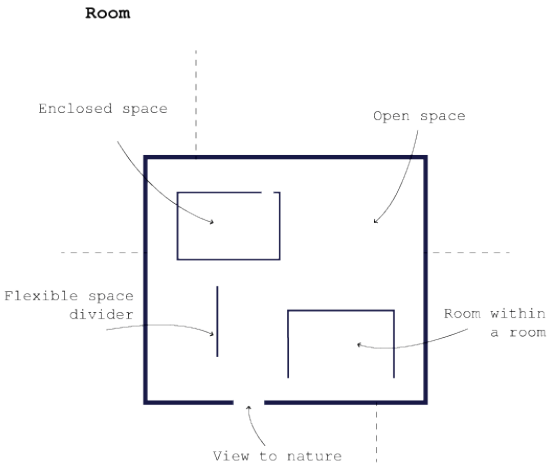
- Keep group sizes relatively small, 20 or less children in each group.

- The group rooms should have direct access to the outdoors.

(Kragh-Müller & Ringsmose, 2015)



Ill. 15. Building layout



Ill. 16. Spaces for children

Spaces for children:
- Spaces for both large and small group activities inside and outside of the group rooms.

- A variety of indoor and outdoor spaces promote risk-taking and exploration while providing a sense of safety and security for the children.

- Spaces to support different types of play and activity levels allow running and playing and quiet spaces for rest and reflection.

- Flexible and adaptable spaces to meet the changing and individual needs with opportunities to provide input.
(Kragh-Müller & Ringsmose, 2015)

Design principles
This thesis is focused on kindergarten children in the preschool age from 3 to 6. Some of the major differences between a Danish and Ukrainien kindergarten is the requirement for education and the amount of time the children spend in kindergarten.

The requirements for education from the age of five demands spaces for (traditional) learning to prepare them for primary school. It is optimal to divide the kindergarten into several clusters with smaller groups and to promote the children's play and independence, smaller spaces with different activities are recommended.

spaces for early childhood development

When designing a kindergarten that promotes children's learning and development, it is essential to understand the spaces in which children thrive. Cognitive, social, and motor skill development and learning are connected and overlapping on specific aspects of overall child development, as they interact in complex and dynamic ways (Singer, 2006).

The brains

The brain's cognitive function is responsible for conscious mental activities such as perception, memory, reasoning, and problem-solving (Buzsáki, 2019). Cognitive development is the process of enhancing these abilities and is connected to the development of the physical body. According to Piaget's theory, the stage relevant to this thesis is the Preoperational stage, characterized by egocentric behavior and a one-dimensional approach to thinking and the environment (Piaget, 1964).

Ill. 17.

Cognitive learning can be achieved by letting the child make observations and associations, for example, by creating plays where the child can assume diverse roles and engage in pretend play. Acting can help the children understand the props' meaning and function and develop linguistic skills through rehearsing lines for the play. The exploration process is crucial to child development as it facilitates independent discovery. The child may study and learn about the new object and include it in their vocabulary. Learning games, including numbers, colors, and objects, is an alternative way of promoting cognitive development, e.g., through pictograms, the child can associate the picture with sounds or other objects. (Singer, 2006)

Cognitive learning can be supported by designing spaces where children can create small theaters and stages. Exploration and independent play is possible by creating the idea of freedom in a constricted frame. Creating a space for concentrated activities and problem-solving, such as puzzles and pictograms, where the child can focus, is beneficial for cognitive development.

Movement through the environment

Motor skills involve the coordination of movement with a specific task in mind, including the ability to control one's posture to adapt to the force of gravity and other environmental factors. A child is very dependent on all their senses to adjust effectively to the physical environment, and by repeating and observing movement, they can learn step-by-step more complex motor skills. (Sundhedstyrelsen, 2016) One's genetic data already incorporates some basic motor skills present from birth (Piaget,1969).

Motor skills can be categorized into two groups: gross motor skills and fine motor skills. Gross motor skills involve larger movements such as running, climbing, jumping, and other activities that require large muscle groups. Fine motor skills involve more precise and delicate movements, such as manipulating small objects, using scissors, facial expressions, and imitating gestures. In order to support the development of motor skills, it is vital to provide children with a range of stimulating and challenging activities that allow them to express themselves physically. (Dziobek-Bepler, 2021)

Spaces with a variety of options promote different physical activities. A child relies on their senses to learn new movements and skills, which the environment should visually and auditorily support.

Ill. 18.

Providing challenging environments such as wavy floors, stairs, and various climbing opportunities improves their balance and coordination abilities. Open and larger spaces allow for higher tempo and more strenuous physical activities, such as running and climbing, that promote gross motor skills. In contrast, fine motor skills can be practiced by drawing, building with small blocks, and playing instruments in specialized spaces where an adult assists them. (Sundhedstyrelsen, 2016)

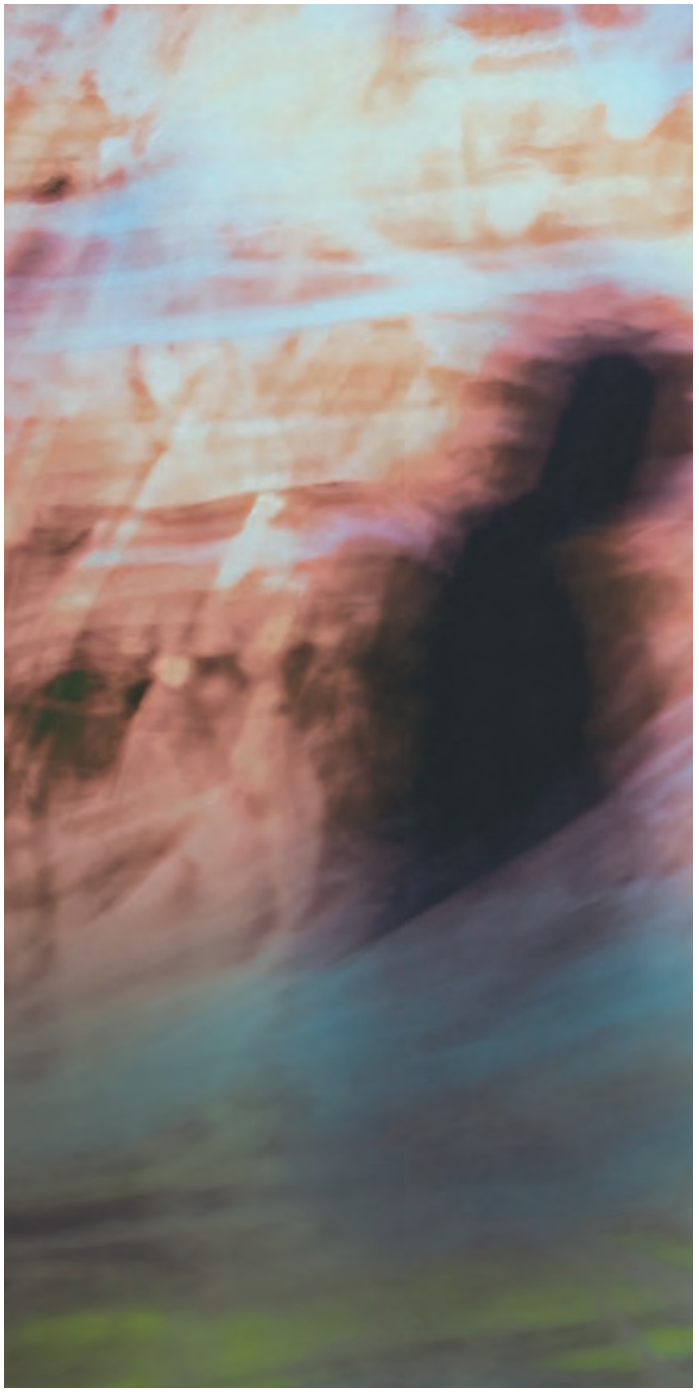
Spaces that accommodate relations

Social development is an ongoing process that involves how individuals participate, communicate, and react in different social settings. This includes understanding oneself as an individual and acknowledging one's role in the community. During this stage of development, a child must begin building relations with adults other than their parents and establish friendships with other kids. As a child learns to play with others, starting small and beginning by playing with one or a small group is essential. Conversations with peers without an adult are vital as they allow for different types of conversations that benefit a child's ability to express themselves without adult interference. A child is learning the value of sharing toys and engaging in play with others using a variety of toys and objects that can assist them in regulating their behavior and thereby promote social skills. (Edward,2018)

Rooms should accommodate spaces for smaller groups and activities for larger groups. Social interaction can be facilitated and promoted Through smaller intimate spaces with fewer or no adults that allow one-on-one or small group conversations.

Design principles

A child requires a variety of spaces, including smaller and larger spaces, to develop diverse skills. By providing smaller spaces for focused tasks that are more manageable for the child and larger spaces for physical activities, kindergartens can meet the diverse needs of a child. The building should allow children to use their imagination and freely explore at their own pace. Children develop at different paces. Therefore, the activities and spaces should provide individual and collaborative play opportunities based on each child's preferences.



Ill. 19.

a child's invisible wounds

Addressing children's trauma is crucial in war zones; a report from December 2022 by War Child revealed that 97% of parents had observed changes in their children's behavior since the war began in Ukraine (War Kid, 2022).
Trauma is a term used to describe a situation where a person experiences too much too fast too soon, causing their body and brain to become overstimulated with the stress hormone cortisol, leading to a state of high alertness or hyperarousal. Children experiencing trauma by the age of two will have altered cortisol levels and negatively impact the levels of cognitive function by the age of four. (Psychology Today, 2015)

Trauma can result from first-hand experiences and secondary exposure, for example, through parents. A child tends to imitate the behavior and emotions of their parents, which can lead to the child experiencing similar symptoms as they observe their parents' reactions and responses when faced with distressing situations.

When a child is exposed to traumatic events, their development in certain areas may regress. This means that previously acquired skills such as toilet training, speaking, and walking may need to be relearned. If the trauma and stress are not addressed, it can lead to long-term mental health issues.(Perry,2005; Alayarian,2015)

Ill. 20.

Traumas impact on Children's Development

Social: seclusion, asocial, over-dependence

The short-term effects of trauma can manifest in reduced social interactions and increased isolation.The child usually shows reduced interest in playing with other kids and expresses an over-dependence on caretakers, seeking assistance even when not necessary.

One of the long-term consequences can be difficulties with attachment and forming relationships later in life. (Perry,2005; Alayarian,2015)

Cognitive: Attention issues, preoccupations with words and symbols

A child who has experienced trauma and stress often has difficulty concentrating and struggles to maintain their attention on a task or topic for an extended period of time. They often develop obsessions with words and symbols, fixating on certain things or triggering negative memories. Hyperactivity, resulting in constant fidgeting with objects and the inability to sit still, can be one of the long-term consequences of trauma in children. (Perry,2005; Alayarian,2015)

Motor skills: memory shut down, regression in motor skills, and hyper

Forgetting or regression of previously acquired skills can be a coping mechanism for displacing memories or neglect from caretakers who may also be traumatized(Perry,2005; Alayarian,2015).

Emotional: Sleeping problems, outbursts, PTSD, anxiety

Experiencing trauma can increase the risk of developing conditions such as PTSD and anxiety, both of which can lead to short and long-term difficulties. Difficulty falling asleep and nightmares are common symptoms shared by these conditions.(Wamser-Nanney,2018). Struggles with regulating emotions can lead to frequent emotional outbursts and difficulties managing anger (Perry,2005; Alayarian,2015).

The right environment

Creating a calming, safe, routine-inspired environment is crucial when assisting children with trauma. A variety of spaces is needed, including spaces for concentration that are distraction-free with minimal sensory input and small, enclosed spaces where to feel secure and safe. Furthermore, it is essential to provide facilities to accommodate the needs of children who may be delayed in some aspects of development, such as using diapers beyond the typical age range.

Sleep is a crucial factor for development. It is a good idea to create a calming and comfortable environment for children to sleep in (BC Childrens Hospitals, n.d).

Theater therapy and forest therapy are effective in helping children cope with trauma. Providing a safe and structured environment for children to express their emotions and share their experiences through theatrical performances can help them communicate their struggles. (Malchiodi, 2015) Nature and forest therapy also provide a calming and inspiring setting for the child. Creating spaces where children can interact and play together is essential for their socialization, even if they prefer to play alone. Professional help, such as a pediatric psychologist, can benefit the child and their parents/caretaker by providing various exercises and activities that support their recovery. (Perry, 1999).

“It is important to meet
children as equals, to see things from their
perspective and to help them
find confidence in their own abilities”

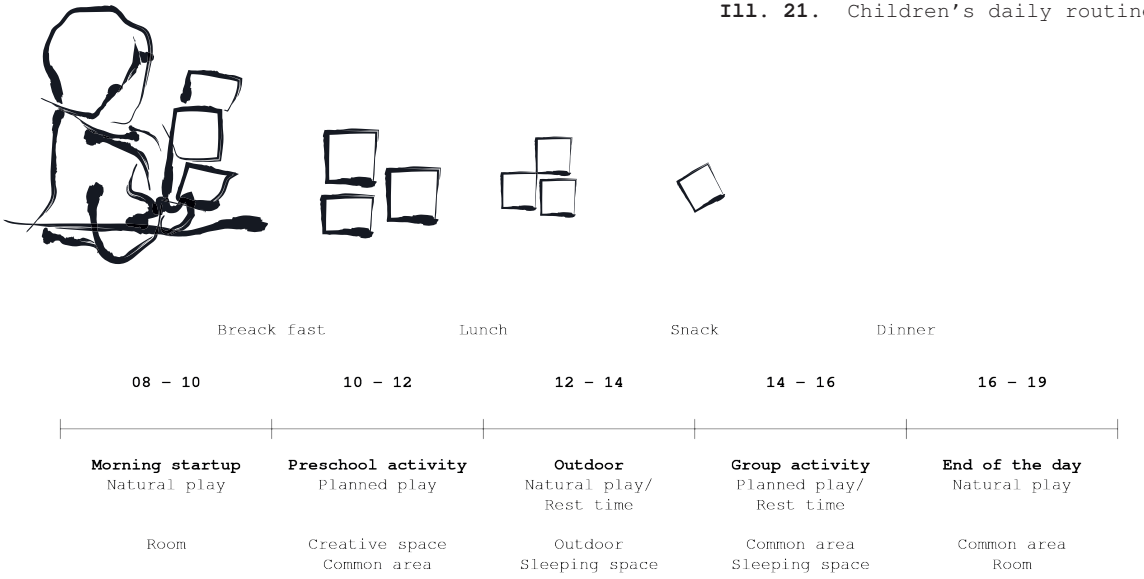
- Dziobek-Bepler et al., 2021, p.8

user

User experience

When trying to enhance the well-being and experience of the user, it is essential to understand the relationship between the user and their environment. Besides meeting the user’s functional requirements, the architectural space should be enriching and consider how users interact with their surroundings.

The user has been categorized into three groups: the children as the primary user, the caretakers as the secondary user, and the parents, kitchen staff, and administration as the tertiary user group. In creating a positive user experience, it is important to think in situations and reflect upon the quality and potential use of the space. Daily routines and the specific needs of the user group are explained, and personas have been developed for the children and caretakers to improve the understanding of their needs and behavior.



Ill. 21. Children’s daily routine

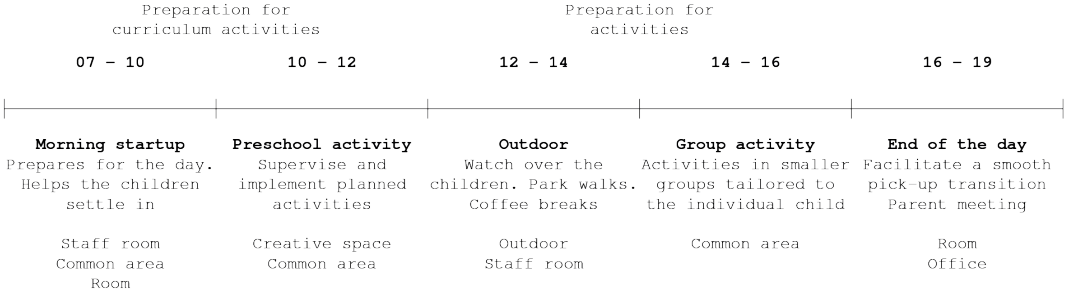
Children (primary user group)

A kindergarten that prioritizes the development, exploration, and rest of the children should be prioritized. Structured daily routines are followed in the kindergarten to create a stable and comfortable environment for the children. This creates a sense of predictability and secure feeling, essential for the children’s well-being.

Personalized attention and a supportive environment that allows self-expression are significant for children with trauma. Personal connection with the caretakers and creative expression helps children to feel seen and heard. For children having difficulties verbalizing their pain, creative expression and play other ways to express their emotions. A calm environment is crucial to let their body and mind recharge.

Balancing between natural and structured activities promotes healthy development. Each child is different, and their needs are changing. A flexible environment allows the caretakers to adapt the daily routine to the child’s needs and mood on a given day. The environment in the kindergarten must be diverse and responsive to allow individual differences to let the children progress at their own pace.

Ill. 22. Caretakers daily routine



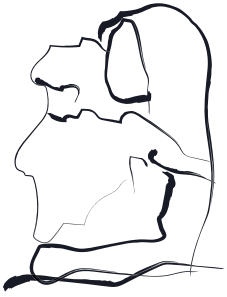
Caretakers (secondary user group)

The caretaker provides children with a safe and nurturing environment through emotional support and guidance. They plan and implement the activities for the children and supervise them to keep them stimulated and active.

Depending on the child, they help assist children with toileting and dressing. They encourage socialization among the children and help facilitate the individual child's development.

The number of children under each caretaker impacts the quality of the care. To ensure that each child receives the attention and care they require, the caretaker must be capable of managing the children. Especially children processing traumatic experiences might need individualized attention. Communication and good relations with the parents are essential to provide the best possible care for the child and experience for their parents.

It is important to understand that a kindergarten is a workplace for the caretakers. Likewise other workplaces, the staff need breaks to recharge their energy and work offices to communicate and spend time with their colleagues.



Ill. 23.

Administration and kitchen staff (tertiary user group)
The administration is in charge of running the kindergarten and consists of the leader and secretaries. Their work is primarily in front of the screen, meeting parents and other services. Although they may not be in the field with the children daily, they still have a sense of an impact on the daily life in the kindergarten.

The kitchen staff is in charge of making the meals for the children and other workers at the kindergarten. They make sure the children get healthy and nutritious food throughout the day. They should be able to concentrate without children running around and causing disruptions when they are busy but also be available to engage with the children when time allows.

Parents (tertiary user group)
The parents drop off and pick up their children from the kindergarten by car, cycle, or walk. Depending on the parent's time, they follow the child into their group room or the common area and share information about sleep and mood with the caretaker. A good collaboration between parents and caretakers is vital to ensure the child's healthy development. Through regular parent meetings, the caretaker can inform their child's progress. Parents experiencing trauma themselves can impact the children through secondary traumatization.

Drawing on the walls

Time to say goodbye to mom

Individual play in the corner

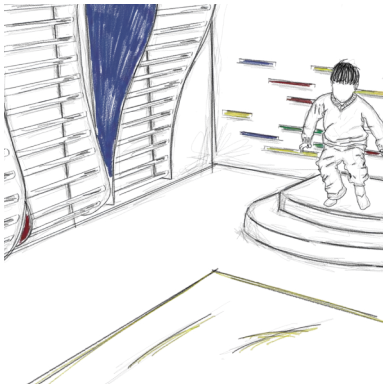
Ill. 24.

persona

Name: Kateryna
Age: 3

Kateryna, a newcomer to the kindergarten, is in the process of adapting to the new environment. As a curious child, she touches every object and surface within her reach for tactile exploration. Due to her strong attachment to her mother, she finds it challenging to adjust to the separation. As a result, she feels uncomfortable in large spaces without her mother's presence and prefers playing in her group room at kindergarten.

She is still in the process of learning how to share and engage in play with other children. Her language skills are still in the early stages, demonstrated by her limited understanding of certain aspects of what she is told. Despite this, she loves hearing others read storybooks. Although she is walking and has developed gross motoric skills, Kateryna still needs assistance to manage her diaper. She is learning and developing her fine motor skills through play, puzzle-solving, and drawing. Taking a nap on a soft blanket halfway through the day serves as a recharger for her.



Playing in the activity room

Story time

Story time

Ill. 25.

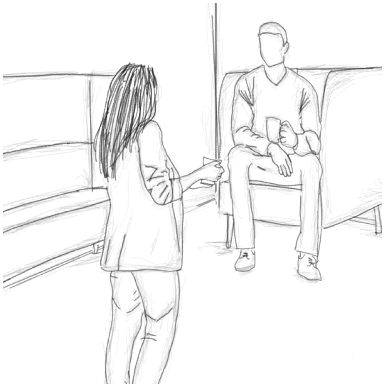
Name: Oleksander
Age: 5

Oleksander displays a high level of physical activity and often runs around without stopping. However, he is less active and skilled at football and other activities than he used to be before the war. When he engages in play, he enjoys running, climbing, and jumping activities. As a result, he prefers larger spaces that allow him to move freely and run at high speeds.

However, sometimes Oleksander demonstrates a degree of social disconnection and hesitation towards group activities, leading him to seek out corners or secluded spaces where he can play independently. He has also started his preschool education according to the Ukrainian education system. However, he experiences difficulty maintaining focus, concentrating, and comprehending the requirements of preschool activities. Sometimes, when attempting to communicate with his peers or caretakers, Oleksander unintentionally speaks loudly when he feels misunderstood by others.

Parent-caretaker meeting

Individual care



Breaktime

Ill. 26.

Name: Klara
Age: 35

Klara is a caretaker with much experience working with children in a kindergarten. She usually starts her workday by drinking a cup of coffee in the break room before greeting the children to prepare herself mentally. Klare knows she can not provide all the care and attention the children require, so she sometimes asks her colleagues for help. Challenged children usually need extra care and attention to process their problems. The kindergartens and Klara know this. One of the more significant daily challenges is carrying out activities in larger groups, as there needs to be more space for the children to be divided into smaller groups in the same room. A physical barrier between the groups, so there is space for Klara to provide more individual care. Klara understands that children can be unpredictable, so she always prepares a backup plan for situations when somebody is having a difficult day and does not feel like participating.

affordance

Affordance, as defined by psychologist James J. Gibson, refers to the relationship between an environment and the actions that can be taken within it. Affordance is the opportunity for interaction that an environment provides. An architect can shape the structure and affordances of space during design development, but ultimately they cannot control how the user interacts with the space. (Maier et al., 2009)

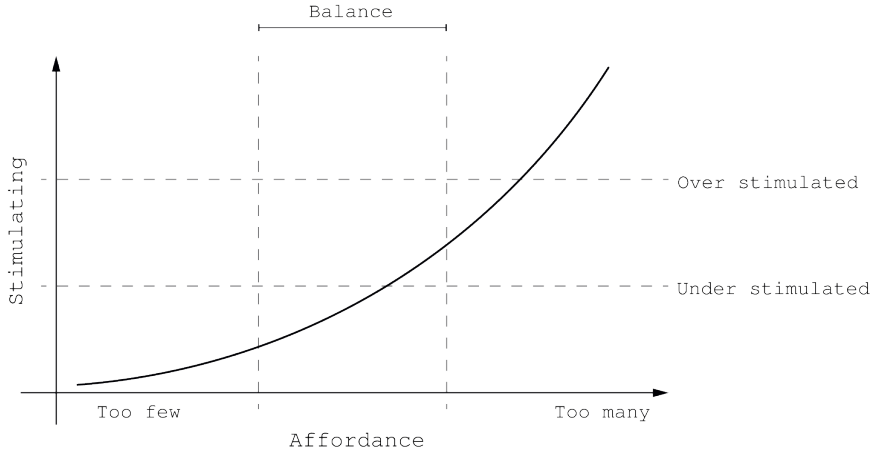
Environments for play

Affordance is an abstract perception that should be considered early in the design process in different design aspects and is not easily added or modified afterward. This thesis elaborates on how affordance for play can offer a child an environment that promotes their development.

”
A room with loads of huge cushions that you use to build a really cozy den. Or a castle. And a room with a giant Lego mountain, so you can build everything you like.”

– Tom, six years old (Dziobek-Bepler, 2021)

Play can be defined as an enjoyable and spontaneous activity that brings pleasure while positively promoting children’s learning and development. Play activities are heavily influenced by the affordances present in the environment. (Dziobek-Bepler, 2021,) How furniture and materials are arranged in space can significantly impact the types of play and learning that unfold.



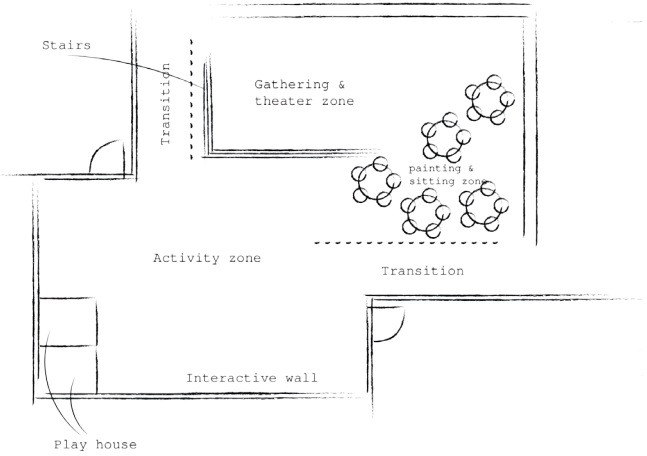
Ill. 27. Affordance Graph

Children's adaptability and creativity allows them to see beyond the intended use of the environment and create their own play scenario. They identify affordances in their surroundings that may not have been initially designed for play. (Miraclerecreation, 2023) For example, a blanket can be transformed into a tent, cape, parachute, or cardboard box, which can become a spaceship, fort, or house, depending on the child's imagination. Thus, it is vital to allow open-ended and unstructured play opportunities by providing a variety of affordances in children's play environments, to nurture their imaginative play and experimentation and encourage exploration (Miraclerecreation, 2023).

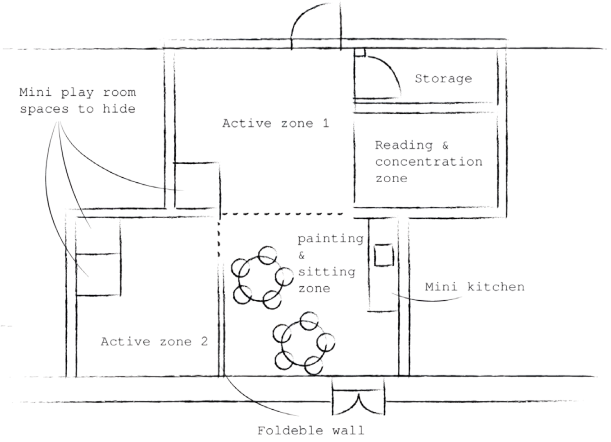
Can an environment provide too many or too few affordances? Finding the right amount of affordance is essential and challenging. Providing too many or too few affordances can negatively affect them, resulting in overstimulation and making them unable to engage with any options due to a lack of focus and concentration. On the other hand, if there are too few affordances, the child may be understimulated and become bored.

“A space is never finished; it rather functions like an organism.”

- Dziobek-Bepler, 2021, P. 19



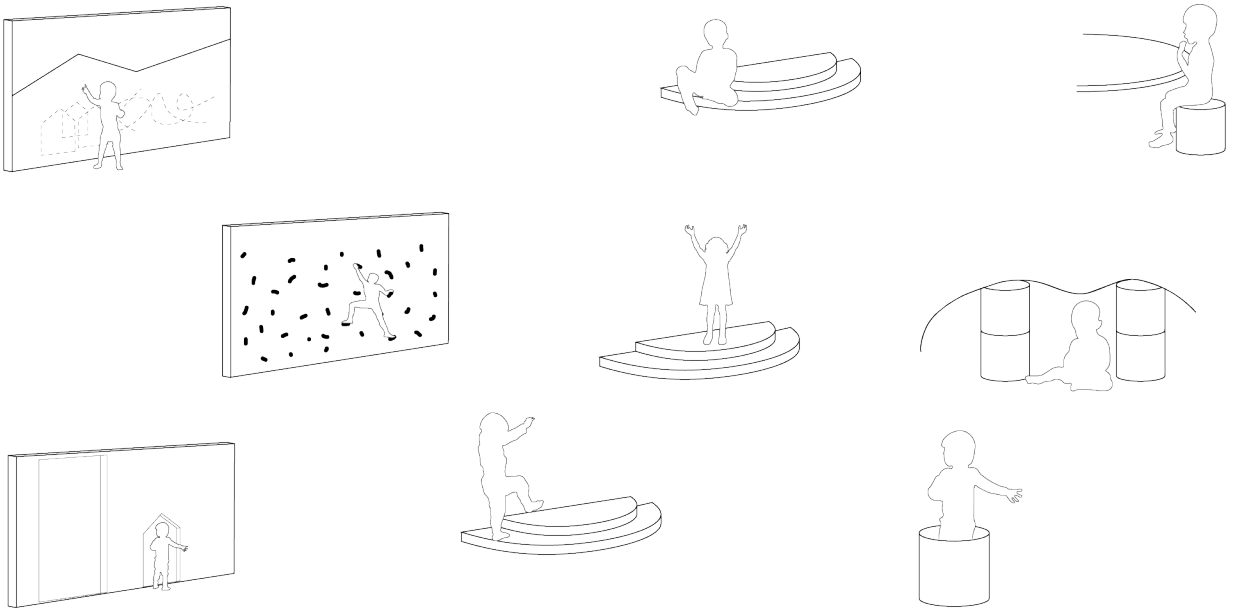
Ill. 29. Common area



Ill. 28. Group room

In making affordance and play environments more tangible, it has been categorized into the following two scales, macro, and micro, covering both the overall spatial layout and the architectural elements of the space.

At plan scale, the layout of the entire space can be designed to provide different types of affordances for learning and playing. For example, an open plan with clearly defined activity zones can provide various opportunities for different types of play in larger groups. A closed plan with clearly defined activity zones can enable calm play in smaller groups. (Dziobek-Bepler, 2021)



Ill. 30. Affordance provided by architectural elements

At the micro-scale, there is referred to individual architectural elements that can provide different affordances for play and learning. For example, lightweight furniture can easily be moved, allowing children to rearrange their environment and create their own play scenarios.

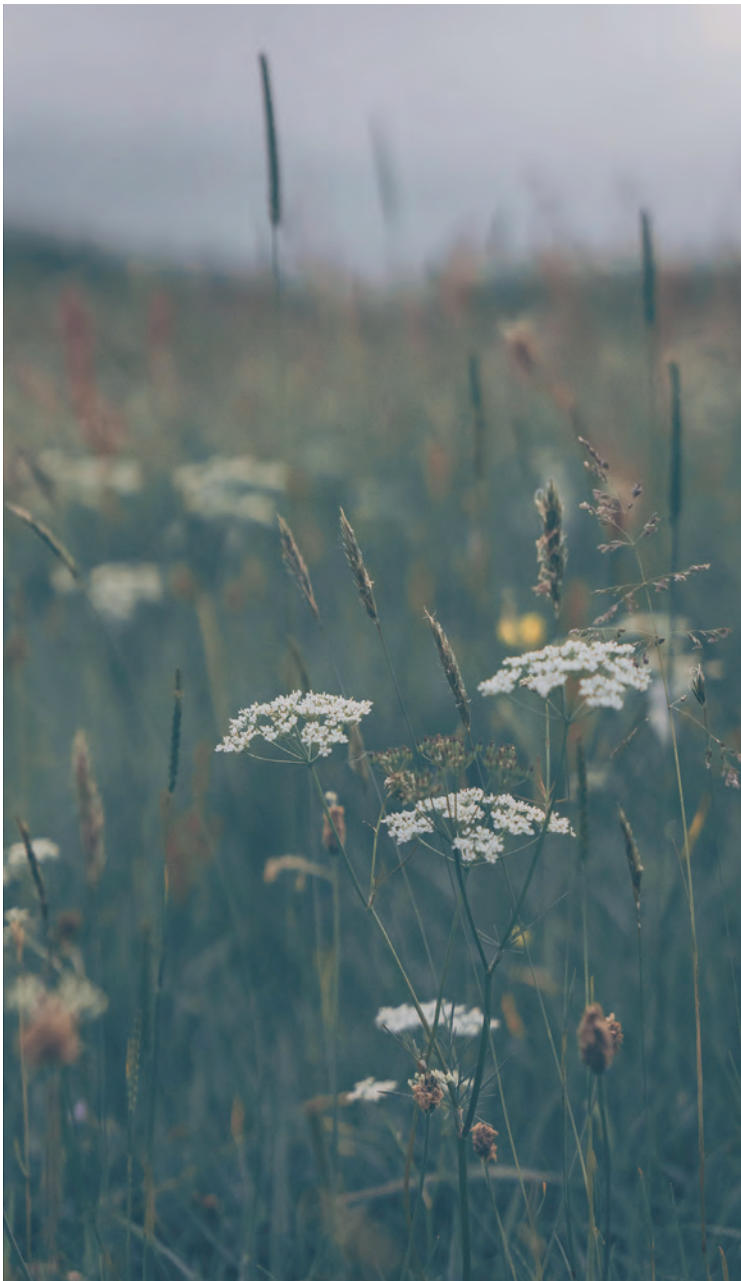
Spaces with built-in elements such as climbing, crawling, and jumping towers promote play in smaller groups only limited by their imagination. Walls can create interaction and play by offering drawing, hanging art, and movement through different holes and openings or simply a place to communicate guidance. (Dziobek-Bepler, 2021)

In both cases, the environment's design significantly impacts the play opportunities and the child's opportunities to explore and create their playful learning environment. Finding the "right balance" between the amount of affordances offered is crucial.

nature as catalyst for therapy

The exact influence that nature has on humans is hard to point out. The therapeutic qualities experienced through interactions with nature are supported by empirical evidence, which involves observing and registering changes under various circumstances (Gill,2014). Evidence-based studies indicate that interactions with nature can positively affect children with trauma, including stress reduction and improved mood. However, more specific details should be given regarding using nature as a treatment for this particular user group.

The practice of ecotherapy, which considers nature as a co-therapist, has become a more common practice among both children and adults. Nature can engage our senses, allowing us to immerse ourselves in the present moment fully. Nature therapy assists children in processing their trauma by utilizing metaphors with objects and forms discovered in the natural world. By engaging with nature, children can tap into their imagination and reenact their traumatic experiences in an alternative setting through role-playing. (Fischer, 2022)



In Israel, a program called ”A Safe Place” has been implemented in over 12,000 kindergartens and schools to help traumatized children. This program involves theater therapy in the forest, providing the child with a safe and expressive environment to express themselves and tap into their creativity and emotions freely. This approach recognizes nature’s capacity to facilitate healing, offering a therapeutic space where children can find comfort and explore their experiences in a supportive and nurturing manner. (Berger, 2016b)

The following section highlights how nature can be integrated into the architecture to create nurturing spaces that promote children’s development, learning, and play.

View to nature

Research demonstrates that observing nature positively impacts mood, stress reduction, and recovery. Within the first five minutes of viewing nature, a significant improvement in self-esteem and mood is observed. It stimulates the visual cortex to a greater extent than spaces with non-nature views, which can enhance concentration and facilitate stress recovery. (Barton & Pretty, 2010)

Access to biodiversity provided by the view should be considered, as greater diversity is preferable (Browning et al., 2014).

Dynamic and diffuse light

Using natural light compared to artificial light has proven to have positive effects, including various benefits that align with the natural view. Skylights and diffuse light connect to nature, giving a changing light during the day.

The spectrum of light can have varying effects on humans. Blue light, for instance, is known to stimulate the production of serotonin in the body, while the absence creates melatonin. These factors influence one’s quality of sleep and mood and even contribute to feelings of depression. (Kandel et al., 2013)

Incorporating specific architectural elements to enhance the utilization of natural light can include implementing dynamic lighting in transitional spaces between indoor and outdoor areas. Circadian lighting is recommended for rooms where occupants spend extended periods, as it positively impacts their well-being and overall experience. (Browning et al., 2014)

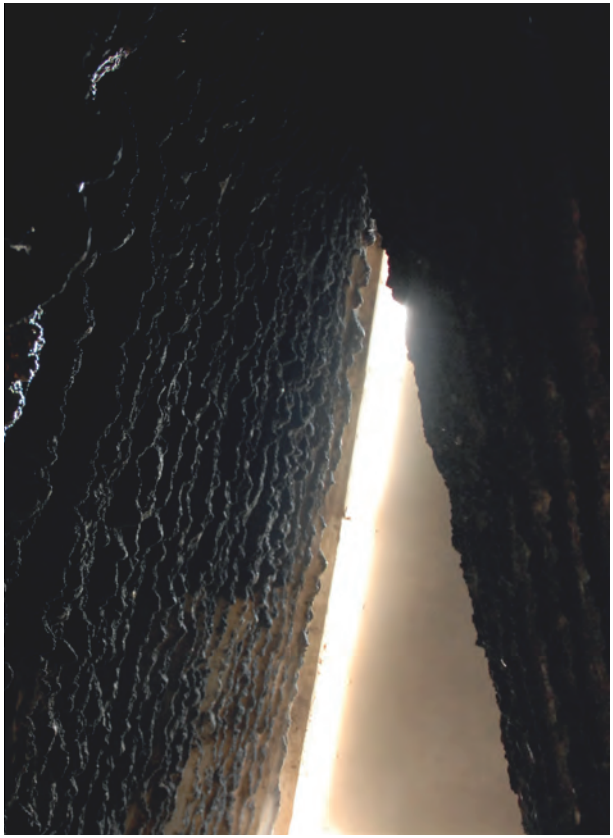
Ill. 31.

Material connections

Materials play a vital role in architectural design, significantly impacting the atmosphere of a space. Natural materials, like wood and stone, are commonly utilized in architecture but often processed or undergone treatment to analogize their natural form.

A study on the ratio of wood used on interior walls found that in rooms with 45 % coverage, changes in the physiological responses, such as decreased diastolic blood pressure and increased pulse rate (Tsunetsugu, Miyazaki & Sato, 2007). Indicating a relaxation response and heightened physiological stimuli, possibly due to increased interest or stimulation.

Several factors should be considered when integrating ”natural” materials, such as the appropriate quantity based on the room’s purpose and function. Rather than relying on a single dominant material, a diverse range of materials and prioritizing natural materials over synthetic alternatives is preferable. (Browning et al., 2014)



Ill. 32. Bruder Klaus Field Chapel, a landmark by Peter Zumthor known for its materiality and natural light. (seier+-seier, n.d.)

Biophilic design

In biophilic design, there are ”Three Pillars,” one of which is the ”Nature of Space.” The Nature of Space pillar focuses on incorporating natural spatial configurations into the design. These pillars involve incorporating patterns and elements inspired by nature into the space. The underlying principle evokes emotions such as fascination, curiosity, safety, and even a hint of fear.

The ”Nature of Space” concept can be implemented in several ways to enhance the overall architectural design by considering the building’s orientation and placement of corridors, allowing for views of activities and destinations, thereby creating a sense of openness and connectedness.

Refuge is a principle of the ”Nature of Space,” providing environments that facilitate engagement, comfort, and a deeper connection between humans and their surroundings. Refuge focuses on designing spaces that provide a sense of withdrawal and safety. These spaces have lower ceiling heights and are designed to offer a sense of security. In buildings with bigger volumes, it is beneficial to incorporate a variety of refuge spaces to cater to different individual needs. Interest in understanding and exploring environments and design elements such as rounded corners can gradually reveal that the space creates a smooth and immersive experience. Using shadows and shades can introduce dynamic and ever-changing qualities to a space. (Browning et al., 2014)

Design principles

Considering the specific needs of a child with trauma, the integration of nature is crucial. Utilizing natural materials and providing views of nature can contribute to a peaceful atmosphere, offering visual biodiversity and natural lighting. Such an environment has the potential to reduce stress, enhance learning opportunities and provide a range of spaces that offer a sense of security and opportunities for solitude. Creating comprehensible spaces that give children a clear overview of their surroundings further enhances their sense of safety and understanding.

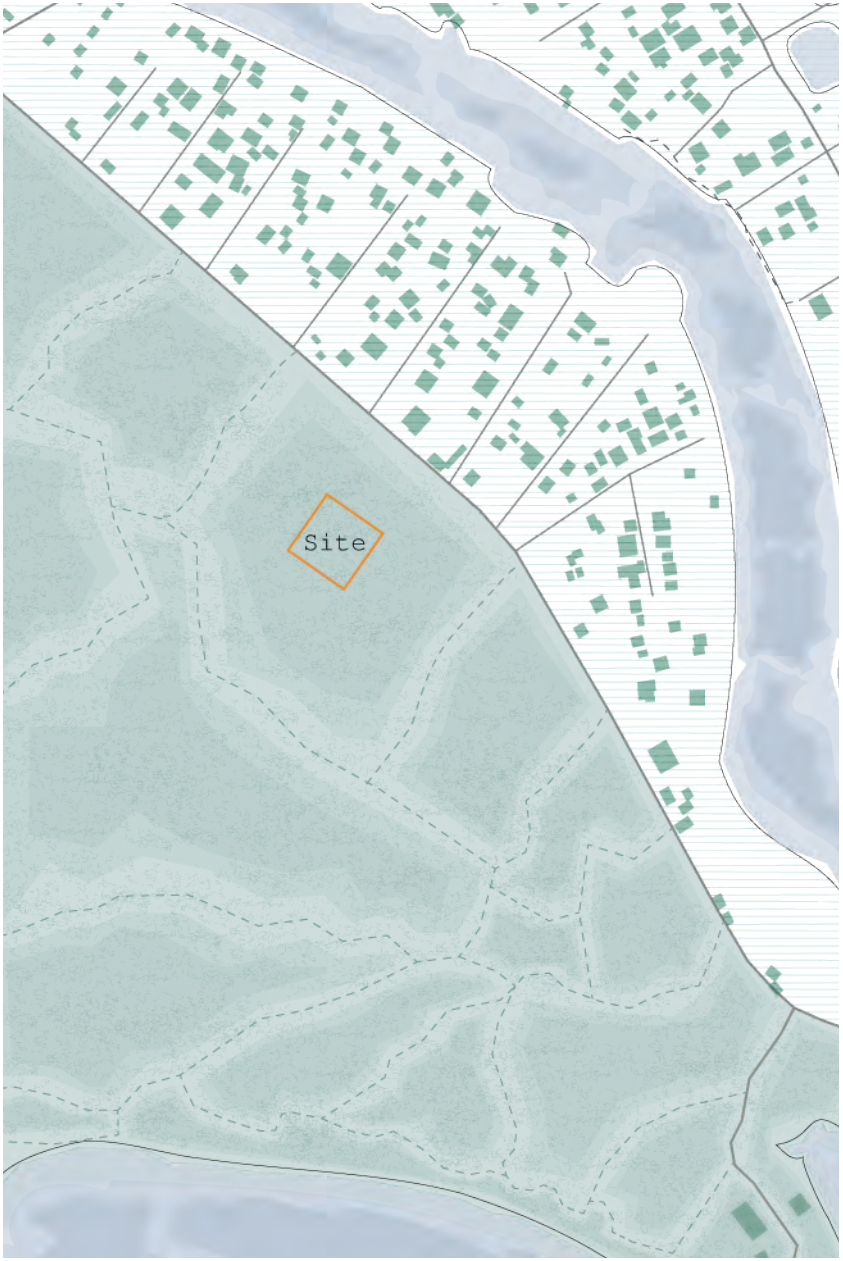
In this context, nature serves as the second therapist, complementing the supportive role of professionals in facilitating a nurturing and enriching environment for children.

Ill. 34. Mood of the site, representation

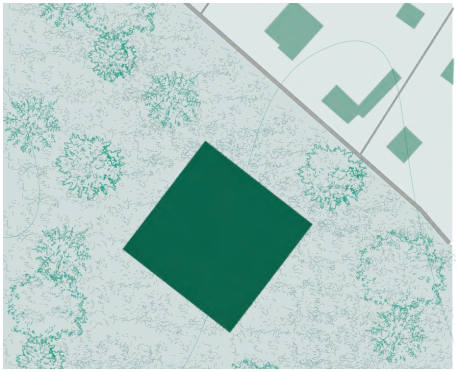
site

The site is located next to an urban residential neighborhood in a forest area, close to the Desenkar river. The houses near the site are all small houses up to two floors. The site provides a calm and peaceful environment for a kindergarten, with a remote location that is distant from the surrounding world.

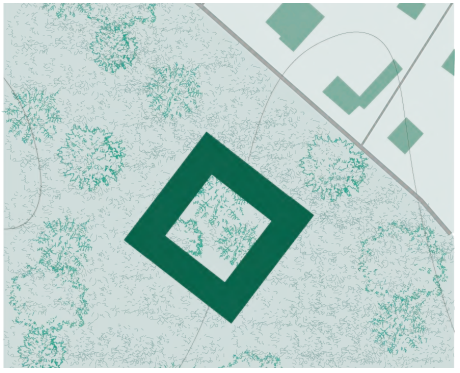
Ill. 33. Section of Site, 1:500



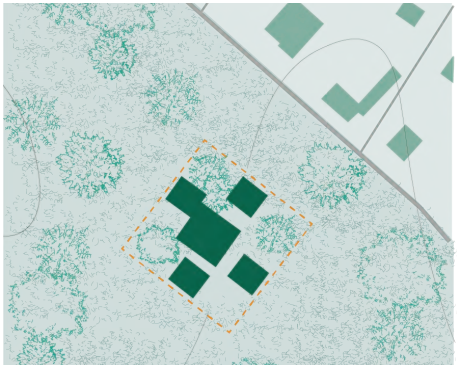
Ill. 35. Project site in Kyiv, 1:5000



Building in nature

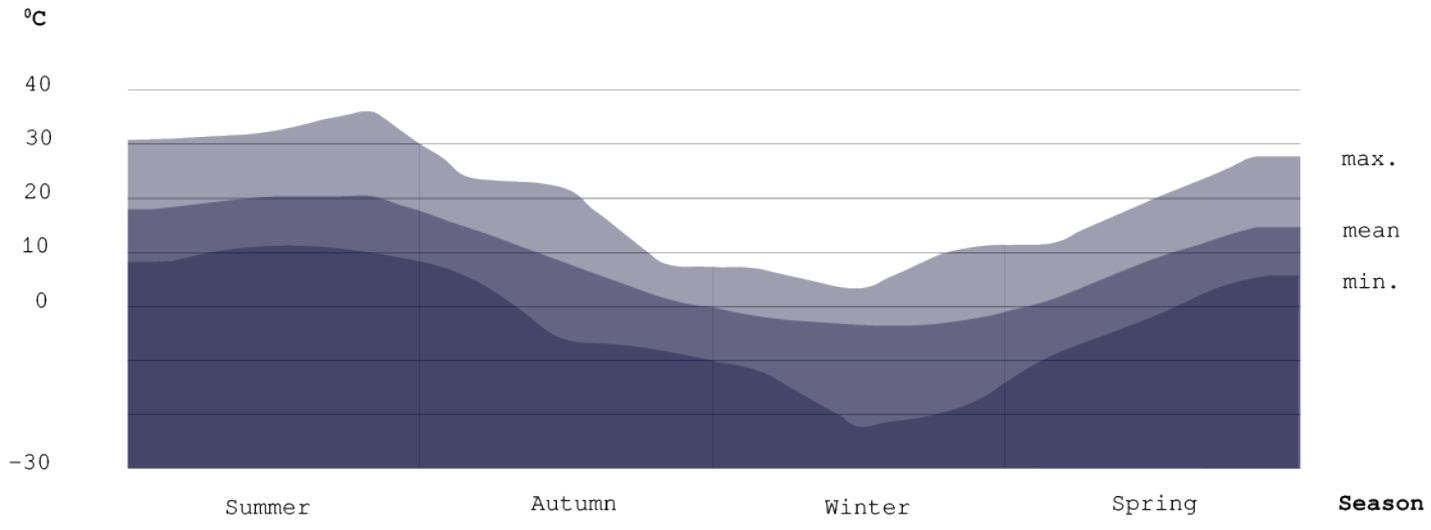


Building around nature



Building with nature

Ill. 36. Early iterations

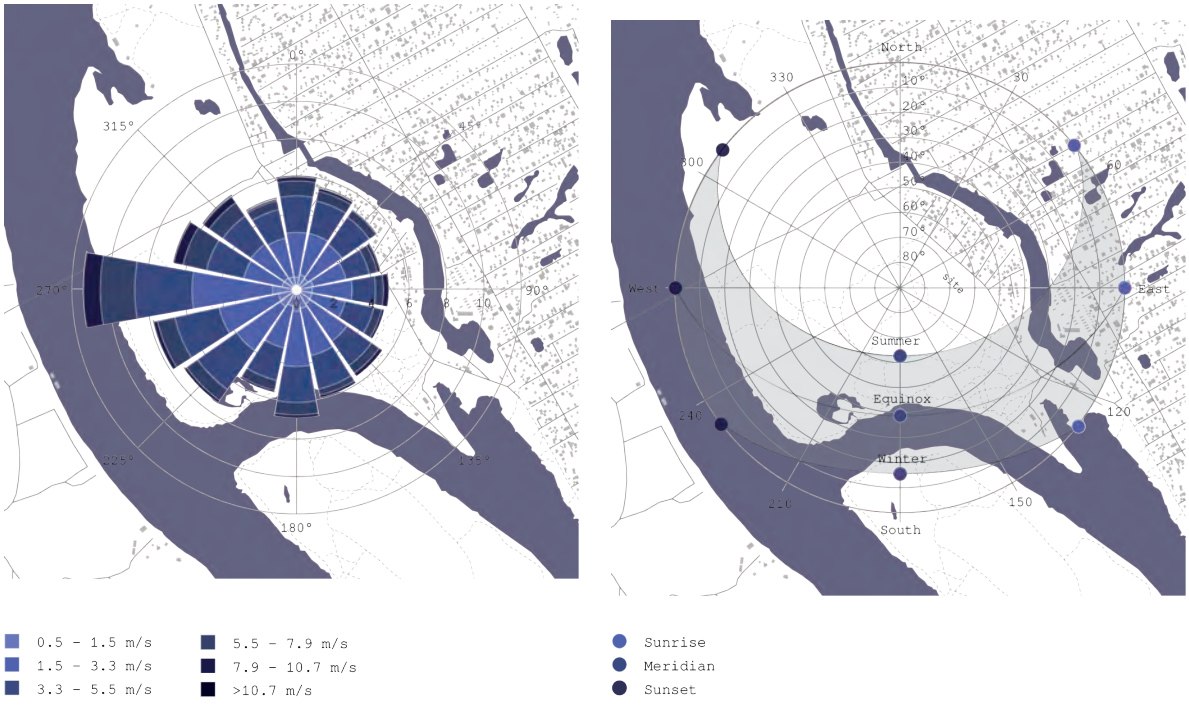


Ill. 37. Temperature profile

microclimate

Kyiv falls under the humid continental climate (Dfb) category according to The Köppen climate classification, which experiences four distinct seasons. Significant temperature variations exist between seasons, with summers being warm to hot and often humid and winters being cold, with average temperatures below 0 C during the coldest months. In addition, the Dfb climate is characterized by a lack of dry seasons and warm summers, with an average temperature below 22 C in the warmest month.

The temperature profile in Kyiv indicates an average temperature of 20 C during summer and −3 C during winter (Betti, 2020). Designing for a continental climate requires seasonal strategies that keep the buildings warm in the winter months when temperatures drop below freezing point and prevent overheating during the summer months.



Ill. 38. Wind rose and sun path

Wind

The wind in Kyiv can be analyzed using wind rose diagrams, which indicate that the wind from the south and west directions is the most bothersome. However, the wind rarely exceeds a fresh to moderate breeze. (Betti, 2020)

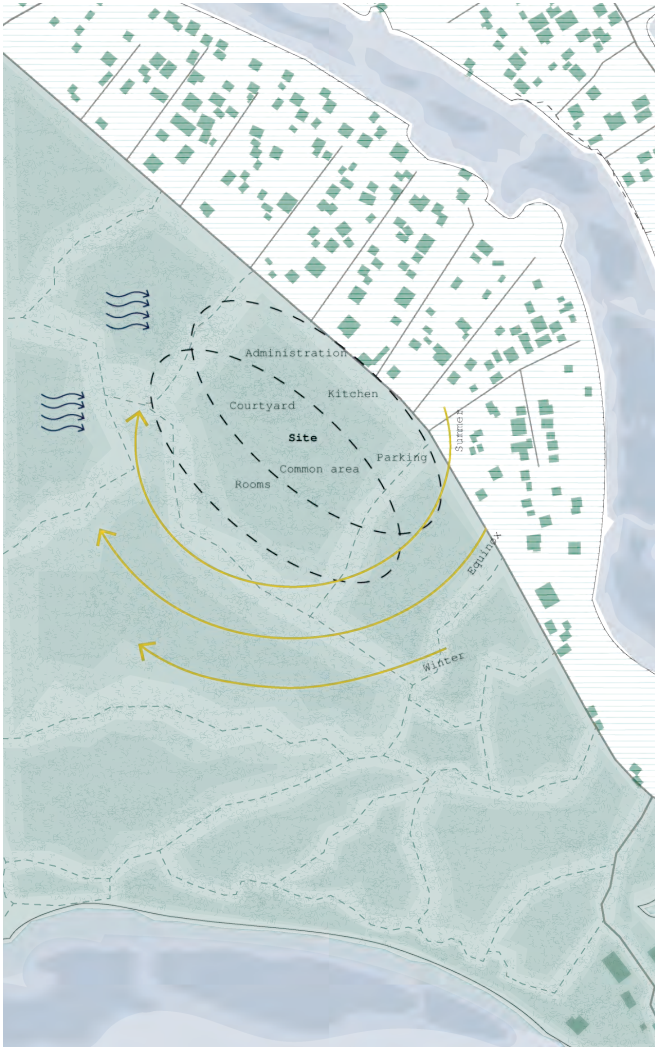
Sun path

The sun’s altitude at noon varies between 16o in the winter months to 63o during summer in Kyiv. The sunrise occurs at 07:55 on the shortest day in winter and at 04:46 on the longest day in summer. The sundown is at 15:56 on the shortest day in winter and at 21:13 on the longest day in summer. (Tukiainen, M, nd) Due to the low altitude angle and the limited sun hours in the colder months, achieving passive solar heat gain during winter is challenging. On the other hand, the sun is set at the perfect altitude to get passive solar heat gain in the warmer months, although it is not needed as much.

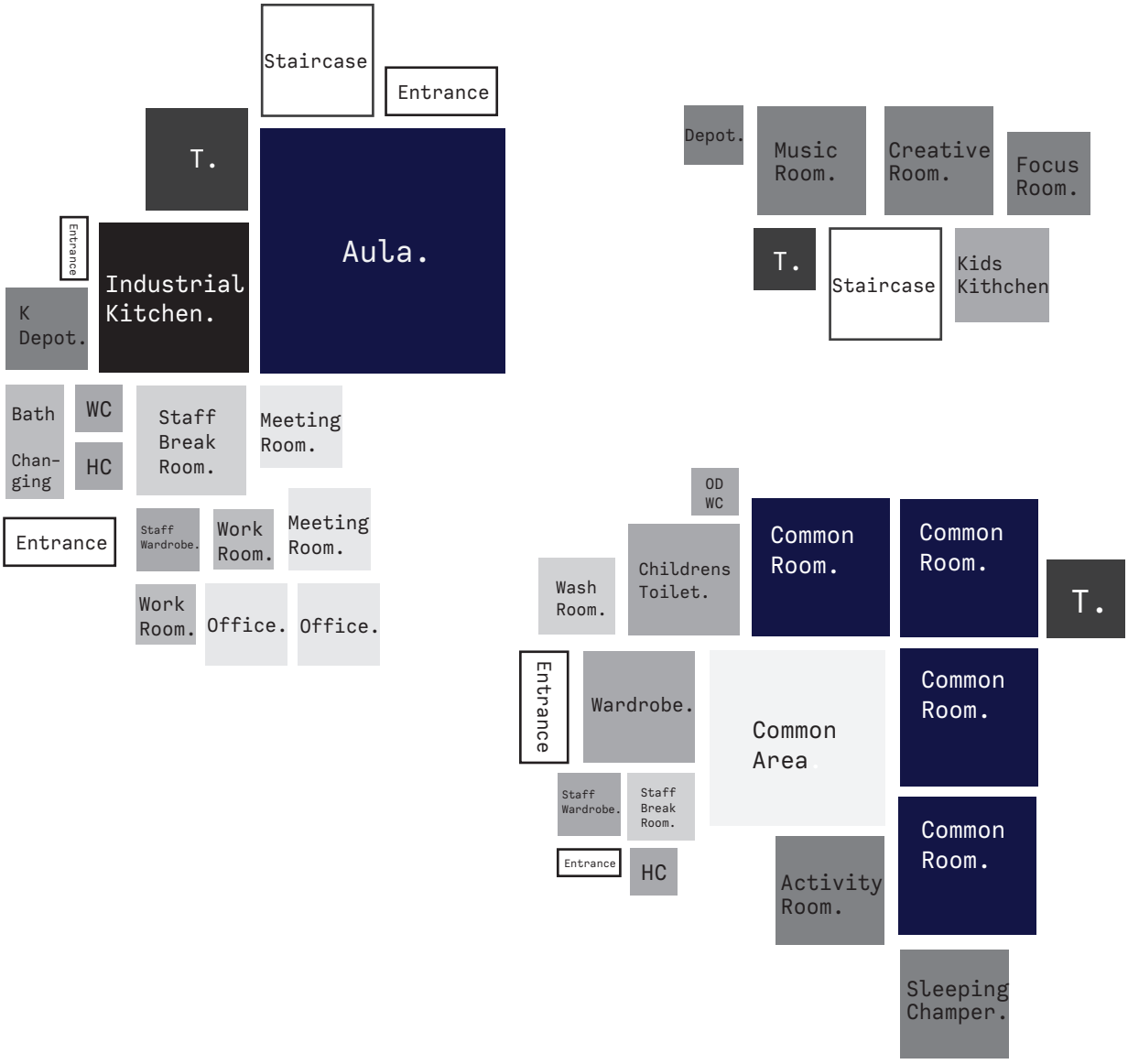
To narrow down the design scope this thesis focuses on implementing passive strategy principles in the design. As window placement and orientation significantly impact passive solar heat gain in the winter months, overheating in the summer months, and daylight, ventilation, and visual comfort. The windows will be positioned in the most optimal way to achieve the best design and user experience while considering these factors.

In order to maintain a comfortable indoor temperature during winter months in a continental climate, it is crucial to have an airtight envelope with a significant amount of insulation, materials with high thermal mass, and passive solar gain. On the other hand, solar shading and proper ventilation systems are essential to prevent overheating during the summer months.

Natural ventilation provides the user control over the indoor environment, as it can be necessary to air out the room quickly in case of accidents such as vomiting. All rooms will be designed with cross-ventilation or stack ventilation when enabling optimal natural ventilation opportunities



Ill. 39. Microclimate design principles



Ill. 40. Function diagram

Room	Number (	m2	Occupants
Cluster			
Group room	12	45	17
Children toilet	6	17	4
Wardrobe	3	35	15
Common area	3	50	30
Staff break room	3	16	8
Staff wardrope	3	7	2
Staff Toilet	3	5	1
Wash room	3	8	1
Tech	3	15	
Sleeping chamber	3	25	15
Motion room	3	15	17
Depot	6	6	
Hallway	3	100	
Outdoor toilet	3	6	2
Main Building			
Aula	1	200	130
Music Room	1	25	17
Cream Room	1	25	17
Focus Room	1	15	10
Children toilet	1	18	4
Wash room	1	8	1
Children Kitchen	1	15	17
Staff common room	1	45	33
Staff Wardope	1	10	2
Staff toilet	1	8	1
Changing room	1	4	1
Bathroom	1	2	1
Office	3	10	1-2
Work room	2	15	2
Child psykologist	1	15	3
Industrial Kitchen	1	75	3
Kitchen depot	1	12	
Tech	1	20	
Hallway	1	150	

Children	Number
Number of clusters	3
Gruops per cluster	4
Number of children per gruop	15
Total number of children	180

Employees	Number
Caretaker per gruop	2
Number of caretakers per cluster	8
Kitchen staff	3
Child psykologist	1
Adminitrative workers	3
Total number of employees	33

Ill. 41. Room program

problem statement

How can we repurpose the waste from the war and create an enriching physical environment for children, which not only nurtures their development but also establishes a way to process their trauma to shape a brighter future?

vision

As you make a turn on the road, you discover the breathtaking forest. As you move deeper into the forest, you are pleasantly surprised by the calming effect of nature; at that moment, you catch a glimpse of the kindergarten.
Upon your arrival at the kindergarten, you are greeted by the rough yet colorful concrete building that sits gently on the grass among the trees. As you walk into the building, the palm of your hand touches the textured surface of the concrete wall that transitions into a wooden wall.

While you explore the building, you encounter a variety of spaces, each radiating a bright and peaceful atmosphere through natural materials that reflect the outdoor nature, accompanied by the melody of children's laughter and playful activities resonating through the space. It is clear that the kindergarten is designed to care for each child's individual needs, including those who require extra care, as it provides an enriching environment that supports children that have experienced distressing events. You notice an environment where children's development is nurtured by letting them unfold themselves through exploration and play.

You see how multiple types of spaces are present. All developed around the principles of spaces within a space. You experience the various opportunities that are provided for play in small, open, quiet, and energetic spaces within all the rooms. You feel a shiver of excitement as you realize each element's endless opportunities in architecture.
As you leave, a sprout of hope grows inside you, as you feel optimistic about the future, knowing that long-term mental health solutions are offered for those affected by a disaster.

design criteria

Expression and Monumentality
The building should stand out from its natural surroundings and rethink the concept of monumental architecture in Ukraine. By incorporating various architectural features inspired by different periods of Ukraine's architectural history.

Sustainable Material Use
Recycled concrete is the primary building material for the design to reduce waste and minimize the depletion of scarce resources.

Child-Centric Design
The design should focus on creating diverse spatial experiences within the same space to stimulate a child's imagination and promote physical, psychological, and emotional development. It should provide opportunities for multiple actions and encourages interactive learning.

Trauma-Informed Design
The architectural layout considers the needs of traumatized children. The flow of spaces, both internal and external, is designed to be easily understandable and calming.

Staff Facilities:
The kindergarten should include dedicated spaces for employees, including break areas and administrative workspaces. Each cluster should provide a private entrance and wardrobe separate from the children's area, ensuring privacy and convenience for the staff.

Integration with Nature:
The group rooms should offer uninterrupted views of the surrounding nature, providing a biodiverse and engaging environment for the children. All indoor spaces should be designed with circadian lighting, connecting with the natural rhythm of daylight.

Aula:
The project should incorporate a spacious aula that allows for larger gatherings. With a higher ceiling, accommodating up to 120 children dining simultaneously is a central space for communal activities.

Design process

Part two

Ill. 42. Collage og sketches

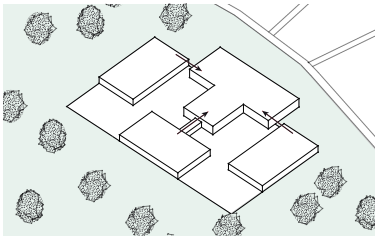
introduction

The design process involves organizing chaos and culminates various ideas and thoughts. The iterations presented in the following section represent a fraction of the development, showcasing different concepts and explorations. The process is structured and presented, starting from a larger scale and gradually progressing toward the finer details. The presented material contains ideas and thoughts as well as iterations of the different aspects investigated where one or more have influenced the design.

form & layout

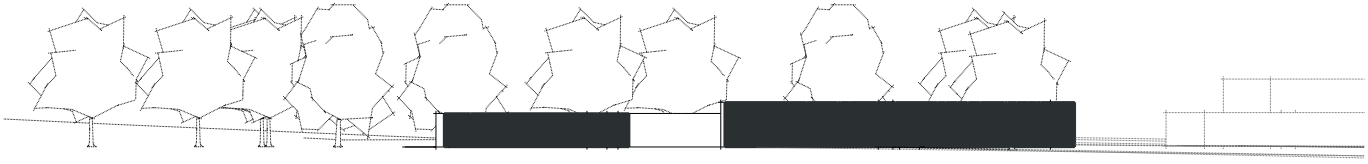
EVALUATION CRITERIA

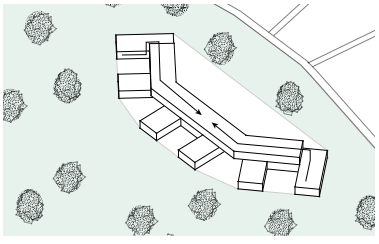
Relation to nature: View to nature
Connection of buildings: The distance between the clusters and the main building and the need to go outside to go inside
Safety: The buildings ability to define inner outdoor spaces
Spaces between buildings: The quality in the sense of variety and the quantity in relation to the different clusters
The child's view: The child's visually overview to outdoor spaces and buildings



The design allows for easy connection to the main building, ensuring smooth access and movement. A variety of spaces are available, enabling different uses and functions while the outdoors is designed so it facilitates easy orientation.

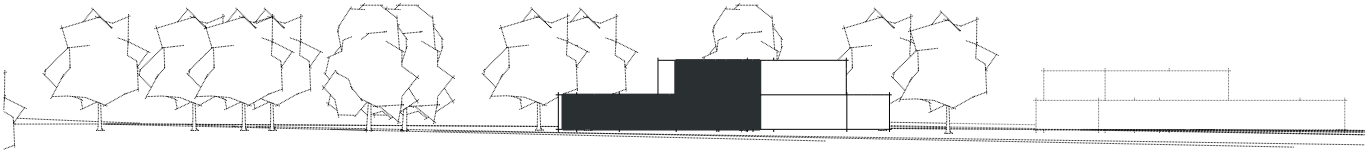
The buildings have only one facade each towards the courtyard, restricting access to nature from certain areas. The outdoor area is divided into two spaces, creating an awkward barrier that disrupts the flow and cohesion of the overall space.

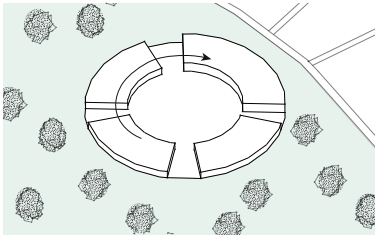




This architectural design provides a great variety of views to nature, with walls positioned at different angles. The design includes indoor connections to all rooms within the volume. Children easily understand the smaller spaces.

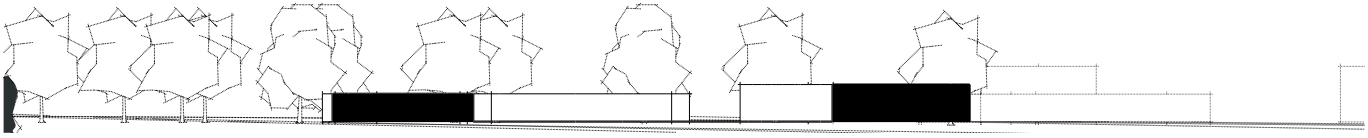
Staff rooms and the industrial kitchen is upstairs, which is inconvenient. It lacks exciting and diverse spaces, and in some spaces, the view to nature is obstructed by the building's volume. The layout limits the natural barrier.

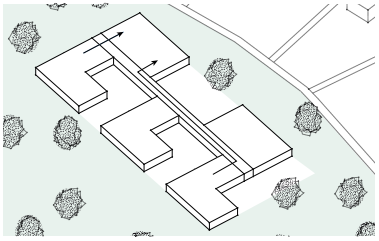




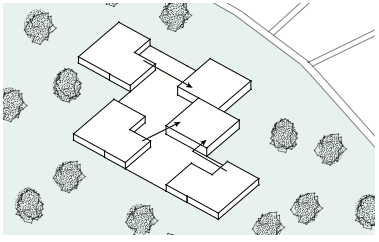
This architectural design strongly connects to nature, framing nature in multiple rooms. The space includes a protective volume surrounding the area. Navigation within the space is easy, with views available in all directions.

There needs to be more variety of spaces, as there is only one central area. The connection between buildings is distant and lacks an indoor solution. For children, the unobstructed view of a large space may be intimidating.

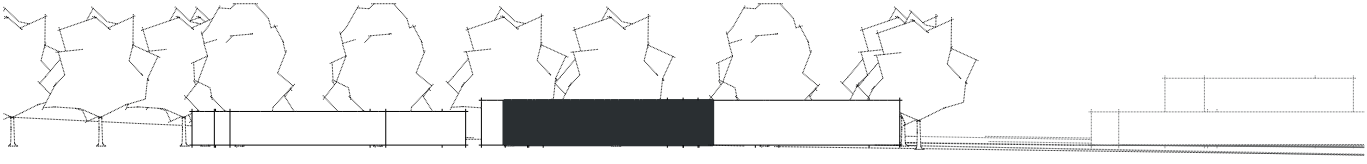




This architectural layout has good indoor connections, views of nature, and good overviews in individual spaces. However, there is a long distance from one end of the building to the other, and outdoor spaces need to be connected.



This design includes good views of nature, a variety of well-connected outdoor spaces, and comprehensible navigation due to the abundance of open spaces. However, the connection to the main building varies between clusters and may only be optimal in some cases. Additionally, while there is some protection of the inner courtyard, it may not be the most effective solution.

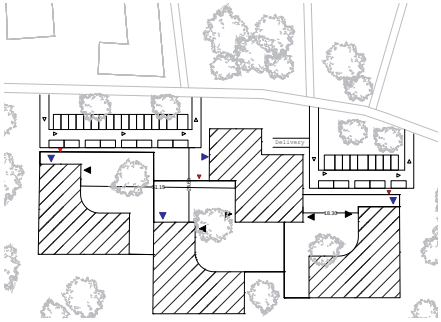


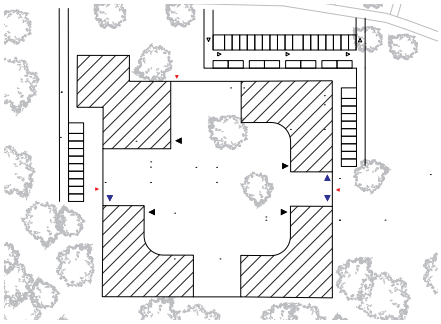
CHOSEN FORM

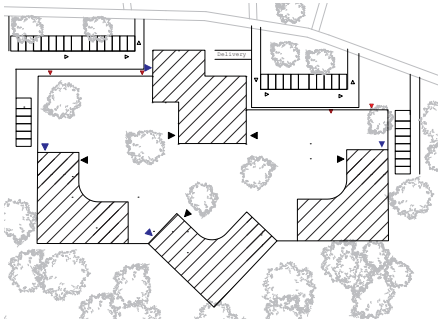
Ill. 43. Section and isometric view of the five design proposals

connection between buildings

CHOSEN LAYOUT







- Access to the kindergarten
- Staff entrance
- Childrens entrance
- Physical division of the courtyard

Scale: 1:2500

Ill. 44. Three iterations of building layout

EVALUATION CRITERIA

Flow to the main building: Flow between the main building and the clusters should be convenient and maintain a short distance.

Parents scenario: Parents should be able to safely escort their children to the individual clusters and navigate the area quickly.

Caretakers entrance: The entrance to the staff area should maintain a certain distance from the main entrance to give the caretakers privacy.

Iteration 1

When considering the layout, it is important to keep in mind the proximity of the main building to the smaller clusters. The small spaces between the clusters can make movement more convenient for everyone. The path to the different clusters from the parking area involve taking three different routes.

Iteration 2

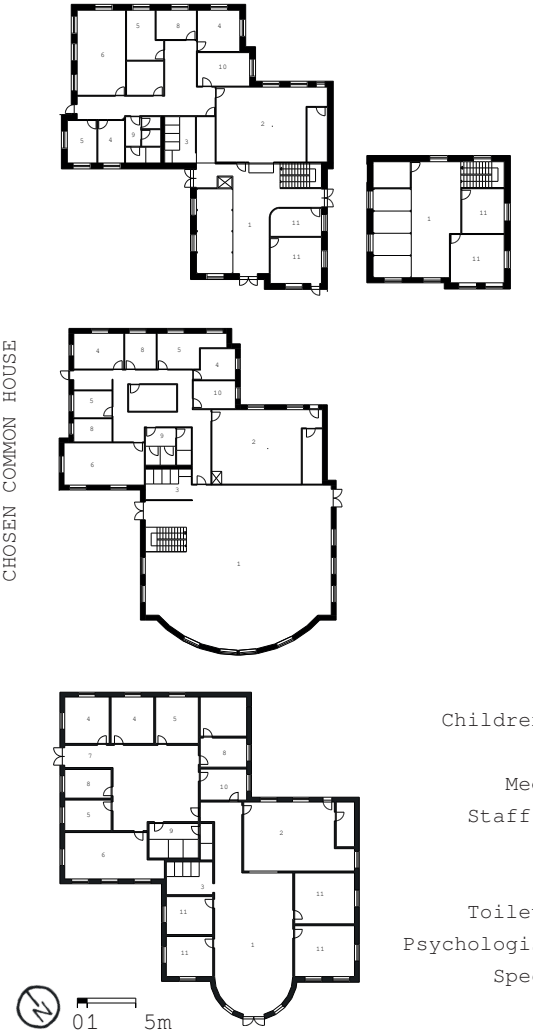
The space is easy to comprehend and navigate in while having protective properties that provide a safe environment. The clusters block the view of nature from the main building. One of the clusters is turned towards the road.

Iteration 3

The clusters provide a view of nature and a good overview of the surroundings from the courtyard. The main building's view of nature is interrupted by the clusters. The buildings lacking a natural separation of the outdoor area.

common house

CHOSEN COMMON HOUSE



Aula :1
Kitchen :2
Children's toilet :3
Office :4
Meeting room :5
Staff breakroom :6
Wardrobe :7
Work room :8
Toilet and bath :9
Psychologist office :10
Special room :11

EVALUATION CRITERIA

The identity of the aula: Making sure the aulas purpose and functions stand clear in the plan layout.
Separation of sectors: The administrative department should be separated from the children's space in the main building.
Spaces within a space: The aula should provide versatile use in different scales.

Iteration 1
This iteration includes a condensed hallway area, a meaningful composition of the staff area, and an exciting and playful outer shape. The aula resembles more a canteen than an aula, and its definition is still unclear. The presence of two floors limits the possibility of having a high ceiling in the aula.

Iteration 2
This design has a spacious aula that provides space for various activities and good access for outdoor flow. The initial plan needed to account for a second floor, which would have been ideal for accommodating creative and unique rooms. There is an unnecessary hallway that should be utilized more efficiently.

Iteration 3
This building has comprehensible plan solutions with a one-way flow and the absence of a first floor. However, the aula is small and undefined, lacking the feeling of a true aula, and the middle hallway section in the staff area needs to be bigger and more appropriate.

Ill. 45. Three iterations of the common house

EVALUATION CRITERIA

View to nature: Group rooms placed toward the nature

Flow: Flow between the Entrance, Toilets, Common areas, and group rooms must be meaningful.

Common area function: The common area should create opportunities for a variety of play opportunities and should not serve as a transition space.

Caretakers area: Caretakers should have their own space with a separate entrance

Iteration 1

This design includes a well-defined and easily understandable common area. The layout allows for efficient utilization. The dynamic hallway offers opportunities to incorporate interactive elements. A lack of restrooms near the entrance is inconvenient and the entrance to the group rooms are hidden.

Iteration 2

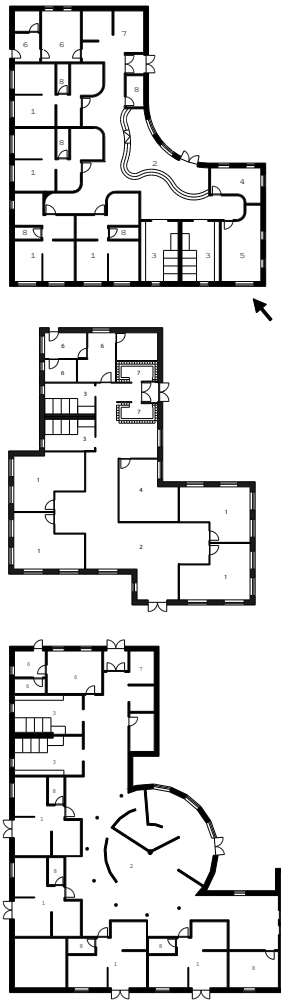
This layout emphasizes the concept of spaces within a space dividing the common area into various smaller spaces. The group rooms are positioned on either side of the central common area. The Common area limits the opportunity for larger gatherings.

Iteration 3

The large outer wall surface in the common rooms, giving direct view to the common area from the entrance. However, the common area is unnecessarily large, lacking curved corners to soften the expression. The placement of columns in the common area appear out of place.

cluster layout

CHOSEN CLOSTER LAYOUT



1: Room
2: Common area
3: Children’s toilet
4: Motoric room
5: Sleeping chamber
6: Staff area
7: Wardrobe8: Storage

0 1

Ill. 46. Three iterations of the cluster

daylight - common area

Ill. 47. Three daylight simulations and layout of windows

The minimum daylight requirement is 2,1 % in minimum half the netpoints in the room in a 0,5 * 0,5 m grit. The first 0,5 m from the walls are not included in the result. (Build, 2018) Our goal is to reach a daylight factor of 3-5 % to achieve a comfortable indoor environment.

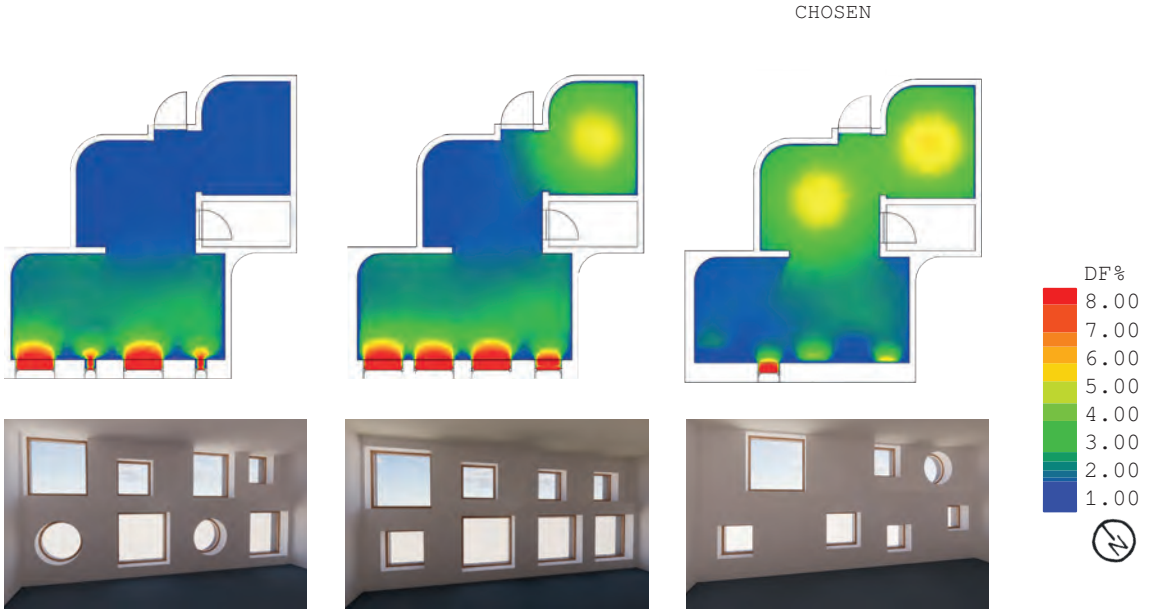
Common area
The following analysis with the facade windows as a constant, the skylight is the changing factor in this simulation.

Iteration 1
The daylight simulation illustrates that the windows in the facade are not enough to meet the requirements, primarily the entrance area and the inner corners.

Iteration 2
In the second simulation, a larger skylight was installed, significantly increasing the amount of light in the common room. The red color indicates a daylight factor of 8% or higher.

Iteration 3
Round skylights are installed in areas where the first simulation indicated insufficient light. The results demonstrate that the skylights effectively reach the daylight factor of 3-4%.

daylight - group room



Ill. 48. Three daylight simulations and layout of windows in rooms

In this daylight analysis both the skylight and the facade differ in all three iterations.

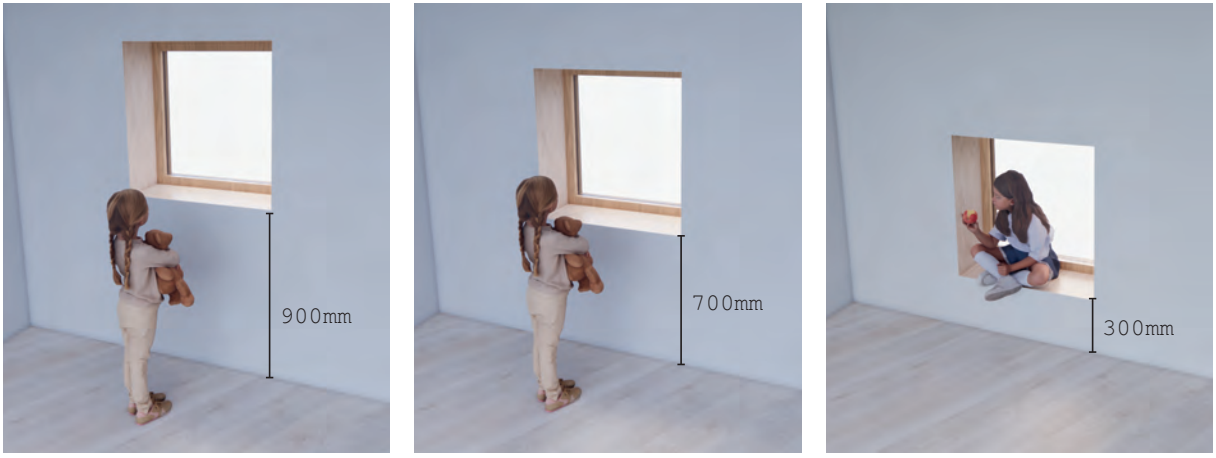
Iteration 1
The analysis reveals that the inner spaces of the room experience limited daylight, with only 2-3% of daylight reaching approximately half of the room.

Iteration 2
In the second simulation, the windows are strategically positioned with larger frames, resulting in improved natural light from the facade. Additionally, including a skylight window partially resolves the issue of inadequate daylight in the room.

Iteration 3
Smaller windows are tested in the facade, leading to inadequate light penetration from the exterior. However, the two skylights prove to be effective in providing an adequate amount of light in the inner part of the room, with a maximum of 5% daylight factor.

the affordance of windows

CHOSEN WINDOW HEIGHT



Ill. 49. Three options for window placement

The placement of windows significantly affects the amount of light, ventilation, and view provided. When designing for children, the height of the windows becomes crucial as it can offer different opportunities for interaction. Standard window height challenges children to look outside or utilize the window for various purposes. By placing windows at standing and sitting heights proportional to a child, access to the view is facilitated. To accommodate a wide range of user groups and enable diverse activities, windows with a height of approximately 300 mm are utilized.

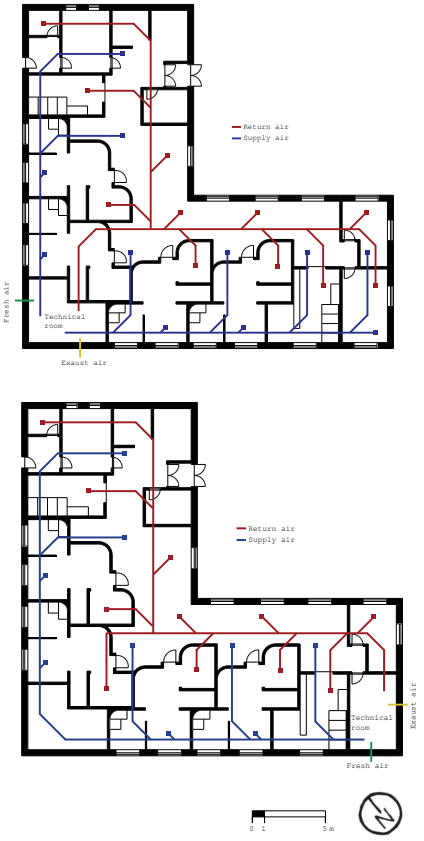
ventilation

Natural ventilation

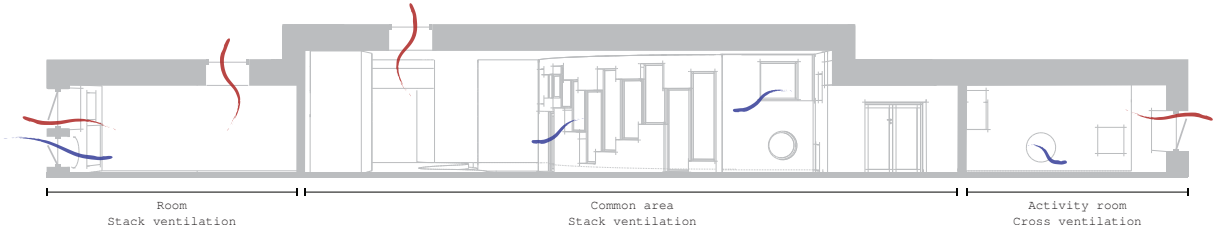
The building has prioritized natural ventilation from its early stages, recognizing its benefits in providing users with control over the indoor environment. Principles such as stack and cross ventilation have been incorporated into the initial design concept, guiding the layout of different rooms as depicted.

Mechanical ventilation

The iterations are designed based on the principle of a central variable air volume (VAV) aggregate that supplies the entire cluster. The placement of the technical room in the center of the building and the corner is explored in the iterations. When locating the aggregate, the power requirements are determined by the distance to the air supplier located furthest away. Placing the aggregate in a central position of the building is considered the most practical approach.



Ill. 50. Two mechanical ventilation solution



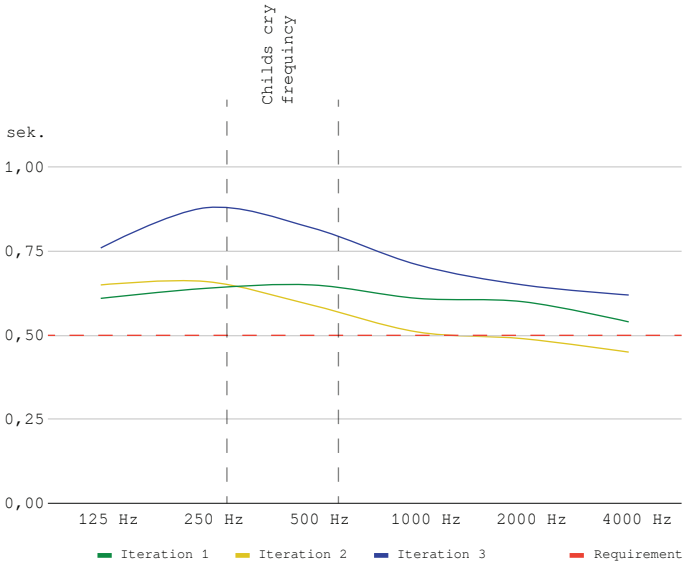
Ill. 51. Natural ventilation principles

acoustic

CHOSEN MATERIALS

Ill. 52. Three material studies

None of the results give the desired outcome, although iteration 2 meets the higher frequencies' requirements. The required reverberation time for group rooms is 0.4 seconds, while other rooms generally require 0.5 seconds (Ecophan, 2018). Iteration 2 performs better in the higher frequencies, while iteration 1 achieves better results in the lower frequencies. This is because acoustic plates are effective in capturing high frequencies, whereas plywood is effective in capturing lower frequencies. It is worth noting that an infant's cry typically falls within the range of 300-600 Hz but can reach up to 80 kHz (Doi et al., 2019). Considering the room volume of approximately 500 m3 used for these iterations in the common area, the results are decent, with a focus on prioritizing the higher frequencies.



Ill. 53. reverberation time

why recycle concrete?

During the initial stages, specifically the problem and analysis phase, extensive research was conducted on concrete to understand its potential and limitations as a material in the design process.

In regions affected by disasters, the lack of proper management of building waste can lead to the following consequences:

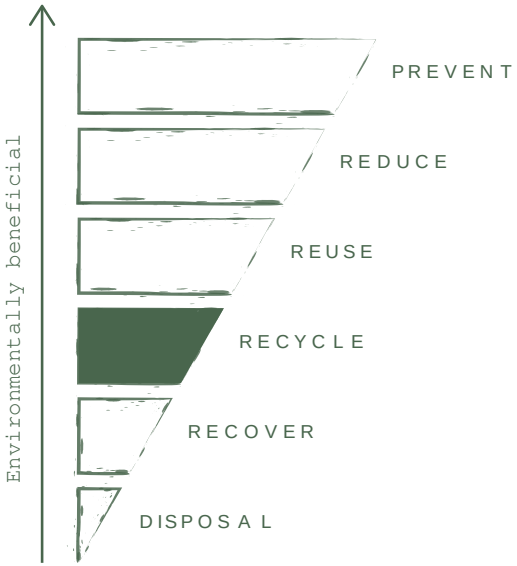
- Waste piles accumulating and polluting urban areas

- Waste collection and disposal systems under stress

- Problem maintaining public sanitation and hygiene

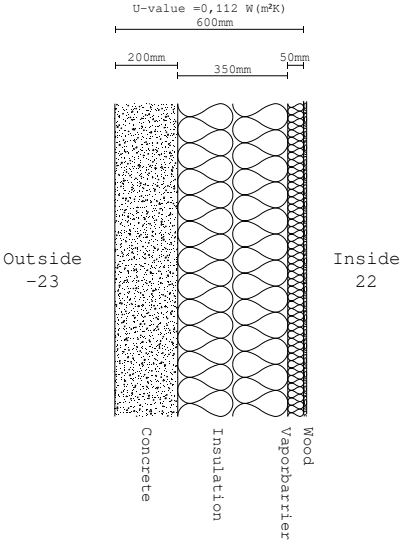
- Lack of space to handle debris materials

(MTPTC,a 2011)

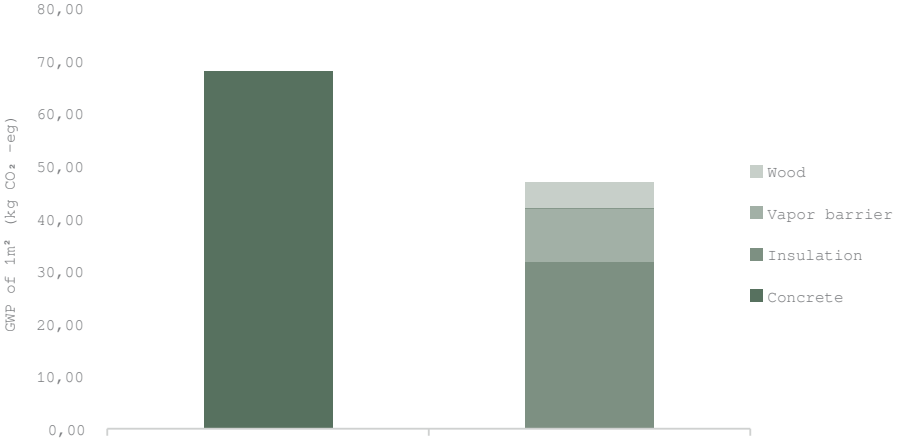


Ill. 54. Zero waste principles time

materials and emissions



Ill. 56. Construction



Ill. 55. Emission

Concrete vs other materials

Concrete is recognized for its relatively high emissions compared to other building materials. To assess the difference, a calculation is provided based on the depicted construction. The calculation incorporates the following data: 400 mm hemp insulation and interior wood material. Regarding transportation, the values assumed are as follows: concrete, is transported at a distance of 25 km via train. In comparison, the transportation distance for other materials is 50 km by truck.

In this example, the environmental emission impact of concrete in the construction is greater than the combined impact of the other building materials. However, the other materials are transported from a distance twice as far. This highlights the significant environmental impact of concrete and underscores the importance of exploring recycling and reuse options for this material. Concrete's durability and widespread availability make it crucial to consider sustainable practices in its usage.

concrete aesthetics

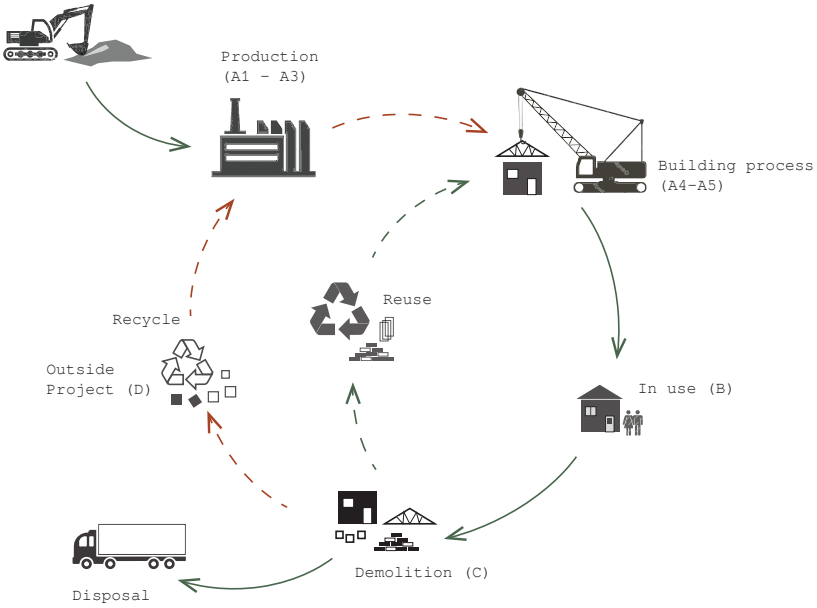
Concrete is a material with many labels. Despite the reputation concrete is also a moldable material that comes with a lot of different opportunities. Forms, shapes, colors and textures can be adjusted to give the wished expression.

Concrete is often associated with certain labels, but it is essential to recognize that it is a versatile material with a range of possibilities. Beyond its reputation, concrete offers numerous opportunities for customization. It can be molded into various forms, shapes, colors, and textures to achieve the desired aesthetic expression.These three iterations show some of the opportunities concrete creates and considerations of the expression the facade could take.

Curved and geometric shapes are considered to appear softer. Organic forms and small staircases integrated into the building in different ways give the facade a playful and lively exterior and new affordances. By raising the building a lighter expression can be achieved. The three iterations visualize different textures that can give the concrete a warmer and softer appearance. Different colors have been considered, such as earth tones, and stronger colors, such as red and blue, have been discussed.

Ill. 57. Facade sudies

conventional vs recycled concrete



Ill. 58. LCA diagram

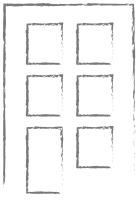
Two distinct scenarios have been formulated based on differing assumptions, one relating to recycled concrete and the other to conventional concrete. The primary emphasis of these scenarios is on the transportation of assorted materials, as the production procedures are identical, and the emissions are equivalent due to the requirement of cement in both instances.

Concrete mixing ratio
The concrete mixing ratio used is 1:2:3 (cement: sand: aggregate);
Consumption per m3 of concrete: maximum water (l), 170, cement (kg): 300, sand (kg): 680, Stone (kg) 1180, Concrete mix (m3): 1.1 (concrete mix contains approximately 50% stone).
To gain the concrete type (MPa) C30/37

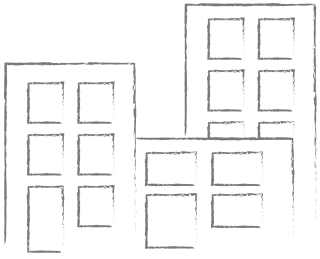
Scenario 1: Recycled concrete
When calculating recycled concrete, the recycling ratio covers 50% of the sand and 100% stone in the mixture. The recycled concrete is assumed to be transported by truck to the factory.

Scenario 2: Conventional
When calculating conventional concrete, it is assumed that the gravel and sand pit is located 50 km from the concrete factory, and the material is transported by train.

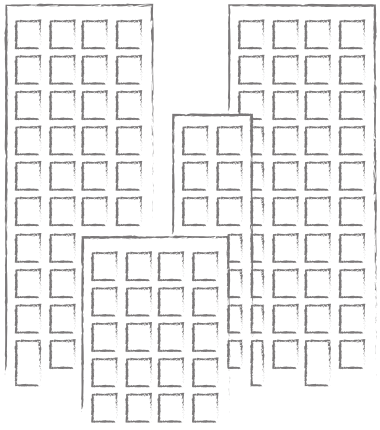
environmental impact



1000 m³ concrete
70 kg emission
1860 tons natural resources



1.000.000 m³ concrete
70 tons emission
1.860.000 tons
natural resources



1000 m³ concrete
350 kg emission
9.300.000 tons
natural resources

Ill. 59. LCA results

Based on the provided factors, it has been determined that recycling concrete can yield a significant reduction of approximately 70 kg of emissions for a building measuring 1000 m³. Furthermore, this process has the added benefit of conserving 1.8 thousand tons of sand and stone.

Larger amount

The impact of recycling concrete may not seem significant when considering the emissions and resources for just one building. However, when scaled up for the rebuilding efforts in Ukraine, the impact becomes much greater. For every one million m³ (2.3 million tons) of concrete produced in Ukraine, 1.86 million tons of sand and stone can be conserved, and over 70 tons of emissions can be saved, which is equivalent to 3-5 % of Ukraine's destruction waste.

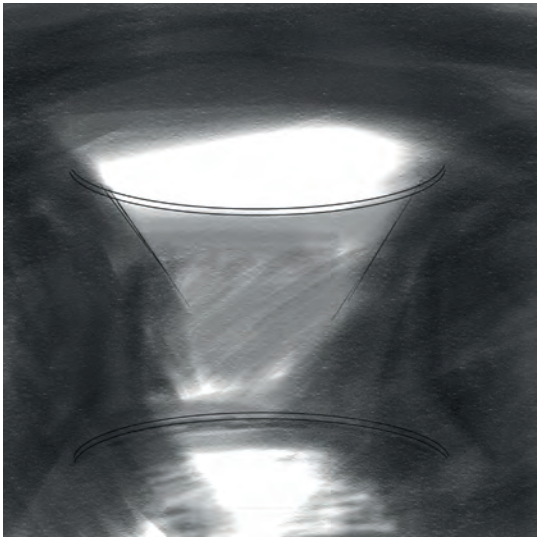
conection to nature

Framing nature is a way to connect to the outside, giving a calming and peaceful atmosphere. This way of incorporating nature is one of the most common.

Water is a part of nature that can be used in a variety of ways. Visually it can be pleasing to look at and can reflect light in different ways. Auditory the sound of water can be calming and pleasing. Water is also an interesting entity to interact with. Playing with water is fascinating, especially for small children.

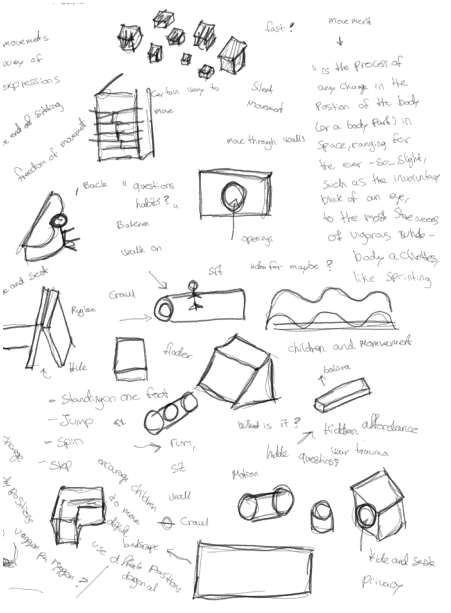
Dynamic light and the contrast of light and shadow can give life to a room in mysterious ways. It can also be used wrongly and give an intimidating feeling and over stimulate the visual senses.

Ill. 60. Connection two nature principles



Ill. 61. Sketch of nature

interior



Ill. 63. Affordance ideas

Ill. 62. Implementing affordance

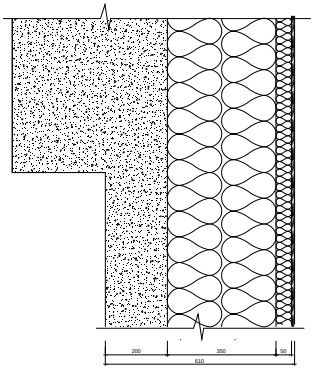
In order to create affordance and engaging, playful spaces, different interior possibilities are investigated. The renders show different ways to implant affordances catered towards children. Climbing and sitting options can be preserved by the user to find the appropriate purpose of the inventory.

The first illustration shows a combination of movement and play.

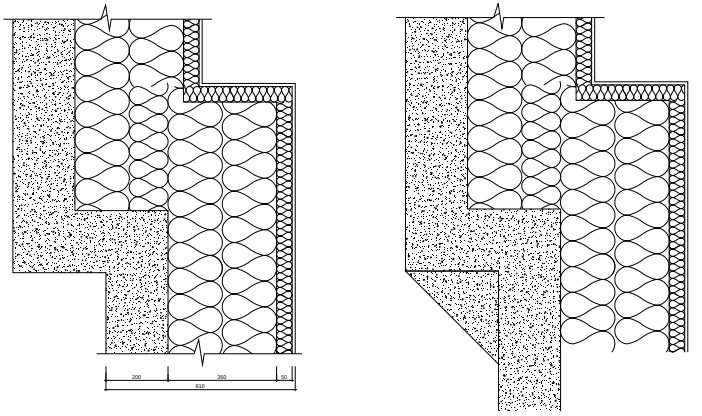
The second illustration is storage and play, where one entity can afford both.

The third illustration combines furniture and play, where the furniture is in the form of a chair.

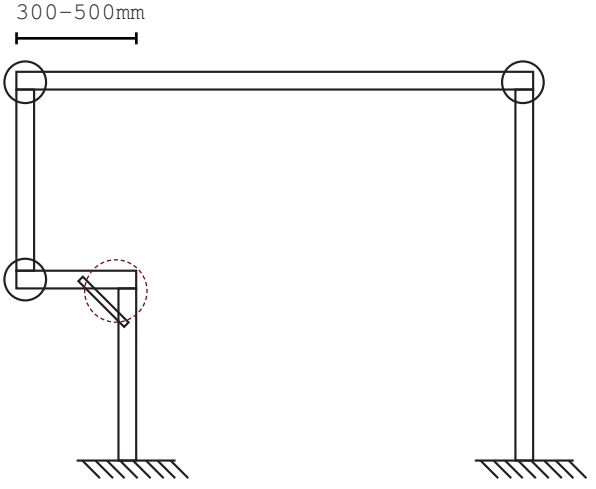
construction



CHOSEN CONSTRUCTION DETAIL



Ill. 64. Three conctruction detail



Ill. 65. Static diagram

In the construction, various areas of the building feature a small overhang ranging from 300 to 500 mm. To address this detail, a static diagram is used to identify the requirement for a robust joint capable of redirecting vertical forces. Three potential methods are illustrated for achieving this. The selected detail aims to minimize the need for an additional strong joint, optimizing the construction process.

3x5 elements = 15 DoF
3x2 support = 6 constraints
3x1 hinge = 3 constraints
2x3 hinges = 6 constrain
DoF = C – Static determined

Presentation

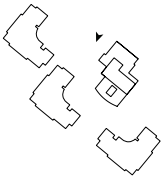
Part three

Ill. 66. Concept sketch

arrival

Ill. 67.

A Little Sprout Kindergarten is an architecturally intriguing structure with three clusters and a common house. Its blue concrete exterior, and dynamic shapes blend thoughtfully with the surrounding lush forest area. The facade exhibits small staircases and displacements, altering one's perception of the structure. Overall, A Little Sprout Kindergarten is unique and new, bringing Ukraine's in a direction for the future.



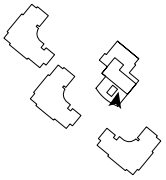
Ill. 68. Scale 1:1000

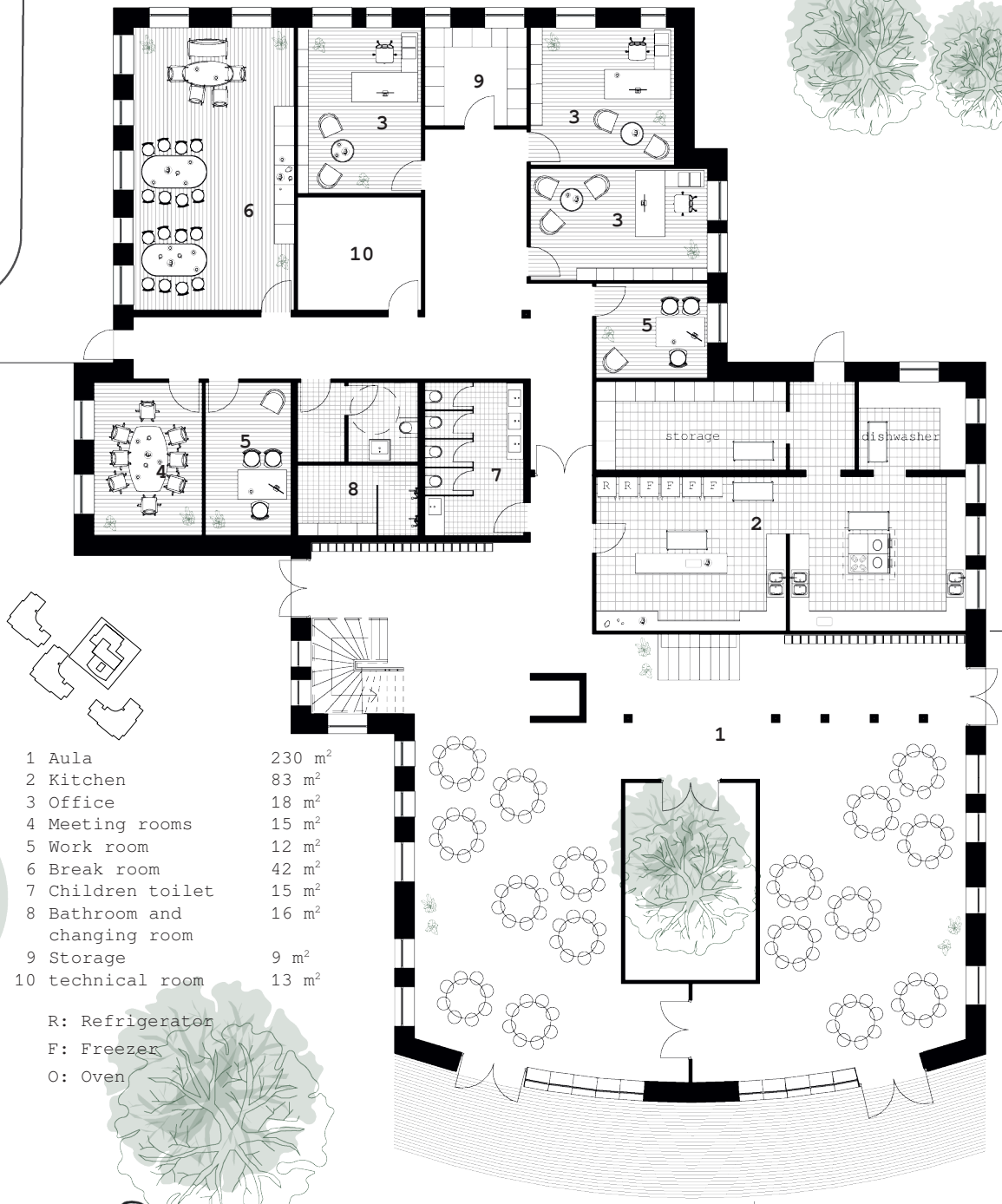
site plan

Ill. 69.

aula

The aula works as an ample gathering space where the children get their daily nutritious meals. A space that can have multiple purposes and inhabit different events. The aula appears large, with an atrium in the middle allowing greenery and light to enter the center.

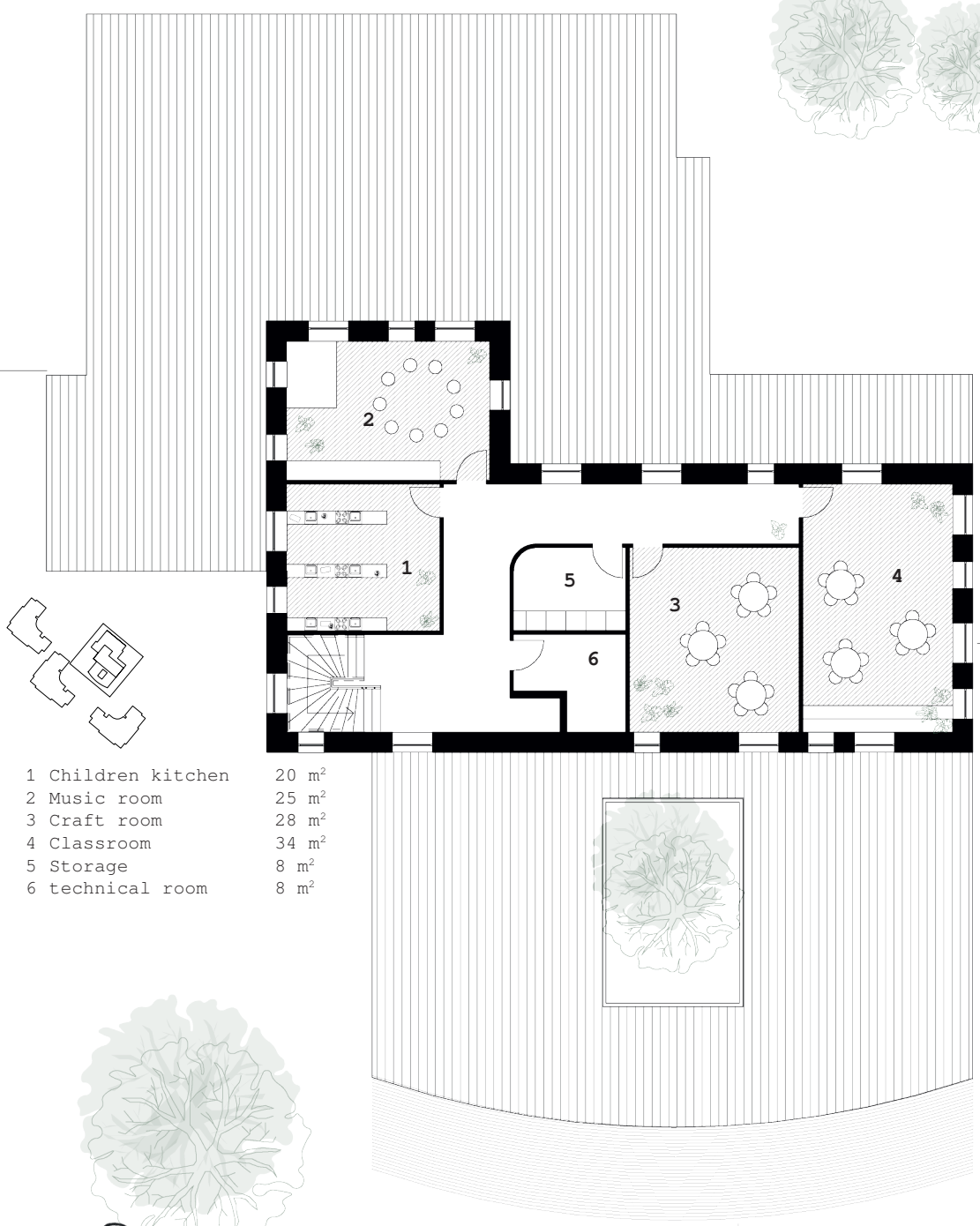




1	Aula	230 m²
2	Kitchen	83 m²
3	Office	18 m²
4	Meeting rooms	15 m²
5	Work room	12 m²
6	Break room	42 m²
7	Children toilet	15 m²
8	Bathroom and changing room	16 m²
9	Storage	9 m²
10	technical room	13 m²

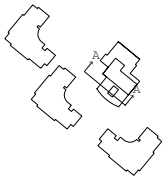
R: Refrigerator
F: Freezer
O: Oven

Ill. 70. Ground floor of common house, 1:200



1	Children kitchen	20 m²
2	Music room	25 m²
3	Craft room	28 m²
4	Classroom	34 m²
5	Storage	8 m²
6	technical room	8 m²

Ill. 71. 1. Floor of common house, 1:200



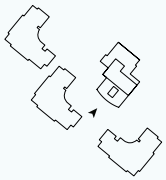
section AA

The aula is a designated area where the kids can enjoy their meals throughout the day. It boasts a range of seating options and a fully equipped industrial kitchen, conveniently located for easy interaction with the playful children.

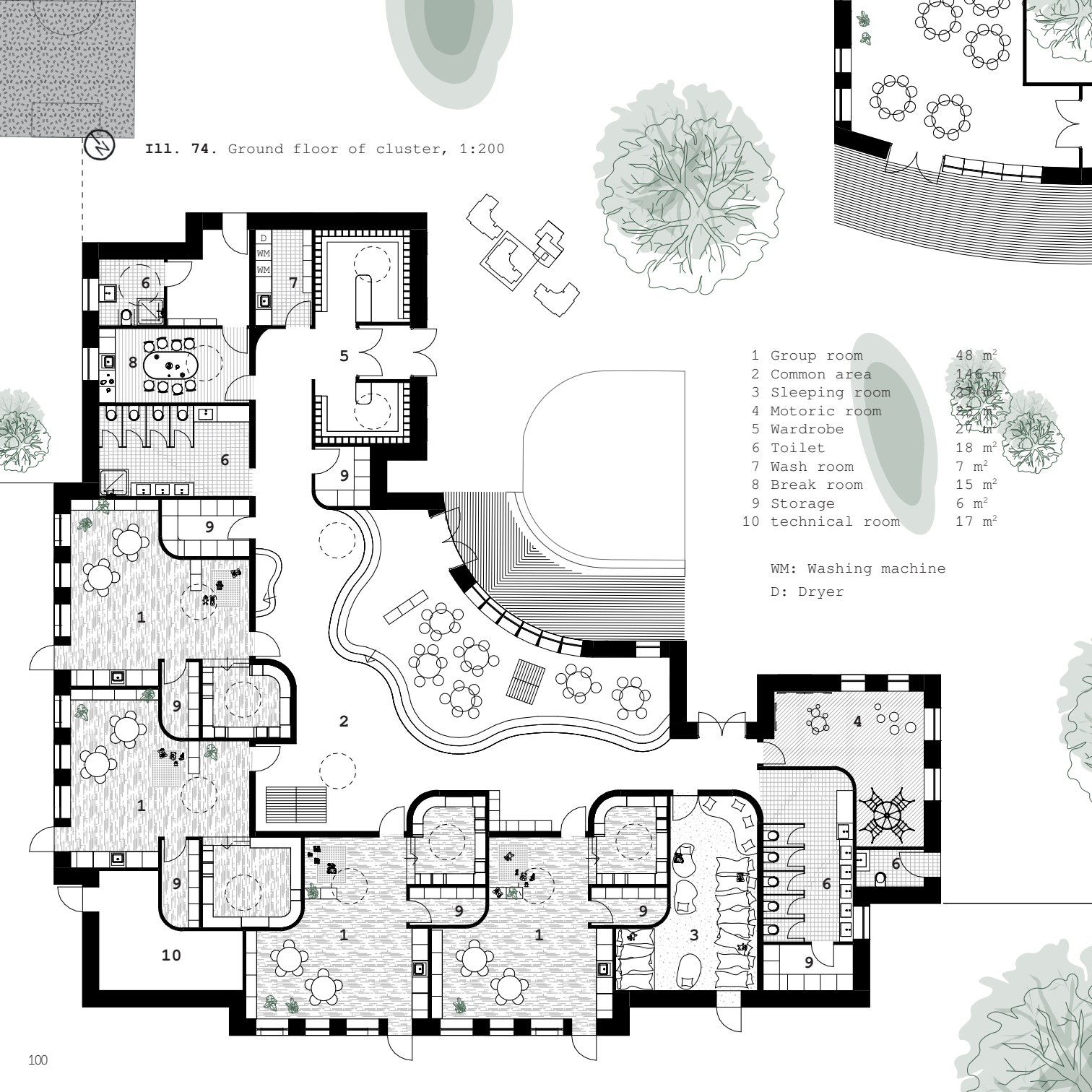
Ill. 72. Section of Common house, 1:200

common house

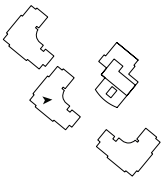
Ill. 73. North-East elevation, 1:200



Ill. 74. Ground floor of cluster, 1:200

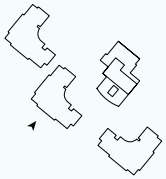


Ill. 75. Common area



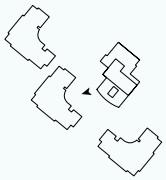
cluster north-east

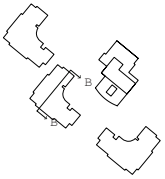
Ill. 76. North-East elevation, 1:200



cluster south-west

Ill. 77. South-West elevation, 1:200



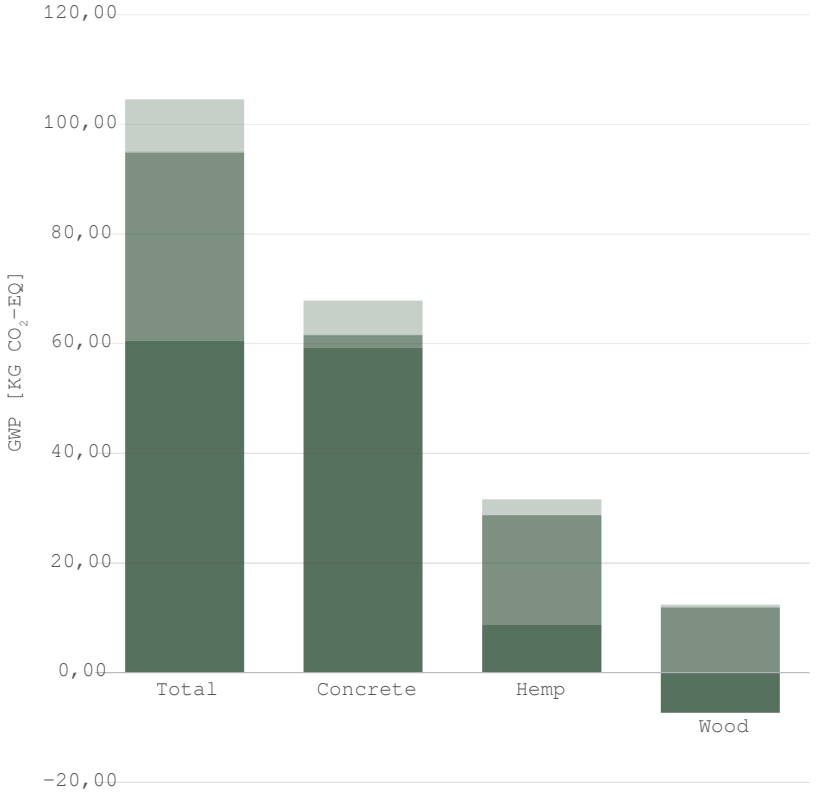


section BB

The common area functions as a pivotal gathering area that links to every other area within the cluster, encompassing the collective rooms

Ill. 78. Section of a cluster, 1:200

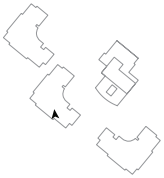
LCA results



GWP	Total	Concrete	Hemp	Wood
A5 Wastage	9,50	6,17	2,88	0,46
A4 Transp.	0,19	0,13	0,04	0,03
C3-4 EoL	34,24	2,34	20,00	11,90
A1-3 Product	60,60	59,20	8,72	-7,32

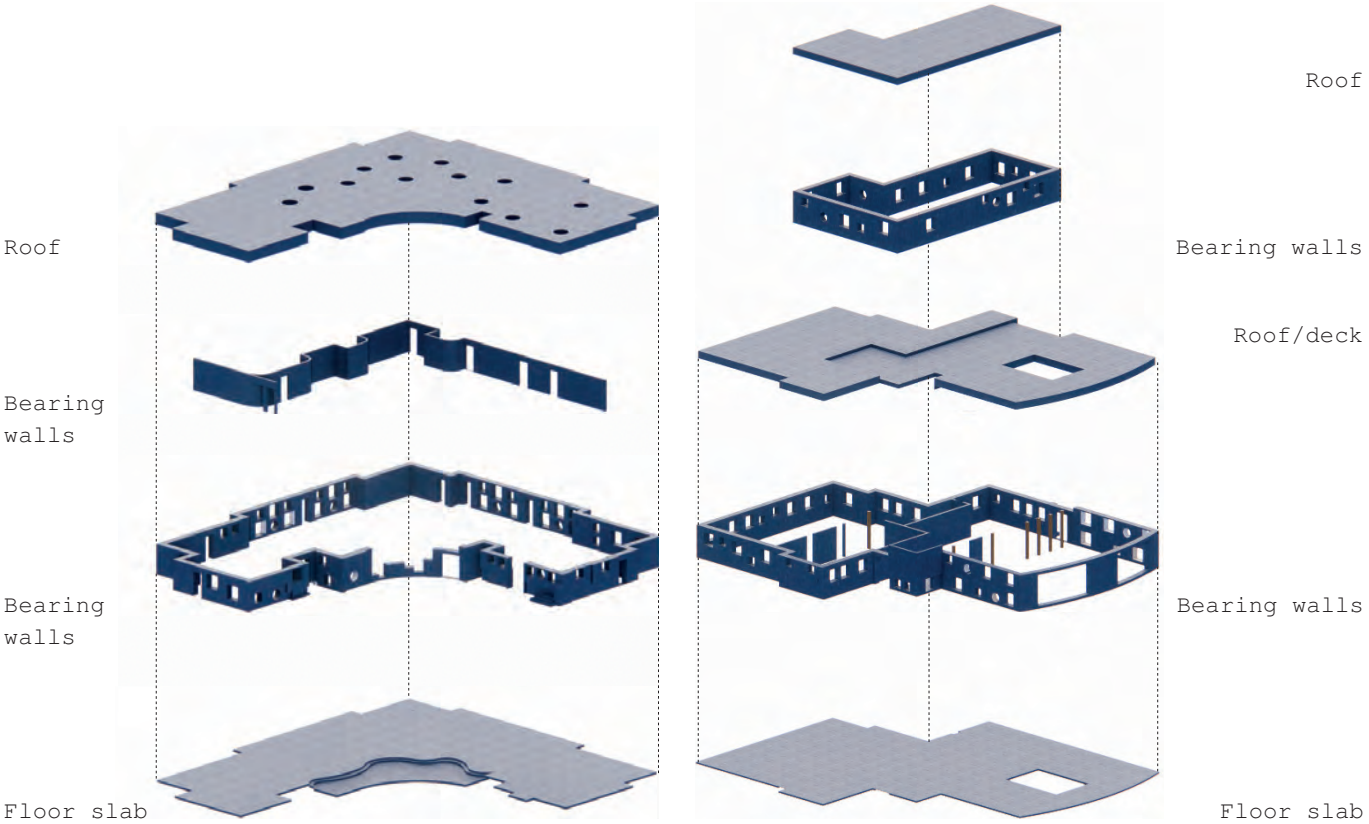
Ill. 79. LCA results

Ill. 80. Group room, drawing zone



Ill. 81. Group room, floor play zone

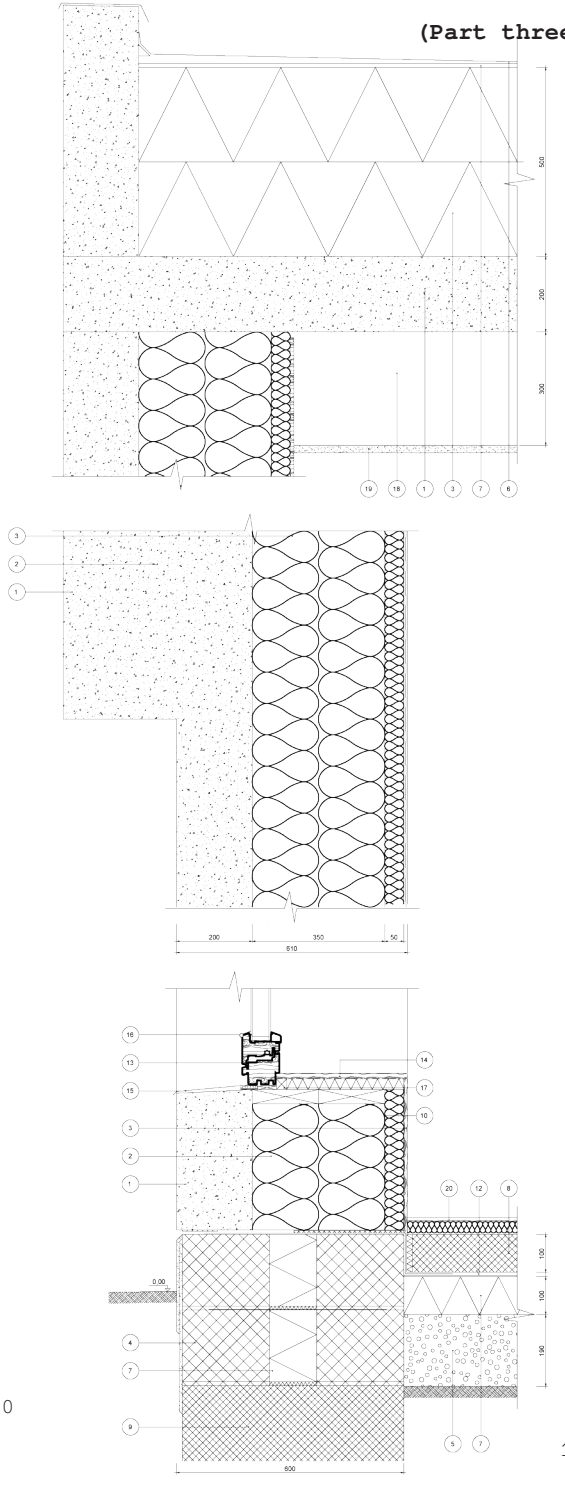
bearing construction



Ill. 82. Exploded axonometric of the construction

detail drawing

1. Concrete
2. Hemp insulation
3. Plywood
4. Lightweight clinker blocks
5. Clinker
6. Roofing felt
7. Pressure resistant insulation
8. Reinforced concrete slab
9. Concrete foundation
10. Vapor barrier
11. plinth plaster
12. Radon protection
13. Wooden window frame
14. wooden window sill
15. Sill
16: Two layer glazing
17. Sealant
18. Space for mechanical ventilation
19. Acoustic panel
20. wooden flooring



Ill. 83. Detail drawing, 1:20

conclusion

A little Sprouse Kindergarten is a kindergarten that focuses on the well-being of the user. The mental and physical health of the individual child is in focus leading to an inclusive design that creates space for activities and development independently and socially. Through affordance, diverse spatial experiences are created to provide the children with multiple actions and interactive opportunities. Windows, furniture, and a playful facade create various play options that lead the child to use these as they see fit.

All group rooms are provided with access to natural views and skylights. The biodiverse view the building creates gives an engaging environment where the surrounding nature can inspire the children. With the skylight providing natural light to the group rooms and the opportunity to regulate the natural ventilation, children and caretakers are given access to circadian light and air, bringing the connection to nature closer. The kindergarten offers a variety of possibilities supporting motor, cognitive, and social development through the music room, art room, and areas for traditional learning, which cater specifically to the needs of preschool children and facilitate focused learning experiences. Together with the different zones and underlying functions in the plan layout, this covers central parts of the child's holistic development.

The spaces are specially designed to care for and support traumatized children by providing safe areas where the children can hide and overview the surroundings. The rounded corners in the building and the natural colors help create a calming environment. Providing rooms with different uses placed in specific locations promotes a daily routine to follow. Lastly, an in-house psychologist is present to provide therapy for the child and the parents.

The building has managed to obtain a monumental expression despite its low height. The architectural style and color are inspired by a variety of architectural periods but, at the same time, strived to achieve a new style for Ukraine's future. The kindergarten's unique and playful use of concrete exemplifies how this can be expressed. An aula has been developed in this thesis to give space for 120 simultaneously. This is done by creating an atrium in the center, bringing a green scenery to the room, and maintaining the feeling of a larger aula.

Concrete is the primary material for this project as there is a considerable amount of debris in Ukraine; this is recycled and used as aggregate in new concrete, reducing the number of natural resources needed. Utilizing the debris material that is the aftermath of the war to reduce the environmental impact of the reconstruction, both regarding emissions and natural resources, is an essential and integrated part of this thesis. Early in the project, life cycle assessments show the minimal difference between recycled concrete and conventional concrete due to the larger amount of concrete emission from cement production.

A Little Sprouse Kindergarten is an enriching environment for children in a disaster-stricken nation where their development is nurtured, and extra care is offered to those in need. A framework for a better future is designed by supporting those who require it now. As part of a long-term rebuilding, the kindergarten provides an alternative and new direction in an architectural style built on the past but used to create possibilities for the future.

reflection

This thesis places a greater emphasis on literature studies due to the complexity and challenges associated with the chosen topic, such as; the post-war context, debris recycling, concrete as the primary construction material, and the care for traumatized children. As the topics individually present new and challenging aspects, the additional complexity of integrating all these elements has posed significant difficulties. It resulted in an extended analysis phase that delayed the subsequent phases, including the sketching phase, which began relatively late in the process. As a result, this reduced the time to design, develop and work with the more minor details in the project.

A pilot project by Arkitekter Uden Grænser inspired the initial idea of a kindergarten. Once the possibility of collaboration was ruled out, it became clear that a new approach was required. We took the time to carefully consider the reasons behind our decision to establish a kindergarten. We asked ourselves: What is the purpose of this project? Why have we chosen Ukraine as the location? And most importantly, how can we make a positive impact on the community? Much time was spent researching these topics and ensuring that the analysis had a solid foundation and argument to support them. Field studies have not been an option in this project as the war in Ukraine is still ongoing, resulting in all site analyses being desktop analysis, limiting our understanding of the site and the atmosphere. Furthermore, the available geospatial data for Ukraine is limited and challenging to attain, resulting in partially estimated mapping, primarily referring to the typographic data. This has made it challenging to incorporate the terrain as part of the design as the obtained data more or less shows the terrain flat, which is now what is observed from google street view.

As previously mentioned, the limited time spent on design development is evident in certain aspects of the main building. Specifically, more attention could have been given to detailing and conducting atmospheric studies for the aula, particular activity room, and the staircase, as it could have been incorporated more seamlessly as an integrated part of the architectural design.

The environmental sustainability in this

thesis primarily revolved around recycled concrete, limiting the resources used to investigate other building materials in the construction. As the aim is to create an environmental sustainability design, it is also essential to understand and investigate the impact of the other materials and how these can be chosen based on specific criteria.

Final technical simulations of the different indoor climate aspects are not provided, as the indoor climate is based on principles gained throughout the design process. When working with a kindergarten, indoor comfort is essential for the child's learning and development; this aspect should have been included to strengthen the project.

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illustrations

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Ill. 18. Picture created by Adobe Firefly Beta

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Site plan
Scale: 1:500
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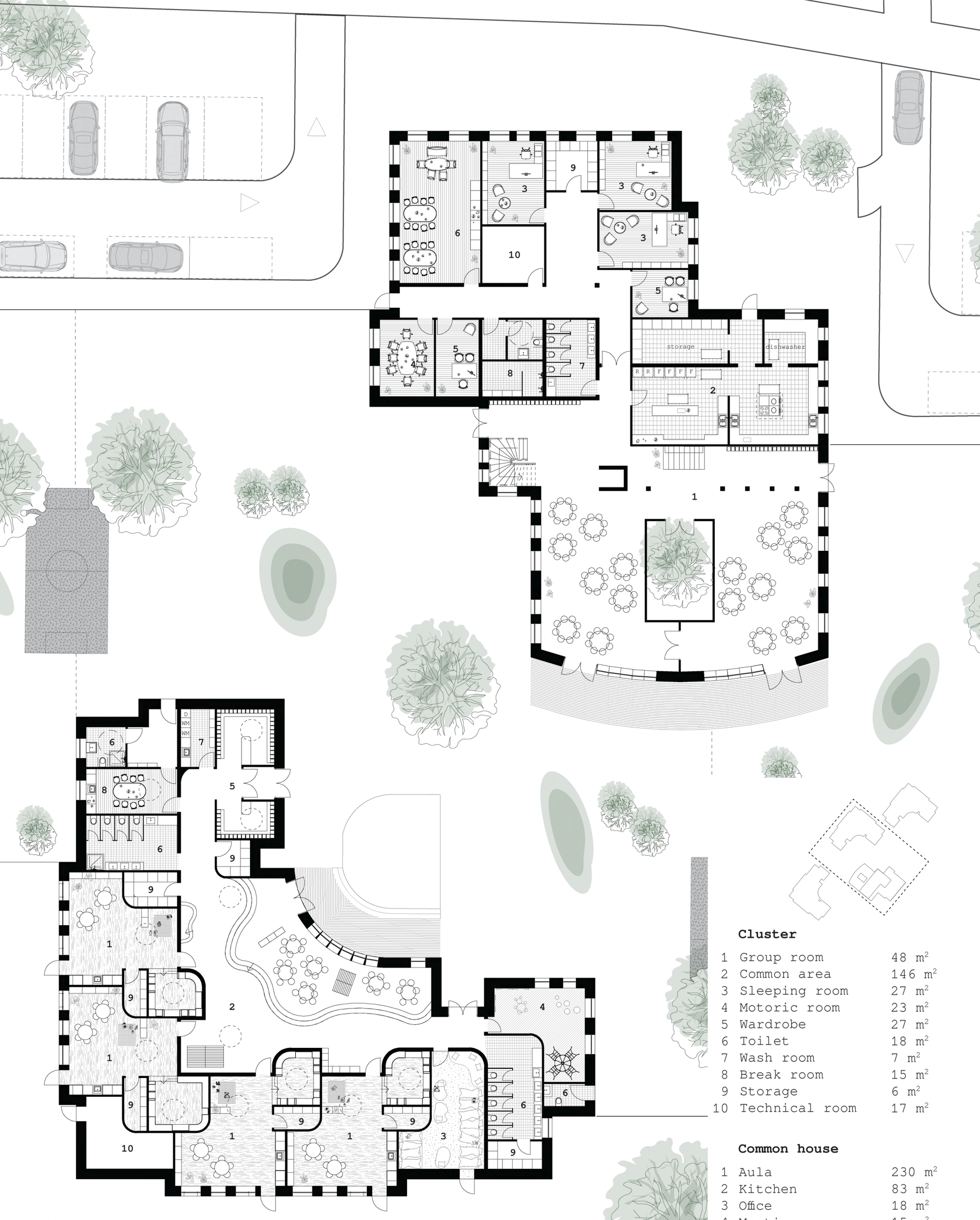


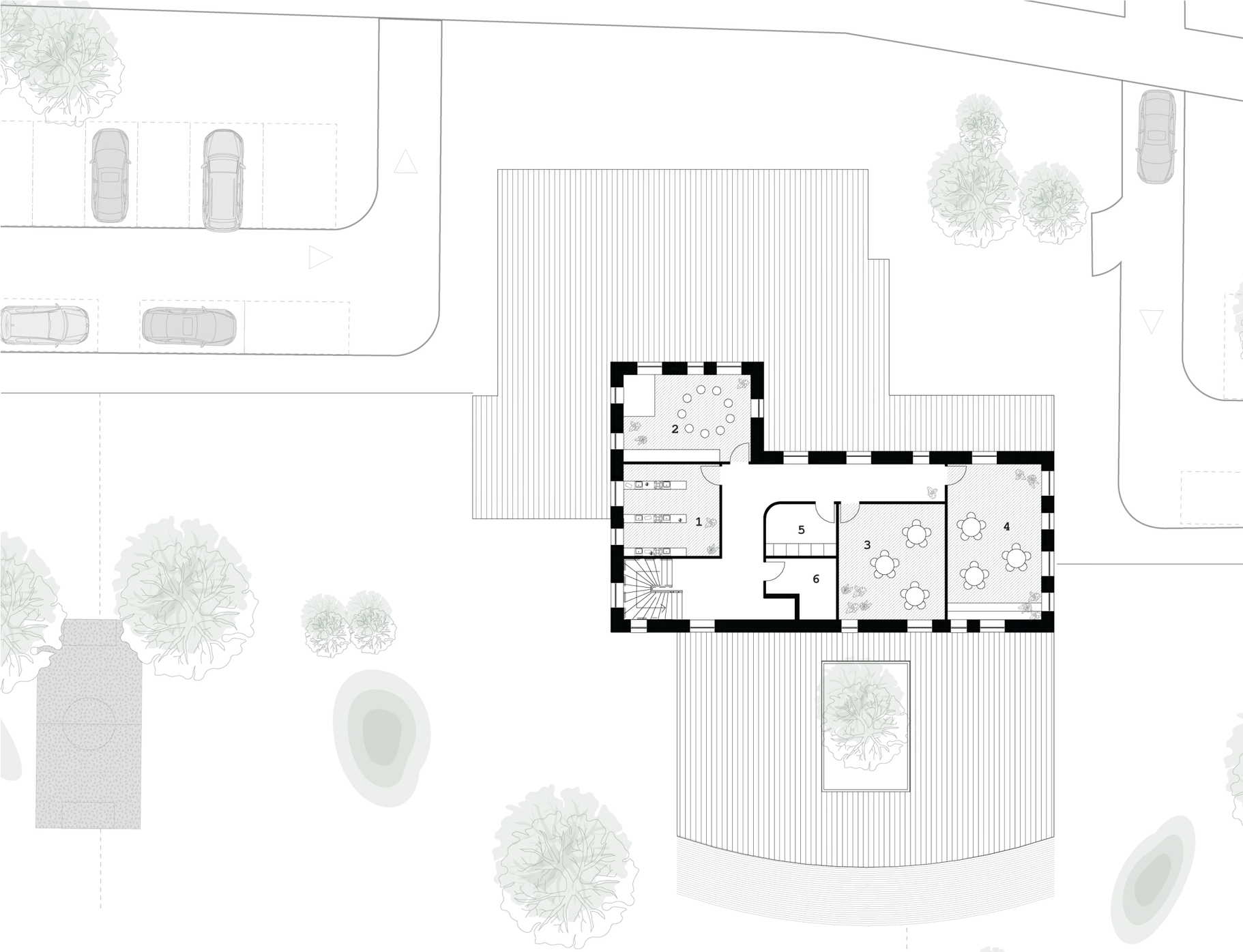
Scale 1:200
Floor plan: Ground floor – Common house & Cluster

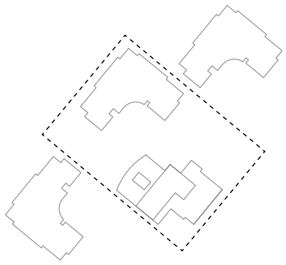
Cluster

1	Group room	48 m²
2	Common area	146 m²
3	Sleeping room	27 m²
4	Motoric room	23 m²
5	Wardrobe	27 m²
6	Toilet	18 m²
7	Wash room	7 m²
8	Break room	15 m²
9	Storage	6 m²
10	Technical room	17 m²

Common house

1	Aula	230 m²
2	Kitchen	83 m²
3	Office	18 m²
4	Meeting room	15 m²
5	Work room	12 m²
6	Break room	42 m²
7	Children's toilet	15 m²
8	Bathroom and changing room	16 m²
9	Storage	9 m²
10	Technical room	13 m²

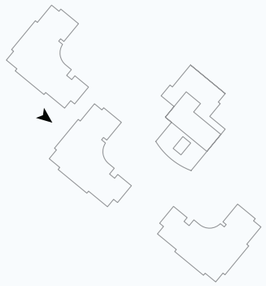




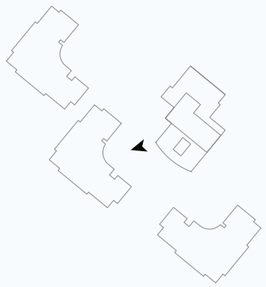
1	Children kitchen	20 m²
2	Music room	25 m²
3	Craft room	28 m²
4	Classroom	34 m²
5	Storage	8 m²
6	technical room	8 m²

Scale 1:200
Floor plan: Common house – 1. Floor

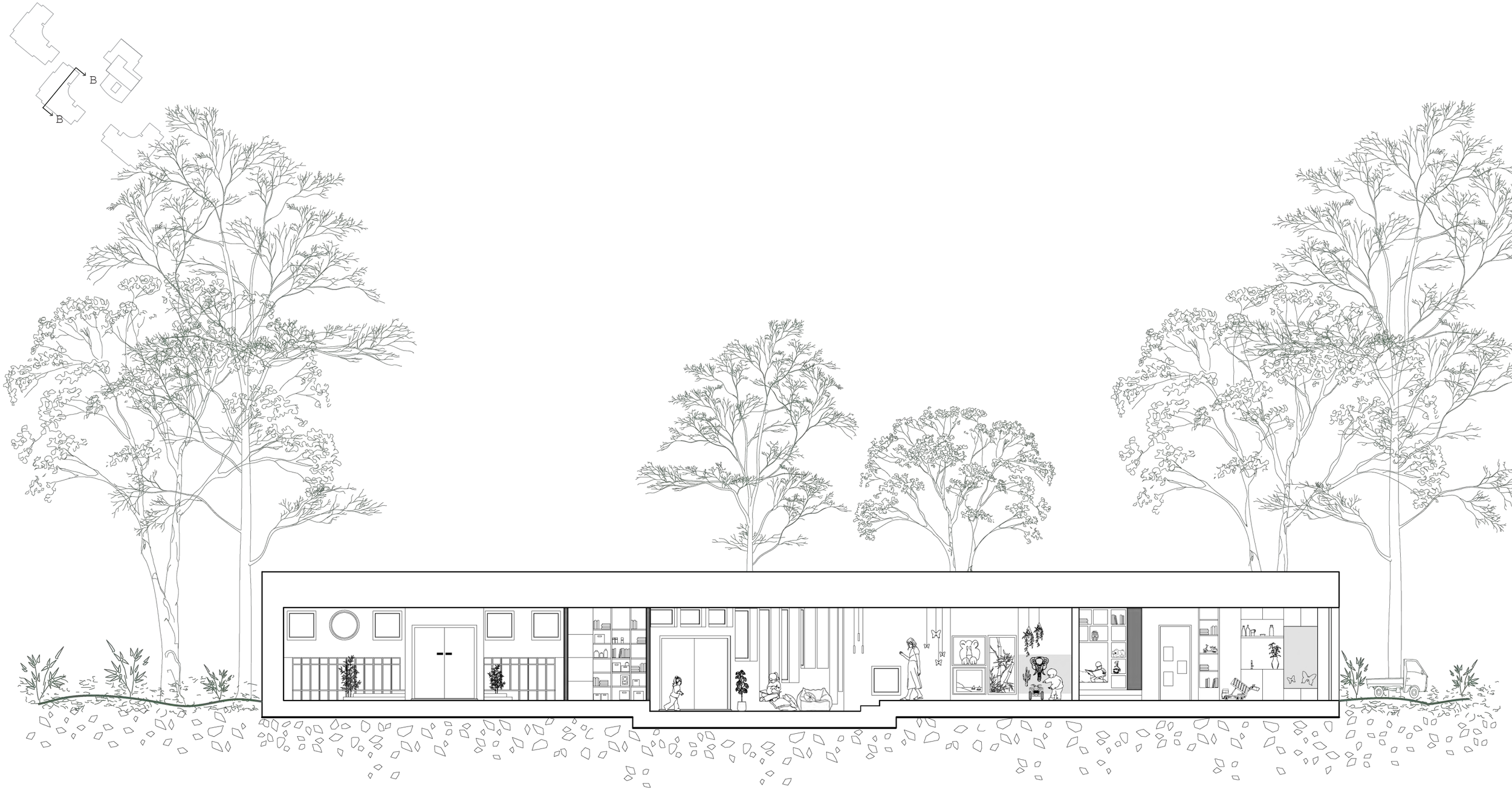
Elevation 1: South – East
Scale 1:100



Elevation 2: South – West
Scale 1:100



Section AA
Scale 1:100



Section AA
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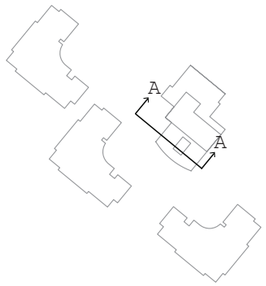
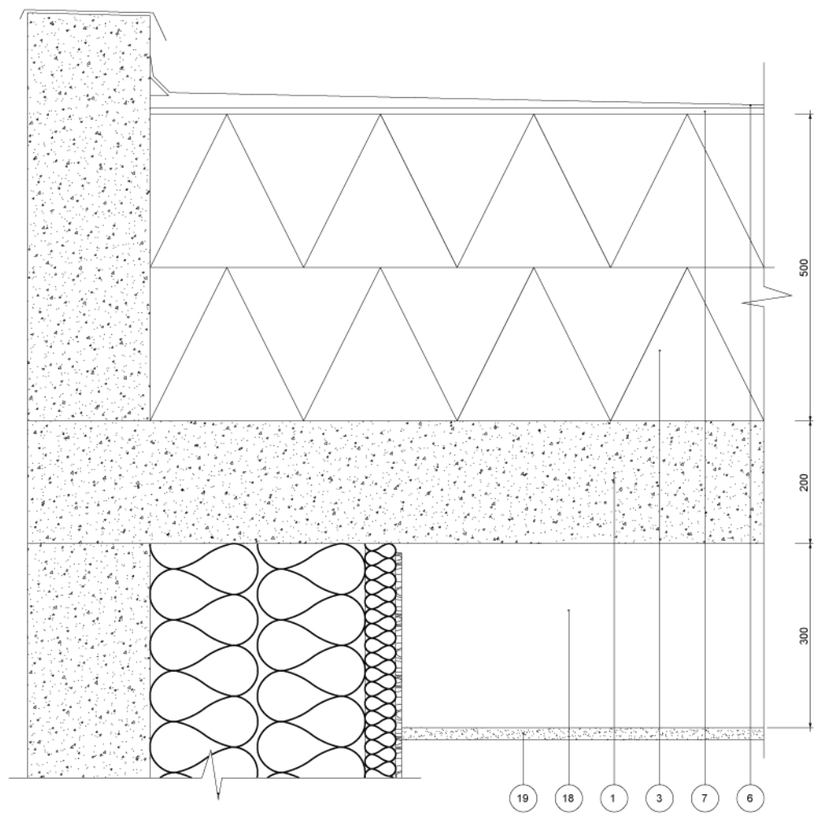
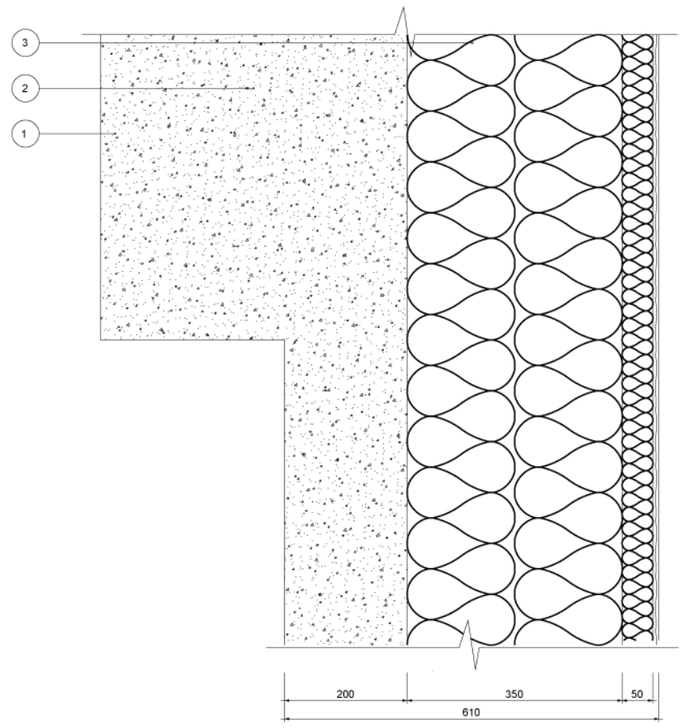


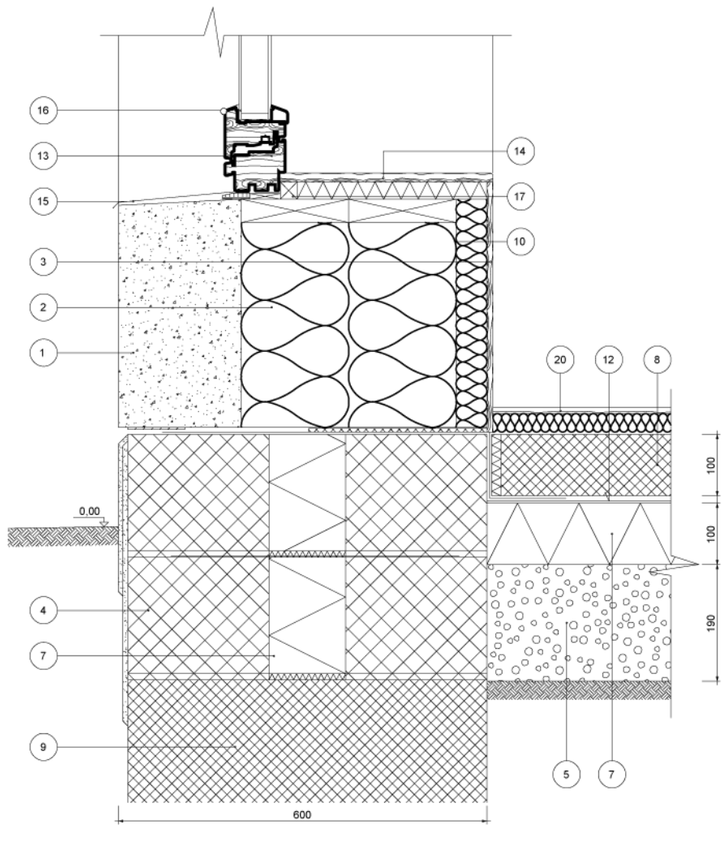
Staff area **Aula** **Atrium** **Aula**

Detail drawing
Scale 1:10





1. Concrete
2. Hemp insulation
3. Plywood
4. Lightweight clinker blocks
5. Clinker
6. Roofing felt
7. Pressure resistant insulation
8. Reinforced concrete slab
9. Concrete foundation
10. Vapor barrier
11. plinth plaster
12. Radon protection
13. Wooden window frame
14. wooden window sill
15. Sill
16: Two layer glazing
17. Sealant
18. Space for mechanical ventilation
19. Acoustic panel
20. wooden flooring



Elevation 3: North – East
Scale 1:100