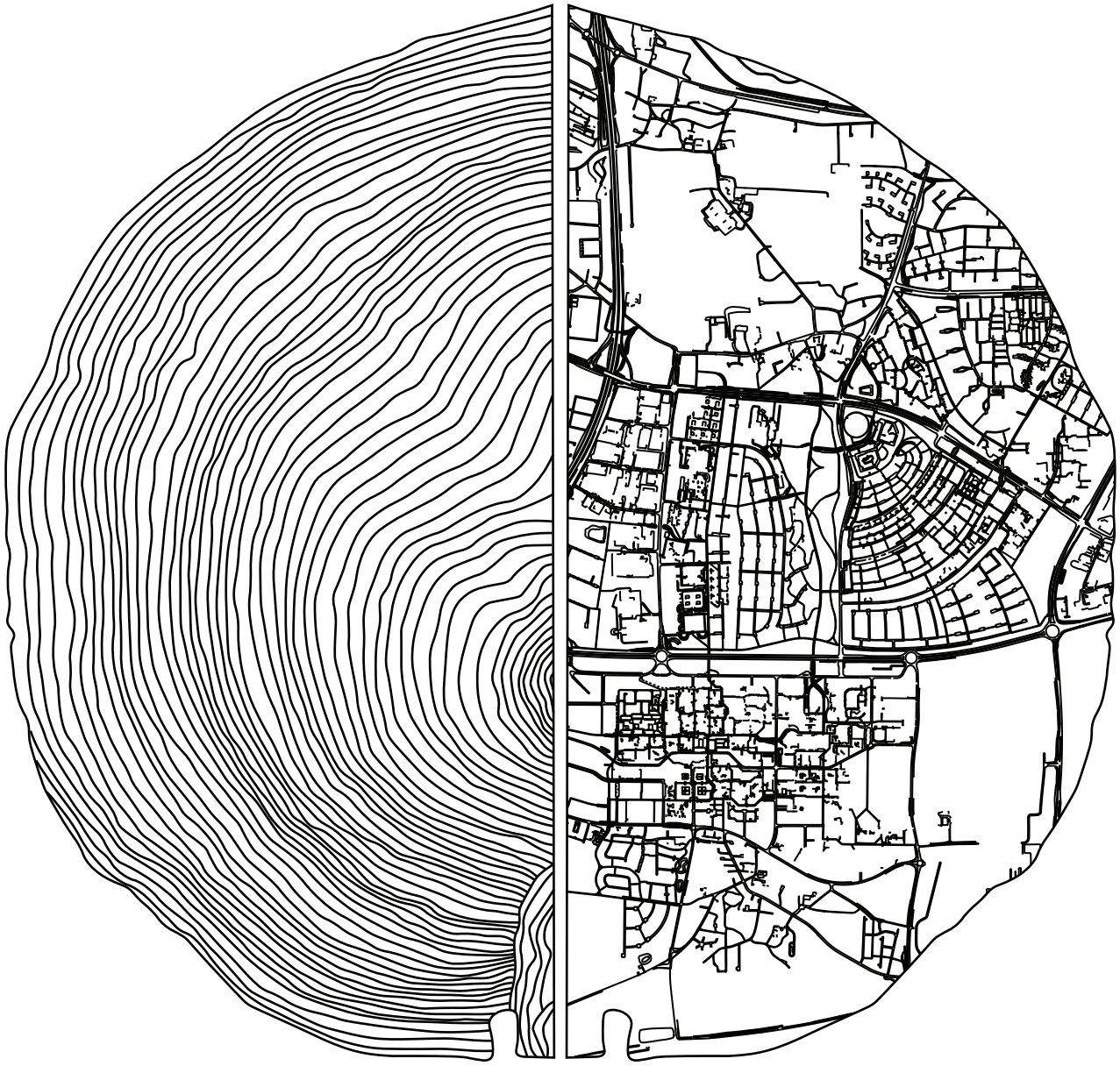
TRÆVÆRK

MSc 04 group 6
September 2024



TITLE PAGE

Acknowledgment

Thanks to Steffen Damsgaard, head of education from Energy and construction, and Anders Møller Hansen, educator, for participating in an interview for this project and showing us around at EUC Nord in Hjørring.

Thanks to Louise Maria Sigurdsson, Cand. Mag. Læring og forandringsprocesser, for helping us create and understand the learning theory.

Thanks to ERIK arkitekter, Havehandel, Jespers planteskole and Profile for giving us permission to use their pictures and illustrations.

SEMESTER: 10th semester
UNIVERSITY: Aalborg university
SUBJECT: Artisan school
MODULE: Master thesis
ECTS POINTS: 30 points
LANGUAGE: English
GROUP NO.: Group 6
GROUP MEMBERS:
Anna Deleuran Weihrauch
Jonas Birger Bech Frederiksen
SUPERVISOR: Zakaraia Djebbara
CO. SUPERVISOR: Jesper Thøger Christensen
SUBSTITUTE SUPERVISOR: Luis Filipe dos Santos
PAGES: Project 127 pages + 48 pages others

Anna Deleuran Weihrauch

Jonas Birger Bech Frederiksen

ABSTRACT

Træværk is a project concerning an artisan school for artisans working with wood. The basis idea was to create a more sustainable future for the building industry. This influenced the placement of the project as the closeness to the engineering department of Aalborg university as the hope is for the educations to be able to work together and gain a civil understanding of one another's profession. It is hoped that this would lead to future projects where the different practitioners have a greater understanding of the different phases in the realization of a project. Furthermore, the hope is that by exposing the engineers to the carpenter and woodworker education, they may be more inclined to think wood into the projects they are working on both during the education and later in life. This could later evolve the use of more wood in Danish construction work.

For the social aspect of sustainability, the focus has been on creating a space that allows for a study life, more in the line of what is experienced elsewhere. This is seen as the students at an artisan school often must grow up much faster as their education is generally shorter when compared to university educations. Meanwhile the youth are leaning to the longer educations which hurts the artisan educations and, in the long run, the Danish workforce. Here the artisans are slowly coming in higher demand as the amount of educated artisans are falling. The solution seems to be to offer more study life and atmosphere giving an appropriate experience of youth and allowing a prolonged youth free from responsibility. This will be tried by adapting the study experience of other educations into the artesian education while still celebrating the strength and necessity they are for the society.

TABLE OF CONTENT

TITLE PAGE 2
ABSTRACT 3
READING GUIDE 6
CONCEPT 7

METHOD 8
PBL 10
IDP 11

THEORY 14
TECTONIC THEORY 16
PHENOMENOLOGICAL THEORY 18
LEARNING THEORY 22
SUB-CONCLUSION 24
PROBLEM STATMENT 25

CASE STUDY 26
TRADIUM CARPENTER SCHOOL 28
SÄYNÄTSALO TOWN HALL 30

ANALYSIS 32
CHOICE OF SITE 34
DEMOGRAPHY 36
TRAFFIC 38
TOPOGRAPHY 40
TYPOLOGY 42
BLUE SPOT 44
NOICE 46
SUN 48
WIND 50
MATERIALS 52
INTERVIEW 53
PERSONA 54
OLD ROOM PROGRAM 56
FUNCTION DIAGRAM 57
ANALYSIS CONCLUSION 58

PROCESS 60

FORM STUDY 62
CONSTRUCTION 64
JOINTS 67
HALLWAY SPACE 68
HALLWAYSPACE 70
MATERIAL STUDY - ACCENT WALLS 74
MATERIAL STUDY - HALLWAY WALLS 76
MASTER PLAN 78
PATIO 81
ROOF PROCESS 82
SKYLIGHTS 84
FACADE STUDY 86
MATERIALS AND LCA 88
INDOOR CLIMATE 90
ENERGY FRAME 92

PRESENTATION 94

ENERGY FRAME 96
FINAL ROOM PROGRAM 97
MASTERPLAN 102
ELEVATIONS 114
LCA 118
STRUCTURAL SYSTEM 120
CONSTRUCTION 121
INDOOR CLIMATE 122

EPILOG 124

DISCUSSION 126
CONCLUSION 128
REFLECTION 129
BIBLIOGRAPHY 130
ILLUSTRATION LIST 134

APPENDIX 140

APPENDIX 1 142
APPENDIX 2 144
APPENDIX 3 147
APPENDIX 4 152
APPENDIX 5 159
APPENDIX 6 164
APPENDIX 7 175

READING GUIDE

In the process chapter the solutions that will be used in the final design will be marked with a blue square.

When only sustainability is mentioned, this involves a combination of environmental and social sustainability.

When mentioning artisans, this involves the carpenter and woodworker professions.

Throughout the report, sources in the text and bibliography will be cited using the Harvard reference method. Furthermore, have the use of pictures and illustrations, not made by the group, been approved by the rightful owners, which can be seen in appendix 5.

As the project consists of three separate buildings, they are often referenced in context to each other as the east, middle and west building.

CONCEPT

The passing of knowledge from one generation to the next is second nature to humans, so it is only natural that this space has a great priority. Currently in Denmark this type of information giving leans more towards the book subjects, leaving a very small group of people to uphold the crafting skills and knowledge to learn the next generation (Gluud, 2018). This is a problem that have grown over the latest years as the universities of Denmark have grown meanwhile the crafting school diminishes.

The theory that this project is based on is that the social aspect of education is the main reason people opt out the craft educations. It can be seen as these educations have people grow up faster as they start and finish their education earlier than those who choose the academia. This gives them more responsibilities and their social life can become overlooked as they spend much time away from the school on internships. (Damsgaard & Hansen, 2024) Therefore, it is important that the school truly is the best place for them to learn and to ensure this, learning theory has been used. Even though the knowledge is passed from teacher to student in the classroom, the space between is where the students socialize and do groupwork. The social aspect is one of three key points in the learning theory and is also one aspect architecture can provide, by creating spaces for meetings, regardless of the teacher's abilities. This means that the architecture can provide a good space for learning by working on atmosphere and programing. This will make the circulation in the building the focal point, as this is where the architecture has the most power in this project.

1 METHOD

In this first chapter, the reader will be introduced to the methodology used for this project, the integrated design process. It consists of many different phases and will therefore be explained here. Furthermore, will there also be explained how the method will be rebuilt so it fits the actual use from the real world.

PBL

PBL or problem-based learning is a method of learning in which the student finds a real-life problem to work with and solve. This allows for a better understanding of the work done in real-life and results in the students working on projects. These are structured differently for every education and project. In the AAU education of architecture and design, the most used method is IDP, or Integrated Design Process, as described below. The reason for this is that it gives a framework to mold the project. PBL also focuses on the mentality of a group and structuring a workday and schedule accordingly. Throughout the education the students have learned to allocate dates for when certain parts of a project should be done. Furthermore, it also teaches the students how to manage the group dynamic by having open conversations about the project, personal and professional opinions. This meanwhile also taking everything into consideration to ensure the best possible result.

IDP

The integrated design process has been developed for the use of the Architecture and Design education at Aalborg University and as such it has to work well with problem-based learning, PBL. The phases of IDP are divided in a way that supports PBL and the integration of engineering in the design process. The five phases of IDP are: **problem, analysis, sketching, synthesizing and presentation.** The IDP is an iterative method meaning the phases are worked with over and over again throughout the project until a final result is reached. The form of the method is meant to ensure iterations and a structure for which a report can account for. (Knudstrup 2004)

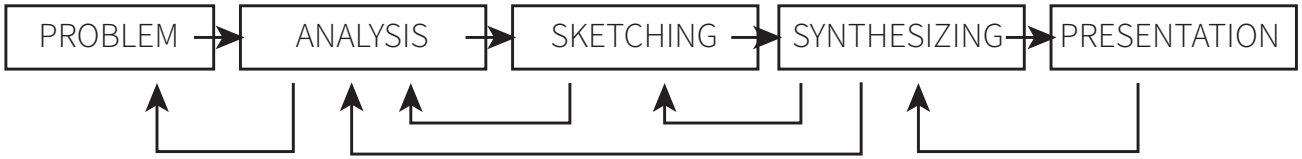
Problem

This will be the defining face for the problem worked with in the project. It consists of the **active choice** of what to work with and is formed by the **initial analysis and theories** from the coming phase. Therefore, the sharp definition of the phases are already erased and rather than the transition between the phases blend into one another, they do not completely mix. The problem is then developed by the wants of the group members, the necessities presented in the guidelines and the information collected when the analysis is started. The final formulation of the problem will be an **ongoing process** throughout the project as the specifics become clearer.

Analysis

This is the phase where information is compiled and created concerning the user, the site, functions, rules and regulative and much more. This is the f**oundation of the entire project** as the information needed for an informed project is being gathered. This, of course, means it will be an **inherent part** of the entirety of the project as additional information will become necessary throughout the development. In order to create a solid foundation for the project some analysis and theories are at the core of this phase and will be described as tools. These tools can be divided into three different categories: Qualitative information, Quantitative information and Theories.

Qualitative information, in the form of **interviews and phenomenological** site analysis, is important as the design is for people and their view on the needs for the building and the surroundings. This is extremely important in order to design for **social sustainability**, which can help ensuring a long lifespan for the building. The use of these kinds of analysis are in order to **create personas** and gain an **understanding** of the site that cannot be reached through only quantitative methods. It is about experiencing and understanding the premise for the project at the site and the possible user.



ILLU: 1

Quantitative information, in the form of site conditions estimated from **existing data**, is in the regard of the users, not explicitly the ones in the building. These kinds of information would rather be the **demographic surrounding** it, the **weather conditions** based on long haul measurements and yearlong data collection. This kind of information is important for **estimations and simulations** and can have a great impact on the **environmental sustainability** of the project. The importance of this focus is imminent as the building sector is one of the most harmful to the environment at the moment.

Theories are used to identify the important parts of a specific project. In addition to **identifying importance** in the project, a theory often offers a view on the intent of the project clearing the road for the solution to be found. Often times a theory will be applied in **unique ways** for every project. It allows for the theory to be very general but becomes more specific in the implementation. Often the method of implementation comes down to the **analytical understanding** reached though reading and absorbing the theory itself. This is always dependent on the context in which it is used.

Sketching

This phase is where the information from the **analysis phase becomes tools** for sketching and exploring the possibilities for a social and environmentally sustainable project. One way to do so is by making **workshops** where **specific parts** are focused on. When sketching it is important to have **concern for all aspects** uncovered in the analysis as this is important for the next phase.

Synthesizing

The results of the aforementioned sketching workshops are used for synthesizing phase. This **combines the strengths** of different sketches and workshops into an overall well-rounded project including the main aspects. This is of course meant to be done **over and over again** in order to evolve and perfect the project to a final result that **fills out the criteria** or needs found in the problem and analysis phases. All of which is the essence of the IDP methodology.

Presentation

The presentation phase is about **showing the final project**. This is the part where **communication is most important** in portraying the project to the general public. It is when presenting the graphical language that it has to be the strongest as it is the best way, alongside models, **to express the scope** of the project. It is also much **more reliant than words** as these can be interpreted very differently from person to person. Presenting the project may also show weaknesses in the project, which later can be used as a tool to improve the project even further. This can be used for detecting weaknesses that then can be taken care of before the end of the project.

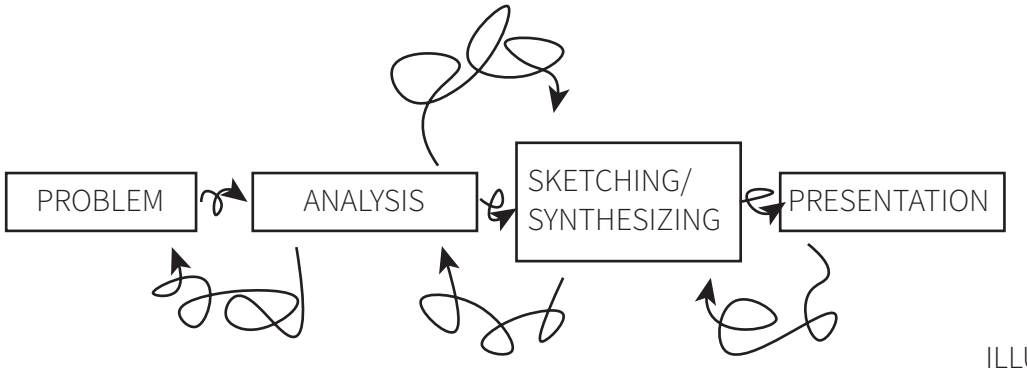
Actual use

In practice this method is **not possible** to adhere to as phases can become **mixed up** with one another, as well as the fact that a design process will **not be this orderly**. This, however, does not equal to a failed method but rather a **theoretical method** that, for every project where it is applied, should be **further defined and fitted** to the project.

The IDP method offers a theoretical system and has its basis in the design between the e**ngineering and the architectural world**. Therefore, it is inherent that the method can be modeled to the more specific project. The method of IDP will be **interpreted** into the specifics of this project. This means that the definition of the **phases may shift** and the description of what the phases will entirely become is much **more defined** in relation to the project at hand.

The modifications to the method, in this case, is **combining the sketching and synthesizing phases** into one, as this will **resemble the actual design process** in real life. Furthermore, the analysis is closer to the sketching/ syntheses phase, as the information should flow much more between these. This is because it is the evolution of the project and is based on going between these two phases. This transition between analysis and design is the basis of the IDP method and the core strength. This process of designing often results in a need for new information, leading to new analysis both of the site and the design. This is necessary in order for the design to be able to evolve. In order to do this, it is necessary to alternate between **producing material and evaluating** the produced material as this helps identify the strengths and weaknesses in the design.

The use of theory in this case will include theories **outside of architectural theories.** They are handled by **connecting the information** found in the specific theory to the understanding of these needs to the architectural theories and translate between the two types of theories. This should result in a very well-integrated design, including a theoretical framework as the basis for the entire project. As important as it is to **evolve** the project, as important is it to **evaluate**. This can be represented in the presentation phase as **displaying small parts** or even the whole thing allows for an assessment of the project. Furthermore, it shows what needs to be done in the next iteration, resulting in a final project.



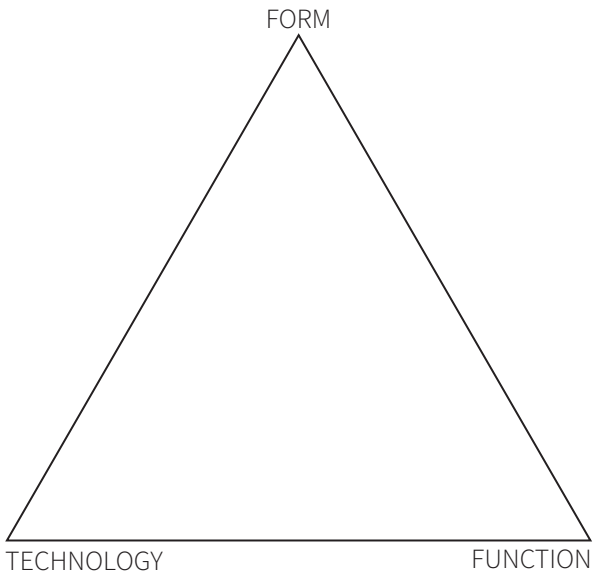
ILLU: 2

2 THEORY

For this chapter, several different theories used in the project will be explained. The theories will have a focus on how to degisn buildings and outdoor spaces for the different kinds of users. Furthermore, the different theories will also be used to identify possible problems throughout the design process and how to solve these problems.

TECTONIC THEORY

Tectonic architecture, as a design theory, started in the old Greece where philosophers tried to explain the complexity of design and architecture. The oldest way of explaining this, is the triangle of Vitruvius and it can be explained as the interplay between form, function and technology. In the middle of this, it is found that no part of tectonic architecture can be left out as it will create an imbalance. This can happen if the focus of an honest construction takes over, when the possibility of forgetting form arises and as stated, it is the interplay between the three parts that creates the basis for the good design. This is of course still a very undefined meaning so, that people through time have interpreted the theory in many different ways. The common denominator is that the design becomes holistic in the nature of architecture. Architecture is the result of function put into a form supported by the technology of the time by the standard of tectonics. Gesture and principle are one of the many interpretations of tectonics and creates an easily understandable definition. This helps with guiding the design process and as a tool for analyzing the final result as well as other works of architecture. (Foged & Hvejsel, 2018)



ILLU: 3

Gesture and principle

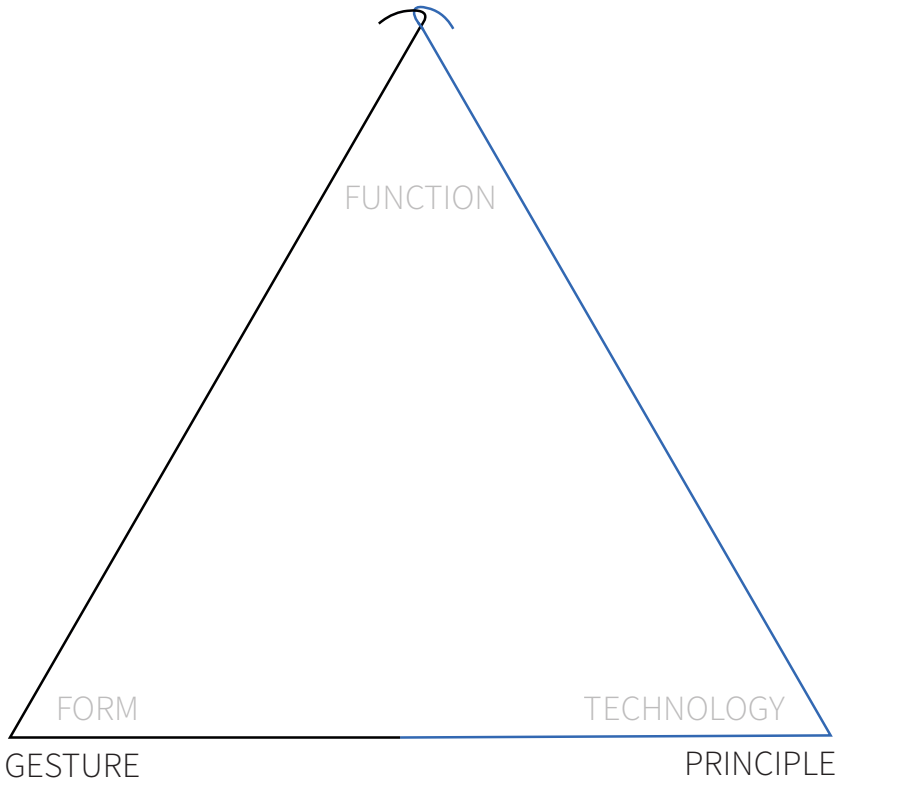
The two concepts are deeply intertwined as the gesture of a building is the feeling of its aesthetics meanwhile the architectural aesthetic of the structural element is known as principle. The principle is furthermore the technological aspect of architecture. (Foged & Hvejsel, 2018)

Gesture and principle as tectonic theory

In tectonic theory, gesture is the physical understanding and aesthetic of the room or building. This is of course related to the function in the triangle of Vitruvius, as the function of a building or a room is based on the presumed usage. Gesture also closely relates to form in the Vitruvian understanding of tectonic. Making gesture the embodiment of the Vitruvian form but pulling in the Vitruvian function as well. This makes the understanding of gesture deeper than the single parts of the Vitruvian triangle. In many instances the gesture will also dictate the materials, to some extent, as in the needed materiality for the wanted experience of the room. This does not limit the understanding of gesture to just experience, even when it is at the core of the gesture.

Principle is inherent in the corner of the Vitruvian triangle but, as it was the case for gesture, the core is just about relation. Principle is the technology needed to create the form of a room necessary for the architecture. This crosses over into the materials as well as the technologies and changes a lot depending on what materials are used. As much as the time in which the building is built, the principle is something so important that the gesture of course has to account for it and how it should show and be perceived. This interlocking system between the concepts is what warrants the use of gesture and principle overall. This is because it allows for a starting point that, when you get into it, you will have to merge everything into it. By doing so, every part will naturally be introduced as the ideas develop.

The understanding of the tectonic approach goes right through to the detail, in the case of architecture, talking about details is also talking about joints. Seeing the joint as tectonic means to see the purpose. It serves for the function, the technique and material that goes into it and the aesthetics of it. A well-made joint will serve its purpose while expressing the technical background and aesthetics thought out by the architect. One of the most prevalent architects, to be named in this context, is Carlo Scapa. He had a complete understanding of creating details that did not just uphold the needs but have given the space more value as the complete feeling of these spaces where the design has been so thought out is quite extortionary (Frascari, 1981). Having the joint as the embodiment of tectonics helps to give a perspective of how to utilize tectonics thoroughly throughout as it does not just concern the overall form. It however goes as deep as to the very detail, combining the tectonic understanding of gesture and principle. With this very narrow insight into how tectonics can be applied, it gives a ground for the tectonic overview, while keeping the focus to the very end and ensuring a complete tectonic project.



ILLU: 4

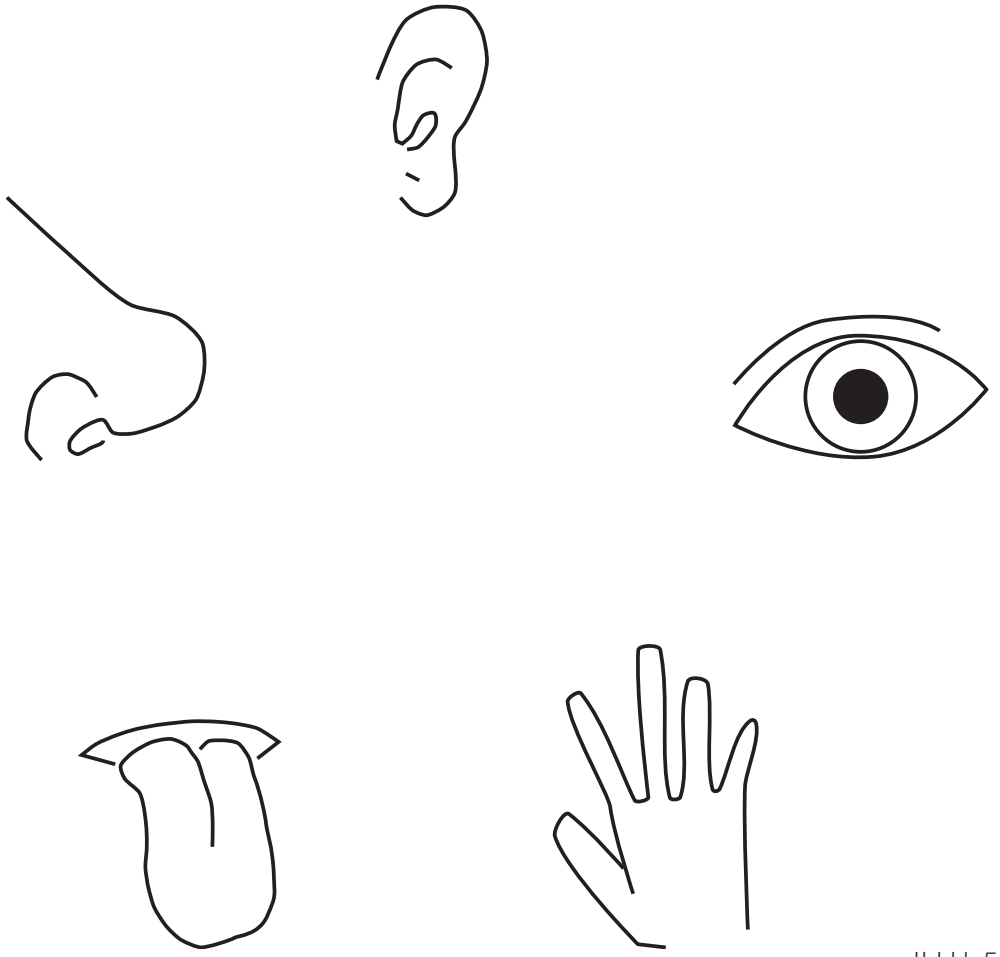
PHENOMENOLOGICAL THEORY

The phenomenological theory is based on the sensory understanding of architecture. This means that the entirety of the sensory system should be included in the experience of architectural works. However, this is not always the case, since the ancient Greeks, the sight has been seen as the more noble sense, meanwhile the other senses have been seen as lower and more animalistic. In many cases, architecture has been reduced to objects for images and pictures. This has been influenced by the way architectural works are presented and shown through the tactility, smells and kinesthetic experiences, which have been overlooked to promote the sight. A solution to this, can be establishing material understanding to keep the initial design phases analog by working with drawings and models. This means, designing with other senses and including the knowledge of the body. One way to work with sight, without neglecting other senses, is in Juhani Pallasmaas orientation, to work with peripheral vision. This is a way to allow for imagining and just getting the general feeling of a space. This allows the sight to play some part in the experience, while the rest can be experienced through smell, touch, sound and movement (Pallasmaa, 2014)

A way to work phenomenologically with architecture is to constantly think atmosphere, meaning designing with thought on smells, scale, light and material. This is because atmosphere is the cumulation of all sensory experiences in and around architecture. This is something that, if accounted for while designing, will help produce architecture that makes people feel and create beautiful architecture. This, in the understanding that beautiful architecture will move people and house people in the intended way. It is not an exact science but gives a guide for the mindset to be in while designing. One of the ways to do this is, as described in the book Atmospheres by Peter Zumthor, by shaping the darkness of the building with light. This approach is a way to look at creating rooms of light and shadow, for their specific uses and for forming sound in the room by working with acoustics. For the atmosphere, it is important to remember the feel of things and here materiality plays a large role and the interplay between materials. (Zumthor, 2005)

Because of the phenomenological theory's base on the human senses, it can also be a way to ensure quality spaces. The quality of space is based on a lot of elements such as utility and atmosphere. The atmosphere can be difficult to define but the phenomenological theory can, to some extent, describe it as the senses are in focus. As described before has sight been a large part of architecture but has also striped it for other sensory experiences. The lack of sensory experience makes the spaces seem dull or unfit to staying, leading to reintroducing the full set of senses to the design process. This does not mean the vison should be negated, but rather that it should be possible to experience the architecture with the whole body. A way to work with the vision, without it dominating to much, could be to work with light and shadow and create interest for the peripheral vision to intrigue but not be to certain leaving space for the rest of the senses to explore. It could for example be done by creating a specific sound or acoustics. This will often be influenced by the material choices made in the space as harder surfaces will create a harder acoustics meanwhile softer or more pours material will give softer acoustics. The material choices will also impact the temperature as some are cold to the touch and others warm, they may seem soft, hard, ruff and smooth. The tactility of materials

are very important to the sense of touch and can tell a story about the use of the room. Time is also a factor in materials as they may change though the use. What starts out as rough stone flooring might through time become smooth and then the sense of time comes through. When as space have been used to this extent, it becomes apparent where most people have moved through the space and it can impact the kinesthetic sense. This sense is the understanding of movement and as a space is designed the movement, it should be much considered as it impacts the way we interact with the architecture. The point of this is to show how things play together and will create an atmosphere based on the sensory experiences and its possibility to imagine the lacking in the spaces, if only vision is in the considerations. This is the same opinion that have been shown by Zumthor and Pallasmaa above. The opinions have been made very differently from one another but when held together, the best of both worlds become apparent. This can be seen as the theoretical side is represented in Pallasmaa and the practical understanding is presented by Zumthor.



ILLU: 5

ARCHITECTURE THEORY

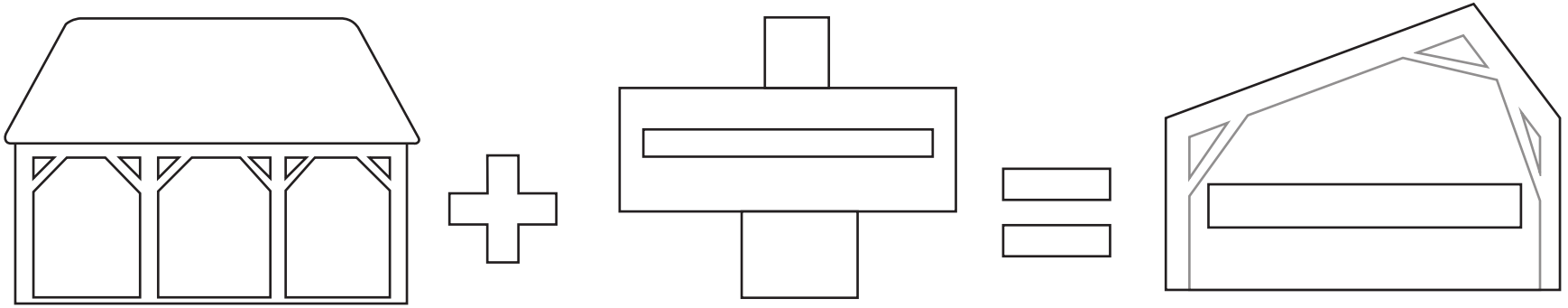
Regionalism

When building and designing for an artisan school it would be appealing and educative to make it according to the technical knowledge of the area it is placed. This is why the architectural theory of new regionalism is investigated. New regionalism, or critical regionalism, is about implementing the centuries of technical knowledge of how to build in specific situations and climates, for example by building after the half-timbered house style. This is done while also collecting inspiration and implementing it into the current architecture to evolve and polish the functionality and the human experience. Part of this movement meant that architects brought back ideas of ancient Greek cities and wanted to implement them into the existing cities of northern Europe like London and Copenhagen. In the eyes of some architects, this focus on functionality seemed boring but not for the Danish architect Kay Fisker, as he defended it in an article in 1950. He found that functionality was very important, and he worked to set the boundary for what was functional and what was simply a fragment of style and trend. (Lund. 2001)

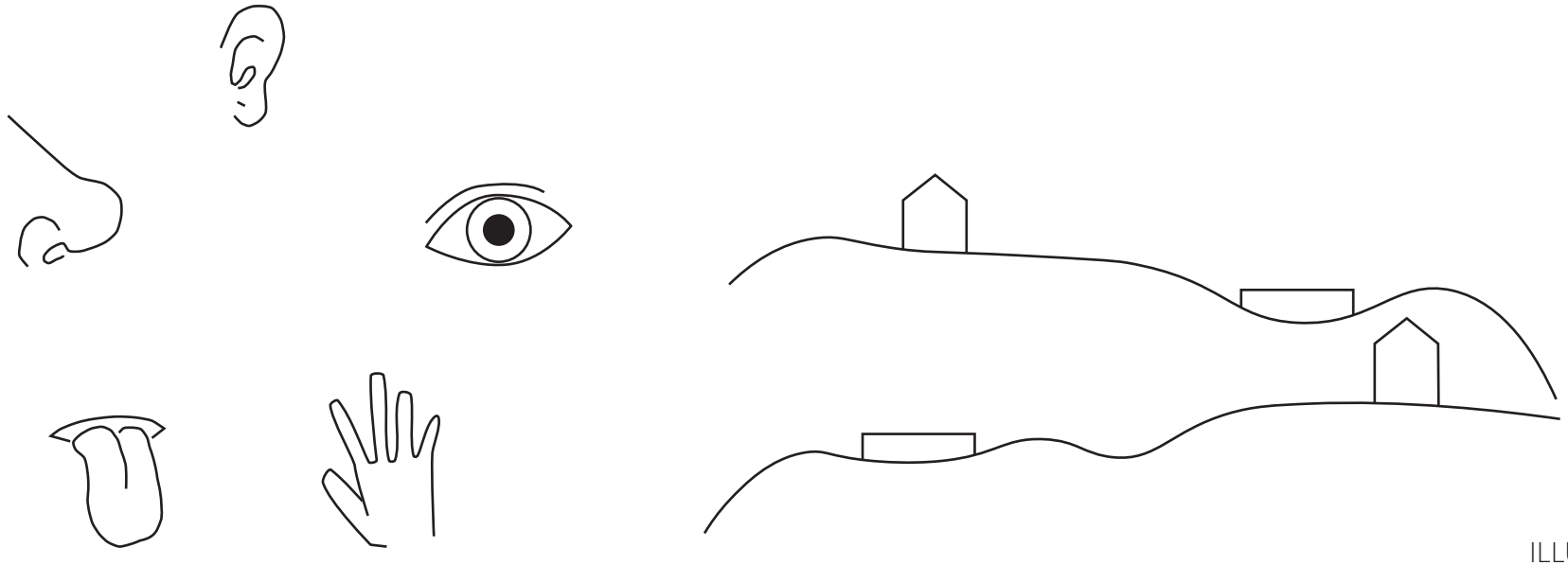
Designing from place and phenomenology

One of the things the modernists where most accused of was forgetting place and senses. The basis of most of the architectural waves after modernism had a form of intervention against the theory behind the modernist movement. One of the ways it was challenged was by new regionalism where the place was located, what the context was and what climate was. Further working with it where some of the modernist principles used but also adapted to the site, both in material, the adaption of form and context. Some of the most renowned architects in this area are Alvar Aalto, Peter Zumthor and Jørn Utzon. The basis for this way of work was in the phenomenological theory which started in Germany around the start of the 1900 and have developed from an understanding of life to a way for describing sensory experience. This would be a valuable instrument in designing for the human body. Some of the designs that truly display this have been designed before the phenomenological theory became what it is today, further proving the importance of this theory and its relevance in the world of architecture. (Lund. 2001)

When looking into architectural theories, thoughts on what a project needs, will be the first point of interest. In the case the combination of theories, accumulates to a theoretical understanding of how to work with the site in creating architecture. Derived from this is the cultural understanding and knowledge of how to build in the environment of discussion. When the connection is built into the very bones of the building, as the construction risk of ending up with a bad building, it becomes significantly less as some risks are avoided and often will reflect a building tradition. This will constructively strengthen the build environment and creates a connection between the older buildings as well as the newer one, even if it evolves over time. By this it is possible to have an aesthetic connection that partly is built on the knowledge of generations of builders and experience with the environment. An extension of this is to work the sensory experiences into the design of architecture, ones again after it being forgotten. This, for a large part, is about designing for the human which, especially the modernists were accused of neglecting, was leading to a variety of different problems in their architecture. This can, for a large part, be avoided by creating spaces that design atmospheres. This brings in the workings of phenomenological theory, as this is one of the ways to break down the human experience of space and is the basis of atmosphere. Designing by these factors gives a lot more points to work from and gives more dimension to the space. A problem with much of the architecture from the modernistic time, and after, is that it seems to flat as it often only is designed for our eyes and created to be beautiful pictures. Having beautiful pictures is good for advertisement but not good for the atmosphere, the use or the experience. In short it does not support the core of architecture as it is mostly seen as the creation of quality spaces for humans that then concerns the entirety of humans and their movement.



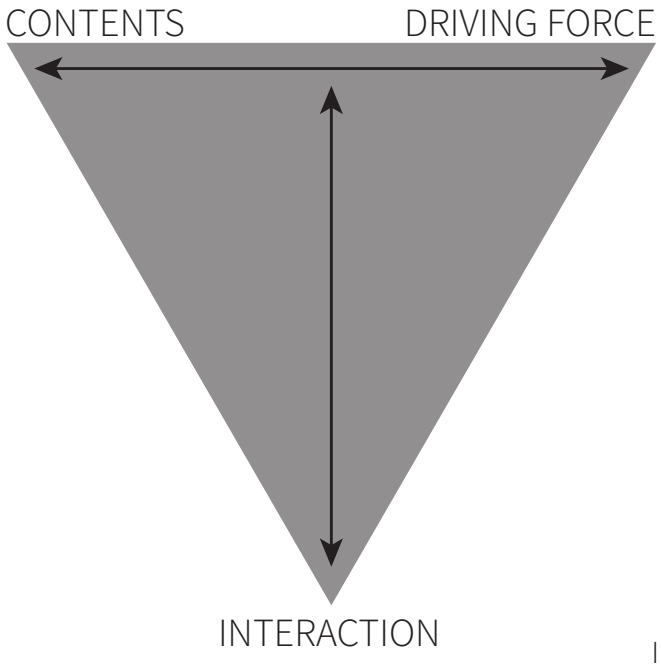
ILLU: 6



ILLU: 7
When creating a building it is important to incorporate the senses and context.

LEARNING THEORY

Learning is not just sitting on the school bench and listening to a teacher give a lecture. It is also how students learn, the different kinds of learning material and even just the surroundings. For a student to be able to learn, it goes through two different processes. The first one is the interaction between the individual and their surroundings, which happens the whole time they are awake and which they more or less can pay attention to. The other process is the individual's psychological processing and appropriation, which happen because of the impulses and influences the interactions contain. (Illeris, 2015)



ILLU: 8

Learning can also be divided into three different dimensions: contents, driving force and interaction. The content dimension is about evolving the learner's insight, understanding and their abilities meanwhile the driving force dimension is about the learner's motivation, feelings and will to learn. Lastly the interaction dimension is about the interaction between the social and material world.

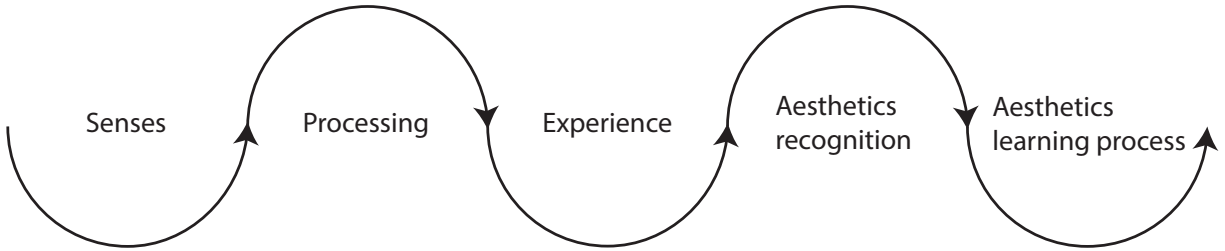
It is also shown that students are more inclined to follow along in the lesson if they feel they are participating in what they are learning about, and which forms of activities are used. There are two ways of managing educational activities. Firstly, what is already decided by the politicians and administration. The second form for managing educational activities is in daily work, where there are three types of management: teacher, participation and self-directed. In teacher management, the teacher is in charge of what needs to happen and how. This is mostly used in the early years of primary school but can go further to secondary education. Participation management means that everyone involved is in charge of the activities. Here there will be created different roles where the teacher ensures the framework regulations are met meanwhile the students are responsible for the material being essential, relevant and educational. Lastly, there is self-directed management which is about the student themself organizing and taking responsibility for their learning. (Illeris, 2015)

When the students need to learn they are rather indifferent if it is theory or practice-based learning. Vibe Aarkrog focuses on practice-related teaching, where the aim is to make the teaching meaningful for the students. In practice-based learning the students are solving assignments or problems in, for example, a workshop and incorporating the theory in the solution. Meanwhile in theory-based learning the students are often sitting in the classroom to learn the theory and practice will be used as examples of the theory or as small experiments. The students' understanding of theoretical knowledge is supported by practice-related teaching, when it is linked to the students' experience from practice.

The different forms of learning have different influences on the students' motivation and thus their learning. Practice-related teaching assumes that the physical framework creates the opportunity for students to develop experimental, practical and procedural learning. (Aarkrog, 2007)

Juhani Pallasmaa perceives architecture, art and spatiality as the basis for how humans perceive and experience and thereby how humans learn. In the book "Arkitekturen og Sanserne", Pallasmaa problematizes that it is the sense of sight, which is in focus in today's architecture, where he believes the other senses are overlooked and forgotten. (Pallasmaa 2014) The senses are also important for learning, especially the sense of touch. According to Pallasmaa, all senses can be seen as "*... extensions of the sense of touch – as specializations of the skin*" (Pallasmaa 2014 s. 68), whereas the senses function as a connection between humans and the surroundings. It is important to create experiences for the whole body because we learn and remember just as much through the body as with the brain. The corporeal memory is essential when we need to remember places and experiences. Therefore, architecture's sensory experiences should appeal to both the mind, body and senses.

This can also be transferred to the so-called "aesthetic learning processes". Human development is seen as a whole, where senses, feelings, language, body and social empathy are linked together. The aesthetic and intellectual languages can be seen as two coherent and inseparable parts, which should be given equal importance. (Froda & Ringsted, 2008) By the absence of the use of the senses, there is a possibility that a part of the aesthetic learning process disappears. The architecture should therefore not only play a visual and practical role, but should also, through the senses, as well as the feelings, moods and experiences, create the outer frames for the human creation of development and learning.



ILLU: 9

SUB-CONCLUSION

By combining the different theories with learning theories can a deeper understanding of how the design has an importance for the human experience of buildings and spaces be reached. Likewise, can the combination help create a holistically oriented design, that not just focuses on form and function, but also on the human experiences and learning. The scientific theoretical point of view comes from phenomenology, as a philosophical direction, which has a focus on the human experience of the world through the senses and consciousness together with the experience of space and place.

The learning theorist Knud Illeris was introduced to illuminate his theory about the different ways on which humans learn. Here was gathered the knowledge that materials and surroundings have a big influence on human learning. In Illeris' model of learning, was the driving force dimension found especially interesting because it illuminates what motivates the human to learning. The driving force may have an outlet in different conditions and feeling. Therefore, should there in the future building be a focus on how materials and architecture can be involved in motivating the students learning.

Vibe Aarkrog focuses on practice-related teaching where the purpose is to make the teaching meaningful for the students. The students understanding of the theoretical knowledge is supported by the practice-related teaching when it connects to the students' experiences from practice. The practice-related teaching assumes that the physical framework creates possibilities so that the students can evolve experimental, practical and procedural learning.

Pallasmaa attaches great importance to how the human senses and thereby learns. The architecture and the space do not only have a visual expression but does also have influence on the human self-understanding. The architecture can be involved in having a focus on being experimental and creative through learning.

Based on this, is it important in the design process to be aware of how the senses is being challenged by the aesthetics to obtain learning. The physical arrangement of the school and the teaching rooms needs to contain an atmosphere that gives the students inspiration and motivation for learning. The physical framework should reflect the connection to the subject. This can be done through the decoration, the coupling and the combination of different materials. Furthermore, does there need to be material there reflects the real life, so the students have the possibility for the practice-related teaching.

PROBLEM STATMENT

How can the theories of learning, phenomenology and tectonics facilitate the design of an environmentally and socially sustainable artisan school for carpenters and woodworkers.

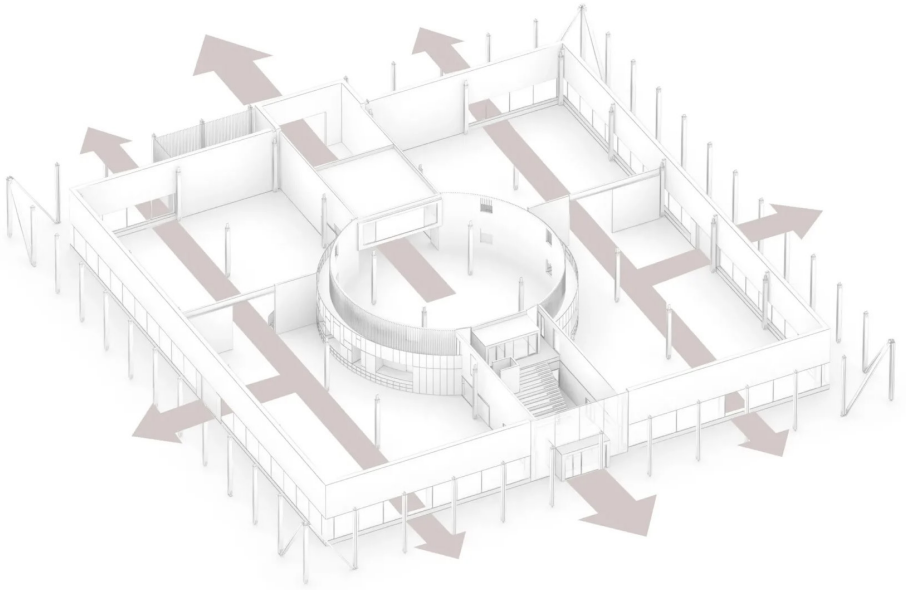
3 CASE STUDY

Throughout this chapter different case studies will be presented and analyzed. These will be analyzed to identify how to create buildings for carpenters and woodworkers and how to build with the senses and the context in mind. The project can benefit from analyzing already constructed buildings because it will avoid problems the case studies already encountered in their processes.

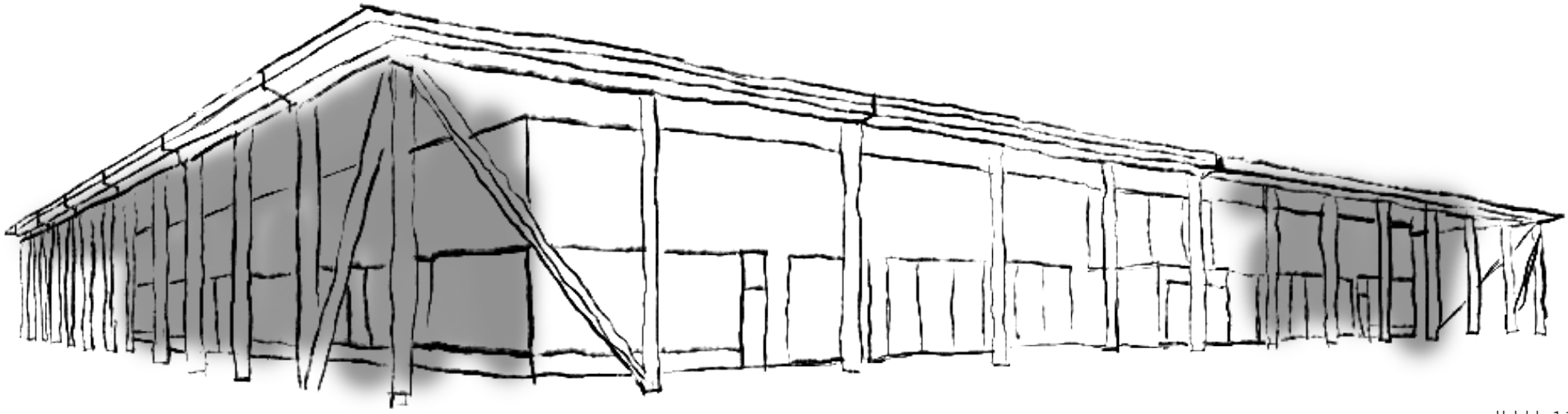
TRADIUM CARPENTER SCHOOL

Tradium is an artisan school located in the city of Randers, Denmark. Their newest building consists of two parts, one remodeled building holding the more traditional school functions like classrooms. The other part is a new building with carpenter workshops and the teachers' lounge. The workshops have the possibility to open up towards each other to create more collaborations between classes or if more space is needed. The project was created by ERIK Arkitekter and is constructed of glulam elements and concrete (Vognsen, 2018)

This case study focuses on the newly built part of Tradium, as this has been built specifically for carpenters and their learning. In order to investigate how Tradium supports the learning environment of the carpenter students, the learning triangle shown in the theoretical chapter above will be used to create connections. The first of three is content where, in the theory, this relates to the informational content of the subject. This is represented in the physical surroundings by showcasing how to build in wood and might be a way for the teachers to point to the specific parts and explain. The second part of the learning triangle is the driving force in the building. Such can be seen as the students are educating themselves to work with wood. The surroundings should inspire the student in the understanding that they will be excited to get to a point where they professionally can do the same type of work. The last part of the learning triangle is interaction and Tradium allows for this aspect as the design creates spaces to meet and interact. This is both for the students in-between and between the students and teachers as the teachers are in close proximity and easy to find. In conclusion it is important for the students that the physical environment can inspire as well as teach and showcase the craft they are learning. This is to create a mindset of what they are working to create and to show the students how impressive their craft is. The last part is extremely important for the learning environment, and it is to create space for connection. The students need to be able to connect and interact both in their studies and on a deeper level to support the wellbeing of the students and keep them motivated to learn.



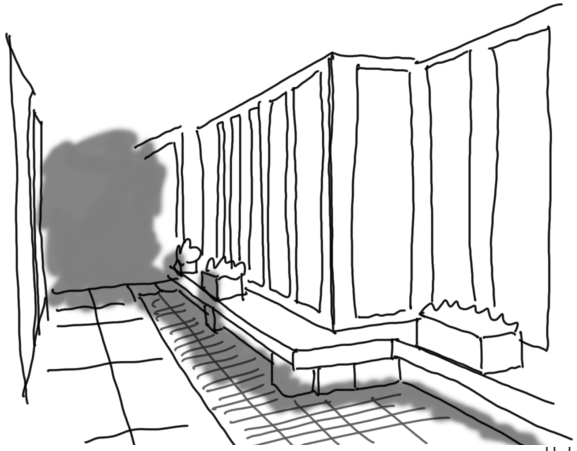
ILLU: 10



ILLU: 11

SÄYNÄTSALO TOWN HALL

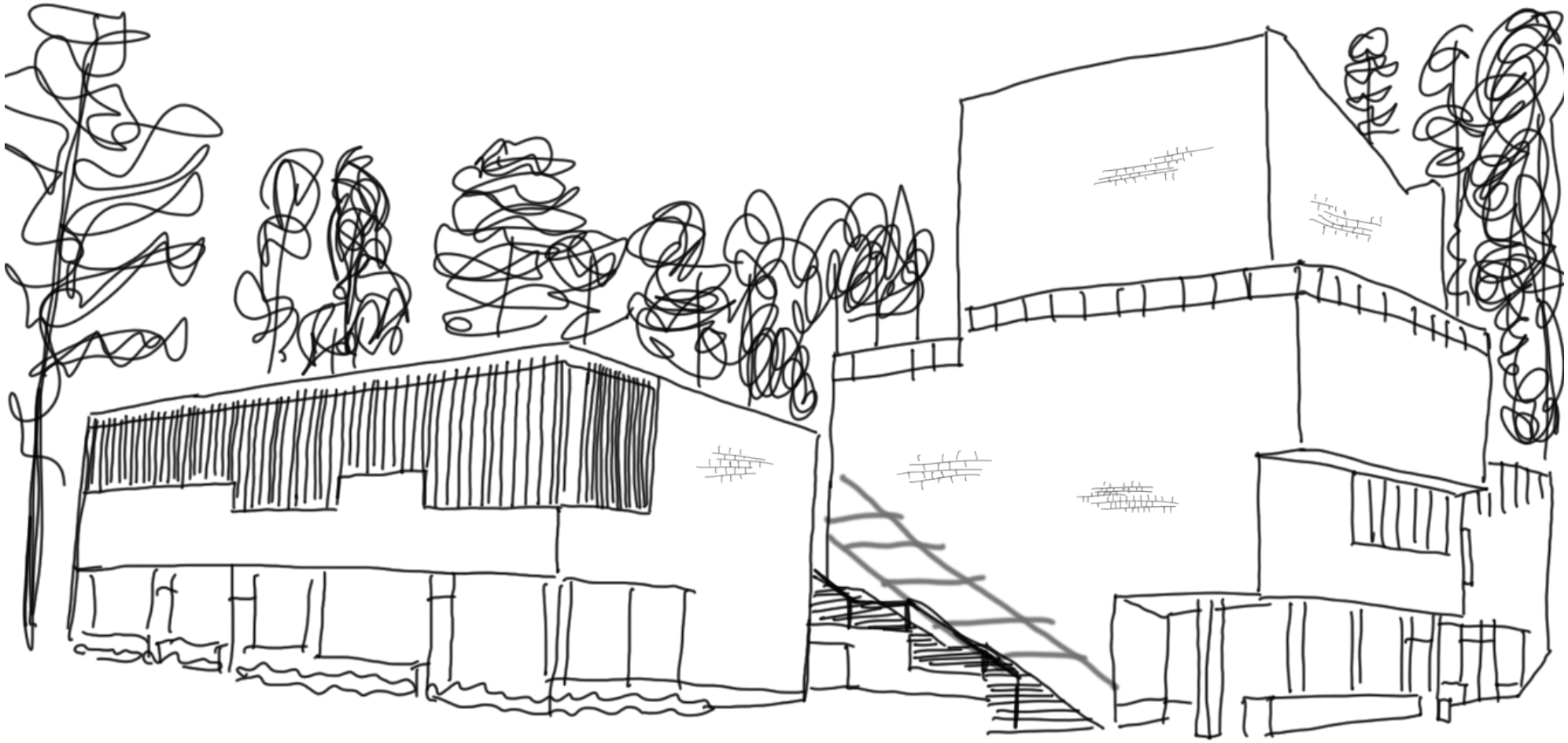
Säynätsalo Town Hall was designed by Alvar Aalto in 1949 and is located in the town of Säynätsalo in Finland. The project is largely done in the lines of regionalism, explained in the theoretical chapter above. The project is designed with many different uses in mind as it functions as the town hall, library, staff apartments and store spaces. (Fiederer, 2016) The many different types of spaces meant that the atmosphere of the spaces was very important to control. Some places this is done by differentiating the height of the spaces and bringing in materiality to create tactility. The height differences are prevalent, especially in the council chamber as it has a much higher ceiling height in order to create an understanding of the importance of the work done here. In other unspecified spaces, the ceiling height is rather normal and allows for less formal use and allows for spaces to feel at ease. The hallways are also deigned in a fashion where the movement is more than straight forward. There are slight shifts in the levels which engage the kinesthetic sense. Alvar Aalto has also been working with light and shadow as he does not seem to have been afraid of the contrast of dark corners and light squares shining from the windows. Furthermore, as mentioned above, Alvar Aalto has worked in what can be classified as regionalism. This results in a new architectural look while maintaining the integrity of the traditional building crafts and fitting the design to the context both architecturally and climatic.



ILLU: 12

In summation, what Alvar Aalto did in this project was to work with the senses and the context of the project. This is similar to the way phenomenological theory can be integrated into architecture. It is important to remember that phenomenological theory have not been an architectural tool for long, so this is more an analysis of what it means to work this into a project, rather than an architect wanting to work with a specific theory. Nevertheless, will the town hall be an example of exactly how much understanding of a space can be conveyed through other means than purely sight

ILLU: 13



ILLU: 14

4 ANALYSIS

In this chapter, different site and demographic analyses will be conducted. These will help create an understanding of the future users and the site itself. Furthermore, it will also identify possible complications there needs to be looked into and designed accordingly.

CHOICE OF SITE

This analysis was made to find the site most suitable for the users which would also follow the groups visions and intentions.

Three different site was in the rafter to become the building site. These were: EUC Nord in Hjørring, Marcantec in Viborg and at BUILD AAU in Aalborg. EUC Nord was investigated because of it already having a carpenter and woodworker education and because of its close proximity to other educations and young people. By placing the site here it would also make it easier for the students to intermingle with other educations and create relations between each other. Marcantec was investigated because of its current facilities are not of the best quality and because there was a possibility to make a new student dormitory. Lastly was the site besides BUILD AAU chosen because there were ample opportunities to create a whole new building with new facilities, not connected to other preexisting building.

The site at EUC Nord was then opted out because it already had all the needed facilities. Furthermore, would there either be needed to demolish existing buildings to make the project or if would need to be a renovation project. Mercantec was opted out because it would also be a renovation project and could not, environmentally, be argued for.

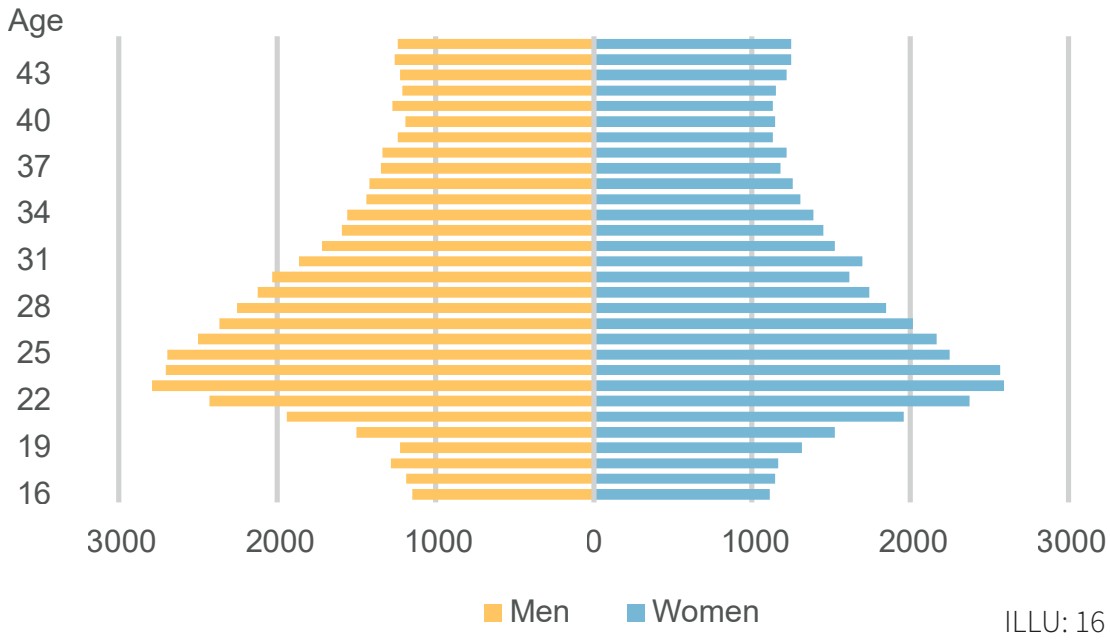
The site on Thomas Manns Vej 24, adjacent to AAU BUILD, was chosen because the group had a vision of a possible collaboration between AAU BUILD and the future school. The close proximity between the engineers at AAU BUILD and the artisans will hopefully result in some sort of interaction and understanding arising between the competences. Furthermore, placing artisans so close to what, at the moment, seems to be the preferred route for living and educating, might help to establish some of the same benefits when it comes to living a student life.

1:5000
ILLU: 15
35

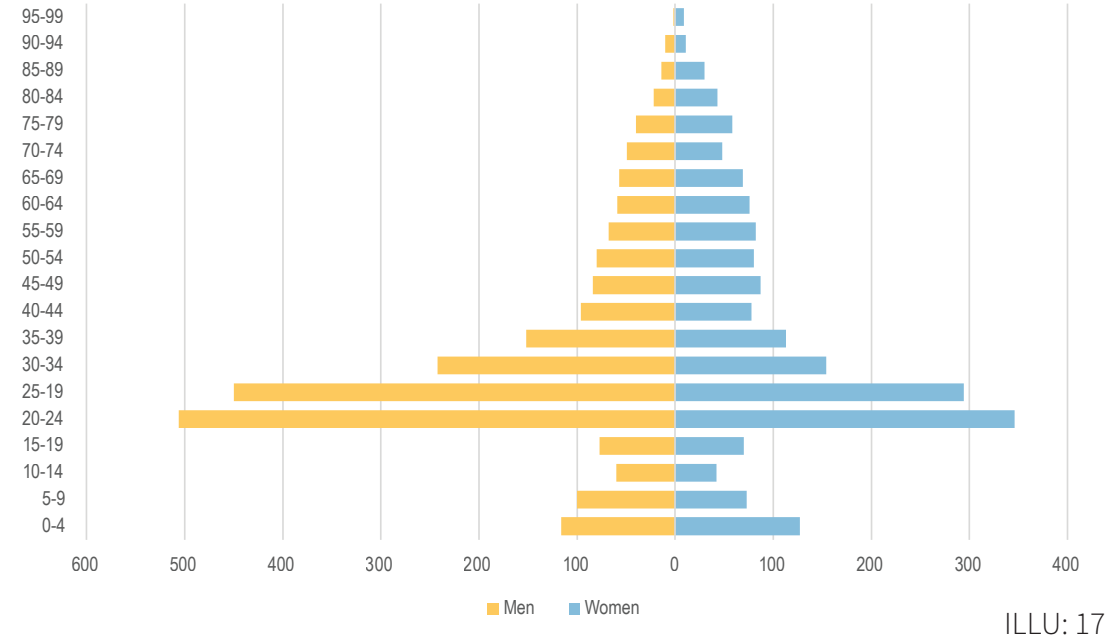
DEMOGRAPHY

This analysis was made both to find support for the choice of building an artisan school at the site and to support the use of the site after school hours as the site is surrounded by educational institutions and general housing. The vision is that the site will offer sensory experiences and value to both the main and secondary user groups. This will be done by having space that facilitates staying and others that can be used for, for example, a small walk. This configuration will have the site used most of the day as the students can reside in breaks and get fresh air and move between classes meanwhile walking and unwinding. When the school day is finished the residents around the site will start coming home and they might need to unwind after work or studying. Therefore, should the outdoor space offer calm surroundings modeled after nature. This can be justified as nature-like environments will have a calming effect on humans and the area should furthermore activate our senses in order to get a feeling of being out in nature.

In the first diagram on illustration 16, the age distribution for the age group who possibly would like to get further education, is shown from Aalborg municipality (Danmarks Statistik a, no date). Meanwhile, the next diagram on illustration 17 shows the age distribution of all inhabitants in the district the site is placed on (Aalborg kommune, 2024). The last diagram on illustration 18 shows how many people each year choose to take a vocational education in the whole country, which is a decreasing number (Danmarks Statistik b, no date). This is concerning for Denmark because there already is a shortage of vocational workers (Gluud, 2018). Therefore, more of the youth need to choose these educations instead of the higher academical ones.

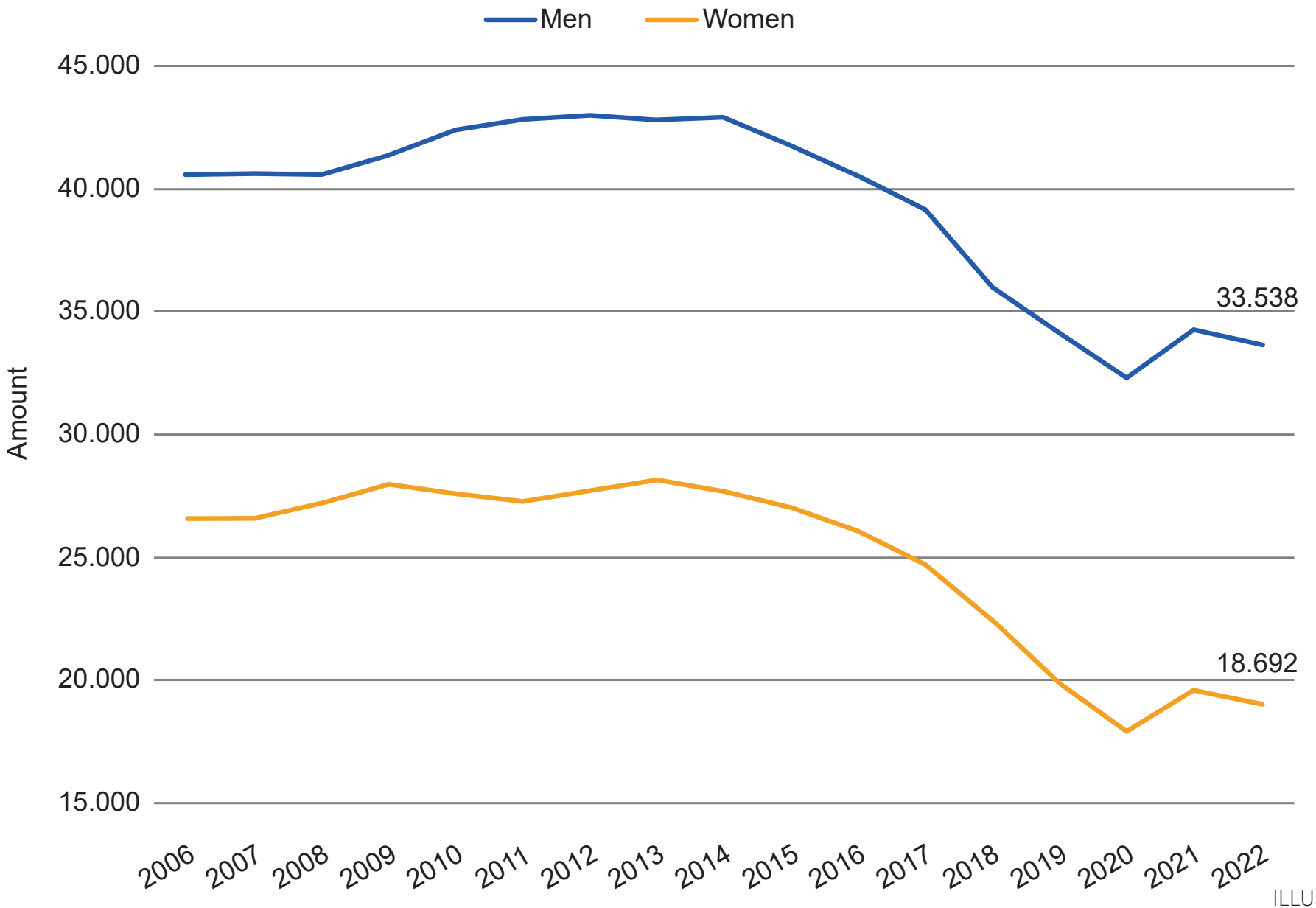


ILLU: 16



ILLU: 17

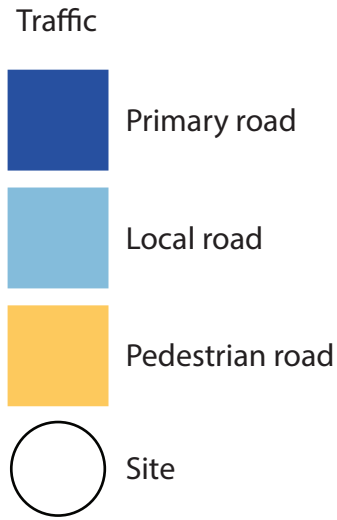
18-25-year-old men and women with a vocational education

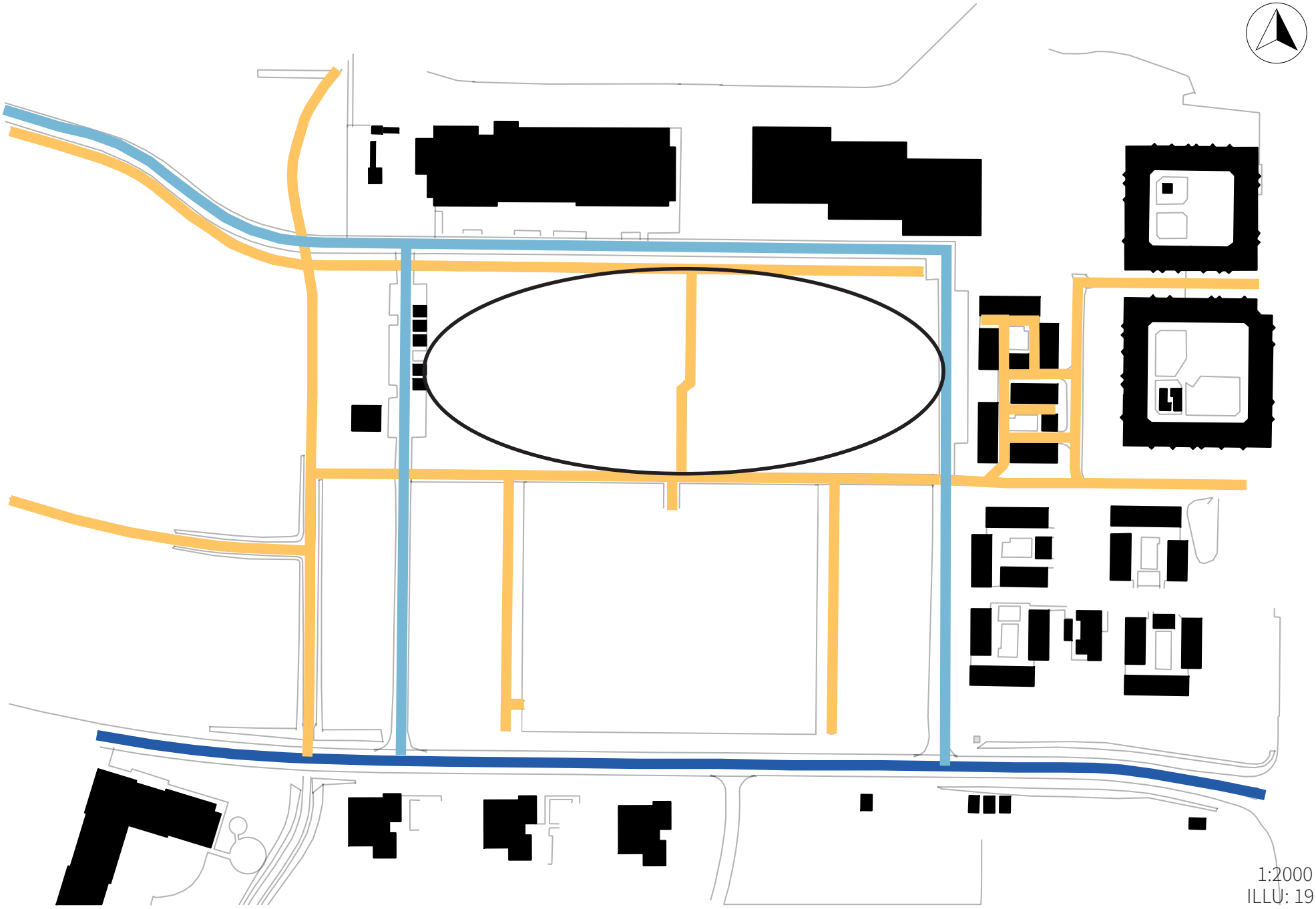


ILLU: 18

TRAFFIC

When analyzing the traffic around the site it is used to locate where most people will be traveling. This information will be used to find a placement where deliveries can be made to the school as well as where most people are thought to come from. The aforementioned will have an impact on where the main entrance should be placed. This will of course also have an impact on how the paths around the site should be placed, as the traffic on the site should be modeled, so as to give easy access to the main functions while leaving space for calmer routes on the site.





1:2000
ILLU: 19

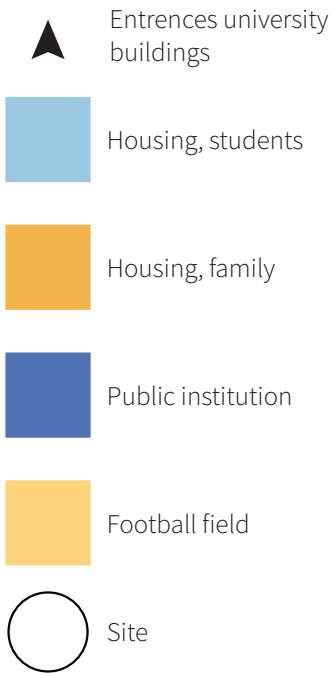
TOPOGRAPHY

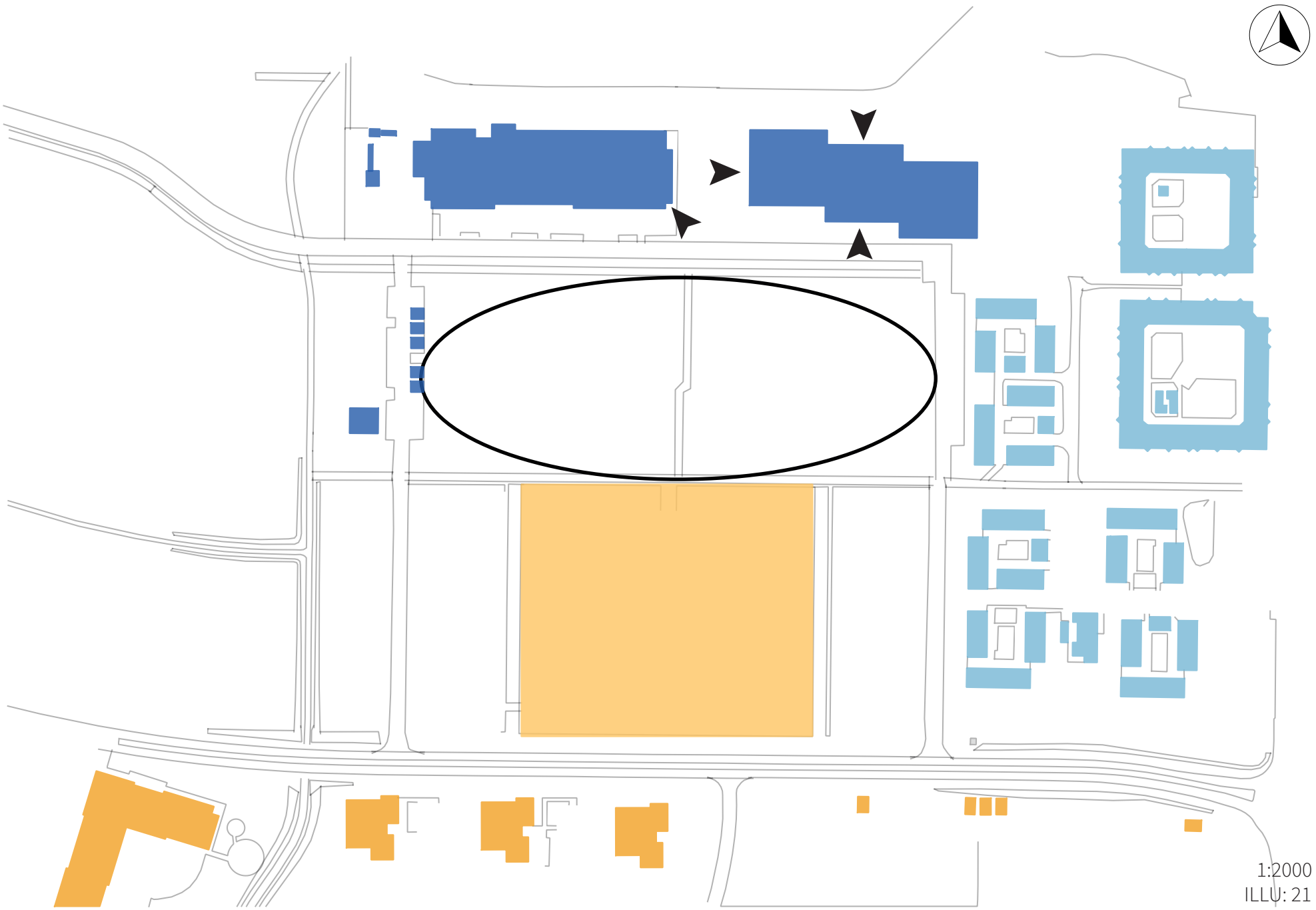
The topography of the site inclines approximately 3 meters to the south. The contour lines, seen on illustration 20 show large spaces where individual buildings can be placed with a minimum impact to the existing topography. Furthermore, can the slight shift in the ground be used in the development of the masterplan as the path and plants should also follow this. The topography can of course have an influence on where water collects, so minor changes might need to happen in order to accommodate this.

1:2000
ILLU: 20

TYPOLOGY

The typology, in the area surrounding the site, is a mix of educational buildings, student housing and ordinary housing. This will of course have an impact on the project and what it should accommodate. As mentioned in the demographic analysis, there are a lot of different users of the space, and they need to be accommodated in some way. The site, due to the location, might become a connection visually between the very tall AAU buildings to the north and the shorter student housing to the east, as seen in illustration 21. Meanwhile, the site will also connect the ordinary housing closer to the green areas within the AAU main campus. The site itself could also be used for a short walk or the start of a longer walk, activating some of the many spaces around the campus.



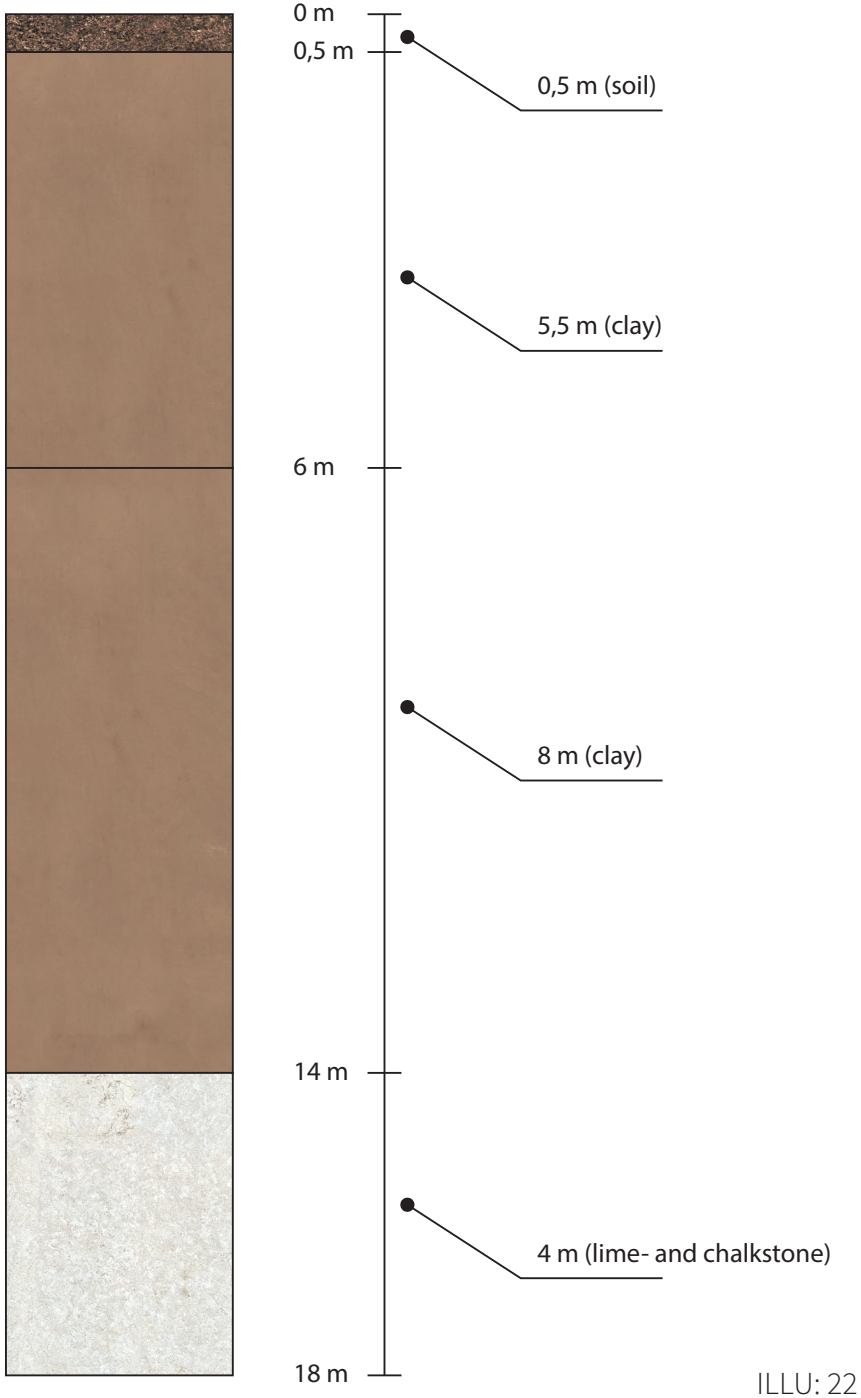


1:2000
ILLU: 21

BLUE SPOT

The blue spot analysis shows the places where water collects during heavy rainfall. This will have an impact on the use of the space, as water collecting close to buildings may lead to fast deterioration and water in the construction. Therefore, it is important to lead water away if the risk is shown in the analysis. One of the ways to lead the water away is by using fascines. This, however, only works where the soil can absorb and filter the water to the groundwater. If the water is not close to the built environment, then it can stay without danger for the lifespan of the project and then other aspects need to be taken into consideration, such as the impact on pavement or plants. Having water on the site will have a benefit for the biodiversity but, as it is now, the water will be too unpredictable to support life. Having a basin to collect the water might be a good solution for having water for biodiversity while not damaging the built environment, pavement or plants. It would also be possible to let water erode certain parts, showing the power of nature and place the path around the water accumulations. Here there could be planted vegetation that can handle water and dryness better. Because plants can handle both, they can be useful when using fascines to disguise the solution as a flowerbed.

As seen on illustration 22 the ground, from a nearby soil survey, consists of mostly clay which can create complications in absorbing rainwater (Geus, 1930). Therefore, would it be an advantage to use SuDS solution, Sustainable Drainage System, to help collect and diverge water from the sewage system.

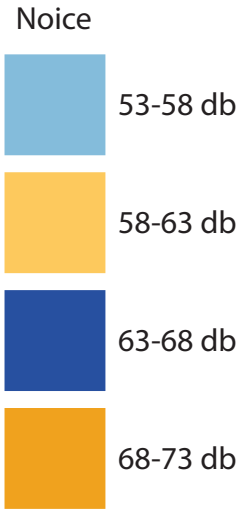


ILLU: 22

1:2000
ILLU: 22

NOICE

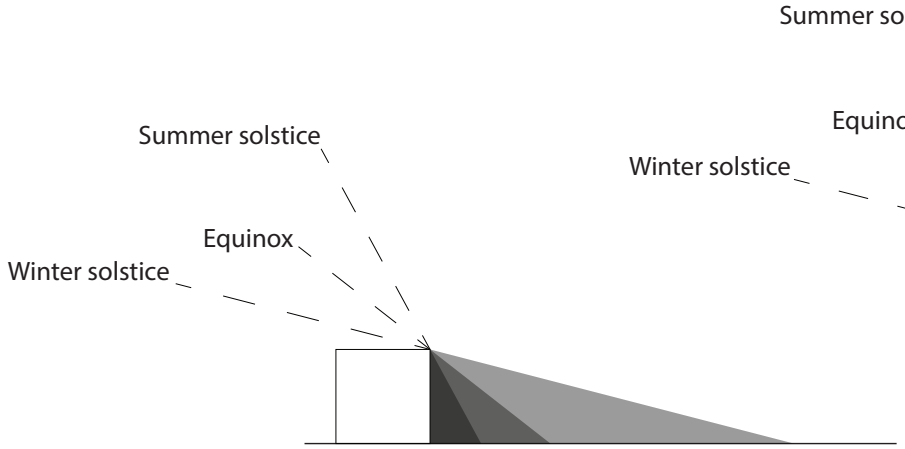
When looking into noise at the site the roads do not affect the sound picture in any significant amount, as seen on illustration 24, leaving only the noise from the site to become a problem (Miljøstyrelsen, no date). In order to ensure this will not be the case, measures can be taken to stop, redirect or break down the sound waves. The noise that might become problematic will originate from the workshops as the sound of tools can be quite loud. This is the reason why noise is taken into consideration and to protect the context, the best method of minimizing sound is to break down the soundwaves. This can be done with plants as every time the wave hits a surface it loses some of its strength and the sound is thereby reduced. Another measure that of course will be implemented is insulation of the buildings to minimize the sound coming out and, if these measures should prove insufficient, movable acoustic panels might be of use.



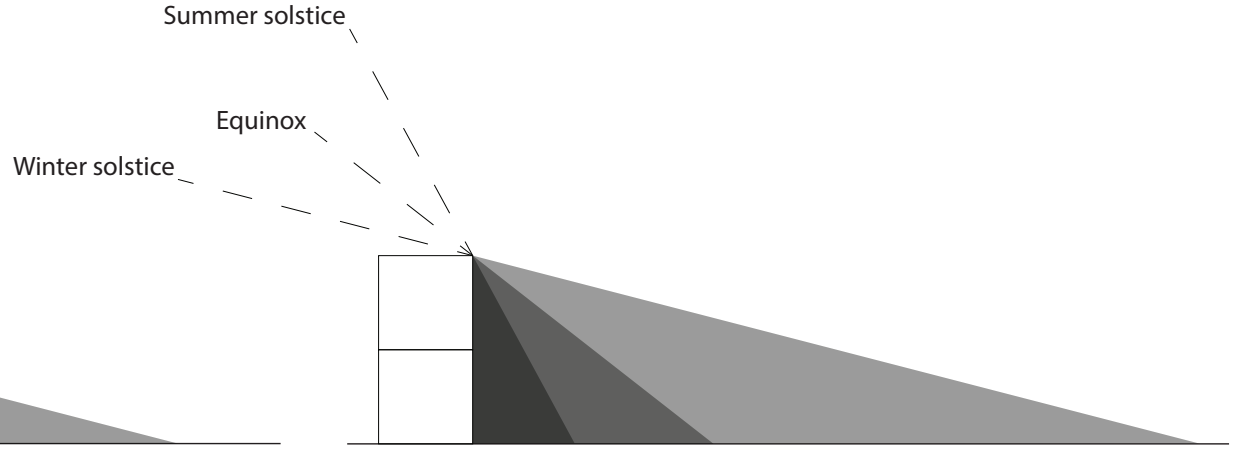
1:2000
ILLU: 24

SUN

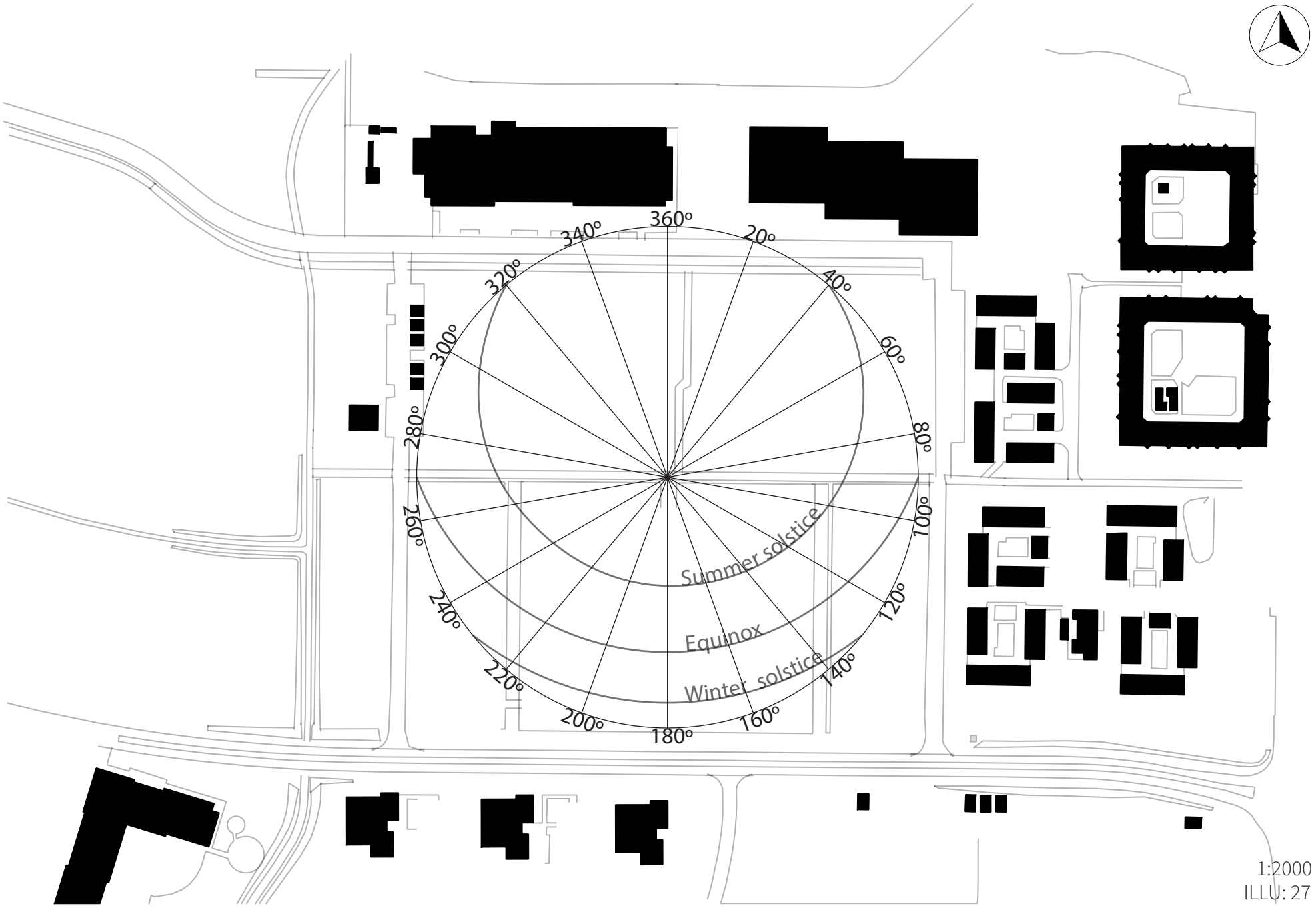
In the sun analysis the path of the Sun over the site is shown on the summer solstice, winter solstice and equinox and on illu 27 is shown the angles of the Sun on the different dates when it is at its highest. This shows that the site is very well lit as the only thing shading the site is the soccer field to the south, that is elevated a few meters higher in the terrain. However, most of the shade from that will fall on the bike path and on the southern edge of the site but not in any of the prime spots for the buildings. When building it is important to make spaces that have sunlight for staying outside and other spaces shaded in the summer. This allows for different types of people and biomes for the maximization of biodiversity on the site.



ILLU: 25



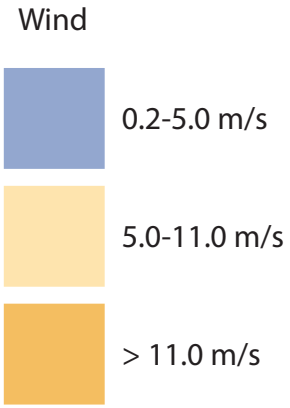
ILLU: 26

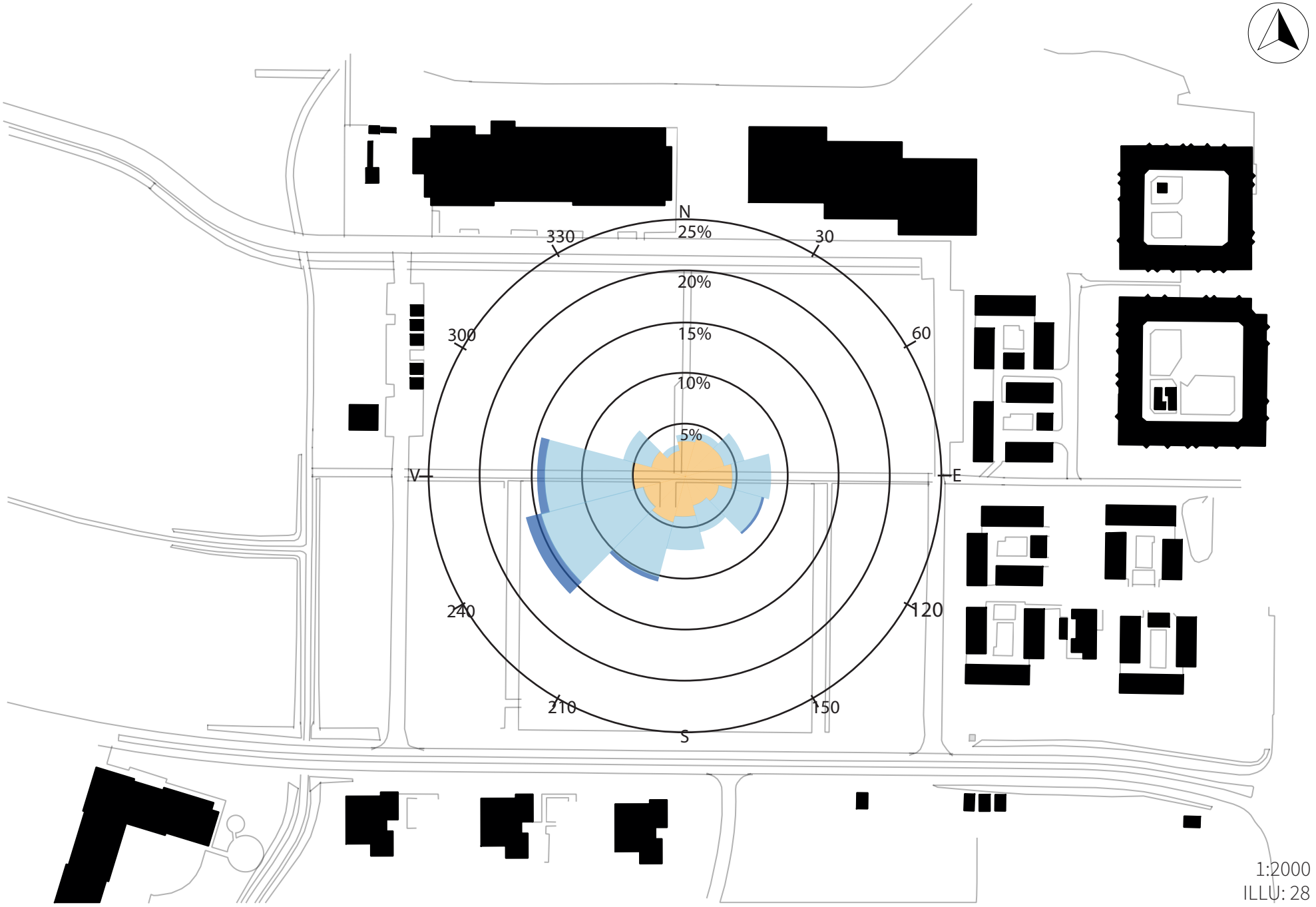


1:2000
ILLU: 27

WIND

The site is relatively open to the wind as there are little to no buildings to the western side (Jørgensen & Cappelen, 1999). Therefore, in order to have nice spaces for staying on the site throughout the year, trees and other plants could be used to create spaces that are protected from the wind. Though, it is important that the whole site does not become protected, as it would take away a lot of sensory experiences such as wind on the skin and in the hair or the sounds of plants moving with the wind. Therefore, the wind protection should be used cleverly. The wind should primarily be kept away where people are sitting as them not moving makes them more prone to feel cold. However, the wind should be in places for walking to cool people off.

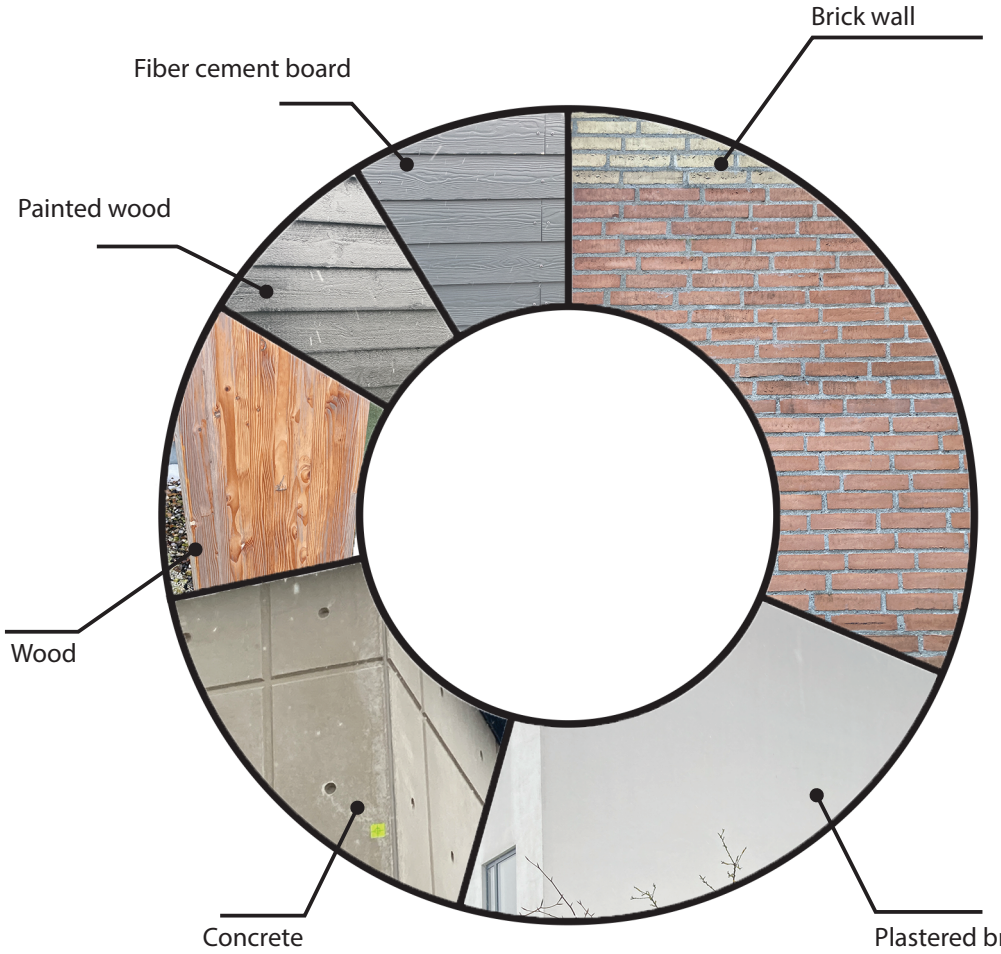




1:2000
ILLU: 28

MATERIALS

When looking into materials for this project, a mapping of the materials in close proximity of the site was made. This clearly shows that wood is used sparingly meanwhile brick and concrete are used the most in the surrounding buildings. This in turn means that the project will either have to fit in with the context or stand out. As wood is to have a great part in this project, it is decided that the new school should stand out while still being respectful to the context. However, a statement will also be made about the primary building material. There will also be looked into the possibly of using traditional Danish building technology, which is lagging a bit when it comes to the close context.



ILLU: 29

INTERVIEW

Through a visit to the secondary education EUX at EUC Nord in Hjørring, were the head of education from Energy and construction, Steffen Damsgaard, and one of the carpenter teachers, Anders Møller Hansen, interviewed. The whole interview can be read in appendix 6. Here it was learned that in the workshop, they did not make much use of the ventilation system because, opening the large gates and skylights were enough. It was also said that they would like to have some classrooms out in the workshops because it is observed that the students would not see it as just theory learning. It is also a benefit to have some kind of TV screen in the workshop so the “classroom” learning can be done in the workshop, and they save time, not going from place to place. It would also be beneficial to have some covered outdoor storage either for materials or for projects on hold. It was also said that they would like to have large window sections looking into the workshops to show everyone, students, teachers, passers-by and bridge builders, what the students are making. Lastly the interviewed revealed their opinion about an artisan school should be made of the materials the studying artisans are using, for example brick for the bricklayer and wood for the carpenter.

PERSONA

Teacher

Brian has been an educator for some years, and he made the decision to become an educator after helping teach trainees in the practice he was working at. An everyday scenario of Brian's day is teaching both practice and theory of carpentry in the workshop. He is the one who overlooks the different projects the students have to go through on the different courses. At lunch he eats in the teacher's lounge and discusses the events of the day, alongside plans for both in his private life and for the classes he is teaching. This interaction assures him in the choices he makes professionally and helps him and his coworkers to feel closer and work better amongst one another. It sometimes happens that one of the students comes to him with problems during the lectures or that one of the students' needs a talking to. In this case he tries to take them aside so as to respect their privacy or not embarrass them in front of the class. It is not always easy as he still needs to have an eye on the rest of the class. This becomes less of a struggle when there are two teachers for a class, even if the class is a lot larger. This is also an advantage whenever a student needs a bit more help than the rest, as these students get a lot more help when two teachers are around. Brian sees the students and wants them to grow as much as possible and be the best they can. Sometimes, he wishes the school could inspire the students more, let them see the students ahead of them during impressive things or just see how much you can do with wood.

ILLU: 30

Student

Gustav gets up early to get to school in time, even when it is not fun getting up. However, his friends and the subject make it worth. He knows it was the right choice because no matter what else he tried out, it was not enough to make him change his mind. The best part is of course when he gets to build something but even the theoretical part is easy enough, when it is related to the actual work as it often is when working in the workshops. In the breaks the friend group gets together and have a talk and a laugh winding off for a bit before going back to the lectures. Whenever they do so they try to find somewhere they are not disturbed, it is not much needed but just the feeling that you actually have a place to be where you are not in the way is rather nice. Most of the friend group is of the same age, nearing the end of the teenage years. When the day is all over, Gustav goes off to do other activities with friends and peers.

ILLU: 31

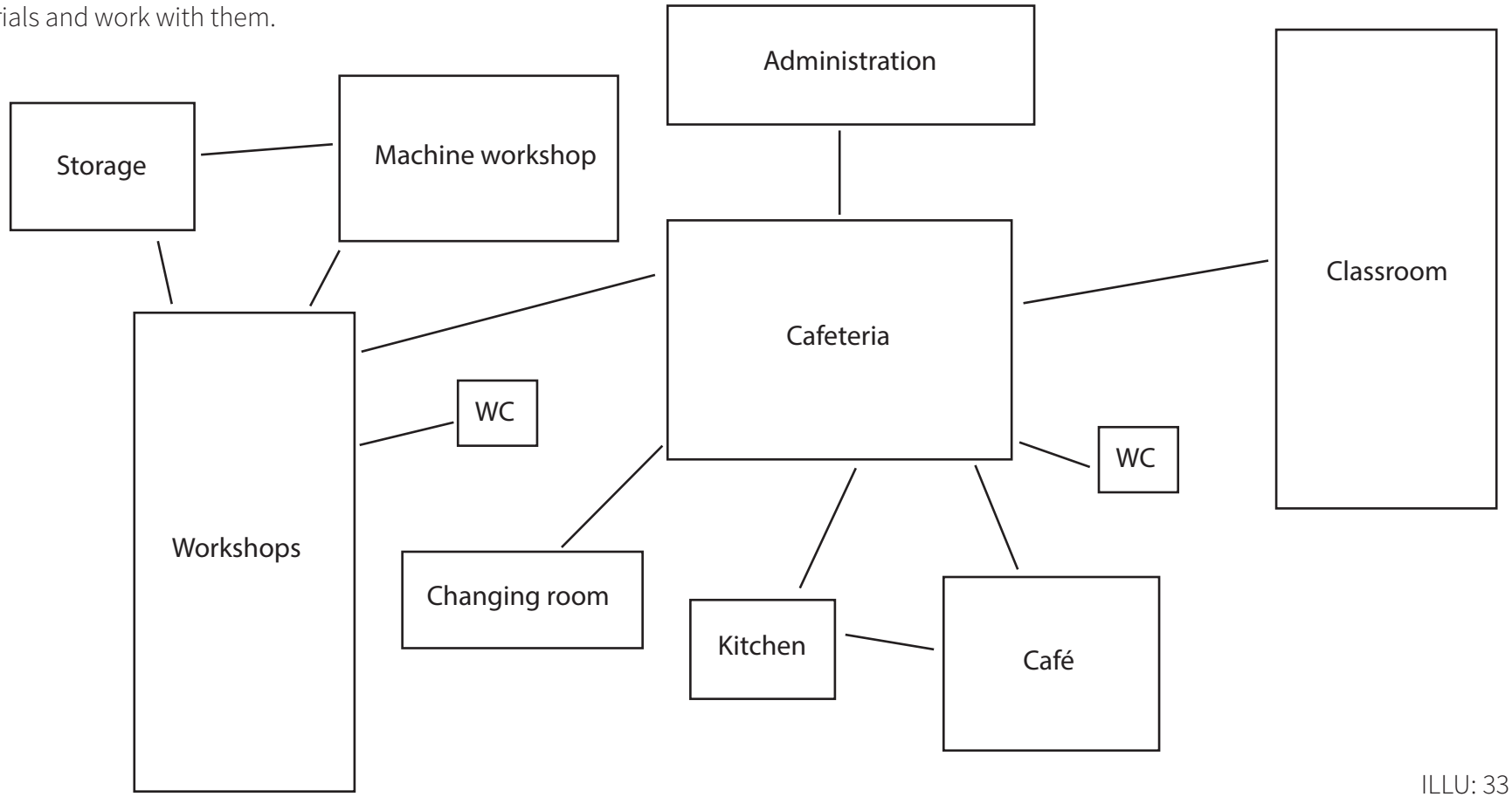
OLD ROOM PROGRAM

Rooms	Amount	m^2	Light	Activity	Durability	Access	Capacity	Atmosphere	Aesthetics	Materiality
Woodworker workshop	3	300	Both	High	High	Both	20	Structured, calm	Industrial	Concrete, steel, wood
Carpenter workshop	3	600	Both	High	High	Both	24	Structured, calm	Industrial	Concrete, steel, wood
Machine workshop	2	230	Both	High	High	Both	15	Structured, calm	Industrial	Concrete, steel, wood
Classroom	8	75	Natural	Low	Low	Inside	30	Structured, calm	Clean	Gypsum, wood
Canteen	1	200	Natural	Medium	Low	Both	200	Loose, talkative	Clean	Gypsum, wood
Kitchen	1	100	Artificial	High	High	Both	5	Clean	Clean	Ceramics, tiles
Wc	20	3	Artificial	Low	High	Inside	1	Private	Clean	Ceramics, tiles
Changing room	2	50	Artificial	Medium	High	Inside	15-30	Inclosed	Clean	Ceramics, tiles, wood
Storage room (inside)	6	10	Artificial	-	High	Both	-		-	Concrete, steel, wood
Storage room (outside)	2	200	Natural	-	High	Outside	-	-	-	Gypsum, wood
Café	1	200	Natural	Medium	Low	Both	50-70	Loose, talkative	Cozy	Gypsum, wood
Meeting rooms	4	15	Both	Low	Low	Inside	4	Structured, calm	Clean	Gypsum, wood
Administration	1	75	Both	Low	Low	Both	10	Structured, calm	Clean	Gypsum, wood
Teachers lounge	1	50	Both	Low	Low	Inside	10	Structured, calm	Clean	Gypsum, wood
Preperation room	1	50	Both	Low	Low	Inside	10	Structured, calm	Clean	Gypsum, wood

ILLU: 32

FUNCTION DIAGRAM

A function diagram is used to create a general idea of how the functions in a building should be distributed. On illustration 33 it is seen that the cafeteria will be a central part of the project. The reason for this is that the cafeteria will function as a large meeting area for every user of the building to use and to bond with each other. It can also be seen that the kitchen is connected to both the café and the cafeteria. This was chosen because it was found that there did not need to be made two different kitchens when both staff easily could use each other's equipment. Lastly, is it illustrated that the workshops are connected to storage facilities and machine workshop. This was chosen to make it easier for the artisan students to both retrieve materials and work with them.



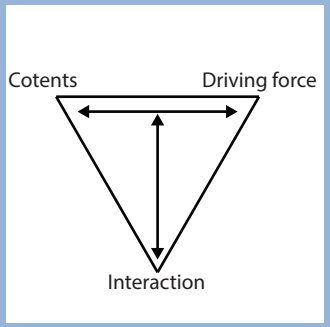
ILLU: 33

ANALYSIS CONCLUSION

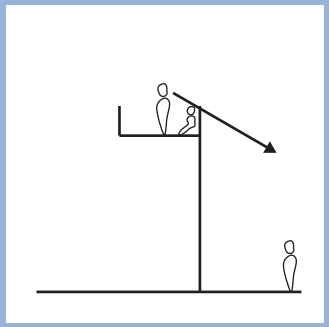
Through investigating theories, some of the main points, when building, are the importance of understanding the site, as it will provide context to the building principles. Furthermore, was Alvar Aalto's theories used to create a deeper connection overall that will help people feel anchored in the space. To further anchor people, it is possible to work with the senses and letting the building be experienced with the whole body. There should be established an atmosphere of learning and different tempos throughout the project both inside and out. To investigate how atmospheres can be created, through the difference in space according to its size and materiality, the case study of Säynätsalo Town Hall created by Alvar Aalto, was made. To further establish a bond between the building and its users, tectonics is a main point for creating spaces. This, to both strengthen the interest and understanding, as the construction principles should be shown. In turn will this create an understanding of how form and construction come together in function. This should then lead to a project of high architectural quality. Furthermore, the needs of the users are at the centre. Therefore, have the theory of learning been investigated, alongside with the case study Tradium carpenter school placed in Randers. Here there were found some parallels between the theory and the composition of Tradium. The purpose of this is to be able to create parallels in the project to better sustain a good learning environment.

When looking into the site, it came to attention that to ensure nice outdoor areas for the users, some sort of protection for the wind should be present around the areas for longer stays. However, there is no problem in having the wind in the walking areas. While looking into the microclimate, some smaller water accumulations were found. These will be of interest as the project is placed to ensure the safety of the building and the quality of the outdoor space. The site in general is relatively flat so adjustments will only need to be made to accommodate ground floor levels without several shift, as well as the project being placed nicely into the terrain. Through the massing, it was found that the project should contain several volumes. This was found because the size and distribution on the site should allow for nice outdoor spaces and a well-functioning distribution of the necessary rooms. It is important, however, not have too many volumes as it then would divide the site too much and lower the quality of the interaction between the volumes and confuse the use of the site. From the users, some defining points for the rooms was given. This was in form of the large workshops having the possibility to take a student out for a talk in relative privacy, while the teacher could keep an eye on the rest of the students. Furthermore, should the workshops also have a hard floor surface as to not worry about the impact on the flooring when working. It was also important for the students to have places for social gatherings, both for work and their periods off, throughout the day. This should be designed into the indoor and outdoor spaces for the placement of the outdoor spaces as they will relate in differing degrees to the main entry. This entry should therefore be placed and designed for the convenience of new students and visitors as they are the ones who needs it the most. The facades will need to showcase the entrance as well. Meanwhile, should the materiality show the focus of the education the same way the construction and inside of the building should.

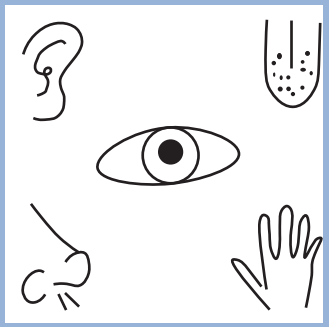
LEARNING THEORY



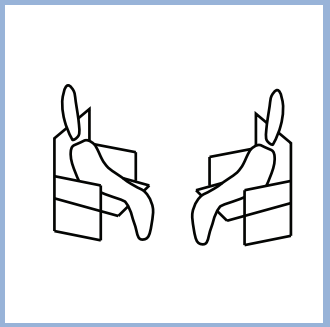
PRIVACY AND MONITORING



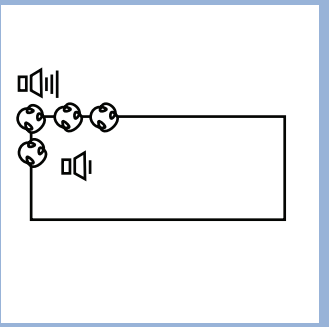
SENSES



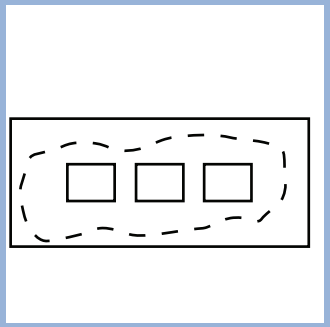
SOCIAL SPOTS



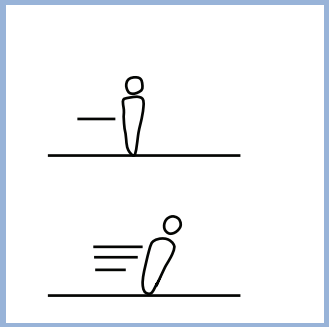
NOISE



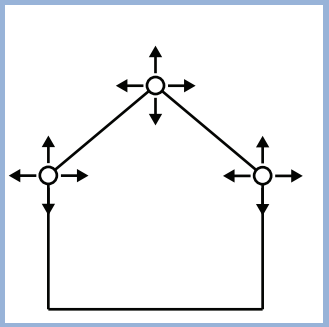
PATH SYSTEMS



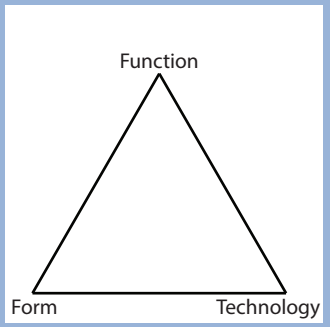
TEMPO



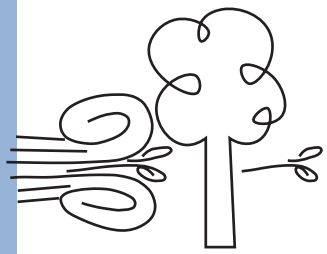
ADAPTING TO BUILDING CULTURE



TECTONIC



WIND

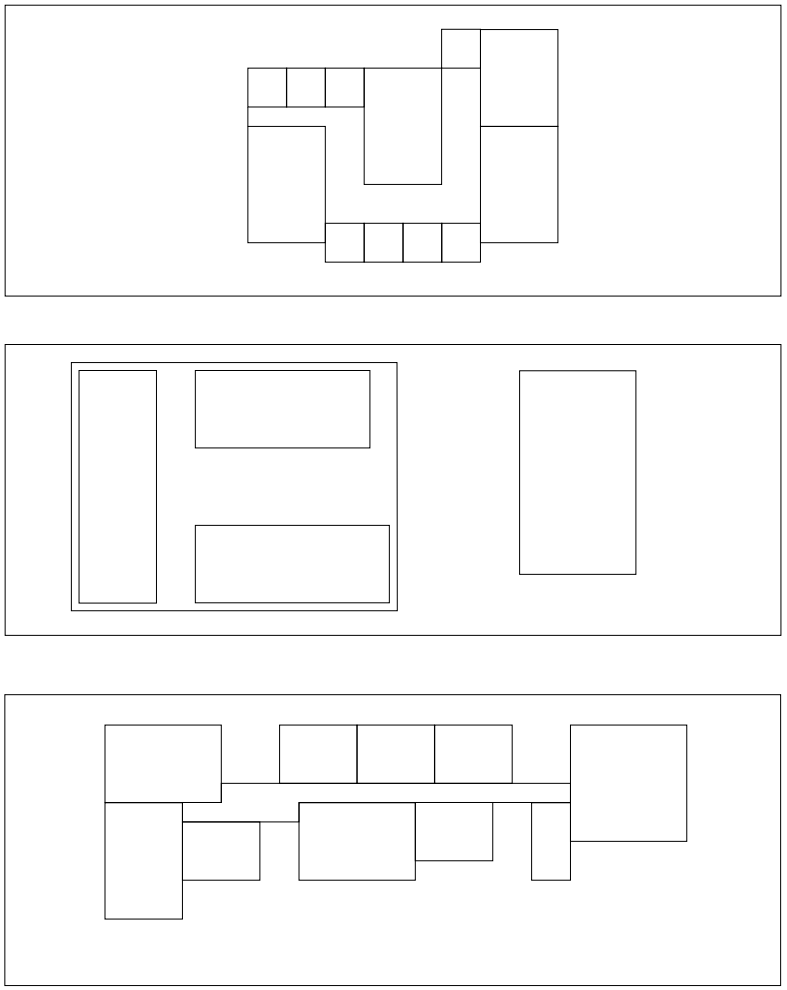


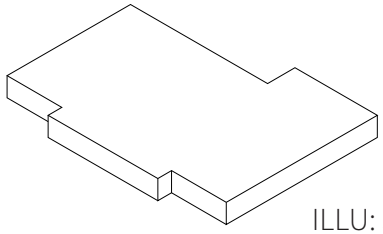
ILLU: 34

5 PROCESS

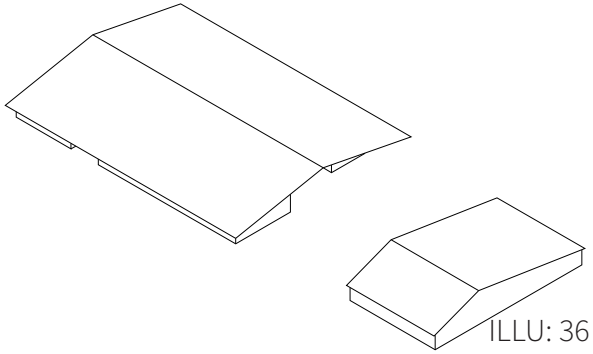
This chapter will show the design process for the project. There will be shown how the design of the buildings came to be both inside and out, but also how the outdoor areas were made. Furthermore, will there also be shown how the buildings were made so environmentally friendly as possible. At the end all of this will show how the final construction came to be.

FORM STUDY

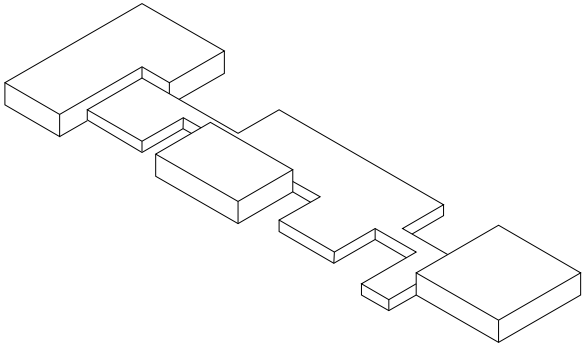




ILLU: 35

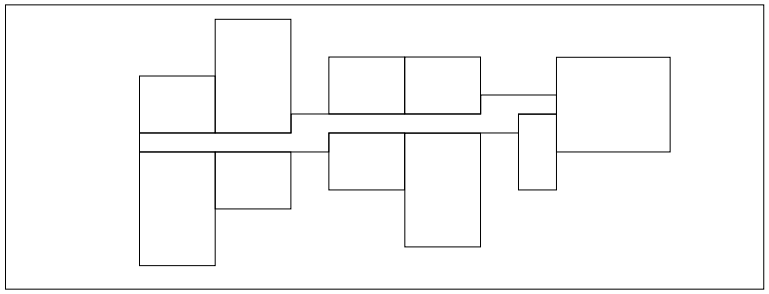


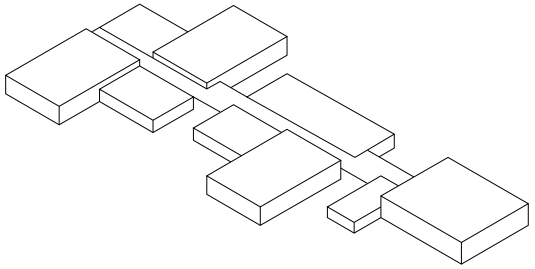
ILLU: 36



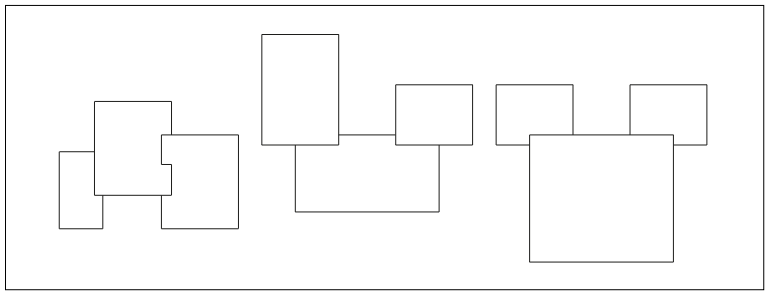
ILLU: 37

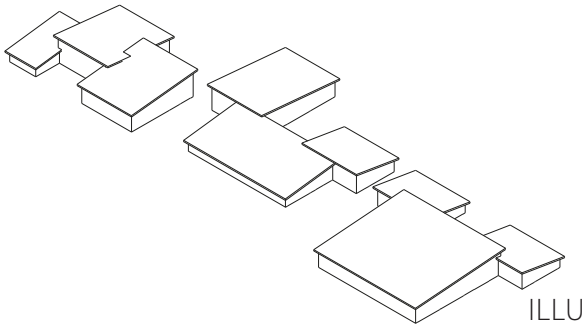
When experimenting with the form for the project the elongated shape of the site becomes slightly problematic. This can be seen when collecting the entirety of the schools needed space into one volume, as the traffic through should not be completely cut off. There should be space for walking all the way around the building. The next step was to divide the building into a few volumes. This allows for traffic to pass through but the ratio between the two volumes seems off and disproportionated, as seen in illustration 36. The next form, seen in illustration 37, is divided into several volumes that are connected to one another, creating a covered space between volumes. This still allows for traffic to pass through, but the shape is so irregular that it would negatively affect the energy frame. Furthermore, would it also be more expensive because of the many corners of the building.



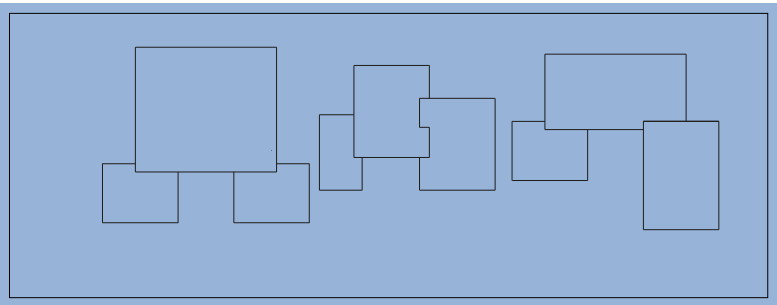


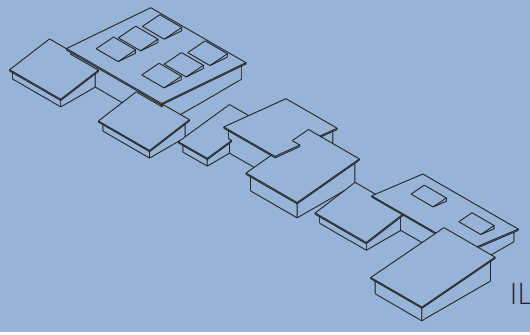
ILLU: 38





ILLU: 39

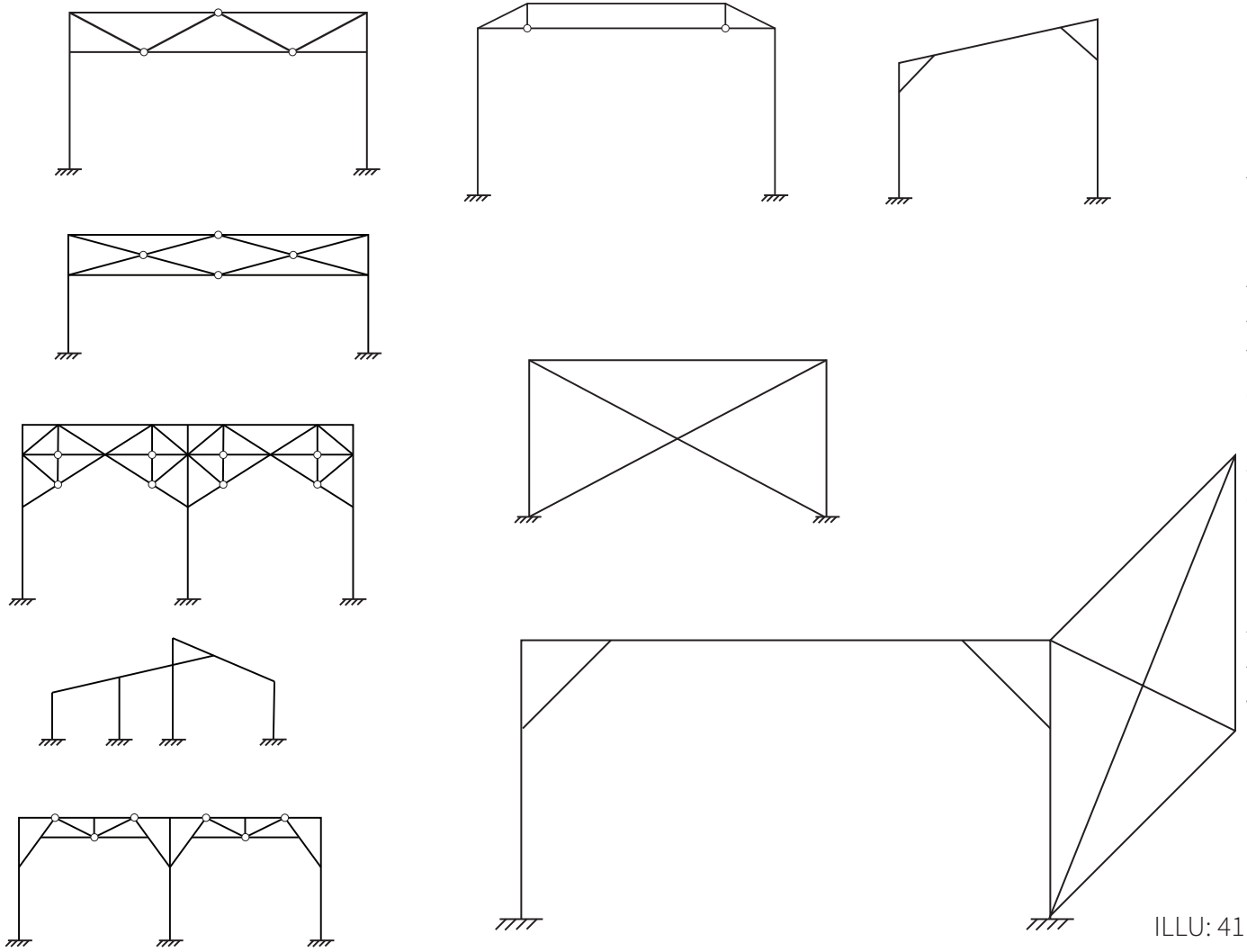




ILLU: 40

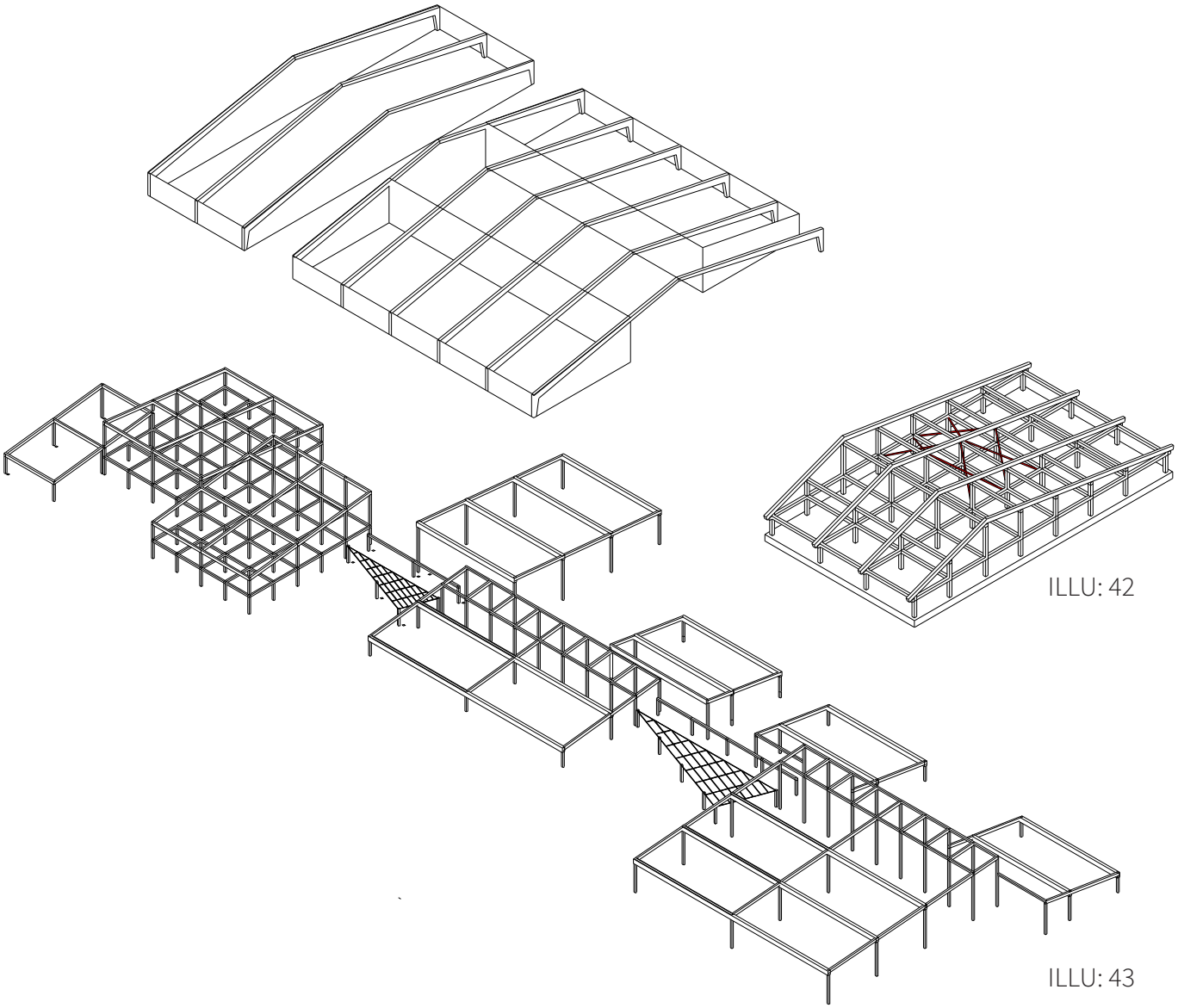
This next form, in illustration 38, is irregular as well but has a clearer programing as the different volumes have different uses and the division starts to become more equal. This next form, seen in illustration 39, was relatively good but the placement in context to one another seemed off as the entrance became very far from most of the large functions. This as well as the orientation could allow for outdoor spaces shaded from the wind but having sunlight. This would allow for working outside for longer of the year as the temperature would be better. These changes lead to the final volume, seen in illustration 40, where the main entrance has been moved to the middle interacting with the established traffic point of the site. The placement, in according to each other, is slightly off from the former line as the volumes are placed after the terrain.

CONSTRUCTION



The first step in the construction was to explore some different possibilities of having a stable frame. This should be able to work with the gesture of the school and be used as a teaching method for the carpenter education. The different frames that are shown support different forms and some of the attempts were made alongside older forms. However, they still show the evolution of the project, and the different approaches used. When looking from a tectonic perspective, especially gesture and principle, it would be important that the frames could be made out of wood and be visible for everyone to see. This would help further teach the future carpenters of what is possible when using wood as a material.

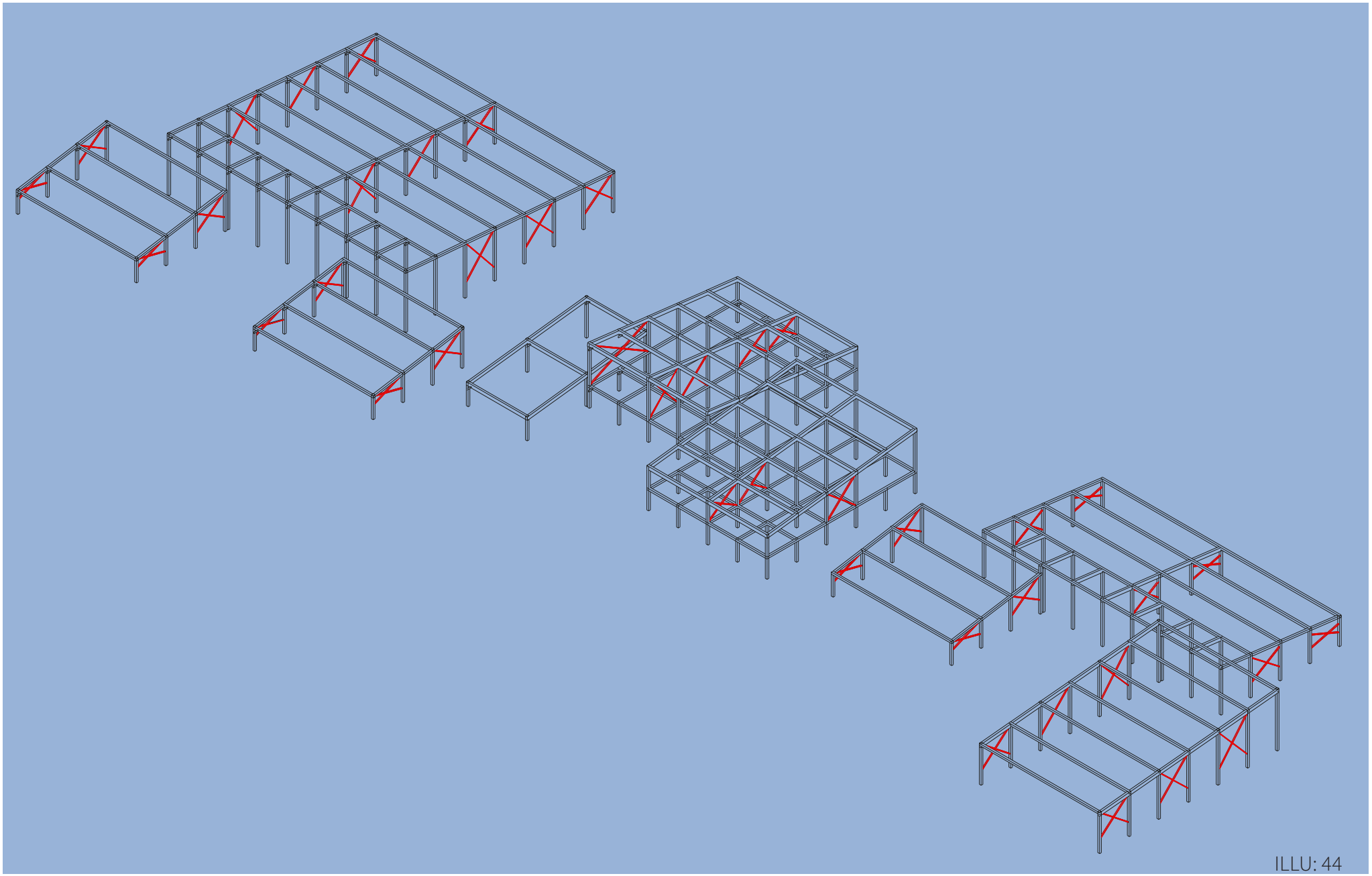
ILLU: 41



ILLU: 42

ILLU: 43

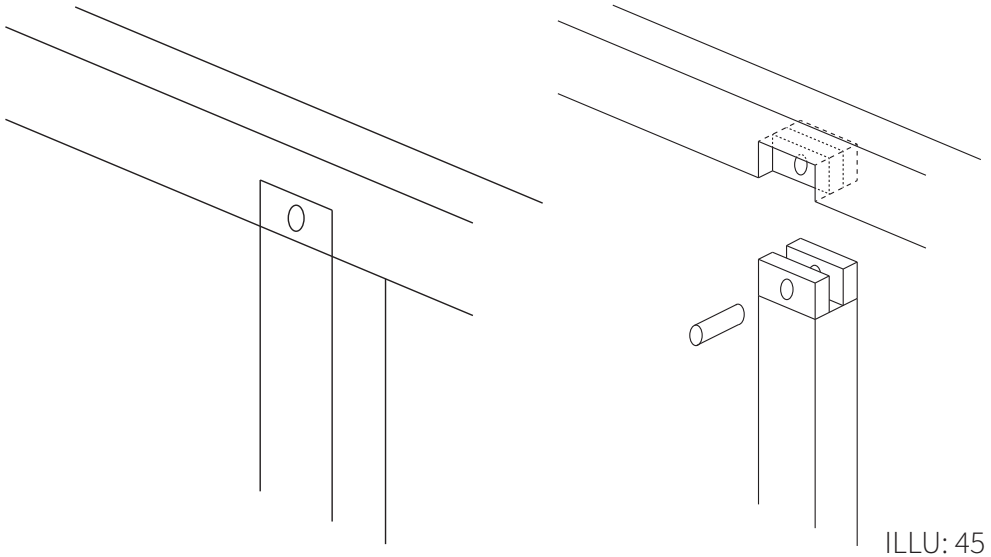
When ensuring the three-dimensional structural integrity, it is important to have stability in both the x and y directions. Some of the changes from earlier iterations was to implement cross bracing and joints inspired by those of the traditional Danish half-timbered house. When seen from a new regionalistic perspective, the inspiration from the old Dainish building tradition is great for showing how tradition can become part of a more sustainable future. Furthermore, by using the traditional building methods, it improves the teaching of what is possible with wood as a material, meanwhile also be a growable and renewable material.



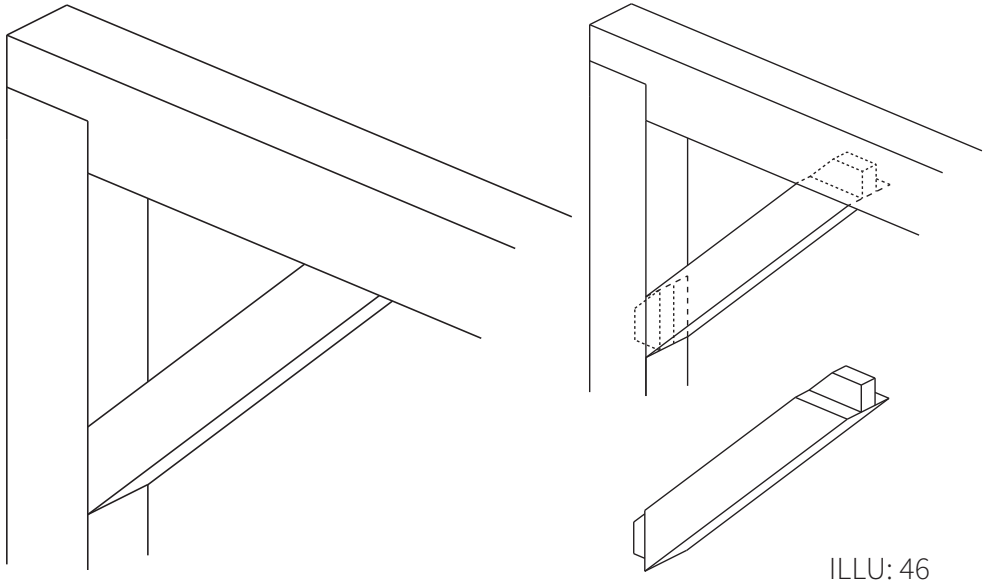
ILLU: 44

JOINTS

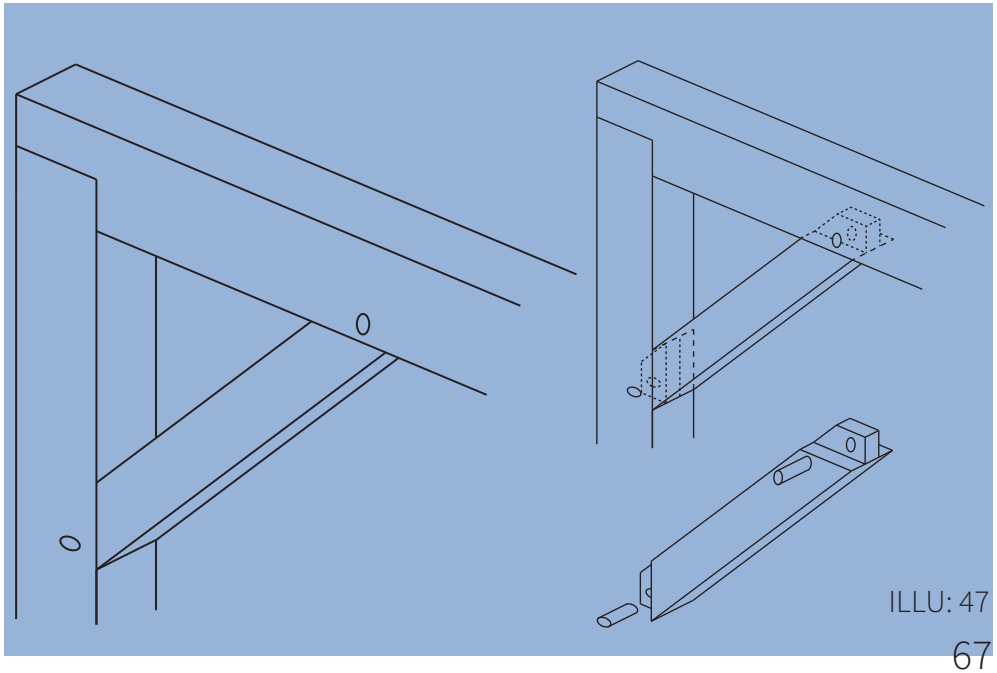
When researching how the joints in the construction could be made, there were looked into how the old Danish building tradition of half-timbered houses were made. On illustration 45-47 can two common, but sturdy, solutions be seen, two with a dowel and two without. By using dowls in the construction, they will function as mechanical fasteners, bridging and fastening the two construction elements together. Furthermore, when applying wood glue to the dowels, they will enlarge and lock the joint in place. (MT Copeland, 2022) Because of this, the solutions with dowels will be used throughout the construction. Again, by using all wooden materials for the construction, even the joints, can contribute to a learning experience for the students. This can be seen by how strong the material is, its functionalities and how environmentally friendly it is.



ILLU: 45



ILLU: 46



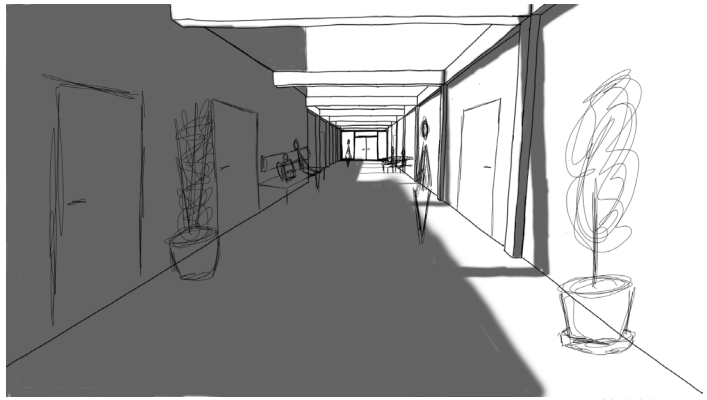
ILLU: 47

HALLWAY SPACE

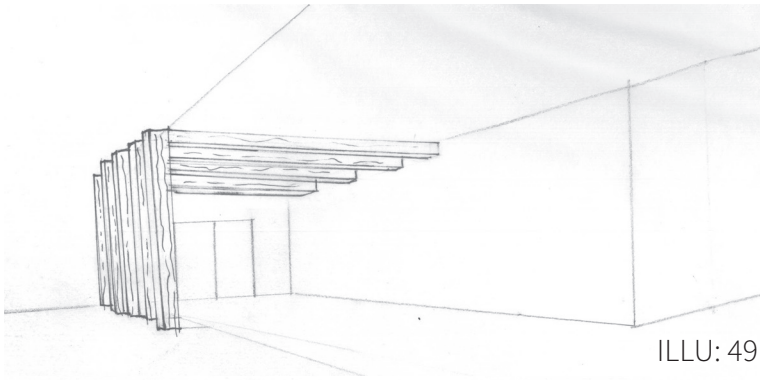
The hallway became a focal point for the entire project, as it is these rooms that allow for socialization and comfort, which are some of the parts of a learning process. This can be done with the help of architecture. Of course, this is not just limited to the transitions in the buildings, but also the paths to and around the site, as these can provide space for socialization.

The surroundings can help to support and promote learning. According to Illeris, the social interaction process deals with the interaction between the individual and his or her surroundings. People strive to be part of a community, this interaction is central to motivation and learning. The inner (content and mental energy) and the outer (interaction) play an important role in learning processes.

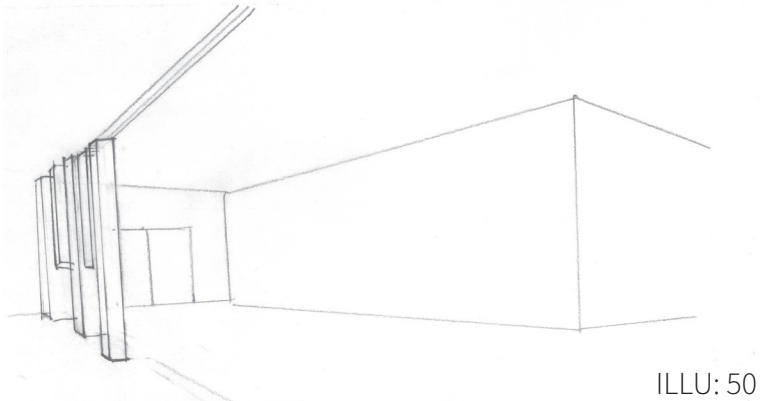
This means that these spaces will be designed in such a way that space for learning and space for socialization are taken into account, as it is essential for motivation for learning. Just as the rooms can give a feeling of working together, even when the rooms are very different from each other. For the hallway, an elevated room is designed to allow for a slow-paced room instead of the high-paced nature of the narrow hallway. For the hallway, an elevated space is designed to allow for a space with low tempo, rather than the high tempo in the straight hallway.



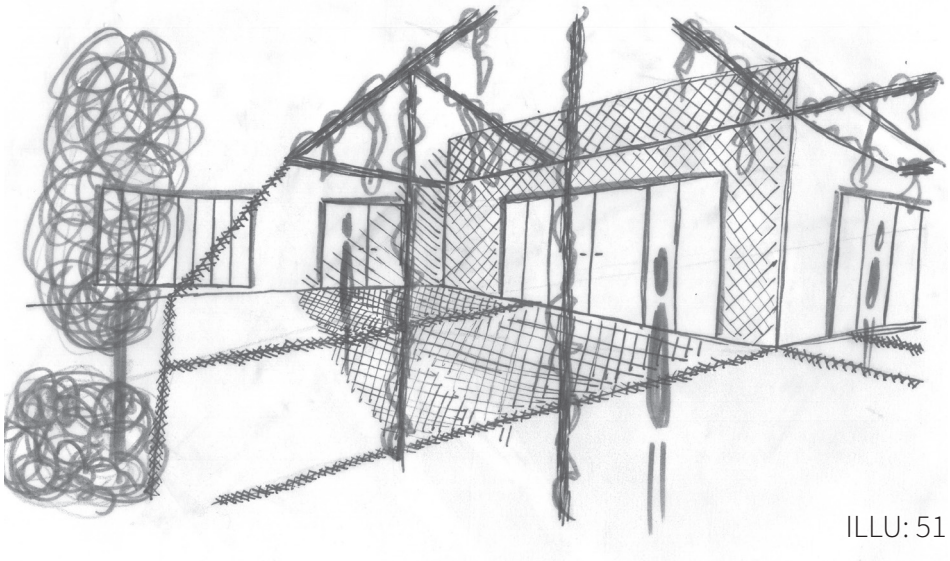
ILLU: 48



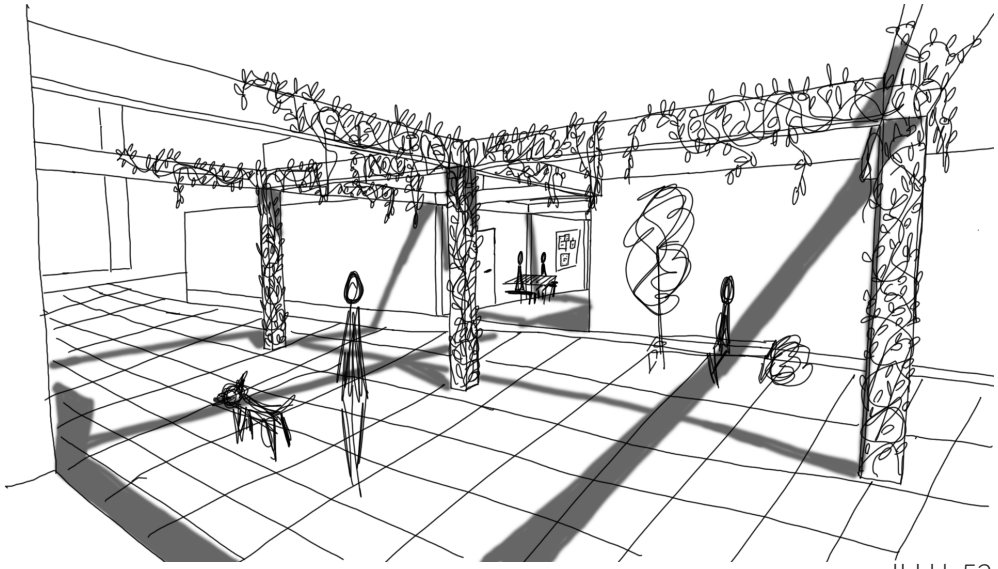
ILLU: 49



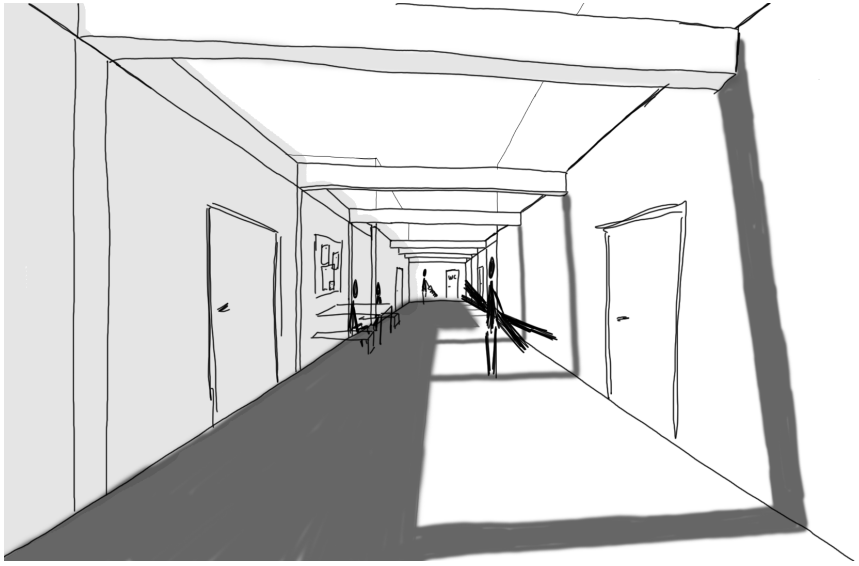
ILLU: 50



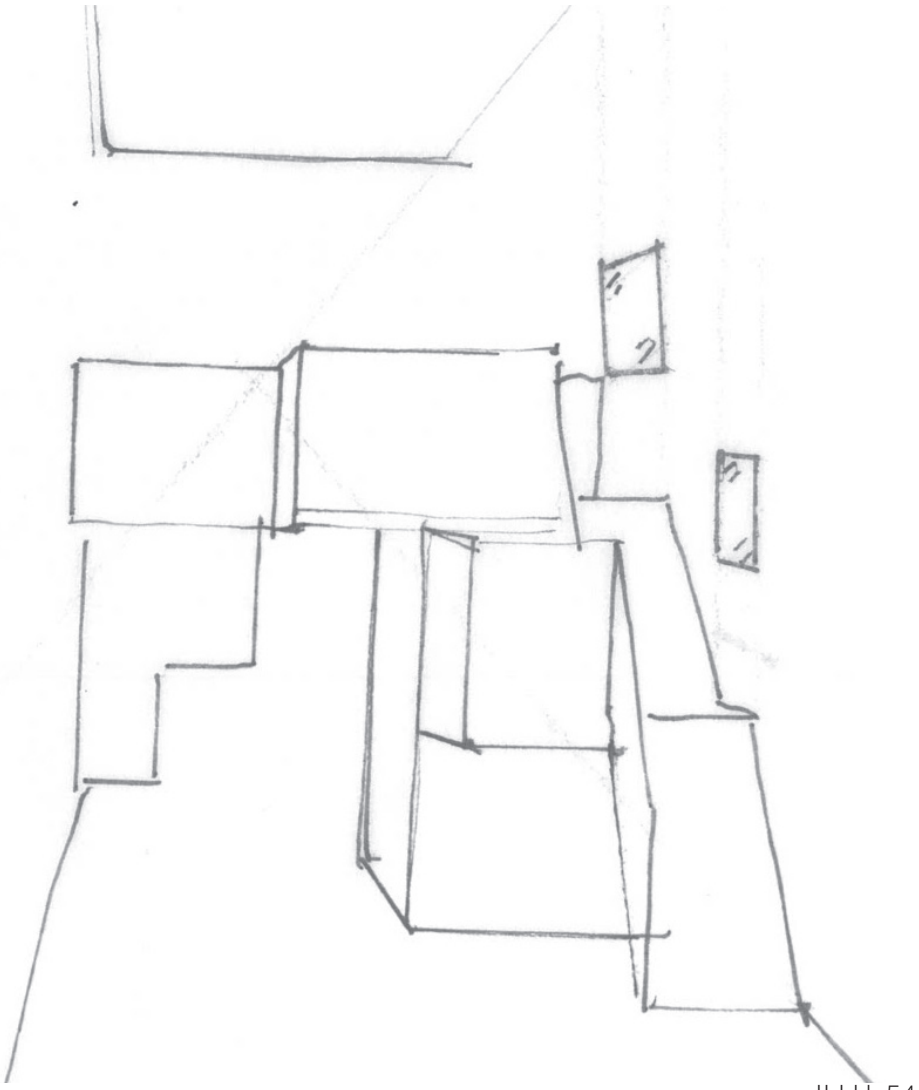
ILLU: 51



ILLU: 52



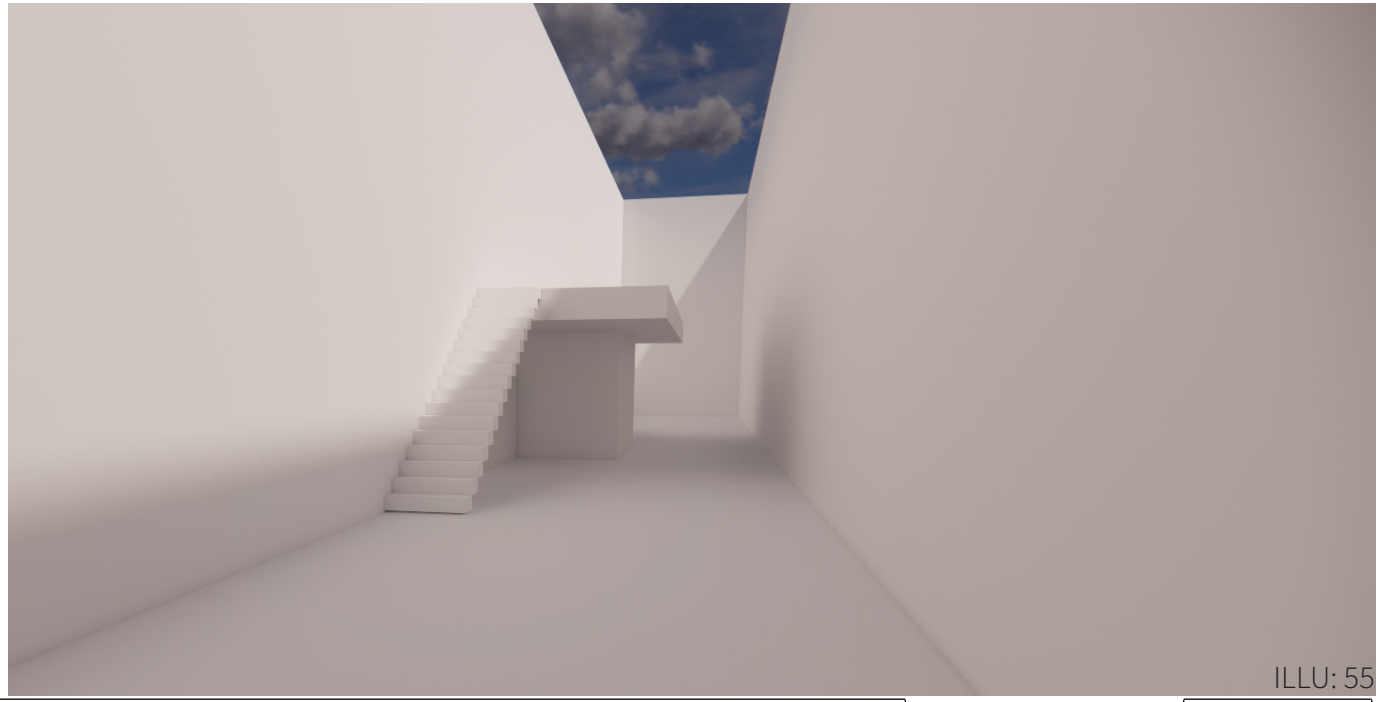
ILLU: 53



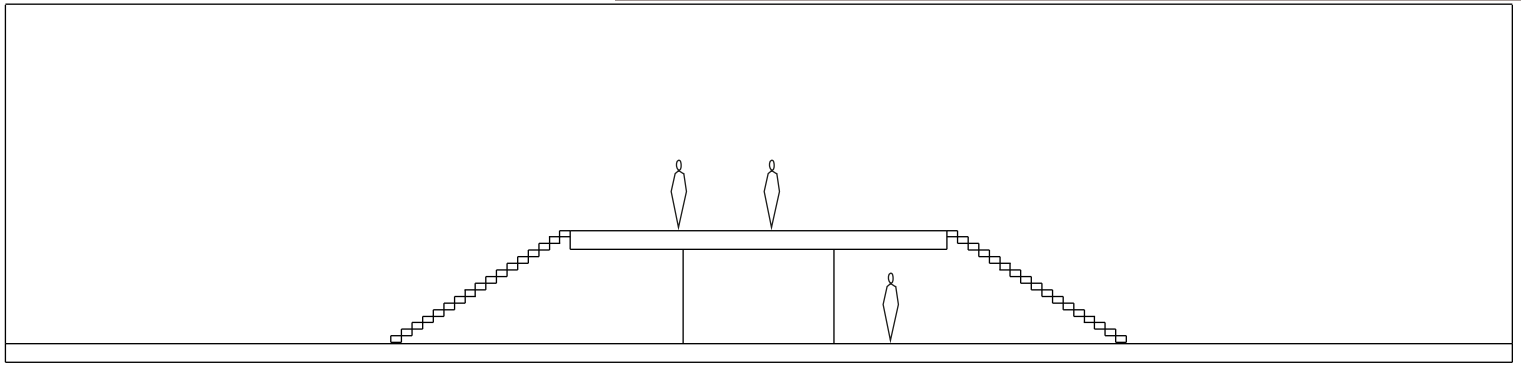
ILLU: 54

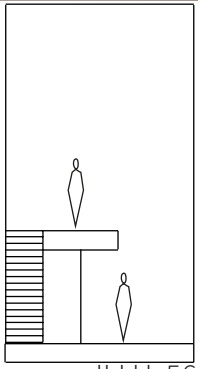
HALLWAYSPACE

The first scenario, seen in illustration 55 and 56, is an elevation that is rather shallow but maximizes the space with double height ceilings. The space itself, on the top the elevation, fails to work as it is so narrow that it only allows for traffic. There is no need for more traffic in the hallway but rather it needs a space for sitting and socializing.



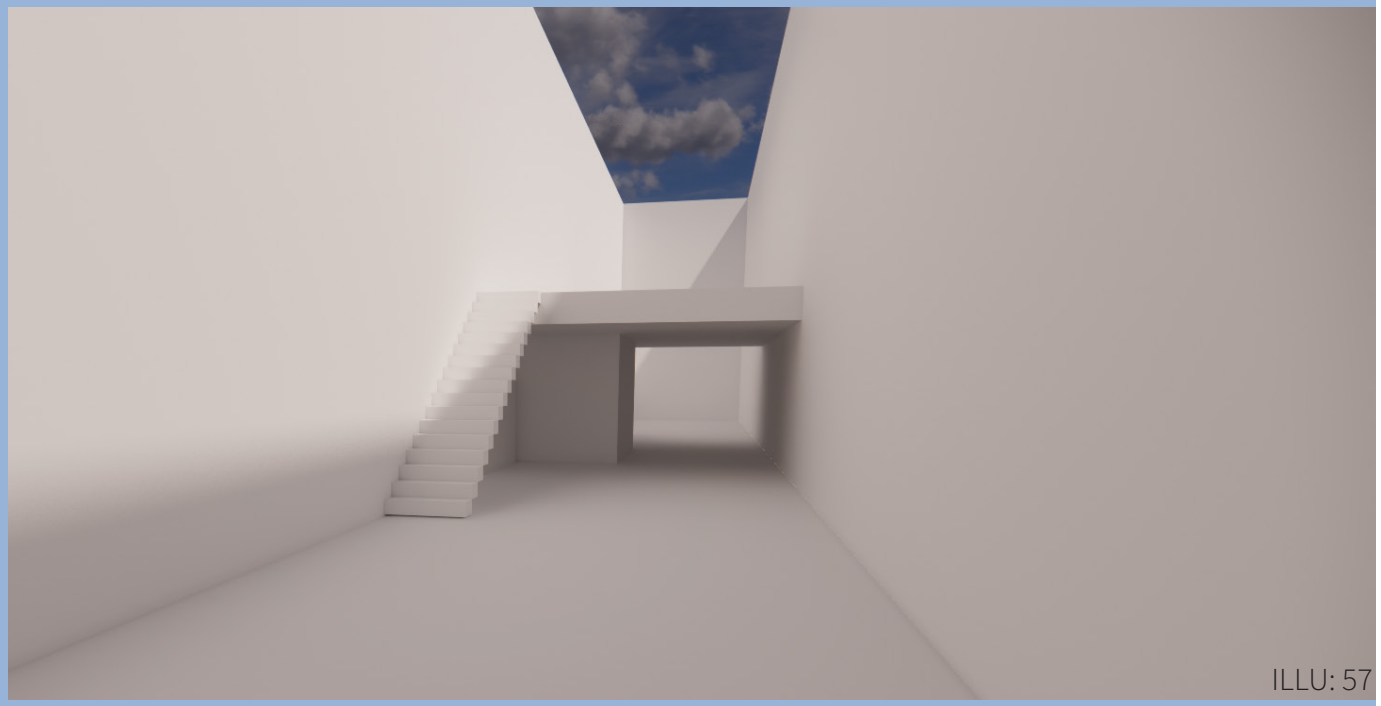
ILLU: 55



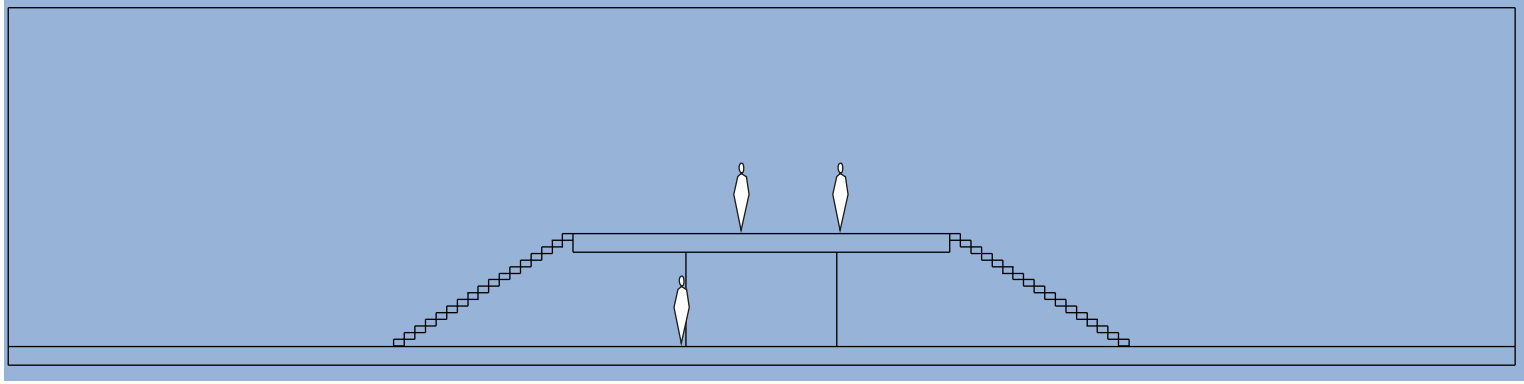


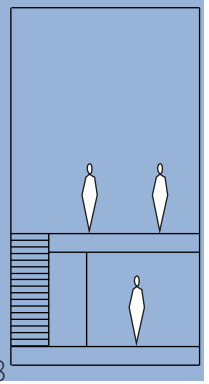
ILLU: 56

The simple space of the design in illustration 57 and 58 works quite well compared to the former design, especially when the depth of the elevation is the full width of the hallway. This breaks up the double-height ceilings, but it does not compromise the space as it occurs around the toilets. Furthermore, the space will enhance the attention to the toilets, working as a guide to their placement. The space underneath the platform may look dark, however, this can be solved by placing windows.



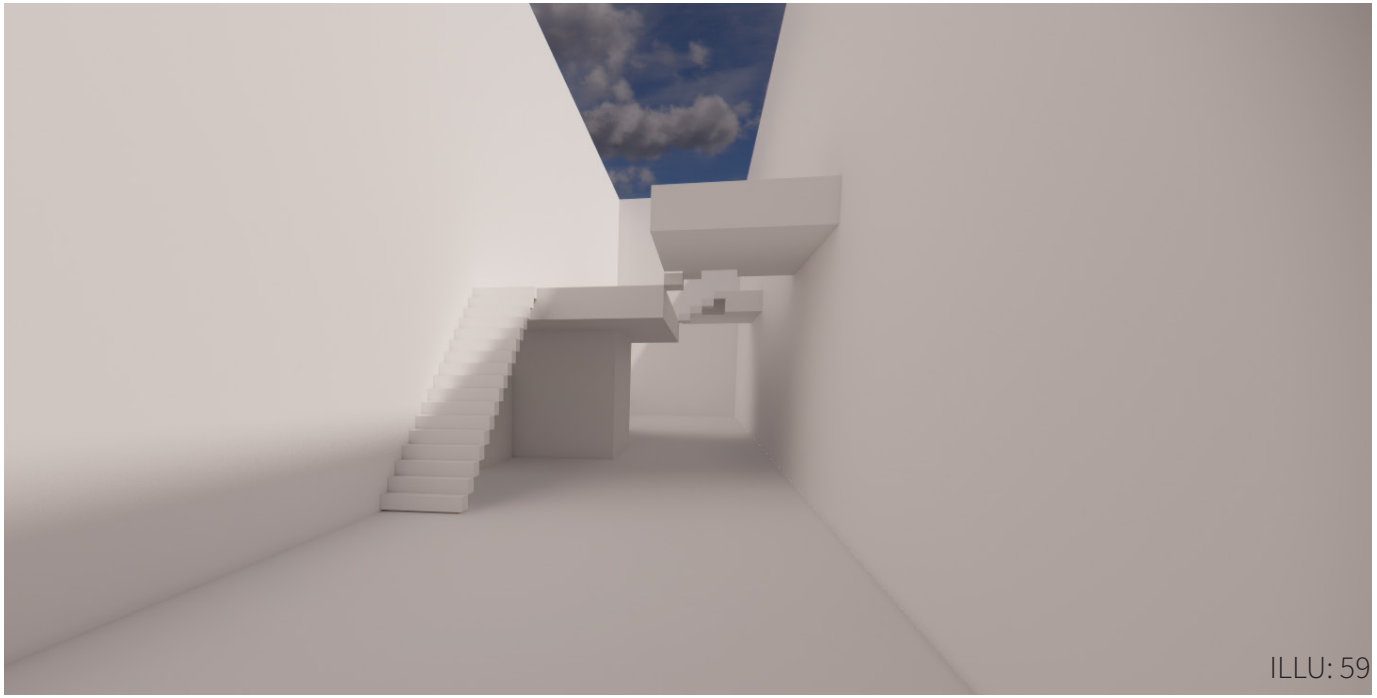
ILLU: 57



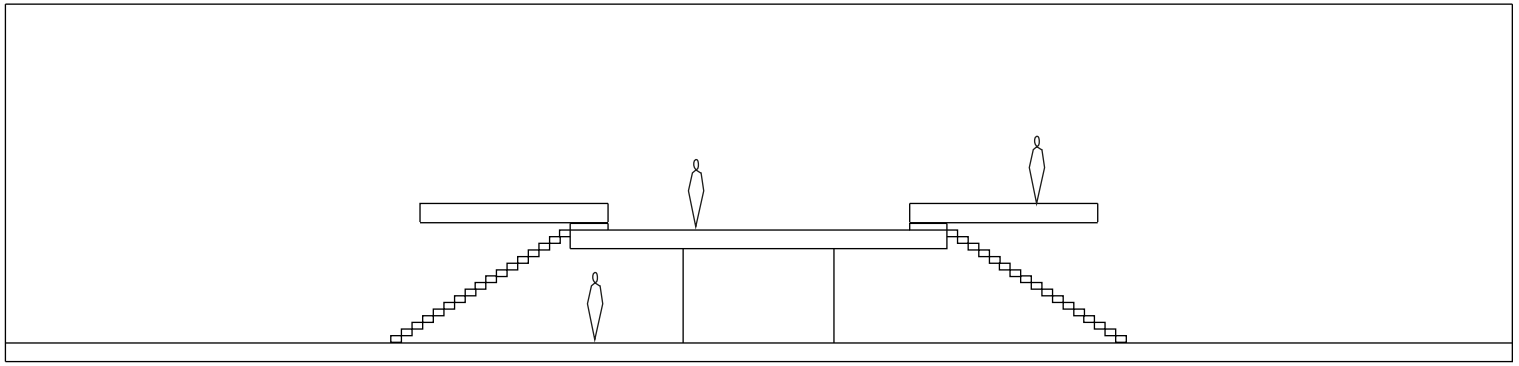


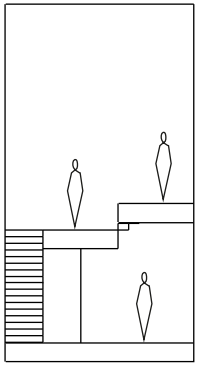
ILLU: 58

The next design, seen in illustration 59 and 60, also splits the double height ceiling but incorporates another level further up, making it a lot more complex. However, it does not seem to add much value to the overall space as both levels are too shallow to allow for any quality use.



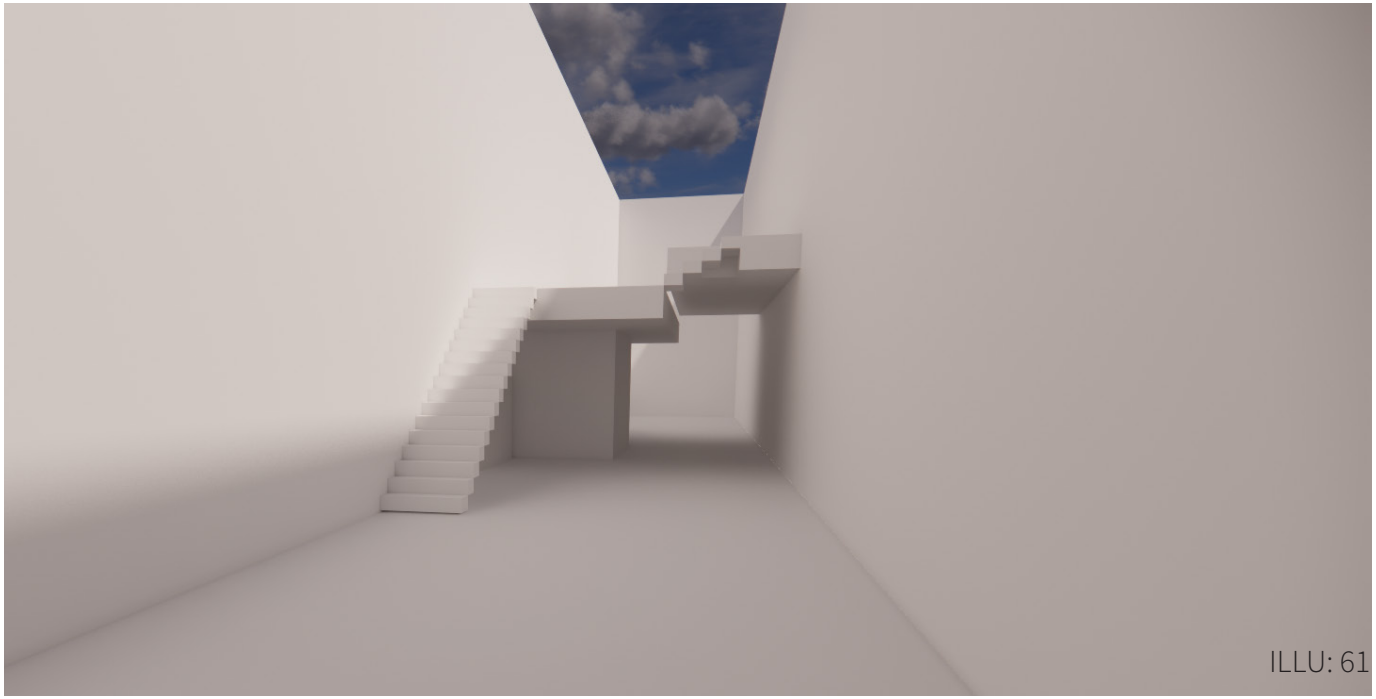
ILLU: 59



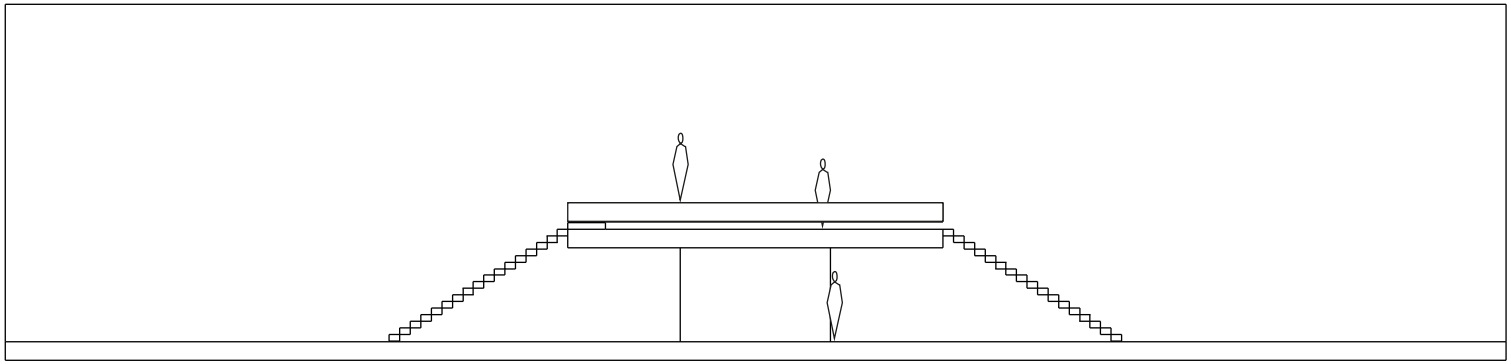


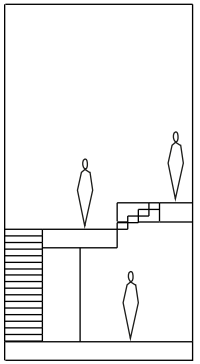
ILLU: 60

The problems of the aforementioned design reappear in this iteration, seen in illustration 61 and 62. It was found that the way the second level splits the space does not work well together. This is seen as the new platforms do not allow for anything that the ground floor of the hallway does not already provide.



ILLU: 61



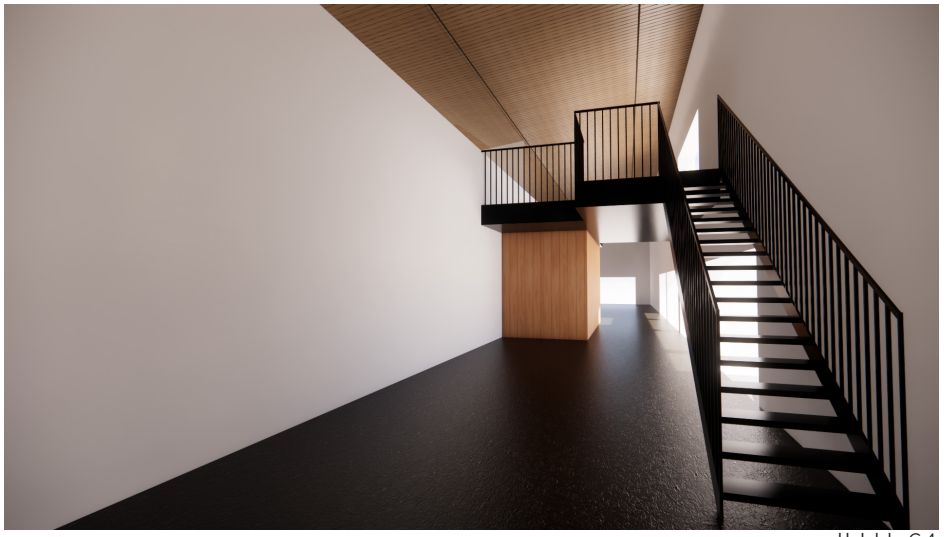


ILLU: 62

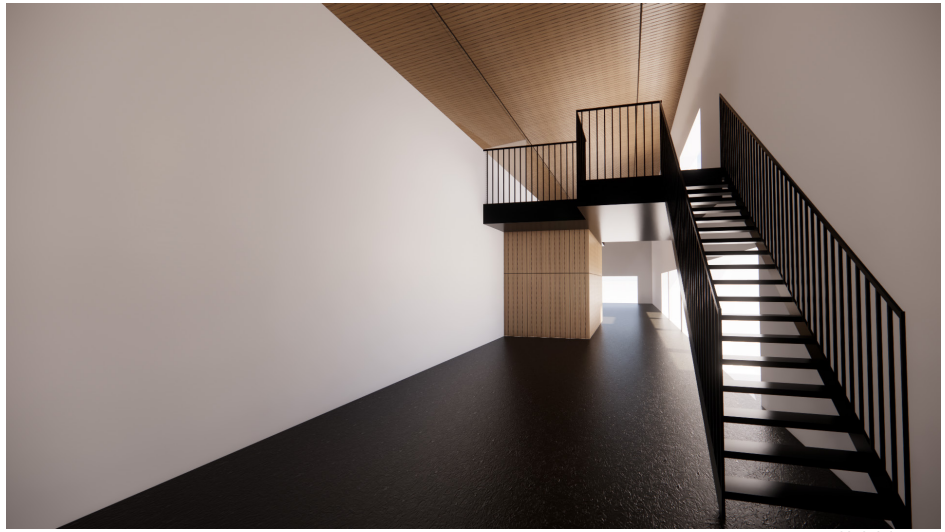
MATERIAL STUDY - ACCENT WALLS

For the toilet rooms, the idea was to have it stand out and make it easy to find. This is already somewhat done by the notion that it is a box coming out of the wall. The different textures used in the experimentation are all based on using wood as it still is a large part of the project and as such this should still be visual. The different textures that have been used for experimentation are shingles, planks, plywood boards and acoustic panels and can be seen in illustration 63-66. The planks and the plywood board offer very little in terms of texture, meanwhile the acoustic panels and shingles offer more as they have more variation in the depth. Furthermore, as the ceiling is covered in acoustic panels, the best choice is shingles as it adds a texture that is not already present and still stands out in a controlled way.

ILLU: 63



ILLU: 64



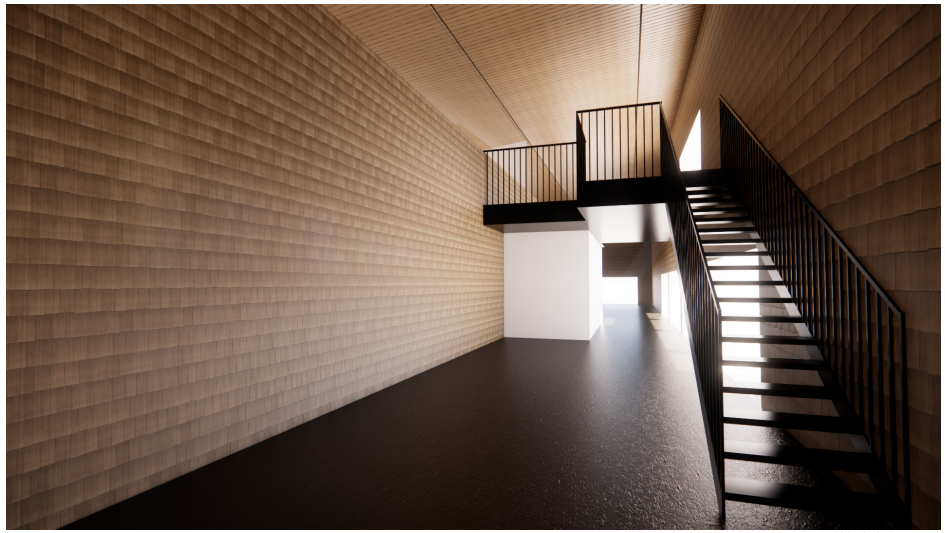
ILLU: 65

ILLU: 66

MATERIAL STUDY - HALLWAY WALLS

The material for the walls has also been investigated by using the same materials as for the toilet rooms. In this case the aesthetic became too confusing with too many different materials and in our opinion, it would take away the rest of the experience of the room.

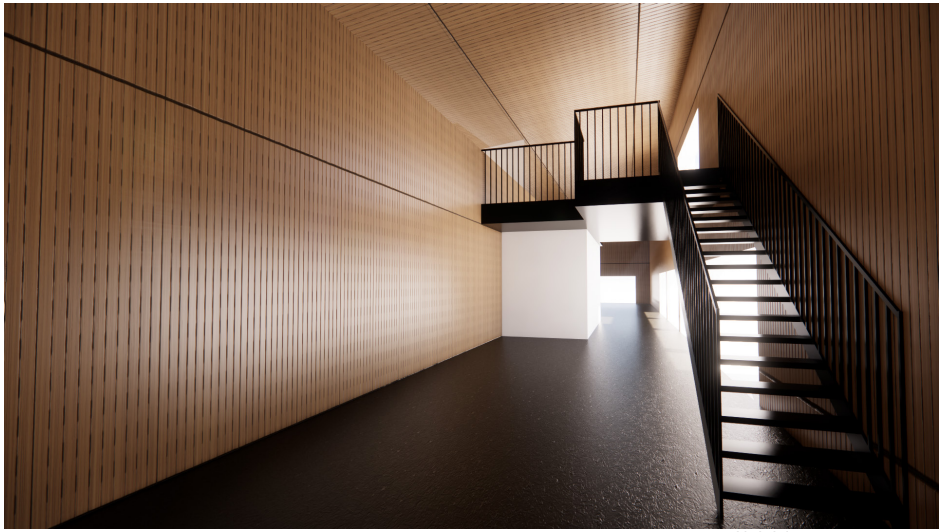
According to Pallasmaa, the choice of materials is essential for the human experience of a space. The architecture must be experienced through the whole body. The colors, textures and tactile properties of the materials help to influence our senses and emotions. Just as light and shadow create contrasts, moods and spatial depths. Our choice of materials can be co-creative of the external framework for learning and development. This leads to the choice of plywood or planks for the walls. The final choice fell on the planks but, as the color is too dark for the large amount of wall, they should be of a lighter wood tone.



ILLU: 67

ILLU: 68

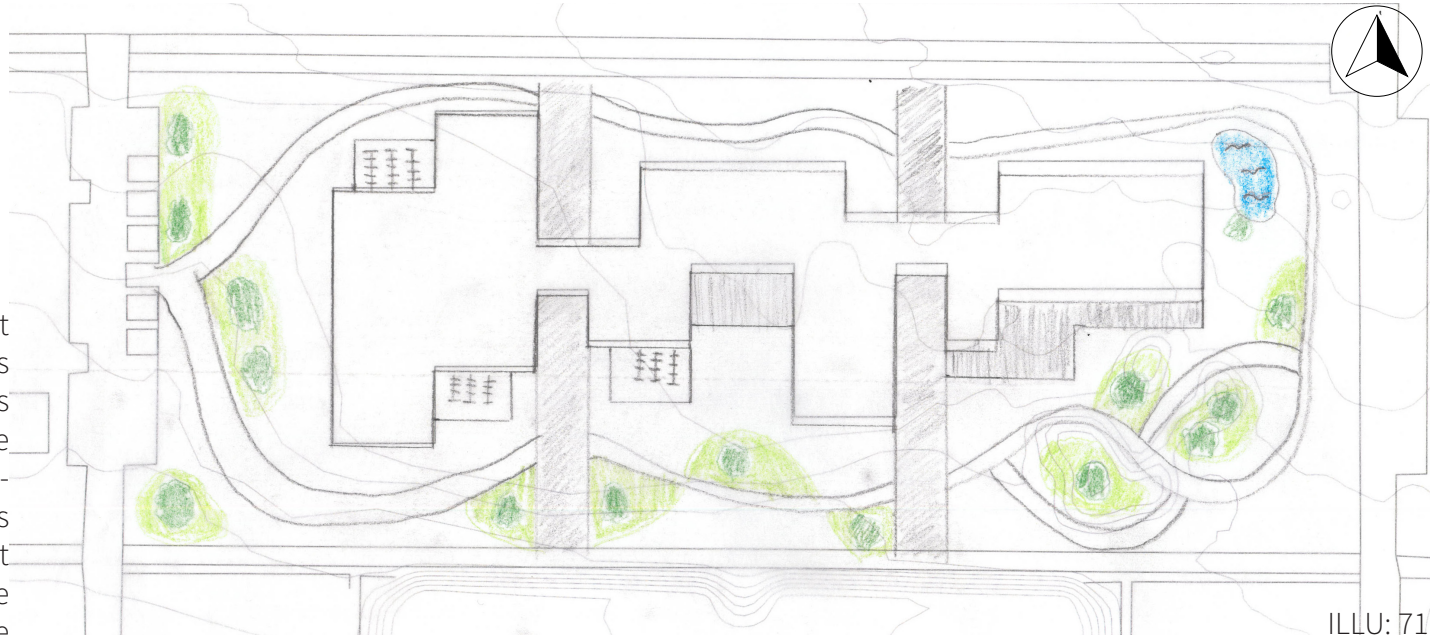
ILLU: 69



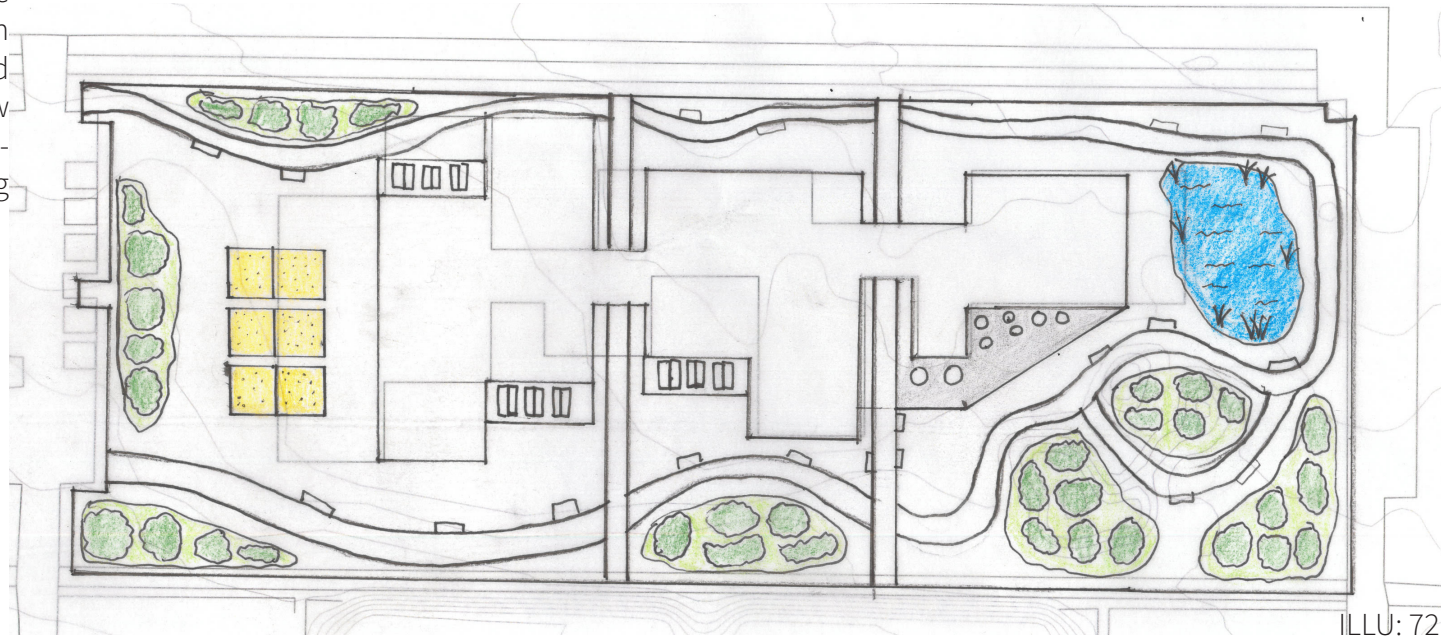
ILLU: 70

MASTER PLAN

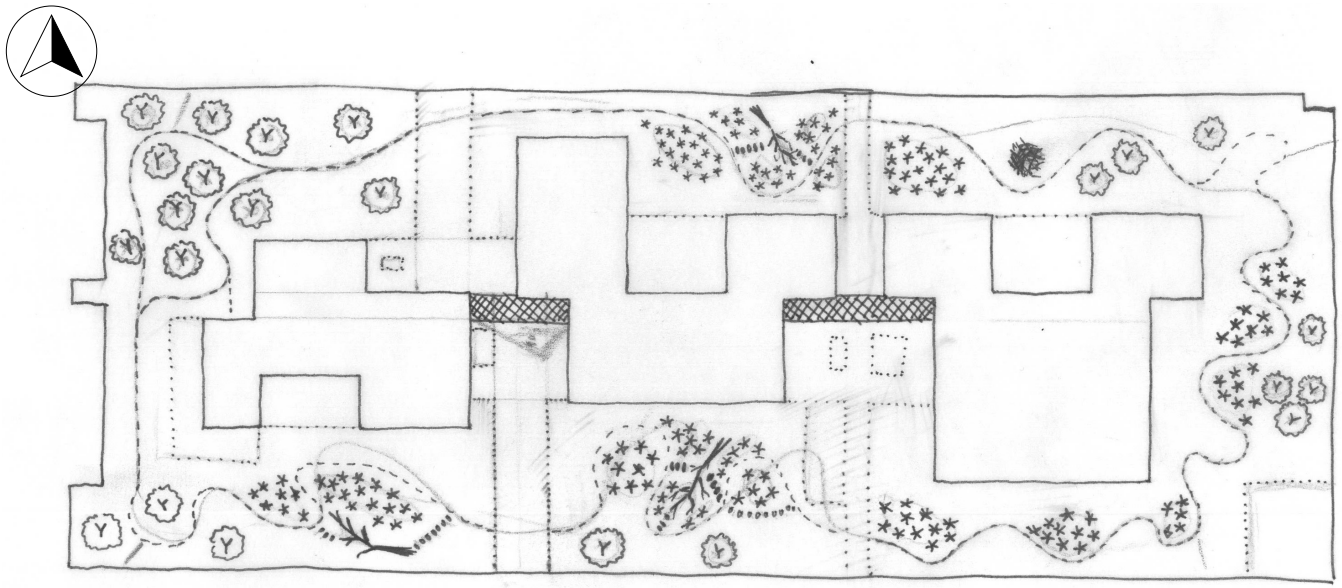
When designing the masterplan, the first choice was to determine which functions should be included. Some of the elements that could have been included were some smaller sport fields for some physical activation of the students. However, this was not needed as there are football fields just south of the school. Therefore, would it be optimal to place something to connect the site to the urban spaces at the AAU main campus by making space for staying and nice walks. This will incorporate the new space and school into the existing atmosphere and have it added to the studying atmosphere.



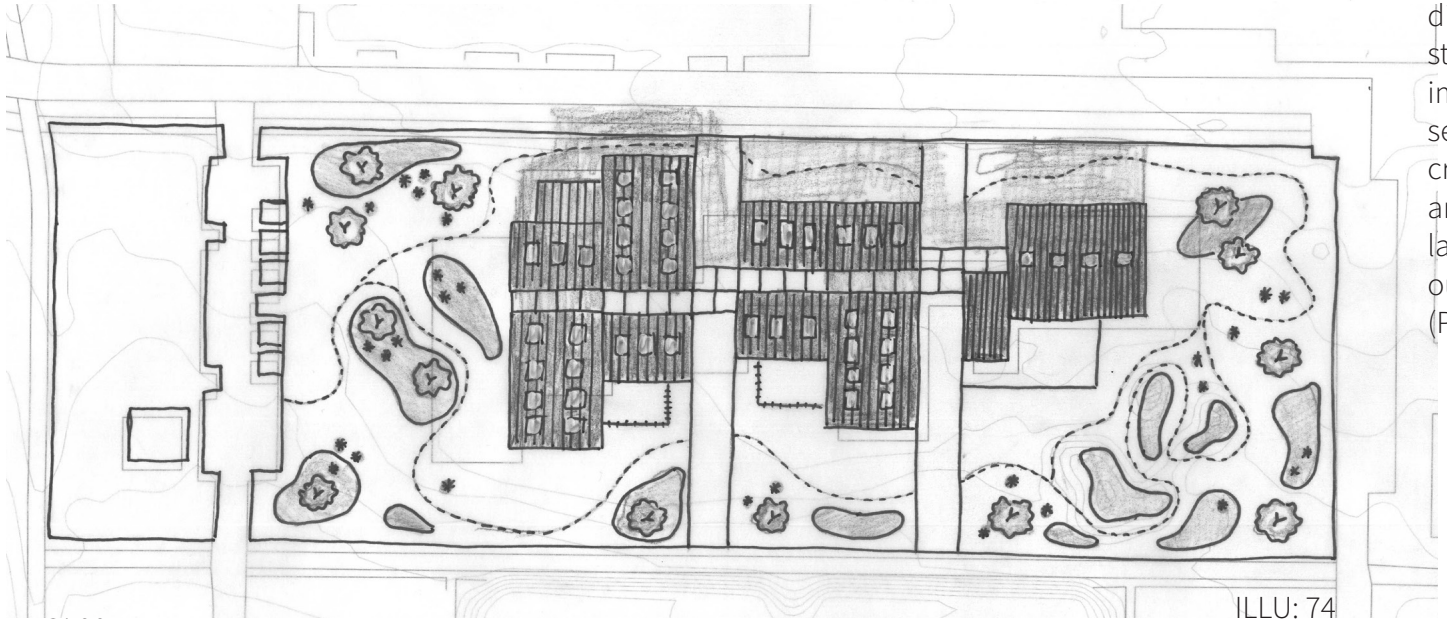
ILLU: 71



ILLU: 72

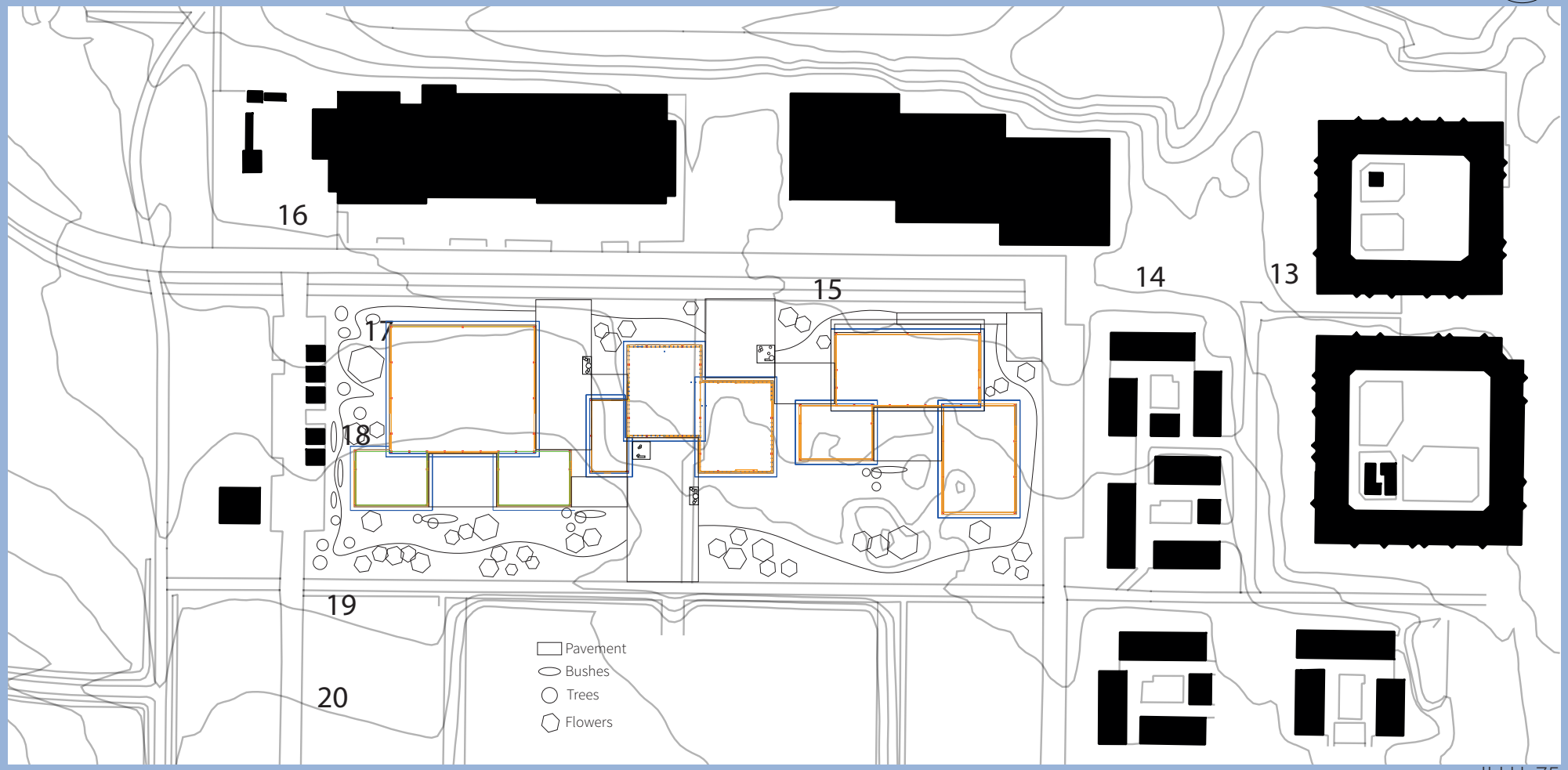


ILLU: 73



ILLU: 74

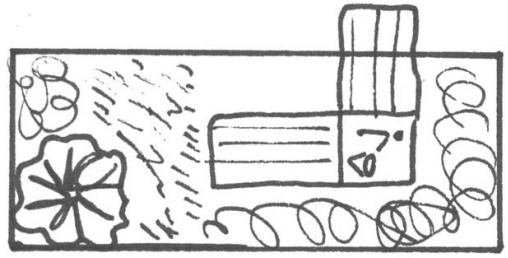
Another part of this project is sustainability and in that regard one element to look into is biodiversity. We have focused on how we can support biodiversity through different trees, flowers and shrubs. Our choice of plants can contribute to the growth of bacteria, fungi, insects, small animals, birds, etc. By adding some piles of old branches and old trees, it can add more habitat and food for insects and other small animals. Having old trees can also add a playing element into the space for the nearby residents. Biodiversity is not only important for ecosystems, but according to Pallasmaa, it is also important for the human senses. When we see, touch, hear and smell nature, it helps to create a better understanding of ourselves and the world around us. That is why Pallasmaa encourages us to create sensuous outdoor spaces and outdoor environments. (Pallasmaa, Arkitekturen og sanserne 2014)



ILLU: 75

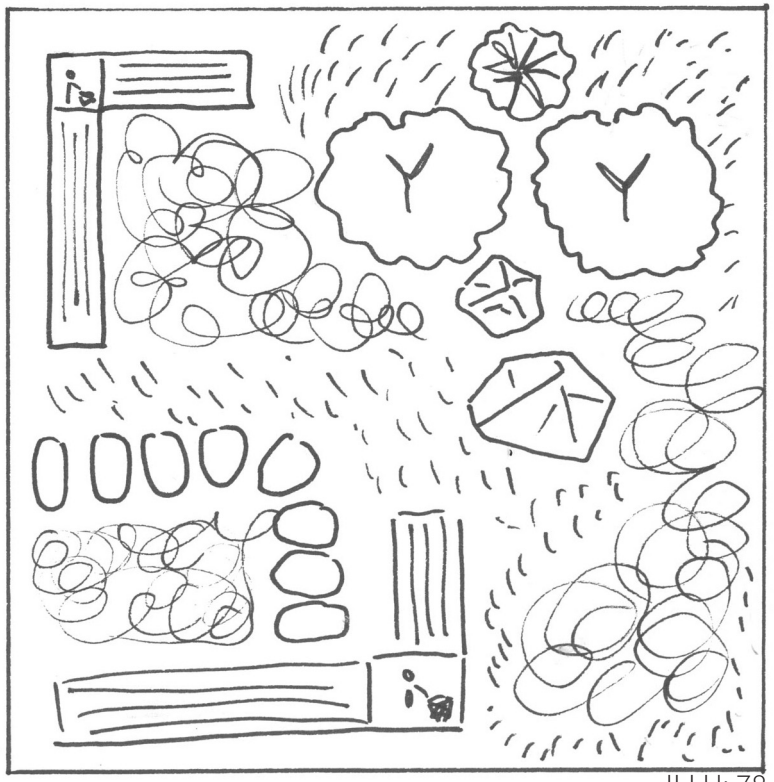
PATIO

For detailing the outdoor spaces, the green patches in the pavement are detailed by combining different plants and natural elements like wood, stones and boulders. These spaces are supposed to work as brakes in the traffic area, mirroring the elevated spaces in the hallway space. Having the large areas of tiles broken up by these green areas minimizes the hard surface areas and subdivides the space. This makes for an overall more useful space and leads people the right way around the site.

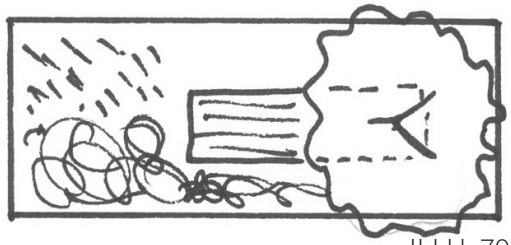


ILLU: 76

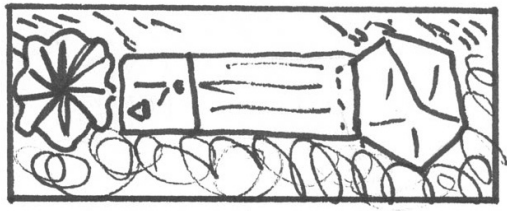
ILLU: 77



ILLU: 78



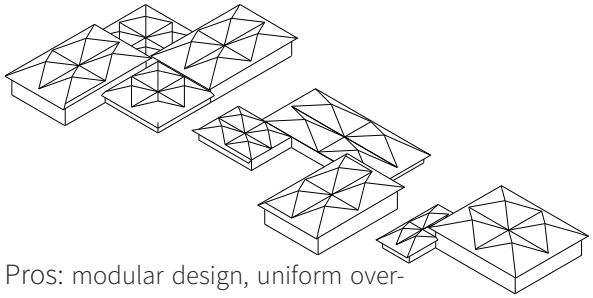
ILLU: 79



ILLU: 80

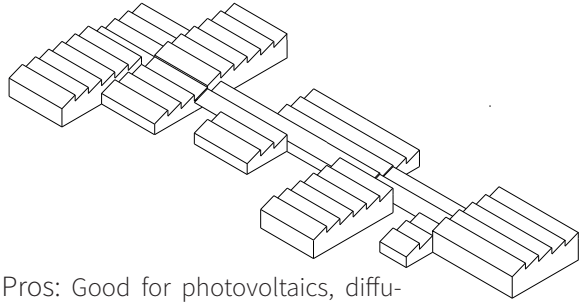
ROOF PROCESS

The development of the roof has gone through pyramids and traditional Danish pitched roof and combinations as seen in illustration 81-86. Many different design proposals were made but only a few is shown here because these were the better iterations. The pros and cons for each design can be seen by the illustrations. The roof design on illustration 87 was chosen among other things because of its angle, which were better for photovoltaic panels than those of illustration 81, 83 and 85. Furthermore, would the pattern of the slopes also help create a uniformly shape, symbolizing the buildings being a part of a whole meanwhile still being separated physically.



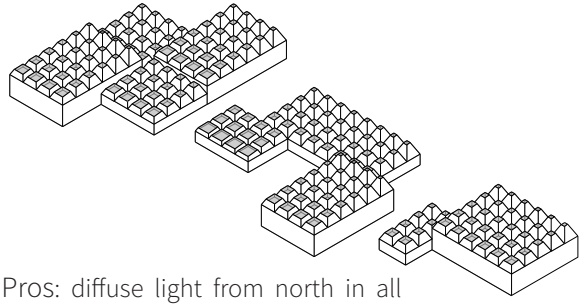
Pros: modular design, uniform overhang. Cons: Bad for photovoltaics, water collecting on the roof, odd diversion of form

ILLU: 81



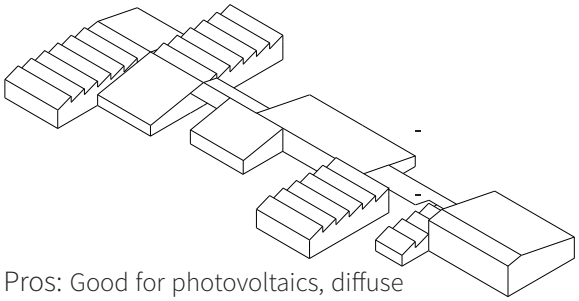
Pros: Good for photovoltaics, diffuse light from north, uniform design. Cons: large amounts of thermal bridges, water collecting on the roof, odd division of form

ILLU: 82



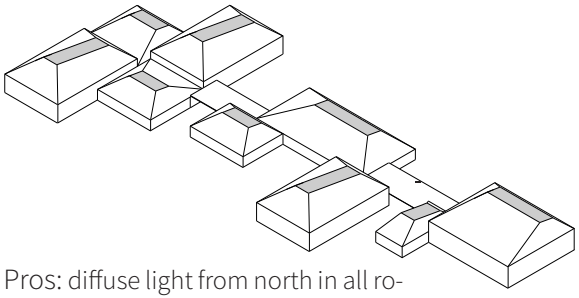
Pros: diffuse light from north in all rooms, symmetrical overhang. Cons: water collection on the roof, large amounts of thermal bridges, overheating, odd acoustics, extreme subdivisions

ILLU: 83



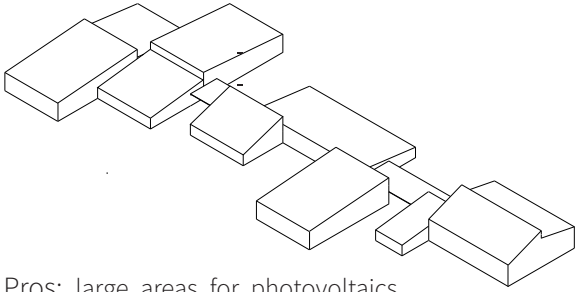
Pros: Good for photovoltaics, diffuse light from north. Cons: odd mixed design, water collection on the roof, odd subdivision

ILLU: 84



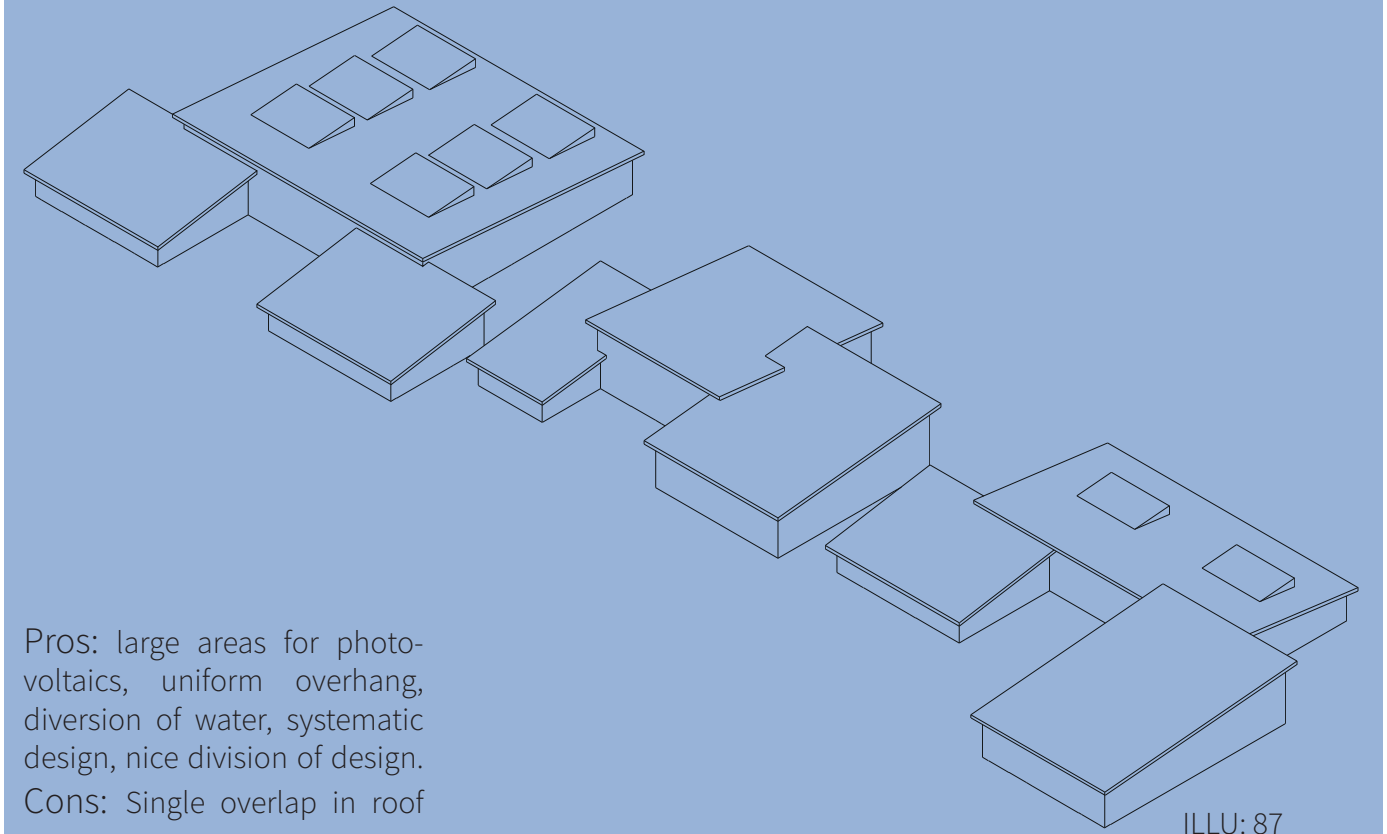
Pros: diffuse light from north in all rooms, diversion of water, uniform design expression. Cons: large amounts of thermal bridges, overheating, odd orientation

ILLU: 85



Pros: large areas for photovoltaics, diffuse light from north, diversion of water. Cons: not optimal slope for photovoltaics, lack of system.

ILLU: 86



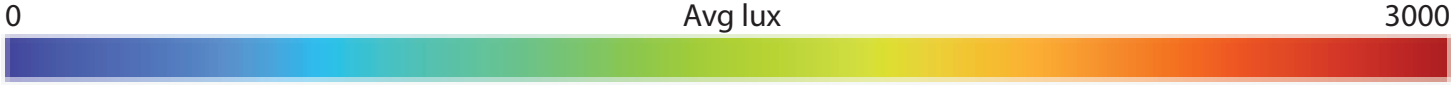
Pros: large areas for photo-voltaics, uniform overhang, diversion of water, systematic design, nice division of design.

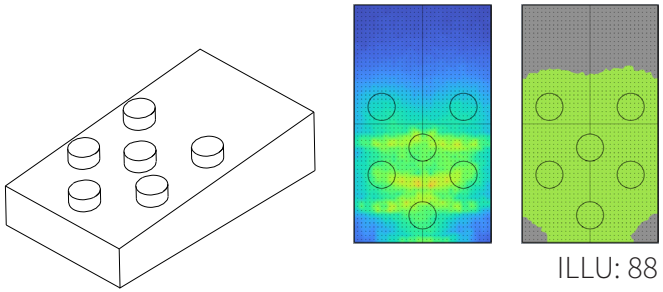
Cons: Single overlap in roof area

ILLU: 87

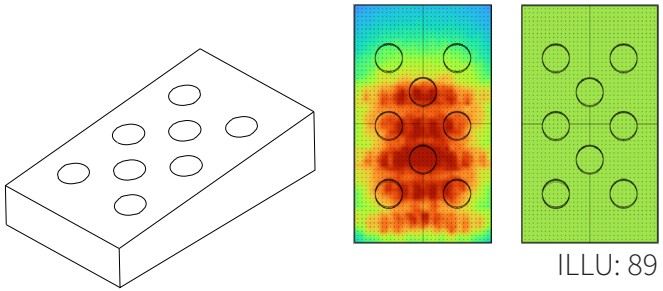
SKYLIGHTS

To ensure the right lighting situation for teaching, a range of skylights have been designed to be placed in the north facing workshops. The designs are made to be symmetrical around the center line of the roof to have as even a light distribution as possible. The analysis is made by using the Rhino plug-in Climate Studio and maps out the lux levels of a room and the areas in the room that gets above 200 lux for at least half of the used hours. On the next page are illustrated the results of the simulations where the lux levels are placed to the left of each iteration and the simulations for above 200 lux are placed on the right. The lux levels should be a light blue color to avoid glare in the room meanwhile also occupying as much of the room as possible. When looking at the areas with above 200 lux, it also investigates the possibilities of glare. Therefore, it is important that the areas marked with green are smaller. Based on these criteria the skylight on illustration 93 will be chosen for the final design.

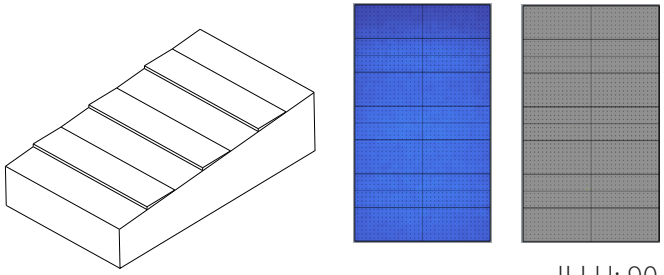




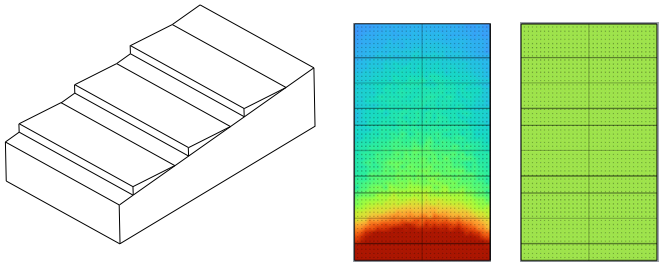
ILLU: 88



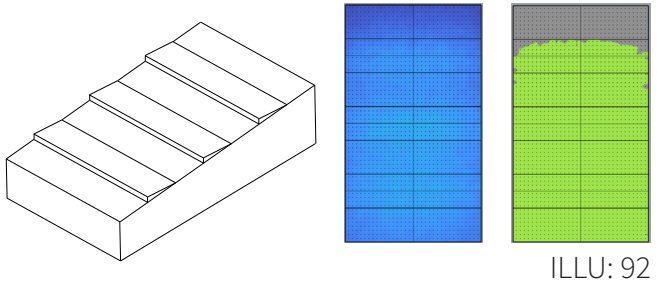
ILLU: 89



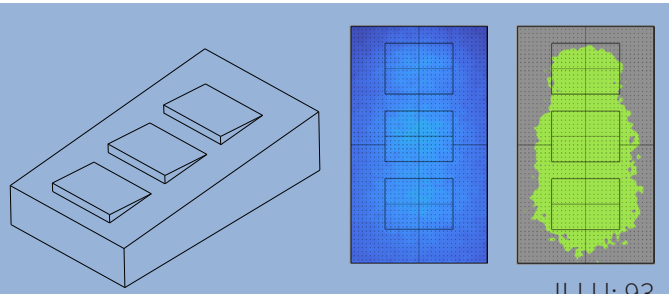
ILLU: 90



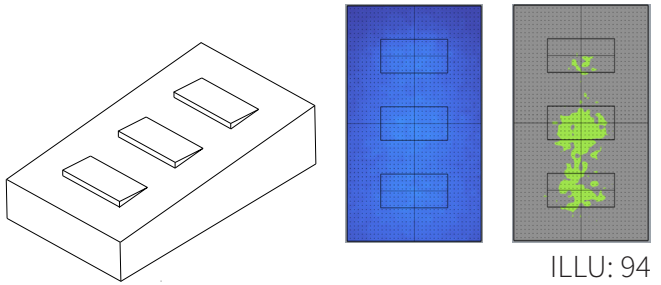
ILLU: 91



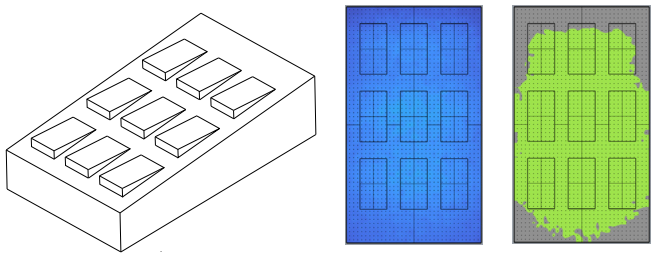
ILLU: 92



ILLU: 93



ILLU: 94

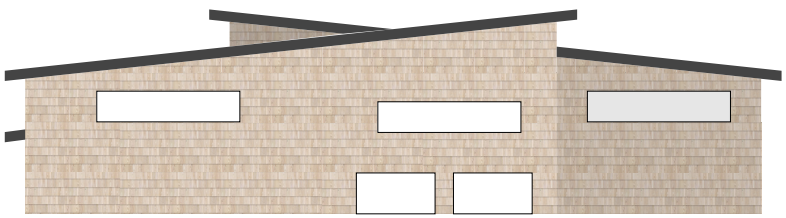


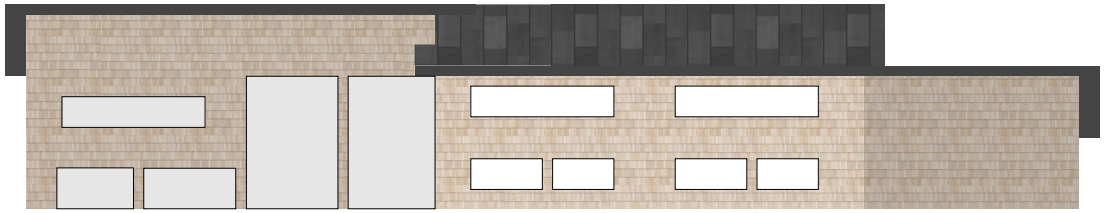
ILLU: 95

FACADE STUDY

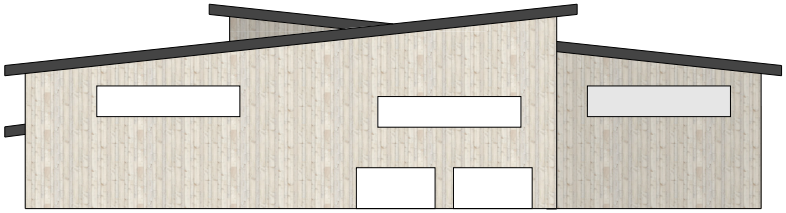
In investigating the material of the facades, two materials have been used: larch and yakisugi. Meanwhile, the textures of shingles and planks have also been used. There were experimented with having the facades being full larch or yakisugi but also a mix of both. Here it was found that the mix worked well and having yakisugi at the top will keep water of the larch and help it not to decompose too fast. Having the façade completely covered in yakisugi would give a very dark look that does not fit the idea of a wooden building. Meanwhile, a facade covered fully with larch would be too uniform and a bit of a boring expression.

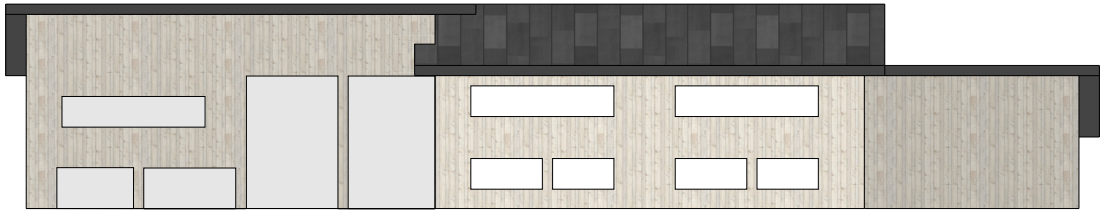
The building is relatively tall and, as a way to keep the scale of the building more understandable height wise, the separation in materials makes it clear how tall each floor is. This creates an interest in the façade in a way that a fully larch or yakisugi façade would not allow as it would be very monotone. The hope is to have a façade that would be intriguing without disturbing the context too much.



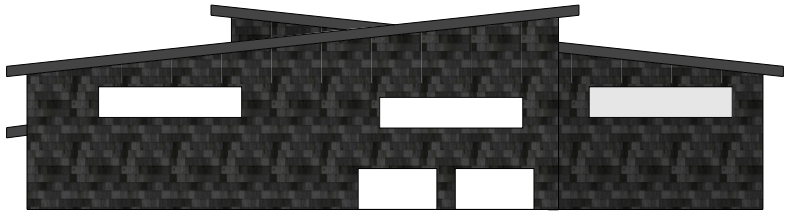


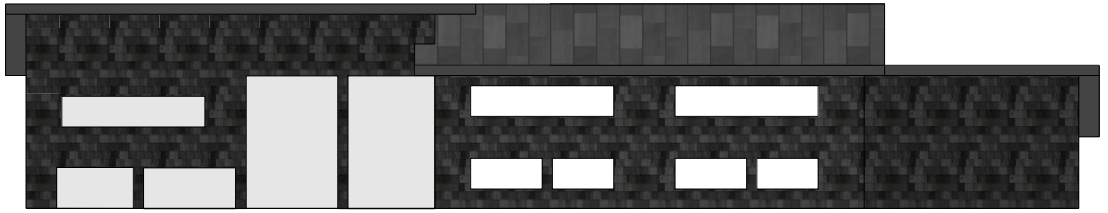
ILLU: 96



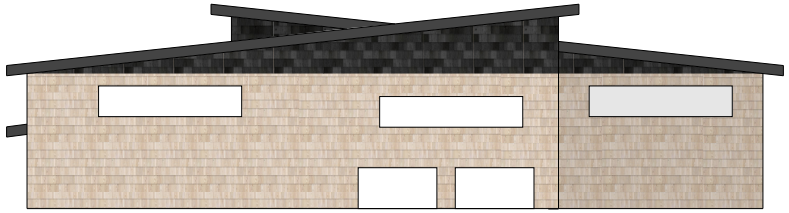


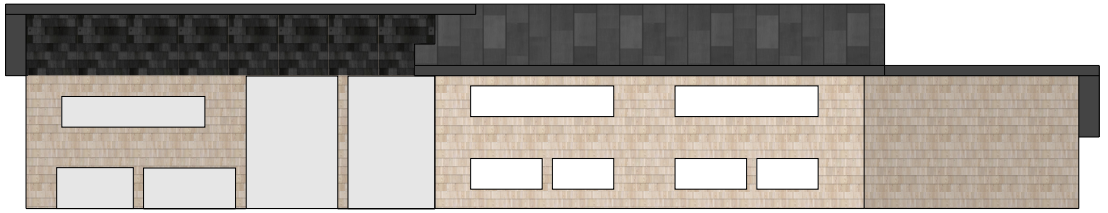
ILLU: 97





ILLU: 98





ILLU: 99

ILLU: 100

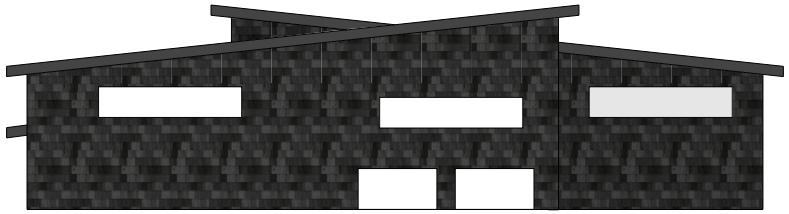
MATERIALS AND LCA

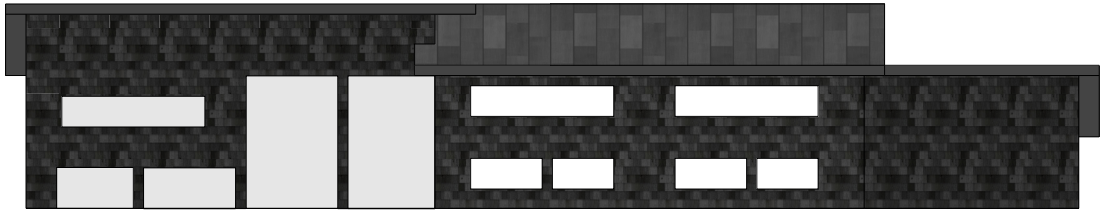
Life cycle assessments, or LCA for short, have not been a large part of the process, but there have been some thoughts. Firstly, since the building would mostly be built of wood, the insulation should also be. Therefore, there is primarily used wood fiber and cellulose insulation. For the flooring, the upper part will be of the material polyurethane which is both robust and soft to walk on and can in some cases be made of recycled plastics (Farsund, 2022). The windows described in appendix 1 were used to make initial calculations, which later were changed to the newer windows in appendix 1. The values for these can be seen in appendix 2. These were created with larch planks as the facade cladding but later, with the new building arrangement seen in illustration 96, there were also tried yakisugi treated planks and a combination of both. On illustration 101 can the results for the different materials on the western building be seen, meanwhile in appendix 3 all results from each building can be seen. On illustration 101 it is seen that yakisugi is the best solution, but the combination will be used because of its aesthetic looks and it is having the next best GWP performance.

	Larch	Yakisugi	Partial
East building	6,699	6,278	6,519
Middle building	5,944	5,622	5,799
West building	6,653	6,284	6,492

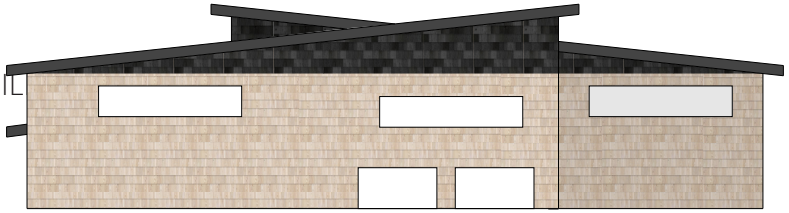
GWP [kg CO_2-eq/m^2/year]

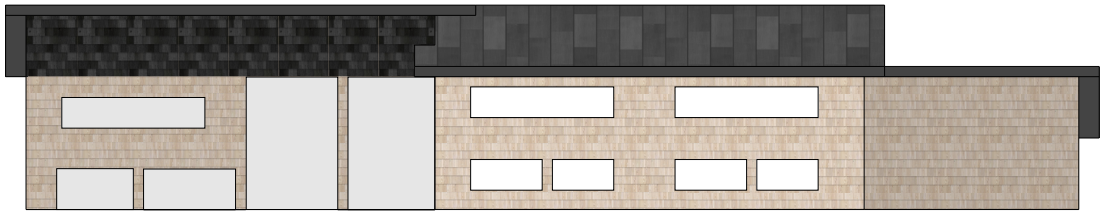
ILLU: 101





ILLU: 102





ILLU: 103

ILLU: 104

INDOOR CLIMATE

To make indoor climate simulations, the program Bsim was used. Here there was chosen to simulate on three different rooms: a classroom on the first floor and a carpenter and woodworker workshop. For the first report, the school building, where the classroom was placed, was the eastern building meanwhile the workshops were placed in the middle building. For this report, the school building is placed in the middle, meanwhile the woodworker workshop is placed in the western building and the carpenter workshop is in the eastern building. Again, as done with the LCA calculations, the first simulations of each room had provisional windows installed until the final windows, from the first report, were chosen. As seen in illustration 105 only the carpenter workshop upholds the Building regulations' requirements of a maximum of 100 hours above 26 °C and 25 hours above 27 °C. After inserting the new windows and making different optimizations, for example more heating and input supply of the ventilation, for each room, the indoor climate ended as seen in illustration 106.

	Value	Classroom	Carpenter	Woodworker
Hours < 18 °C	h	707	0	415
Hours > 18 °C	h	8053	8760	8345
Hours > 26 °C	h	50	79	10
Hours > 27 °C	h	10	22	1

ILLU: 105
Initial building

	Value	Classroom	Carpenter	Woodworker
Hours < 18 °C	h	0	0	0
Hours > 18 °C	h	8760	8760	8760
Hours > 26 °C	h	25	79	74
Hours > 27 °C	h	6	22	18

ILLU: 106
Previous iteration

Since the rooms later got new placements, there also needed to be made new simulations. As described in the energy frame chapter there were made two different versions of how windows and skylights could be placed. The first one, which results can be seen in illustration 107, had skylights facing both north and south, meanwhile the second, which results can be seen in illustration 108, had windows placed on the northern and southern facade. Here it is seen that the rooms without skylights performed the best, so therefore, together with other earlier results, there should only be skylights towards the north and windows on the facade towards north and south.

	Value	Classroom	Carpenter	Woodworker
Hours < 18 °C	h	0	0	0
Hours > 18 °C	h	8760	8760	8760
Hours > 26 °C	h	25	83	77
Hours > 27 °C	h	6	21	23

ILLU: 107
Extra skylight windows

	Value	Classroom	Carpenter	Woodworker
Hours < 18 °C	h	0	0	0
Hours > 18 °C	h	8760	8760	8760
Hours > 26 °C	h	25	63	80
Hours > 27 °C	h	6	9	25

ILLU: 108
Groundfloor windows

ENERGY FRAME

Each of the three buildings started with the provisional windows described in the LCA chapter, whereafter the energy frame calculations could begin. In illustration 109 it is seen that the energy frame was surprisingly good as the school and eastern buildings reached the requirements to be a low energy building, meanwhile the middle building nearly reached the requirements. This would of course change when the skylights and new windows are installed in the model. These would worsen the result quite a bit, especially the middle building since it has the most skylights, as seen in illustration 109. The western building would nearly reach the low energy class, the middle building would nearly reach energy frame BR2018 and the eastern building would be in the middle of the two energy classes. After all this, the buildings were optimized by placing overhangs in the roofs, placing movable lamellas in front of the windows and incorporating more natural ventilation.

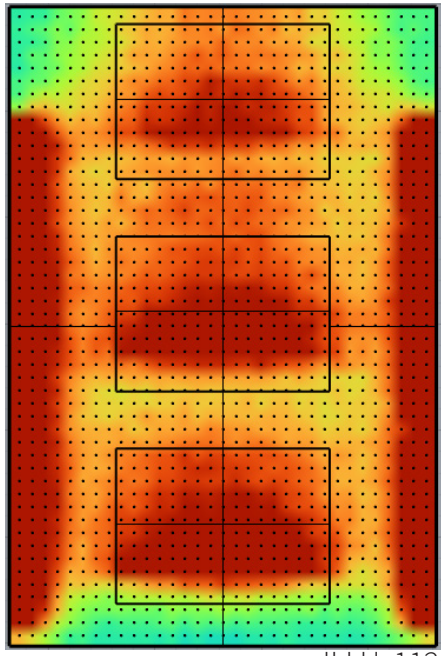
After the building arrangement changed, of course it was also necessary to make new energy frame calculations. As described in the LCA chapter, there were made two different window and skylight arrangements where their energy frames can be seen in illustration110 and 111. Here it shows that the buildings with more skylights are slightly better than the buildings with windows on both the northern and southern facades. Furthermore, is there in illustration 112 and 113 shown the lux levels for the different window types in a workshop facing south. Here it is seen that having skylights would result in having a lot of glares throughout the whole room. At the same time can be seen that the windows in the facade create far less glare and should therefore be used. This simulation was also conducted on the smaller workshops and can be seen in appendix 7.

	Western building	Middle building	Eastern building
Initial building	27,8 kWh/m² pr year	33,2kWh/m² pr year	32,3 kWh/m² pr year
New windows	33,8 kWh/m² pr year	40,2 kWh/m² pr year	36,9 kWh/m² pr year
Optimized	33,8 kWh/m² pr year	33,8 kWh/m² pr year	33,8 kWh/m² pr year
Optimized with photovoltaics	8,8kWh/m² pr year	14,3kWh/m² pr year	10,4 kWh/m² pr year

ILLU: 109

	Western building	Middle building	Eastern building
Energy frame	37,7 kWh/m² pr year	34,9 kWh/m² pr year	38 kWh/m² pr year
Energy frame with photovoltaics	12,7 kWh/m² pr year	9,9 kWh/m² pr year	13 kWh/m² pr year

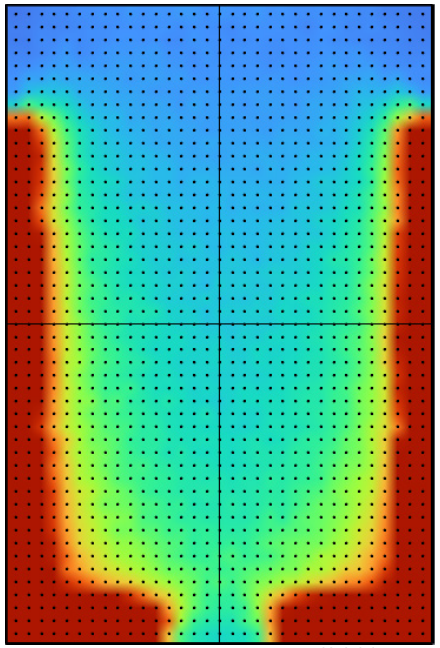
ILLU: 110



ILLU: 112

	Western building	Middle building	Eastern building
Energy frame	39,6 kWh/m² pr year	34,9 kWh/m² pr year	37,7 kWh/m² pr year
Energy frame with photovoltaics	14,6 kWh/m² pr year	9,9 kWh/m² pr year	12,7 kWh/m² pr year

ILLU: 111



ILLU: 113

6 PRESENTATION

All the aforementioned chapters will here be used in creating the final building. The building will be shown in its entirety together with its performance according to the energy frame, LCA and indoor climate.

ENERGY FRAME

In illustration 114 the final energy frame can be seen. To achieve these values there were installed a one-meter overhang coming out from the roof and surrounding the whole building. Afterwards, there were also placed solar shading in form of movable lamellas in front of all windows, except the north facing ones. To put the energy frame further down, the natural ventilation system in the buildings were put up. All this made the buildings go beneath the BR 2018 classification and by installing photovoltaic panels on the roofs of every building. Their energy frame went far beneath the low emission classification.

	Western building	Middle building	Eastern building
Energy frame	39,6 kWh/m^2 pr year	34,9 kWh/m^2 pr year	37,7 kWh/m^2 pr year
Energy frame with photovoltaics	14,6 kWh/m^2 pr year	9,9 kWh/m^2 pr year	12,7 kWh/m^2 pr year

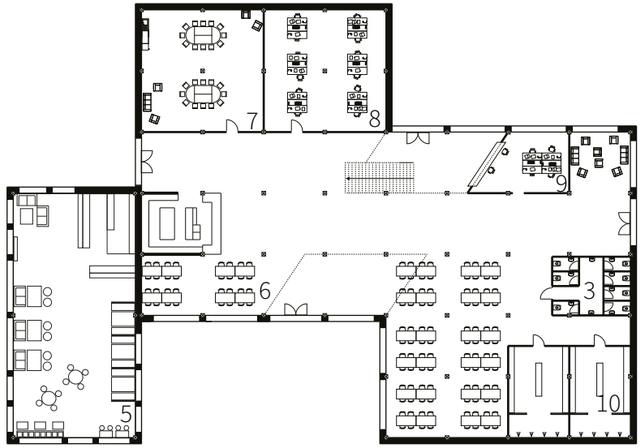
ILLU: 114

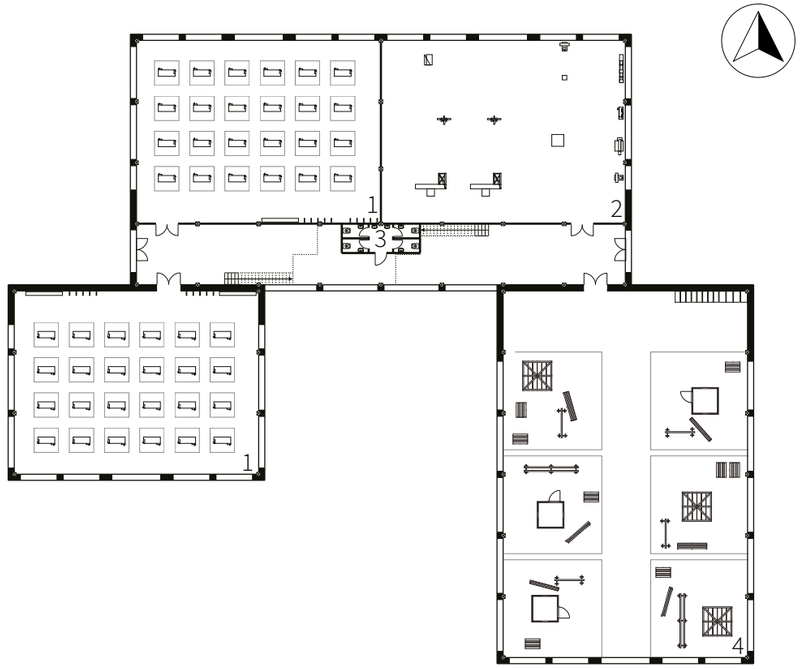
FINAL ROOM PROGRAM

Rooms	Amount	m^2	Light	Activity	Durability	Access	Capacity	Atmosphere	Aesthetics	Materiality
Woodworker workshop	3	300	Both	High	High	Both	20	Structured, calm	Industrial	Concrete, steel, wood
Carpenter workshop	3	600	Both	High	High	Both	24	Structured, calm	Industrial	Concrete, steel, wood
Machine workshop	2	300	Both	High	High	Both	15	Structured, calm	Industrial	Concrete, steel, wood
Classroom	6	100	Natural	Low	Low	Inside	30	Structured, calm	Clean	Gypsum, wood
Cafeteria	1	317	Natural	Medium	Low	Both	200	Loose, talkative	Clean	Gypsum, wood
Kitchen	1	50	Artificial	High	High	Both	5	Clean	Clean	Ceramics, tiles
Wc	22	2	Artificial	Low	High	Inside	1	Private	Clean	Ceramics, tiles
Changing room	2	38	Artificial	Medium	High	Inside	15-30	Inclosed	Clean	Ceramics, tiles, wood
Lounge/study area	6	25-100	Both	Low	Low	Inside	2-5	Loose, talkative	Cozy	Gypsum, wood
Café	1	200	Natural	Medium	Low	Both	50-70	Loose, talkative	Cozy	Gypsum, wood
Administration	1	50	Both	Low	Low	Both	10	Structured, calm	Clean	Gypsum, wood
Teachers lounge	1	100	Both	Low	Low	Inside	10	Structured, calm	Clean	Gypsum, wood
Preperation room	1	100	Both	Low	Low	Inside	10	Structured, calm	Clean	Gypsum, wood

ILLU: 115

The plan is based on the movement and connection between the different functions of the school as well as the necessary divides. Because the social aspect is so important to one's education, the administration building, with its cafeteria, café and large areas for group work, was placed in the middle of the three buildings. IT was also important to have a physical division between classrooms and workshops as the noise from the workshops would lower the quality of the lectures. This divide between the functions is purely functional and supports the quality of education. However, the division in the workshops is partly based on creating more proportional buildings to further the interaction and connection between the single volumes. This has created many subdivisions in the urban space.





1: Woodworker workshop

2: Machine workshop

3: Toilets

4: Carpenter workshop

5: Café

6: Cafeteria

7: Teachers lounge

8: Preperation room

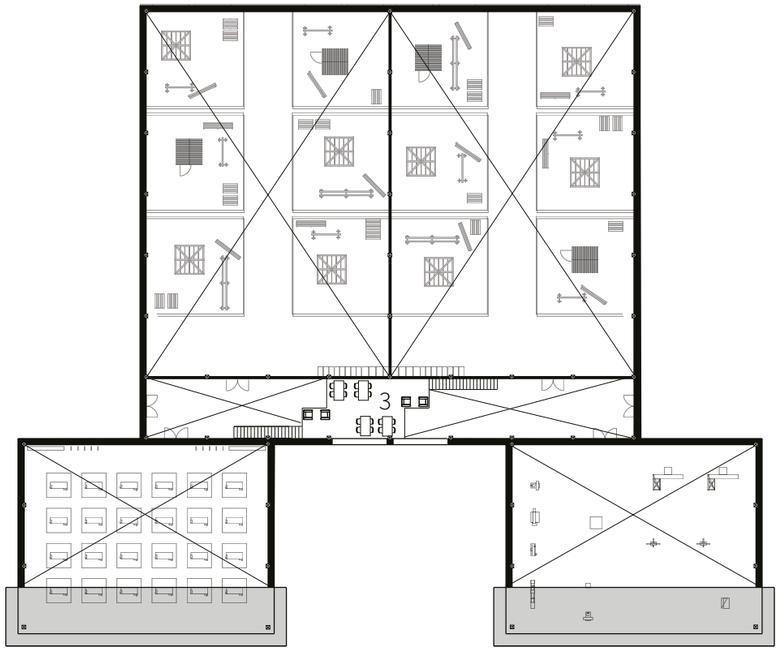
9: Administration

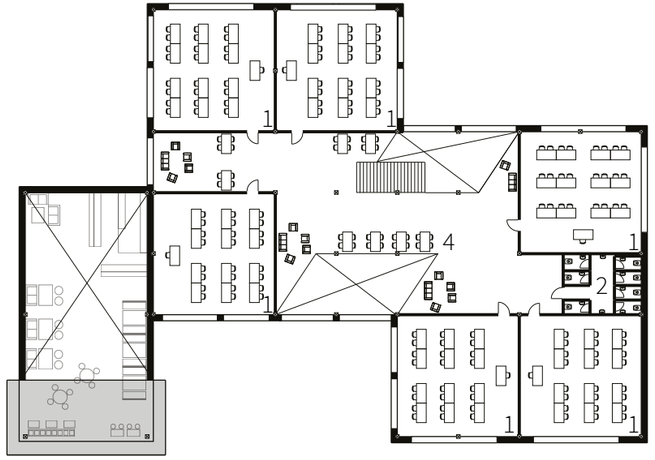
10: Changin room

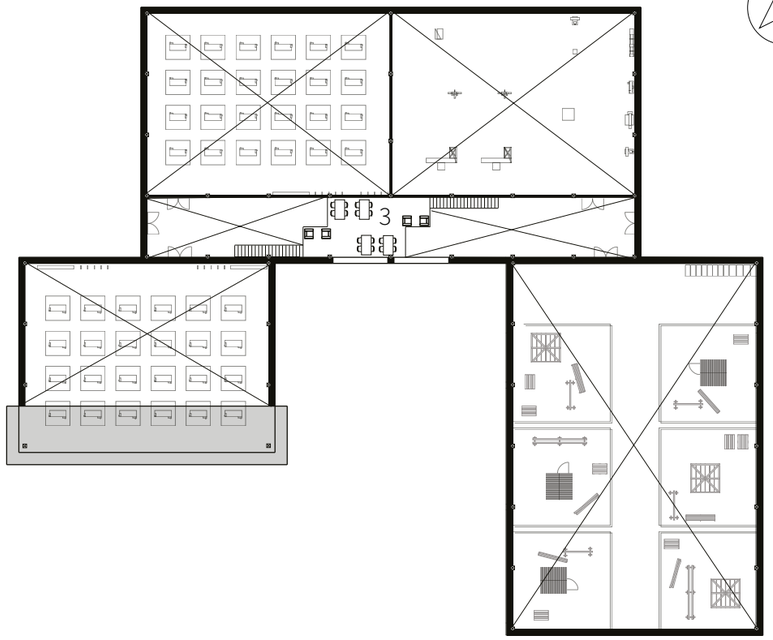
1:500

ILLU: 116

The classrooms in the administration building are placed on the first floor. This is done to create a quieter learning environment for the students, rather than the bustling atmosphere of the cafeteria. However, there is still the possibility to follow the activities on the Groundfloor by looking down from the two smaller atriums placed in the building. These helps with leading more sun light into the building and creates a feeling of enlarging the areas. The first floor also enhances the possible to follow the calming environment of the outdoor areas with its upkept and wilder patches of nature. These elements are also incorporated into the workshop buildings, albeit on a smaller scale.







1: Classroom

2: Toilets

3: Platform

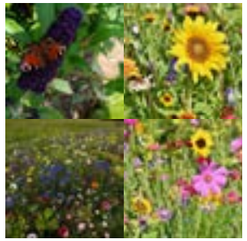
4: Halway area

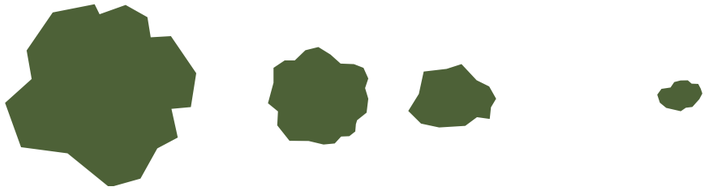
1:500

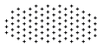
ILLU: 117

MASTER PLAN

Creating spaces with sunlight and others with shadow makes space for all types of people. It is important to have diversity in the spaces as preferences can shift widely. This is also incorporated as there are spaces with many trees and some are very open. All of this is done to create spaces with diversity that harmonizes with the project. The most designed urban spaces are the entry spaces where people are drawn into the building. This space is designed to have spaces for sitting and sensory experiences with herbs and bushes in small pockets in the pavement, giving of a feeling of zen gardens. These breaks in the pavement are also a way to continue the attention to the natural elements, which is how they were introduced into the project and as they were further developed. They started to resemble the Zen gardens known from Japan and this was not intention from the start. However, it is understandable as both are designs have the purpose of creating imitations of nature for humans to feel at ease.







ILLU: 118

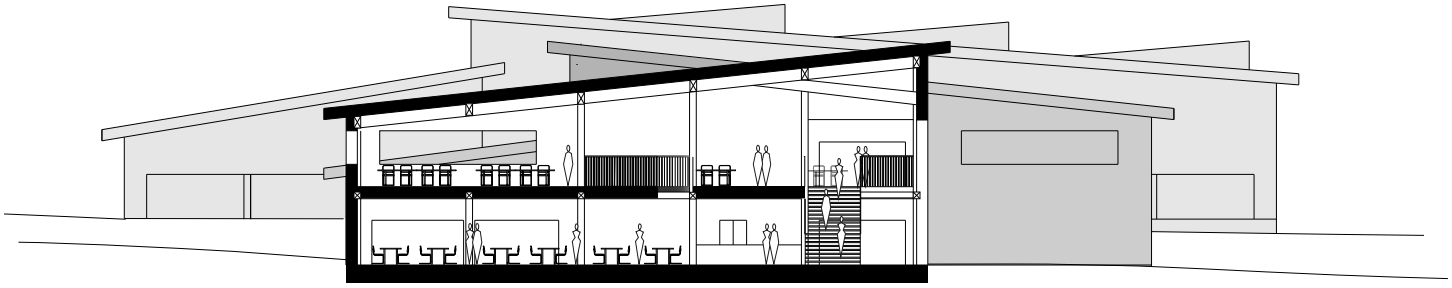
1:1000
ILLU: 119
103

In this view, on illustration 120, the meadow like part of the master plan design allows for a well-lit sitting area for the café and cantina and the path is shown to move organically through the flowers. This is done to have the users interact as much with the natural elements as possible and engage their kinesthetic senses as well as their other senses. The general idea of the master plan was to engage the senses and fully utilize the phenomenological theory.

Before arriving in the lobby, the user will move through the urban space and, immediately before entering, meet a large, paved area with the small green pockets. The pavement makes it possible for the students at the school to showcase their project to by passers and possible employers. Furthermore, were the sitting areas in the green pockets implemented to allow for further use as the space was without much possibility of getting sensory experiences like on other areas on the site.

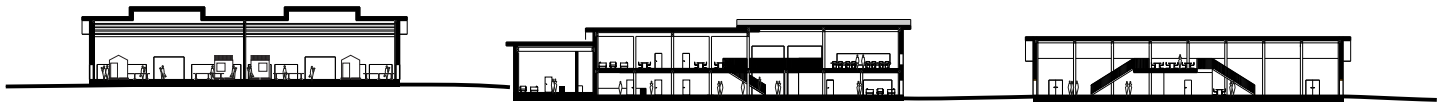
ILLU: 121

The lobby is designed with a double height space right as the user enters it. This is done to create a light and airy space. The shadows are soft as the room is primarily lit through the natural light reflected of the sky. The use of the lobby is to lead the users to the information centre and give space for waiting in the case of meetings or the like. This means that there is the need for both a large flow and a space to sit in relatively calm surroundings. Another reason for the large amount of traffic in the lobby is that it is part of the hallway system.



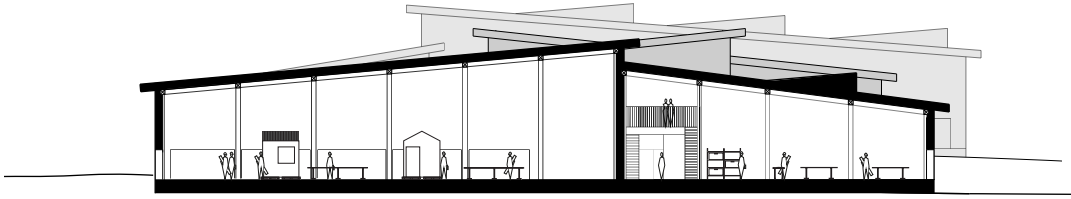
1:250
ILLU: 122

The hallway space in the main building with the lobby is very different from the rest as these have double height -ceilings all the way through the space. This has allowed for the division of the space in the vertical direction. Therefore, the traffic and flow are prioritized on the ground floor level as furniture is only placed out of the way of the flow. This creates less harsh lines and a gradient of the tempo in those areas which ensures the utility of the space. This is because a fast transition in the area would function well in leading the users through it.



1:1000
ILLU: 124

When moving up the stairs, the fast flow disappears, and the tempo becomes slow and spaces for group work and general sitting areas takes over. This is a space created for a slow tempo and for creating perspective as well as activating the kinesthetic sense and experiencing the room. This will happen as the celling height will change more and create different zones both on the ground level and on the first floor. One of the ways to create perspective is to give a look into the education itself as a view can be gained in the workshops. This can give the younger students something to look forward to for their education or give the older student a piece of nostalgia. The large window panels also help with leading more light into the hallways, making it a much brighter place to be.



1:500
ILLU: 126

ELEVATIONS

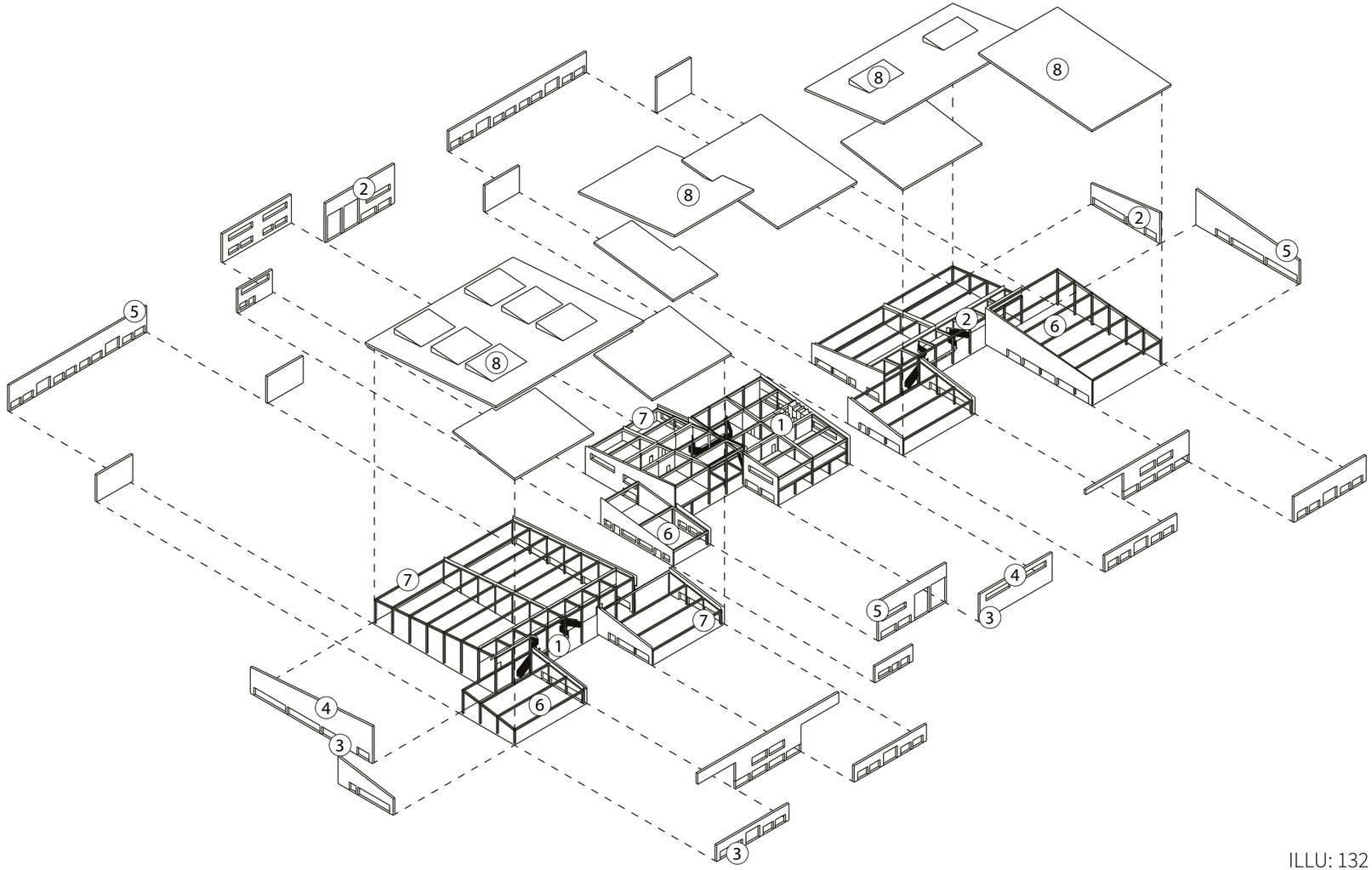
The facades have a cladding of larch in a traditional Nordic pattern with a modernizing twist, elevating the look to work with the slightly modified traditional shape. The choice of material is based in the properties of the type of wood and on the aesthetics. Other options were ruled out due to the impact on the aesthetics as it then did not fit the wooden look of the project. The wooden look has been a stable in the entirety of the project and different ways of working with wood have been experimented with, but the best result came with this combination of material and cladding formation. Looking at the window placement, it is based on the symmetry around the pillars in the construction, combined with an assessment of the impact on the look of the façade. The facades have been opened up with windows to show the students work and to gain more light in the space.

1:500
ILLU: 128

1:500
ILLU: 129

1:500
ILLU: 130

1:500
ILLU: 131



ILLU: 132

- Easy to repair
- Unique aesthetic
- Enviromentally friendly
- Fire retardant (with coating)

1: Wood shingles

- Long service life
- Acoustic benefits
- Low maintenance
- Enviromentally friendly

2: Planks

- Long service life
- Aesthetic aging
- Insect resistant
- Enviromentally friendly

2: Board on board, larch

- Weather resistant
- Insect resistant
- Fire retardant
- Aesthetically pleasing

4: Yakisugi planks

- Renewably made
- Soundproofing
- Fire resistant
- High thermal performance

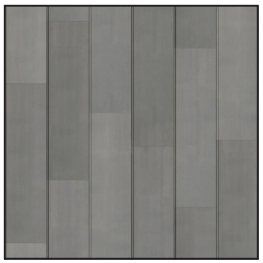
5: Cellulose insulation

- Elastic properties
- Scratch resistant
- Slip resistant
- Durable

6: Polyurethan

- Light weight
- Aesthetic apperance
- Fire resistant
- Durable

7: Glulam



- Light weight
- Low maintenance
- Long service life
- Recyclable

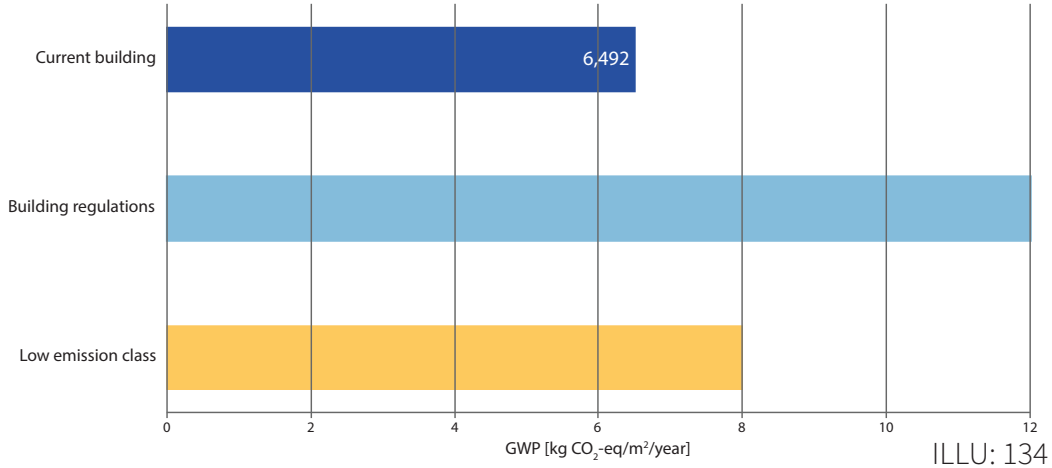
8: Zinc roofing

ILLU: 133

LCA

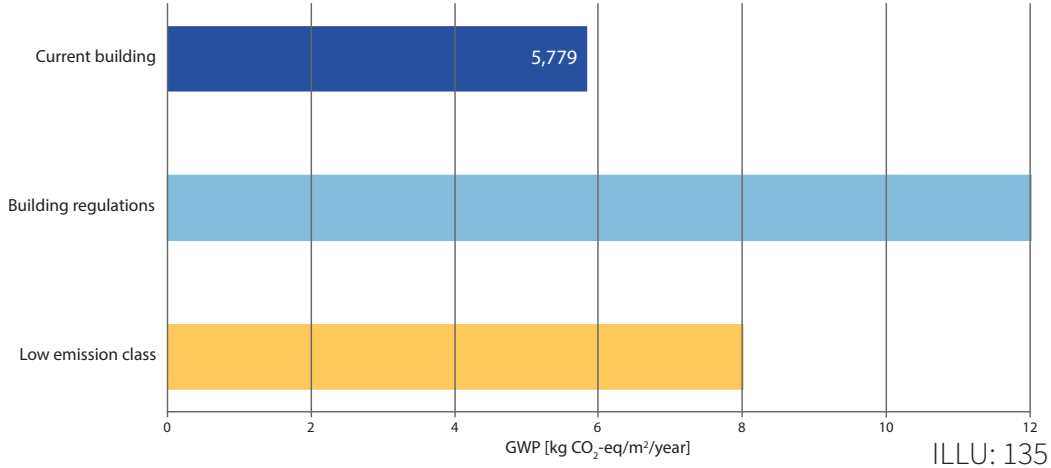
Here can the final LCA analysis for the three different buildings be seen. In illustration 134-136 it can be seen that all buildings are under the Building regulations and the low emission class's requirements. This was achieved by using mostly environmentally friendly materials such as wood for everything other than the roof, floor and foundation. These were made, among other things, of zinc, polyurethane and concrete.

WESTEREN BUILDING



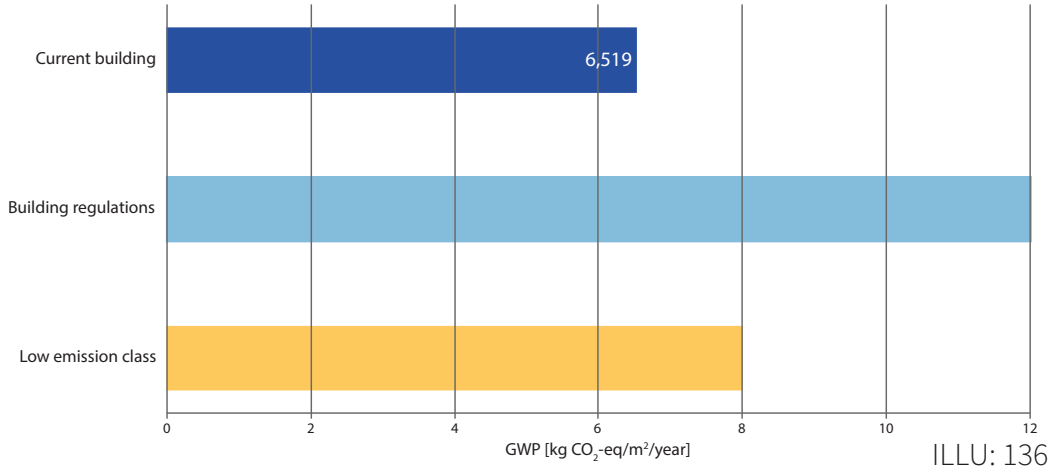
ILLU: 134

MIDDLE BUILDING



ILLU: 135

EASTERN BUILDING

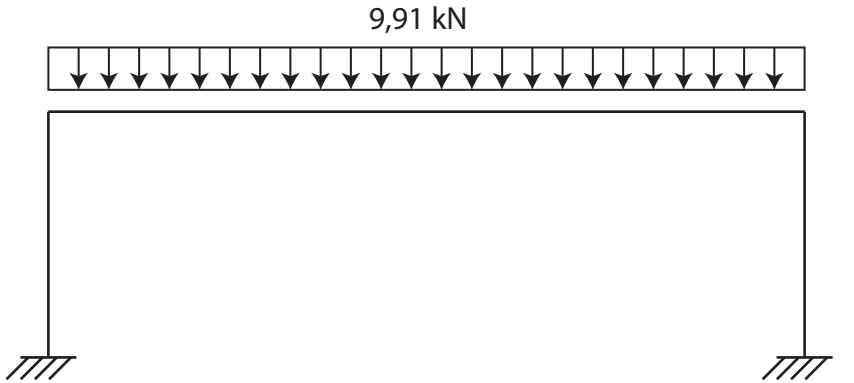


ILLU: 136

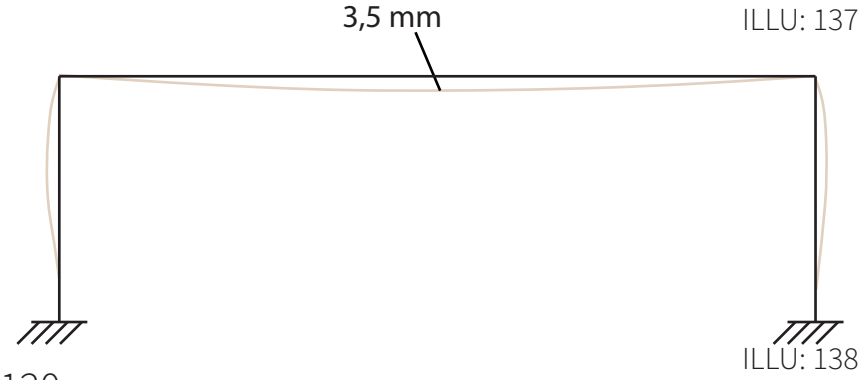
STRUCTURAL SYSTEM

The structural system in the building has been dimensioned and placed so it is visible in every room and workshop. This is done to follow the doctrines of the different theories, especially gesture and principle, phenomenological theory and the aesthetic learning processes. It can among other be seen in all the sensory inputs the user gets by being in the buildings. This can be by the touch or sight of the materials, the wooden smells and the sense of different scales when walking around. It can also be seen in the structure itself and how it can teach people about the materials, how they work and make the building. This also makes it easier for the students to understand how to make structures like these.

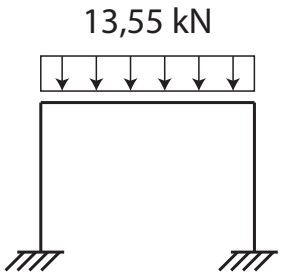
With the choosing of the structural system in the last chapter, is also needed to be calculated to ensure it is steady enough. In appendix 4 can the different calculations be seen. There is experimented with: the overall length of the beam, the cross-section size and strength of the material. For the big spans in the carpenter workshops, illustration 137 and 138, a glulam beam with strength class gl32c and a cross-section on 0,3 x 0,3 m were chosen. The same beam was in the last iteration of the project 0,5 x 0,8 m. This change was possible because of the discission of placing more beams and columns in the workshop and therefore decreasing the load distribution of each beam. For the beam in the school building, seen in illustration 139 and 140, the same type and cross-section was chosen.



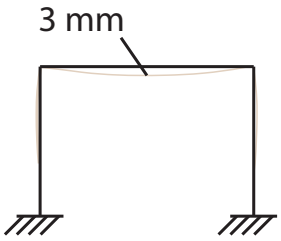
ILLU: 137



ILLU: 138

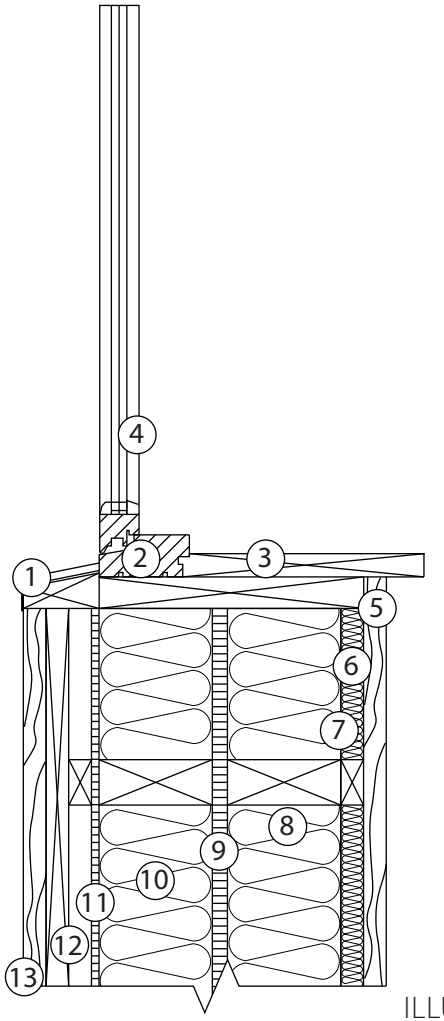


ILLU: 139



ILLU: 140

CONSTRUCTION



1:10

ILLU: 141

1: External window sill

2: Window frame

3: Internal window sill

4: 3-layer thermo glass

5: Plywood

6: Cellulose insulation

7: Vapor barrior, PP

8: Cellulose insulation

9: MDF

10: Cellulose insulation

11: MDF

12: Ventilated layer

13: Larch and yakisugi planks

U-value: 0,127 W/m^{2}*K

INDOOR CLIMATE

Here the final optimized simulation for the indoor climate of the three rooms will be illustrated. To optimize the rooms, different things were changed in the system in Bsim. For the classroom to meet the Building regulations requirements, less than 100 hours above 26 °C and 25 hours above 27 °C, the ventilation system in the room were increased in its input supply. The carpenter workshop had a lot of hours with under temperature, so there installed bigger heat sources with a larger maximum power. Furthermore, would the heating be turned on in two extra months. This got the room to meet the requirements but to make the rooms time of use more realistic, the number of weeks the room would be used, was put down so it was not used in the summer vacation. The same was done to the woodworker workshop, however, it was not necessary for the heating sources maximum power to be increased as much as in the carpenter workshop. There were still some hours above 27 °C so the ventilation systems input supply were increased a bit. The final temperatures can be seen in illustration 142.

	Value	Classroom	Carpenter	Woodworker
Hours < 18 °C	h	0	0	0
Hours > 18 °C	h	8760	8760	8760
Hours > 26 °C	h	25	63	80
Hours > 27 °C	h	6	9	25

ILLU: 142

7 EPILOG

In this chapter the conclusion of the project will be presented. Furthermore, will there also be discussed choices made and reflected on what could be better if more work would be needed. There will also be placed a bibliography for all the materials needed to construct the report together with a list of all the illustrations.

DISCUSSION

In the design process, a lot of decisions have been made and some of these might not have been complete enough as the same take could have been more consistent. One of these instances is the placement of the three buildings. For this iteration, they are placed a bit irregularly to each other toward the north of the site. This has given way for a large attractive outdoor area toward the south and done so that the building can follow the terrain without disturbing it too much. However, this has meant that the northern recreation area is quite small and a relatively dark place to be because of the buildings. In spite of this it is not a big problem because it will encourage people to use the areas to the south. Furthermore, will the areas around the northern paths still get some sunlight. When dealing with the temporary and permanent storage areas, which earlier were placed towards the south, it has been advantageous to place them toward the northeastern part of the site. It has both made it easier for the distributor to deliver materials and for the staff at the school to move the materials around. Earlier in the process the buildings were placed so the hallways of each building connected into one long hallway. This made it easy to traverse from one end of the building to the other. However, this created a feeling of the journey seeming very long and boring and it locked the positioning of the buildings. This was solved by the irregular placement the buildings have now, however, it made it harder to place the canopies.

When speaking of the hallway space, in the earlier iteration it changed to a canopy space two times throughout the site. It was done by the hallway having room for sitting along the vertical axis and in the canopy space, this was moved by the horizontal axis. Another difference was the height of the roof. In the two cases, the roof on the inside was placed very high and the one on the outside, the canopies, was much lower. This was done in order to give better shelter from rain and minimize the area of the canopy and the material use. Throughout the process, finding the correct way to design the canopy was a big issue. Should it be part of the roof? Should it be its own or something in between? Through trials, the best solution for this, especially after the reorganisation of the building, was to remove the canopies altogether. The reason for this was that with the new layout it would be difficult to incorporate the canopies in an aesthetically pleasing way and it would take up a lot more space than previously. However, the missing canopies that could lead people over to the next building will not be a problem because of the nooks every building creates. These makes a clear case of showing where the entrance for each building is situated.

A focal point in the project is the hallway space as this is what connects the entirety of the project. It has been a defining point in the design process as the different connections have changed dramatically with the hallway and whether it allowed outside traffic to gain access through the site. This has impacted the possibilities both outside and inside. As shown here, the hallway has led to many thoughts and possibilities and in a space as defining as this, it is important to investigate the possibilities for flow and breaks. The idea to create elevated spaces came from a problem with placing areas where it would be possible to sit with groupwork as well as hanging out in between periods. This was because of the space is very straight and does not naturally create many areas for sitting down. The idea then was to create a space above the traffic that would allow for less activity. This space has been proven useful, both to create space for group work and sitting but also to create a view into the workshops. This is a great opportunity to create perspective between the different years at the school as they can see what they will become and where they started. The elevated space offers a lot which is why there were placed windows in their levels towards the south, compared to the earlier iteration. This made the area much more well-lit and an attractive place to stay.

CONCLUSION

When starting the project, the idea was to create an artisan school that was simultaneously environmentally sustainable and offered a holistic student experience. In order to complete this, different tools were used. For the holistic experience the phenomenological theory offered a lot of thoughts and helped steer the project towards an experience for the entire human being. This was done among other things by implementing the large attractive outdoor areas, which would activate most of the main senses. The building itself will also participate in this with its different materials. For example, will the different wood types and how they are used, be intriguing for the sight and tactile senses. The different parts of student life have been investigated in order to make sure the spaces offer what the students will need outside of the classrooms and workshops. Therefore, was the café implemented into the school so it could function as a meeting place and space for relaxation. This could also entice other users of the surrounding area to use the cafe and create relations with the artisan students. It was also important for the students learning to have good study areas, both for single work and for groupwork. Therefore, there was in the middle buildings placed large areas with great opportunity for the students to find a place to sit and study. Furthermore, can the hallways of the workshop building also be used for this. By having the platforms, the students can also choose to sit up there and be more private if needed. Both areas were implemented because the social part of education is extremely important for the quality of the student's education.

In order to ensure an environmentally sustainable design, there has been a close interaction between different tools and the design process. The tool BE18 has been used throughout the project to monitor the energy performance of the project, but it has not been the sole deciding factor. This could have impacted the architectural expression in a disadvantageous way as the tool only accounts for the energy frame. Therefore, would there in some cases by made decisions that negatively affected the energy consumption. This was for example that the energy frame would decrease if the number of windows was reduced. However, the quality of having more windows compensated for the loss in the energy frame by having more natural light in the rooms and sight towards the outdoors. This does not mean that the performance of the building is terrible, as the performance, at its worst, has always been in the region where it would be able to be built without compensation. When the active strategies have been applied, it would result in a low energy building that fits well within the guidelines. To further ensure the environmentally sustainability of the design but also function as a learning experience for the students, it was chosen to use mostly wooden materials. The only exceptions to this are the floors and the roof. Since the floors, at least in the workshops, needed to be very sturdy, concrete with a layer of polyurethane was chosen instead. This has the advantages of giving the building more thermal mass for heating, less prone to wear and tear and it is easier to replace. When looking at the roof, even if zinc roofing is not the best GWP wise, it is still better than aluminum and lighter than roof tiles. Furthermore, does it also have a longer lifespan than wood.

REFLECTION

The theoretical framework for this project has been quite wide and includes theories that have been used more or less. The theories that have been used the most are the tectonic and phenomenological theories as these are the theories that have been referenced most. Meanwhile, the architectural and learning theories have been supplements to the main theories. The project has benefitted from this by having a strong core in the sensory experience and a clear tectonic expression. This is seen as the design throughout the project has been based on the notion that the architectural spaces should be supported by the construction. As such, the construction should add to the architectural experience and every room should be fitted to specific uses in expression and dimension. The phenomenological aspect has played a role in the choices of materials as the chosen material has a certain feel to them, both in the texture and temperature. Furthermore, these are mostly materials that are nontoxic and that humans understand. This creates a closer connection between the user and the room. The type of atmosphere in a room full of wood and a room made of concrete or gypsum is massively different. Generally, wood will create a more welcoming environment as the materiality is something that is instinctively understood. Meanwhile, concrete and gypsum are cold, without texture and synthetic, meaning that people have a harder time understanding the material. The phenomenological theory has also been used for the design of the masterplan where touch, smell, sound and taste have been implemented by introducing different plants for eating, smelling and to attract certain types of insects and animals. These will add a natural sound to the entire place, and this can help sustain the atmosphere. The other theories are used more or less to support the result of the first and to add in more necessary information, even if it is not the main focus. This project has been influenced by a lot of thoughts and this has resulted in a very diverse design but as the overall form concept is simple, the project itself can house a lot of diversity. This shows how much can be done in simple forms and materials and how this can sustain a far more complex situation by simple adaptation.

The design process has been conducted as an integrated design process meaning that everything has been overlapping at some point. For example, was the form not done first and then the roof, but it has been a motion for trying or figuring out what about it worked and in what aspects. Then it would move through the process, changing small bits as well as taking the ideas and seeing if a new form or a new idea could result in a better product. The roof was one of the things where the overall idea was found by stating the parameters and trying out every possible variation. The best variation would become the starting point for the later iterations as the project evolved and things changed. The way of the iterative method, when looking at the method by itself, seams relatively straight forward and easy but when performed, everything melts together. This is why the different parts have had to be separated for the design process. In some cases, the method of problem-based design has been used but not as a method of its own but rather as a tool in the integrated design process. This combination has worked well as it has offered a solution for most problems along the way and has resulted in a process with very few problematic incidents. This has also allowed for the design decisions to be made based on technical and architectural analysis.

Bibliography

Books

Frascari, M. (1983). The Tell-the-Tale Detail. I: Foged, I.W. and Hvejsel, M.F. red. Reader - tectonics in Architecture. Aalborg, Denmark: Aalborg University Press, s. 85-94.

Foged, I.W. and Hvejsel, M.F. (2018) Reader - tectonics in Architecture. Aalborg, Denmark: Aalborg University Press.

Froda, J. and Rigsted, S. (2008) Plant er værksted: Grundbog om æstetisk-skabende virksomhed Kbh.: Hans Reitzel forlag.

Illeris, K. (2015) Læring. Copenhagen, Denmark: Samfundslitteratur.

Lawson, B. (2005) How designers think: The design process demytifyed. Oxford: Architectural Press

Lund, N. (2001) Arkitekturteorier siden 1945. Skive, Denmark: Arkitektens Forlag

Pallasmaa, J. (2014) Arkitekturen og Sanserne. Copenhagen, Denmark: Arkitektens Forl.

Zumthor, P. (2005) Atmospheres. Switzerland: Birkhauser

PDF

Aarkrog, V. (2007) Hvis det skal gi' mening. Copenhagen: Undervisningsministeriet.

De Natiolane Geologiske Undersøgelser for Danmark og Grønland. (1930) Borerapport DGU arkivnr: 34. 26. Copenhagen: Geus.

Jørgensen, B. and Cappelen, J. (1999) Observeret vindhastighed og -retning i Danmark - med klimanormaler 1961-90. Copenhagen: Dansih Meteorological Institute.

Knudstrup, M-A. (2004). Integrated Design Process in Problem-Based Learning: Integrated Design Process in PBL. In Kolmos, Anette : Fink, Flemming K. : Krogh, Lone (eds.) (Ed.), The Aalborg PBL Model : Progress, Diversity and Challenges (pp. 221-234). Aalborg Universitetsforlag.

Pictures and illustrations

ERIK arkitekter (2018) Tradium tømreskole, ERIK arkitekter. Available at: https://www.erik.dk/projects/tradium/ (Accessed: 2024)

Plant diagram for mapping, some pictures borrowed form Jespers planteskole and Have handel

Jespers planteskole (no date) Purløg (allium schoenoprasum) Jespers planteskole. Available at: https://www.jespersplanteskole.dk/allium-schoenoprasum (Accessed: 28 May 2024)

Jespers planteskole (no date) Mynte Marokkansk (Mentha spicata'Marokko') 14 cm potte Jespers planteskole. Available at: https://www.jespersplanteskole.dk/mentha-spicata-marokko-13-cm-potte (Accessed: 28 May 2024)

Jespers planteskole (no date) Kryspersille (Petroselinum) Jespers planteskole. Available at: https://www.jespersplanteskole.dk/kruspersille-petroselinum-crispum-13-cm-potte?gad_source=1&gclid=CjwKCAjwgdayBhBQEiwAXhMxtqIHzlY4xUptts5a7L6qvB-wtD0TfTau_AsXqsizOB61KWxorI8KhxoCLdcQAvD_BwE (Accessed: 28 May 2024)

Jespers planteskole (no date) Økologisk rosmarin(Rosmarinus officinalis) potte 12 cm Jespers planteskole. Available at: https://www.jespersplanteskole.dk/okologisk-rosmarin-rosmarinus-officinalis-potte-12-cm (Accessed: 28 May 2024)

Jespers planteskole (no date) Solbær (ribes 'big ben') 30-50 Jespers planteskole. Available at: https://www.jespersplanteskole.dk/solbaer-ribes-big-ben (Accessed: 28 May 2024)

Jespers planteskole (no date) Sommerfuglebusk (Buddleia davidii 'black knight') Jespers planteskole. Available at: https://www.jespersplanteskole.dk/sommerfuglebusk-buddleia-davidii-black-knight-flere-varianter (Accessed: 28 May 2024)

Jespers planteskole (no date) TORNFRI HINDBÆR (RUBUS IDAEUS 'RASPBERRY SHORTCAKE' / 'RUBY BEAUTY') 30-50 CM Jespers planteskole. Available at: https://www.jespersplanteskole.dk/rubus-ideaeus-rasberry-shortcake-ruby-beauty (Accessed: 28 May 2024)

Jespers planteskole (no date) TRÆDEBREGNE (LEPTINELLA-COTULA 'MINIMA') Jespers planteskole. Available at: https://www.jespersplanteskole.dk/leptinella-minima-cotula-minima

(Accessed: 28 May 2024)

Jespers planteskole (no date) TORNFRI BROMBÆR (RUBUS FRUTICOSUS 'NAVAHO') 30-50 CM Jespers planteskole. Available at:https://www.jespersplanteskole.dk/tornfri-brombaer-rubus-fruticosus-navaho-40-80-cm(Accessed: 28 May 2024)

Jespers planteskole (no date) STORFRUGTET HASSEL (CORYLUS AVELLANA 'BOLVILLER') 100-150 CM. Available at:https://www.jespersplanteskole.dk/storfrugtet-hassel-co-

rylus-avellana-bolviller-60-100-cm(Accessed: 28 May 2024)

Jespers planteskole (no date) KRYBENDE TIMIAN (THYMUS PRAECOX 'COCCINEUS' (SERPYLLUM)). Available at:https://www.jespersplanteskole.dk/thymus-serpyllum-coccineus Accessed: 28 May 2024)

Havehandel (no date) Pluk-selv-blomster blomsterblanding – 50 m2 Havehandel. Available at: https://havehandel.dk/produkt/pluk-selv-blomster-blomsterblanding-50-m2/ (Accessed: 28 May 2024)

Havehandel (no date) Vilde blomster - guide Havehandel. Available at: https://havehandel.dk/vilde-blomster-guide// (Accessed: 28 May 2024)

Havehandel (no date) Plantning af vilde blomster Havehandel. Available at: https://havehandel.dk/vilde-blomster-guide// (Accessed: 28 May 2024)

Website

Aalborg kommune. (2024) Nøgletak og statistik. Aalborg kommune. Available at: https://www.aalborg.dk/om-kommunen/oekonomi-og-statistik/noegletal-og-statistik (Accessed: 17 July 2024)

Danmarks Statistik a (no date) Befolkningstal. Danmarks Statistik. Available at: https://www.dst.dk/da/Statistik/emner/borgere/befolkning/befolkningstal (Accessed: 28 February 2024).

Danmarks Statistik b (no date) Unges status på ungdomsuddannelser. Danmarks Statistik. Available at: https://www.dst.dk/da/Statistik/emner/uddannelse-og-forskning/befolkningens-uddannelsesstatus/unges-status-paa-ungdomsuddannelser (Accessed: 28 February 2024).

Dataforsyningen (no date) Dataoversigt. Styrelson for Dataforsyning og infrastruktur. Available at: https://dataforsyningen.dk/data (Accessed: 28 February 2024).

Farsund,P. (2022) Hvad er et PU-gulv? Bolius. Available at: https://www.bolius.dk/hvad-er-et-pu-gulv-98501 (Accessed: 13 May 2024).

Fiederer, L. (2016) AD Classics: Säynätsalo Town Hall / Alvar Aalto. Archdaily. Available at: https://www.archdaily.com/783392/ad-classics-saynatsalo-town-hall-alvar-aalto (Accessed: 18 March 2024).

Gluud, M. (2018) Mangel på håndværkere: 'Det er nærmest Umuligt at Finde Medarbejdere'. DR. Available at: https://www.dr.dk/nyheder/regionale/hovedstadsomraadet/mangel-paa-haandvaerkere-det-er-naermest-umuligt-finde (Accessed: 28 February 2024).

Miljøstyrelsen (no date) Kortlægning af Støj. Miljøstyrelsen. Available at: https://mst.dk/erhverv/rent-miljoe-og-sikker-forsyning/stoej/kortlaegning-af-stoej (Accessed: 28 February 2024).

MT Copeland. (2022) a guide to dowel joints & how to make them. MT Copeland technologies. Available at: https://mtcopeland.com/blog/a-guide-to-dowel-joints-how-to-make-them/ (Accessed: 29 August 2024)

Skoven i skolen. (no date) Lærk. Skoven i skolen. Available at: https://skoven-i-skolen.dk/leksikon/laerk (Accessed: 19 May 2024).

Thornton Tomasetti (2023) Ascent, Thornton Tomasett. Available at: https://www.thorntontomasetti.com/project/ascent (Accessed: 17 March 2024).

Vognsen (2018) Tradium, Vognsen. Available at: https://vognsen.dk/projekt/tradium/ (Accessed: 08 March 2024).

Interview

Damsgaarg, S. & Hansen, A. Interview at EUC Nord. Interviewed by Anna Deleuran Weihrauch & Jonas Birger Bech Frederiksen. [mp3- and PDF-file] Hjørring, 13.02.2024

Illustration list

Ill 1: IDP illustration, own illustration

Ill 2: Realistic IDP illustration, own illustration

Ill 3: Vitruvius triangle, own illustration

Ill 4: Gesture and principle tectonics diagram, own illustration

Ill 5: Senses for phenomenological theory, own illustration

Ill 6: New regionalistic theory, own illustration

Ill 7: Designing form place and phenomenolgy theory, own illustration

Ill 8: The learning theory triangle, own illustration

Ill 9: Aesthetics learning process, own illustration

Ill 10: Flow diagram of Tradium carpenter school, borrowed from ERIK arkitekter. ERIK arkitekter (2018) Tradium tømreskole, ERIK arkitekter. Available at: https://www.erik.dk/projects/tradium/ (Accessed: 2024).

Ill 11: Sketch of Tradium, own illustration

Ill 12: Hallway sketch of Sâyätsalo town hall, own illustration

Ill 13: Closed off hallway sketch of Sâyätsalo town hall, own illustration

Ill 14: Sketch of Sâyätsalo town hall, own illustration

Ill 15: Map of context, own illustration

Ill 16: Demography of possible students, own illustration

Ill 17: Demography of the University area district, own illustration

Ill 18: Amount of artisan students per year, own illustration

Ill 19: Traffic map around site, own illustration

Ill 20: Topography map, own illustration

Ill 21: Typology map, own illustration

Ill 22: Soil survey, own illustration

Ill 23: Bluespot map, own illustration

Ill 24: Noise map, own illustration

Ill 25: Shadow analysis one story, own illustration

Ill 26: Shadow analysis two stories, own illustration

Ill 27: Sun path map, own illustration

Ill 28: Wind rose, own illustration

Ill 29: Material analysis, own illustration and pictures

Ill 30: Persona (teacher), own illustration

Ill 31: Persona (student), own illustration

Ill 32: Old room program, own illustration

Ill 33: Function diagram, own illustration

Ill 34: Analysis conclusion, own illustration

Ill 35: Form study 1, own illustration

Ill 36: Form study 2, own illustration

Ill 37: Form study 3, own illustration

Ill 38: Form study 4, own illustration

Ill 39: Form study 5, own illustration

Ill 40: Form study 6, own illustration

Ill 41: 2d construction, own illustration

Ill 42: 3d construction 1, own illustration

Ill 43: 3d construction 2, own illustration

Ill 44: 3d construction 3, own illustration

Ill 45: Joints 1, own illustration

Ill 46: Joints 2, own illustration

Ill 47: Joints 3, own illustration

Ill 48: Hallway sketch 1, own illustration

Ill 49: Hallway sketch 2, own illustration

Ill 50: Hallway sketch 3, own illustration

Ill 51: Hallway sketch 4, own illustration

Ill 52: Hallway sketch 5, own illustration

Ill 53: Hallway sketch 6, own illustration

Ill 54: Hallway sketch 7, own illustration

Ill 55: Hallway render sketch 1, own illustration

Ill 56: Hallway section 1, own illustration

Ill 57: Hallway render sketch 2, own illustration

Ill 58: Hallway section 2, own illustration

Ill 59: Hallway render sketch 3, own illustration

Ill 60: Hallway section 3, own illustration

Ill 61: Hallway render sketch 4, own illustration

Ill 62: Hallway section 4, own illustration

Ill 63: Accent wall 1, own illustration

Ill 64: Accent wall 2, own illustration

Ill 65: Accent wall 3, own illustration

Ill 66: Accent wall 4, own illustration

Ill 67: Hallway walls 1, own illustration

Ill 68: Hallway walls 2, own illustration

Ill 69: Hallway walls 3, own illustration

Ill 70: Hallway walls 4, own illustration

Ill 71: Masterplan sketch 1, own illustration

Ill 72: Masterplan sketch 2, own illustration

Ill 73: Masterplan sketch 3, own illustration

Ill 74: Masterplan sketch 4, own illustration

Ill 75: Masterplan sketch 5, own illustration

Ill 76: Patio sketch 1, own illustration

Ill 77: Patio sketch 2, own illustration

Ill 78: Patio sketch 3, own illustration

Ill 79: Patio sketch 4, own illustration

Ill 80: Patio sketch 5, own illustration

Ill 81: Roof process 1, own illustration

Ill 82: Roof process 2, own illustration

Ill 83: Roof process 3, own illustration

Ill 84: Roof process 4, own illustration

Ill 85: Roof process 5, own illustration

Ill 86: Roof process 6, own illustration

Ill 87: Roof process 7, own illustration

Ill 88: Skylight simulation 1, own illustration

Ill 89: Skylight simulation 2, own illustration

Ill 90: Skylight simulation 3, own illustration

Ill 91: Skylight simulation 4, own illustration

Ill 92: Skylight simulation 5, own illustration

Ill 93: Skylight simulation 6, own illustration

Ill 94: Skylight simulation 7, own illustration

Ill 95: Skylight simulation 8, own illustration

Ill 96: Facade study 1, own illustration

Ill 97: Facade study 2, own illustration

Ill 98: Facade study 3, own illustration

Ill 99: Facade study 4, own illustration

Ill 100: Facade study 5, own illustration

Ill 101: Lca table, own illustration

Ill 102: LCA facades 1, own illustration

Ill 103: LCA facades 2, own illustration

Ill 104: LCA facades 3, own illustration

Ill 105: Indoor climate table 1, own illustration

Ill 106: Indoor climate table 2, own illustration

Ill 107: Indoor climate table 3, own illustration

Ill 108: Indoor climate table 4, own illustration

Ill 109: Energy frame table 1, own illustration

Ill 110: Energy frame table 2, own illustration

Ill 111: Energy frame table 3, own illustration

Ill 112: Glare analysis 1, own illustration

Ill 113: Glare analysis 2, own illustration

Ill 114: Final energy frame table, own illustration

Ill 115: Final room program, own illustration

Ill 116: Groundfloor plan drawing, own illustration

Ill 117: First floor plan drawing, own illustration

Ill 118: Plant diagram for mapping, some pictures borrowed form Jespers planteskole and Have handel

Jespers planteskole (no date) Purløg (allium schoenoprasum) Jespers planteskole. Available at: https://www.jespersplanteskole.dk/allium-schoenoprasum (Accessed: 28 May 2024)

Jespers planteskole (no date) Mynte Marokkansk (Mentha spicata'Marokko') 14 cm potte Jespers planteskole. Available at: https://www.jespersplanteskole.dk/mentha-spicata-marokko-13-cm-potte (Accessed: 28 May 2024)

Jespers planteskole (no date) Kryspersille (Petroselinum) Jespers planteskole. Available at: https://www.jespersplanteskole.dk/krusper-sille-petroselinum-crispum-13-cm-potte?gad_source=1&gclid=CjwKCAjwgdayBhBQEiwAXhMxtqIHzlY4xUptts5a7L6qvB-wtD0TfTau_AsXqsizOB61KWxorI8KhxoCLdcQAvD_BwE (Accessed: 28 May 2024)

Jespers planteskole (no date) Økologisk rosmarin(Rosmarinus officinalis) potte 12 cm Jespers planteskole. Available at: https://www.jespersplanteskole.dk/okologisk-rosmarin-rosmarinus-officinalis-potte-12-cm (Accessed: 28 May 2024)

Jespers planteskole (no date) Solbær (ribes 'big ben') 30-50 Jespers planteskole. Available at: https://www.jespersplanteskole.dk/solbaer-ribes-big-ben (Accessed: 28 May 2024)

Jespers planteskole (no date) Sommerfuglebusk (Buddleia davidii 'black knight') Jespers planteskole. Available at: https://www.jespersplanteskole.dk/sommerfuglebusk-buddleia-davidii-black-knight-flere-varianter (Accessed: 28 May 2024)

Jespers planteskole (no date) TORNFRI HINDBÆR (RUBUS IDAEUS 'RASPBERRY SHORTCAKE' / 'RUBY BEAUTY') 30-50 CM Jespers planteskole. Available at: https://www.jespersplanteskole.dk/rubus-ideaeus-rasberry-shortcake-ruby-beauty (Accessed: 28 May 2024)

Jespers planteskole (no date) TRÆDEBREGNE (LEPTINELLA-COTULA 'MINIMA') Jespers planteskole. Available at: https://www.jespersplanteskole.dk/leptinella-minima-cotula-minima

(Accessed: 28 May 2024)

Jespers planteskole (no date) TORNFRI BROMBÆR (RUBUS FRUTICOSUS 'NAVAHO') 30-50 CM Jespers planteskole. Available at:https://www.jespersplanteskole.dk/tornfri-brombaer-rubus-fruticosus-navaho-40-80-cm(Accessed: 28 May 2024)

Jespers planteskole (no date) STORFRUGTET HASSEL (CORYLUS AVELLANA 'BOLVILLER') 100-150 CM. Available at:https://www.jespersplanteskole.dk/storfrugtet-hassel-corylus-avellana-bolviller-60-100-cm(Accessed: 28 May 2024)

Jespers planteskole (no date) KRYBENDE TIMIAN (THYMUS PRAECOX 'COCCINEUS' (SERPYLLUM)). Available at:https://www.jespersplanteskole.dk/thymus-serpyllum-coccineus Accessed: 28 May 2024)

Havehandel (no date) Pluk-selv-blomster blomsterblanding – 50 m2 Havehandel. Available at: https://havehandel.dk/produkt/pluk-selv-blomster-blomsterblanding-50-m2/ (Accessed: 28 May 2024)

Havehandel (no date) Vilde blomster - guide Havehandel. Available at: https://havehandel.dk/vilde-blomster-guide// (Accessed: 28 May 2024)

Havehandel (no date) Plantning af vilde blomster Havehandel. Available at: https://havehandel.dk/vilde-blomster-guide// (Accessed: 28 May 2024)

Ill 119: Final masterplan, own illustration

Ill 120: Garden render, own illustration

Ill 121: Patio area in from of lobby, own illustration

Ill 122: Short section through administration building, own illustration

Ill 123: Lobby render, own illustration

Ill 124: Long section, own illustration

Ill 125: Hallway Groundfloor render, own illustration

Ill 126: Short section through workshops, own illustration

Ill 127: Hallway platform render, own illustration

Ill 128: West elevation, own illustration

Ill 129: East elevation, own illustration

Ill 130: North elevation, own illustration

Ill 131: South elevation, own illustration

Ill 132: Exploded view, own illustration

Ill 133: Exploded view materials, own illustration

Ill 134: Western building LCA, own illustration

Ill 135: Middle building LCA, own illustration

Ill 136: Eastern building LCA, own illustration

Ill 137: Workshop beams load, own illustration

Ill 138: Workshop beams deformation, own illustration

Ill 139: Administration beams load, own illustration

Ill 140: Administration beams deformation, own illustration

Ill 141: Window/wall construction, own illustration

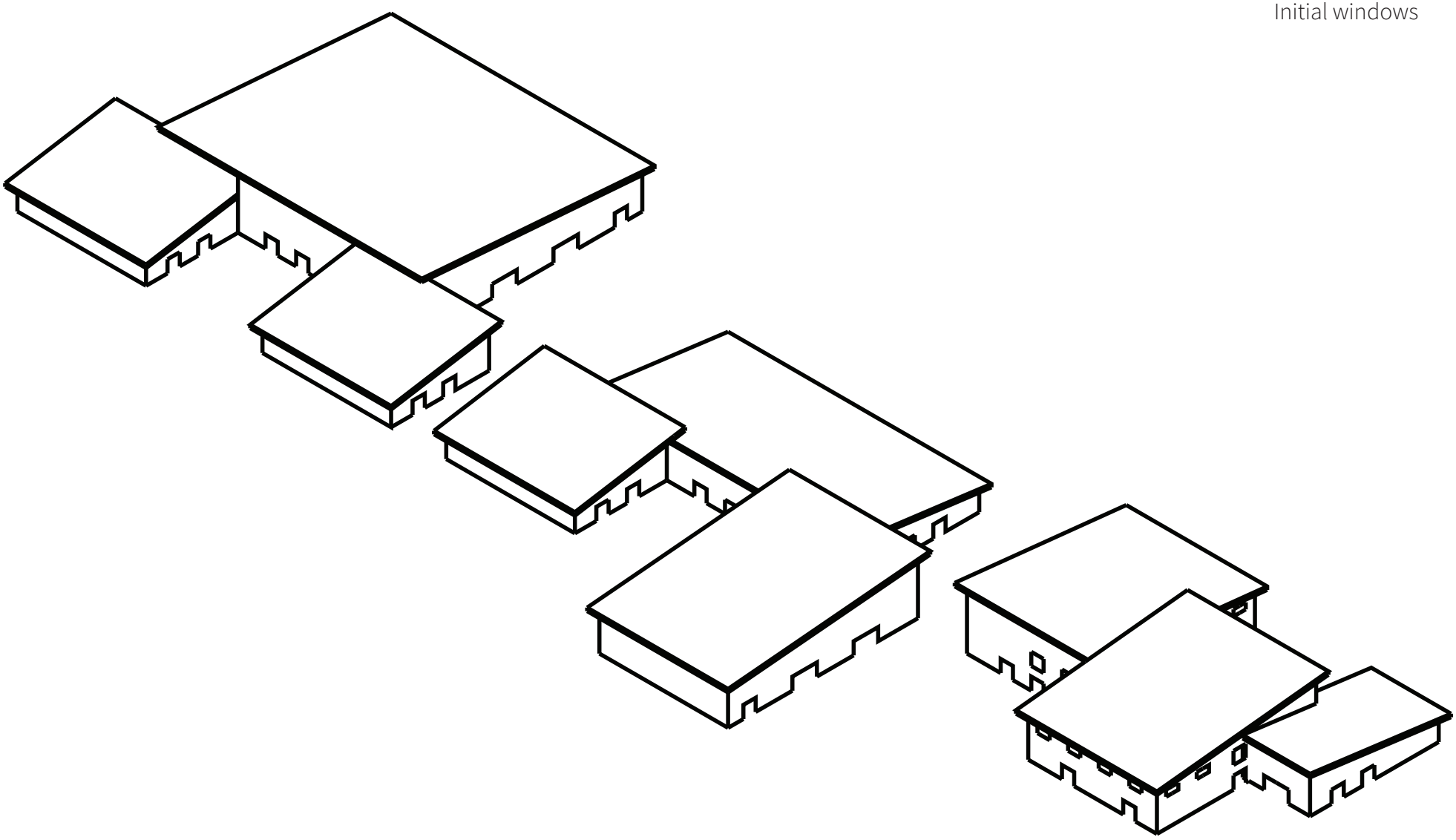
Ill 142: Indoor climate table, own illustration

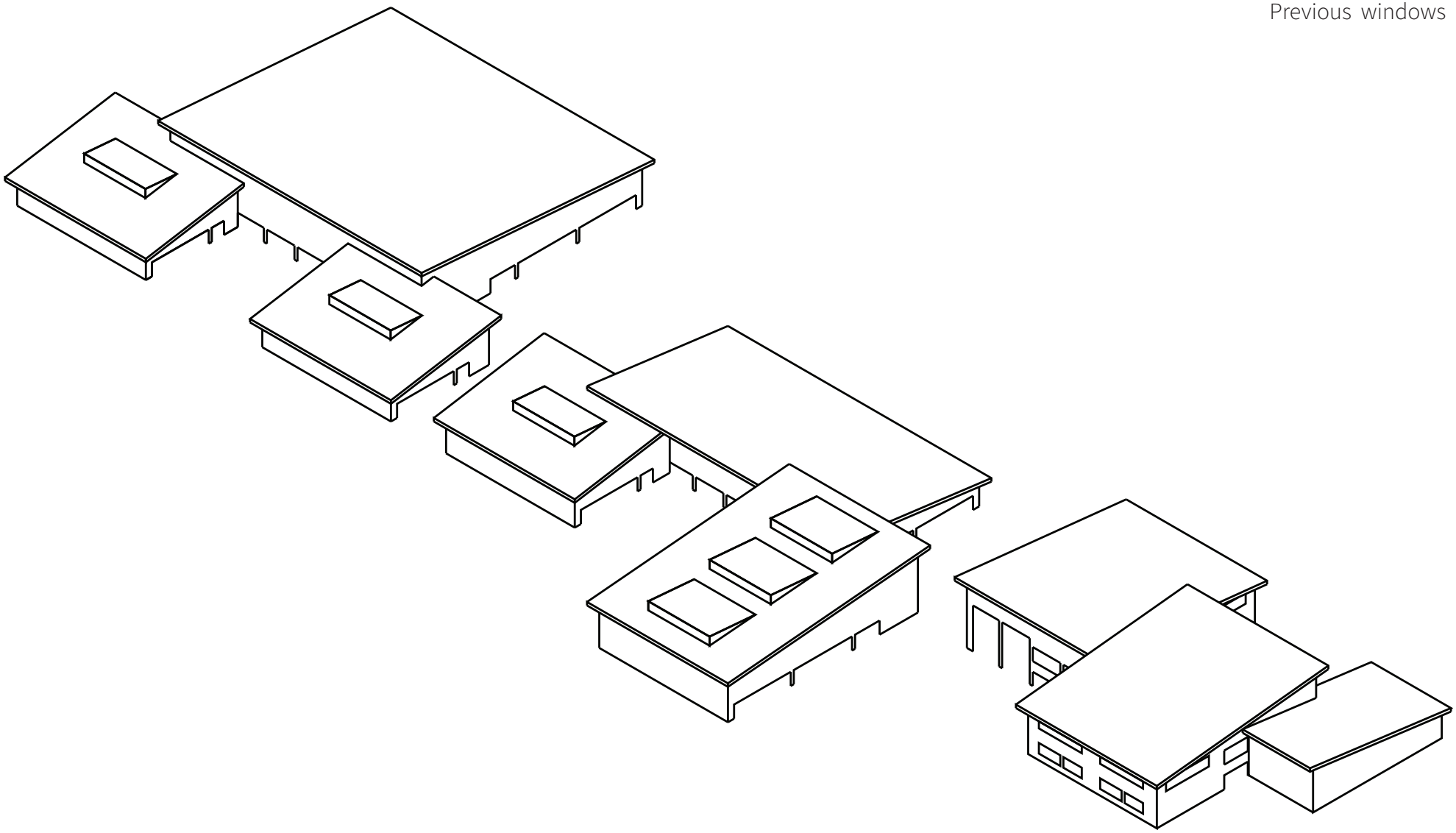
8 APPENDIX

The last chapter contains supplementary contents from the process chapter together with a transcription of the interview conducted at EUC Nord and permissions for uses of images not produced by the group.

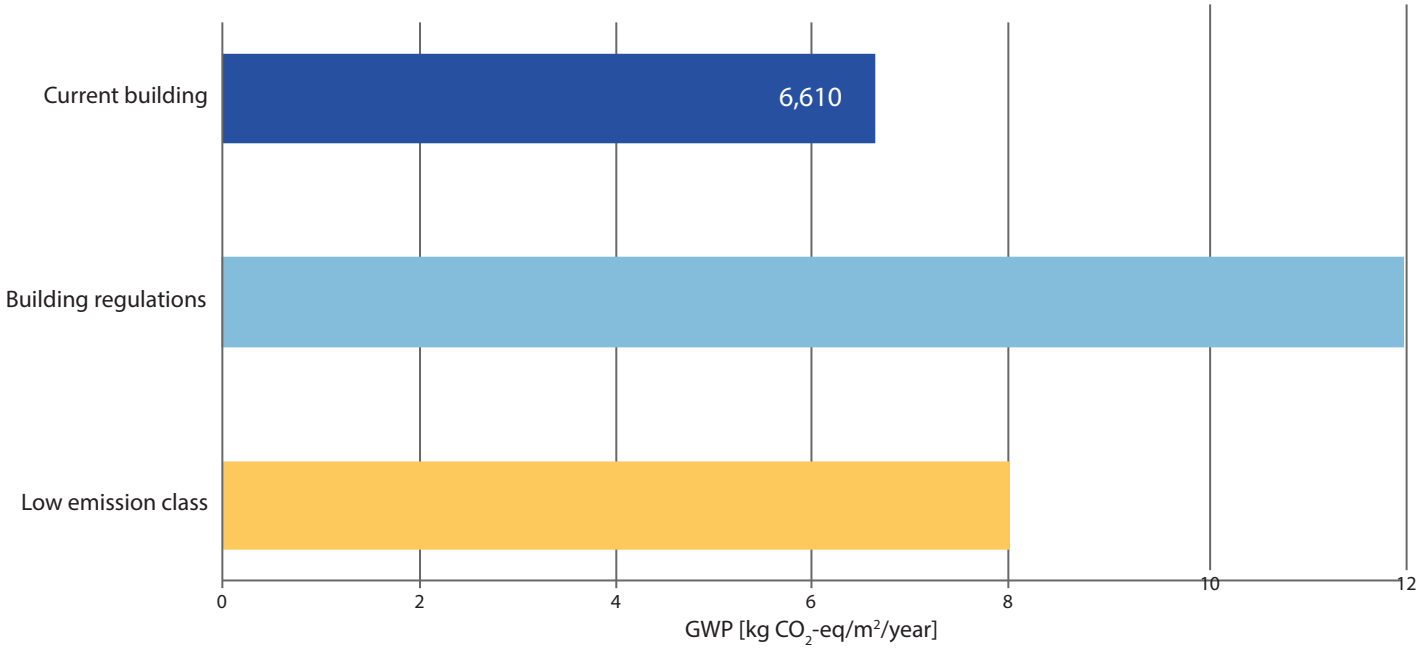
APPENDIX 1

Initial windows

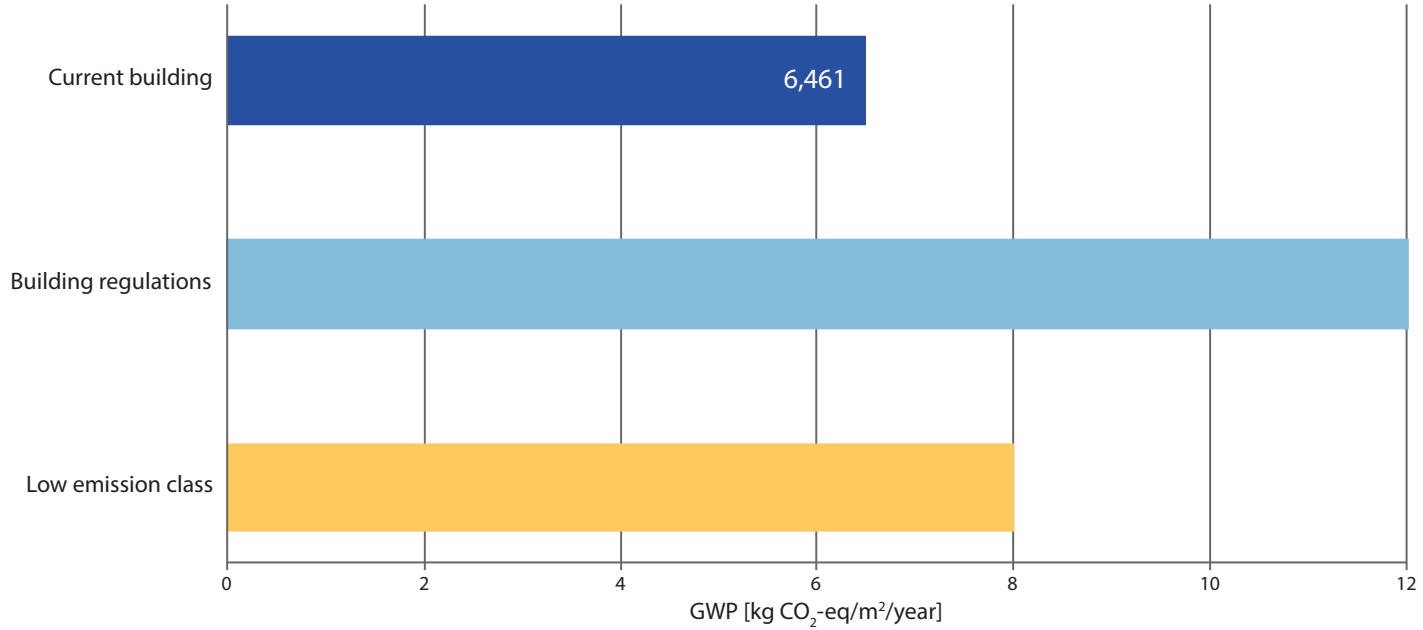




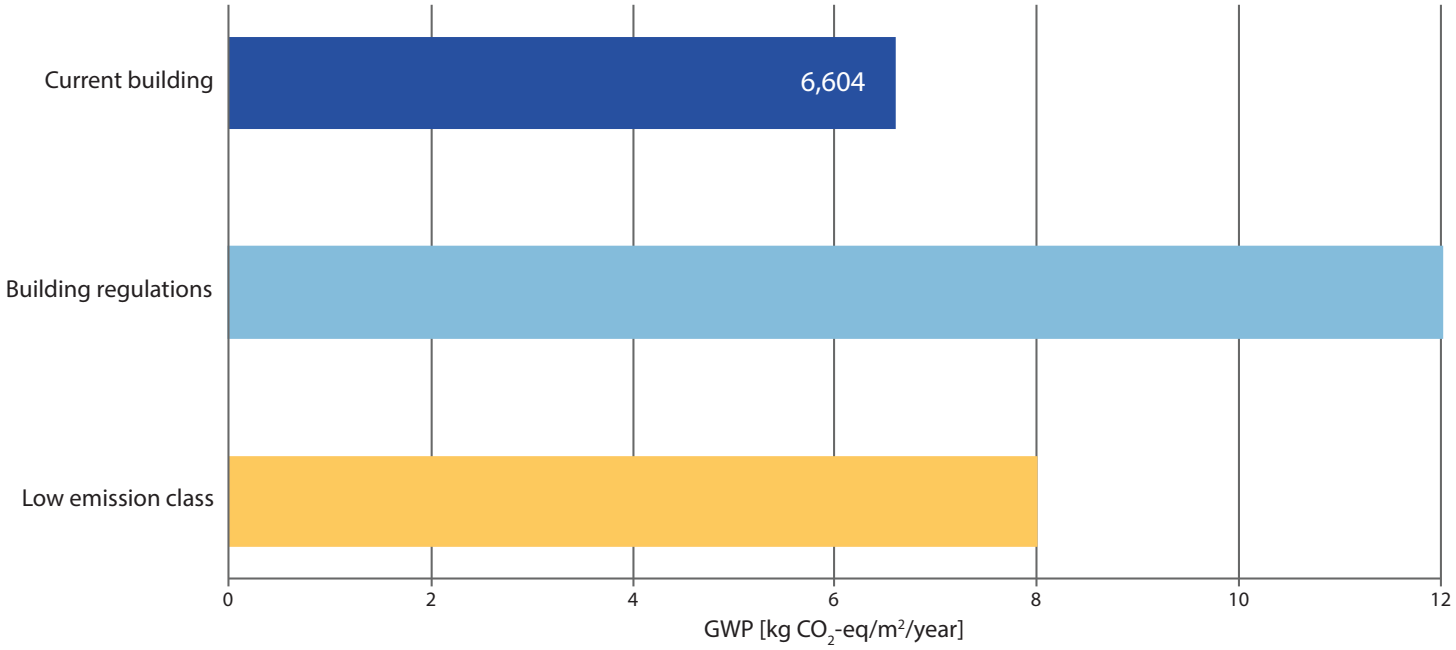
APPENDIX 2



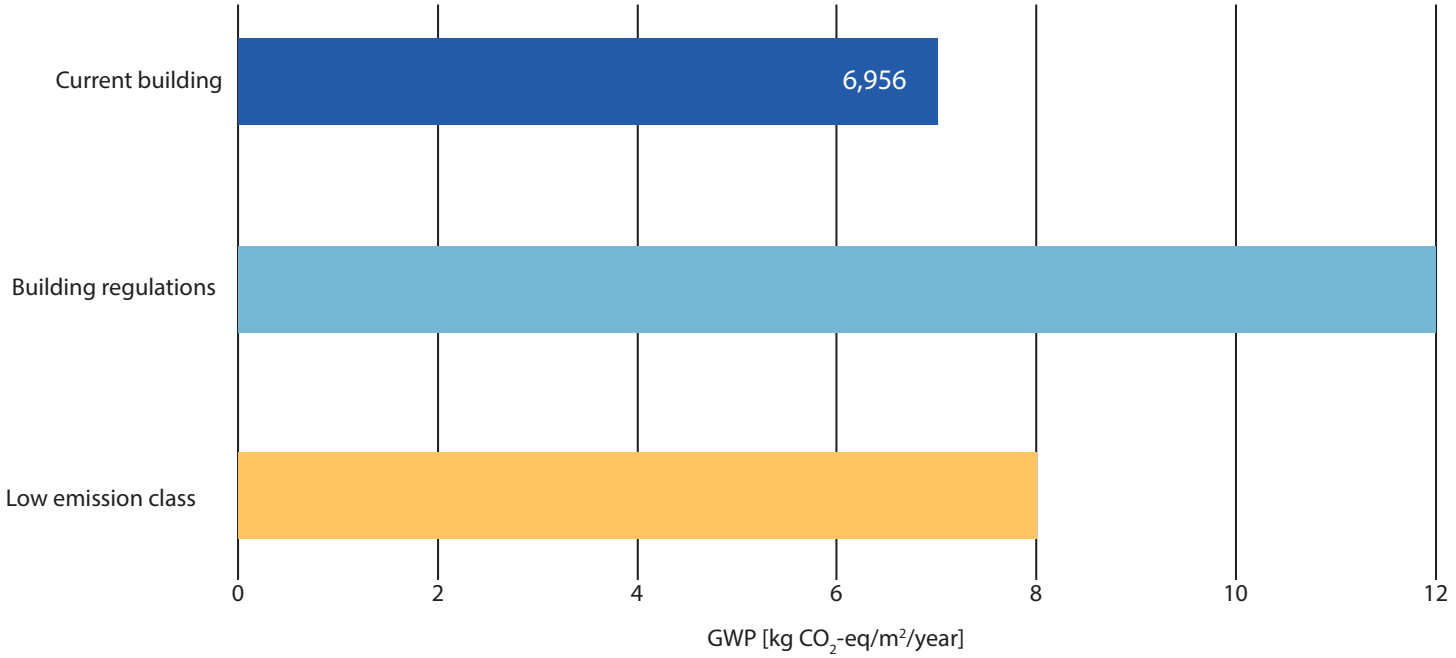
Initial western building



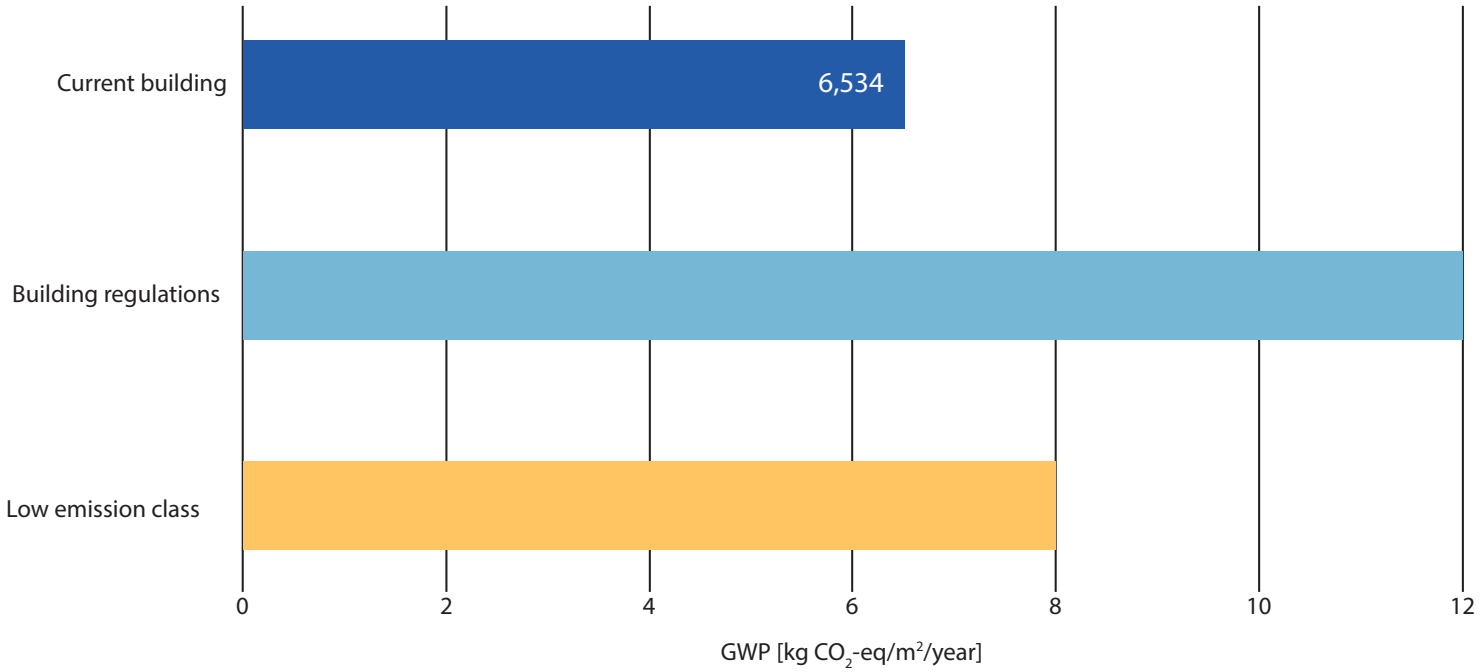
Initial middle building



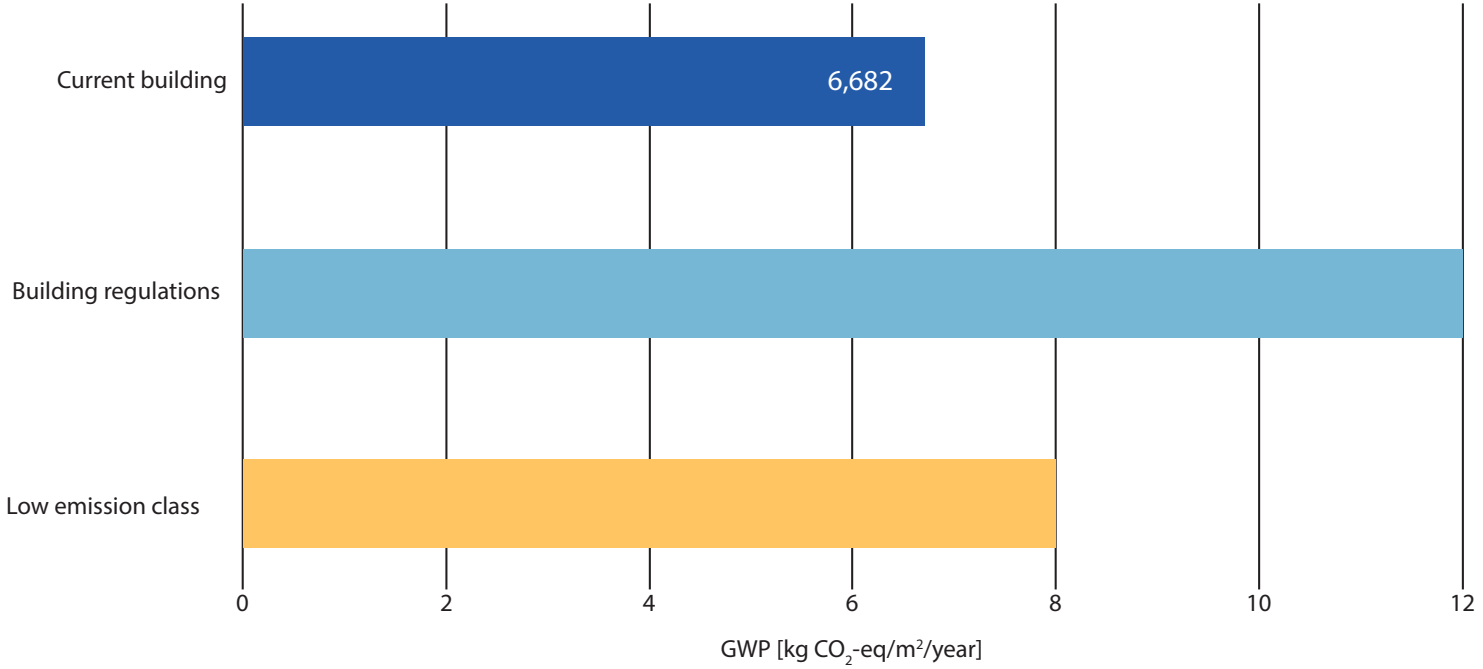
Initial eastern building



Previous iteration western building



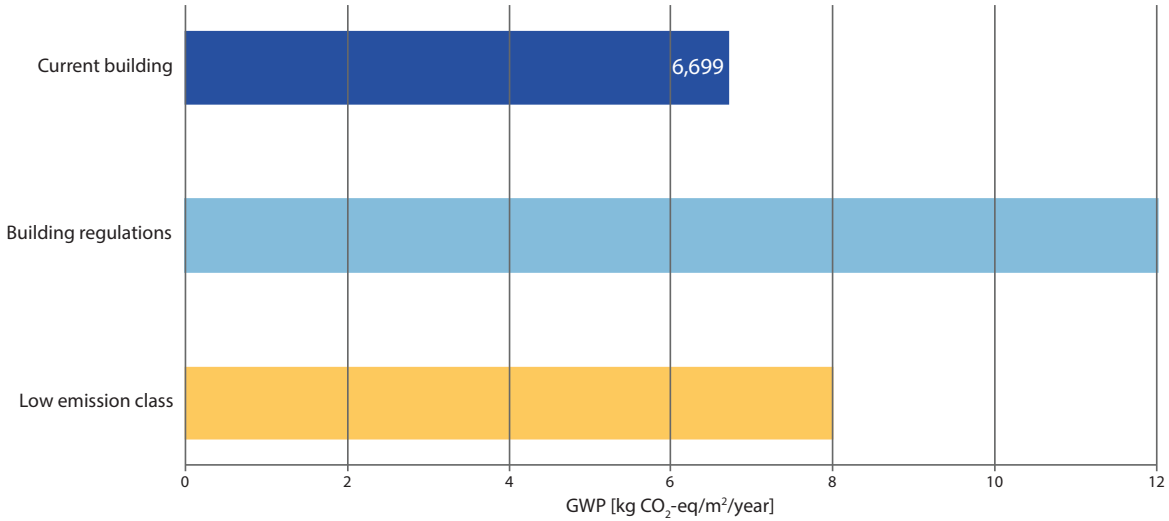
Previous iteration middle building



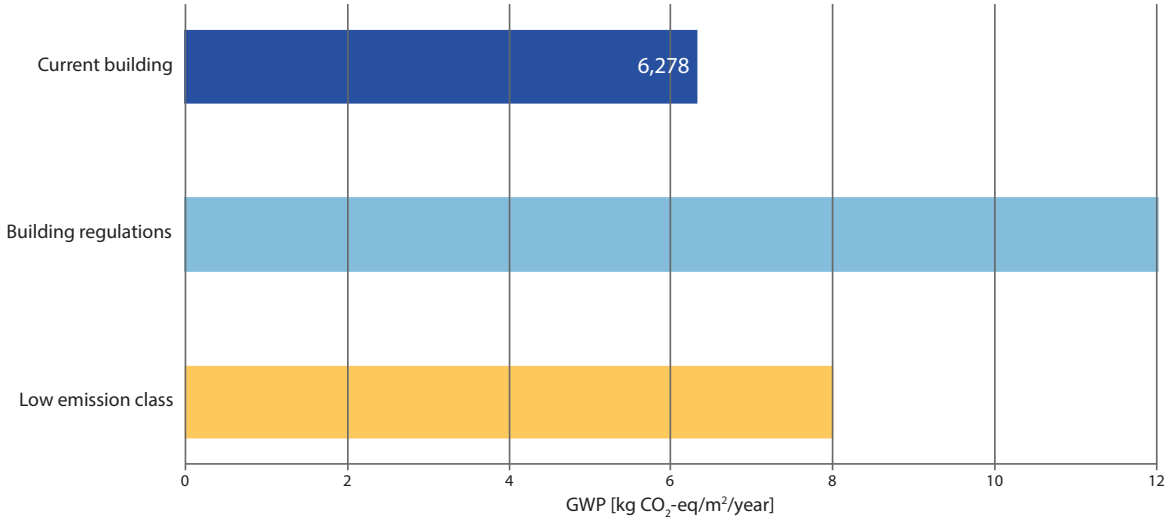
Previous iteration eastern building

APPENDIX 3

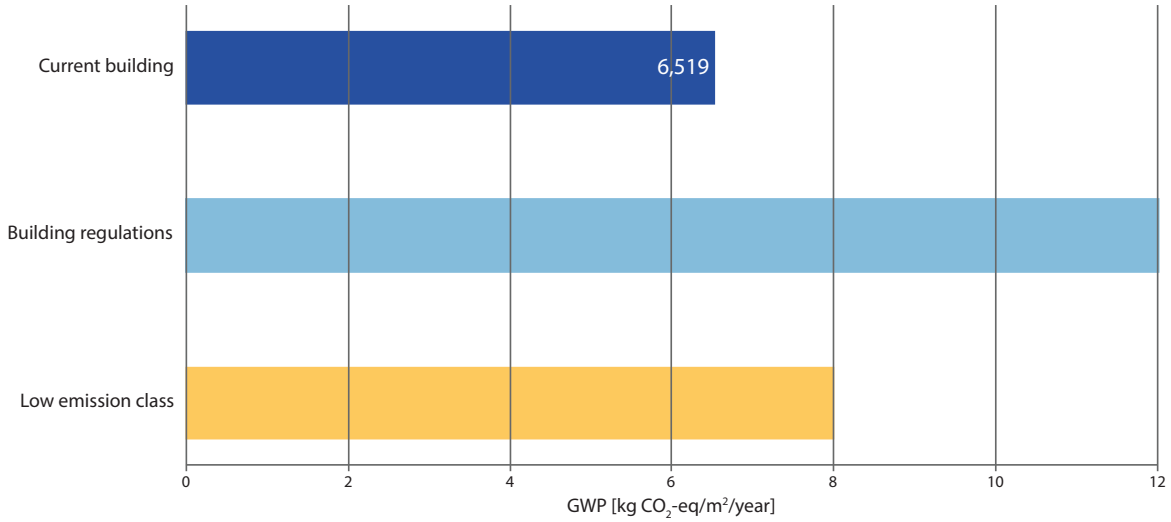
Life Cycle Assessment of facade materials



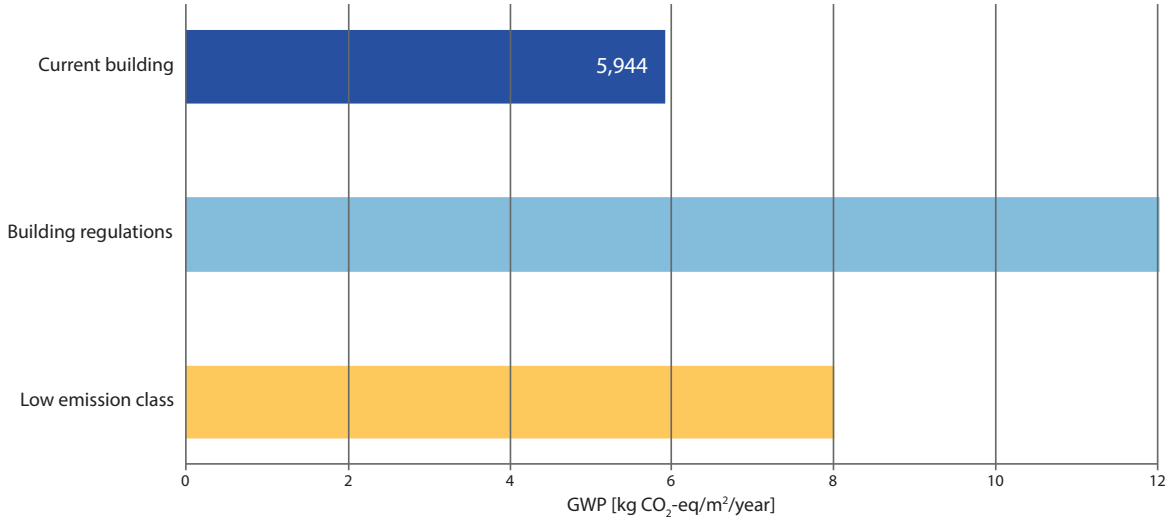
Values of the eastern building with larch as facade cladding



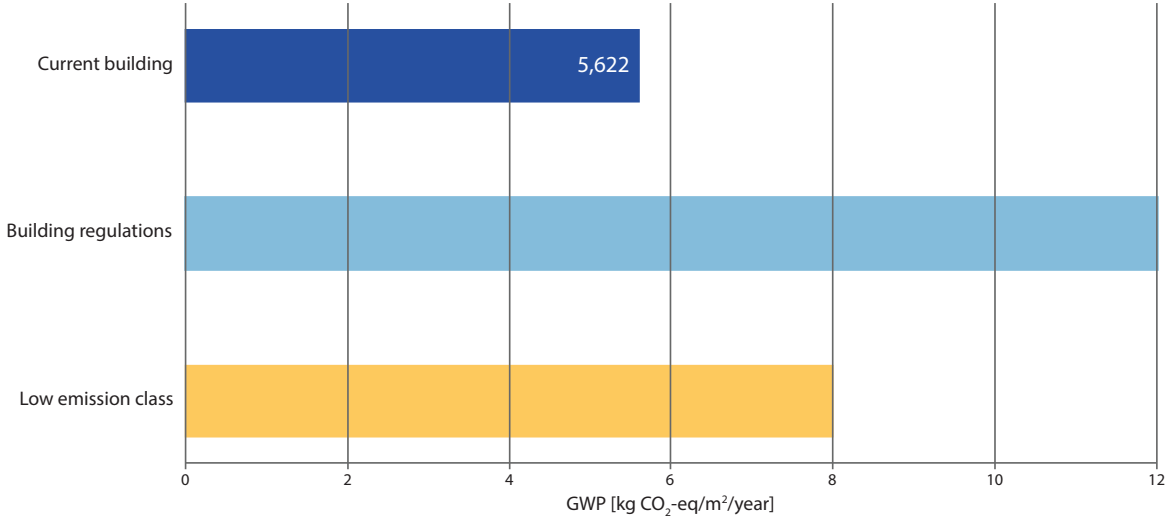
Values of the eastern building with yakisugi as facade cladding



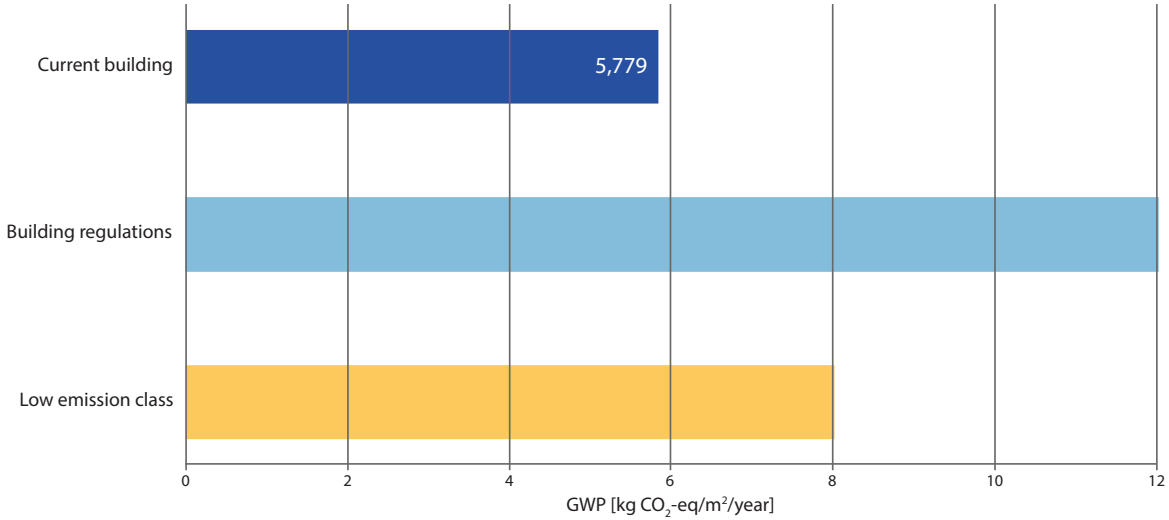
Values of the eastern building with a combination of larch and yakisugi as facade cladding



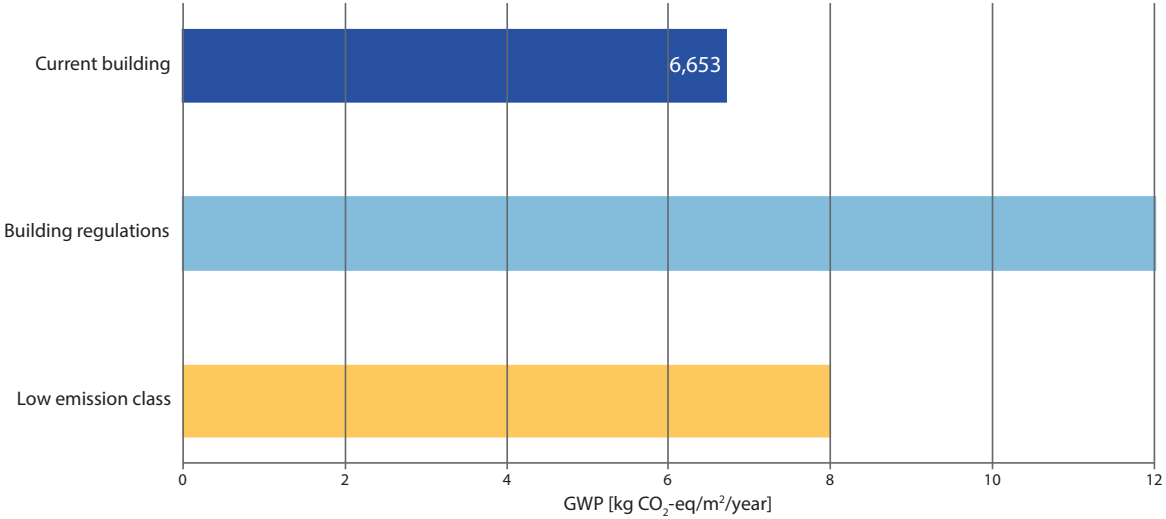
Values of the middle building with larch as facade cladding



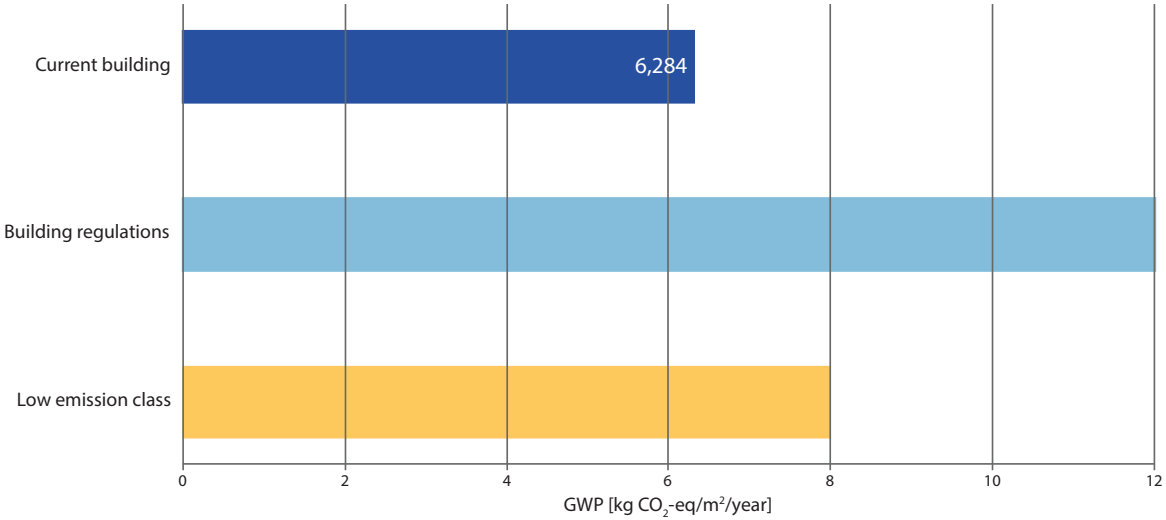
Values of the middle building with yakisugi as facade cladding



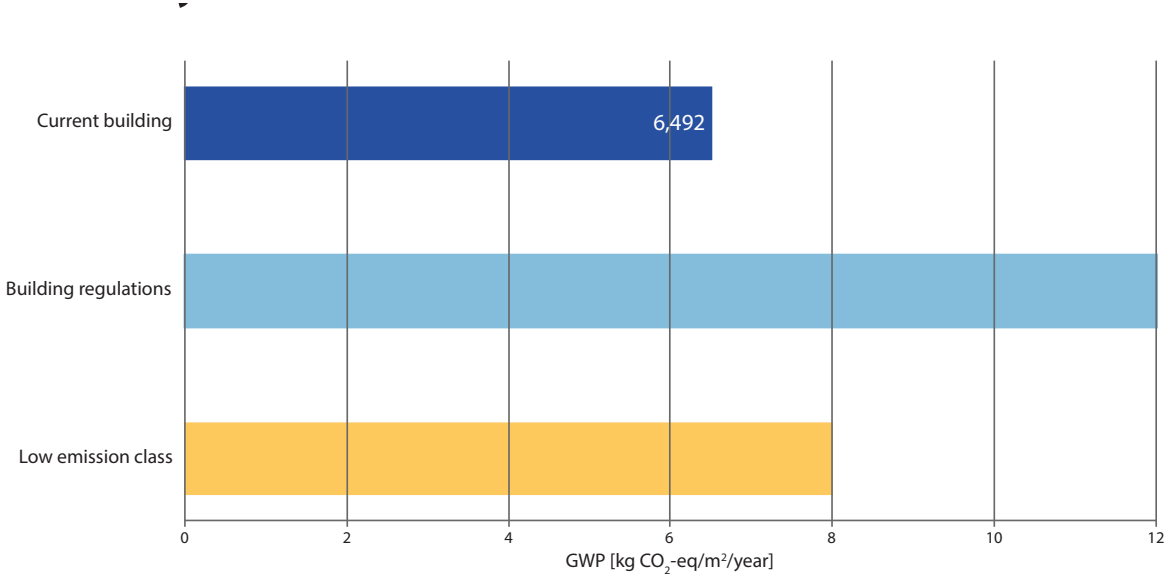
Values of the middle building with a combination of larch and yakisugi as facade cladding



Values of the western building with larch as facade cladding



Values of the western building with yakisugi as facade cladding



Values of the western building with a combination of larch and yakisugi as facade cladding

School building

Lastkombinationer

Nuværende løsning er markeret med gul

Dominerende snelast

$$k_{FI} \cdot y_G \cdot G + k_{FI} \cdot y_{sne} \cdot Q_{sne} + k_{FI} \cdot y_{vind} \cdot \psi_{0,vind} \cdot Q_{vind} + k_{FI} \cdot y_{vind} \cdot \psi_{0,vind} \cdot Q_{vind}$$

$$1{,}0 \cdot 1{,}1 \cdot 5{,}003 \frac{kN}{m^2} + 1{,}5 \cdot 1{,}1 \cdot 4 \frac{kN}{m^2} + 1{,}5 \cdot 0{,}3 \cdot 1{,}1 \cdot 2{,}93 \frac{kN}{m^2} \approx 13{,}55365 \frac{kN}{m^2}$$

Dominerende vindlast

$$k_{FI} \cdot y_G \cdot G + k_{FI} \cdot y_{sne} \cdot \psi_{0,sne} \cdot Q_{sne} + k_{FI} \cdot y_{vind} \cdot Q_{vind}$$

$$1{,}0 \cdot 1{,}1 \cdot 5{,}003 \frac{kN}{m^2} + 1{,}5 \cdot 1{,}1 \cdot 4 \frac{kN}{m^2} = 12{,}1033 \frac{kN}{m^2}$$

Dominerende egenvægt

$$k_{FI} \cdot y_G \cdot G$$

$$1{,}1 \cdot 1{,}2 \cdot 5{,}003 \frac{kN}{m^2} \approx 6{,}60396 \frac{kN}{m^2}$$

AGT

Tværsnit

0,5m X 0,5m

inertimoment

$$\frac{1}{12} \cdot 500mm \cdot 500mm^3 = \frac{15625000000}{3} \approx 5{,}208333 \cdot 10^9$$

Omregning

$$\frac{5{,}208333 \cdot 10^9}{1000 \cdot 1000} = 5208{,}333\ mm^4$$

Øjeblikkelig udbøjning

$$\frac{1}{384} \frac{13600 \frac{kN}{m} \cdot 10\ m^4}{13{,}7\ MPa \cdot 5208{,}333\ mm^4} \approx 4{,}963504\ mm$$

Endelig udbøjning

$$4{,}963504\ mm \cdot 1{,}6 \approx 7{,}941606\ mm$$

Tilladt udbøjning

$$\frac{10000\ mm}{400\ mm} = 25\ mm$$

AGT

Tværsnit

0,5mX 0,5m

inertimoment

$$\frac{1}{12} \cdot 500\ mm \cdot 500\ mm^3 = \frac{15625000000}{3} \approx 5{,}208333 \cdot 10^9$$

Omregning

$$\frac{5{,}208333 \cdot 10^9}{1000 \cdot 1000} = 5208{,}333\ mm^4$$

Øjeblikkelig udbøjning

$$\frac{1}{384} \frac{46900\ \frac{kN}{m} \cdot 10\ m^4}{13{,}7\ MPa \cdot 5208{,}333\ mm^4} \approx 17{,}11679\ mm$$

Endelig udbøjning

$$17{,}11679\ mm \cdot 1{,}6 \approx 27{,}38686\ mm$$

Tilladt udbøjning

$$\frac{10000\ mm}{400\ mm} = 25\ mm$$

AGT

Tværsnit

0,5mX 0,5m

inertimoment

$$\frac{1}{12} \cdot 500\ mm \cdot 500\ mm^3 = \frac{15625000000}{3} \approx 5{,}208333 \cdot 10^9$$

Omregning

$$\frac{5{,}208333 \cdot 10^9}{1000 \cdot 1000} = 5208{,}333\ mm^4$$

Øjeblikkelig udbøjning

$$\frac{1}{384} \frac{46900 \frac{kN}{m} \cdot 5\ m^4}{13{,}7\ MPa \cdot 5208{,}333\ mm^4} \approx 1{,}069799\ mm$$

Endelig udbøjning

$$1{,}069799\ mm \cdot 1{,}6 \approx 1{,}711678\ mm$$

Tilladt udbøjning

$$\frac{10000\ mm}{400\ mm} = 25\ mm$$

AGT

Tværsnit

0,3m X 0,3m

inertimoment

$$\frac{1}{12} \cdot 300\ mm \cdot 300\ mm^3 = 675000000 = 6{,}75 \cdot 10^8$$

Omregning

$$\frac{6{,}75 \cdot 10^8}{1000 \cdot 1000} = 675\ mm^4$$

Øjeblikkelig udbøjning

$$\frac{1}{384} \frac{46900 \frac{kN}{m} \cdot 5\ m^4}{13{,}7\ MPa \cdot 675\ mm^4} \approx 8{,}254624\ mm$$

Endelig udbøjning

$$8{,}254624\ mm \cdot 1{,}6 \approx 13{,}2074\ mm$$

Tilladt udbøjning

$$\frac{10000\ mm}{400\ mm} = 25\ mm$$

AGT

Tværsnit

0,3 m X 0,3 m

inertimoment

$$\frac{1}{12} \cdot 300\ mm \cdot 300\ mm^3 = 675000000 = 6{,}75 \cdot 10^8$$

Omregning

$$\frac{6{,}75 \cdot 10^8}{1000 \cdot 1000} = 675\ mm^4$$

Øjeblikkelig udbøjning

$$\frac{1}{384} \frac{13600 \frac{kN}{m} \cdot 10\ m^4}{13{,}7\ MPa \cdot 675\ mm^4} \approx 38{,}29864\ mm$$

Endelig udbøjning

$$38{,}29864\ mm \cdot 1{,}6 \approx 61{,}27782\ mm$$

Tilladt udbøjning

$$\frac{10000\ m}{400\ m} = 25\ mm$$

AGT

Tværsnit

0,3 m X 0,5 m

inertimoment

$$\frac{1}{12} \cdot 300\ mm \cdot 500\ mm^3 = 3125000000 = 3{,}125 \cdot 10^9$$

Omregning

$$\frac{3{,}125 \cdot 10^9}{1000 \cdot 1000} = 3125$$

Øjeblikkelig udbøjning

$$\frac{1}{384} \frac{13600\ \frac{kN}{m} \cdot 10\ m^4}{13{,}7\ MPa \cdot 3125\ mm^4} \approx 8{,}272506\ mm$$

Endelig udbøjning

$$8{,}272506\ mm \cdot 1{,}6 \approx 13{,}23601\ mm$$

Tilladt udbøjning

$$\frac{10000\ mm}{400\ mm} = 25\ mm$$

AGT

Tværsnit

0,3 m X 0,5 m

inertimoment

$$\frac{1}{12} \cdot 300\ mm \cdot 500\ mm^3 = 3125000000 = 3{,}125 \cdot 10^9$$

Omregning

$$\frac{3{,}125 \cdot 10^9}{1000 \cdot 1000} = 3125\ mm^4$$

Øjeblikkelig udbøjning

$$\frac{1}{384}\frac{13600\frac{kN}{m} \cdot 10\ m^4}{9\ MPa \cdot 3125\ mm^4} = \frac{340}{27} \approx 12{,}59259\ mm$$

Endelig udbøjning

$$12{,}59259\ mm \cdot 1{,}6 \approx 20{,}14814\ mm$$

Tilladt udbøjning

$$\frac{10000\ mm}{400\ mm} = 25\ mm$$

AGT

Tværsnit

0,3m X 0,3m

inertimoment

$$\frac{1}{12} \cdot 300\ mm \cdot 300\ mm^3 = 675000000 = 6{,}75 \cdot 10^8$$

Omregning

$$\frac{6{,}75 \cdot 10^8}{1000 \cdot 1000} = 675\ mm^4$$

Øjeblikkelig udbøjning

$$\frac{1}{384}\frac{26100\frac{kN}{m} \cdot 5\ m^4}{9\ MPa \cdot 675\ mm^4} = \frac{18125}{2592} \approx 6{,}99267\ mm$$

Endelig udbøjning

$$6{,}99267\ mm \cdot 1{,}6 \approx 11{,}18827\ mm$$

Tilladt udbøjning

$$\frac{5000\ mm}{400\ mm} = \frac{25}{2} = 12{,}5\ mm$$

AGT

Tværsnit

0,3 m X 0,32m

inertimoment

$$\frac{1}{12} \cdot 300\ mm \cdot 320\ mm^3 = 819200000 = 8{,}192 \cdot 10^8$$

Omregning

$$\frac{8{,}192 \cdot 10^8}{1000 \cdot 1000} = 819{,}2\ mm^4$$

Øjeblikkelig udbøjning

$$\frac{1}{384}\frac{46900\frac{kN}{m} \cdot 5\ m^4}{13{,}7\ MPa \cdot 819{,}2\ mm^4} \approx 6{,}801601\ mm$$

Endelig udbøjning

$$6{,}801601\ mm \cdot 1{,}6 \approx 10{,}88256\ mm$$

Tilladt udbøjning

$$\frac{5000\ mm}{400\ mm} = \frac{25}{2} = 12{,}5\ mm$$

Carpenter workshop

Lastkombinationer

Dominerende snelast

$$k_{FI} \cdot y_G \cdot G + k_{FI} \cdot y_{sne} \cdot Q_{sne} + k_{FI} \cdot y_{vind} \cdot \psi_{0,vind} \cdot Q_{vind} + k_{FI} \cdot y_{vind} \cdot \psi_{0,vind} \cdot Q_{vind}$$

$$1{,}0 \cdot 1{,}1 \cdot 5{,}003 \frac{kN}{m^2} + 1{,}5 \cdot 1{,}1 \cdot 8 \frac{kN}{m^2} + 1{,}5 \cdot 0{,}3 \cdot 1{,}1 \cdot 4{,}9 \frac{kN}{m^2} \approx 21{,}1288 \frac{kN}{m^2}$$

Dominerende vindlast

$$k_{FI} \cdot y_G \cdot G + k_{FI} \cdot y_{sne} \cdot \psi_{0,sne} \cdot Q_{sne} + k_{FI} \cdot y_{vind} \cdot Q_{vind}$$

$$1{,}0 \cdot 1{,}1 \cdot 5{,}003 \frac{kN}{m^2} + 1{,}5 \cdot 1{,}1 \cdot 8 \frac{kN}{m^2} \approx 18{,}7033 \frac{kN}{m^2}$$

Dominerende egenvægt

$$k_{FI} \cdot y_G \cdot G$$

$$1{,}1 \cdot 1{,}2 \cdot 5{,}003 \frac{kN}{m^2} \approx 6{,}60396 \frac{kN}{m^2}$$

AGT

Tværsnit

0,5 m X 0,8 m

inertimoment

$$\frac{1}{12} \cdot 500\ mm \cdot 800\ mm^3 = \frac{64000000000}{3} \approx 2{,}133333 \cdot 10^{10}$$

Omregning

$$\frac{2{,}133333 \cdot 10^{10}}{1000 \cdot 1000} = 21333{,}33\ mm^4$$

Øjeblikkelig udbøjning

$$\frac{1}{384} \frac{21100 \frac{kN}{m} \cdot 20\ m^4}{13{,}7\ MPa \cdot 21333{,}33\ mm^4} \approx 30{,}08098\ mm$$

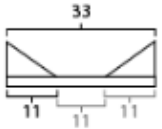
Endelig udbøjning

$$30{,}08098\ mm \cdot 1{,}6 \approx 48{,}12957\ mm$$

Tilladt udbøjning

$$\frac{20000\ mm}{400\ mm} = 50\ mm$$

Beregning af bjælke



Last opland 10 meter

Laster

Vindlast

$$F_w = C_s C_d C_f \cdot q_p(z_e)$$

$$C_s C_d = 1$$

$$C_f = 0,28$$

$$q_p(z_e) afl æst\ til\ 0,75$$

$$1 \cdot 0,28 \cdot 0,75 \approx 0,21 kN/m^2$$

$$0,21 \cdot 10 = 2,1$$

Egenlast

Tagkonstruktion 0,5kN/m²

Bjælkens egenlast 0,5m *1,5m

$$0,5 \cdot 1,5 \cdot 510 = 382,5kg$$

$$\frac{382,5}{10 \cdot 1000} = 0,03825kN/m$$

$$0,5 \cdot 10 + 0,04 = 5,04$$

Snelast

$$S = \mu_i C_e C_t s_k$$

$$\mu_i = 0,8$$

$$C_e = 1$$

$$C_t = 1,0$$

$$s_k = 1,0$$

$$1 \cdot 1 \cdot 1 \cdot 0,8 = 0,8$$

$$0,8 \cdot 10 = 8$$

Lastkombinationer

Dominerende snelast

$$k_{FI} \cdot \gamma_G \cdot G + k_{FI} \cdot \gamma_{snc} \cdot Q_{snc} + k_{FI} \cdot \gamma_{vind} \cdot \psi_{0,vind} \cdot Q_{vind} + k_{FI} \cdot \gamma_{vind} \cdot \psi_{0,vind} \cdot Q_{vind}$$

$$1,0 \cdot 1,1 \cdot 5,003 + 1,5 \cdot 1,1 \cdot 8 + 1,5 \cdot 0,3 \cdot 1,1 \cdot 4,9 \approx 21,1288$$

Dominerende vindlast

$$k_{FI} \cdot \gamma_G \cdot G + k_{FI} \cdot \gamma_{snc} \cdot \psi_{0,snc} \cdot Q_{snc} + k_{FI} \cdot \gamma_{vind} \cdot Q_{vind}$$

$$1,0 \cdot 1,1 \cdot 5,003 + 1,5 \cdot 1,1 \cdot 8 \approx 18,7033$$

Dominerende egenvægt

$$k_{FI} \cdot \gamma_G \cdot G$$

$$1,1 \cdot 1,2 \cdot 5,003 \approx 6,60396$$

Last opland 5 meter

Laster

Vindlast

$$F_w = C_s C_d C_f \cdot q_p(z_e)$$

$$C_s C_d = 1$$

$$C_f = 0,28$$

$$q_p(z_e) afl æst\ til\ 0,75$$

$$1 \cdot 0,28 \cdot 0,75 \approx 0,21 kN/m^2$$

$$0,21 \cdot 5 = 1,05kN/m$$

Egenlast

Tagkonstruktion 0,5kN/m²

Bjælkens egenlast 0,5m *1,5m

$$0,5 \cdot 1,5 \cdot 510 = 382,5kg$$

$$\frac{382,5}{10 \cdot 1000} = 0,03825kN/m$$

$$0,5 \cdot 5 + 0,04 = 2,54kN/m$$

Snelast

$$S = \mu_i C_e C_t s_k$$

$$\mu_i = 0,8$$

$$C_e = 1$$

$C_t = 1,0$

$s_k = 1,0$

$1 \cdot 1 \cdot 1 \cdot 0,8 = 0,8$

$0,8 \cdot 5 = 4$

Lastkombinationer

Dominerende snelast

$k_{FI} \cdot \gamma_G \cdot G + k_{FI} \cdot \gamma_{mc} \cdot Q_{mc} + k_{FI} \cdot \gamma_{vind} \cdot \psi_{0,vind} \cdot Q_{vind} + k$

$1,0 \cdot 1,1 \cdot 2,54 + 1,5 \cdot 1,1 \cdot 4 + 1,5 \cdot 0,3 \cdot 1,1 \cdot 1,05 \approx 9,913$

Dominerende vindlast

$k_{FI} \cdot \gamma_G \cdot G + k_{FI} \cdot \gamma_{mc} \cdot \psi_{0,mc} \cdot Q_{mc} + k_{FI} \cdot \gamma_{vind} \cdot Q_{vind}$

$1,0 \cdot 1,1 \cdot 2,54 + 1,5 \cdot 1,1 \cdot 1,05 = 4,5265$

Dominerende egenvægt

$k_{FI} \cdot \gamma_G \cdot G$

$1,1 \cdot 1,2 \cdot 2,54 \approx 3,3528$

AGT

Tværsnit

0,5mX 0,8m

inertimoment

$\frac{1}{12} \cdot 500 \cdot 800^3 = \frac{64000000000}{3} \approx 2,133333 \cdot 10^{10}$

Omregning

$\frac{2,133333 \cdot 10^{10}}{1000 \cdot 1000} = 21333,33$

Øjeblikkelig udbøjning

$\frac{5}{384} \frac{9,9 \cdot 20^4}{13,7 \cdot 21333,33} m \approx 0,07056913$

Endelig udbøjning

$0,07056913 \cdot 1,6 \approx 0,1129106$

Tilladt udbøjning

$\frac{20000}{400} = 50$

AGT

Tværsnit

0,3X0,3m

inertimoment

$\frac{1}{12} \cdot 300 \cdot 300^3 = 675000000 = 6,75 \cdot 10^8$

Omregning

$\frac{6,75 \cdot 10^8}{1000 \cdot 1000} = 675$

Øjeblikkelig udbøjning

$\frac{5}{384} \frac{9,9 \cdot 20^4}{13,7 \cdot 675} = 2,230333$

Endelig udbøjning

$2,230333 \cdot 1,6 \approx 3,568533$

Tilladt udbøjning

$\frac{20000}{400} = 50$

APPENDIX 5

Permission for pictures

Havehandel

Jonas Birger Bech Frederiksen
I går, 15:29
kundeservice@havehandel.dk

Svar til alle

3 vedhæftede filer (2 MB) Download alt

Hej Havehandel

Vi er en gruppe studerende på Aalborg universitet på linjen Arkitektur og design. Vi er i gang med vores kandidatprojekt, hvor vi skal bruge nogle billeder til projektets udeområde. Derfor ville vi høre om det er jer, som har rettighederne til de vedhæftede billeder og om vi må have lov til at bruge dem, selvfølgelig med en kilde/henvisning til jer. Hvis det ikke er jer, der har rettighederne til billederne, har I mulighed for at sige hvem der har, så vi kan kontakte dem?
På forhånd mange tak.

Med venlig hilsen

Jonas MSc04 ARK på Aalborg universitet

Mark Nissen (Havehandel.dk)
18. apr. 2024 11.25 CEST

Hej Jonas,

Dem må i gerne benytte til jeres projekt. :-)

Med venlig hilsen

Mark Nissen
Medindehaver
Havehandel.dk
CVR: 38748882
Tlf.: +45 20 60 25 06
Adr.: Smedegårdvej 2, 7500 Holstebro

Jespers planteskole

11 vedhæftede filer (2 MB) Download alt

Hej Jespers planteskole

Vi er en gruppe studerende på Aalborg universitet som er i gang med vores kandidatprojekt på linjen Arkitektur og Design. Her er vi i gang med at designe en håndværkerskole samt dets udeområder. Derfor vil vi høre om vi må have lov til at bruge nogle af de billeder I bruger til jeres planter, mere specifikt de vedhæftede billeder, selvfølgelig med kilder dertil. Hvis det ikke er jer der har taget billederne, kan I give en mail til personen/personerne som har, så vi kan kontakte dem?
På forhånd mange tak.

Med venlig hilsen

Jonas Frederiksen MSc04 ARK på Aalborg universitet.

Jespers Planteskole <info@jespersplanteskole.dk>
I dag, 13:07
Jonas Birger Bech Frederiksen

Hej Jonas

Tak for din henvendelse.

I må gerne benytte billederne mod henvisning.

De varmeste havehilsner,

Anders

Jespers Planteskole
BLOMSTER OG HAVECENTER

Profile

Jonas Birger Bech Frederiksen
ma 11-03, 09:16
info@profile.dk

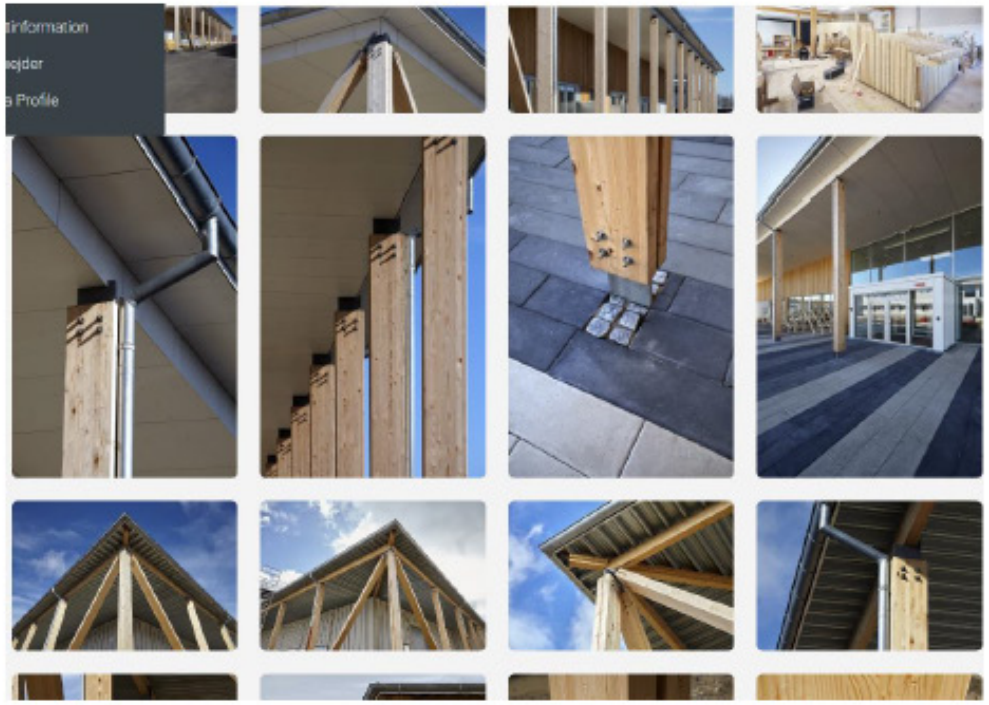
Svar til alle

Hej Profile

Vi er en gruppe fra Arkitektur og design uddannelsen på Aalborg universitet og vi er i gang med at lave vores afgangsprojekt. I den anledning er vi ved at kigge på forskellige træbygninger til nogle case studies. Her fandt vi projekt "Tradium tømreskole" på jeres hjemmeside og så ville vi høre om det er jer der har ophavsretten til billederne på dette link https://profile.dk/limtrae-referencer/tradium og i det tilfælde om vi må bruge nogle af billederne i vores rapport, selvfølgelig med en kilde til dem vi bruger. Hvis det derimod ikke er jer der har ophavsretten, kan I fortælle hvem der har, så vi kan sende en mail til dem?

Med venlig hilsen

Jonas fra MSc04 ARK på AAU.



Hanne Bjerrum Andersen <hba@profile.dk>
ma 11-03, 09:55
Jonas Birger Bech Frederiksen

Hej Jonas,

Så er der svar. I må gerne bruge billederne med kildehenvisning.
Profile A/S har ophavsretten.

Måske I kan bruge noget fra vores håndbog "Limtræ i praksis".
https://profile.dk/files/limtrae-i-praksis

Jeg kan skaffe udvalgte billeder i en højere opløsning, hvis I har brug for det.

Rigtig god arbejdslyst med projektet.
Med venlig hilsen / Best regards / Mit freundlichen Grüße
Hanne Bjerrum Andersen
Grafisk designer / Marketingkoordinator
D: 8851 1097 / M: 5155 5621 / hba@profile.dk

PROFILE

OBS - Vi har nye deadlines omkring helligdagene.
Se her https://profile.dk/deadlines

Erik arkitekter

Jonas Birger Bech Frederiksen
ma 11-03, 09:03
mb@erik.dk

Svar til alle

Hent

Hej Morten

Vi er en gruppe fra Arkitektur og design uddannelsen på Aalborg universitet og vi er i gang med at lave vores afgangsprojekt. I den anledning er vi ved at kigge på forskellige træbygninger til nogle case studies. Her fandt vi jeres projekt "Tradium tømreskole" og så ville vi høre om vi måtte bruge det vedhæftede diagram i vores rapport, selvfølgelig med en kilde dertil.

Med venlig hilsen

Jonas fra MSc04 ARK på AAU.

Morten Bluhm <mb@erik.dk>
ma 11-03, 09:21

Hej Jonas,

Det er i velkomne til😊

Nævn gerne, at det er tegnet af ERIK, ok?

Morten Bluhm
Forretningsudviklingschef Vest, associeret partner, arkitekt MAA

+45 61 61 12 99
mb@erik.dk

APPENDIX 6
Interview

(
In the carpenter workshop)
Anders: In some ways the box is brilliant. We are very happy about it because if the EUX students forget to do their homework, then you, for example, get a mail from Jan that this person has forgotten to submit their homework. But that's fine because then he can just go into the box and work with it meanwhile the others in the group can build. Then they can continue building while the other can just look at it. They are not very excited about that so they will be better at remembering their homework for the next time, so that's good.
Steffen: There is used a lot of money on the ventilation system, and we don't have a use for it.
Anna: Oh okay.
Anders: There is of course suction, and we can clean and vacuum without problems, but it is a classroom ventilation system. It's not very good, it's a city in Russia.
Anna: It isn't needed.
Anders: exactly, because we have the gate, we just open, right, or else we open the roof windows in the summer, right? Else there isn't need for more.
Anna: I guess that it is very important to get lots of air inside here, especially in the summer or else it can get very hot when you go about and work?
Anders: Yes, that is, we open them gladly, those roof windows, so yes.
Steffen: But steel hall. Don't do it
Anna: That wasn't the plan either
Jonas: Because we have seen the carpenter school Tradium in Randers where we thought "oh okay, there was a lot of wood everywhere" and thought that it would be nice if we did that.
Steffen: It at least gives an impression of what the school or which education you do here. This building doesn't do that, but it of course doesn't affect the tuition
Anna: No no, of course not.
Anders: But there is of course also a lot of learning about materials, like going for a walk and looking.
Steffen: Well, when Anders gets new student on g2 (basic course 2) then tjere is always the question "What kind of clothes do you use?", it's brown pants, rather than what you are going to use them for. Like, to get the thought of finding an identity in what you are doing. It also recurs in the building and the tools, what kind of electrical tools we are using and such. It is a fashion phenomenon between the carpenter students.
Anders: But we would like to have theory out in the workshop, because then the students discover they have theory.
Anna: oh alright.
Steffen: it is a bit of a funny story because we made these TV screens on wheels, some time ago we had projectors, because under the corona time, we could only be a certain number in the classroom, and we weren't allowed to change team on the same day. So, we needed to do something. Then hello, we bought some cheap TV screens at A-Z or Elgiganten.
Anders: Yep, for1500 kr.
Steffen: and then a computer on it, and then the students they are doing something, and they come to the next thing Anders doesn't need to take them into the classroom. So, you don't need to wait, you can just teach them the theoretical here in the workshop. And it is very practical, it is indispensable.
Anders: Yes, it is very good.
Steffen: This may be simple, but it is something that has moved the carpenter education. The thing that digitalized carpenter education the most. It is actually just a screen and a computer here out in the carpenter's room. Yes, but it doesn't need to be a projector and canvas. It doesn't work in the same way. It needs to be something that can be moved.
Anna: That makes great sense.

Anders: But we can also run the absence log on them and say "Oh, he is not here" so he turns red, right? Yes, there are many things we check out, so that is good.
Steffen: It can be moves over to their project if needed.
Anders: Yes, and I have a place where I am landing. In this way I can find my computer at closing time.
Anna: Yes, that is also quit good
Anders: And there is power on it. It is easy, it is nice that you don't need to think about it.
Anna: How much classroom teaching does the students have against tuition out in the workshop?
Steffen: It is very different. Anders, he has what is called EUX. They have three days in the workshop and 2 days with theory.
Anders: Like mathematics and physics.
Steffen: And he has theory besides that.
Anders: Well, Monday there is school until 15 o'clock. So, there we take at least an hour of theory in the morning, but they also get homework, they need to draw and such. We also have board where the assignment for g2 are listed which goes horizontally and the students' names vertically and then they have done an assignment the mark it. They can only mark it when we have seen their ring binder and signed it. By doing this, they can see how far they are, and we can see if we need to talk to someone. For example, Magnus, we may need to look at your ring binder and see how it goes. It of course turns out a bit public, but we need to do it or else they may not have done their work.
Anna: It is a bit like when the teacher asks who did their homework and you need to put a hand up because you haven't done it.
Anders: But it is also good because we can see if a student is behind and then we can get a talk with them. Like, "Thomas, I don't see a mark for you, is everything alright?"
Anna: How many of these workshops would you ideally want if you also would use them for theory?
Steffen: Og hvis vi skulle have.
Anders: It is more the houses (the projects) on g2 we are counting on and the EUX's are 5-6 on a team meanwhile the EUD's are four. It is because we have a bit less time so they get to be more, then it will fit the time schedule. But you could say the outdoor workshop is a good size compared to the assignment.
Steffen: If we should have merged the carpenter and woodwork educations, with the number of students we have, then I would go with 4 wood workshops, if it would be ideal. Going back to the houses then we have 9 small areas for them. But you can always push another one in
Anna: Yes yes of course.
Steffen: A challenge we have is, because we have different addresses, so the educations are not centralized. If you, in theory, also would like to have wood workers in here, you need to utilize the workshop capacity better. This is because the houses use a lot of space, especially in the main course. But there are maybe a couple of weeks the carpenters aren't here, only their projects. There are some possible solutions to utilize the capacity better. On a school like ours we are always short on rooms but there are always some which are unoccupied. It's kind of a paradox. It is a problem the workshop has had for many years. And the workshop is significantly larger than it was 30 years ago. This in relation to the students and the assignments have become more comprehensive and such. But it should preferably be close together. It would be nice to have a theory room per class but it is not a necessity.
Anna: Of course not
Steffen: Another challenge is the wooden floor. It is nice and as I said it should be wood, but we can't use it for anything other than wood. Like, we can't put the bricklayers in here and make walls.
Anders: there also needs to be able to drive a truck on the wooden floor, so you can't have joist flooring, thet you would get tired of.
Anna: No, that wouldn't be good.
Anders: Yes, so you need concrete under it.

Steffen: And also, by having carpenters and especially wood worker machines, it can create some limitations for what you can make in here. Because of this we like the outdoor workshop. It is a bit rougher.
Anna: it is something about the interior design compared to the usage and such.
Anders: And printers, we also need those. Would you like to see the outdoor workshop.
Jonas: Yes, we would thank you.
Anders: If we need some more room, we have it here and also some storage space.
Jonas: Would you say you need more space or is this amount fine?
Steffen: Well, we could have use of some pent roof outside if we have some assignments there isn't in use which could in dry weather. It could be nice, and I don't think it is expensive square meters.
Anna: No, a pent roof is just to manage
Steffen: But it is also very dangerous area to have because when you have lots of storage.
Anna: Then it will get messy
Steffen: It will get full and messy. But if I would reduce it, we need to think of alternatives. I'm coming from another industry than Anders does, so it is maybe not in the wood industry you use the most glue. I mean, you can have 10 different screws, but it is not necessary. You perhaps only need three different and some over dimensional ones, but it is cheaper than needing to go to the hardware store and get 10 different boards. So, it is the thought that you don't need to drive to the hardware store each time you need something. We still have two deliveries each day or something like that, but that's fine.
Anders: We also have a bit of storage outside for scaffolding. These two gates are a bit special, you don't see it very often.
Steffen: Yeah, I don't know who.
Anders: Nobody knows, it is something with fire safety, I think.
Steffen: The outdoor workshop gets some criticism because it gets very cold, and the wind goes straight through it.
Anders: Yeah, it's not very nice
Anna: Who can buy the project houses?
Anders: Everyone can.
Anna: Okay so also private individuals?
Steffen: Especially private individuals. They use them as annexes
Anders: It is something we get permission for from a professional committee, so we don't take jobs from anybody
Anna: Do the skilled workers have a teacher's lounge?
Anders: Yeah we do. It's a shame we were just over there, it was just behind the pool table.
Steffen: The coffee room is in there.
Anders: Ja, Det kan man sige. Det er skolens bedst. Det er det faktisk. Det er konge
Anders: Yeah, and you can say it is the school's best coffee. It really is, it is great.
Steffen: Det er der mange holdninger til, men Jeg tror mange andre har faktisk rimelig enig med Det er nu er det bare til et projekt, der skal være en meget lokal kaffestue.
Steffen: There are many opinions on it, but I think many are quite agreeable on it. But there needs to be local coffee rooms.
Anna: Yeah okay, so there needs to be several.
Steffen: There is an employee kitchen down at the cafeteria and then all teachers can go over and eat together. So HTX teachers, electrician and blacksmith teachers and such. I'm a bit against that. I think it is fine to go down there occasionally and have a central coffee room. But the coffee room where in your brakes eat you lunch and get a free space from the students. Sometimes some work through the breaks, some don't, because we have paid breaks. Sometimes for example Anders and I, through the break, can talk about a student and say "this guy is kind of a fool" because when you are in the classroom you need to be professional. It is of course chemistry between each other. So there needs to be a place to eat your lunch.
Anna: yeah, where there is quiet, and you can...
Steffen: Well, there is never quiet in the coffee room.
Anna: No no, but like, quiet as where you can kind of relax even when there isn't quiet in the room.

Anders: But the students knows where we are, so they can just knock on the door, right? And then come in and talk to us.
Anna: Yeah, of course. As in other schools.
Anders: It makes so there isn't much distance between us and the students.
Steffen: And there needs to be preparation rooms.
Anna: Yes and how many? Like, does there need to be one seating per teacher? Or, is it like a hybrid where people share seatings or?
Steffen: Well, it is done widely differently on the different schools. There are both pros and cons. I am not there because I have an office, but Anders am a supporter of having your own seating.
Anders: Jan and Flemming, they live where they are and then there are some of us, we are in Frederikshavn half the year. So sometimes you are down there and then you get home to the school again. Then it is great to sit where you are used to rather than seeing a lot of stuff on your table. You can also just sit in the classrooms, that doesn't mean much to me.
Anna: No okay.
Steffen: Men der er nogle der har, Altså Jeg synes bare Det er med hvordan man arbejder, men hvis man skal pille det helt altså rode det sammen hver eneste dag, og du arbejder meget på computeren Anders, men hvis man skal bruge det helt sit ting sammen og Sådan noget det Det er et rod og Det er den måde det virker hvis man har Sådan nogle kasser man kan gå hen og booke.
Steffen: Some fell the same, but I just think it is about how you work but if you need to figure things like presentations and notes out each day, it will get messy. Like you work on the computer each day Anders. It is this way it works if you have some classrooms, you can book yourself in at.
Anna: Yes yes, of course
Steffen: Something we are missing, we didn't walk about, was that we actually are missing some conversation rooms.
Anna: Okay so something like meeting rooms or should it be smaller?
Steffen: Well, it would be fine it the coffee room could be used as a meeting room, but it is not ideally for it.
Anders: Yes yes, it is more if you have a student that needs a scolding and such.
Steffen: Or a talk with a guidance counsellor and such, where you can go to, where you are close but still have the ability to close a door. But sometimes you have students at the same time, where you quickly go in and talk. Then the others should preferably not be able to look inside but it should be private. There can happen a lot to those talks, sometimes personal thing, sometimes not. So those kinds of rooms are needed.
Anna: Yes. Something we also talked with Steffen about before you came, was about how is the perception of artisans and how many choose for example the carpenter education. Have you experienced fluctuations in how many have enrolled the education?
Anders: Well, the EUX have grown exponentially. Of course, some drop out and some enroll and we also steal some from EUD. Some choose EUX because they also get the student cap, and some enroll mom thinks it's a good idea. Then she can also get a new kitchen and the student get a cap.
Steffen: We also have insanely many more students than the other schools, if we are looking percent wise.
Anna: Okay.
Steffen: there you can say that the carpenter education, not the woodworker, that is not that popular in Denmark, but the carpenter education is the biggest vocational education and the most, is you can say that, the most popular vocational education. Sometimes too popular.
Anders: Yeah, you can say it has been running smoothly.
Steffen: There are enough carpenters. Vi have some in school internship and such. But you asked why people doens't choose the education, I don't know if that's why, but they still choose it, even when the job opportunities are not so great. It's not the jobs they choose it for.
Anders: But they also go out from the school internship. It is not like they get fully trained at the internship, but they all are done the same Friday in week 25. And then the boss is on his way to Majorca with all

his dirty money and burn it all hehe. So, some of them get to have summer vacation but we can still have some who lags behind and stay in school internship. Then we are done in September, October and then it is already better with the job opportunities.
Anna: Yeah, so it is something about when some have time to take them in because some employers are on vacation and such.
Anders: Yes, and that is just how it is.
Anna: Can you tell something general about the students you have? Like, what is their mentality in relation to be taught in this profession? Like, do they like to work with tools or is it more material based or just because it was what felt right?
Anders: Well, they do like to build houses.
Anna: I guess it is because they see a future in construction housing or other buildings. But it is not like there are a more specific reasoning
Anders: no, but it does lie in the back of their mind for the EUX students, because they can choose to study further if they want to.
Anna: Yes of course, if they needed it or just wanted to.
Anders: Ja og Vi har altså. Vi kører jo også brobygning ud til til bygningskonstruktøren og den vej rundt, så digitalt dage og hvad eller er med til.
Anders: Yes, and we also have bridge building out to the building constructors and such, also through Digital days.
Steffen: Have you heard about it? Digital days?
Anna: It is not something I have heard about.
Jonas: Me neither.
Steffen: It is actually something AAU Build is a part of.
Anna: Oh, that's why. We are a part of another education. So, it is those who are kind of like us but without the architectural part.
Jonas: I think it is the education "Byggeri og anlæg" who are a part of it.
Anna: Yeah, so it is probably out there.
Anders: It is kind of funny those Digital days.
Steffen: Det er konstruktør og og ingeniør studerende og håndværk studerende, arbejder sammen om at dimensionere et byggeri på 3 dage og så laver man det man kan, så hvis Der er en frisk luft ingeniør med eller en elektriker med speciale i lys eller en tømrer, Der er god til at affaldssortering, så laver man ligesom de ting. Der er nogle ting man skal lave Sådan.
Steffen: It is constructors, engineers and artisan students who work together to create a building on three days and when they make what they can. So, if there is a ventilation engineer or a electrician who specialize in lightning or a carpenterwho is good at garbage sorting, when they make whose things. There are also thing which must be done.
Anna: Yes, of course
Steffen: So, it is groupwork across professions, which is intriguing.
Anders: And then they get tuition on top-of-the-line digital tools like 3d and such.
Anna: Yeah, but that is also something we hoped could happen with our project. We are thingking of placing it in Aalborg around the AAU main campus where Build also is placed. That way they could work together. Our project will of course not be built, but our idea is to try to advance especially wood crafts in building in the future. This meanwhile also trying to nudge our engineers to see that wood also exist but need more working with because they kind of forgets it because of concrete and steel and it is easy. So, it is also something we have talked about. This is maybe a bit of a weird question but have you, especially you Anders, experienced to be looked at as an artisan in a certain way. Because sometimes you can say there is a difference on how people interact depending on which education you have. And have you experienced a certain way you speak to each other? Is it something that maybe scare someone away from the education?
Anders: Well no, I would not say that.
Steffen: Well, there are made a lot of studies on that. When you choose a vocational education instead of an upper secondary education, some will look askance on you. A mother wishes their child to be educated without dead ends and the mothers have the idea that a carpenter education is a dead-end education.
Anna: Yes, it is exactly something like that.

Steffen: Or a brick layer. Its kind of doesn't matter. And then there are also a hierarchy within educations.
Anna: It is also kind of what we are trying to find out about. If you can help us, find out what creates these hierarchies because it is something you would like to avoid.
Steffen: Well, it is kind of hard to say, like in theory there are no education which is harder than others. There are maybe some which suitable for someone than others. But there is this hierarchy where carpenter and woodworker are placed reasonably high. Electricians are also placed high, and hairdressers are also getting higher up.
Anders: Yes, and maybe electricians above all else. I usually say that you can look behind in the company car and see that happens there. The carpenters and electricians have a lot in the car, meanwhile the bricklayer just have a concrete bag which got a small amount of water on it and a mixer.
Steffen: So, the hierarchy rules a bit. But what I find funny is that one doubts a vocational students choice of education but when they are done nobody questions it. Nobody says "Dang, he's only a carpenter?" Like it gets recognized to be an artisan.
Anna: It is a weird exchange in some kind of way. I have a lot of artisans in my family, so I have heard about it. I have also experienced that my uncle was talked down to because he only is a blacksmith by someone he went to elementary school with. That was of course without reason because he is a skillful blacksmith and proficient in his work. So, we wanted to find out if this is something that still happens or if it is a thing of the past because my uncle is of course older than my generation and me.
Anders: Well, the boys can talk a lot about if they are going to the workshop or not because then they don't need to take work-clothes on and I'm like "You can just draw in you work trousers.
Anna: Yes of course.
Steffen: I think it differensiate of where you come from.
Anna: Yeah, that may well be.
Steffen: And that can be seen in the registration numbers. Like, let us say we have Copenhagen, Aarhus, Aalborg and Odense of the bigger places and then smaller places like Hjørring and Holstrebro and such. There is no doubt that the registration up here are significantly higher. Aarhus is actually not close to being the biggest technical school even though they are twice as big. But it is something about the culture or the demographics. I am certain the opinion of artisans are different up here and in Copenhagen, especially Aalborg which is and old workers city. And then you look at Hjørring, it is prestigious to be an artisan. So, there it is much different depending on where you live and here it is not so bad.
Anna: Yeah, for sure.
Steffen: But there is still something in the choice. It is not like on HTX like you (Jonas) went to. And EUD actually study cafes, parties and Friday cafés together, so it is not a problem. But we wouldn't get HHX, which is a part of the school, and STX to come over here and get a beer or such.
Anna: Where is it STX is placed compared to the school?
Steffen: It is about a kilometre from here. Each of these educations are placed within 1,6 kilometres from each other. There are also made studies about the choice of education. The choice is of course the student themself but the person who has most significance of the choice is actually mom.
Anna: Yeah, that sounds about right.
Steffen: And then comes the friends, the grandparents and then dad who before decided what you should do, if you were a boy. He actually come down to fourth or fifth place. So, the heart for this comes from the mother. It is also her who comes to open house meanwhile dad gets dragged to do it. The mother also participates in webinars and all sorts of school stuff and her who decides but she also gets scared for all these educations, so it is kind of paradoxically. But they get advertisements about you get a bad back when you turn 50. When you are an artisan, you need to eat pills when going to work, like Anders do. So, it is the thought of that, and some artisans gets worn out over time. But there are also firm who, though the working environment act, has become better so you for example only can lift 15 kg.
Anna: Yeah, so you don't get worn out in the same way.

Steffen: So, you don't do that, but we also know that sometimes you will lift a window and...
Anders: men Det er også noget, som mand itu. Det er også Meget mere udbredt end da jeg var i lære for eksempel. Der fandt det sgu ikke altså.
Anders: But it is also more widespread to not do that, than when I was a student. There it didn't exist.
Steffen: And window lifter.
Anders: Yeah, but you can say that now the windows has gotten a lot heavier so you can't lift them.
Anders: No, so that's done doing now.
Anna: So, it is more, I believe, something like that which will scare someone off because "Oh God, do I want to have it that bad when I turn 60?" No and that is maybe not a necessity, you can say.
Steffen: No, but now it is architecture you talk about but there is also political about it. All the way through the zeros we were told that we all needed to be engineers for the country to survive but now now we are told we need to be artisans.
Anna: Yes, so it is maybe to create a balance between it.
Steffem: So, there is a tendency, which also changes with the change of governments, that we should begin to choose an education from when we are in third grade. And there has become so many educations to choose from and you are so afraid to go to a dead end because there have been stories about when you are done studying, you as engineers and our students as carpenters, you will work until the retirement age and that age for you will be 74.
Jonas: Yeah, or else it will be 80 or more.
Steffen: Yeah, or something like that and there are many who are afraid of there their whole life. Like, it can be that you architect engineers after 5 or 6 years choose to be kindergarten teachers because you want to try something new. There are nobody who necessarily thinks that we would end here and it's like that for everyone, but there is a story that you quickly need to get into the work force and pay taxes.
Anders: Yeah, and that it is a bad idea to take a sabbatical year in Australia.
Steffen: So, that far down the road I actually think that the opt-out over to STX and HTX, sometimes HHX, also is an opt-out of you don't need to be a part of the work force so quickly.
Anna: That is also something we have talked about. It was one of the reasons for our project contract with our supervisor for this assignment. It is that you grow up a bit faster when you, let's say, goes from ninth grade and enroll to the carpenter education. Then there goes, what four to five years and then you are fully trained and become a real adult. Meanwhile someone like me take three years at high school and then five years at the university and then I'm an adult.
Steffen: But it actually goes much faster because when the student arrives on basic course 1, and we normally say, maybe not Anders', but the normal students are less mature than those who starts at the high school. But in a year, they need to have found an apprenticeship contract. Then some of them need to arrive on a construction site at 7 o'clock in Aarhus meanwhile they live in Aalborg or Hjørring. Therfore, they need to drive at 4.30 o'clock in the morning and then work until they get home at 18 or 19 o'clock when football or badminton practise or what else you go to, are over. Then you need to do the same the morning after. By this you opt out on unbelievable many activities. Maybe you still want practice football as a 16- or 17-year-old, but they practice in the afternoon because the seniors do it in the evening. There are so many things and as you say it is not job and economy there constitutes the youth educational choice today.
Ana: No, so it is more about where you can be and still be young.
Steffen: Yes, it is the desire that drives the work, so some maybe chooses to postpone their choice of education by choosing, if you have the grades for it, high school and even if you have bad grades, you can still pass the time for five years there.
Anna: Yeah, there are sometimes you think "it is unbelievable that this person passed high school".
Steffen: Well, if you come in, you need to do a great effort to be kicked out.

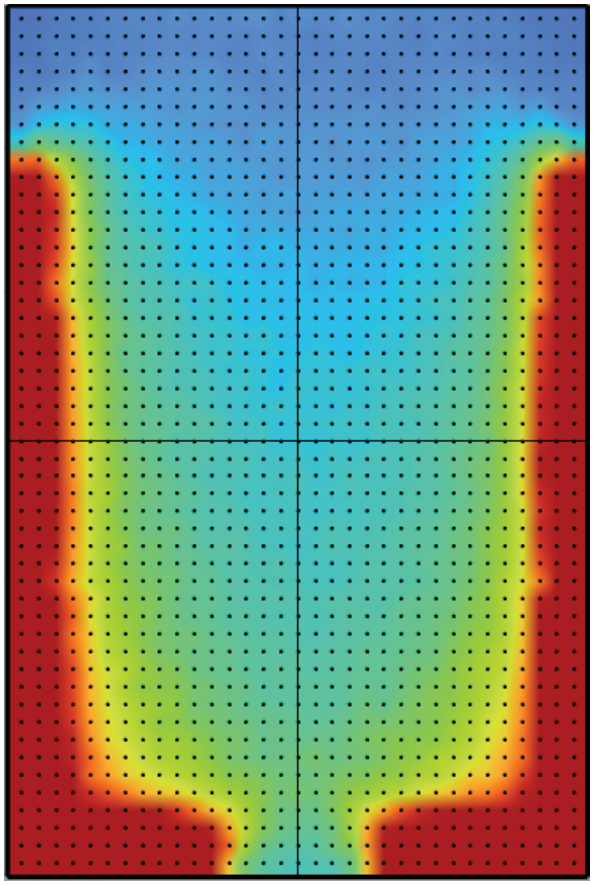
Anders: We also get a few bonus children from STX when they have gone there the first 10 weeks and then it gets a bit harder, so they come over here on the basic course 1.
Steffen: We also experience that some doesn't like to sit still in a classroom and after the start on STX says "nope, I would rather go to EUX and make something.
Anna: That makes sense.
Anders: Yeah, it's fine it's fine.
Steffen: And the dead end, the story of it, it is terrible.
Anna: So that is something there needs to be removed and that is something we also hope to do with our project. It's to show there is no dead end. That it is the future, it is our future. It gets build in wood and sustainable materials. At least there is some of what is most normal to build in, which is still classified as very sustainable, is wood. This is also the reasoning for the kind of educational institution we want to make. It is wood workshops, so woodworkers and carpenter we want to focus on.
Steffen: It's also, maybe not our basic courses they are really care, but...
Anna: Yeah, but it can maybe help for mom and if she pushes for it.
Steffen: Well, if you think about an electrician and the blacksmith, you don't think much about sustainability.
Anna: No, of course.
Steffen: But maybe are promoting sustainability than the carpenter because he works with wood. It is like "uh it grows and saves CO2" and such. But where some of the industrial things maybe are more sustainable because these competences come more from over there. It is very hard but nice and easy with wood.
Anna: It will be some really bad pipes the blacksmith needs to put down if it is made of wood, haha.
Steffen Hehe yeah, but it is him who needs to capture the CO2 or transport it and him who are making the biogas plant, and the electrician must provide that something flies though the pumps. So, you can't avoid at least some corporation. It is also them who put Windmills and voltaic panel up. Maybe the carpenter can also put them up in a year or two.
Anders: Søren did it at least haha.
Steffen: Hehe, but yes that is that. But it is a good place to show it.
Anna: You could say that you can always expand later if you should take the theory into reality and say "we start here" and then show the other vocational educations can also be more sustainable. And maybe later get more people to choose the education. I also think that the coming generation will be more sustainable minded. It is at least something I sense in the younger in my family.
Steffen: Yeah, but it is like on Roskilde festival or McDonalds, like you want to, but it is still the youth who trough tents or trash or such. But they make many demands, that is completely true. You also wanted to know something about economy?
Anna: Well, we wanted actually wanted to know how many students there needs to be in a class to run a school, so we know how many to dimension for.
Steffen: Okay.
Anna: So, does there for example need to be three classes per year or can you just have two or is there another way to calculate how many there need to be room for?
Steffen: There needs to be room for a minimum of 24 students in the workshops.
Anders: It is many for a teacher.
Steffen: I didn't say it wasn't, but I just say it because it is an easy number. It is the maximum number of students when we talk about the main course, there we usually have 24. For it to be economically sustainable we need 12 students to just break even and if we don't earn on it we shouldn't have the team but we do it anyway. We need to have 16 students before we get a profit. So, for it to give something pedagogical there should be between 16 and 20 students.
Anna: Yeah, okay that's really nice to know because, again when we are making a program over all the material and rooms we need.

Anders: But now we have two teachers with 30 EUX students and that's really fantastic because if one of us are dealing with a problem they can finish it, meanwhile the other
Anna: Can have the big overview?
Anders: Yes, who keep it going. You sometimes say the two men can do three men's work and it's kind of the same in pedagogy
Anna: That makes sense.
Steffen: And there is also the bigger the class, now I don't mean 50 students or something like that, but the bigger the class the bigger is the chance for creating good relations, which is important regardless of which education you are taking. It's what keeps people the most. Like, if we have a team of eight and one of them are a bit of an outsider, then there actually a big chance for them to drop out, because he or she doesn't find a group. If there are 20 students there are nearly always on or two you get along well with. It is not like that when there are 12 students.
Anders: It's kind of funny when we have two super nerds within the electrical field and they come, I have one in Frederikshavn, so there goes one up there and they meet at the basic course 2 and, ding, they really stick together.
Steffen: It is something important we should be better to think about, but we are more prefessional thinking.
Anna: Yes of course.
Anders: Yeah, there are many things in making a class, right, do they need to have math and the levels.
Steffen: But you recognise it from your own class on the university.
Anna: Yes yes, well it is more the smaller educations dies out faster where our class started as a very large class. It is of course gotten smaller with time but there are enough to have someone you can relate to. I think we started out as 120 on the first day of the first semester.
Jonas: Yeah, I think we lost the first 20 in the first couple of weeks.
Anna: Wasn't it when they went over to URB?
Jonas: No, I think we only was about the 100 when we split to the 3 specializations.
Anna: Maybe, but there were a lot who dropped out because they found it wasn't the right thing and we have been divided out in three different specializations later on as the education went on. But again, it makes sense, and you can feel when there isn't anyone you get along with, it is hard to come to school. It is of course a consideration there needs to be room for.
Steffen: We have the basic course 1 here, which could correspond to your division. Anders are running the basic course 1 and what we call Energi og byggeri, which has carpenters, bricklayers, woodworkers and.
Anders: Yes, and painters, but Frederikshavn is a bit different.
Steffen: But we also experience, and that is not necessarily just the presentation of the education, but it is actually who you have a relation to to learn and reflect yourself to. Of course, you do a bit of what your friends do, but there is also an excitement for that Anders is both a teacher and a carpenter. Without Anders being the best role model, they reflect themselves to him and chooses him just as much as they do the education. That is maybe because they think "Anders is good at working with wood". It could also be Mads there is a bricklayer or another who is an electrician, but there is some in it that you look at us. The person's identity but also the building you are in which have an importance.
Steffen: It's kind of fun and I have a few educations and carpenters and blacksmiths, if you look at it, it is kind of the same things they make. Like, I know a carpenter makes houses and in wood and a blacksmith he builds some other things and in steel, but the identity is kind of the same except that the wears black clothes. They er two widely different persons. There are unbelievably many smithing jobs up here in this part of the country and you can earn, now I just say it, you can earn quite a bit more than the most carpenters do for the same work effort as a smith. Like the collective agreement er just a bit better and so forth. That change, you can't get them to change from like mechanic to smith or.
Anders: And we have been out and see Hirtshals harbor and intake and all the top of Hirtshals yard and all of that. It got presented and they

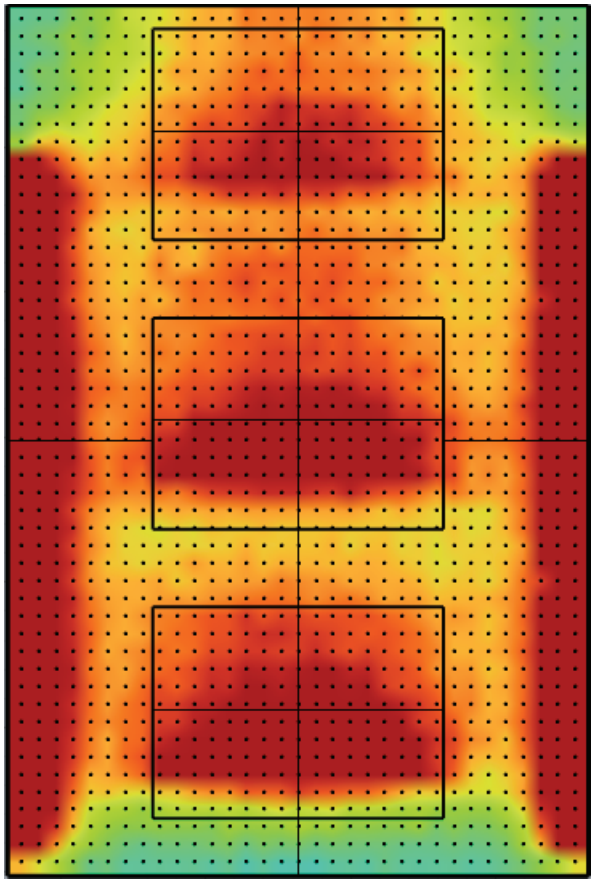
were inside and weld it. It is really really really only one or two out of a hundred.
Steffen: So, it is really hard. The way we get many students is by bridge building through the primary school where many try the different educations. I guess you (Jonas) have tried it?
Jonas: Yeah, I tried some of your EUX things over her for example the electrician.
Steffen. That is something you maybe also should think into the project.
Anna: Yeah, there needs to be room for bridge building and such.
Steffen: Yeah, where they can look into the windows on the others in there.
Anna: Yeah, there needs to be something you can se and what can come out of it.
Anders: I sometimes look out the window her, Steffen and is a little like Bob-Bob on the new.
Steffen: On the wall over there?
Anders: Yeah, but we don't need to talk about that.
Steffen: I would like to have a window over there. And a dry wall.
Anders: Yeah, it is not that great, I am a bit pressured over there. It is a bit irritating, but it is sometimes what happens when you have an engineer design firm to draw. And if you want to see something from Bjerg Arkitektur you can look at the main entrance.
Anna: Yeah, I was told by that from over here (points at Jonas)
Anders: But it is a bit, like, brutal and it is really a shame, I think.
Steffen: That (points at building) is a new bricklayer hall and as I told before, when we went through the procedure in Randers (for Tradium) with building the carpenter school, then the procedure actually went on for two years before we began to get projects home, to say what our needs were. Here, we needed a carpenter workshop, so we went out and took measurements by foot on a Friday afternoon and was like "We need to be a little longer, how long can those rafters be" and then we have a building, and it is made of bricks. It's good and brick fit in for the building, but we have a bricklaying school with wet walls and the joints are not that good looking. Like, you think at those who make it, it's actually a local firm, you would wish that they had put in just a little more energy in it and thought that everyone who a becoming a bricklayer, taking a continuing education and everybody else come by and look at it with professional glasses. I don't know if you noticed it, I wouldn't but now I have been her so long that I do, but with professional glasses it is some shit. And it gives a signal of what you learn in there. So, when you are making a school, it needs to be of quality. You need to be careful that, now you are a kind of architects, it doesn't end up as Aalborg super hospital where it is architecture rather than usability like where we don't have wet walls and such. So, it's better to build a bit more traditionally but it is holding because we can't afford to, as a public institution, repair everything, like our flat roofs, light boxes and such. Everyone knows something like that become wet at some point or another
Anna: Yeah, it won't last.
Steffen: Although maybe it looked insanely good at one point, I actually think it did, but it is some shit. It would be better if we had some tall roofs with an angle or something, but not inwards running. You really need to think about that.
Anna: we will take the climate into account, like the climate we live in. We live in a place where it snows and rain a lot.
Steffen: Yes, durability and then it is fine it is made of wood and such but build traditionally. Like when you are building a public building for billions of Danish crowns, you can't play with it. You can play a bit with the appearance, but you need to know that you need to have an overhang, so the walls don't get wet. Like whom builds a building without overhang, right Anders?
Anders: Well like the super hospital, it is just a fabric to repair sick people. In my world you can use concrete elements and sea stones like Jacob did for his pigsty.
Steffen: Like, you can just paint it in a nice colour.
Anders: I wouldn't care only for it to be functioning.
Steffen: Make glass partitions and use concrete. Then you could also make a nice-looking tree trunk inside as in the Novo Nordisk construction. I know we are a bit rough about it, but I would prefer, if I

were a building owner and I needed to go out and approve a building for millions, like what you are making, when I would think "Are you sure that water won't go backwards when it blows from the west or east or northwest or if the wind blows in general. Like it is some of the things we are dealing with here on the school, but it certainly also does that at the Super hospital.
Anna: Yeah, we have certainly heard quite a few histories about that.

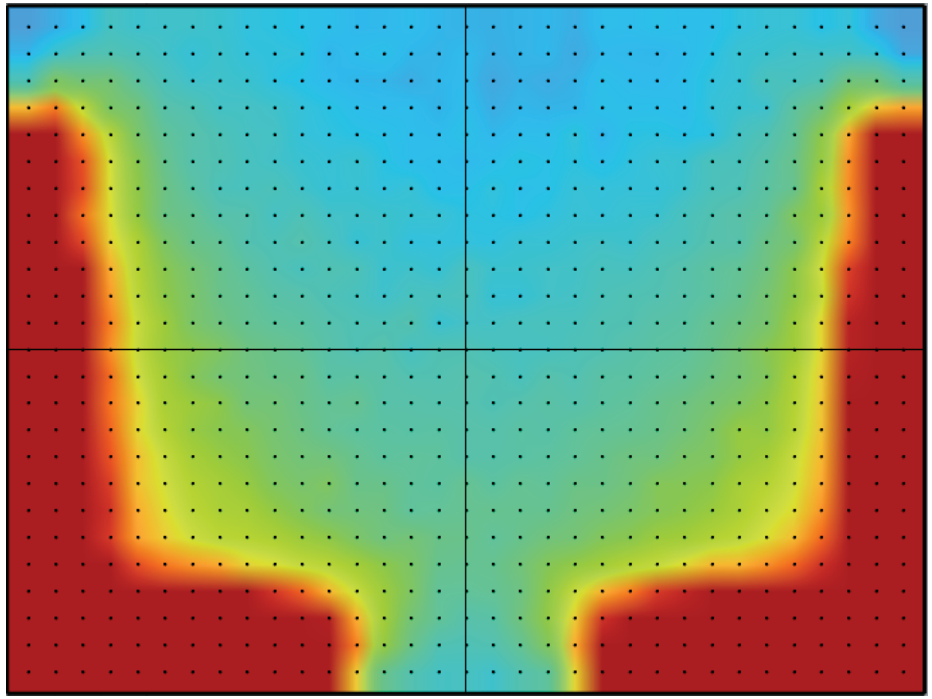
Southern window study



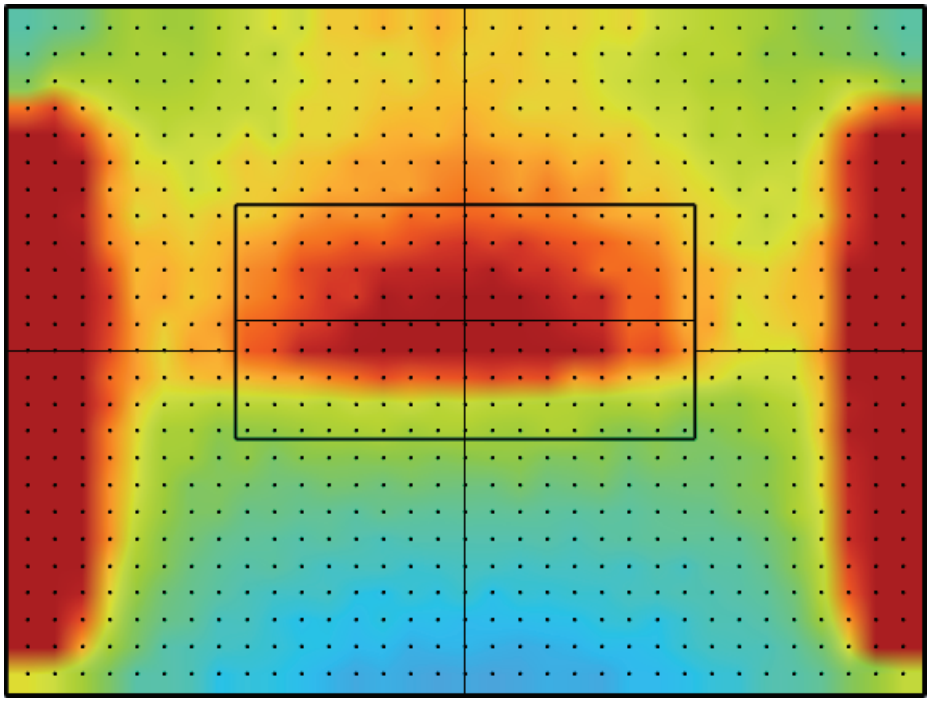
Above: Carpenter workshop with windows on the facades facing towards the south



Above: Carpenter workshop with skylights facing towards the south



Above: Carpenter workshop with windows
on the facades facing towards the south



Above: Carpenter workshop with skylights
facing towards the south