DEPARTMENT OF ARCHITECTURE, DESIGN & MEDIA TECHNOLOGY

ØSTRE HAVN

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MASTER THESIS | GROUP 6 | AALBORG UNIVERSITY | MAY 2021

I ABSTRACT

This paper expresses, the redefining of an old integral part of the city of Svendborg using Transformation Architecture. Firstly, the use of the Integrated Design Process (IDP) and Dive analysis are announced, as there is a wish to investigate Svendborg and the site from a cultural and historical perspective. To reach a more holistic approach related tools are presented as well.

There is then the introduction to the relevant theory, that helps support the idea of the sustainable use of transformation architecture, where there also is presented context to this phenomenon is happening around Denmark, as Danish harbors are facing great changes. By buildings also are facing tougher standards than ever before, specific cases are introduced to provide reason for the use of transformation architectures. The dilemma of having volumes from the harbor in contrasting scales and how they affect the urban space surrounding will also be stated in.

To give the reader an understanding of where the site of the project is placed, the introduction of Svendborg has been made, where there is presented the past, present, and future of Svendborg. In addition to Svendborg placement in Denmark, the climate has been presented as it introduces future challenges, that must be considered.

After the introduction of the city, a more in-depth analysis of the site is made, where history, atmosphere, mapping, climate, and the active use of the DIVE analysis is presented, as documentation, interpretation and valuation of the site is given. Together with another casestudy this part helps introduce possibilities for the buildings on the site.

To support the future programming of the buildings, an investigation towards the related users has been made, where stakeholders, functions and supposed users are introduced, where needs are introduced. At last, a vision has been made to present the intention of this program, besides a conclusion that acts a foundation for the future sketching.

Through the sketching phase the knowledge gained from the different investigations, was translated into design proposals with background in the design criterion, that was extracted from the results of the investigations. This covering the guidelines for the work on the project according to how the angle was intended to be dealt with.

I TITLE PAGE

TITLE	ØSTRE HAVN
THEME	SUSTAINABILITY
PROJECT	MASTER THESIS
PROJECT PERIOD	01TH FEBRUARY 2021 - 27TH MAY 2021
GROUP	MA4 - GR06
SEMESTER	4TH
SUPERVISOR	MICHAEL LAURING
REPORT PAGES	190

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PREFACE I

This report represents a Master Thesis made at the education Architecture & Design at Aalborg University, specializing in sustainable architecture and accounts for 30 ECTS.

The project took its place on South Funen in the city of Svendborg, with the specific location for the site on Østre Havn. Through this location, analysis of the site and the city have been made, to provide a proper understanding of the city and the specific site.

We would like to thank Klaus Johannesen and Helle Baker from Fremtidens Havn, for the help and feedback they have provided from the very beginning of the project. This has given us a lot of insight in the plans for the harbour, that has been appreciated during the project. A thanks should also be adressed to Ole Hjorth from Cushman & Wakefield RED, for his help in reaching a realistic outcome of the project. An appreciation to DLG for the allowance of visiting the area and providing the opportunity for a guided tour through the area and the buildings. Finally, we would like to give a thanks to our supervisor Michael Lauring, for his help and guidance throughout the project.

The project Østre Havn is presented through this project report, that consists of three main phases. Chapter 1 to 6 defines the program and the first phase of the project. Here the reader is brought through the different steps of analysis, each providing an understanding of the site or the city on variating levels. The reader is introduced to the whole process in the development of the program, through the chronological structure. From here the report transitions into the design process phase defined by chapter 7, that outlines the process of translating the knowledge achieved during the program, into actual design proposals. The final phase is reached in chapter 8, being the presentation chapter, organized to present the project, on all of the different topics, that the final design builds on.

1 INTRODUCTION

SEA FARING NATION

The position of Denmark, surrounded by water, has been important, in the establishment of a sea faring nation. Yet the footprint of the past remains visible, and the greatness of the harbour is being praised. Today municipalities of the country strive to organize the harbour and cities together, to promote attractive life within the cities. Among proactive municipalities are Svendborg, that as prior described is where this project originates.

SVENDBORG MUNICIPALITY

The site for this project is located on the harbour in the city of Svendborg and represents the vision of a transformation of the old industrial area on Østre Kaj, that will take place in the future years. The project focuses on preservation of the area, as it is a big part of the city´s history and cultural heritage. By transforming the old area, rejuvenation of the area could unfold, by the implementation of suitable functions and activates, that appeals to several users in Svenborg. The background for this transformation, lies within the amount of maritime industrial activities on the harbour, that has gone through a drastic decrease over the past 30 years.

The project presents how the transformation redefines the old industrial buildings and its functions. This in correlation with meaning of the scale of the built environment and its relation to the city and preservation of this relation. Through this, transformation architecture helps, in showcasing the environmental advantages, focusing on circular economy and embodied energy.

The work on the project has been aimed, on a conceptual level, towards a realistic approach, with a relation to the city and its market potential for the different functions, implemented into the project.

MOTIVATION OF THE PROJECT

The motivation for choosing this specific site, lies within the ideas and vision of Fremtidens Havn, as the plan made for the harbour had a strong focus on keeping its identity. This focus on the cultural heritage and identity was an interesting perspective to have.

Fremtidens Havn, refers to the developement of Svendborg Havn, which consist of many different projects along the harbour, among those Østre Havn. By having a general interest in working with transformation architecture, the project was an opportunity to investigate elements such as cultural heritage and big volume potentials, with a focus in sustainability. Furthermore, it invites to the implementation of integrated design, as it highlights the need for aesthetic, functional and technical methods, when working with the transformation of building expression Svendborg's heritage. As this theme has become highly topical and generally seen as a great challenge, simply made the choice of this project irresistible.

III. 2 LOCATION OF THE SITE

SVENDBORG 5700, DENMARK

How can an areas character and history be preserved when the function changes?

I CONTENT

00

METHODOLOGY

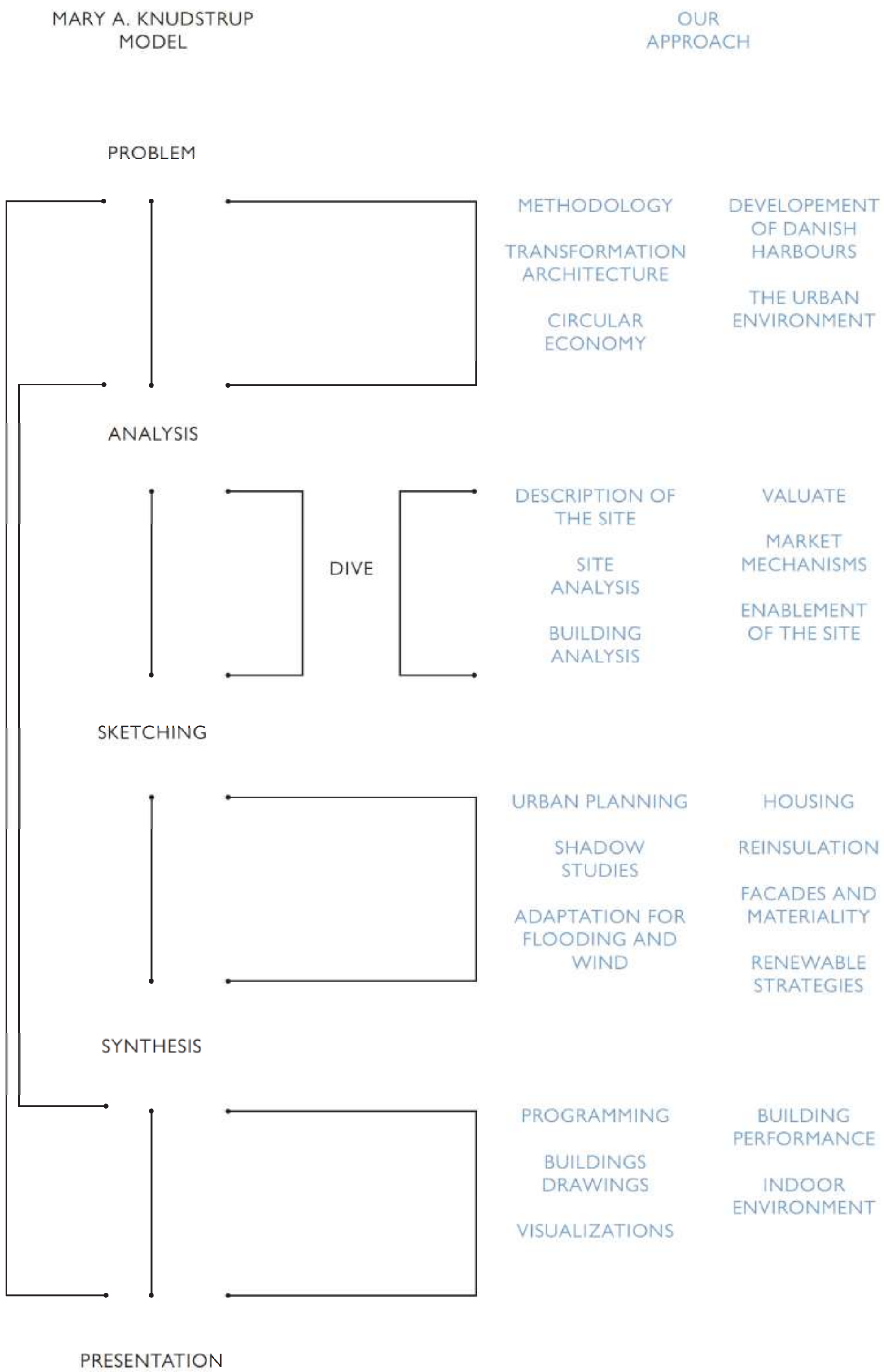
INTEGRATED DESIGN PROCESS

THE METHODOLOGY

The Integrated Design Process (IDP) is method developed by Mary Ann Knudstrup from Aalborg University for the curriculum at Architecture & Design. This method is used to combine the engineering and architectural aspects, hence the project development becomes optimized and integrated. As the topics, that will be investigated in this project, among other are transformation architecture and circular economy, which depends on several variables from both aspects, the IDP method can help strive for a more holistic design. To have a more structured process, the method divides the project into five floating phases seen as seen on ill. 3. This figure also presents what topics, that are intended to be approach in the different phases.

THE PHASES OF IDP

The problem lays the groundwork and functions as the main driver for the next phases, as it sets the direction of the project. It also functions as the introduction for the reader, by presenting abovementioned topics such as transformation architecture and circular economy, but also historical mapping of Danish harbour and the urban environment. As the foundation is defined, the analysis phase begins, where critical information based on the problem is procured. With roots in transformation, the DIVE methodology for cultural historical understanding, will be used for structuring the analysis phase. Among topics to be addressed are the city, the site and the market. The gathered data both encompasses analysis methods from both the architectural and the engineering field. As the relevant information has been collected, the projects design criteria are defined. The next phase is used to investigate concepts based on the gathered information from the analysis phase. The experimentation happens on several topics of the project, focusing on the functional, aesthetical, and technical properties, where actions also will be measured from the viewpoint of LCA and LCC. This experimentation concludes to a concept created. The concept by now is yet now far from complete, therefore synthesis phase is where the proposal is refined and supplement the project with simulations software. This results into a more developed and complete project. As the last phase, the presentation functions as a conclusion and reflection of the entire project, by presenting the project with building drawings, renders and illustrations (Knudstrup, 2004).



III. 3 INTEGRETAED DESIGN PROCESS

(KNUDSTRUP, K.)

METHODS AND TOOLS

PROJECT MANAGEMENT deals with the complexity of the work on project making, revealing when a given task must be finished according to deadlines, this is to secure a successful process of developing the project. The answer for management lies in Notion, which is an application, that has been used to structure the project, providing activity lists, calendar and timelines. The use of the planning tool has improved the communication between group members, which is an important aspect of managing the project.

DOCUMENT STUDIES which refers to the critical approach of reviewing documents, has been used to examine the development of Danish harbours, that is oriented towards historical research. The method has also been used for the collection of knowledge regarding architectural topics within transformation architecture, circular economy and urban environment. The approach sheds light on phenomenon's and raises further questions, which navigate the project into relevant investigation topics.

MAPPING has been used in this project to understand the several aspects of working with the city of Svendborg. This through a historical comparison of functions from the past, present and future, but also specific topics such as housing, noise, accessibility, etc. are identified and visually presented through mappings. These topics are both addressed separately and in correlation to each other, as they provide additional context to conclusions.

DIALOGUE WITH CLIENT to ensure qualitative input, but also securing a project that works with the site, the integration and collaboration with Svendborg Municipality from the beginning has been important, though it is important to stay critical. This makes the education Architecture and Design optimal, as it combines aspects from the artistic and technical fields, that provides a background to discover the possibilities.

PHOTOGRAPHIC DOCUMENTATION is based on an excursion to the site, from which the camera, will be used to capture atmospheres. Beforehand focused topics are selected, such as the townscape, as the site visually defines the townscape of Svendborg. Additionally the focus on capturing the qualities on the site, that gives an insight of the historical background of the building. The camara is also used to document the position of the site related to the city.

SENSES is used for the site analysis, the approach is based on a sensuous experience, with background in the approach of Juhani Pallasamaa (Pallasmaa, 2005). The atmosphere of the site will be addressed through senses because the site carries a variation of impressions. The observations have been written as a personal narration, which gives an insight of the characters of the site, and thereby also the qualities.

VISUALIZATION a combination of analog and digital sketching, but also modelling is used throughout this project. The combination gives a flexibility and ensures that there are several ways to design. This as the analog methods relates to more freeform and tactility, while the digital methods are more refined. In this project the chosen tools for the digital sketching and modelling is, AutoCad for developing precise 2D drawings in plan, façade and section. Sketch Up is used for the creation of 3D visualizations, together with real-time rendering software Enscape, where spatial- and material studies will be conducted, resulting in a realistic image of the concept.

SIMULATION as this project has a sustainable approach, it is important to see if the climate can be integrated into the design. Hence the use of simulations through Rhino 6 plugins, both Ladybug and Honeybee, with inclusion of weather properties of the site, will be implemented in the project. To ensure that a satisfactory building performance is fulfilled simulation software such as Be18 and BSim will be used in this project. Where the critical functions and the overall building will be held up against the key numbers of the simulation.

To support the circular approach, the software LCAbyg and LCCbyg will used. LCAbyg focuses on the reviewing of building materials global environmental impact, therefore, it is possible through this software to find the best solution for the given circumstances. LCCbyg focuses on the economic impact of materials in the project, as economy is a huge factor when building. Consequently, LCCbyg finds the better approach when handling building materials in this project.

DIAGRAMS can be carefully explained illustrative and lessen the amount of text when explaining principles in a project. Therefore, a balance of text and illustrations will be used during the presentation of the project, so lyrical and artistic skills can be presented as well. To achieve that level of precise explanation, the software Adobe Ilustrator and Photoshop combined with InDesign is used in the project.

DIVE ANALYSIS

THE METHODOLOGY

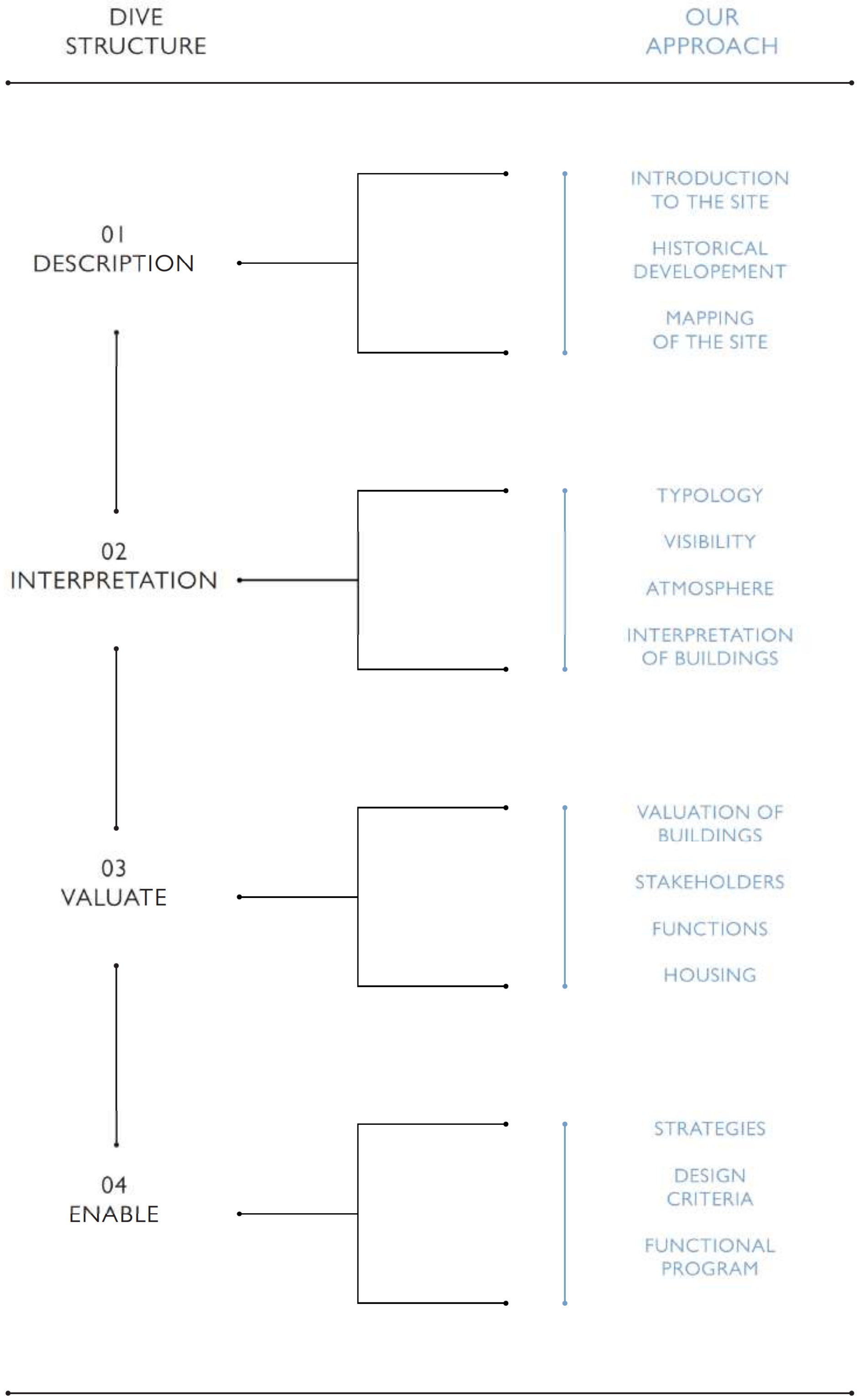
Since the 1970s, international organizations such as UNESCO, ICOMOS and the Council of Europe have stated the importance in the work of cultural heritage in urban settings, to be better integrated into future planning and management. Based on a prototype developed in 2002, by researchers, architects and municipalities, the methodology was created as interest of the cities historical and cultural qualities was increasing.

THE MODEL OF DIVE

Describe, Interpret, Valuate and Enable (DIVE) describe four key steps during the analysis. Describe investigates how the present landscape and environment has influenced a sites origin, development and character. Interpret, understands what characteristics and elements of the site, that has an impact on the surrounding society. Valuate, specifies the historical value of certain elements and characteristics, that can be developed and evaluated in terms of adaptability to future developments. Enable, is the practical use of the areas prioritized historical and cultural elements that are further developed into concrete design criteria.

As the method focuses on looking into the past, the name conveys to take a deep dive into the historical influence and heritage of buildings. It invites for multidisciplinary cooperation, as it integrates procedures from target group such as, stakeholders, planners, cultural heritage professionals and decision makers involved with planning and conservation of urban heritage sites.

The integration of cultural heritage as a resource offers more opportunities when designing buildings, as it adds a new layer of depth of appreciation and promotion of the areas existing history. Based on past and present conditions through clarifying social economic, cultural and physical features, the DIVE analysis creates suggestions on what to preserve, integrate or demolish. For this project, the methodology will be used to organize the analysis of the site, where it draws attention to essential features, that highlights potentials and qualities, showcasing the cultural and historical heritage. With the structure of stages, follows development from floating observations to solid design criteria, which sets the frame for the following sketching phase. The ill. 4 shows, the topics, that are to be addressed in the stages of DIVE (Reinar et al., 2010).



III. 4 DIVE CULTURAL ANALYSIS

OUR APPROACH

01

FRAMEWORK

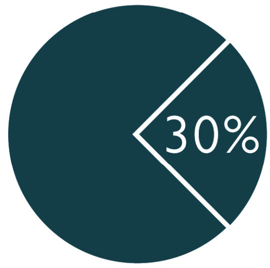
TRANSFORMATION ARCHITECTURE

INTRODUCITON

The following text presents transformation architecture with roots in sustainability. The term is described isolated as social, economic and environmental impact, but these influence each other. The section defends the importance of the topic.

SUSTAINABILITY

Through the 1970s debates on harmonizing development and environment together were growing. In 1972 United Nations, held the first conference of what would become many, in what today is referred as the Climate Conference. The reaction came from the difference in wealth, between industrial and development countries, where the poverty was alarming. The human mastery of the nature was inconsiderate, promoting an economical growth, but yet accelerating a globally environmental degradation (Anand et al, 2016). In 1983 the World Commission on Environment and Development was appointed to introduce a new political ambition. The leader of the commission came to be Gro Harlem Brundtland, who in 1987 submitted the report of Our Common Future. In this material, there was a focus on sustainable development, defined as solidarity weighted against future generations of the planet. In Denmark the building sector is responsible for 30 % of the total energy consumption, with a significant share in the emission of greenhouse gasses. With the common target of the European Union of reducing emission by 2050, the energy efficiency of new buildings is looking ambitious. However, now focus has moved towards, what is already built.

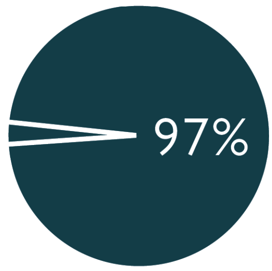


Ill. 5 The amount of waste generated in Denmark from the building the building sector

(Concito and Techno. Instution)

TRANSFORMATION

Renovation, rehabilitation, restoration, modernization, revitalization, are all combined, in what is considered as transformation. The importance of this trend, transformation, is that it extends the life of buildings, which supports ideals of sustainability by lowering consumption in materials, transportation, and pollution, from the perspectives of environmental, economic and social, with an indication of the potentials within this field. Because of changes in functionality, production and transportation, buildings are getting abandoned (Hansen et al. 2013). As a result, buildings are either demolished or left empty, for the purpose of constructing new buildings. A major issue of the debate is that transformation of buildings is relatively costly, why it is a challenge is to find a recipe, that economically can outmatch demolishment of buildings. Although, there is still a growth in exciting transformational projects. Improving buildings by adaptation is considered as an effective strategy, that covers the aspect of rehabilitation, renovation and restoration. Within this topic reuse is unavoidable, as these buildings carries valuable community resources, reducing land acquisition and construction cost. Definition of adaptive reuse is given as following



Ill. 6 Waste generated in the building section from demolishment of existing buildings

(Concito and Techno. Instution)

“A process that retains as much as possible of the original building while upgrading the performance to suit the modern standards and changing user requirement“ (Latham, 2000)

In a future of challenges with loads originating from the building sector, transformation, carries an important value. Commonly adaptions of new buildings will not reach the heights of a new building, based on performance. Although, this should be balanced with the social values. The life of existing materials will be short, compared to new ones, which effects the maintenance of the building, as adaptation projects has a higher maintenance than new buildings (Bullen, 2007).

SOCIAL IMPACTS

A great quality of the building is the heritage, that the building carries, which is important in cities, as it allows them, to prevent the development of a monocultural city (Buthke et al, 2019). Reuse of buildings appear as attractive for firms, educational and cultural institutions. With planning of the heritage architecture in combination of functionality, infrastructure, location, urban space, it creates the possibilities of improving the local community e.g., developing tourism, consumption, settlement or workspaces (Noldus et al, 2014). Such examples can be found in Denmark, where several cases have been successful.

ECONOMICAL IMPACTS

By looking at the economy from the viewpoint of usage of existing materials, the existing building will secure savings. As this will affect the cost related to production, transportation and construction, thereby lessen the need for new building components. Typically, this encompasses the framework, foundation, deck, roof, windows or bearing construction. Importantly financing of facilities as roads, road lightnings, supply network and sewerage would be avoided (Noldus et al, 2014). Transformation projects are connected to an insecurity, where the location of the project has a significant value (Bullen, 2007). The geographical background, has been the backbone of successful transformational projects in Aarhus, Aalborg and Copenhagen. If the economy is seen in the light of building components, cost related to maintenance and reparation are high.

ENVIRONMENTAL IMPACTS

The environmental impacts of transformation influence the social and environmental development, where reductions in emissions are among others based in reuse of building components. A preserved concrete framework reduces emissions, compared to the establishment of a new framework. The pressure in the creation of the framework is lessened, referring both to extraction and production of the material. Finally, the waste which the building leaves after demolishment is prevented, as this secures a better usage of the material and falls in line of embodied energy. By using existing buildings, the density of the city is kept, and sprawl is reduced, which effects transportation and energy consumption (Noldus et al, 2014).

CONCLUSION

Based on the study, transformation carries an enormous value, within the frames of social, economic and environmental impacts, which all should be used to critically review the design. The social impacts should ensure, that the design contributes to the development of the local environment. The economic impact should justify the selection of reused components, which should outmatch the selection of new construction materials. The environmental impact should be investigated further in the form of embodied energy.

CIRCULAR ECONOMY

INTRODUCTION

The purpose of this section is to understand principles of circular economy in architecture, which is closely connected to transformation, where the benefits of life cycle cost and life cycle analysis will be introduced.

RESCOURCE SCARCITY AND DAMAGE

The steady economic growth within policies of countries, originated from activities linked to extraction and industrialization of natural resources, leads to resource scarcity and environmental damage (Shceel et al, 2020). These were the concerns of the European Commission, that presented strategies on, how to approach the global conflict. The answer was found within the frames of circular economy, with reduction in creation of waste, increase of reuse, and better resource efficiency. This leading to an extension of the service time of the materials, where the value is kept, both in a technical and biological loop (Beim et al. 2019 - 1). With the building industry being responsible for a third of the waste generated in Denmark, the potentials in the field are in front of designers. The reason for the huge number is because of the linear structure, also referred to as the take-make-dispose model. This encompasses the raw materials extraction for the construction, to the manufacturing, the usage of buildings before ending up as waste (Circle House, 2018). The ideal circular economy requires a better understanding of the materials, which goes beyond the functional abilities. The answer of the building industry is to develop strategies of buildings, that secures efficiency, in the disassembly stage. Left are materials, that can be reused for new projects. Beyond the perception of the construction, serving functional services, it should be considered as a material deposit, where resources are stocked for future generations of buildings (Beim et al. 2019 - 2).

STRATEGIES

Within the field of circular economy terms as up, down and re-cycling are commonly used. The re-cycling refers to materials, that are kept in the same form and function. There might be a need for cleaning before use. Hence the value is neither increased nor decreased. The up-cycling covers reuse of materials, or part of materials, where these are processed, with addition of raw materials, thus gets a new function and increases the value of the original product. The down-cycling means reuse of materials, firstly decomposed, secondly used in new form or function. With this follows a decrease in the value of the product, because the alternative would be combustion (Olesen, 2021). Maintenance covers the protection of the existing components. Commonly for all of these, are the interplay with life cycle cost. As it secures an understanding of, how these approaches will influence the service of the building, whether it is for maintenance, exchange or demolition.

EMBODIED ENERGY 1:
The total need for fossil fuels based on primary energy (CEDf or PEf).

EMBODIED ENERGY 12:
The total need for non-renwable primariy energy (CEDnr or PRnr)

EMBODIED ENERGY 3:
The total need for both renawable and non-renewable primary energy (CEDnr+r or PEtot)

EMBODIED ENERGY

The embodied energy of the materials must be seen in the whole process of the service time, which encompasses production, transportation, installation, maintenance, exchange, and treatment after the service time. The embodied energy is not found directly in the material, but is related to its life cycle, why it is important to understand the stages. The definition of the embodied energy is the total primarily energy for processes related to production, maintenance and treatment of the material after the service time. The embodied energy is expressed in MJ or kWh (SBI, 2017). However, the total energy need is presented differently, depending on the energy source, among common definitions.

LIFE CYCLE ANALYSIS

The studies on the embodied energy are desirable for targeting phases, with high energy demands. For expansion of the analysis, embodied environmental impacts are evaluated. The impacts encompass the amount that must covered, which is also related to stages of the life cycle. Among environmental impacts are: Global Warming Potentials (kg eq. CO2), Ozone Depletion (kg eq. R11) , Eutrophication (kg eq. PO4) and Acidification (kg eq.SO2).

CONCLUSION

Based on the theory of circular architecture, in relation to transformation of the existing building, strategies of down-cycling, up-cycling and recycling must be introduced, to justify circular thinking. To promote the optimized solution among the strategies, calculation of life cycle cost will be used. For selection of materials embodied energy will be a decisive parameter. As for the embodied environmental impacts, the global warming potentials, will be calculated, because it carries the highest weight, in the calculation.

CASESTUDY NORDKRAFT

INTRODUCTION

The following casestudy comes as an extension of the discussion of transformation architecture and it focuses on the treatment of the preserved architecture.

Nordkraft by Cubo Architects is one of Aalborg's epicenters for cultural activities. In correspondence with the city of Aalborg, transitioning from industrial to a cultural city, several of the big factory buildings lost their purpose. Established in 1947, Nordkraft functioned as the city's main power source for 50 years. As technology advanced, the coal powered powerplant was shut down, as more efficient and sustainable solutions were growing. This resulted in an enormous building volume left without a purpose. The municipality states, demolishment of the building would be costly, therefore an architectural competition was initiated. In the competition brief, there was an interest in reusing the aesthetic of the original structure from the power plant, for the sake of preserving the cultural heritage. Combined with social activities such as sports, a library, restaurants, a cinema and other events suggested by Cubo. Nordkraft is today an integrated part of the city, leading the city's identity towards a culture and educational oriented city (Nordkraft, 2021 - 1).

During the transformation, several extensions were demolished such as the two big chimneys and other volumes. Even though the loss in volume the building today still has a gross area of 30.250m² (Cubo Architects A/S, 2012). Several elements from the existing building have been kept, preserving the cultural significance the building has had for decades. This can be seen both in the exterior and interior, where raw materials such as concrete and brick are expressed. Combined with the steel on the internal surfaces, the industrial and raw atmosphere is kept. (Nordkraft, 2021 - 2). In the establishment of an inviting building, the design operates with an inclusion of transparency. This is based on the increased use of windows both on the ground floor, but also on the upper floors, which opens the building. However, the windows are kept within the band, harmonizing with the bearing structure.

CONCLUSION

Nordkraft manages to refer to the history of previous times in Aalborg, but still follows up with the potentials of preserved architecture. The building has become a catalyst for generating activity for the inhabitants through the programming of the building, which sets a demand for the furnishment of rooms. The interest of the project was to reuse the structures, that carry the narration of the buildings previous use, which will also be reflected in the approach on the project in Svendborg.

Ill. 7 TRANSPARENT FACADE
NORDKRAFT, AALBORG

Ill. 8 FACADE
NORDKRAFT, AALBORG

DEVELOPMENT OF DANISH HARBOURS

INTRODUCTION

The following section presents the historical development of Danish harbours, from industrial areas to cultural spaces, divided in periods of the industrial harbour, the modern-day harbour and the period after, based on a report developed by Kulturarvsstyrelsen.

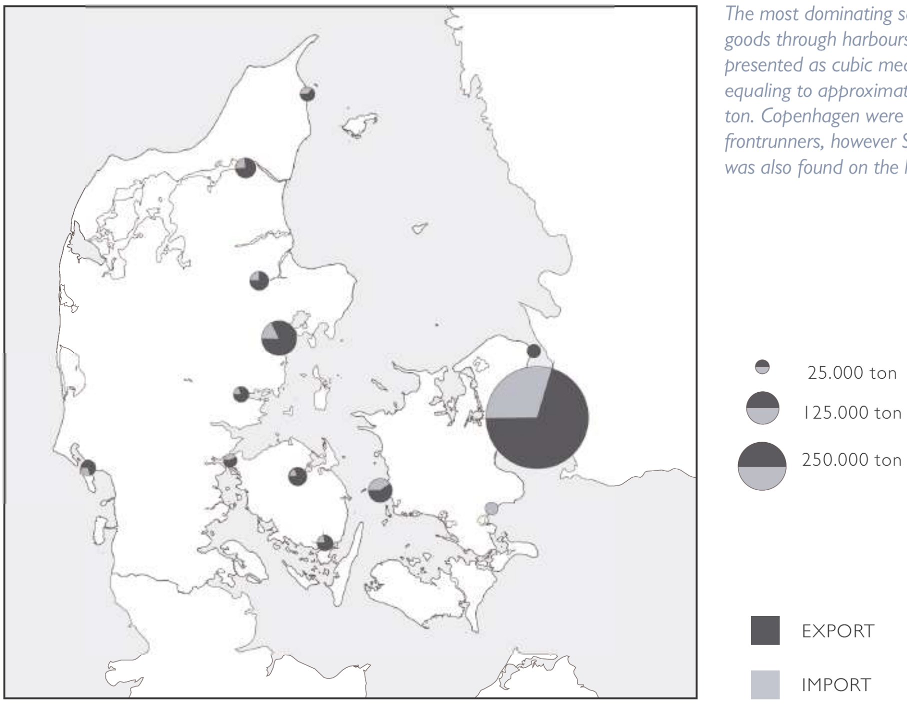
THE INDUSTRIAL HARBOURS

In the period of 1870's to 1930's there was growth in Denmark, also known as the industrialization, that was representing a transition from peasant to industrialized society. The first factories were driven by watermills, which was followed up by important drivers in terms of electrical, oil and diesel motors that pushed the industrialization. This was supported by the development in the transportation sector, from steamships to an expansion of the railway, which was the precondition for a development in the economy, as it secured better distribution across the country, but also for shipments abroad (Granov, 2021).

Towards the end of 19th. century, the industry was growing in the city, as a result of agriculture, which was going through changes, as it was industrialized, and thereby improved. Products of the agriculture were important in the establishment of the Danish market, where harbours in Denmark became important, as these were providing exchange, trade and work for the inhabitants. The period also reflected a growth in welfare and improved health conditions, with focus on renovation, sewage and drinking water, which also resulted in an increasement of inhabitants. With this development followed demands for work, food, clothing, and housing, which attracted the city life, and paved the way for, what became the urbanization (Christensen et. Al., 2007).

The factories were growing across Denmark, where a location on the harbours provided optimized conditions for distribution, conditional on association with agricultural export or import and fishery. These buildings were pushing the industrialized character into the harbours by becoming a big part of the visual appearance of the harbours. The location of firms also raised demands for harbours to accommodate shipments, e.g. with quays, cranes, tramps or railway tracks, improving the efficiency. The harbour came to appear as functionally divided, as it encompassed a fishing port, a shipyard and a commercial harbour. The first steps in the establishment of recreational life at the harbour came in the 1890s, with the introduction of the yachting harbour. This addition represented the hunt of industrial society, in experiences and fresh air. (Christensen et. Al., 2007).

The most dominating sales of goods through harbours are presented as cubic measure, equaling to approximatly 2.8 ton. Copenhagen were the frontrunners, however Svendborg was also found on the list.



Ill. 9 SALES OF GOODS 1877
HARBOUR SIZES, DENMARK

(Kulturarvstyrelsen, 2007)

THE MODERN HARBOUR

The period of 1920s to 1970s, defined a period of advancements in technologies regarding building technology, reinforced concrete, electricity, and petrol driven motors. The network of harbours was improved with a range of fixed routes, including passenger transportation. The first car ferry was seen in 1930, which also pushed the harbour in direction of experiences and culture. The area of the harbour was developed with silos and storehouses in 1950-1960s, from where development was going through a period of stagnation. The entry of the lorry became important in the exchange of goods, as it led to changes in the infrastructure, because of the flexibility of the vehicle, which supported the development of road networks. The size of the ships grew, hence only few cities of Denmark, could accommodate them, among those were Aarhus, Esbjerg and Copenhagen. The container was introduced in the 1970s, which improved the mobility of goods. (Christensen et. Al., 2007).

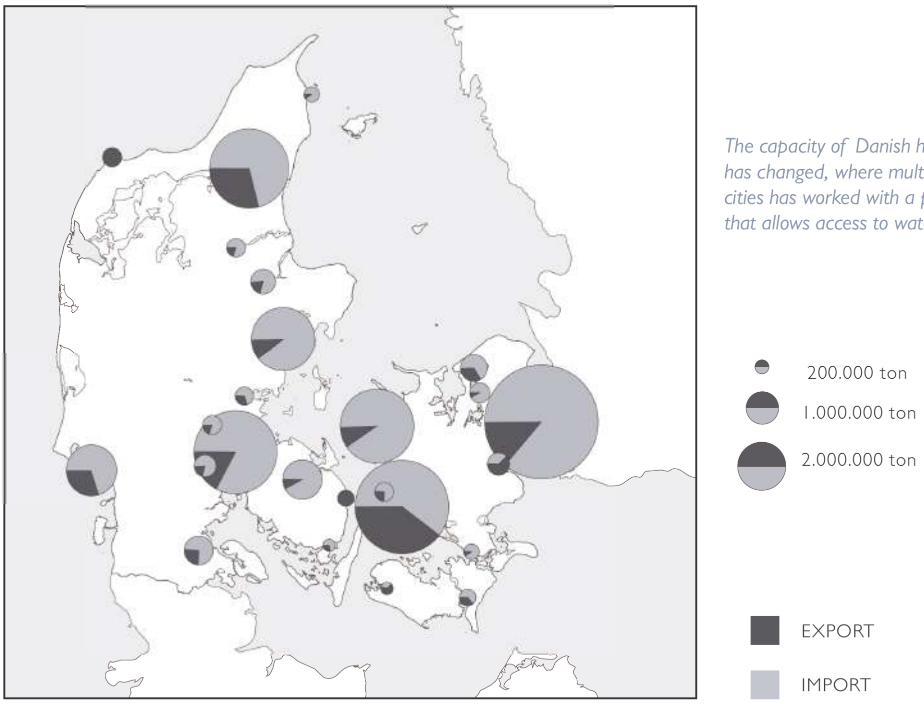
AFTER 1970

After the 1970s a range of incidences effected the development of the Danish harbour, among important ones were the crisis of the shipyards in the 1980s e.g., with a shutdown of the Burmester & Wein, previously the biggest workplace. Industrial firms were shut down and relocated, as these were serving better with lorries, leaving empty buildings. Previously, the harbour was tailored for specific user groups, and was not considered in the traditional planning of the city. However, with the unused buildings, they were now involved in the development of the city. Thereby, buildings were demolished, or restored, organized for dwellings and offices, eliminating the traditional harbour activities. (Christensen et. Al., 2007)

Today the interest in the transformation of harbours has grown, with several municipalities striving to link cities together with their harbours, among the successful ones are Copenhagen and Aarhus. The harbour represents a quality, that municipalities strategically use with the aim to stay competitive, where cities e.g., Randers, Horsens and Kolding are in the planning of, how to approach the harbours, where experience economy plays an important role in the strategy. The experience economy refers to the fusion of business and culture, from where experiences within tourism, hotels, restaurant, art, culture, and entertainment originates. Therefore, the harbour represents a potential earning source, providing a mix of offers within cultural, educational, residential, reactional, and work-related facilities, following the line of the modern harbours. (Christensen et. Al., 2007).

CONCLUSON

The Danish harbour has been important, in the development of the country, where the location has been exploited in the establishment of a market. Previously, the harbour was representing a work district, containing the biggest workspaces and employed the inhabitants. Today the harbour has become an attraction, that carries the potential of creating growth based on broad programming. This will also be the driver for the design, which must contain a mix of functions, thereby generate growth and yet still be able to emphasize the importance of the harbour in Danish context.



The capacity of Danish harbours has changed, where multiple cities has worked with a postion, that allows access to water.

Ill. 10 SALES OF GOODS 1970
HARBOUR SIZES, DENMARK

(Kulturarvstyrelsen, 2007)

III. 11 INDUSTRIAL ROOTS
HELSINGØR, DENMARK
(DANMARK SET FRA LUFTEN, n.d.)

CASESTUDY HELSINGØR

INTRODUCTION

The following study looks at a case within Denmark, that has roots to its industrial past, but today has been developed into a cultural hub through programming.

Located in Northern Sealand, Helsingør is a town historically known for its maritime landmarks, such as the ferry to Helsingborg, Kronborg Castle and harbour industry. As the industrial development had taken seriously effect the harbour of Helsingør had become known for its shipyard and fishnet factory. In the period from 1920 to 1970, the populous grew from 22.999 to 42.425 inhabitants, because of the thriving industry. Though as Asian shipyards began to be competitive it resulted in Helsingør Shipyard closing. This also resulted in a decrease of inhabitants in Helsingør, as the number of jobs were decreasing (Dupont, Grønnegaard, 2021).

To combat this decline, the municipality made changes regarding the harbour. A method used was to cultivate the existing tourism and local communities, as there were many holiday homes in the region of Northern Sealand, with only 45 kilometers to the capital Copenhagen. As mentioned Helsingør Harbour houses one of Denmark's most famous castle's Kronborg Slot and the ferry connection to Helsingør, as current tourist attractions. In this transition of identity, the old shipyard was transformed into a cultural hub, also referred to as the Culture Yard by AART Architects, where it now houses a library, cafes, street food and other cultural activities involving locals and visitors (AART, 2021). The old dock of the shipyard was transformed into, what is known today as the '' Danish National Maritime Museum'' by BIG Architects. These elements shaped Helsingør Harbour to a cultural juggernaut domestically, as many prestigious awards were given out to each project, where even The New York Times chose to highlight Helsingør as a place worth visiting (AART, 2021) (BIG, 2021).

CONCLUSION

Helsingør is an example of how it is possible to give new life to older buildings, while still preserving most of the cultural heritage, as this expresses the history of the site. Therefore, there is a wish for cultivating the original buildings, through programming. This will be used in the transformation of the harbour, to ensure the history of site appeals to contemporary development, and still is prevalent.

III. 12 CULTURAL YARD
HELSINGØR, DENMARK
(MØRK, ADAM)

III.13 DANISH MARITIME MUSEUM
HELSINGØR, DENMARK
(BIG ARCHITECTS)

THE URBAN ENVIRONMENT

INTRODUCTION

To any kind of building typology follows the idea of a certain size, that is expected. The range of typologies is what creates the diversity among the buildings of the city. The reason for the diversity in typologies could be many, but one could for sure be the time in which it is built, as well as the programmed functions. This section tends to focus on the meaning of what kind of influence, a certain building or buildings, can have to the surrounding area, including what kind of space that is created between the buildings. Through the theme of typology, the interesting part is the scale that follows with the large industrial buildings found on site, as well as how it influences the context, both in terms of the nearby area, but also in the whole city.

APPROACHES IN CITY PLANNING

Many different approaches have been used to plan our cities throughout history. The functional orientated approach in the modernism, initiated a response in the development of urban space analysis', that focuses less on the functional aspects and more on the perception of the space. The fact that it was based on the human's own perception of the space, placed this type of approach in the phenomenological field. One of the most prominent people who have spent a lot of his life studying urban spaces and how they affect people, is the Danish architect and city planner Jan Gehl. That stated a problem with the functional way of looking at city planning, were all the spaces between has got no attention, leading to his eruption in the 1960s (Dansk Byplanlaboratorium, 2016).

JAN GEHL

Through Gehl's many years of studying urban spaces, he has developed a wide set of approaches to work with the urban environment, that can help create or improve how a given urban space is functioning, as well as the comfort within it. One of them is an analysis consisting of 12 quality criteria, that is a tool to valuate a given urban space according to themes like, protection, comfort, and delighting values. Each theme consists of different criteria that tends to clarify rather or not the space is a good place to be. Through this, each criterion must show a certain standard through the analysis, for the urban space to be of a satisfactory character. (Gehl, 2010)

BUILDING SCALE

One of the criteria particularly relevant for this project, is the scale. Because the scale of the buildings found on the site is out of proportions, in relation to its context.

Ill. 14 DIFFERENCES IN SCALE
KALUNDBORG, DENMARK
(KIP REGISTRERING, n.d.)

According to Gehl, the design of urban areas must be brought into the planning of the city and work with the development of the city and urban areas, through varying scales. As the project consists of transforming existing buildings, this way of looking at the scale cannot be used directly. But non the less, the knowing of the importance of looking at the project in relation to the different scales, might have an influence on how it affects the city influences the city on different levels.

THE LARGE SCALE

This is the city seen from above, focused on the functional aspect as well as describing quarters and their connections. Looking at the site through this scale will put the project site in relation the whole city.

THE MEDIUM SCALE

This range of buildings create a certain perimeter of quarters. Therefore it works with how the buildings related to each other. In relation to the project this scale will give an understanding of how the buildings create their own quarter, as well as how it influences the context.

THE SMALL SCALE

This is according to Gehl, the key to a good urban space, as it describes how the specific urban space is perceived by the people using it. The relevance of this is the fact that the project site will become a part of an urban development, The Blue Edge, presented in the next chapter.

DESIGNING THE GROUND FLOOR

ACTIVE 15-20 doors
FRIENDLY 10-14 doors
MIXTURE 6-10 doors
BORING 2-5 doors
INACTIVE 0-2 doors

Another relevant aspect to the project is the ground floor, where the space in between the buildings must be handled according to the human scale. This leads to another study made by Gehl, that focuses on how the ground level is defining for how you perceive a given facade. Through this, 5 different categories are defined, based on the building scale, number of doors per 100 meters, and the variation in functions that the buildings contain (Gehl, 2010).

CONCLUSION

Based on this investigation the project will be seen in relation to the scales of large, medium and small scale. The large scale looks at the city, from the viewpoint of its function. The medium scale looks at the site, how the buildings are organized. The small scale looks at the space, that is created between the buildings.

02

SVENDBORG
THE CITY

| THE PAST

INTRODUCTION

The following section presents the history of Svendborg, focusing on the harbour´s impacts across generations, as an important factor in the development of the city.

The city of Svendborg was founded in the 11th century, with the background of a good and safe location in a small bay, from were trading and shipping could take place. The city grew into the next biggest city on Funen, and from here it became one of many trading towns. Svendborg is closely connected to the smaller islands that forms what today is known as the South Funen archipelago, including Tåsinge, Thurø, Langeland, Ærø and other lesser-known islands.

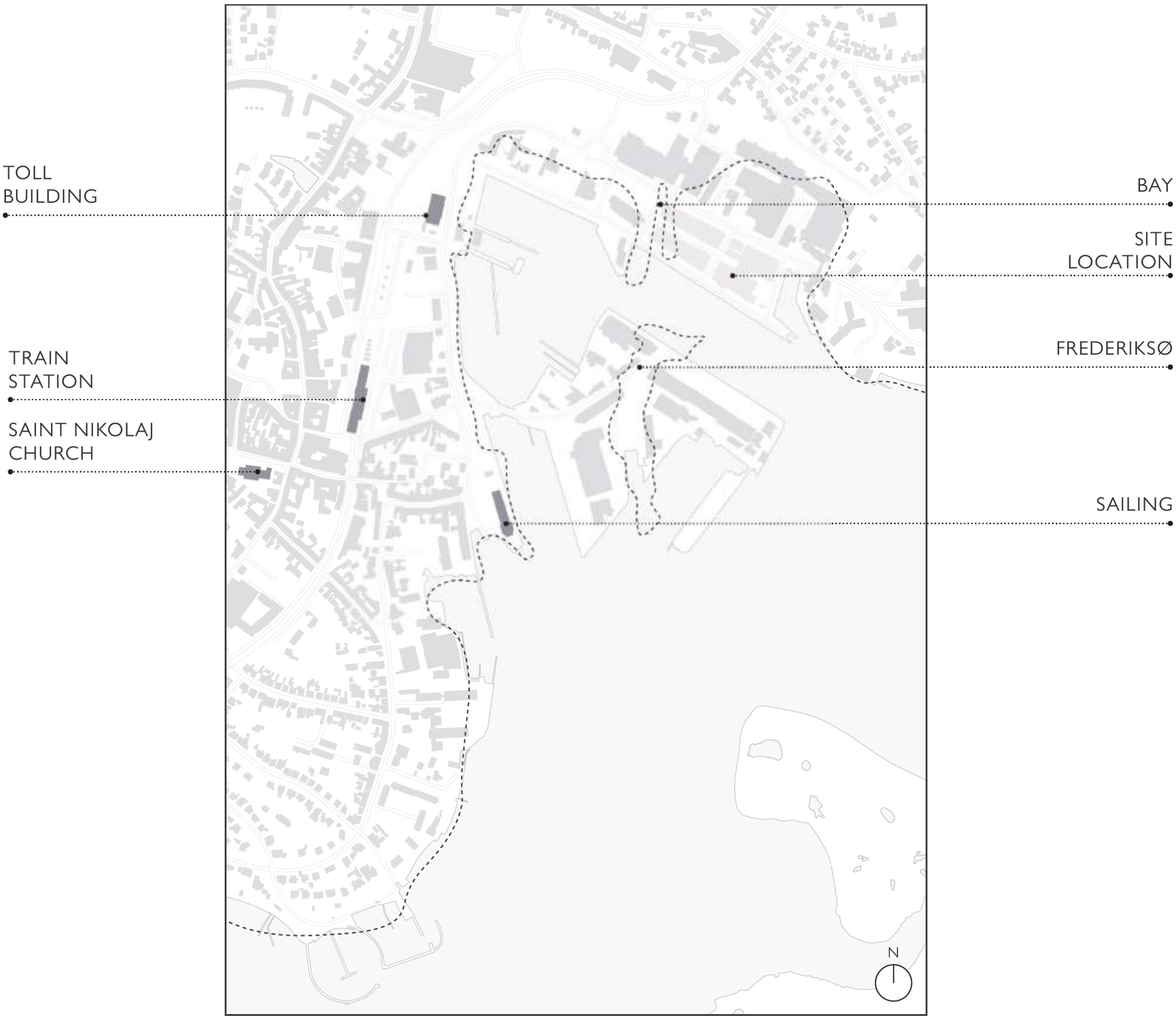
In the 15th and 16th century the city had kept growing, and had become the leading shipping city of Funen, but the city took a major setback, when it was attacked during The Swedish Wars mid 16th Century. From here, it took the city many years to recover, until they began establishing themselves as ship builders in the 18th century, which became a turning point for the city.

From here the industrialization of Denmark made the city grow, and almost half of the inhabitants of the city was working for companies within the harbour industry and craftsmanship. This evolution led to several expansions of the harbour, as there with the industry followed an increasing demand for trading ships, which also was the reason to why the navigation school opened in 1852 (Danmarkshistorien.dk, 2012). The harbour was a good location for industry, and its placement on the harbour played a big part in the expansions that Svendborg went through, as their primary transport link was by ship. Among these industries was one located on the site for this project, as they at a time had shipments to 52 countries (Svenborg Historie, 2021 - 1).

As the city once again kept growing, shipping remained a central part in the city's development leading to the opening J. Ring-Andersen's wooden shipyard in 1867 (Svenborg Historie, 2021 - 3), and later to the opening of Svendborg Shipyard in 1907, that grew into being the biggest workplace in the city, from the manufacturing of steel ships (Danmarkshistorien.dk, 2012). The shipyard went through some turbulent years, where they went bankrupt in 1925, then purchased and restarted by AP. Møller, with the plan of making it a branch of the bigger shipyard Lindø, near the city of Odense. Since that did not turn out well, the ownership of Svendborg Shipyard changed hands several times, resulting in a second bankruptcy in 1997, and once again in 2001, after a failed attempt to restart the shipyard (Svenborg Historie, 2021 - 2).

CONCLUSION

The position of Svendborg with a location within a bay, paved the way for growth in the city. From trading with neighbor islands to a broad list of countries, formed the identity, that was marked by the maritime history. The past of the city contains a local history, that must be presented in the design.



Ill. 15 SVENDBORG HARBOUR
PAST, 1842

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I THE PRESENT

INTRODUCTION

The maritime connection remains in Svendborg, as a big part of the city's identity. This is highlighted through the many old industrial buildings and shipyards remaining. This contributes to a strong sense of history and is a defining characteristic for the harbour, as some are still functioning today. But the former use of the harbour for shipping, peaked many years ago, resulting in a harbour area with fewer companies related to the maritime industry and therefore also fewer jobs. With the drop in maritime businesses following a harbour whose economy no longer shows a profit, the harbour today faces a yearly deficit on more than 5 mio. DKK. (Fremtidens Havn, 2014 - 1).

THE CITY

Svendborg city has 27.068 inhabitants making it the second biggest city on Funen and the 35. biggest city in Denmark (Bolius, 2020). But as the central city of the municipality, it acts as a link between all the inhabitants of the island community the South Funen archipelago and the mainland of Funen. As of the many connections the city holds important central functions, such as the hospital, central library, and youth educations. The city also offers higher education's such as the nursing education, and with the city's background in the maritime history, it also has the maritime educational center Simac, that educates machinist, shipmasters, and ship officers (Simac, 2021). The city has a broad spectrum of cultural offers for the inhabitants and tourists visiting the city, including two theatres, several venues, museums, galleries, and event centers.

Harbour ACTIVITIES

As the harbour is a central part of the city's identity, the harbour also takes its part in providing certain cultural experiences, other activities related to the water, and a range of restaurants. But as mentioned the harbour also acts as a link, connecting the smaller islands and Ærø to the mainland. The cultural offers on the harbour are concentrated around the small island Frederiksø, that has been made more open to the public, after it having served as the location of Svendborg shipyard through many years. Today certain activities of boat repair and other businesses related to the maritime still takes place, though it is in a much smaller scale than in the past. The Danish Museum of Yachting is found on Frederiksø, which also substantiates the maritime cultural heritage that Svendborg has.

BUISNESS AND INDUSTRIES

In relation to what kind of industries that are situated on the harbour, most of it is centralized around Frederiksøen, but also the site. Around the harbour area different offices are found, that not directly has a relation to the maritime life, among these are the Fremtidsfabrikken, that focuses on helping startup companies and new entrepreneurs. It functions as a working café, as well as containing different office spaces, that are rented out. (Fremtidsfabrikken, 2021). Restaurants and pubs also contributes to the life on the harbour, concentrated around the bridge to Frederiksøen. Closer to the site, the floating harbour office and Bølgen is located, containing distinct maritime functions, important for the sailing tourists, visiting the city.

CONCLUSION

The design must work with the variations of offers the harbour provides for the inhabitants, to contribute to an exclusive harbour. However, ensure that the new programs do not conflict with the existing, e.g. as the culture is already established on Frederiksøen.

Ill. 16 SVENDBORG HARBOUR
PRESENT, 2021

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| THE FUTURE

INTRODUCTION

The intention with the following section is to describe the future plans for the harbour and how these will be approached, from the viewpoint of the municipality, to provide an understanding of the environment, that this project is situated in.

THE FUTURE HARBOUR

As a result of the bad economy for the harbour, there has during the last decades, been a lot of talking and discussion on what should happen on the harbour in Svendborg. This process has led to the foundation of Fremtidens Havn, that presents the development plan for the harbour from 2014. With the maritime history that Svendborg has, the preservation of this history and strong identity that lies within it, is a central element of the plan for the transformation of the harbour, that will take place over the following decades. This transformation follows the same movement seen for the danish harbour cities as described in the chapter 01 (Fremtidens Havn, 2014 - 1).

VISION

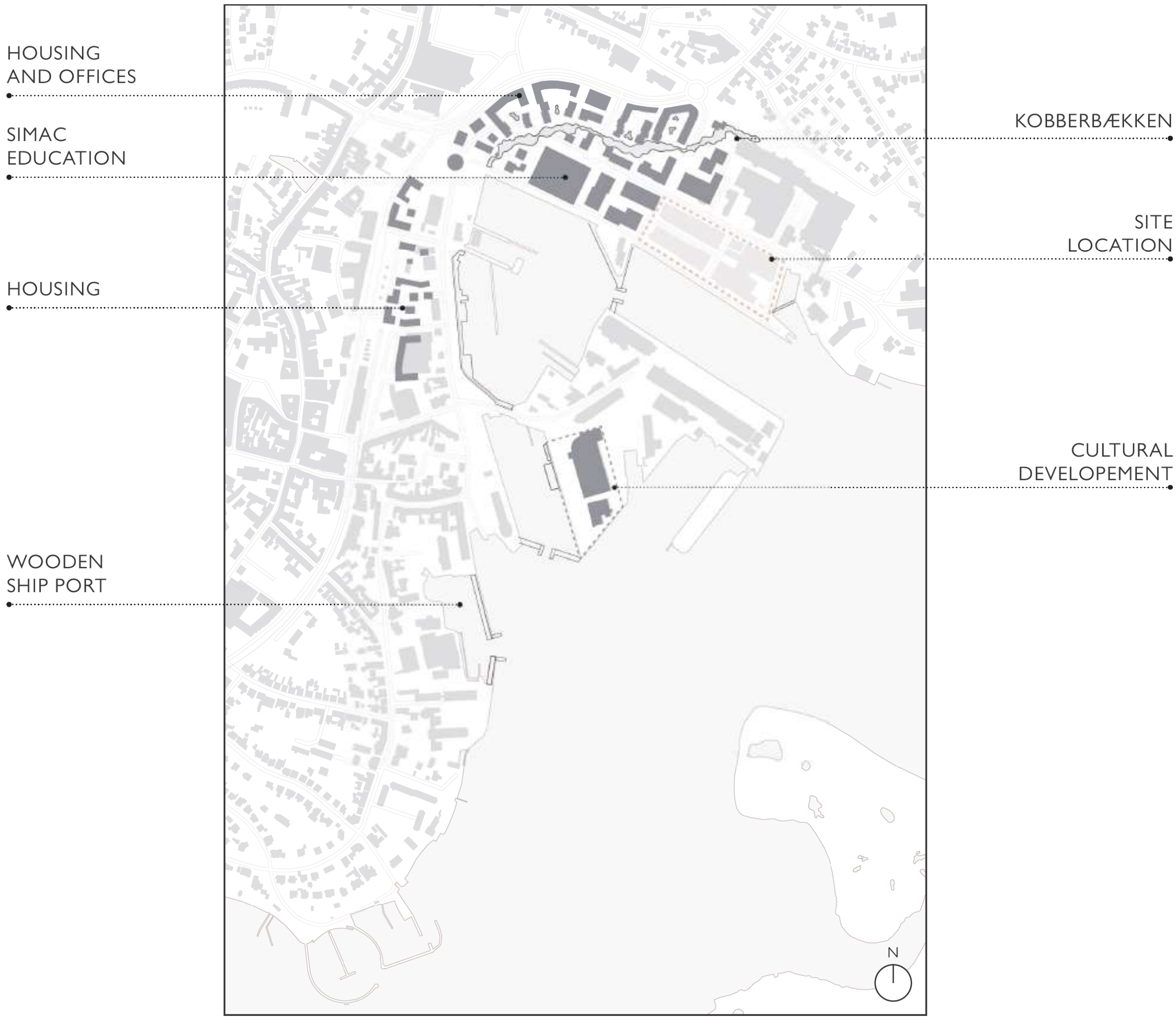
"Svendborg Harbour must be an open and sustainable district rotted in the maritime heritage – Where working places, educations and housing must function in a close interaction with the cultural offers and activities on the water". (Fremtidens Havn, 2014 - 2).

THE OVERALL STRATEDY

The city council sees a lot of potential for the transformation of the harbour, that is derived from the well preserved cultural-historic heritage, where a central element is to turn to the people, that see the potentials lying within this maritime heritage. Through this, businesses, culture and housing are going to be the three main drivers for the transformation of the harbour. In addition to the potentials for the creation of good recreational spaces will be an attractive resource for the citizens as well as tourists. (Fremtidens Havn, 2014 - 1).

AREA

The area that the transformations consider is the entire central part of the harbour, that then is divided into different areas, based on the intentions of the expected building mass' function. To this a plan has been made, explaining what kind of functions each area should contain. The general idea from the municipality relies on the creation of a harbour whose former functions interacting with newer functions on a city level (Fremtidens Havn, 2014 - 3).



Ill. 17 SVENDBORG HARBOUR
FUTURE, 2021-

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FUTURE STRATEGIES

INTRODUCTION

The plan of the future harbour contains strategies that must be considered during the transformation. Through the following section, the strategies found relevant for this project will be introduced.

BUSINESS COMMUNITY

The strategy for the business community relies on attracting smaller and less industrially heavy companies related to the maritime life, or companies wanting to be associated with the harbour. Furthermore, a part of the strategy is to expand activities related to tourism and experience economy, as the harbour is seen as the gateway to experience the South Funen Archipelago.

HOUSING

The strategy for increasing the amount of housing towards the harbour is intended to be located closest to the city, therefore the site for this project was not intended to be used for housing, though the municipality still remains open to the idea.

CITY STRUCTURE

In the new developments of the area on the harbour, the current strategy is to mix the functions of businesses and housing, placing housing on top of businesses. . Through these developments, it is their aim to create more open courtyards between the buildings, unlike the narrow and darker courtyards in the older parts of the city.

URBAN LIFE AND URBAN SPACE

For the harbour to become well connected to the rest of the city, the urban spaces are intended to act as important links, allowing visitors and inhabitants of the city to have a short route to the waterfront. Through working with these transitions, the harbour becomes a more integrated part of the city, and the city becomes a more integrated part of the harbour.

ACTIVITIES ON WATER

As the former use of the harbour has been reduced radically, the activities taking place on the water must be adjusted, through this a focus will be on good conditions for the remaining shipping activities, as well as the ferries. Furthermore, it is a strategy to create good conditions for yachting, as well as for cultural exploration of the South Funen archipelago by sea.

LANDSCAPE

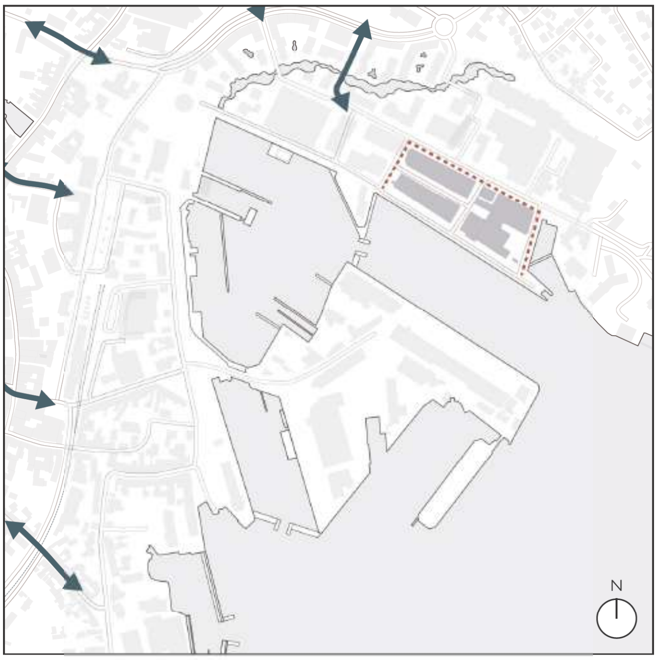
As the city is located on a hill, a strategy in the transformation of the harbour is to put a limit to the building height on the harbour, this is to see the raising of the terrain. In line with this the view towards the harbour from the city, should gradually become wider.

TRAFFIC AND PARKING

As the development of the harbour increases, the traffic load is expected to rise. Therefore, it is the plan to provide the needed access to the nearby public transport, as well as build out the bike lanes. Parking should when possible be made as parking basements.

MARITIME CULTULURAL HERITAGE

The strategy for preserving the maritime cultural heritage, relies on the harbour being divided into different cultural environments, that tends to focus on each environment and its position in relation to the harbour from a historical point of view as well as a functional. (Fremtidens Havn, 2014 - 4)



Ill. 18 CONNECTIONS TO THE CIY

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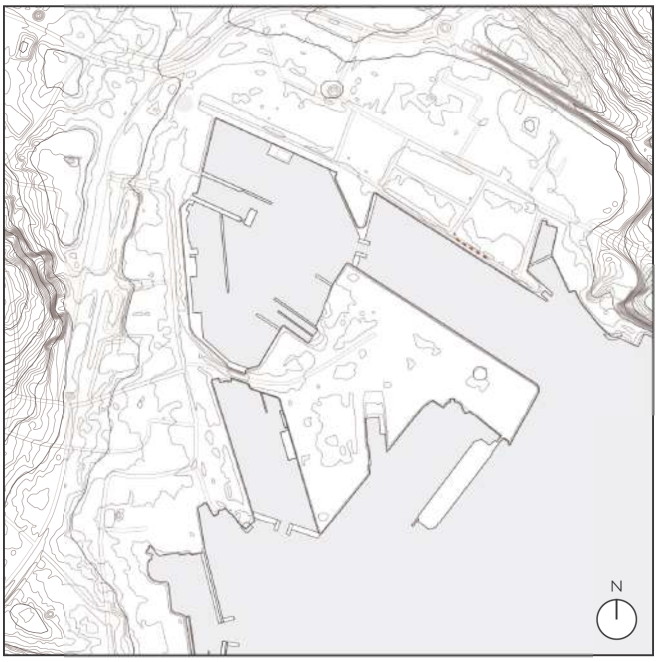

Ill.19 HEIGHT CONTOURS

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| THE CLIMATE

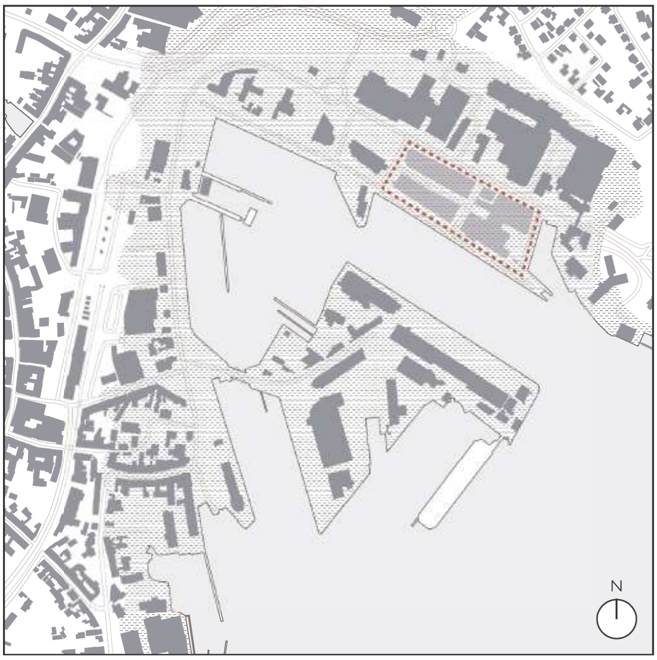
INTRODUCTION

Like many other harbour cities around Denmark, Svendborg is exposed to storm flooding, and the raising sea level. The following section looks at the climate changes, and how the municipality is planning to address the topic.

The topic is of high importance through the future plans of the harbour. Here it is the city councils' aim to ensure the survival of the harbour and nearby areas and avoid flooding that causes damage to the buildings on the harbour. Through this, the city council tends to work on sustainability through different aspects such as health and social relations, economy, environment, and energy. In 2014 the municipality initiated a storm flood analysis of Svenborg, creating the underlaying challenge. It illustrates which areas would be affected by an expected 100-year coincidence of an increased sea level up to 2-3 meters above normal sea level. Therefore, actions must be made to handle future coincidences, using long-term solutions like a dike (Fremtidens Havn, 2014).

THE BLUE EDGE

The plan for the dike is a part of the project The Blue Edge made by Effekt Architects, that won the competition put to tender Svendborg municipality. The project that both works with connecting the city along the harbour and protecting the city in case of storm flooding and cloudburst. The project has some relation to the earlier described strategy for urban life and urban spaces about connecting the harbour to the city. Though the plan for The Blue Edge is that it should join the harbour along the waterfront and making it more accessible for citizens and tourist either by foot or bicycle. Through this the harbour will be connected all the way from the beach and the green areas at Christiansminde, through and along the harbour area, and all the way to the marina, this through created pathways and different recreative areas (Effekt Arkitekter, 2018).



Ill. 20 SEA LEVEL RAISING 3M

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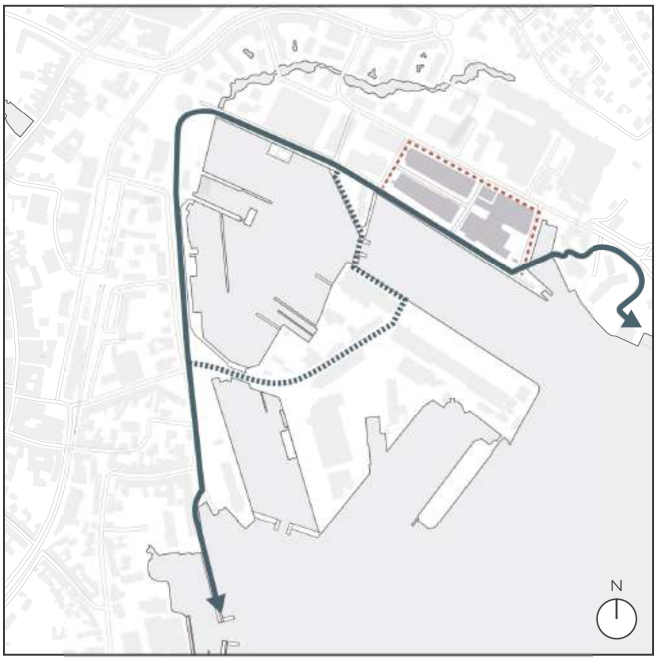

Ill. 21 THE BLUE EDGE

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THE LOCKS

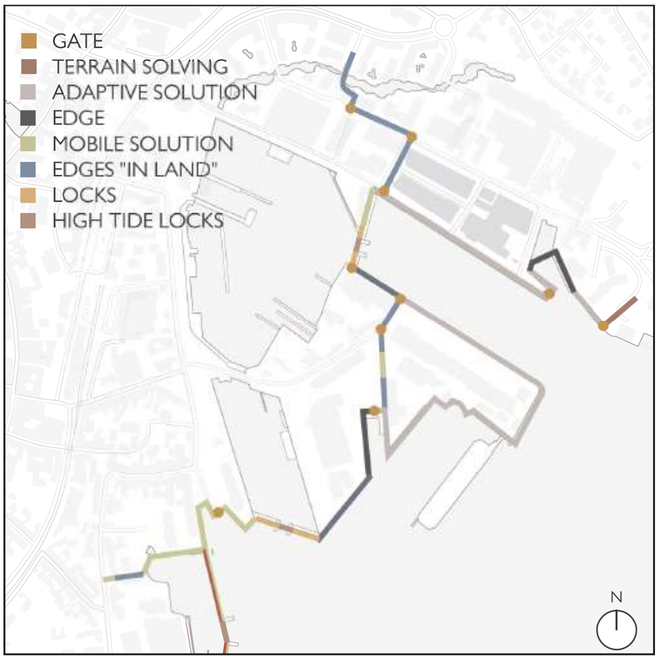
The plan is that the inner harbour should be protected by a lock system, that in case of storm flooding can be activated, to keep sea levels in the harbour to a tolerable level, to avoid the harbour area being flooded. The winning proposal works with the creation of a barrier around the harbour, rather than along it, as it originally was thought from the municipality. Through this it will be easier to work with the creation of recreational areas along the harbour. The strategy to handle storm flooding relies on the implementation of locks and dams, that combined with smaller dikes and raised edges helps creating a barrier, as seen on . The lock system is intended to be able to withstand the expected maximum rise in the sea level as previously mentioned. By the small wooden ship harbour south of the ferry terminal, the lock system will, other than protecting the small harbour, become a part of the blue edge and act as bridge. This will connect the harbour towards the round marina in the south (Effekt Arkitekter, 2018).

THE CLOUDBURST

The coincidence of cloudburst is happening more often and when it happens, they are more extreme compared to the past. Therefore, the general plan is to partly expand the sewers to be able to handle the rainwater. To ease the load on the sewer systems, it is planned that the urban areas on the harbour must contain a lot of greenery, as this will act as a delay. Furthermore, it is the plan to open the Kobberbæk, which is a small stream, currently running underground, ending in the harbour basin on Nordre Kaj. By opening the stream, diversion of the surface water coming from the higher elevated eastern part of the city would happen (Fremtidens Havn, 2014). In addition to the municipalities existing plans for handling this, the winning proposal also works with principles to handle the surface water in case of cloudbursts. Where open gutters are integrated along the harbour, to lead the surface water directly into the harbour basin and thereby easing the load on the sewers (Effekt Arkitekter, 2018).

CONCLUSION

The investigation gives an insight of how the municipality tends to handle the climate changes. The ambitions of The Blue Edge, relies on recreational facilities, that accommodates challenges through dikes and locks. As the pathway runs just past the site for this project, it is considered an essential element, in connecting this project to the city and the rest of the harbour, on a functional level. But the waterfront by the site is also a part of the protection of the harbour, explaining why it will be an element in the project.



WATER RESISTANCE

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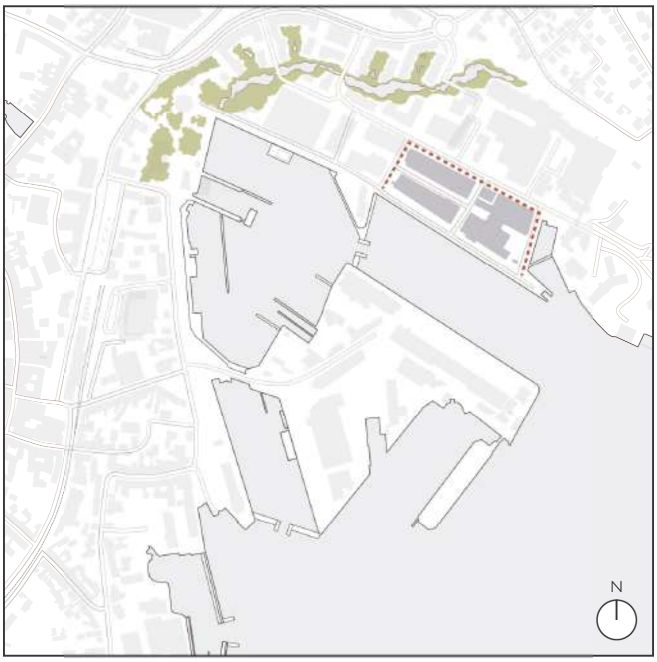

KOBBERBÆK

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Ill. 22

03

THE SITE

D I V E

INTRODUCTION TO THE SITE

INTRODUCTION

The introductory studies of the chapter belongs to the stage description, where the intention is to establish a foundation of knowledge, that describes the origin of the site, including the character of the site.

SITE AND BUILDINGS

As described earlier, the maritime culture is a big part of the city's identity, explaining why there today, spread across the harbour of Svendborg, are many well preserved buildings to be found. Together they describe how important the harbour has been for the city by providing employment, shipping, shipyards and trade, throughout history of the city.

CONTEXT

A selection of these well-preserved buildings are located at the site on Østre Kaj, where they represent the industrial part of the harbour, that is characterized by enormous industrial buildings, serving purposes within production of crops, fodder and wood pellets. The site encompassing both enormous silo buildings, administration buildings and warehouses, organized in a grid-based pattern, in functionalistic style. Beyond that, technical installations as railway tracks, weigh house, cobblestone elements and cranes are preserved at the site.

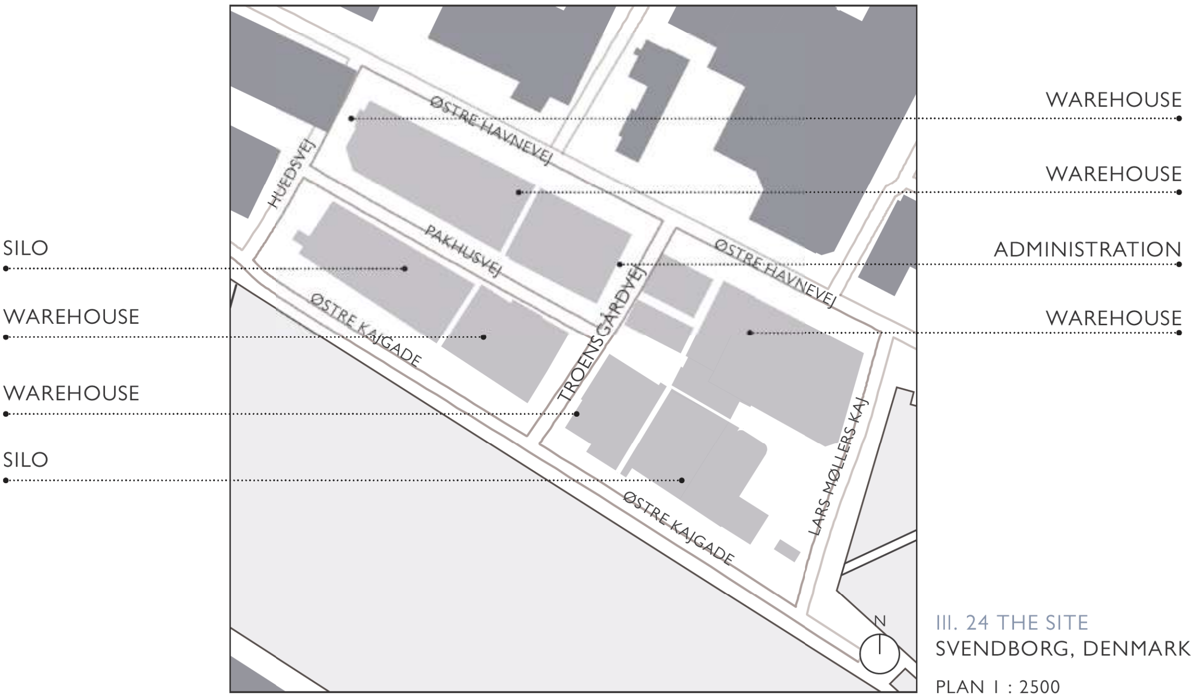
LOCAL PLAN

The site has previously been driven by the two companies DLG and FAF, but today it is only DLG that operates on the site. The municipality has a general interest in eliminate or lower the noise level coming from the heavy industrial work. DLG is the owner of the buildings on the site, but the site is owned by the municipality. Therefore, the site is rented on a contract that expires in 2027, a contract that is unlikely to be extended. The hatch is that the contract signed many years ago, stated that the company was bound to leave the site empty, once the contract expired. Going through with this, will both be a huge expenditure for the company, but the municipality also has an interest in preserving the architectural, cultural and environmental value of these. Explaining why tearing down the buildings is no option, as it is not what any of the parties want. What purpose these buildings are intended to serve, is yet to be planned, therefore there is not an actual local plan for the area, since it is an ongoing process with Slots- og Kulturstyrrelsen.

Ill. 23 THE SITE
NORTH VIEW

(Udviklingsplanen, 2014)

FACTS
SITE AREA 18162 m²
GROSS FLOORAREA 19368 m²
CURRENT FAR 106 %
NUMBER OF VOLUMES 8



Ill. 24 THE SITE
SVENDBORG, DENMARK
PLAN 1 : 2500

DEVELOPEMENT OF THE SITE

INTRODUCTION

The following text presents the development of the site focusing on the sites transition through the years. This development of the site over time, is illustrated through the ill. 25, spanning from 1895 to 1970 (appendix 1). A period, where the architecture was witnessing several changes in style, crossing periods as the historicism, the national romanticism, the new classism and the functionalism, which also was reflected on the buildings, located at the site. This also gives an indication of the diversity.

ØSTRE KAJ

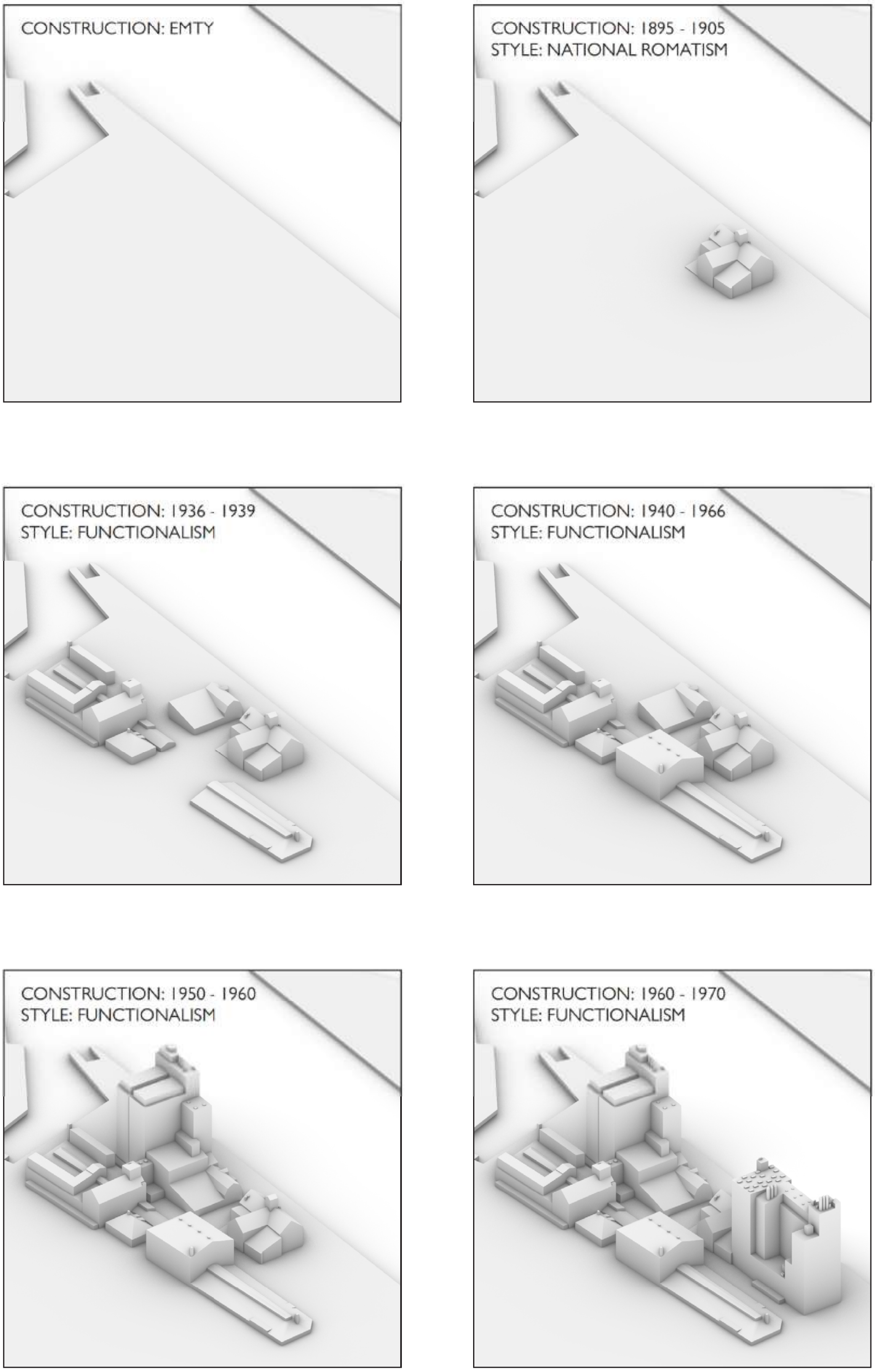
As described in the section Svendborg Past, the site for the project is located on filled land, the extension that got the name Østre Kaj was finished in 1901. The background for the extension were to fit the harbour to the bigger ships, allowing them to maneuver to and from the harbour (Svendborg Historie, 2021 - 1).

THE INDUSTRIES

Svendborg Boghvede- & Havremølle refers to the business by FAF (Maskinbladet, 2014) located at Østre Havn in 1906, that was manufacturing oatmeals. With cooperation from facilities in the form of the watermill, warehouses and residential property on site, the firm was shipping cereal to 52 countries. In 1963, a collaberation between the established Svendborg Boghvede-& Havremølle and Kelloggs located near by took place. This accelerated a growth on the site as existing buildings expanded, new production building was built, as neighboring properties were bought (Svenborg Historie, 2021). This production contributed to Kelloggs being a leading manufacturer of cereal in Scandinavia for that time span, before finally winding up production in Svendborg in 1997. In this period FAF had been acquired by DLG. As the production declined and DLG relocating functions to Kolding, it resulted in the termination of soya-based production of fodder, which was transported from South America. This left empty buildings, serving the purpose as warehouses for offloading wood pellets. In recent years, the areas have also been responsible for transportation of wood to cellulose fabrication, where lorry traffic still takes place (Søsiden, 2017).

THE BUILDINGS

Through this, the site is an area, that has involved a range of different companies throughout its history. Additionally, it has experienced the drop-in activities on the harbour, that changes the image of the site and opens for a transformation of the area, as some buildings are meant to be demolished as mentioned previously in the introduction.



III. 25 DEVELOPEMENT OF THE SITE

I ATMOSPHERE

INTRODUCTION

The following study looks at the overall impression of the site from viewpoint of the senses, with the purpose of shedding light the environment. The investigation has been written as a personal narration from the journey to the site.

"I step out of train station; I sense the past identity of the city as a market town. The terrain is falling towards, what is the harbour. I see small yet old housing, that I associate with town houses. Among those I find new buildings of present time, which typically would be sky high, yet are kept in a small scale to harmonize with the remaining city.

As I stroll by fellow people walking along the harbour, while looking at all the beautiful yachts docked in the bay, I begin to sense buildings in my horizon. What catches my eye is these colossal industrial structures. I trek towards the structures, at the same time I notice the transition from leisure to industrial area, as the yachts are replaced with cargo ships. As I approach the site, I sense the sound, from the shipyard where steel is being cut in the distance. As I transition between these two areas, I walk past a line of people. To my curiosity it is revealed that they are in line to buy today's catch from the local fishmonger. As I pass by this local activity, I begin to see what had caught my eye, as I had arrived to Svendborg. There is no doubt in my mind. It is the silos standing tall by the waterfront. One in this brutal white concrete with the DLG logo plastered on the façade and the more refined red brick silo, with relation to the old masonry techniques.

In my excitement I get disturbed. What is this noise? A new building is being raised next by the silos. This city is undergoing a development. A project, that is intended to improve quality of the harbour. How is this going to turn out, I wonder. As I approach the silos, I feel overwhelmed by the silo buildings. These monoliths used to employ the city. In my wonder, I notice, that the sun starts to show its face between the silos, as I get hit by the sun ray. I come to realize that between the silos lies all these varying sizes of industrial buildings almost like an architectural collage expressing different periods in time. An urban industrial town varying in scale is expressed here, as I also se graffiti and a mix of 1 to 3 story buildings next to the silos. Are these buildings still in use? Where are the workers? I try to get an overview of these buildings. Maybe I can divide them in concrete and brick buildings? This does not work, as there is such a much diversity in the used materials, as several technical additions have been plastered on the façade of the buildings. It is quiet here, a small humming from inside the silos can is present. I suddenly hear people shouting nearby. A group of people in front of a fitness center enjoys the outdoor workout. I begin to imagine a little pocket by the harbour of Svendborg expressing the industrial heritage, where all kinds of people inhabit the spaces."

CONLCLUSION

Based on the observations, to bring life to the site, neighboring functions are references for the establishment of life, and would be used to build bridge between the site and the remaining part of the city.

Ill. 26 IMPRESSIONS OF THE SITE

D I V E

| MAPPING

INTRODUCTION

The following text looks at site from the viewpoint of noise and infrastructure, both essential, to the perception of the site.

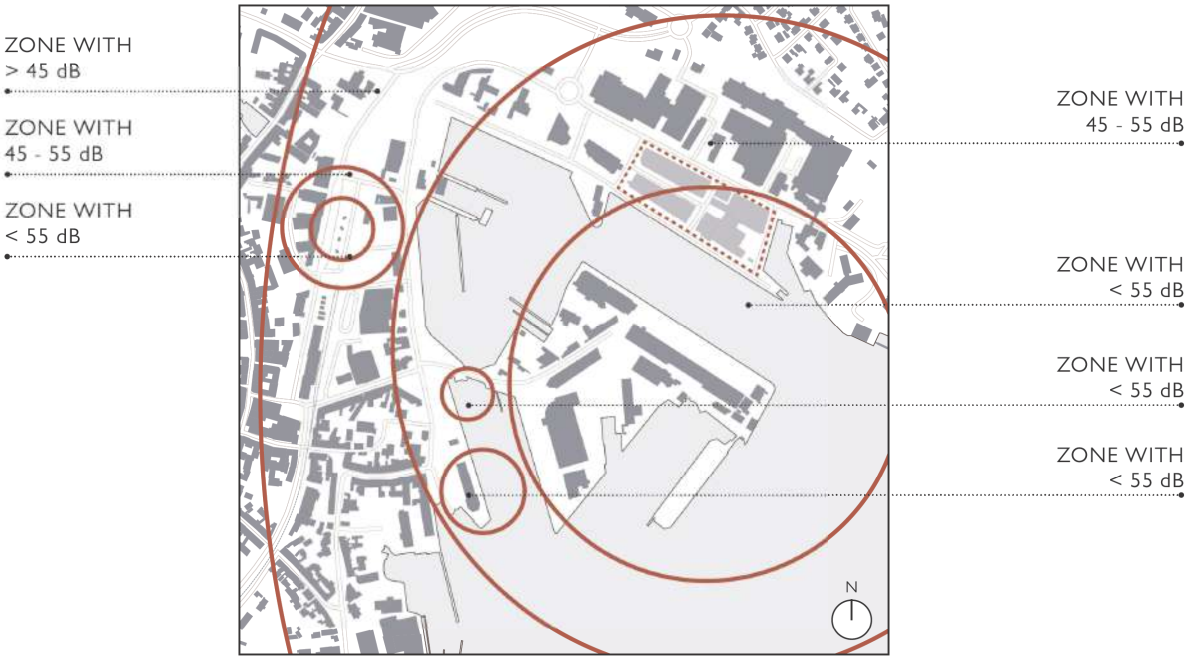
Noise is considered greatly in the establishment of an attractive environment, where placement of mixed functions successfully takes place. The statement regarding noise indicates that the site is exposed to noise, exceeding boundaries of 55/44/40 dB (A) for day/evening/night, where values are specifically reaching above 55 dB (appendix 2). Sources in the form of bus station, harbour crane, ferries, firms and roads, contributes to reaching these numbers. Importantly the shipyard located at Frederiksøen burdens the site. The elimination of activities on the site, will lessen the challenge, yet additional, as the noise sources are in the planning of being addressed.

Accessibility to the site defines the arrival of the upcoming users, as the city is planning to open towards the harbour, linking these together. The size of the volumes are challenging the sightlines and the human scales acting as a solid wall in the townscape. The existing network of roads allows users to arrive by car from Østre Havnevej to Østre Kajgade. The network was designed to accommodate heavy traffic from lorries, which conflicts with the interest of the municipality in creating an accessible harbour, appealing to the broad group of inhabitants. The pedestrian network has been given a low prioritize at the site, which further is supported by gates, that rejects inhabitants.

Parking spots are mapped out, as this will be an aspect to be addressed, where buildings, as it looks now, are organized with parking spots above mainland. However, SIMAC is intended to be raised with a multi-story parking car park (Fyens Amt, 2018).

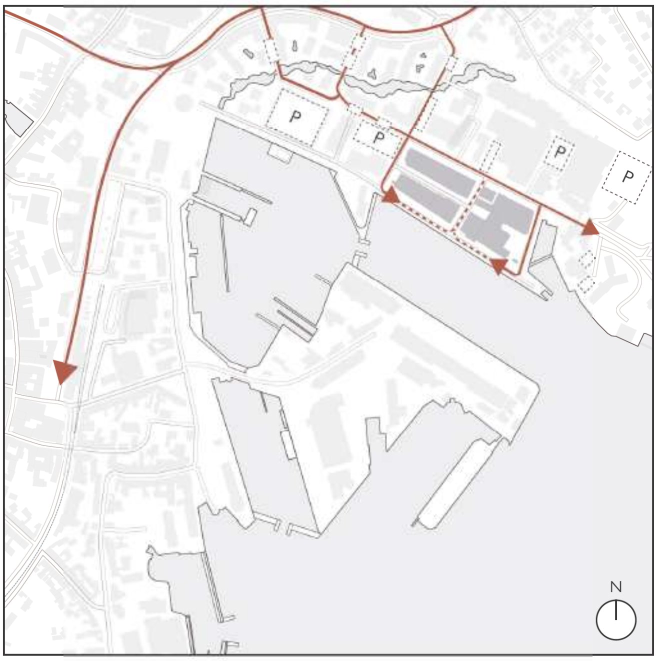
CONCLUSION

Noise studies showcases the demand for future designs, that can have noise reduction attributes, as noise could disturb future placement of functions. The accessibility of the site, indicates, that site prioritizes heavy traffic, and thereby overlooks pedestrian traffic, which must be accommodated. Parking spots will be an issue to be considered, as this also will affect the circulation on the site, which will be investigated further.



Ill. 27 NOISE POLLUTION, DAY, 07 - 18

1:10000



Ill. 28 ACCESSIBILITY & PARKING

1:10000

D I V E

LOCAL CLIMATES

INTRODUCTION

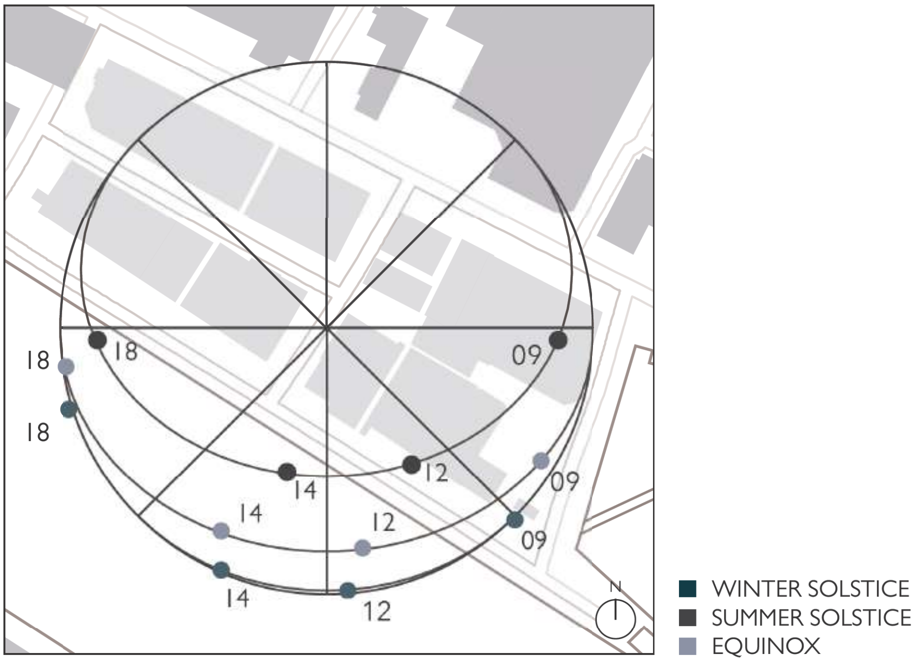
The following text looks at the climate on the site, from the viewpoint of sunlight hours and wind, as these aspects will be decisive in the organization of functions.

The site is organized with enormous buildings located at Østre Kajgade, which are oriented towards south, without obstacles throwing shadows. This means, that these building are exposed to sun, that from a technical viewpoint provides active and passive heating possibilities. Where the materiality of buildings raised, in robust materials, with good properties regarding heat storing capacity also helps. However, buildings placed behind, are challenged, because of the size, of the buildings placed in front. During the summer period, the angle of the sun, manages to shed light on the majority of surface, because of its high position. The buildings behind, located at Østre Havnevej, are placed within shadows, where the access to sun is critical, especially during winter, with the low position of the sun. Few parts of these buildings do get access to sun, however, this is on the rooftop. The distribution of sun, defines, the restrictions, of where functions should be placed. The alternative is, that buildings or parts of these should be torn down, for the purpose of providing better access to sun. Although, this wouldconflict with the high values within preservation, that the buildings carry (appendix 3).

The analysis of wind, indicates, that the dominating wind direction is switching, depending on the season of the year. The wind rose for a period of a year indicates, that the wind, will be coming from the west and southwest. However, the wind, which especially appear as strong at waterfronts, influences the experience of the outdoors space. However, there will be a focus on natural ventilation, which will be utilized during the summer (appendix 4).

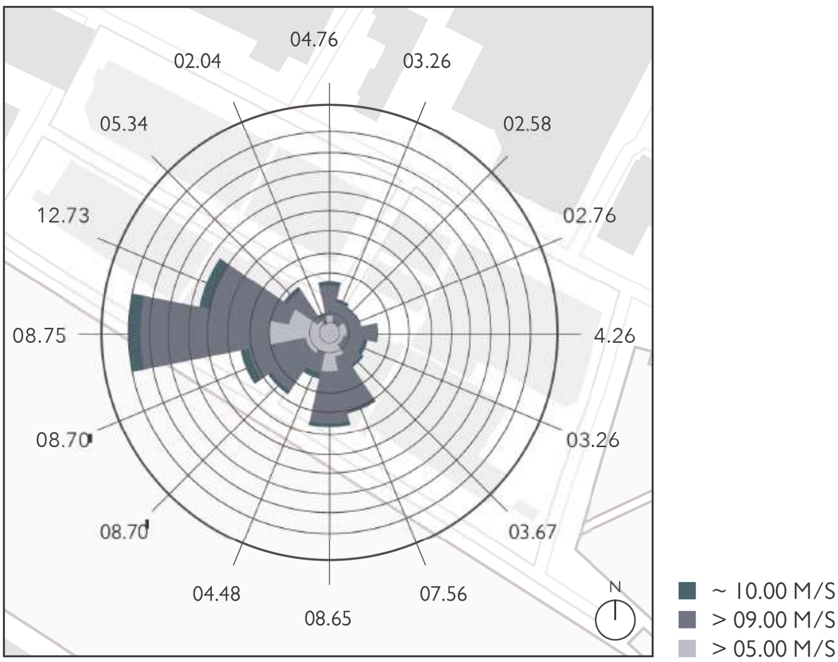
CONCLUSION

Based on this study the access of sun, will define, the placement of functions. The position with exposure towards south for a range of buildings should be turned to inclusion of active and passive strategies. With wind, the intention is to ensure, that design of windows will accommodate natural ventilation and that outdoor spaces can provide shelter in case of strong winds.



Ill. 29 SUN POSITION

1:10000



Ill. 30 WIND CONDITION

1:10000

Ill. 31 LOCATION OF PHOTOS

D I V E

VISIBILITY OF THE SITE

INTRODUCTION

This section presents the results of the site analyzed in relation to the influence, that the buildings have for the city in terms of its visibility, but also how the volumes influences the nearby area. Furthermore, it will present how an analysis made in relation to the ground level, explaining what aspects related to the small scale that must be handled, during the process of transforming this area.

The two silo buildings, Østre Kajgade 11 and Østre Kajgade 25 has an extreme size related to the size of Svendborg as a city. Which is why the site can be seen from a distance, caused both by the sloping terrain towards the harbour area, but also because the highest building rises to 45 meters. Of the two silo buildings, Østre Kajgade 11 is the one taking the most visual attention, as the construction in light gray concrete makes it appear more clearly. To illustrate this visibility of the buildings images has been taken towards the site, from different locations around the city and island of Tåsinge and Thurø. With the fact that the area is as visible as it shown, makes it a big part of the image of the harbour. But with the distances it can be seen from around the city, also makes it a part of the image of the city itself and demolishing it would change the identity.

CONCLUSION

This sets demands for the building, which must respond to its position. As it in present time of Svendborg is associated with industry, that is not related to the inhabitants. The buildings should be a symbol of previous times, raised to the standards of today.

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Ill. 32 SERIES OF PHOTOS

D I V E

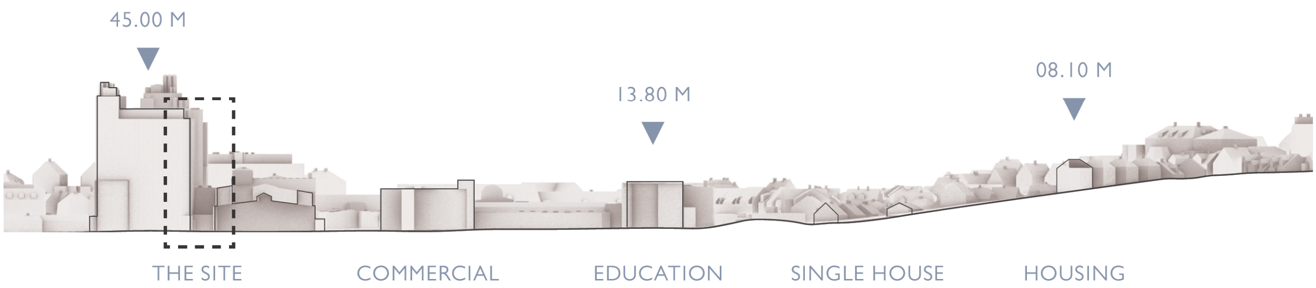
I SECTIONS

LARGE SCALE
When the buildings on the site are as visible as they are, it is because of the contrast that appears, related to the buildings in the near area. Through working with the typologies and their related dimensions, in both plan and section, it is shown how the footprint and built height varies. Though this it is revealed how big of a contrast especially between Østre Kajgade 11 and 15, respectively the silo and warehouse, is to the villa area in the eastern part of the city, even with the raising terrain from the site towards northeast. Furthermore, these large industrial buildings show a big contrast to the nature area along the coastline east of the site, as shown in ill. 33. Through the same section, the future Simac educational center is with its 5 stories still a minor scale, compared to the two buildings on site.

SMALL SCALE
The buildings found on site is arranged in a way so the form an internal grid structure of access roads, made for trucks to handle the crops going to and from the area. This space between the buildings is heavily dominated by the tall buildings raising towards the sky, as presented on ill. 34 Through analyzing the cross sections on different parts of the internal grid, it is revealed that the sections on different parts of the site, shows a big variation in terms their appearance, this caused by the variation in the scale represented internally between the buildings on the site. This analysis of the sections presents the sense of staying on the spaces within the site, and how the streets will be interacting with the ground floor of each of the buildings (appendix 5).

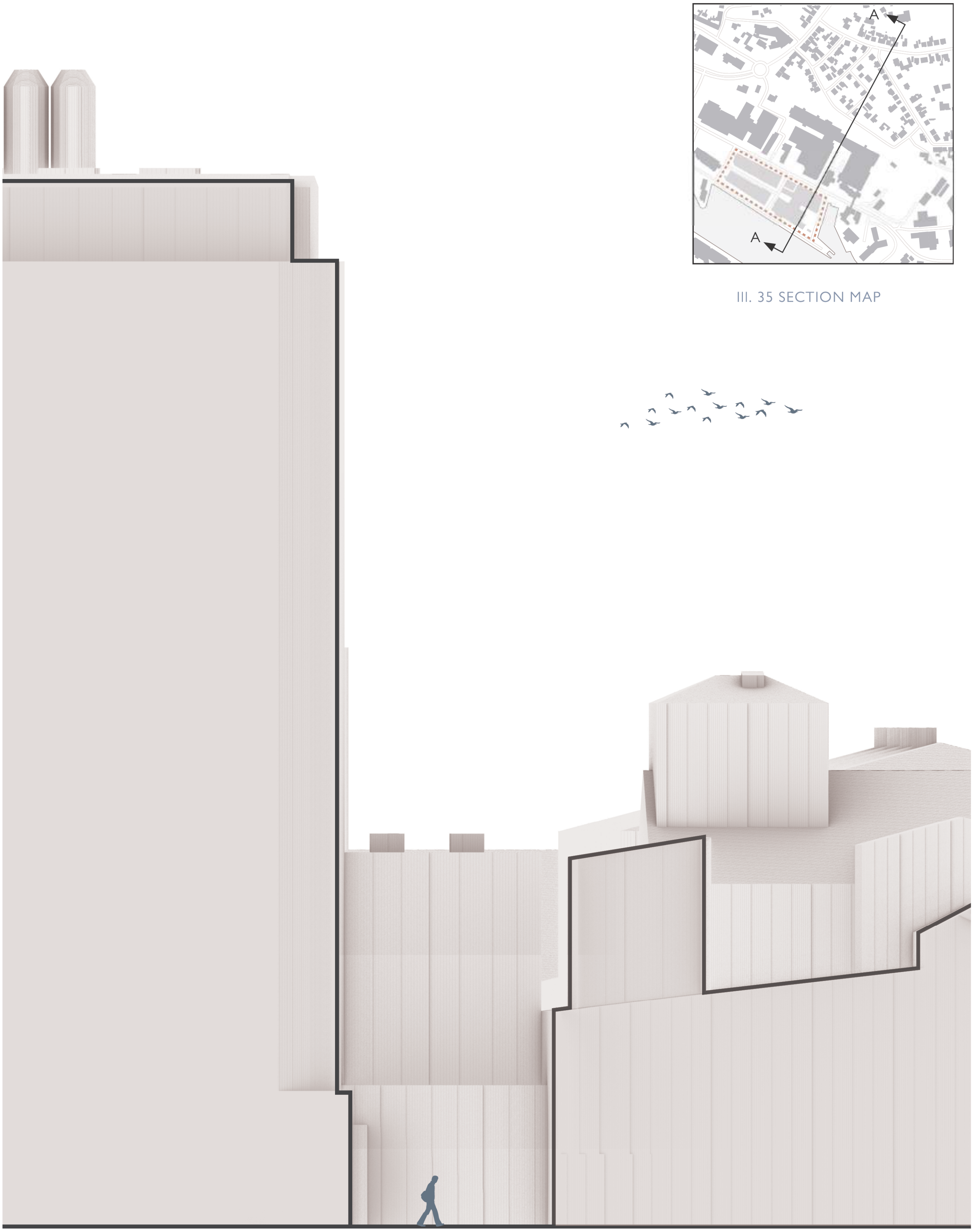
CONCLUSION
The analysis made on the scale of the build environment speaks for themselves, as the analysis on the visibility of the site reveals that the buildings on the site can be seen from multiple locations around the city, variation from shorter to longer distances. Highlighted dimensions reveal a rather large diversity among the scales.

SECTION A - A
1:200



Ill. 33

SECTION A - A [THE SITE]
1 : 200



Ill. 35 SECTION MAP

Ill. 34

I INTERPRETATION

INTRODUCTION

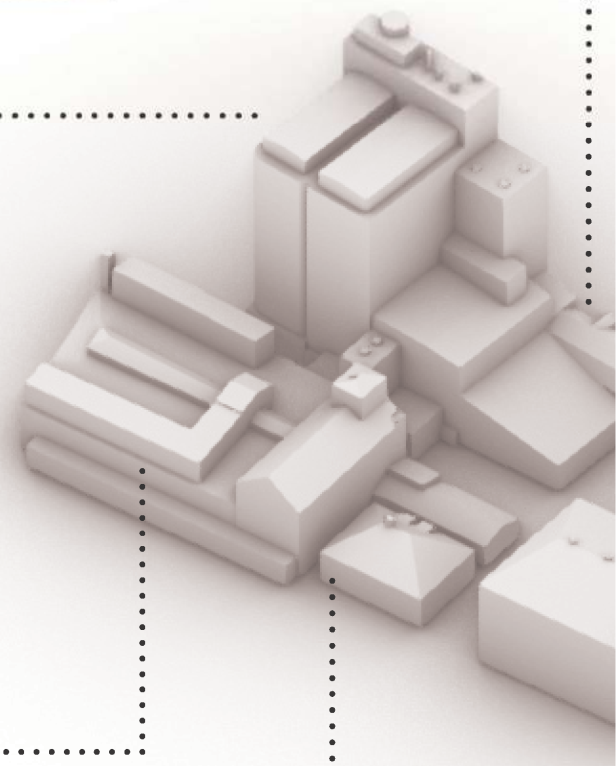
The following section represent the interpretation stage of the DIVE analysis, where there is a focus on exploring the buildings integrity and authenticity, its significant and communicative contents. The site is organized with multiple volumes, in several distinctive styles, functions and timestamps. The study highlights characteristics of buildings found on the site.

ØSTRE KAJGADE 23

This is one of the older buildings on site constructed with bricks. The building has previously served the purpose of warehouse and weighing booth. Also been through countless renovations and additions to the existing structure, some resemblance of historic value is found through its detailing on the façade and gable roof. However, this in contrast to the surrounding brick buildings on site, its authenticity is not as prevalent.

ØSTRE KAJGADE 25

This building is built in the 1950s and is the second biggest structure on site, it stands as a contrast to Østre Kajgade 11, as a mix between concrete and brick. The impression of the building relies on elevated level of detailing with mullions, openings, gates, secures a sense of transparency in terms of authenticity, as the overall condition of the building is maintained, even though some additional volumes has been added on.



ØSTRE HAVNEVEJ 12

This is one of the buildings that has been through most changes. From a raw brick façade and several openings, the building now has had several additional volumes on the roof, walled up openings and a painted facade. This todays makes the original building hard to decode. It shares the same motive as Østre Havnevej 15 with a less stringent geometric footprint. The buildings overall conditions are not great with graffiti on the façade and holes through the roof.

ØSTRE HAVNEVEJ 10

This is the smallest volume on site, this building decorates the site with a petite size, yet with details praising symmetry, arches, and older masonry techniques. The building expresses is prior staff and administrative functions, as the house expression is used.

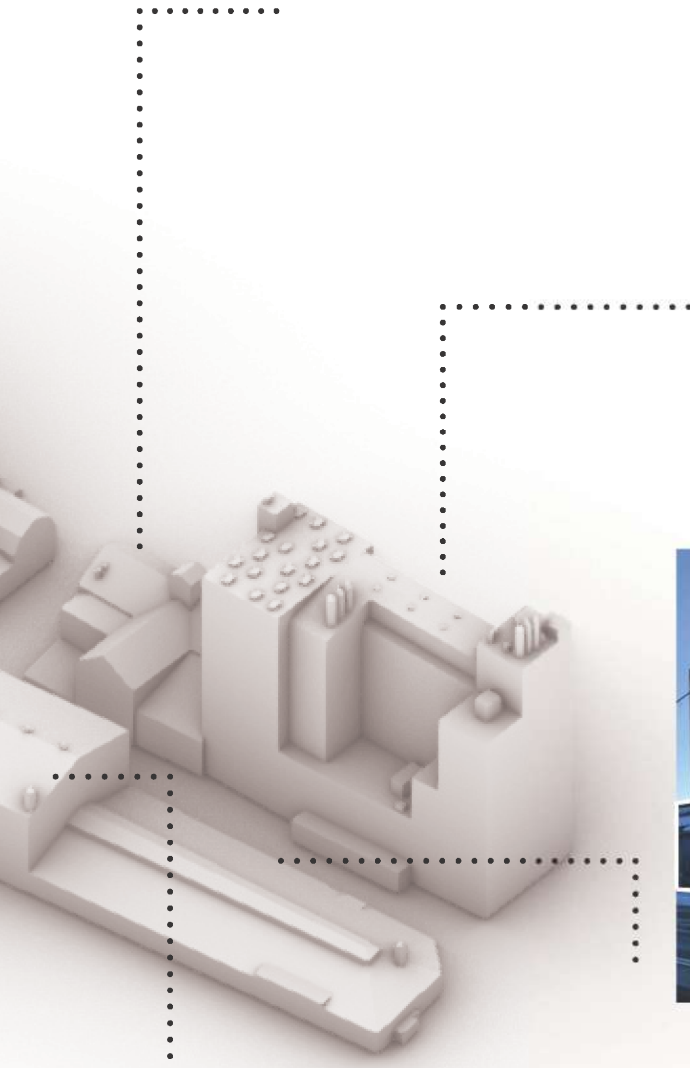
Ill. 36 PHOTOS OF BUILDINGS

ØSTRE KAJGADE 15

This is the oldest building on site, it still standing as well preserved on the site.. With ornamental motives in the brickwork through the arch and gable in openings and roof, where the building stands as a time capsule from the beginning of the 20th century. Beyond the dominance of brick, wood is used in openings, in combination providing variation of tactility. By having the vertical bands in the façade protruding outwards, it creates a depth to the overall design.

ØSTRE KAJGADE 11

This building is the latest built structure on the site. Besides its huge mass, with its white and simple exterior it stands out on site. Built in the beginning of the 1960's and as the singular building in concrete, it narrates the shift of material usage. Since its construction, the overall function and aesthetic has not changed, besides the logo on the façade, as it was previously owned by FAF, before DLG bought the company.



ØSTRE HAVNEVEJ 6

This building previously served the function as a warehouse. Being built before the 1960's few changes to the overall structure has been made, with some openings walled up. Lack of maintenance is prevalent through graffiti on the walls and moss on the roof. The buildings overall condition is not that great compared to others on site.

ØSTRE HAVNEVEJ 8

This building is raised in brick and it is one of the newer warehouses on site, sharing the same level of detailing as Østre Kajgade 15 with an addition of circular openings. The building reflects previous times, with its stringent expression with dominating extruding bands, creating vertical lines in the façade, leaving the expression as compact and neat. Today openings have been walled up, which indicates a change in function.

CONCLUSION

As mentioned, each building is different and has been going through changes with varying number of additions, as the industry on site has transitioned. This has either changed its functions or changed its original expression. A tendency is that these additions were a result of a present need, back when the industry was running. Therefore, the focus was on establishing physical frames for expansion, without planning of the architecture, the function was prioritized. There is a wish to keep the original buildings, therefore a chart has been made to compare and summarize the level of architectural quality, authenticity and condition, that has been preserved on each building. The chart does also visually map out additions to original buildings, highlighted with a red color.

Architectural quality – is considered as, the buildings significance and communicative content. The buildings vary in their presence as storyteller of previous time, why these do not share the same value, as buildings worthy of preservations. The scores are based on the ratings of the city council (appendix 6).

Authenticity, when it comes to reusing buildings, investigating the changes the building has underwent is important, as it gives insight of how much of the building that must be preserved. Additions to the original building blur the original structure, since there is a wish to use original buildings. From the viewpoint of authenticity, the buildings vary, as the buildings do not serve the purpose, as they used to, openings in the buildings have been covered. The score of the authenticity is based on following questions:

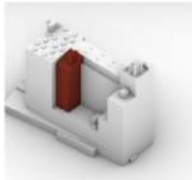
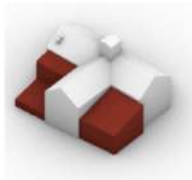
Is the original design of the building visible?
Is the original design of the building with openings kept?

Condition refers to the intention of reusing an older structure, it is important that the current state of the building is good, in terms of build quality, the construction and expression. The construction tells rather the construction is vulnerable. The appearance of the building will also have an impact as theses building have gotten a new patina or vandalized. Looking into the condition of each building on the site, would give an insight, to what degree, buildings must be renovated. The score of the condition is based on following questions:

Is the building from a constructive viewpoint, still kept?
Does the interior of the building appear as in bad condition?
Has the building been vandalized?

The volumes mapped out with red represents additions, that hides the original building, and thereby its authenticity. These will as a principle be removed, with the potential of being reused. Based on the score, Østre Kajgade 25, Østre Havnevej 10 and Østre Kajgade 15, would carry structures, that would require less interventions. The remaining building, Østre Kajgade 11, Østre Kajgade 23, Østre Havnevej 12 and Østre Havnevej 6 would require higher interventions. However, this will be valuated furtherer. that would require less interventions. The remaining building, Østre Kajgade 11, Østre Kajgade 23 and Østre Kajgade 12, would require higher interventions. However, this will be valuated further.

Ill. 37 RATINGS OF BUILDINGS

ARCHITECTURAL QUALITY	BUILDINGS AUTHENCITY	CONDITION OF BUILDING	BUILDINGS ADDRESS
LOW	MIDDLE	GOOD	 ØSTRE KAJGADE 11
HIGH	MIDDLE	GOOD	 ØSTRE KAJGADE 15
LOW	MIDDLE	GOOD	 ØSTRE KAJGADE 23
HIGH	MIDDLE	GOOD	 ØSTRE KAJGADE 25
LOW	LOW	BAD	 ØSTRE HAVNEVEJ 12
HIGH	MIDDLE	GOOD	 ØSTRE HAVNEVEJ 10
HIGH	MIDDLE	BAD	 ØSTRE HAVNEVEJ 8
VERY LOW	MIDDLE	BAD	 ØSTRE HAVNEVEJ 6

I INSTALLATIONS

INTRODUCTION
A part of the area's identity is visually found within the technical installations found throughout the site. The installations are of varying character and appear through a variation in dominance. In the following section these symbols of the industrial lifetime of the buildings are investigated, creating an understanding of their importance for the identity of the area.

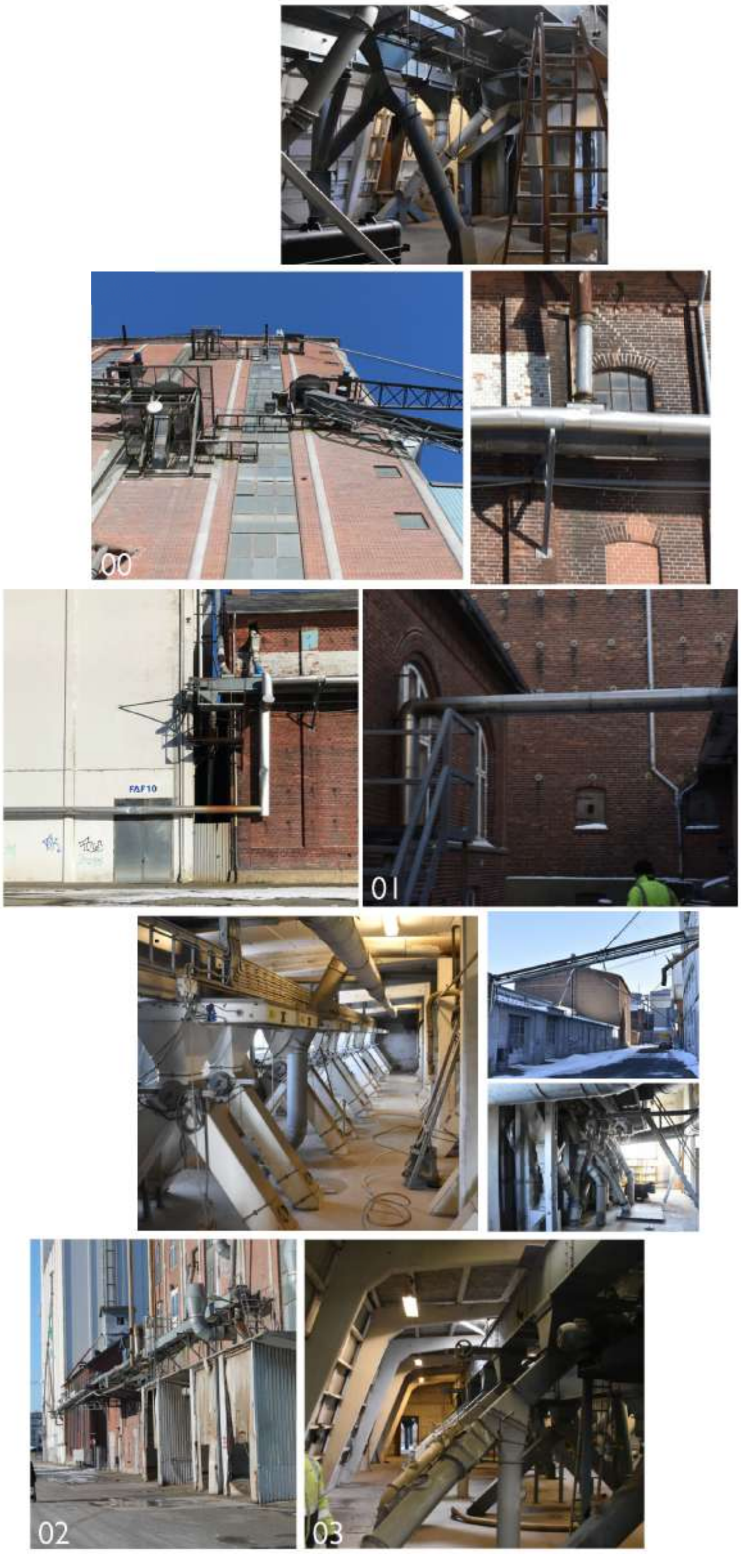
CRANES & PIPES
Among the installations that can be mentioned as some of the most prominent installations, are the cranes placed on the harbour side of both Østre Kajgade 11 and 25. In both cases the cranes break up the facades and the simple geometric shapes behind them, creating a more variegated expression of the buildings, making it a part of the building's identity.

PIPES
Another prominent installation to be found on the site, actually consists of multiple elements, though it in relation to its meaning of the site, is considered as a unified element. Because the buildings actually has a physical connection through each other, in terms of the installed piping running to and from the different buildings. The connections comes, from a former functional demand and describes the functional interplay between the buildings.

STEEL PLATFORMS
Along the harbour a series of pipes, connects the buildings from Østre Kajgade 25 to Østre Kajgade 15, creating a tray that connects the buildings. The tray defines defines the entrance to the site, by the water side.

INTERNAL INSTALLATION
Throughout the two silo buildings of Østre Kajgade 25 and Østre Kajgade 11, the existing decks are organized with machinery that runs the distribution of the crops. In the same sense as the external installations, they must be removed to implement the desired functions.

CONCLUSION
The technical installations represents a big part of the history of the area, explaining why tehy are considered as important elements, in the preservation of the area. To the consideration of preserving some of the technical installations, it must be considered whether they will influence the desired function. For the cranes, the difficult part in the preservation of them, could be that these are located on attractive spots, mounted on the southwest oriented façade of the two silo buildings. The piping, that runs between the buildings are found to be an element worthy of preservation, because of the story it tells, of how these individual building volumes has worked as one unit. To this it must though be considered that the time has left its trace on the piping, setting a clear demand for the piping to be secured to avoid it from falling down.



// 00. CRANES
// 01. PIPES
// 02. PLATFORMS
// 03. MASHINERY

III. 38 INSTALLATIONS OF THE SITE

The following section represents the valuate stage of DIVE, where the development potentials, capacity for change are considered, but also tolerance of the buildings are measured. Buildings are presented with building charachteristics, and building qualities. This analysis will supply material for further user investigations.

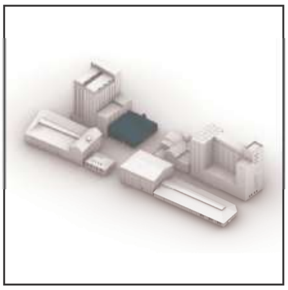
D I V E

ØSTRE KAJGADE 23

BUILDING CHARACTHERISTCS

HEIGHT: 11M
GROSS AREA: 1110 M²
NET AREA: 1411 M²
INT. CONSTRUCTION: STEEL

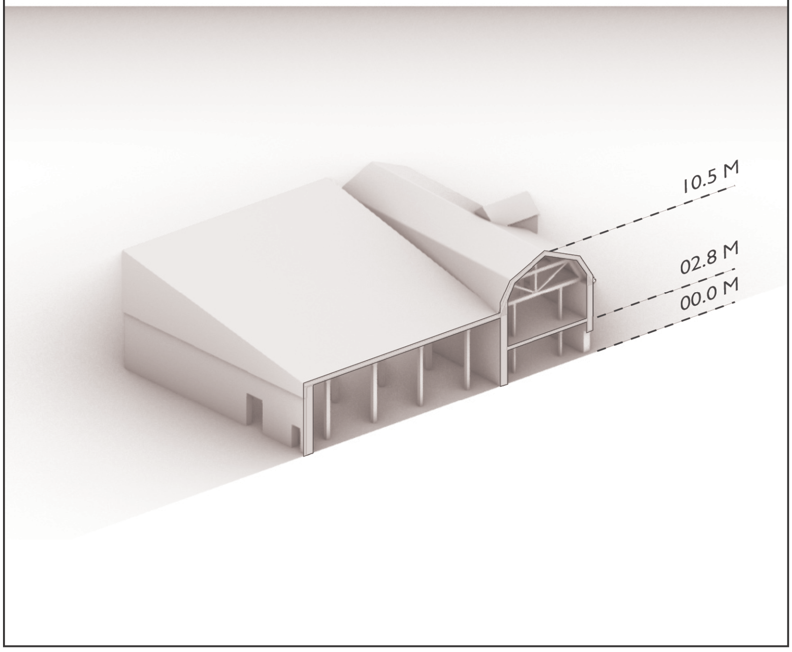
Østre Kajgade 15 has an unobstructed view, though only consisting of one level, the housing is not an option, where public functions could benefit more from the exposure. By being built integrally in steel in a grid structure and a load bearing wall with a tall room height. There is a high degree of flexibility inside the building. The building relates a lot to the buildings on Østre Havnevej, Therefore It would be beneficial to integrate a connection, so that functions can benefit from each other.

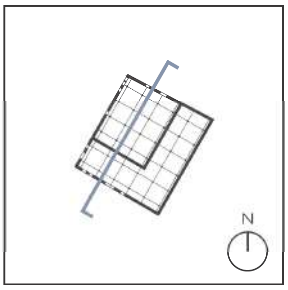


III. 39 AXONOMTERIC SITE

BUILDING QUALITIES

VIEW TO HARBOUR: YES
STRUCTURAL FLEXIBILITY: YES
SUNLIGHT HOURS >5 HOURS: YES
LEVELS < 3: YES
LEVELS > 3: NO
HEATED SPACE: NO





III. 40 GROUND FLOOR [1:1600]

III. 41 WAREHOUSE AXONOMETRIC SECTION

ØSTRE KAJGADE 15

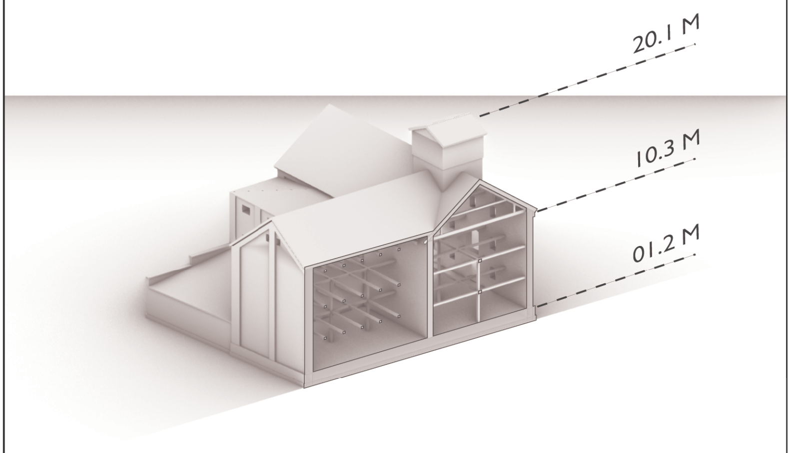
The position in first row creates an unobstructed view across the harbour and provides a direct access of sunlight from the south. This is considered not to be ideal for housing, because the apartments would be located close to street level by the waterfront. The internal structures can transform into fitting the desired inner layout, as it is an internal grid structure with load bearing walls. Furthermore, the small openings could be made bigger to reach a proper daylight level inside the building, as the robust outer brick wall should be able to accommodate that transformation. By the building being placed at the waterfront, activities who could benefit from the exposure would be a consideration, when transforming.

BUILDING CHARACTHERISTCS

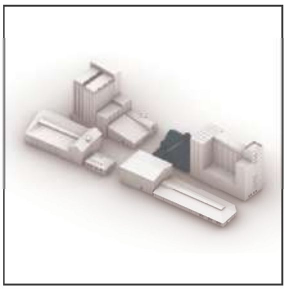
HEIGHT: 20 M
GROSS AREA: 1271 M^2
NET AREA: 706 M^2
INT. CONSTRUCTION: WOOD

BUILDING QUALITIES

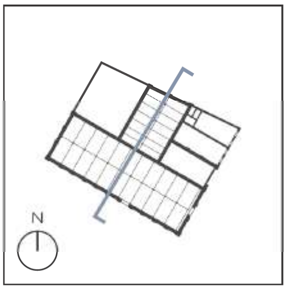
VIEW TO HARBOUR: YES
STRUCTURAL FLEXIBILITY: YES
SUNLIGHT HOURS: YES
LEVELS < 3: YES
LEVELS > 3: NO
HEATED SPACE: NO



Ill. 42 WAREHOUSE
AXONOMETRIC SECTION



Ill. 43 AXONOMTERIC SITE

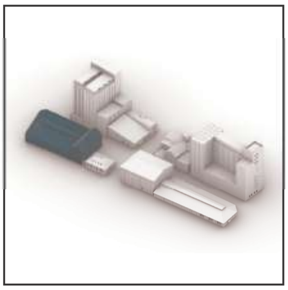


Ill. 44 GROUND FLOOR [1:300]

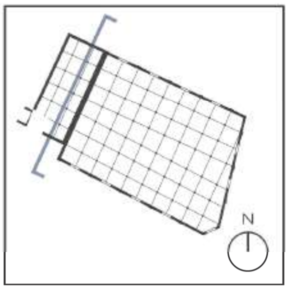
ØSTRE HAVNEVEJ 12

BUILDING CHARACTHERISTCS
HEIGHT: 21M
GROSS AREA: 2727 M^2
NET AREA: 2064 M^2
INT. CONSTRUCTION: STEEL

This building consists internally of the same steel grid as Østre Havnevej 6 and 8, providing the same possibilities of dividing the building. As mentioned during the interpretation of the site the condition that this building is in, is considered poor, suggesting that the building will require quite a renovation. For it to become useful as it is. Therefore functions that do not require massive changes would be preferable, such as parking or unheated physical activities. Though there is a lot of sunlight on the south façade, which could create opportunities for housing on top of the building on that side.

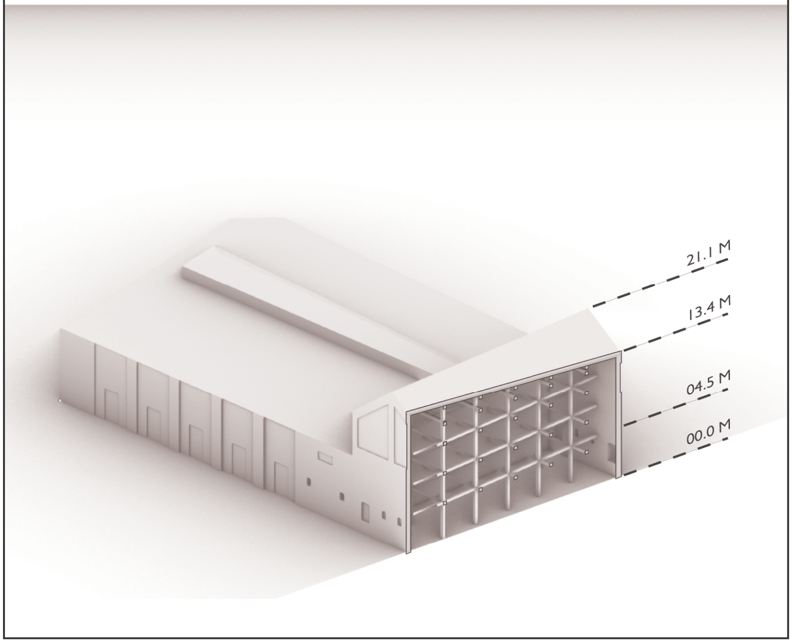


Ill. 45 AXONOMTERIC SITE



Ill. 46 [GROUND FLOOR [1:2000]

BUILDING QUALITIES
VIEW TO HARBOUR: NO
STRUCTURAL FLEXIBILITY: YES
SUNLIGHT HOURS >5 HOURS: NO
LEVELS < 3: YES
LEVELS > 3: NO
HEATED SPACE: NO



Ill. 47 WAREHOUSE
BUILDING DRAWINGS

ØSTRE HAVNEVEJ 10

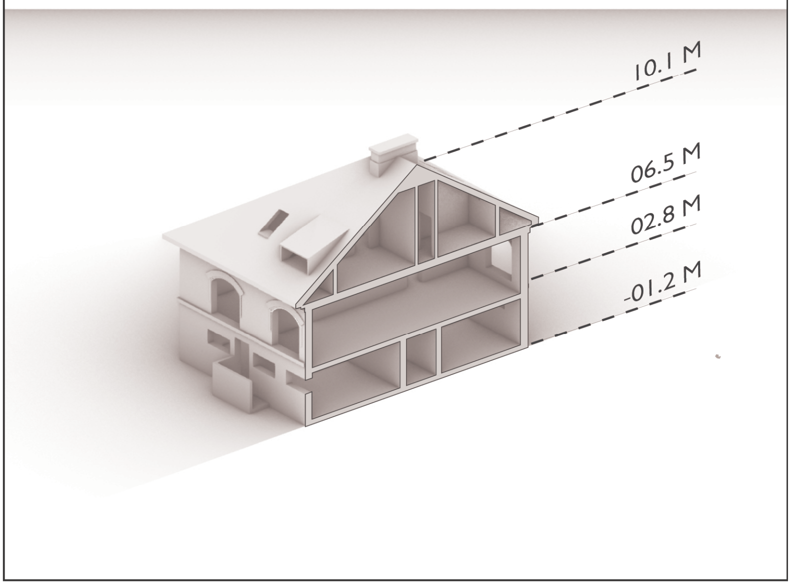
This building is constructed as a typical villa of its time, only a bit bigger, and with a different inner layout, coming from the former function as administration building. Its position as this small and quite different volume compared to its neighbors makes the use of it as housing an inappropriate choice. Internally the building reveals some possibilities in being modified into the desired layout. As this building is isolated, a conversion to an office building would be beneficial or functions that need heated properties.

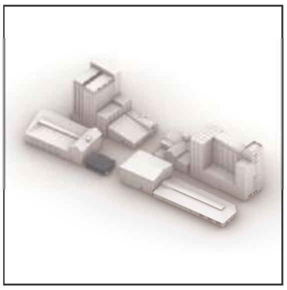
BUILDING CHARACTHERISTCS

HEIGHT: 10 M
GROSS AREA: 624 M^2
NET AREA: 519 M^2
INT. CONSTRUCTION: WOOD

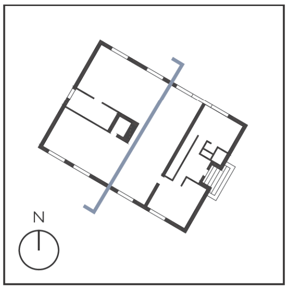
BUILDING QUALITIES

VIEW TO HARBOUR: NO
STRUCTURAL FLEXIBILITY: NO
SUNLIGHT HOURS: NO
LEVELS < 3: YES
LEVELS > 3: NO
HEATED SPACE: YES





III. 49 AXONOMTERIC SITE



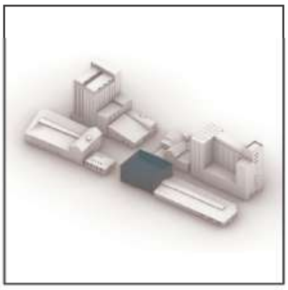
III. 50 GROUND FLOOR [1:800]

III. 48 ADMINISTRATION
AXONOMETRIC SECTION

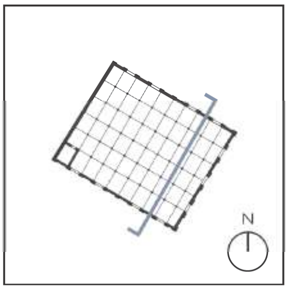
ØSTRE HAVNEVEJ 8

BUILDING CHARACTHERISTCS
HEIGHT: 18 M
GROSS AREA: 2920 M²
NET AREA: 22680 M²
INT. CONSTRUCTION: STEEL

The building's internal structure consists of one big steel grid, where the façade functions as a loadbearing wall. If the wall is kept the interior can be used for several functions, where you need big open spacers such physical activities. As the building has access to sunlight from the south façade, it makes It is possible to the implement offices, in terms of passive strategies. Though as the view is covered by the buildings in front, housing is not preferable.

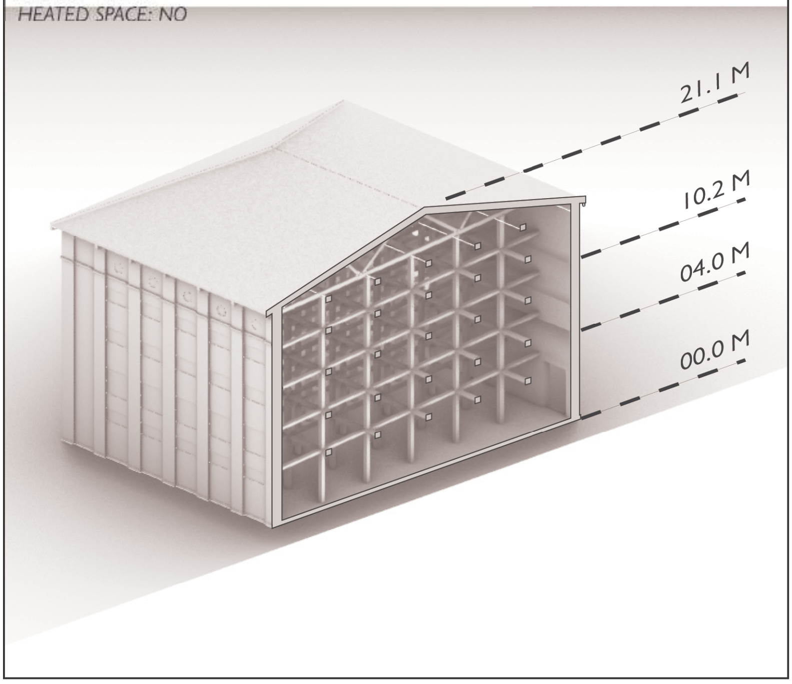


Ill. 51 AXONOMTERIC SITE



Ill. 52 GROUND FLOOR [1:2000]

BUILDING QUALITIES
VIEW TO HARBOUR: NO
STRUCTURAL FLEXIBILITY: YES
SUNLIGHT HOURS >5 HOURS: NO
LEVELS < 3: YES
LEVELS > 3: NO
HEATED SPACE: NO



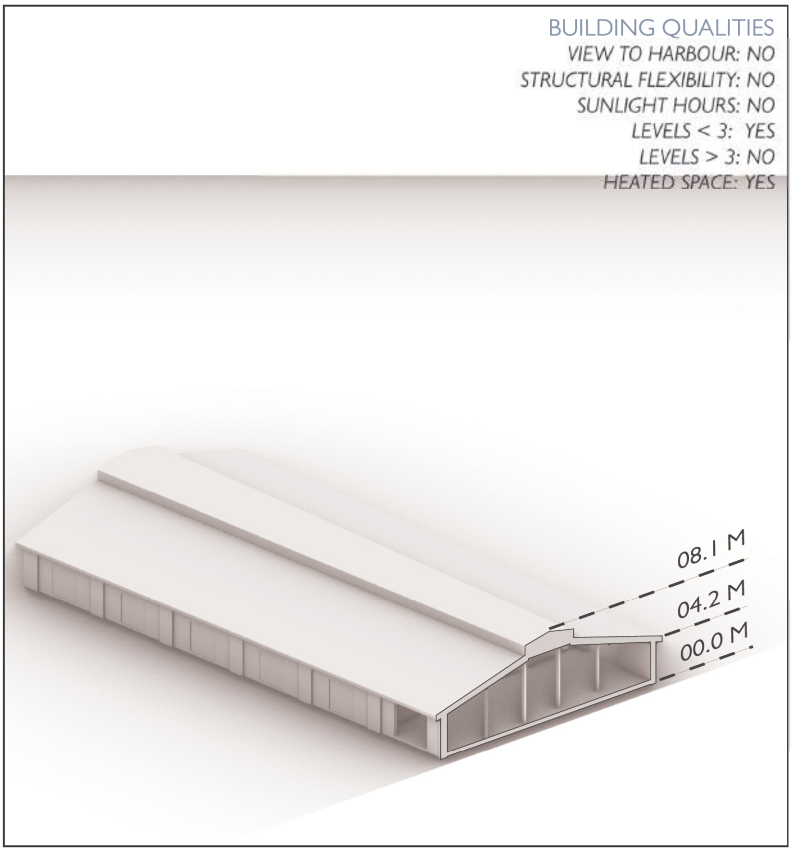
Ill. 53 WAREHOUSE
AXONOMETRIC SECTION

ØSTRE HAVNEVEJ 6

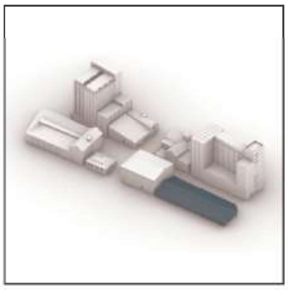
The building is one of the lowest buildings on the site and therefore contributes to the diversity on the site. Internally the building consists of large and open rooms, only disrupted by the columns carrying the roof. The only internal diversion on the building is that the space is divided by firewalls creating 3 sections. With the placement behind the large and tall silo (Østre Kajgade 11) the building hardly gets any sunlight and views towards the harbour is not an option. Combined with the building previously being used for unheated functions such as storage, it is therefore not ideal for housing. However, as the building additionally has openings, for their potentials for more unheated functions related to physical activities or parking.

BUILDING CHARACTHERISTCS

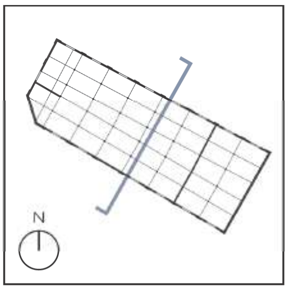
HEIGHT: 8 M
GROSS AREA: 1488 M²
NET AREA: 1400 M²
INT. CONSTRUCTION: STEEL



Ill. 54 WAREHOUSE
AXONOMETRIC SECTION



Ill. 55 AXONOMTERIC SITE



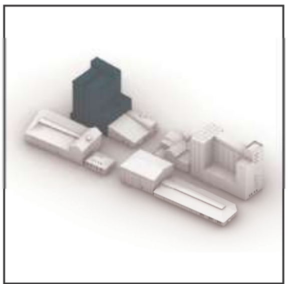
Ill. 56 GROUND FLOOR [1:2000]

D I V E

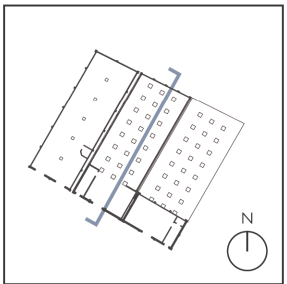
ØSTRE KAJGADE 25

BUILDING CHARACTHERISTCS
HEIGHT: 47 M
GROSS AREA: 6764 M^2
NET AREA: 3768 M^2
INT. CONSTRUCTION: CONCRETE

This building is also raised in different heights, sharing the qualities of Østre Kajgade 11, with good orientations towards south and views to harbour. However, the dept of building reaches approx. 30 meters, which provides more surfaces, in different directions, which can be used for different programming. The interior of the structure is also organized with silos, both circular and rectangular, that also conflicts with open rooms. As the building is raised with openings in the form of windows, placed on the southern façade, which appeals to dwellings.

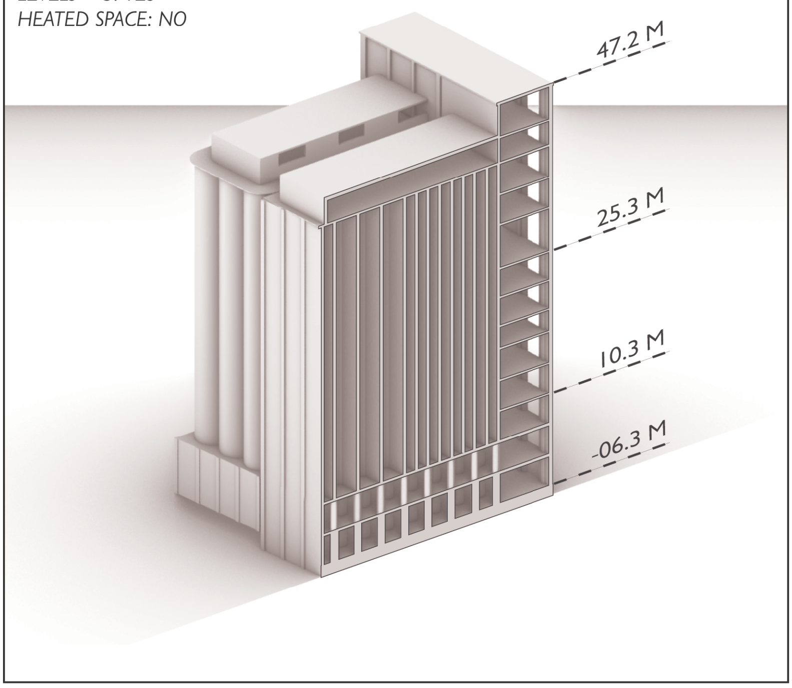


Ill. 57 AXONOMTERIC SITE



Ill. 58 GROUND FLOOR [1:1600]

BUILDING QUALITIES
VIEW TO HARBOUR: YES
STRUCTURAL FLEXIBILITY: NO
SUNLIGHT HOURS >5 HOURS: YES
LEVELS < 3: NO
LEVELS > 3: YES
HEATED SPACE: NO



Ill. 59 SILO
AXONOMETRIC SECTION

ØSTRE KAJGADE 11

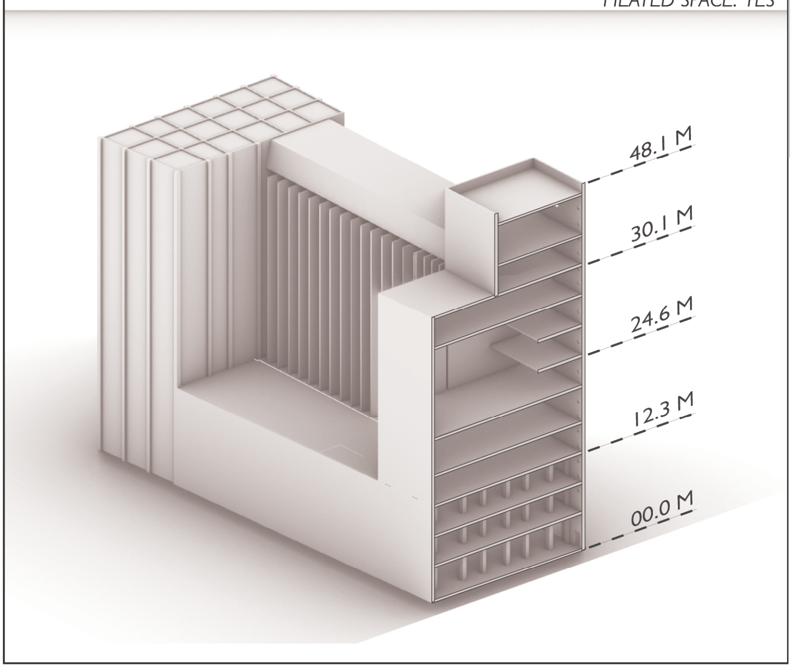
This building is consisting of multiple volumes, that rises to different heights, with big surfaces oriented towards south and north. The orientation towards south and the view to the harbour are considered attractive for housing. The depth of the building varies, stretching from 20 meters to 12 meters, where selected depths are better for specific functions, regarding daylight access. The building is based on cast in-situ concrete, which still stand as robust, where reinforced concrete columns are placed both in the façade and within the building levels. This construction sets restrictions, as the façade with the present structure, cannot fully be covered in glass. However, for dwellings or offices the interior of the building is disturbed by silos, which conflicts with establishment of open rooms.

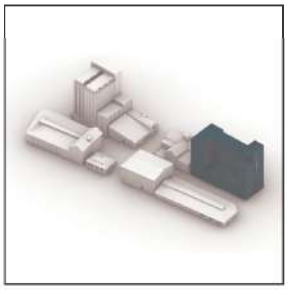
BUILDING CHARACTHERISTCS

HEIGHT: 48 M
GROSS AREA: 7727 M^2
NET AREA: 4000 M^2
INT. CONSTRUCTION: CONCRETE

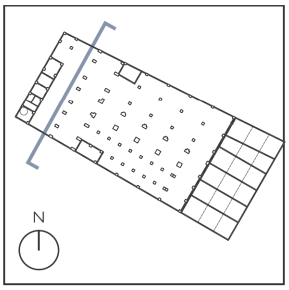
BUILDING QUALITIES

VIEW TO HARBOUR: YES
STRUCTURAL FLEXIBILITY: NO
SUNLIGHT HOURS: YES
LEVELS < 3: NO
LEVELS > 3: YES
HEATED SPACE: YES





Ill. 61 AXONOMTERIC SITE



Ill. 62 GROUND FLOOR [1:1600]

Ill. 60 SILO
AXONOMETRIC SECTION

CASESTUDY - 03 FRIHAVNSTÅRNET

INTRODUCTION

The following case study sheds light on an approach of how to attack an existing building volume in the form of a silo, which previously served the function as an industrial building.

The building is a former DLG silo raised in concrete, that appears in the townscape as a massive block. Because of the location at the Frihavn in Copenhagen, the interests of the municipality were demanding before the publication of the building as a competition. The winning proposal from Praksis Arkitekter, was praised for a strong yet classical expression, that manages to stay inviting (Frihavnstårnet, 2017). The facade is dominated by the balconies, also raised in concrete, intentionally as fiber concrete, that secures reduced dimensions and eases the impression of the building. This is also supported by the projections of the columns in the balconies leaving a decorative impression. The original impression of DLG silos as a block, disappears. Beyond the balconies, the dwellings within the building carries enormous quality with an average room height of 3.5 meters. The original bearing structure is kept, and stays visible within the building, where both columns and beams are seen, thus the raw spirit lives. Beyond the concrete, oak is used, on external and internal surfaces, creating a contrasting meeting between materials, emphasizes the relation between the old and modern materials. The ground floor of the building is designed with an arcade, uniting the inner with the outer. As the arcade provides roof, it protects the bypassers. The programming of the building contains, bike parking, circulation, deposit, placed on the ground floor. However, common facilities are both placed on roof top and ground floor. The concerns of regarding the placement of these functions were based on a location with risk of flooding. (Christiansen, 2017.)

The transformation required a removal of the internal silo chambers. Furthermore, the building had to be renovated because of the previous use of lead painting via sandblasting, which commonly is used for concrete buildings. This was especially challenging during cleaning the silo, as cables had to go through these. Walls were removed with diamond blades, while the silos were cut using robots. The transformation required 4 km of cutting through concrete, removing 2500 ton of concrete and 100 ton of iron (Kingo, 2015). The cutting of concrete secured placement of opening for windows, but also for installations in the form of shafts, electrical cable, pipes, and ducts. The facade of the building is insulated from the outside, which reduces the risk of thermal bridges (Praksis Arkitekter, 2015).

CONCLUSION

The case study delivers an approach of how to change the perception of the industrial values, crucial for this typology. The building responds with technical solutions, to secure that the building meets the standards of today. The architects decided to remove technical installation, among those, silo champers, as it would justify, the possibility of housing more residents. The principles will be reflected in actions during the design.

Ill. 63 PROMINENT BALCONIES
PRAKSIS ARCHITECTS

(Lindhe, Jens)

Ill. 64 VISIBLE STRUCTURE
PRAKSIS ARCHITECTS

(Eskerod, Thorben)

04

THE USER

D I V E

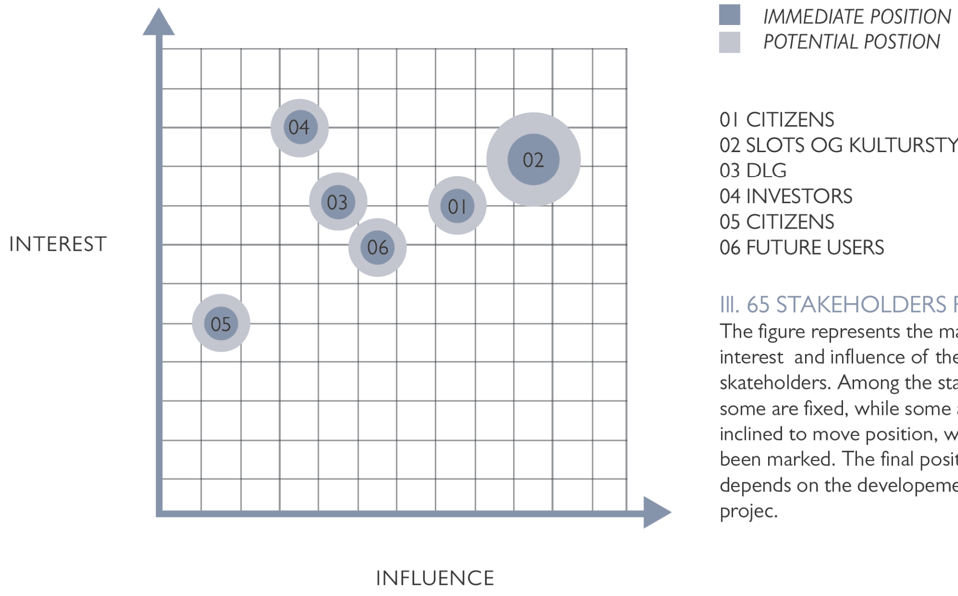
STAKEHOLDERS

INTRODUCTION
This chapter focuses on revealing the various aspects that must be considered in the development of the project. Through this, the involved as the involved stakeholders, the approach on how to handle the entire process of transforming the area, but also which functions that the project should contain and the users that follows.

MUNCIPALITY
The municipality wants something to materialize on the site, as the current plan is to demolish the buildings, according to the groundlease of the area. This is not in the municipality's, which would not be in the municipality's own interest., since it would compromise their intention of using it as part of the plans for the harbour through the preservation of it. It is though important to mention, that this could lead to a financial expenditure for the municipality in form of operating and maintaining the area.

SLOTS & KULTURSTYRELSEN
They have the general task to make sure that the industrial plants, buildings and areas throughout Denmark, that are worthy of preservation, is preserved. The same applies for this project of conserving the cultural heritage, however to this also follows the consideration between preservation and usability, seen in relation to a change in functions for the area.

DLG
The ground lease that DLG has with the municipality expires in 2027. In their agreement with the municipality, it is stated that the site must stand empty after the groundlease expires, through this demolishing the buildings on site are planned, as they are owned by DLG. Demolishing the buildings would be a big expenditure for the company, but it will also conflict with the agenda coming from both the municipality and Slots- & Kulturstyrelsen. In cases like this it is seen before that the money the company would have to used for clearing the area, is given as a financial support, that can support a transformation rather than a demolish.



01 CITIZENS
02 SLOTS OG KULTURSTYRELSEN
03 DLG
04 INVESTORS
05 CITIZENS
06 FUTURE USERS

Ill. 65 STAKEHOLDERS POSITION
The figure represents the mapping of the interest and influence of the relevant skateholders. Among the stakeholders, some are fixed, while some are more inclined to move position, which has been marked. The final position of these depends on the developement of the projec.

INVESTORS & DEVELOPERS

The people, who in the future intend to invest and develop the area, are mostly motivated by economic reasons. Therefore, the site must show potentials before investing, as generating profit is a main driver for the future developers.

CITIZENS OF SVENDBORG

The opinions on a project like this, coming from the citizens of Svendborg could be many, and the level of involvement will vary as well. Through this the background of the citizens to involve themselves, could have varied reasons. The involvement of the citizens could both result in positive and negative opinions, explaining the involvement of them can be tricky. Their interest comes from them being visually exposed to the area, live close by or have a general interest in the preservation of the city’s identity, the citizens will be heard but will not necessarily have a direct influence, compared to other stakeholders.

THE FUTURE USERS

The future users will have an indirect influence and interest, as the project would have to be based on how the expected market is going to look like, which the future users is a part of. The type of future user is most likely to differ, which increases the difficulty in recognizing the exact expectations. Furthermore, can the future user’s interest to a given project, be depending on other projects in the area. (Hjorth, O. 2021).

CONCLUSION

Through this section it is revealed there are many things to consider in relation to who has an interest and influence in a project. Each stakeholder has their own agenda that in a way must be met for a project like this to be a success and to even be realized. Though there is chosen in this project to focus on the municipality of Svendborg's view of the project. This is because it is a mix between the cultural, historical, and economic aspects of the site. Contrary to the developer economy focused perspective, the municipality also investigates if the project additionally can have a cultural and historical benefit on the city of Svendborg.

D I V E

APPROACHING FUNCTIONS

INTRODUCTION

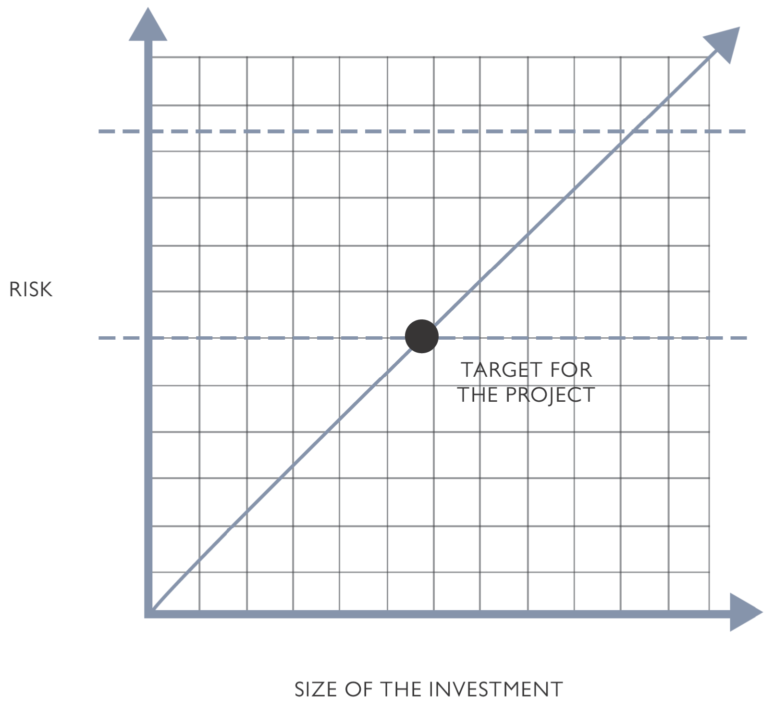
With the previous considerations in mind, this section tends to focus on elaborating distinct functions and their possibilities to fit into the project. This will both be based on the previous described investors point of view, but it also treats the harbour area in terms of existing functions as well as their placement.

FINANCE WITHIN TRANSFORMATION

The functions intended to be implemented into the project takes part of its background from a conversation with Ole Hjorth (property adviser Cushman & Wakefield RED, 2021), who is working with market analysis in Svendborg and therefore presents a broad spectrum of knowledge regarding developers in the local area. Especially his considerations on how a project like this could or should be handled, according to implementation of functions, as it is revealed, it is an assortment of many factors. Currently he works with the municipality on another project at Svendborg harbour called Godsbanearealet, located northwest to the side, next to where Simac is to be build. Doing a transformation in this case, could in the eyes of an investor be a considerable risk since it can become an expensive project. With the site for this project located in Svendborg, it would become difficult to find people willing to invest in the project, because the demand of city would not match the economic costs. This refers back to the discussion of transformation in the framework chapter. Therefore, it is suggested to think of the implementation of simple functions, that can move into the existing buildings, in this case, as it would require functions suitable for raw environments. Thus, from an investor's point of view the project would become a manageable investment, again in relation to the size of Svendborg and the size of the investment. In line with this, it is optimized to work with functions that the buildings must adapt the least for, because it would keep the investment low and avoid the economy of the project, to raise to unrealistic level. (Hjorth, O., 2021).

CONCLUSION

The aim for this transformation is to approach the project, on a conceptual level, towards a realism according to the fact that without the money coming from the investors, the project cannot be realized. This through working with the volumes on the site in relation to what they are most suitable for, according to their dimensions, constructions and condition, which was collected in valuate of the building. The potential profit for the investor will be higher, since it will require less money to be put into the project.



Ill. 66 RISK OF STAKEHOLDERS
Simplification of how the size of the investment is illustrated is illustrated through raise in risk. The illustration does not count in the developement of the market.

CULTURE VS PHYSICAL ACTIVITY

CULTURE

The harbour area takes its part in supplying diverse cultural possibilities that the city has to offer. Through this, a dense cultural life is to be found on and close to Frederiksøen. Creating an area rich on venues, restaurants, and museums. As every municipality has a certain limit of financial support towards cultural offers, as well as the city itself has a limit how many cultural offers it can absorb. This suggests that the implementation of cultural offers on the site, from a realistic point of view, would have to be considered carefully.

PHYSICAL ACTIVITIES

The part of the harbour where the site is located, also has several functions related to physical activities such as fitness, bowling, laser tag and other physical activities. That outlines the functions that already exists, and therefore these will not be brought into consideration as activities. However, the implementation of functions such as those mentioned, would fit, and might even enforce this character for this part of the city. Furthermore, it is also an example of a category of functions, that does not have the same requirements to the technical requirements, as functions like housing or offices. Therefore, these functions could support an investment, that do not have to rely on financial support by the municipality, as it can be driven by private investments. Furthermore, functions such as these could be temporarily over a duration of time, until the final way of using the building is found. These could benefit from the raw unpolished environment, because of the character of buildings of the site. (Hjorth, 2021).

SPORTS ASSOCIATIONS

In line with the theme of functions related to physical activities, sport associations around the area are investigated, with the background of creating a complex within the project, where the different associations could be placed together. The reason for doing so, lies within the idea that each of the association could benefit from each other, as they would have the opportunity to share many of the facilities that they already have in common. Placing similar function or activities close to each other is no invention, as it is commonly seen among grocery stores, and popular sport centers.

CONCLUSION

Cultural activities take place on and around ''Frederiksøen'', explaining why the aim will be to focus on the implementation of more active functions, to avoid, that this project from thins out the cultural life of the harbour, but also to stays on the same track as some of the functions in the nearby area. Therefore, are the functions intended to be implemented based a mixture of what is missing, trends of today and what contributes to a collaboration with nearby activities and sports associations, which includes functions as climbing, paddle tennis, indoor football, in relation to associations on site martial arts, crossfit, and workshops.

III. 67 CLARIFICATION OF DEMANDS

The following scheme represents a classification of mentioned activities, where the objectives are to clarify the demand of each function, hence these will be distributed to the relevant buuldinng on the site.

FOOTBALL [200 - 1200 m^2] + PADELTENNIS [200 m^2] + CLIMBING [200 - 1200 m^2]

	HEATED SPACE	MECHANICAL VENTILATION	ACCESS TO SUNLIGHT	VIEWS TO HARBOUR	BUILDING ACCOUSTIC	ABOVE 200 M^2 SPACE	EXPOSURE TO HARBOUR
NEED					X		
NEUTRAL	X	X	X	X		X	X
NO NEED							

MARTIAL ARTS [500 - 1000 m^2] + CROSSFIT [200 - 1200 m^2]

	HEATED SPACE	MECHANICAL VENTILATION	ACCESS TO SUNLIGHT	VIEWS TO HARBOUR	BUILDING ACCOUSTIC	ABOVE 200 M^2 SPACE	EXPOSURE TO HARBOUR
NEED	X	X			X		X
NEUTRAL			X	X		X	
NO NEED							

OFFICES & SMALL BUSINESSES

INTRODUCTION

Today the composition of the harbour has a wide range of diverse types of employments, back in 2010 the harbour provided 485 full time positions. Among these 15 % were directly depending on the harbour, e.g., work within reparation of ships and shipment of goods. Furthermore, 33 % had a minor relation to the harbour e.g., restaurants and ship broker. The remaining 52% of the workspaces are not related to harbour, a number most likely to raise further in the future. (Svendborg Kommune, 2014).

VARIATION IN BUSINESS

In the hunt of professions to be located the municipality insist on a variation in offers. As a potential firm to be located at the harbour, considerations regarding e.g., whether the location in the specific context, will strengthen the working condition, is an obvious question to raise. The challenge of today is that the heavy work of the harbour that remains, which could be a disturbance towards any workspace, with elimination of these, a growth in small companies will occur. In the report of Fremtidens Havn the municipality presents a list of services, that can be accommodated on the site, with services within technology, development, reparation, service, shipping, maritime equipment etc. A detailed description of these is as following: The creative professions are often attracted by the industrial buildings, which could set the frame for an environment that allows new start-ups to innovate and develop. To this, it would potentially clash with ''Fremtidsfabrikken'' located on the harbour, that serves that specific purpose (Svendborg Kommune, 2014).

CREATIVE PROFESSION

Due to the size of Svendborg there is not the biggest demand for office space and as mentioned before, it is expensive to transform industrial buildings into office space (Hjorth, 2021).The plan is to further investigate creative professions, as these are attracted to old raw industrial buildings. Through this companies that work with good artisanship and small industrial productions, is discovered. As it would be an excellent location since they would be able to expose themselves.

CONCLUSIONS

Through the thoughts on this these functions, the aim is to put work towards creating more room for businesses and small industries rather than offices, that can create an interplay between craftmanship and art. This is based on the considerations on the profit for a potential investor, but also according to the marked. Importantly because creative professions are drawn by old industrial buildings, making them an ideal fit for this project.

III. 68 CLARIFICATION OF DEMANDS

SPECIAL STORE [200 - 500 m²]

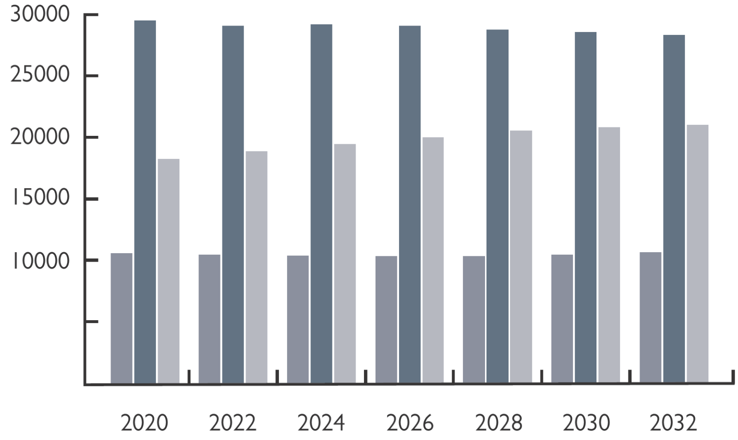
HEATED SPACE	MECHANICAL VENTILATION	ACCESS TO SUNLIGHT	VIEWS TO HARBOUR	BUILDING ACCOUSTIC	ABOVE 200 M² SPACE	EXPOSURE TO HARBOUR	
X	X			X	X	X	NEED
		X	X				NEUTRAL
							NO NEED

OFFICES [500 - 2000 m²]

HEATED SPACE	MECHANICAL VENTILATION	ACCESS TO SUNLIGHT	VIEWS TO HARBOUR	BUILDING ACCOUSTIC	ABOVE 200 M² SPACE	EXPOSURE TO HARBOUR	
X	X			X	X		NEED
		X	X			X	NEUTRAL
							NO NEED

ARTIST COMMUNITY [200 - 500 m²]

HEATED SPACE	MECHANICAL VENTILATION	ACCESS TO SUNLIGHT	VIEWS TO HARBOUR	BUILDING ACCOUSTIC	ABOVE 200 M² SPACE	EXPOSURE TO HARBOUR	
	X	X	X				NEED
X				X	X		NEUTRAL
						X	NO NEED



III. 69 COMPOSITON OF INHABITANTS
The figure represents the prediction of inhabitants, where the municipality is going through a growth. To house these people housing will be prioritized.

(Svendborg Kommune, 2020)

D I V E

I HOUSING

INTRODUCTION

From the previous mentioned conversation with Ole Hjorth, it is further elaborated that the project Godsbanen on Svendborg harbour, that he currently works on, is expected to fill up the demand for housing for the next 10 years, explaining why this would become a future development. A topic that in relation to housing is relevant to discuss, in the current economic landscape. This because the price per square meter that housing can be sold for, often is about twice the amount compared to an office space on the same location, but to this a bigger risk is related. As mentioned, housing is the most profitable function that could be implemented, but it is also related to a big risk, in terms of the size of the investment (Hjorth, 2021). Explaining why this will be a focus in this project when implementing housing. The following study is based on the settlement and demographic development of Svendborg Municipality and is intended to shed light on the user groups expected to move to the city.

DEMOGRAPHIC DEVELOPEMENT

The municipality of Svendborg is experiencing changes in inhabitants, where numbers of new arrivals are growing on a yearly average of 275 people (Svendborg Kommune, 2020). In the insistence of this growth the municipality wants to provide attractive facilities for settlement, as bigger population groups will secure strong workflow and stronger contribution to the local economy. Four groups of inhabitants are emphasized by the municipalities in the form of Home-comers, Copenhageners, Students and Empty-nester, that are to be addressed in future interventions.

The homecomers represents a group of people, who because of the education left the municipality, but returns to the South Funen as a newly established family with children. Reasons for returning to the municipality, is to bring children closer to their grandparents, and because the parents want to ensure that the children get a similar childhood. Besides that, compared to educational cities the house prices are low. For these people there is an interest in providing attractive buildings both in the urban areas and suburbs, places with short distance to schools and daycare, but also nature and water.

The Copenhageners shares the similarities of the Home-comers, but have not previously lived in Svendborg. The background of these is settlements in major cities primarily Copenhagen, but also Aarhus and Odense. These people are young families, who wants the possibility to experience an active culture, recreational life, and participate in communities. The variety of schools and gymnasiums is also a reference for their children. In terms of settlements both city and country are in their interest, but the municipality will prioritize placement of these families in the cities, which includes the harbour.

The empty-nesters is the couple or single, who is still living in the big dwellings, that previously contained the whole family. The children of the family have moved out, leaving unused square meters, this being a reason for leaving the dwelling. An interest of these people is to find smaller dwellings preferably in the city or at the harbour, among culture life, close to several public transport opportunities. In the creation of a moving chain, the municipality wants to further investigate for building senior communities for Empty-nesters. Thereby allowing Home-comers or Copenhageners to take over buildings of the Empty-nesters.

The students are a result of the position of Svendborg as the city containing educations within medicine, education and maritime. The students prefer settlements near their education, with engagement in the local cultural life, as a consumer, but also as a workforce benefitting local businesses through either voluntarily or part time jobs. Based on the years spend in the city, there is a potential for these, to become permanent residents of the city (Svendborg Kommune, 2020).

CONCLUSION

Housing will be added to list of functions to be located by the waterfront, where types of residents, expected to be most interested in living on a location such the area for this project.. The target groups for the further development, is defined as a simplification, based on the previouly described residential groups. The project is thereby, in relation to the implementation of dwellings, aimed at two user groups, consisting of a group in form of families and a group consisting of couples and singles. Through this the apartments should manage to be suitable for a broad range of ages, within the two groups..

III. 70 CLARIFICATION OF DEMANDS

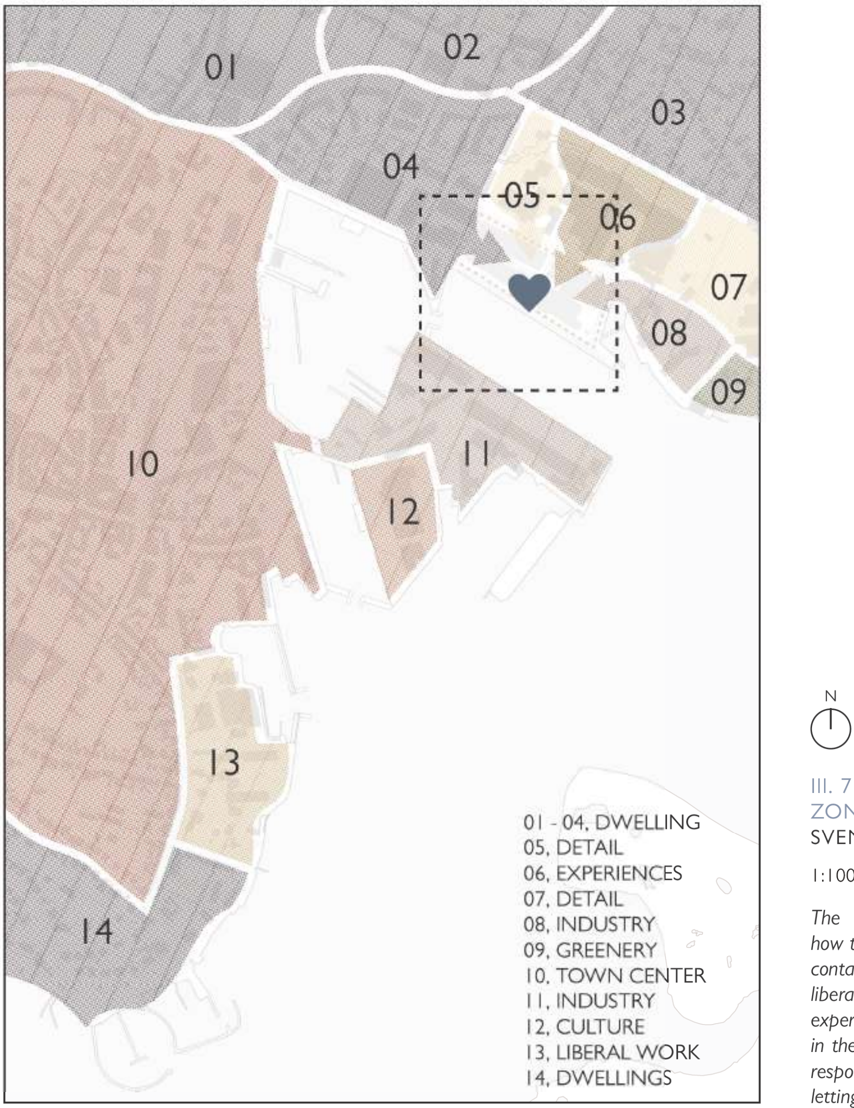
FAMILIES [100 - 180 m^2] + SINGLES/COUPLES [70 - 120 m^2]

HEATED SPACE	MECHANICAL VENTILATION	ACCESS TO SUNLIGHT	VIEWS TO HARBOUR	BUILDING ACCOUSTIC	PRIVACY	EXPOSURE TO HARBOUR	
X	X	X	X	X	X	X	NEED
							NEUTRAL
							NO NEED

05

SUMMARY

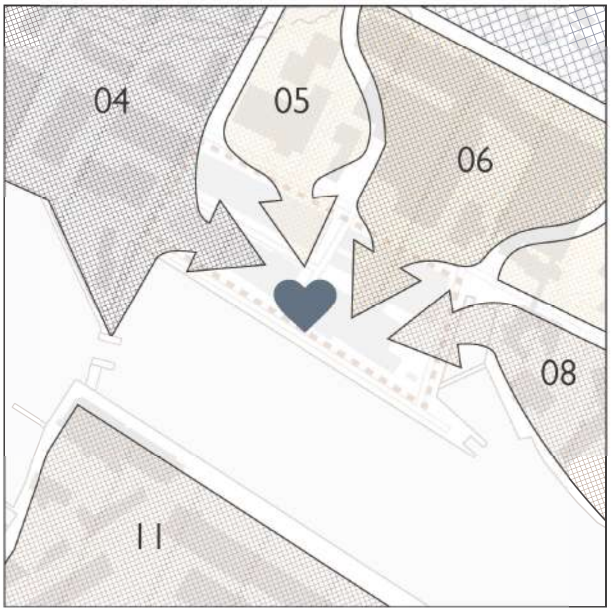
READABILITY OF THE CITY



Ill. 71
ZONE DIVISION
SVENDBORG

1:10000

The following study maps out, how the city is divided into zones, containing dwellings, town center, liberal works, industry, culture and experiences. As the site is placed in the mixed zones, the site must respond to surrounding zones, by letting these float into the site.

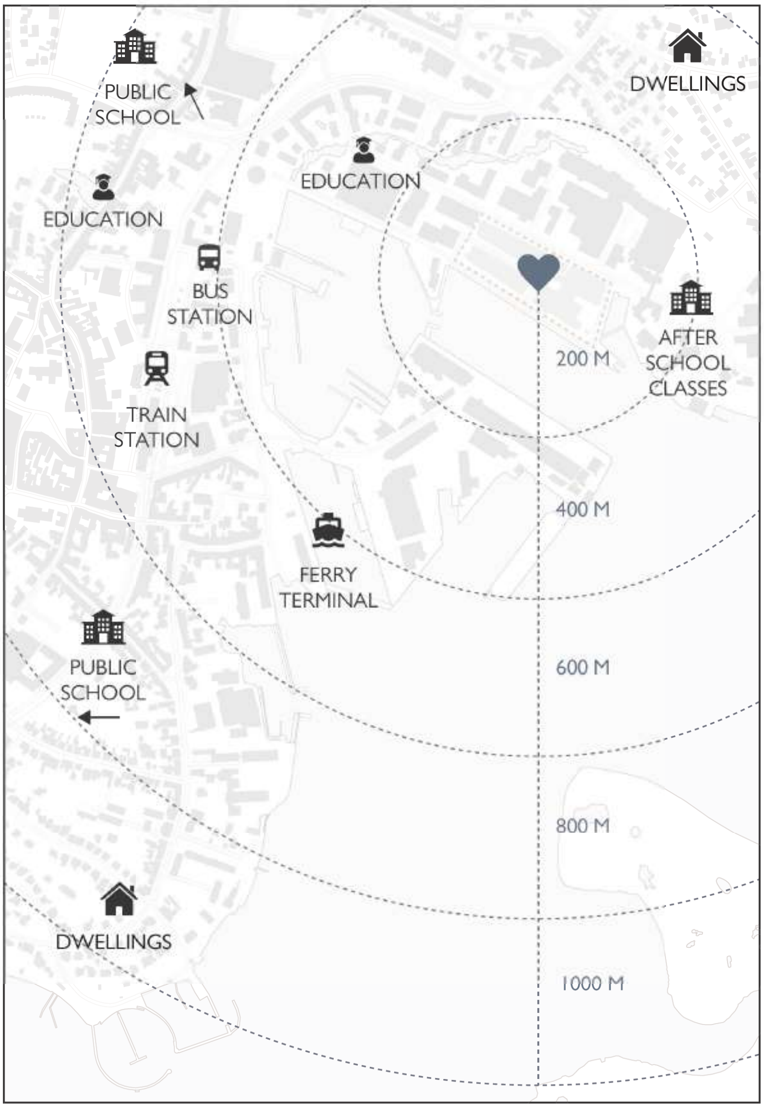


Ill. 72
ZOOM IN - SITE
SVENDBORG

1: 5000

The illustration shows how the remaining zones, dwelling, experience, detail and industry floats into the site, importantly, gets closer to the harbour.

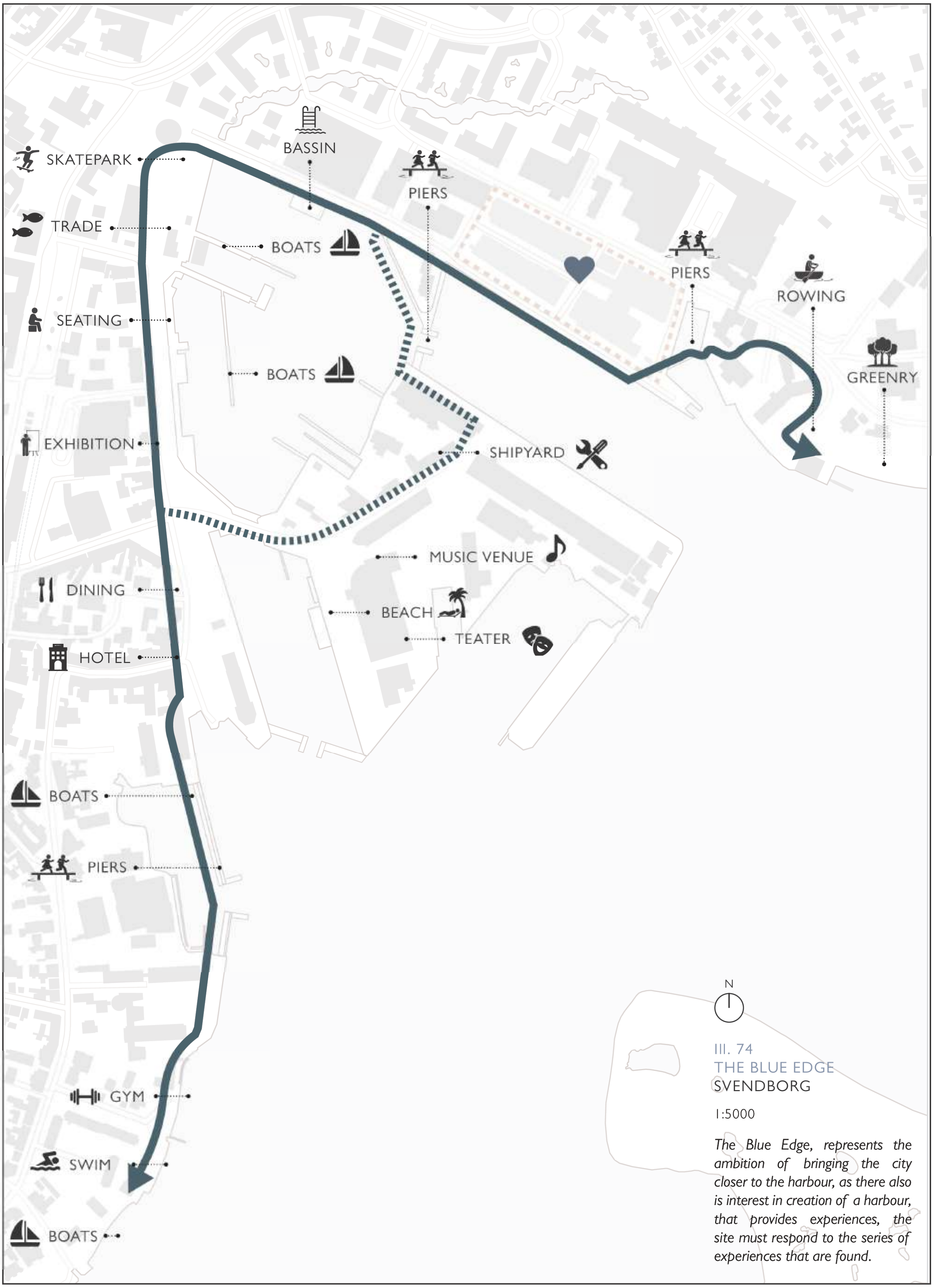
READABILITY OF THE USER



Ill. 73
USERGROUPS
SVENDBORG

1:10000

Svendborg contains a broad user group, within a short range as shown with access to educations, infrastructural nerve centers, dwellings, that becomes relevant users for the design.

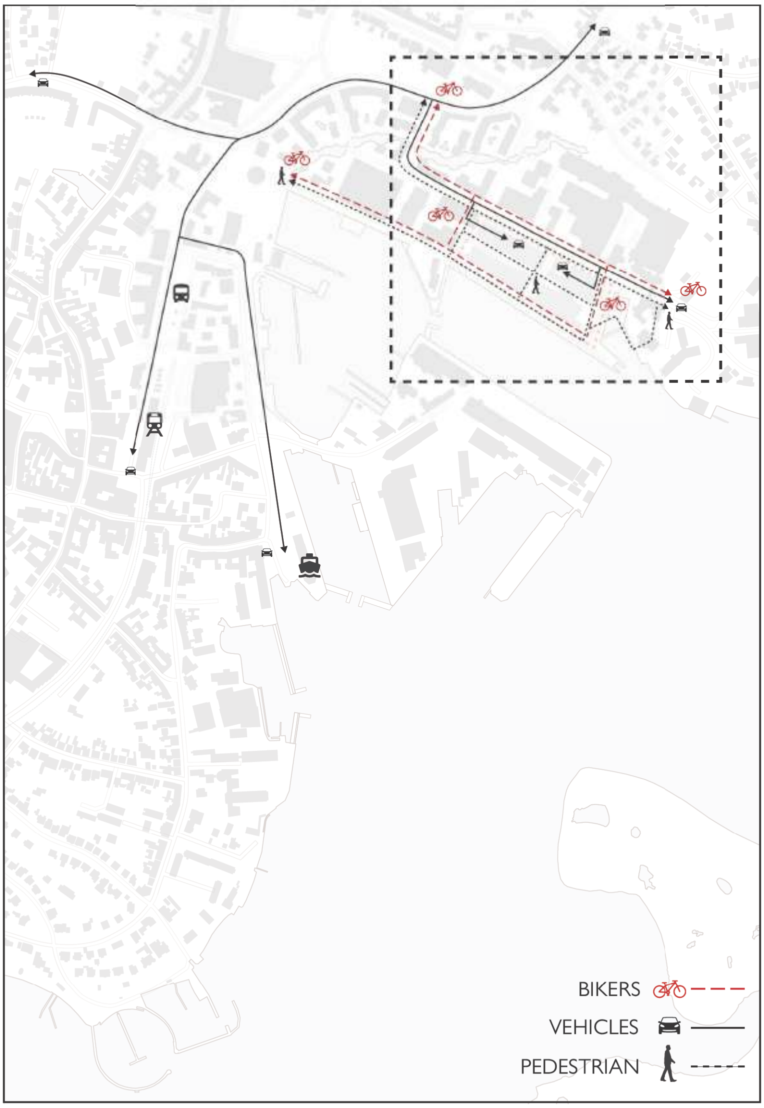


Ill. 74
THE BLUE EDGE
SVENDBORG

1:5000

The Blue Edge, represents the ambition of bringing the city closer to the harbour, as there also is interest in creation of a harbour, that provides experiences, the site must respond to the series of experiences that are found.

INFRASTRUCTURE AND CONNECTIVTY

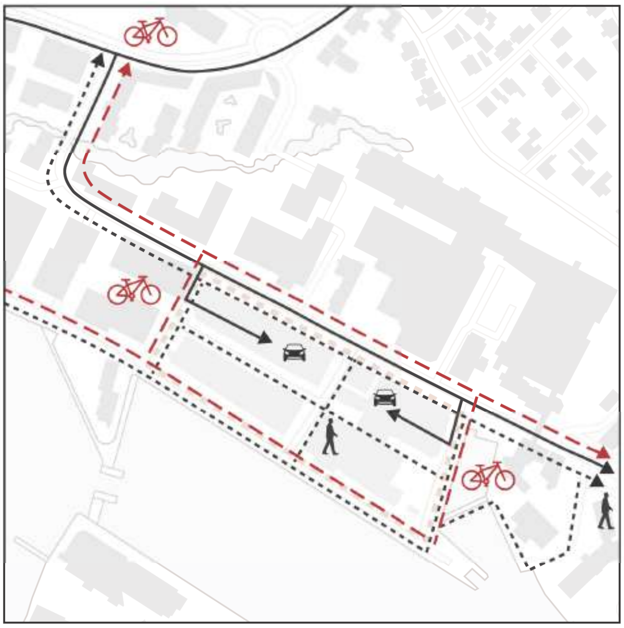


N

Ill. 75
CONNECTIVITY
SVENDBORG

1:10000

The following study maps out, how the city is connected to the site from the viewpoint of pedestrians, bikers and vehicles. The map also reveals, where infrastructural nervecenters are placed, with bus, train and ferry terminals.

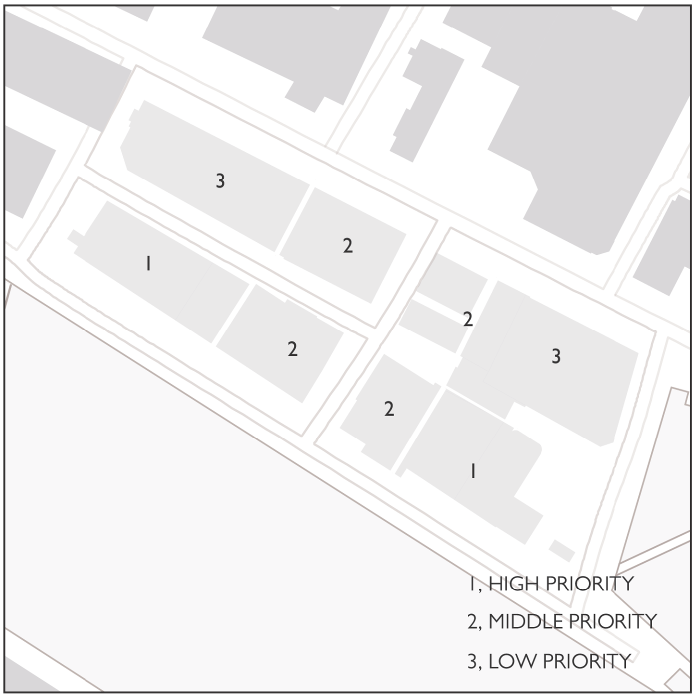


N

Ill. 76
ZOOM IN - SITE
SVENDBORG

1: 5000

The illustration shows how the site builds further on the intention of the municipality, by keep vehicles away from the harbour. Thereby prioritize environment for pedestrians and bikers.



N

Ill. 77
PRIORITIES
SVENDBORG

1: 5000

The illustration shows the self chosen priorities of the buildings. The focus will be on the silo buildings as they are considered as the buildings on the site, with the biggest visual impact to the harbour

PROGRAMMING OF THE SITE

	ØSTRE KAJGADE 11	ØSTRE KAJGADE 15	ØSTRE KAJGADE 23	ØSTRE KAJGADE 25
FAMILIES	X			X
SINGLE/ COUPLE	X			X
OFFICE	X			
SMALL BUISNESS			X	X
ARTIST COMMUNITY		X		
WORKSHOP				
PADDLE TENNIS				
ACTIVITY PLATFORM				
CLIMBING	X			
MARTIAL ARTS				
CROSS FITNESS				
DANCING				
SQUASH				
HEALTH CLINIC				

Ill. 78 THE SITE

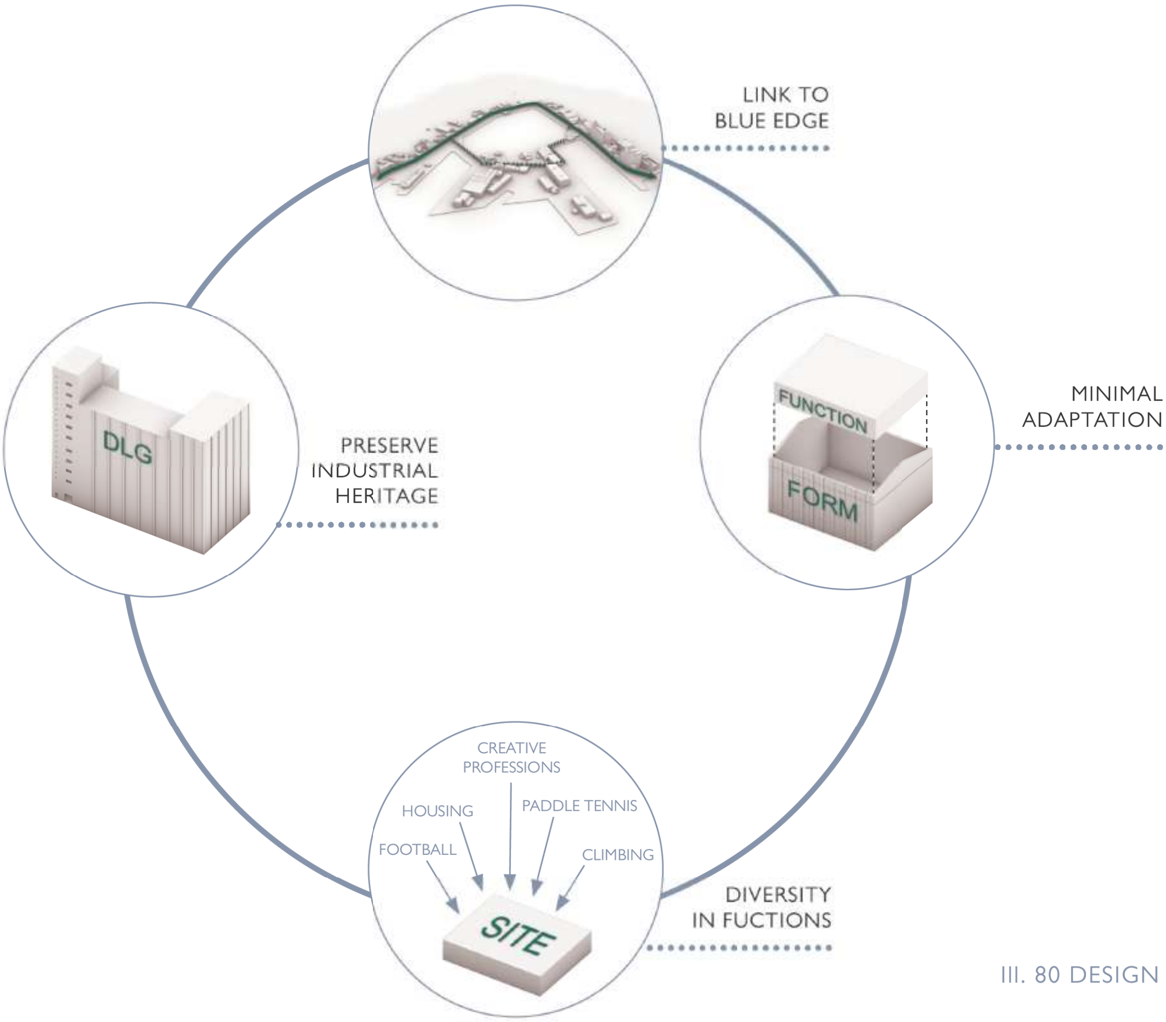
	ØSTRE HAVNEVEJ 6	ØSTRE HAVNEVEJ 8	ØSTRE HAVNEVEJ 10	ØSTRE HAVNEVEJ 12
FAMILIES				
SINGLE/ COUPLE				
OFFICE				
SMALL BUISNESS			X	
ARTIST COMMUNITY				
WORKSHOP				X
PADDLE TENNIS				X
ACTIVITY PLATFORM	X			
CLIMBING				
MARTIAL ARTS		X		
CROSS FITNESS		X		
DANCING		X		
SQUASH		X		
HEALTH CLINIC			X	

Ill. 79 DISTRIBUTION OF FUNCTIONS

I VISION

The vision for this project is to work with the ideals of Fremtidens Havn, by contributing to the creation of a new attractive part of the harbour, that additionally acts as an integrated part of the harbour transformation in the big scale. Both managing to work with the urban spaces on site, according to the scale of the built environment as well as the waterfront to become an integrated part of the Blue Edge. Though it is just as important, that the site manages to create its own character, through working with the preservation of the cultural heritage, which the site contains both in the terms of the industrial and the maritime. Through the transformation it is furthermore the vision to create an area that integrates both housing, businesses and functions related to physical activity into a well-functioning and unified area, that achieves the needs coming from each function. Therefore, the ambition is to build on the existing industrial environment of the district, based on a contemporary investment basis. This means, that the project responds to the interest of today, where stakeholders and economy are highly in focus, working with minimum adaptation of the buildings to the different functions. The design will be raised to contemporary standards, where qualities of social-, environmental- and economical aspects will be recognized.

How can transformation of old industrial building, secure a unified housing, culture, and businesses area, that maintains the identity of the area with respect of its cultural heritage?



Ill. 80 DESIGN DRIVERS

DESIGN CRITERIA I

FUNCTIONS
The buildings must conform to the need of the future residents, in terms of families, singles and couples.

Dwellings must be organized towards the aim, of all of them getting access to views towards the city and the water.

Functions for physical activities must be placed towards Østre Havnevej, since they do not benefit from the view and the sun.

Business must be arranged around the square, defined by the internal grid on the site, to create a point of connections.

The design should be integrated with The Blue Edge, by offering activities and experiences, that contributes to the connectivity of the city.

SUSTAINABILITY
Studies of global warming potentials and embodied energy, must be a decisive parameter in the development of the project.

Climate challenges will be met, by intentionally placement of programming a ground floor which tolerates future rising water levels.

The large surfaces towards southwest should take advantage of its orientation, integrating both active and passive strategies.

URBAN AREAS
The accessibility of the site, indicates, that site prioritize heavy traffic, and thereby overlooks pedestrian traffic, which must be accommodated, working with the human scale and the light traffic.

The site should contribute to an open an accessible harbour, by enabling paths and views and complete the internal grid in the longitudinal direction of the site.

PRESERVATION OF CULTULRAL HERITAGE
The buildings must reuse the structures of the building that carries the narration of the buildings previous use therefore original buildings must not be teared down.

The project must manage to work with preservation or abstractions of industrial ornaments, using the technical installations as a driver.

06

SKETCHING

THE URBAN PLANNING

INTRODUCTION

The following study opens the design process with focus on establishing strategies, that should be used for programming of the site. This encompasses, how the site should meet the surrounding areas, but also internally, with the space in between buildings.

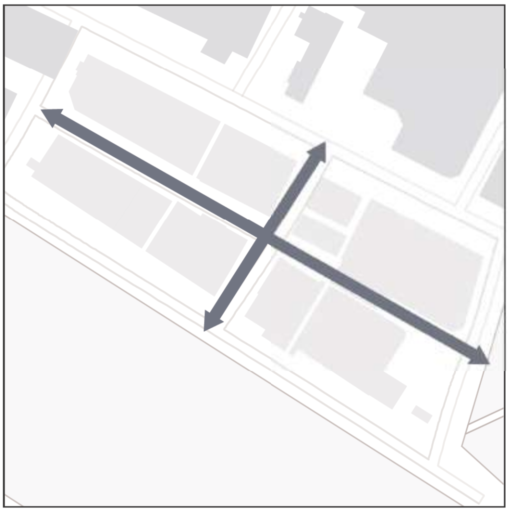
Because of the dimensions of the buildings found on the site, they act as barrier, blocking the view and physical access. The charm of these barriers, is that they contributes to the density of the site, which has roots in the industrial past, where functionality was prioritized. To improve the access to the site, obstacles, in the form of expansions of original buildings are removed, are removed for the sake of accessibility, which naturally defines axis between the building

The site is divided into smaller zones with individual qualities, as shown in ill. 82, these zones would have the character of passages, sidewalks, relation to water, or being placed in center, also referred as the plaza. Beyond providing view to the harbour, the relation to the water, does also carry the place for spatial qualities. The spaces, in between buildings share the character of passage. However, the center, in which passages naturally meet each other forms a cross, where the plaza environment would be established. This is the background the following iterations, where the intention is use center of the site as a space, with public functions. As the circles grow, the privacy grows.

The space in between the buildings on the site should bring the indoor facilities outdoors through outdoor rooms, terraces and plazas. Doing so, improves the quality of the life between the buildings and activates the outdoors space. The functions should be able to collaborate with each, where the plaza should provide the frames for establishment of relations.

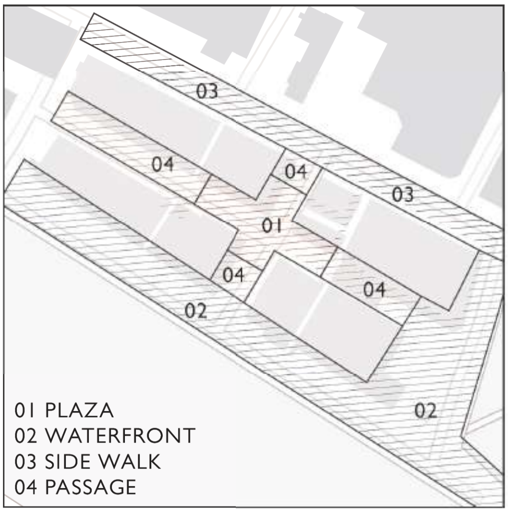
CONCLUSION

Based on the observations of an analysis of the site, there is an intention to maintain the industrial undertones through urban functions, that should reamin visible in the groundfloor and townscape. The spaces created on the site should be positioned in a spot between open and closed, as it should provide paths and sightlines, that attracts local users, but still carry the charm of the dense industrial environment. The industrial environment will further be strengthened by the placement of urban functions, that activates the space between, and the townscape of the site.



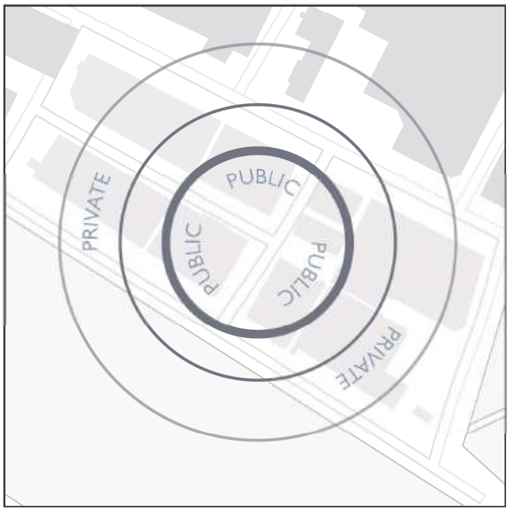
III. 81 DEFINED ACCESS

1: 4000



IIII. 82 ZONE DIVISIONS

1: 4000



III. 83 CENTRALIZED PUBLIC FUNCTIONS

1: 4000

III. 84 IMPORTANT ORIENTATIONS

1: 4000

SHADOW STUDIES

INTRODUCTION

The following study builds further on the interest of understanding the urban environment, that beyond being accessible also should be characterized as well lit. The study looks at how the shadows are distributed at the site for selected days in the form of equinox, summer solstice and winter solstice. These circumstances, will influence the placement of functions. Further shadows studies, at other times of day are found in appendix 3.

As the buildings found in the central part of the site, are lowered in heights, they leave less shadows, which paves the way for a well lit plaza. This does also fit, with interest of creating an attractive plaza with access to sun. The sun reaches the northern part of the inner plaza, where outdoor spaces with sun access would be created. The space in front of the silos are exposed to sunlight, where attractive space could be established, with relation to the water. At this place, there are no obstacles for the access of sunlight. In between buildings, shadows are found, because of the heights of the silos. As the shadows are related to the dense industrial environment, these spaces, should be used to maintain these intimate spaces with industrial roots. The shadow studies reveals, that the roof behind silo buildings, partly gets sun light, explaining why it is a possibility, to create outdoor spaces on roof tops, despite them being placed behind silos. The critical days are found during the low sun, where the space in between the buildings are in shadow, as seen in ill. 89 - ill. 90. However, as this is during the winter, where outdoors activities are lessened, this is reasonable, and not considered as a problem.

CONCLUSION

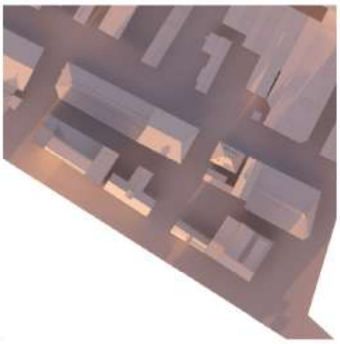
Facilities, that would benefit from having outdoor space with access to sun, should be placed towards north-eastern corner of the plaza, since there is an interest in activating the plaza. The roof will be used for gathering users. The spaces in front of the buildings, are exposed to sun light, explaining why outdoor facilities also will be placed there.

Ill. 85 EQUINOX - 15.00
PLAN VIEW

Ill. 86 EQUINOX - 15.00
ON SITE

Ill. 87 SUMMER SOLSTICE - 15.00
PLAN VIEW

Ill. 88 SOLSTICE - 15.00
ON SITE



Ill. 89 WINTER SOLSTICE - 15.00
PLAN VIEW

Ill. 90 SOLSTICE - 15.00
ON SITE

CASE STUDY 04
LIMFJORD WATERFRONTS

INTRODUCTION
Aalborg and Nørresundby, are both cities that have waterfronts towards the Limfjord. In order to find adaptive solutions that can be implemented on the site, these will be analyzed, as they like Svendborg in the future will experience the effects of rising sea levels (Schønherr, 2021).

NØRRESUNDBY
The waterfront was built in 2015, where it was designed by by Schonherr to heighten the value of the harbour and create attractive spaces for outdoor recreational use. The area stretches between the bridges, as it is also particularly exposed to flooding, therefore focus has also been on improving the flood protection on the stretch (Schønherr, 2021). The use of concrete has been the back bone of the project, where it covers most of the stretch. The concrete has both been used for barriers and ramps to the water to create accessibility, but also to slow down the water. The concrete is used to highlight the coastline through the stretch, besides acting as flood protection. Green patches in the form of rowan trees and grass are also placed all over the site to create spaces to stay, but also to work as a drainage of water.

AALBORG WATERFRONT
With completion in 2015, the project was designed by C.F. Møller Architects, with assistance from Vibeke Rønnow Landscape Architects, during stage 1. The harbour was redesigned, as Aalborg transitioned from an industrial identity to experience and educational identity. Therefore, the idea was to create a space by the water where activities and stays could take place. The intention was also to connect the existing city to the water, as this was not possible before, as the industry filled most of the waterfront. The waterfront is also used to showcase buildings such as Aalborg Slot and Utzon Center. Submerged terraccesand stairs towards the water enables activities. Access to water and sunken city gardens have been made, where some serves the frame for park and sports facilities, also designed to act as flood prevention.

Ill. 91 CONCRETE RAMPS [1]
NØRRESUNDBY

Ill. 92 GREEN PATCHES [2]
NØRRESUNDBY

Ill. 93 CONCRETE SURFACES [3]
NØRRESUNDBY

Ill. 94
OVERVIEW OF LIMFJORDEN
NØRRESUND AND AALBORG

(Driftkort, 2020)

Ill. 95 LOWERED SPACES [4]
AALBORG

Ill. 96 LOWERED TERRACES [5]
AALBORG

Ill. 97 GREEN PARK [6]
AALBORG

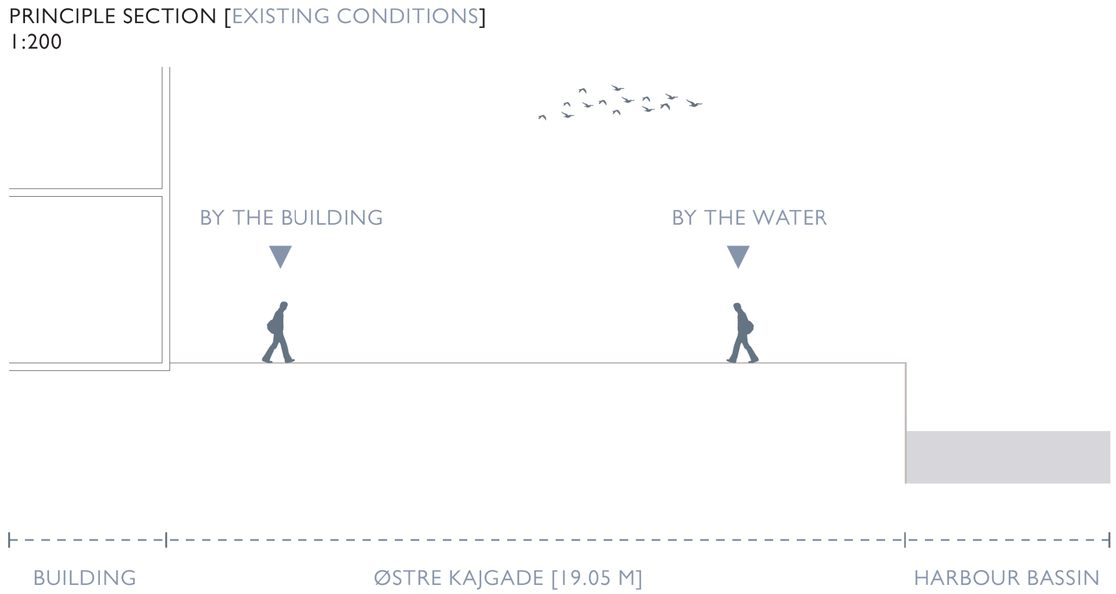
ADAPTATION OF FLOODING

INTRODUCTION

As an extensions to the casestudy at waterfronts of Limfjorden, this study transform the princples to the site. Svendborg. The site is located at level 1.8 m above sea levels, and cosist of a flat terrain, with barely any variations in height. The predicted worst-case scenario for flooding is 3 meters, which leaves a span of 1.2 meters that must be addressed. As mentioned, the site will be protected by adaptive solutions, serving both as the protective barrier as well as recreational areas, to enable activities on the site. The flooding preventions, that are present are based on evidence-based solutions. Theres is a focus on using passive strategies in the considerations of adaptive solution coastal flooding, because they are less depended on human interaction and have no energy use.

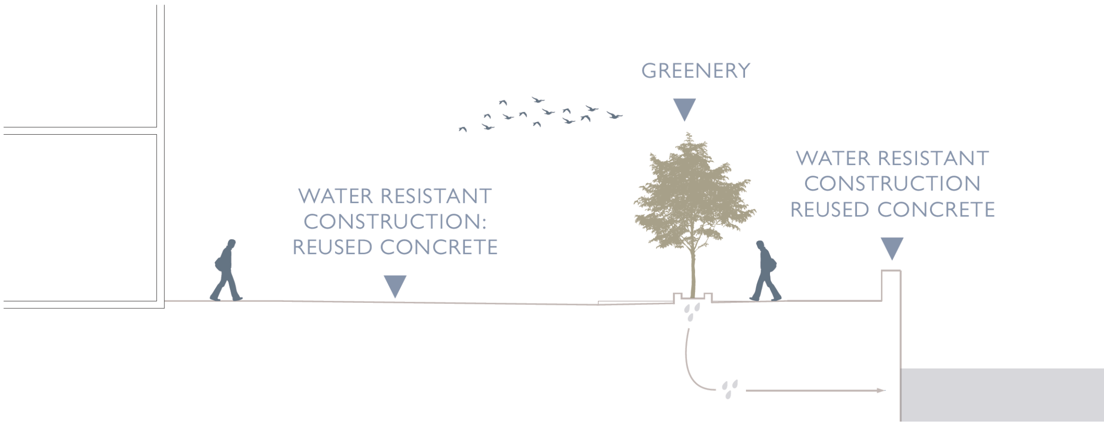
PRINCIPLES

Østre Kajgade, which represents the quay, function as the first line of defense in case of flooding, shown in ill. 98. A redesign of the waterfront, the wet proofing the new and existing elements (water resistant constructions), would be necessary to provide longevity to the harbour, without making any major changes to the existing harbour (Adaptive solutions, 2021 – 1). The addition of green patches along the harbour helps the in the creation of an attractive area, where the water can seep through and return to the ocean (Adaptive solutions, 2021 – 2). The idea is to support activity, by being able to reside by the waterfront in front of the site. By redesigning the quay using ramps down to the water and elevating small barriers in the form of walls without obstructing views, it protects the harbour from future coastal flooding, while making the water accessible. This creates a space by the water for people walking by or ships docking (Adaptive solutions, 2021 – 3). The buildings close by the water have minimal openings, as these are casted in concrete made for aggressive environments by the water. The buildings can be used for flood defense (Adaptive solutions, 2021 – 4).



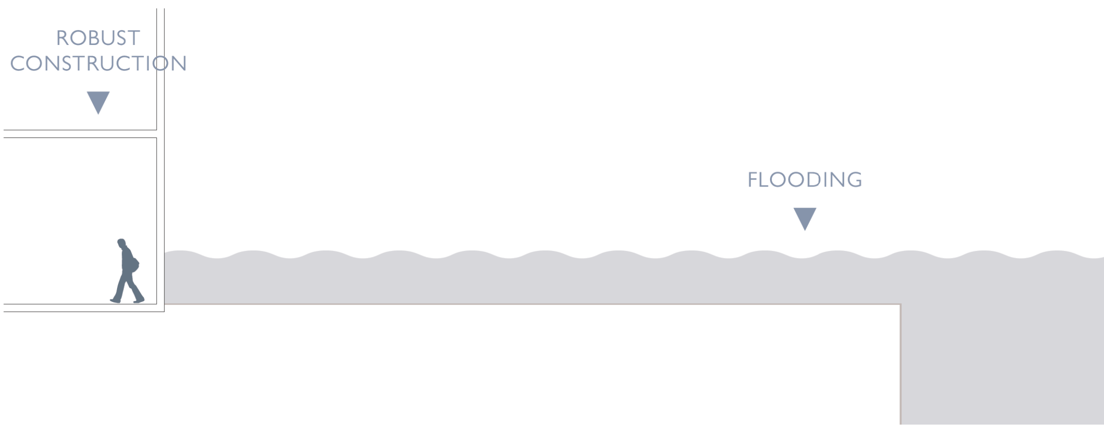
Ill. 98

PRINCIPLE SECTION [GREENERY]
1:200



PRINCIPLE SECTION [QUAY]
1:200

PRINCIPLE SECTION [ROBUST CONSTRUCTION]
1:200



Ill. 99

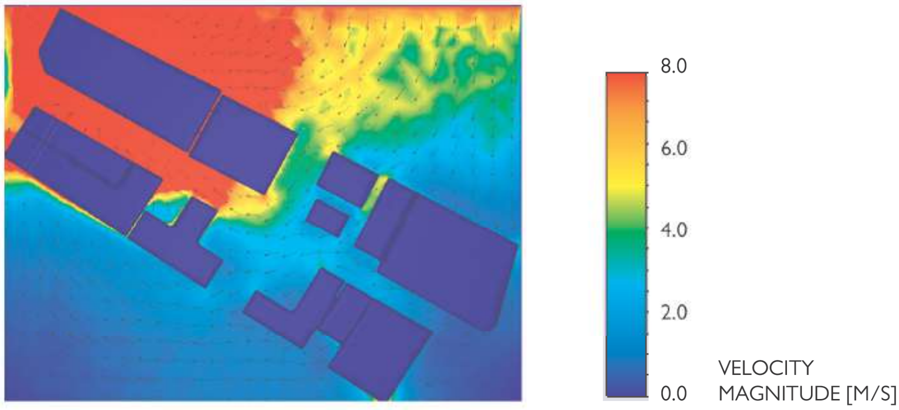
WIND TUNNEL STUDIES

INTRODUCTION

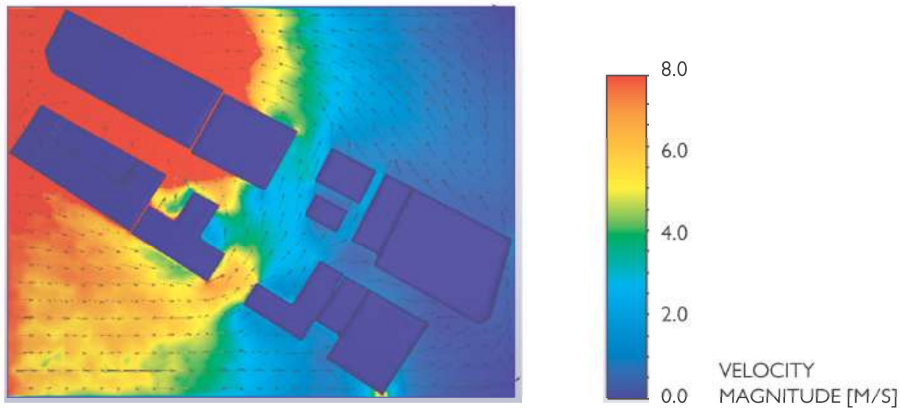
The following study highlights the wind condition on the site, from the viewpoint of how it will influence the urban environment. The good wind environment, requires, that the space supports pedestrian comfort and safety for cyclist.

The studies focus on the ground floor during the timeslot 11-16, where people would inhabit the area, for lunch or an afternoon coffee. Wind directions variate during the season, therefore the intention is to affect the site with the most frequent winds, that sets the worst case scenario. The winds effect is divided into 3 stages. The mechanical effect, that is felt with windspeeds over 4-5 m/s. Over 10 m/s windspeeds pedestrians move with difficulty and over 15 m/s there is risks for accidents (Sbi, 1981). Theres an interest in reaching velocities of maximum of 5 m/s in spaces, that are beneficial for sitting arrangement.

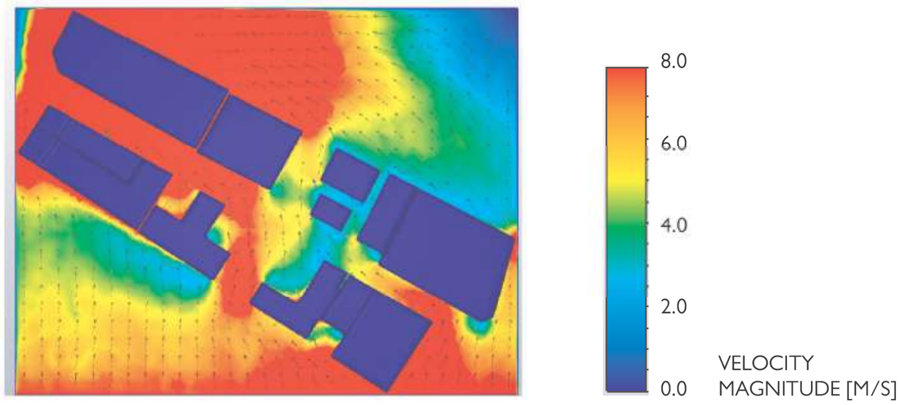
The site is exposed to wind, due to the placement towards the water, where the heights of buildings also challenges the conditions. As a result, there is a lot of wind entering the site, as seen on ill. 102, that reveals how wind tunnels are established in between the buildings reaching critical velocities, especially in zones, classified as passage in previous studies.



Ill. 100 EQUINOX
WIND VELOCITY STUDIES

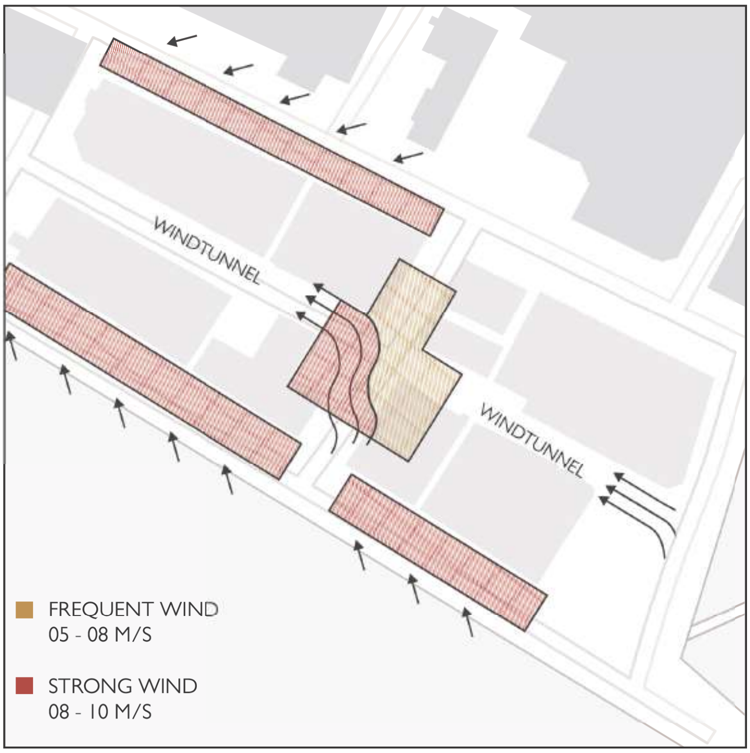


Ill. 101 SUMMER SOLSTICE
WIND VELOCITY STUDIES



Ill. 102 WINTER SOLSTICE
WIND VELOCITY STUDIES

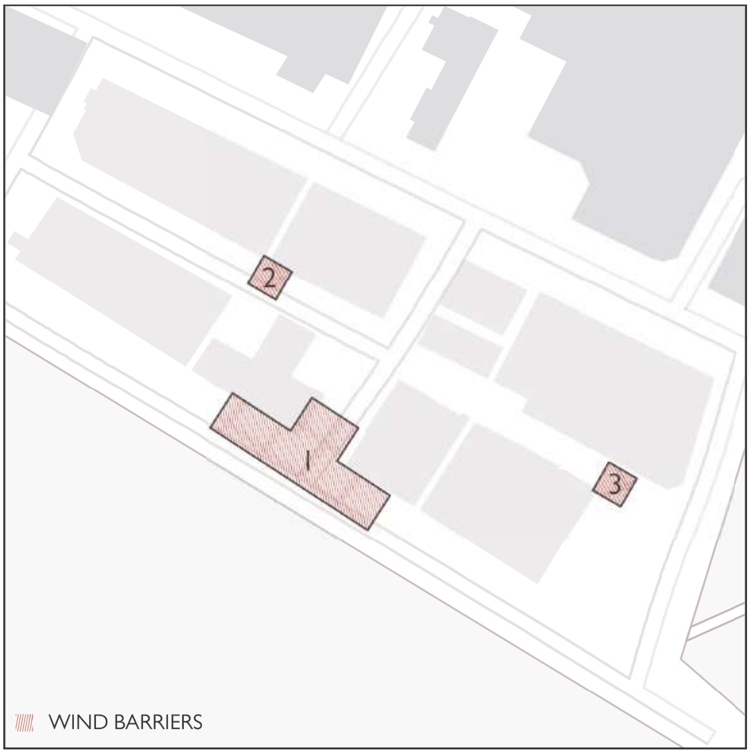
ADAPTATION OF WIND



Ill. 103
WIND CONDITIONS
SVENDBORG

1 : 4000

The urban environment will be affected by wind, that is over the comfort level of 5m/s. The wind velocities in the passages have a big effect, as they are 10 m/s. By looking at the previous studies, the site is divided into zones, with individual characteristics.

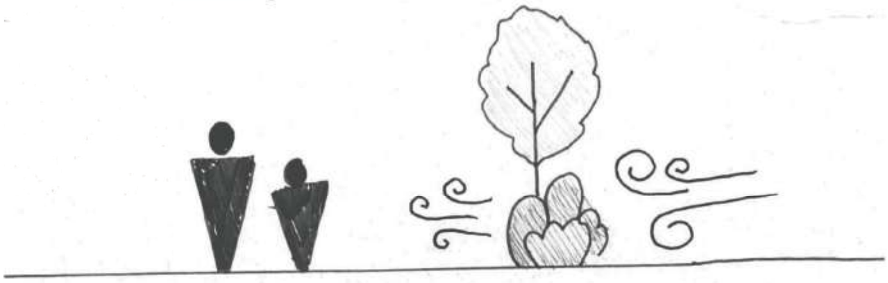


Ill. 104
WIND DAMPEN ZONES
SVENDBORG

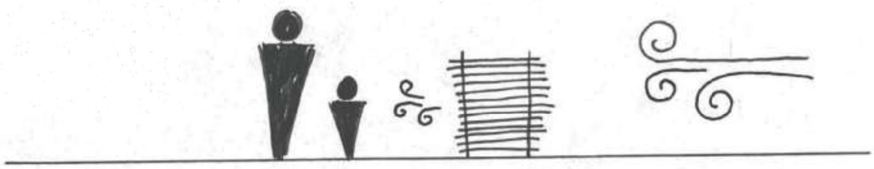
1 : 4000

This further leads to three critical zones that must be addressed, by damping the wind and providing shelter. This is intended to be done through through the use of greenery, slats or sheets. The use of strategies depends on the zones, as greenery needs sunlight. Greenery will be used in area 1 and 3, whereas key 2 will depend of walls rather than greenery, because of the passages do not have direct access to sunlight as the harbourfront.

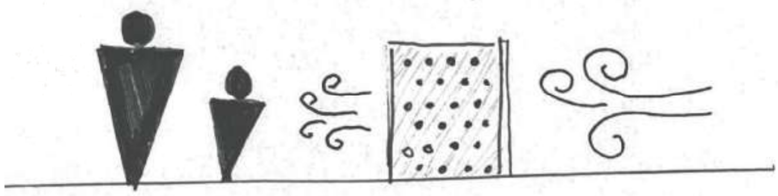
Ill. 105   WIND DAMPENS [GREENERY]



Ill. 106 WIND DAMPENS [SLATS]



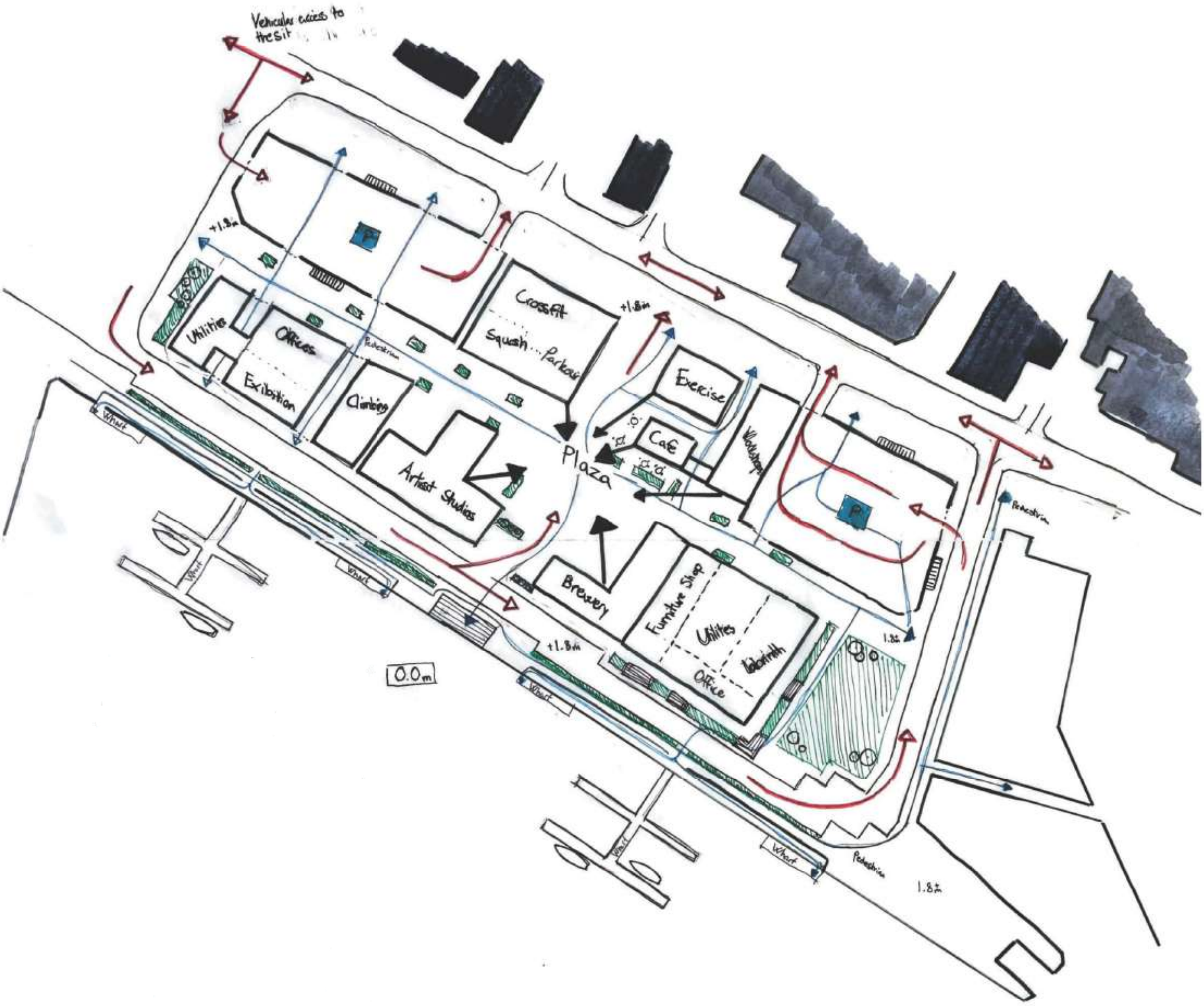
Ill. 107 WIND DAMPENS [ROBUST CONSTRUCTION]



INTRODUCTORY MASTERPLAN

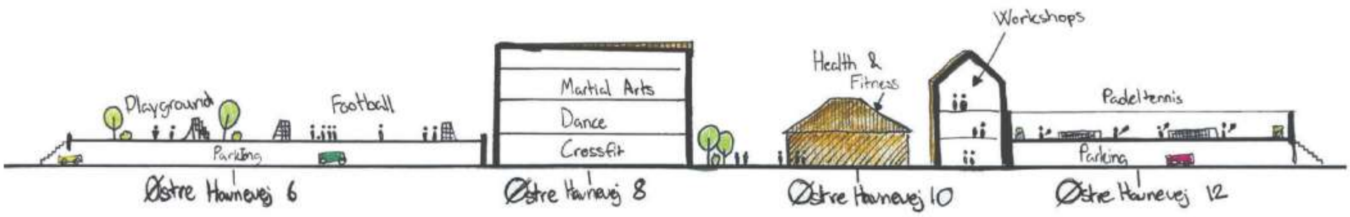
Ill. 108 INTRODUCTORY MASTERPLAN

The following section summarize the results of the previous analysis through an introductory masterplan, with the functions of each building distributed in the groundfloor. Through the masterplan it is shown, how the flow of the site in the form of circulation is visible. The layout reflects accessibility, how inner buildings are related to the plaza and how the waterfront is intende to be activated.



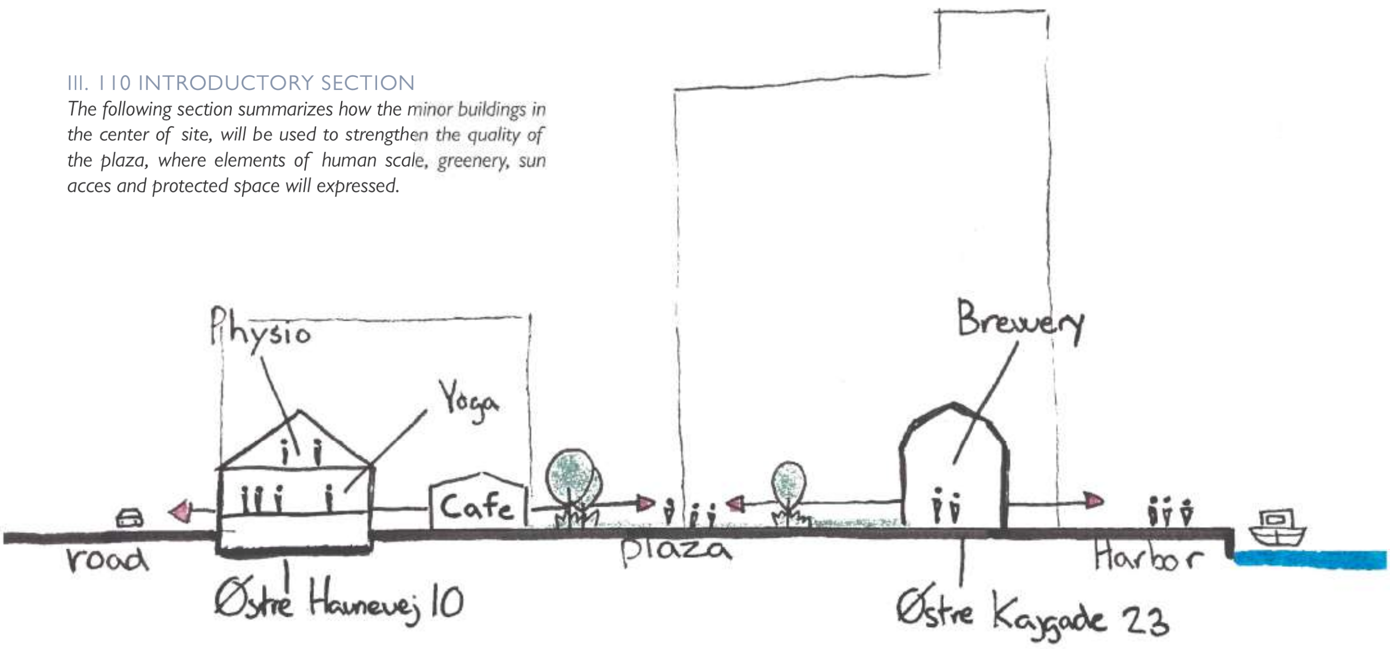
Ill. 109 INTRODUCTORY SECTION

The following section summarizes how both building, and space in between building is intended to be activtated. Life is established, on the streets, on rooftops and inside of buildings.



Ill. 110 INTRODUCTORY SECTION

The following section summarizes how the minor buildings in the center of site, will be used to strengthen the quality of the plaza, where elements of human scale, greenery, sun acces and protected space will expressed.



SCENARIOS FOR HOUSING

INTRODUCTION

As revealed in the summary the intention is to program the silo buildings with housing units, based on their unique location, orientation and height. Through this, the following study looks at different scenarios of utilizing the silos.

The dimensions of the housing units are based on a mapping of the existing construction and initial daylight studies, also found in appendix 7. Three scenarios are established of each silo building, that represents three strategies of utilization of the existing construction of each building. The background of this approach is based on, what was formulated in the theories, with how the location of the transformation project, tightens the budget. This was brought to discussion in the user chapter, how the design should respond to the market, where the location in Svendborg, complicates the process of finding money and limits the process of how many apartments that can be sold, as well. what they can be sold for.

The investigations are intended to enlighten, what the strategy would be, when when implementing housing into the site, according to economics and environmental aspects. Therefore, the investigations will be based on considerations regarding, aesthetical, technical and functional considerations. The three scenarios are defined as:

SCENARIO 1

This investigation discovers where housing units could be implemented, using nothing but but only using the existing decks. The reason for looking into this option, is that by using only the existing decks, less modifications would have to be done to the construction, which also would secure less removal of existing materials. Because of this approach, the silos of the buildings are kept.

SCENARIO 2

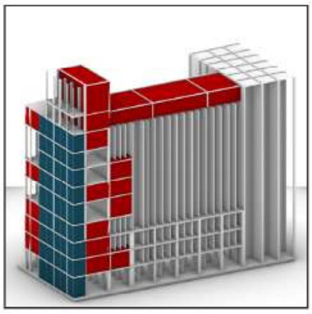
This approach takes basis in the previous investigation, by exploiting the existing decks, with what is defined as minor modifications. The reason for taking the previous investigation further, is the inappropriate placement of housing units, as seen in ill. 111, on Østre Kajgade 11. Minor modifications to this building improve the frames of increasing a coherent segment of housing units.

SCENARIO 3

The last investigation is based on exploiting the two silo buildings, to their maximum potential of containing housing units, using the existing outer shell as a limit. This includes removal of the internal silos for the purpose of replacing these with housing units. As a result, the outer shell is left as the main preserved structure combined with the internal bearing structure

SCENARIO 1
EXPLOITATION
OF EXISTING DECKS

■ DWELLING
■ CIRCULATION



Ill. 111 ØSTRE KAJGADE 11
NO. OF APARTMENTS: 19
SQUAREMETERS: 1568 M²

Ill. 112 ØSTRE KAJGADE 25
NO. OF APARTMENTS: 26
SQUAREMETERS: 1624 M²

ØSTRE KAJGADE 11

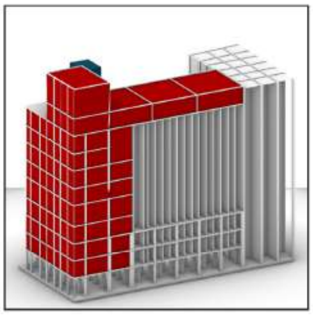
SIZE [M2]	58	65	100	130	35	29
AMOUNT	4	2	3	6	2	2

ØSTRE KAJGADE 25

SIZE [M2]	50	56	61
AMOUNT	11	11	4

SCENARIO 2
EXPLOITATION
OF EXISTING DECKS
WITH MODIFICATIONS

■ DWELLING
■ CIRCULATION



Ill. 113 ØSTRE KAJGADE 11
NO. OF APARTMENTS: 29
SQUAREMETERS: 2412 M²

Ill. 114 ØSTRE KAJGADE 25
NO. OF APARTMENTS: 15
SQUAREMETERS: 1624 M²

ØSTRE KAJGADE 11

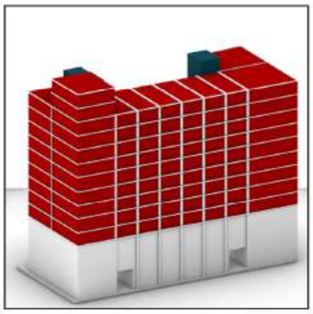
SIZE [M2]	58	59	100	115	120
AMOUNT	8	8	2	8	3

ØSTRE KAJGADE 25

SIZE [M2]	98	112
AMOUNT	4	11

SCENARIO 3
MAXIMUM
OPTIMIZATION

■ DWELLING
■ CIRCULATION



Ill. 115 ØSTRE KAJGADE 11
NO. OF APARTMENTS:67
SQUAREMETERS: 6649 M²

Ill. 116 ØSTRE KAJGADE 25
NO. OF APARTMENTS: 71
SQUAREMETERS: 7045 M²

ØSTRE KAJGADE 11

SIZE [M2]	58	94	97	119	143
AMOUNT	11	11	27	9	9

ØSTRE KAJGADE 25

SIZE [M2]	81	86	100	104	109	115
AMOUNT	11	11	16	11	11	11

ØSTRE KAJGADE 11

INTRODUCTION

The investigations works with the existing decks, as these have an irregular organization as well as the fact that a large part of the building volume consists of silo and thereby not contain any decks.

ØSTRE KAJGADE 11 - SCENARIO 1

The building has decks placed in the western part of the building, but also with an addition of deck, in the top of the central part of the building. This means, that concentrations of housing units differ, with vertical and horizontal bands of units, that challenges the flow within the building, as well as increases the complexity of technical installations. As the illustration reveals, there would be a non-rational placement of housing units, as a result of the irregular decks. As a further result of this, is the surface area of the housing units, that increases, and thereby complicates the work with reinsulating the building.

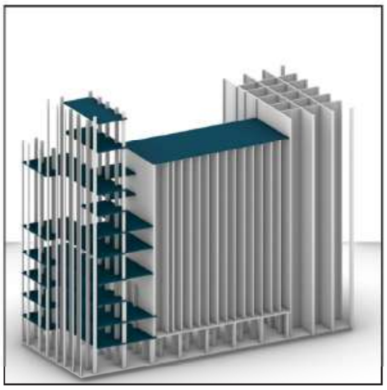
ØSTRE KAJGADE 11 - SCENARIO 2

The concrete mass that is removed consists of the concrete coming from the smaller silos, that will be replaced with concrete decks, reusing the concrete that is removed, to complete the decks. Minor modifications to this building eliminates the irregular decks, and enables the possibility to create a rational placement of housing units. The concrete that is removed, furthermore consists of the part removed for making openings. From the description, it is seen that the amount of concrete added is less than the amount removed.

ØSTRE KAJGADE 11 - SCENARIO 3

The building, has been completed with decks, utilizing the volume in the best possible way. This investigation is based on demolishing all the internal structures in the building, including the existing decks, for the optimization of number of apartments and stories. For this an additional investigation has been made on what happens if the existing decks are kept and extended, letting them define the ceiling height for the apartments. Through this it is seen that the number of apartments drops, but with it the use of concrete drops as well. Resulting it in having a smaller environmental impact.

■ EXISTING DECKS



ØSTRE KAJGADE 11
SCENARIO 1

REMOVAL OF CONCRETE:
31.6 M^3

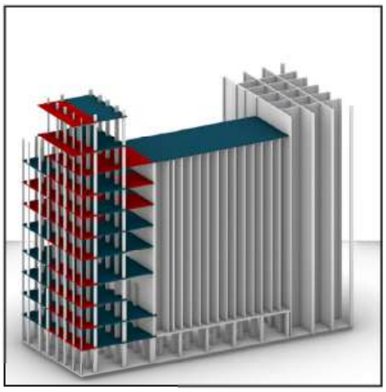
ADDITION OF CONCRETE:
00.0 M^3

RELEASE OF EMBODIED ENERGY:
12.0 KWH / M^2

RELEASE OF CO2 EMISSIONS:
9.3 KG CO2 eq./ M^3

COSTS OF REMOVING CONCRETE:
109.740,65 DK

■ EXISTING DECK
■ NEW ADDITION



ØSTRE KAJGADE 11
SCENARIO 2

REMOVAL OF CONCRETE:
408.1 M^3

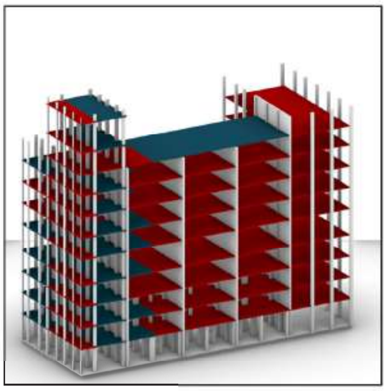
ADDITION OF CONCRETE:
137.6 M^3

RELEASE OF EMBODIED ENERGY:
75.5 KWH / M^2

RELEASE OF CO2 EMISSIONS:
55.0 KG CO2 eq./ M^2

COST OF REMOVAL:
1.056.033,51 DKK

■ EXISTING DECK
■ NEW ADDITION



ØSTRE KAJGADE 11
SCENARIO 3

REMOVAL OF CONCRETE:
2995.6 M^3

ADDITION OF CONCRETE:
1508.9 M^3

RELEASE OF EMBODIED ENERGY:
207.3 KWH / M^2

RELEASE OF CO2 EMISSIONS: KWH / M^2
159.2 KG CO2 eq./ M^2

COST OF REMOVAL:
18.815.038,43 DKK

Ill. 117

ØSTRE KAJGADE 25

INTRODUCTION

The building on Østre Kajgade 25 has good preconditions for the establishment of housing units, as the building is organized with decks placed placed on top of each other, and in full height of the building. As these decks are placed in front of the building, these enables, the possibility for placements of units with views towards the harbour. This is also supported by the openings of building, that fits better with present standards to windows. The back of the building contains the large silos, not containing any decks.

ØSTRE KAJGADE 25 - SCENARIO 1

As the housing units would be kept together in the front, the basis, for achievement of a compact surface area, and reinsulating, would be good. However, as this building should be considered as threes individual towers, large part of the space will be dedicated to circulation, which results in less sizes of housing units.

ØSTRE KAJGADE 25 - SCENARIO 2

The building which consists of three towers are connected to each other, which concentrates the circulation, while increasing the sizes of the housing units. To secure better flow between these, decks must be extended, while openings must be established in wall. This requires both removal and addition of the material.

ØSTRE KAJGADE 25 - SCENARIO 3

The organization of the housing units has been maximized, to the shields of the building, which means, that silos has been replaced by housing units. These are organized in different sizes, with several orientations. This approach enables the possibility of organizing the circulation around a central placed circulation core, which accommodates planning of technical installations.

■ EXISTING DECKS

ØSTRE KAJGADE 25
SCENARIO 1

REMOVAL OF CONCRETE:
8.14 M^3

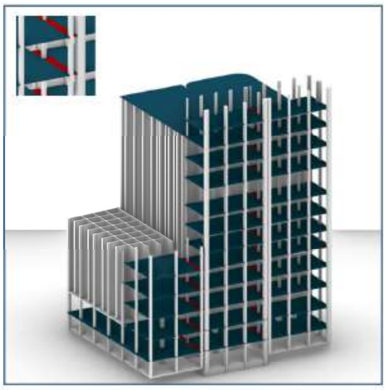
ADDITION OF CONCRETE:
0.0 M^3

RELEASE OF EMBODIED ENERGY:
2.3 KWH / M^2

RELEASE OF CO_2 EMISSIONS:
3.0 KG CO_2 eq./ M^3

COSTS OF REMOVING CONCRETE:
32.220,10 DKK

■ EXISTING DECK
■ NEW ADDITION



ØSTRE KAJGADE 25
SCENARIO 2

REMOVAL OF CONCRETE:
8.14 M^3

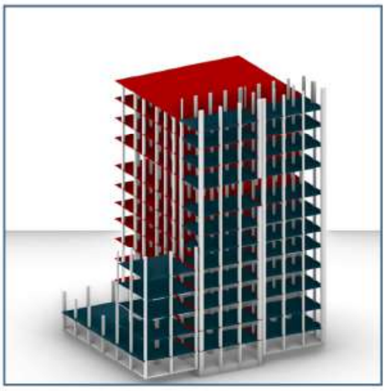
ADDITION OF CONCRETE:
9.3 M^3

RELEASE OF CO_2 EMISSIONS:
3.9 KG CO_2 eq./ M^2

RELEASE OF EMBODIED ENERGY:
5.0 KWH / M^2

COST OF REMOVAL:
32.220,10 DKK

■ EXISTING DECK
■ NEW ADDITION



ØSTRE KAJGADE 25
SCENARIO 3

REMOVAL OF CONCRETE:
2995.6 M^3

ADDITION OF CONCRETE:
1508.9 M^3

RELEASE OF EMBODIED ENERGY:
114.6 KG CO_2 eq./ M^2

RELEASE OF CO_2 EMISSIONS:
150.4 KWH / M^2

COST OF REMOVAL:
7.551.760,72 DKK

Ill. 118

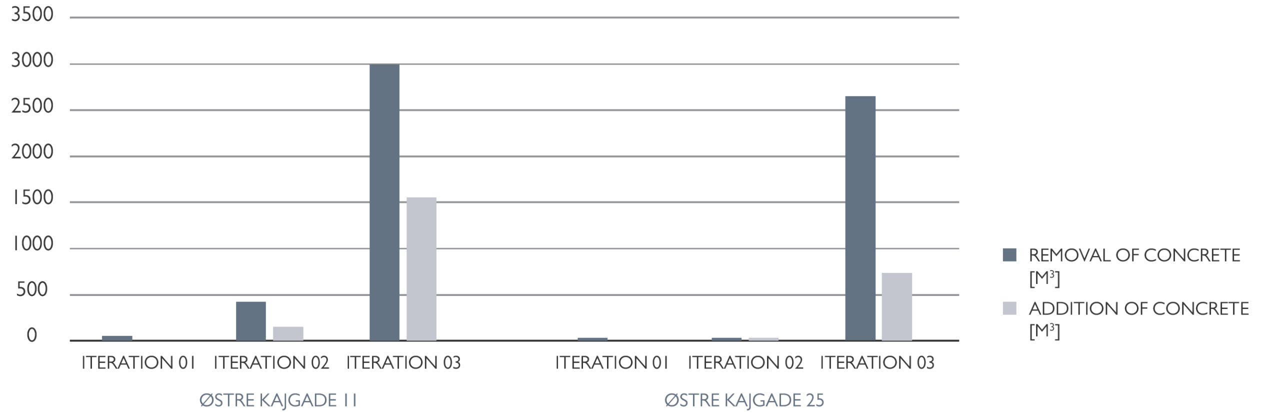
| SUMMARY

Based on the study, strategies have been applied to each silo building, that have been evaluated from a functional viewpoint, held up against environmental and economic considerations. However, this should also be seen in the light of the marked in Svendborg. The costs linked to the project are high, why there is an interest in selecting a strategy, that responds to the contemporary and futural demand, through efficient exploitation of the buildings. Today residential buildings in Svendborg, are found along the harbour where the challenges they face, are that these are for sale for a longer duration. This caused by the lack in demand from the inhabitants, and the purchasing power, explaining why by a lack in demand from the inhabitants, why the quantity of apartments in this context should reconsidered.

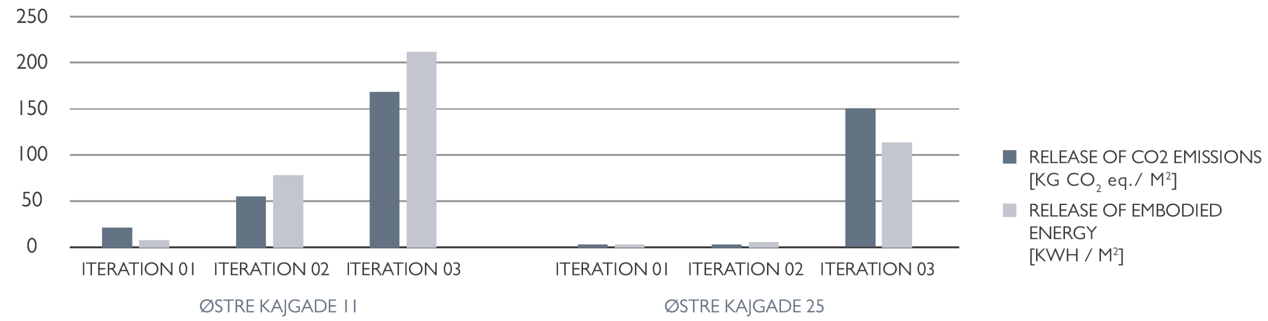
Each of the scenarios each represents a different degree of intervention, which is also reflected in ill. 119 - ill. 121 i, streching from removal of possibly 0 – 2995 m^3 of concrete. Beyond the economical impact, these also result in, environmental impacts, that encompasses, energy and emissions of, removal and addition of concrete, that both varies.

In the selection of a scenario, the intervention, also represents the economic impact. Therefore, the lower interventions, results in lower costs, which means, less investment costs per square meter. This fits with interventions of scenario 1, in both buildings, where the layout works with the existing decks. However, to secure that, the design accommodates better frames for circulation, efficient integration of dwellings and development of a compact building envelope, scenario 2, for both buildings, is the efficient approach, and thereby desired strategy.

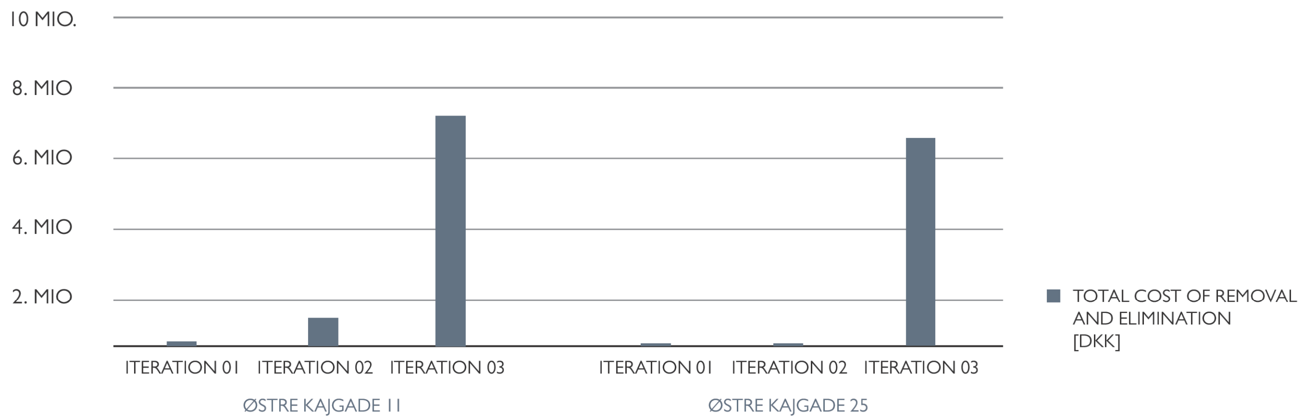
ILL. 119 DEGREE OF INTERVENTION



ILL. 120 ENVIRONMENTAL IMPACT



ILL. 121 COST OF REMOVAL AND ELIMINATION



PROGRAMMING OF SILOS

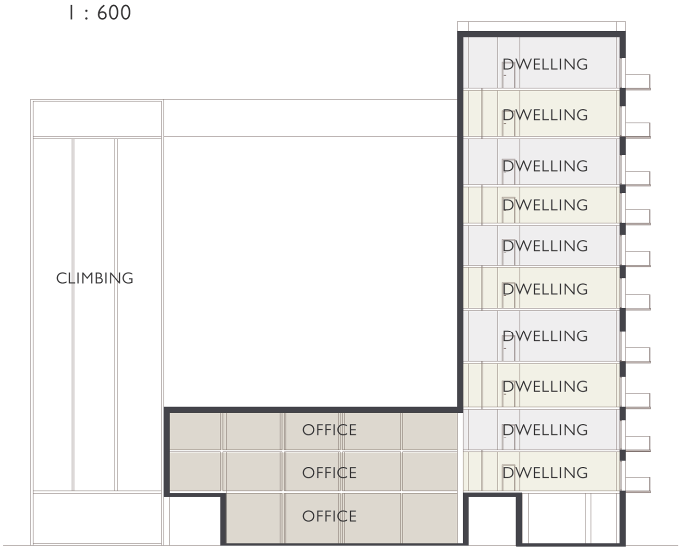
INTRODUCTION

The following section looks further at the silos and how these can be improved, in the of the capacity of dwellings, based on initial strategies regarding minor modifications. Both silos are presented in two variations. Commonly for these building drawings are, what is found within the thick outlines, is the parts of the building intended to be heated space.

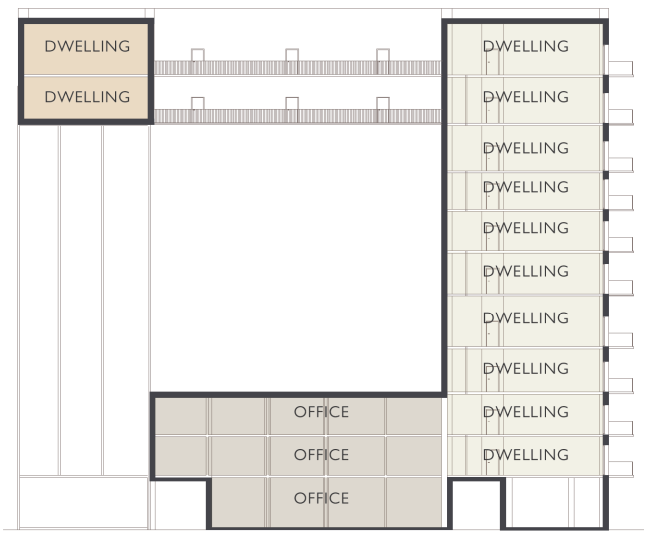
ØSTRE KAJGADE 11

The programming of this silo is approached through two iterations, where the main functions are located in the western part of the building volume in iteration 1, while iteration 2 gets the addition on top of the central volume. Circulation is defined by the passages, as reflected in the plan layout. The ground floor contains a mixture of functions, among other storage, office, climbing and exhibition. In the remaining floors, dwelling and offices are found.

SECTIONS
1 : 600



Ill. 122 ITERATION 01
ØSTRE KAJGADE 11



Ill.123 ITERATION 02
ØSTRE KAJGADE 11

Ill. 124 ITERATION 01

Ill. 125 ITERATION 02

PLANDRAWINGS
1 : 600

Ill. 126 GROUND FLOOR
[ITERATION. 1 + ITERATION 2]

Ill. 126 FIRST FLOOR
[ITERATION. 1 + ITERATION 2]

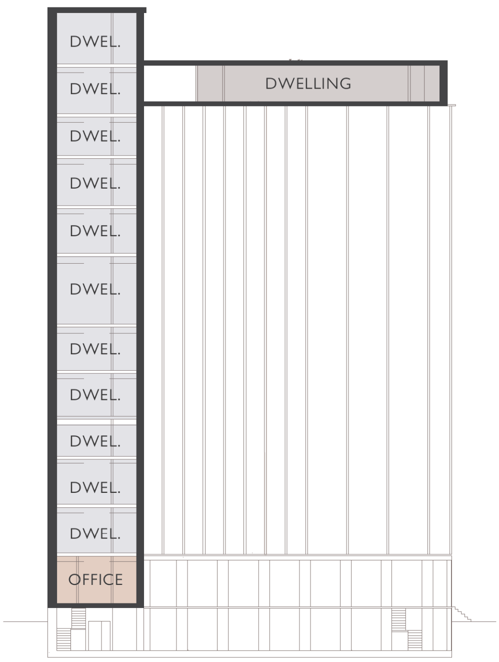
Ill. 127 STANDARD FLOOR
[ITERATION. 1 + ITERATION 2]

Ill. 128 TOP FLOOR
[ITERATION 2]

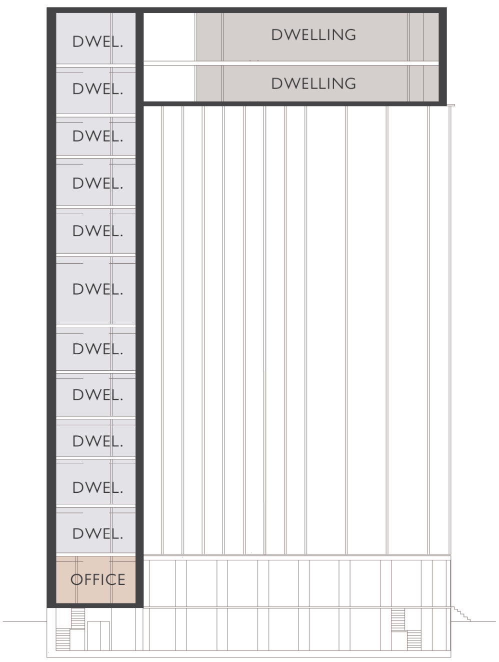
ØSTRE KAJGADE 25

Commonly for these iterations are the focus on the front of the building, that is oriented towards southwest. This part is intended to be insulated, and therefore contain the main functions, where the circulation core also is to be found. The differences of the iterations lies in the addition of flooring, as the section also reveals. The basement is organized with storage, ground floor with public function, while the remaining floors are dedicated to dwellings. The plan layout works with the existing openings. The challenge of this building lies in, the oblong layout of the apartment, which will be investigated further.

SECTIONS
1 : 600



Ill. 129 ITERATION 01



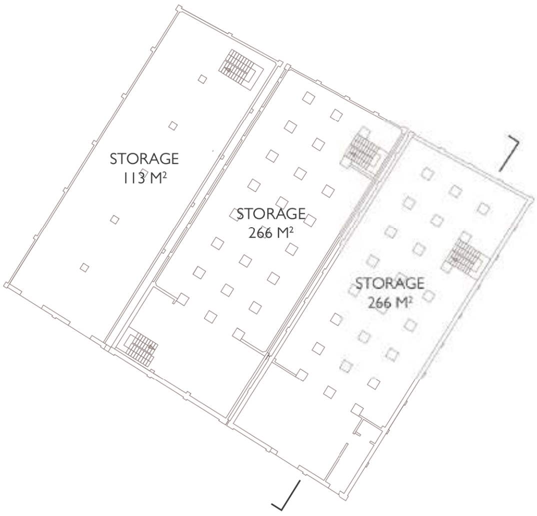
Ill. 130 ITERATION 02

Ill. 131 ITERATION 01

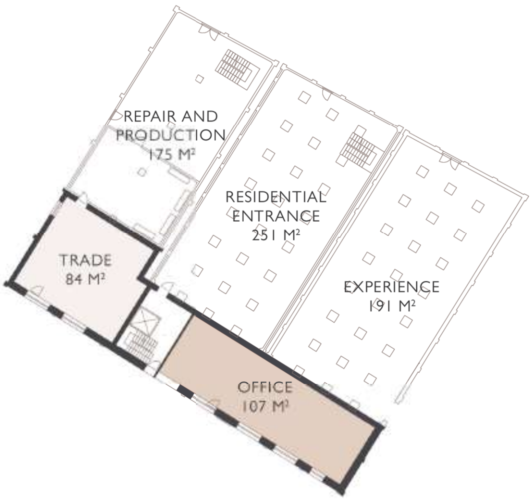
Ill.132 ITERATION 02

N

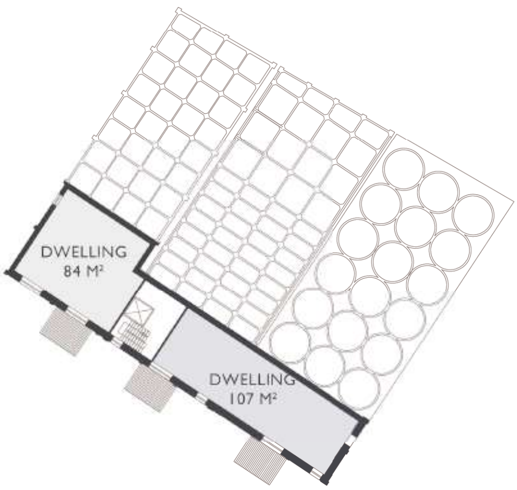
PLANDRAWINGS
1 : 600



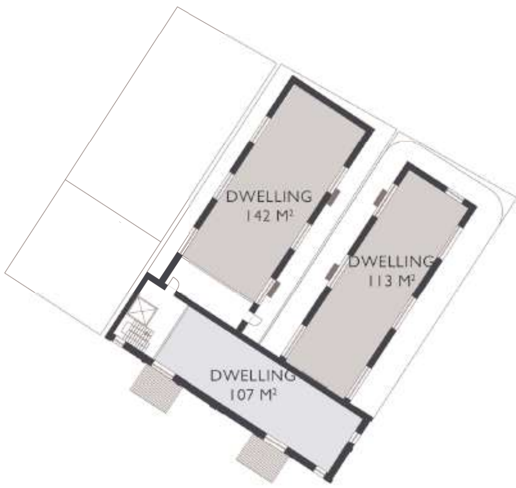
Ill. 133 BASEMENT
[ITERATION. 1 + ITERATION 2]



Ill. 134 GROUNDFLOOR
[ITERATION. 1 + ITERATION 2]



Ill. 135 STANDARD FLOOR
[ITERATION. 1 + ITERATION 2]



Ill. 136 TOP FLOOR
[ITERATION. 1 + ITERATION 2]

CONCLUSION

1. SCALE/PROPORTIONS The two iterations reveals a rather big difference in terms of their proportions between the untouched part of the silos and the new apartments. Iteration 1 presents itself as a smaller volume than the silos, while iteration 2 almost overcasts the untouched volume, landing on top of the silos.

2. CULTURAL HERITAGE In line with the scale and proportion of the two iterations, follows a question of respect to the building and thereby to the preservation of the cultural heritage. Through this it is the scale and proportion, that reveals how iteration one presents a respectful way of not overgrowing the silos.

3. APARTMENTS WITH VIEWS With the placement directly on the waterfront with a great view of Svendborg and the water, an obvious evaluation parameter is how each iteration creates these views. Here it is clear that iteration two wins, as it creates almost double the number of apartments oriented directly to the water.

4. THE MARKET Iteration one requires a lower investment and with the lower number of apartments, the apartments will be sold quicker. The potential profit in iteration two is bigger, but to it also follows bigger risks.

5. CONSTRUCTION With the addition of apartments in iteration two, the complexity raises in terms of construction, by that being said it is not unsolvable. The background for this is that in stead of only having apartments placed on top of each other, they are also placed next to each other.

6. NEW MATERIALS The addition of apartments seen in iteration two, ads to the part of building with new materials, as it cannot be based on using the existing building as a part of its envelope. It is therefore assumed that that the emission per square meter apartment would be lower in iteration one.

7. COST Based on the assumption of it being cheaper per square meter to build new, the addition of the apartments on top of the building, is assumed to lower the cost of the apartments in total, seen per square meter.

Ill.137 Table showing the difference in surface area pr. m² housing for the two iterations valid of Østre Kajgade 11

CRITERIA	ITERATION 01	ITERATION 02
M² TO OUTSIDE PER M² HOUSING	1.21	1.31
M² TO UNHEATED PER M² HOUSING	0.18	0.30

Ill. 138 Table showing the complete score of the iterations of both Østre Kajgade 11 and Østre Kajgade 25

PARAMETER	ITERATION 01	ITERATION 02
01	WINNER	
02	WINNER	
03		WINNER
04	DRAW	DRAW
05	WINNER	
06	WINNER	
07		WINNER
08	WINNER	

INSULATION STRATEGIES

INTRODUCTION

There is an interest to raise the buildings to the standards of today, with basis in the frame of energy class 2020. Definition of the energy class is that the buildings need for supplied energy to heating, ventilation, cooling, domestic hot water and lightning pr. m^2 heated area, is not exceeding 20.0 kWh/m2 per year (Bygningsreglementet, 2021 - 1). The following section looks at passive strategies, in the form of a strong building envelope, whether buildings should be insulated internally or externally, for Østre Kajgade 11 and Østre Kajgde 25.

The internal insulation is often not recommended, but this becomes necessary, during the work with protected buildings. The precondition of internal insulation is to have a tight vapor barrier, if not, moisture will travel into the construction and condensates, as it hits the cold surfaces, in the form of concrete or brick surfaces and the risk for mould to develop will rise (Bolius, 2018). The approach complicates the process of installing and uninstalling the insulation.

The common approach is to raise a wooden framework, with insulation covered with plaster. The external insulation wraps the building in insulation and ensures, that it is kept warm. This can be approached by mounting insulation on an external skeleton, as seen in ill. 139 - ill. 142, as this would not influence the statical system, and therefore not have any breakthroug, which will in the end lessen cold bridges. The external finish could be plaster or plates, that gives freedom, to further change of the façade (Rockwool, 2021).

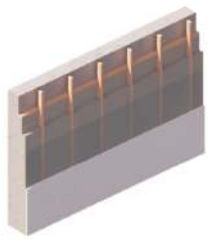
CONCLUSION

The external insulation will be used for the insulation of both of the buildings, where the characteristics of the existing façade, in especially Østre Kajgade 25 will be kept, to maintain a reference to previous times.

Ill. 139 EXTERNAL INSULATION
ØSTRE KAJGADE 25

Ill. 140 INTERNAL INSULATION
ØSTRE KAJGADE 25

Ill. 141EXTERNAL INSULATION
ØSTRE KAJGADE 11



Ill. 142 INTERNAL INSULATION
ØSTRE KAJGADE 11

HOUSING PLANS

INTRODUCTION

Where the previous studies looked at the programming of the silos, the following study will look at the programming and planlayout of dwellings.

FIRST ROUND

The first iteration of plan studies resulted in the discovery of physical properties and opportunities of both buildings, as Østre Kajgade 11 had more potential with different types of layout and views, because of the rectangular shape, while Østre Kajgade 25 with an elongated shape, was limited to in views and planlayout.

ØSTRE KAJGADE 11

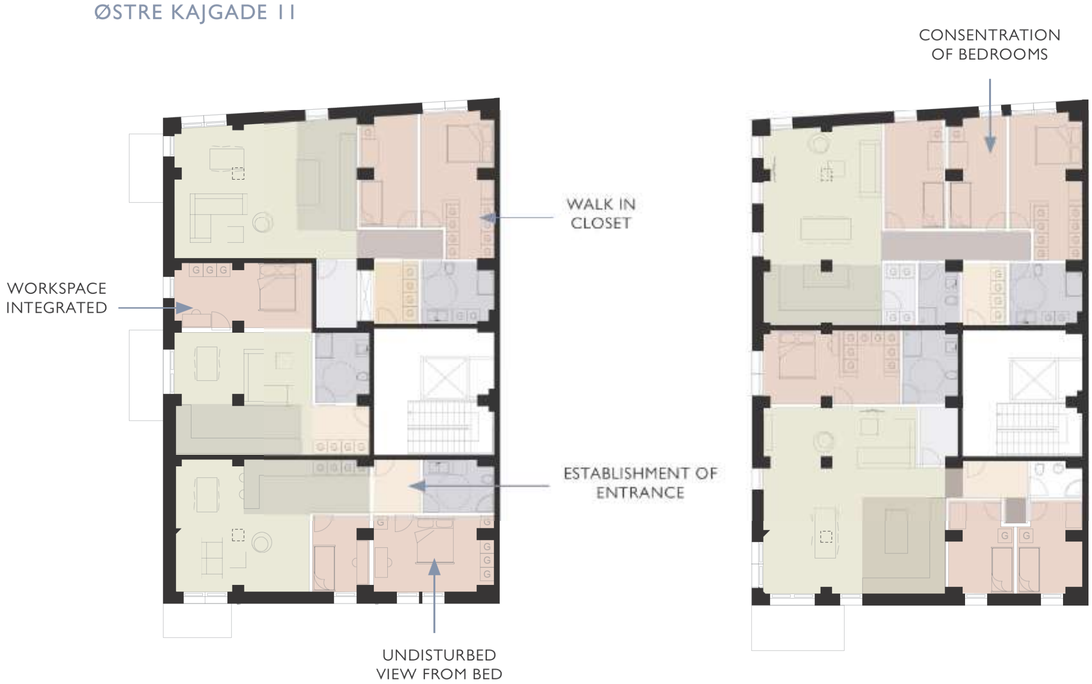
ØSTRE KAJGADE 25

Ill. 143

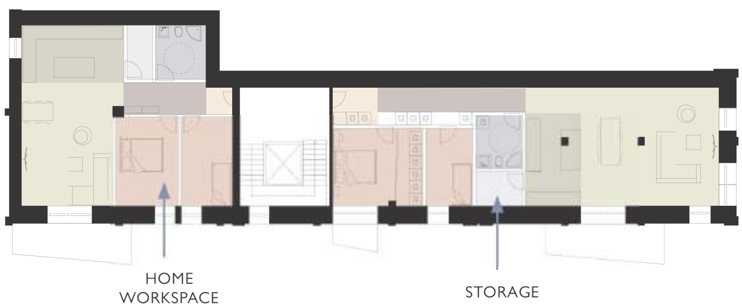
FIRST ROUND

The next iteration of plans was made with optimization of rooms, regarding wheelchair users, importantly also improving daylight access and providing home work spaces. The second iterations of plan drawings ensures more usable, open, and spacious living/dining rooms. The rooms are intended for rest, can provide flexibility for the other functions. All apartments have a bathroom with access for a person in a wheelchair. In Østre Kajgade 11, a specific column have been removed for the purpose of creating usable living rooms. The removed element, shown by a dotted sqaure on the illustrations below, would be replaced by a beam. Apartments have access to private outdoor spaces, where the balconies serves as an extension of the living/dining room, yet bigger apartments have an additional balcony for the master bedroom.

ØSTRE KAJGADE 11

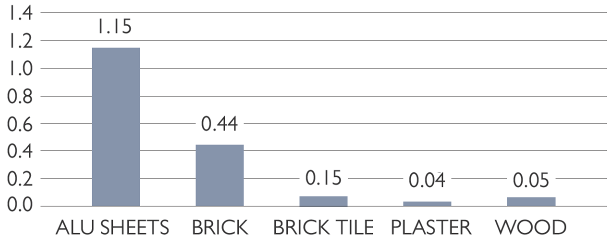


ØSTRE KAJGADE 25

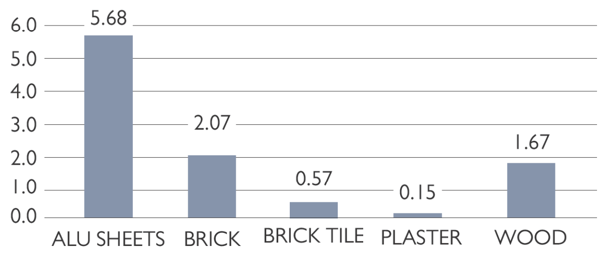


Ill. 144

Ill. 145 GLOBAL WARMNING POTENTIAL [GWP]
KG CO2 eq. / M² / YEAR



Ill. 146 EMBODIED ENERGY [PETOT]
KWH / M² / YEAR



| MATERIALITY

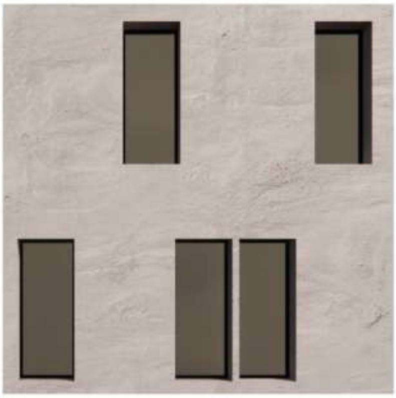
INTRODUCTION

The following study looks at the external cladding of the building, where the range of materials are restricted to which materials, that are found on the site. Hence the material selection supports the industrial environment. The study is supported by an LCA analysis, with a comparison of 1 m2 of cladding.

The analysis of these, looks at the environmental impact, both regarding global warming potential and embodied energy. However, the intention is to select claddings that justifies the original aesthetics of the building, why remaining aspects in the form of the harsh environment, installment and transportation should be considered. Commonly for the buildings are to maintain an expression, which follows the original design, respectively in the form of grey and red tones, for Østre Kajgade 11 and Østre Kajgade 25. The materials should also reflect lightness, as a reference to the dwellings, which becomes relevant for Østre Kajgade 11, due to the solid expression. As the illustration reveals, sheets of metal, plaster, brick, brick tile and wood are used as cladding.

CONCLUSION

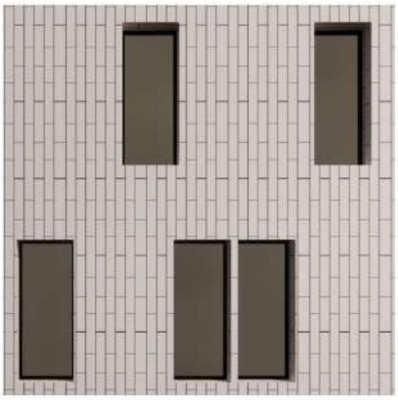
Based on the study Østre Kajgade 11 will be raised in alu sheets, while Østre Kajgade 25 will be raised with brick tiles, both materials, capable of tolerating the harsh environment. Importantly these materials are considered as materials, that accommodates good properties regarding installment.



Ill. 147 PLASTER FACADE
ØSTRE KAJGADE 11

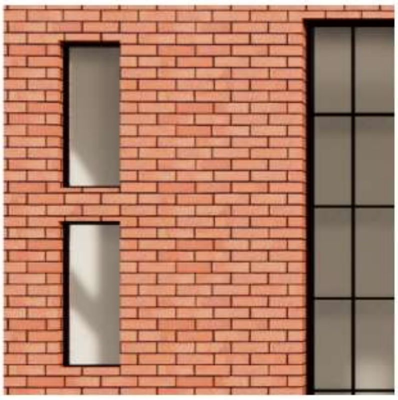
Ill. 148 PERFORATED FACADE
ØSTRE KAJGADE 11

Ill. 149 WOODEN FACADE
ØSTRE KAJGADE 11



Ill. 150 ALU FACADE
ØSTRE KAJGADE 11

Ill. 151 BRICK TILE FACADE
ØSTRE KAJGADE 25

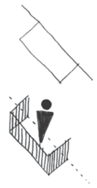


Ill. 152 BRICK FACADE
ØSTRE KAJGADE 25

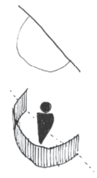
| WINDCOMFORT

INTRODUCTION

Beyond representing the aesthetics of the façade, the balconies requires functional and technical investigations. These encompasses both, Østre Kajgade 11 and Østre Kajgade 25. The following section strives to looks at them from viewpoint of wind comfort, sun, expression and materiality. The basis for the expression of the balconies are the curved and rectangular balconies, as seen in ill. 153 - ill. 154.



Ill. 153 RECTANGULAR BALCONY

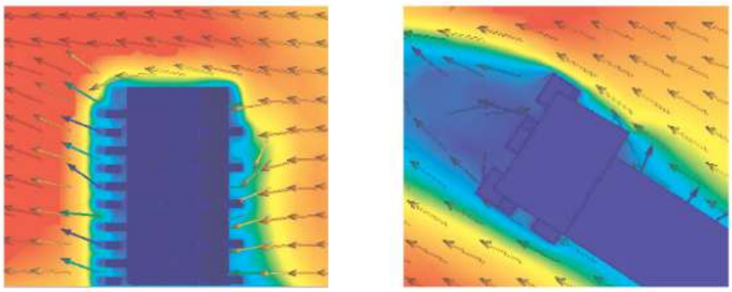


Ill. 154 CIRCULAR BALCONY

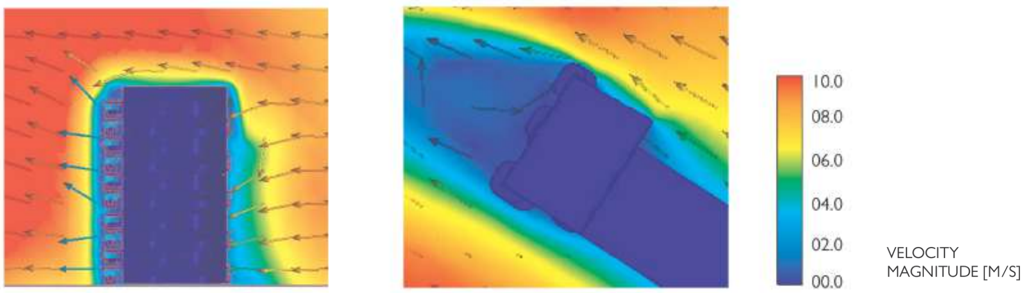
WIND COMFORT

The characteristic of working with tall buildings lies in the windy environment that they produce, which conflicts with the interest of creating a good outdoor environment on the balconies. The wind simulation looks at the rectangular balconies against curved balconies, to give an insight, of what shapewould function better for balconies and how wind would act up against each form. The simulation takes basis during summer period, where the frequent wind hits the south side towards the waterfront.

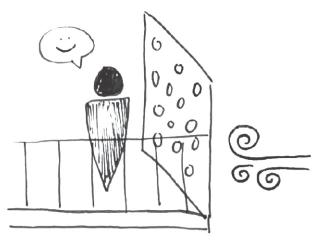
Ill. 155 RECTANGULAR BALCONY [FRONT + TOP VIEW]



Ill. 156 RECTANGULAR BALCONY [FRONT + TOP VIEW]



For the curved balconies, the wind speed is higher and more concentrated on the northwest oriented side. For the geometric balconies the wind speed is higher and more concentrated on the southwest oriented side. In terms of comfort at the ground floor of the apartment, the wind is calmer at the geometric balconies compared to the curved ones, which will be considered in the further programming of the ground floor, by including shelter. Through the simulation a definitive answer cannot be found, as these have not shown a clear reason to pick one from another from a comfort viewpoint. However, this will be investigated further. From previous analysis of the masterplan, perforated sheets were used for sheltering, this would be considered when further designing, as this improves the comfort levels on the balconies.



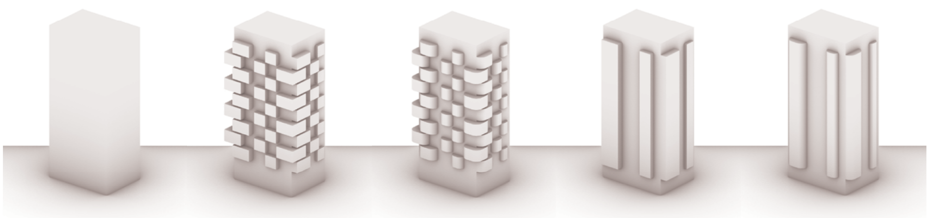
Ill. 157 BALCONY WITH SHADING

EXPRESSION |

INTROUDCTION

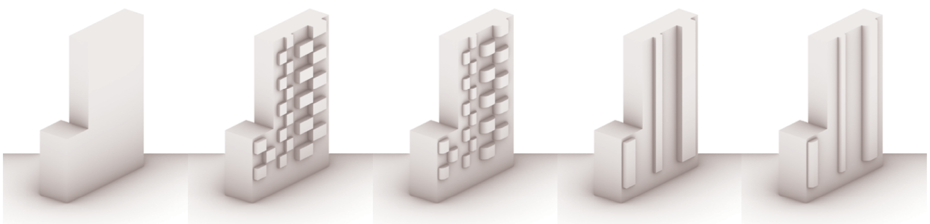
The previous study did not show, differences in the rectangular or curved balconies, in relation to wind comfort, explaning why the following section looks at both designs approaches, on both silo buildings.

Ill. 158 ØSTRE KAJGADE 11



BASIS VOLUME	VARIYING RECTANGULAR	VARIYING CURVED	LINEAR RECTANGULAR	LINEAR CURVED

Ill. 159 ØSTRE KAJGADE 25



BASIS VOLUME	VARIYING RECTANGULAR	VARIYING CURVED	LINEAR RECTANGULAR	LINEAR CURVED

CONCLUSION

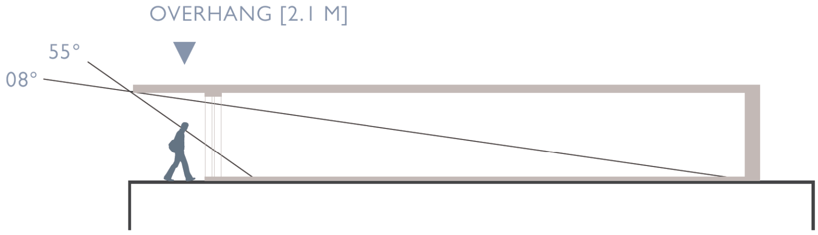
For Østrer kajgade 11, the expression is very subtle in terms of any variations, as it is this big concrete block. Therefore a variated placement of the balconies can help ensure, that the façade becomes more dynamic. As the shape of the building can have wariating floorplans, which means different views to the outdoors and allows for varyating balconies as well. In terms of curved and geometric balconies, a lighter expression is ensured by the use of curved, which helps make the building seems less massive.

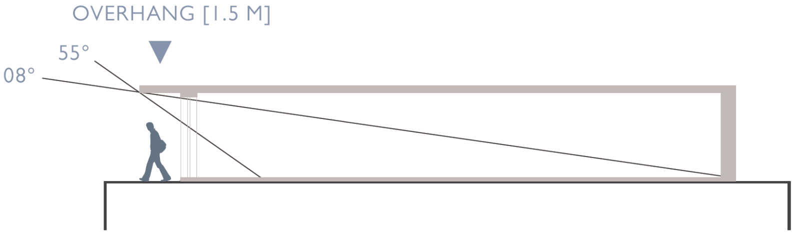
For Østrer Kajgade 25, the building is more characteristic compared to Østre Kajgade 11, with its dominating vertical expression. Though as it is intended to externally insulate the building, the current expression would then be less relevant. The vertical expression is seen as a key indentity of the building, instead of the old pilasters, the balconies should accentuate these vertical bands on the façade. Previous stuides have shown, that variations in the floorplans is not possible, caused by the the slender form, therefore the balconies should be a way to showcase the vertical expression, after insulation.

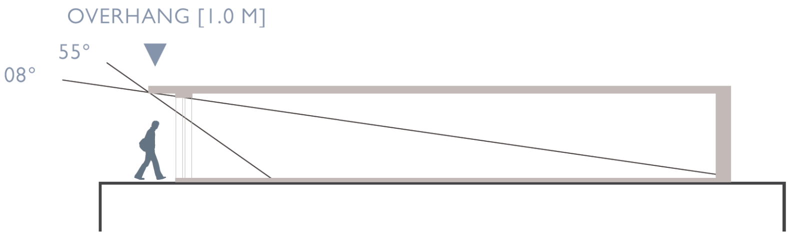
| SHADING

INTRODUCTION

Because of the use of sheltering on the balconies, to ensure a more integrated design shading from the sun is wanted as well through the balconies. The shading depends on the depth of the balconies therefore a study on 3 different depths have been done. These examples are based on real life references:



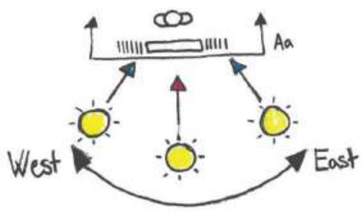


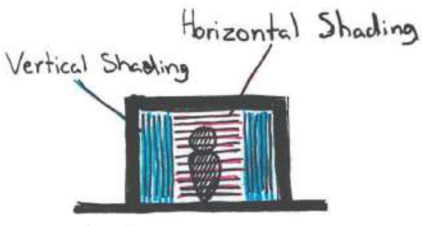


CONCLUSION

The longer the overhang, the more shading is created when the sun has a high angle, though during the winter the sun will enter the building, this should be taking further into account, as this could blind people inhabiting the apartments, therefore additional external shading will be used.

Ill. 161 STRATEDGIES REGARDING SHADING



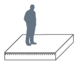
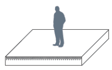
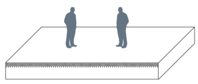


DIMENSIONING OF BALCONIES

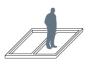
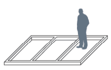
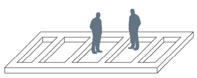
INTROUDCTION

The material used for the balcony platform has not been defined yet as well, though as the site historically known for its industrial image a focus has been on the use of concrete and steel. Therefore, a study has been made to see which material is most efficient.

Ill. 162 CONCRETE DECKS
(appendix 8)

PARAMETER	PROTRUSION	DIMENSIONS
	1.0 M	2000 x 300 MM (74 pcs of ø20 mm with 40 mm cc)
	1.5 M	3000 x 400 MM (123 pcs of ø20 mm with 40 mm cc)
	2.0 M	6000mm x 800mm (245 pcs of ø20 mm with 40 mm cc)

Ill. 163 STEEL DECK
(appendix 8)

PARAMETER	PROTRUSION	DIMENSIONS
	1.0 M	100 X 60 X 10 MM
	1.5 M	100 X 60 X 10 MM
	2.0 M	2000 X 200 X 10 MM

CONCLUSION

The chosen materials for the balcony will be steel, as this results in less material needed, and a lighter construction in total compared to the concrete balconies. The slimmer profile of the steel also makes it easier to install and stack on top of each other.

FACADE ENABLEMENT

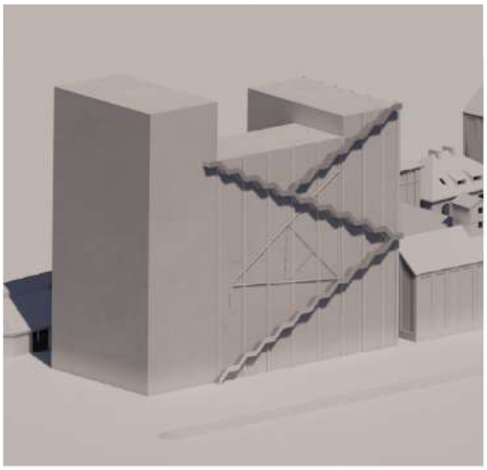
INTRODUCTION

Previous studies show the interest of establishing a tower of dwellings in Østre Kajgade 11, which enables a segment of the façade. However, the remaining façade of the building carries the potentials of improvement. The following study looks at how the facade should be approached. The quality of the building comes down to the history the façade carries, the orientation and the exposure of the building.

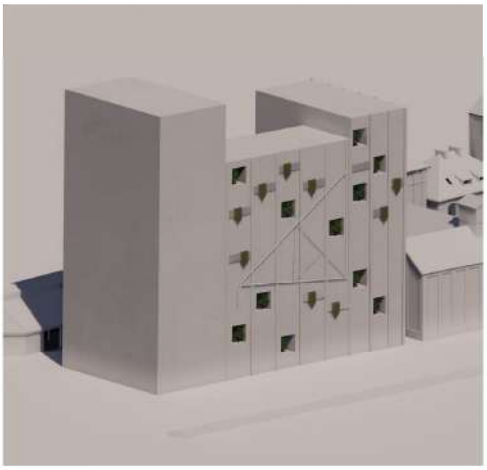
As a result of this, iterations in the form of visual, technical or functional facade expression have been produced. The functional façade represents the external staircase and green pockets, that utilizes the height of the building, for the purpose of inviting the inhabitants. The challenge of this approach are the meetings between the private and public. The visual façade utilizes the size of the building, to lighten up the harbour, while the technical façade utilizes the orientation to supply the dwellings with renewable energy. Commonly for both the visual and technical façade is to develop strategies that works with aesthetic of buildings.

CONCLUSION

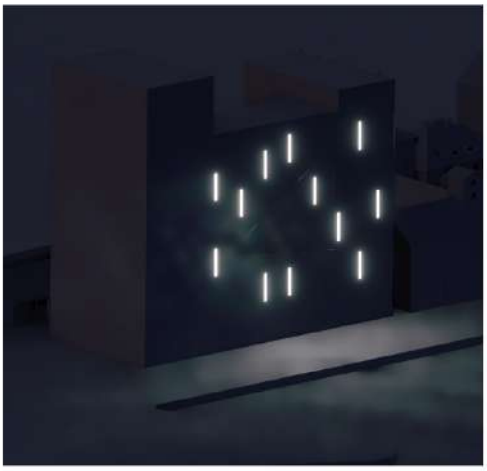
Based on these iterations a combination of the visual and technical façade is chosen, as it is considered as additions to the building, that do not require interventions on the actual buildings, and challenges the meeting between private and public.



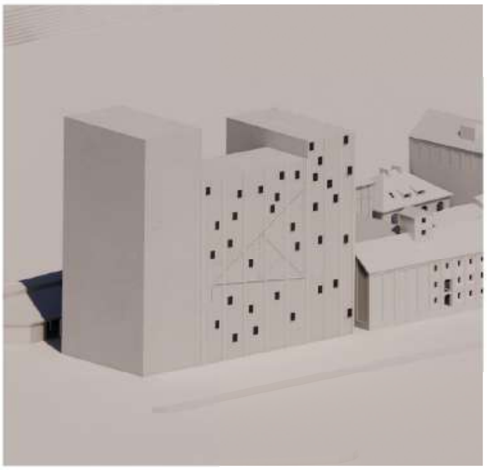
Ill. 164 FUNCTIONAL FACADE
EXTERNAL STAIRCASE



Ill.165 FUNCTIONAL FACADE
GREEN POCKETS



Ill. 166 VISUAL FACADE
LIGHTNING



Ill.167 TECHNICAL FACADE
PHOTOVOLTAICS

RENEWABLE STRATEGIES

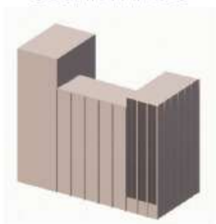
INTRODUCTION

Through this, renewable strategies will be implemented, as an integrated strategy to, reach the desired energy frame. The section presents a range of different strategies, that are investigated for their ability to act as an integrated part of the design, measured through their technical capabilities in terms of how much they produce, their abilities to be well integrated from an aesthetic point of view. Finally, the strategies are examined for their functional abilities, in terms of how they are installed.

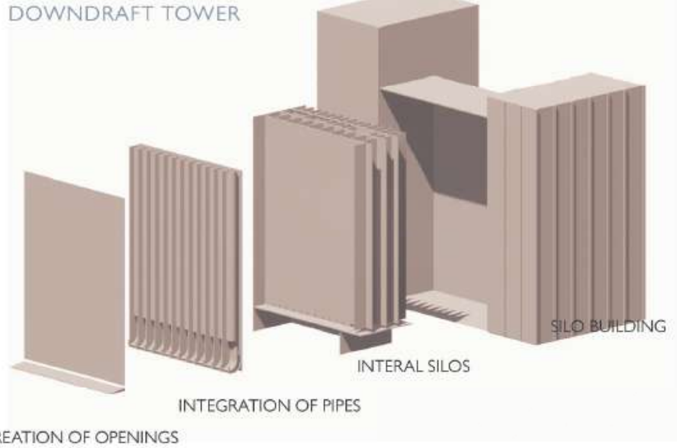
Based on studies done in appendix 9, the relevant strategies chosen are Ridgeblade on the roof and Solar panels on the roof and the facade, as they both fit into the idea, of creating a sufficient energy supply. Furthermore, they provide the remaining part of the silo some functions, that can benefit the buildings without any big impact on the existing volume, this goes especially for Østre Kajgade 11, as on a third of the façade is currently activated. Kajgade 11, as on a third of the façade is currently activated. case be mounted a bit differently, by placing the turbine on the corner where the roof meets the wall. How it would look on the building will also be investigated.

Ill. 168
WINDTURBINES

Ill. 169
SOLAR PANELS



Ill. 170 UPDRAFT AND DOWNDRAFT TOWER

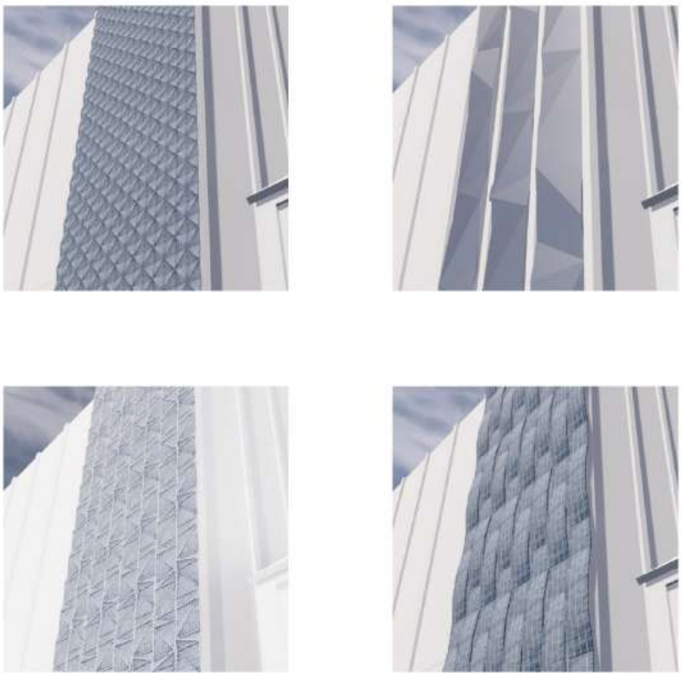


DESIGN

The overall expression of the PV's (photovoltaics) was now investigated. Some concepts on how it could look was based on either the existing expression on the building and how they could relate to functions. Because of the building having this 3-division of the building Dwellings – silo – Activities, the placement of PV's would be on the side of the buildings, where activities take place. Therefore, are expression that relates to cliff, as climbing and rappelling was the intended activity. Additionally a expression where the PV's fitted to the buildings existing pilasters on the façade. The type of PV was also considered, as polycrystalline and monocrystalline has different expressions. In appendix 9 ridgeblade was the used windturbine for the façade. As the product originally is made for the placement on a ridge, the product must in this case be mounted a bit differently, by placing the turbine on the corner where the roof meets the wall. How it would look on the building will also be investigated.

CONCLUSION

Through the study the expression where the PV's fitted into the buildings existing expression, as this was the more optimized solution for creating energy, as the cliff expression would leave panels in the wrong angle. The use of polycrystalline, would additionally create a natural and dynamic expression. Compared to monocrystalline panels, the polycrystalline panels can be sold in different colors and if matched with the dwellings a more holistic approach would be achieved. In terms of the turbines influence on the building's expression, they will have a visual influence as they will be visible from the ground. To make them more seamless with the rest of the building, having the same light grey expression, but also relate to the industrial identity of the façade.



Ill. 171 DESIGN OF SOLAR PANELS

07

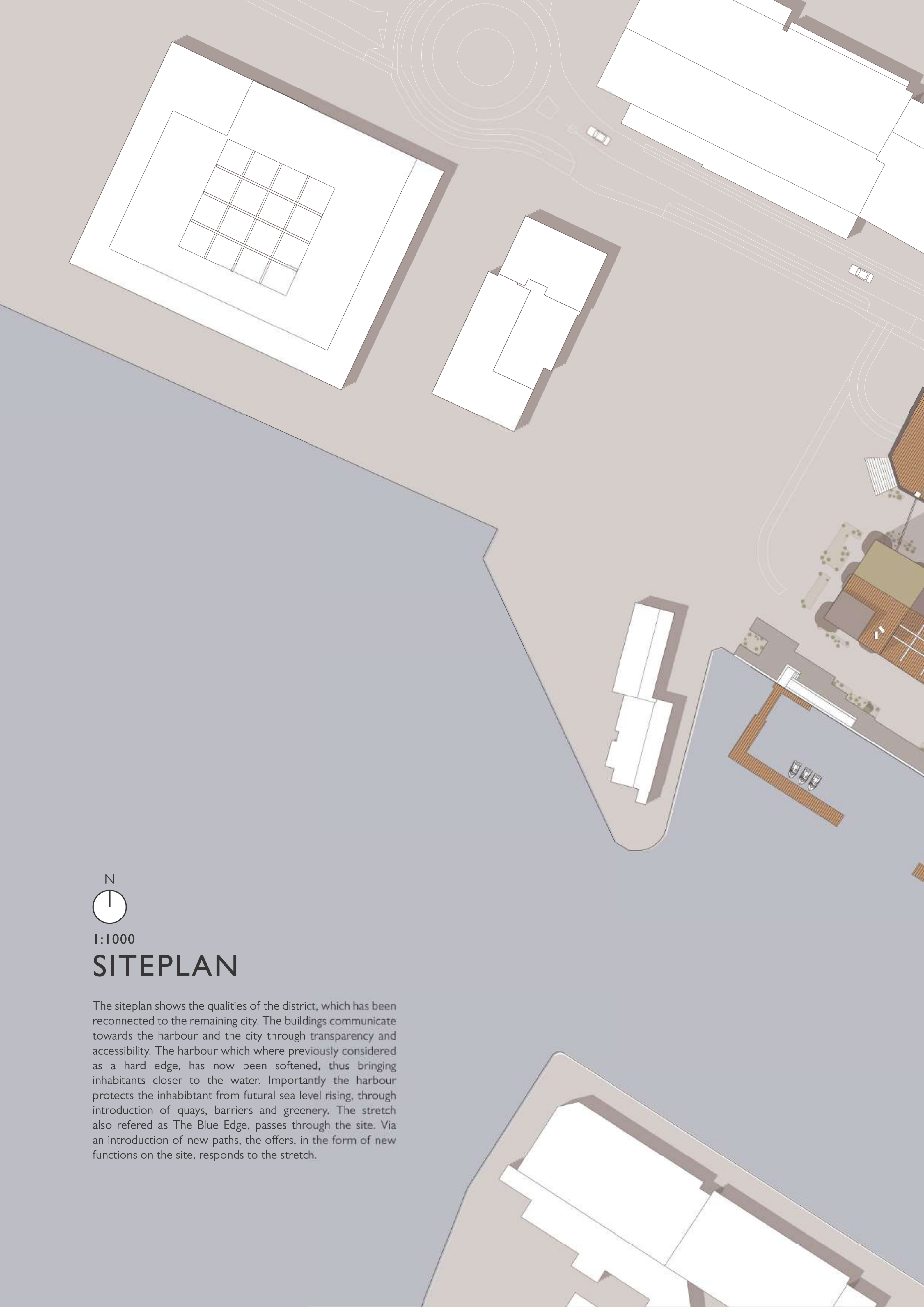
PRESENTATION

ØSTRE HAVN

The new Østre Havn is a new pulsating district for the inhabitants of Svendborg. The variety in the programming of functions invites to residential, recreational and business purposes among the historical frames. With introduction of new faces, the proposal welcomes materiality, that reinterprets the industrial atmosphere, maintaining the character of being a landmark of Svendborg. Each of the volumes representing the area has been treated in its own unique way, focusing on reinforcing each building identity, whereas the overall image and expression of the area is upheld.

Ill. 172 ØSTRE HAVN

ILL. 172 ØSTRE HAVN



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1:1000

SITEPLAN

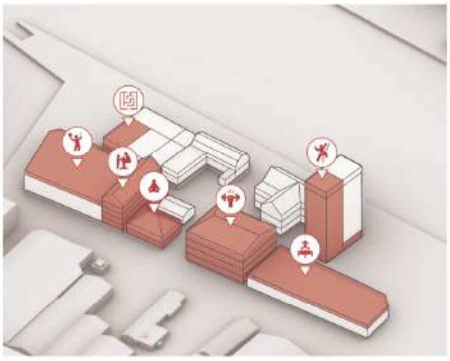
The siteplan shows the qualities of the district, which has been reconnected to the remaining city. The buildings communicate towards the harbour and the city through transparency and accessibility. The harbour which where previously considered as a hard edge, has now been softened, thus bringing inhabitants closer to the water. Importantly the harbour protects the inhabibtant from futural sea level rising, through introduction of quays, barriers and greenery. The stretch also refered as The Blue Edge, passes through the site. Via an introduction of new paths, the offers, in the form of new functions on the site, responds to the stretch.

Ill. 173 SITE PLAN

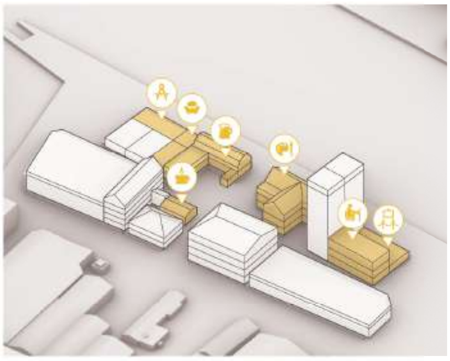
PROGRAMMING OF THE SITE

DESCRIPTION

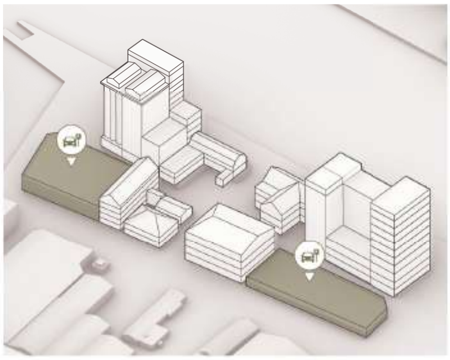
Through the programming of the site, the functions intended for implementation has been organized carefully according to the needs, related to each function, as described previously in the user chapter. The illustrations below show how the many different functions can be divided into 4 different groups, consisting of recreational functions, business functions, dwellings and parking. Through this it is illustrated how the business functions and dwellings is depended on the access of daylight and views. In the sake of the businesses, the exposure related to a placement on the waterfront, is also important. Finally, it shows how recreational function has a smaller need for the access of sun. Even though they are not located on the waterfront, they still get exposed to the people passing by on Østre Havnevej, to which parking is located closest to.



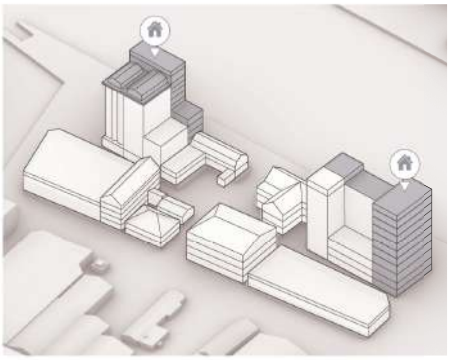
Ill. 174 RECREATIONAL FUNCTIONS



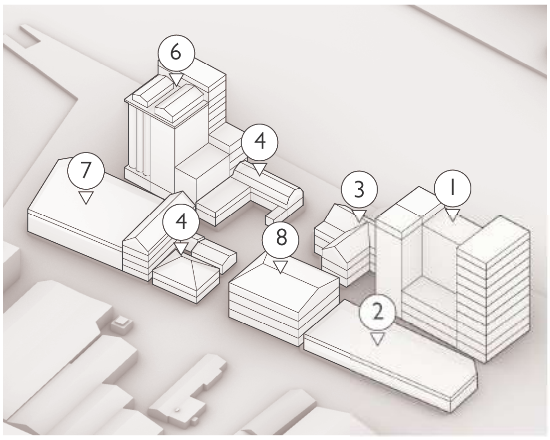
Ill. 175 BUISNESS FUNCTIONS



Ill. 176 PARKING FUNCTIONS



Ill. 177 DWELLINGS FUNCTIONS



Ill. 178 ROOMPROGRAM

Ill. 179 Tables showing each functions gross area

[1] ØSTRE KAJGADE 11		
FUNCTION	QUANTITY	AREA [M²]
OFFICE		764.0
EXHIBITION		183.5
CLIMBING		379.4
APARTMENTS		3779.3
- APARTMENT 1	5	72.4
- APARTMENT 2	5	98.0
- APARTMENT 3	5	127.0
- APARTMENT 4	5	145.7
- APARTMENT 5	4	151.7
- PENTHOUSE	1	222.6
- CIRCULATION	11	35.5
- STORAGE		106.2
- BIKE PARKING		86.0
- COMMON ROOM		151.7

[2] ØSTRE HAVNEVEJ 6	
FUNCTION	AREA [M²]
PARKING	1468.4
ACTIVITY PLATFORM	1468.4

[3] ØSTRE KAJGADE 15	
FUNCTION	AREA [M²]
ARTIST COMMUNITY	1223.0

[4] ØSTRE KAJGADE 23	
FUNCTION	AREA [M²]
BREWERY	258.8
SALES AND SERVICE	186.0

[5] ØSTRE HAVNEVEJ 10	
FUNCTION	AREA [M²]
HEALTH CLINIC	666.6

[6] ØSTRE KAJGADE 25		
FUNCTION	QUANTITY	AREA [M²]
CREATIVE OFFICE		143.3
FURNITURE STORE		114.4
PRODUCTION		184.9
STOCK		304.7
LABYRINTH		281.4
APARTMENTS		3914.7
- APARTMENT 1	5	114.4
- APARTMENT 2	11	143.3
- PENTHOUSE	1	202.1
- CIRCULATION		556.9
- STORAGE		579.8
- BIKE PARKING		268.7
- COMMON ROOM		158.9

[7] ØSTRE HAVNEVEJ 12	
FUNCTION	AREA [M²]
PARKING	14047.9
PADDLE TENNIS	14047.9
WORKSHOP	909.2
CAFE	124.2

[8] ØSTRE HAVNEVEJ	
FUNCTION	AREA [M²]
CROSS FITNESS	719.4
DANCING	719.4
SQUASH	719.4

THE CLIMATE PROOF HARBOUR

Approaching the area along the blue edge, coming either from the city center or the beach in Christiansminde, the former industrial area reveals an openness to people passing by. It is eager to draw people's attention and awake their curiosity through form, materiality and expression. The waterfront supports the interest of a sea level resistant district, that beyond the use of adaptive solutions, provides green recreational pockets, yet also invites to water access, from the site and surrounding city.

Ill. 180 THE CLIMATE PROOF HARBOURS

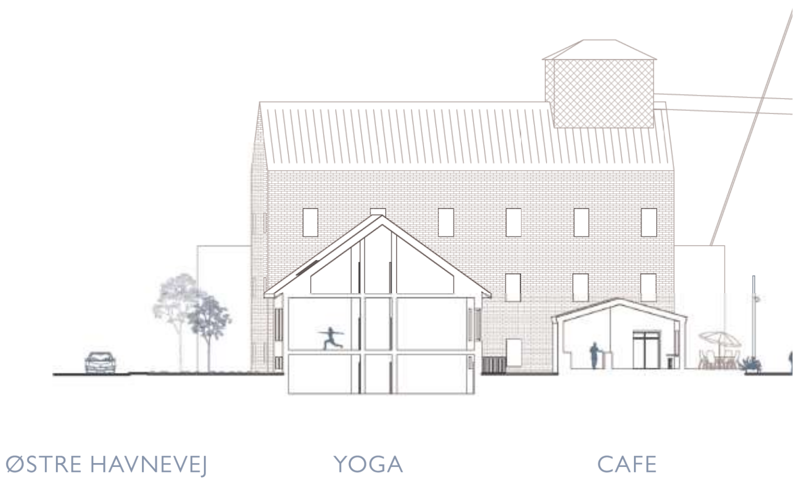

ØSTRE HAVNEVEJ
ØSTRE HAVNEVEJ
+1.8
ENTRA
B
PARKING
WORKOUT
+2.8
STAIRS
+1.8
PASSAGE
+1.8
STORAGE
OFFICE
EXHIBITION
CLIMBING
TRASH
+1.8
ARTIST
COURTYARD
ARTIST
COMMUNITY
+3.1
+1.8
RAILS
ØSTRE KAJGADE
BARRIER
+1.0
MARINA
0.0
+1.0

1:500

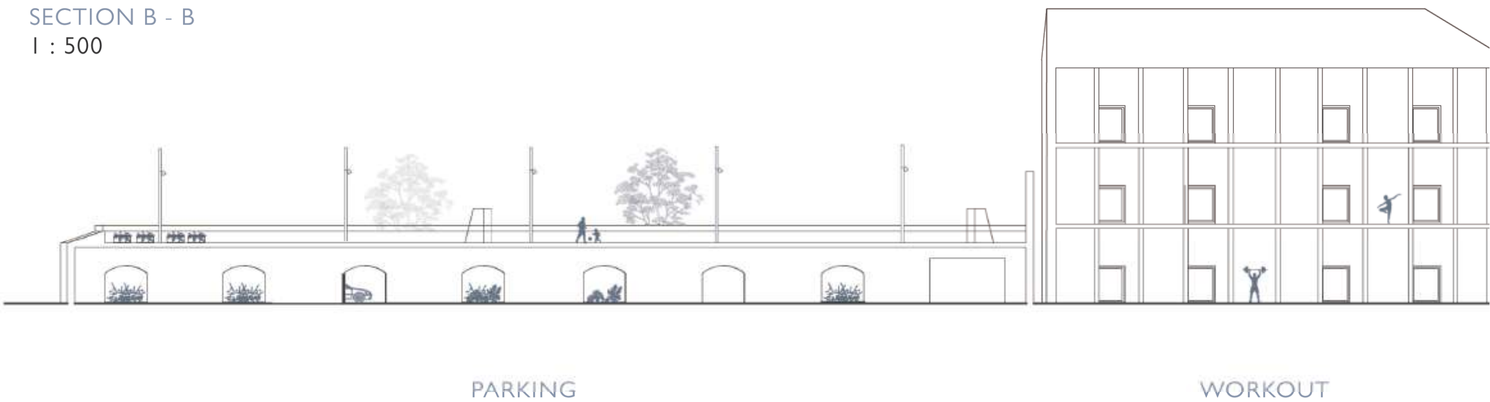
MASTER PLAN

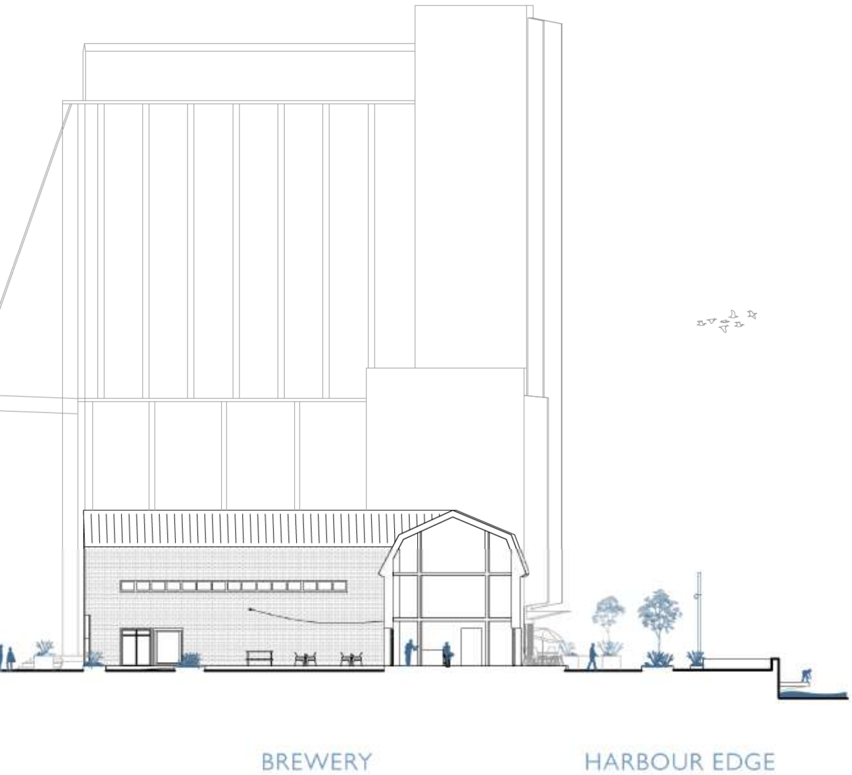
URBAN SECTION

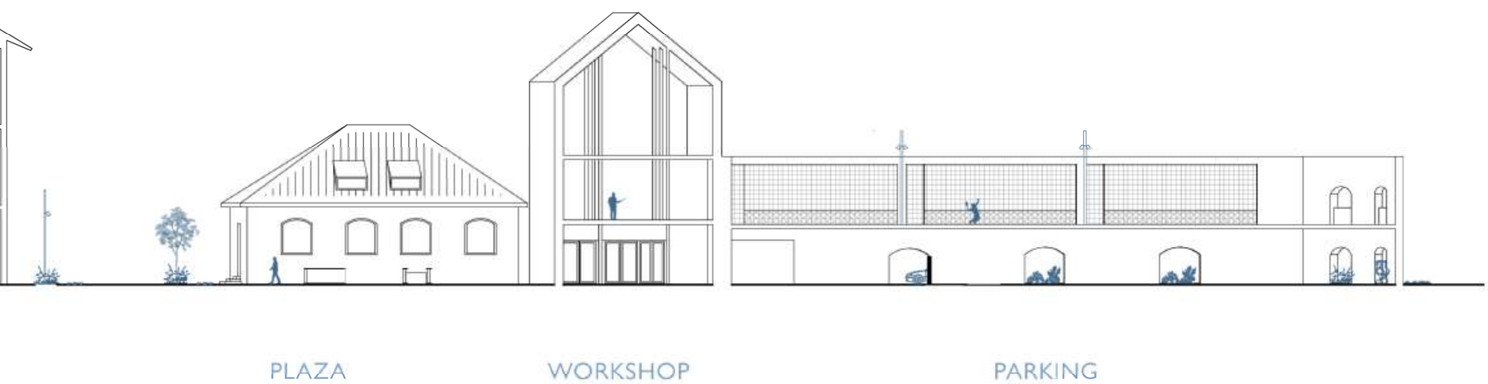
SECTION A - A
1 : 500



SECTION B - B
1 : 500







Ill. 182 SECTION

THE PLAZA

Internally the area consists of two main pathways, that in their crossing creates a central plaza. The plaza acts at this catalyst of activities as functions inside of the buildings towards the plaza live of each other. Functions such as a café, businesses, an artist community and physical activity centers provide the site with diversity and visual activity from a distance. As the mentioned functions surrounds the plaza, life would be expressed differently depending on the orientation and interactions between the functions would take place as well. The preservation of the identity, from the buildings forming the plaza, enforces the industrial atmosphere, through the old brick walls and the preservation of different technical installations. The building stand with a recurring motif, through expression and materiality, thus they are defined as their own through the variation in their use.

Ill. 183 THE PLAZA

ØSTRE KAJGADE 11

BUILDING LAYOUT

The silo building at Østre Kajgade 11 contains different functions, for fully overview, these can be found in the drawing folder. Spread across three floors, 764 m^2 of office space, with its own private access within the building. The silos in the eastern part of the building are transformed into a climbing center, allowing users to take the climb of 36 meters, from the ground floor all the way to the top of the building. In ground level an exhibition area of 183 m^2 is implemented, suitable for different types of exhibitions. The use of the building for apartments, still accounts for 25 apartments, with a total gross area of 3779 m^2. For further information on the building see drawing folder drawing.

APARTMENTS

The 25 apartments are organized in two different plan layouts, creating 5 different apartments ranging from 72 m^2 to 222 m^2. The orientation of the apartments is based on the existing prerequisites for the building, resulting in variations in the orientation of the apartments, with view to and across the city and the harbour. The apartments are shaped to focus on having access to two external surfaces, allowing light to enter the apartments from different orientations.

FOCUS

A focus has been to activate the view to the water, the harbour and the city, resulting in an almost panoramic view when entering the living spaces, through the allowance of looking in two directions. In the living space, the balcony acts as an extension of the space, where the same value in the possibility of looking in two directions has been implemented. The balconies are developed to break down the wind, avoiding the space of becoming uncomfortable. In terms of the materiality within the apartments, a translation of the buildings outer has been made to the inner, resulting in a grey scaled toning of the inner surfaces, broken up by the use of the warmth found in the wooden elements. the warmth found in the wooden elements. the warmth found in the wooden elements.

Ill. 184 COMBI OF LIVING AND DINING ROOM

In terms of the materiality within the apartments, a translation of the buildings outer has been made to the inner, resulting in a grey scaled toning of the inner surfaces, broken up by the use of the warmth found in the wooden elements.

III. 185 BUILDING DRAWINGS [1:400]
ØSTRE KAJGADE 11

CONNECTING TO THE CITY

By the central access point, from the waterfront to the plaza, a brewery and a café are placed, providing the visitors of the area with culinary experiences, when visiting the area. The two functions have been placed and programed with a big focus on the climatic conditions in the area. By having awareness and understanding of the altering of the local wind and sun behavior, suitable sitting arrangements have been made so that guest can inhabit both the plaza and waterfront. Along the waterfront as well as in between the buildings, a focus has been on braking down the wind, through the use of a combination between perforated steel plates and a variated vegetation, that also acts as a buffer in case of cloudbursts.

Ill. 186 CONNECTION TO THE CITY

ØSTRE KAJGADE 25

BUILDING LAYOUT

The building is designed with serveral functions, for fully overview, these can be found in the drawing folder. The apartments are designed with a total gross area of 3914 m^2, though both a creative office on 143 m^2 and a small furniture shop with its own warehouse and production on totally 604 m^2, is implemented into the ground floor of the building. Furthermore, the lower levels contain some practical functions such as storage, bicycle parking and the technical room. The ground floor also contains the labyrinth as one of the attractions in the area, located below the round silos to the green park towards east. For further information of building drawing, see the drawing folder drawing.

APARTMENTS

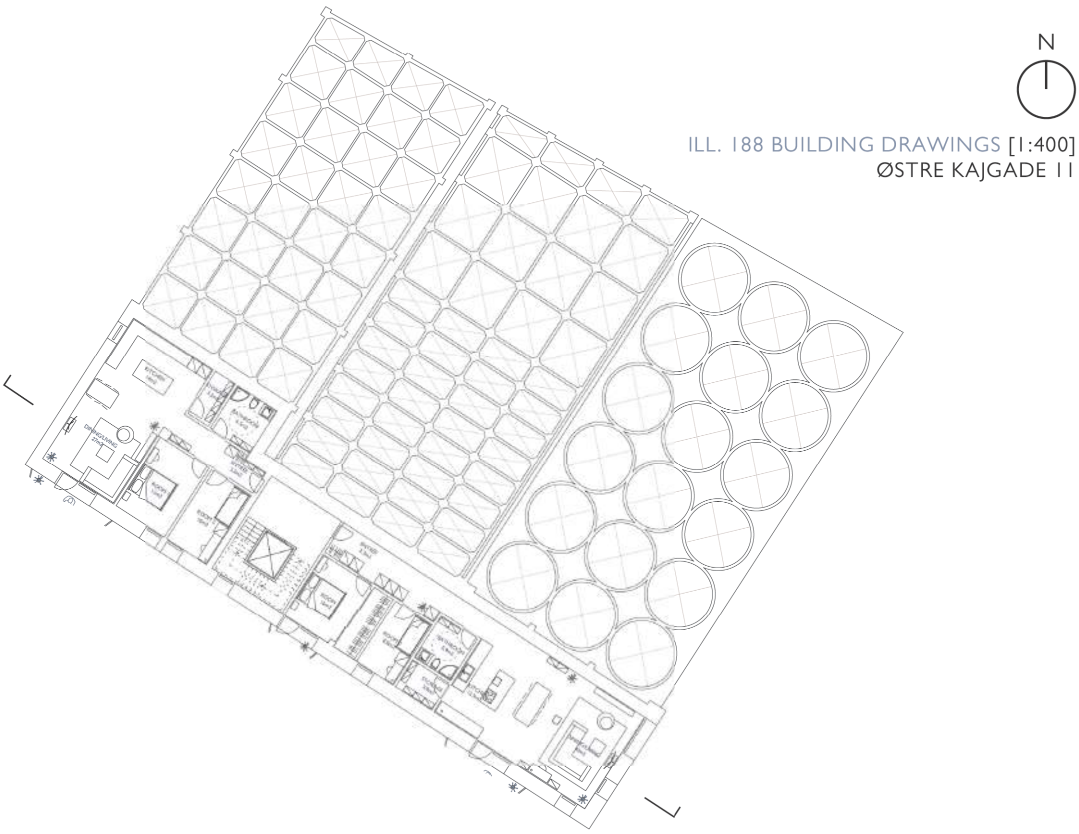
The building consists of two types of apartments, apartment 1 on 114 m^2 and apartment 2 on 143 m^2. Both of the apartments have their primary orientation towards south-east, this as result of the silos blocking the option to create openings towards north-east. These prerequisites have led to the luxury of being able to enjoy the view to the water and the city, from almost every room in both of the apartments. The apartments share the same layout through all the storeys, except at the top where the penthouse resides.

FOCUS

With the layout of the apartments a focus has been on the creation of big, bright and open living spaces, that both manages to embrace the square shape in apartment 1, as well as the long-stretched shape is apartment 2. In the creation of the open living space, the suspended celling in an important feature, as it enforces the perception of the space entering a room with a higher ceiling height, coming from one with a lower. Preserved visual bearing structure and raw internal surfaces of the concrete wall, sets a contrast to the warmth from wooden panels placed on the backside of the apartments, stretching in full length of the apartment, as seen on ill. 187.

ILL. 187 COMBI OF LIVING AND DINING ROOM

Preserved visual bearing structure and raw internal surfaces of the concrete wall, sets a contrast to the warmth from wooden panels placed on the backside of the apartments, stretching in full length of the apartment.



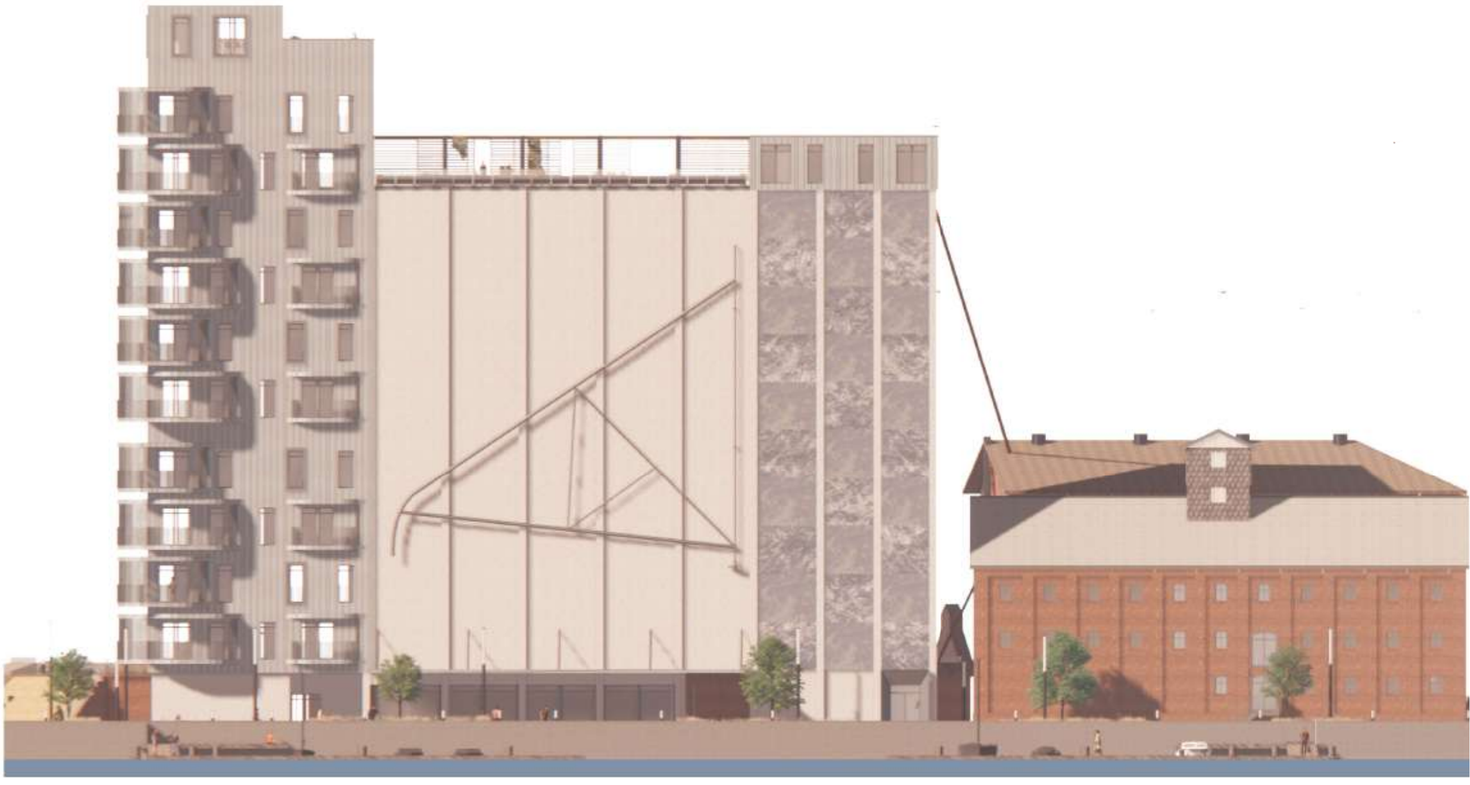
ILL. 188 BUILDING DRAWINGS [1:400]
ØSTRE KAJGADE 11

| FACADES

III. 189 SOUTHWEST
1 : 500

Ill. 190 NORTHEAST
1 : 500

Ill. 191 NORTHEAST
1 : 500



Ill. 192 SOUTHWEST
1 : 500

Ill. 191 FACADES

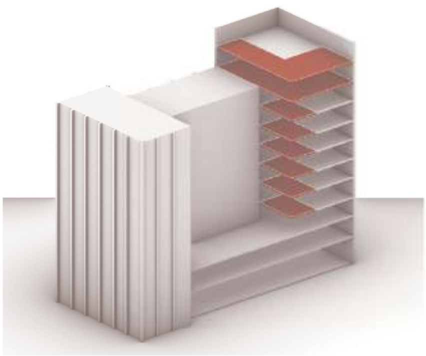
I CONSTRUCTION

DESCRIPTION

In the transformation of the building a total of 4 different types of prefabricated elements is used, as shown on the illustrations below, containing a deck element (D2), a roof element(T1) and two different types of façade elements (F1 & F2), these elements are products produced locally by Tåssinge Elementer and can be found on their website. (Taasinge Elementer, 2021)

USE OF ELEMENTS

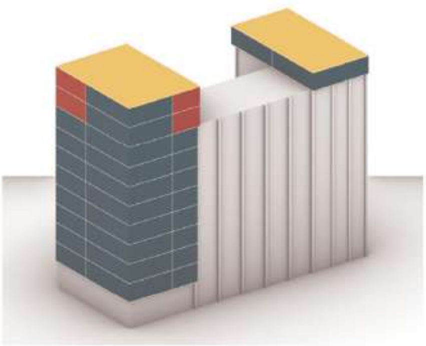
On ill. 193 it is shown how the addition of the D2 deck elements completes the tower and creates the background for the compact organization of the apartments. The first wall element that is used, is the non-bearing filling façade element F1, marked with blue on ill. 194 - ill.195. The filling façade serves the purpose of being the insulating part, on all of areas of the building where the existing concrete walls are located. The other façade element is the load carrying element F2, marked by the red, that serves the purpose of being the structural element in the new part of the building. Other than serving the purpose of distributing the loads down through the building, it serves the purpose of being the insulating layer. At the top, the new roof element T1, completes the envelope of the building.



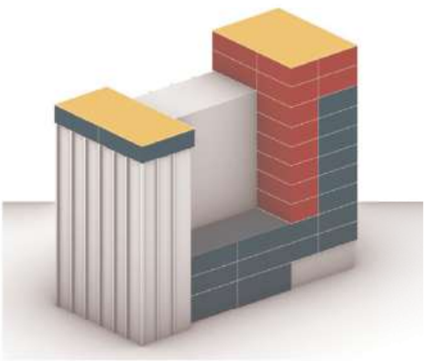
SOUTH EAST AXO

Ill. 193 ORGANIZATION OF DECKS

- D2 - WOOD DECK [ADDITION]
- CONCRETE DECK [EXISTING]



NORTH WEST AXO



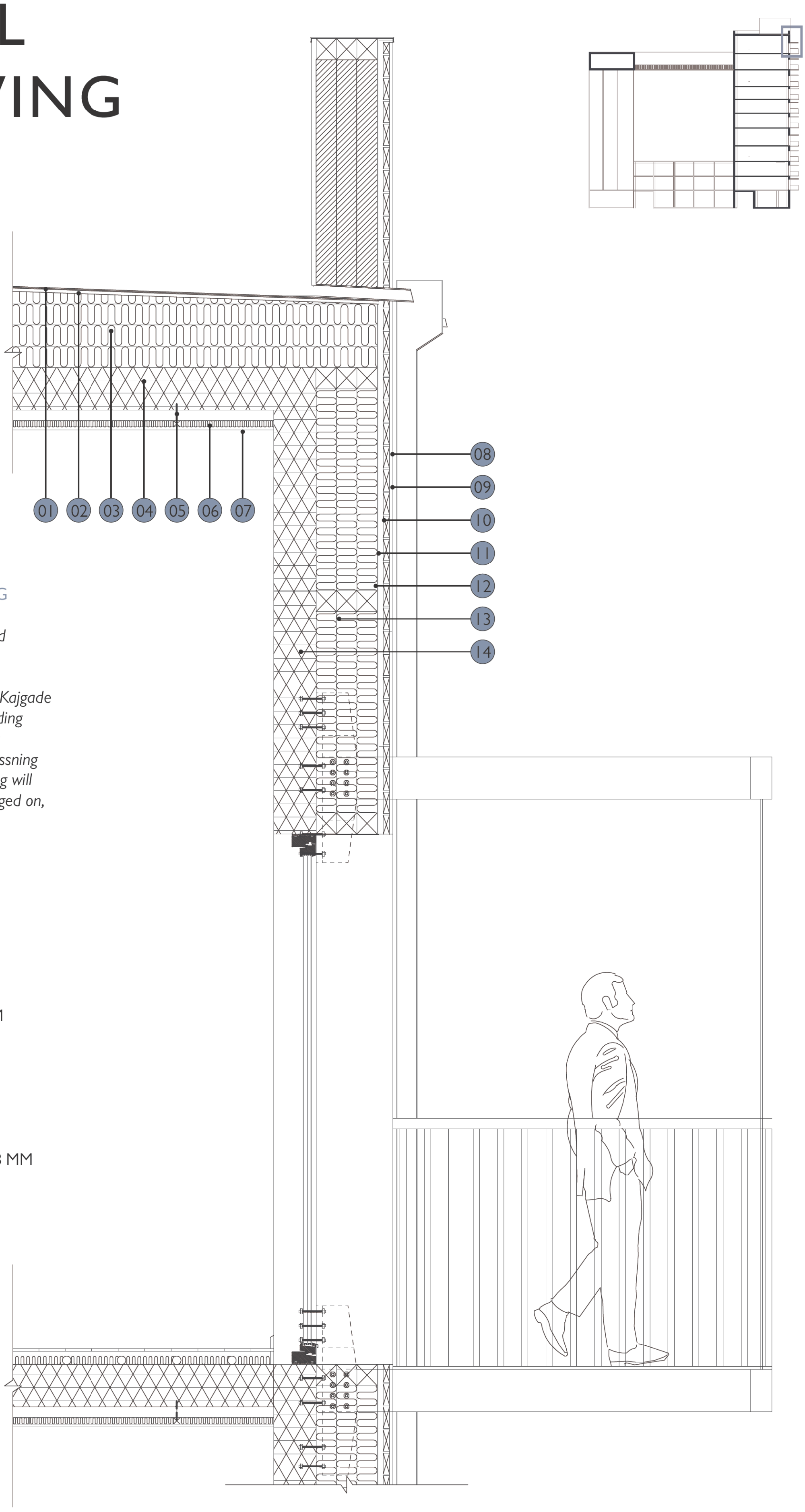
SOUTH EAST AXO

Ill. 194 ORGANIZATION OF ELEMENTS

- [T1] ROOF ELEMENTS
- [F1] FILLING FACADE
- [F2] BEARING FACADE

Ill. 195 BALCONIES

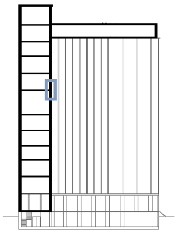
DETAIL DRAWING

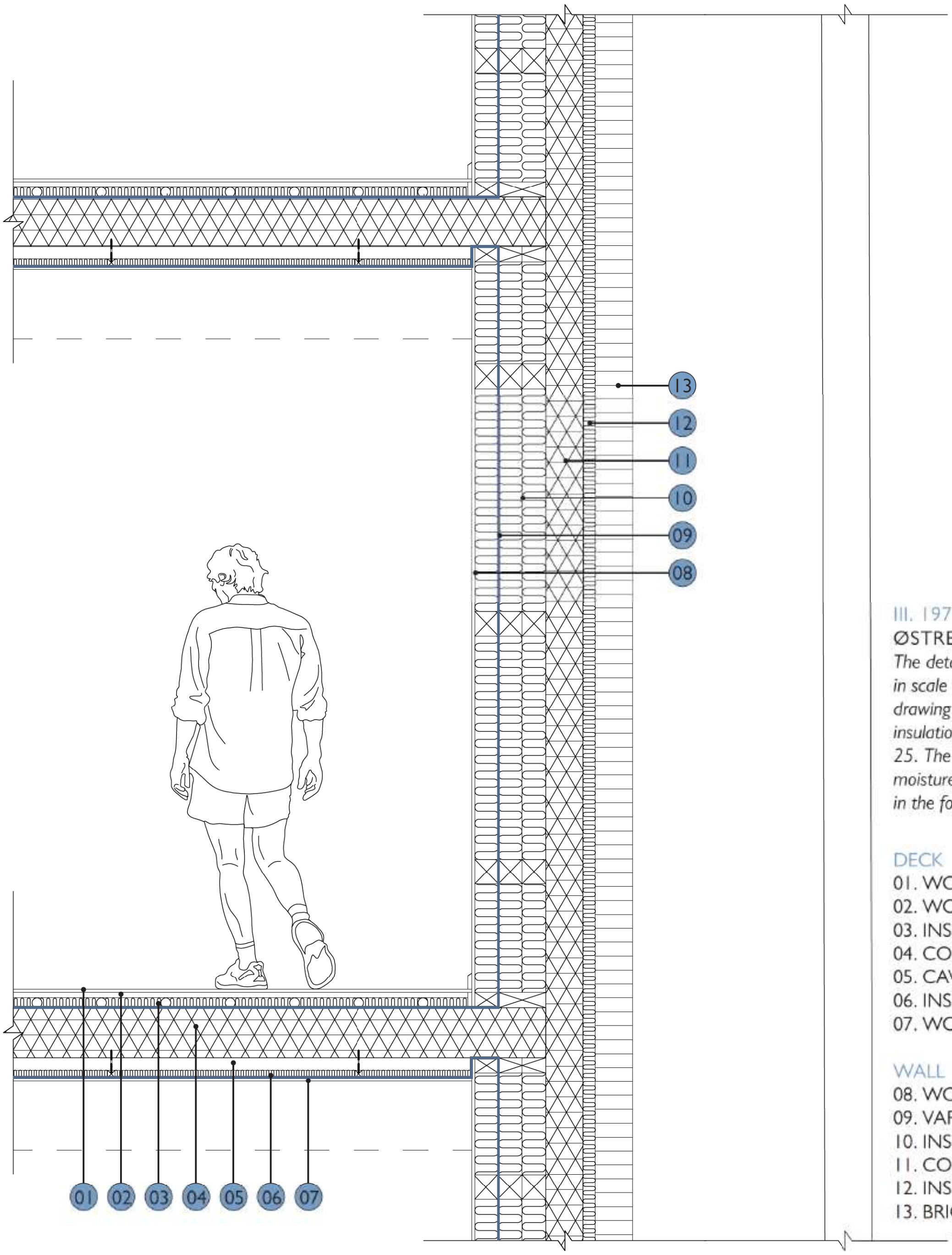


III. 196 DETAIL DRAWING
ØSTRE KAJ 11
The detail drawing can be found in scale in the drawing folder. The drawing illustrates how the aluminimum cladding on Østre Kajgade 11 meets the facade. The cladding requires venting, yet also an alu seperator, for the purpose of lessning the travel of sound. The building will be designed with balconies hanged on, to softenen the facade.

ROOF
01. ROOFING FELT
02. WOOD BOARD, 13 MM
03. INSULATION, 350 MM
04. CONCRETE, 200 MM
05. CAVITY, 50 MM
06. INSULATION, 30 MM
07. GYPSUM BOARD 13 MM

WALL
08. ALU CLADDING
09. ALU SEPERATOR
10. BATTENS 30 MM
11. VENTILATED AIR GAP
11. WINDPROOF BOARD 8 MM
12. INSULATION 50 MM
13. CONCRETE 200 MM





Ill. 197 DETAIL DRAWING
ØSTRE KAJGADE 25
The detail drawing can be found in scale in the drawing folder. The drawing illustrates how internal insulation is used on Østre Kajgade 25. The intention, is to ensure that, moisture air do not hit the cold surfaces in the form of brick.

DECK
01. WOOD FLOORING
02. WOOD BOARD, 22 MM
03. INSULATION, 40 MM
04. CONCRETE, 200 MM
05. CAVITY, 50 MM
06. INSULATION, 30 MM
07. WOOD BOARD 13 MM

WALL
08. WOODBOARD 13 MM
09. VAPOUR BARRER
10. INSULATION 300 MM
11. CONCRETE 150 MM
12. INSULATION 50 MM
13. BRICK 150 MM

BUILDING PERFORMANCE

DESCRIPTION

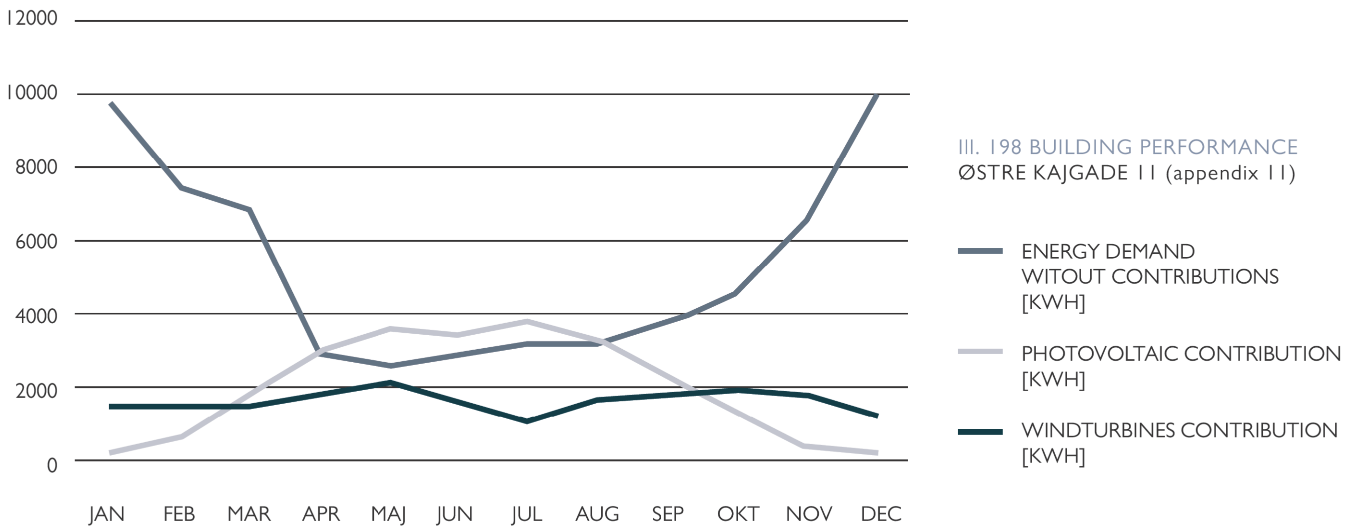
With the optimization of the building to contemporary standards follows a strong building performance. In the achievement of building class 2020, a series of initiatives have been introduced. The building reaches the energy frame of 23.6 kwh/m2 per year based on a mixture of active and passive strategies. The introduction of renewable strategies tightens up the energy frame to 4.2 kwh/ m^2 per year.

ACTIVE AND PASSIVE STRATEGIES

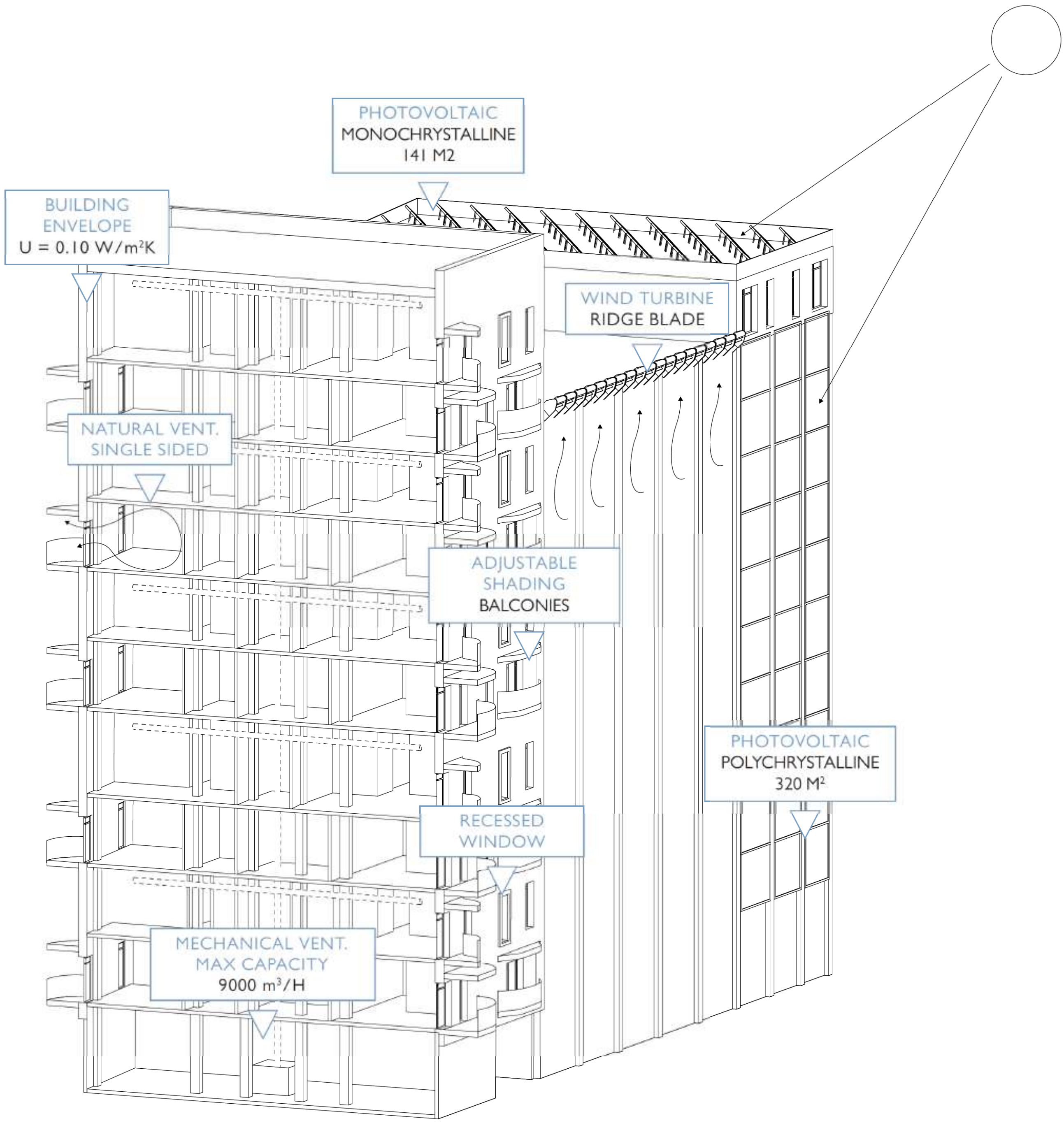
The building has been reinsulated, which secures a better building envelope, studies of these are found in appendix 10. The specific building is oriented with surfaces towards south and west, that allows high internal heat gains. These gains are reduced by recessed windows, that provides shading. These are further supplied with shading on balconies, that provides flexible shading. The ventilation system is organized as hybrid, accommodating mechanical and natural ventilation, where last mentioned, supports the mechanical system during the summer.

RENEWABLE STRATEGIES

The further supply of energy from photovoltaics and wind turbines, accommodates needs for electricity for systems in the form of ventilation and pumps. The mixture of energy sources contributes differently to the supply of energy, as shown in ill. 198. The photovoltaics provides a bigger contribution during the period of Marts to October, while the wind turbines are even in their contribution, but exceeds the contribution of the photovoltaic in remaining months.



Ill. 198 BUILDING PERFORMANCE
ØSTRE KAJGADE 11 (appendix 11)

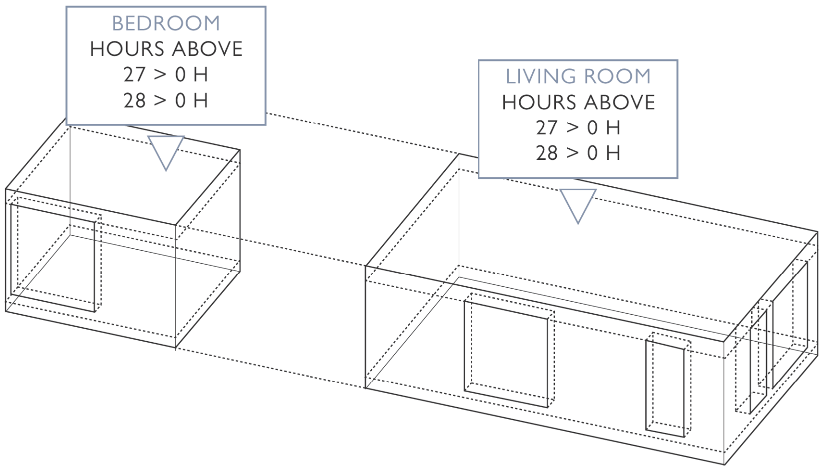


III. 199 STRATEGI SECTION
ØSTRE KAJGADE 11

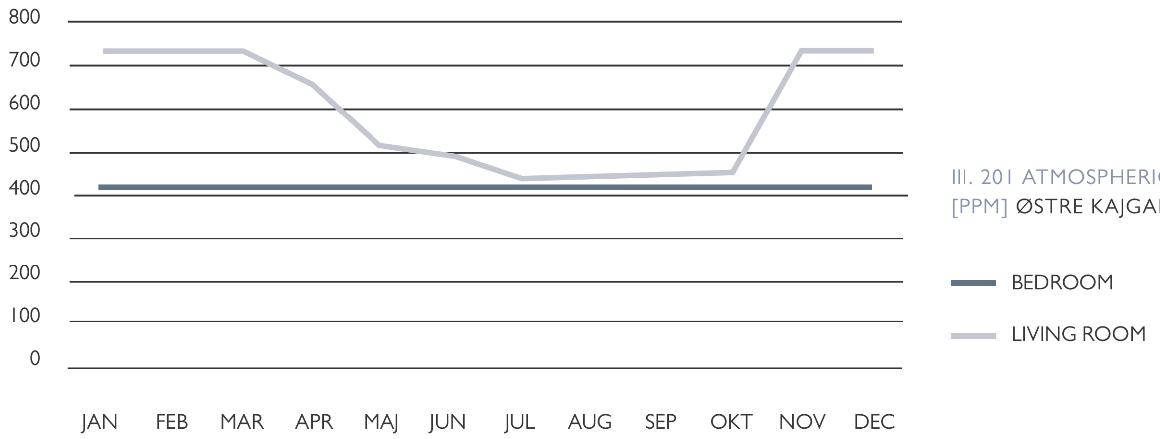
INDOOR ENVIRONMENT

INTRODUCTION

The orientation of the silo building combined with the openings, challenges the comfort, in relation to overheating. This has been evaluated, for critical rooms, where the selected, bedroom and living room both avoid overtemperatures. This has also been evaluated in relation to atmospheric comfort, while the bedroom, has an even load, the livingroom differs, as a result of heavy presence in people load.



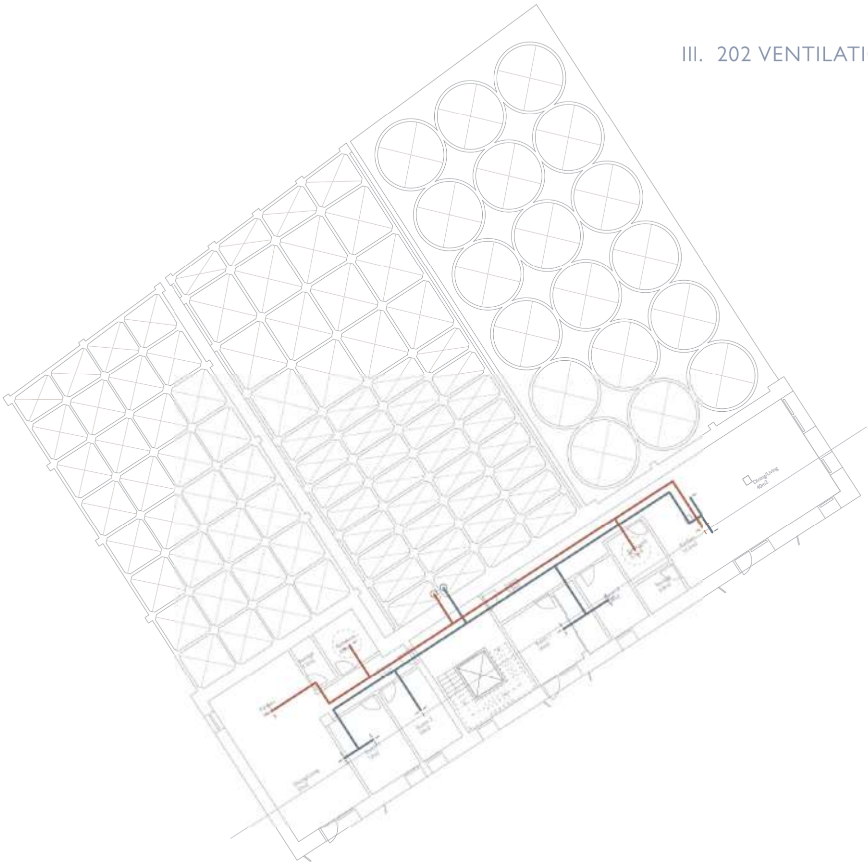
II. 200 CRITICAL APARTMENT
ØSTRE KAJGADE 25

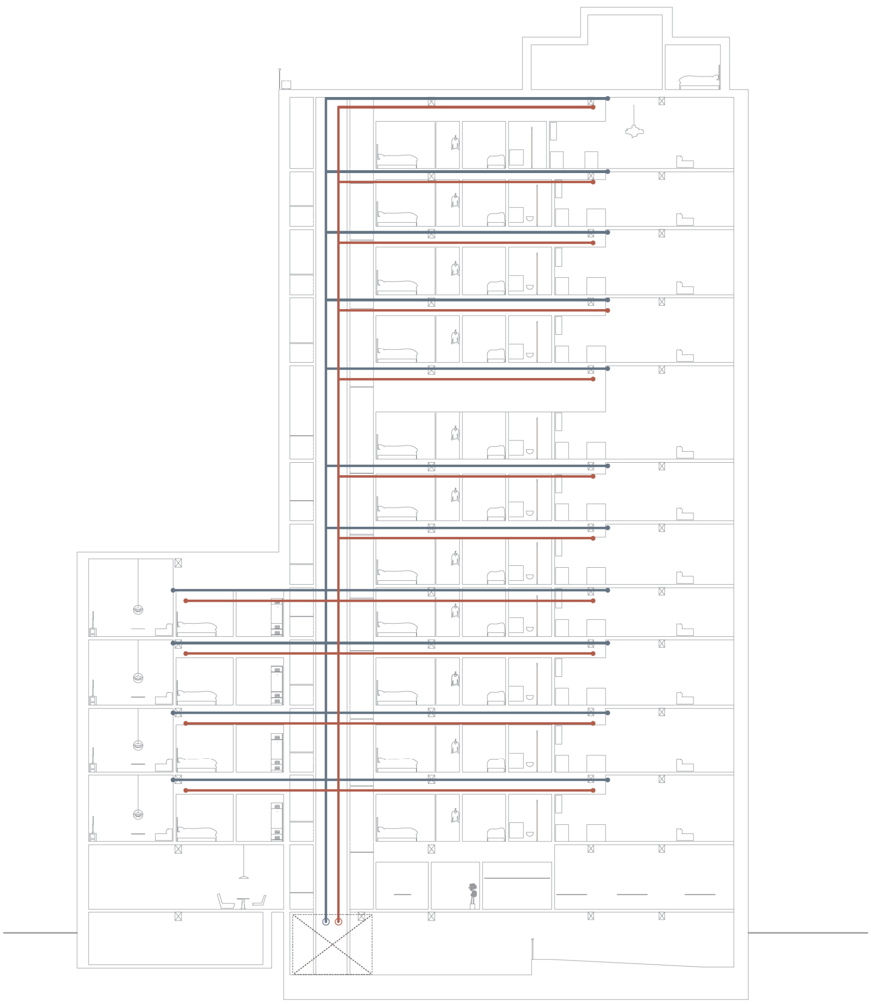


III. 201 ATMOSPHERIC COMFORT [PPM] ØSTRE KAJGADE 25

N

III. 202 VENTILATION DRAWINGS [1:400]
ØSTRE KAJGADE 11





CONNECTING TO THE HARBOUR

By the central access point, from the waterfront to the plaza, a brewery and a café are placed, providing the visitors of the area with culinary experiences, when visiting the area. The two functions have been placed and programed with a big focus on the climatic conditions in the area. By having awareness and understanding of the altering of the local wind and sun behavior, suitable sitting arrangements have been made so that guest can inhabit both the plaza and waterfront. Along the waterfront as well as in between the buildings, a focus has been on braking down the wind, through the use of a combination between perforated steel plates and a variated vegetation, that also acts as a buffer in case of cloudbursts.

Ill. 203 CONNECTING TO THE HARBOUR

08

EPILOUGUE

| REFLECTION

PRESERVATION

The project works with the preservation of the buildings on the area at Østre Havn, that all are praised since these represent traces of the past in Svendborg. The buildings of the site are rated differently, by the municipality, for the purpose of preservation. This rate was used in the classification of the buildings, as it gave an indication of, to what extent, the individual buildings would tolerate an intervention. The buildings were mainly raised during the period of functionalism, where sudden growth in the industry, resulted in expansions of original buildings. Today, these expansions and technical installations, supports the readability of the building, demonstrating how these have grown through time. In this project many of these expansions have been eliminated, as these were assessed to hide the original aesthetic of the buildings. Importantly also, because an elimination of these would improve aspects within views, access, daylight and sun hours, qualities that all praised in present time. The theme of preservation in transformational architecture leads to the question of: When do we erase the history, and what defines history? In the final design many of the expansions and technical installations have been eliminated but could more of the character have stayed and become a part of the new design. Would that have maximized the preservation of buildings, providing spaces, that would reflect barriers, dense and dark spaces, which are this charm of previous functionalism, or would that have put the future use of the area and the buildings at stake?

REALISM

The initial analysis of the local market in Svendborg, revealed that the city is not looking for introduction of a new housing district at this very moment. This based on the plans of creating a residential area further west of the site, an area that is expected to account for the coming 10 years demand of housing on the harbour. This might be a great fit as the contract that DLG has with the municipality expires in 2027. But as it was stated, residential functions are considered as the costliest functions. This in terms of the investment that a developer must make to develop the area, but the big investment is also related to a potential big profit. The neighboring harbour area referred to as Jessens Mole, was representing a housing project providing 39 apartments, that over the span of two years, still have difficulties in selling out all of apartments. With background in this the quantity of apartments was reduced in the process of the project from 138 in the early stage, to 44 apartments as the final quantity. As early case studies of Frihavnstårnet, demonstrated, how a major intervention with removal of 2500 ton of concrete, secured implementation of 78 dwellings. However, this was seen in the light of the context, in Copenhagen, which allowed this intervention. This staged a big question about realism in relation to geographical locations, as it shows how big of a saying geography can have to a project like this, as well as the major influence it has to the course of action for a given project.

SILO BUILDINGS

The realism of the project is a topic pulling many threads through the project, including the development and programming of the two silo buildings essential to the development. Generally, the silos have been programmed through the idea of letting the geometries of the existing building, be defining for the new functions it is intended to house. Letting the function follow the shape of the building, is a further thread leading back to the realism of the project, and it raises a question related to what makes sense to do to the buildings from a functional point of view, and what brings in the most value from a financial point of view, and where is the balance? The idea of working with the building letting the function follow the shape, has led to the programming of the silos and as a result a mixture of functions have been created. The programming of the silo buildings shows in both cases a dedication to a variation of public services to be located on the ground floor, with apartments placed on top. Based on the original sketches, the columns on the ground floor, carries the load from the silos, resulting in a layout of the ground floor, dominated by a range of large columns. These columns restrict the potentials of the ground floor, explaining why functions such as labyrinth, exhibitions, entrance and storage, has been introduced on these floors.

CLIMATE & ENERGY

In the work on utilizing the remaining silos, many considerations where made. As a result of the conclusion regarding implementation of dwellings in a part of both silo buildings, considerations regarding alternative usage of the remaining silos were introduced. Among other updraft towers, downdraft towers and solar chimney, where introduced, all working with the existing structure of the silos, turning the silos to energy sources. The final outcome came down to the fact that some of the silos where left standing without an internal function. This makes one wonder, what the purpose of their preservation is, because what is a preservation without a functional purpose and is a new assigned function a necessity to justify the preservation of them? According to the final outcome, photovoltaics and wind turbines, the favorized solutions, that works with context of the buildings, in terms of orientation according to the sun and wind. The implementation of these functions actually gives the silo purpose in terms of utilizing its surfaces, but is it enough? The project was intended to respond to aspects of circularity in the form of recycling, downcycling and upcycling. All considered as aspects, that would summarize the next phase of materials, that would have been eliminated from the site. However, the circularity has been boiled down to studies of the embodied energy, found in the design process.

SCALE & FUNCTIONS

The project site represents the industrial district of Svendborg Harbour, an area expressed through multiple scales of the built environment. This defines a difference in the buildings visual impact, which also came to light in the summary through a reflection on the hierarchy among the buildings. All of the buildings have been transformed, in terms of functions, with a new layout securing each building to play a part in a new modern and yet preserved part of industrial history of Svendborg Harbour. To the functions implemented into the project a major task would be to make sure that the environments, that the area is intended to consist, of is actually created. Doing this is mostly likely to have a relation to the creation of businesses on attractive conditions, including the implementation of functions with small start-up investment. Is the implemented function important to the area, or is it just the importance of activities to take place that matters?

I CONCLUSION

Østre Havn, a project that responds to the interest of Svendborg Municipality in preserving industrial buildings of the habor. Today, the buildings are driven by industry, with contracts nearing expiration date. As a reaction the project rethinks a future planning of these buildings. This led to an initial problem thesis, as following: How can an areas character and history be preserved, when the function changes? This secured fully mapping of Transformation, Danish Harbours, Embodied Energy and The Urban Environment, all accounting for the consequences in changes of a character, touching social, environmental, and economical challenges. To accommodate, the complexity of these branches, DIVE methodology, cultural analysis, was introduced, resulting in a broad analysis, with a main analysis of existing buildings, but with inclusion of analysis of the site and market mechanisms. This resulted in a summary, containing strategy regarding a mixture in programming, with an infrastructural and functional connection to the city. This led to a problem thesis as following: How can transformation of old industrial building, secure a unified housing, recreational, and businesses area, that maintains the identity of the area with respect of its cultural heritage? This leaded to a design process both touching the buildings, and the space in between the buildings, where the good urban space was examined, from the viewpoint of accessibility, sun access, wind comfort and flooding management. The design of buildings highlights the silos, were possible interventions on these, have been measured from parameters in the form of CO2, Embodied Energy and Costs in removal and elimination, respectively environmental and economical parameters. These parameters were linked to conclusions stated in the analysis of the local market, where the capacity of Svendborg was favorizing an approach, that secures efficient utilization of buildings through minor modifications. Hence the project was leaning towards a realistic approach, which become decisive for the remaining design studies, as segments of silo buildings, were dedicated to residential use. This leaving remaining surfaces and silos untouched, why strategies for these were incorporated, suggesting usage of these for visual or functional purpose, before concluding a technical purpose through renewable energy would strengthen the site. The evaluation of the building confirmed, that the design of building with active, passive and renewable strategies, secured a reasonable indoor environment, based on thermal and atmospheric comfort. Importantly the performance of the building revealed, that the silo meets building class 2020.

Ill. 204 THE PASSAGE

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ILLUSTRATIONLIST |

Ill.11 - Danmark set fra Luften, n.d. [image] Available at: <http://www.5.kb.dk/danmarksetfraluften#zoom=18&lat=56.03871414533=lng=2.616167068481447

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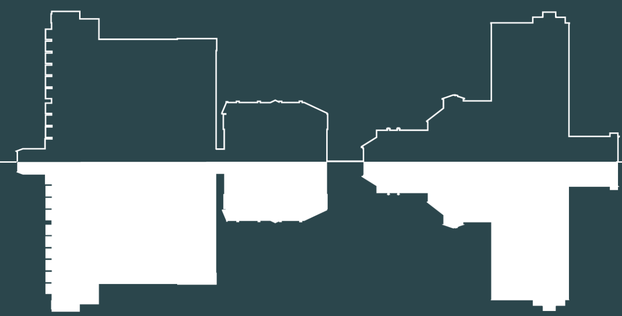
DEPARTMENT OF ARCHITECTURE, DESIGN & MEDIA TECHNOLOGY

ØSTRE HAVN



APPENDIX & DRAWING FOLDER

KENNETH A. HANSEN | ANOSANT SELLADURAI | LASSE F. ANDERSEN

MASTER THESIS | GROUP 6 | AALBORG UNIVERSITY | MAY 2021

| TITLE PAGE

TITLE	ØSTRE HAVN
THEME	SUSTAINABILITY
PROJECT	MASTER THESIS
PROJECT PERIOD	01TH FEBRUARY 2021 - 27TH MAY 2021
GROUP	MA4 - GR06
SEMESTER	4TH
SUPERVISOR	MICHAEL LAURING
PAGES	45

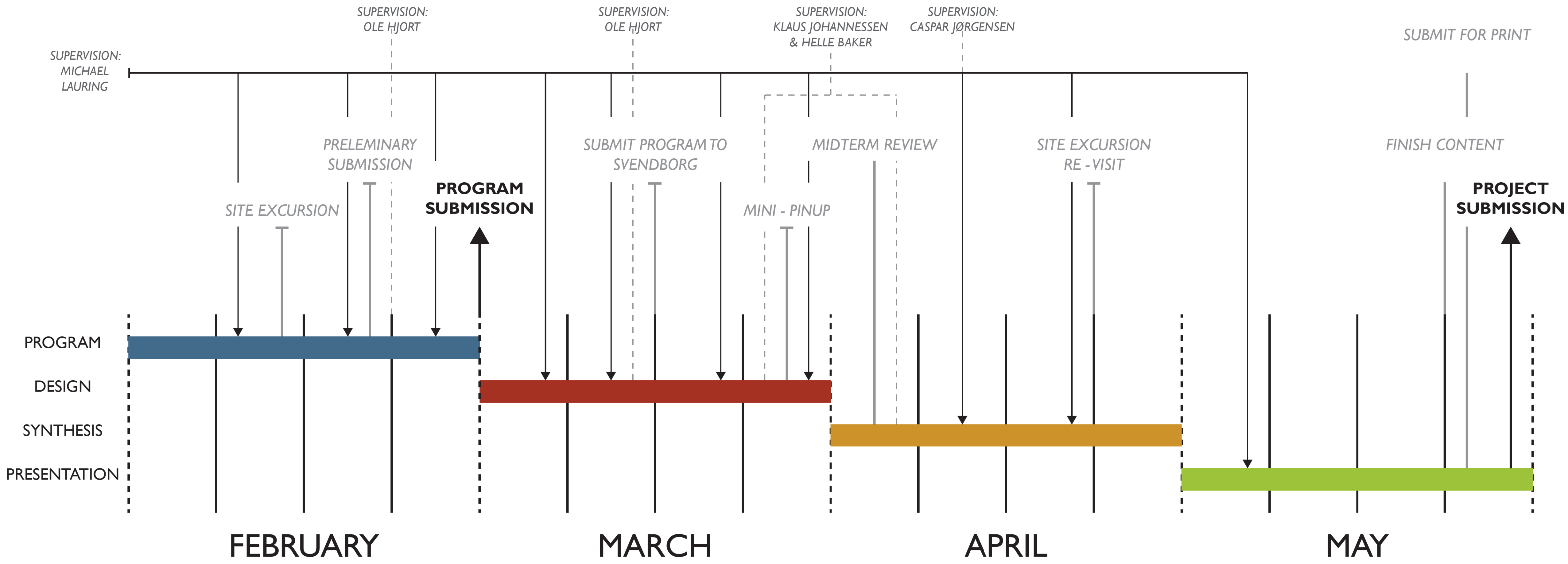
ANOSANT SELLADURAI

KENNETH ANDERS HANSEN

LASSE FOGED ANDERSEN

CONTENT

| GANTT DIAGRAM



APPENDIX 1: HISTORICAL MAPPING

The following section builds furtherer on, the development of the site. As the buildings were raised in a wide span of time, 1895 - 1970, where different styles of architecture were established, that indicates the diversity of the site. The section highlights the characteristics of these periods, in which the buildings were raised in, and thereby classifies the buildings.

Beginning with historicism architecture (1850 - 1990), with mixtures of characteristics from across several historical styles. Frequent references were the antique, the renaissance, the gothic or the baroque. Specifically, cornice, surround of windows, friezes, Dannebrog windows and round arch doors, contributed to a facade rich on decoration. Because of development of the building technology, these buildings were based on an iron structure. This architecture within this period was referred as catalogue architecture (Historicismen, 2021).

The national romantism (1890 - 1914) praised, what was characterized as Danish building traditions with masonry, timber, and granite (Nationalromantik, 2021). Among inspiration were ornamentation found from the Viking Ages and Middle Ages, where the timber framing, Swedish wood housing and Norwegian stave church originated. Buildings did not have to be raised symmetrical, but could consist multiple units. The characteristics of the buildings were among others visible base, wood gables with symbols of Vikings and woodwork through roof constructions (Bygningskultur, 2021)

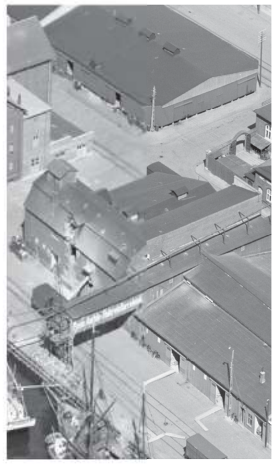
The new classicism (1915 - 1930) turned the focus yet again towards previous times, this time, the antique and thereby also the danish classism. The characteristics of this period were simplicity, clean surfaces, straight lines, symmetrical composition. These were a reaction of previous time where the architecture, was dominated by a range of elements, providing a mixed expression (Nyklassicisme, 2021)

The functionalism (1930 - 1965) was a reaction on the previous periods, as the function of the building should be readable. The function of the building was important. The expression should reveal the industrial background through simplicity in use of materials as concrete and steel. The use of ornamentation was removed, the architecture should appear as functional and objective (Modernisme, 2021).

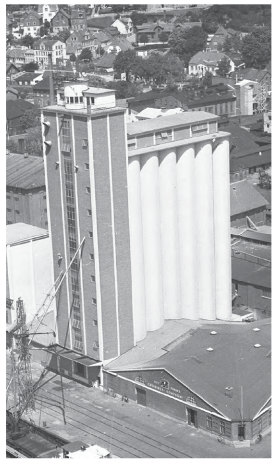
The buildings of the site are raised over periods of time, where different styles within architecture have been dominating. Based on the construction of the buildings, these are distributed across national romanticism (1890 –1914) and functionalism (1930 – 1965). However, the characteristics of the building, indicates that the buildings also belong to the style of historicism (1850 – 1990) and new classicism (1915 – 1930), which gives an insight of the diversity of the buildings. The classification is presented in the series of ill. 1 – ill. 8.

Ill. 1 ØSTRE KAJGADE 11
FUNCTIONALISM
1960-1970
(LANDINSPEKTØRERNES, 1967)

Ill. 2 ØSTER KAJGADE 15
NATIONAL ROMANTICSM
1895 - 1905
(SCHLEIMANN, 1905)

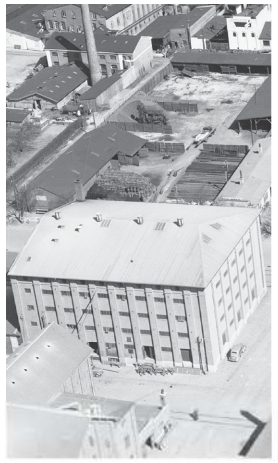


Ill. 3 ØSTRE KAJGADE 23
FUNCTIONALISM
1936 - 1939
(JENSEN, 1939)

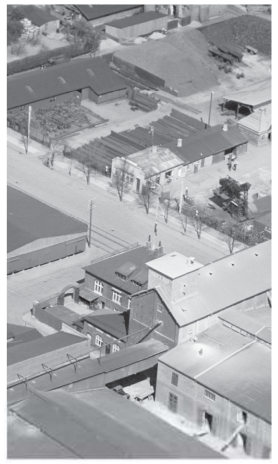


Ill 4 ØSTRE KAJGADE 25
FUNCTIONALISM
1950-1960
(JENSEN 1956)

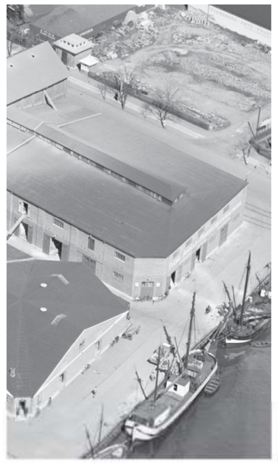
Ill. 5 ØSTRE HAVNEVEJ 6
FUNCTIONALISM
1936 - 1939
(JENSEN, 1939)



Ill. 6 ØSTRE HAVNEVEJ 8
FUNCTIONALISM
1940 - 1946
(JENSEN, 1969)



Ill. 7 ØSTRE HAVNEVEJ 10
FUNCTIONALISM
1936 - 1939
(JENSEN, 1939)

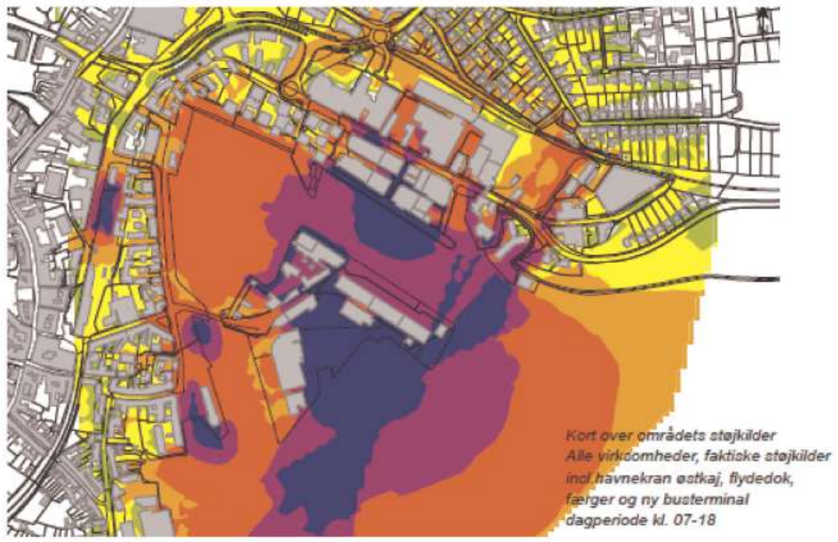


Ill. 8 ØSTRE HAVNEVEJ 12
FUNCTIONALISM
1936 - 1939
(JENSEN, 1939)

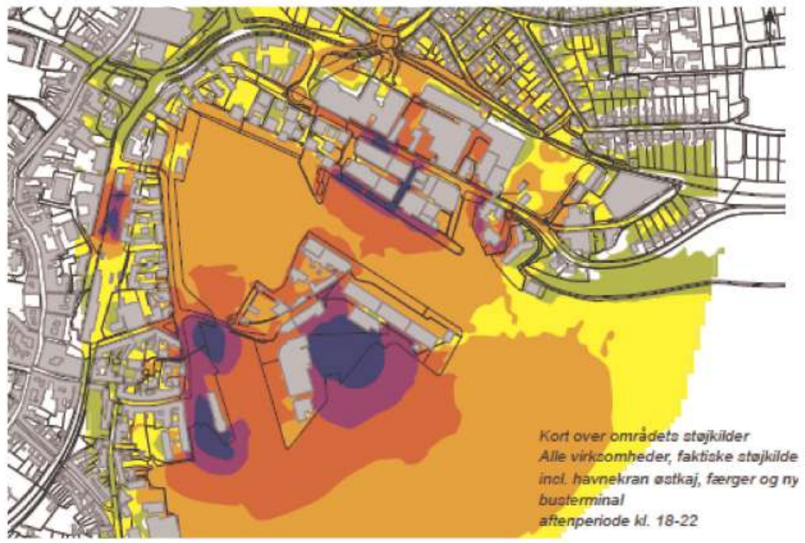
APPENDIX 2: NOISE INVESTIGATION

The following study extends the investigation of noise on the site, looking at other timespan of the day, including noise from the roads. The studies are from Svendborg Municipality (Svendborg Kommune, 2014). Regarding the colors, these can be considered as: green, no exceeding, yellow, minor exceeding (5 dB), orange, essential exceeding (5 – 10 dB) and red, big exceeding (10 dB). The interest of the municipality is to keep the noise level within 55/44/40 dB for day/evening/night. (Svendborg Kommune, 2005).

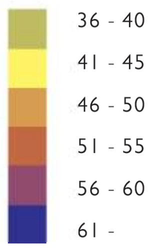
DISTRIBUTION OF NOISE 07 - 18



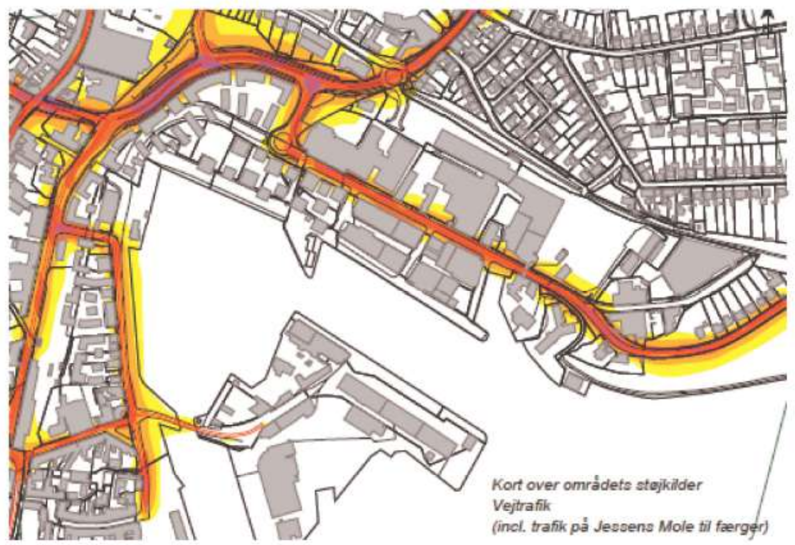
DISTRIBUTION OF NOISE 18 - 22

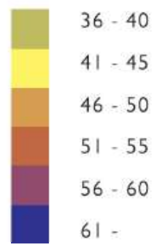


DISTRIBUTION OF NOISE 22 - 07



DISTRIBUTION OF NOISE FROM ROADS



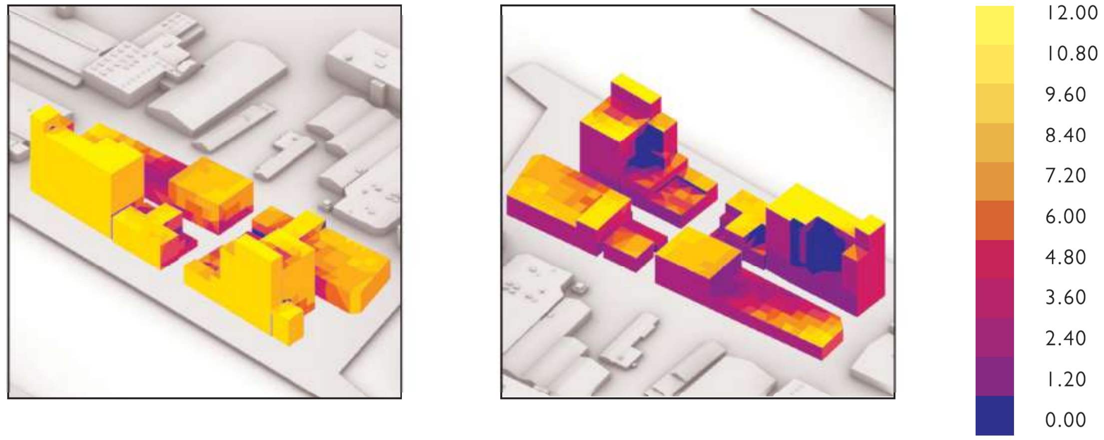


III. XX - III. XX
(Svendborg Kommune, 2014)

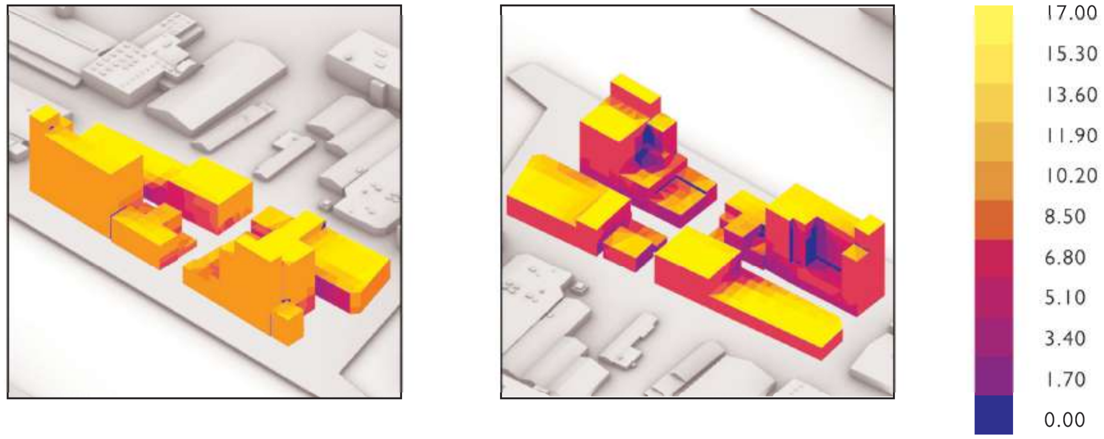
APPENDIX 3: SUNLIGHT STUDIES

The following studies investigates the available sun hours on the site both annually, and for specific days, and gives an insight, of how the sun light is distributed on the site. The rhino plugins Grasshopper and Ladybug has been used to generate the local climatical conditions.

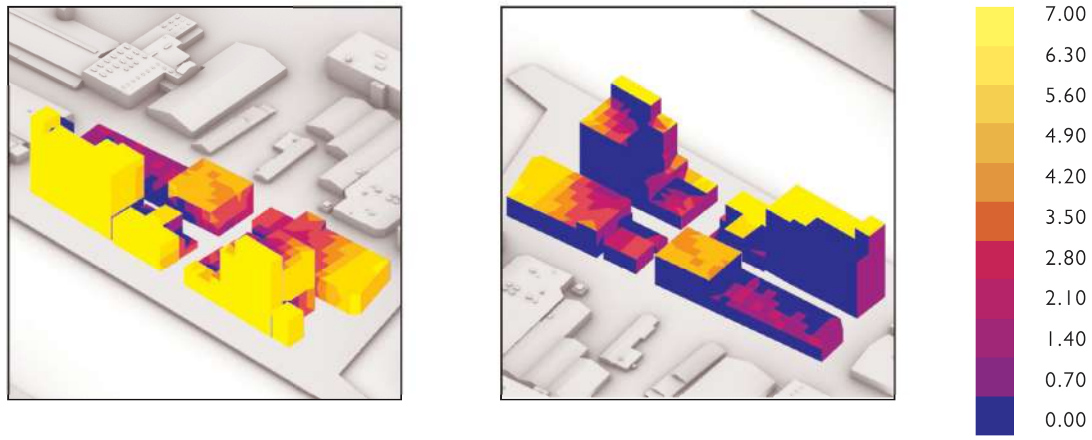
SUNHOURS
MARTS 21st



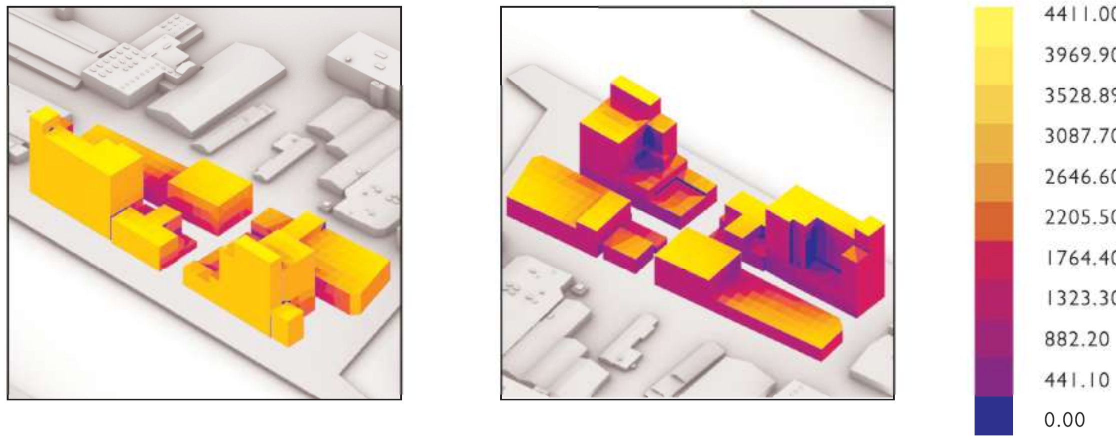
SUNHOURS
JUNE 21st



SUNHOURS
DECEM. 21ST

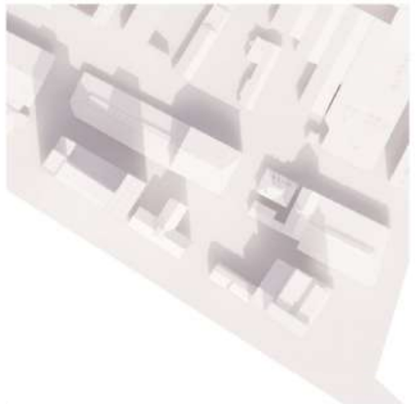


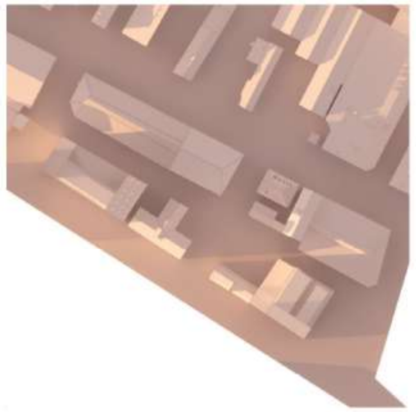
SUNHOURS
YEARLY



APPENDIX 4
WINDSTUDIES

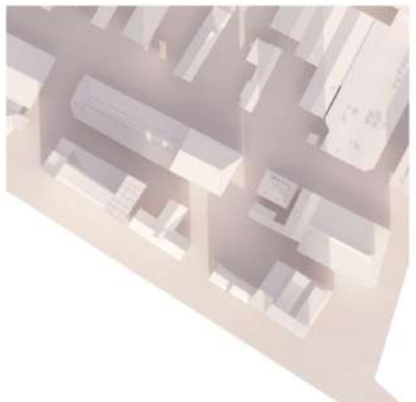
EQUINOX

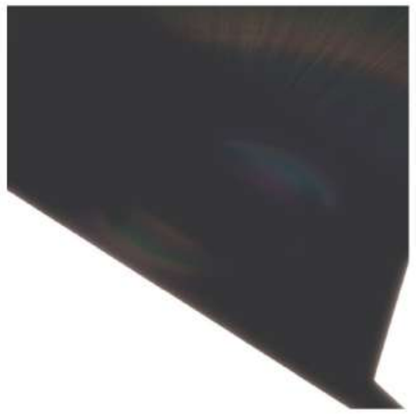




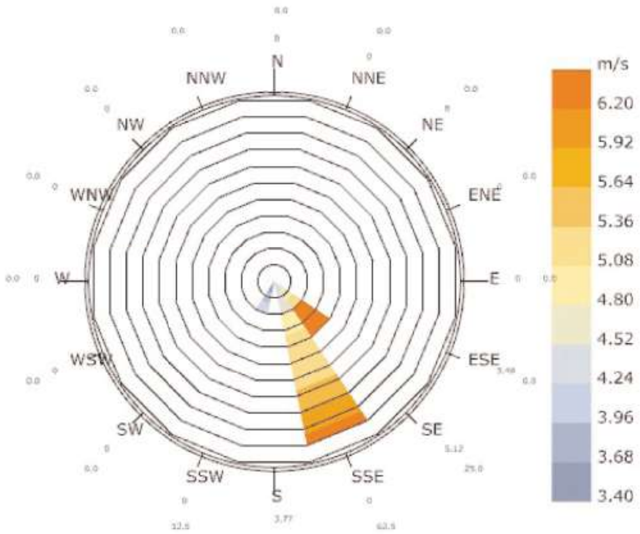
SOLSTICE

SOLSTICE



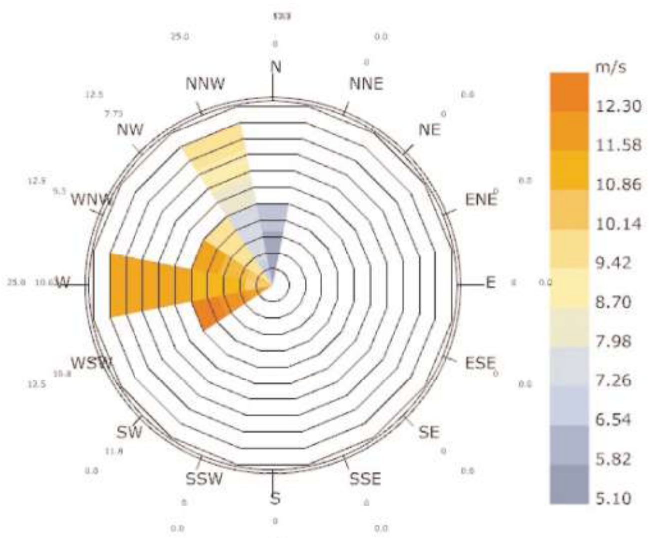


The following studies investigates how wind interacts with the site, annually and for specific days, both the orientation and velocity of the wind is presented. The rhino plugins Grasshopper and Ladybug has been used to generate the local climatical conditions.



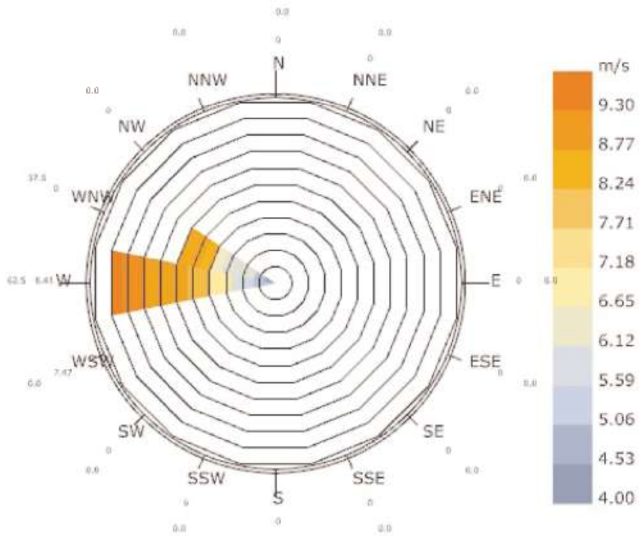
Wind-Rose COPENHAGEN_DNK 21 DEC 1:00 - 21 DEC 24:00 Hourly Data: Wind Speed (m/s) Calm for 0.00% of the time = 0 hours. Each closed polyline shows frequency of 6.3%. = 1 hours.

DEC 21st 1:00 - DEC 21st 24:00



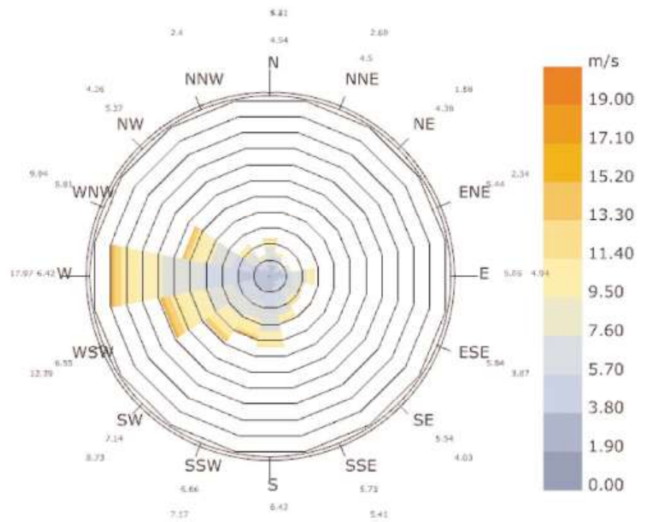
Wind-Rose COPENHAGEN_DNK 20 MAR 1:00 - 20 MAR 24:00 Hourly Data: Wind Speed (m/s) Calm for 0.00% of the time = 0 hours. Each closed polyline shows frequency of 2.5%. = 0 hours.

MAR 20th 1:00 - MAR 20st 24:00



Wind-Rose COPENHAGEN_DNK 21 JUN 1:00 - 21 JUN 24:00 Hourly Data: Wind Speed (m/s) Calm for 0.00% of the time = 0 hours. Each closed polyline shows frequency of 6.3%. = 1 hours.

JUNE 21st 1:00 - JUNE 21st 24:00



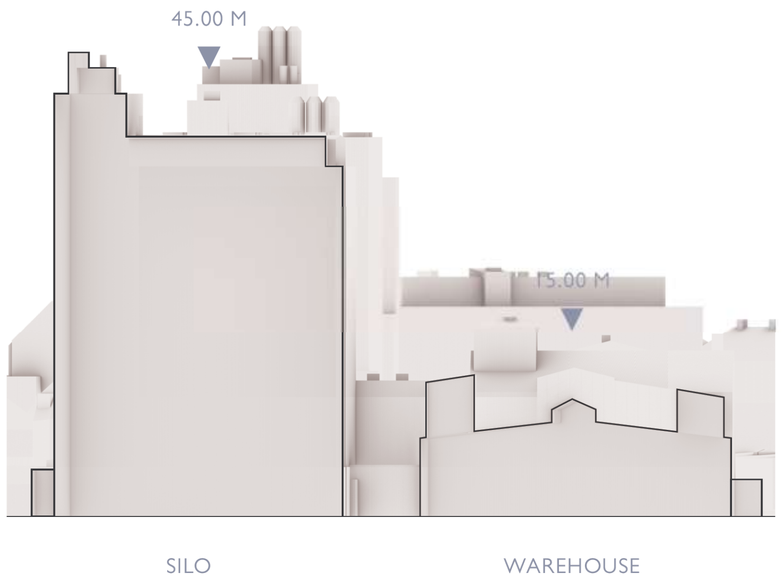
Wind-Rose COPENHAGEN_DNK 1 JAN 1:00 - 31 DEC 24:00 Hourly Data: Wind Speed (m/s) Calm for 0.15% of the time = 13 hours. Each closed polyline shows frequency of 1.8%. = 157 hours.

JUNE 1st 1:00 - DEC 31st 24:00

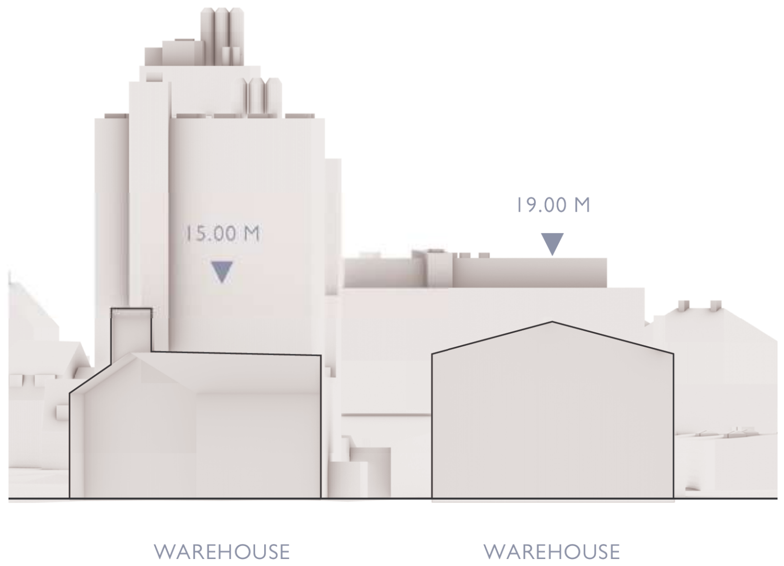
APPENDIX 5: SECTION STUDIES

The following studies supports the diversity of the site trough section studies. These reveals, the difference between the volumes, in scale and sizes.

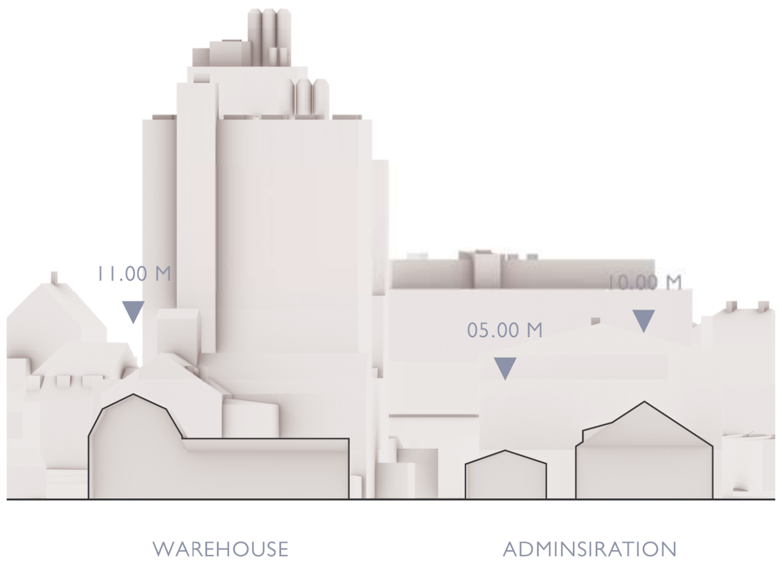
SECTION A-A



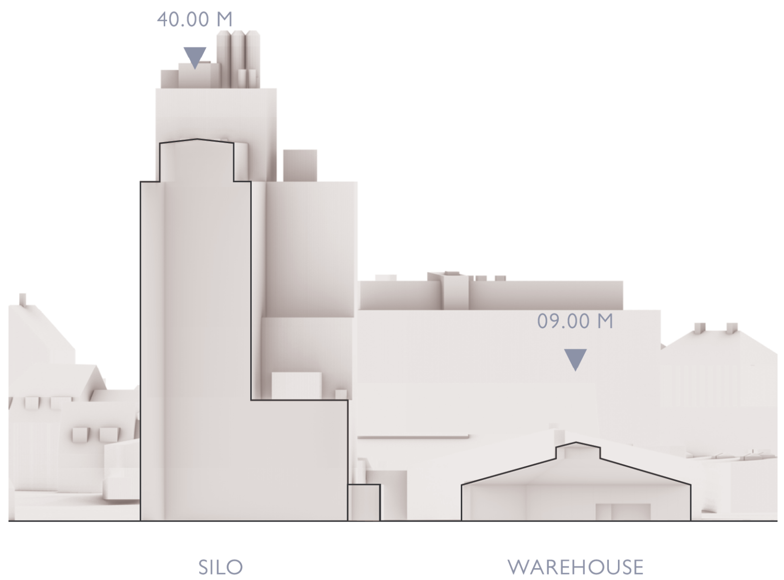
SECTION C-C



SECTION B-B



SECTION D-D



SECTION E-E

SECTION F-F

APPENDIX 6: WORTH OF PRESERVATION

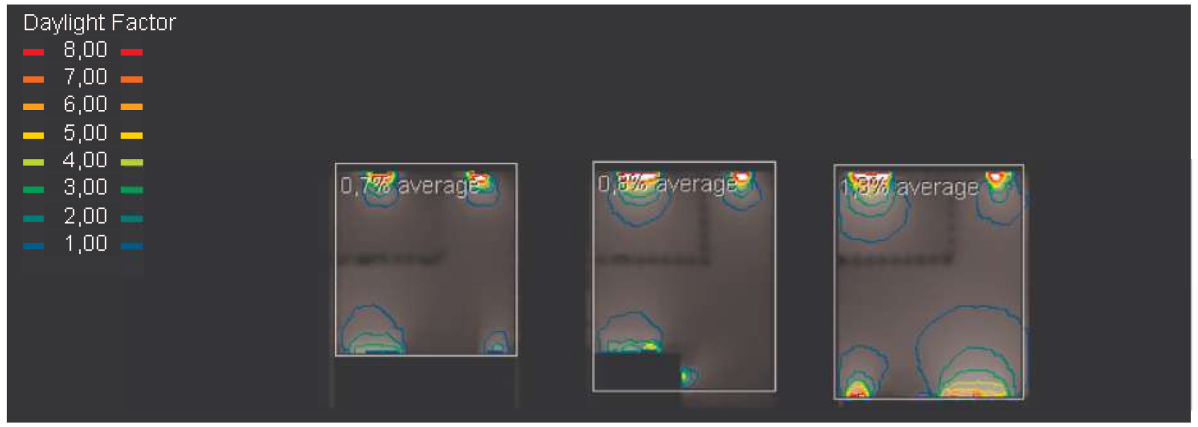
The following studies are used to understand the size of the potential plaza located on the site. The basis is the area size of the plaza. This size will be compared to well-known plazas, in Aalborg. All illustrations are presented in the scale of 1 : 500.

Ill. 15 PRESERVATION
(UDVIKLINGSPLANEN, 2014)

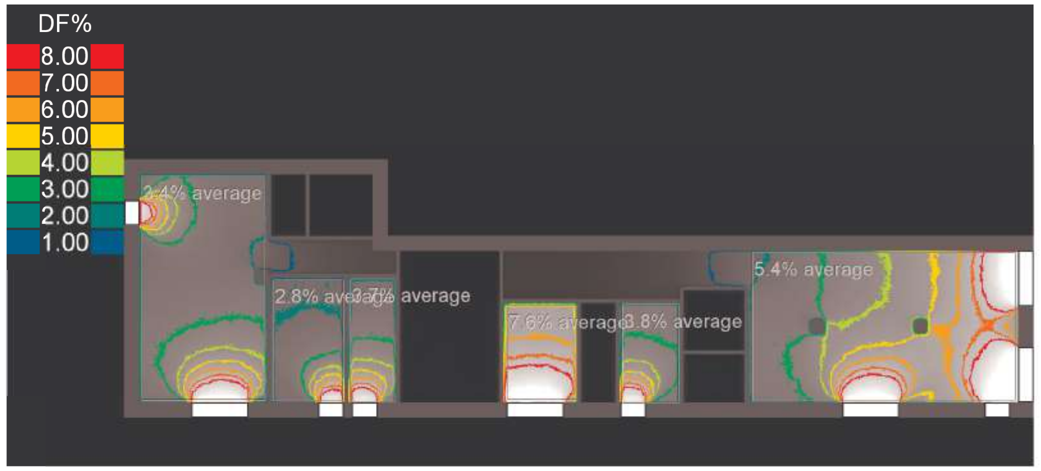
APPENDIX 7 DAYLIGHT STUDIES

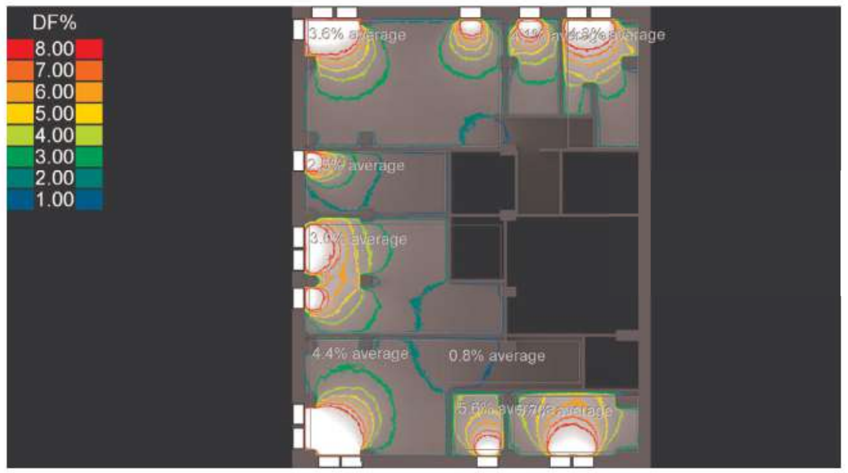
The following study show the improvement of daylight condition.

INITIAL STUDY



FINAL STUDIES





Ill. 16 DAYLIGHT STUDIES

APPENDIX 8: TECTONIC STUDIES

The analysis of a balconies from a tectonic perspective:

The analysis studies on how dimensions differ, when comparing the materials, concrete and steel. Before the calculations take place, to simplify the baclonies they are seen as clmaped beam. This made most sense, as the idea was to externally insulate the buildings.

To ensure the structures usablilty, it is tested with two pricipal criteria such as, Ultimate limit state (ULS) and Serviceability limit state (SLS), also in danish known as BGT (Brudgrænsetilstand) and AGT (Anvendelsesgrænsetilstand). These criteria are tested through the structure with the loadcombinations. The appendix will show the calculations for both one of the concrete and steel balconies.

ULS:

$$\sum_{j\geq 1}\gamma_{G,j}\cdot G_{k,j}"+"\gamma_{Q,1}\cdot Q_{k,1}"+"\sum_{j\geq 1}\gamma_{Q,i}\cdot\psi_{0,i}\cdot Q_{k,i}$$

(Hvass, 2013)

SLS:

$$\sum_{j\geq 1}G_{kj}"+"\cdot Q_{k,l}"+"\sum_{j\geq 1}\cdot\psi_{0,i}\cdot Q_{k,i}$$

(Hvass, 2013)

The building is inhabited, therefore these are the used Partial coefficients

$\gamma_{G,j} = 1.1\cdot K_{FI}$

$\gamma_{Q,1} = 1.5\cdot K_{FI}$

$\gamma_{Q,i} = 1.5\cdot\psi_0\cdot K_{FI}$ (Hvass, 2013)

Permanent load = self load

For concrete $G_{k,j} = 4\ \frac{kN}{m}$ and For Steel $0.6\ \frac{kN}{m}$ (Gammel, 2010)

Dominant variable load = wind load

$w_e = q_p(z_e)\cdot c_{pe}$ (Eurocode1 s. 83)

q_p = *peak velocity pressure*

$q_p(z) = 455.6250000\ \text{Pa}\cdot 1.666666667 = q_p(z) = 759.3750002\ \text{Pa}$

$759.3750002\ \text{Pa} \xrightarrow{\text{replace units}} 0.7593750002\ \frac{kN}{m^2}$

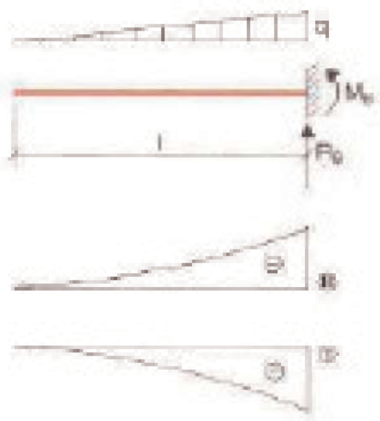
z_e = *reference height* **for** *the external pressure* (eurocode 1, s.105 og 106)

$z_e = 0.3m = z_e = 0.3\ m$

c_{pe} = *the form factor of the external pressure*

$c_{pe} = 1-(1-10)\cdot\log_{10}(1.000\cdot 2.000) = c_{pe} = 3.709269961$

Used Equation:



$$R_B = \frac{1}{2}ql\ ;\ M_B = -\frac{1}{6}ql^2$$

$$M(x) = -\frac{1}{6}q\frac{x^3}{l}$$

$$u(x) = \frac{1}{24}\frac{ql^4}{EI}\left(\frac{4}{5}-\frac{x}{l}+\frac{1}{5}\left(\frac{x}{l}\right)^5\right)$$

$$u(0) = \frac{1}{30}\frac{ql^4}{EI}$$

$$\alpha(0) = -\frac{1}{24}\frac{ql^3}{EI}$$

(Jensen and Mohr, 2013)

$Q_{k,1} = w_e = 0.7593750002\ \frac{kN}{m^2}\cdot 3.709269961 = w_e = 2816.726877\ \text{Pa}$

$2816.726877\ \text{Pa} \xrightarrow{\text{replace units}} 2.816726877\ \frac{kN}{m^2}$

$q_{linje} = (1m + 1\ m)\cdot 2.816726877\ \frac{kN}{m^2} = q_{linje} = 5633.453754\ \frac{kg}{s^2} \xrightarrow{\text{solve for q\_linje}}$

$\left[\left[q_{linje} = 2816.726877\ \frac{kg}{s^2}\right]\right] \xrightarrow{\text{replace units}} 5.633453754\ \frac{kN}{m}$

(Forkortet udgave af Eurocade 1 - Last på bærende konstruktioner, 2021)

Other variable load = snow load

$Q_{k,i,l} = s = \mu_i\cdot C_e\cdot C_t\cdot s_k$ (Eurocode: 1 s.51)

$s = 0.8\cdot 0.8\cdot 1.0\cdot 1.0\frac{kN}{m^2} = s = \frac{0.6400}{m^2}\ kN$

From flat load to line load:

$q_{linje} = 1m\cdot\frac{0.6400}{m^2}\ kN = q_{linje} = \frac{0.6400}{m^2}\ m\ kN \leftrightarrow 0.6400000000\ \frac{kN}{m}$ (Forkortet udgave af Eurocade 1 - Last på bærende konstruktioner, 2021)

Other variable loads = payload

$Q_{k,i,2} = 1m\cdot 2.5\frac{kN}{m^2}$ (Eurocode 1 page 19.)

The used combination is the one where the wind was the dominant variable load.

Our ψ-factors:

Snowload - $\psi_0 = 0$

Payload - $\psi_0 = 0.5$

(Forkortet udgave af Eurocade 1 - Last på bærende konstruktioner, 2021)

ULS Calculation:

$$(1.1\cdot 1.0)\cdot 4\ \frac{kN}{m} + (1.5\cdot 1.0)\cdot 5.633453754\ \frac{kN}{m} + \left((1.5\cdot 0\cdot 1.0)\cdot 0.6400000000\ \frac{kN}{m}\right) + \left((1.5\cdot 0.5\cdot 1.0)\cdot 2.5\ \frac{kN}{m}\right)$$

$$= 14.72518063\ \frac{kN}{m}$$

SLS Calculation:

$$4\ \frac{kN}{m} + 5.633453754\ \frac{kN}{m} + \left(0\cdot 0.6400000000\ \frac{kN}{m}\right) + \left(0.5\cdot 2.5\ \frac{kN}{m}\right) = 10.88345375\ \frac{kN}{m}$$

We must make sure that the calculated bending moment is less than or equal to the calculated bearing capacity. (The bearing capacity of the beam must be greater than the moment load that the beam is affected by.
A beam in concrete is roughly dimensioned so that everywhere:

$M_{Sd} \le M_{Rd}$

Calculation method:
- Plastic Calculation

<u>1. The permissible strength of the material is determined.</u>
Since a beam is affected by both pressure and tension and it is concrete as a material, we were reinforcing in concrete to withstand the tension in the beam. Since it is a clamped beam, we put reinforcement at the top of the column. Since that where there will be pressure.

The example sued for the calculations for the concrete beam is:
2000mmx1000mmx300mm and 74 *pcs of ø20 mm with 40 mm cc*

ULS
Since reinforcement has other strengths than concrete, we calculate them separately.
For Concrete:

$f_{ck} = 90MPa$

$\varepsilon_{cu} = 0.26$

$\gamma_c = 1.45$

For Reinforcement:

$f_{ck} = 550MPa$

$\gamma_c = 1.2$

Permissible compressive strength of concrete:

$$f_{c,d} = \frac{f_{c,k}}{\gamma_c} = \frac{90MPa}{1.45} = 62.06896552\ MPa$$

Armerings tilladlige trykstyrke:

$$f_{y,d} = \frac{f_{ck}}{\gamma_c} = \frac{550MPa}{1.2} = 458.3333333\ MPa$$

2. The effective height d of the cross section and the reinforcement area (Jensen and Mohr, 2013).

The center of gravity of reinforcement is determined:

$$c_s = \frac{74 \cdot 40mm}{74} = c_s = 40\ mm$$

The effective height of the cross section is determined:

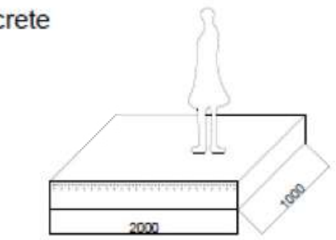
$$d = h - c_s = 300mm - 40mm = 260\ mm$$

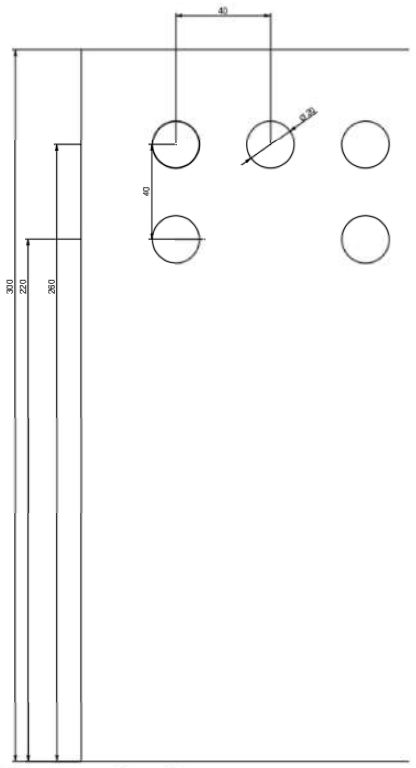
The reinforcement area is determined:

$$A_s = amount \cdot \pi \cdot r^2 = 74 \cdot 3.14 \cdot \left(\frac{20mm}{2}\right)^2 = 23236.00\ mm^2$$

3. The strength of the wooden reinforcement and the concrete is determined
(Jensen and Mohr, 2013).

concrete





Concrete Reinforcement Properties:

It is assumed as a starting point that the cross section is normally reinforced, that when the concrete is crushed there is flow in the reinforcement ( )
$(\varepsilon_s > \varepsilon_y)$

The force in the tensile reinforcement when it flows:

$$F_s = A_s \cdot f_{y,d} = 23236.00mm^2 \cdot 458.3333333MPa = \overset{simplify}{=} 1.064983333\ 10^7\ N$$

4. Horizontal equilibrium gives the zero line height x:
We do this by setting the force for the tensile zone equal to the force with pressure and isolate for x.

$$F_c = F_s$$
$$\Updownarrow$$
$$A_c \cdot f_{c,d} = A_s \cdot f_{y,d} \leftrightarrow x = \frac{A_s \cdot f_{y,d}}{A_c \cdot f_{c,d}}$$
$$\Updownarrow$$
$$x = \frac{A_s \cdot f_{y,d}}{A_c \cdot f_{c,d}} = x = \frac{23236.00mm^2 \cdot 458MPa}{0.8 \cdot 2000mm \cdot 62.06896552MPa} \xrightarrow{\text{solve for x}} [[x = 0.1071599139\ m]]$$

$$0.1071599139m = \overset{simplify}{=} 0.1071599139\ m \xrightarrow{\text{replace units}} 107.1599139\ mm$$

5. The moment load capacity of the beam is determined
The moment bearing capacity of the beam is found by taking the moment around the middle pressure zones:

$$M = F_s \cdot z$$
$$\Updownarrow$$
$$F_s \cdot (d - 0.4 \cdot x)$$
$$\Updownarrow$$
$$1.064983333\ 10^7\ N \cdot (260mm - 0.4 \cdot 107.1599139mm) = 2.312462576\ 10^9\ N\ mm \xrightarrow{\text{replace units}} 2312.462576\ kN\ m$$

6. Now to see if the concrete beam can withstand the load for ULS:
Since it is a clamped beam we have, this formula is used:

$$M_B = -\frac{1}{2} \cdot q \cdot l^2 \leftrightarrow M_B = -\frac{1}{2} \cdot 14.72518063\ \frac{kN}{m} \cdot (1m)^2 = \xrightarrow{\text{solve for M\_B}} [[M_B = -7362.590315\ J]]$$

$$-7362.590315\ J = -7362.590315\ J \xrightarrow{\text{replace units}} -7.362590315\ kN\ m$$

$$2312.462576\ kN\ m > -7.362590315\ kN\ m$$

Conclusion: The building can withhold the load based on the ULS Criteria.

SLS
The permissible strength of the material is determined area:
Transformed area:

$$A_{t,tr} = A_c + (\alpha - 1) \cdot \alpha \cdot A_{sc1} + \alpha \cdot A_{sc2}$$

$\alpha = 20$

$A_c = 2000 \cdot x(\alpha - 1) \leftrightarrow 2000 \cdot x(20 - 1)$

$A_{sc_1} = 49 \cdot 3.14 \cdot \left(\frac{20\text{mm}}{2}\right)^2 = \quad A_{sc_1} = 15386.00\ \text{mm}^2$

$A_{s_2} = 25 \cdot 3.14 \cdot \left(\frac{20\text{mm}}{2}\right)^2 = A_{s_2} = 7850.00\ \text{mm}^2$

$A_{t,tr} = 2000 \cdot x + (20 - 1) \cdot 20 \cdot 15386.00 + 20 \cdot 7850.00 = \quad A_{t,tr} = 2000\ x + 6.15440000\ 10^6$

2. Determinating the static torque around the zero line

$A_s = 74 \cdot 3.14 \cdot \left(\frac{20\text{mm}}{2}\right)^2 = A\_ = 23236.00\ \text{mm}^2$

$S_{tr} = 0$

$\updownarrow$

$A_c \cdot y_c - \alpha \cdot A_{sc} \cdot y_{sc} = 0$

$\updownarrow$

$2000\ x \cdot \frac{1}{2} x - 20 \cdot 23236.00\text{mm}^2 \cdot 40\text{mm} = 0$

$\updownarrow$

$2000\ x \cdot \frac{1}{2} x = 20 \cdot 23236.00\text{mm}^2 \cdot (40\text{mm} - x)$

$\updownarrow 20 \cdot 23236.00 \cdot (40 - x) = 1.858880000\ 10^7 - 464720.00\ x$

$1000\text{mm}\ x^2 = 1.858880000\ 10^7\text{mm}^3 - 464720.00\text{mm}^2\ x$

$\updownarrow$

$1000\text{mm}\ x^2 + 464720.00\text{mm}^2 \cdot x = 1.858880000\ 10^7\text{mm}^3$

$\updownarrow$

$1000\text{mm}\ x^2 + 464720.00\text{mm}^2 \cdot x - 1.858880000\ 10^7\text{mm}^3 = 0 \xrightarrow{\text{solve for } x}$

$[\,[x = 0.03704669925\ \text{m}\,], [x = -0.5017666992\ \text{m}\,]\,]$

$0.03704669925\text{m} = 0.03704669925\ \text{m} \xrightarrow{\text{replace units}} 37.04669925\ \text{mm}$

3. Moment of inertia:

$$I_{sr,tr} = \frac{1}{12} \cdot b \cdot x^3 + A_c \cdot y_c^2 + (\alpha - 1) \cdot A_{sc1} \cdot y_{sc1}^2 + \alpha \cdot A_{sc2} \cdot y_{sc2}^2$$

$$I_{sr,tr} = \frac{1}{12} \cdot 2000\text{mm} \cdot (37.04669925\text{mm})^3 + 2000\text{mm} \cdot 37.04669925\text{mm} \cdot \left(\frac{37.04669925\text{mm}}{2}\right)^2 + 20 \cdot (15386.00\text{mm}^2) \cdot (260\text{mm} - 37.04669925\ \text{mm})^2 + 20 \cdot (7850.00\ \text{mm}^2) \cdot (220\text{mm} - 37.04669925\ \text{mm})^2$$

$= \xrightarrow{\text{solve for I\_sr,tr}} [\,[I_{sr,tr} = 0.02058518602\ \text{m}^4\,]\,]$

$0.02058518602\text{m}^4 \overset{\text{simplify}}{=} 0.02058518602\ \text{m}^4 \xrightarrow{\text{replace units}} 2.058518602\ 10^{10}\ \text{mm}^4$

4. Stresses in concrete:

From earlier we found out what our moment was:

$-7.362590315\ \text{kN m} = -7.362590315\ \text{kN m} \xrightarrow{\text{replace units}} -7.362590315\ 10^6\ \text{N mm}$

$\sigma_c = \frac{-7.362590315\ 10^6\ \text{N mm}}{2.058518602\ 10^{10}\ \text{mm}^4} \cdot 37.04669925\ \text{mm} = \xrightarrow{\text{solve for sigma\_\_c}} [\,[\sigma_c = -13250.28925\ \text{Pa}\,]\,]$

$-13250.28925\ \text{Pa} = -13250.28925\ \text{Pa} \xrightarrow{\text{replace units}} -0.01325028925\ \text{MPa}$

5. The total deflection can now be calculated as follows:

$u = \frac{1}{10} \cdot \alpha \cdot \frac{\sigma_c}{E_s \cdot x} l^2 \leftrightarrow u = \frac{1}{10} \cdot \frac{200000}{20} \cdot \frac{-0.01325028925\text{MPa}}{200000\text{MPa} \cdot 36.02569084\ \text{mm}} \cdot (1000\text{mm})^2 = \xrightarrow{\text{solve for } u}$

$[\,[u = -0.001839005574\ \text{m}\,]\,]$

$0.001839005574\text{m} = 0.001839005574\ \text{m} \xrightarrow{\text{replace units}} 1.839005574\ \text{mm}$

Appearance and general applicability of the structures should be taken into account:

$\frac{l}{250} = \frac{1000\text{mm}}{250} = 4\ \text{mm} > 1.839005574\ \text{mm}$

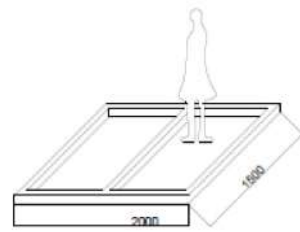
However, there may be problems with adjacent components:

$\frac{l}{500} = \frac{1000\text{mm}}{500} = 2\ \text{mm} > 1.839005574\ \text{mm}$

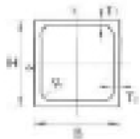
The Chosen Beam fits under AGT GUIDELINES:

ULS

Steel



When we calculate too large our calculation moment:



Firkantrør H×B×T 1)	H mm	B mm	T1 mm	T mm	R mm	A mm² 10³	A mm²	mm² 10⁶	g kg/m	I_{xy} mm⁴ 10⁶	W_{el} mm³ 10³	mm⁴ 10⁶	W mm³ 10³	E MPa 10³
100 x 60 x 8	80	60	8	8	4	2,31	1,44	0,86	4,18	2,84	57,0	1,21	40,3	23
100x100x6	100	100	6	6	4	2,27	1,08	1,08	4,06	3,36	67,2	3,36	67,2	23
100x100x8	100	100	8	8	4	2,96	1,44	1,44	5,32	4,21	84,2	4,21	84,2	23
120x120x6	120	120	6	6	4	2,75	1,30	1,30	4,96	5,98	99	5,98	99	23
120x120x8	120	120	8	8	4	3,60	1,73	1,73	6,48	7,57	126	7,57	126	23
160x160x8	160	160	8	8	8	4,92	2,30	2,30	8,85	19,1	238	19,1	238	23
200x200x10	200	200	10	10	10	7,69	3,60	3,60	13,84	46,5	465	46,5	465	23
240x240x12	240	240	12	12	12	11,1	5,18	5,18	20,0	96,5	804	96,5	804	23

stål styrkeklasse	materialetykkelse t mm	karakteristisk værdi f_y MPa	f_u MPa	E MPa	Kl
	$t \leq 16$	450			
S450	$16 < t \leq 40$	430	550	$0,21 \cdot 10^6$	1,528
	$40 < t \leq 63$	410			

(Jensen and Mohr, 2013)

Calculation:

$$M_B = -\frac{1}{2}\cdot q\cdot l^2 \leftrightarrow M_B = -\frac{1}{2}\cdot 10.98518063\ \frac{kN}{m}\cdot(1\,m)^2 = \overset{simplify}{=} M_B = -5492.590315\ J$$

$$5492.590315 J = 5492.590315\ J \xrightarrow{replace\ units} 5.492590315\ kN\ m \xrightarrow{replace\ units} 5.492590315\ 10^6\ N\ mm$$

$$W_{el} > \frac{M_{ed}\cdot\gamma_{M0}}{f_y}$$

$$\frac{5492.590315 J}{450 MPa}\cdot 1.2 = \overset{simplify}{=} 0.00001464690751\ m^3 \xrightarrow{replace\ units} 14646.90751\ mm^3$$

$$\sigma_{md} < f_{yd} \leftrightarrow \frac{M_{ed}}{W_{el}} < \frac{f_y}{\gamma_{M0}}$$

$$\frac{M_{ed}}{W_{el}} = \frac{5.492590315\ 10^6\ N\ mm}{57.0\cdot 10^3\ mm^3} = \overset{simplify}{=} 9.636123360\ 10^7\ Pa \xrightarrow{replace\ units} 96.36123360\ MPa$$

$$\frac{450 MPa}{1.2} = 375.0000000\ MPa$$

$$96.36123360\ MPa < 375.0000000\ MPa$$

Conclusion: The building can withhold the load based on the ULS Criteria.

SLS

Deformations for beams and decks must be observed as follows:

$$u_{sl} = \frac{1}{400}\cdot L \leftrightarrow u_{sl} = \frac{1.0}{400}\cdot 1\,m = \xrightarrow{solve\ for\ u\_sl} [[u_{sl} = 0.002500000000\ m]]$$

The permissible deflection is as follows:

$$0.002500000000\cdot 1000 = 2.500000000 mm$$

The maximum deflection:

$$u(0) = \frac{1}{30}\cdot\frac{q\cdot l^3}{E\cdot I}$$

$$\updownarrow$$

$$u(0) = \frac{1}{30}\cdot\frac{7.483453754\ \frac{kN}{m}\cdot(1\,m)^3}{0.21\cdot 10^6 MPa\cdot 2.84\cdot 10^3 mm^3} \overset{simplify}{=} u(0) = 0.0004182569725\ m$$

$$0.0004182569725\ m = 0.0004182569725\ m \xrightarrow{replace\ units} 0.4182569725\ mm$$

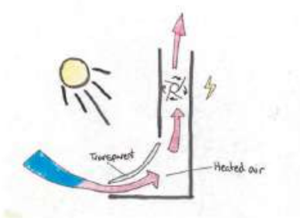
The Chosen Beam fits under AGT GUIDELINES:

The proces is then done with other profiles, to see what dimensions ar necessary for the profile, in order to handle the loads.

APPENDIX 9 RENEWABLE STRATEGIES

The first group of renewable strategies consist of two different ways of utilizing the silos, where the first two represent the concept of internal integration of renewable energy, while the last two represent external renewable energy. The reason for them being investigated is for this project to take good use of the silos that are left, yet not used.

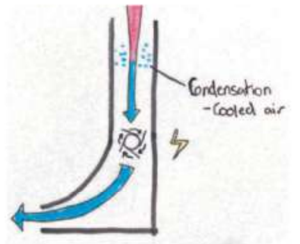
UPDRAFT TOWER



Ill. 19 UPDRAFT TOWER

The smaller silos in Østre Kajgade 11 are investigated for implementation of a solar updraft tower, which is a wind turbine placed in a chimney producing electricity by the wind draft caused by the air being heated. Among the important parameters for the efficiency of a solar updraft tower are chimney height, chimney diameter, humidity, temperature. It is therefore obvious that the geographical location is of high importance for how the system is functioning. (Allwörden, Gasser and Kammboh, 2021).

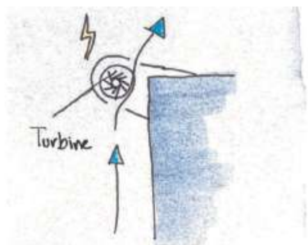
DOWNDRAFT TOWER



Ill. 20 DOWNDRAFT TOWER

The downdraft Tower shares similarities with the Updraft Tower, with difference in the air movement, as it is in reversed order compared to the previous. The principle behind the technology is that cold air is heavier than warm air, resulting in it being possible to cool down the air in the top, by spraying it with cold water, resulting in it to cool down and create the downward going effect. The turbine placed in the bottom generates electricity as the air is pushed through. (Ferris, 2021).

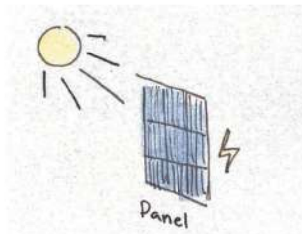
RIDGEBLADE



Ill. 21 RIDGE BLADE

The product used for this investigation comes from the Canadian company The Power Collective, designed to produce wind energy on the ridge of a given building. The specific product that is examined is the product named Ridgeblade 2 Commercial. A standard system consisting of 5 turbines, with a full length of 6 meters, can produce 8000 kWh per year with an average windspeed of 6 m/s. The turbines reach their maximum capacity at 11,2 m/s, from where the speed of the rotations is limited. The estimated production is based on a 40 degrees sloped surface. (The Power Collective, 2017).

PHOTOVOLTAICS

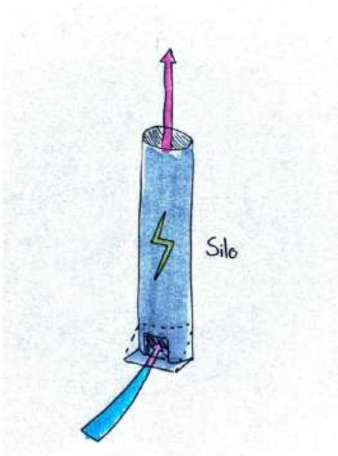


Ill. 22 PHOTOVOLTAICS

Østre Kajgade holds a huge potential in the production of energy coming from the sun. Through this the following investigations are made on the production of electricity, using standard specifications for the panels, where the location of the panels will be investigated in terms of the efficiency and how much they produce in total. The part of mounting the solar panels on the roof is functionally, an easy way to place them. This because the flat and open surface provides the space for the work related to preparing the surface for mounting, as well as the part of connecting the panels.

COMPARISON

Implementing either the Solar updraft Tower or the Downdraft Tower, similar modifications would have to be made to the silos, allowing the air to move through. This includes creating an opening in the top and the bottom of the silos, followed by the mounting of the turbines inside the silos. Other than that, a thermal collector would have to be constructed, if the Updraft solution were to be implemented. The idea of utilizing the silos to produce energy would have a very low visual impact on the building, caused by the production taking place inside the building. In that sense the implementation of one of these renewable strategies would present themselves as a very well-integrated part of the building, resulting in some sense in a non-visible power plant. Explaining why these technologies were investigated further. Caused by a lack in material and existing cases on the Downdraft Tower, the following investigations only takes further consideration to the implementation of the Updraft Tower.



Ill. 23 ENERGY PRODUCTION

FURTHER INVESTIGATION

By looking into different cases of constructions of the Solar Updraft Tower, a theoretical downscaling was made based on the physical dimensions on two examples from Spain and China, sharing similar dimensions, but the one in Spain was the only one to be build. The downscaling is shown on table 1. Though it is possible that a proportional downscaling will not work, it did lead to a result from the down scaling based on the size of the collector, to control the downscaling. The result is a downscaling of the case example by a factor of 0,05.

Ill. DOWNSCALING OF FOREIGN CASE

Elements	Case example	Downscaling
Chimney height	200 m	10 m
Chimney diameter	10 m	0,5 m
Collector area	45000 m2	111,8 m2
Maximum power output	50 kW	2,5 kW

CLIMATE

During the investigation of the Solar Updraft Tower, it was discovered how the calculations behind the technology were quite complex and thereby how it would require more time, if the technology where to be controlled for it being implemented into the project, as it would be a project of its own. From looking into the locations in which the power plant is constructed, or planned to be constructed, it became clear that the climatic conditions on the different locations were quite different from the location in Svendborg.

Location	Elevation above sea level (m)	Relative humidity (Summer/winter)	Yearly average temperature	Radiation kWh/m2 year
Svendborg, Denmark	2 m	75% / 93 (Vejrarkiv, 2021)	8,3 C (Temperaturen i Danmark, 2021)	1000 (Solar resource maps of Denmark, 2021)
Yinchuan, China	1111 m	64% / 55% (d.o.o., 2021)	10,4 C (Hui, 2021)	1600 (Solar resource maps of China, 2021)
Manzanares, Spain	676 m	78% / 40% (Climate of Madrid, Spain, 2021)	14,5 C (MADRID CLIMATE (SPAIN), 2021)	1650 (Solar resource maps of Spain, 2021)

RIGDEBLADE IMPLEMENTATION

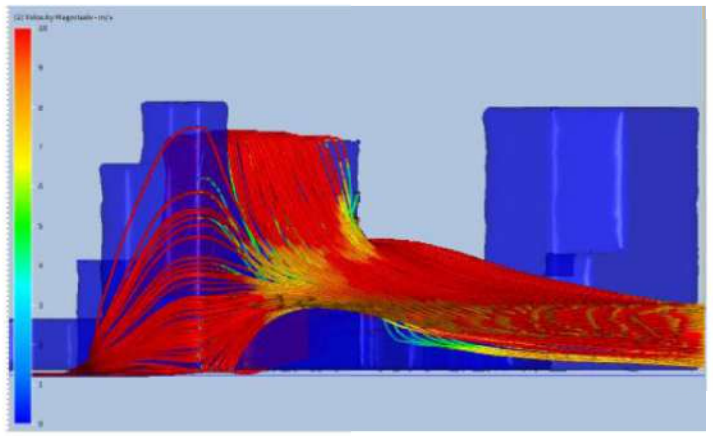
With the placement on the harbour often follows a quite wind dominated environment and the same goes for the location in the project, as seen previously in Appendix XX. Though in this section different turbines are investigated for their potential implementation in this project. The first two investigated strategies do not rely on the wind speed, as they are not driven by wind in general, as they are creating their own wind through the creation of temperature differences.

Based on the wind conditions around the building and how wind behaves around large and tall buildings, a strategy of implementing wind turbines on the roof of Østre Kajgade 11 is investigated for its possibilities in terms of aesthetics and production of energy. The product used for this investigation comes from The Power Collective, designed to produce wind energy on the ridge of a given building. The specific product that is examined is the product named Ridgeblade 2 Commercial. A standard system consisting of 5 turbines, with a full length of 6 meters, can produce 8000 kWh per year with an average windspeed of 6 m/s. The turbines reach their maximum capacity at 11,2 m/s, from where the speed of the rotations is limited. The estimated production is based on a 40 degrees sloped surface.

In that way the relation between the angle of the surface and the position of the turbine is kept, that combined with the behavior of the wind going above tall buildings, increasing the windspeed at that very spot, justifies the implementation of the product.

In the case of implementing this strategy it will be possible, from the desired placement, to mount 20 turbines. If the average wind speed were assumed to be the same 6 m/s, as prior described, the potential energy production would become 32000 kWh per year. Caused by the wind conditions on the site being a bit differently, the production is calculated from the wind conditions on the site. The wind hits the building from the right direction in just above 50% of the time, seen across a hole year. When it does the average windspeed is 6,7 m/s, which leads to the following estimated energy production.

Ill. 24 RAYTRACE



Number of turbines	Average windspeed	Total production
20	6,7 m/s (50% of the time)	20.000 kWh / year

Ill. 25 RIDGEBLADE ENERGY PRODUCTION

An investigation of Photovoltaic placement was done on the roof and the façade of Øster Kajgade 11. The placement on the roof creates a lot of freedom in how the panels are rotated and inclined. The disposable surface area on the roof that the open to the placement of PV's are 700m2. Through the 2 examples shown below the effects of the orientation of the panel is examined according to the production of energy in total, as well as the efficiency in the production per m2 solar panel. Example 1 is generated on behalf of creating the best orientation, while example 2 is generated from utilizing the available space.

Ill. 26 PANEL PROPERTIES

Example	Panel area m2	Peak power kW/m2	Efficiency %	Orientation	Inclination	Horizon	Shadows
1	283 m2	0,105	0,75	S	45	14	R: 0, L: 0
2	314 m2	0,105	0,75	SW	45	14	R: 0, L: 0

Ill. 27 ENERGY PRODUCTION DIFFERENCE DEPENDING ON THE ORIENTATION

Example	kWh / m2 year	Annual total production	kWh / m2 panel
1	5,8	25.112 kWh	88,7
2	5,2	22.514 kWh	71,7

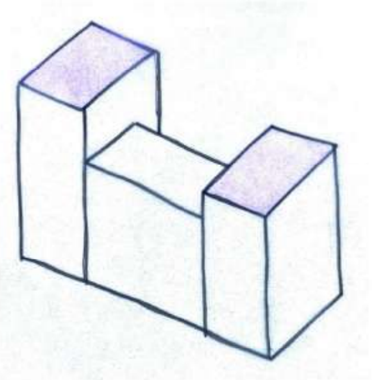
An investigation into the placement of photovoltaics on the façade has been done. This is because the big disposable area for mounting photovoltaics onto the façade, holds a huge potential in terms of the production of energy. The 2 examples shown below is intended to explain potential energy production that the surface can produce, as well as how it affects the buildings aesthetics. The flat concrete surface creates a robust base for the mounting of the solar panels, the part of mounting the panels is not as easy as on the roof, because the surface is not flat. The mounting is still considered easy to execute because fact that very few things must be considered.

Ill. PANEL PROPERTIES

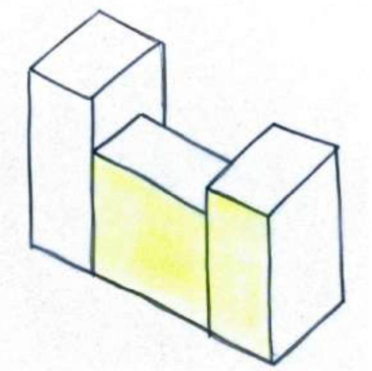
Example	kWh / m2 year
1	12,9
2	4,3

Ill. PANEL PROPERTIES

Example	Panel area m2	Peak power kW/m2	Efficiency %	Orientation	Inclination	Horizon	Shadows
1	960 m2	0,105	0,75	SW	90	0	R: 0, L: 0
2	320 m2	0,105	0,75	SW	90	0	R: 0, L: 0



Ill. 26 ØSTRE KAJGADE 11



Ill. 27 ØSTRE KAJGADE 11

Ill. 28 MONOCHRYSTALLINE (FUTURASUN, 2021)

Ill.29 POLYCHRYSTALLINE (SISA, 2021)

Ill. 30 THIN FILM (SPIRIT ENERGY, 2021)

The further study looks at solar panels, in the light of what aesthetic these carry. The market offers monocrystalline, polycrystalline, and thin film solar panels.

The monocrystalline is characterized by the black and grey color, providing an homogeneous surface. The technology is a composition of cells, installed in a grid of metal, placed between layers of glass. This variant is considered as the most efficient panel, therefore also the most costliest. The service time of the panel is 30 - 40 years.

The polycrystalline is characterized by the blue color, as result of the cast, which leaves a surface of crystals, that reflects light, creating a living surface. These are available in the desired color. However, coloring of these works against the efficiency of the panels. The service time of the panel is 40 - 50 years.

The thin film solar is characterized by the brown and black color, with undisturbed expression. As the name indicates, these are based on the thin film. These panels, are considered as the cheap panels.. The service time of the panel is 35 - 40 years (Solceller, 2012).

CONCLUSION

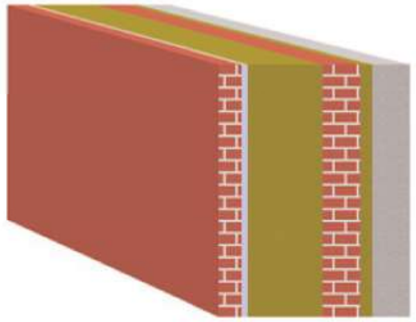
Through the broad range of investigations made on the renewable .strategies suitable for this project, a lot of discoveries has been made. The internal renewables consisting of the Updraft - and Downdraft Tower might have been the most integrated renewable strategies that has been examined through this section, this is because they are directly utilizing the existing silos. Because of the examples take place in foreign countries, with contrasting climates to Denmark, the odds for the solar chimney to properly working is less possible. The processing of the silos into solar towers is a big process, combined with the uncertainty about the effect of the concept, this integration is seen as unlikely. As the construction cost might potentially outweigh the energy return. Explaining why these strategies will not be taken further into the development of the project. As solar panels are a much more developed and common renewable energy source, their production can be calculated into the energy calculation. Both the placement of them on the façade and on the roof will be taken further in the development of the project, this based on them providing a high production of energy to lower the buildings energy demand. The wind turbines will also be taken further into the development of the project, as the show a stable energy production, seen across a year, supplying the building with more energy when it is needed the most. Other than that, it has a minimal impact to the expression of the facade, while the photovoltaics carries the potentials, of improving value of the facade. Combining the production from the photovoltaics and the wind turbines, shows a big difference in terms of their energy production seen monthly. How they complement each other in their energy production is shown below and seen in relation to the energy demand of the building.

APPENDIX 10: INDOOR CLIMATE

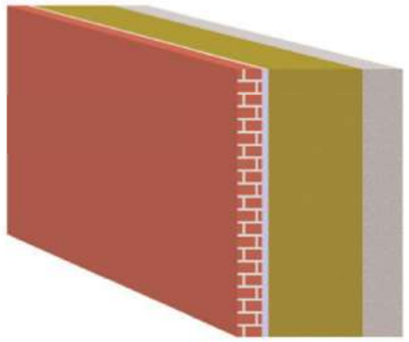
BSIM – Documentation:
The recommended U-value is U: 0.12 W/(m²K), therefore the wall for the development should share the same value or be below to fit requirement of low energy building:

Øster kajgade 25:

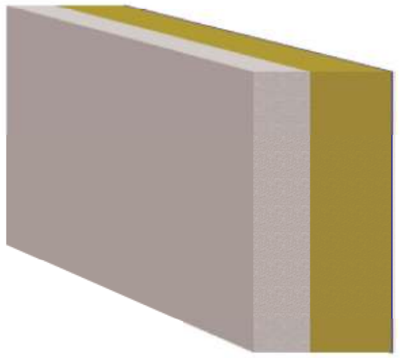
External wall 1 – 772mm – U: 0.10 W/(m2K)
In -> Out
a. Concrete – 150mm
b. Insulation – 50mm
c. Brick – 150mm
d. Insulation – 300mm
e. Wind barrier – 2mm
f. External ventilated layer – 25mm
g. Façade – 95mm



External wall 2 – 622mm – U: 0.10 W/(m2K)
In -> Out
a. Concrete – 150mm
b. Insulation – 350mm
c. Wind barrier – 2mm
d. External ventilated layer – 25mm
e. Façade – 95mm



External wall 3 (internal insulation towards the north) – 505mm
In -> Out
a. Concrete – 200mm
b. Insulation – 290mm
c. Vapour retarder - 0,02mm
d. Façade – 15mm



Internal Floor 1
In -> Out
a. Concrete – 200mm
b. Insulation – 50mm
c. Wooden flooring – 22mm

Living/Dining/Kitchen:
<u>Systems</u>

o Equipment
-In this there usually well be kitchen appliances, a tv and a space for a computer.
-In weekdays this space is usually used during the morning, late afternoon, and evening.
-In the weekdays the space is more used during the weekend.

o Floor Heating
-Floor heating is mostly used during the winter.

o Infiltration
-This happens constant, as there always will be openings tothe outdoors, where heat will seep through.
(Hvad er infiltration?, 2021)

o Lighting
-In the summer lighting happens during the evening
-In the winter happens more frequent, but not during the daytime

o People load
-An elderly couple accompanies the space, for our worst-case scenario. The to people will accompany the living room 2 thirds of the day, where the third is used for outdoor activity.

o Ventilation
-Mechanical Ventilation takes place inside the space as fresh air is blown inside the room. And as there is a kitchen, there will be an outtake.

o Venting
-In the room there is windows and glass door towards the south/west and south/east parts of the room, which gives access to utilize single sided ventilation during the summer.
The windows would stay open during the late spring and summer.

Bedroom
<u>-Systems</u>

o Equipment
-In the bedroom they will be a phone, that is charging and lamp
60x3 = 120W

o Floor Heating
-Floor heating is mostly used during the winter.

o Infiltration
-This happens constant, as there always will be openings to the outdoors, where heat will seep through.

o Lighting
-In the winter happens more frequent, but not during the daytime.

o People load
-As it is a shared bedroom there is 2 people accompanying the room during evening/night so, 21 – 07.

o Ventilation
-Mechanical Ventilation takes place inside the space as fresh air is blown inside the room.

o Venting
-In the room there is windows and glass door towards the south/west of the room, which gives access to utilize single sided ventilation during the summer. The windows would stay open during the late spring and summer.

WINDOWS:
-Recess - The window is recessed by 800mm
-Systems
o Regulation – where the windows get opened during the spring/summer periods.

Results:

Dining/living/kitchen

	Sum/Avg	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
PPM	603.3	736.2	735.5	734.7	637.6	491	461.7	409.3	415.3		418.6	733.3	734.3
Hours > 21	8451	683	626	699	671	743	720	744	744	720	740	677	684
Hours > 27	0	0	0	0	0	0	0	0	0	0	0	0	0
Hours > 28	0	0	0	0	0	0	0	0	0	0	0	0	0
Hours < 20	145	46	23	14	0	0	0	0	0	0	0	23	39

Bedroom

	Sum/Avg	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
PPM	417,7	417,9	417,7	417,8	418,3	417,9	418	417,5	417,9	416,8	417,5	417,3	417,5
Hours > 21	5935	744	671	311	222	285	125	328	352	701	737	715	744
Hours > 27	0	0	0	0	0	0	0	0	0	0	0	0	0
Hours > 28	0	0	0	0	0	0	0	0	0	0	0	0	0
Hours < 20	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX 11
BE18

MODEL DATA

The table below shows the basic information on the building, as entered in BE18.

Building type:	Dwelling
Rotation:	32,9 deg.
Heated floor area:	4329,7 m2
Area heated basement:	0,0 m2
Area existing/other use:	0,0 m2
Heated gross are including basement:	4329,7 m2
Heat capacity:	167,0 Wh/K m2
Time in use:	0-24

THE ENVELOPE

For the different surfaces the makes the envelope of the building, the data below shows the complexity of the building envelope, through the mix of surfaces towards outdoors as well as towards unheated space.

Building part	Area (m2)	U-value	B-factor	Indoor temp.	Outdoor temp.
Roof	742,3	0,1	1,0	20	-12
Floor (terrain)	410,9	0,1	1,0	20	-12
Floor (outdoors)	164,1	0,1	1,0	20	-12
Floor (unheated space)	324	0,1	1,0	20	-12
Walls (to outdoor)	3111,6	0,1	0,7	20	-12
Walls (unheated space)	771,1	0,1	0,7	20	-12

WINDOWS

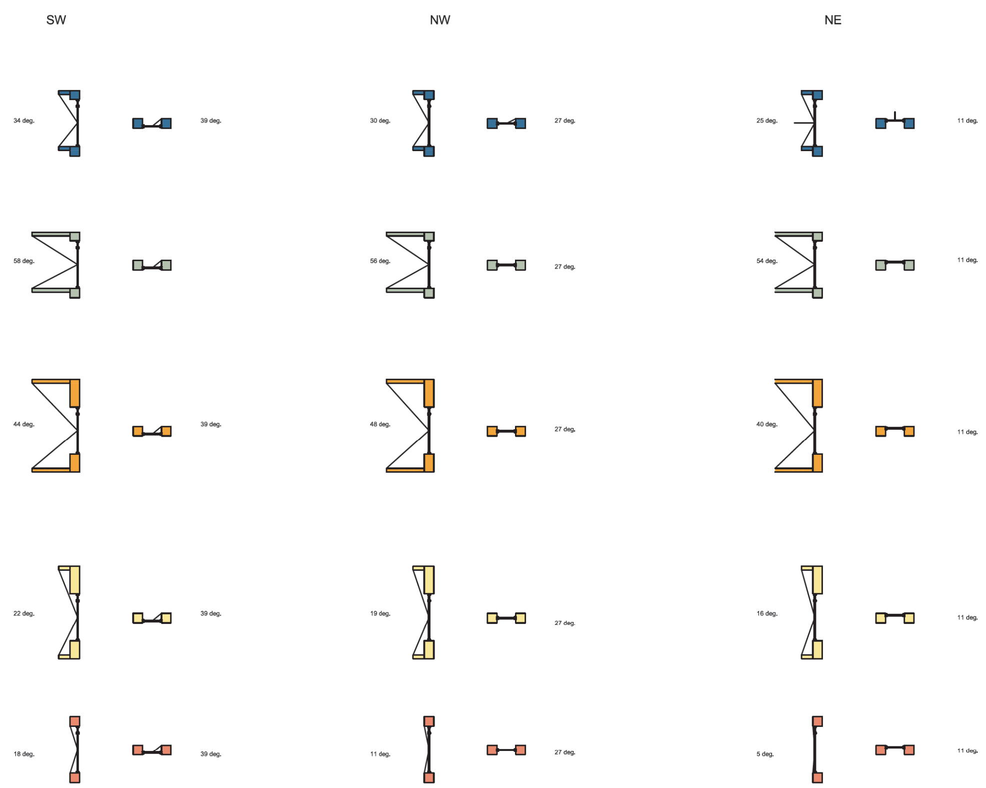
According to the windows openings made in the building, the table below shows the three main orientations, where each orientation contains a range of windows with specific properties according to shadows.

Type	Amount	Orientation	Inclination	Area	U-value	B-value	Ff	g	Shadow	Fc
SW (1)	10	112,9	90	2,5	0,8	1	0,8	0,55	SW (1)	0,8
SW (2)	10	112,9	90	2,5	0,8	1	0,8	0,55	SW (2)	0,8
SW (3)	5	112,9	90	2,5	0,8	1	0,8	0,55	SW (3)	0,8
SW (4)	5	112,9	90	2,5	0,8	1	0,8	0,55	SW (4)	0,8
SW (5)	25	112,9	90	2,5	0,8	1	0,8	0,55	SW (5)	0,8
NW (6)	5	302,9	90	2,5	0,8	1	0,8	0,55	NW (6)	0,8
NW (7)	10	302,9	90	2,5	0,8	1	0,8	0,55	NW (7)	0,8
NW (8)	15	302,9	90	2,5	0,8	1	0,8	0,55	NW (8)	0,8
NW (9)	5	302,9	90	2,5	0,8	1	0,8	0,55	NW (9)	0,8
NW (10)	35	302,9	90	2,5	0,8	1	0,8	0,55	NW (10)	0,8
NE (1)	15	32,9	90	2,5	0,8	1	0,8	0,55	NE (1)	0,8
NE (2)	10	32,9	90	2,5	0,8	1	0,8	0,55	NE (2)	0,8
NE (3)	30	32,9	90	2,5	0,8	1	0,8	0,55	NE (3)	0,8
Total	180									

SHADOWS FOR WINDOWS

The shadows that the table below describes, is a result of the variation in shadows, coming from balconies. Where variations in depths and displacements along the façade, creates the reason for the many shadows. The shadows from the table, are further linked to a section study made for investigations on the windows as well as for the entry in BE18. Though this the position of the window within the wall, ads to the number of different shadows, as these changes the properties for the windows. Sections are shown below the table.

Type	Horizon (deg.)	Overhang (deg.)	Left shadow (deg.)	Right shadow (deg.)	Window%
SW (1)	0	22	39	39	40
SW (2)	0	34	39	39	40
SW (3)	0	18	39	39	40
SW (4)	0	44	39	39	40
SW (5)	0	58	39	39	40
NW (6)	0	19	27	27	25
NW (7)	0	30	27	27	25
NW (8)	0	11	27	27	25
NW (9)	0	48	27	27	25
NW (10)	0	56	27	27	25
NE (1)	0	54	10	10	10
NE (2)	0	5	10	10	10
NE (3)	0	25	10	10	10



VENTILATION

The need for ventilation has been calculated both on the background of the sensory load in terms of olf, as well as atmospheric load in terms of CO2. The calculations for the apartments are made on background of all the apartments, in one calculation.

CALCULATION ON SENSORY LOADS

Room	Net area (m2)	Height (m)	Pollution per person (olf)	Number of persons	Total pollution (olf)	Needed air (l/s)	Needed air (l/s per m2)	Needed air (m3/h)
Apartments (in use)	2085	3,6	1	80	288,5	2060,71	0,99	7418,57
Apartments (not in use)	2085	3,6	1	0	208,5	625,50	0,30	2251,8
Toilets	236,5	3,6	1	5	28,65	204,64	0,87	736,71
Staircases	423,5	3,6	1	0	32,45	97,35	0,30	350,46
Offices (in use)	734,2	3,6	2	42,5	158,42	1131,57	1,54	4073,66
Offices (not in use)	734,2	3,6	1	0	73,42	524,43	0,71	1887,94
Common room (in use)	139	3,6	2	15	43,9	313,57	2,26	1128,86
Common room (not in use)	139	3,6	2	0	1,4	41,7	0,3	150,12

CALCULATIONS ON ATMOSPHERIC LOADS

Room	Net area (m2)	Height (m)	Number of persons	Total pollution (m3/h)	Needed air (l/s)	Needed air (m3/h)
Apartments (in use)	2085	3,6	80	1,632	1813	6528
Apartments (not in use)	2085	3,6	0	0	0	0
Toilets	236,5	3,6	1	0,0272	30,3	108,8
Staircases	423,5	3,6	1	0,0272	30,3	108,8
Offices (in use)	734,2	3,6	42,5	1,156	1284,4	4624
Offices (not in use)	734,2	3,6	0	0	0	0
Common room (in use)	139	3,6	15	0,408	453,3	1632
Common room (not in use)	139	3,6	0	0	0	0

Activity level	*met*	*Pollution per person (l/h)*	*Pollution per person (m3/h)*
Activity level 1	*1,6 met*	*27,2*	*0,0272*
Activity level 2	*1,2 met*	*20,4*	*0,0204*

Pollution from fresh air	350 ppm
Maximum pollution	600 ppm

VENTILATION IN BE18

The table below shows the entered values according to ventilation of the different functions within the building.

ZONE	Area (m2)	Fo	Qm winter (l/s m2)	N vgv	ti	El-VF	Qn winter (l/s m2)	Qi,n winter (l/s m2)	SEL	Qm,s summer (l/s m2)	Qn, s summer (l/s m2)
Apartments (in use)	2565,2	0,8	0,99	0,9	18	yes	0	0	1,0	0,5	0,3
Apartments (not in use)	2565,2	0,2	0,3	0,9	18	yes	0	0	1,0	0,5	0,0
Toilets	291	1	0,87	0,9	18	yes	0	0	1,0	0,5	0,0
Staircases	399,2	1	0,3	0,9	18	yes	0	0	1,0	0,5	0,3
Offices (in use)	903,3	0,7	1,75	0,9	18	yes	0	0	1,0	0,5	0,3
Offices (not in use)	903,3	0,3	0,71	0,9	18	yes	0	0	1,0	0,0	0,0
Common room (in use)	171	0,1	3,26	0,9	18	yes	0	0	1,0	0,0	0,3
Common room (not in use)	171	0,9	0,3	0,9	18	yes	0	0	1,0	0,0	0,0

VENTILATION SYSTEMS

The three ventilation systems located in Østre Kajgade 11, are dimensioned according to the expected worst-case pollution. (WOLF, 2021)

System	Needed air (m3/h)	Model
System 1 (apartments)	8505,75	CRL-iD-9000
System 2 (common room)	1632	CRL-iD-2500
System 3 (offices)	4624	CRL-iD-4800

RENEWABLES

The work on implementing renewables into the project consisted of both an implementation of photovoltaics and wind turbines. The entered data from Be18, according to the two placements of panels are illustrated on the table below.

SOLARPANELS

Photovoltaics (facade)		
Area: 320 m2	Orientation: SW	Inclination: 90 degrees
Horizon: 0,0 degrees	Shadow left: 0,0	Shadow right: 0,0

Photovoltaics (roof)		
Area: 141 m2	Orientation: S	Inclination: 45 degrees
Horizon: 14 degrees	Shadow left: 0,0	Shadow right: 0,0

WINDTURBINES

The data entered on the implemented wind turbines consists of the following data:

Wind turbine	
Nominal performance	11,5 kW
Nominal wind speed	11,2 m/s
Start wind speed	2 m/s
Hub height	35 m
Ambient height	5 m
Roughness	0,05 m

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DRAWING
FOLDER

ØSTRE HAVN - SVENDBORG

AALBORG UNIVERSITET

ØSTRE HAVN
SITEPLAN 1 : 500

MA4-ARK6

DRAW. NO. 00 17.05.2021

ØSTRE HAVN - SVENDBORG	N
AALBORG UNIVERSITET	
ØSTRE HAVN MASTERPLAN	1 : 500
MA4-ARK6	
DRAW. NO. 01	17.05.2021

ØSTRE HAVN - SVENDBORG

AALBORG UNIVERSITET

ØSTRE HAVN
SECTION A - A 1 : 500

MA4-ARK6

DRAW. NO. 02 17.05.2021

ØSTRE HAVN - SVENDBORG

AALBORG UNIVERSITET

ØSTRE HAVN
SECTION B - B 1 : 500

MA4-ARK6

DRAW. NO. 03 17.05.2021

ØSTRE HAVN - SVENDBORG N

AALBORG UNIVERSITET

ØSTRE KAJGADE 11
GROUNDFLOOR 1 : 200

MA4-ARK6

DRAW. NO. 04 17.05.2021

ØSTRE HAVN - SVENDBORG

N

AALBORG UNIVERSITET

ØSTRE KAJGADE 11
APARTMENT PLAN 1 | 1 : 200

MA4-ARK6

DRAW. NO. 05 | 17.05.2021

ØSTRE HAVN - SVENDBORG

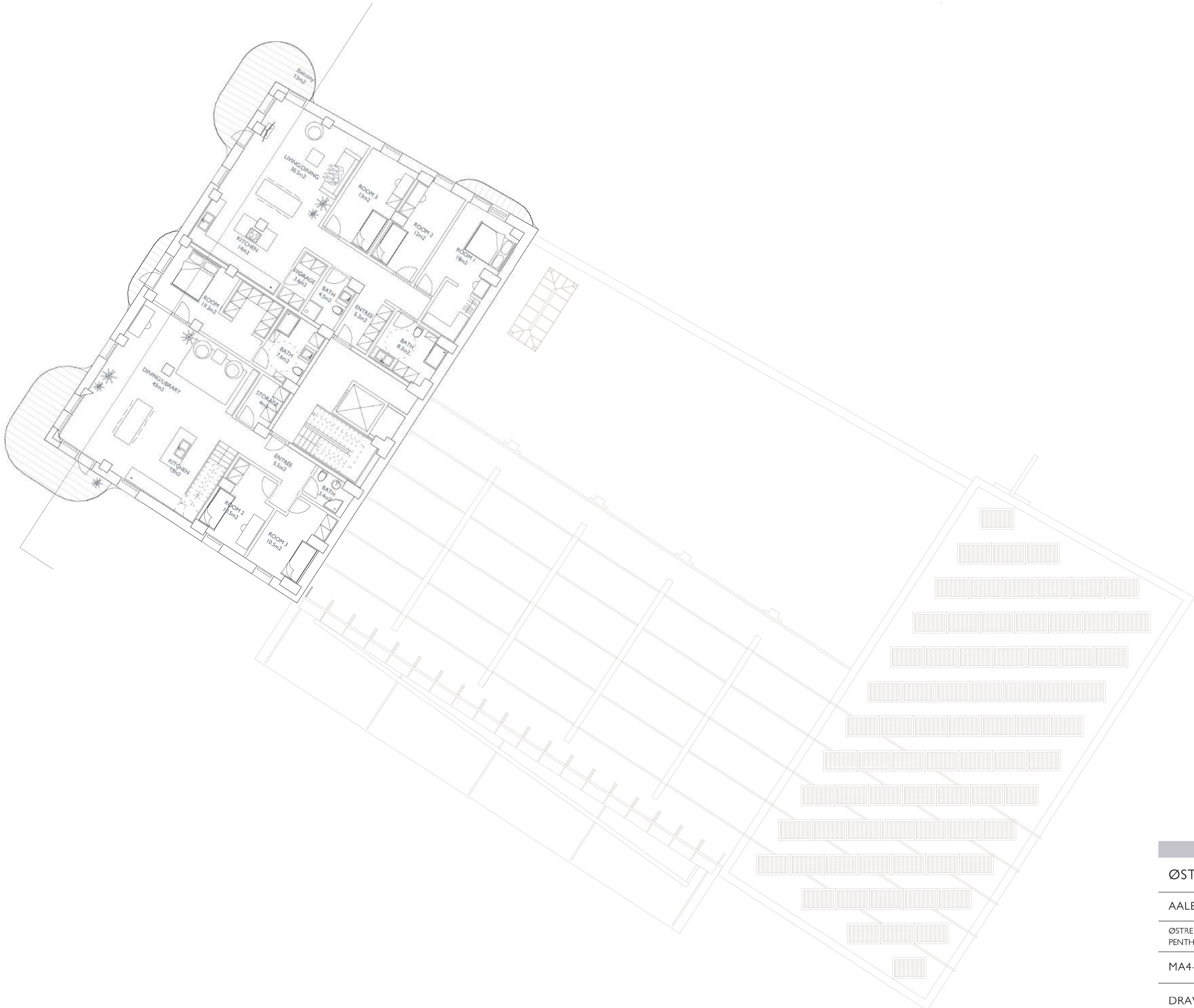
N

AALBORG UNIVERSITET

ØSTRE KAJGADE 11
APARTMENT PLAN 2 WITH ROOFTERRACE 1 : 200

MA4-ARK6

DRAW. NO. 06 17.05.2021



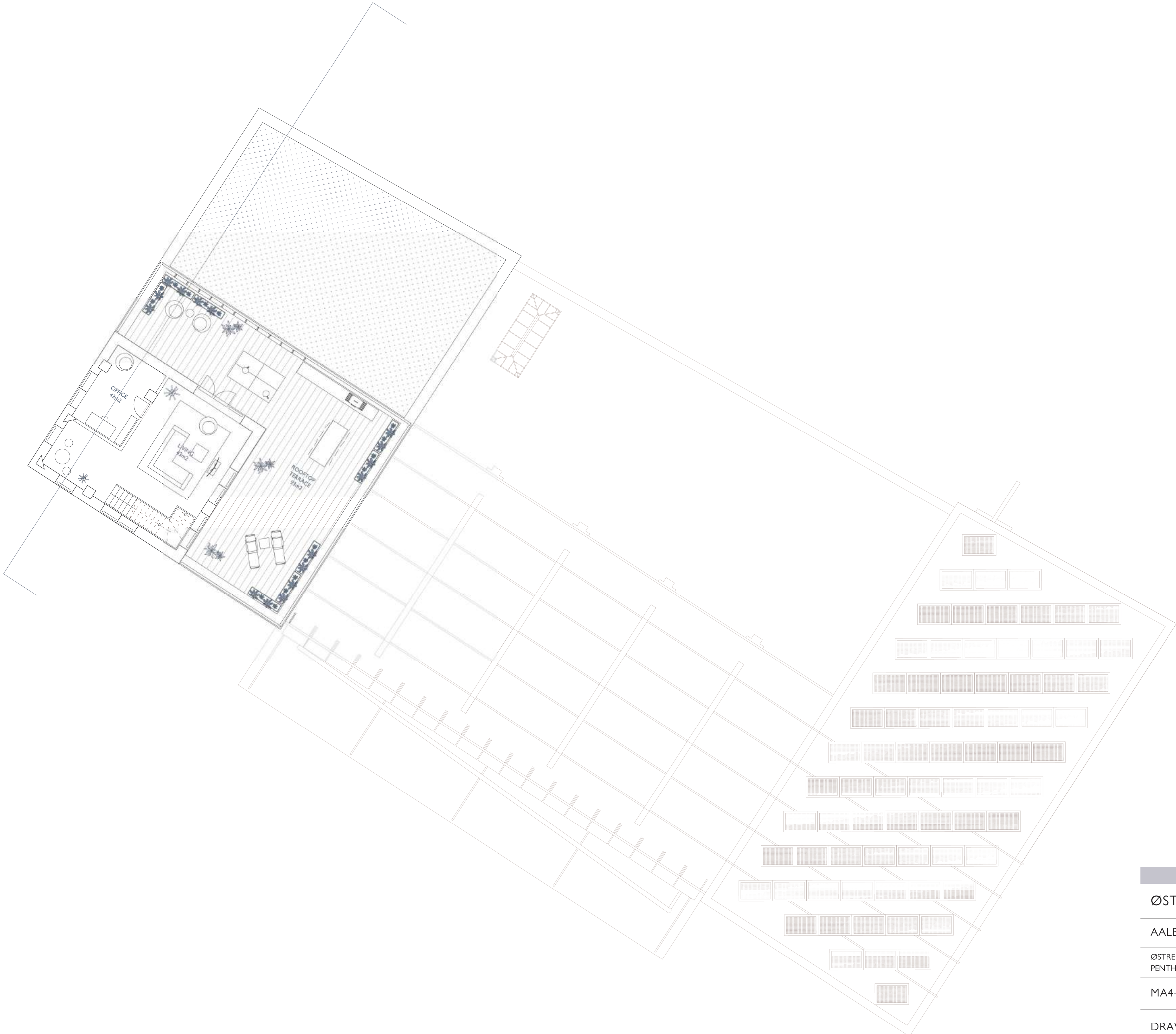
ØSTRE HAVN - SVENDBORG

AALBORG UNIVERSITET

ØSTRE KAJGADE 25
PENTHOUSE 1 | 1 : 200

MA4-ARK6

DRAW. NO. 07 | 17.05.2021



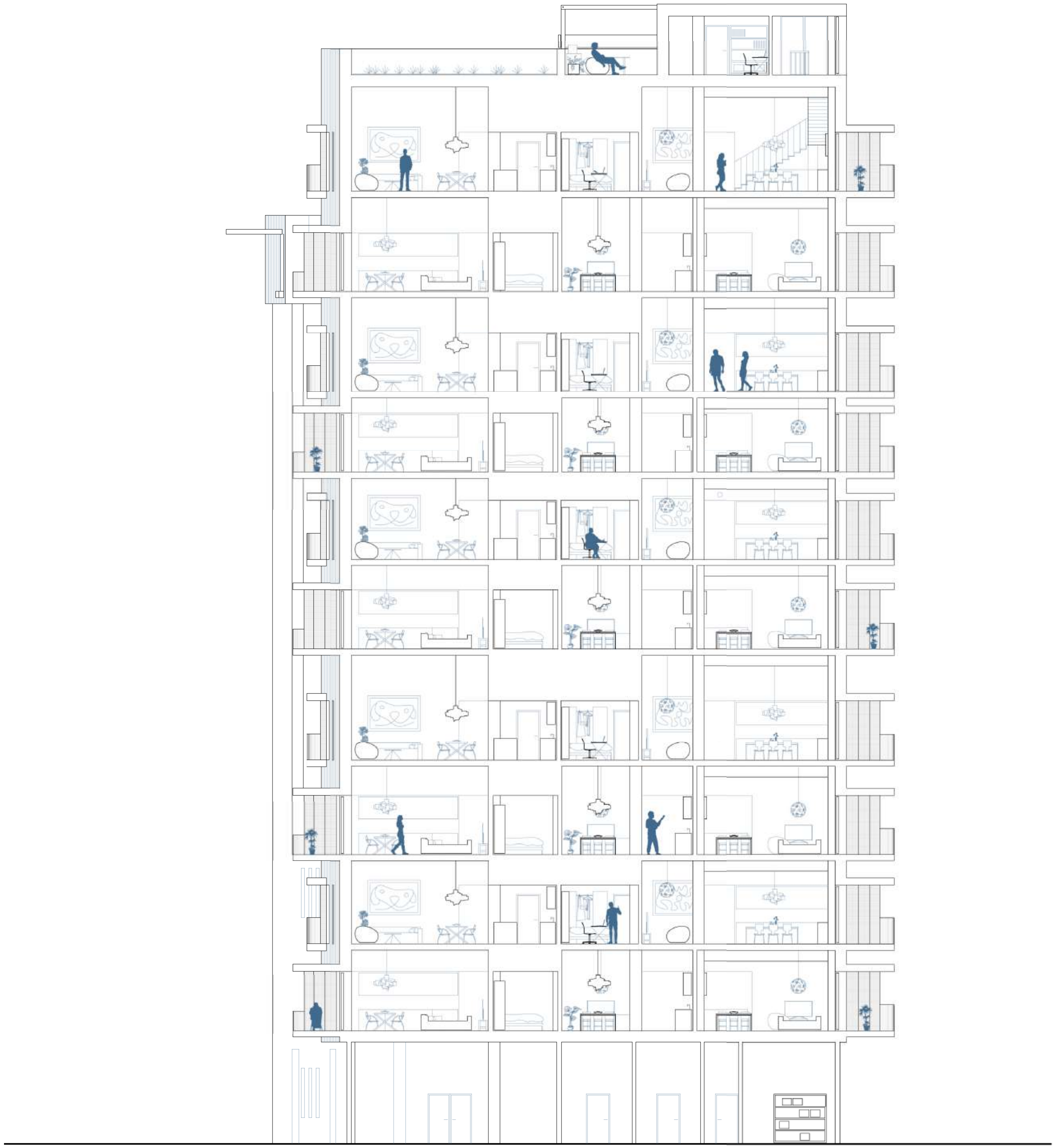
ØSTRE HAVN - SVENDBORG N

AALBORG UNIVERSITET

ØSTRE KAJGADE 25
PENTHOUSE 2 1 : 200

MA4-ARK6

DRAW. NO. 08 17.05.2021



ØSTRE HAVN - SVENDBORG

AALBORG UNIVERSITET

ØSTRE KAJGADE 11
SECTION 1 : 200

MA4-ARK6

DRAW. NO. 9 17.05.2021

ØSTRE HAVN - SVENDBORG

N

AALBORG UNIVERSITET

ØSTRE KAJGADE 25
BASEMENT 1 : 200

MA4-ARK6

DRAW. NO. 10 17.05.2021

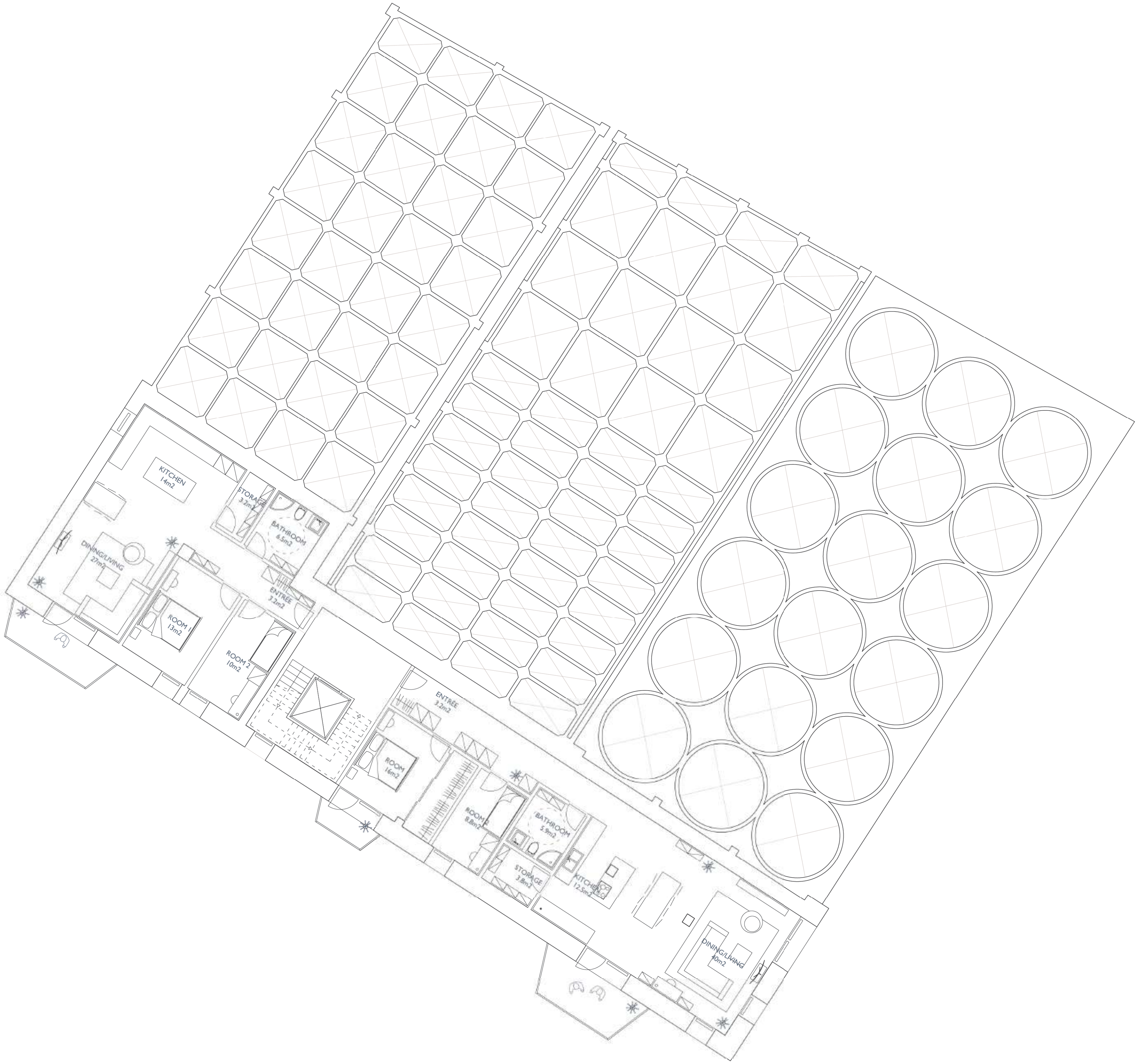
ØSTRE HAVN - SVENDBORG N

AALBORG UNIVERSITET

ØSTRE KAJGADE 25
GROUNDFLOOR 1 : 200

MA4-ARK6

DRAW. NO. 11 17.05.2021



ØSTRE HAVN - SVENDBORG

AALBORG UNIVERSITET

ØSTRE KAJGADE 11
STANDARD FLOOR 1 : 200

MA4-ARK6

DRAW. NO. 12 17.05.2021

ØSTRE HAVN - SVENDBORG

N

AALBORG UNIVERSITET

ØSTRE KAJGADE 25
PENTHOUSE 1 : 200

MA4-ARK6

DRAW. NO. 13 17.05.2021

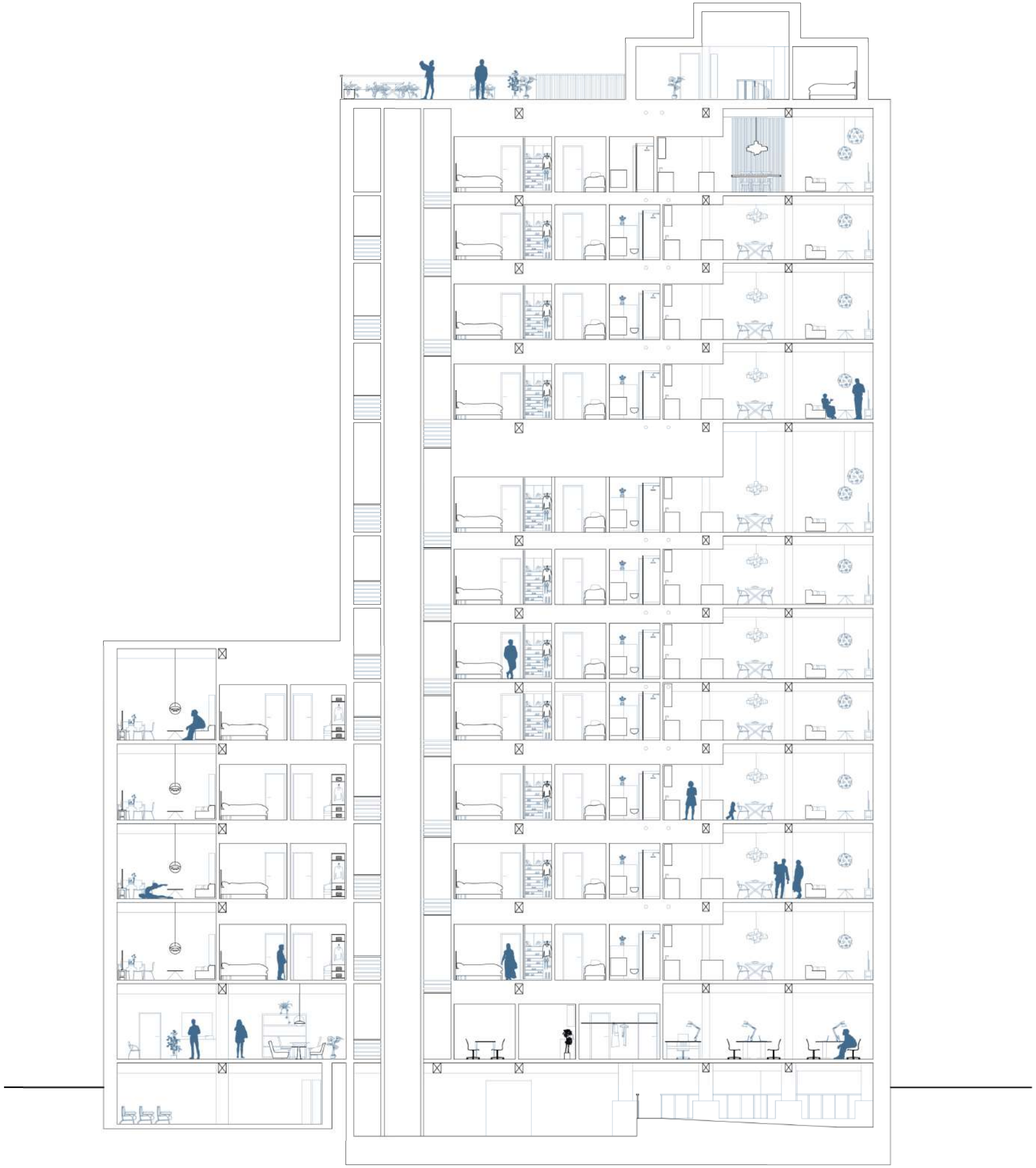
ØSTRE HAVN - SVENDBORG

AALBORG UNIVERSITET

ØSTRE KAJGADE 11
ROOFTOP 1 : 200

MA4-ARK6

DRAW. NO. 14 17.05.2021



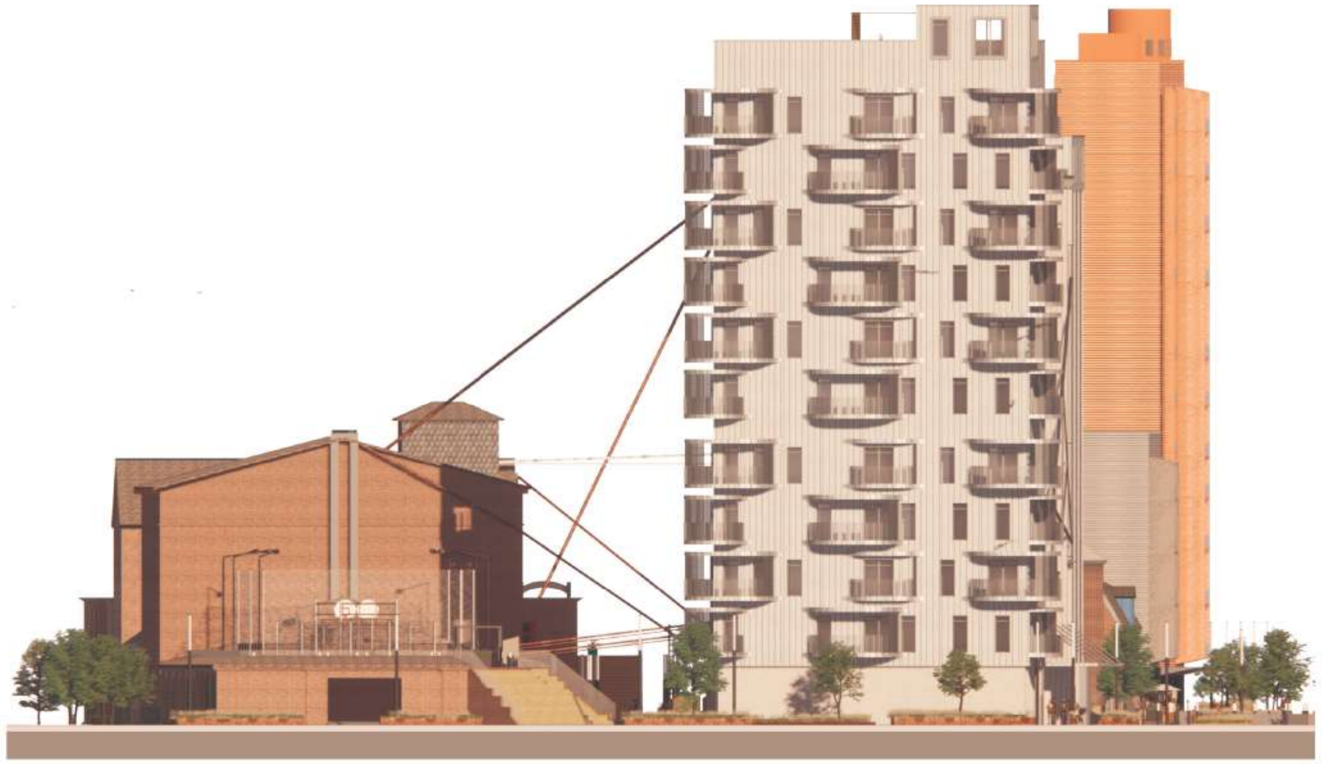
ØSTRE HAVN - SVENDBORG

AALBORG UNIVERSITET

ØSTRE KAJGADE 25
SECTION 1 : 200

MA4-ARK6

DRAW. NO. 15 17.05.2021



NORTHWEST

SOUTHEAST

ØSTRE HAVN - SVENDBORG

AALBORG UNIVERSITET

FACADES
NORTHWEST & SOUTHEAST 1 : 500

MA4-ARK6

DRAW. NO. 16 17.05.2021

ØSTRE HAVN - SVENDBORG

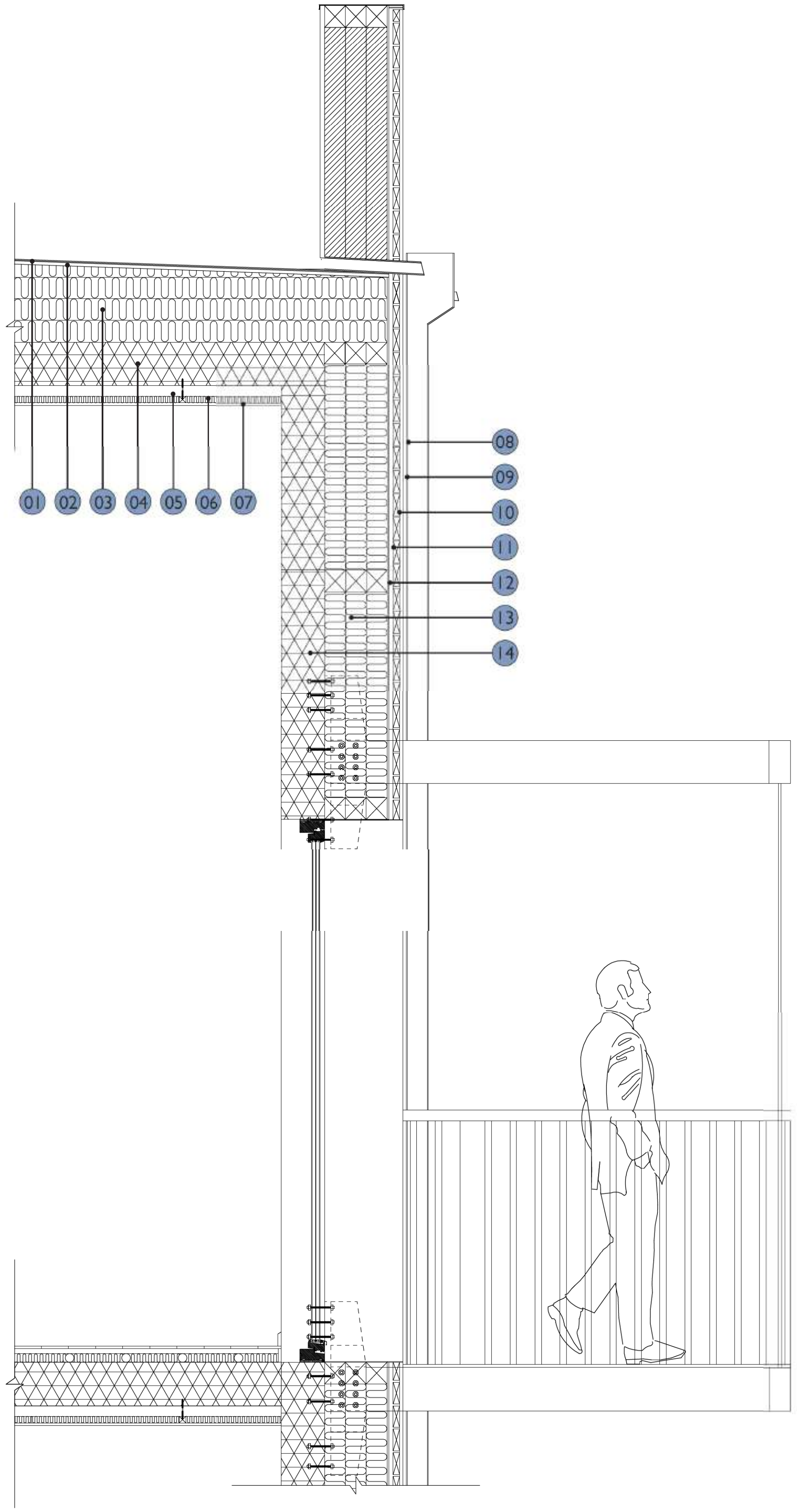
AALBORG UNIVERSITET

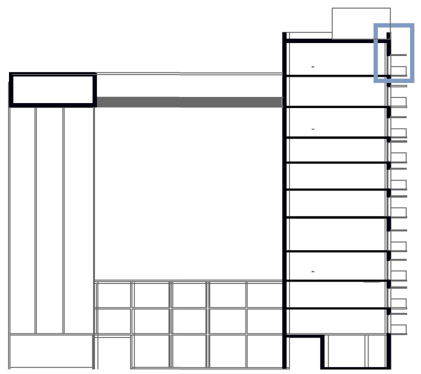
FACADE
NORTHEAST 1 : 500

MA4-ARK6

DRAW. NO. 17 17.05.2021

ØSTRE HAVN - SVENDBORG	N
AALBORG UNIVERSITET	
FACADE SOUTHWEST	1 : 500
MA4-ARK6	
DRAW. NO. 18	17.05.2021





The drawing illustrates how the aluminimum cladding on Østre Kajgade 11 meets the facade. The cladding requires venting, yet also an alu seperator, for the purpose of lessning the travel of sound. The building will be designed with balconies hanged on, to softenen the facade.

DECK
01. ROOFING FELT
02. WOOD BOARD, 13 MM
03. INSULATION, 350 MM
04. CONCRETE, 200 MM
05. CAVITY, 50 MM
06. INSULATION, 30 MM
07. GYPSUM BOARD 13 MM

WALL
08. ALU CLADDING
09. ALU SEPERATOR
10. BATTENS 30 MM
11. VENTILATED AIR GAP
11. WINDPROOF BOARD 8 MM
12. INSULATION 50 MM
13. CONCRETE 200 MM

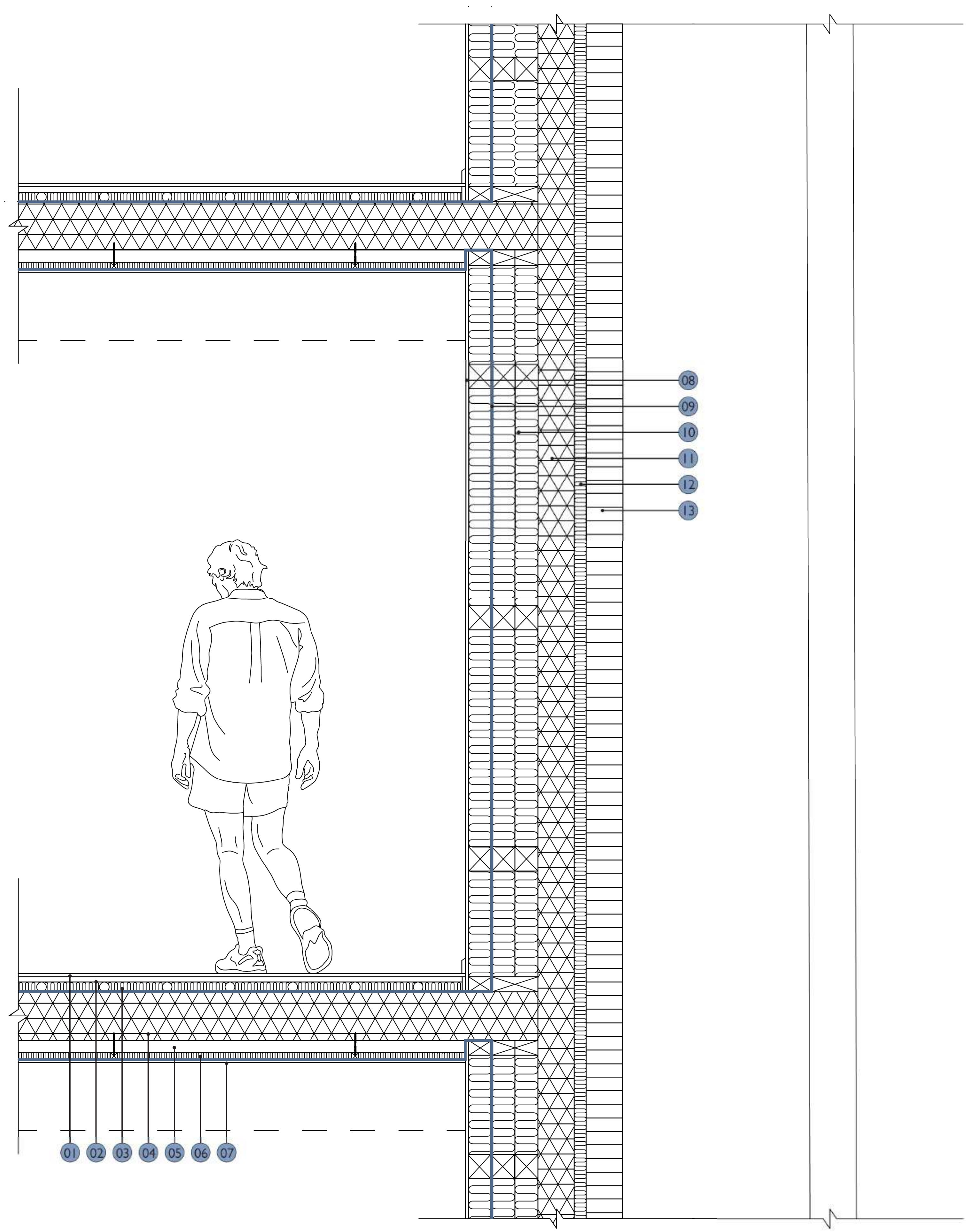
ØSTRE HAVN - SVENDBORG

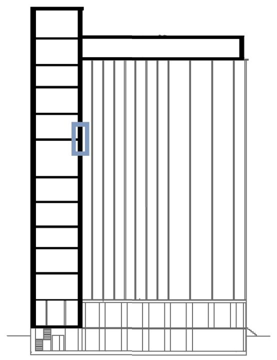
AALBORG UNIVERSITET

DETAILDRAWING
ØSTRE KAJGADE 11 [EXTERNAL INSULATION] 1 : 30

MA4-ARK6

DRAW. NO. 19 17.05.2021





The drawing illustrates the relation between silos and dwellings, where internal insulation is used, on Østre Kajgade 25. The intention, is to ensure that, moisture air do not hit the cold surfaces in the form of brick.

DECK
01. WOOD FLOORING
02. WOOD BOARD, 22 MM
03. INSULATION, 40 MM
04. CONCRETE, 200 MM
05. CAVITY, 50 MM
06. INSULATION, 30 MM
07. WOOD BOARD 13 MM

WALL
08. WOODBOARD 13 MM
09. VAPOUR BARRER
10. INSULATION 300 MM
11. CONCRETE 150 MM
12. INSULATION 50 MM
13. BRICK 150 MM

ØSTRE HAVN - SVENDBORG N

AALBORG UNIVERSITET

DETAILDRAWING
ØSTRE KAJGADE 11 [INTERNAL INSULATION] 1 : 20

MA4-ARK6

DRAW. NO. 20 17.05.2021