EXTENSION OF THE MØNTERGÅRDEN MUSEUM

- A Reinterpretation of the half-timber tradition

Thesis project -ARCH

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ma4-ark12 JUNE 2010
Architecture & Design
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SYNOPSIS/TITLE PAGE

Synopsis:
This project focuses on reinterpretation of traditional half-timber buildings through a digital approach, inspired by deformations in this structural tradition. The project uses a competition brief for the new extension of Møntergården Museum, Odense, as its platform for the development of the reinterpretation.

Thesis Projet:
10th Semester 2010
ARCH
Architecture & Design
Aalborg University

Project Period: 01.02.2010 - 02.06.2010
Copies: 4
Pages: 127

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0.2
INTRODUCTION

The overall theme of this thesis project is reinterpreting traditional half-timbered building tradition, focused on specifically the Danish tradition. The project has two main focuses. The first being proposing a design for the extension of the Møntergården Museum in Odense, an architectural competition that has ended, but the competition brief is used as a theoretical platform upon which to develop this project.

The second focus is on materiality and how especially materiality is considered in digital contemporary architecture. Often, this type of architecture is focusing on cutting edge materials, or only on form and less on its materialization. This project combines the qualities of traditional materials and building tradition with a contemporary modern approach to architectural form development, aesthetic and production, in order to investigate how these two different periods of architecture can be united and propose a new idea for what is understood as a half-timber building.

The main motivation for the project is found in how old half-timber buildings over time have been affected by natural forces that have led to various types of deformations in their structural system. These deformations often lead to a transition from a strict geometric form to areas where organic surfaces appear due to the settings in the building envelope. It is the way wood and brick start behaving in these deformed areas that inspired to the idea of developing a reinterpretation based on those deformations as the generator for the architecture in this project.

The project is divided into several main phases that are explained in the Readers guide, and as such these represent the way and order in which the project was developed.

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PROGRAMME - TABLE OF CONTENTS

0.4
READERS GUIDE/METHODOLOGY

The project is to be based on The Integrated Design Process (IDP) authored by Mary Ann Knudstrup, Aalborg University. IDP will be used as a method of the project in order to achieve the design of an integrated building. The aim of the IDP is to combine architecture, design, functional aspects, and technical requirements. The IDP is an iterative process and will be applied during all phases of the main project.

The Integrated Design Process consists of different phases:

Problem Formulation
Analysis Phase
Concept Development Phase
Documentation Phase
Presentation Phase

The final project is presented in a report, drawings, 3d-visualizations, and physical models.

This model has been reformulated into three main phases to be better implemented in this project:

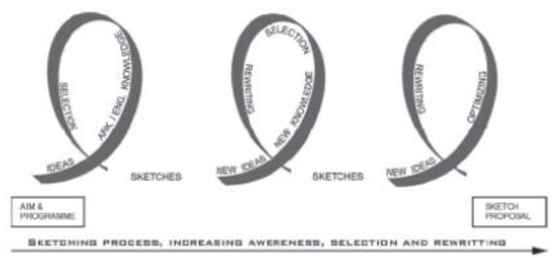
Define
Respond
Elaborate

Define splits into two overall themes: Platform and Strategy. This is due to the way this project is constructed, focusing mainly on the implementation of digital approaches to architecture and their capability to reinterpret tradition, thus striving at a material understanding and quality. Strategy defines this intention, and Platform is the foundation that Strategy is tested on. These two themes are the Problem Formulation, Analysis Phase, and part of Concept Development Phase.

Respond is divided into three overall themes: Context, Form, and Materialization. These relate to the approach and method of working defined in Strategy and Respond develops the design through three, more or less chronological iterative processes. These three themes are the part of the Concept Development Phase and part of the Documentation Phase.

Elaborate is the last phase and consists of two overall phases Visualize and Reflectione. These will together present the project architecturally but also put it in a reflective perspective regarding the proces and final design, and as such they consist part of the Documentation Phase and the complete Presentation.

This report is divided into three overall phases as main chapters; Define, Respond, and Elaborate. A further subdivision is then done using major subchapters: Define Platform, Define Strategy, Respond Context, Respond Form, Respond Materialization, Elaborate Visualization, and Elaborate Reflection. This results in a chronological presentation of the project where the iterations are shown in their respective subchapter.



ill. 1 Diagramativ illustration of The Integrated Design Process

DEFINE
PLATFORM

1.10
INTRODUCTION TO COMPETITION BRIEF

ill. 2 Photograph of Møntestræde at Møntergården, Odense

In 2007 Odense City Council decided that the new historical museum was to be realized as an extension of the existing Møntergården Museum. Before that, Odense City Museums, counting all together seven museums/exhibition spaces, had worked with plans on how a collected historical museum could be developed which could cover and exhibit the history of the city and the region. The New Historical Museum is to be a supplement to the already existing museums/exhibition spaces. The head office of Odense City Museums, with its professional, technical, and administrative functions, is already placed in Møntergården and is to stay there, even after the completion of the new historical museum right next to it.
The location for this project is in the eastern part of Odense which is an area, characterized by many historical buildings, cosy streets, alleys, and plazas. The area already plays an important cultural role in Odense with institutions like Odense Concert hall, the H. C. Andersen House, the Tinderbox – children's culture house, Carl Nielsen Museum, and in the nearest future, the area will be further improved with the completion of the new Music and Theatre House.

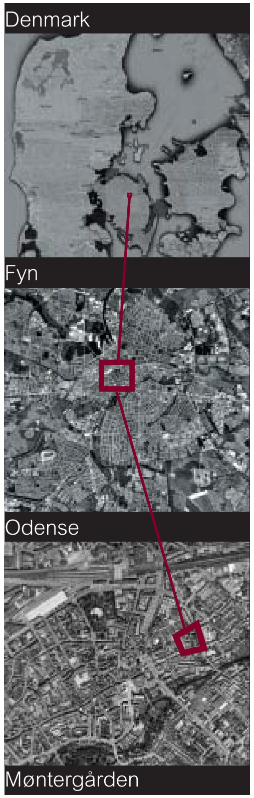
Møntergården is the main museum for Odense City Museum and provides jobs for 85 employees working with investigation, research, preservation, communication, or having technical functions and are placed primarily in the buildings towards Overgade and Claus Bergsgade. The areas of responsibilities that Odense City Museums are working with are archaeology and ancient monuments, history of Odense and Fyn, building history and topography, art and culture history, the poet H.C. Andersen, and the composer Carl Nielsen.

This project has to involve the entire block defined by Overgade, Hans Mules Gade, Sortebrødre Stræde, and Claus Bergsgade. The site includes listed and worth to be preserved buildings that already serve functions related to the museum; and the new historical museum is to be integrated functionally and architecturally with the existing one and is to be located in the north-eastern part of Møntergården where Sortebrødre Stræde meets Hans Mules Gade.
The overall aim for Odense City Museum with this architecture competition is to obtain proposals for:

1. Overall plan for the entire site´s future disposition as a museum complex.
2. The New Historical Museum containing permanent and special exhibition spaces and multipurpose auditorium for lectures and conferences.

"The area has many preserved buildings from the Renaissance and later periods. Through the block runs the very well preserved Mønterstræde, which is intended to have a central role in the development of the museum's historical storytelling. The assignment of adding a new exhibition building to this area… therefore sets significant demands to the understanding of how qualitative values can be introduced to an area as a whole, characterized by old and new, by adding a new building." - taken from the competition brief

1.11
INTRODUCTION TO SITE



ill. 3 Site Location

ill. 4 Site Overview of Møntergården Museum Complex

1.12
THE VISION OF MØNTERGÅRDEN

With this competition, Møntergården is looking for the best and most visionary proposal for a new exhibition building and the surrounding outside areas. A proposal that is designed and thought through in close relation to the very specific historical and urban context, found in Møntergården.

The mission for Odense City Museums is to:
- Preserve and give access to the historical heritage
- Communicate the historical story of Odense leading to the present time
- To put time and place, things and thoughts in perspective

As such, Odense City Museums considers history as a basic mutual historical heritage and frame of reference which is important in order to understand oneself and the present society.
Odense City Museum formulates these ideas into a vision for the future of the Møntergården complex and the new building, consisting of various elements and scales presented below.

The future Møntergården complex is to:
1. - be an exciting and modern museum
2. - maintain/preserve the historical neighbourhood
3. - preserve Møntestræde and make it a significant element in the museum complex as a whole
4. - program the already existing buildings with functions according to their time period, spaciousness, and coherance
5. - allow visitors to have free access to the complex during aytime, thus making it an integrated part of the cultural eastern part of Odense inner city.
6. - have several access paths starting from Sortebrødre Stræde, Claus Bergs Gade, and Overgade leading into and through the complex
7. - utilize its courtyards with programmes like café environments, performances, and markets.
8. - include a new historical exhibition building.

The new historical exhibition building is to:
a. – create an architectural and communicative interplay between old and new.
b. – be a visual significant element in Møntergården while giving consideration to its location as an in-fill in a historical context with great architectural and urban qualities.
c. – signal openness to visitors
d. – give the best possible conditions for visitors and the preservation and presentation of the archaeological and historical collection of artefacts and art pieces.
e. – be flexible in its interior organization to allow for various sizes of exhibitions and events.
f. – have optimal security and climate conditions.

These are the overall elements in the vision of the future Møntergården complex. More specific, small scale requirements will be introduced later in this report.

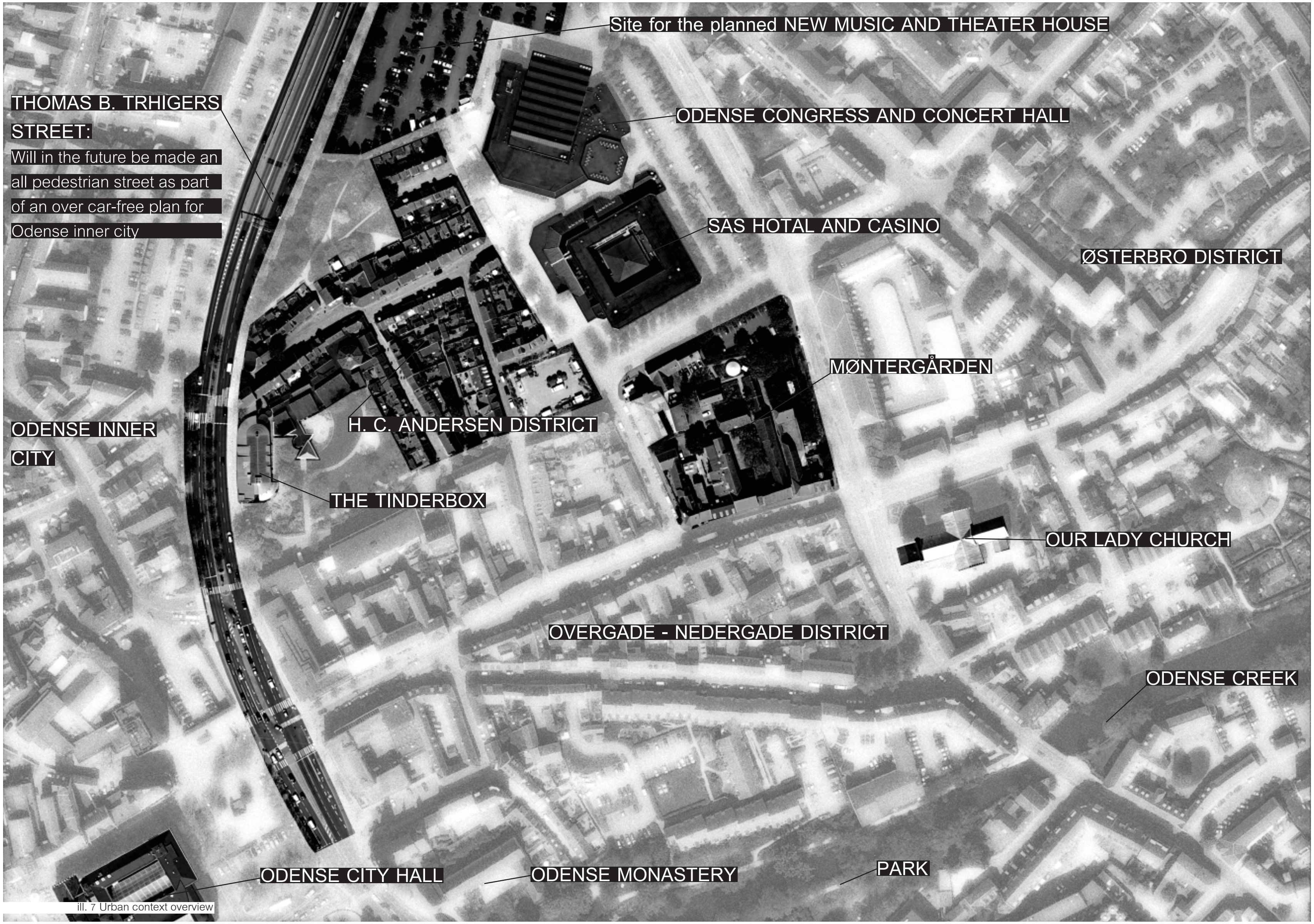
1.20
SITE ANALYSIS

This subchapter analyzes various different parameters that are important for how the future overall plan and the new exhibition building should be thought through. These elements should impact the design of all scales from orientation of the new exhibition building and planning of outdoor spaces, future flow lines outside and inside and combined, and all the way down to details such as openings in building envelope and connection to existing buildings.

The project site, as illustrated on figure 5, shows the boundaries for the overall plan proposal that is part of this project. The site itself is around 9300 m2 including the turning area for cars at the end of Sortebrødre Stræde and Sortebrødre Torv, and the sidewalk north of Sortebrødre Stræde, see figure 5. These two areas are on the periphery of the boundaries of this project, but they will play a role in the future logistics implemented in the new overall plan for the Møntergården complex. The building marked in black on the border of the site outline is mixed residential and commercial, four story building not owned by Odense City Museums. Changes made to the outdoor areas, flow lines, and other overall plan decisions can, therefore, not result in changes made to this building but should consider as a necessary part the restrictions or possibilities this building can have on the layout.
The site reserved for the new exhibition building can be seen on figure 6 as plot 1 and 2. The reason for the division is that Møntestræde that divides them, has to be a very central element in the future of the Møntergården complex. It is a requirement in the competition brief that this path is kept clear at ground level but does not imply that the two plots cannot connect at a higher level.
The size of the total area reserved for the new exhibition building is 1800 m2 and can fit in the entire square meters needed for the new exhibition building, 1750 m2, but this would mean to build only on one story and not leaving any area for outdoor spaces at ground level.
The rest of this subchapter will present in diagrams and pictures the other elements in this analysis.

ill. 5 Overall site dimesion

ill. 6 Specific building plot



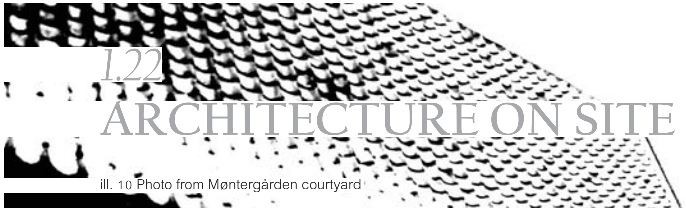
ill. 7 Urban context overview

1.21
AREA MAPPING

ill. 8 Walking distance to nearby important urban areas

ill. 9 Urban programmes

The location of Møntergården is in close connection to many different types of urban programmes, see figure 7 on page 14. To the east is the Østerbro district, which is mainly a residential area where many future visitors to the new historical exhibition building live.
To the south lies a more mix programmed area, Overgade – Nedergade District, where residential, commercial, and recreational programmes are weaved together.
To the north and west of Møntergården it is shown the close connection that Møntergården has to the extensive cultural and recreational places in Odense as the SAS Hotel and Casino, the Congress and Concert Hall, the soon to be realized New Music and Concert Hall, and H. C. Andersen District, the Tinderbox and others. These all have started drawing potential visitors to the area. Historically, Odense has much to offer as well. The closest to Møntergården, shown on the map, are Our Lady Church, Odense Monastery, and of course H. C. Andersen´s House.
Recreational areas like Odense Creek, the Park just south to the Overgade – Nedergade District, green parks around the H. C. Andersen District and Sortebrødre Torv, all support the potential in expanding the existing Møntergården Museum. The future transformation of Thomas B. Thrigers Street into a completely car-free street will only raise the amount of pedestrian flow through the area and give an even stronger foundation for expanding the outdoor offers in the courtyards in the Møntergården Complex.



1.22 ARCHITECTURE ON SITE

ill. 10 Photo from Møntergården courtyard

Odense as a city is more than 1000 years old and due to a willingness in preservation of its architectural history, it contains buildings from all historical periods; from the medieval monasteries, the Renaissance bourgeoisie houses to the historicism period of public buildings like theaters and archives. This is also the case with the Møntergården complex where several buildings are listed buildings, and others are considered worth preserving for historical reasons. The complex is a mix of buildings that was originally built on that site, while others have been relocated to the complex in order to preserve them.
The competition brief points out five important buildings placed in the Møntergården complex which can be seen on figure 11; in addition, two more buildings have been included because of the importance they play in the location of the new exhibition building.

These are:

1. Møntergården
This is an example of one of the finest buildings in Odense from the Renaissance. It was built in 1646 and got its name from its location next to Møntestræde. It is constructed as a half-timber construction with finely detailed carved rosettas. The infills in the timber constructions are bricks since this was considered finer than wood at that time, and the roof is red tile. The building was bought in 1930 by Odense Municipality from a private person in order to bring it back to its original state and preserve it.

2. Rønnows Gård
This building was completed in 1547 and served as home for the nobleman Ejler Rønnow. It was originally located in Nørregade 62 in Odense, but in 1899 it was bought by Odense and relocated to its present location in the Møntergården complex. It is a half-timber construction like Møntergården but with practically no carved decorative details in the wood. Instead, the ornament element presents itself

ill. 11 Mapping of important buildings

in the brick infills. Here, various patterns are used, resulting in a finer decorative expression of the façade – a form of experimentation in bricklaying.

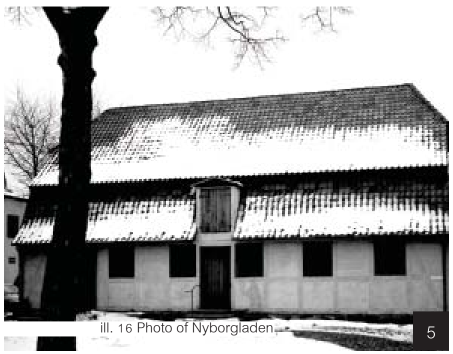
3. Pernilles Lykkes Boder
These buildings are the oldest buildings still located in their original location and date back to 1617. They were built to accomodate three poor women and two parentless boys, and their function is almost visible in the lack of expensive decorative details or ornamentation in the façades, otherwise common in buildings from that time. The buildings flank Møntestræde and play an important part in the experience of walking through this narrow street.

ill. 12 Photo of Møntergården

ill. 13 Photo of Rønnows Gård

ill. 14 Photo of Pernilles Lykkes Boder

ill. 15 Photo of Østerbys Gård



ill. 16 Photo of Nyborgladen

ill. 17 Photo of Overgade 52 A

ill. 18 Photo of Overgade 52 A

4. Østerbyes Gård
The building is from 1631 and was built for the regional priest. It was original located in Vestergade 76 in Odense but was moved to Møntestræde in 1942, and then later to its present location on Sortebrødre Stræde in 1982. It is preserved with its original ceilings and walls. The façade is decorated with carved ornaments common to its historical period of construction, the Renaissance. Today it serves as space for special exhibitions and is otherwise not open to the public.

5. Nyborgladen
This old barn was built in the middle of the 18th century in Nyborg. It was used as warehouse and stable. In 1950 it was moved to its location in Møntergården complex and now serves as an important exhibition space. The architecture is very basic for its time and purpose, not detailed in anyway if not important for its function.

6. Overgade 52A
The reason for including this building in this site analysis is its location, where it flanks almost half the length of Møntestræde, making it an important part of the experience of this narrow street that is to be a central element in the future overall plan of Møntergården complex. This is, like the other buildings, a half-timber construction with infills of brick. The date and period is not known.

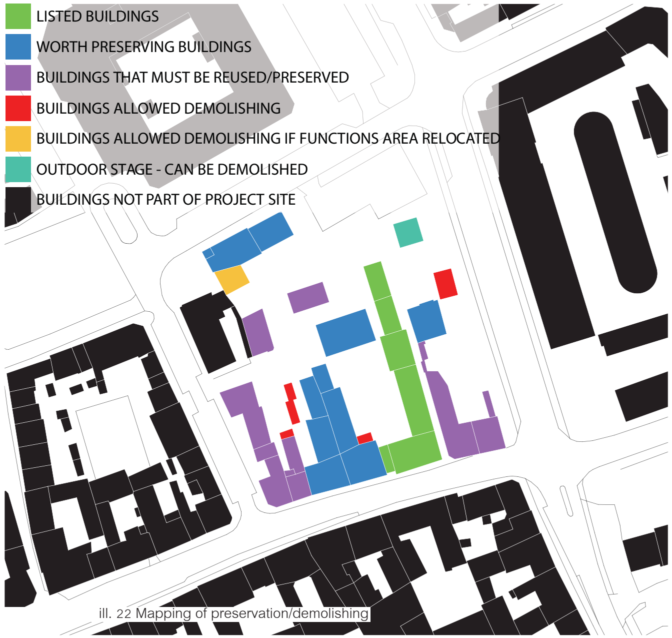
7. Overgade 52B
This building is also part of the views, seen from Møntestræde, and, therefore, important in the future planning. Another important factor is that this building can be connected directly to the new exhibition building, if decided. The building is also a half-timber construction, with brick infills and red tiles for roofing like the rest.

ill. 19 Photo of Northern possible connection point

ill. 20 Photo of Eastern possible connection point

ill. 21 Mapping of possible connection points

Two buildings are allowed to be physically connected to the new exhibition building. These are shown on Figure 21 and both are distinctive half-timber construction houses. This implies that if decided to make any physical connections, not only it must be considered how the new functions meet old or how two forms connect, but also how the new will meet the distinct patterns of the half-timber construction.



ill. 22 Mapping of preservation/demolishing

ill. 23 Mapping of Architectural Type

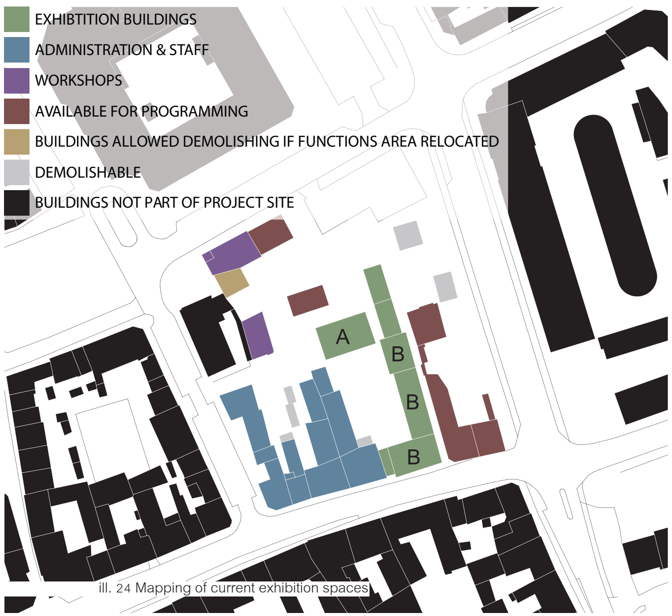
The existing buildings in the Møntergården complex, as previously described, are of a varied historical quality. This can be seen on Figure 22, where the listed and worth to be preserved buildings far exceed the amount, allowing demolishing. This, of course, puts restrictions to what can be proposed for the overall plan, and, therefore, demands integration of new into existing. The buildings that are allowed to be demolished are mostly smaller sheds for bicycles and other minor functions, as well as the existing outdoor stage.

The above mentioned integration of new into existing and, in this case, historical buildings goes further than just what can and cannot be demolished but extends into a specific type of traditional architecture – the half-timber construction. The history and speciality of this traditional type of construction will be explained later, for now the focus is put more on the domination of this specific type of architecture that is present in the Møntergården complex.
Figure 23 maps the buildings that are built as half-timber constructions and those, that are not. As it can be seen, half-timber houses represent more than half of the buildings present. More important is the concentration along Møntestræde, which is to be a central part of the museum complex as well as the concentration around the plots, reserved for the new exhibition building. This clearly specifies the type of architecture that any new element has to integrate with or communicate.

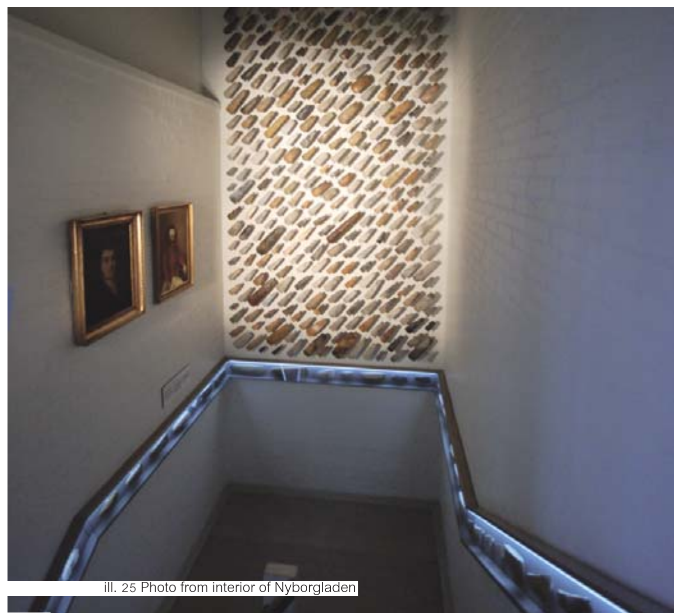
1.23
EXISTING EXHIBITION SPACES

This paragraph will shortly describe and illustrate the current exhibition buildings at Møntergården and how the exhibition communicates with the historical architecture. The only spaces currently used for permanent exhibition are marked on figure 24 in green as A and B. The B exhibition consists of several buildings all connected indoors as one continuous route. There is no indoor connection between exhibition A and B, likewise there is no connection between exhibition spaces and administration where the ticket sales is, other than through the outdoor courtyard space. Both exhibition spaces have a flow through their exhibition space which requires that visitors must exit the same way they entered and thus walk through the same spaces twice. This is in many ways a flow that can disturb other visitors and unnecessarily complicates a natural flow through the exhibition spaces.

The current exhibition is a play between new and old. The elements used to communicate are light projections on the walls, finely detailed installed artefacts like seen on figure 25, an example from the staircase in building A. Showcases and other tools used for communication and showing the items are all designed in a contemporary language, creating a contrast between the new and old, which enhances the experience of both. This is a clear sign of the willingness of Odense City Museums to combine time periods and use that as their main tool in the communication to the visitors.



ill. 24 Mapping of current exhibition spaces

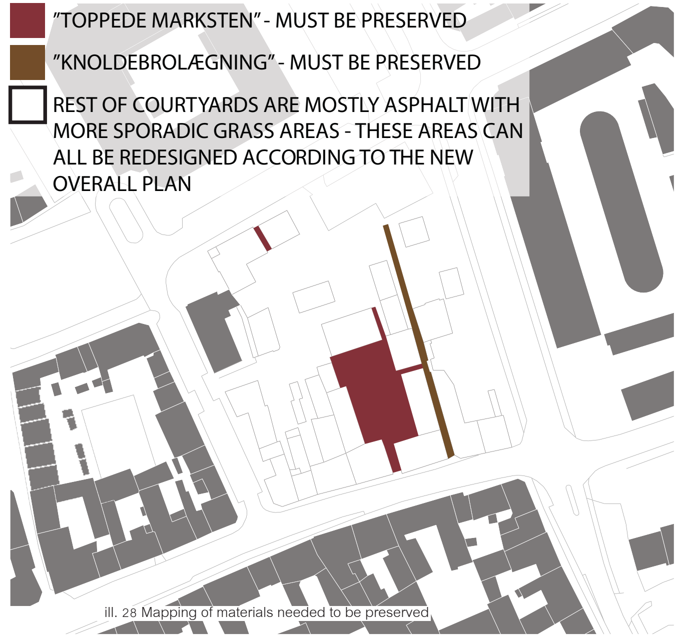


ill. 25 Photo from interior of Nyborgladen

1.24
OUTDOOR SPACES


ill. 26 Photo from Møntergården courtyard


ill. 27 Photo from Møntestræde



ill. 28 Mapping of materials needed to be preserved

The Outdoor spaces play a very important part in the storytelling and communication of the historical exhibitions inside. It is a first-hand encounter with historical buildings, pavements of various types and old trees, like a small version of what the city looked like hundreds of years ago. It is a picturesque experience that is unique for Møntergården, and thus the reason why it wants to preserve the motives of big solitary trees in close relation with the buildings.

The future plan must integrate the new outdoor spaces designed in this existing environment and integrate them into the surrounding city. As it can be seen on the figures 28, very few elements are required to be preserved in the new overall plan that is to be proposed in this project.

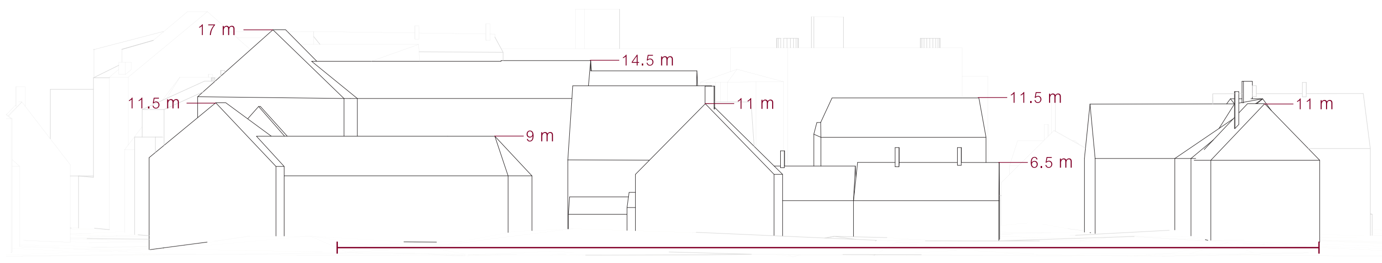
The areas with historical pavement that must be preserved are shown on Figure 28 in red and brown. The rest of the outdoor areas are a mix of asphalt and grass. These areas can be altered and rede-signed in any way decided to support the overall vision for the “new” Møntergården, with free access and flow of people through and into Møntergårdens buildings.


ill. 29 Photo from Møntestræde

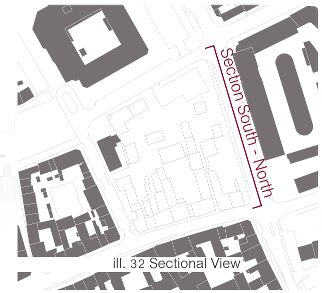
ill. 30 Mapping of trees on site

The second element in this mapping is the trees, which besides the grass areas are the only vegetation. Some of these trees must be preserved, as seen on Figure 30, because of their history and their aesthetical importance in the urban landscape, while others can be removed. The part of the trees that can be removed is mainly placed in the area where the new exhibition building is to be located, thus making that a necessity. The trees marked in red and yellow must all be or are preferred preserved. Some of these trees are also within the location intended for the new exhibition building, which underlines the importance of making considerate decisions when designing the new exhibition building.

1.25
BUILDING GUIDELINS



ill. 31 Sectional view seen from Hans Mules Gade



ill. 32 Sectional View

The overall plan for Møntergården and the design of the new exhibition building has to be integrated in the existing urban area in which it is situated. The Odense Municipality has not as such formulated a district plan with requirements and restrictions as to how they want the new exhibition building to be designed. Instead, a larger urban analysis has been initiated by Odense Municipality to gather guidelines for how the area should develop in terms of urban spaces and architecture. The final district plan will be formulated when the extension of the museum is completed.

This subchapter will present these, so they can be included as guiding parameters for the development of the design of this project.
The new exhibition building must be able to meet the energy demands for a low-energy-building class 1, according to the Danish Building Regulations as of 2008.
This implies the following:

1. To obtain the status of a low energy building class 1, the collected energy demand for heating, ventilation, cooling, hot water and lighting cannot exceed;
   (50 + 1100/A) kWh/m2 per year,
   where A is the total heated floor area.

2. This can be obtained by considering the following guidelines:

a. Reduce thermal bridges
b. Implementing extra isolation in building envelope
c. Use of highly isolating windows and components
d. Optimize the use of heat from sun and natural light
e. Orienting the building optimal in terms of sun and shadow conditions
f. Energy-efficient ventilation
g. Minimize the shift in temperature indoors by using materials for interior with high thermal mass.

These guidelines should be considered in this project but will not be of first priority as the aim of this project is not solely to build a low energy building.

The following guidelines are all focusing on the layout and design of the building in terms of how it should relate to its urban context:

1. Any concept should insure that the new building should be designed so that it supports and respects the character of the closed block layout – see figure 33.

2. Concepts should stay within the already existing general building height in the area - see figure 34.

3. Concepts should insure that the experience when crossing Hans Mules Gade is also in the future an experience of going from one urban layout to another – see figure 35.

4. As previously described in this report, Møntestræde should be preserved – see figure 36.

5. New concepts can, if desired, work with different building expressions towards Hans Mules Gade and the connecting streets, respectively – see figure 37.

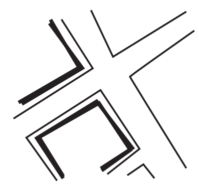
6. Concepts should respect the dominating façade aesthetic in the H. C. Andersen district with small scale and many details

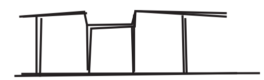
7. Concepts should aim at a varying façade expression from Hans Mules Gade to Sortebrødre Stræde – see figure 38

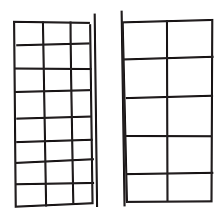
8. The view from south along Hans Mules Gade should also in the future be characterized by a visible line of façades – see figure 39.

9. Concepts should respect brick and tile as the dominating materials in the area – this can be combined with new materials and a modern architectural language and form.

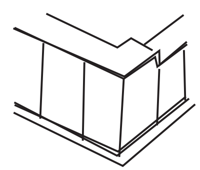
As with the guidelines for energy demand, these will, in this project, not be the sole parameters for the development and continuous evaluation of the design for the new exhibition building, but they will be part of the process to the extent it is found reasonable.

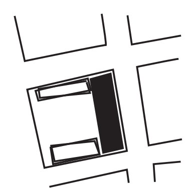

ill. 33 Closed block layout

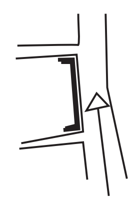

ill. 34 Building height


ill. 35 Urban Layouts


ill. 36 Møntestræde


ill. 37 Different expression


ill. 38 Varying façade


ill. 39 Framed view

1.26
INFRASTUCTURE


ill. 40 Type of infrastructure


ill. 41 Parking conditions


ill. 42 Existing pedestrian flowlines

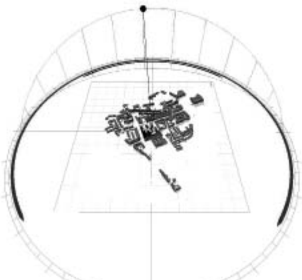
The present situation in terms of infrastructure just outside of the Møntergården complex is to be more or less unchanged in the future, even with the extensive car-free inner city plans currently being executed in Odense. This means that the traffic on Sortebrødre Stræde to the north still has to allow for traffic in two directions, see figure 40. At Claus Bergs Gade on the west-side of the complex access by car also has to be unchanged in order to ensure access for renovation and fire trucks to the site. All streets are bike and pedestrian friendly and allow for easy access to the site.

The current parking situation will be changed as a result of the new exhibition building since large part of it is now located on the building plot. The parking spaces that can be removed or relocated are marked on Figure 41, as well as parking that is required to stay unchanged. Removing a lot of the available parking space because of the design of the building does not leave a lack of parking to be solved as many new underground parking spaces are being built around the H. C. Andersen district as part of the inner city´s transformation according to the car-free inner city plan.

Many of the existing and future visitors are expected to arrive by either bicycle or on foot. The already existing access points and possible flow seen on Figure 42 allow for easy access to any part of the Møntergården complex. These flowlines should be supported or extended in the new overall plan for the complex to ensure that the outdoor spaces will be as attractive as possible. The internal outdoor infrastructure at Møntergården is important for two reasons; the first being the success of the outdoor cultural and recreational offers available in the courtyards, and the second being the success of the flow from one exhibition building to another.

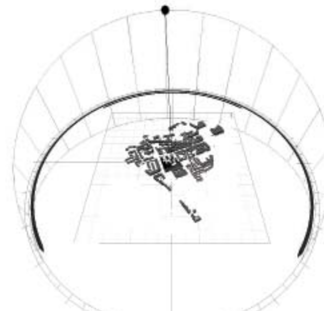
1.27
SUN CONDITIONS

Odense Denmark Lattitude: 55.6° Longitude: 12.5°



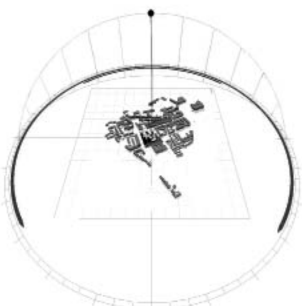
ill. 43 Spring Equinox

Spring	Equinox
Date:	21st March
Azimuth:	(92.8°) - (-93.7°)
Altitude:	(0°) - (34.1°)
Peak:	Time: 12:30
	Azimuth: (-176,1°)
	Altitude: (34,1°)
Sunrise:	06:18
Sunset:	18:15



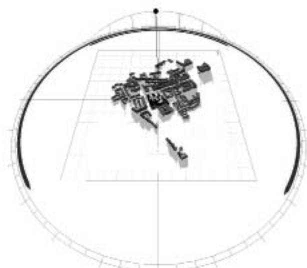
ill. 44 Summer Solstice

Summer	Solstice
Date:	21st June
Azimuth:	(50.5°) - (-49.1°)
Altitude:	(0°) - (57.8°)
Peak:	Time: 12:00
	Azimuth: (175°)
	Altitude: (57.8°)
Sunrise:	03:34
Sunset:	20:48



ill. 45 AutumnEquinox

Autumn	Equinox
Date:	21st September
Azimuth:	(88.8°) - (-89.9°)
Altitude:	(0°) - (35.4°)
Peak:	Time: 12:00
	Azimuth: (179.1°)
	Altitude: (35.4°)
Sunrise:	05:57
Sunset:	18:08

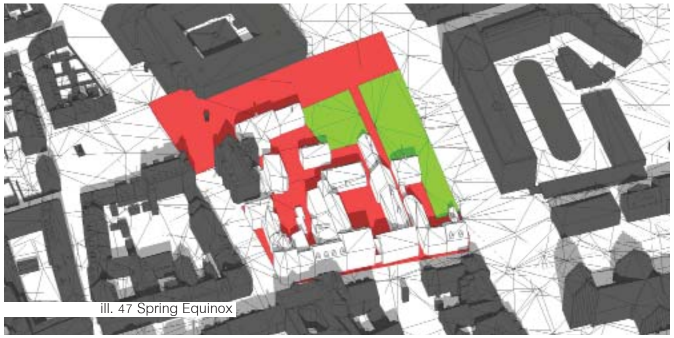


ill. 46 Winter Solstice

Winter	Solstice
Date:	21st December
Azimuth:	(137.9°) - (-134.9°)
Altitude:	(0°) - (10.9°)
Peak:	Time: 12:00
	Azimuth: (178.2°)
	Altitude: (10.9°)
Sunrise:	08:45
Sunset:	15:30

There are two overall reasons for mapping the sun conditions for the project site; one relating to the indoor climate, and the other to the outdoor courtyard spaces. These mappings can be seen on figure 43-46 where the overall sun conditions for the area are mapped according to spring and autumn equinox and summer and winter solstice. A closer look at the shadows made by the existing buildings can be seen on the next page on figure 47-50

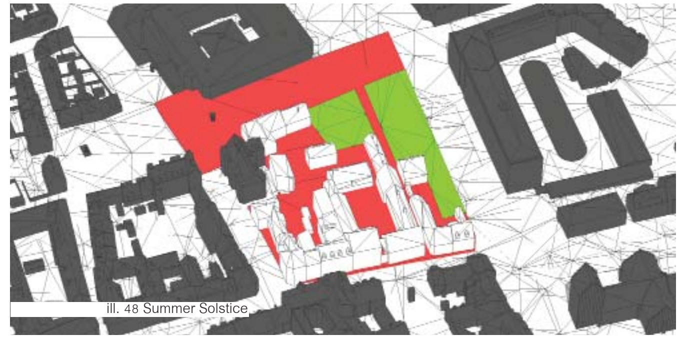
The competition brief clearly states that natural lightning should be used as much as possible and that clear views of the outside surroundings from the exhibition spaces are to be part of the storytelling of the exhibition. This makes it crucial to understand the sun path, height, and angle at any given time of year in order to design a solution that will give optimal conditions for natural lightning in the exhibition spaces, while still preventing any direct light on the art and artefacts. This is a must since the effect of a direct sunlight on sensitive material will shorten its lifespan. In relation to these mappings, the effect on the design of the exhibition building itself will mostly be seen in how the openings made in the building envelope are designed – their size, amount, orientation etc.



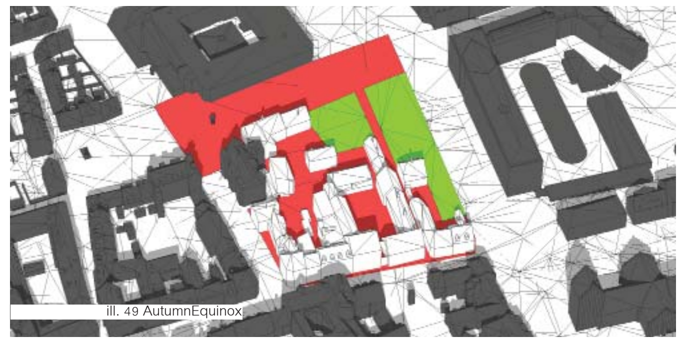
ill. 47 Spring Equinox

The outdoor functions like café, market, stage and audience seating etc., needed to be implemented in the overall plan for this project, all relying on the weather conditions, and especially the sun since this is probably the most important parameter in order to ensure their success and the length of the season they can function. The figures show the shadows already there as a result of the existing buildings. These can already give a good indication of where these places should be developed in order to ensure that they can function in the spring as well as in the autumn.

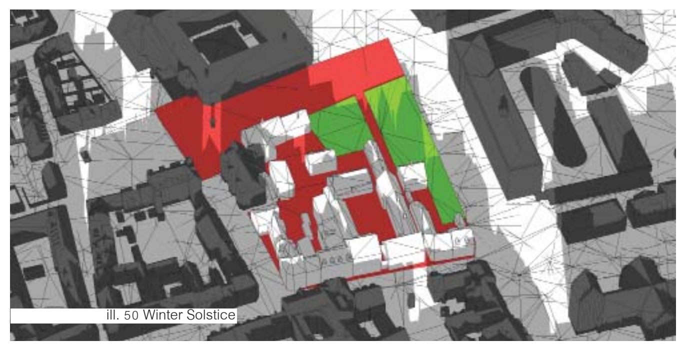
These are, of course, initial mappings and far from enough to ensure the quality of both indoor and outdoor spaces. When the process of designing these elements begin, continuous mappings should be done in order to establish if the intention is also in fact a reality, or if the new designs, whether it is a stage or a building, are prevented from functioning optimal or if they start preventing already existing functions, thus lowering the qualitative experience of the Møntergården complex.



ill. 48 Summer Solstice

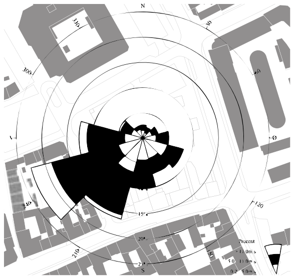


ill. 49 AutumnEquinox

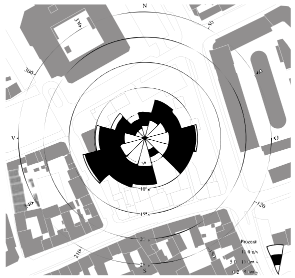


ill. 50 Winter Solstice

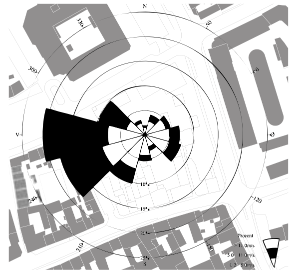
1.28
WIND CONDITIONS



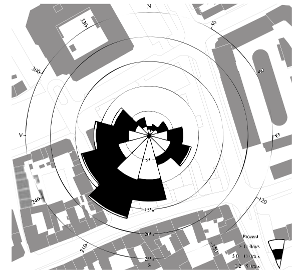
ill. 51 January - Dominating wind direction



ill. 52 April - Dominating wind direction



ill. 53 July - Dominating wind direction



ill. 54 October - Dominating wind direction

The overall plan of Møntergården that is part of this project includes proposing and designing a number of outdoor spaces for activities like concerts, outdoor serving from the café, staff garden, markets etc. All these functions rely on the wind conditions for them to be able to function well for as much of the spring/summer/autumn period as possible. To allow for better decisions to be made in the design process, the wind conditions for four months representing the seasons have been mapped. These are January, April, July, and October.

In the coldest part of the year the dominating wind direction is from the south-west. The location of the new museum building at the north-east corner already insures its immediate areas around it to be in lee as is much of the courtyard spaces, see figure 55. The existing buildings at Møntergården will block some of the wind but could also result in turbulances in the courtyard spaces, which should be considered when designing the overall plan.

In the summer, the wind direction, still partly coming from the south-west, shifts to being dominated by more directly western winds. This could give strong winds in narrow streets that originate from Claus Bergs Gade and resulting in venturi effect in certain areas - this is an important issue if placing outdoor spaces, intended for staying, close to these wind paths.

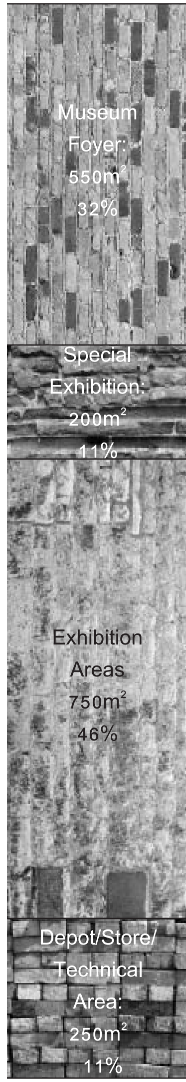
ill. 55 Summer/Winter wind conceptual mapping

SUMMER - DOMINATING WIND DIRECTION

WINTER - DOMINATING WIND DIRECTION

1.30
EXHIBITION BUILDING ROOM SCHEME

It is the intention of Odense City Museums to be able to exhibit very important and valuable art pieces in the new exhibition building. This gives many specific room requirements and for how they should work together. The presented room scheme on this page lists these in an organized way and supplements with short descriptions of secondary requirements to each facility.



ill. 56 Room Scheme

Total Buidling Area: 1750 m^2

Weather Porch	n/a m^2	- no level diffierence and handicap friendly
Information/Ticket Sale	n/a m^2	- 2 workplaces and clear view of arrival area
Introduction Exhibit	75 m^2	- integrated part of entire museum foyer
Showcases/-Room	10 m^2	- integrated lockable niche or as an element
Museum Shop	50 m^2	- register placed in information - clear view to shop
Gathering Area	75 m^2	- possible for gathering of groups 25-30 people
Wardrobe	n/a m^2	- for 100 visitors, lockable boxes, 50 small, 5 big
Toilets	n/a m^2	- service both permanent and special exhibiton
Staff Break Room	n/a m^2	- including tea kitchen and staff toilet

Multipurpose Room	160 m^2	- flexible solution that allows for it to funciton separately outside and during normal museum opening hours
Operator Room	10 m^2	- placed in direct connection to multipurpose room
Depot	15 m^2	- placed in direct connection to multipurpose room
Kitchen Facilities	15 m^2	- have separate delivery access and direct access to multipurpose room

Permanent Exhibition

- capable of exhibiting various constallations of artefacts
- direct visual contact to outside: Møntergården and city
- prefered is few large flexible rooms
- various ceiling heights
- one room minimum 5 meter high
- further separate rooms by moveable walls and ceilings
- must be considered: planning of emergency exits, installations and lighting
- integrated technical sollutions a must

Stairs/Lifts	n/a m^2	- 5 person lifts for visitors
Receiving/Handling	20 m^2	- large size delivery of art and artefacts
2nd Entrance	n/a m^2	- small size delivery like food
Plant Room	n/a m^2	- to be placed close to 2nd entrance
Storage	60 m^2	- intended as storage space for a shop
Cleaning room	15 m^2	- is to cover entire building
Transit/Security Storage	50 m^2	- secure space for preparation of items
Ventilation Unit	n/a m^2	- intergrated sollutions in all installations

1.31
ADDITIONAL ROOM SCHEME

The additional room scheme consists of functions that have to be incorporated into the overall plan for the complex, either in the new exhibition building or in the existing buildings. If, during the process, it is decided that the Room Scheme should be expanded, this is allowed, and those areas will be added to the total amount of square meters presented in this program.

Total Additional Room Area: 420 m^2

ill. 57 Room Scheme

Museum Café
- must be designed so it can function as both the museum café and a city café
- included in m^2 is kitchen, storage, dining area, toilets, wardrobe etc.
- must be directly connected to a courtyard for outdoor serving

Lunch-Room
- can be either a separate building or a room in another building
- suitable for lunch for school classes and other similar size groups

Lecture Room
- can be either a separate building or a room in another building
- education of school classes and other groups

Stage Room
- located close to outdoor stage
- toilet + wardrobe for performers
- technical facilities for stage light and sound

1.32

OUTDOOR ROOM SCHEME

In the overall plan for the Møntergården Complex, the previous presented “Exhibition Building Room Scheme” and “Additional Room Scheme” have to be incorporated. In addition to those funcitons, four other functions have to be included in the proposal. These are all outdoor functions and aim at tying the entire complex together as a well functioning as an urban space that provides visitors with an experience that goes beyond what is exhibited in the indoor facilities.

ill. 58 Room Scheme

Stage + Audience Seats

- stage can be either permanent or dismantable
- suitable for activities as theather, music performances, etc.
- to be a scultural element
- located in a way that it can draw attention from visitors
- prefered located in connection with the café´s outdoor serving area
- seating must be provided for 50-100 spectators

Outdoor Service/ Café

- directly connected to indoor café
- seating must be provide for 50-75 dining visitors
- prefered located with direct leveled connection to surrounding streets
- must be able to be open outside normal museum opening hours
- visible but still shielded from traffic noise

Parking: 5 Admin. 2 Handicap 130 Bicycle

- admin and handicap parking to be located in the western part of the complex
- parking must be provided for at least 50 bicycles close to the new entrance from Sortebrødre Stræde
- on special occations bicycle parking can be forbidden resulting in a need for the design and location of the facilities not to limit a flexible use of the outdoor spaces.
- parking must be provided for 20 bicycles in connection to existing main entrance towards Overgade
- parking must be provided for 60 bicycles reserved for employees in the south-west part of the complex.

Staff Garden South-East

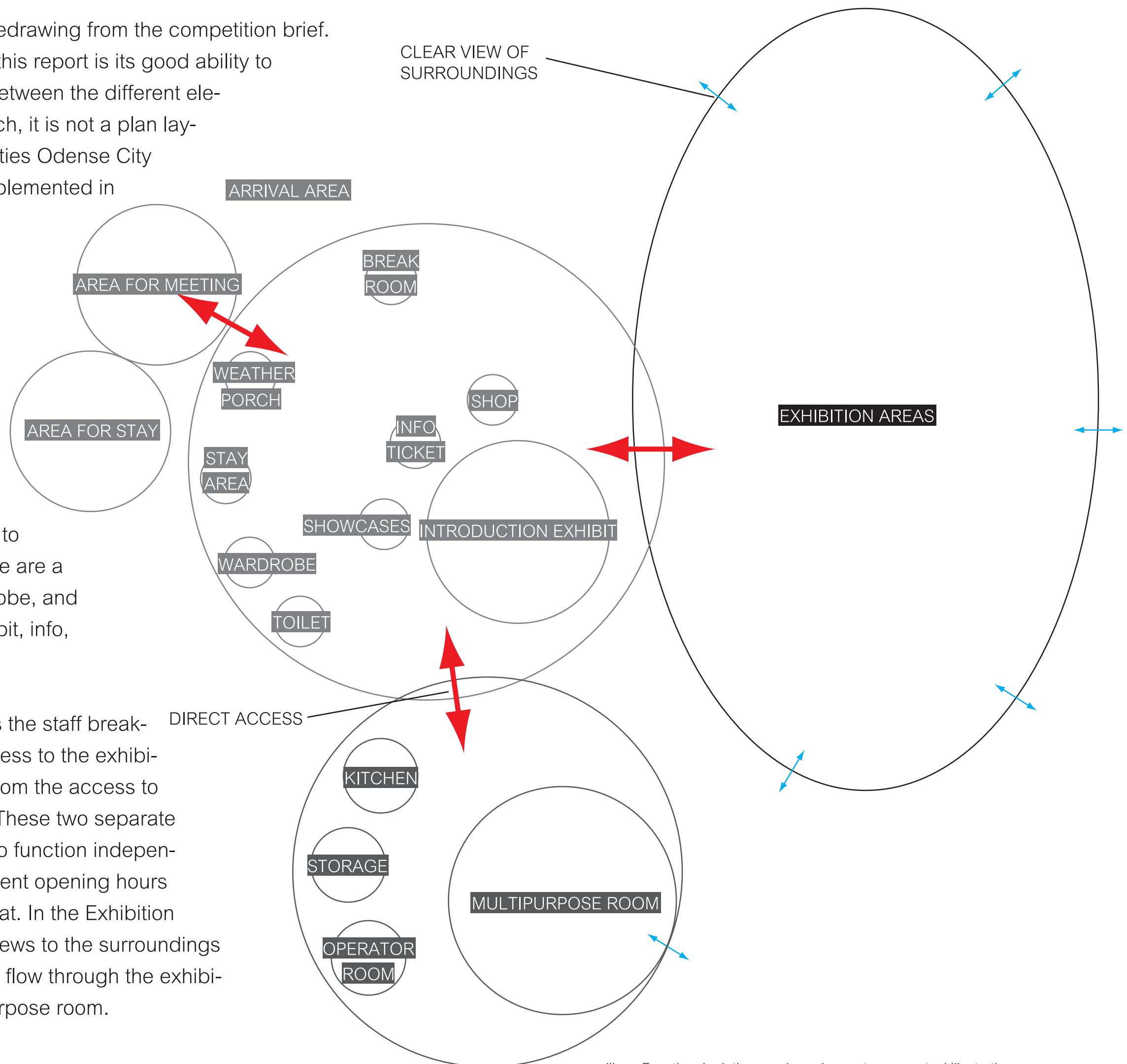
- to be located in the south-west part of the complex
- must be visually separated from the public accessible outdoor courtyard spaces

1.33
ELEMENTS AND THEIR COHERENCE

The presented diagram is a redrawing from the competition brief. The reason for including it in this report is its good ability to clearly illustrate the relation between the different elements of the functions. As such, it is not a plan layout, but an illustration of qualities Odense City Museum would like to see implemented in the proposal.

Starting from outside there is a close relation between the areas for arrival, meeting and general stay, all closely connected to the entrance. In the museum foyer there are several smaller groupings of functions that are preferably placed together in order to benefit from each other. These are a waiting area, toilet and wardrobe, and showcases, introduction exhibit, info, ticket sale, and shop.

Overlooking this entire area is the staff breakroom. From the foyer, the access to the exhibition is direct and separated from the access to the multipurpose room area. These two separate accesses will allow for them to function independently, and thus, during different opening hours without posing a security threat. In the Exhibition area several points of clear views to the surroundings should be incorporated in the flow through the exhibitions as well as in the multipurpose room.



ill. 59 Functional relations and requirements conceptual illustration

1.40

THE COLLECTION


ill. 60 Example from exhibition

Tybrind Vig
Flint and bone artefacts
Archeological finding

Seden Syd
Sacrifice from Iron Age


ill. 61 Example from exhibition

Altar Board
Middle Age


ill. 62 Example from exhibition

The museum collection consists of approximately 55.000 items, 20.000 coins and medals, 750.000 photos and negatives, and 30.000 archeological findings. All these different types of exhibition items vary in material, age and size, thus having different requirements for preservation, climate, and security. The materials range from stone, gold, iron, tree, textiles to paper, and from the classical ancient period to the present time. The sizes vary from small coins to a 10 meter altar board. The general theme for most of the items in the collection is their porosity due to either the material used or the age, and thus, deterioration of the art pieces.
In order to exhibit material of varying type, a new exhibition building will have to be able to handle sometimes contradicting requirements since one item might require one climate condition and another, a different climate condition. This is further explained in the following subchapter.

Coin Collection
King Knud the Great period


ill. 63 Example from exhibition

1.41
TECHNICAL REQUIEREMENTS

The following technical requirements are a mixture of requirements presented in the competition brief and guidelines set forward by the Danish Institute of Cultural Heritage. These should serve as important parameters in the design process for two reasons. The first is that it can help optimizing the success of the building in order to function as an exhibition building, both in terms of security, but also in terms of efficiency. The second is the importance of these parameters in order for the exhibition building to obtain the National Indemnity recognition, which is the approval needed in order to be approved and insured by the government, which again is crucial when borrowing art from other museums.
The parameters presented are as such kept to a minimal technical level in order to be better suited for implementation in the early design process.

Receiving and storing facilities:

- Separate room for receiving and determining if the received goods are infected before they are mixed with the art already in storage.

- Main installations for electricity, water, and heating cannot be located in these areas, but should be placed in a separate room.

Internal transportation:

- The route from storage to exhibition should be as simple as possible and allow for a minimum of two persons assisting the transportation.

- Hall ways etc that are part of the transportation route should be optimized for the use of wagons for transportation.

- The access path to storage and workshop facilities should avoid including stairs or otherwise be combined with a freight elevator.

- Doors should be able to open wide and should be reduced to a minimum amount.

Materials:

- Flooring in exhibition and storage should be easy to clean.

- Materials should not be able to produce dust themselves that can spread into the collection, eg. Concrete surfaces should be treated in a way that seals the material from dusting.

Indoor climate – temperature and humidity:

- Certain items will always have to be exhibited in showcases that isolate them from the climate in the rest of the exhibition, and thus produces a microclimate different from the rest of the building.

- Temperature should be stable and never exceed 25°C.

- In general the temperature should be held as low as possible since it slows down deterioration of art and artifacts.

- The humidity must be held within 40%-60% relative humidity (RH) on a yearly basis (ideal is 45%-55%). The relative humidity is never to exceed 70%, since this increases the risk of pests, microorganisms, and corrosion. A RH lower than 40% could result in damages from drying out.

- The control of humidity is often more important than the temperature since a changing humidity can make items expand or contract and result in deformations.

- Using materials with good thermal capabilities can help prevent drastic changes in the indoor climate.

Light:

- As an absolute minimum, direct light on art and artifacts must be avoided.

- Daylight is always to be filtered from UV-light in areas with sensitive items.

- The absolute maximum of UV-light acceptable is 75 μ W/lumen, but it is recommended to completely remove any UV-light or to limit it to 10 μ W/lumen.

- The recommended light intensity for items that are sensitive is maximum 200 lux, and for very sensitive material maxi mum 50 lux.

- Light sources should be able to be shut off when the museum is closed in order to minimize the light dosage (lux times hours) the items are exposed to.¨

- Transparent and colourless UV-filters removing at least 99% of UV-light should be mounted on any light source in the exhibition space.

- A solution is needed where these requirements do not result in having no direct visual contact from the exhibition spaces to the outside surroundings.

Acoustic:

- The reverberation time should be targeted for each indi vidual room.

- As a guideline, the exhibit spaces and the arrival area should have a damped acoustic in order to allow for Audio – Video equipment to be used in different areas and for having small conversations.

- The Multipurpose Room should have an acoustic intended for its use as a hybrid space suitable for small concerts, lectures and art exhibition.

1.50
SUMMERIZING AND VISIONING

This subchapter will summarize on the introduction to the competition brief, the working platform for this project, and the analysis done on the conditions given by the site, before moving on with defining a strategy for how this can be solved and the approach intended.

The design of the new exhibition building for Møntergården has to give consideration and integrate many different intentions and requirements from both Odense City Museums, the Odense Municipality, and the Danish Government in order to succeed as a technological modern and advanced museum capable of taking on the responsibility of exhibiting and handling art and artefacts of high value, both financial and historical, and fragility. These have been listed in this chapter “Define Platform” as “Technical requirements” and are in the end what determines if the proposal is of a high enough quality. Can the new exhibition building document or illustrate how it solves these requirements in an integrated way? This question should, at the final stage of the project, be able to be answered with a “yes, it can”.

The other important factor is how the proposal will solve the relations of its internal functions within itself, and how these are connected to the rest of the functions in the Møntergården complex, and how the new functions needed to be integrated in the overall plan interact with these. These functions were all described in the room schemes and should be solved with consideration to many of the elements described in the site analysis. Not alone is this important for the efficiency of the museum as a business but just as much it is important to the quality of the experience visitors get when visiting the future Møntergården Museum. These are the two most important factors that are developed through this introduction to the competition brief and the analysis.

The two factors just described are, on the other hand, not sufficient enough alone in order to develop a successful proposal. The task that lies above them both is finding an answer to the much more soft and diffuse question of how to develop a design that at the same time is a contemporary piece of architecture while having closely integrated ties to its dominating historical context. This is very important since it is the sole foundation of the Møntergården Museum itself. A museum, which is focused on communicating the relation between the old and the present, should also reflect this in its physical presence, the architecture. The answer to this can be a thousand different architectural solutions. This dilemma can be formulated into a question that the next chapter “Define Strategy” should develop an approach to.

If the words used by the museum be rephrased and oriented towards an architectural vision, instead of the mission of the museum, this could be:

How can a piece of architecture be contemporary while rooted in its present society by integrating its context’s historical heritage as a frame of reference?

DEFINE
STRATEGY

1.60
ARCHI-TECTONIC STRATEGY

In the process of developing what in the end has become an Architectonic strategy, the question raised as a closing remark in the summarization of the chapter "Define Platform" has been central. In order to build upon this dilemma and develop something sustainable and visionary as a response, it is important to look at the two overall elements that make it a dilemma in the first place.

How can a piece of architecture be contemporary and rooted in its present society by integrating its context's historical heritage as a frame of reference?

The immediate challenge lies in the contrast between contemporary and historical, and how they should meet. Therefore, each element and how they are understood in this project should be defined further, starting with the past, leading to the present/future.

By historical and even historical heritage, this is in the case of Møntergården very much focused on the exhibition itself. How we, as humans, have developed our society from the ancient times until today. It is, therefore, much related to the art and artifacts that it exhibits. What sets Møntergården Museum aside from many other museums is the extent of this exhibition since it goes beyond the exhibited items themselves and reaches into the entire physical surroundings that the exhibition is incapsulated in – the architecture. A large part of the buildings in the Møntergården complex are of great historical importance in our ability to understand our past in a much wider sense than just reading about it, but actually walking around in it. When considering this from in a strictly architectural point of view, not including the exhibited material but only the physical surroundings, the term 'historical heritage' is dominated by the building tradition of half-timbered houses.

This already makes the question more graspable since it narrows the meaning of historical heritage to a specific type of building tradition.

The other more diffuse element is the term 'contemporary' since this term like 'historical', only refers to a place in time - as of the present time or modern. Modern, on the other hand, is often related to a very defined and in many ways a past architectural époque, even though its constant presence in artistic expression and structural understanding is seen in most recent built architecture. Contemporary should instead be focused on the movements that are currently developing at the given time, in order to contribute to a new understanding of architecture, rather than repetition.

The development in architecture today is very much oriented around technology, and the immediate control architects can have a wide range of parameters that span from hard core technical to the more artistic possibilities in form development. This intention immediately brings contemporary into a digital understanding since the more and more advanced tools introduced, all belong to the category of software. The evolution in the more experimental digital architecture being proposed today is spreading into many different directions, but it often seems that what drives the projects is the implementation of new technology itself, and not necessarily a wish of making it relevant to the surrounding society. The Swiss architectural firm "Gramazio & Kohler" formulates this in the following way:
"The fact that no new conventions have arisen in the design and building world in recent decades shows that built architecture has so far benefited only marginally from digital technologies." They argue that the new technologies should find links of inspiration in the tradition of construction in order to change the culture of architecture, both in its expression and in its productive capacity. "Architects are predisposed to forge links between technology and the built environment."

With that understanding, the term 'contemporary' suddenly shifts from being only focused on time to also include technological advancement. This, when combined with historical heritage, implies striving towards an architectural proposal that utilizes the possibilities of the digital tools available, and through its rooting in the understanding of its context, the historical heritage results in a design that aims at taking part in the necessary endeavour towards expanding the limits in the understanding of what architecture is and can be, rather than repeating. This could, in other words, be described as reinterpretation. There is only one reason to reinterpret anything, that being the wish for proposing something new.

The idea of reinterpretation and, in this case, the architectural and structural tradition of half-timbered buildings, also fits into the vision of Odense City Museum of communicating an understanding of our present time through a historical perspective. If the intention of keeping Møntestræde the very central element in the overall plan for the entire complex and locating the new exhibition building in the north-eastern part of the site is to be taken seriously, this will immediately require the two things to be very tied together. The existing buildings flanking Mønterstræde are a showcase of the historical developments in half-timbered buildings; the two existing buildings that the new exhibition building can physically connect to are both half-timbered buildings. Placing a reinterpretation of this tradition in this location, as the new exhibition building, would thereby complete the architectural journey. It would be an experience of different types of historical examples, spanning from around 1600 to 1800 and then pausing since the evolution of this tradition started to be replaced with other structural evolutions, and finally re-emerging as a more than 200 year later reinterpretation - a collected perspective on the influence of time and technology. This will in the next subchapter be elaborated further on.

ill. 64 Signification of Møntestræde


ill. 65 Completing the Architectural Experience

1.61 REINTERPRETATION OF TRADITION

The decision of developing the project's archi-tectonic strategy already at the stages of the programme and analysis is a matter of personal curiosity for the already existing architecture on the site and the extreme material quality – texture, sense and feeling both the main materials, wood and brick, have, and how the combination of these two only enhances that experience. Both are organic materials but different in warmth, hardness and use. Another important thing is the history that lies in them and how they are specific to and already dominating that site, but is that alone a good enough reason for narrowing from the beginning the possibilities in what material sense a building should have?

As an overall personal motivation lies also the importance of distancing a building from other contemporary architecture. Not for the sake of making it different, or just alone to be different, but for making it local - a point of view, formulated very well by Tadao Ando in an article entitled "Beyond Minimalism", published in the magazine "New Architecture". In it, Ando discusses the way architecture evolves as a result of the more and more economic interests that are involved in architecture, and the effect of globalization. He sees it as a threat to differences between culture and the resulting blend of homogeneous uniformity, which destroys characteristics and traditions inherited in a region, and if ignoring this... "it will kill the sense of association to a specific region, the moral and spiritual character in its roots, and event the individual races themselves." He sees architecture's ability to move people through its poetic and creative power, and constantly re-raise the question of whether architecture can be a true culture in and of itself.

The discussion is especially focused on how contemporary architecture is made of techniques and materials - these being steel, concrete, glass and aluminum that are common all over the world. The unfortunate result is that buildings tend to look essentially the same around the globe, and architecture becomes more like a dull repetitious lifestyle, mundane and boring. Despite these similar preferences in materials, Ando sees no reason why architecture in some parts of the world should be exactly the same. If architects were more considered about that, it is not a specific plan or design, or technique or cost relationships that makes architecture become "true" architecture, but instead, the aesthetic expression of the architect's awareness of the issues involved, "then the definition lies not only in architecture as a completed structure but within the process that is involved in its creation."

The task set forward with this project through its Archi-tectonic strategy takes its origin in the present history, context and craftsmanship, and seeks inspiration in these elements to develop the reinterpretation that combines architecture that is contemporary with history and tradition. This approach is very much similar to the opinion expressed by Ando, stressing how one should preserve or be inspired by the craftsmanship of a region.

"The intrinsic culture, tradition, history, the moral and spiritual character of a people is intimately entwined in the process of deliberation and will determine whether or not the architect´s understanding of these issues will reach the heights of architectural expression."

It is a similar intention that the Archi-Tectonic strategy of this project develops, starting with the understanding of the history and craftsmanship in search of an approach or inspiration that might not lie in the obvious, but can serve as a platform for a further exploration in to a meeting of the history and the contemporary.

1.70
HISTORY OF HALF-TIMBERED BUILDINGS

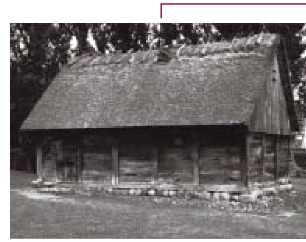
The Archi-Tectonic Strategy of this project takes its origin in a reinterpretation of the half-timbered building tradition. In order to be able to do that with some amount of understanding of the elements and reasons for why the half-timbered buildings look and are constructed the way they are, this subchapter will briefly present the history of this tradition. It is considered that an understanding of this is important in order to develop a reinterpretation that, while proposing an experimental contemporary design, still respects the origin it reinterprets.
The half-timbered house, as we know it today and in many ways like it is seen at Møntergården, is a building tradition that has its roots all the way back to the Stone Age, even though Stone Age and timber constructions might sound contradicting. At that time in Denmark, the area of the country covered in forest far exceeded anything we see today. In that perspective, it makes sense that the preferred material to work with was wood, since there was plenty of it and its qualities as a good and warm material as opposed to the hard and difficult to deal with stones.

The wooden houses of that time were constructed as a timber frame construction, most often from oak, as its main support, and the walls were made by weaving smaller branches around the main construction. The roof was done using either thatched roofing with various types of straw or a living roof made of grass or moss. Today almost no remnants of these houses from the antiquity are found, mainly because of the organic material used and their poor ability to survive for that long in the Danish climate. The picture of this type of house, shown on figure 66, is therefore also a reconstruction done in modern times.

As time passed, the “half-timbered” house developed into more of what is seen today in the Danish city and countryside. Better tools meant better control in cutting the large timber into structural elements, and this leads to the next important stage of development, the mud-built half-timbered house. These were like its predecessors based on

ill. 66 Reconstruction of timber frame house from the stoneage - Djursland. Weaved walls made of branches and thatched roof.

ill. 67 House from mid Jutland, date unknown. The weaved wooden walls are replaced clay/mud. Because of the weather's effect on the walls more clay/mud had to constantly be added to cover cracks, resulting in these belly out infills.



ill. 68 All wooden house from Haderslev Museum. (Bul-house). Date unknown, but the tradition of these type of houses can be dated as far back as around 1100 A.C.

ill. 69 Above: Peasant house from Stenstrup, Fyn. The date is unknown, but it is an example of the implementation of using burned bricks and mortar in the less wealthy part of the population.

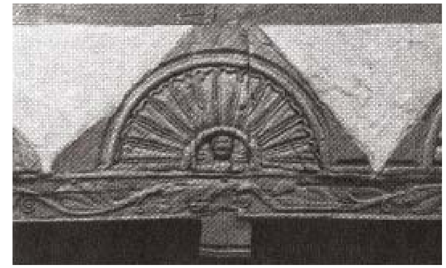
ill. 70 Left: A half-timbered house from Haderslev, dated back to 1795. It is built in the period of classicism with a nordic simplicity to its design. In many ways the common type of half-timbered houses that are still seen in the Danish cities.

a large timber frame construction, but instead of using solely branches for completing the walls, clay was introduced as second material, or in the early primitive development as unburnt bricks. This construction gave a better insulation against the weather and could cut down on the amount of tree material needed. The downside to this type of wall is the high amount of maintenance needed when rain and wind start dissolving the clay. Straws were often mixed into the clay mud to make it more durable and lasting.

The next major step in the development of the half-timbered houses split into two directions: one, the invention of the burnt brick, and the other the “bul”-house - “bul” being an ancient Danish word for large log. To start with the last mentioned, the all timber house, the examples found in Denmark date back to around 1500, but definitely started much earlier. The benefits of this method where the clay or primitive bricks were replaced with large planks of wood, lie in the ability of being able to much better maintain and keep the walls tight to resist the weather. Still the construction relied on the timber-frame construction for stability, implying that the much added amount of wood for the infill only served as insulation, and not as structure. This historical walk-though will not rest much more on this branch of the development since it is not what is found at Møntergården, and, therefore, not part of that context. As a closing remark on these all timber houses can be mentioned, that already in 1550, the Danish King Chr. III had forbidden peasants in north Jutland to build in this way, due to its large demand of wood and the resulting in shrinking forests. This is the main reason why the more traditional Half-timbered house is the general type seen in Denmark today, even though the peasants to some extent ignored this, and examples of these type of houses that were built can be found as late as in the 19th century.

Moving on to what is considered a traditional half-timbered house today, this building tradition saw great benefit of the invention of the

ill. 71 Wood carvings from the Renaissance, from a building in Helsingør. The structural elements are given an artistic ornamentation that was mostly seen in the wealthier classes of society.



ill. 72 Another example of carved ornamentation in wooden elements of the building. This example is from Randers and dates back to 1592.

burned brick that was far more resistant to the climate than any other material used so far, and was thus in the beginning reserved for the people who could afford it like any other breakthrough in other industries. The combination of brick and mortar as infill has two effects: one being the already mentioned weather durability, the other its stability. With less and less forests in Denmark, as a result of inconsiderate logging, the main timber frame construction started to be more sparse. Some might argue that it was optimized, but it was an optimization that came from sometimes rather daring attempts to minimize the use of wood, and not always with a lasting result. Whether or not it was intended, the introduction of burnt brick and mortar gave structural benefits in its resistance against wind and its ability to deal with vertical pressure.
As burnt bricks became more and more common and affordable to all classes of people, the distinction between rich and poor came in the introduction of ornamentation, especially around the Renaissance. Examples of this can be seen in some of the buildings described in the sub-chapter “Architecture on Site” in the site analysis in this report. The level and detail of these carved ornamentations never saw the extent as seen in e.g. England or Germany but kept a maybe more traditional, modest Nordic expression.

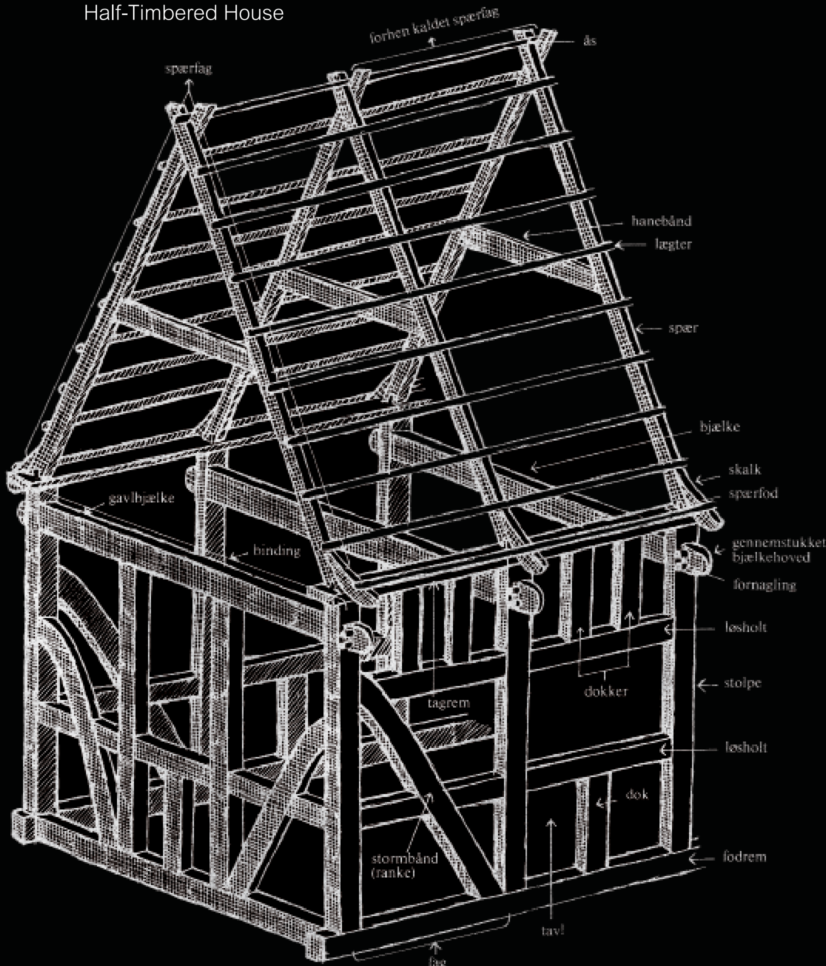
The oldest examples found in Denmark of this level of development date back to around 1500 and were being built as late as into the beginning of the 20th century, though during that time period it became more and more of a countryside house, as the buildings being built in the cities shifted more and more to all brick and mortar houses.

It can be argued that the half-timbered house has become a lost and more historical building tradition in Denmark, and definitely in the cities, and in that sense a romantic part of our history. No serious attempts have been seen in the modern period of Danish architecture to continue develop on this specific combination of materials, wood and brick, and its distinguished architectural aesthetic. This is most likely due to the focus on the international movements in architecture during the 20th century which has resulted in a somewhat uniform global architecture seen today. Sporadic leftovers of this tradition is seen in most cities in Denmark, but its affiliation to the history of Danish architecture is made clear when considering how Copenhagen looked in the Middle Age, where the dominating architecture was half-timbered houses.

ill. 73 Photograph of model illustrating the extent of the half-timber buildings in Middle Age Copenhagen.

1.71
TIMBER FRAME CONSTRUCTION

ill. 74 Principles of Half-Timbered House



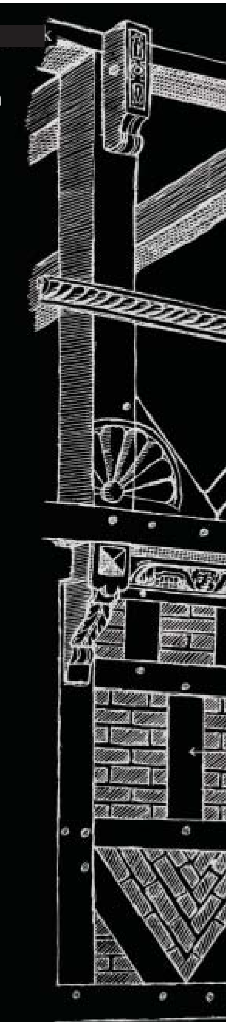
The timber frame construction is the solel most important element in the half-timbered building, as the name might also imply. It is the element that ensures the stability of the entire building and carries the roof. In extension of the history of the half-timbered house explained in the previous sub-chapter, this will focus on the basic principles of the timber frame construction used in these houses and its variations.

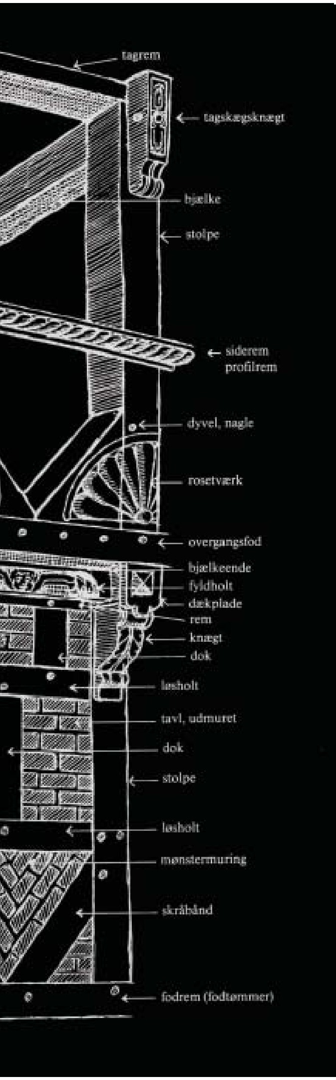
Starting from the ground and up the walls, the structure is constructed from an array of columns that are fixed in an equally sectional proportioned beam, placed on the ground. Each column is connected to the one beside it by horizontal pieces of wood, again using the same sectional proportions as the column. The number of horizontal connectors varies depending on the height of the floor, the quality of wood and the wanted architectural expression. These two elements form the basic grid-frame structure that gives the building its horizontal stability. If the amount of timber available and the budget allows it, this rectangular grid frame is added stability by introducing cross bracing elements, typically at the corner columns.

Moving on up to the beginning of the roof, the long sides of the rectangular plan are connected with beams, thus spanning the shortest distance. The illustration shown to the right is the most common way to complete the roof when dealing with shorter spans, like in many peasant houses and town houses. Arrays of trusses resting on the columns meet at the centerline of the building, creating the classic and very characteristic triangular saddle roofs. These are connected horizontally by lath, giving stability and providing the skeleton for whatever type of roofing is laid on top. This is a such a very common structural system, and the variation from country side houses to town houses are mostly seen in the finish of these details and added ornamentation like seen on the illustration to the left.

ill. 75

Town House Construction





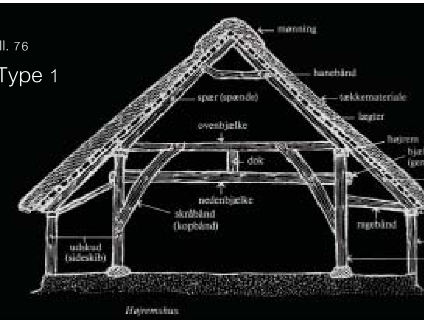
The most interesting structural solutions in half-timbered houses are seen when having to span the roof over longer distances like in a barn. In Denmark two techniques were developed; “Højremshuset” and “Sulehuset”, in this case referred to as type 1 and type 2, respectively.

Type 1: This type of structural system is the one dealing best with large span roofs. The exterior walls are constructed like described above, but their load bearing importance is far less. Instead, a secondary primary load bearing structure is built “within” the house. Two lines of arrayed larger and more massive columns carry the main load from the roof. These are connected with two horizontal beams at the top, and further stabilized as a frame construction by adding cross bracing beams. When further connected in the opposite horizontal direction, running along the long side of the building, this develops the structure in one collected system, a space frame that gives high stability and enables it to support the added weight due to the long span of the roof. These inner columns are connected to the columns in the exterior walls and thus completing the timber frame construction as a whole.

Type 2:This type of structural system is commonly seen on Fyn, and unlike the “HøjremsHus”, which relied on a combination of two systems of colums – exterior and interior, this system solely relies on a secondary interior element in order to support the roof. “Sulehuset” got its name from the array of very large timber columns placed along the centerline of the plan of the house. The name of these columns is “Sule”, and these alone carry the roof. The columns are connected at the top by a long massive log, on top of which the two sides of the roof are hung. The bottom part of the roof rests on the exterior walls but does not rely on them for vertical support, only horizontal. In areas where it was hard to get long straight pieces of logs for center columns, curving logs were used. Besides from a dynamic and interesting architectural expression, these curved columns are also said to deal well with wind pressure because of their flexible ability.

ill. 76

Type 1



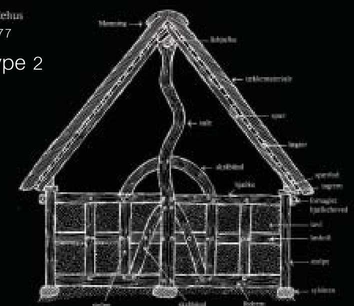
ill. 78

Tools

Sulehus

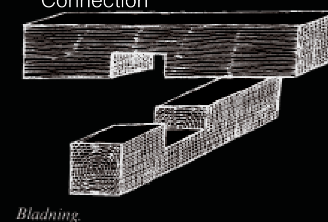
ill. 77

Type 2



ill. 79

Connection



These are the main principles behind the half-timbered houses found in Denmark. Their importance is as much structural as it is aesthetical since they present themselves in the visual impression no matter where the house is viewed from, exterior as well as interior and downstairs as well as upstairs.

1.72
CRAFTSMANSHIP AND URBAN LEGENDS

There exists an old urban legend about the construction of large half-timbered buildings which really points out the craftsmanship needed to build these types of buildings and the pride that carpenters put into their work.

A very skilled carpenter gets the assignment to build a half-timbered manor barn. Convinced as he is of his own skills, he brags to the contractor, saying that he is able to precisely calculate in advance how many pieces of timber and dowels is needed for the construction. The contractor does not believe him, but the carpenter is stubborn to prove his skills, and the two settles on the following bet: if the contractor is right, the carpenter is to be paid the double amount, if on the other hand carpenter is wrong, he gets paid nothing.

The carpenter spends a couple of days measuring and calculating. He then gives orders to his employees to start cutting the timber – a certain amount of columns, boards, beams, dowels etc, and then the actual construction starts.

The pace of the construction is fast, and the barn is starting to take shape. The contractor gets nervous about whether or not the carpenter was right and that he might lose the bet. To insure his victory he orders one of his workers to go to the construction site during the night and remove a couple of dowels. When the building is almost done and the last piece of timber is about to be placed, the number of dowels left is of course not enough. The spiteful contractor informs the carpenter that since he, the carpenter, did not live up to his promise, he lost the bet, and, therefore, he will not be paid anything for his work. The honest carpenter, not knowing he has been deceived, is out of his mind of despair and under the excuse of having to go and check up on something, goes into the barn. He does not return and after some time his workers go in looking for him.

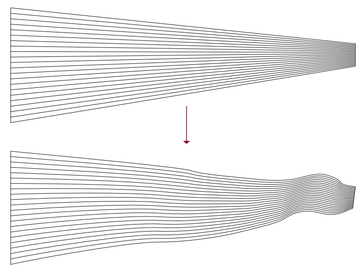
They find him hanging from one of the beams.

In that way the contractor got his barn for free, but everyone knows that barns with that history is not a blessed place; Some will burn down soon after, others will collapse, and for those that do neither, a specter carpenter will run around every midnight looking for his lost dowels. This urban legend is a loose translation from “Gammelt Dansk Bindingsværk” – Old Danish Half-Timbered Houses, by Gorm Benzon. Even though it is an urban legend, it is a testimony of how well prepared the craftsmen had to be for the construction of a building in this period. It was necessary that each single piece of timber was cut out with great consideration and fitted into a large numbering system. Even where timber was plenty, the irregularities of the timber meant that they often were of different sizes. As a result of that, each piece could not be used anywhere in the construction but was meant for one place only. That is why each piece was marked with a sign, explaining exactly where in the construction this was meant for. In that time it was the way things worked; today we would consider that mass customization, a term used by the New York based architectural firm “Reiser + Umemoto”, and something that will be a dominant element in this project.

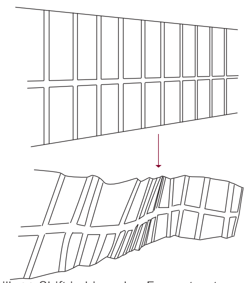
ill. 80 Hanging Carpenter

1.80
TRANSFORMATION OF NATURE

ill. 81 The effect of wind and gravity over time has deformed the half-timbered barn from being defined by the strict geometry of a rectangle to topology-like surfaces, a shift in geometry and hierachy.



ill. 82 Transformation in geometry. From plane to double-curvature surface.



ill. 83 Shift in hierachy. From structure defining surface to surface difining structure.

The solely most important element of inspiration for the chosen path for this project in terms of reinterpretation of the building tradition is found in how nature over time has affected the structural system of half-timbered buildings into deformation, a failure in the structural system but without total collapse. The image shown above exemplifies this to its fullest extent. The long barn once as close as humanly possible in its geometry to a perfect rectangular box, has, due to gravity and wind over time changed into a soft curving and bending mass, a transformation of the geometry. The, now extremely dynamic and organic wall has an almost poetic expression of materials' ability to adapt to forces greater than themselves. Parallels of this could easily be drawn to contemporary experimental design exploring in fields of performing architecture.

If the transformation of geometry is further analyzed, two things seems to happen: the first being the overall change in the walls geometry, which is a transition from a plane into a freely developable surface with double-curvature in various places, and the second, moving from strict geometry to something topological, each other's opposite, and in that sense, a drastically change.
The second thing that can be interpreted out of this transformation happens as a result of the first, a change in hierarchy. With the original strictly rectangular shape the wooden frame construction set the boundaries and behavior of the plane, structurally maintaining everything in position. By saying that a change in hierarchy takes place, the relation between structure and overall geometry is what is referred to. Looking at the deformed wall it appears that the surface is controlling the behavior of the structural timber frame, as if the structural system adapts to the surface. The hierarchy has shifted from being first "structure then surface" into "surface then structure". Whether or not this is totally true from an engineering point of view is really not the important thing here, but instead, the architectural associations it gives and sets a direction in how to reinterpret this.

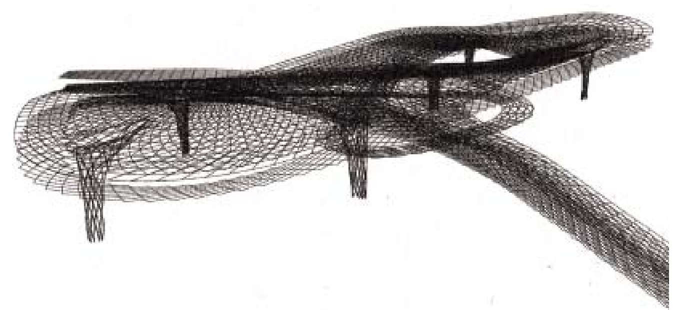
The previous mentioned architectural firm Reiser + Umemoto describes this as "systems becoming other systems". Their office has for a long time been experimenting with how structural and typological models like material can be stretched, warped, and otherwise subjected to formal and organizational transformations. This is especially oriented around modernist structural system's capacity to transform - work they consider as operating..."as a form of critical history, because it opens up once solidified models to broader interpretation and, even more importantly, application." This point of view is very much the architectural inspiration that the picture of the deformation has given to this project.

1.81
RETHINKING THE AESTHETIC/FABRICATION/PRODUCTION

The intention of swapping the hierarchy from structure defining surface, to surface, or form defining structure, as described on previous page, also means a shift in production, especially today where a lot of architecture still relies on economic benefits of predefined elements. But this actually just refers back to the original way half-timbered buildings were constructed which is as a collected system of unique pieces; an area, where the digital tools intended to be implemented in this project will be crucial.

Implementing the idea of developing a design that relies on production of unique elements that supporting, or is developed according to a form or series of organic surfaces, introduces another important aspect, which is switching from standard architecture to what can be described as non-standard architecture. If the project is to from the beginning work from that idea of architectural production, as being non-standard in the way it is thought through and designed even before the first sketch, this has to answer the practical question that was the starting point for Bernard Cache & Patrick Beaucé, working together under the name of “Objectile”, when they formulated their manifesto entitled “Towards a non standard mode of production”. “Under what conditions can a term like “non-standard architecture” have meaning?”

They begin answering this in a negative way. If “non-standard architecture” takes its origin solely in the digital capabilities of modern CAD software to generate more or less soft surfaces, and then call them buildings by transferring them to a palette of production software, only resulting in creating very expensive kinds of sculptures, that from the beginning has not had “any relationship with the historical and social sedimentation that makes up a city, then we are only perpetuating the Romantic myth of the artist-architecture.”



ill. 84 Reiser + Umemoto´s BMW Event and Delivery Center proposal. Structural system transformation and adaption to accommodate for local stress challenges, resulting in a non-standard system made of thousands of unique elements.

Instead of this form just for the sake of form, it is crucial to implement a series of criteria from the beginning, parameters, which the design has to positively respond to. This will prevent what is really in play in non-standard architecture from escaping the focus of the architect – the question of form, city and productivity. “Parameters must be introduced in order to control or modify these surfaces, by intervening on their coordinates….architects cannot simply shift this problem onto someone else while multiplying the budget.” If this is ignored, the term non-standard is locked to synonyms like “original” or “complex”, remaining stuck in a Fine-Arts state of mind, instead of part of the solution in solving the complexities of a building in an integrated way. In order to approach the design in this way, the first thing to do is defining these parameters. In the case of this project, the first and probably the most important thing is the flow and coherence of the new exhibition building to the site and of itself, but these are more overall factors that any project should start with before even thinking about architectural concepts or aesthetic. Instead the parameters that can inform these surfaces to perform in a way that makes non-standard architecture more than just a language of form lies in the technical aspects.

1.82
INTEGRATING TECHNICAL ELEMENTS

These parameters will in this project be:

Production – a proposal that specifies how the intended production method is integrated in the design.

Structural stability – this will happen in the transition from informed surfaces to detailing the elements needed, shape and material optimization.

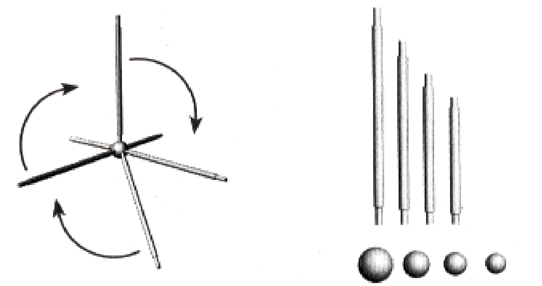
Light – taking its starting point in the specific needs described in the subchapter “Technical Requirements”.

Acoustics – being able to solve different types of acoustic according to the use of space

Ventilation –which in this project will be limited to integrating the elements in the architectural aesthetic, and not dimensioning the system.

To exemplify what is meant with these parameters’ ability to intervene or raise demands in how the surfaces are developed, references will be presented in the following.

Beginning from the top, production of non-standard architecture, a reference is drawn to the already mentioned architectural firm Reiser + Umemoto and their proposal for BMW Event and Delivery Center Competition, Germany, 2001. This project was based on their previously described experimentation with systems becoming other system. It developed a structural system capable to transform accordingly to meet the different stresses in local areas of the entire structure. The design ended up with a structural system consisting of thousands of unique elements. In order to propose this as a design solution, following the thought of Bernard Cache & Patrick Beaucé, this system has imbedded in its logic the way it is considered being produced.



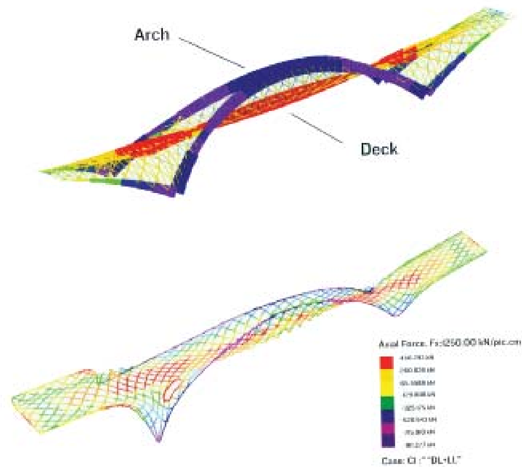
ill. 85 Reiser + Umemoto´s BMW Event and Delivery Center proposal. Varyation in structural components are simplified to angle between struts, length of struts, diameter of nodes, and placement and number of drilled holes in nodes.

ill. 86 Reiser + Umemoto´s BMW Event and Delivery Center proposal. Non-standard architecture consisting of a large amount of unique elements requires an implementation of numbering the pieces in order to insure their placement in the right position in the construction of the design. This is similar to how carpenters used to number the columns, beams etc. when building half-timbered buildings.

Any system like this will depend on mass customization, and following the logic of the term, this is to do with a large amount of unique elements where each piece has a modification that sets it apart from the rest, but the important thing is the extent of these differences, or how many different parameters are involved. In the case of BMW Event and Delivery Center Competition, this is reduced to two element’s nodes and struts, where the first has three parameters that make it unique, which is diameter, number of drilled holes, and their placement in the node. The second is the struts, which only change in one parameter being their length. In this way, the logic in the structural system allows for great diversity, structurally adapt to any situation inside the overall shape of the building, and optimizes the production of the needed elements due to its understanding of the fabrication processes involved. In the same way this project should be aware of how the process from non-standard architecture to something that is a reasonable proposal for a building is carried out.

ill. 87 Reiser + Umemoto´s Alishan Tourist Route proposal. The predesigned surface undergoes a transformation into a structural system that: 1. satisfies the structural demands and 2.´becomes the design itself and allows spectators to still read the initial design of the surface.

Continuing down the list and thus staying within the boundaries of the structural system is its stability or performance and the use of material. The reference used here to exemplify how this project will implement this is once again from Reiser + Umemoto, but a different project, a proposal for a pedestrian bridge as part of a bigger project called Alishan Tourist Route, Taiwan, 2003. This exemplifies how the transition from surface or form into a supporting structure is developed.

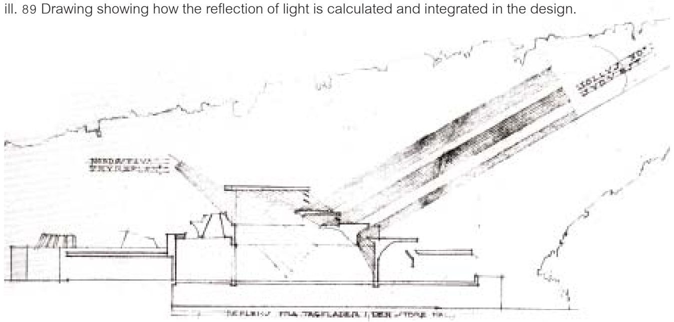


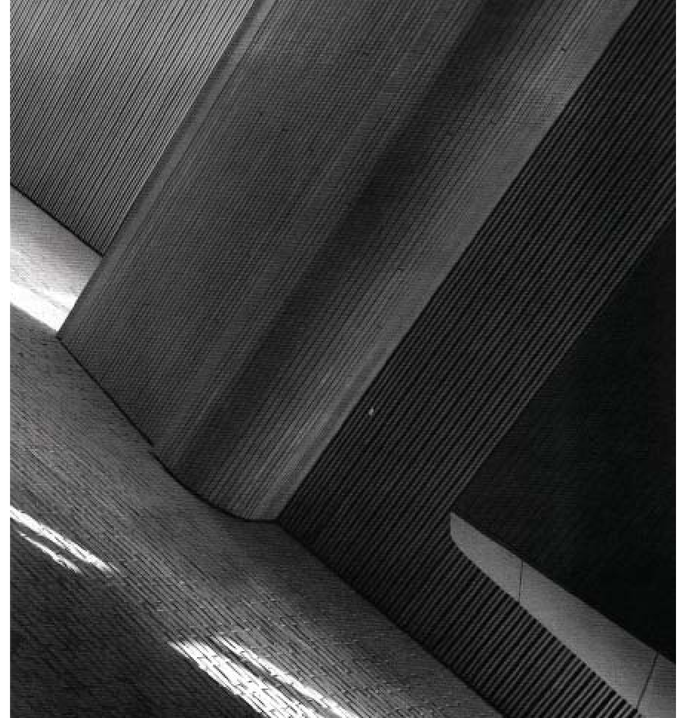
ill. 88 Through iterations using FEM Analysis software the individual members are iteratively optimized to meet the shape of the initial design, but also optimizing its use of material.

The design of the structural system then undergoes further investigation in FEM software where it is optimized according to levels of stress and the amount of material used, keeping in mind the intended architectural intention from the first model. If this is done in an interplay with the consideration of the production as just described, the structure thus defined by an already designed form - as it originates from the surface - will start being part of the answer to the overall design. This is due to the fact that the experimental structure´s purpose is not just to ensure that things stand, and then gets covered behind another surface for aesthetic reasons, but instead is a very important element in the aesthetic understanding and sense of that surface.

This is very similar to how the experience of looking at a half-timbered building is. The wooden frame structure is at the same time structurally necessary for the surface/wall/façade to perform its load-bearing task, but at the same time crucial in the aesthetic of the building, both when seeing it from the outside and inside. It is the part of that surface that makes us recognize its logic; thus, it being a half-timbered building. This concludes the exemplification of the intention with this project seen from a structural point of view.

ill. 89 Drawing showing how the reflection of light is calculated and integrated in the design.





ill. 90 Photo of light reflecting surfaces in exhibition space ceilings at Alvar Aaltos Kunsten (Former Nordjyllands Kunstmuseum)

The next three parameters that are to be implemented as form-factors in the development of the envisioned surfaces relate all to the element of indoor climate; these being light, acoustic and ventilation. The references used to illustrate how these are intended to be implemented in this project are all from Scandinavia and are all working with materials that have the same qualities and aesthetic as what are intended to use in this reinterpretation of the half-timbered house.

As mentioned earlier in this report, Odense City Museums has put emphasis on the importance of natural light in the new exhibition spaces. This has two overall purposes, the first being clear views of the surroundings and the other lightening the exhibition space. Both will have a positive effect in keeping the energy demands within the limits of the “Low-Engery Class 1 Buildings”, as described earlier in the programme. For now only the last, lightening the exhibition space, will be illustrated how it is seen implemented in the project.

The idea of having free developable surfaces be the main architectural tool in this project will also have to implement the ability to direct sunlight into the places wanted. As a reference of how this can be done is Alvar Aalto and his museum of modern art in Aalborg, now called Kunsten, from 1972. The overall architecture will not be discussed here but will only focus on how natural light is controlled so when lightening the exhibition space is redirected from direct light to indirect light, thus avoiding the damaging effect direct sunlight has on art and artefacts. This is done by introducing single curving surfaces in the exhibition space, designed with consideration of the angle of the sun and the angle that the light is to be redirected in – see figure 89.

Not only is this aesthetical impressive solution, it also minimizes the amount of artificial light needed. This implements an important parameter in the form-finding of the archi-tectonic design to be pursued in this project.

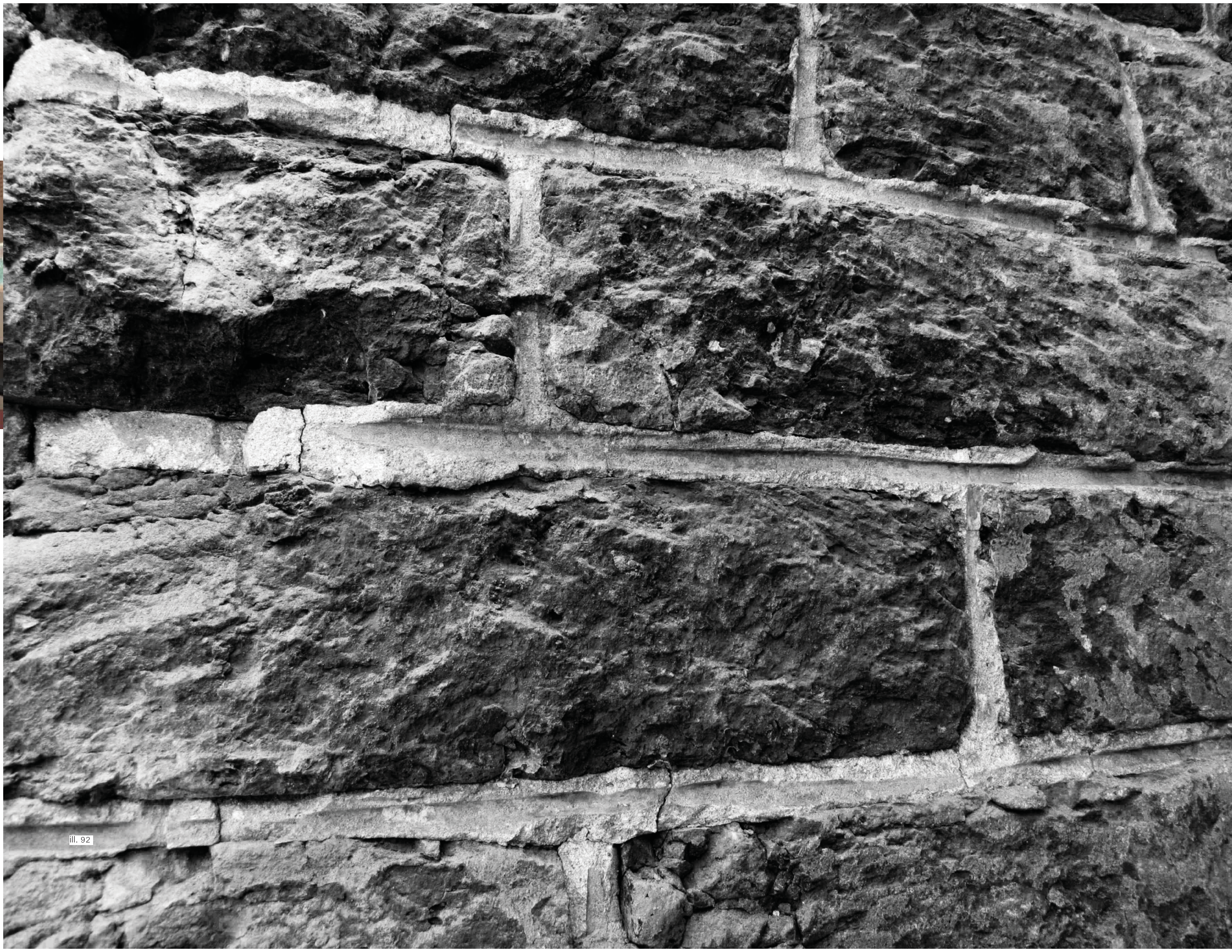
When it comes to acoustic in the new exhibition building, two overall solutions are needed. These relate to the functions in the exhibition spaces. The most simple of them is the damp acoustic needed in the permanent exhibition space to allow for small conversations and film and audio showings, and at the same time this will not disturb the people focusing on the exhibited items. The solution here should, like the rest of the parameters, be an integrated part, and thus a parameter in the design and materialization of the surface elements.


ill. 91 Integrated Acoustic sollution at Holbæk Meeting House by BBP Architects

The reference chosen to illustrate this element is from the Danish firm "BBP Architects" and their "Holbæk Meeting House". The elements used to reduce the reverberation time are hidden behind the wood panels covering the wall. Perforations are made in the panels in the needed amount, allowing the sound waves to be absorbed, thus improving the indoor climate. A similar integrated solution is pursued in this project in order to blend together aesthetic and function.

The last parameter is the ventilation. This is considered the least important of the five, but it is not to be understood as complete ignorance of its importance to the quality of the indoor climate, nor the preservation of the exhibited art and artifacts. The demands needed for mechanical ventilation in terms of temperature, moisture and filtering are all complex elements when dealing with spaces for exhibiting art and artifacts. With respect to that, this project will only work with this parameter to the extent of proposing the placement of the ventilation system and how it can reach the areas needed in a way that will not disturb the architectural experience of the museum, as an integrated part of the aesthetic, not in terms of dimensioning nor testing it, but stay on a more conceptual level.

This concludes on the parameters that are to be implemented in the free developable surfaces that will be the approach to the process of developing the architectural response to the demands and wishes of the competition brief and those additionally defined during the analysis phase. The references presented in order to illustrate how these are intended to be implemented in the form-finding are all chosen for the relation to how information introduced to a non-standard type of architectural language can both affect or define the shape globally and locally, and perform according to indoor condition requirements.



ill. 92

1.83
HISTORICAL EXPERIMENTATION

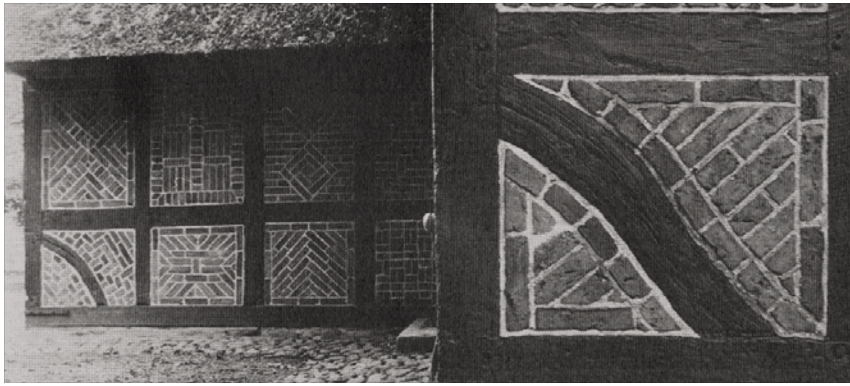
The last part of this main chapter, “Define strategy”, will focus on the element that is the infill in the structure and as such completes the reading of it as a surface, the bricks. These have, through the historical development of the half-timbered building, been subject to some experimentation, like the timber frame structure has. The experimentation has mainly focused on aesthetical aspects, more like ornamentation, but also other reasons like shortage of straight timber has forced bricklayers to adapt to working with more organic solutions. These will shortly be presented here, followed by an introduction to contemporary experimental approaches to brick and concrete that can point in a direction to how this brick infill can be reinterpreted in the project.

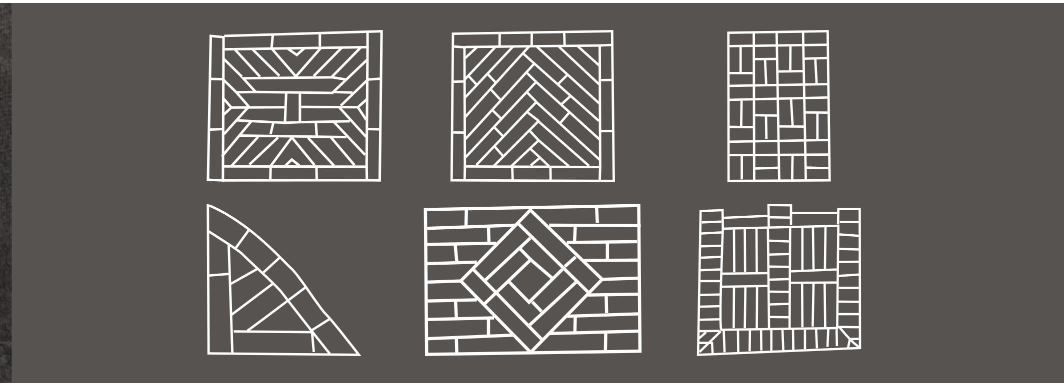
Brick-layer patterns seen in half-timbered buildings can be diverse and experimental. The intention of this tradition was to enhance the ornamental aesthetics of the building, not using carved figures or patterns in the wood like previously described, but in the patterns possible in the orientation of the bricks. A clear example of this is seen in Notmark vicarage in Als, Denmark. The brick layering is almost like a catalogue of different patterns ranging from the simpler to the complex. The patterns could be further intensified by using more than one colour of stone in a pattern, or enhancing the contrast between bricks and joints by colouring the mortar bright white. This exemplifies and illustrates how the tradition of half-timbered buildings, like with the unique elements that were needed for the timber frame, is very much focused on distinguishing one house from another through the use of customized solutions, at least for the people who could afford it.

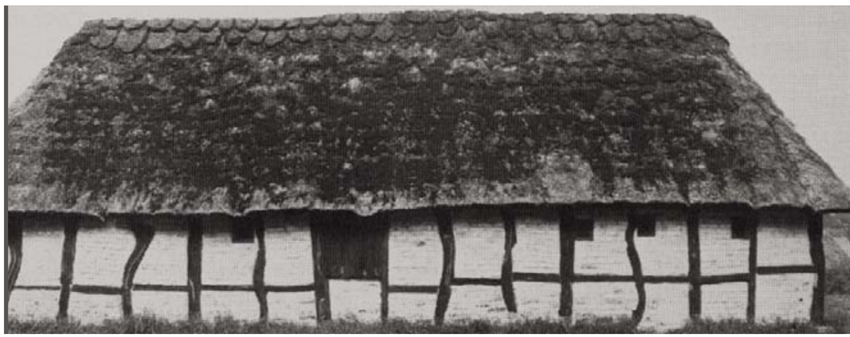
In other cases, half-timbered buildings really stood out with a unique expression compared to the norm, not because of expensive ornamental elements, but on the contrary, because of lack of resources. The picture, shown as figure 94, is of a building from Herning Museum. When looking at the curving wood columns in the façade it is testified that the building was constructed in an area and time with shortage in proper timber, meaning straight, long and thick enough for producing good upright columns. Once again, the half-timber construction adapts to nature. The implementation of the curving columns changes the overall geometrical strictness mostly seen in half-timbered buildings.

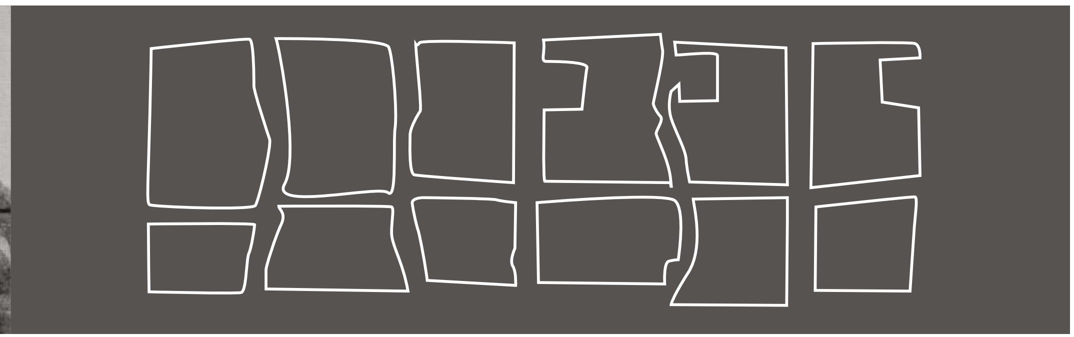
This is again like the deformations described earlier in this chapter, deformations of nature, seen as an interesting approach to the reinterpretation of this tradition; when the geometry of the columns change, the brick infill must adapt to these changes as well. This changes the geometry of the infill from square or rectangular to more irregular elements, which is still in some respect close to the original but with sides that curve, or corners that deviate from the right-angled. The variation in the infill is another element that makes it unique, since no single infill element in the façade is similar to another, a highly customized solution.

The third historical example that is included in the approach to reinterpreting these infills is from previously described Skårup Gård on West Fyn, used in the chapter deformations of nature. As explained, the deformation by wind and gravity changes the geometry of the entire surface, façade, and thus not alone the structural system but also the brick elements. These transform from planar elements to being defined by curvature and in some areas, double-curvature. This is another interesting aspect to include in the reinterpretation of the brick infills. Nature has produced these curvatures, but the challenge will be how these can be incorporated in a design of the new exhibition building in a way in which the challenges of all this customization is responded to with a thought through design, imbedded with a logic and understanding, that allows this to be produced in an efficient way.

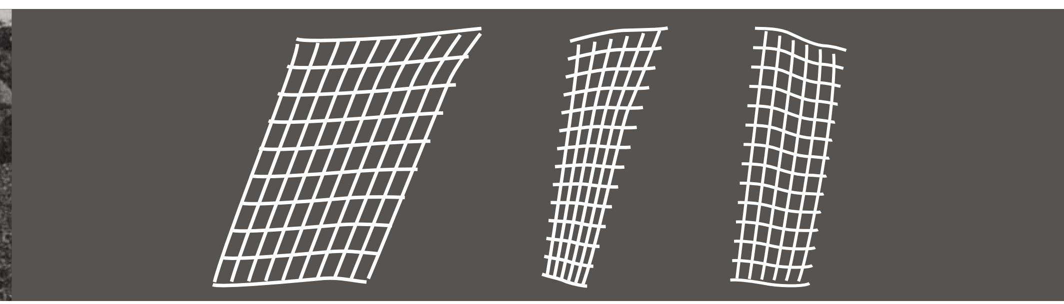

ill. 93


ill. 96


ill. 94


ill. 97


ill. 95

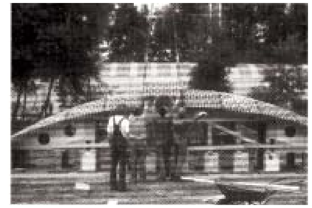

ill. 98

RETHINKING THE ELEMENT

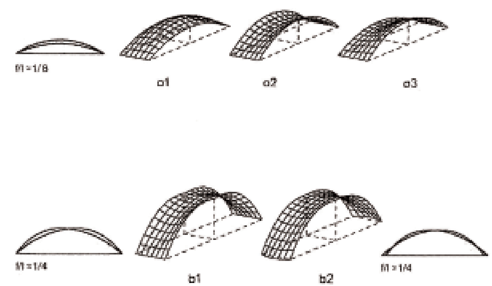
To illustrate how the approach to this reinterpretation of the brick elements was intended, three references are here introduced which relate to each other in their objective, mass customization, but differentiate in their technology or preferred material.

The first reference is an experimental bridge made of bricks at the Center for Architectural Structures and Technology at the University of Manitoba, where the project was led by Mark West. This project experimented with the production of customized hand-built shell elements made of brick, and thus relates to the fabrication of curvature. The technique used was setting up one cast where the bricks with spacers were placed on a suspended fabric, then mortar was poured on top and distributed into the places needed. When the mortar was sufficiently cured, the element was flipped out and secured, and the production of the next element could begin. When all the elements were done, they could be transported to the site and put together to form the complete bridge. This reference is following the principles of what makes non-standard architecture interesting since from the beginning of its design it has a close connection to the logic it has to be produced upon, and as a tool for how reinterpreting the brick and its application in this project has potential in its efficiency. It is still a very man-hour consuming production method and hence expensive approach, which leads to the next reference.

The Swiss architectural firm Gramazio & Kohler has in their close corporation with ETH Zürich experimented for many years in what they call “Digital Materiality in Architecture”. This spans over a wide palette of experiments, with one thing in common, the possibilities in digital design tools and how this can be materialized, produced. The focus in this project is on their experiments with brick laying done using a robot in order to control the precise placement of each brick when designing various wall elements of curving and transforming shapes. They believe that “digital materiality” leads to a new expression and sensuality

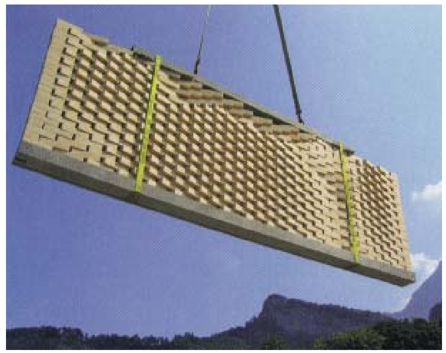




ill. 99 -103

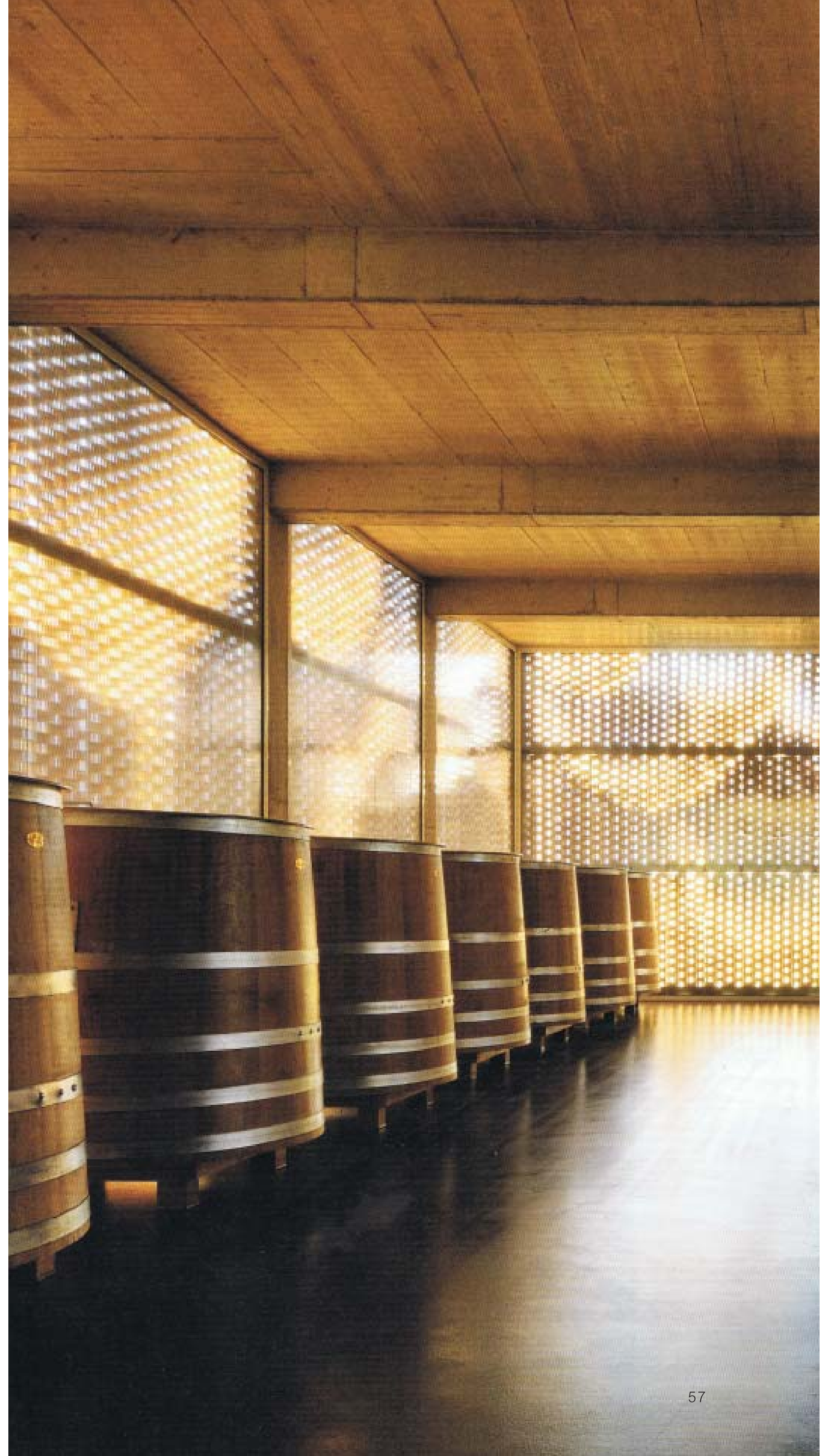



in architecture, by allowing the architect to control the manufacturing process through design data. This is very similar to the previous described opinions by Reiser + Umemoto and Objectile. “From now on we are no longer designing the form that will ultimately be produced, but the production process itself. Design and execution are no longer phases in a temporal sequence – design sketches do not need to be converted into execution drawings anymore. The design incorporates the idea and knowledge of its production already at its moment of conception.” This approach becomes very essential when deciding to reinterpret the tradition of brick infill in half-timbered houses as in this project through deformations, transformation, patterns and curvature. The logic of production will have to develop along with the evolution of the design in order to end up with a proposal that makes sense in more ways than a “fine arts” statement.

ill. 104-107



The digital materiality described by Gramazio & Kohler is experienced to its fullest extent in their façade system for Gantenbein Vineyard in Switzerland, 2006. Here the system is design as prefabricated elements that are built by the robot in a production facility off site and then transported to the site and installed in their right place. The aspect of prefabrication is very important in keeping down the costs of customized solutions. The result is a very dynamic façade system made of bricks were curvature the bricks adapt to results in both material pattern and patterns of light, due to the openings in the façade that are a result of keeping the geometry of the brick intact while pursuing a form language of curvature. Aesthetical qualities can be compared to those seen in the half-timbered examples for reinterpretation both in terms of patterns and curvature.



ill. 108-109

The third and last reference included in this archi-tectonic strategy is in many ways closely related to Gramazio & Kohler, but opens up a wider palette of possibilities for the development of this project. But at the same time questions whether or not a reinterpretation of the half-timbered tradition should stay completely true to the two main materials, timber and brick, or if it is the sense of the material combination that is the important. This is to be understood that the relationship between wood and brick is based on the contrasting sense of a soft material, wood, and of a hard, brick and mortar. At the High Tech Concrete Laboratory, a division of the Danish Technological Institute, experimentations with the capabilities of robots used in fabrication of customized building elements has resulted in focusing on concrete. Here the robot is used to produce advanced casts, negatives for concrete elements.

The philosophy behind it is very much inspired by Gramzio & Kohler and will, therefore, not be more thoroughly explained. Instead, it is the ability to implement details in the concrete shells that otherwise would require the brick and mortar such as patterns, textures and porosity, while being able to work very unlimited with irregularity and curvature because of reinforced capabilities to stay intact. This is the beginning of an aesthetical, architectural and production discussion that are to be solved during the development of this project, and not in this chapter or phase of the project. The purpose of these references were instead to illustrate the intended path of reinterpretation, of how the project can use historical experimentation in half-timbered buildings or their unintended structural failure as a door into a contemporary experimental suggestion of what a half-timbered building could be.

As a closing remark of this entire “Define strategy” chapter, a final quote is brought in. The quote is from Gramazio & Kohler and relates to the intention of this project’s archi-tectonic approach that is founded in the use of digital tools and their ability to reinterpret the history of a type of architecture that is very limited in its nuances of how people experience it in the urban space. “Digital materiality changes the physics of architecture; changes the Gestalt, and ultimately the image that society has of architecture.”
– Is this not the solely most important aspect of reinterpreting anything? To play with the predefined perception of what things are, by proposing what it could also be.

1.90
SUMMERIZING AND PREPARING

Throughout the chapter “Define Strategy”, the term parameter has been used extensively which could imply that the project strives towards a parametric design, understood in the technology it uses to produce the design. This is not the case though. Implementing a parametric technology can prove useful in some areas of the design but is not the aim itself. Instead, parameters refer to the elements that the design should constantly include in its evaluation of the process of striving towards the overall vision. These parameters are, as described, its structural system, production, acoustic qualities, the usability of natural light and its integration of the often, most visible technical element, ventilation. Overshadowing all these five parameters is necessarily its success in functioning as a museum and the way it connects to the existing functions on site which calls for a structured approach to the order the things are solved in the next phase of this project and referred to as the “Response” in this report.

This can be seen as chronological process, which in its definition contradicts to the iterative process described as the “Methodology” used in this project. When chronological is used here, it focuses on the order the different types of iterations are done in order to be most effective. This can be further defined when preparing the tools needed to solve the complexities given by the many parameters.
The phase of responding to the vision should, therefore, strive at addressing the different issues in the given order:

1. Context
Overall plan for the collected Møntergården Museum. This means developing the layout where all planned outdoor functions, additional room requirements and the new exhibition building´s room scheme is included. How the different functions relate to each other on a collective scale and in their own smaller groupings. This will also end up in a narrowed layout of the functions in the new exhibition itself, and thus be the first iterations of the form finding process.

2. Form
Solving the flow and indoor climate requirements. This phase will be an iterative process with focus on how the new exhibition building should develop in its interior and the immediate outdoor areas. The focus will be on perception and understanding of form and architectural space, acoustic quality and how it expresses itself in an architectural language, and finally the usability of natural light and its quality in functionality and spacious understanding.

3. Materialize
Developing the structural system. This is as described earlier a term that covers many aspects: structural stability and the use of material, materials architectural quality, the implementation of a logic of production, performance according to energy restrictions etc. This phase will introduce new tools and thus shift the iterative relationship to consisting of the modeling software, Rhinoceros 3d and StaadPro 2007. The result of this phase, since it builds on top of the two previous phases, has been imbedded in the result “The Respond” to all the parameters defined from the beginning, hence being the foundation for the next and final part of the project, the “Elaboration of the design”.

This concludes on the first of the 3 major phases in this project “Define”, “Respond” and “Elaborate”, and leads to the beginning of the design process.

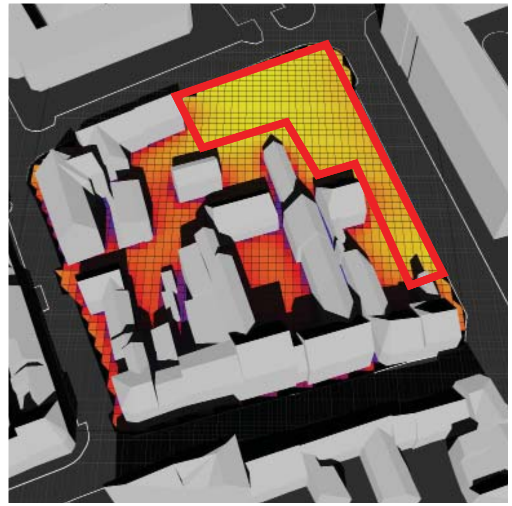
ill. 110

RESPOND

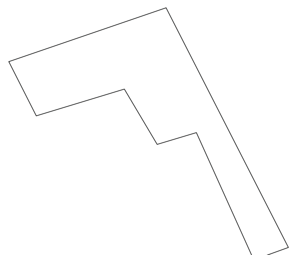
2.00
CONTEXT

This sub-chapter "Respond" will focus on how the form of the entire museum is developed before it is materialized. This includes initial considerations done regarding outdoor functions and placement of volumes, experimentations, developing principles for final architectural language for form, flow considerations, light and distribution of program. The process is not in any way a linear one but has gone in many different directions, having to step back and reconsider many times, until finally being ready for the materialization process. In this report this will be explained in a more linear process in order to insure and better present the development in an understandable way.

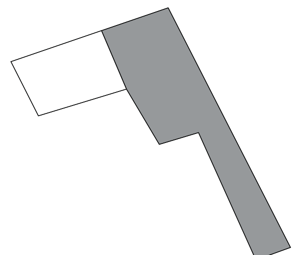
First phase in the form-finding process is focusing on deciding where to place the different functions in the program and how they relate and connect to each other – resulting in one of the most important elements in a museum, flow. Several outdoor functions were listed in the program and these rely on the sun conditions in order to ensure a long seasonal operation. Café´s outdoor serving, stage and seating are important elements in order for Møntergården to really utilize the outdoor courtyards, which is already happening but should be further improved. Illustration 111 shows an example of a series of sun analysis done at the site's outdoor spaces, without trees but only building volumes generating the shading, since trees can be removed if decided to use its location in other ways. The analysis shows the difference in direct sunlight over an entire year. Not surprisingly, the site cleared for this project is the most exposed to sunlight, since there are no volumes shading yet, but the difference between the amount of sunlight on the site and the existing courtyards is dramatic. If taking into consideration that large part of the project site is shaded by trees where some must be preserved – see ill. 113, this leaves only the north western part of the site suitable for placing the café and the stage area, if intended to be sun optimized. As a result of this, the café program is implemented in the museum program, making the total amount of net square meters 2000 instead of 1750 – gross 2500 m2.



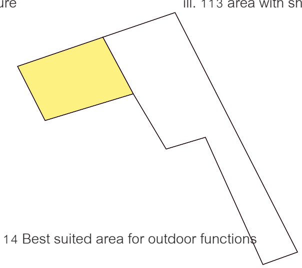
ill. 111 analysis of direct sunlight one year total - only existing building volume shading included.



ill. 112 area with most exposure



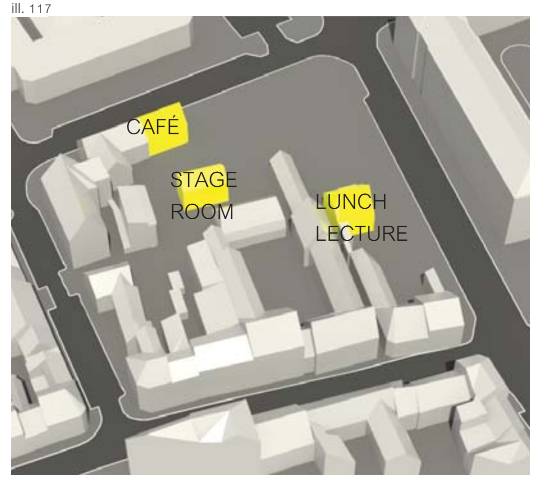
ill. 113 area with shading from preserved trees



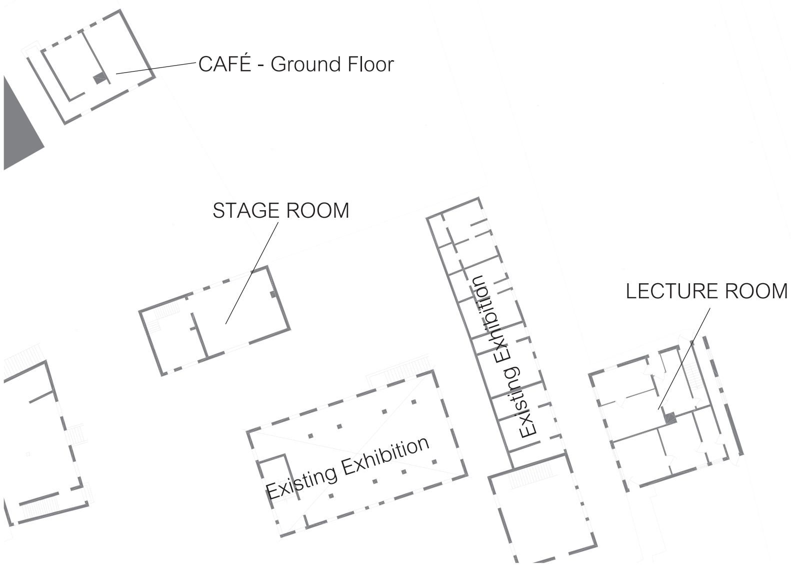
ill. 114 Best suited area for outdoor functions

Before continuing developing the actual museum building, the rest of the additional program is placed in order to determine if this can benefit with any parameters in deciding how the museum program should be distributed. The approach is to look at the buildings already on site that are not currently serving any purpose and their size to see if these can be used, and thus actively included in the experience of visiting the Møntergården complex – see ill. 117. To the north, the old “Nyborgladen” is chosen for hosting part of the café since it can only host 110 m2 - this leaves a remaining 140 m2 that must be included in the museum program. The lunch and lecture facilities are placed in Overgade 52b, where the ground floor is for lecture and 2nd floor for lunch. These two mentioned buildings are both allowed to be physically connected to the new exhibition building, making it possible to develop the new museum with these buildings as part of the interior space.

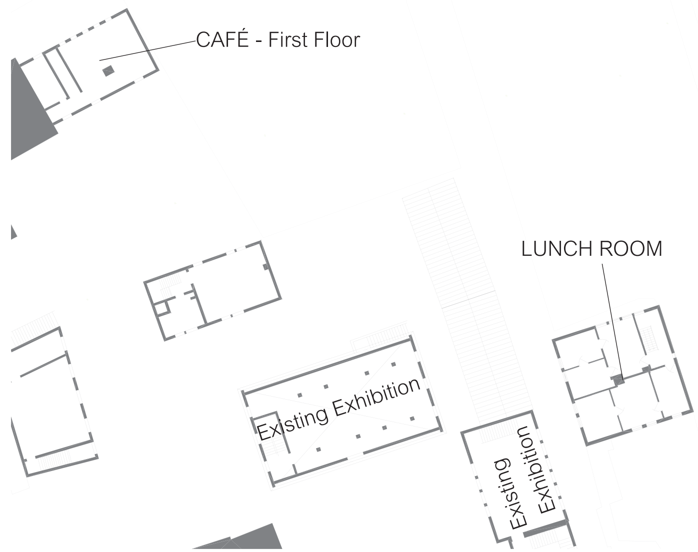
ill. 117



ill. 115



ill. 116



2.01
PROGRAMATIC PROCESS

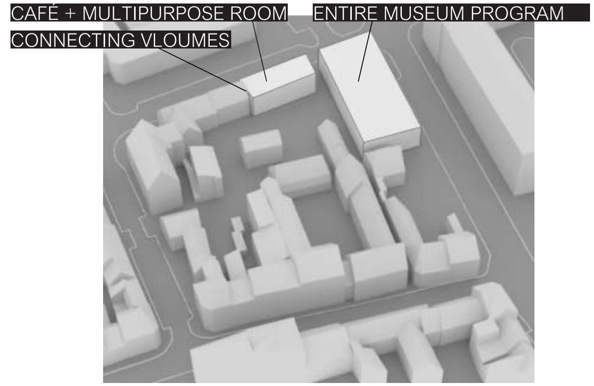
Based on the considerations and decisions described in the last sub-chapter, the development of the museum building itself is presented here through illustration 118-123. It is important to underline that the development seen in the volumes are not architectural but purely programmatic. This is to be understood that what is seen are volumes that represent the different functions of the museum, their relation to each other, and initial considerations of where connections should be made in the future development, minimum room height and square meters needed. In that sense they lay the foundation for starting a more experimental form later on, being able to ensure that the requirements of the "Room Scheme" are fulfilled.

The development started with splitting the museum program into two volumes, placed on each side of Møntestræde – see ill. 118. The west volume is combining the café and multipurpose room into one building. The eastern volume holds the entire exhibition, administration and foyer.

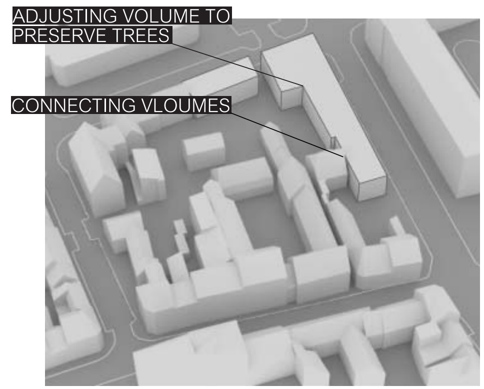
Next iteration remodeled the east volume so that it allowed for three out of the four trees that are regarded worth preserving to be incorporated in the design, making the building volume thinner and longer towards south. The preservation of the trees automatically introduces shaded areas to the building site that can be utilized in the further design.

The museum program is separated into exhibition and foyer + administration – see ill. 120. The exhibition spaces are placed on the first floor and the rest, on the ground floor. The entrance to the museum is planned to be a two-sided entrance that allows visitors to enter from the complex itself and from the city. It then becomes both an entrance to the museum building but also to the outside areas of Møntergården.

ill. 118

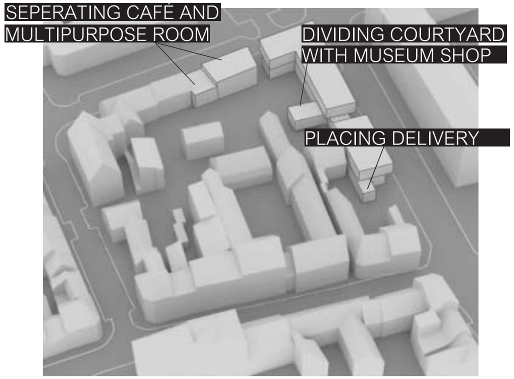


ill. 119



ill. 120

ill. 121



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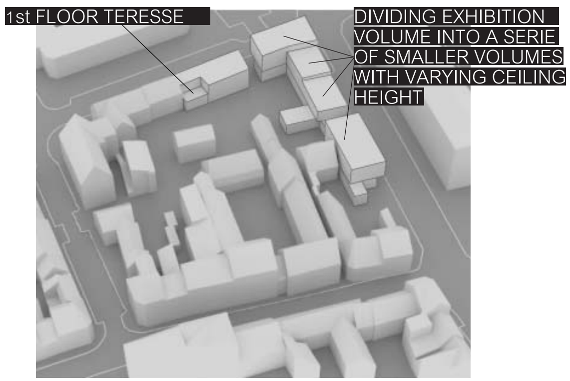
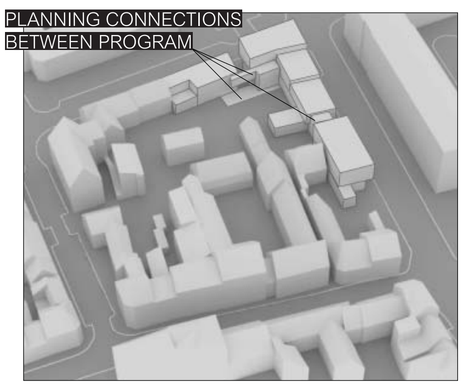


ill. 123

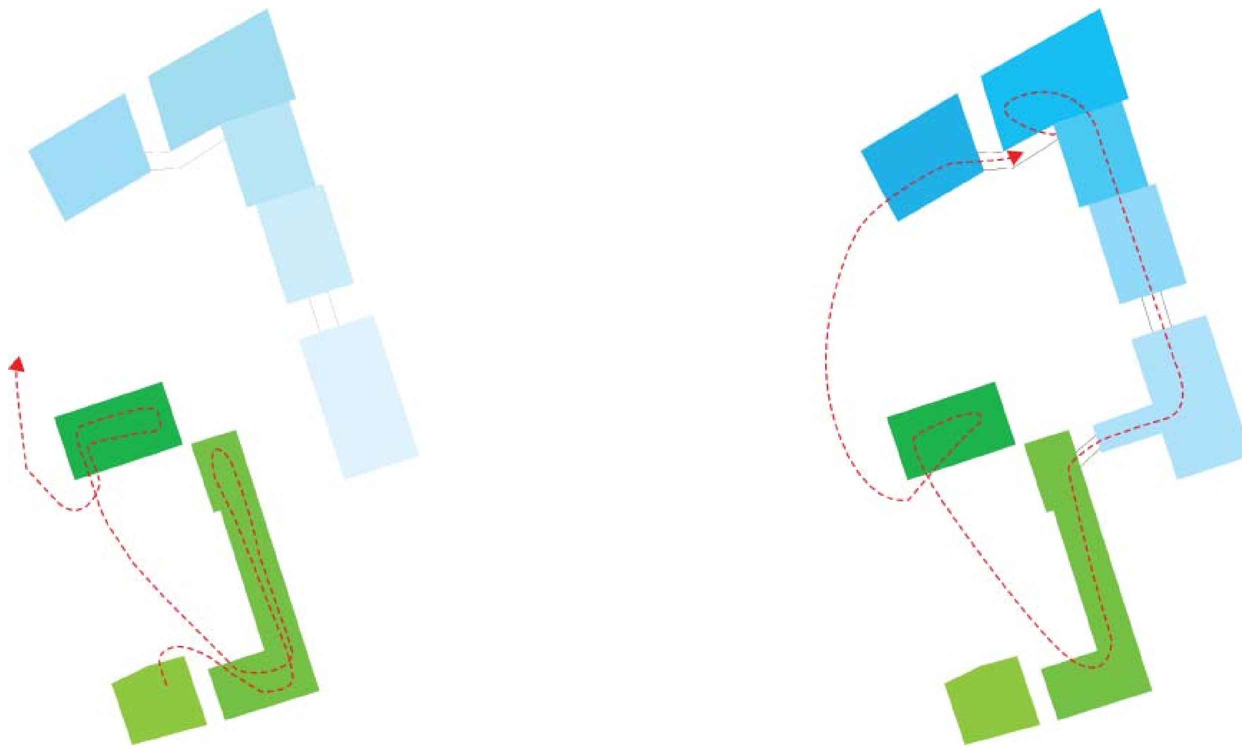


The Café and multipurpose room are split into two volumes, making them part of the series of smaller buildings they physically connect to – see ill. 121. The courtyard with the two trees to the west of the museum volume is divided by extruding the museum shop, creating two smaller intimate courtyards that resemble the smaller courtyards among the existing buildings. These two courtyards can serve as meeting area for visitors' gathering before entering the museum. They are small pockets that lie adjacent to the narrow Mønterstræde.

The museum volume is further broken into smaller connecting volumes, imitating the shifting heights and meetings that are seen in the historical city houses that Møntergården consists of – see ill. 122. The composition of smaller shifting volumes and the intimate spaces between them is what characterizes Møntergården most, and this play with volume should continue throughout the site – the museum building. The café is remodeled to implement a 2nd floor terrace where visitors can get a new perspective on the outdoor areas.

The last iteration of programmatic volumes is planning the future connections between museum and café + multipurpose room – see ill. 123. This is to be done with an underground connection with facilities like wardrobe, restroom and technical facilities so that all functions can serve both volumes. The second connection is introduced in 2nd floor height crossing Møntestræde, connecting the exhibition with special exhibition and café. Finally, the exhibition space in the museum building is connected over the intended two-sided entrance.

2.02
CONTINUOUS FLOW



ill. 124

The existing exhibition is distributed in two different areas, making it necessary to go through the outdoor spaces in order to get from one exhibition to the other. This also means that the existing flow through exhibition spaces is not continuous. Visitors exit the same way they enter, meaning that once visitors have seen a series of exhibition spaces they have to go through them again in reverse, resulting in a two way flow in very small spaces that can disturb other visitors. The new museum building could minimize this by connecting the two largest exhibitions, the extension and the main exhibition along Møntestræde – See ill. 124. This would have to be done through a second bridge crossing Møntestæde, resulting in a flow that would connect all exhibition spaces in Møntergården in one circular flow, minimizing the necessity to exit buildings when going from exhibition to exhibition.

This concludes the development of the programmatic volumes and the foundation for developing the architectural language that will become the final design of the extension of Møntegården museum.

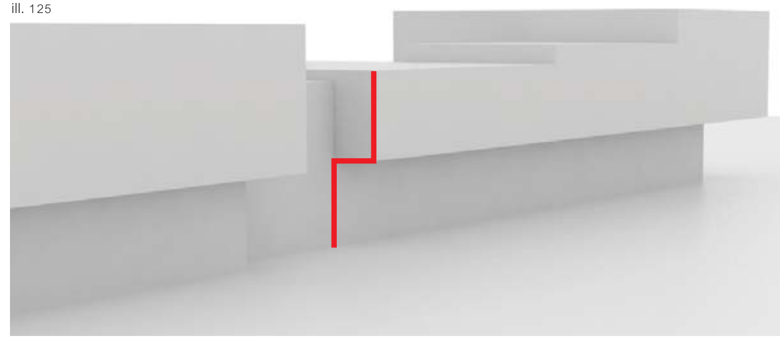
2.10
FORM

The next phase presented in this report is focusing on how inspirations in deformations of old half-timber buildings are reinterpreted into architectural principles and language that becomes the final design/aesthetic of the new museum buildings. Previous to what is explained in this development was a longer process of different experimentation with organic modeling that is not presented. Instead, illustrations can be found on the appendix - CD-Rom included in the report.

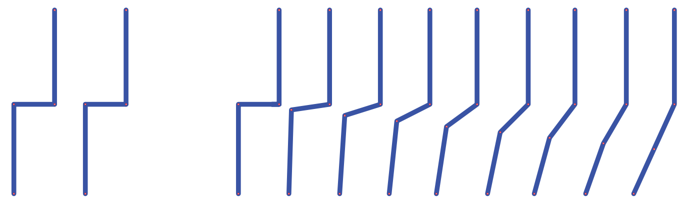
The process of reinterpreting deformations is not intended to imitate these, but to be inspired by its transitions from the strict geometry to organic surfaces, areas or elements that are used on a more abstract level to develop a more experimental form for the museum building.

Looking at the deformations of old half-timber buildings, it becomes clear that for a large part of them it is often in the failure of joints between one structural element and another that allows the settings in a construction to start deforming setting of a chain reaction in the structural elements close to it. These deformations can, as previously mentioned, be caused by wind or gravity combined with loose foundation and week joints. This led to start looking at the programmatic volumes, developed earlier as a series of sections where each meeting of lines was a joint that could be manipulated – see ill. 127. This manipulation was used as a way to make the ground floor façade and the overhang of the first floor start collapsing/deforming from a clear 90 degree corner to a slanted wall that in its final stage becomes one line with a slight crest, marking the transition from ground floor to first floor – see ill. 128. This manipulation became the principle for all façades in the museum.

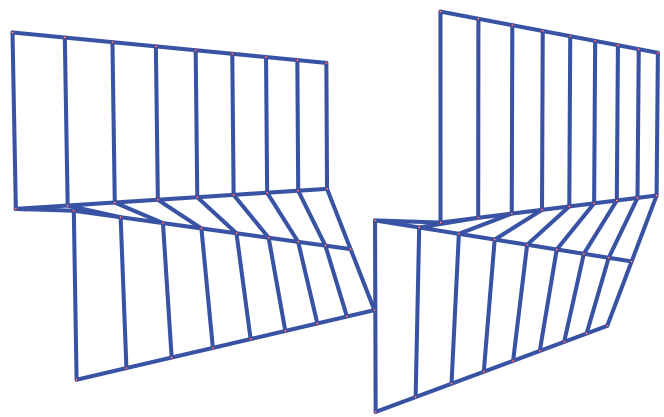
ill. 125



ill. 126

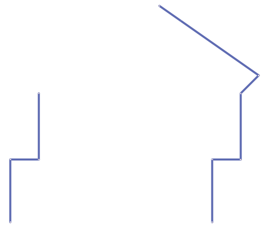


ill. 127

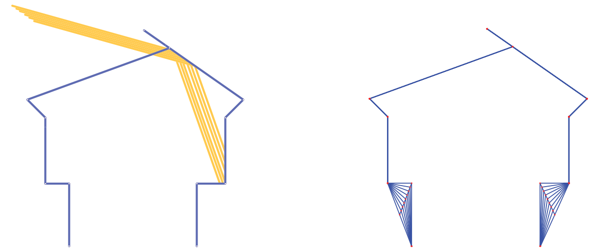


ill. 128

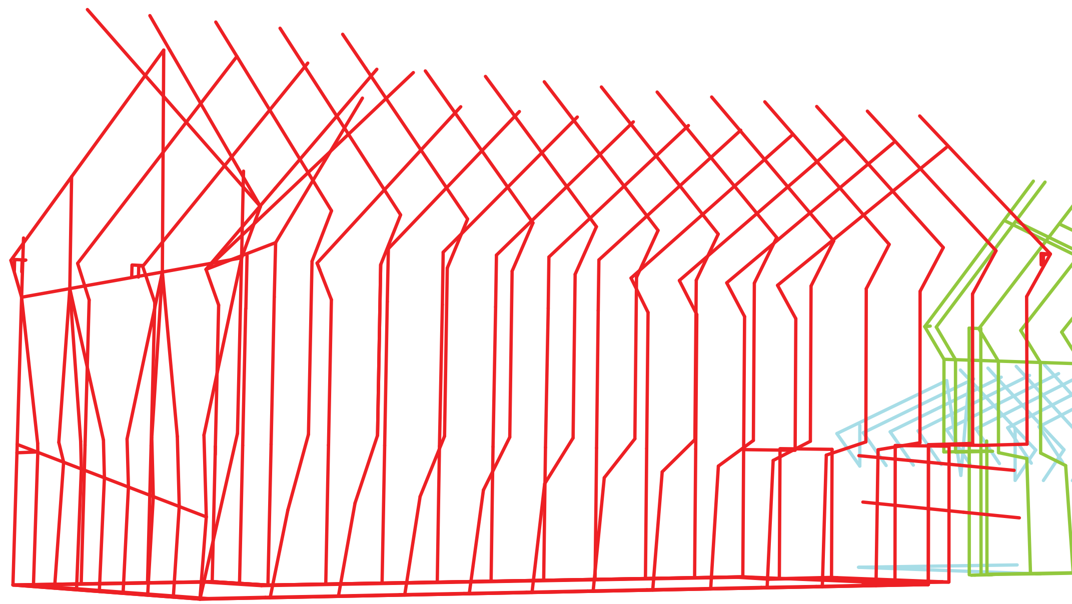
ill. 129



ill. 130



ill. 131



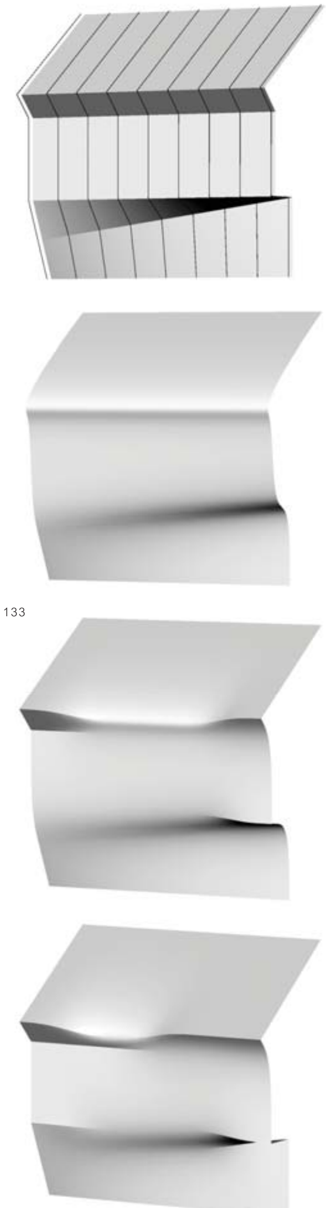
ill. 132

One characteristic about the half-timber houses in general and in the Møntergården complex is the saddle roof and how it extends further out from the façade – see ill. 129. The meeting between roof and façade was reinterpreted as a continuous line that made façade and roof become part of the same section- see ill. 130. Two adjacent façades would have different inclinations, resulting in a shifted meeting that displaced the center roof line according to the center line of the building, starting to play with the spacious understanding in the interior.

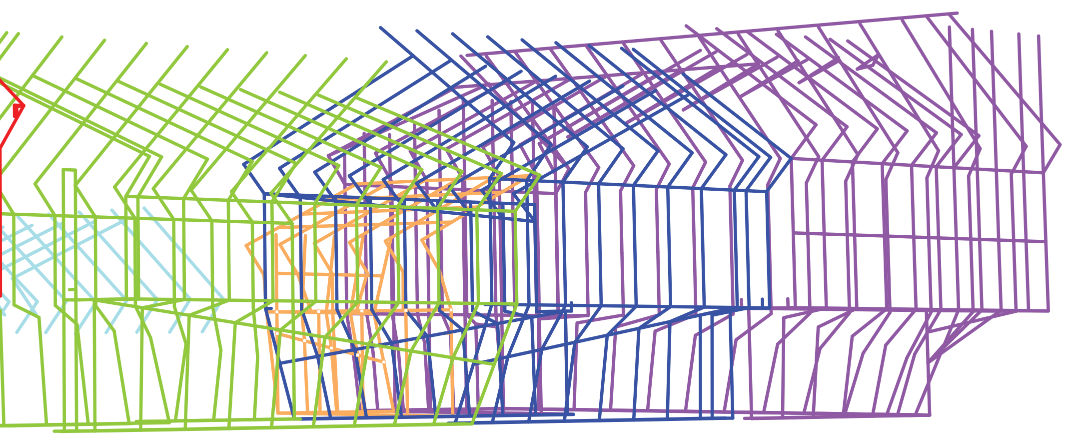
The roof side with the steepest inclination is extended so that it overlaps the other and makes a gap between them that would serve as a way of getting indirect light into the exhibition spaces. The last step in this process of transforming the programmatic volumes into a series of changing sections was to implement these principles to the entire building volume – see ill. 132. The deformations and roof lines vary according to the necessary minimum volume it must contain, and as such starts emphasizing the idea of this entire extension being made of a series of independent houses that function as one, referring again to a close connections between city houses.

2.11
LINE DRAWINGS FOR SURFACES

The next phase of the form-finding process was to start implementing soft curving surfaces that would refer to the way the entire façade starts changing from a plane surface to a more curving, sometimes double curving in order to maintain a closed surface during deformation. This process used the just developed sectional line drawings as a foundation for controlling their behavior. The digital tool in this process was T-splines, which is a modeling technology, specially developed for working with organic shapes. It allows great control of where a form should be strictly geometrical and where it is allowed to stay in its original organic shape – see ill. 133

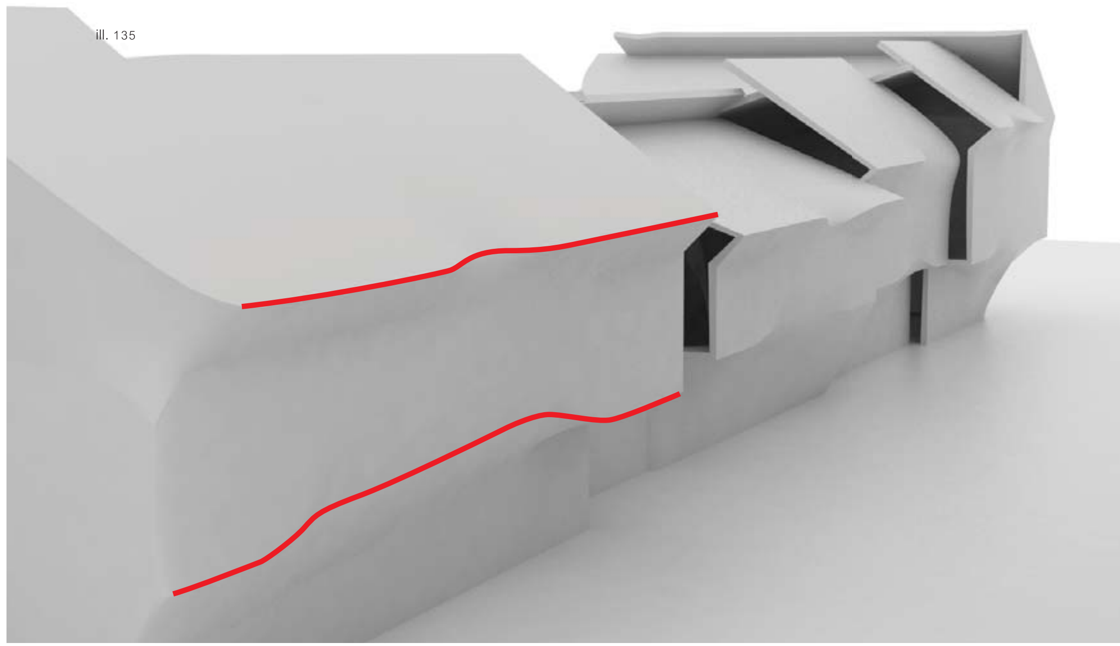


ill. 133



This control was used to make organic transitions between the sectional transformations of the line drawing and on a more abstract level imitate how a beam deforms when its support in a limited area start setting. Throughout the entire building this method was applied resulting in an architectural principle that varies according to the proportions of the volumes and compositional preferences. Thickness was then added as first step towards making it into a façade that could have a material property.

ill. 134

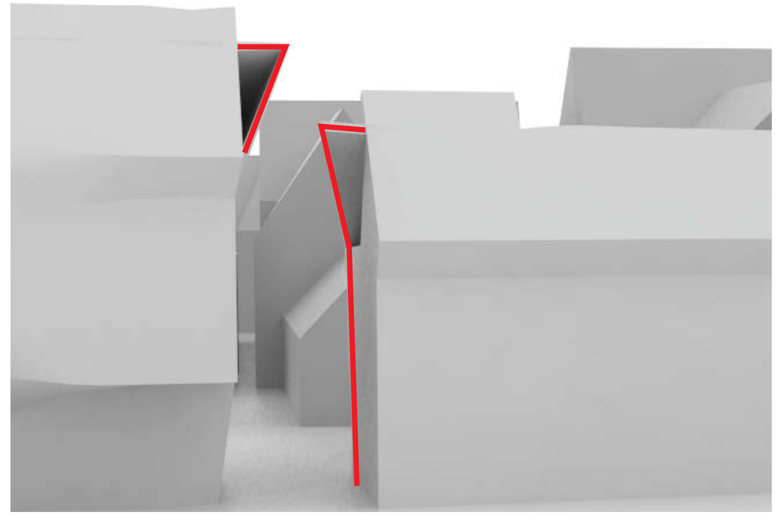


ill. 135

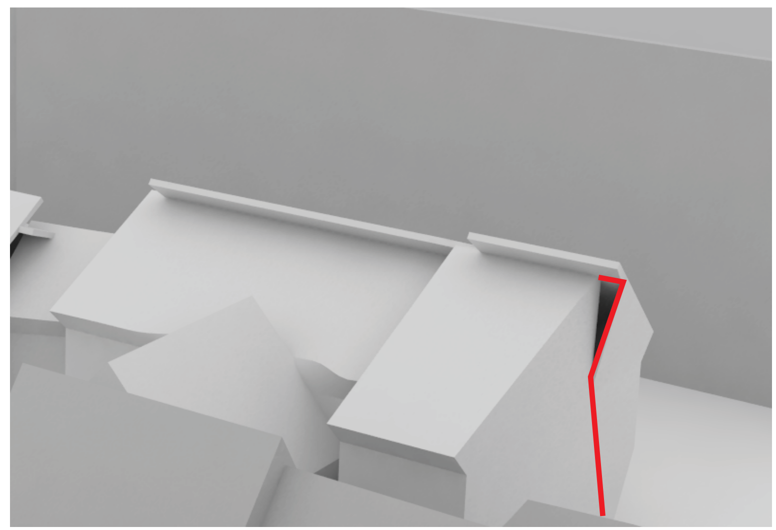
2.12
INCLINING END WALL DEFORMATIONS

A last reference to deformations in half-timber buildings was implemented, inclining end walls. As can be seen on ill. 136, the end wall is affected by the settings of the house pushing it out of its original position, again with origin in its joint connection to the underlying beam. This was reinterpreted into the end walls of the new museum building, but only for part of the wall allowing it to become a source of natural light in the exhibition spaces. Like with the rest of the parameters developed in this process, it was introduced consequently in all closed end walls of the new museum building.

ill. 136



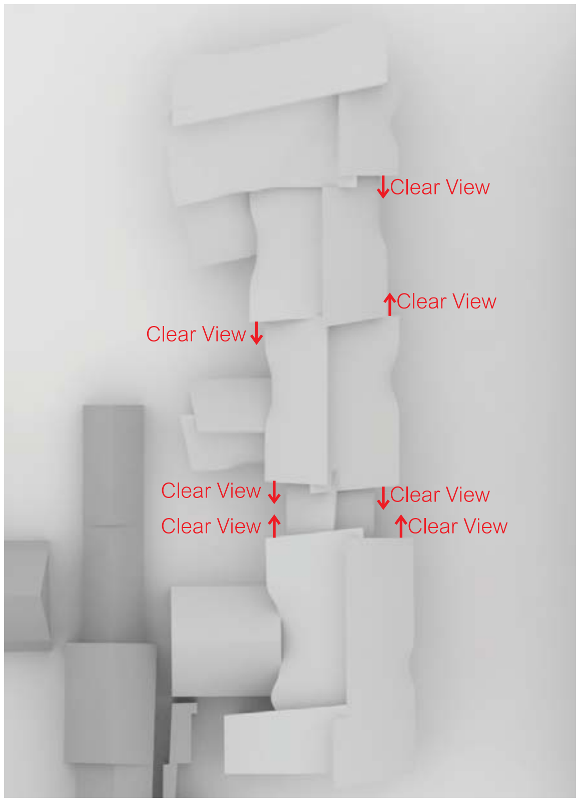
ill. 137



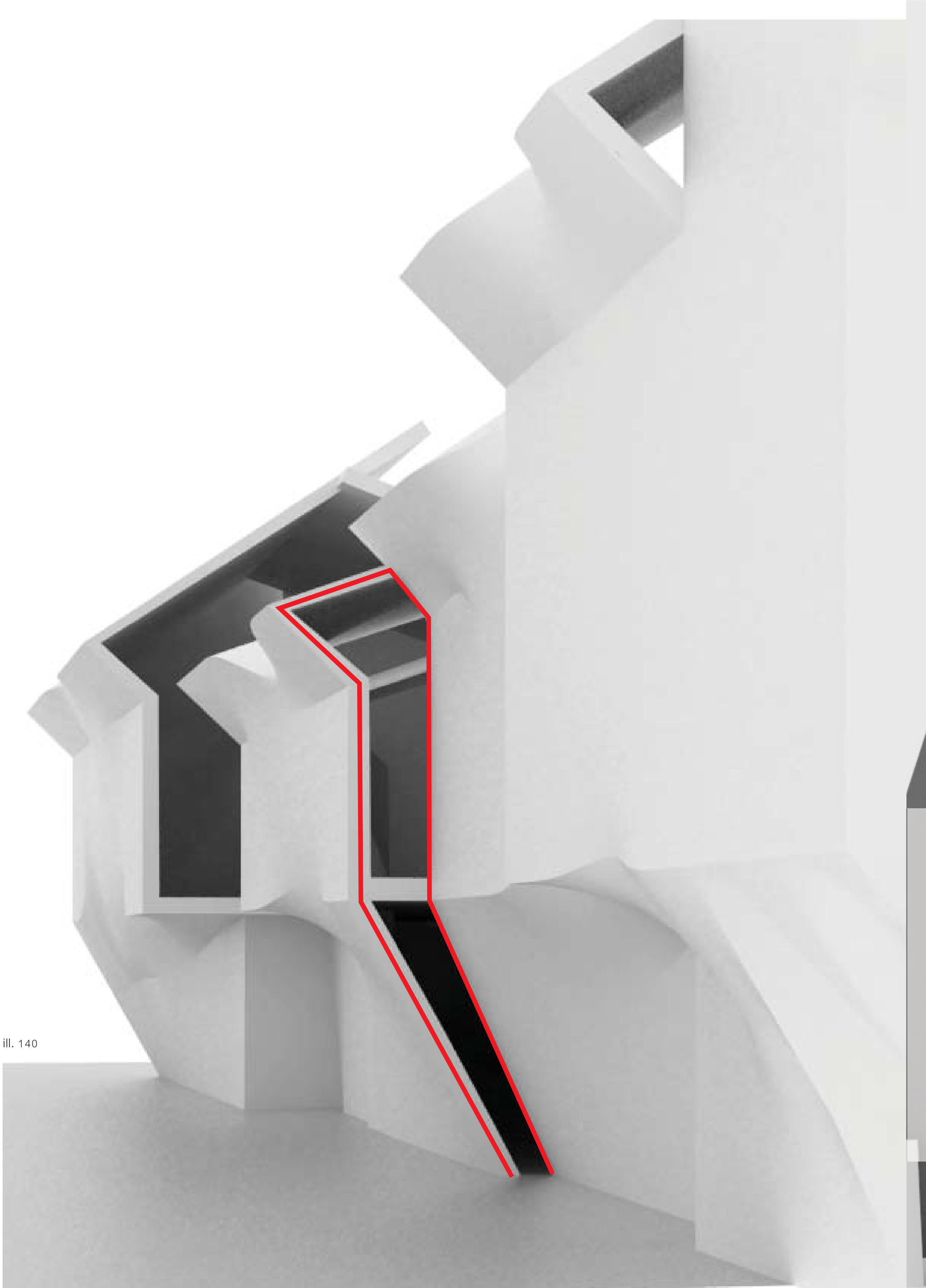
ill. 138

2.13
CLEAR VIEWS

The different size of each volume and the way they meet shiftedly according to each other results in gaps between them that are left completely clear of any surface. This introduces clear views to the surroundings from the exhibition spaces, changing point of views and placement of these from side to side of the series of exhibition rooms. Another element is the gap between the different height of roof lines and their shifted meeting, allowing for another source of natural light into the exhibition. This can be seen on ill. 139 -140

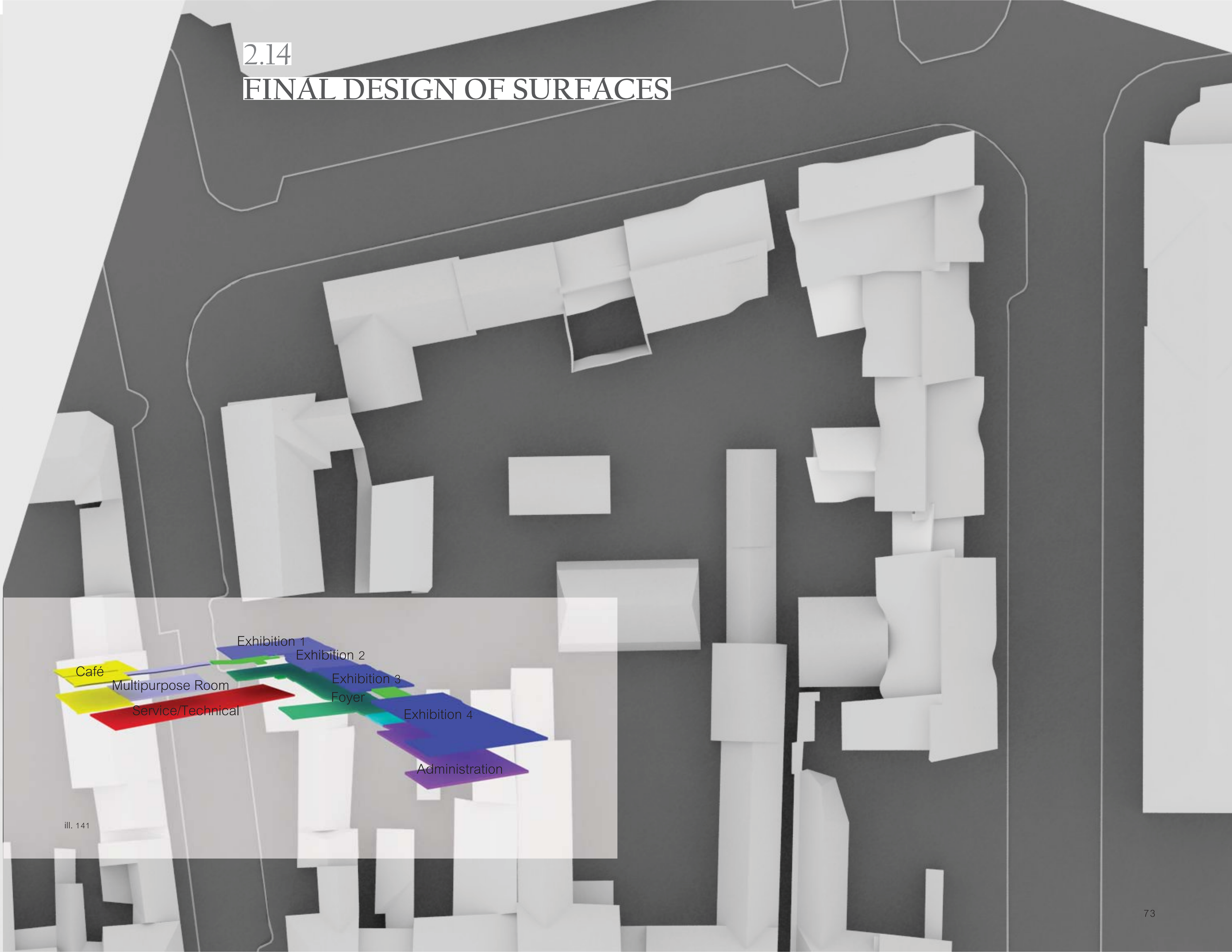


ill. 139



ill. 140

2.14
FINAL DESIGN OF SURFACES



ill. 141

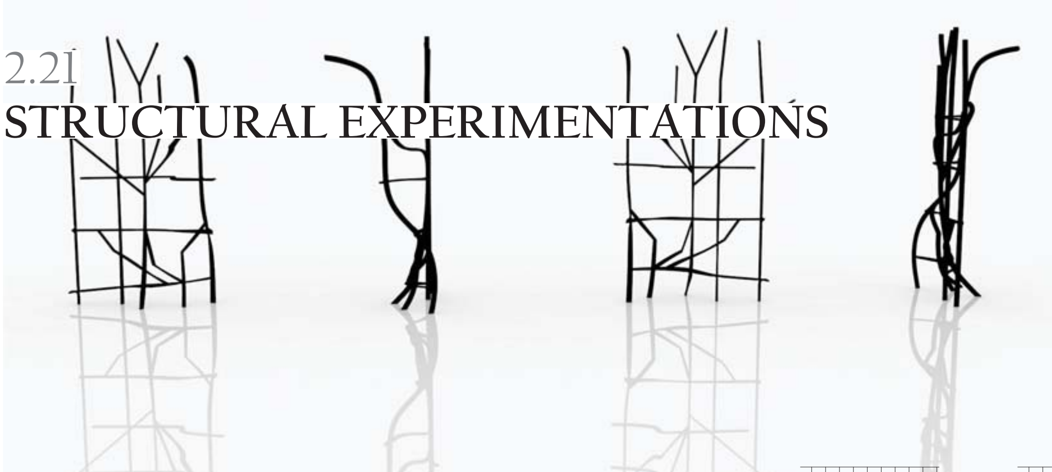
2.20
MATERIALIZATION

The first step in materializing the form in the previous explained process is developing a structural system. Before it is illustrated how this is done in this project, it is necessary to explain the importance of the wood elements in half-timbered buildings. The focus in this project has been put on how the wooden structure in half-timbered buildings is constantly present in the architectural aesthetic. The fact that the structural elements in the façade are first of all dividing the surface into several smaller elements is what characterizes this type of buildings from the exterior. The façade becomes a composition of lines and fill-ings, sometimes replaced with window openings. This first encounter with the building becomes an important part of the complete experi-ence when entering the building. In traditional half timbered buildings, built before the energy requirements started demanding thicker build-ing envelopes, the wood columns and beams are continuous through the section of the façade, resulting in as important and aesthetic element in the building´s interior as of the exterior. This is in this proj-ect regarded as one of the most important demands to the structure developed. When entering this type of building, the structural storytell-ing that began on the exterior is continued when the same elements show themselves in the interior façade. More layers are added to this experience through additional columns and several beams, often crossing and connecting to each other in the ceiling. This experience of constantly being able to see how the single elements in the entire structural system perform, is the very core of a half-timbered building. One can constantly follow and interpret how this building is structurally thought through, thus giving the entire experience of the building a high level of genuineness, or in other words, its archi-tectonic quality. Through the process of developing a structure for this project, these just explained qualities have been strived to implement, and this being an interpretation, refined to a more minimalistic expression that would tie together the form, structure, infills and other building elements into a more coherent whole, that is emphasizing the aspects of the experi-mental form with its transformations from the strict linier sections to the more organic areas of deformation. The process of developing the wooden part of the building envelope will be explained in the following chapters.

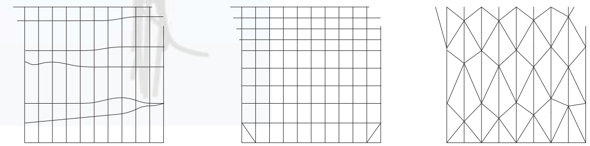
ill. 142

ill. 143

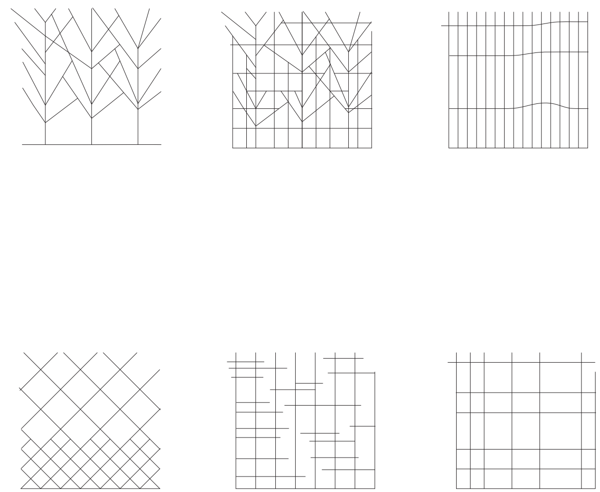
2.21
STRUCTURAL EXPERIMENTATIONS



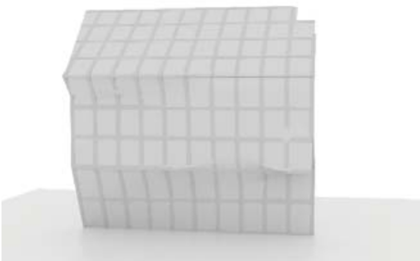
The first phase in developing a structural system for the form, was experimenting with the structure more as a pattern that would be applied to the surfaces, since pattern is an important part of the architectural language of a half-timbered building. The traditional way is operating with a more practical system where columns are placed with a certain distance between each other and the horizontal elements dividing the façade into a series of almost equally sized rectangles. The path to the chosen structural system in this project starts out with a more free approach where different types of patterns were tested in order to choose the one, best complimenting and enhancing the changes and area specific characteristics of the developed form. The different patterns shown to the left are inspired by different references or inspirations. They vary from being inspired by the curvature already present in the form, ideas of starting to implement the motif of trees into the façade, shifting the traditional rectangular grid 45 degrees to develop a grid of diagonals, to considering the vertical of the horizontal elements that follow no strict order other that placing them where they structurally perform the best. These different ideas of system can be seen applied to a façade on the next page. They are all iterations towards the chosen design of the project. They are not chosen with consideration to what is structurally the best performing, nor with consideration to how they should be assembled, but purely on how they aesthetically start dividing the façade into line elements and infills, and how that affects the way the transformations in the form are perceived.



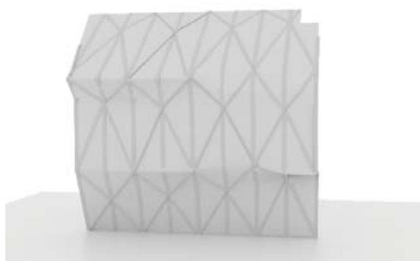
ill. 144



2.22
FINDING A STRUCTURAL AESTHETIC

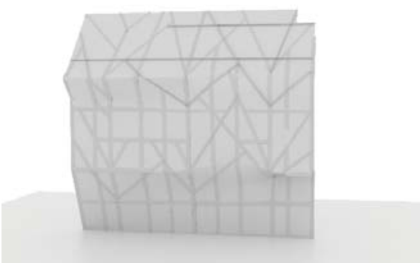


Traditional subdivision ill. 145

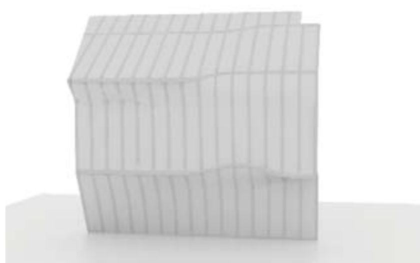


Vertical and diagonal subdivision combined ill. 146

Tree structures ill. 147



Traditional and Tree blend ill. 148

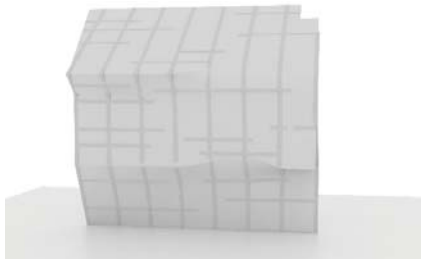


Extensive vertical subdivision + horsontal lines following the deformations in the form ill. 149

45 degree rotated traditional subdivision with 2 layers of intensity ill. 150

The different patterns were translated into structural systems for the façade and evaluated for their coherence or ability to communicate the changes in the form, or if it could bring another layer to the façade that might deviate, but in its correlation make a coherent understanding of the dynamic changes taking place. The different iterations will not be thoroughly described since their importance in the further process is minimal, but instead their effect will be discussed.
The traditional and the 45 degree rotations both had strong ties to what is understood as half-timber construction but lacked quality in really underlining and emphasizing the most important element in the form, transitions, and in that way became alienated.
The combination of the vertical and horizontal subdivisions introduced a pattern of divided diamonds that as reinterpretation of the traditional half-timber structure took it from frame to grid. But as with the previous experiments, it ignored the importance of the bending horizontal lines, and thus became a foreign element in the complete impression.

The tree structure, both the pure version and the blend, was intended to implement the motif of buildings and trees - so very present at the site - into the façade itself, thus emphasizing their close relation. The system would in a further refinement mean that the thickness of each single element of the structure should be designed in order to give an image of the thicker and solid trunk and a finer branching. The concept was discarded due to similar reasons as the previous.

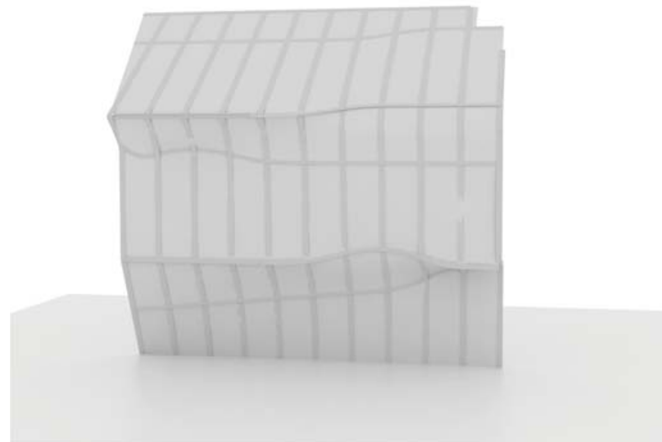


Uniform vertical subdivision combined with sporadic horisontal elements ill. 151

Sequencially diviating horisontal and vertical subdivision ill. 152

The extensive vertical subdivision combined with horizontal elements following the deformations in the form was so far the concept that best emphasized the changes in the form. The vertical elements draw sectional lines that give a clear understanding of the changes in the façade, while the horizontal elements draw attention to the effect these changes have in the meeting between ground level and 1st level.

These systems were experimented with further by first only keeping the vertical subdivision and then play with more sporadic horizontal elements, based on an idea of only inserting these where they had the highest structural performance. This had some effect in starting to view the shape as more horizontal dynamic, but the relation between the dynamic effect of the horizontal elements and the dynamic movement



Chosen base for the final structural system: Vertically uniform subdivision (sequence to be further developed. Horisontal elements based on the existing transformations from rigid to organic, to further emphasize these characteristic areas. ill. 153

of the form did not meet in a coherent understanding, thus in a way alienating each other that was the opposite of what was intended. The last of the iterations put both the horizontal and vertical elements into play by starting to break the set linier sequences into shifting distance. The result only confused the understanding of the form, by not having a clear rule or intention of why one element should be placed further away from the other than the previous.

This led to returning to the strict linier vertical subdivision and horizontal elements following the curvature in the façade but lowering the amount of the vertical elements. The proportion between the surface area and the number of subdivision did still not seem right, but the further refinement would need to take structural performance and thickness of elements into consideration, thus leading to the next phase in the process of materialization, iterations with FEM software.

2.23
TESTING THE STRUCTURAL SYSTEM

In order to more precisely develop a design for the structural system chosen in the previous subchapter, a series of FEM iterations are carried out. These are all focusing on the volume at the north eastern corner, since this is the volume with the largest spans, highest walls and longest spanning roof, thus giving the highest structural challenges of all the volumes in the design. This also implies that an acceptable performing structural system in this volume can be used in the other volumes without a chance of failure since these all are less structurally challenging and designed based on the same rules in their form.

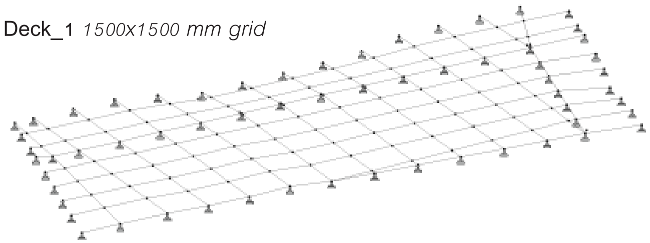
The FEM iterations were divided into three phases. The first two were focusing on establishing a rigid frame in 1st level height that together with the fixation of the columns in the ground and their horizontal running beams would generate a solid base for the remaining structure.

The façade and roof structure were not tested together with the deck due to wanting to simplify the iterations, allowing changes to be tested more quickly. This gives some results in the analysis that needs to be considered according to how they would be in the complete system. This is explained later in this chapter.

The load's cases applied in the different iterations are shown on the opposite page.

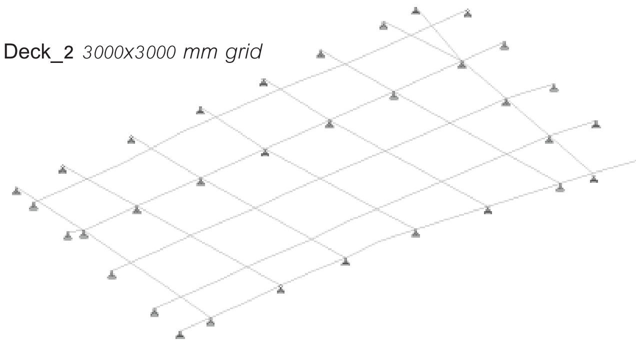
The first series of iterations were done on a deck, constructed as a framework originating from each of the columns in façade, with a spacing of 1.5 meter. It was tested with different profiles all with material properties of Glulam GL24h.

Deck_1 *1500x1500 mm grid*



ill. 154

Deck_2 *3000x3000 mm grid*



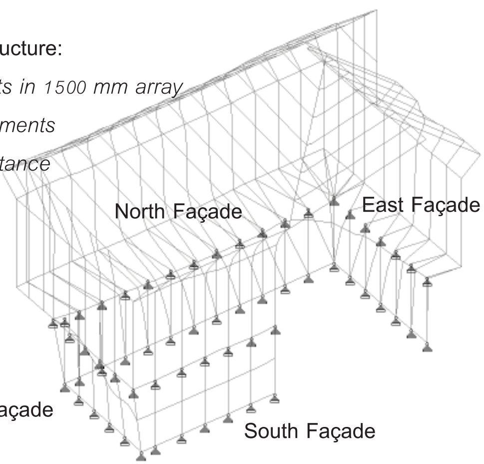
ill. 155

Façade+roof structure:

Vertical elements in 1500 mm array

6 Horisontal elements

with varying distance



ill. 156

2.24
LOAD CASES

Load Cases Deck_1 1500x1500 mm grid:

Self weight: -
Service Load: -6.75e-006 KN/mm

Material Specification 1500x1500 mm grid:

Glulam GL24h
E-module: 11600
Recommended max stress levels:
Tension: 11,8 N/mm^2
Pressure: 17,8 N/mm^2

Load Cases Deck_2 3000x3000 mm grid:

Self weight: -
Service Load: -0,0006 KN/mm

Material Specification 3000x3000 mm grid:

Glulam GL24h
E-module: 11600
Recommended max stress levels:
Tension: 11,8 N/mm^2
Pressure: 17,8 N/mm^2

Load Cases Deck_1 Façade+roof structure:

West Façade:
Selfweight: -
Wind Load: 0.003885 KN/mm (pressure)

North Façade:
Selfweight:-

East Façade:
Selfweight: -

South Façade:
Selfweight: -

East Façade:
Selfweight: -
Windl Load: 0.001665 KN/mm (suction)

Roof:
Selfweight: -

Entire Stucture:
Weight of infill material: -0.003 KN/mm

Glulam GL28h
E-module: 12600
Recommended max stress levels:
Tension: 14 N/mm^2
Pressure: 20,3 N/mm^2

2.25
STRESS TEST ON DECK_1

ill. 157-163

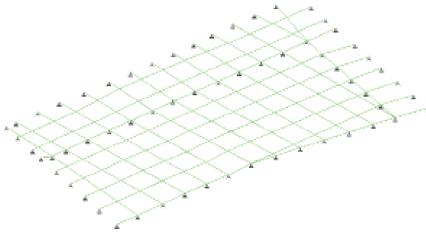
200x50 mm

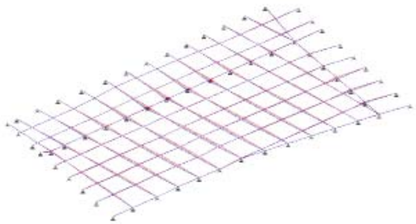
Node Displacement:

Max less than 7 mm

Beam Stress:

Max less than 7 N/mm^2





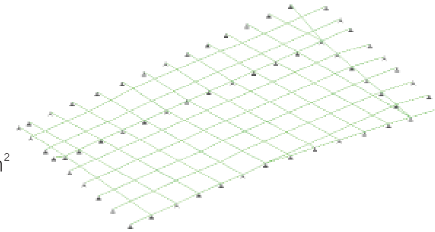
200x100 mm

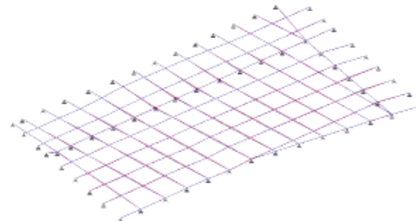
Node Displacement:

Max less than 6 mm

Beam Stress:

Max less than 3 N/mm^2





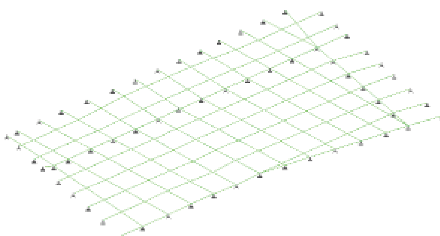
250x100 mm

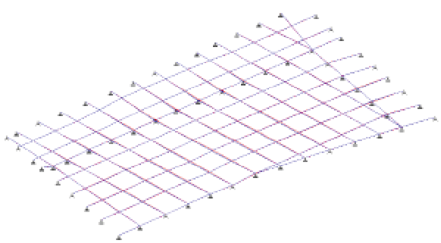
Node Displacement:

Max less than 4 mm

Beam Stress:

Max less than 3 N/mm^2





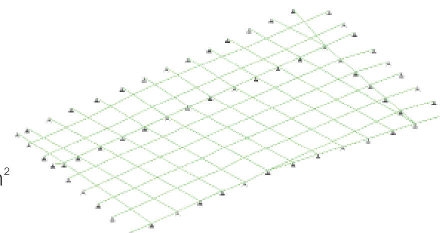
300x150 mm

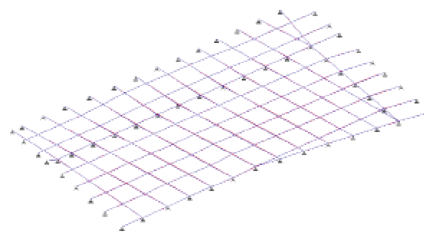
Node Displacement:

Max less than 3 mm

Beam Stress:

Max less than 2 N/mm^2





2.26
STRESS TEST ON DECK_2

ill. 164-170

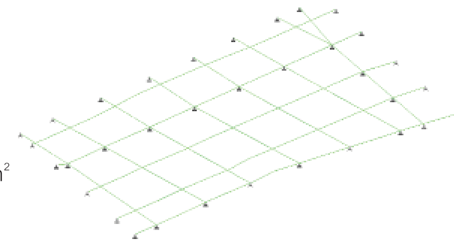
300x150 mm

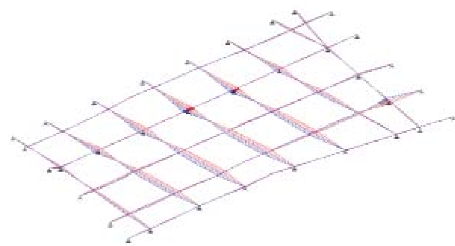
Node Displacement:

Max less than 10 mm

Beam Stress:

Max less than 8 N/mm^2





250x100 mm

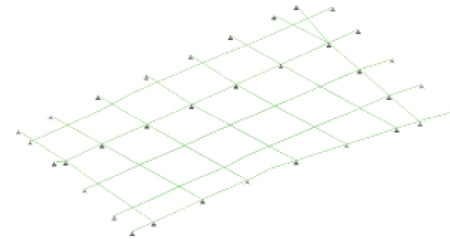
Node Displacement:

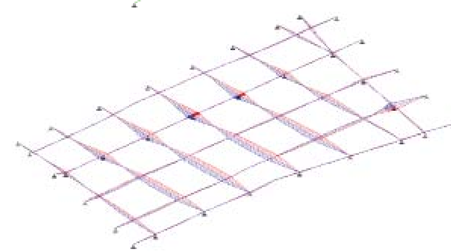
Max less than 25 mm

Beam Stress:

90% max 11 N/mm^2

10% max 18 N/mm^2





300x100 mm

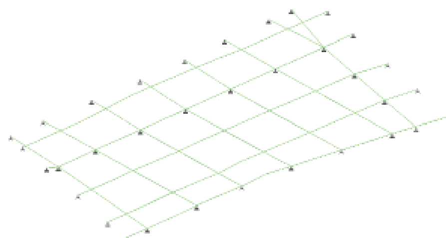
Node Displacement:

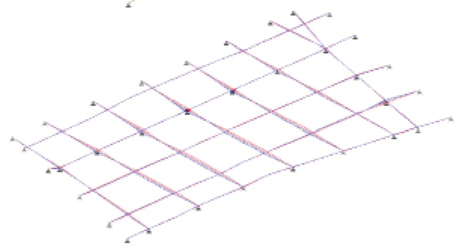
Max less than 16 mm

Beam Stress:

90% max 11 N/mm^2

10% max 16 N/mm^2



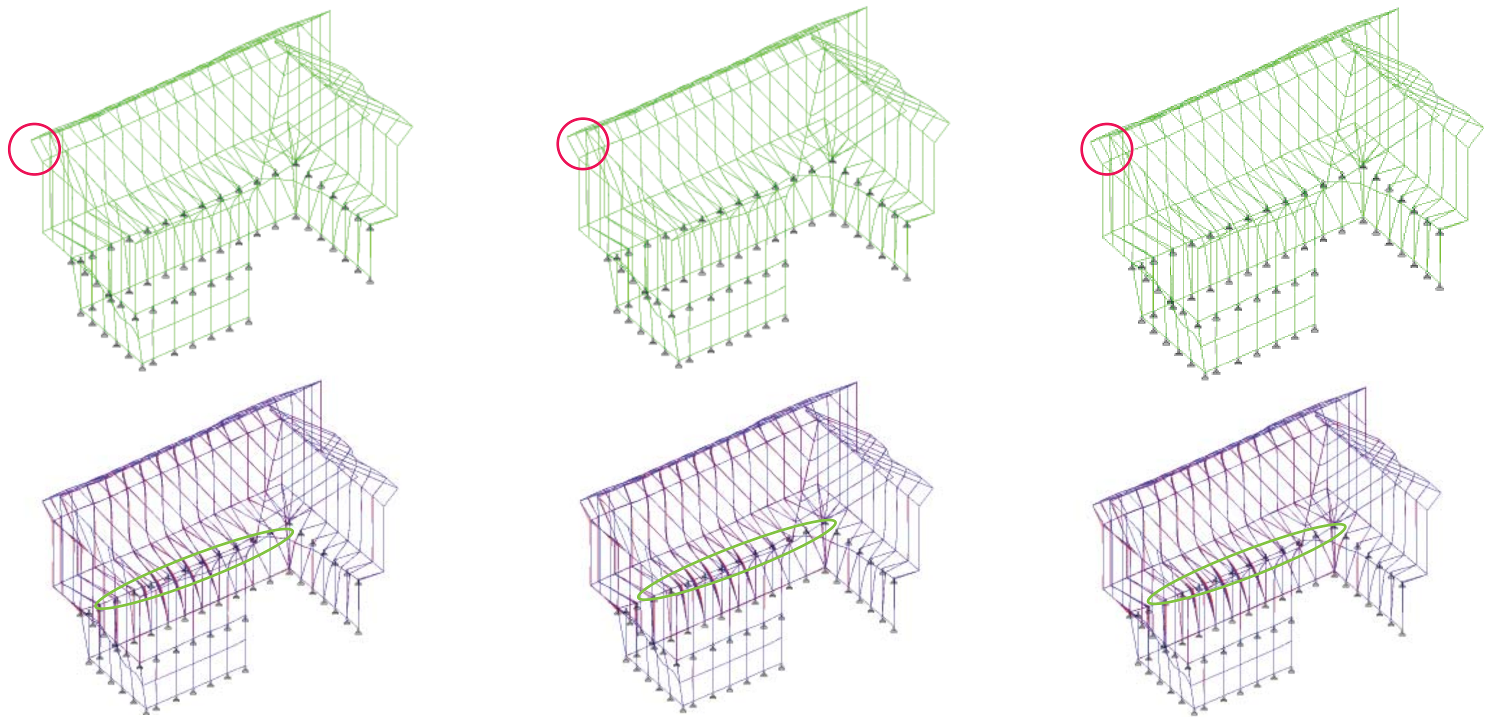


Using profiles with a low dimension of 200x50mm (see opposite page) the node displacements were low and max stress results only 2/3 of what is acceptable. This meant that the initial constructed structural system based on 1.5 meter spacing in order to not be excessively over dimensioned has to be reconsidered, unless thin elements of wood are used. This is not intended since it gives a less clear understanding of the wood, being the main structural element in architectural understanding and possibly give a false impression that the infills, which are only meant to provide enough stability in order to maintain their shape, are the structural important.

The next phase of iterations were done on a frame work using a 3 meter spacing, and here there was a better relation between the amount of material wanted for aesthetic reasons and the amount needed for meeting the structural demands.

2.27
STRESS TEST ON FACADE+ROOF

ill. 171-176



150x100 mm

Max relative beam displacement:

Less than 0,3 mm

Node Displacement all within acceptable, one corner would need rework see ill. - marked in red

Beam Stress:

80% max 14 N/mm^2

10% max 60 N/mm^2 (These are all in the marked in green areas)

200x100 mm

Max relative beam displacement:

Less than 0,02 mm

Node Displacement all within acceptable, one corner would need rework see ill. - marked in red

Beam Stress:

85% max 14 N/mm^2

10% max 30 N/mm^2

5% max 50 N/mm^2 (These are all in the marked in green areas)

250x100 mm

Max relative beam displacement:

Less than 0,02 mm

Node Displacement all within acceptable, one corner would need rework see ill. - marked in red

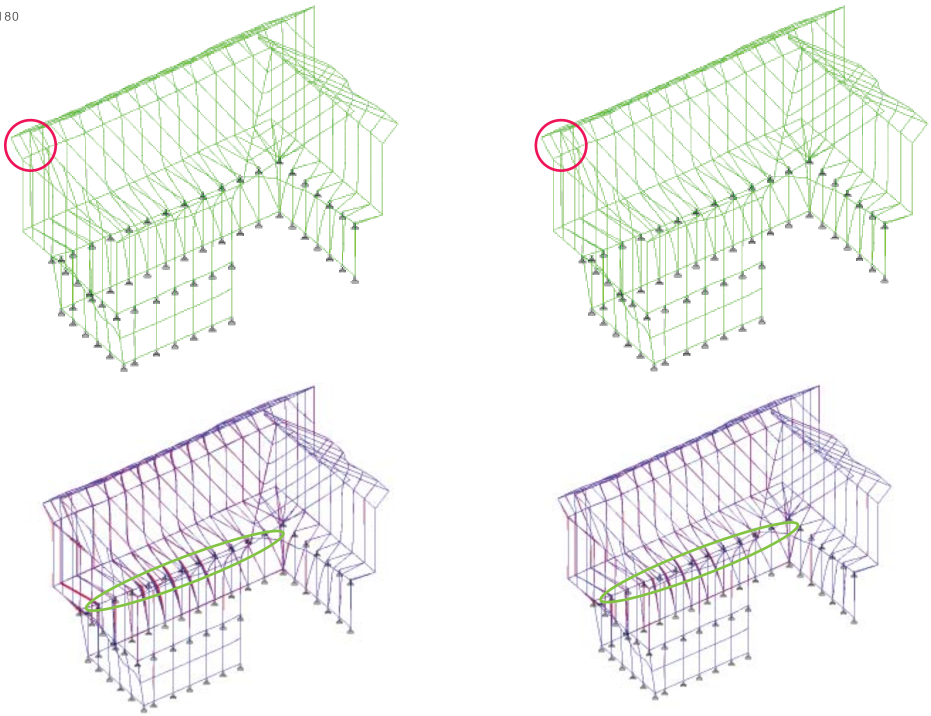
Beam Stress:

80% max 8 N/mm^2

10% max 15 N/mm^2

5% max 20 N/mm^2

5% max 40 N/mm^2 (These are all in the marked in green areas) ill. 177-180



300x100 mm

Max relative beam displacement:

Less than 0,01 mm

Node Displacement all within acceptable, one corner would need rework see ill. - marked in red

Beam Stress:

85% max 5 N/mm^2

10% max 14 N/mm^2

5% max 25 N/mm^2 (These are all in the marked in green areas)

300x150 mm

Max relative beam displacement:

Less than 0,01 mm

Node Displacement all within acceptable, one corner would need rework see ill. - marked in red

Beam Stress:

85% max 4 N/mm^2

10% max 14 N/mm^2

5% max 20 N/mm^2 (These are all in the marked in green areas)

The next phase of iterations was done on the façade and roof structure. The iterations were done using the original spacing of 1.5 meter. The results of the iterations have to be read with a consideration in mind; they do not include the frame work of the deck and thus do not include the structural and stability improvements this would add to the system. As such, these iterations were not meant to give a final clear answer to the precise spacing needed but to evaluate whether or not the further work on the proportioning of the resulting divisions in the façade could increase in area or had to become a finer mesh. This means that where the top volume has the longest free hanging span, the north façade, there was a constant showing of too high stress levels. How they are dealt with is explained later, but it is important to mention that this area only makes up for a very small percentage of the entire system that otherwise tested stable and well performing.

If a profile of 200x100 was used, 85% of the structure would have stress levels within what is recommended for Glulam GL28h which was the material properties used in these iterations. The iterations continued showing improving results for the entire structure as the dimensions of the profile increased which also was the intention. The last iteration was done using a 300x150 mm profile. If the structural elements had to be visible both from the inside and the outside, with reference to the importance of this visual characteristic of half-timber constructions described in the beginning of this process of structural development, a profile of this dimension would result in an envelope thickness of around 300 mm. This would allow for, depending on how the infill elements are constructed, a highly insulating building envelope and improve the energy usage of the building.

The 300x100m profile was chosen for the final design. 85% of the elements showed stress values that were almost as low as ¼ of the recommended maximum. This meant that the amount of elements could be reduced significantly, without fear of structural failure. The

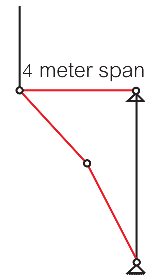
2.28
SOLUTION TO HIGH STRESS LEVELS

final design is based on a 2.5 meter spacing. This specific design has not been tested using FEM but based on the results on the 1.5 meter spacing analysis is considered to stay within the acceptable limits. If a FEM analysis on the final design would result in values that were a little too high for large parts of the entire structure, the Glulam GL28h could be replaced with GL28h, resulting in a higher E-module and density, thus higher recommended maximum stress values.

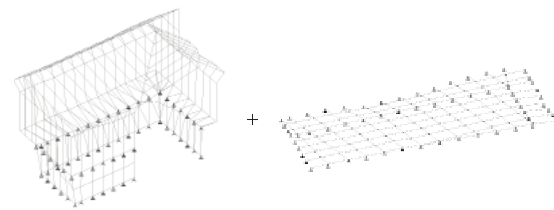
The last part of this process of defining a structural system focuses on the area that kept having unacceptable stress levels, the large free hanging span on the north façade. The series of illustrations to the right shows the elements with too high stress levels, and how this can be resolved. The first step that should be done is to test the entire system where the deck´s frame work is included. The beam element in the test of the façade and roof system is not continuing into the deck, thus not tested as a part of this, but instead as one element between two node points. In the final situation this is a much longer beam, that is fixed in several points in the framework. This will result in a much stiffer beam, and, therefore, transfer a larger part of the forces to the entire system. If that would show not to be enough, a diagonal member could be introduced from the bending point in the slanted column to the top of the vertical. This would make the entire area into a lattice construction and further improve its structural performance. With these considerations in mind this concludes the FEM analysis' part of the structural development.

ill. 181-184

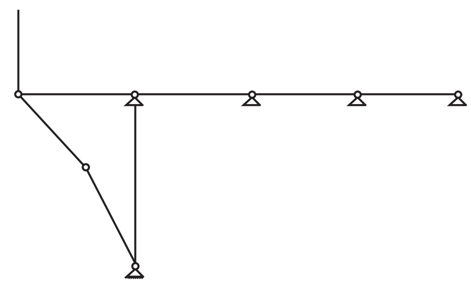
Members with too high beam stress levels



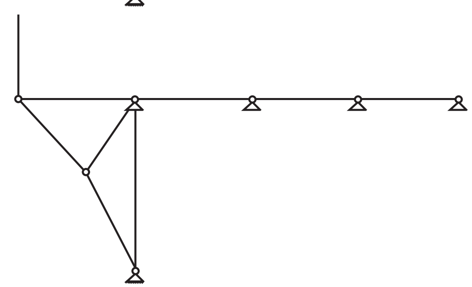
Real situation would be a combination of these façade+roof and deck



Spanning beam is part of a longer beam fixed every 3 meters



Alternative solution would be adding diagonal member in façade with 4 meter span

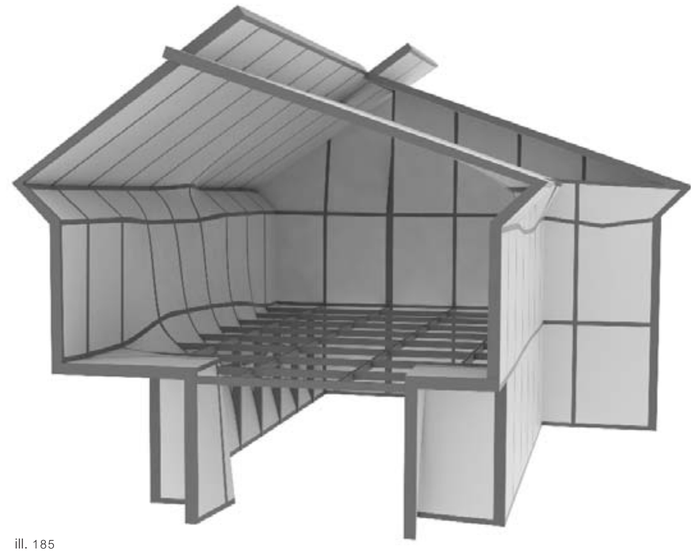


2.29
STURCTURAL SYSTEM CHOSEN

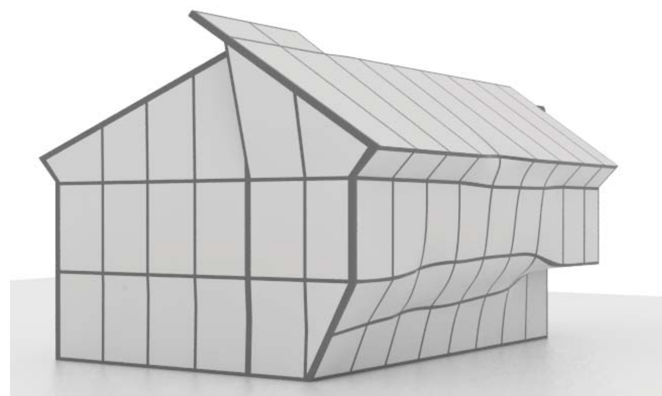
The chosen structural system consists as previously mentioned of vertically elements arrayed along the façades with a 2.5 meter interval. They run from the ground and all the way to the top roof line; one continuous line that adapts to the creases and the curvature of the section of the form where they are placed.

The horizontal elements underline the buildings meeting with the ground, emphasize the deformation from free hanging span to a slanted wall, the end of the ground floor and the beginning of the 1st floor, roof overhang, and the start and end of the roof. In its curving lines it follows the deformations occuring in these areas, marking where the centerline used to be before the deformations took place.

The subdivision of the façade is in rectangular elements, almost all are different from each other, some recognizable from a distance, others not showing their specific unique characteristics before a closer look is done. The deformations in the façade are visible in the interior along with the bending structural elements. This changes the strictly geometrically defined spaces in areas where soft curving parts of wall or ceilings extend into the room and continue the architectural storytelling through the entire building, giving a constantly developing spacious experience.

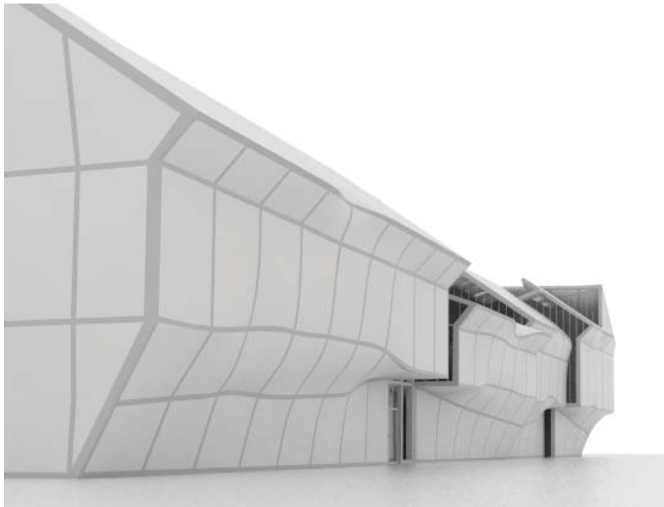


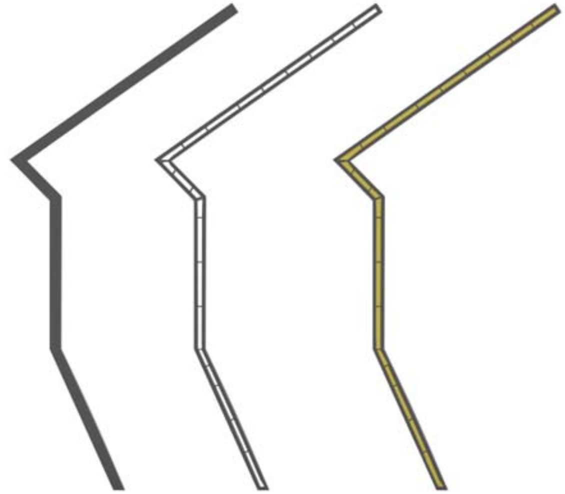
ill. 185



ill. 186

2.30
VERTICAL FACEDE ELEMENTS

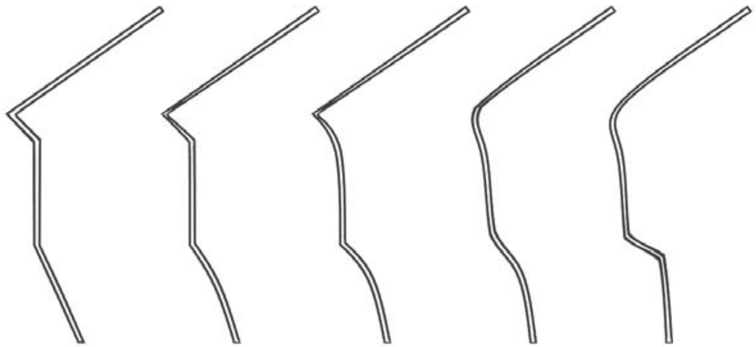

ill. 187


ill. 188

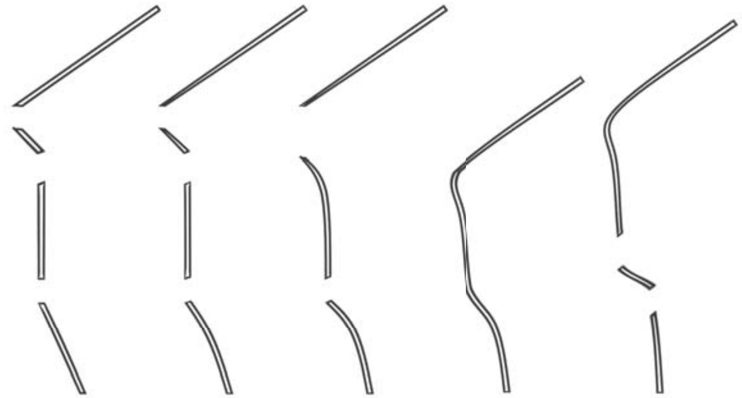
The vertical façade elements - the columns - are a strong part of the architectural language, both in the building's exterior and interior. Due to the low u-value of wood, one 300 mm thick column extending from the exterior to the interior does not reduce the energy performance of the entire building complex noticeably, but when they become such a big part of the building envelope as the case in this design, the linear thermal transmittance of the columns becomes an element that can result in a higher energy demand, thus working against the intention of Møntergården Museum of a new exhibition building, capable of meeting the requirements of Low Energy Building Class 1. Due to this consideration the columns and beams are split into two and connected with smaller pieces of wood. This reduces the linear thermal transmittance drastically and has the benefit of lowering the weight of the column itself while preserving its structural performance. The space between the two elements is filled with rigid insulation to improve its energy performance and adds further stability to the columns and beams.

Due to the changes in the form along the façades the structural elements will have to adapt to these. Focusing on the columns, they change drastically from one end of the façade to the other. This is the beginning of another material story told in the collected perception of the façade - the change from one element into several.

Illustration 188 shows how the different elements change along one of the façade. It is a change from a hard corner to soft curving changes of directions. This implies that at certain places the column cannot be a continuous element from ground to top roof line, but must be made of up to four individual parts that connect together, forming the final structure. This can be seen on illustration189 where the five vertical elements used in the exemplified façade are shown in their individual parts. These changes from 4 to 3 to 1 to 3, depending on their place-



ill. 189

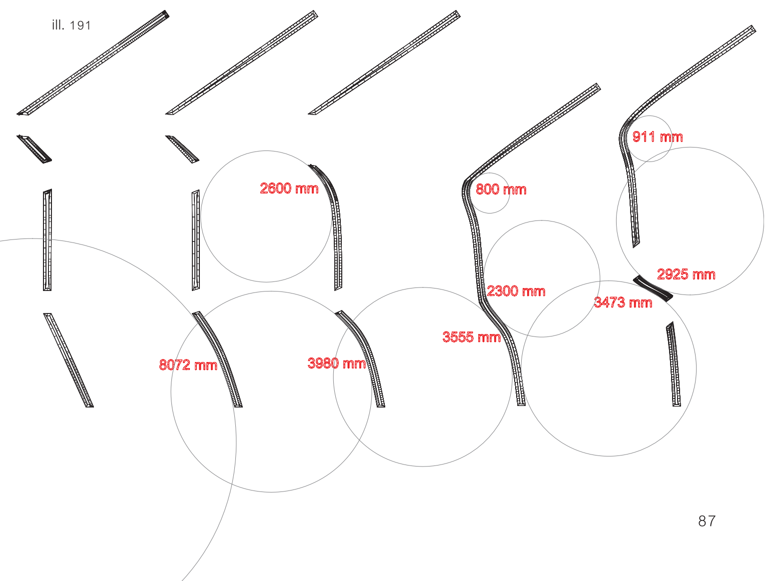


ill. 190

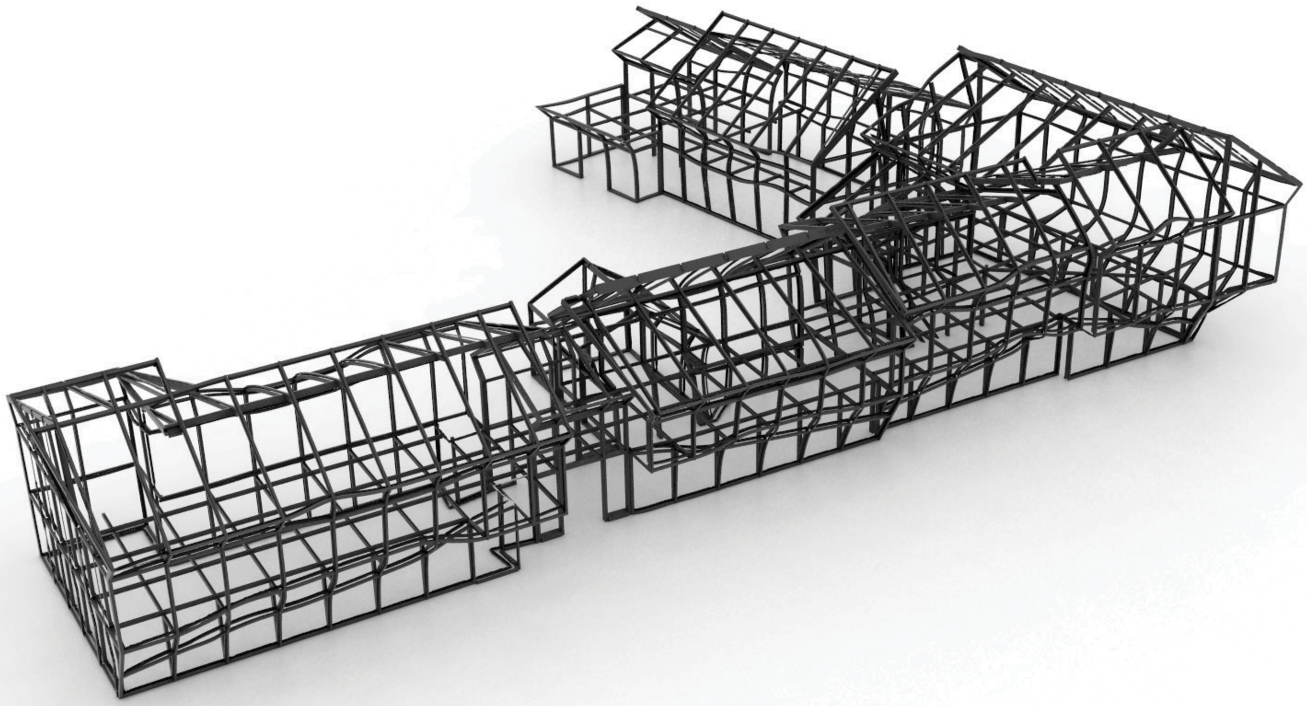
ment in the façade. The previously mentioned material story told in the façade is based on these changes. If one looks at a column, the amount of connecting elements will vary compared to the column standing next to it that might be placed at slightly different heights etc, telling the story of the production technology and its limitations.

The material chosen for the structure is Glulam, which can be bent. Depending on the refinement of the production facility, these bends can be done with radiuses as small as around 1 meter. The smaller the radius, the finer the lamellas need to be used in gluing together the beam. This means that the finest bends should be where they are to perform least structurally. If looking at illustration 191, it can be seen that the radius of the bends decreases towards the top, automatically meaning that the level of stress from the collective loads and forces acting on the structure decreases. This integrated parameter allows finer bends at the top and results in smaller bend radiuses where the material's rigidity is most important.

ill. 191



2.31
COMPLETE WOOD STRUCTURE



ill. 192

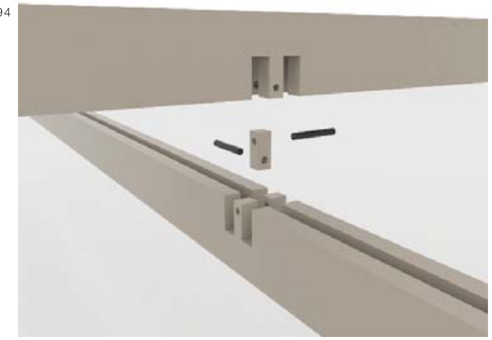
2.32 CONNECTIONS _DECK BEAMS

ill. 193

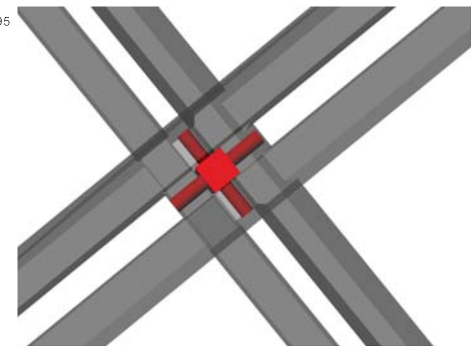
The wooden beams carrying the deck are an important part of the interior aesthetic in the ground level foyer area. As described in the introduction to this subchapter, the structural storytelling in traditional half-timber building is one of its most distinct characteristics. This also made it clear that these elements should be visible in the ceiling as extruded lines, dividing the plane white surface in a grid of squares, connecting each adjacent column. In the traditional half-timber construction, the beam elements are often the same sectional dimension as the wood used as columns in the façade. Another noticeable feature is how they are placed on top of each other, often with little overlapping or grip, resulting in a less rigid framework. The reinterpretation of this construction done in this project is striving towards a more minimalistic solution, where connections become an integrated feature that does not reveal itself before a closer look is taken.

The columns that the beams connect to are all 300x150 mm, which is to keep the proportions fort the beams the same in order to make clean connections between a beam and a column. Each beam is divided into two thinner elements, 60mm with 40 mm spacing. This

ill. 194



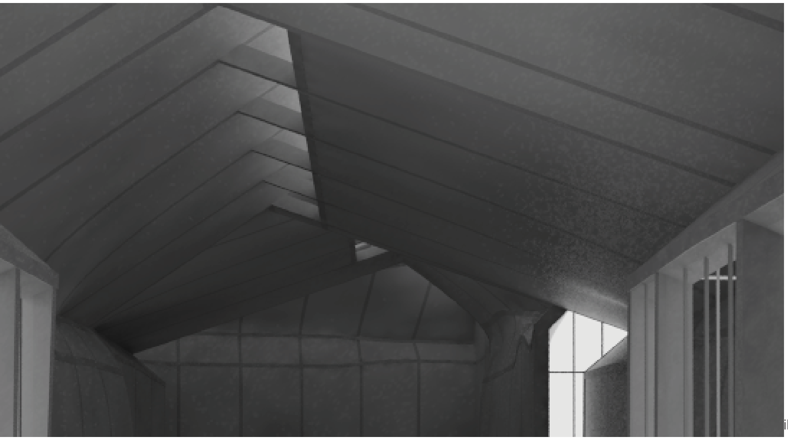
ill. 195

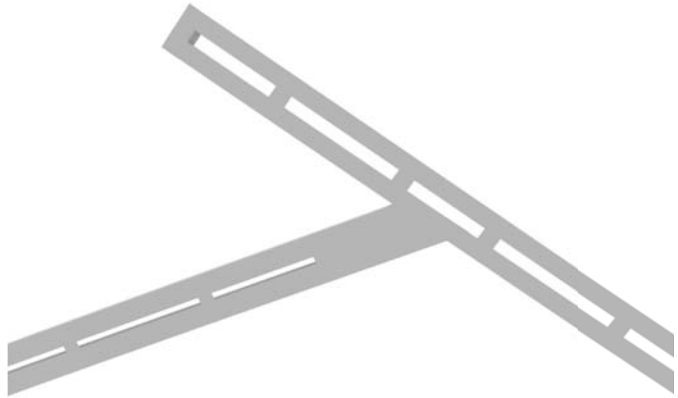


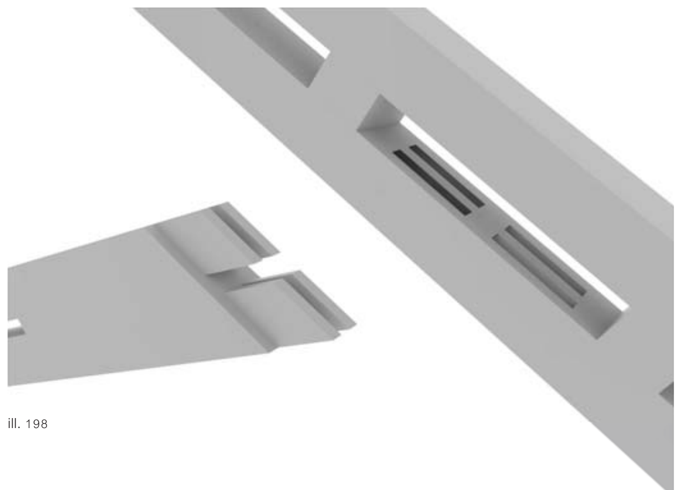
emphasizes the path each beam travels along the ceiling, and gives it a more dynamic expression that is better suiting to the rest of the buildings dynamic and elegant expression.

Crossing beams meet in two different heights and are precut to fit exactly into each other to form a rigid joint that is important for the framework. The connection is further strengthened by inserting a wooden lock in the connection's center point, and locking each beam with a dowel. This solution is inspired by the traditional building style where the dowel played an important role in the stability of the construction.

2.33
CONNECTIONS - ROOF BEAMS

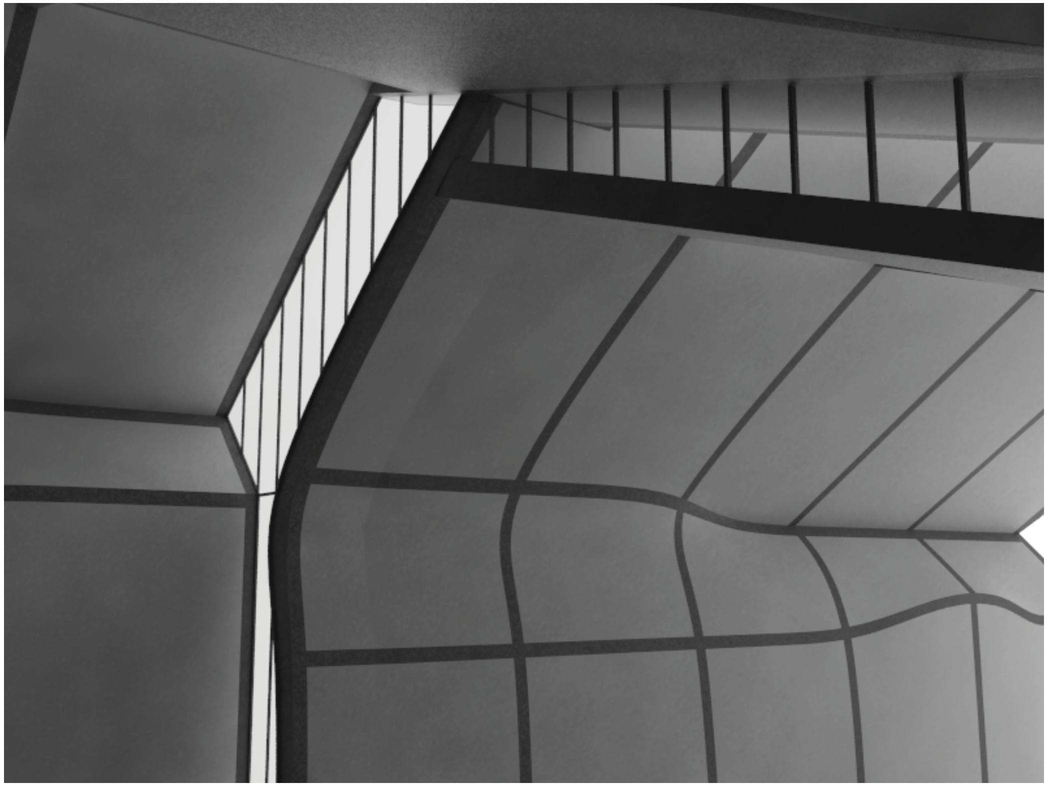

ill. 196


ill. 197


ill. 198

The ceilings in the exhibition spaces are a series of different angled planes referring to the traditional saddle roof, characteristic for the Møntergården complex. The impression of each volume's meeting with another is a dynamic encounter where light enters from the outside; one roof does not align with the one to follow, and this shifts the centerline of the room constantly when walking through the exhibition, and breaks the entire volume into smaller volumes, referring to the close and shifted meeting between city houses. This effect is a strong element in the spacious experience, and in order not to add another element like more complicated and exposed connections between wooden elements, the connections in the ceiling are hidden within the elements themselves. This minimalistic solution is chosen to prevent the architecture not to become too dominating in the exhibition space, avoiding disturbing visitors encounter with the exhibited art.
The two sides of one roof are angled differently, giving the impression that one side is carrying the other. The intention of hiding the connection is to enhance this experience, making it seem like it is only the end of the carrying roof's beams that touches the beams in the other - as if there is no rigid connection, but only two angled planes in balance, enough to maintain their span.

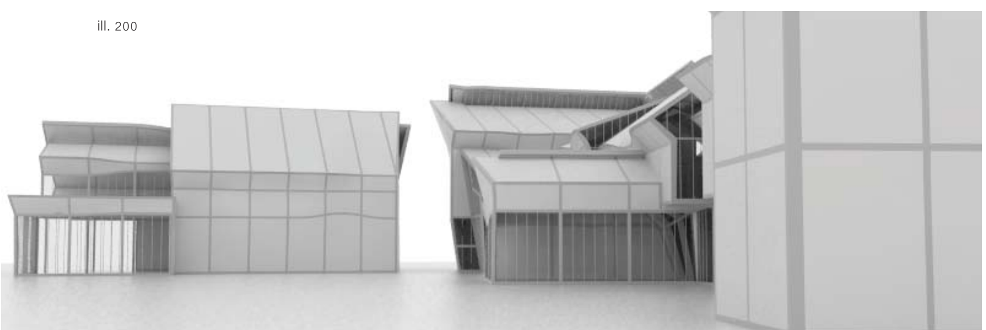
2.34
FROM WOOD TO WOOD



ill. 199

An important architectural element is how the façade surfaces begin, end and meet. Every end of a surface ends in a wooden element – base, sides and roof line. This is a consequent element through the entire museum building and the multi purpose/café building. The gaps between surfaces, light and clear view points are closed off with glass and thin mullions, striving at disturbing as little as possible. These glass openings always connect from wood to wood and never break or interrupt the concrete fillings, thus not having to introduce and frame material in connection with the concrete. In areas of the building where larger parts of the façade are opened up with glass, the entire concrete infill is removed completely to again have glass always extending from wood to wood. This is done to have minimal confusion about the architectural principles used in the museum and to not disturb the way the dynamic reading of collective form itself, the transitions from strict geometry to organic movements.

ill. 200



2.35
IN-BETWEEN STRUCTURE

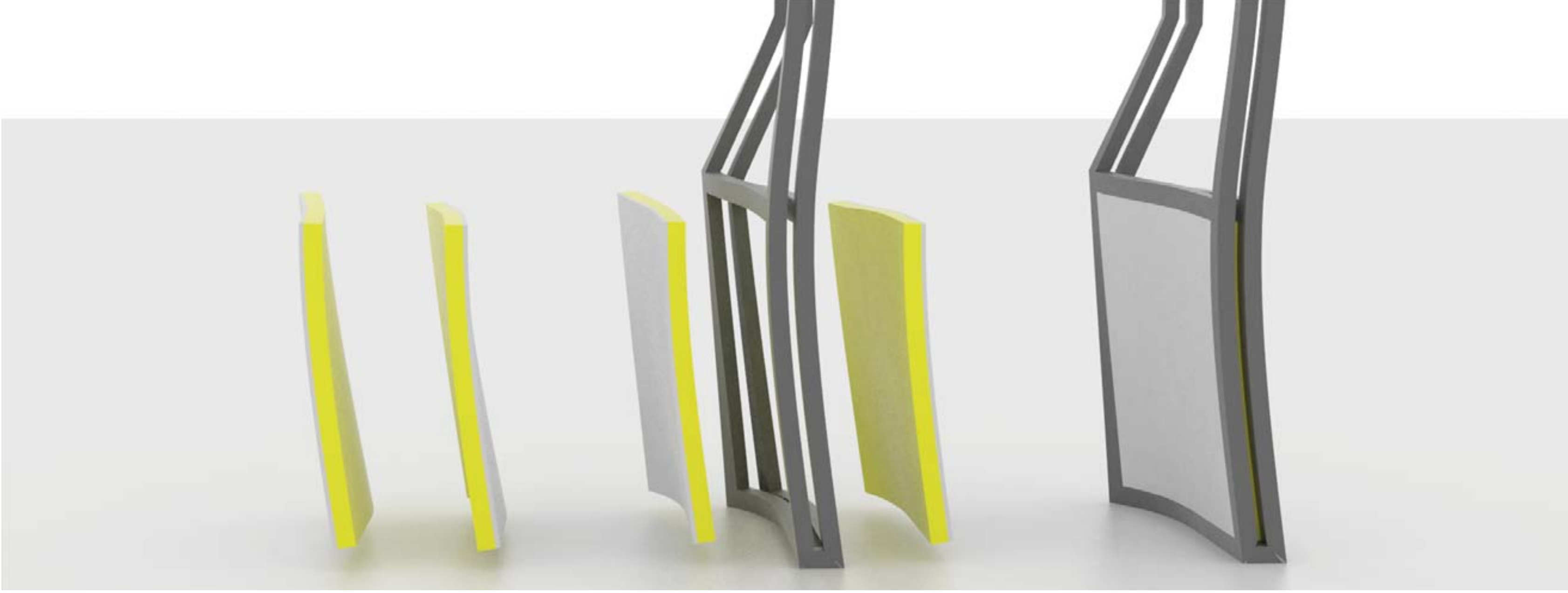

ill. 201


ill. 202


ill. 203

The following sub-chapters will focus on the infill, the second material besides wood, defining the surfaces. Traditionally this was brick work, and depending on the financial situation of the client this could be more or less elaborative in decorative patterns, colour of bricks and detailing. The inspiration used in the design of the infill and its relation to the wood work in this project is much more modest. The old wall running along Møntestræde that needs to be removed as it is located on the building site – see ill. 201, has both brickwork and painted wood, resulting in a slight change in nuance. The distinctive brick pattern looses its clear outline of mortar around each brick, and only the indention around is left, making it a matter of only light and shadow. The close nuance difference between wood and brick is another inspiration used in this project, where once again the focus on the difference between the materials is shifted to the different material pattern of wood and brickwork, finer to more rough indentions, thus light and shadow. The material chosen to produce the infills for the new exhibition building is concrete since this makes it possible to produce thin light weight shells, strong enough to support itself and increase the stability of the collected structure. Indentions in these shells can start imitating the material pattern of brickwork, and thereby become a reference to how these infills were produced in the traditional half-timber building.

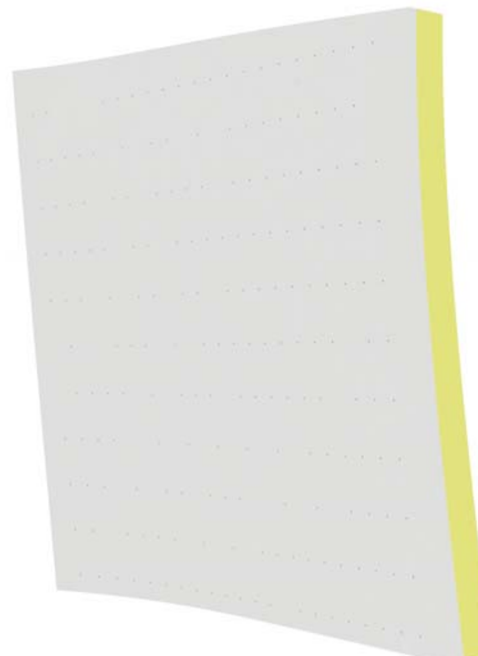
The various shells in the new museum building are more or less all unique making it necessary to think of them in terms of production as being able to produce the same way, in order to set up a production line effective enough to minimize their cost. Here the reference from Danish Technology Institute presented in the “Archi-Tectonic Strategy” in “Define”-phase of this report is suggested as a method. Using robots to produce the form work in foam will make it possible to upload the dimensions and shape of each shell to the robot, and then start carving the inverse shape out of the foam block. A production method that is relying more on hours of technology working than on expensive man-hours.
To further enhance the material experience and reference to half-timber buildings, a bump map is applied to each carved formwork, creating small indentions in the final produced shell that will produce a difference in light and shadow on the shell – see ill. 203.



ill. 204

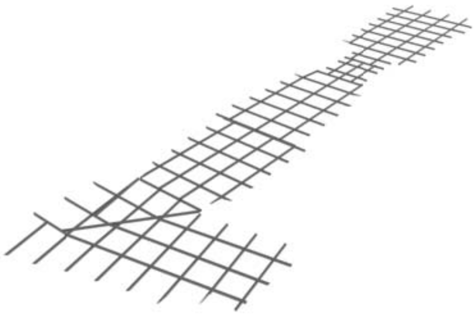
If the shells are produced in high performing concrete, they can be produced with a thinness around 2-3 cm. With a wall thickness of 300 mm this will allow for up to 240-260 mm of insulation, which further improves the collective energy usage of the museum building to stay within the limitations of a Low Energy Building Class 1. The insulation is placed in each shell at the production facility along with the space needed for any installation in the specific shell. The shells are then delivered complete to the construction site where they can be placed in their specific location in the Glulam construction.

Due to the long and high exhibition room, with hard materials like concrete and wood, the acoustical quality needs to be addressed. The size of the volume and the little sound absorption ability of the materials will result in long reverberation time – producing an echo effect, which is the opposite of what is intended in an exhibition room where quite talk and video projections are part of the sound scheme. In order to control the acoustic in the exhibition, a second version of the shell is produced. Small holes are made in the shell where sound absorbing material is inserted, with the same white colour as the concrete. Before these are produced, a thorough analysis of the acoustics must be done in order to determine the amount of sound absorbing material needed and the optimal placement of these in the rooms.

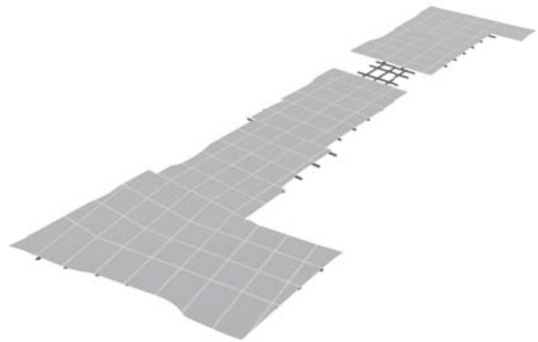


ill. 205

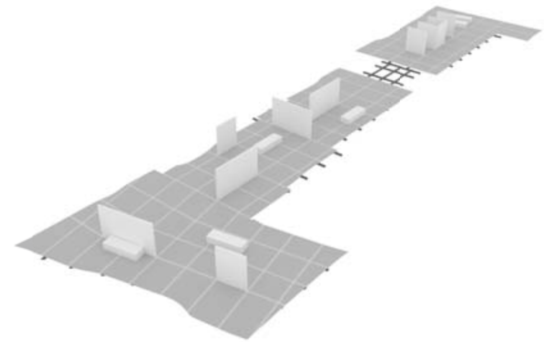
2.36
FLEXIBLE WALL SYSYTEM



ill. 206

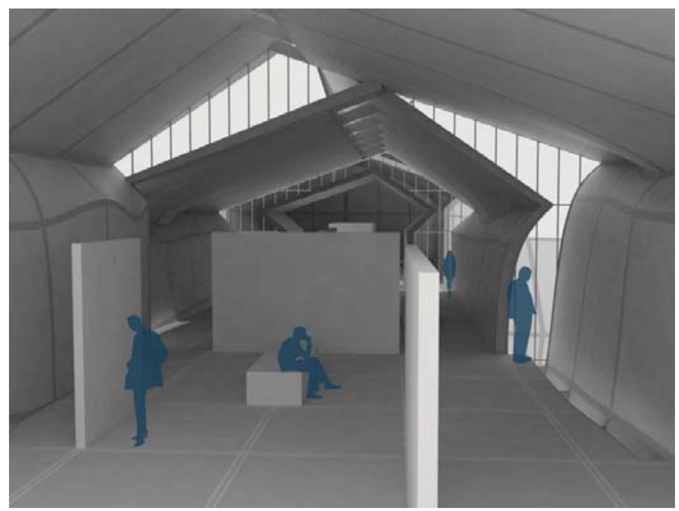


ill. 207



ill. 208

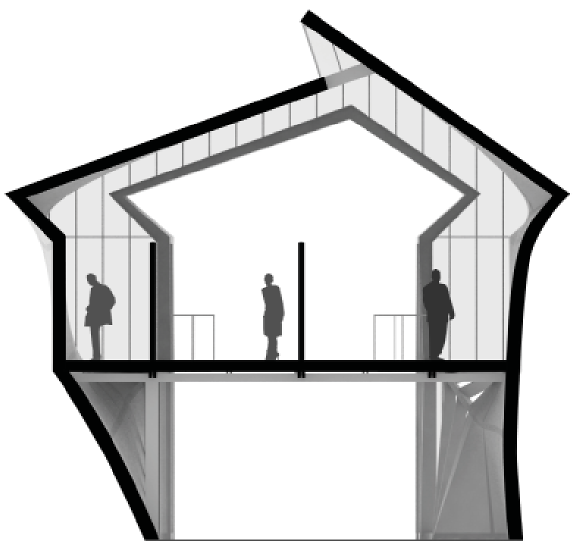
The exhibition volumes are as shown on ill. 209, one continuous space, since all end walls of each volume are removed. In order to provide more exhibition surfaces for the curators to work with, a flexible wall system is introduced. This is done by projecting the pattern of the beams visible in the foyer ceiling, onto the floor in the exhibition space, and using this pattern as the layout for grid of rails in the floor where removable walls can be inserted in the amount needed for any exhibition. When the rails are not being used, they are covered with plates of wood in a slightly different colour nuance than the rest for the floor. They are a reference, reminding the visitor in the exhibition spaces of the importance of the wooden structure and how it is ever present in the reinterpretation of the half timber construction.



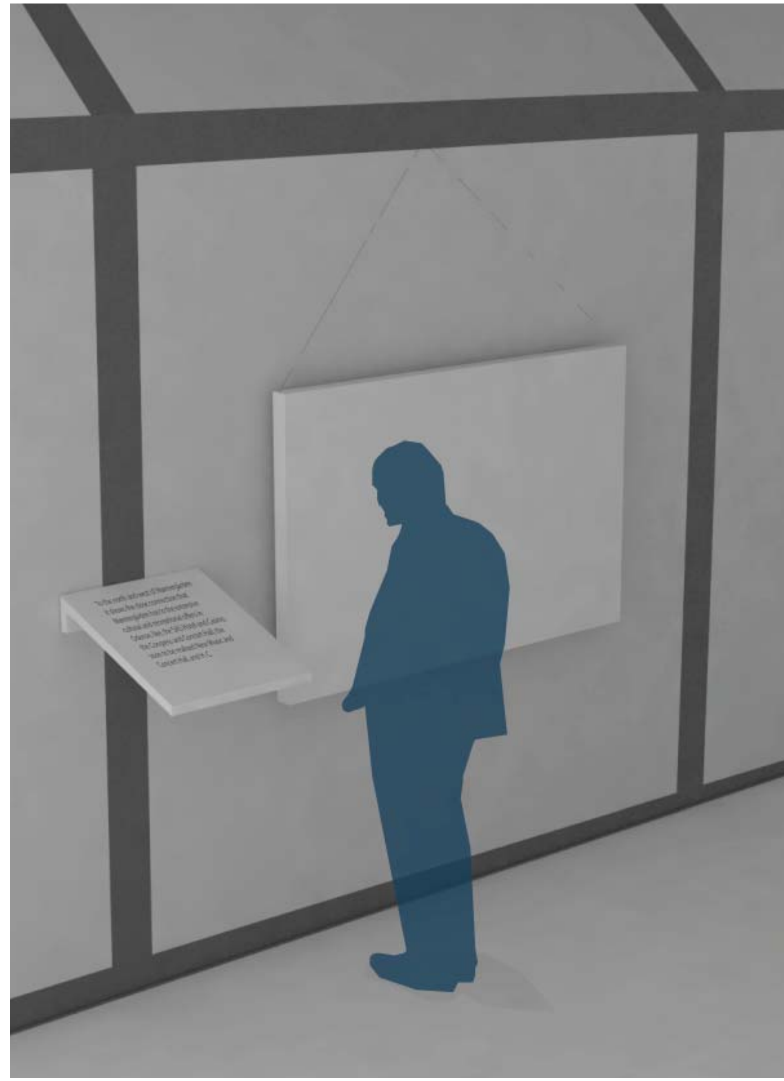
ill. 209

2.37
EXHIBITING ON ENVELOPE WALLS

In addition to the flexible exhibition walls, the interior façade walls can also be utilized. The curvature in the walls caused by the implementation of the reference to deformation in the architectural language are restricted to limited areas of the walls, leaving most of the walls as plane vertical surfaces. These can be used for exhibiting art of various kinds. The intended way to work with art installations on these surfaces are to only hang art from the wooden elements, continuing the idea of only relying on the wooden structure as a load bearing element, in this case, in a much smaller scale. This leaves the concrete elements free from adding, cutting or in other way interrupting the concrete surfaces, just like how the windows always span from wood to wood.



ill. 210

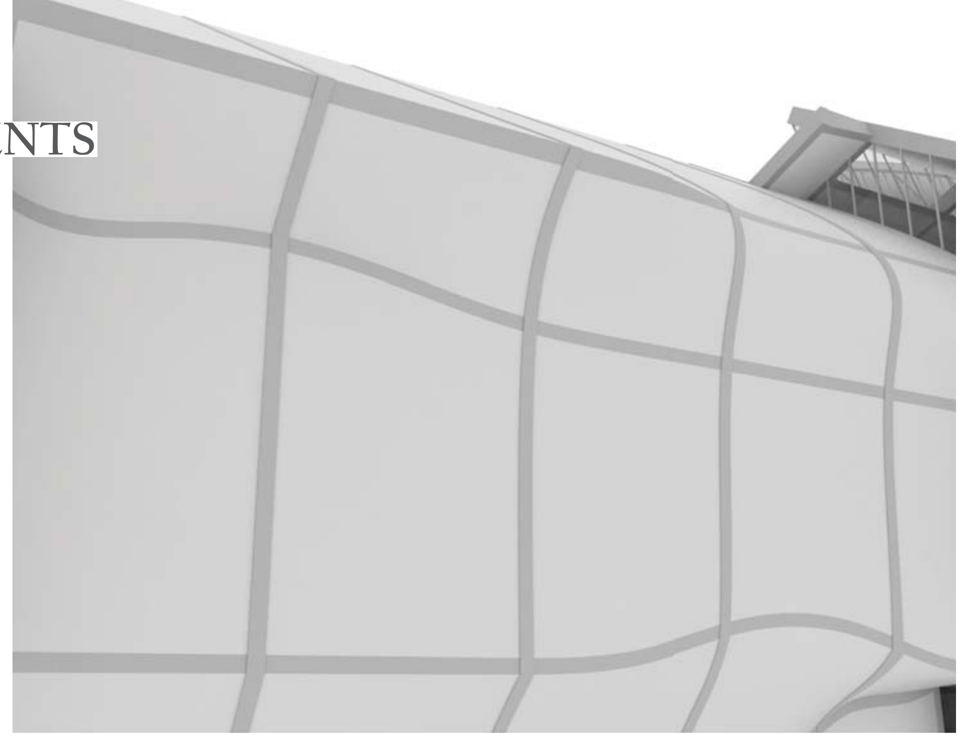


ill. 211

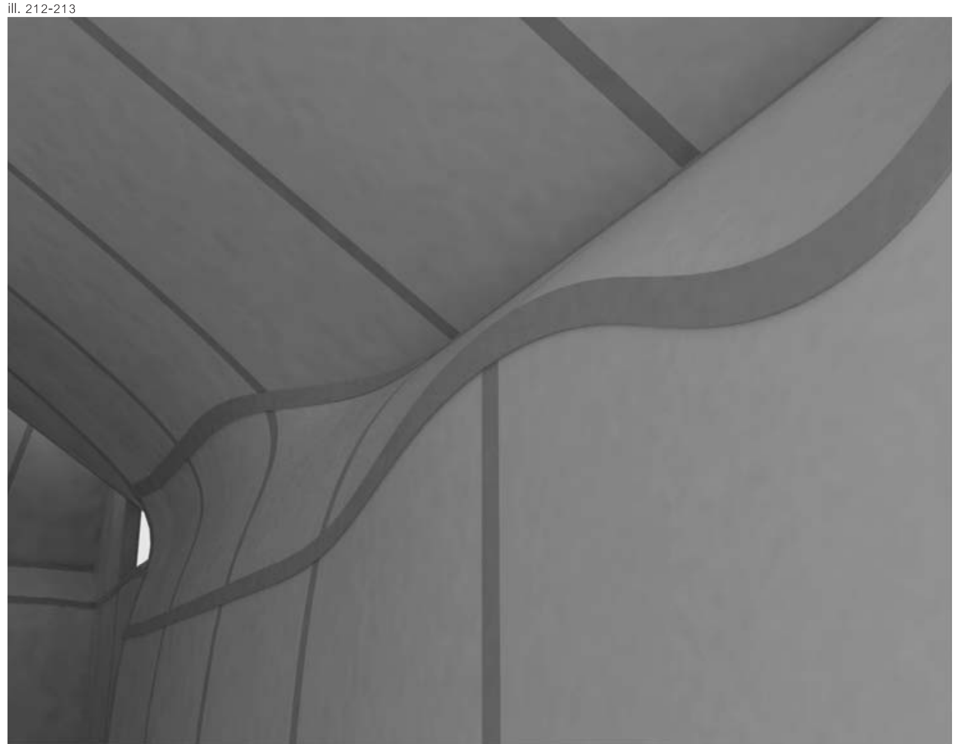
2.38
EMPHASIZING WOODEN ELEMENTS

In order to emphasize the importance of the Glulam structure, its role as the one material ensuring the stability of the entire building, two similar effects have been applied differing from the exterior to the interior. In the exterior façade, the vertical columns are extruded 150 mm from the concrete surfaces, making them slightly stand out, underlining the sectional transformation that have been an important part of developing the form.

In the interior wall, the same effect is used but unlike with the horizontal elements it underlines their curving paths across the surface that at certain times passes underneath the flooring, disappear and then reemerge again after a distance. They also emphasize the organic areas of the wall that curves or bends into the room. In order to let visitors experience that they serve a structural purpose as well as an aesthetical, the floor is removed in two places in the exhibition room, revealing how their disappearance underneath the floor line is genuine and not only a decorative element. The cuttings in the floor also allow more natural light to enter the foyer space, giving a different lightsetting on the walls that are placed in these areas.



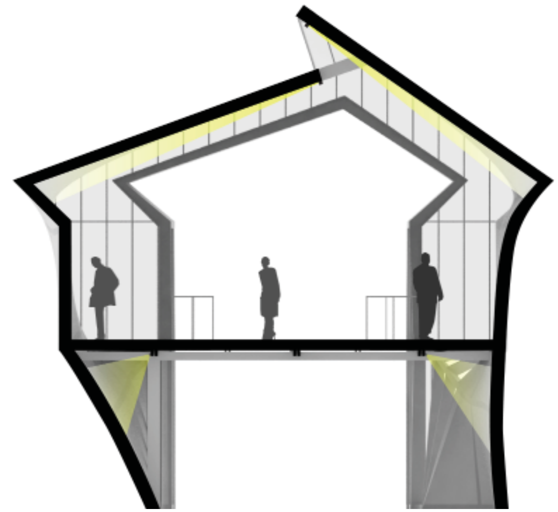
ill. 212-213



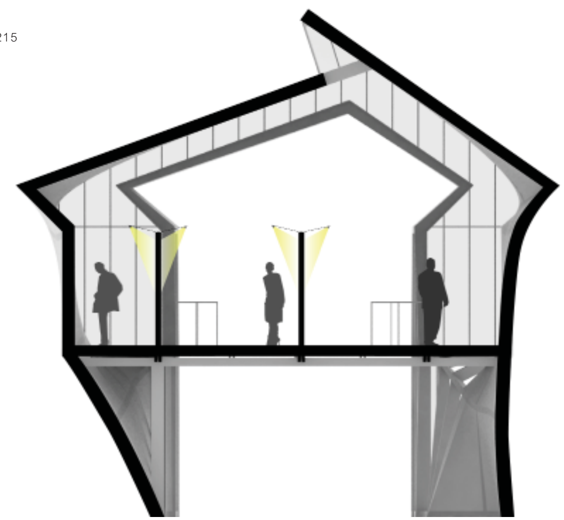
2.39
ARTIFICIAL LIGHT

The artificial light in the exhibition spaces are working in two different ways. The first principle is purely for lighting the architecture when natural light levels are too low. Integrated light sources are placed in the wooden beams, framing the windows in the ceiling. Their lights are focused so that they light along the inclined ceilings, imitating how these surfaces are bathed in light during the day by the sun. This artificial light should also provide enough reflected light into the exhibition volume to allow visitors to move around the spaces without any problems. They are not intended to serve as a light source for the presentation of the art.

The flexible walls in the exhibition room are an element that is perceived, and with intention, as being added to the exhibition space – giving an impression of a flexible solution that is controlled by the structural system – the projected beam pattern. In the same way, the light for these walls should be flexible and capable of constantly being modified to serve any art installation in the best possible way. Their practical function is underlined by allowing them to be a visible element attached to the flexible walls, inserted on a rail on the top. This customizable solution allows curators to add or remove as many light sources as needed, and to orient them in exactly the direction needed.



ill. 214

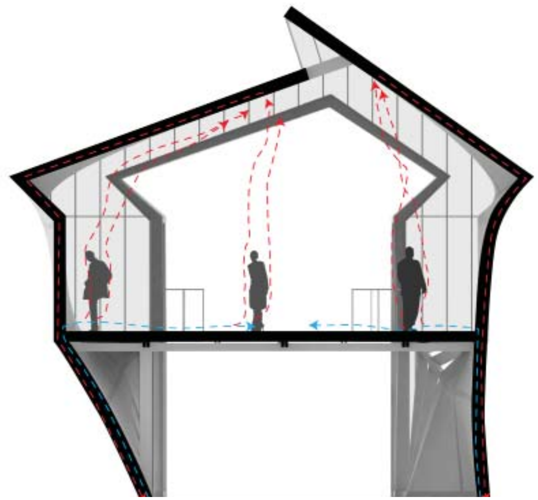


ill. 215

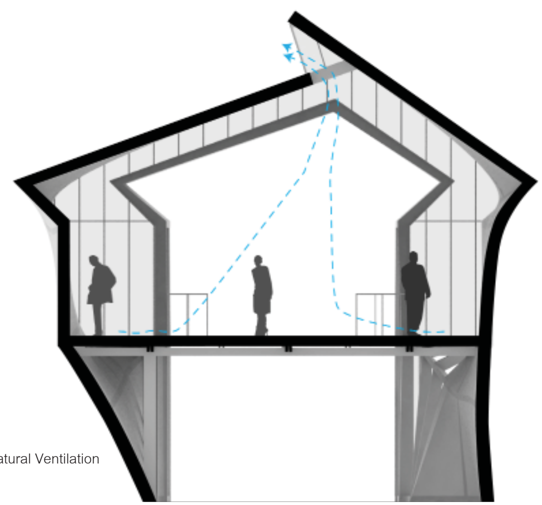
2.40
INTENDED VENTILATION

The intended ventilation approach is using displacement air flow. Cooler air is blown in at floor level, which can run under the flexible walls, and heated by visitors and natural light. The warmer air rises towards the ceiling, resulting in lifting the polluted air, where it can be removed by mechanical ventilation. The space needed for the ventilation shafts in the wall would be made during production of the concrete shells. This would enable installing the ventilation shafts in the Glulam structure before the infill is inserted that would fit perfectly around it.

On days where the outside temperature and moisture level is not posing a threat to the exhibited art, natural ventilation can be used by opening the ceiling windows and parts of the windows at the floor level. This will save energy and better insure that the museum building can meet the requirements of a Low Energy Building Class 1.



ill. 216 Displacement air flow



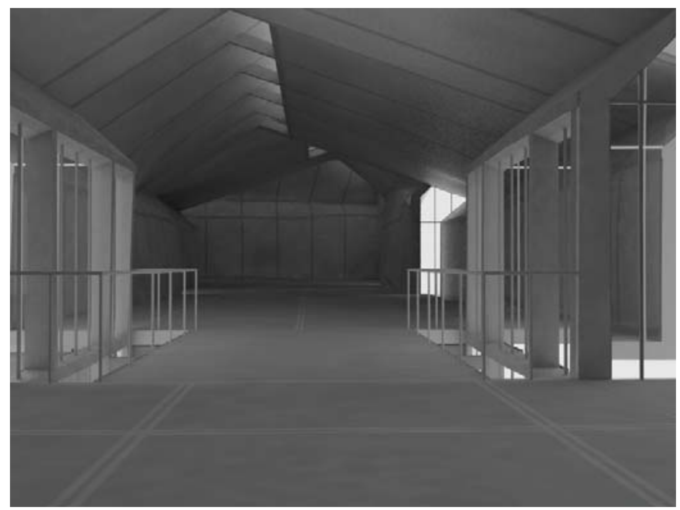
ill. 217 Natural Ventilation

LIGHT AS A GUIDE


ill. 218 Entrance


ill. 219 Staircase

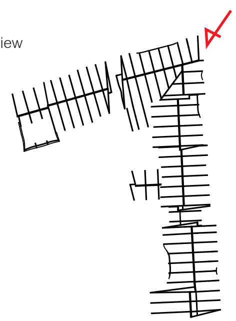
All the improtant logistical parts of the museum building are characterized by completely open facades, where the light level increases and large clear views are present. This guides the visitor through the building from the foyer with introduction exhibition, to the first series of exhibition spaces to the final. The same is the case with the bridges guiding from the main museum building to either the multipurpose room or the existing exhibition spaces in the old Møntergården Museum.


ill. 220 Bridge above entrance

ELABORATE

3.00
VISUALIZATION

View

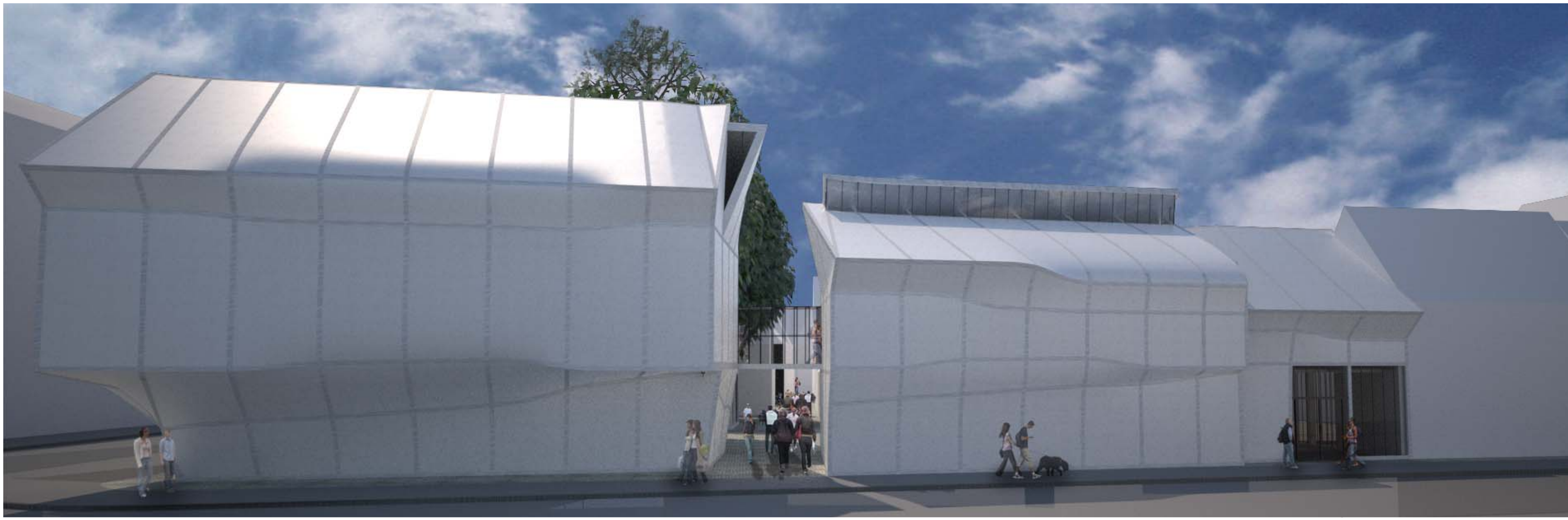


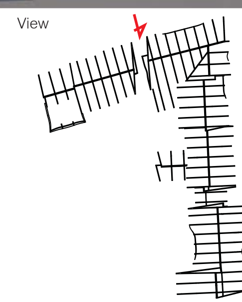
The following chapter "Elaborate - Visualization" will in morst illustrations describe the final design of the Extension of The Møntergården Museum. This is done first by describing the different exterior views and outdoor spaces that are generated by the new museum volume. Then the interior will be presented through plans, sections and renderings, and finally materials applied and light in the exhibition space will be more thoroughly described.

The above image shows how the new exhibition building presents itself from the main acces point by car. The experimental architecture and its references to the closely build together city-buildings, the interplay between roof inclinations,displaced volumes and the deformations, all manifest them sefl in the facade towards the city.

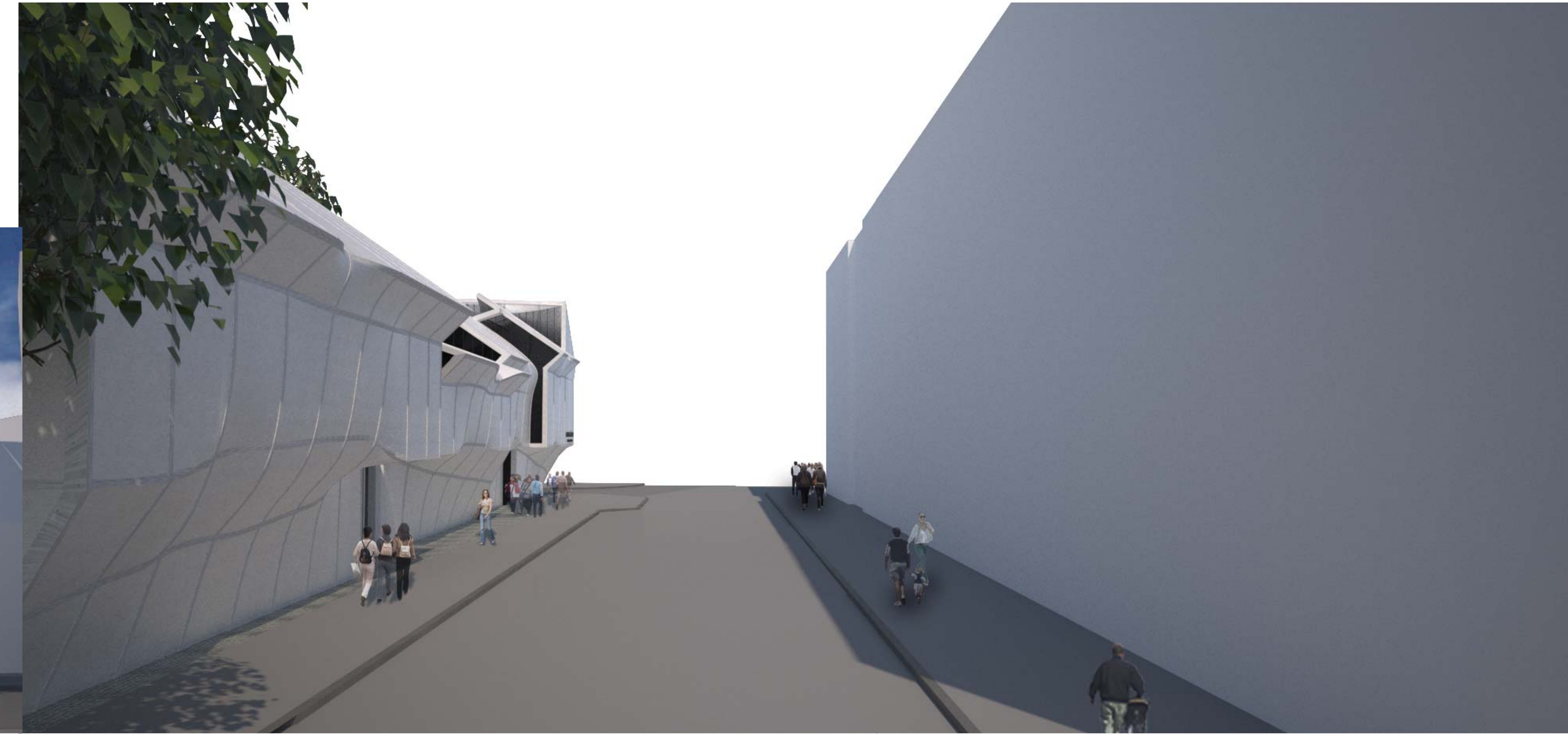
The facades are kept closed every where except from where the clear views are, and the entrances. In this way it is clearly understood where the access points are to the museum.

3.01
COMPLETING THE BLOCK

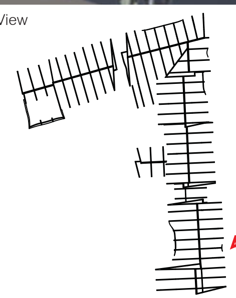




The new exhibition building is with its design completing the block, which is to be understood that it encloses the inner courtyards from the surrounding city. The only openings in the facade is the entrance to the café and multipurpose room, and the important Møntestræde leading through the entire museum complex and to one side of the main entrance. The view down this narrow street is framed by the bridge connecting exhibition part with café and special exhibition.



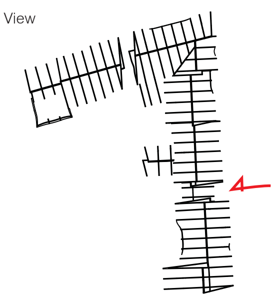
View



The view down Hans Mules Gade is dominated by the existing building volume to the right. The new exhibition building responds to this with a similar size volume, but a in a more fragmented composition. The main entrance is seen as the part that is pushed back a little from the street in order to allow for a bigger gathering space outside for visitors.

3.02
ENTRANCE FROM HANS MULES GADE

View

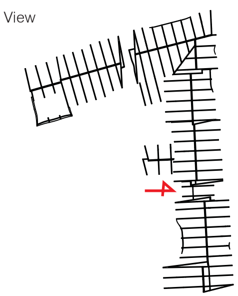


The entrance to the new exhibition building from Hans Mules Gade is a transparent portal, that allows people passing by to look into one of the court yards in the museum complex. This is done to invite people into the museum or the outdoor spaces. The entrance is both considdered as access to the museum and a path into the complex of small narrow streets and intimate court yards. In this way the design allows passage encen though its layout is very enclosing

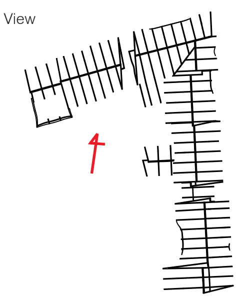
ENTRANCE FROM MØNTSRÆDE

The entrance from Mønterstræde is both an acces point to the museum foyer, but also just a place for stay. The space is intimately enclosed while still allowing for views to Møntestæde, Hans Mules Gade and into the foyer and museum shop. Dominating the courtyard is one of the old preserved trees, creating the motif of the close relation between trees and buildings present all over the museum complex.

View



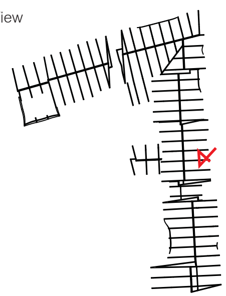
3.03
NEW RECREATIONAL SPACE



The biggest courtyard space created is divided by a wall that defines the outside serving area. The settle division of the space refers to the more intimate courtyards, while still giving the impression of one big courtyard, where markets, shows and other recreational things are to take place in close connection with the café and multipurpose room.

3.04
LIGHT AND MATERIALS

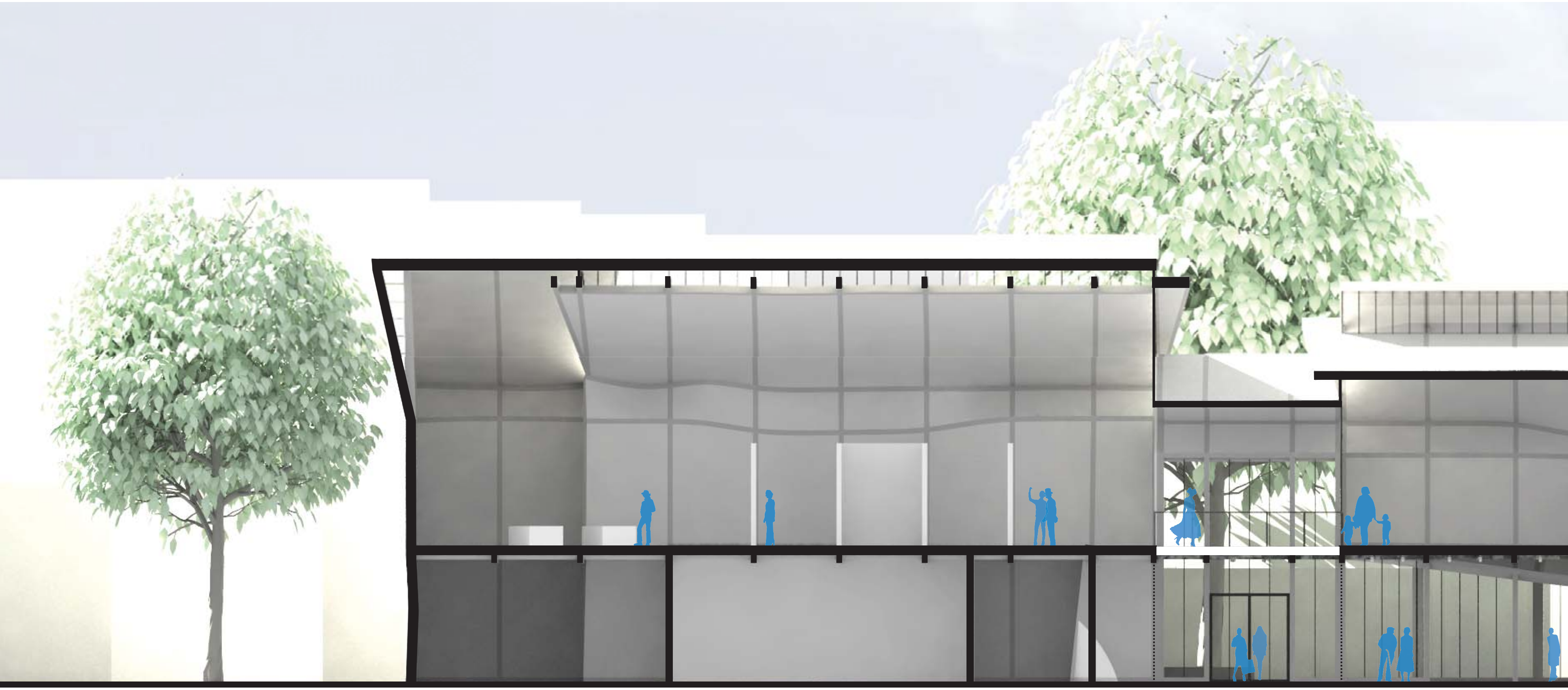
View



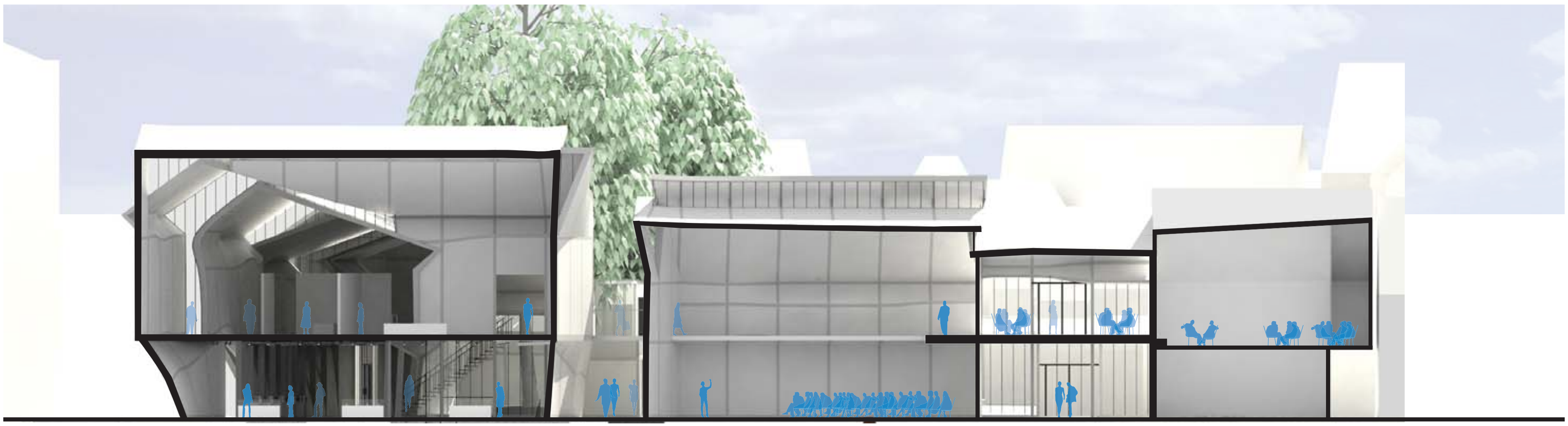
The concrete elements are fabricated with an embedded pattern that refers to the materials traditionally used - the brick. It is a settle pattern that visitors will not notice before getting really close to the building. From the distance it will only give small variations in light and shadows in the facade.

The long skylights that are present in all the exhibition volumes are seen, and how the roof beams extend behind them, creating a shadow effect in the interior space.

3.05
SECTION SOUTH-NORTH



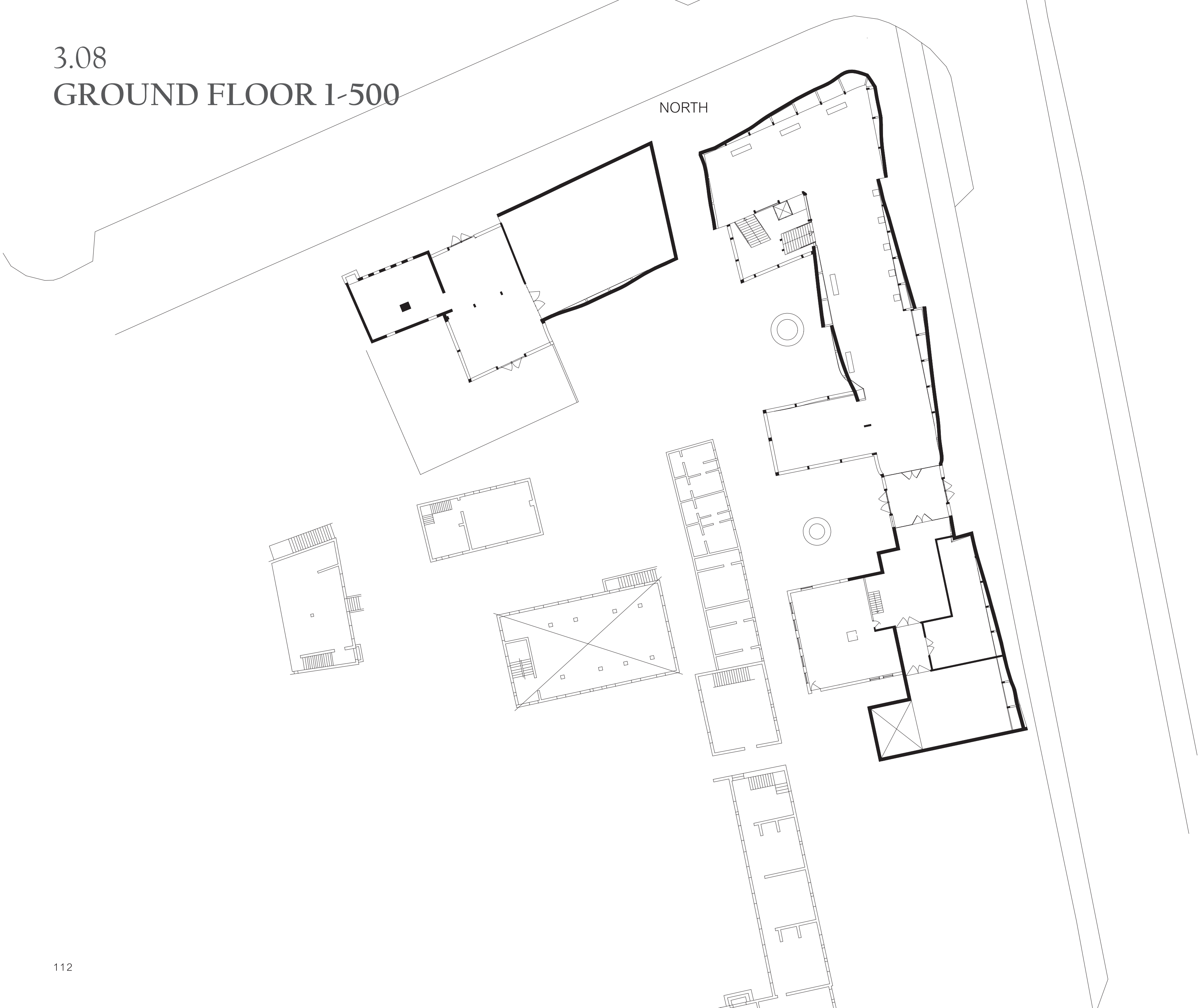
3.06
SECTION EAST-WEST



3.07

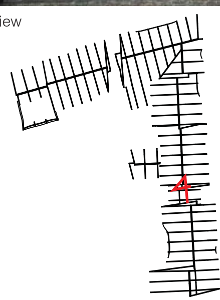
SITE PLAN 1:600

3.08
GROUND FLOOR 1-500

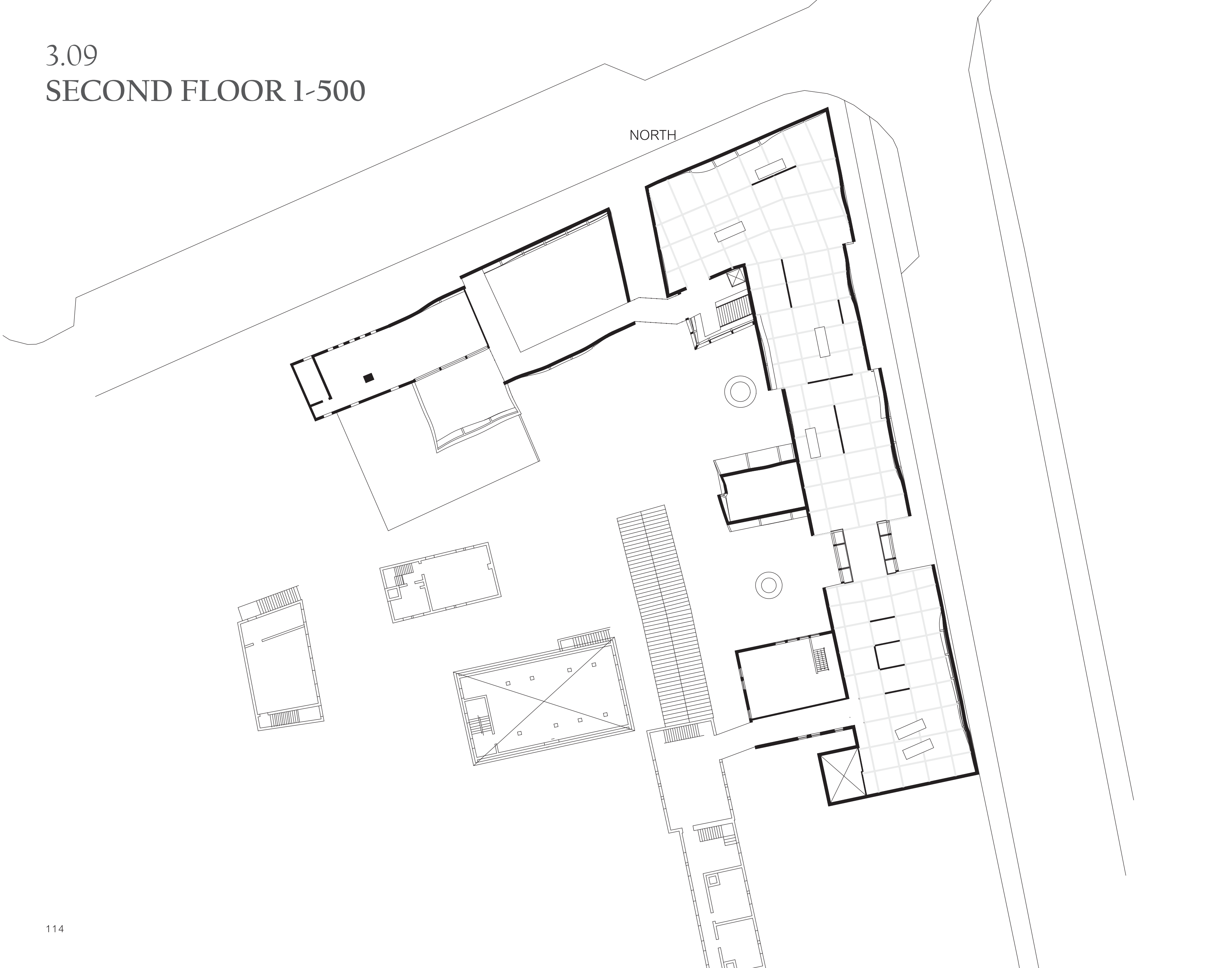


FOYER

View

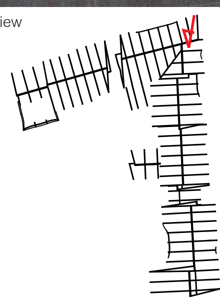


3.09
SECOND FLOOR 1-500

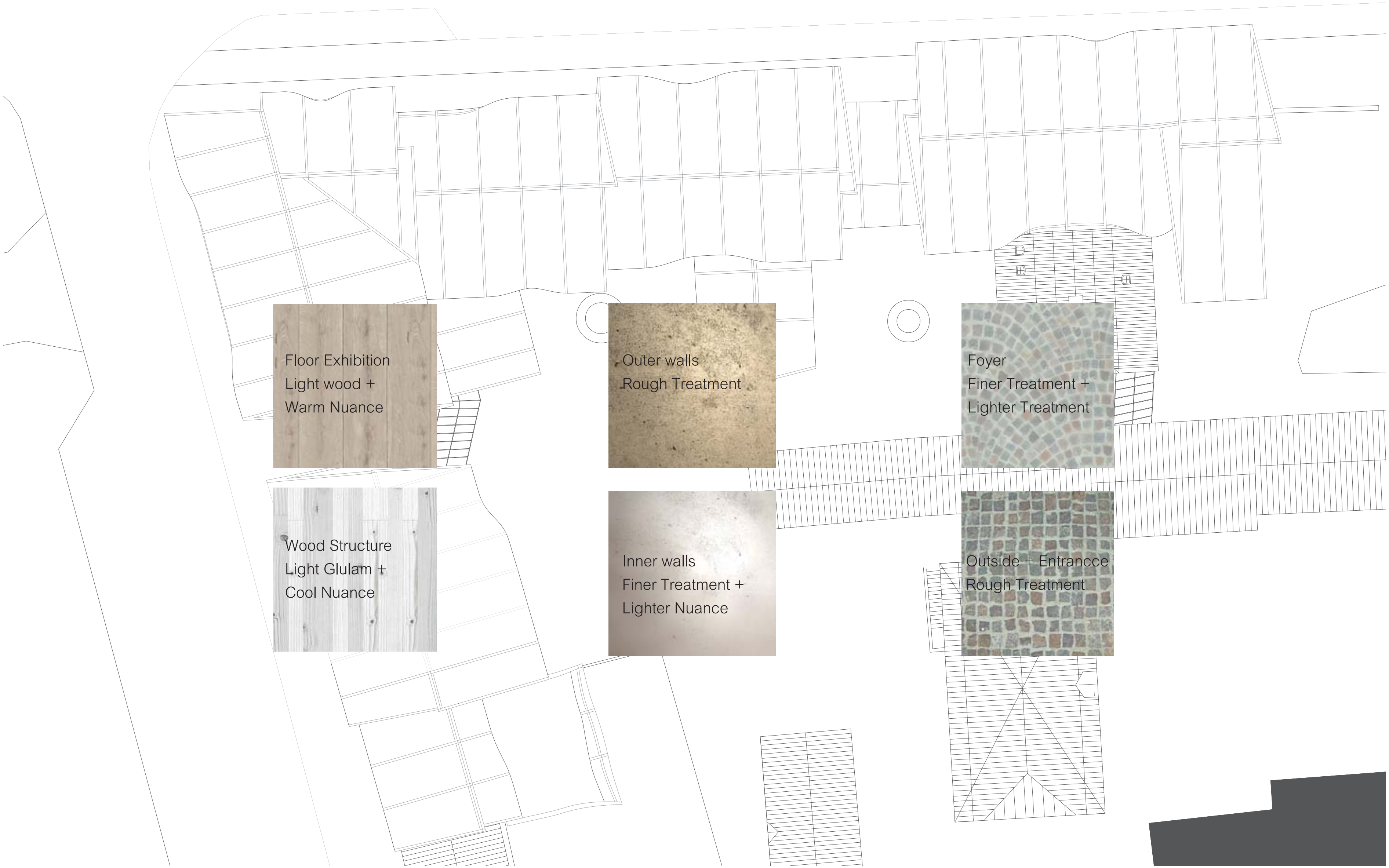


EXHIBITION SPACE VOLUME + MATERIALS

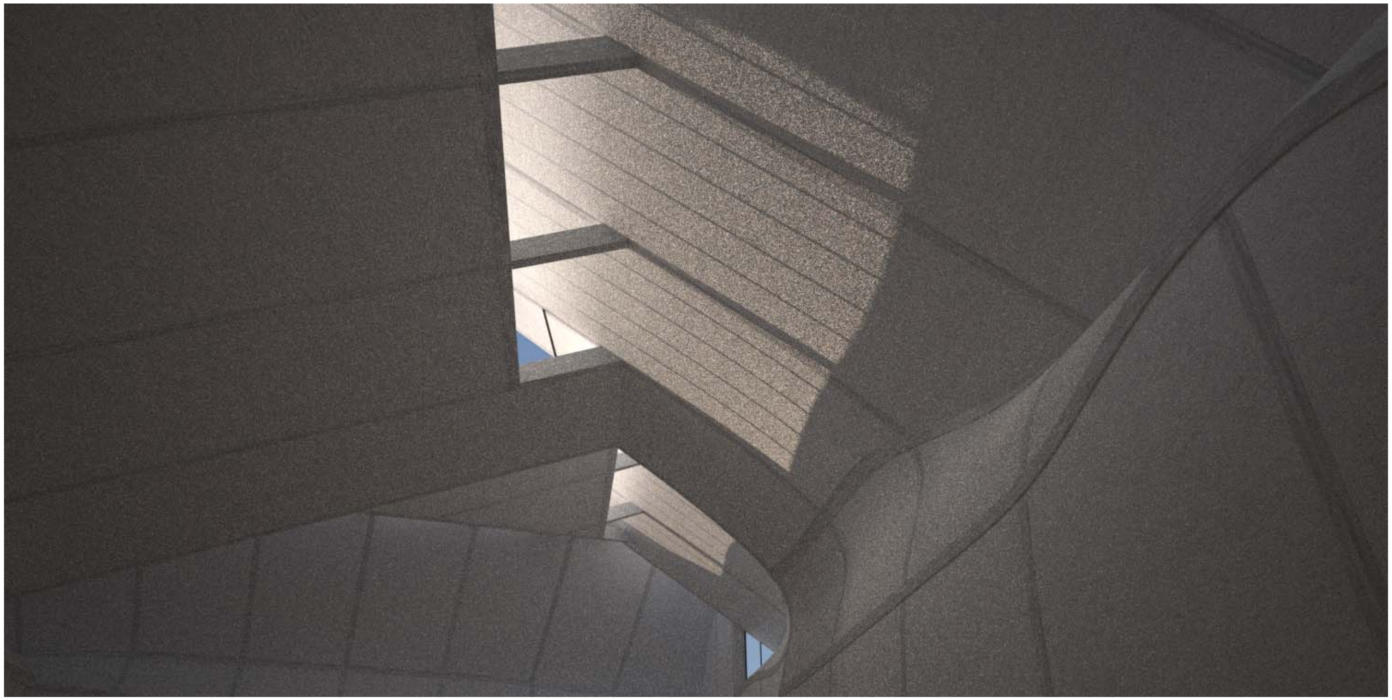
View

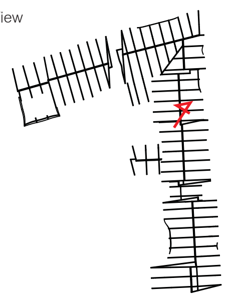


3.10
MATERIALS AND THEIR RELATION



3.12
NATURAL LIGHT IN EXHIBITION

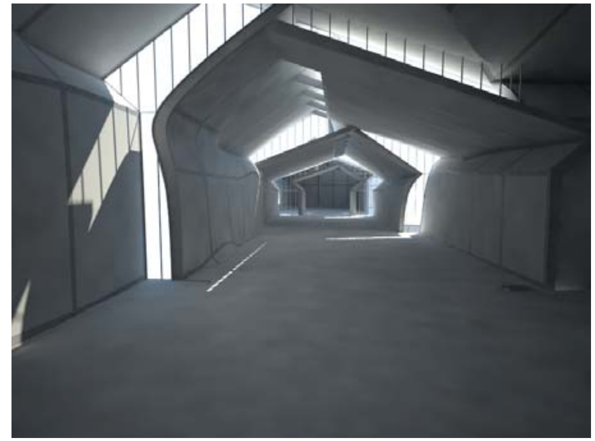




SUNS PATH ON ARCHITECTURE

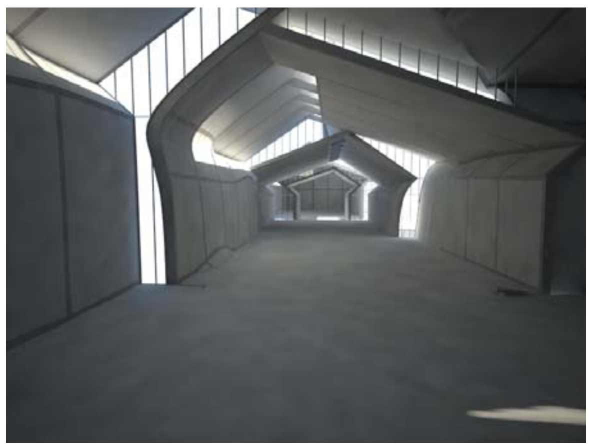
Time: 09:30 Date: June 23rd

Time: 11:00 Date: June 23rd



Time: 13:30 Date: June 23rd

Time: 15:00 Date: June 23rd



Time: 16:30 Date: June 23rd

Time: 18:00 Date: June 23rd

3.20
REFLECTION

The final chapter in this project is a reflection on the concept, process and final design presented. It will focus on if the intension and vision were realized, and can as such be considered an evaluation based on the chapter “Archi-tectonic strategy”. Despite that it can be problematic to evaluate one´s own design on a neutral level because of the personal feelings that are put into a project, this reflection will address both elements that are considered a success and also point towards areas that would need further development and consideration.
The process of reinterpretation was two-folded. Firstly, focused on form, and then on materializing, both with the intention of making the design site specific and strive towards genuity in the experience of materials, which are the true essence of traditional half-timber buildings.

FORM

The development of the form was from the beginning of the process focused on a way of reinterpretation based on the deformations of old half-timber houses. The idea of considering these deformations as something that was intended from the start, instead of happing over many years, was intriguing. Could this inspiration be implemented on an abstract level to develop architectural principles for an experimental language, which while being a purely modern digital design, still to relate and include the surrounding architecture that originated more than 100 years ago? These inspirations from the deformations were not to stand alone, but were to be combined with an abstraction of the composition of the density of old city houses and their displaced meetings, and the resulting intimate outdoor surroundings. It became a way to fragmentize the museum design, and instead of thinking of it as one volume, it became one consistent piece of architecture based on combining various size volumes in displaced connections. The process was far from linier as presented in this report and lasted much longer that originally planned. This becomes clear when the form-finding process included on the appended CD_ROM is reviewed. The sole reason for allowing these constantly pushing deadlines for final form was that the result of it was crucial in order to accept it as a reinterpretation. The final design is not intended in its form to immediately reveal its different inspirations, but instead be more of a continuing storytelling for the visitor. The saddle roof, overhangs, displaced volumes and density are more quickly recognizable elements, but its transformations, the slanting end walls and the organic movement are all much more abstract and would perhaps stay that way for many visitors, without having a photo of its inspirations at hand. This is as such considered a positive result of the design. Architecture should be based on principles and some amount of order, but it should never stand alone without abstraction, since this is what keeps it interesting to come back and discover new elements and understanding of form and space.

The long duration of this process did make it necessary to reconsider the amount of intended different technical iterations included. The final design though, is very concerned of how light is used as both a way of allowing visitors to move through the building and how it brings out architectural features in. On the other hand, more thorough iterations with light analysis software to evaluate the result on a technical level were left out. Instead, the development had to base itself on a more practical level of the sunlight’s changing direction, clear view openings and as in the case of the entrance , staircase and bridges being these very bright areas that would give visitors towards them, as a way of guiding people from point A to B and further.

Another element that had to be ignored in the process of form-finding were initial calculations on the energy demand of the design. If this had been done together with the light analysis, it could perhaps have resulted in an even finer detailing in the materialization process. Still the design has many considerations with regard to energy usage and, especially in Denmark, concerned on heating the building. Almost all openings, glazed areas in the design are oriented towards the south, south-east or west, allowing it to make use of indirect heating from the sun. In the summer, where heat is less a concern, the implementation of the trees on the site in the design, results in a great deal of natural shading of large parts of the glazed areas in the mid-day period where the heating from the sun is at its most.

The work with how the different functions should be placed on the site and how they are connected to each other, resulted in a solution where the main part of the exhibition is placed on the 2nd level and connected to the largest part of the existing exhibition and the special exhibition in the multipurpose room via bridges to create a more continuous flow and allow easier access for visitors. In that way, the new museum exhibition building contributes to the existing and ties it more together as a complete experience, rather than just focusing on itself. The administrative and foyer placements on the ground level allow easy access and combined with the two-sided entrance, it becomes more than just an entrance, but also a path directly into the intimate outdoor areas on site. These contributions to the Møntergården Museum are considered as one of the most successful elements in the design of the new exhibition building.

MATERIALIZATION

The evolvement from pure form to actual structural elements in wood and concrete, experimented for a while with more foreign structural systems and patterns, before realizing the solution much closer to the traditional half-timber construction was what functioned the best aesthetically with the experimenting form. The final design is constantly complementing and enhances the features and characteristics of the changes in geometry in the design. The iterations with FEM analysis could, if it had been allowed to continue for a longer period, have led to perhaps a higher level of refinement in the dimensioning of the wooden elements, thus allowing for designing and detailing even more connections and joints that are so important for the architectural experience in this type of building tradition. The reason for closing this series of structural iteration at the achieved level was needed in order to, within the time frame of this semester, think it through a process of production that would allow for a mass-customization of these different structural elements and their infill. It was considered necessary to achieve this in order to fully being able to argue for the reason in this experimental non-standard architecture. Otherwise it would never reach a level beyond more solely artistic ideas which is important in order to ever try and push for new ways of thinking in a field with a long tradition, like architecture. This can only be done if it is combined and presented with reasoning and communication of the principles and the logics it is founded on.

The materialization process also took into consideration of proposing ideas and details that would have a positive demand on the energy demand of the proposed design. These ideas were combined with how the production was to be done and as such, considered a satisfactory interplay. Even that all these ideas were integrated, it is still not considered to be a design proposal that would be realizable within the suggested budget of 45 million DKK total by the competition authors, but in attempt to justify this, budget has not been a focus point in this project. The reason for this was to allow for a more free process of design development within the time span of this semester. Keeping budget track would have been a project more or less in itself.
The acoustical part of the architecture was necessary to treat on a more conceptual plan. This was done by acknowledging that the proposed exhibition spaces will have a long reverberation time due to their volume and the materials used. This was responded to with a proposal of how this could be solved in an aesthetically integrated way. A more thorough acoustic investigation would have resulted in a

more detailed illustration in the way it would aesthetically work in these spaces as the amount of sound absorption needed and its placement in the spaces would have been closer determined. The same is the case with the detailing of the multipurpose room that is to hold both exhibitions and musical events.

The proposed ideas of the principles of how the exhibitions should be utilized to display art and artifacts are intended to give more overall clear guidelines of how the architecture and exhibition should work in co-operation, but they are still conceptual enough and limitless to not start prohibiting curators to experiment and evolve in their own profession which is from a personally point of view just as important as insuring an optimal flow when designing museums. Architects are not curators, and the acknowledgement of that must be visible.

As a final remark in this reflection on the project, focus is shifted back to the starting point for the entire project; to propose something new by reinterpretation and to give shape to a building that would communicate the vision of the Møntergården through references and materials. The final design is somewhat rarely seen in its architectural language, at least in the materials proposed, and as such is considered to have found a result that combines a digital contemporary aesthetic with references to tradition and materials that ties it together with the historical architecture, that is, its ever present context. Whether or not this is considered a success in terms of the philosophy of Møntergården museum, to be part of the communication of a basic mutual heritage and frame of reference, which is important for the understanding of oneself and the present society must be left to the judgement of the individual reader. One thing is certain - that a walk through Møntestræde would now definitely be a travel through history from early half-timber buildings and their evolvement in details, rounded of with the new exhibition building as a statement of what this tradition could have evolved into had it continued its status as the common way of building.

Jonas Aarsø Larsen

APPENDIX

5.0
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6.0
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