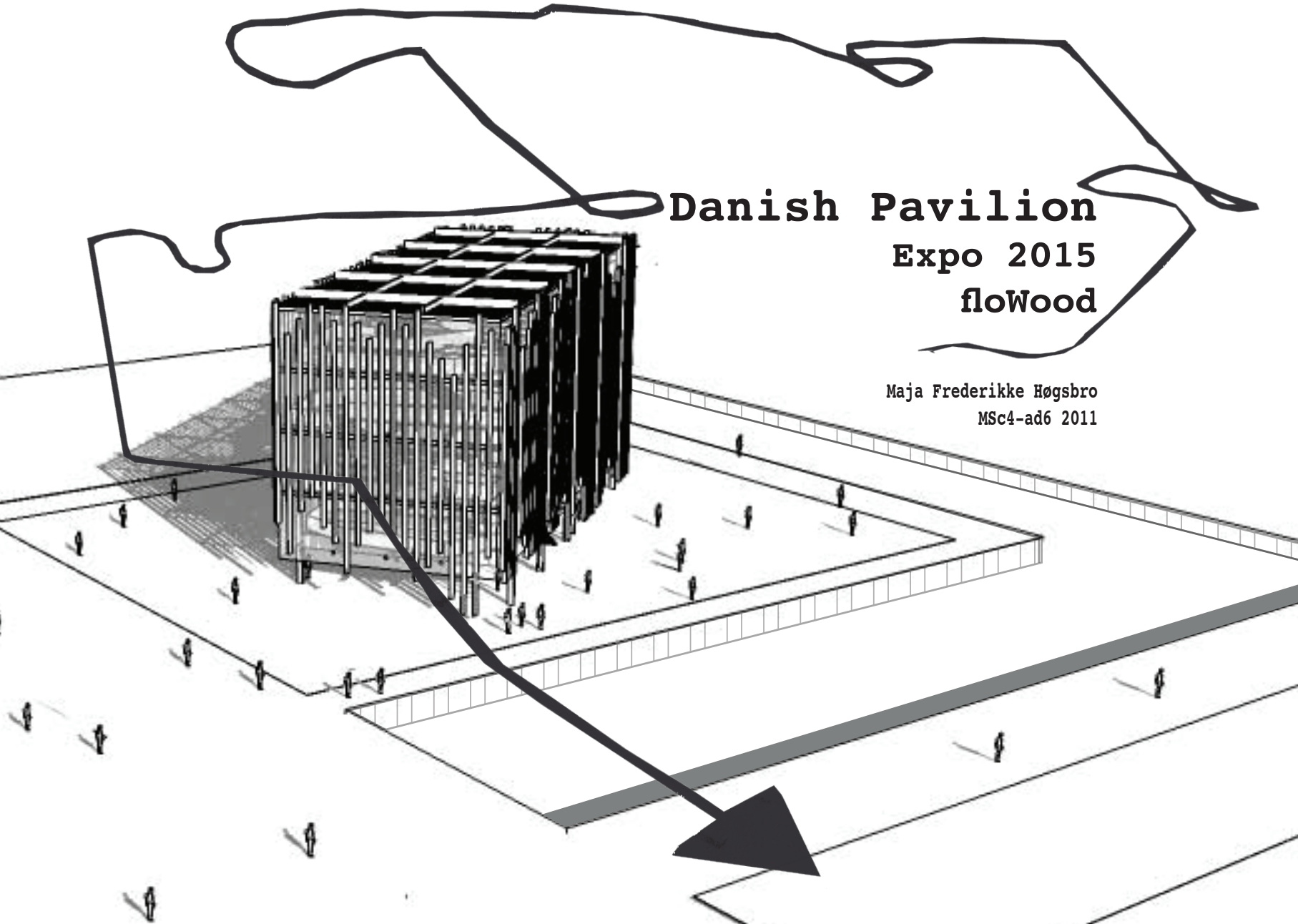
Danish Pavilion

Expo 2015

floWood

Maja Frederikke Høgsbro
MSc4-ad6 2011



Title page

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Synopsis

This project is a proposal for the Danish Pavilion for the next World Fair in Milan in 2015. The theme for Expo 2015 is: “Feeding the Planet, Energy for Life” which should be understood as, everyone on the planet earth should have access to clean water, enough food and a healthy life style through nutrition and energy.

This proposal has been developed based on Danish culture and habits about food and water. The theme prepares the ground for a larger debate, which is already ongoing and will in this project only be discussed briefly in the analysis. Many backgrounds and approaches are discussed to find out how Denmark could be best represented through the theme.

The Danish Pavilion has the qualities of Nordic architecture and the expression is simple, clean and attractive. It invites people passing by to visit Denmark, and to encourage attendees to get in line and be curious about what the pavilion has to show as a role model and icon for Denmark.

The inside traffic flow has been the main issue in the design of the exhibition spaces and also for defining the environment within the pavilion. The choice of materials and the structure shows that the pavilion is concerned about energy use, sustainability and reusability. It should reflect thoughtfulness about the environment, nature and human beings. The fact that it is a temporary pavilion plays a big role in the choice of the material, structure and construction.

The project has been developed iteratively and that is why some illustrations are not shown in the order they were made.

Table of contents

Introduction

Expo 2015

The Expo 2015 in Milan will probably be an important World International Exposition because of the theme, “Feeding the Planet, Energy for Life”, asking questions about some of the big fundamental problems in the world.

Is there enough food to feed the whole planet?

What are the most sustainable and healthy choices for eating?

[001 - Logo for Expo 2015]

Another big problem about the World’s Fair is the expenses, pollution and material waste. The pavilions are only contemporary and maybe five (in 2010 only five pavilions were voted to remain) will be chosen to stay permanently. In the earlier years it was clear that architects designing the pavilions for their own countries were not or did not want to be aware if the problem of the waste generated because of the short useful life of the construction compared to the construction time and the costs of material transportation and waste. As an example, the Dutch pavilion at Expo 2000 in Hannover was considered too expensive to move or demolish. It still stands in Hannover but for no purpose. It is ruined and abandoned [Expo1].

Even though many countries participating in the expos want to integrate sustainable solutions for the pavilion it is often not done. The architect designs remarkable pavilions without really integrating the economical aspect. Often pavilions for the worlds expositions are expensive to construct when looking at the time to build it, and the transport at the end to get rid of the materials. A lot of expense compared to the useful life of only 6 months. So another question to the theme would be.

How to design with cheap and light materials that will not impact the look and feel of the pavilion?

The focus for this project will be an idea originated from the theme of how Denmark feeds itself and how Denmark could eat better and in a more healthy way. Additionally the focus is on Denmark’s input in making sure that there will be food for all people on earth. These themes might be shown as a debate in the exhibition in the Danish Pavilion 2015 but also to show and make clear how a pavilion can be as inexpensive and useful as possible by the choice of the right structure and material.

How can the Danish Pavilion tell an exceptional story about food and culture along with the importance of structure and material being sustainable ?

Methodology

The Integrated Design Process (IDP) will be used as a method for designing the pavilion and to make sure that aspects from architecture and engineering have been taken into considerations [Knudstrup, 2008].

The structure of the project is divided into 3 main phases, the analysis, the sketching and the synthesis phase. An idea has been given as the basis for the process and the project will be documented in the presentation at the end as in ill. 002. The planning and the working period can be seen at the Gant chart in appendix A.

[002 - The Integrated Design Process]

Idea
The idea is based on the theme for the Expo 2015 and will be described in the introduction. The initial thoughts for the focus in the project can change through the analysis phase.

Analysis
This phase is the step to find the vision and the exact idea for the project.
Only some aspects from the context will be analyzed, as the weather and other that might influence the pavilion.
A short description of the history of the world's fair will be made.
The theme for Expo 2015 will be discussed through a dialogue.
Case studies of three earlier pavilions will be made.
Different sustainable materials will be discussed and described.
The user group must be found and then the space program for the pavilion can be developed. The analysis phase ends up with the vision for the project.

Sketching
Both aesthetics and technical solutions will be reached in an iterative parallel process, see ill. 003. This will happen first through initial sketching to find a concept then sketching on the concept and finally developing the concept where the final form takes place.

Synthesis
Here the final form will be optimized through use of different programs and the details will be documented.

Presentation
The pavilion will be presented and explained through illustrations of the physically model and drawings of the plan and sections.
Site plan 1:1000
Sections 1:200
Floor plans 1:100+1:200
Facades 1:200

[003 - The Integrated Design Process]

Details 1:20
Perspectives exterior and interior

Tools

Different tools will be used to develop the project.
Physical models
Hand sketches
Autocad
Sketchup
Ecotect

Reading guidance

The sources are referred according to the Harvard method and listed in the source list in alphabetic order.

Books: [Author, year, page]
Web pages: [Name]
Visual media: [Name, year, page]

Visual media will be included as pdf's, brochures or newspaper articles found at the internet.

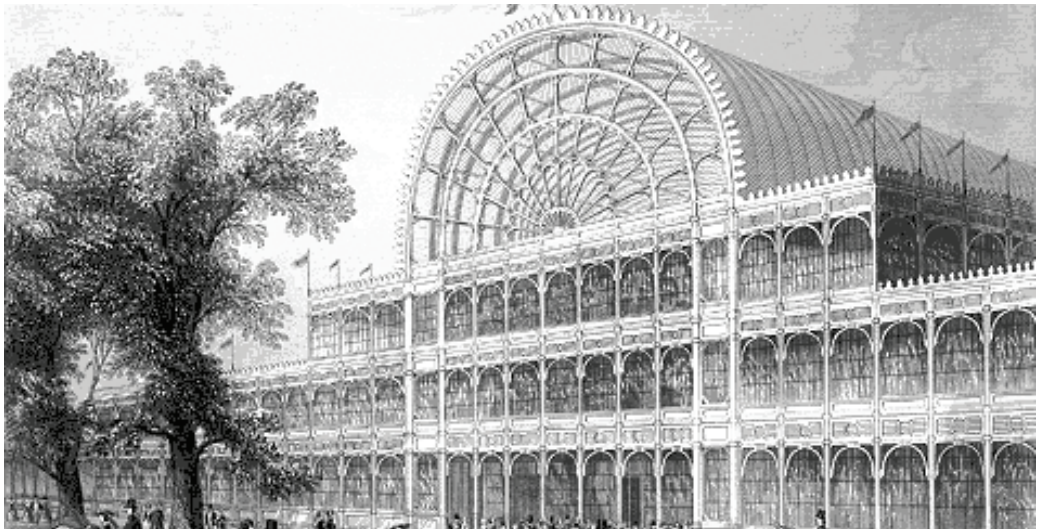
Sources for illustrations are indicated by a number and to be found in the source list. If an illustration does not have a number, author has produced it. Example as follow:

[000 - Illustration explanation]
|
Illustration number

Analysis phase

Introduction

The analysis phase is set up in different parts. First the history and the different types and themes of world expositions will be explored and shown in a time line. Next the context that is important for the project will be analyzed. What does it mean for Milan to be host city and how is the master plan developed for the area? Concerning the climate only, the sun path, temperature, wind and rain will be important to know.
The meaning of the theme for the Expo 2015 will be discussed, and it will be defined in terms of what is important for Denmark to show and what statement Denmark wants to give. This is also a step closer to find the vision and the exact idea for the project. The space and function program for the pavilion will be found and some cases that clearly shows a statement or has been a successfully pavilion will be made.
Analysis for the technical part will consist of a short description of different ideas for materials.
The analysis phase ends up with the vision for the project.



[004 - Crystal Palace, London 1851]

History

Many world expositions have been held but the definition, size and theme have never been the same. One of the first bigger ones was in London in 1756 and sponsored by the Royal Society of Arts. Here the focus was on the production of the displayed articles rather than the artistic expression [History1]. In general the first exhibitions were more a market for attracting craftsmen, innovators and producers from all over the world to make a mutual understanding between people of different nations.

More world's fairs were to come in the following years, but the first recognized world exhibition was held in London in 1851. The title for this exposition was "Great Exhibition of the Works of Industry of All Nations" and for this aim the Crystal Palace was built to host the expositions. The years after, Expos were planned in other big cities where the city itself defined the title and theme. The success and popularity grew but along the way different problems arose as for example agreement.

Already in 1907 a group of principal organizers planned to establish an international framework for Expos, another establishment was planned, but did not succeed before the Bureau International des Expositions (BIE) (International Exhibitions Bureau) was created by an international convention in Paris, France in 1928 where 32 countries signed the first agreement.

The organization was created to make sure that all Expos are of equal relevance and importance. The headquarter is in Paris and their responsibility is to maintain the quality of Expos, choose the themes, organizing and finding host countries of the World and International Expos [History2].

Types

There are different types of World's fair, but they all have different titles. The first one is the International Expo, Specialized Expo or the Recognized Expositions and must not exceed 25 hectares in size. It is placed in between two Universal Expos and lasts between 3 weeks and 3 months. The other big exhibition is the Universal Expo or Registered Exposition which is bigger, more extravagant and more expensive than the recognized ones and there is no limit to the size of the exposition site. It takes place every fifth year and lasts about 6 moths [Bie1].

A third and newer category of expositions is the horticultural exhibition, which is recognized by BIE and involves gardening and greenery expositions. Recent horticultural international exhibitions includes for example the International Gardens and Greenery Exposition in Osaka, Japan in 1990.

Expenses for the Universal Expo are bigger than the International Expo and the participating countries must build the pavilion with their own resources, compared to the recognized exposition where the largest pavilion must not exceed 1,000 m2 and the host committee, usually with the prefabricated structure already completed will provide resources. Countries then have the option of 'adding' their own colors, design etc. to the outside of the pre-fabricated structure and filling in the inside with their own content. Only one recognized exhibition and one horticultural can be held between two registered exhibitions.

One Universal Exposition in New York City in 1964-65 was not approved by BIE because those organizing the Expo did not respect the limitation of the duration on about 6 months and it made the exhibition more tourist and trade minded by hosting national pavilions [History3].

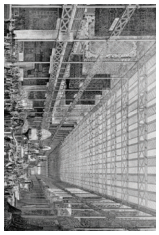
Themes

The BIE always chooses a theme to make sure there will be a common understanding through the expositions. BIE says that "the theme makes the expo" so a successful world exposition must be aware of the hot topics in the media to generate a common interest and importance for the whole world to participate in the Expos. Often the themes deal with human rights and the earth's welfare. An overall theme will always make the framework for the registered expositions compared to the theme at the recognized exhibition that is specific and narrow such as Transportation in Vancouver 1986 or in 2008 hosted by Zaragoza, Spain with the theme Water and the Sustainable Development.

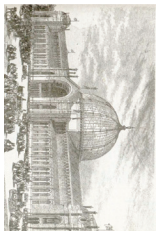
The two next recognized world expositions will be in 2012 in Yeosu, South Korea, with the theme The Living Ocean and Coast: Diversity of Resources and Sustainable Activities and the horticultural exhibition in Venlo, Netherlands also in 2012 [Bie2].

Time line

Listed as follow:
year city (country) - type - theme



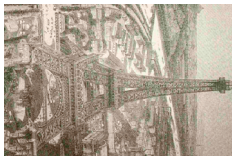
[005 - Expo 1851]



[006 - Expo 1862]

[007 -Expo 1876]

[008 - Expo 1878]



[009 -Expo 1889]

[010 -Expo 1897]

[011 - Expo 1900]

1851	London (Great Britain) - Registered - Industry of all Nations.
1855	Paris (France) - Registered - Agriculture, Industry and Fine Arts.
1862	London (Great Britain) - Registered - Agriculture, Industry and Fine Arts.
1867	Paris (France) - Registered - Agriculture, Industry and Fine Arts.
1873	Vienna (Italy) - Registered - Culture and Education.
1876	Philadelphia (United States) - Registered - Fine Arts, Industry, Mine and Soil.
1878	Paris (France) - Registered - Agriculture, Industry and Fine Arts.
1879	Sydney (New South Wales, British Australia) - Registered
1880	Melbourne (Victoria, British Australia) - Registered - Arts, Manufactures, Agricultural and Industry.
1884	New Orleans (United States) - Registered
1888	Barcelona (Spain) - Registered - Arts and Industry.
1889	Paris (France) - Registered - Centenary celebration of the french revolution
1893	Chicago (United States) - Registered - 4th centenary of the discovery of America.
1897	Brussels (Belgium) - Registered - Automobiles.
1900	Paris (France) - Registered - Evaluation of a century.
1901	Buffalo (United States) - Registered
1904	St. Louis (United States) - Registered - Centenary celebration of Louisiana purchase.
1905	Liège (Belgium) - Registered - 75th anniversary of Belgium independence.
1906	Milan (Italy) - Registered - Transport and opening of the Simplon Tunnel.
1907	Dublin (Ireland) - Registered
1907	Norfolk (United States) - Registered - 300th Anniversary of Jamestown's settlement.
1909	Seattle (United States) - Registered -Development of the Pacific Northwest.
1910	Brussels (Belgium) - Registered - Industries.
1911	Turin (Italy) - Registered
1913	Ghent (Belgium) - Registered
1915	San Francisco (United States) - Registered - Inauguration of the Panama Canal.
1915	San Diego (United States) - Registered - Celebrating the Panama Canal.
1929	Seville (Spain) - Registered
1929	Barcelona (Spain) - Registered - Arts and Industry
1933	Chicago (United States) - Registered - A Century of Progress.
1935	Brussels (Belgium) - Registered - Transport, Colonization.
1936	Stockholm (Sweden) - Recognized - Aviation.
1937	Paris (France) - Recognized - Art and Technology in modern life.
1938	Helsinki (Finland) - Recognized - Aeronautic.
1939	New York City (United States) - Recognized - Building the World of Tomorrow.
1939	Liege (France) - Recognized - Water techniques.

[012 - Expo 1915]

[013 - Expo 1929]

[014 -Expo 1936]

[015 - Expo 1992]

[016 - Expo 2000]

[017 - Expo 2005]

[018 - Expo 2008]

[019 - Expo 2010]

1939	San Francisco (United States)
1949	Stockholm (Sweden) - Recognized - Sports and Physical activities.
1949	Port au Prince (Haiti) - Recognized - Peace and Progress.
1951	Lille (France) - Recognized - Textile.
1953	Rome (Italy) - Recognized - Agriculture.
1953	Jerusalem (Israel) - Recognized - The conquest of the desert.
1955	Turin (Italy) - Recognized - Sport.
1955	Helsinborg (Sweden) - Recognized - Arts and Professions.
1958	Brussels (Belgium) - Registered - A more human world.
1961	Turin (Italy) - Recognized - Centenary celebration of the unification of Italy.
1962	Seattle (United States) - Recognized - Man in the Space age.
1967	Montreal (Canada) - Registered - Man and his world land.
1968	San Antonio (United States) - Recognized - Confluence of civilizations in the America.
1970	Osaka (Japan) - Registered - Human progress into harmony.
1971	Budapest (Hungary) - Recognized - World Exhibition Hunting.
1974	Spokane (United States) - Recognized - Tomorrow's Fresh Environment.
1975	Okinawa (Japan) - Recognized - The Sea We would like to see.
1982	Knoxville (United States) - Recognized - Energy turns the World.
1984	New Orleans (United States) - Regocnized - The worlds of Rivers.
1985	Tsukuba (Japan) - Recognized - Dwellings and Surroundings. Science and Technology for Man at home.
1986	Vancouver (Canada) - Registered - World in Motion, World in Touch.
1988	Brisbane (Australia) - Recognized - Leisure in the Age of Technology.
1990	Osaka (Japan) - Horticultural
1992	Seville (Spain) - Registered - The Era of Discoveries.
1992	Genova (Italy) - Recognized - The ships and the Sea.
1993	Daejeon (South Korea) - Recognized - The Challenge of a New Road of Development.
1998	Lisbon (Portugal) - Regocnized - The Oceans: A Heritage for the Future.
1999	Kunming (China) - Horticultural
2000	Hannover (Germany) - Registered - Human, Nature, Technology.
2005	Aichi (Japan) - Registered - Nature's Wisdom.
2006	Chiang Mai (Thailand) - Horticultural
2008	Zaragoza (Spain) - Recognized - Water and Sustainable development.
2010	Shanghai (China) - Registered - Better City, Better Life.
2012	Yeosu (South Korea) - Recognized - The Living Ocean and the Coast.
2012	Venlo (Netherlands) - Horticultural
2015	Milan (Italy) - Registered - Feeding the Planet, Energy for Life

Context

Milan

[020 - Milan, Italy, Europe]

[021 - The Simplon tunnel, 1906]

Population: 1,310,320
Area: 183.77 km2
Density: 7,130.2/km2

BIE decided in a general meeting in 2008 that Milan will be the host city for the Expo 2015. Milan won over the Turkish city Izmir with 86 votes against 65 [Ebst1]. Milan has one time before in 1906 been hosting the universal exposition under the theme of Transport. The occasion was used to celebrate the opening of the new Simplon Tunnel being 19.700 meters long, which actually made it the longest railway tunnel until 1988 [Simplon].

Milan is an old city and was founded under the name 'Medhlan' by the Celtic people. In 222 BC it was captured by the Romans. Milan grew very popular under the Roman Empire but in the 16th century the Spanish ruled it and in the 18th the Austrians took over. In 1796 Napoleon conquered the city and made it the capital of his Kingdom of Italy. During the Romantic period Milan became a major cultural metropolitan city where artists and composers met. In World War II the city was bombed but despite this Milan after the war attracted many people from the Southern Italy and abroad and made for considerable economic growth and now (2009) Milan is the EU's 10th most important centre for business and finance [Milan1].

[022 - Fiera Milan]

[023 - Galleria Vittorio Emanuele]

Milan is world famous for high quality fashion and design shows that have been held in different types of expositions and shows over many decades. The famous Fiera Milan was created for this purpose to be an exposition for industrial design. It is located near where the Expo 2015 will be held. The role for Milan being the host city is to organize the exposition and the exhibition site. Also Milan needs to make sure that it is ready to deal with all the visitors. This will brighten the city's economical future and the new development of the area of the expositions site.

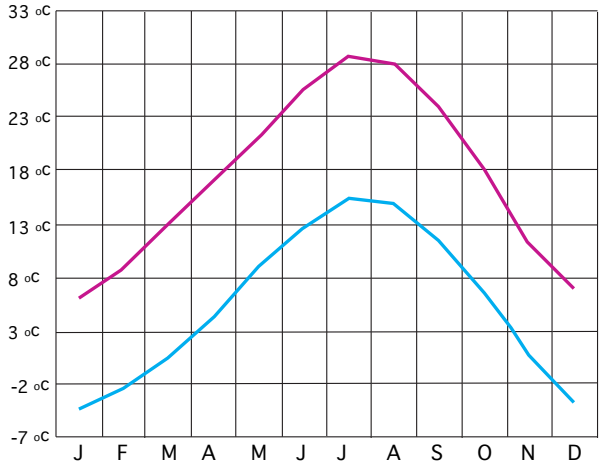
Ill. 23 shows the Galleria Vittorio Emanuele that is a famous shopping gallery. It was originally designed in 1861 but not finished until 1877. The central octagonal space is topped with a glass dome and the streets are covered by an arching glass and cast iron roof, which was a popular design for the nineteenth-centuries arcades. The gallery connects two other famous landmarks in Milan, the Duomo and the Teatro Alla Scala [Milan2].

Climate

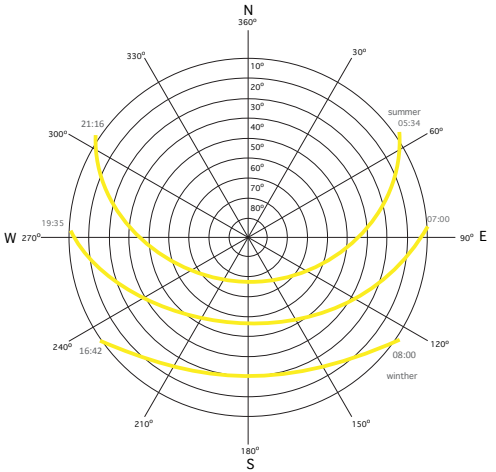
The climate in Milan is typical for the middle latitudes but in contrast with the rest of the Italy. Milan has hot and humid summers and wet and damp winters. The average temperatures in the city center are –3 to 4 °C in January and 19 to 30 °C in July. In winter it occasionally snows. But humidity is common for all seasons.
The annual rainfall is in average 976 millimeter. The rainfall is highest in June and November, see ill. 026.

In the summer the sun rises at 5.34am and the sunset around 9.16pm. In winter daytime is between 8am until 4.42pm.

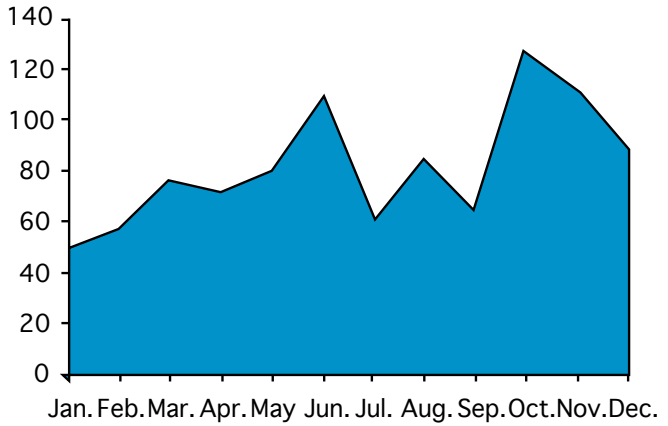
The wind diagrams are showing the average wind directions for the four seasons. They are measured at midday. The wind is generally absent but bigger windstorms can occur because of the wind blowing from the Alps or by Bora-like winds from northeast. Looking at the diagram it especially comes from the south west and south during the summer and autumn [Milan1].



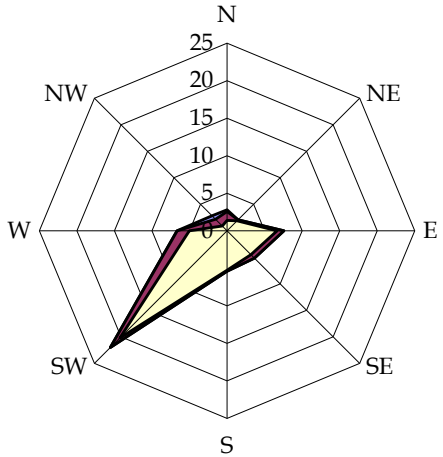
[024 - Temperature diagram]



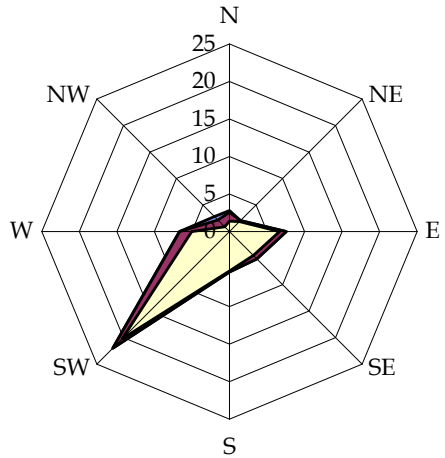
[025 - Sun path diagram]



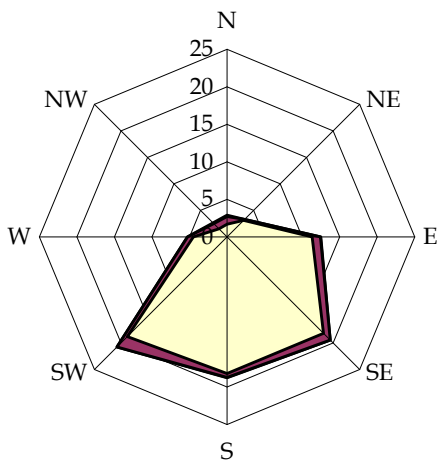
[026 - Rainfall diagram]



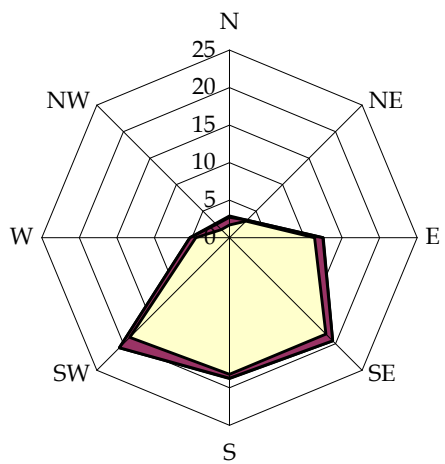
Winter



Spring



Summer

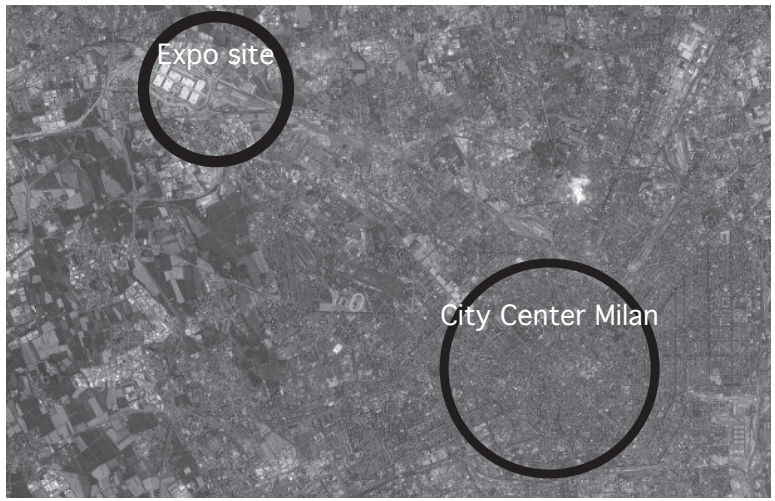


Autumn

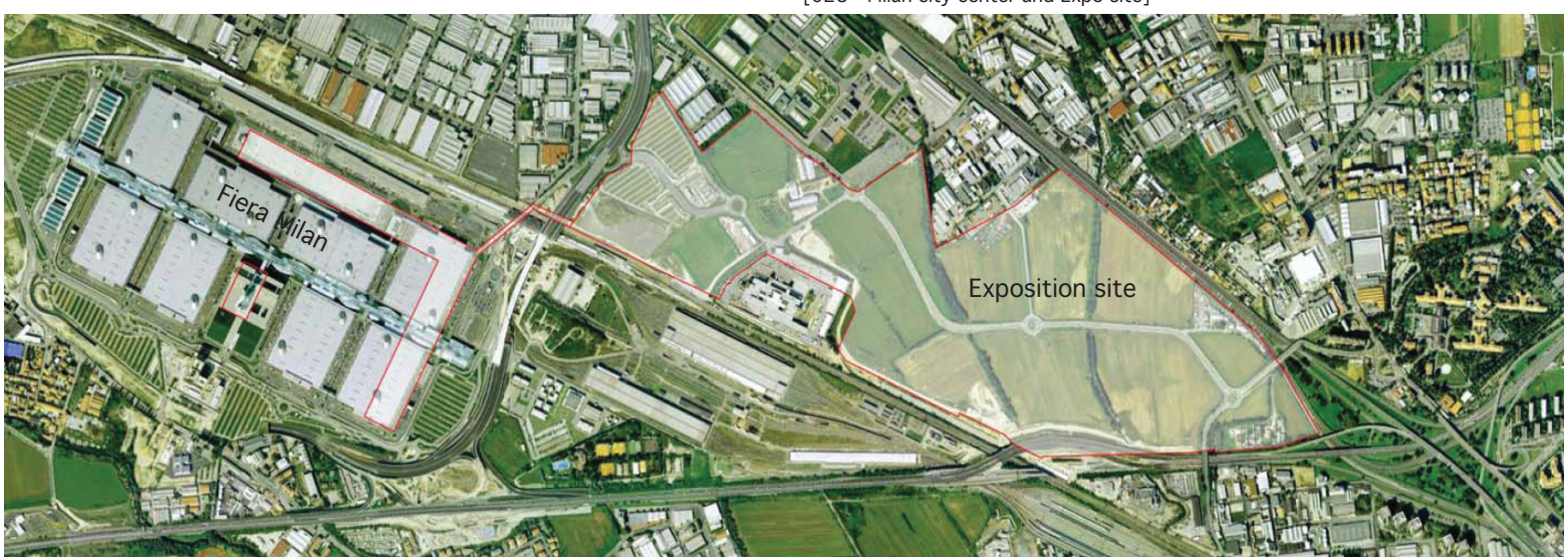
[027 - Wind directions]

Master plan

The exhibition site is located north-west of Milan near Pero and Rho, that have been occupying manufacturing industries during the first half of the last century. It will be held near the already existing Fiera Milano exhibition complex, that is project of Massimiliano Fuksas. The master plan generated for the world exposition site is drafted by a group of five internationally known architects: Stefano Boeri, Richard Burdett, Jacques Herzog, Joan Busquets and William Mc Donough. It is not yet chosen where the different countries should be placed but the exhibition area is about 1.7 million m2 including some parts of the cities of Pero and Rho [Expo2].



[028 - Milan city center and Expo site]



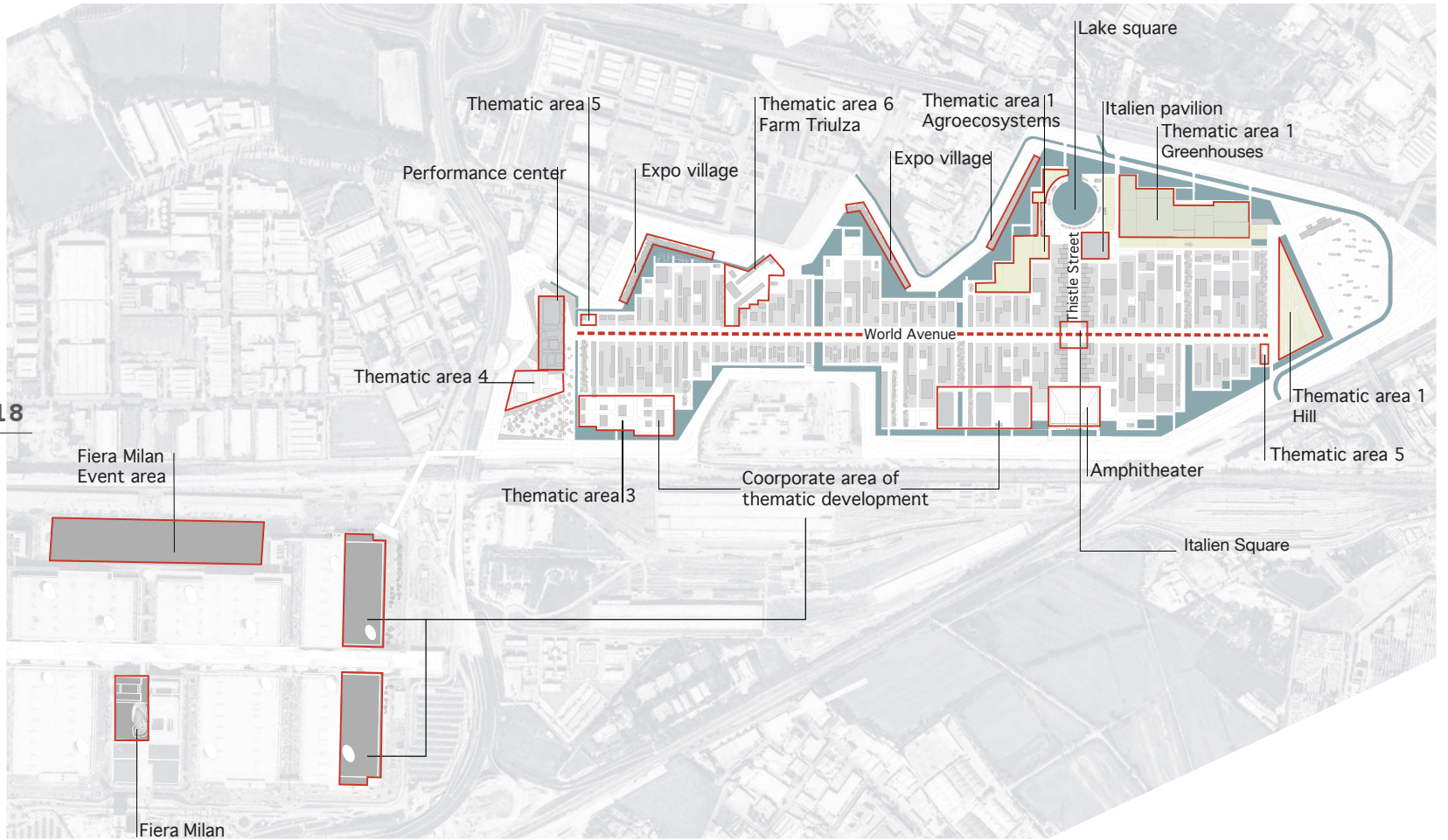
[029 - Zoom on exposition site]

The underground Line 1 connects the site from Molino Dorino to the city center of Milan. Three motor ways are surrounding the area that makes it easy for international traffic to arrive. A high-speed rail will have its own station near the east entrance to the complex as well as serving two local railway lines connecting to the Milan metro. Many convenient parking possibilities will be available. Ill. 029, the map, shows the area identified for the exposition site. The connection between the already existing exhibition area Fiera Milan and the Expo 2015 site is clearly shown here. Ill. 030 shows the area seen from south, just cutting the Fiera Milan off.

Ill. 031 on the next page shows the proposal for the master plan and the exhibition site, where the World Avenue is running through the whole area and smaller streets where the pavilions will be are connected to the big Avenue. The World Avenue will be 35 meters wide and about 1,5 kilometers long [Expo 2015, p. 4].

The exposition area will be surrounded by a canal and make the exhibition area an exposition island. Milan, in its early years was made up of many small canals and that might be what the architects want to recreate [Milan3].
The exposition site already has planned some overall functions. The area is split up in 5 different thematic zones to display different methods for greenery and agriculture [Expo 2015, p. 6].

[030 - View from south, Expo site]



[031 - Organizations, Expo site]

Expo atmosphere

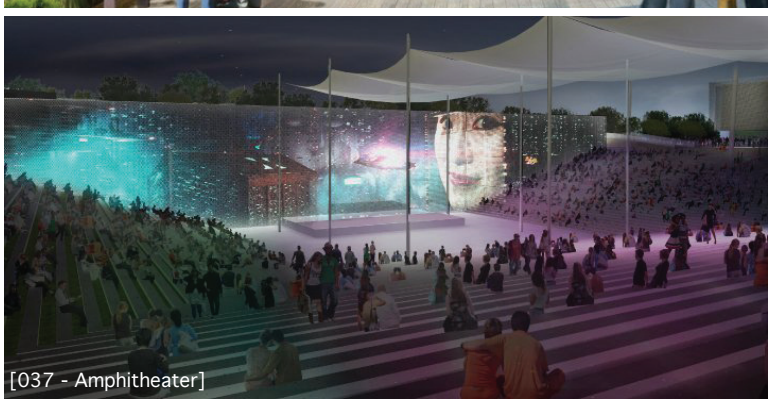

[032 - Greenhouses]


[033 - Hill zone]


[034 - World Avenue]


[035 - Thistle street]


[036- Lake square]


[037 - Amphitheater]

Users and space program

The functions in the pavilion will follow the project brief given by the Danish Enterprise and Construction Authority for the Expo 2010 [Økonomi- og Erhvervsministeriet 2, p. 13-15]. Of course exceptions must be taken and the project brief will be evaluated in terms of the conditions in Milan. The estimates given about visitors for Expo 2010 will be used as a guideline for this project. People from all over the world will be visiting the pavilion, but probably European people will make up the majority.

The following are all estimations:

- 3.000.000 visitors expected in the Danish pavilion during 187 days.
- 15-18.000 visitors daily with a stay about 20-30 min.
- Exhibition space for about 500-600 visitors at the time.
- Access at the entrance must be made adjustable.
- The pavilion should provide access throughout the entire space for physically disabled people and provide the capability for disabled persons to pass by the entrance queue.
- It is recommended that a space be made of at least 300 m2 in front of the pavilion adjacent to the queue for shows and entertainment.
- Possible to accommodate a queue of about 500 people.
- The pavilion must have at least one entrance and exit.
- Connection to common streets must be 5m wide and be possible to use as exit.

Exhibition/Café/Shop – about 2.300 m2:

- 20% of the exhibition must be café/shop.
- Separate entrance to kitchen/shop for delivering goods.
- Functional placement of kitchen, storage room, and waste depot compared to the kitchen.
- Washing-up room separated from the kitchen.
- No restrictions about toilets for visitors except toilets for disabled people.
- Storage room for furniture and events.
- Storage room for merchandise and foodstuff.
- Technique room.

Conference/meeting – about 500 m2:

- Conference: 70 guests, toilets, easy to serve the room from the kitchen/café, separate entrance and exit to the exhibition, small reception room.
- Meeting: 25 guests, toilets, wardrobe, pantry with refrigerator, coffee machine and sink.

Staff - 50 people in total – 200 m2:
5 secretaries, 20 guides, 20 kitchen crew, 5 employees

- Place for small meetings.
- 5 office spaces.
- Canteen for the staff.
- Storage room.
- Changing room including toilet and bath.

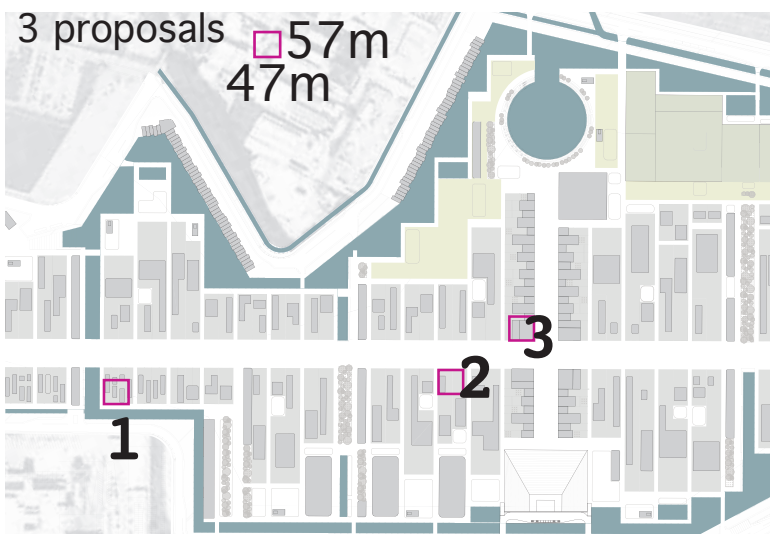
The pavilion is expected to be around 3000 m2 brute.

Materials:
Sustainable, easy to produce, build, move, demolish and capable of dealing with changing forces in the structure.

Climate must be taken into considerations.

Danish territory

The location of the Nordic or Scandinavian corner has not yet been determined and therefore neither the location of the Danish pavilion. As a result, a fictional place will be identified where the pavilion might be either very exposed or less exposed. Both would be convenient and the actual location depends on the topic and history the pavilion will express and tell. It could be a notable place, for example near one of the main entrances, although a placement more central on the axis of World Avenue and the Thistle street near the amphitheater would give it more exposure to all the visitors passing by. But maybe the pavilion story does not prepare the ground for an exposed place. The decision will be made about this issue later in the process. The area will be of the same size described in the project brief for the Danish Pavilion at Expo 2010 in Shanghai, Chine. The area is 47 x 57 m = 2.679 m2. Following the regulations by building 3 m from the boundary makes the building area 2.337 m2. The building height must not exceed 20m and the terrain is flat [Økonomi- og Erhvervsministeriet 2, p. 10].



[038- Situation plan for the Danish Pavilion]

Summary

In the previous chapter the focus has been on the context, climate, master plan and the more specific situation for the Danish pavilion with functions and spaces. The master plan and context in general does not necessarily have an influence on the expression of the Danish pavilion. Because it is not possible, and if it was it is not important, to take the context into considerations for the expression of the Danish pavilion.
It might happen that when the concept is determined, it might turn out that some functions and spaces will not be needed and some changes might be made.

Expo 2000

Theme: Humankind, Nature, Technology
Type: Registered, World Exposition
Period: 1st of June – 31st of October 2000
Participating countries: 155
Exposition size: 160 ha
Visitors: 18 millions
Focus on: Dutch Pavilion
Architects: MVRDV
[Expo3]

The Dutch pavilion was mentioned earlier because of its current status, where it is abandoned. The architects behind it had great thoughts about the pavilion and that is the focus here. MVRDV came up with their proposal for how a house or city can run under the topic “Holland creates space”.

The theme prepared the ground for a debate on how countries can focus more on developing and presenting solutions for the future. Because Holland saw the problem of the world’s development in increasing of the population of the Dutch people and not having enough space. They dealt with the problem and made a 36 m high building on 6 levels, each showing different Holland eco-system. Visitors entered from the bottom and were guided upwards through outside staircases. On each different levels were sustainable artificial Dutch landscapes, like an oak forest, a meadow of flowers, sand dunes for purifying irrigation water and on the top level a small lake surrounded by windmills that generated power for the building [MVRDV].

MVRDV won international acclaim fifteen years ago by presenting this solution for treating the world’s problems about food, space and development. The ideas are great, and the pavilion is just one result of research generated by MVRDV. The fact that the pavilion still stands without any purpose is unfortunate. The intention as mentioned earlier was to move it back to Holland, but it turned out that it was much cheaper to just let it stand and build a new one. Planning for the entire useful life of the building was not well thought out.

[039 - Dutch pavilion, MVRDV, Expo 2000]

Expo 2008

Theme: Water and Sustainable Development
Type: Recognized, International/Specialized Exposition
Period: 14th of June – 14th of September 2008
Participating countries: 140
Exposition size: 25 ha
Visitors: 7 millions
Focus on: Danish Pavilion
Architects: Spektrum Arkitekter
[Expo4] [Expo5]

In the Danish pavilion showroom in 2008 there were five different exhibition cylinders or as the title “Circles in Water” hanging down from the ceiling so one had to bend over to step inside the atmosphere of the cylinder. The ambiances were different and the purpose was to give the visitors an experience of real wind, water, biology, light and sustainability.

One cylinder was used for a shop and a café called, Den Gode Hverdagsmad (the good everyday meal) and where run by Madeleines and Kost & Ernæringsforbundet. The purpose was to show how Denmark works with human beings, food and a million meals per day, by serving the same food that are served at Danish public institutions as hospitals, children’s daycare, elder home. Furthermore so focus will be on the quality of food, to develop the quality and maybe also to improve the reputation of the traditional Danish meal [Information]

On their “National Day”, which every country has for a day during the exposition period, the Denmark cultural focus was on traditional food where the Danish food theater troop, Madeleine Madteater, had designed installations of food in circles for example rødgrød med fløde set up in a lovely way [Madeleine].

The Danish pavilion won a silver medal for its clean and pure design and aesthetic performance [Food1].

[040 - Cafe and shop]

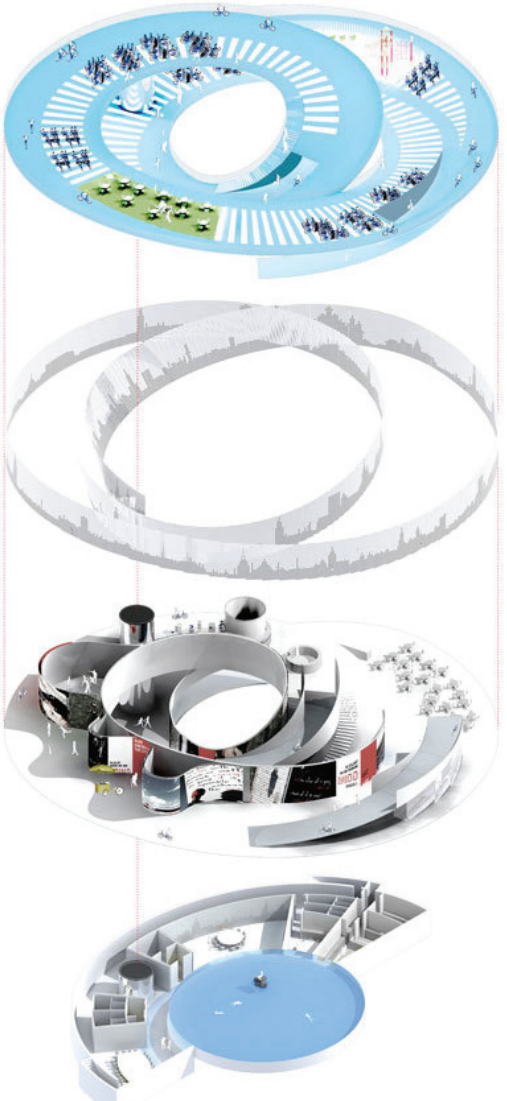
[041 - Installation, Danish pavilion, Expo 2008]

Expo 2010

Theme: Better City, Better Life
Type: Registered, World Exposition
Period: 1st of May – 31st of October 2010
Participating countries: 190
Exposition size: 5.28 square km
Visitors expexted: 70-100 million
Focus on: Danish Pavilion
Architects: BIG – Bjarke Ingels Group
[Expo3]

The pavilion is named ‘Welfairytale’ and is a contraction of the two words welfare and fairytales. It is intended to appeal to the personal experience attendees get from visiting the pavilion and is told with small stories shown on the path within the exhibition. Bikes are available for the visitors to use to get the experience of biking through a Danish city. The pavilion is built with steel construction in a double curved Möbius strip. The strip starts on the ground and leads the visitors 12 m up in the air and down again. In the middle of the pavilion is the ‘Little Mermaid’ sitting in clean seawater from the Copenhagen harbor. ‘Welfairytales’ presents Denmark as a family friendly, comfortable, beautiful and nature friendly country and shows Copenhagen’s best attractions [Ebst2].

The reason to show this project as case was not only to give another impression on how Denmark already has been presented and to see the latest proposal but also to get an understanding of the spaces needed in a world expositions pavilion. What will happen with this pavilion in end of October has not been decided yet but BIG proposed to move and relocate it in the Peoples Park after it has been used in the Exposition. [BIG].



[042 - Danish pavilion, Expo 2010]

[043 - Danish pavilion, Expo 2010]

Summary

The Dutch pavilion demonstrates a great idea about farming and agriculture and how this topic has already been developed for many years. Concepts from this project that can be brought further could be the way they show how agriculture works in their country, by dealing with it in a new way.

The two latest Danish pavilions on the world expositions were shown as a case, in order to be aware of the statements and points Denmark already have been giving in the recent past and to explore whether some of these topics might be of any interest to for further work.

The concept in Zaragoza 2008, was interesting in terms of where focus has been on traditional food. This case shows that it is important to increase awareness about healthy food and the experiences around food. These ideas will be further considered for the project.

The brief for the present pavilion in Shanghai 2010 is also used as case to get an idea about what area would be required to have inside and how much space the entire pavilion could use.

[044- Carrots]

Theme

Feeding the Planet, Energy for Life

"The theme makes the Expo"

[Bie2]

The theme has been chosen by BIE for Expo 2015 and thus starts the debate that will create the frames for Expo 2015. The theme is a great issue concerning the entire world and might support a new campaign started by the Food and Agriculture Organization "1 BillionHungry", which has been launched in many big cities of the world and whose purpose is to collect one billion signatures for the one billion people that suffer from hunger. The occasion was at the World Food Day in October 2010. The signatures appeal to national and international leaders to move hunger to the top of the political agenda [Expo6].

But hunger in the world is not at all caused by a lack of food, because if it were possible to distribute the food easily there would be enough healthy food so all the 6.869.500.000 people [World1] on the planet Earth would be properly fed, nourished and live a healthy life. Hunger exists because of poverty and when natural disasters like earthquakes, floods and droughts occur in certain areas where poor people live. Hunger also exists because of conflicts between countries. It exists because people sometimes use natural resources not in a sustainable way and because many countries do not invest and support agricultural development [World2].

The theme concerns questions about traditions of food in the specific countries, and creativity and innovation in the business of food. Many themes and other world expositions have already tried to deal with this topic in some aspect, but with this combination it will be explored on a new global basis and with fresh answers. How do we deal with the world requirement for access to clean water and food that is healthy, safe and sufficient for all people on the planet Earth?

"Terra Madre is a network of food communities, each committed to producing quality food in a responsible, sustainable way."

Terra Madre is coordinated by the organization 'Slow Food', where innovative concepts in the field of food, gastronomy, globalization and economics have been introduced. Since 2004, each year in October, the Terra Madre conference takes place, where around 100 countries meet and discuss topics concerning organic certification for food, rural communication and indigenous agriculture. There is a large focus on the relationship between food communities, cooks, universities and scientists [Terra Madre]. Where to begin this discussion about what to deal with and what will be important for Denmark to show?

To determine specific and important topics for Denmark, a text or brainstorming session will generate and kick off the process.

Food

Dealing with food, habits, traditions, dealing with the theme.

It is important to see the theme food in a wider sense yet with a focus on Danish food and habits. The Danish traditional kitchen's history will shortly be outlined. It would be difficult to define the exact origins in Danish traditions in the kitchen, but initially it must have been quite simple. People had to eat what the seasons brought for plants that grew wild, wild animals that were around, and wild fruit and vegetables. For example with the Grauballe man, that was initially discovered in 1952, that in 2001 with new technology and scans, the contents of his last meal were discovered. It was consisted of many different types of corns, like barley and oats and seeds from over 60 different herbs and grass. He lived around 290 years before Christ [History4].

The first recipes went through housewives and generations orally like cooking advice. The first recipes published in a Danish cookbook originate from 1616, the time when Christian the 4th was king. These were not detailed and not intended for the ordinary home. Until 1700 two more cookbooks were published and then slowly the popularity of cookbooks rose [Food2].

The innovation of ovens came around 1850th. The average housewives got better facilities to cook and that increased the popularity of cookbooks as well. Cooking wives as Madam Mangor, Fru Nimb, Emma Gad and frk. Jensen are just some of the very popular housewives that started to publish what is known currently as the Danish Traditional meal on recipes in cook books. In the 20th century many more cookbook writers became popular.

Eating problems

Today, even with ecological products and all the recommendations to eat healthy, the majority of the Danish population are actually overweight:

"20 procent af alle danskerne spiser mad eller slik uden at være sultne hver dag eller næsten hver dag."

" 20 % of the Danes eat food or candy without being hungry every day or almost every day". [Politiken1]

This is interesting to see. Maybe the reason is a stressed Danish population that produces the overweight problem in Denmark. Studies show that ten years ago the tendency to buy ready-made-meals or fast food was greater than today [Politiken2] and indicates that more Danish families are making the dinner at home which should be more healthy. But why is overweight then still a problem?
It might be due to the habit of not buying the real raw products or caused products sold in the supermarket or maybe even because food is sold in bigger bags than before.

A study on Danish habits has shown that people continue to eat, even though they are not hungry. Maybe the Danish people are afraid of being hungry [Politiken3]. This leads to other types of questions, if it is the food, the culture, the behavior or all three that gives problems behind food? How can the tendency of over eating, overweight and waste of food be dealt with? Is the solution for sustainable food to cook healthy and eat less?

GMO

Scientists have been studying genetically modified organism (GMO), foods that have been produced artificially by modifying the heritable characteristics in the living organisms. There is endless debate as to whether it is damaging for the human body or a fine new way to secure food for all people in the world. It is reasonable to ask why many people have difficulties getting pregnant naturally, if it is because of changes in food that are caused the GMO?

"Når vi slipper gmo løs i naturen, sker der ændringer, som vi ikke har nogen som helst kontrol over – det kan have meget store konsekvenser, og vi har ingen mulighed for at gøre det ugjort."

"When we let GMO go wild in the nature, there will be changes that we do not have any control over - it can have very serious conse-

[045 - GMO lemon]

quences, and we have no ability to do the undone." [Politiken4]

In America there are no rules about labeling GMO food products sold in the super markets.

»I USA har de en anden holdning til GMO-fødevarer. Der mener myndighederne, at det grænser til vildledning, hvis man skulle fortælle forbrugerne, at en fødevare var genmanipuleret, for ifølge dem er der jo ikke noget særligt over genmodificerede fødevarer. De opfatter det nærmest blot som en form for forædling«

"In the U.S.A, they have a different attitude towards GMO foods. The authorities say that it borders on misrepresentation, if you should tell consumers that a food was genetically modified, according to them there's nothing special over GMO foods. They regard it almost just as a form of growth."

Says Hanne Boskov Hansen from the Danish Veterinary and Food Administration to a Danish journalism from Politiken.dk [Politiken5].

The Danish population's opinion about GMO is very varied. But the fact that the process for GMO is not completely natural growth make it seem not right to eat the products.

"For the first time in the world, we've proven that GMO are neither sufficiently healthy nor proper to be commercialized. (...) Each time, for all three GMOs, the kidneys and liver, which are the main organs that react to a chemical food poisoning, had problems."

indicates Gilles-Eric Séralini, an expert member of the Commission for Biotechnology Reevaluation, created by the EU in 2008. That is why there should be more focus on organic sustainable food [Food3].

Sustainable

Organic sustainable food and cooking should be the future and as mentioned earlier the organization Terra Madre precisely wants to act, put focus and encourage people to promote sustainable food production methods. The vision of Terra Madre is to do research in this area and to enhance and protect the local products and culinary cultures. The organization has identified the most important factors to the notion of quality of Slow Food, an originally Italian organization concerning better conditions for food. The food should be:

Good – where good refers to the quality and taste of food

Clean – production methods are environmentally friendly and right to dignity'

Fair – fair payment for producers and fair prices paid by consumers.

The nodes in the organization are the food communities, the process and the distribution of quality food in a sustainable way. It is linked to a territory in terms of historical, social and cultural terms, because the theory about the food industry endangers the very existence of small productions.

Cooks and chefs of Terra Madre understand that it is not possible to separate the pleasure from liability to producers, without influencing the cooking. Therefore restaurants, canteens and places where food get served or sold are a good place to convince the consumers about the philosophy of Terra Madre.

Space

Another big question in the debate is, if there is enough space on earth to develop organic food for everyone? Would there not be more food if producing only GMO food, and would GMO food not be the solution against hunger? But the answer is giving in a report by the organization Greenpeace, where the chef for International As-

[046 - Potatoes]

sessment of Agricultural Knowledge, Science and Technology for Development, IAASTD, is giving a clear “No!” [Balusa, 2009 p. 4].

That means there should be enough space on the planet to feed everyone. For example looking globally on the planet earth there are enough fields to grow corn and cereals for everyone to be fed, the problem is just that it is concentrated so in some parts actually too much are being grown and must be thrown out in the ocean and in other parts there is not enough space [Jensen, 2009, p. 7]. Looking at the third world and starvation, how can it be helped to grow their own products?

An existing solution is to help the countries just by buying products produced there, for example products labeled ‘Fair Trade’, which shows that the products are grown and made organically and under good conditions for the workers, the exact vision in the Fair Trade organization [Fair Trade].

[047 - Amish people]

A sustainable future requires an agriculture driven without GMO not because new technology cannot be used, but it should just work risk-free without giving the problems that GMO can give.

It does not necessary mean that people in the world should live like the Amish-people, a religious population in the U.S.A. that are saying no to the modern technology and therefore only are developing organically grown products, actually it is shown that the fields of the Amish-people gives the highest profit of all agriculture in the U.S.A. [Jensen, 2009, p. 10]. It guides us to another question. Should there not be a better debate about life styles and living areas and dwellings? Of course all people on earth could not live like the Amish-people. It would not be sustainable to demolish plenty of already existing cities and farms to produce that kind of life style. But it is proven that for example in Denmark if people lived in apartment blocks in the city it would be more sustainable. It would be better for the earth if everyone lived close to every day facilities to make the transport more green. But the Danes do live too thinly and spread out, because the habits and traditions are based on comfort and the idea of Danish coziness, hygge [Botæt].

If the future is about living compactly, what would happened in Denmark, a small country with already a lot of fields and small villages, but where the people would live in a more concentrated way? What would happen to all the small villages? It is another discussion for another Expo or project but never the less it is as important as the theme food.

Summary

The futuristic kitchen and way to cook could be the focus area for Expo 2015. The fashion about slow food is becoming more common in many circles and when asking the Danish population a majority says that their intention is to eat healthy and slow food. But that being said, it is not really always done according to a number of surveys made on the Danish eating habits [Politiken6].

“There is enough for everyone’s need, but not for everyone’s greed” Ghandi [Jensen, 2009, p. 10].

Denmark could contribute by making a proposal for one of the biggest problems and challenges of our time with healthy food, security in food and hunger in focus. But the focus should be narrowed down.

Topics could be to eat healthy, organic and slow traditional food in a modern and inspiring way. That should be a tangible problem to prepare the ground for a debate on how the food, life, dwellings and habits will be dealt with in the future. This must all be done simultaneously with the choice of materials and structures for the pavilion. It must be sustainable in terms of its useful life of only 6 months. That will be discussed further in the next chapter.

Technical

The construction methods and materials must follow each other's requirements. A sustainable solution might be a flexible material that is cheap to produce, light in weight to reduce the CO2 during transport and easy to transport to the construction site. Or a construction that is easy to construct, to demolish, to decompose and/or to reuse.
Never the less, the pavilion will only stay for about 6 months at the exposition site, it could probably be moved to another place to continue its purpose or the materials could be recycled. In general a sustainable material and or construction that reflects care for the nature, energy and the human being should be chosen.

An example of material taking up less space during transport could be like the new experiments, but not yet so sustainable, that a designer has announced; clothing on spray. The cloth-spray is sprayed out in short felt-like fibers combined with polymer fabric directly on the body. A solvent makes it liquid for a few seconds and then it hardens on the skin [Politiken7]. A textile like that, which stiffens up and can be formed in infinite ways, could be interesting to work further with.

Decomposable material like some types of plates and cutlery that are made out of corn flour would be more nature friendly way to get rid of the materials after use. Or even an edible material like ill. 049 where food is used as material. The talk show host Ellen DeGeneres, on the right, gives Lady Gaga a "veggie bikini" inspired by her "meat dress" [Meat dress]. Veggies for clothing are probably more sustainable than a dress made out of meat! Maybe food could be used as a membrane or it could somehow grow on the structure. It is fascinating to imagine a pavilion where the material changes over time, so it would not be the exact same as visiting it in the beginning and at the end.

Some construction methods and materials used to build contemporary dwellings allows them to stand for over 100 years. Is that also relevant for the future, to build lifetime constructions? It is impossible to say what will happen with the Earth, but for example the sea level is rising all around the world due to global warming; maybe it would be interesting to see how buildings of the future would be. For example the old Nordic countries have build cottages lifted up from the ground on the field side due to the melting snow in springtime. One solution could be to build in the same style in the future.

It should either be possible to produce the pavilion in Denmark, in an simple construction to build, take down and that does not take up space during transport. Or it should be possible to find all materials needed close to Milan, to reduce transportation.

[048 - Fabricon-spray produced by designer Torres and professor Luckham]

[049 - Meat dress and veggie bikini]

Summary analysis phase

On the basis of the analysis phase a history, theme or topic will be generated to give the setting for this project. It will be necessary to have a very topical and strong statement for the Danish pavilion to make it notable in the larger context of all the other pavilions at the expo. This does not necessarily require wild architecture but it does need the sense of showing the statement in a strong, aesthetic and expressive way. The architecture should mirror the statement so visitors clearly understand what is going on and exit the pavilion with an 'A Ha' feeling.

The analysis phase is based on the world expositions history, context, case studies and a debate on the theme 'Feeding the Planet, Energy for Life' and how it could be approached in this project. The chapter about food, the different methods, ways and ideas about getting enough food for the whole world is to give a basic common knowledge about the theme and what is being discussed for the world exposition. Furthermore, different ideas behind some of the materials and different structures are described. The introduction to the traditional Danish food is made to show how basic cooking was done a long time ago and how food and views on food have changed and developed.

This project should not be an exhibition showing concerns, issue and solutions; it should rather propose a solution to a concern or issue is shown as a statement in the whole concept for the building.

So is it important for Denmark to show how to eat more sustainably or in a healthier or in a traditional way?

Or what should the Danish statement or history be?

The first part in the next phase, the sketching phase, will deal with different ideas based on the analysis phase. A concept will be found and on the basis of that concept, a final proposal will be developed.

[050 - Beech leaves]

Designing parameters

Follow a history/theme found for the pavilion

Design - aesthetic and evolving

Sustainable materials and/or structure

Reduced or no transport

Story telling

Vision

Alessandro and Fabiana are passing by the Danish pavilion. They do not really know anything about Denmark but get attracted by the placement and site.

- ATTRACTS VISITORS.

They are entering the Danish Pavilion after waiting in line for short while. In the line they got fascinated by the waiting area and the interaction there between the visitors and they did not even realize that the queue moved quite fast.

- INTERACTING IN THE WAITING AREA.

When they enter the Danish pavilion, it almost feels like entering a new world or another unknown space on earth.

- ENTRANCE INVITES VISITORS INSIDE THE UNIVERSE OF THE PAVILION.

The exhibition they are passing is impressing the visitors. Not many special effects are used to give the positive feeling.

- EXHIBITION IS PASSIVE.

It is clear to see how material and the structure are important for the pavilion, a very sustainable way to build a pavilion with a lifetime of only 6 months.

- SUSTAINABLE STRUCTURE AND MATERIALS.

At the end, they stop in the café and shop that is selling Danish specialties. It is a Danish cozy atmosphere. Alessandro and Fabiana buy a “Kartoffelmad” before continuing the long day at the exposition site.

- COZY CAFÉ AND SHOP, INVITING PEOPLE TO STAY A LITTLE BIT LONGER.

After the visit in the Danish pavilion, they decide to go and visit Denmark. The impression was really powerful and they are almost entering the pavilion flying.

- AHA-FEELING.

Sketching phase

Part 1 - concept

The sketching process is iterative, but it has been set up as a linear process to make the form finding clear and understandable. The sketching phase is therefore split up in three parts. The first focuses on narrowing down and finding the concept. The second part focuses on the concept and developing the interior and exterior. The third phase merges the ideas together.

The concept for the pavilion will be found and different themes will be explored before making a decision . The concept and idea about the materials and the use of the materials in a structure should be considered from the beginning.

Six themes have been in the loop. The first theme is a concept about trees showing sustainability in a clear way. Then a tower concept was also briefly explored. A block concept, might show a future way of living. Living on the hillside is then explored. Textiles or membranes are also being used as one of the main factors when designing.

While growing up in Denmark one would say it would seem naturally to know what exactly Denmark could impart the rest of the world with. Therefore to start, different facts about Denmark were researched [DK1]. How Denmark is divided and organized was also explored as a concept for the site [DK2].

Kongeriget Denmark - The Kingdom of Denmark

Population:	5.511.451 inhabitants
Square meters:	43.098 Square kilometers
Population density:	approx. 128 inhabitants per sq. km
Ethnic Distribution:	90,9 % Danes
Language:	Danish
Form of government:	Constituted monarchy
Currency:	Danske kroner (Danish crown - DKK)
Highest natural point:	Møllehøj, 170,86m
Lowest natural point:	-7,5m
Distance E-W:	452 km
Distance N-S:	368 km
Coastline:	7.314 km
Islands:	1419, whereof 433 are named
Ave. life expectancy:	Women, 80,5 yrs. Men, 76 yrs.
Capital:	Copenhagen, 1.167.569 inhabitants.
Agriculture:	62 %
Forest:	13 %
Lakes:	4 %
Beach:	1 %
Built up area:	10%


62%
[052 - Rape field]

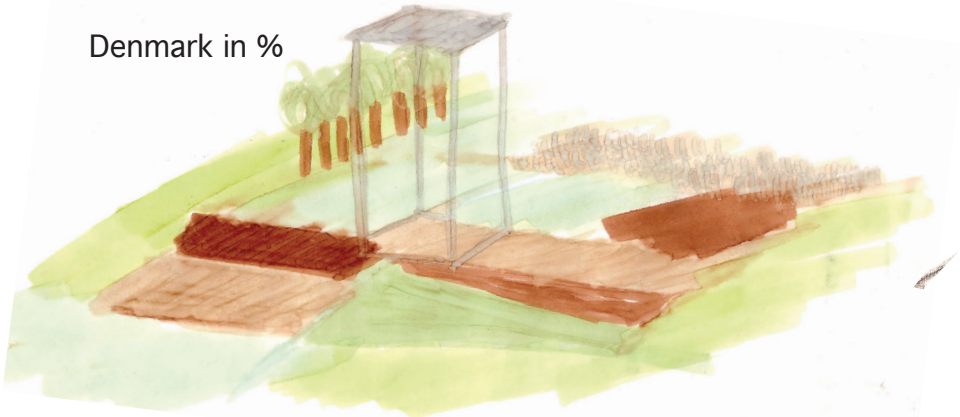

10%
[053 - Copenhagen]

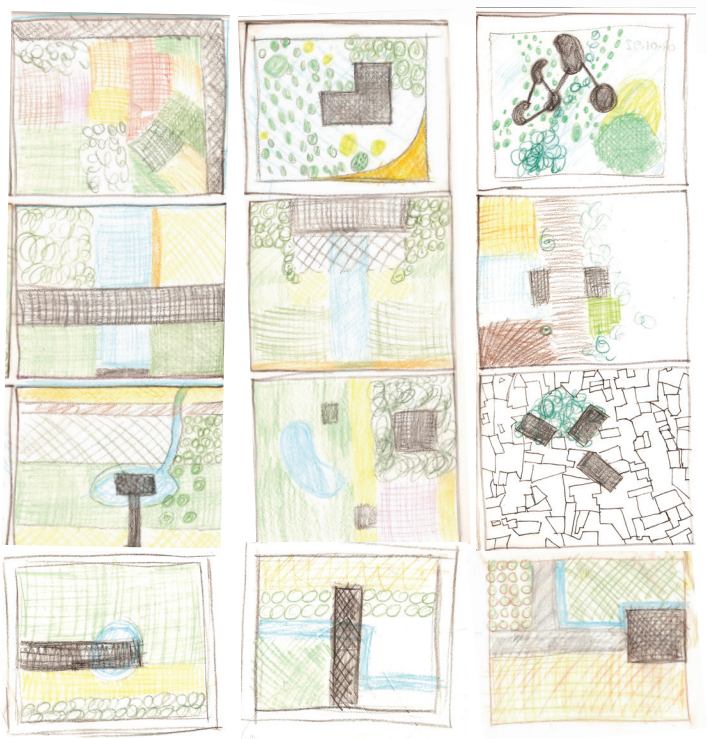

1%
[054 - The beach at the North Sea]


13%
[055 - Beech forest]


4%
[056 - Lake]

Denmark in %



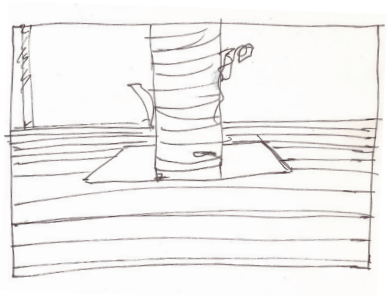


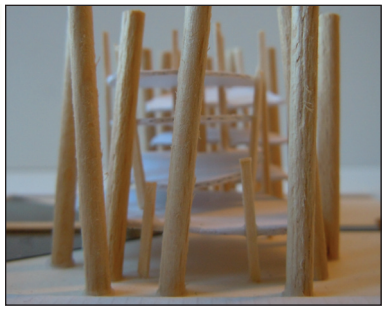
Positive: Awareness about agriculture.
Living up to the expo theme.

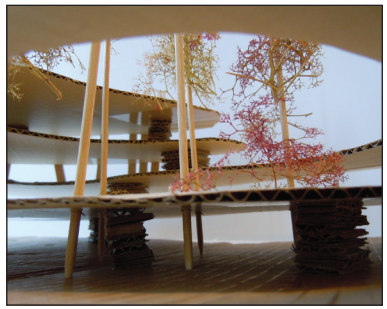
Negative: Too many things will be visible on the site and the point might not be clear.

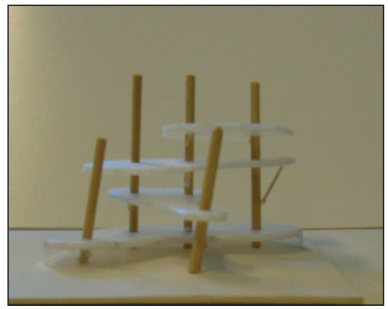
- Show fields, forest, built up area, lakes and beach in percent.
- Living animals on the site.
- Show Danish farm life.
- Denmark's way of dealing with the theme feeding, by showing fields of different corn sorts.
- Change over time caused growing fields.

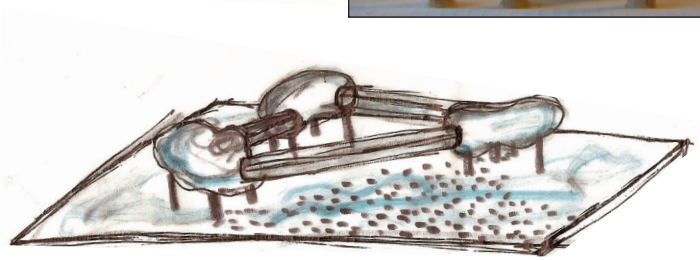
Trees









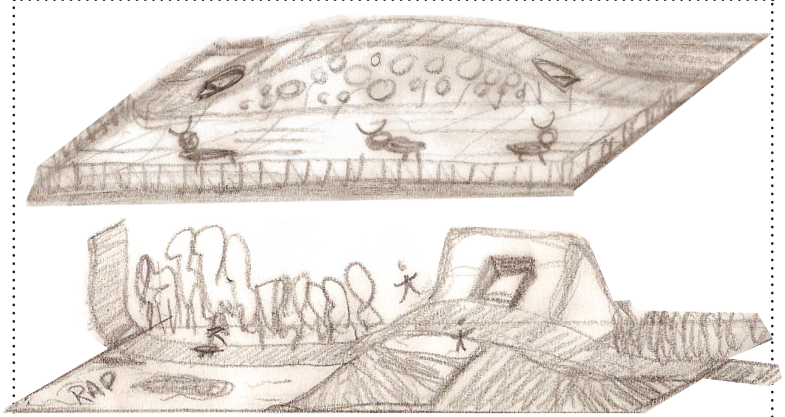


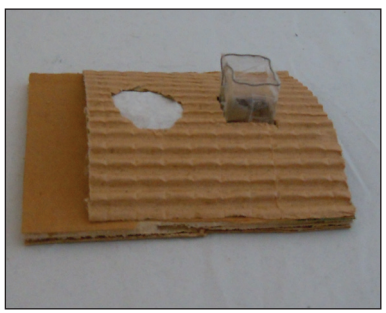
Positive: Fine idea – sustainable – shows awareness

Negative: Will the trees be there and be usable when time arrives?
Is it right to present Denmark as a forest country?

- Should be planted now and used as holding construction.
- One in each corner and extend a membrane between the trees.
- A holding scaffold on the inside to make it more than one floor high.
- Trees planted coincidental on the site and balconies built up in between.
- Trees growing up through the levels in the pavilion, giving a green touch.
- Expression of being in a Danish forest.
- Trees planted now, but will be cut down later to use the wood as timber.
- Things hanging down from the trees like food, swings, beds, chairs, hammocks etc.

Hill



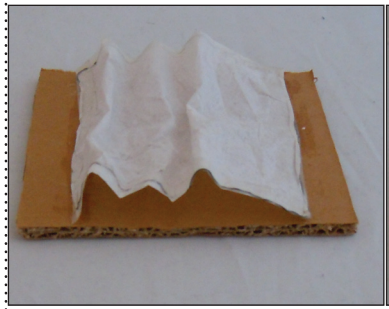


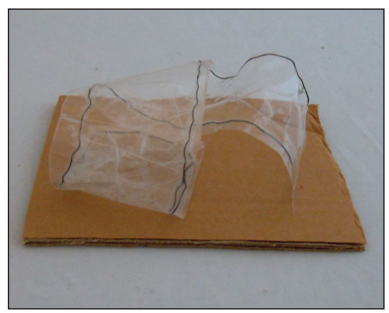
Positive: Gives a playground-landscape.
Slightly hilled shows the Danish landscape.

Negative: Might not be enough space for all the function.

- Hide all functions under the earth. Earth or clay build cave.
- Wooden planks build up in a system, resembling a small hill. Maybe some towers are peeping up from the structure in another material. Maybe with a trampoline integrated in the structure.
- A hillside with small lake in a transparent structure.
- Playground for children and adults.

Membrane



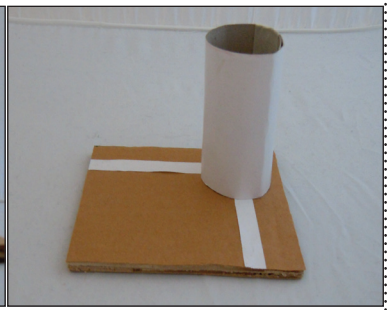


Positive: Flexibility in the façade, light in transport.

Negative: Might be difficult to control.

- A holding structure on the inside with a membrane as the façade.
- Wrap up a structure like Christo is wraps buildings.

Tower

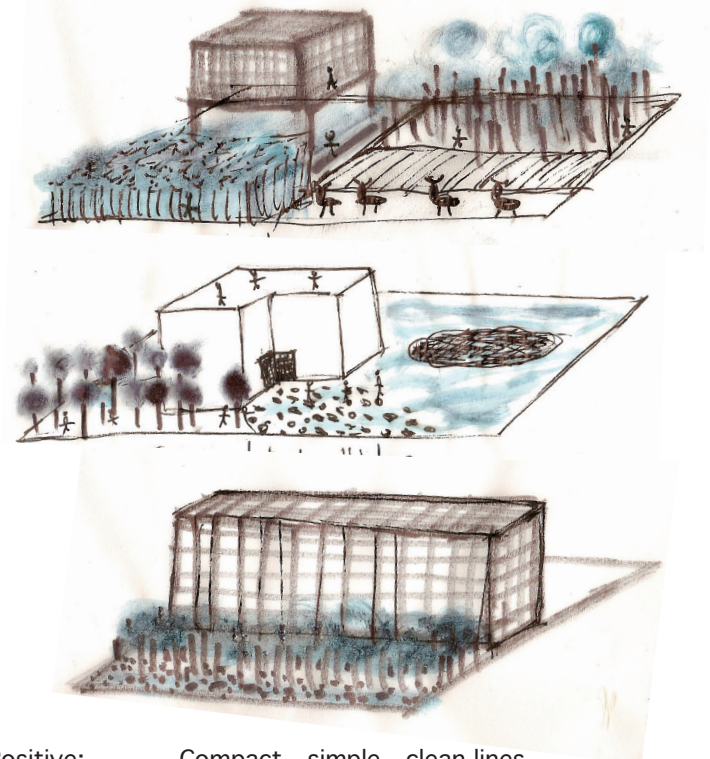


Positive: Small footprints – compact – seen from far away.

Negative: It will easily surpass the limit of 20m.

- Round tower as the round tower in CPH.
- The four seasons façade. Four transparent facades put together and hold up in a structural system. Showing typical Danish weather during the seasons or symbolizing the food normal for the seasons in DK.
- Water tower. Symbolizes the importance of clean water.

Block



Positive: Compact - simple - clean lines.

Negative: There should not be too many things happening on the site, then it would be confusing to visit.

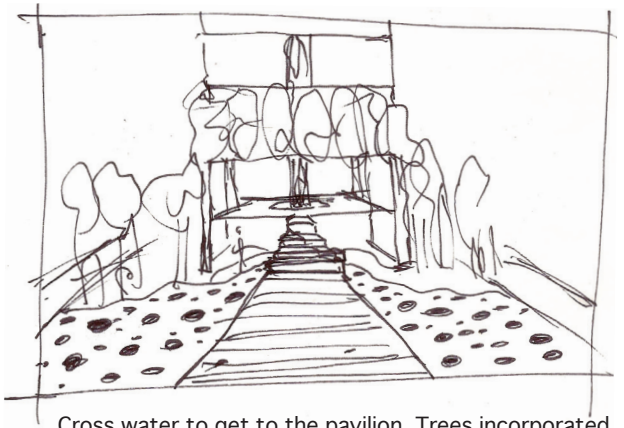
- Interpretation of a traditional Danish 3 wing farm analyzed in another form or structure.
- Just a simple cube or bar placed on the ground.
- Simple, clean lines and Nordic architecture.
- Nothing else should happen on the site.

What is Danish architecture and the Danish pavilion?

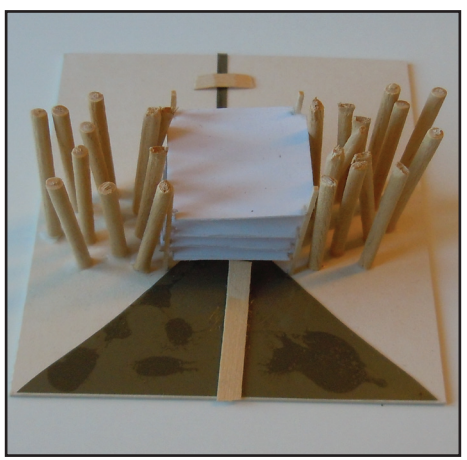
The exploration of the previous themes has led to many good ideas and different concepts, where some of the ideas are going along the exploration and are seen in different concepts.

Initial inspiring words and main architectural concept:

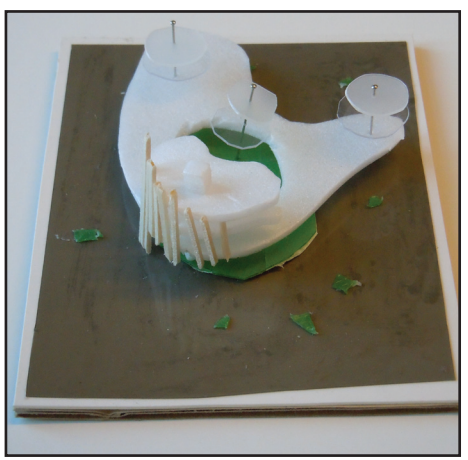
- Simple form - Nordic architecture
- Clean and clear lines
- Use of few materials and effects
- Trees or green effect -Awareness about sustainability
- Water - Denmark is surrounded by water and has clean drinking water.



Cross water to get to the pavilion. Trees incorporated in the design around and in the pavilion.



Cross water on a path. Simple form in between the trees.



Water covering the site, possible to cross without being wet, but form too complex.

Collection of rainwater on roof, awareness about reuse of rain.

[057 - Simple - Boxhome 2007, Oslo, Norway - Rintala]

[058 - Water effect - Kamogawa River, Kyoto, Japan 2008]

[059 - Green - Yellow Treehouse 2008, Auckland, New Zealand - Pacific Environment Architects]

Summary

What would be Danish Architecture and how should Denmark be represented. Nordic and thereby Danish architecture is often referred to as clear and clean lines, minimalistic architecture and often accomplished with the use of few materials.

It is chosen to work further with the block, simple forms and the clear lines. With use of few materials the expression Denmark will give will be seen and also what should be represented through the exhibition and maybe what Denmark can do in the terms of sustainable building.

Different ways to developed an exhibition and museums flow will be examined before going further in the design of the pavilion.

In part 2 the focus will be on the block and the indoor flow and the facades and the structure will be explored further.

Exhibition

The exhibition in the pavilion will present Denmark and be one of the important things that gives visitors an impression about Denmark. It should be clear, simple and interesting.

Therefore, different paths through the exhibition space will be explored.

Also it is necessary to know what the exhibition should be about, so the atmosphere and the rooms will be designed on the basis of parameters set up for the purpose.

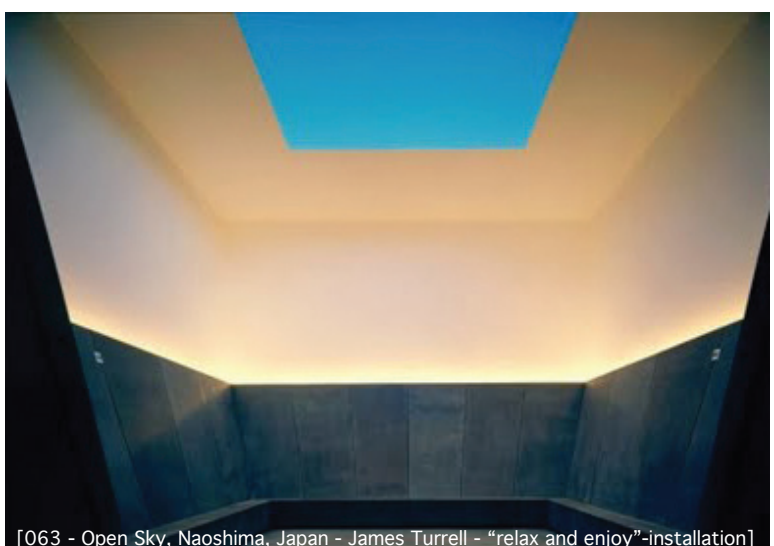
[060 - Moss wall 1994 - Olafur Eliasson - “look and experience”-installation]

Desires for the exhibition space in the Danish pavilion:

- The building creates spatial effects and interesting areas for exhibition.
- The room itself should be interesting and catch the visitor’s attention immediately.
- Installations in the exhibition space as a part and experience of the room, “feel-”, “relax-”, “eat-” installations.
- The exhibition should consist of two parts. One exhibition before entering the cafe end one exhibition after leaving the café.
- The first part should experiment with the rooms themselves. Perhaps the work of different modern artist’s and their view on how to feed the planet and gain energy for life.
- The second part could have live video streaming from different Danish eating situation. For example a canteen at a high school, the sausage wagon at the town hall square in Copenhagen and maybe many small screens showing normal Danish families’ eating table habits. This to support the theme Feeding the Planet, Energy for Life.

[061- Jewish Museum 2001 Berlin, Germany - Libeskind - “walk over”-installation]

[062 - Church of light 1989, Osaka, Japan -Tadao Ando - light and spatial effect]



[063 - Open Sky, Naoshima, Japan - James Turrell - “relax and enjoy”-installation]

[064 - Trapholt museum - the wall creates different spaces and experiences]

Flow

The room and exhibition area itself can be developed very differently. Therefore, different typologies for museum flows are set up to create a better understanding and to find out which typology works for this type of exhibition.
The exhibition will be as described on the previously pages and should be clear, simple and interesting.

The exhibition itself will not be defined any further than this.

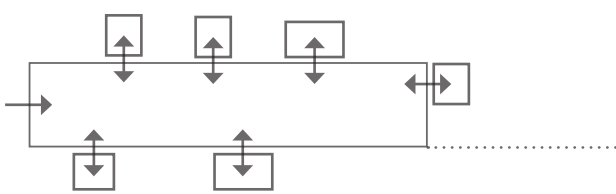
Different flows of exhibition spaces' will be explored and are set up with a concept sketch and with an example.

Continuos flow.

Continuos flow with breaks.

One large space is often seen at galleries. It gives the room flexibility for different types of exhibitions. The visitors' flow depends on the exhibition and the visitors themselves. An example could be the Mies van der Rohes' Neue Nationalgalerie where the first floor entrance is one large open space.

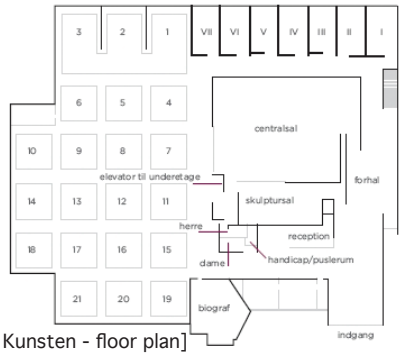
One open space.



One large space with connection to smaller.

[065 - Neue Nationalgalerie 1968 - Berlin, Germany]

[066 - Kunsten museum 1972- Aalborg, Denmark]

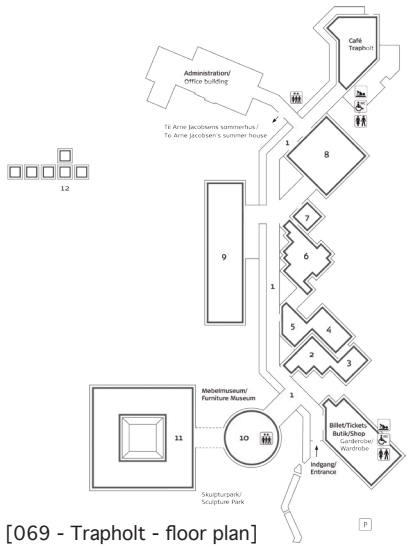


[067 - Kunsten - floor plan]

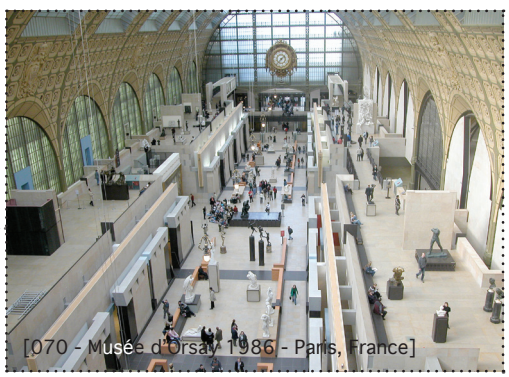
Continuous flow makes the visitors experience all of the exhibitions. It is evident which way to go and what to see first and last. At Alvar Aaltos' Kunsten the showrooms are placed right after each other and gives a naturally flow through the whole exhibition without really any breaks.

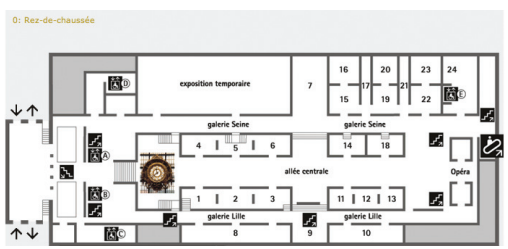

[068 - Trapholt museum 1988 - Kolding, Denmark]

Continuous flow with breaks. The same principle as without breaks, the difference is just that the visitors will have the change to reflex over the exhibition between the different parts or showrooms. An example could be Trapholt where you have a long and some smaller paths, which give the visitor some time between the different exhibition rooms.



[069 - Trapholt - floor plan]


[070 - Musée d'Orsay 1986 - Paris, France]



[071 - Musée d'Orsay - floor plan]

One large space with a connection to smaller spaces. This type of exhibition gives the visitor a choice of what to see or not to see. Musée d'Orsay is an example of this kind, where the visitors arrive in a large open space and from there are let out in smaller exhibit halls.

Part 2 - focus

Previously the simple block was chosen. To work further with the development of the block the two previously descriptions on exhibition and museum flow will be used for further development.

Firstly in part 2, flow and functions will be developed and the placement of the block on the lot. Zone 1 as described in the analysis phase is chosen, because it is near the water and will give further dimension to the pavilion.

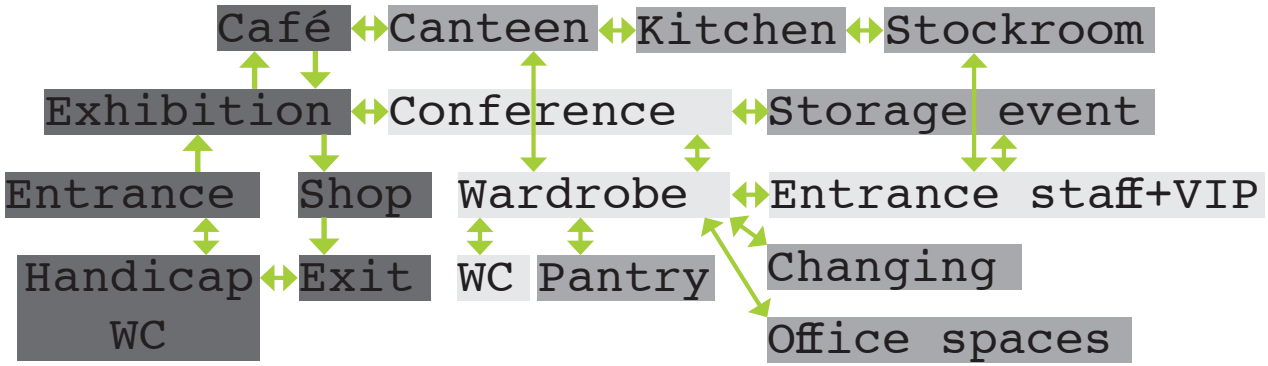
The flow will influence the development of the floor plans, and maybe the floor plans will influence and make changes to the block.

The expression will be explored by use of materials on the facades. Different strategies will be set up for the materials and facade concerning the theme of being sustainable and environmentally friendly.

Part 2 will end up with a proposal for the structural system.

Connections

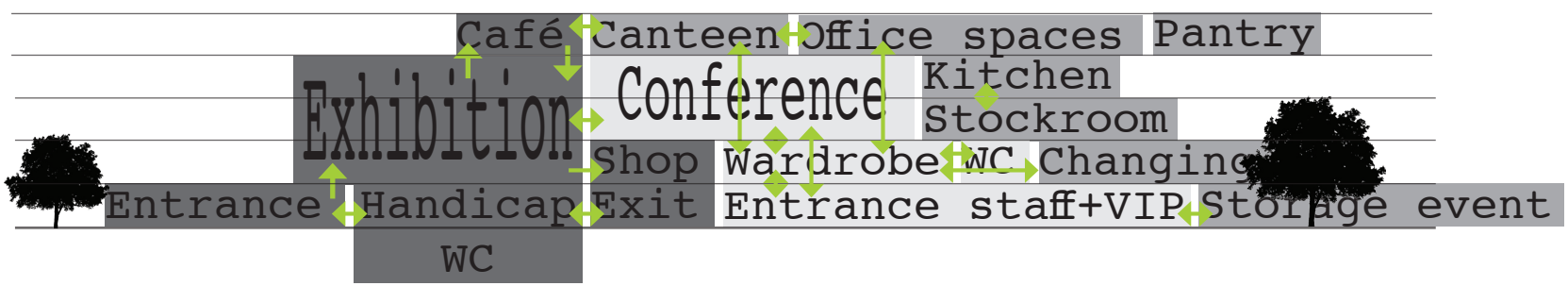
Connection diagram between the functions and whom are allowed in the spaces.



Visitors
Staff
VIP

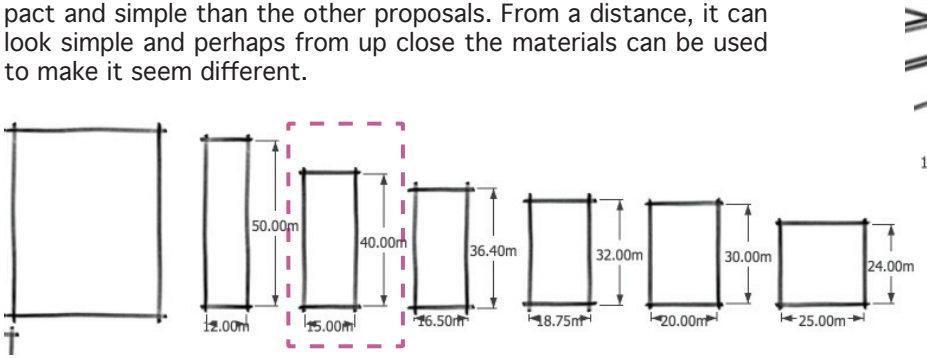
Flow vertical

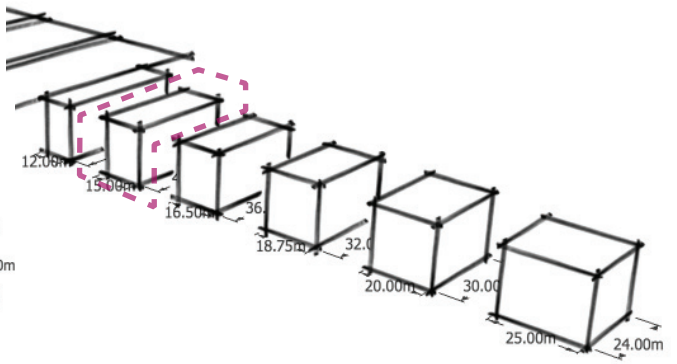
Vertical flow and connections.



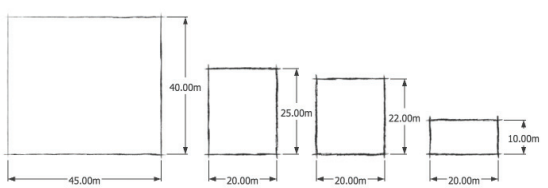
Form

The form of the block is found by making cubes in different sizes where all of the 3000 m3 can fit in.
The size of 15m x 40m is chosen because it appears more compact and simple than the other proposals. From a distance, it can look simple and perhaps from up close the materials can be used to make it seem different.



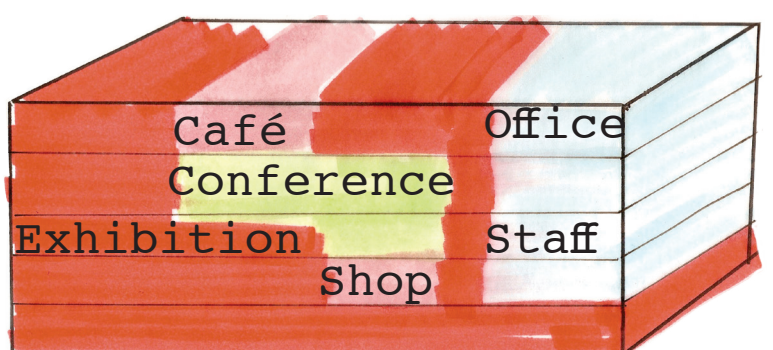


The function are set up in overall sizes.



1800m3 Exhibition | 500m3 Conference | 440m3 Café+Shop | 200m3 Office space

The sketch is based on the form and the connection between the overall functions. It gives an understanding of the direction of the block.



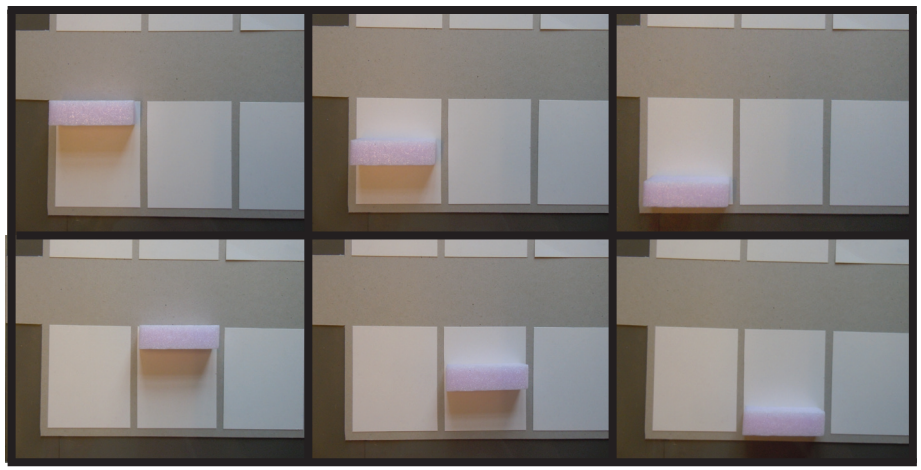
Placement

The placement on the ground, as described in the analysis phase has not yet been chosen. The placement has been narrowed down to the area near the water, to emphasize the water concept in the Danish Pavilion.

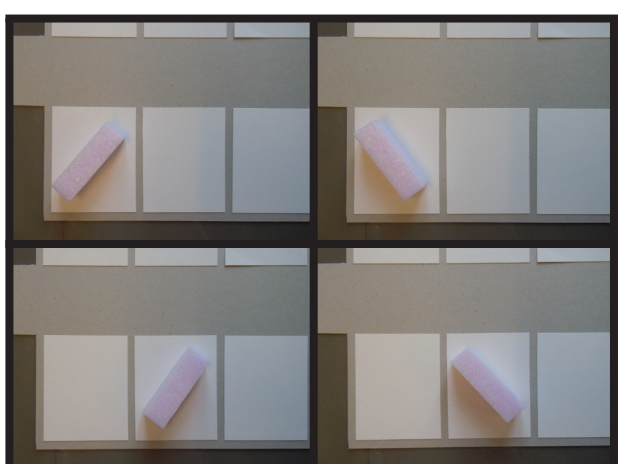
In the following photos, the block is placed on the long and short length of the lot and also diagonal. Two lots are in consideration where one of them has water on two sides and the other just on one side.

The placement will be on the long side or diagonal, because these placement divides the areas in a interesting way.

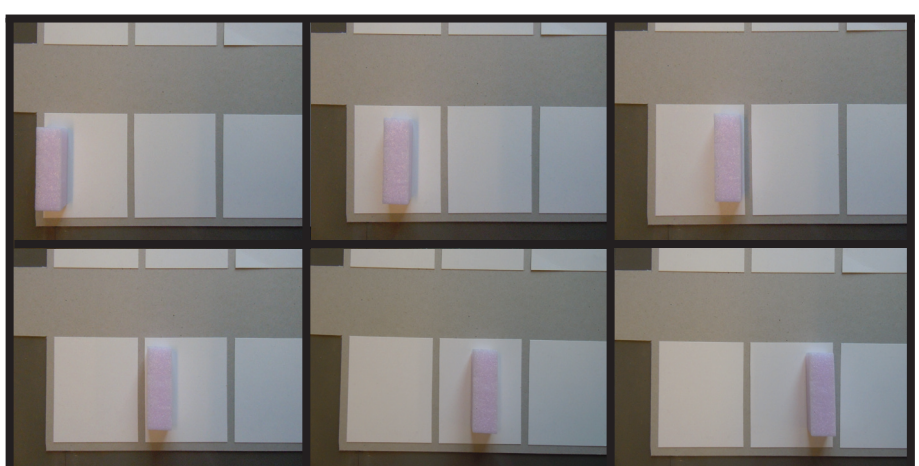
Which of the two lots will be chosen in the beginning of part 3.



The block is placed on the short side of the lot.



The block is placed on the short side of the lot.

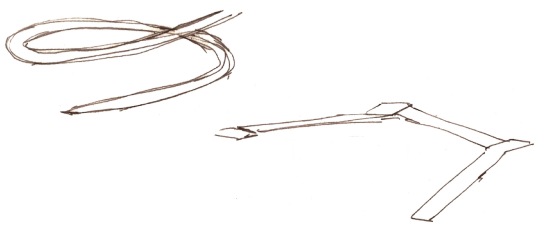


The block is placed on the longer side of the lot.

Flow typology

The spiral or ramp

The visitor is entering and being let up and through the exhibition. It gives a natural flow around the exhibition. With the right angle, wheelchairs can use the ramp as well. It can be a spiral or it can be angled for example with platforms.

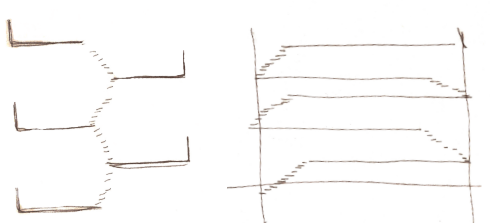


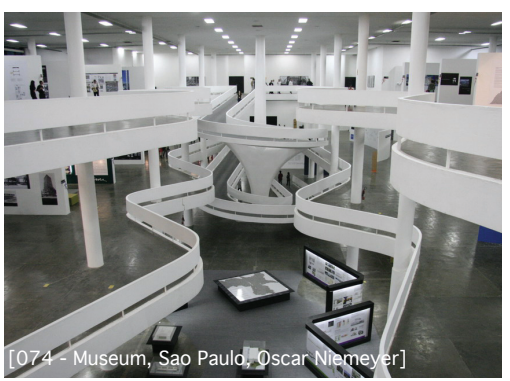
[072 - Guggenheim 1959, NYC - Frank Llyod Wright]

[073 - Umschreibung 2004 , Munich - Olafur Eliasson]

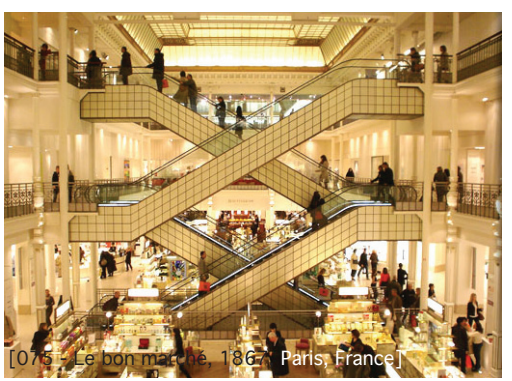
Stairs with or without view to exhibition

The visitor is entering and being let up and through the whole exhibition. Can be organized so the visitor can see up or down at the different levels. It can also be located at the ends of the level and it will be a surprise what comes next.





[074 - Museum, Sao Paulo, Oscar Niemeyer]



[075 - Le bon marché, 1867, Paris, France]

The typology about being let through the exhibition area will be combined with the earlier strategies found on flow through a museum.

The visitor in the Danish pavilion should not come back to the same room but instead being let through the whole exhibition, with some breaks as the café and on the stairs or ramps.

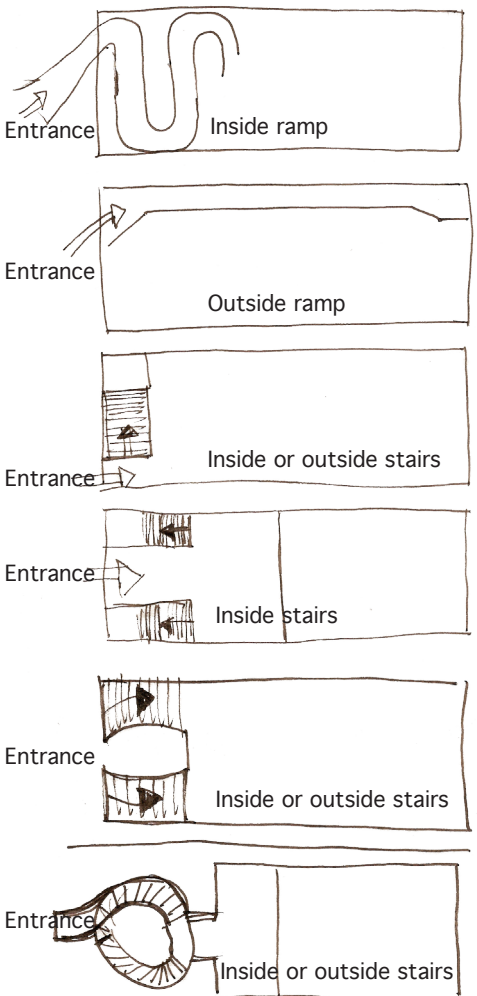
The café all on the top, gives a longer break where the visitor can take a refreshment and afterwards continue in the live streaming section.

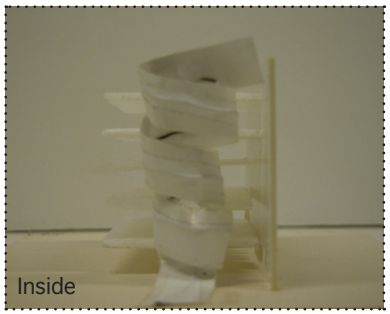
The strategy for the flow through the pavilion is found, continuous with breaks.

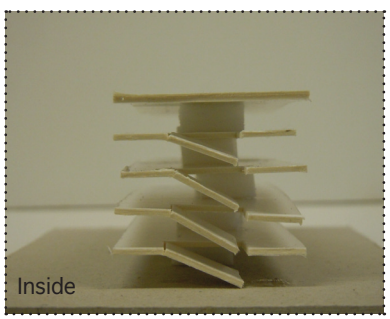
Before deciding the exact type path, the ramp and stairs must be designed.

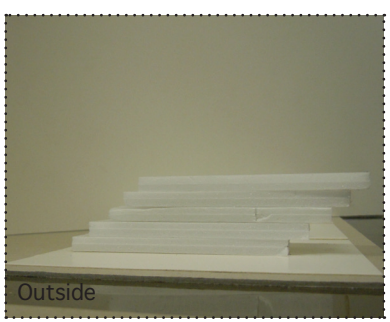
It can be inside or outside of the pavilion.

The entrance and exit should not be at the same place, it could be at the middle of the pavilion or at the end.

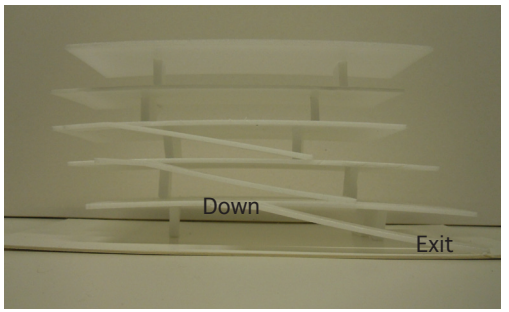






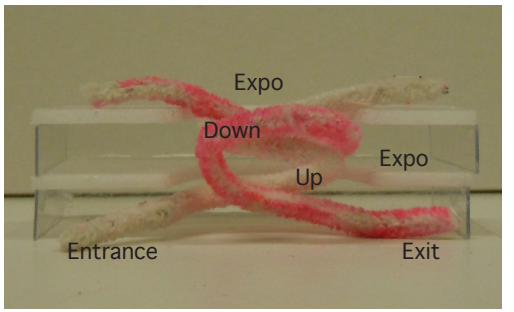


Outside flow



The outside flow is shown on the above model. As seen on the floor plan the visitors are going upwards on stairs and then going down again on outside ramps. This gives an entrance flow different from the pavilions exit flow and could support the exhibition if it is different from one another.

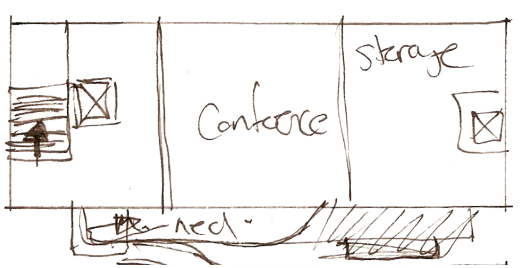
Inside flow

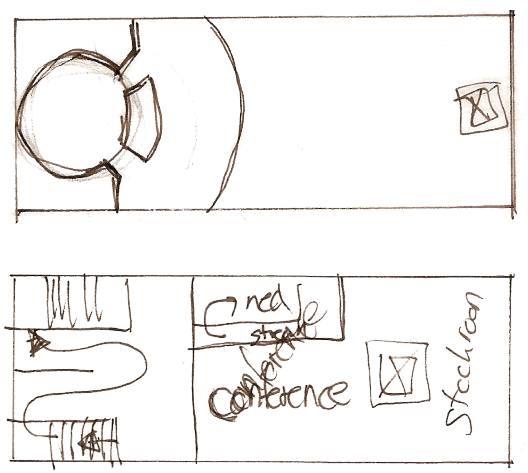


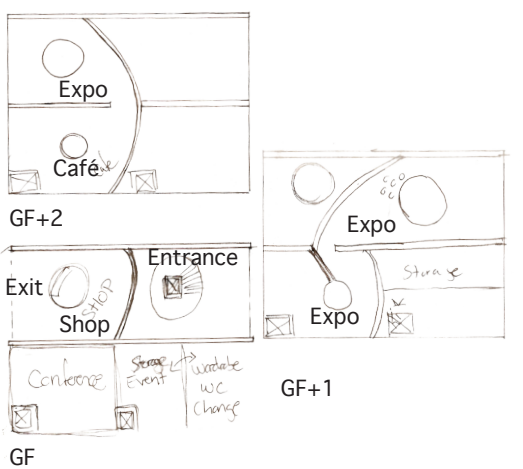
The principles are the same on the two sketches and the photo. The principle is that the entrance and exit flow is the same type, stairs, ramps or spiral stairs. This strategy might give a calmer visit of impressions.

Continues flow

The flow in this pavilion is continues and going through the different showrooms, but in this model it is spread out on double size floor plan compared to the other strategies. A mix between this flow on a floor plan as the size of the others could be interesting to work further with.







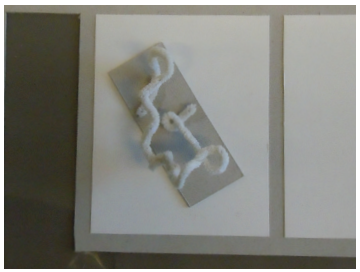
The concept of the flow will be found on base on the continues flow with breaks.

Three different types of flow will be designed, without any other things, only the placement on the site and the connection diagram will dictate the flow .

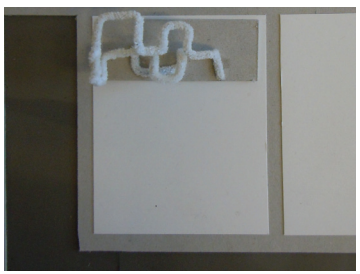
The inside room might be with many different levels and views.

Adding will be used as a strategy for putting these levels and areas on the flow.

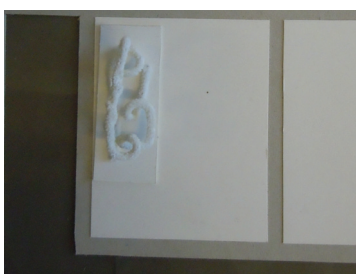
Continues flow



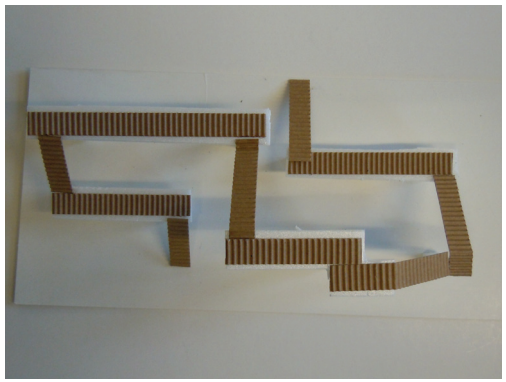
Placed diagonal on the site.



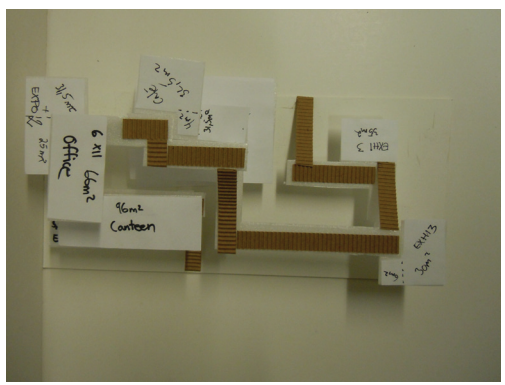
Placed closed to the main World Avenue.



Placed closed to the river side.



Placed diagonal on the site.



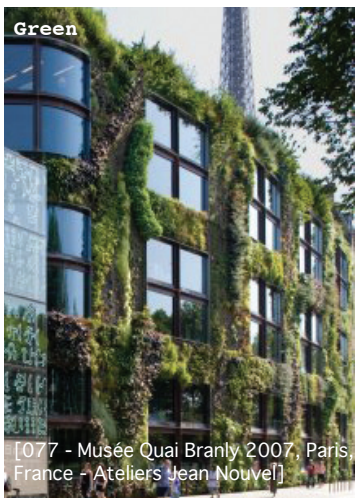
Areas are added to the flow based on the connection diagram.

Facade typology

The facade typology gives a short overlook on different possibilities on materials to determinate the expression on the facade.

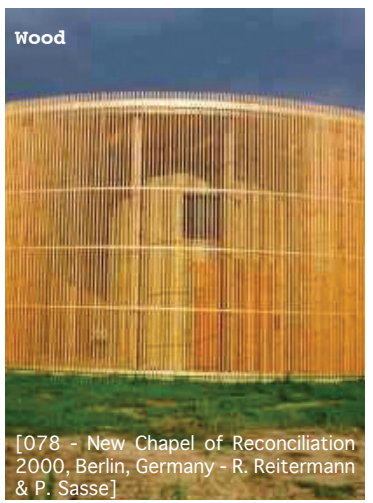
[076 - Darwin Center 2010, London, Great Britain - C.F. Møller Architects]

A glass facade shows what is on the other side. It does not hide, unless the structure is closed on the inside or the glass is translucent. It gives a light expression and can be reused.



[077 - Musée Quai Branly 2007, Paris, France - Ateliers Jean Nouvel]

A facade with growing vegetation gives an interesting sustainable expression and the facade will change with time. It can also be used for cooling, if needed.

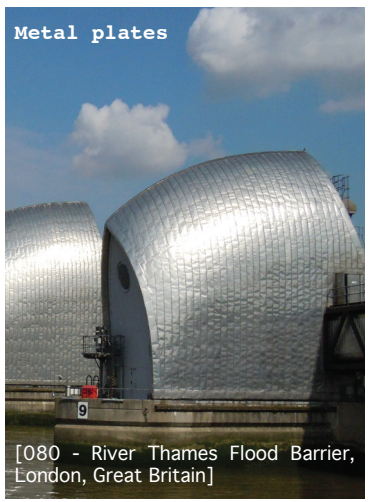


[078 - New Chapel of Reconciliation 2000, Berlin, Germany - R. Reitermann & P. Sasse]

Wooden structure can be used in many ways and easily combined with many other materials. It is a sustainable material and is often used in Danish/ Nordic architecture.

[079 - DR House 2008, Copenhagen, Denmark - Ateliers Jean Nouvel]

Membrane structure can be executed in many different forms. It is easy to transport, reusable, light in structure and expression.



[080 - River Thames Flood Barrier, London, Great Britain]

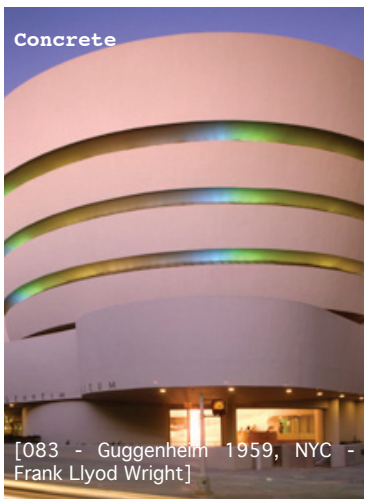
A facade of metal plates is shiny and can easily be perforated and/or curved. It can give an interesting glittery facade.

[081 - Cathedrale d'Evry 1995, Evry, France - Mario Botta]

Bricks are used in many Danish housing constructions and a foreigner would probably state the brick as a common Danish material to build with. It is heavy in the expression.

[082 - Laban Dance Studio 2002, Deptford, Great Britain - Herzog & de Meuron]

The polycarbonate plates come in different colors and be easy to find in the area. They give an interesting facade with different colors. It is a light material both in weight and expression and is isolating noise.



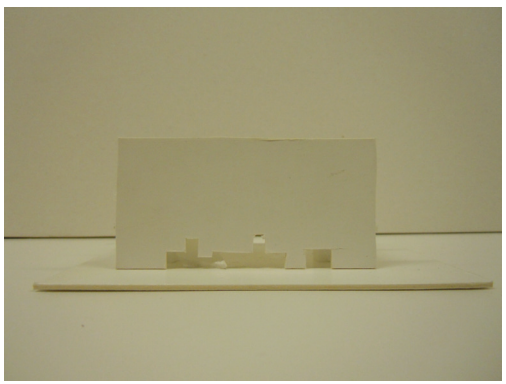
[083 - Guggenheim 1959, NYC - Frank Llyod Wright]

Concrete used for the facade in a temporary building might not be the right solution. It gives a heavy expression. But it might be necessary for the foundation.

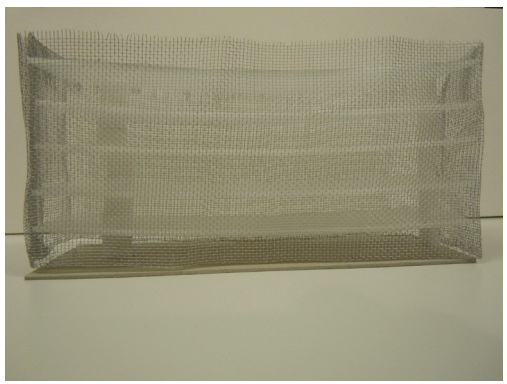
The facade typology has helped to determine if the block should have a closed, open or semitransparent facade. Also different approaches in small models are being explored to discover the difference between light and heavy facades.

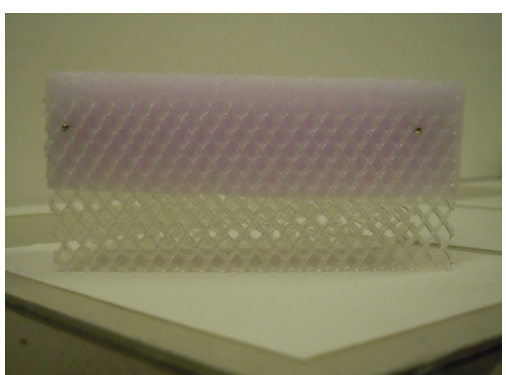
The main materials used for the facade should be wood or metal and glass to make it light and Nordic in the facade expression.

Closed and heavy facade.

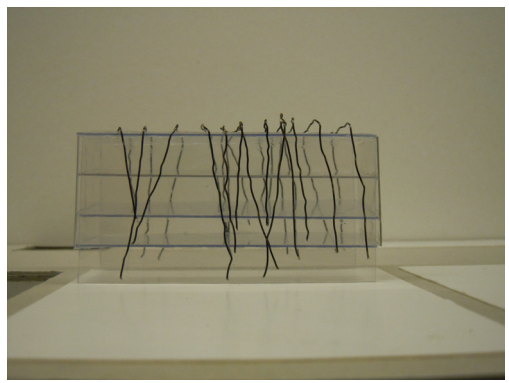


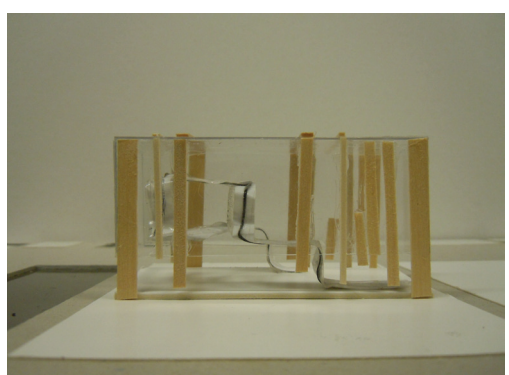
Semitransparent and light facade.



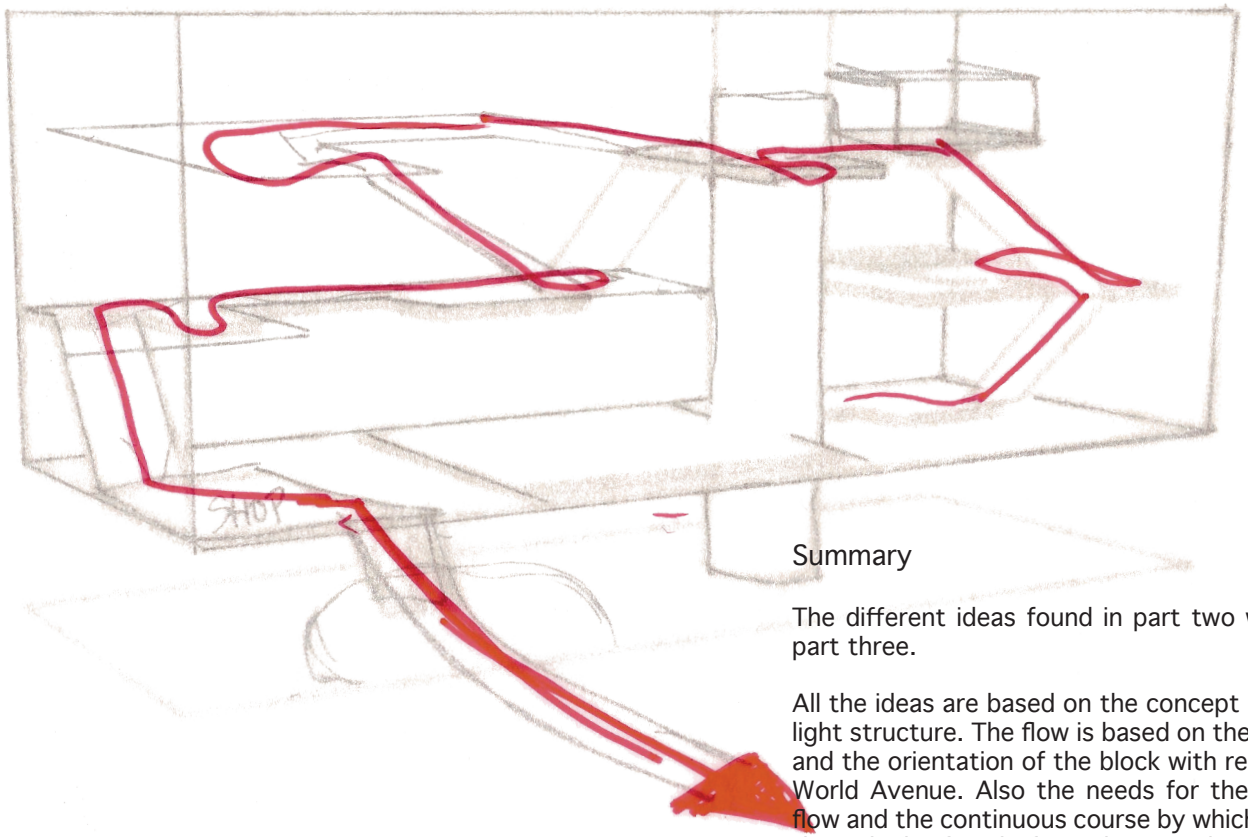


Transparent and light facade.





The facade should be semi or full transparent and appear lighted in the structure. It will be effective and make people want to visit the pavilion because some of the things happening inside can be seen from the outside.



Summary

The different ideas found in part two will be merged together in part three.

All the ideas are based on the concept about the simple block in a light structure. The flow is based on the experiences wanted inside and the orientation of the block with relation to the water and the World Avenue. Also the needs for the exhibition have given the flow and the continuous course by which one can more or less skim through the facade from the outside. This attracts the attention of by passers.

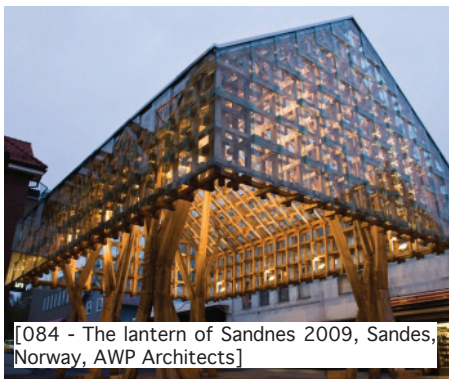
The facade typology is more or less a rough estimation to make decision concerning the materials to be used.

Before the merge of the concepts in part three, the structure and facades will be examined as a conceptual system.

Structural concept

It is expected that the holding structure should be on the outside of the transparent cube and perhaps made out of wood, metal or at least kept in few materials.
Below some examples are shown, common for all of them is that the structural principles are clear.

The structural concept for the pavilion should outline that the pavilion is a box held up by a structural system. It should be clear what is the holding structure and what is there to make a screen for the sun or hide the facilities behind the facade.



[084 - The lantern of Sandnes 2009, Sandes, Norway, AWP Architects]

The lantern of Sandnes is a glass cube held up by a timber structure. It is supported by two large and three smaller columns. A wooden pattern is supporting the inside of the glass facade. The construction is about three stories tall. It is an experiment and a sculptural element in the urban context in Sandes.

[085 - Museum of art 1947, Sao Paulo, Brazil, Lina Bo Bardi]

São Paulo Museum of Art, designed by Lina Bo Bardi, is held up by only two huge red frames made out of concrete. This makes the circulation under the building easier, because it is located next to a large road. It consists of two open floors for exhibition area. It is clear to see what is holding the cube.

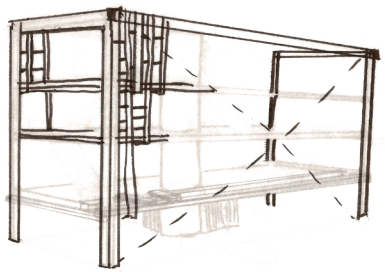
[086 - La Fondation Cartier 1994, Paris, France - Jean Nouvel]

Le fondation Cartier seen from the front. This facade is a glass facade lined up next to a big boulevard in Paris. It is the facade of the area behind it, because between this glass facade and the glass facade of the museum is an about 2 meter wide outdoor area. The metal structure in the glass facade is attached to the buildings facade. Green effects are used by planting trees just behind the facade.

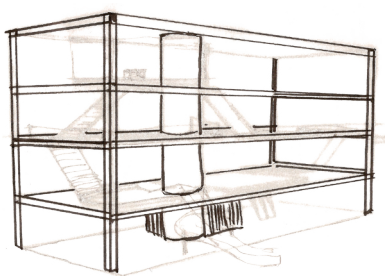
[087 - Notre cetier 1998, Paris, France - Architecture

The holding structure is seen on the outside of this church in Paris. It is clear to see that the cube is held up by a cubic metal structure. The structure goes through the building and makes it stable and can also be seen on the inside.

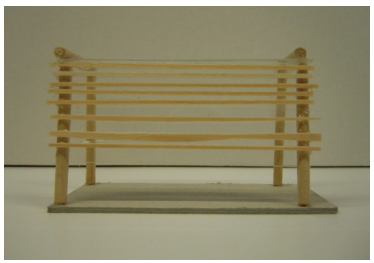
Different methods for the structure are being sketched and made in models. The transparent box should be held up from the ground and either hanging down from a wooden carrying structure or supported by a holding core. It can build in different ways.

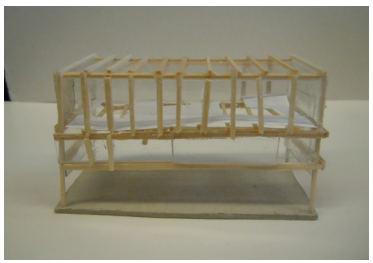


The sketch shows how two frames stabilized by diagonal cables are the holding elements. The platforms are hanging down from the frames.

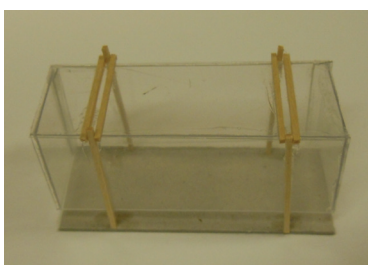


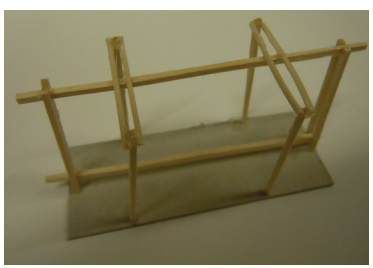
The sketch is supposed to show the core as the holding structure.





Horizontal facade versus vertical facade. Both solutions are possible. It all depends on the final choice of structure and the way it can be attached. But to make a varied facade that reflects the inside of the pavilion, there would be more flexibility to divide the facade with the vertical lines.





Two models show how simple the structure could be, just like the Museum of Lina Bo Bardi, with the red frames.

It is important that there will not be any doubt about what is the holding structure. The principle about a holding core and the principle about frames holding up the structure will be the two structural systems examined in the sketches on the plans.

Part 3 - merging

The form and concept is matching the placement on the lot with two sides of water, because the outside of the pavilion is helping dictate the inside flow and to make a more interesting flow, the lot with two sides on the water is chosen.

The lot also dictates how the pavilion should be placed. The pavilion placed on the diagonal gives an interesting flow inside the pavilion and divides the lot in two interesting triangular areas.

The flow and areas must be reshuffled a bit before the synthesis phase can start. Plans of more specific proposals are shown.

The facades will change during the synthesis phase, but here different ways and concepts on how it should work are shown.

The structure must optimized in the synthesis phase to find the exact size of the holding structure.

Placement

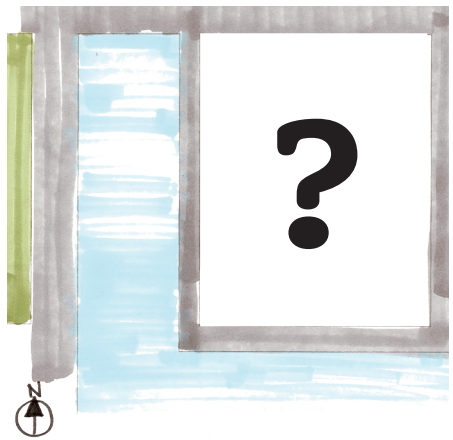
It is earlier shown that the position of the pavilion on the lot can be many.

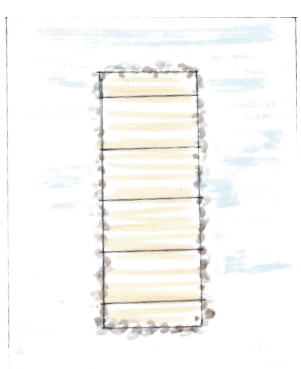
A diagonal placement splits the ground floor into a welcoming area at the front of the pavilion and a more calm area behind, which the visitors can experience after their visit. Whereas, if the pavilion is placed on the long side to the edge, there would be a large common welcoming and departure. Placed centrally, two smaller and narrower spaces are created, as shown on the sketches to the right.

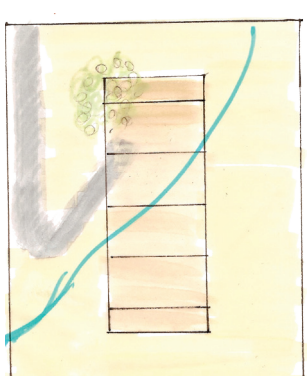
The choices of the ground surface of the site can be varied and different sketches are shown. Denmark is surrounded by water, it could also be obvious not only to have the water on two sides next to the lot, but also integrated within the site.

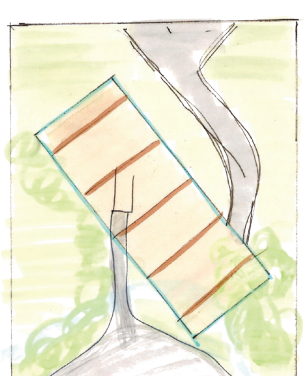
The diagonal placement is chosen because it creates interesting outdoor spaces and because of the view that can be generated according to the inside rooms.

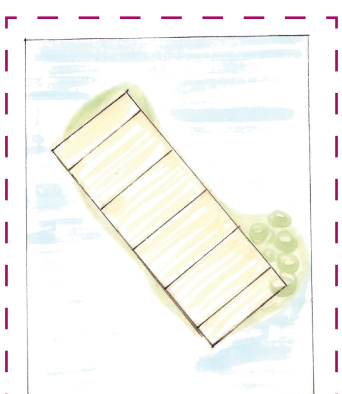
The water surface is chosen to fill the site as a symbol of Denmark being surrounded by the sea. The choice is marked on the with a dashed pink square.











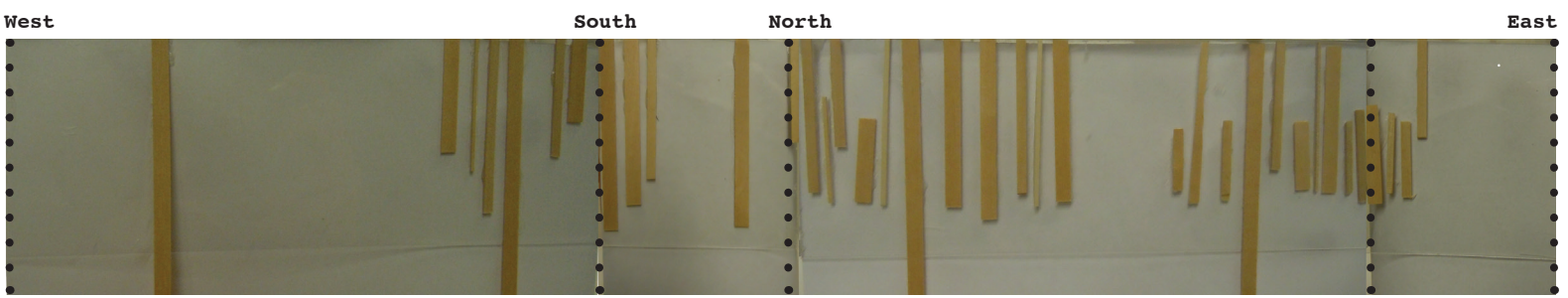
Pattern on facade

The pattern in the facade is consisting of vertical lines in different width and length, defined by the orientation of the pavilion, the flow, the functions and views to and from the inside.

The pattern is also consisting of the holding structure. These factors mixed together makes the facade.

The first experiments in model are shown but due to structural system the diagram is only a guideline for the wished pattern.

In the synthesis this diagram will be used to make the construction, but when it is determined, it will influence the facade pattern and the transparency as well. It will probably be more dense.

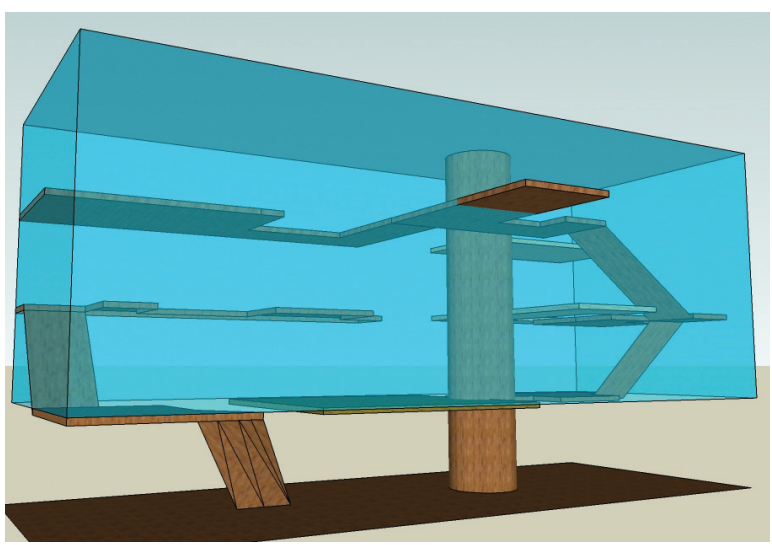


Merge 1

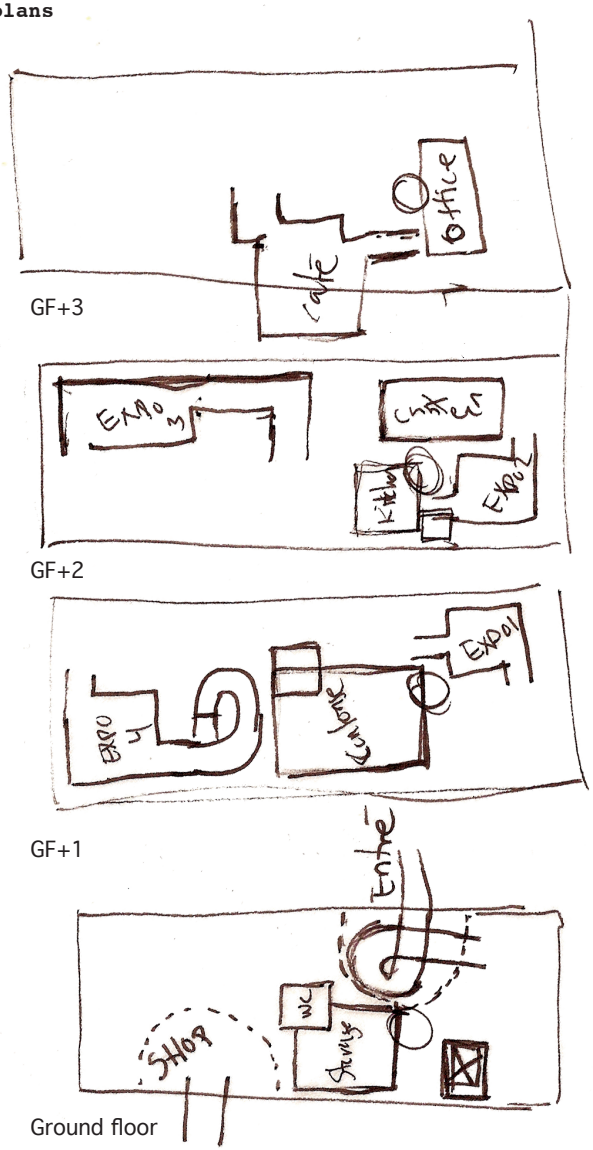
In this merge are only four levels, because it gives the rooms a good height to the ceiling, if working with the maximum of the building height of 20m.

The circulation consists of ramps and stairs and one cylinder for circulation and the holding structure. The circulation is thought as an elevator for the staff, VIP and disabled people. There are 5 different exhibition areas and a part of the café is sticking out of the construction on the upper floor in the fresh air.

This illustration shows a glass cube hold up by only the core. But shading on the facade is missing and would therefore change the look.



Floor plans

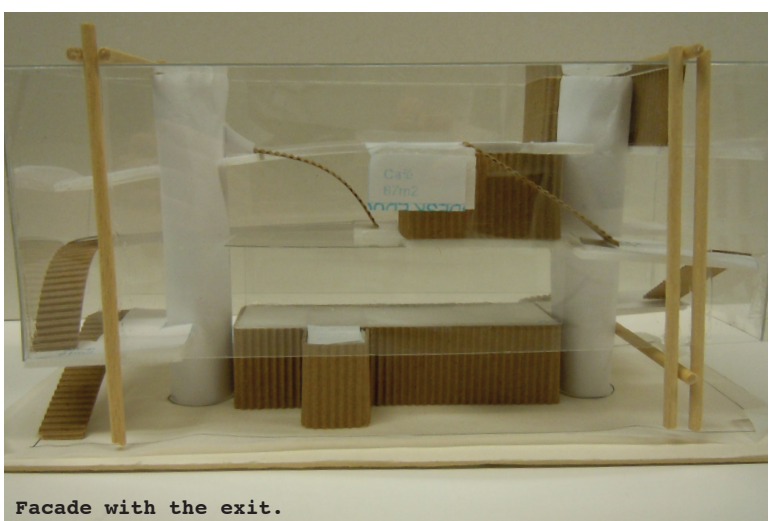


Merge 2

In the second example the plan is explored with two cylinders, one for staff and VIP circulation and the other one for disabled visitors directly to the exhibition areas.
In this development there are also five exhibition areas. But the area of the pavilion in general is too small, with only 949m2. Some of the café is still sticking out, but somehow it ruins the facade expression and will be removed. The exit ramp is not working as thought and might be changed to stairs.
The conference room is made transparent, to give a visible connection between the conference and the exhibition.
It is on the model difficult to see if it is the two cores holding the cube or the structure on the facade. The expression must be worked further.

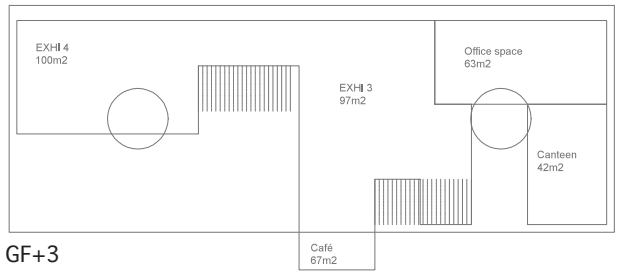
Exhibition area: 354m2
Café: 67m2
Conference: 125m2
Kitchen: 72 m2
Office spaces: 63m2

Shop: 61m2
Wardrobe: 40m2
Storage event: 125m2
Canteen: 42 m2
Total: 949m2



Facade with the exit.

Floor plans



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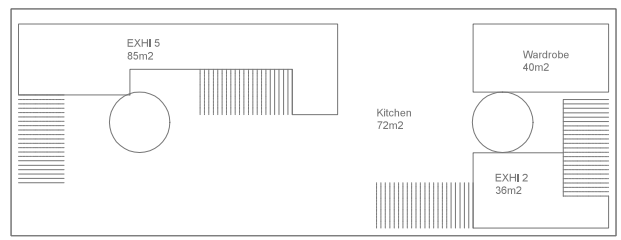

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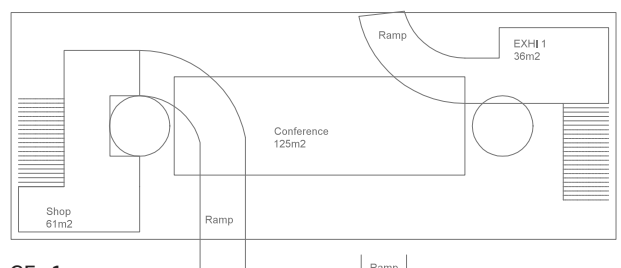

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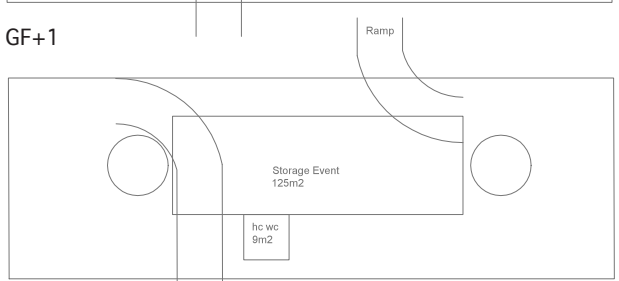


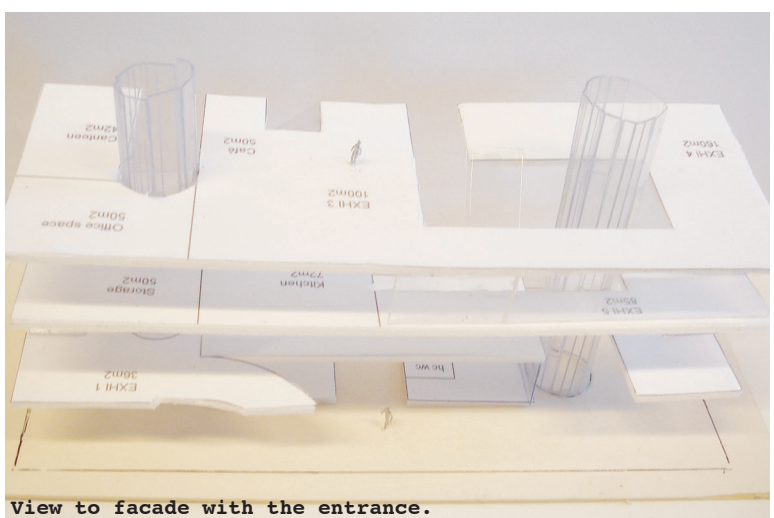
Ground floor

Merge 3

This proposal has more exhibition area and the exit has changed to stairs from a ramp. The pavilion is in total 1780m2. This size is acceptable because the purposes of the different exhibition areas dictate the need. It is the experience and history that is making the pavilion. The conference room will also be a bit smaller than in the regulations. It can be discussed if that is acceptable or not. It is meant to be a meeting room with enough space for around 50 guests, which is a little less than described. But still some work needs to be developed concerning the views from the different exhibition areas to another.

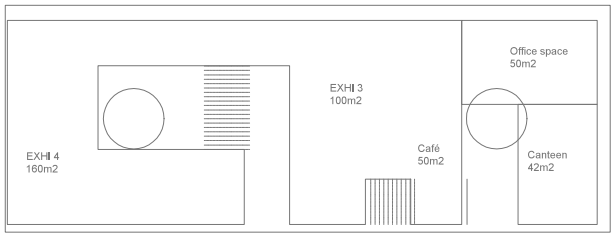
Exhibition area: 440m2
Café: 50m2
Conference: 125m2
Storage: 90m2
Canteen: 45 m2
Circulation: 744m2

Shop: 61m2
Wardrobe: 40m2
Storage event: 50m2
Kitchen: 75 m2
Office spaces: 50m2
Total: 1780m2



View to facade with the entrance.

Floor plans



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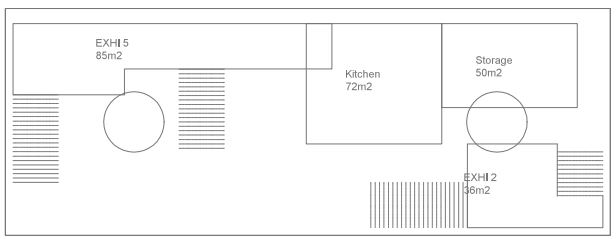

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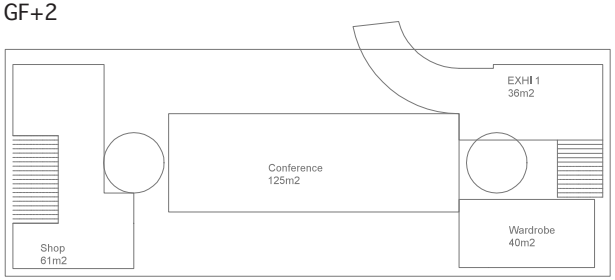

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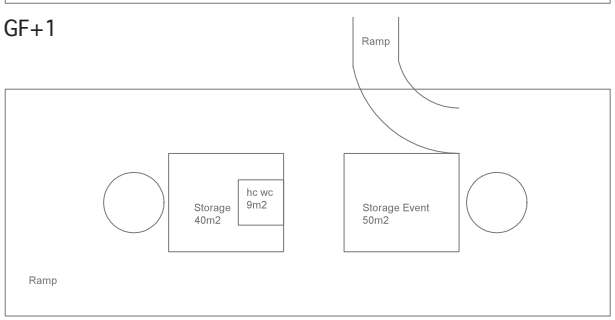


Ground floor

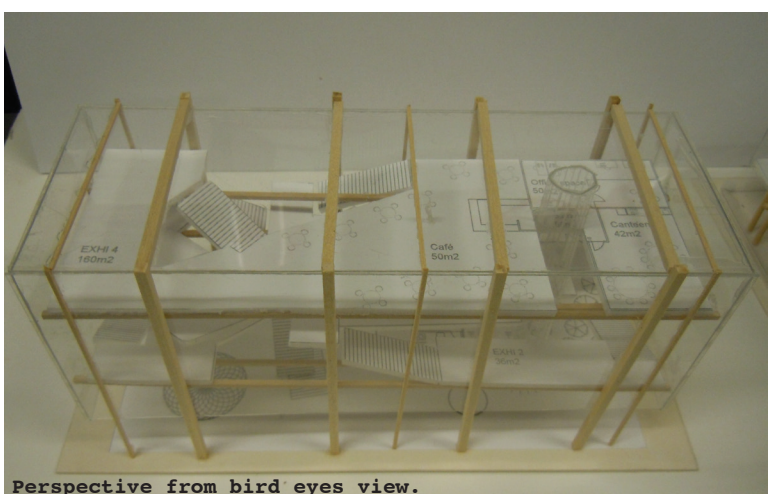
Merge 4

Merge 4 and 5 are different from the earlier, because now the holding structure is on the outside of the box as frames and not two cores. It gives more flexibility to work with the views inside the pavilion, when there is not a core in the middle of each level. The inside view from the different exhibition areas to another works better and those needing to be invisible can be that.

There should be at least one place where the visitor can see all the way up from the ground floor to the top ceiling. This is one of the differences between merge 4 and 5.

Exhibition area: 485m2
Storage shop: 20m2
Wardrobe: 40m2
Storage event: 51m2
Kitchen: 60 m2
Office spaces: 50m2
Total: 1975m2

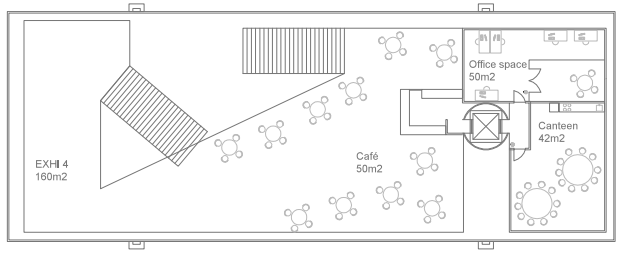
Shop: 81m2
Café: 188m2
Conference: 110m2
Storage kithen: 54m2
Canteen: 66 m2
Circulation: 770m2



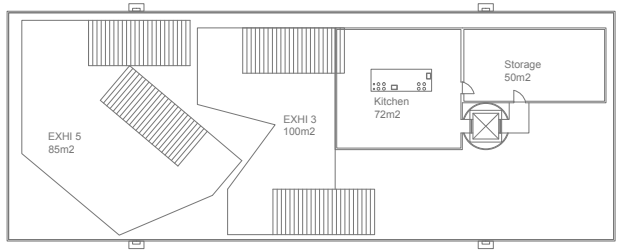
Perspective from bird eyes view.

Floor plans

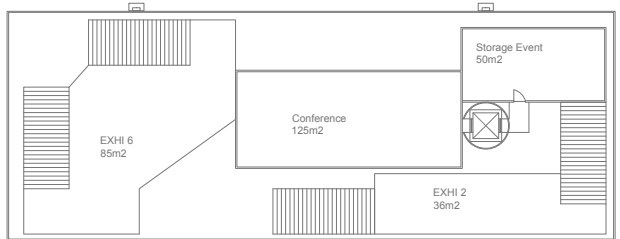
GF+4



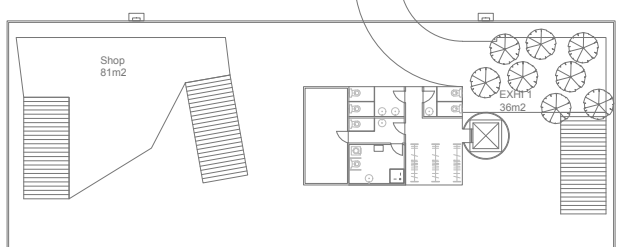
GF+3



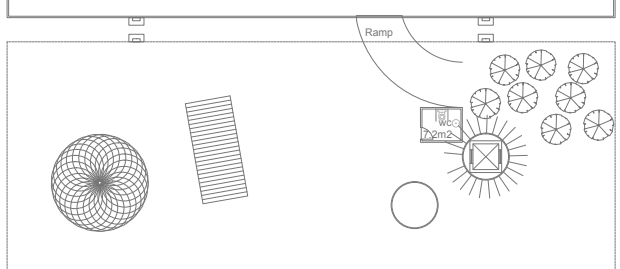
GF+2



GF+1



Ground floor



Another difference from the earlier merges is that one more level is added because in the earlier merges, the ground floor was used for stocking rooms. It did not make the pavilion look light and lifted up from the ground.

The areas that need to be covered for the public and to the exhibition area is the kitchen, canteen, offices, wardrobe, toilets and storage rooms. These will be covered with a room divider wall, with that means that it should not touch the ceiling so one would be able to look over the walls.

With the new merges more exhibition area has come and the holding structure is clear. It is with these plans and structure the further developing will happen.

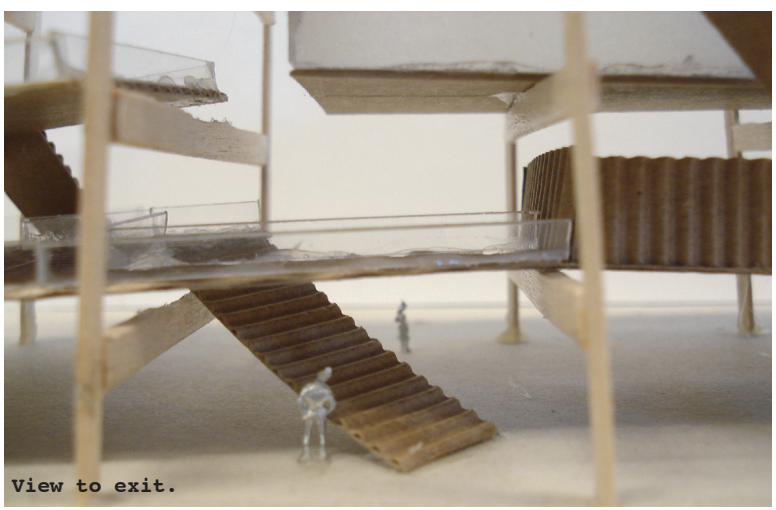
Merge 5

Final areas:

Exhibition area: 440m2
Storage shop: 20m2
Wardrobe: 40m2
Storage event: 47m2
Kitchen: 45 m2
Office spaces: 50m2

Shop: 117m2
Café: 190m2
Conference: 115m2
Storage kithen: 48m2
Canteen: 55 m2
Circulation: 770m2

Total: 1940m2



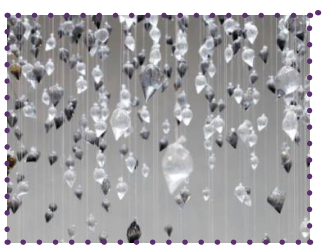
View to exit.

References exhibition

Visitors
Staff
VIP

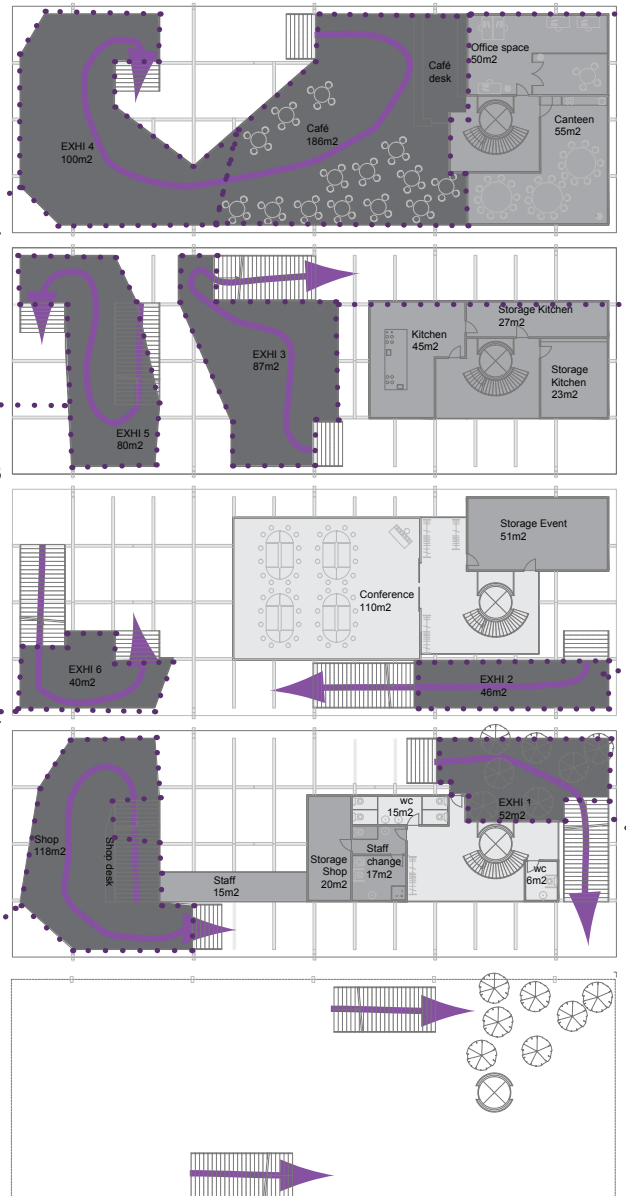
[Exhi 6 - as exhi 3 raw floor boards - grow your own food]

[088 - Exhi 5 - film or live streaming from Danish eating situations]



[089 - Rethink 2009 - Exhi 4 - hanging down from the ceiling concerning make your own energy]

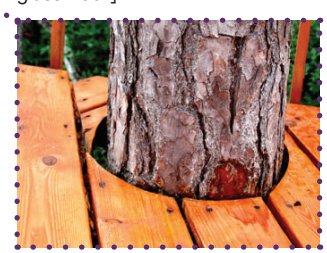
[Shop - Selling Danish products concerning how to eat sustainable and make your own energy]



[090 - organic Danish food served in the café]

[091 - Exhi 3 - artist showing DK's point of view on energy by placing art directly on the raw floor boards]

[092 - Exhi 2 - walking over a glass floor]



[093 - Exhi 1 - Danish trees are growing up through the deck]

View to facade with the entrance.

View to exhibition 1.

View to facade with the exit.

Summary sketching phase

The sketching phase has led to many different ideas.
The final concept has been chosen with the simple block carried by a framing system giving different views from the inside to the outside and the opposite. In merge 5, the views inside to and from the exhibition areas are successful in giving an architectural experience. But all of this with reservation of that chances might occur.

The structural system, with the box held by a framing system will be further developed in the synthesis phase. It is wished to have various patterns in the facade to give the indoor space a differentiated light optimized with the framing construction.

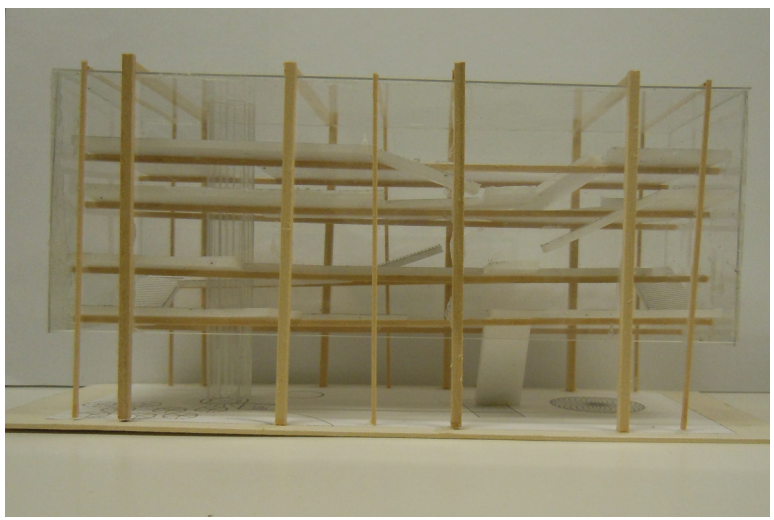
Synthesis phase

In the synthesis phase the ideas from the previous phase will be optimized through different methods.

Ecotect for optimizing the daylight quality of light inside the office and in general for the pavilion.

A structural system with the desired expression will be verified by finding the best size for the holding structure and the perfect density for the facade on basis of the daylight tests.

The concept for the structural framing system is shown in the model photo below.



Construction

The structural system has been chosen based on both the architectural concept and the structural necessity. It has been an iterative process and it has been essential to try out different methods to understand what would give the expression wanted for the pavilion.

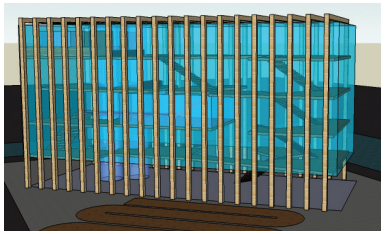
The frames are chosen as the holding structure. It will hold up the glass cube, decks and functions. The frames consists of glue laminated wood of Norway spruce and act like disks in their own plane. It is decided to have only the amount of beams needed without influencing the architectural expression.

The frames consist of columns and beams fixed along the ground. The span is large and with the amount wanted it will define the size of the beam. The forces act down in the foundation on each side of the cube.

Three conceptual alternatives are first set up to find out what is exactly desired as expression from the frames. Alternative 1 has larger frames than alternative 2, where alternative 3 is a mix of the two sizes.

A diagram of the light distribution and shadow is only shown for alternative 2 to verify that a more dense pattern around the office space will probably be needed if the structural system is going to have more distance between the frames than alternative 1.

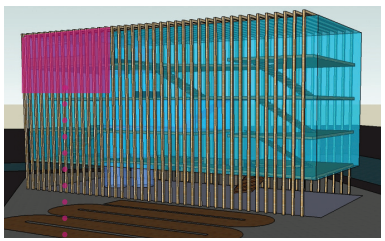
On the basis of the three alternatives it became clear that it is necessary to show the difference between the primary structural system going down to the ground and the secondary shading/ orientation system not necessary touching the ground.



Alternative 1
Distance: 1.5m

Frames: 20

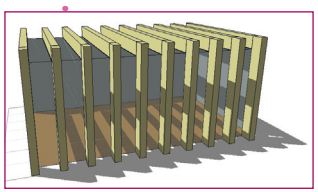
Width: 0.5m
Height: 0.5m

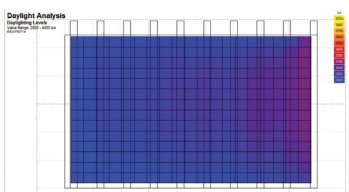


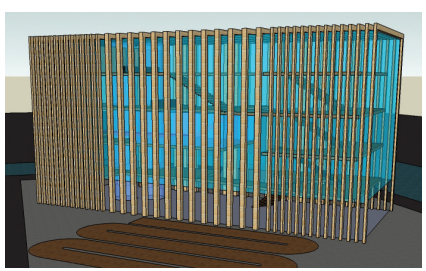
Alternative 2
Distance: 0.5m

Frames: 40

Width: 0.25m
Height: 0.5m







Alternative 3
Frames from tryout 1 and 2.

Distance: 0.5m and 1m depending on the frame size.

Frames: 40

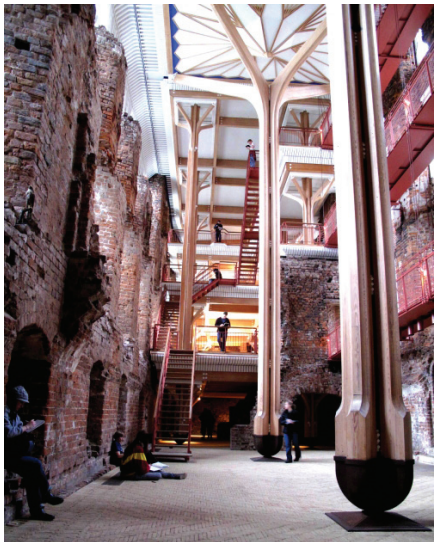
The frames are simple supported beams and are giving vertical stability. In order to be able to span 15m it seems reasonable to use glue laminated wood in the strength class L40.

To stabilize and give horizontal stability to the frames two beams will go across on the top.

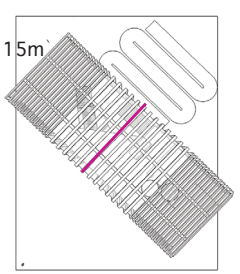
The dimensions are estimated from the books Dimensionering med diagrammer.

Firstly when looking at the diagrams according to Ahler [2002] the estimation will be made on heavy construction [Ahler, p. 9]. The diagrams used to size the beams and columns can be seen in appendix B.

It was decided to look more closely at the solution with either 8 or 5 frames, because these solutions give a light architectural expression.

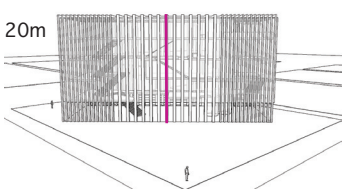


[094 - Koldinghus 1994, Denmark - Exner Tegnestue, Pillars made of laminated wood]



Distance beam	Load	Dimension
1m	1m	W: 185mm H: 900mm
2m	2m	W: 185mm H: 1200mm
3m	3m	W: 185mm H: 1300mm
5m	5m	W: 185mm H: 1300mm
8m	8m	W: 185mm H: 1300mm
10m	10m	W: 185mm H: 1300mm

[Ahler 2002, p. 273]



The gray area is an example on load area for a column.

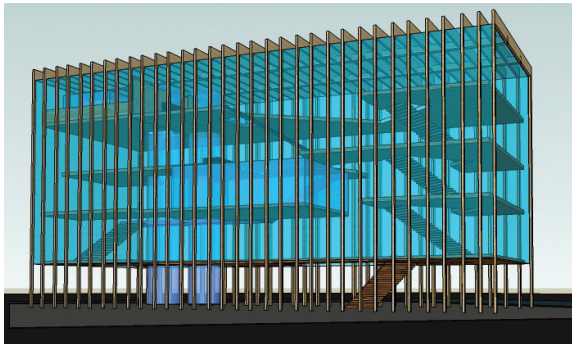
Distance column	Load	Dimension
1m	7.5mx1m = 7.5m2	W: 185mm H: 200mm
2m	7.5mx2m = 15m2	W: 185mm H: 200mm
3m	7.5mx3m = 22.5m2	W: 185mm H: 200mm
5m	7.5mx5m = 37.5m2	W: 185mm H: 233mm
8m	7.5mx8m = 60m2	W: 185mm H: 400mm
10m	7.5mx10m = 75m2	W: 185mm H: 500mm

[Ahler 2002, p. 292]

Version 1
Distance: 1m

Frames: 33
Width: 185mm

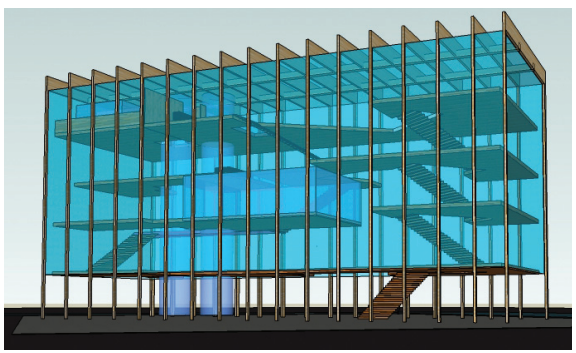
Height
Beam: 900mm
Column: 200mm



Version 2
Distance: 2m

Frames: 17
Width: 185mm

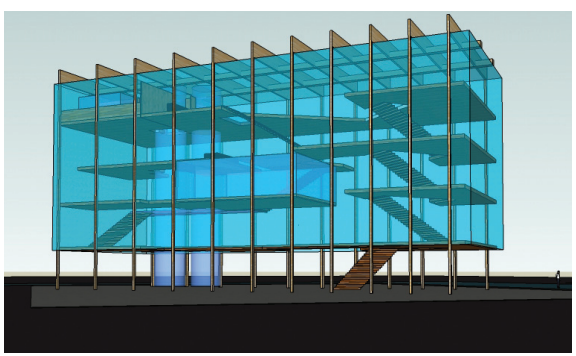
Height
Beam: 1200mm
Column: 200mm



Version 3
Distance: 3m

Frames: 11
Width: 185mm

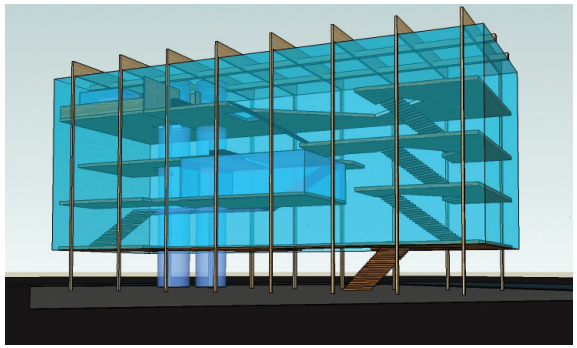
Height
Beam: 1300mm
Column: 200mm



Version 4
Distance: 5m

Frames: 8
Width: 185mm

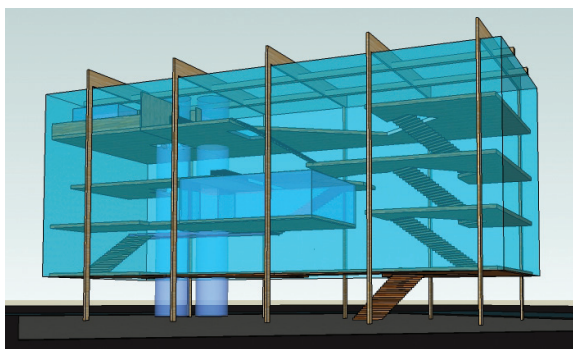
Height
Beam: 1300mm
Column: 233mm



Version 5
Distance: 8m

Frames: 5
Width: 185mm

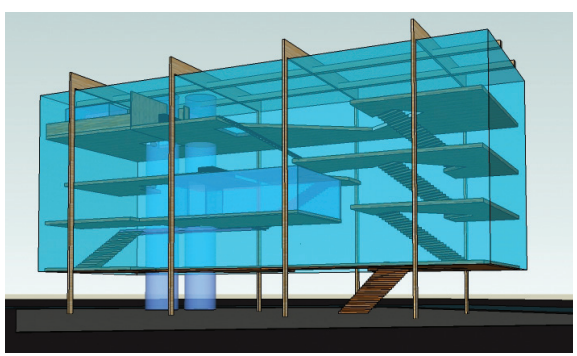
Height
Beam: 1300mm
Column: 400mm



Version 6
Distance: 10m

Frames: 4
Width: 185mm

Height
Beam: 1300mm
Column: 500mm



Detailing facade

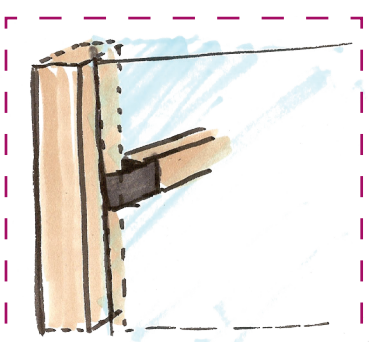
It is decided to look more closely at version 4 with 8 frames or version 5 with 5 frames as the primary structural system. There is a visible difference in the size of the columns.

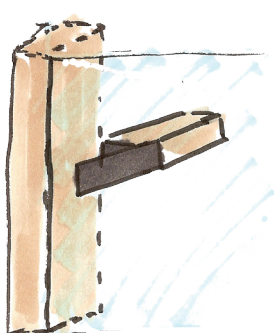
Looking at the two versions chosen with a sketched pattern on the facade it can be further defined that the facade with only five frames has the right expression. It gives more flexibility to the secondary element - the pattern on the facade - without being compact and a light expression can appear.

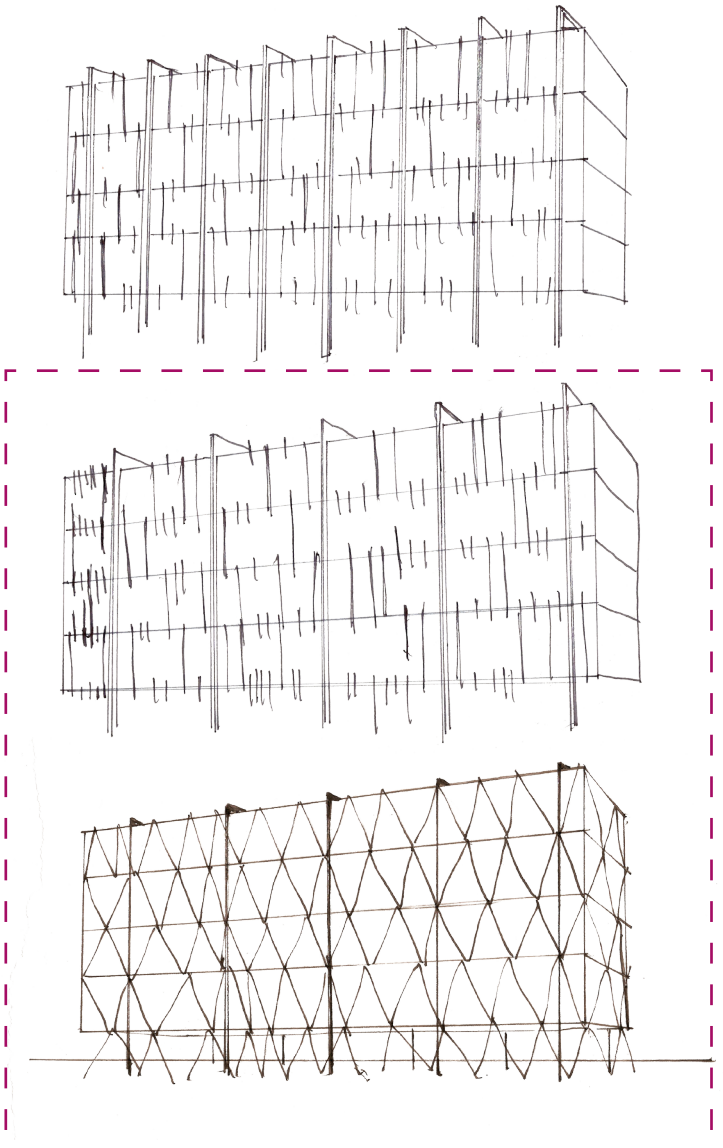
The secondary element will probably be held up by horizontal beams in the same plane as the decks. That makes five beams in a smaller dimension than the columns, go horizontally across the facade.

The primarily structural system will continue to be the dominating visual effect, but the horizontal beams will be visible and give the impression of a musical note system.

The glass facade will be placed in the middle of the pillar as shown on the illustration below. This gives flexibility to work with the facade instead of letting it be on the inside.







Daylight

The tests made of the daylight analysis are different versions of the office spaces for the staff. The office is located in the east/ north corner on the top of the building as shown above. It is assumed to be one of the few spaces where the staff will be sitting during the day. This is why the office space was chosen for the daylight analysis.

The tests are performed in Ecotect and given in lux on basis of the natural light source. The tests will be accomplished with vertical timber beams (200mm x 100mm) in the facade and with the primary pillar sticking up in the top.

Test 1: 11 planks with 800mm distance.

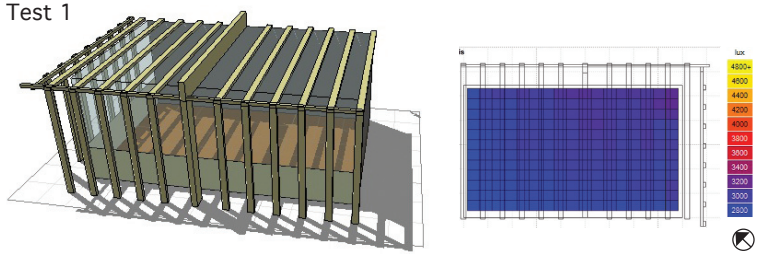
Test 2: 11 planks, every second double size in width. Distance 800mm or 400mm.

Test 3: 7 planks set up on basis of a note system.

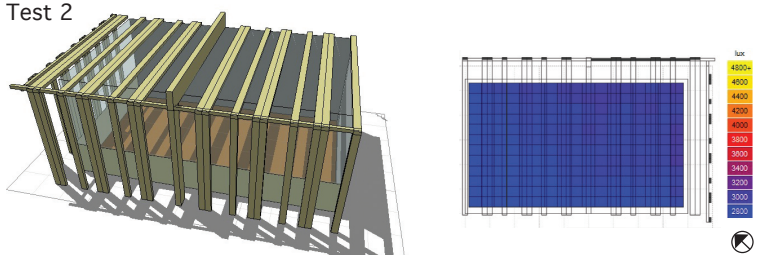
Test 4: Only the frames no planks or beams.

The test results are very close to each other. The blue dominating color is 2800lux which corresponds to the luminance of a dull winter day. The norms for office spaces are 500 lux, but the results from the tests are acceptable because it is not directly glow and that the light rooms will be perfect for the exhibition [Mullins 2009].
It is assumed on basis of these tests that, with a vertical facade used on the rest of the pavilion, the natural daylight will be comfortable, nice and clear throughout the entire pavilion.

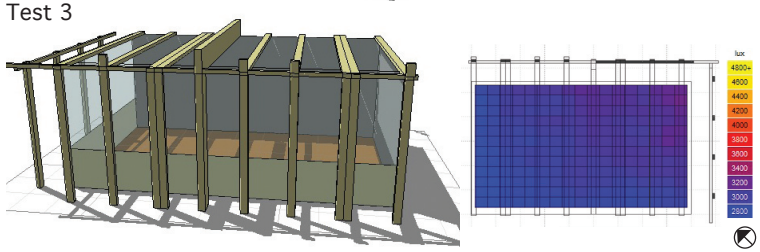
Test 1



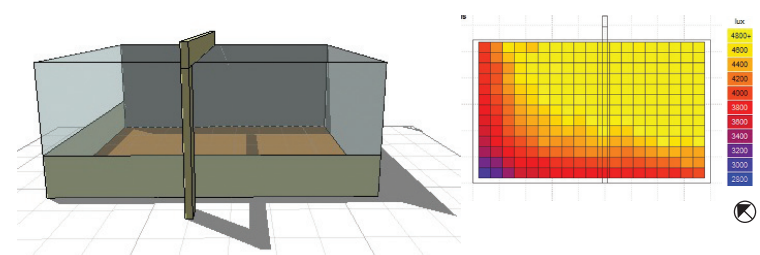
Test 2



Test 3



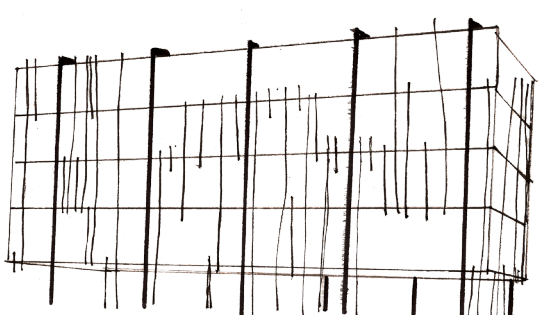
Test 4



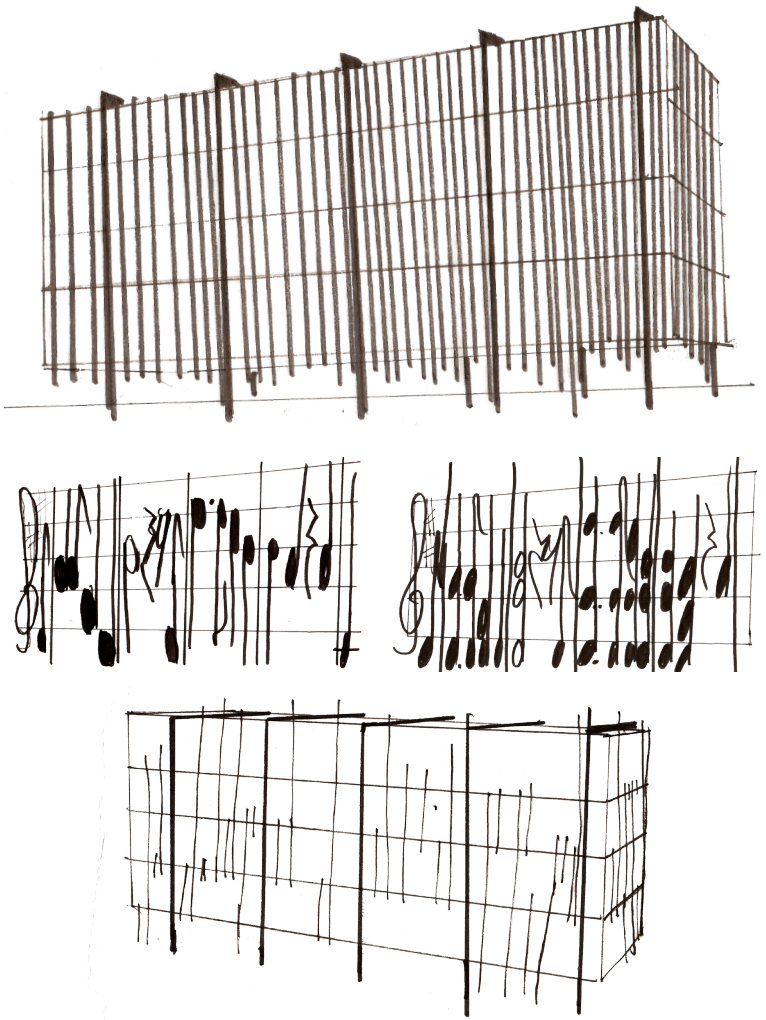
Based on the experiments with light, further work will optimize the facade pattern. The concept of the facade symbolizing a musical note system is an interesting one to develop further. The vertical lines on the top sketch on the right indicate rhythm, and the distance between the vertical lines (bars) is the same going around the pavilion. To make a more varied pattern a melody line of notes could help to define the facade.

The two sketches on the right are literally transmitted to the facade, the one to the left is unison notes and the other is polyphonic notes, to see the difference on the graphically system.

Looking at the unison system graphically, it is covering the facade as described earlier with the requirement for both a dense and open facade. The note system will in this project be used graphically.



Sketching a unison melody on the south west facade

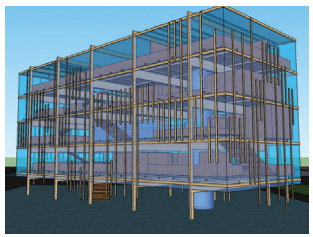


Sketching a unison melody on the north east facade

Further alternatives shown on the 3d model, show that the glass facade will end up being too large compared to the covered part and too transparent compared to the desires. The glass facade shown on the illustrations are 640 m2.

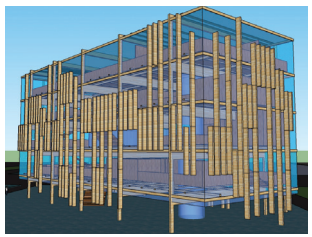
A third effect can influence the facade. For example, where a translucent facade is desired and therefore without timber planks, the glass can have a structure or silk pattern printed on the surface

Further alternatives are generated on the 3d model and one will be chosen as the final. The models are all seen from directly south and the orientation of the sun will influence the choice.



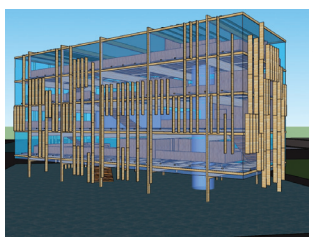
102 Flat planks
Angled 90°
W: 200mm
H: 50mm
L: 4100mm

84 m2 = 13%
covered facade



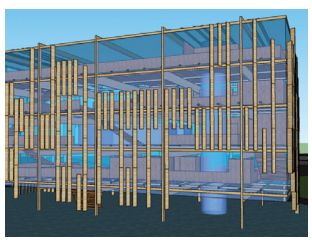
102 Flat planks
Angle 0°
W: 150mm
H: 500mm
L: 4100mm

62,73 m2 = 9,8%
covered facade



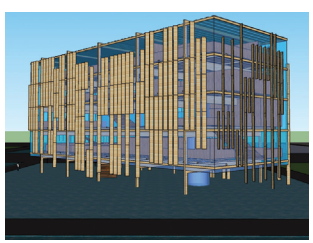
102 Flat planks
Angle 90°
W: 50mm
H: 500mm
L: 4100mm

21 m2 = 3,3%
covered facade



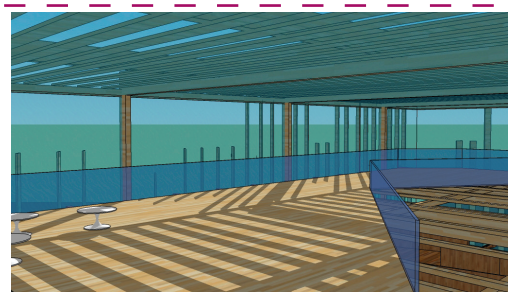
102 Flat planks
Angle 45°
W: 50mm
H: 500mm
L: 4100mm

21 m2 = 3,3%
covered facade

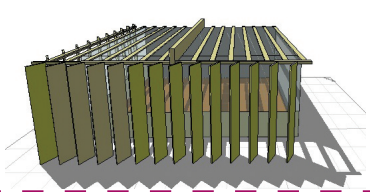


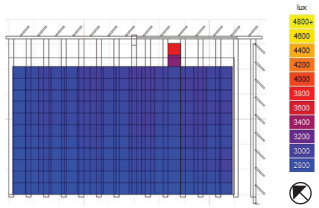
195 Flat planks
Angle 45°
W: 50mm
H: 500mm
L: 4100mm

43 m2 = 6,7%
covered facade



View and shadows to the café on the top level.





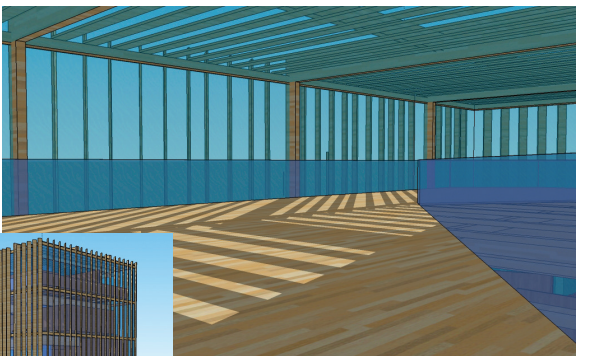
Further tryouts are developed with the secondary system of planks angled 45 degrees. The planks angled like this works as a sun screen.

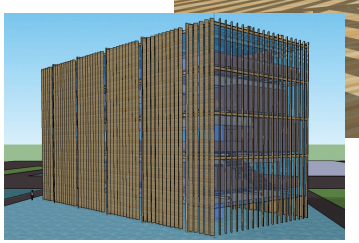
The afternoon daylight is illustrated on the top level in the café on the illustration above on the right.

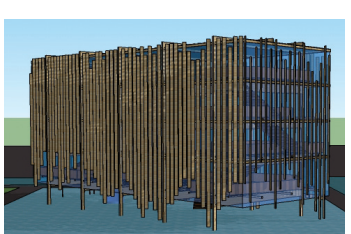
It gives clear light and is represented by the facade on the illustration just below.

To make the facade with the desired experience, the facade gets shaped as the graphical system found earlier.

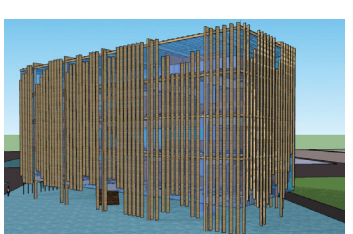
It gives the facade a more light and interesting expression as shown in the illustrations below, where the inside view is also represented.



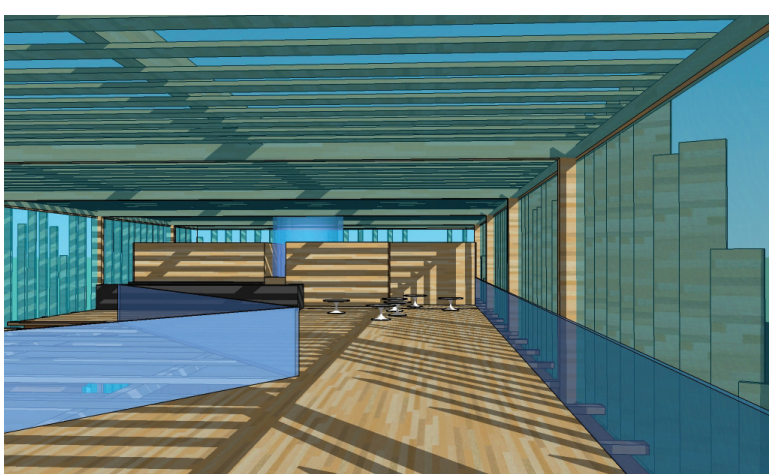




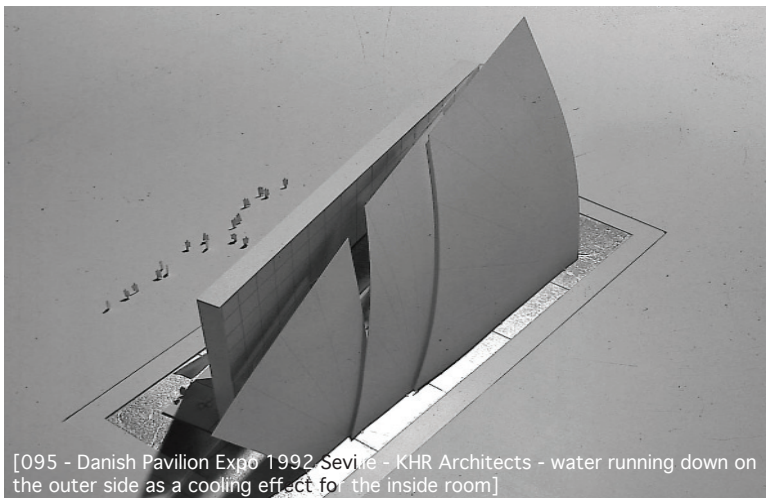
View from north



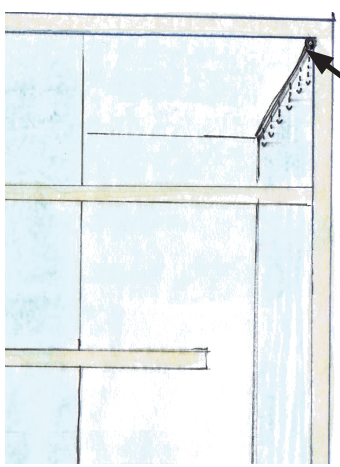
View from south



View to the open part in the facade.



[095 - Danish Pavilion Expo 1992 Sevilla - KHR Architects - water running down on the outer side as a cooling effect for the inside room]



View to slim water hose at the top level , where water is running discretely and steady down the facade to the ground floor.

As shown in the early merges of the plans, the café was to be outside. There was a change in approach for a nice rooftop café in the shadow of the pavilion's facade, by opening and cutting the glass out above the café area and half way down on the south facade.

Giving one more effect to the exhibition area, a water surface will tranquilly run down the inside of the facade to the north.

This will not only give a visual and experiential effect but it also has the further benefit of the water running on the facade cooling down the inside space. This was actually an effect used in the Danish Pavilion at Expo 1992 in Sevilla as in ill. 095.

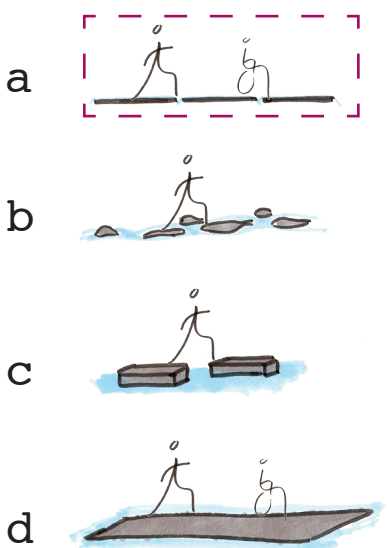
Detailing site

This typology concerns the water in the site. How to pass over the water and how the pavilion should be placed on it.

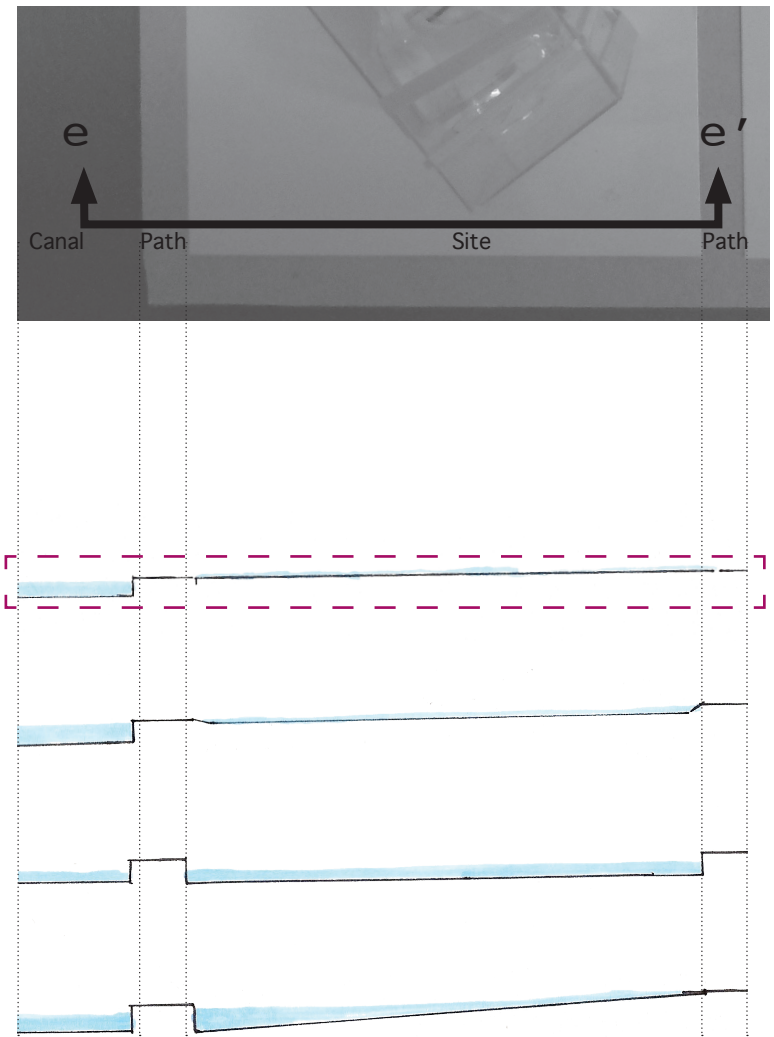
The water on the site could be at different levels. It could be at the same level as the surface on the path (ill. 1), a bit under the paths surface (ill. 2), at the same level as the canals surrounding the site (ill. 3) or a mix (ill. 4).

When people should pass over the water it could be directly on the water surface (ill. a), on Danish stones (ill. b), walk on large concrete step stones (ill. c) or on a bridge/path (ill. d).

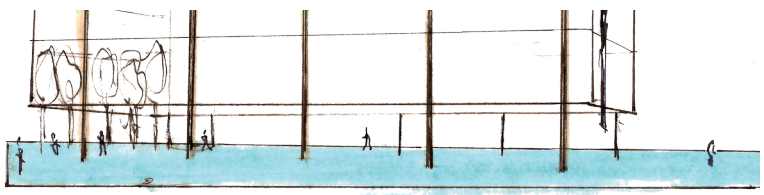
It is decided that solution 1 and solution a are better, because the feeling of walking on water is powerful, the water surface would not be deep -so the visitors would not get their shoes destroyed. It would be possible for both pedestrians and wheelchairs to pass.



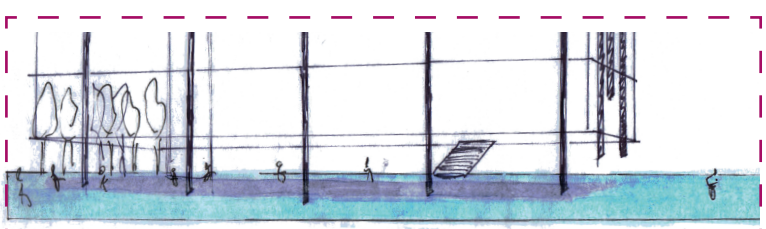
Ways to pass over the water



Section e-e' through site



Water under the pavilion.



Dry under the pavilion by placing stones.

[096 - Bordeaux, France - water used as an urban effect]

The area under the pavilion will be a dry area and the water on the ground surrounding the pavilion will be as the reference photo from Bordeaux.

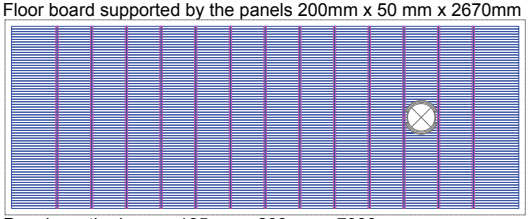
This area is used as an urban effect where people pass over or through it because of the sprinkling water coming up from the ground now and then.

The water surface and the sprinkling water is minimal so the people will not be soaked in water, only refreshed.

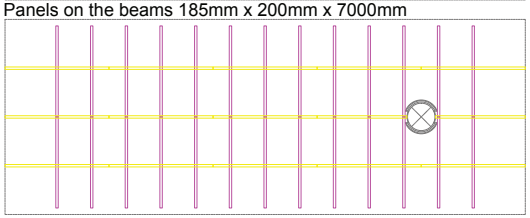
Detailing construction

On the diagram below the estimated size and placement of the beams, panels and floor board are shown to get a better idea about where the joints and construction work are placed.
For detailing the construction and the junctions different sketches are made to begin with, based on ideas from [Riberholt 2002] and [Herzog 2004].

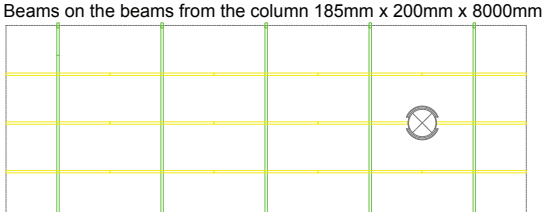
Floor board supported by the panels 200mm x 50 mm x 2670mm



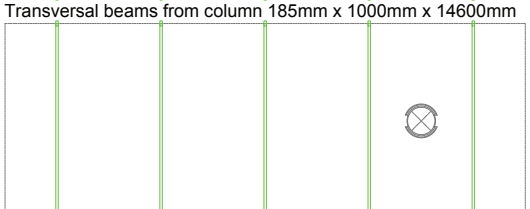
Panels on the beams 185mm x 200mm x 7000mm



Beams on the beams from the column 185mm x 200mm x 8000mm

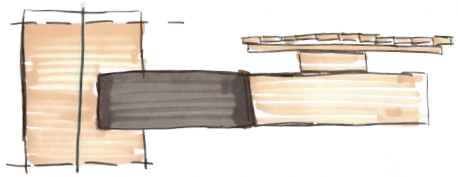


Transversal beams from column 185mm x 1000mm x 14600mm

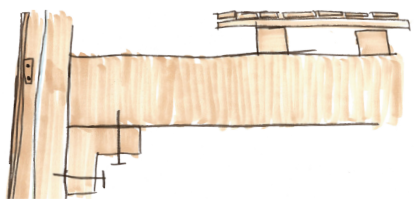


Below are sketches shown in the section, with both metal plates and wood as joints. The glass facade is placed in the middle of the pillar.

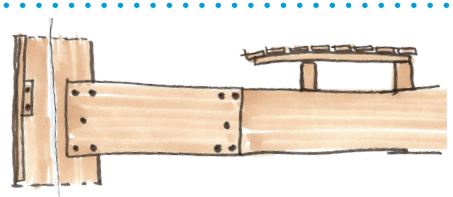
1



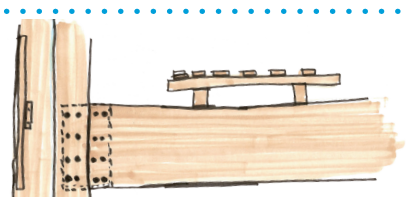
2



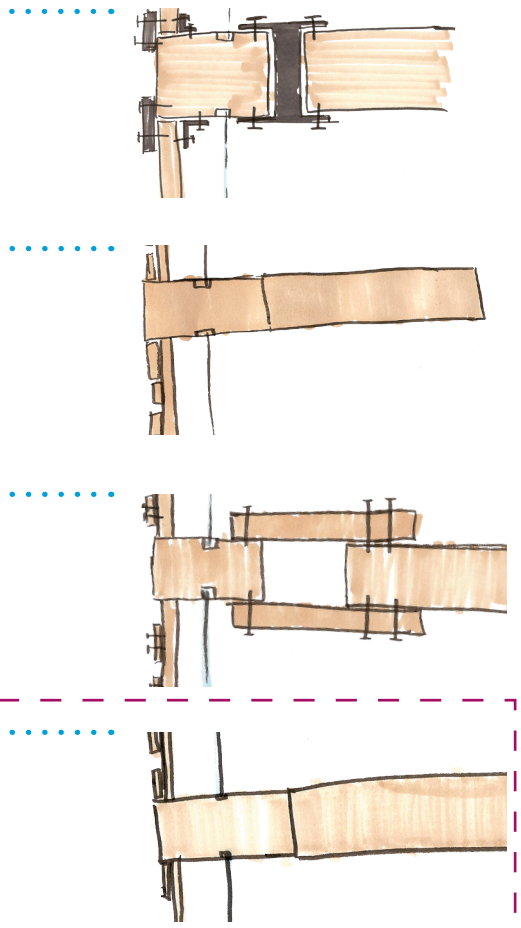
3



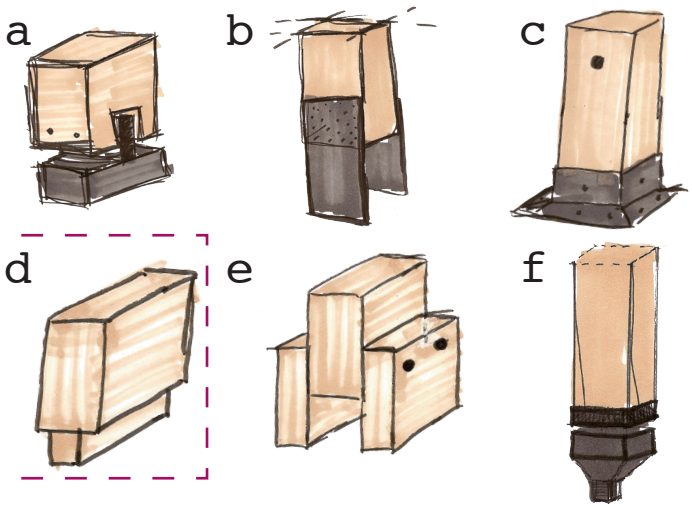
4



The same ideas but here sketched in the plan.

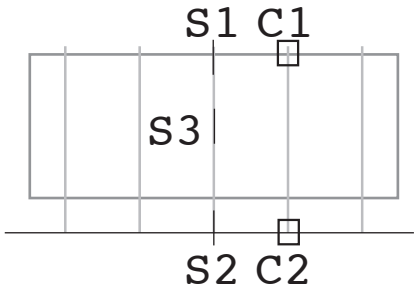


The connection to the ground. Different ideas both with metal, concrete and only wood are being sketched on. a) Connected to concrete element coming up from the ground. b) Steel fixed.
c) Steel fitting. d) Connected to a concrete slab underneath. e) Wood connected directly to the ground. f) Steel fitting.

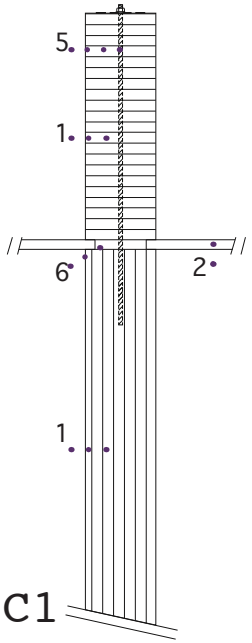


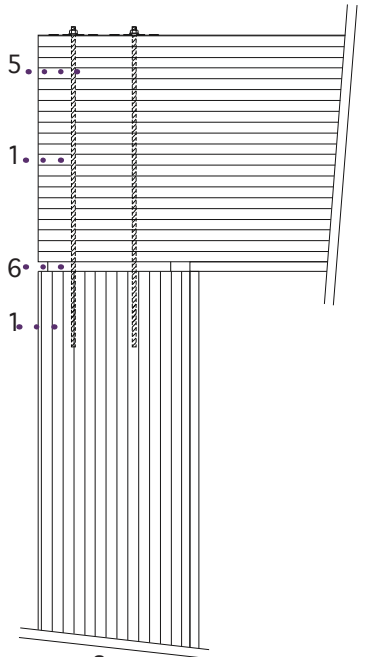
On some of the sketches the joints are done with metal and on others only wood. However, the expression of the joints must be Danish and Nordic. As mentioned earlier, it should be simple. Therefore a solution with fewer different materials will be chosen, the joints where only wood is visible, as in solution 4 of the section and plan is chosen.
With regard to the junction to the ground, solution b or d will be used. The difference is that one is made of wood and the other with metal plates, but both solutions lift the column from the ground in a nice and simple way. Solution d will be also chosen to keep the pavilion expression in the same materials.

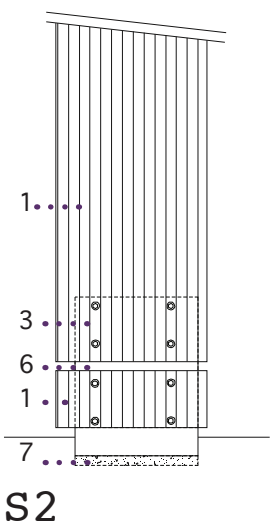
Details 1:20

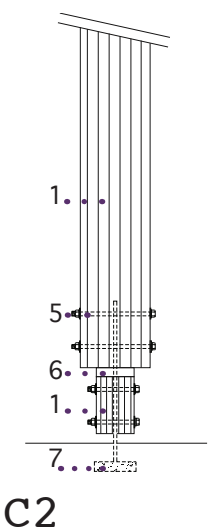


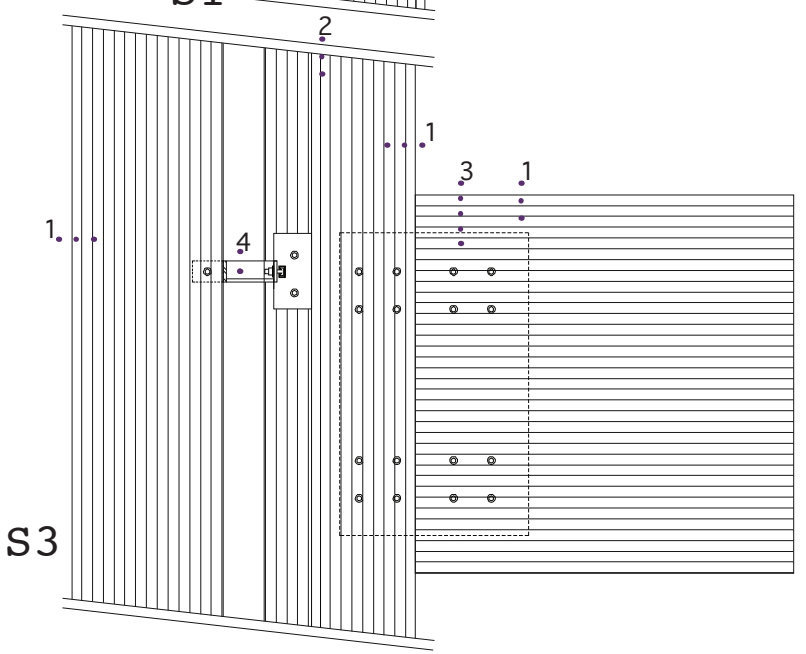
1. Glue laminated wood - Norway struce
2. Glass
3. Steel plate
4. Aluminium fitting
5. Bolt
6. Plywood
7. Concrete foundation











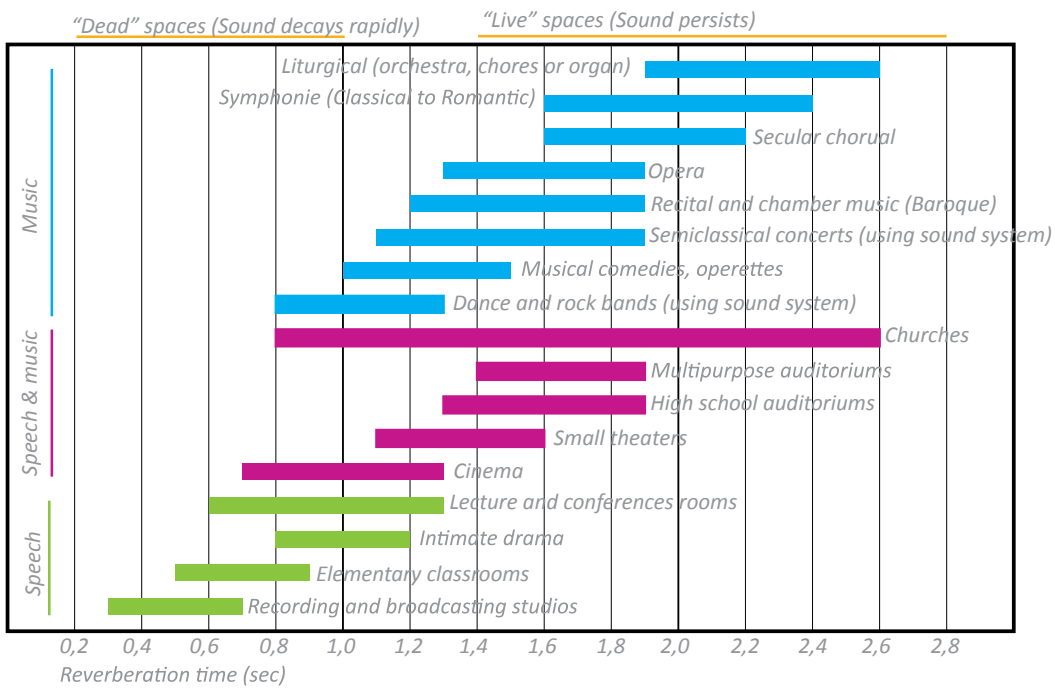
Acoustics

It seems reasonable to anticipate what might occur acoustical problems in the pavilion. The cube made in glass can be in the problem zone together with the open spaces and other spaces going all to the top of the building. The interior materials choices are therefore very important while talking about acoustics.

The pavilion is mainly made out of wood and is the material mostly represented in the pavilion. It is used as the primary construction material as used in the frames on the outside and inside as the holding structure for the decks. The flooring is also timber.

In terms of acoustics, glass is a hard material and reflects the sound whereas wood is a softer material that absorbs sound to some degree. Glass only reflects and does not absorb sound.

The acoustic environment that is desired to be achieved in the pavilion are calm and quiet rooms for the staff and VIP, which could be closed by the room-divider walls. In other spaces as in the exhibition and the open spaces a feeling like being in a church is desired.



[097 - Reverberation time]

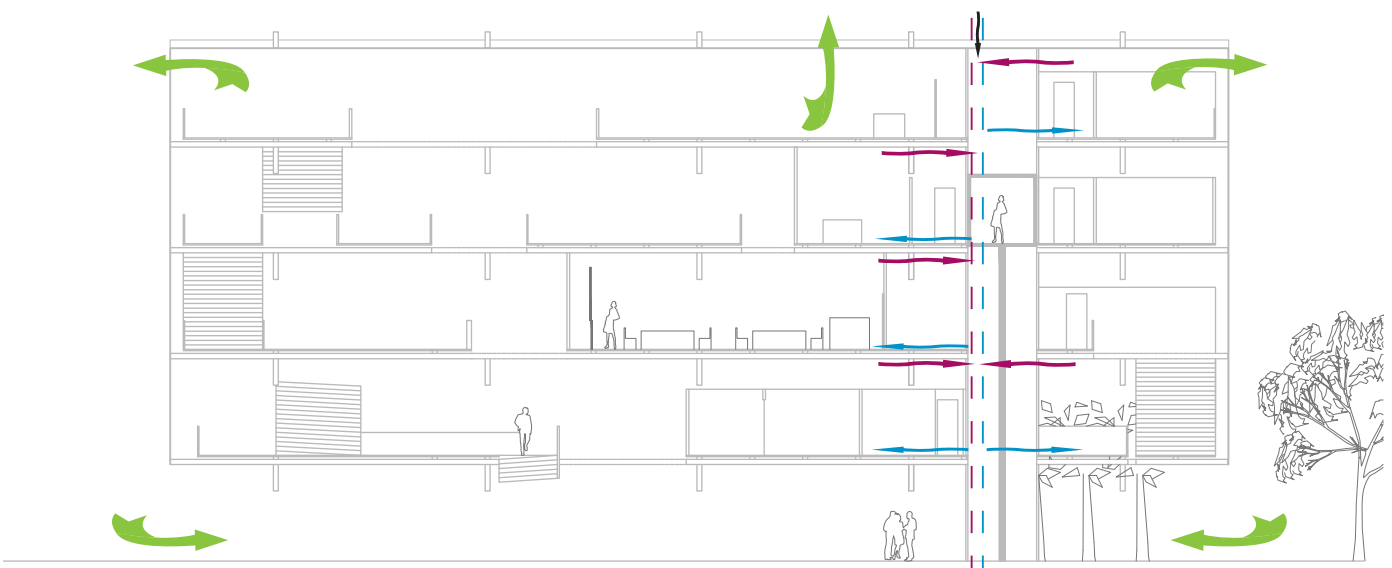
Ventilation

The ventilation system will only be described conceptually for the pavilion. The pavilion is open to the ground and fresh air can be dragged under the pavilion and lifted up and released in the top at the café opening and the sides, this is shown on the illustration with the green arrows.

Natural ventilation will mostly be used in the pavilion because of the open spaces and surfaces. But the fact that the period of time the pavilion is standing in Milan is mostly summer and hot, cooling might be needed also.

One solution could be that the vegetation in one of the exhibition zones and a zone with water could contribute to cooling down the air. Furthermore the pavilion can benefit from the water surface on the lot and the two sides from the canal to make the air more fresh.

It might be necessary to have mechanical ventilation for the kitchen, conference room, bathrooms and office rooms. The pipes needed for that will run in the elevator core with the water pipes (black arrow). Cooler air (blue arrows) will be blown in at the bottom, the air will get hotter and rise to the top where the air will return to the core (red arrow).



Summary synthesis phase

The project has been an iterative process and some of the illustrations in the synthesis phase might not have been defined at the point where they are shown in the proposal. But in this phase the structural concept, the facade and the floor plans have been completed, and this has led to the final proposal for the Danish Pavilion 2015.

The choice of building the pavilion only in wood, glass and metal bolts as fasteners, gives a sustainable and natural look and along with the possibility to reuse the materials from the pavilion.
It is possible to find all the materials required in Milan to reduce or eliminate the transportation costs from Denmark. It will be fast and easy to build and take down.

Glue laminated wood is a strong material because of the many layers of wood glued together and therefore there will be less wood used compared to using of normal timber. Laminated materials are light to transport and a normal truck can be used for mounting the construction [Riberholt, p.6]. Along with these desirable qualities, this wood is also resistant to fire, if it begins to burn; the wood extinguish any flames [Riberholt, p.10].

The choice of glue laminated wood as a way to construct the pavilion makes the solution sustainable.

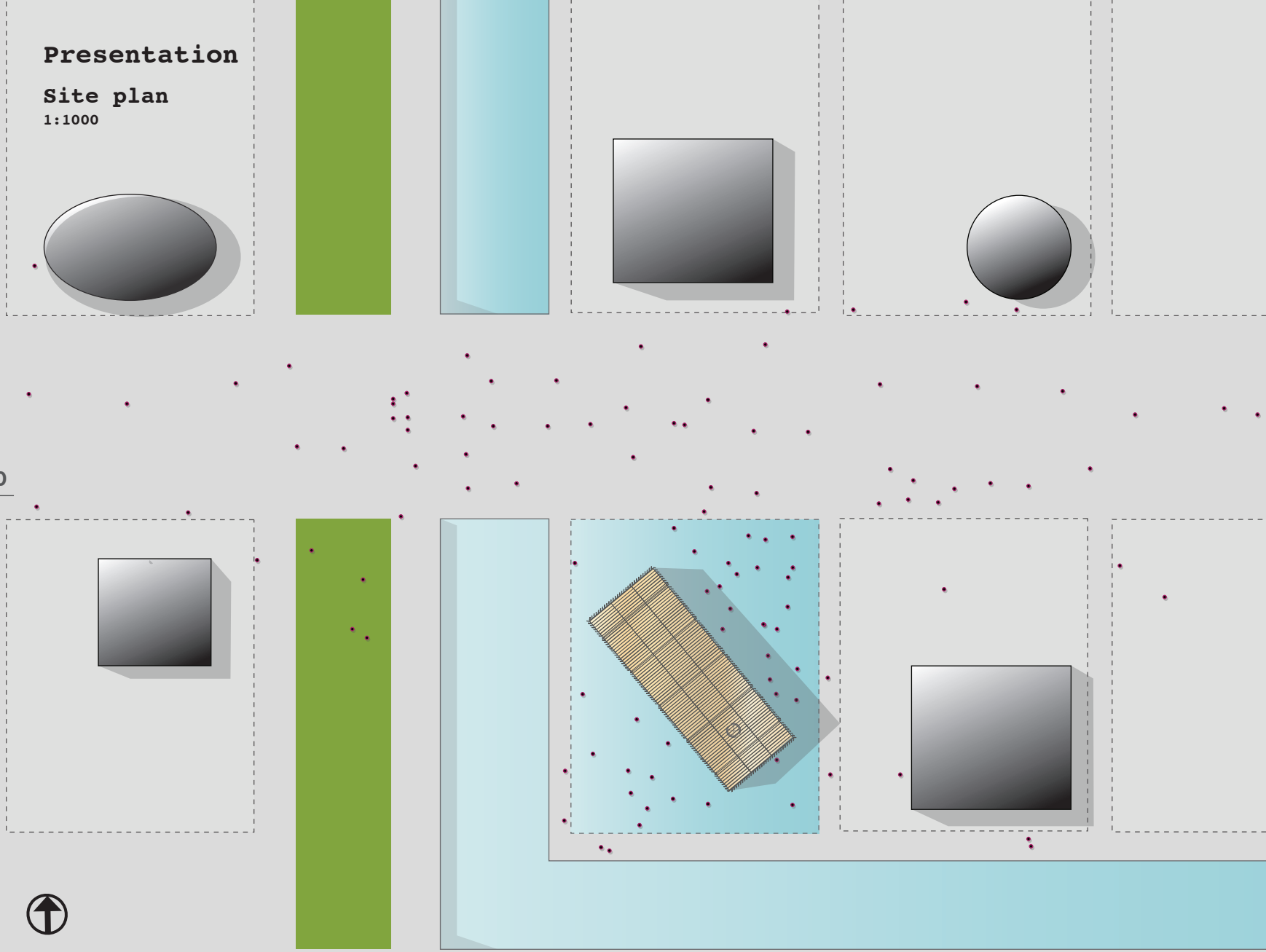
The water on the site will be used and then recycled. It will eventually be collected in a system that circulates it again. Perhaps rain water will also be collected and circulated again.

The indoor environment will be lit well and it will be comfortable for the staff to use everyday and for the visitors' brief stay.

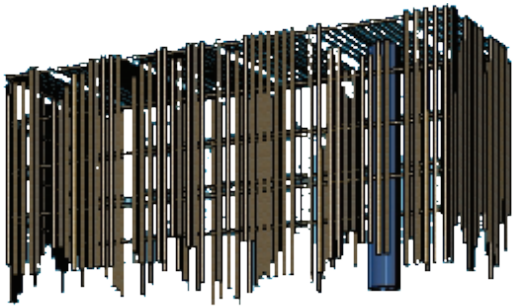
Presentation

Site plan

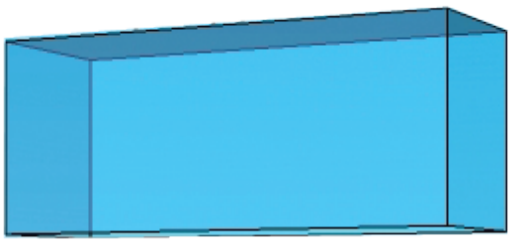
1:1000



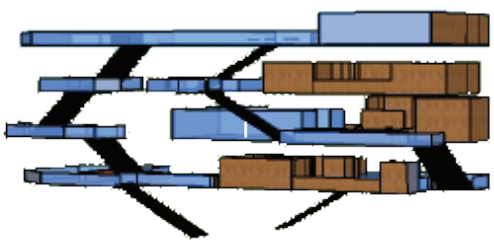
Model



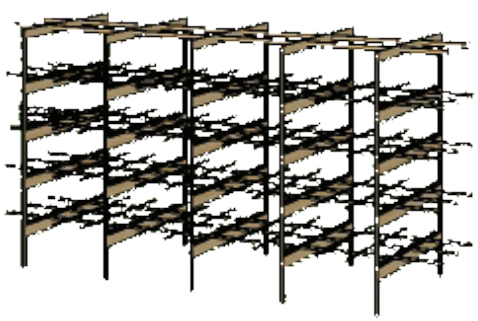
Sun screen



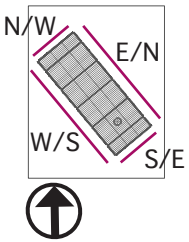
Glass cube



Levels and
Connections

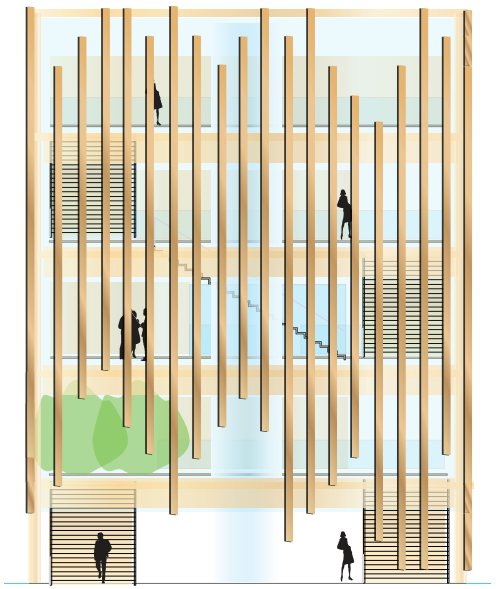


Structural system



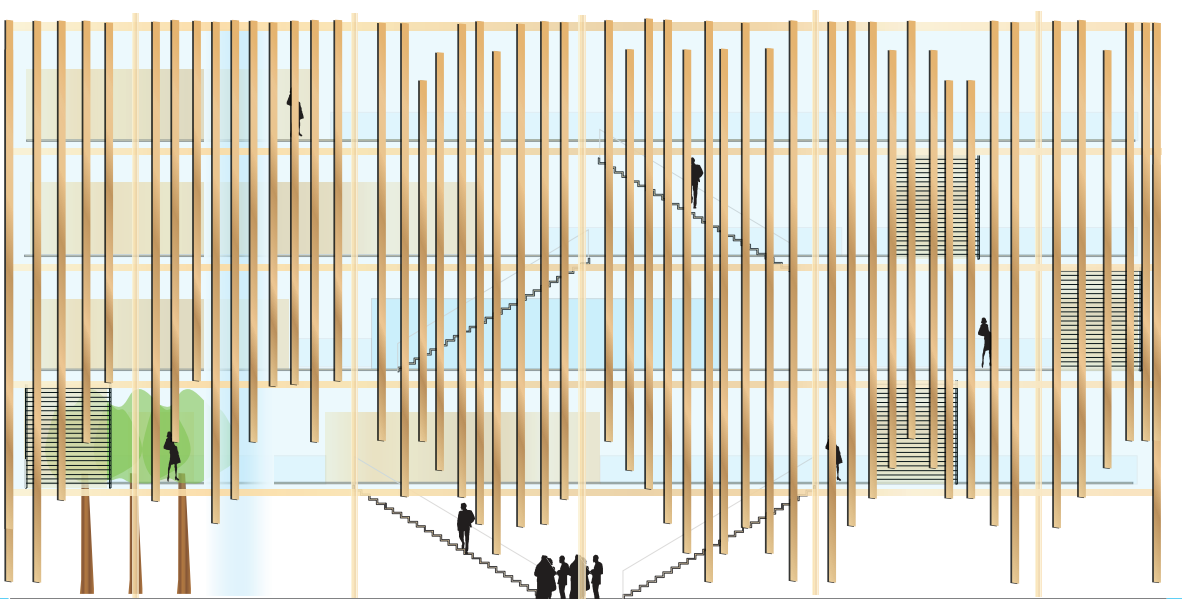
Elevation North/West

1:250



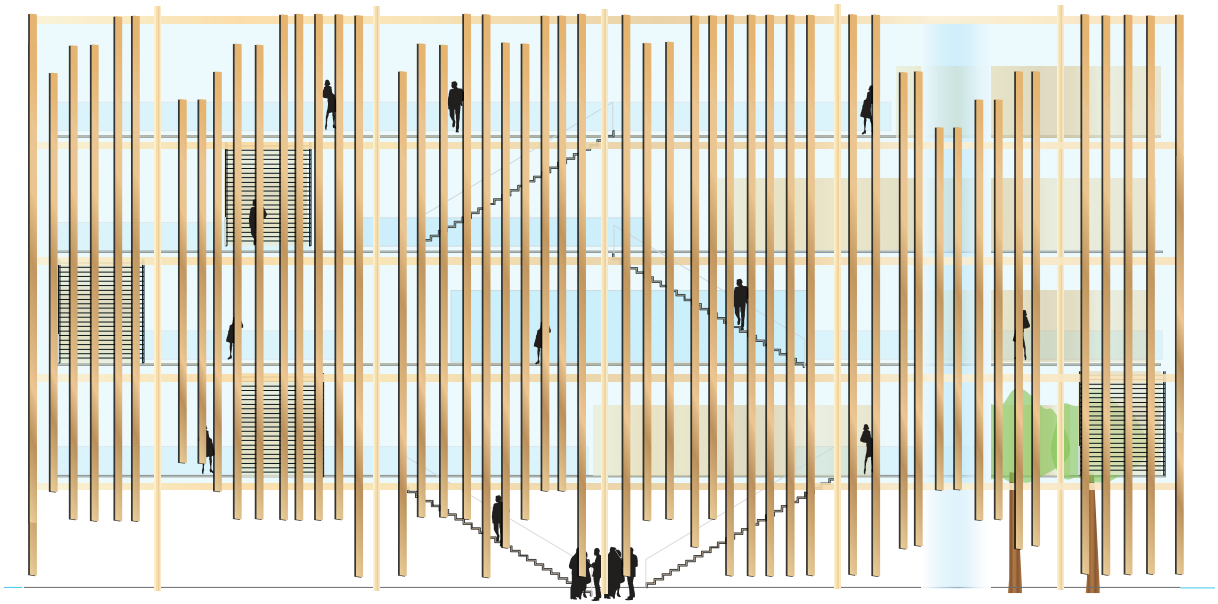
Elevation East/North

1:250



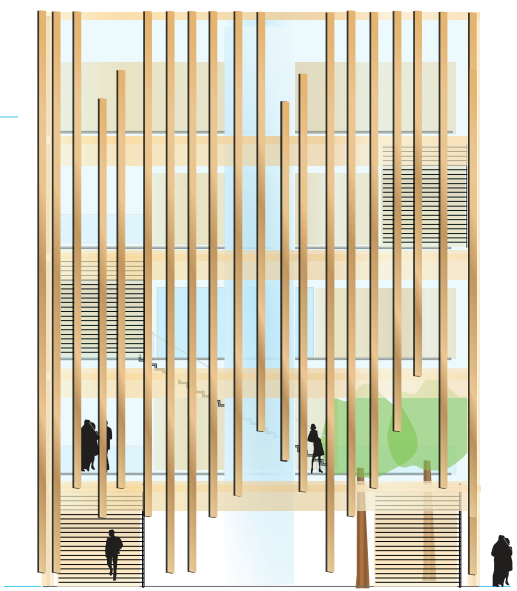
Elevation West/South

1:250

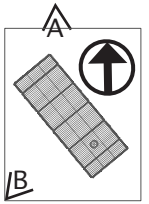


Elevation South/East

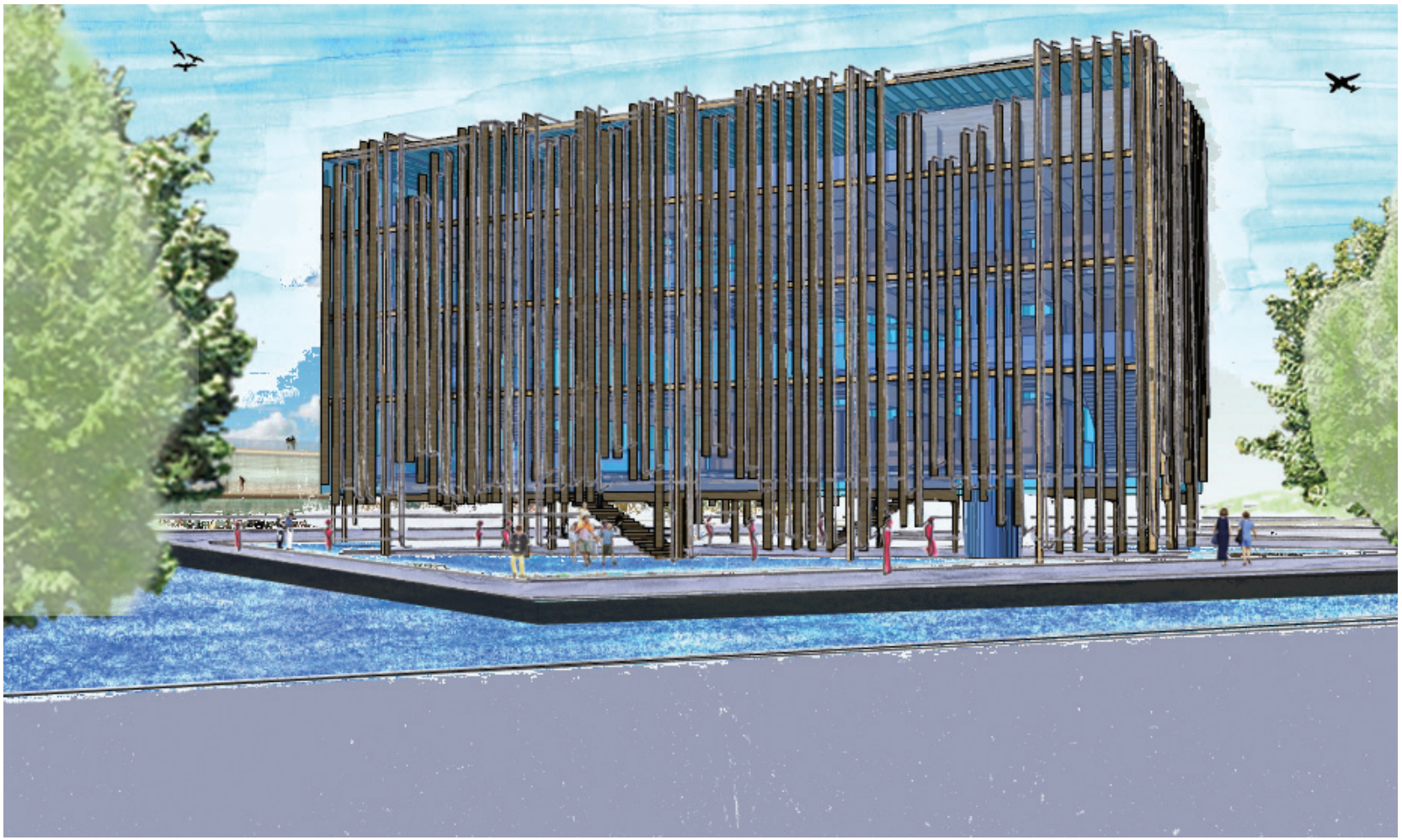
1:250



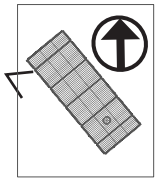
Perspective exterior A



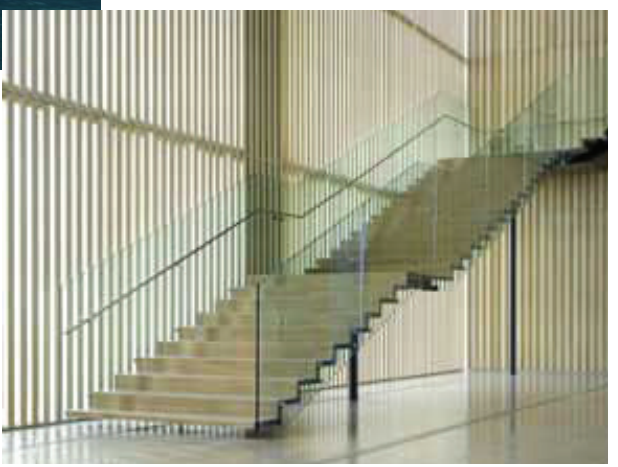
Perspective exterior B



Perspective ground floor



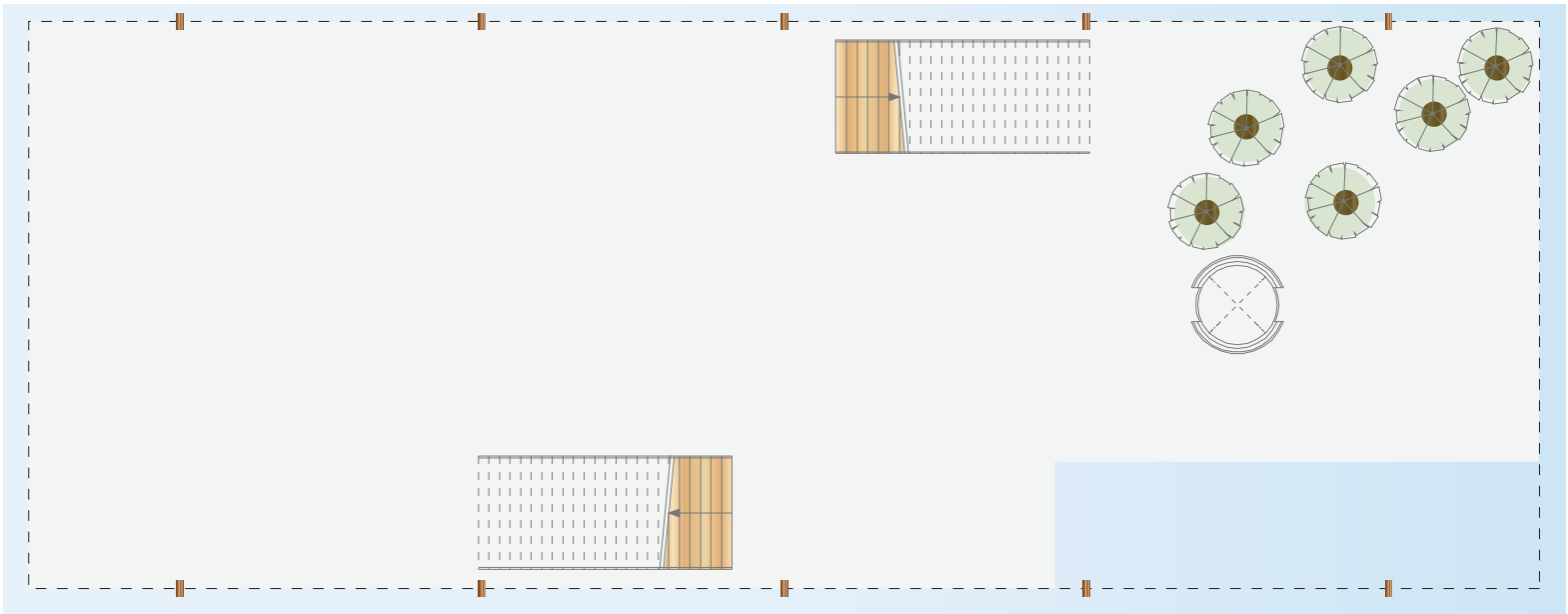
View to the dry area underneath the pavilion.
The staircases through the pavilion will all be the same style as ill. 098.



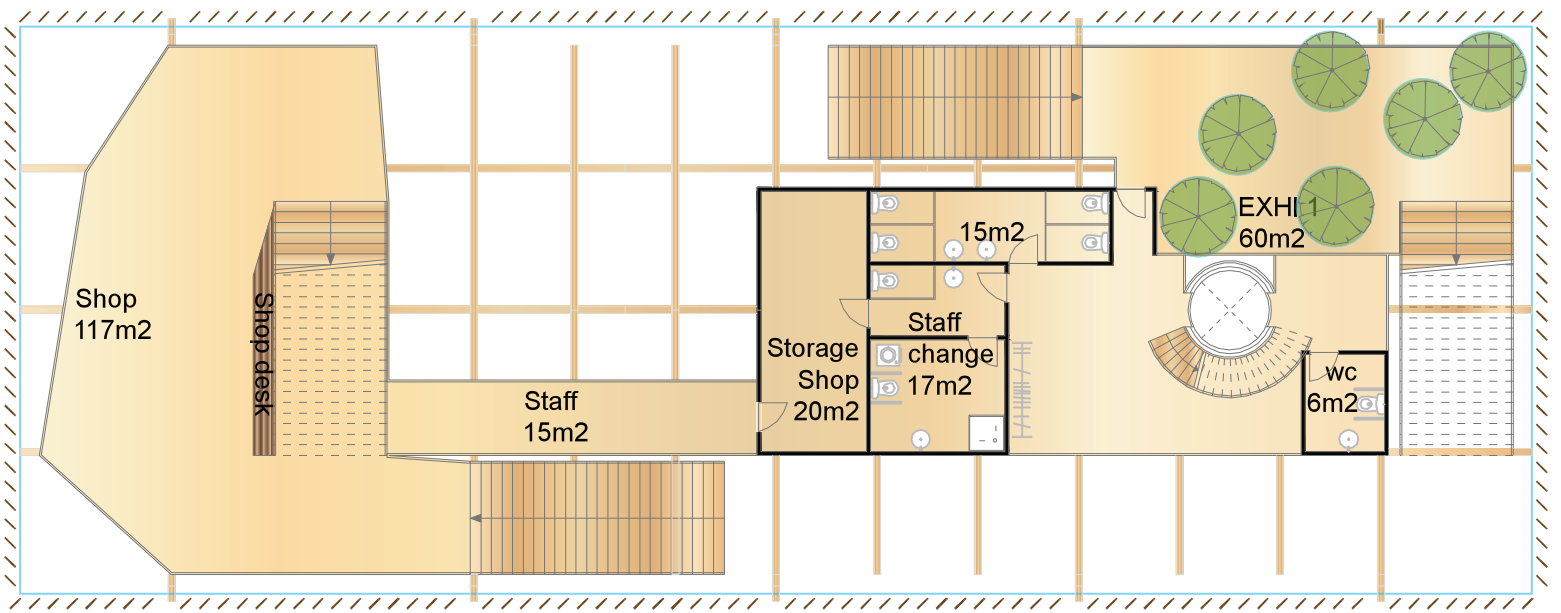
[098 - Suntory Museum of Art 2007, Tokyo, Japan - Kengo Kuma]

Floor plans

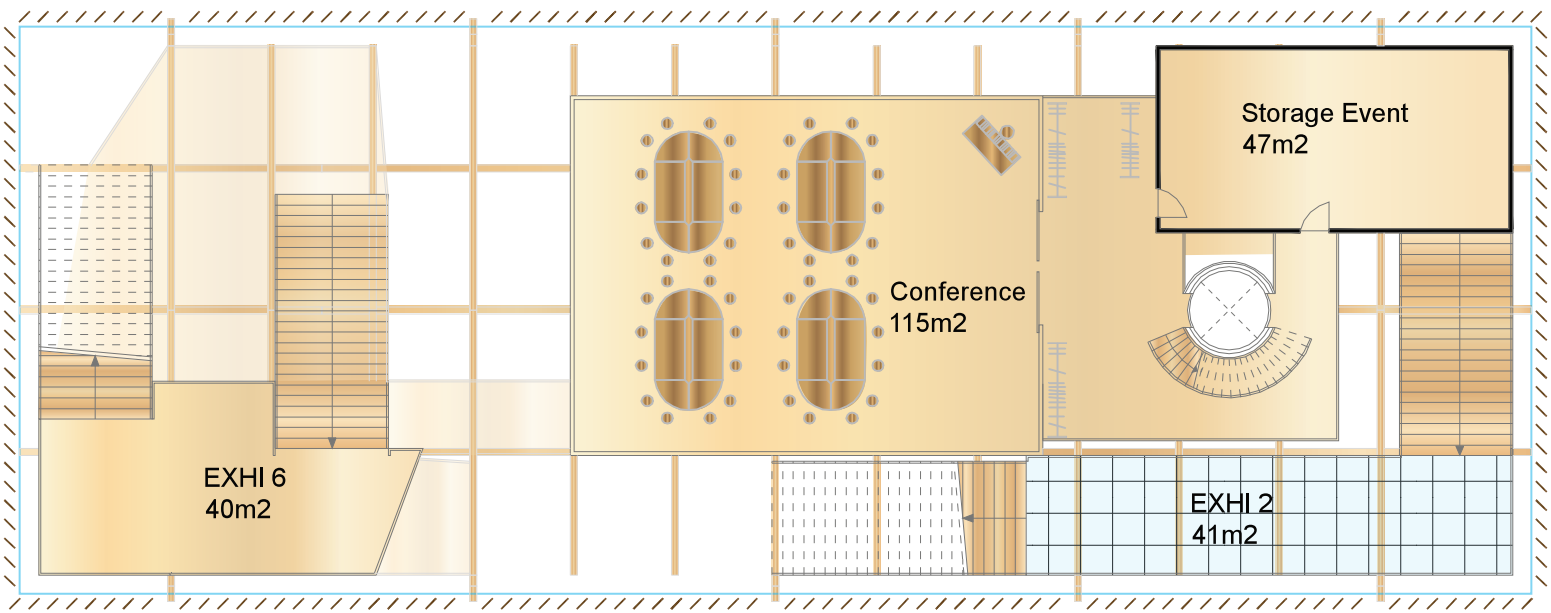
Ground Floor
1:200



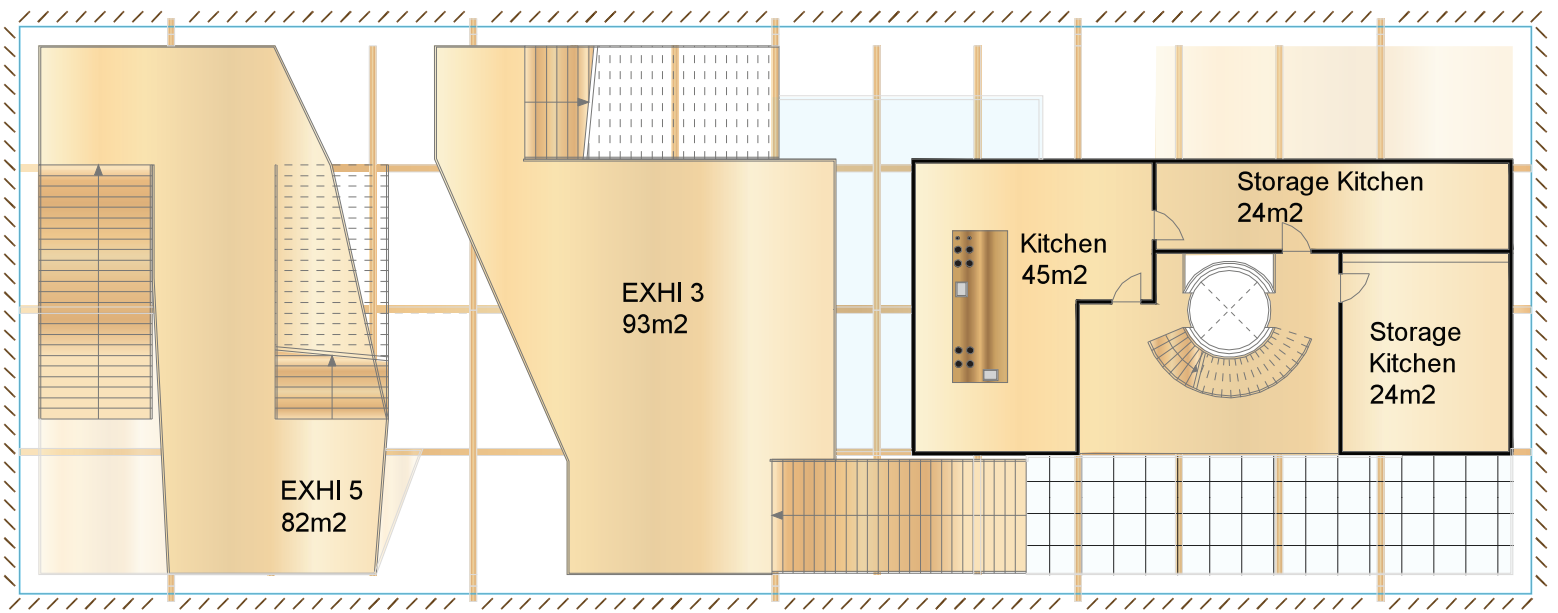
GF+1
1:200


Shop
117m2
Shop desk
Staff
15m2
Storage
Shop
20m2
15m2
Staff
change
17m2
EXHI 1
60m2
wc
6m2

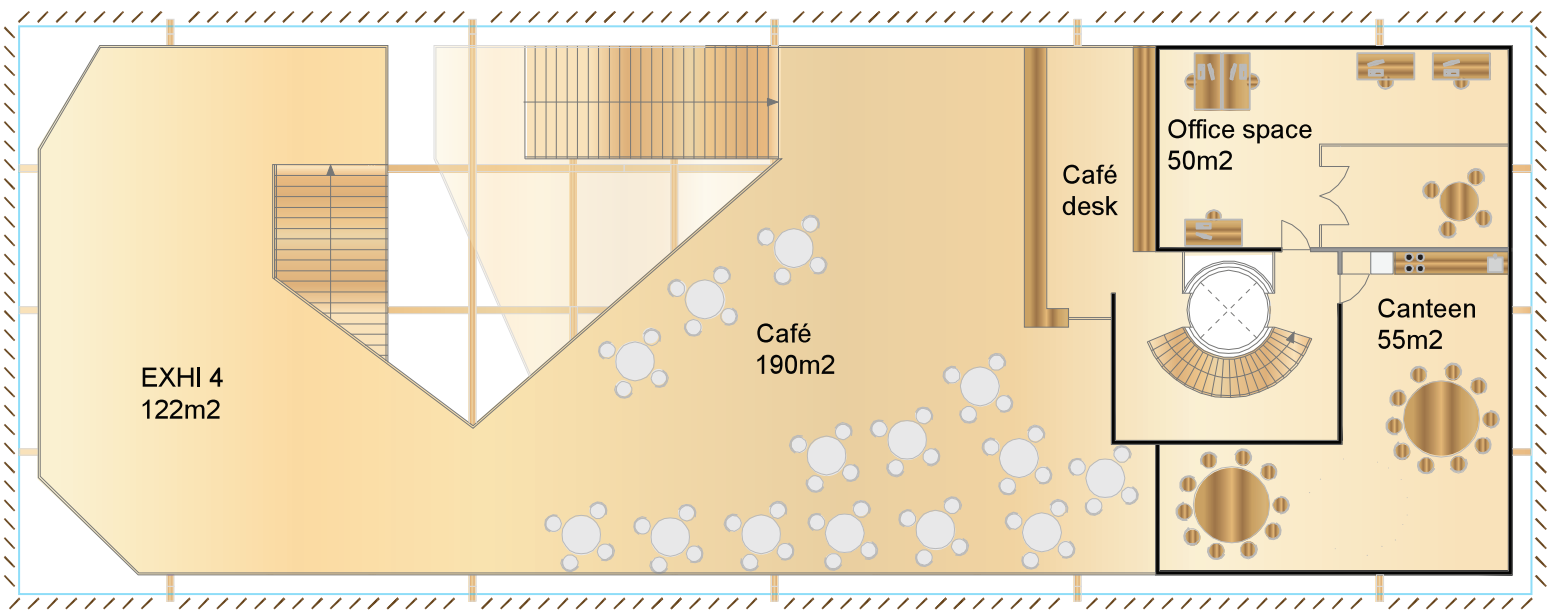
GF+2
1:200



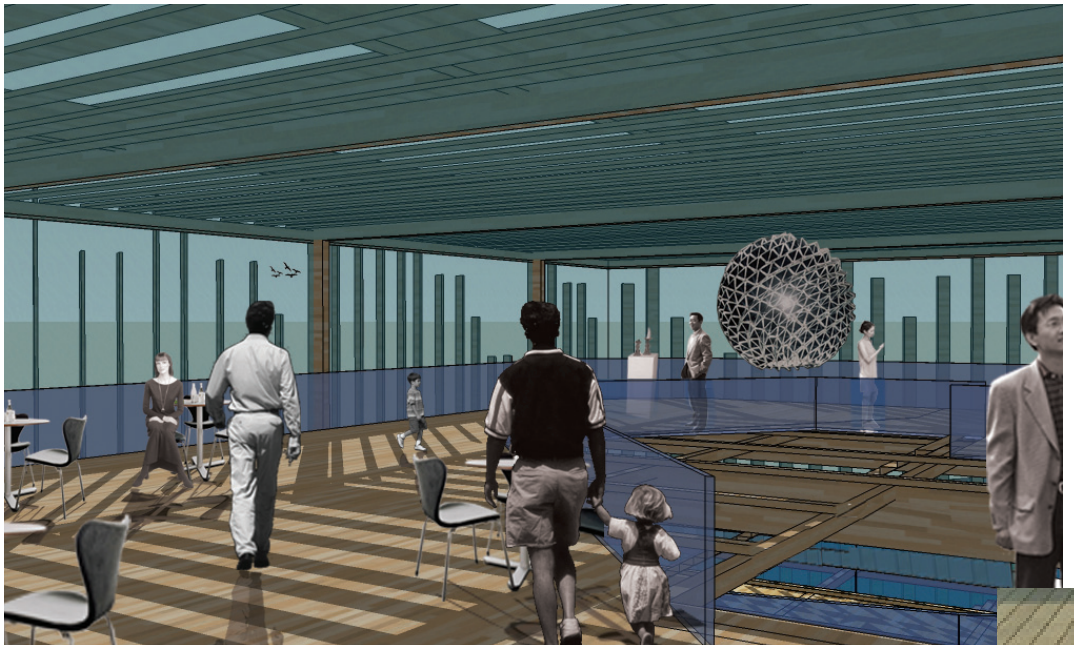
GF+3
1:200

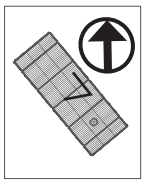

EXHI 5
82m2
EXHI 3
93m2
Kitchen
45m2
Storage Kitchen
24m2
Storage
Kitchen
24m2

GF+4
1:200

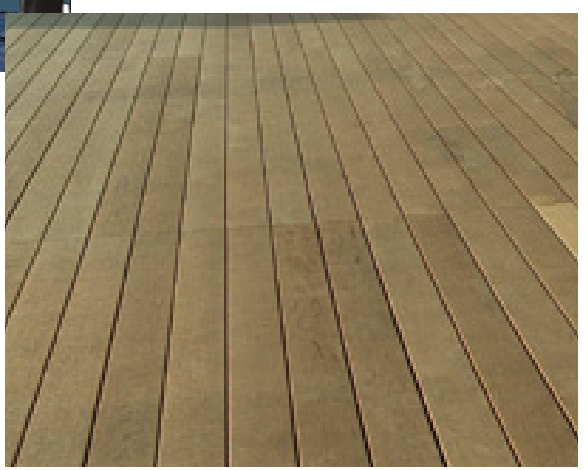

EXHI 4
122m2
Café
190m2
Café
desk
Office space
50m2
Canteen
55m2

Perspective top level



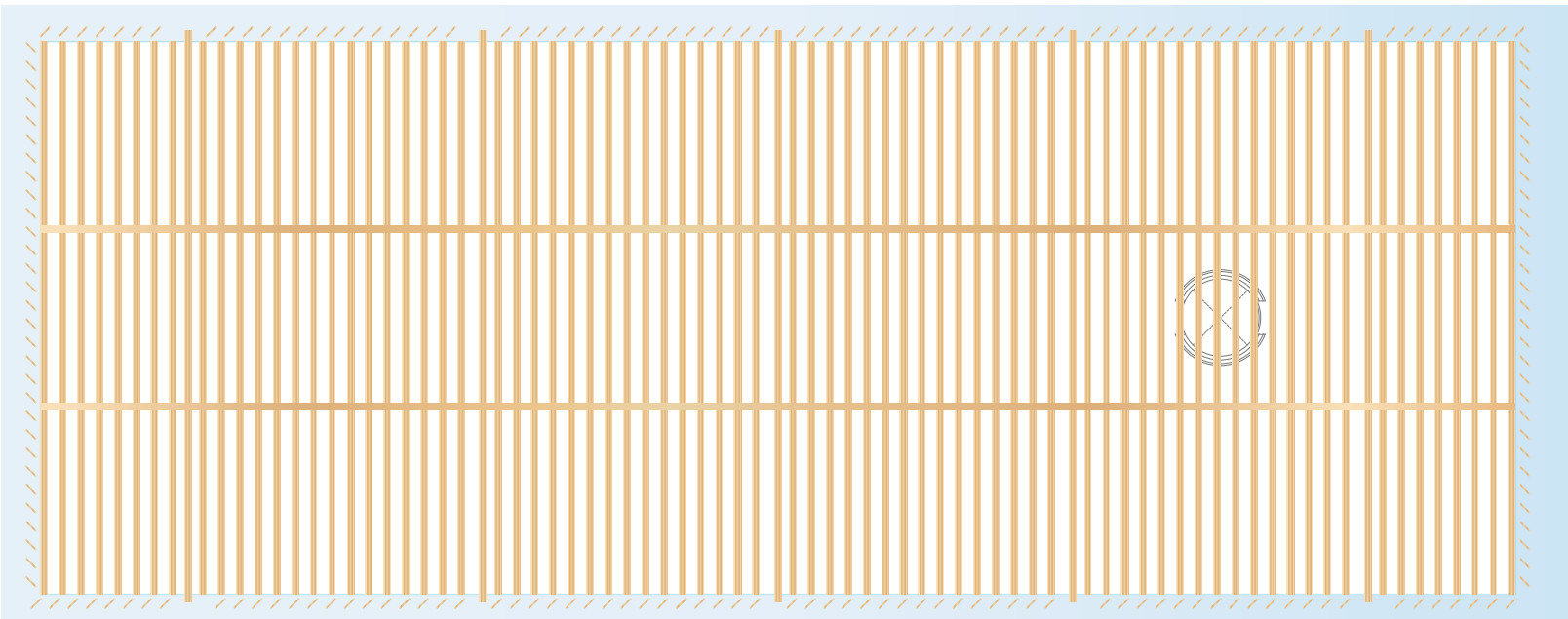


View from the café desk at the top level.
The floor wooden planks are on all levels like ill. 099.



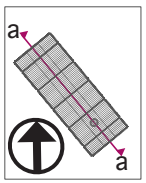
[099 - Oak flooring]

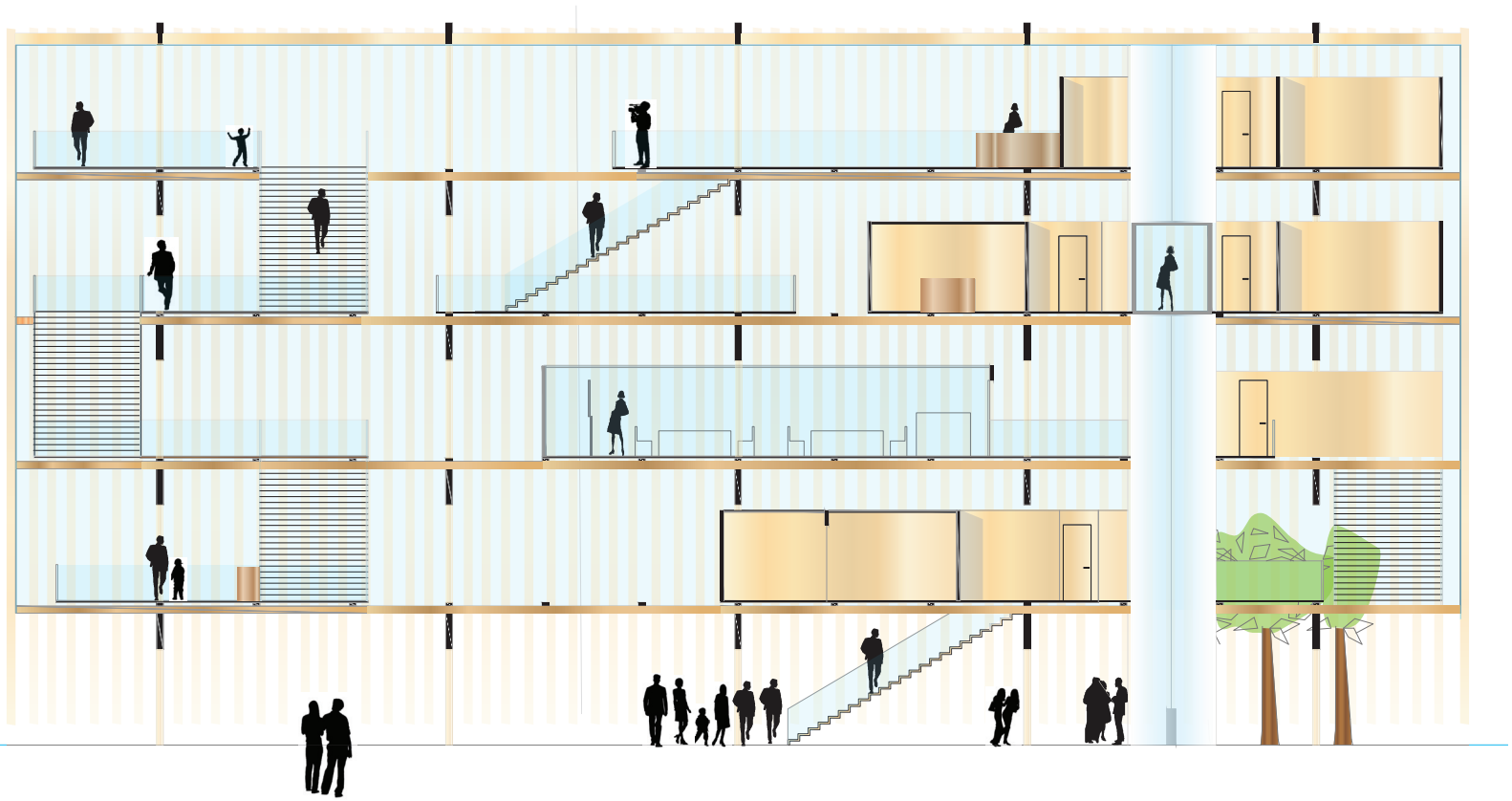
Roof
1:200



Section a-a

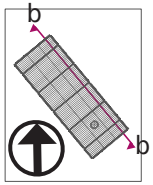
1:200

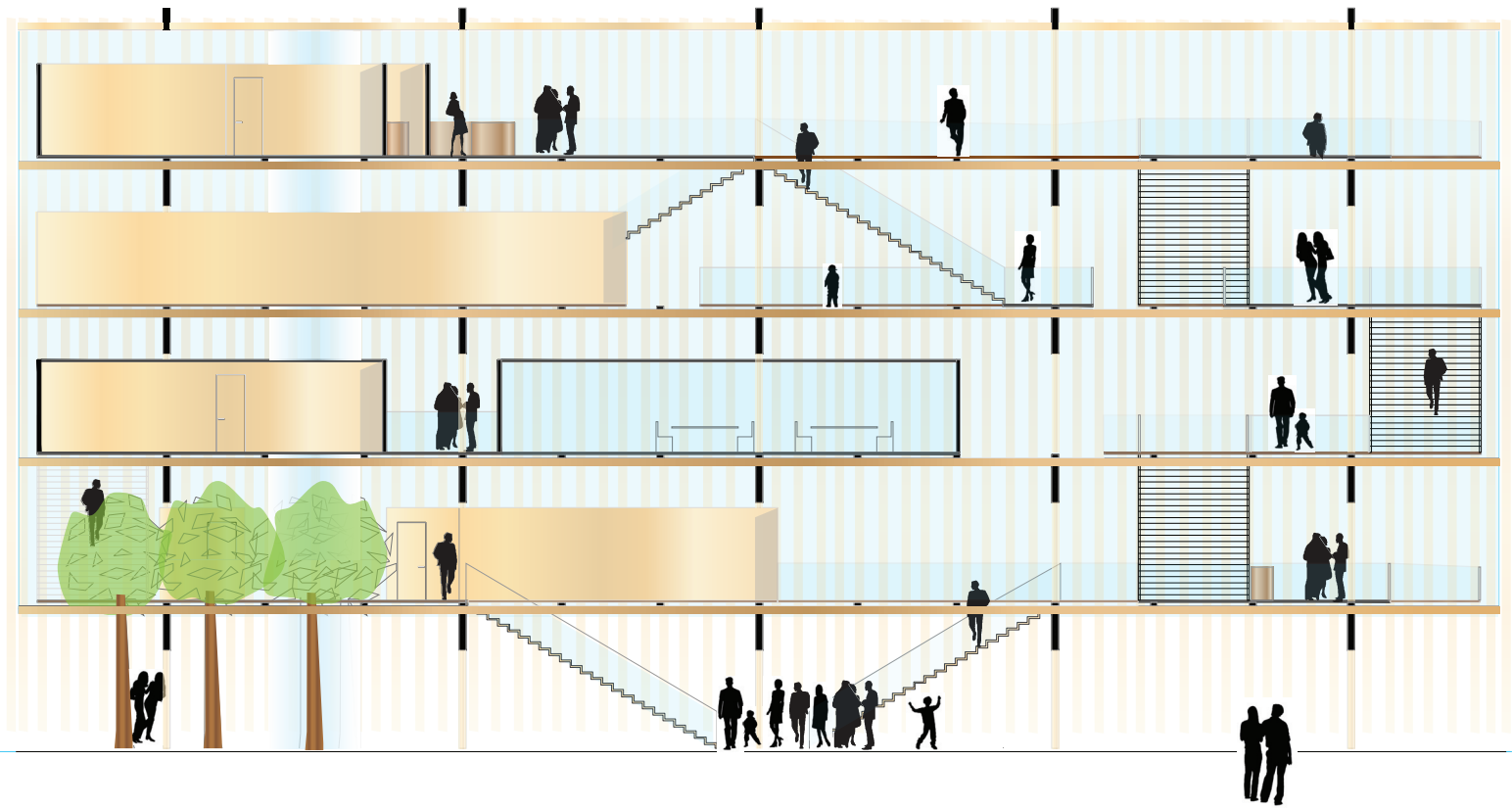




Section b-b

1:200





The project and the proposal for the Danish Pavilion can now be set in perspective and evaluated to see if it has met the criteria set up.

”The theme makes the expo” means that ”Feeding the Planet, Energy for Life” defines in general the basis for the world exposition. The theme for Expo 2015 in Milan makes a serious statement, concerning how to solve existing problems. The theme, with parallel connection to the problem statement, has defined this project.

If this project should provide a solution regarding how everyone on Earth could have access to clean water, enough food and a healthy life style, it could only be estimated and given by a conceptually ethical thought. The answer can only be ideas about how to help and afterwards see if it has worked. This project tries to answer these questions. One could say that focus for each of the two parts “Feeding the Planet” and “Energy for Life” has been equal.

To meet the part for “Energy for Life”, construction, materials and reusability are all criteria to underline the awareness of how transport, structure and the choice of materials influence the energy use on a building site and the energy used in general for construction of a building. Focus could also have been on renewable energy sources where solar cells could have been integrated to generate energy or other alternatives could contribute to energy for the pavilion.

The focus on “Feeding the Planet” has mostly to do with the exhibition, the indoor flow and the café. The focus is set up on themes about food defined in the analysis phase. Here are ancient food habits, current over-eating-problems and an increasing problem about fat-epidemic being discussed. The answers to these questions are shown in the exhibition as approaches to solve the future world problems about food. This will be up to the artists how to come up with solutions. When focusing on problems people increase their awareness. The more aware people are about the problems, the closer the world gets to a common understanding and solution of the world’s shared problems.

The pavilion reflects consideration for the environment, nature and human beings. The fact that it is a temporary pavilion has played a large role in the choice of the material, structure and construction. The structural system and the technical aspects have met the requirements. The structural system lives up to the criteria about using material that easily could be found in the area and constructed, taken down and reused. The holding structure is glue laminated Norway Spruce and is sustainable in terms of being reused.

The expression in the Danish Pavilion is Nordic, simple and with the use of clear lines in the structure. This makes the pavilion clear in tectonic expression and stands out in its own architecture. The pavilion attracts and invites people passing by to visit Denmark.

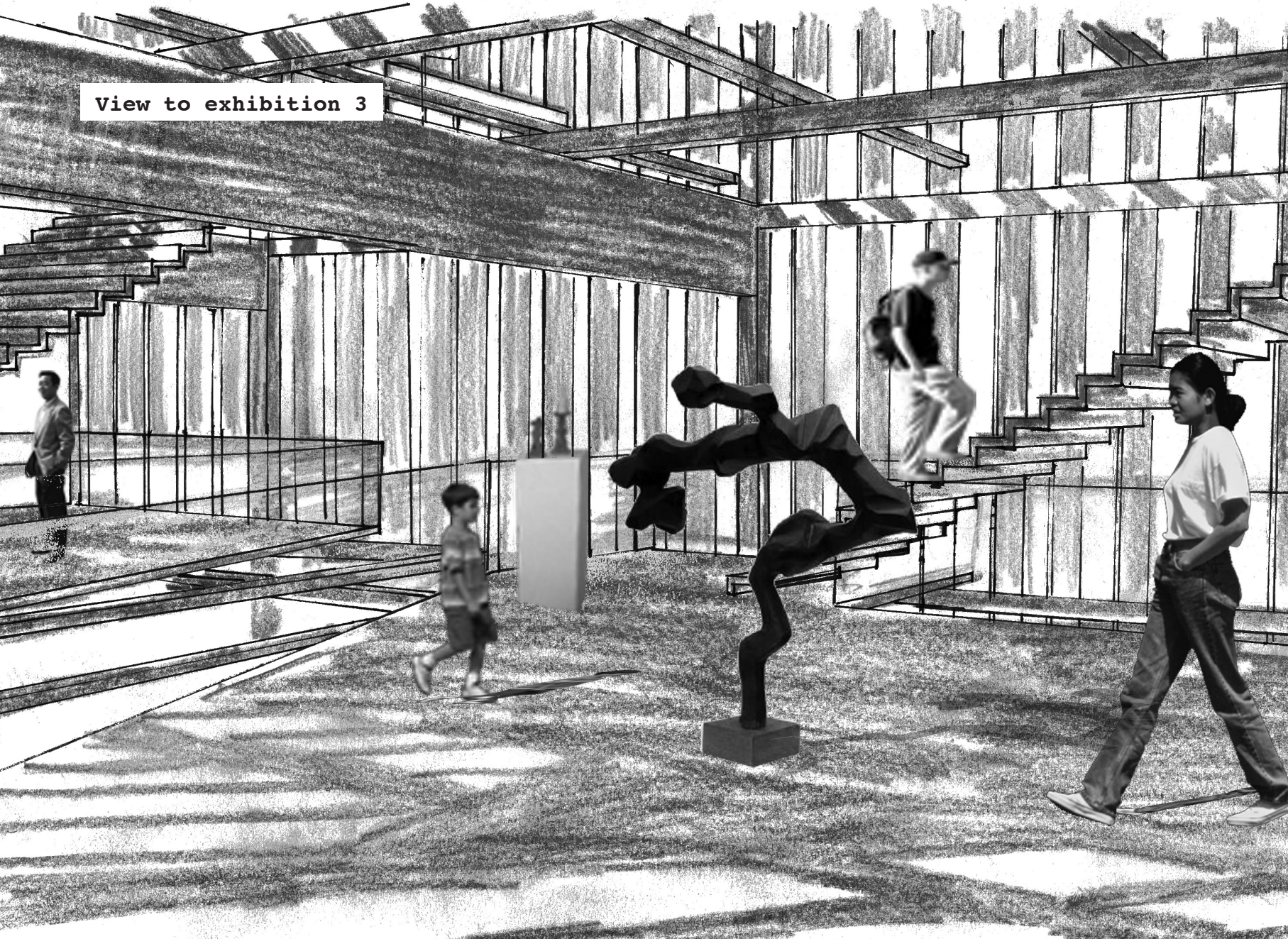
Pavilion

When approaching the Danish pavilion from a distance, walking down the World Avenue, the facade structure changes due to the timber planks angled 45 degrees on the facades. This has more than just one purpose. It is angled to work as shading for the inside environment and for the visual effect of a changing facade while passing the pavilion. It also changes the views to and from the inside space so visitors get a varied and differentiated experience while circulating in the pavilion.

At arrival to the site, the visitors are to go over the water surface. It feels refreshing when the sparkling water comes surprisingly up from the ground. The water is recycled in a system that leads the water to the top of the pavilion and slowly washes down inside the south and north façade.

Flow and exhibition

From the entrance the visitors are led through the exhibition. The development of the flow has been completed by the choice of different exhibitions and the desired visitor experience for the pa-


View to exhibition 3

vilion. There are changes of direction in the indoor flow, and the views to the outdoor are also changing. The visitors gets orientated and disorientated, but not confused. There is only one way for the visitors through the exhibition. The stairs between each exhibition floor are to meet the visitors' curiosity and make the visitors aware that something new will be told at the next level.

First the visitors will be led through a part with beech trees, the sort most represented in Danish forests. The trees growing in the exhibition will benefit to give a cooler indoor atmosphere and affect the experience of the exhibition.

The second exhibition is a glass floor. For experimenting with the human limit, the visitors have to pass over it. The experience has an architectural effect. It symbolizes a Danish stream or river; because the water surface on the ground level is visible through the floor from this exhibition level.

The third exhibition is a Danish artist's view and approach on energy use and recycling products. The exhibition should be in easily understandable media with not much text, hanging down from the ceiling, placed in showcases or directly on the floor.

A book will be available in the café for loan or for sale in the shop, explaining what kind of problems little Denmark has to solve and deal with and what to be proud of like wind turbines as energy, clean water in the faucet, abundant public transportation, biking to and from activities, recycling and large common trash disposals.

The flow leads the visitors to the top level with the café. One part of the façade is open to the outdoors and the visitors can buy refreshments. The waitresses will be serving Danish specialties, like open-faced sandwiches on Danish rye bread with potatoes, herring or other Danish classics. The food being served should be presented in a modern healthy way and all of the ingredients should be fresh and organic.

Just past the café another exhibition by a Danish artist will be presented. This area should focus on healthy food and outline the problems and differences between the western civilization of over consumption and the third world starvation.

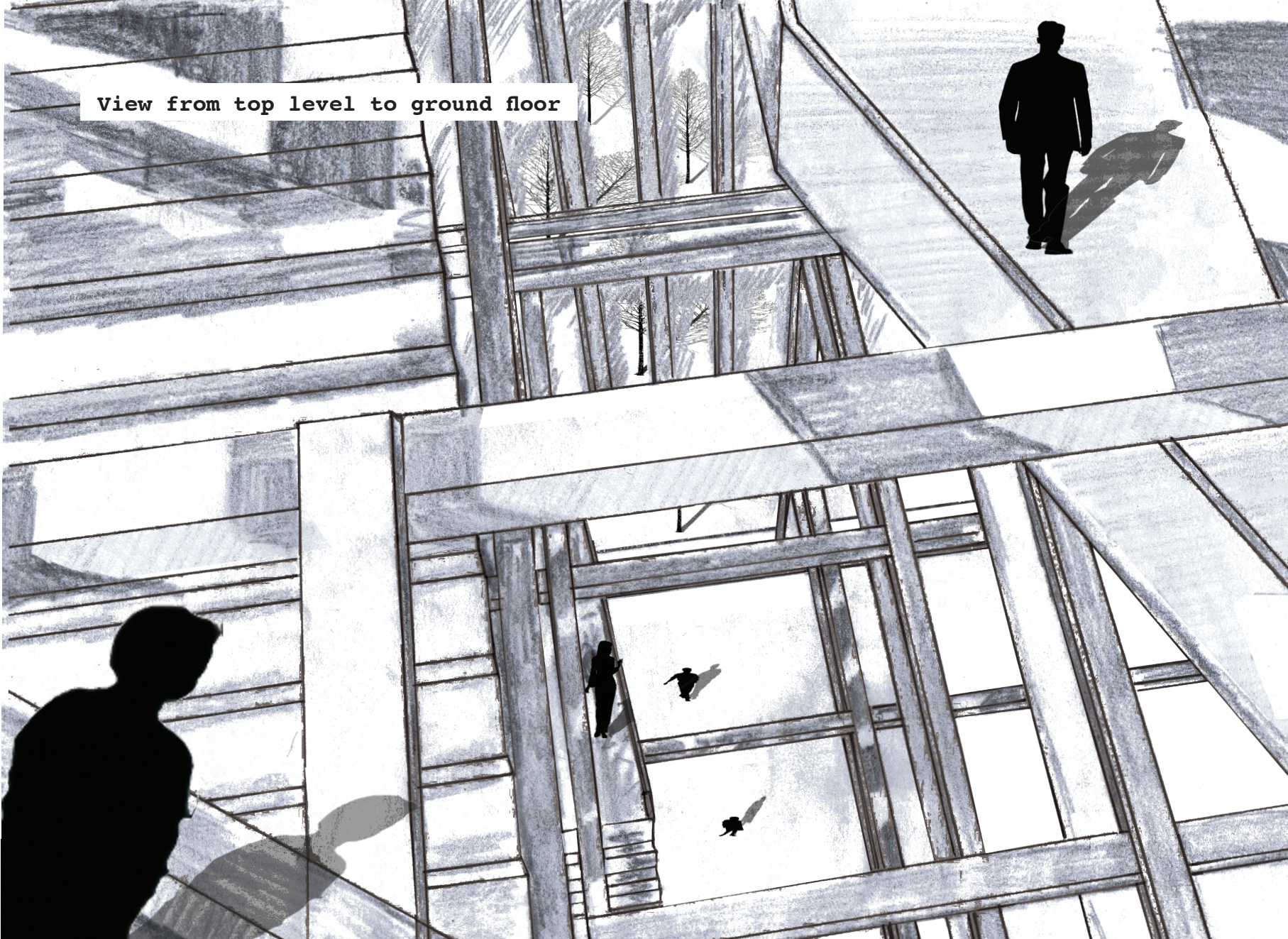
Then the visitors are guided down to the 5th exhibition space where Danish real life eating situation are directly transmitted on the floor and on room dividers. The live streaming could for example be transmitted from the sausage wagon at Copenhagen Town Hall Square, a canteen at a high school, a soup kitchen contra a luxurious restaurant and also the contrast between the eating table habits of a rich Danish family compared to the ones of a less comfortable Danish family.

The last exhibition area is an art installation where the visitor's experience is to pass through the installation. Another artist would define this.

The visitors then arrive at the shop where merchandise shown in the exhibition are sold, and maybe some Danish grown crops are sold to spread the idea about healthy and sustainable food for all people.

Alessandro and Fabiana, the characters from the story telling (p.35), get the exact experiences that were defined. They can now exit the pavilion on the calmer site facing the canal and reflect over the stimulation of the different senses they received during the visit.

The staff can enter with the visitors or take the lift to the level of changing rooms, bathrooms and shower. All VIP people would be taken to this level in the same way. From here there is one level up to the conference room, which is connected by an indoor staircase. This is available for the staff and VIP, but a lift is available all the way to the top for merchandise and food-supplies to the kitchen. On all staircases are mounted foldable lifts for disabled people.


View from top level to ground floor

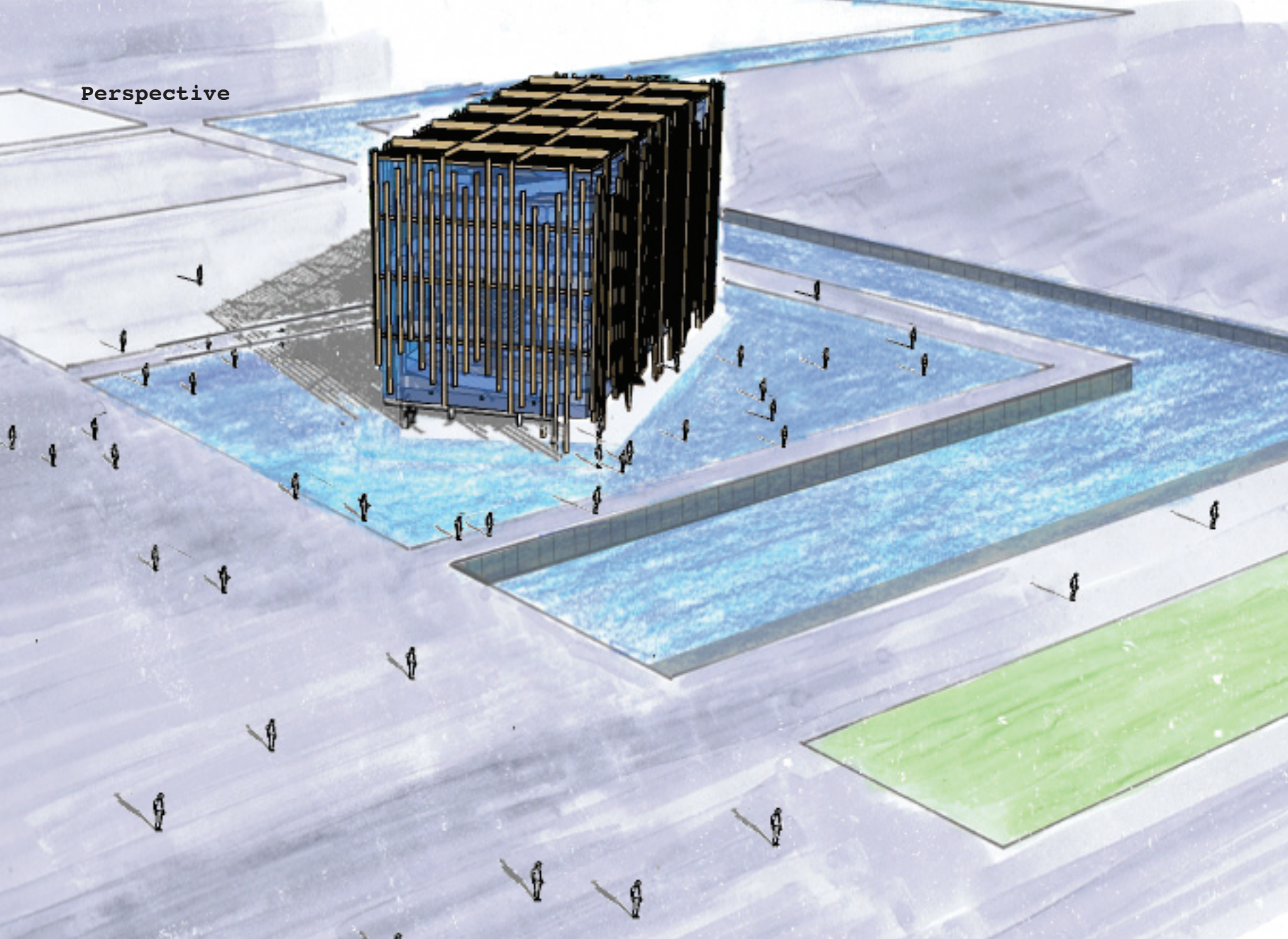
Project process

While developing this proposal it was important to design a pavilion as an icon for Denmark as well as the requirements of the vision and the problem statement. In particular, building a pavilion representing one's native country, brings high expectations to the design and ideas. In the beginning it was difficult to narrow down and focus on a specific theme and history. It was not necessary to integrate the pavilion in the context, the lot only relates to the two sides of the canal and the main street, World Avenue. There were not many limits during the design process and different themes and ways to build were explored to be sure not to overlook a better solution.

During the sketching phase, hand drawings, physical models and 3d computer visualizations were used to create and visualize the different ideas. The decision to use the simple form met the requirements for the attractive simple Danish pavilion.

It can be concluded that the proposal for the Danish Pavilion 2015 meet the criteria set in the vision and problem statement by allowing an exceptional story to be told about food and culture and also by applying sustainable structural methods and materials. The building requirements set by the Danish Enterprise and Construction Authority are fulfilled. The pavilion has an attractive architectural quality and gives the visitors and staffs an interesting experience.

Perspective



Source list

Books

Ahler, K. 2002. *Dimensionering med diagrammer*. København: InginørenlBøger

Dirckinck-Holmfeld, K. 1992. Den danske pavillon Expo 1992. København: Arkitektens Forlag

Herzog, T. 2004. *Timber Construction Manual.* Basel: Birkhäuser Verlag AG

Jensen, D.S. & Jensen, L.A. 2009. *Jorden er rig.* Mørkøv: Skou & Asmark

Jensen, C.G & Olsen, K. 2009. *Teknisk Ståbi.* 20th edition. København: Nyt Teknisk Forlag

Neufert, E. & P. 2000. *Architect's Data.* 3rd edition. Oxford: Blackwell Publishing

Riberholt, H. 2002. *Limtræ.* Kgs. Lyngby: Træbranchens Oplysningsråd

Tell, J. 2008. *100 måder at redde verden...* København: Nyt Nordisk Forlag Arnold Busck A/S

Visual media

Expo2015 2010. *Masterplan*. Italy: Expo2015 - the 12.11.2010 at 2pm, pdf available on: http://www.worldexpo2015.it/masterplan/masterplan.pdf

Kirkegaard, P.H. 2009. Lecture 3. *Building Technology and Architectural Design.* Aalborg University.

Knudstrup, M.A. 2004. *Integrated Design Prosess in Problem Based Learning.* Aalborg: Aalborg University Press.

Mullins, M. 2009. Lecture 8.1. *Architectural Lighting Design Considerations*. Aalborg University.

Økonomi- og Erhvervsministeriet 1. 2008. *Expo 2010, den danske pavillon, dommerbetænkning.* København: AA Konkurrencer

Økonomi- og Erhvervsministeriet 2. 2008. *Expo 2010, den danske pavillon, konkurrenceprogram.* København: AA Konkurrencer

Belusa, D. 2009. *GMO mod sult?* København: Greenpeace - pdf available on: [Balusa 2010]

Web sites

[Balusa 2010] www.greenpeace.org/raw/content/denmark/press/rapporter-og-dokumenter/gmo-mod-sult-den-forkerte-m.pdf

[Botæt] www.botaet.dk/

[Bie1] www.bie-paris.org/site/en/expos/intro-to-expos.html

[Bie2] www.bie-paris.org/site/en/focus-on-the-theme.html

[BIG] www.big.dk/

[DK1] www.denmark.dk/NR/rdonlyres/916BAEE6-AFB8-4720-B118-

03366AB1154A/0/DenmarkOverview.pdf

[DK2] www2.dmu.dk/Pub/FR682_final.pdf

[Ebst1] www.ebst.dk/euinternationalhandelfokus/79544

[Ebst2] www.ebst.dk/expoinfo.dk/dendanskepavillonshanghai

[Expo1] www.ivarhagendoorn.com/photos/series/dutch-pavilion-expo-2000

[Expo2] http://en.expo2015.org/ht/en/milan/exhibition_areas.html

[Expo3] http://en.wikipedia.org/wiki/Expo_2000

[Expo4] http://en.wikipedia.org/wiki/Expo_2008

[Expo5] www.expozaragoza2008.es/

[Expo6] http://en.expo2015.org/ht/en/participate/let_s_talk_about_it.html

[Fair Trade] www.fairtrade.dk/

[Food1] www.dengodehverdagsmad.dk/-/id-359/page-blog

[Food2] www.mados.dk/content/view/14/44/

[Food3] http://shatterlimits.com/study-proves-three-monsanto-gm-corn-varieties-pose-health-hazard/

[Greenpeace] www.greenpeace.org/denmark/vores-arbejdsomraader/ud-med-gensplejsning-ind-med/losning

[History1] http://en.wikipedia.org/wiki/First_Exhibition_(1756)

[History2] www.bie-paris.org/site/en/main/history.html]

[History3] http://en.wikipedia.org/wiki/Expo_(exhibition)

[History4] http://da.wikipedia.org/wiki/Grauballemanden

[Infomation] www.information.dk/161748.

[Madeleine] www.madeleines.dk/index.php?id=25#verdensudstillingen

[Meat dress] www.emirates247.com/lifestyle/fashion/lady-gaga-shocks-mtv-crowd-with-meat-dress-2010-09-13-1.290185

[Milan1] http://en.wikipedia.org/wiki/Milan

[Milan2] http://en.wikipedia.org/wiki/Galleria_Vittorio_Emanuele_II

[Milan3] http://fr.wikipedia.org/wiki/Milan

[MVRDV] www.mvrdv.nl/#/projects/sustainability

[Politiken1] http://politiken.dk/tjek/sundhedogmotion/article1009685.ece

[Politiken2] http://politiken.dk/tjek/tjekmad/article967006.ece

[Politiken3] http://politiken.dk/tjek/sundhedogmotion/levevis/1051037/klarlund-danskerne-er-overdrevent-bange-for-sult/

[Politiken4] http://politiken.dk/debat/kroniker/article892845.ece

[Politiken5] http://politiken.dk/tjek/dagligliv/mad/article1064648.ece

[Politiken6] http://politiken.dk/tjek/tjekmad/tjekmadartikler/article1061987.ece

[Politiken7] http://politiken.dk/tjek/dagligliv/toej/article1061690.ece

[Simplon] http://en.wikipedia.org/wiki/Simplon_Tunnel

[Terra Madre] http://en.wikipedia.org/wiki/Terra_Madre

[Terra Madre2] http://www.terramadre.info/pagine/rete/

[World1] http://en.wikipedia.org/wiki/World_population

[World2] www.1billionhungry.org/maja9/hunger/why-is-there-hunger/

Illustrations

If an illustration does not have a number, author has produced it.

[001] the 05.09.2010: http://en.wikipedia.org/wiki/File:Expo2015Milan.jpg

[002] [Knudsen, p.4]

[003] [Knudsen, p.6]

[004] the 07.09.2010: http://en.wikipedia.org/wiki/File:Crystal_Palace.PNG

[005 - 019] the 07.09.2010: www.bie-paris.org/site/en/component/docman/cat_view/100-expo-documents.html

[020] the 07.09.2010: www.maps.google.com/

[021] the 09.09.2010: http://en.wikipedia.org/wiki/File:Simplontunnel01.jp

[022] the 10.09.2010: www.wayfaring.info/2008/03/04/the-fiera-milano-exhibition-center/

[023] the 31.12.2010: www.bestourism.com/medias/dfp/3544

[024] the 02.10.2010: www.meteoam.it/modules.php?name=viewClinoMinMax&station=066&name_station=Milano%20Malpensa

[025] the 01.10.2010: www.gaisma.com

[026] the 04.11.2010: www.at-rejse-er-at-leve.dk/vejr/milano_vejr.htm

[027] the 28.10.2010: www.meteoam.it

[028] the 07.09.2010: www.maps.google.com

[029-038] [Expo2015 2010]

[039] the 05.10.2010: http://en.wikipedia.org/wiki/File:Expo2000_nl.jpg

[040 - 041] the 25.09.2010: www.madeleines.dk/index.php?id=27

[042] the 31.12.2010: www.archnow.com/2010/05/danish-pavilion-at-shanghai-expo-2010-by-big/

[043] the 31.12.2010: www.archidir.com/architecture/sustainable-danish-pavilion-design-for-expo-2010-in-shanghai/

[044] the 27.10.2010: www.carletti.dk/Default.aspx?ID=169

[045] the 27.10.2010: www.dreamstime.com/stock-photo-gmo-lemon-image5299930

[046] the 27.10.2010: www.fdb.dk/samvirke/nyheder/Sider/Uheldig%20kartoffel.aspx

[047] the 27.10.2010: www.moonbattery.com/archives/2006/06/government_stin.html

[048] the 26.09.2010: www.politiken.dk/tjek/dagligliv/toej/article1061690.ece

[049] [Meat dress]

[050] the 29.09.2010: www.koldborg.dk/templates/26%20maj/gode%20gaveideer.html

[051] the 29.09.2010: www.hcandersen-homepage.dk/bogense-eventyr/bog.jpg

[052] the 03.11.2010: www.grafikk.dk/_billeder-retouch.php

[053] the 03.11.2010: http://picasaweb.google.com/lh/photo/CfF36nadag6o2oosmOLtJg

[054] the 03.11.2010: www.autocamper-nyt.dk/pages/webside.asp?articleGuid=51464

[055] the 03.11.2010: www.samvirke.dk/samvirke/nyheder/Sider/Iranske%20bøgetræer%20kan%20hjælpe%20klimatruede%20danske%20træer.aspx

[056] the 03.11.2010: http://home1.stofanet.dk/pnm/kajaksider/kajak_2007/juli_07.htm

[057] the 23.11.2010: www.rintalaeggertsson.com/

[058] Own photo

[059] the 25.11.2010: http://2.bp.blogspot.com/_Zev0h9JuJ18/Sw_nnpkusil/AAAAAAAABjw/w32Jgmm3RaE/s1600/1960992908_treehoues-high-res-2.jpg

[060] the 22.11.2010: www.olafureliasson.net/works/moss_wall_1.html

[061] Own photo

[062] the 24.11.2010: http://alwayspeppercorn.blogspot.com/2008/07/tadao-ando.html

[063] the 23.11.2010: http://blog.plaid-creative.com/page/3

[064] the 20.11.2010: www.trapholt.dk/00327/00362/

[065] the 24.11.2010: http://blog.tate.org.uk/_/wp-content/uploads/berlin0508-5691.jpg

[066] Own photo

[067] the 26.11.2010: www.kunsten.dk/Default.aspx?ID=293

[068] the 26.11.2010: www.trapholt.dk/00345/00477/

[069] the 26.11.2010: www.trapholt.dk/documents/00046.pdf

[070] the 26.11.2010: http://upload.wikimedia.org/wikipedia/commons/6/62/Musée_d%27Orsay_interior_panoramic.jpg

[071] the 26.11.2010: www.musee-orsay.fr/en/tools/plan-salle.html

[072] the 26.11.2010: www.guggenheim.org/new-york/about/licensing-location-shoots

[073] the 25.11.2010: www.olafureliasson.net/works/umschreibung_1.html

[074] the 24.11.2010: http://commons.wikimedia.org/wiki/File:4_oscar_niemeyer.jpg

[075] the 24.11.2010: www.materialiste.com/style/le-bon-marche-inaugure-treeslbmcom

[076] the 25.11.2010: www.architecturesdesign.com/2008/10/19/new-cancer-research-facility-underway-in-lisbon/

[077] the 31.12.2010: http://plusmagazine.rnews.be/fr/artdevivre/jardin/artikel/529/jardins-tendance

[078] the 31.12.2010: www.dab.uts.edu.au/ebrf/conferences/modern_earth_2002.html

[079] the 28.11.2010: www.bt.dk/danmark/dr-lukker-doeren-skandalebyggeri

[080] Own photo

[081] the 31.12.2010: http://lormes.chez-alice.fr/cathedrale/economiseur.htm

[082] Own photo

[083] the 27.11.2010: www.guggenheim.org/new-york/about/frank-lloyd-wright-building

[084] the 25.11.2010: http://uapmarker.com.au/2010/03/26/the-lantern-of-sandnes-by-awp-architects-and-atelier-oslo/

[085] the 25.11.2010: http://blogportobello.com.br/tag/lina-bo-bardi/

[086] the 31.12.2010 www.arcspace.com/books/guides_birkhauser/guides_birkhauser_book.html

[087] the 24.11.2010 http://commons.wikimedia.org/wiki/File:Notre-Dame-de-l'Arche-d'Alliance.jpg

[088] the 02.12.2010: http://picasaweb.google.com/lh/photo/Js0D9r_Kj-87M2MbEjKJvg

[089] the 02.12.2010: http://politiken.dk/kultur/kunst/ECE827800/klimaud-stillere-vi-laver-kunst-ikke-politik/

[090] the 02.12.2010: http://engstrupgaardblomster.dk/default.asp?Action=Menu&Item=81

[091] the 03.12.2010: www.kunstonline.dk/profil/hans_christian_rylander.php4

[092] the 03.12.2010: http://hobrosolutions.com/wp-content/uploads/2010/07/the-glass-floor.jpg

[093] the 03.12.2010: www.apartmenttherapy.com/boston/look/look-building-a-deck-around-a-tree-boston-056090

[094] the 05.12.2010: http://ytiffanie.wordpress.com/2009/02/15/jutland-jaunts/

[095] the 07.12.2010: www.khr.dk/#/144825/

[096] the 30.12.2010: www.wayfaring.info/2009/05/13/9702/

[097] the 02.12.2010: [Kirkegaard, slide 16]

[098] the 01.01.2010: www.arcspace.com/architects/kengo_kuma/suntory/suntory.html

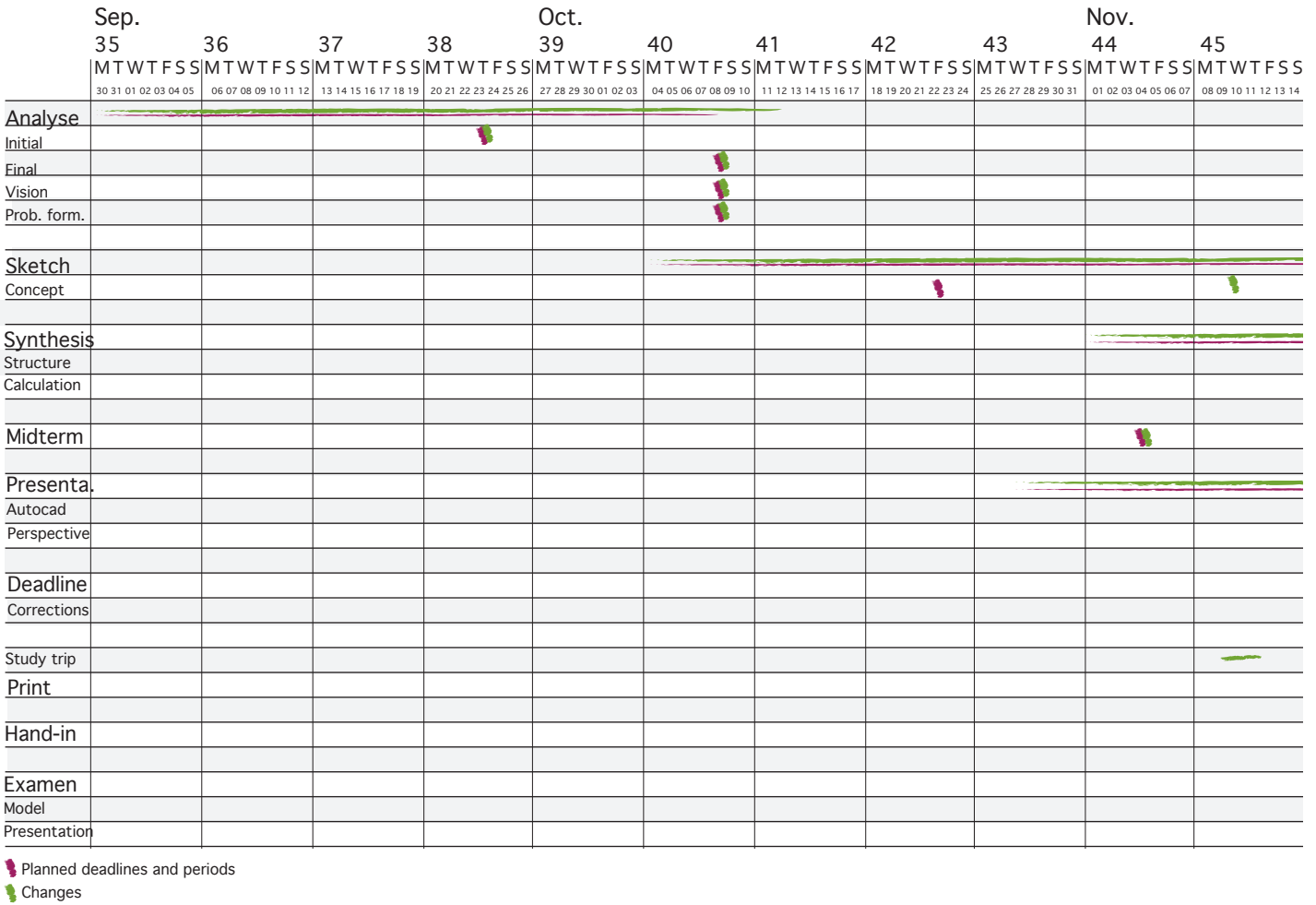
[099] the 02.01.2010: www.horningfloor.dk/inspiration.asp

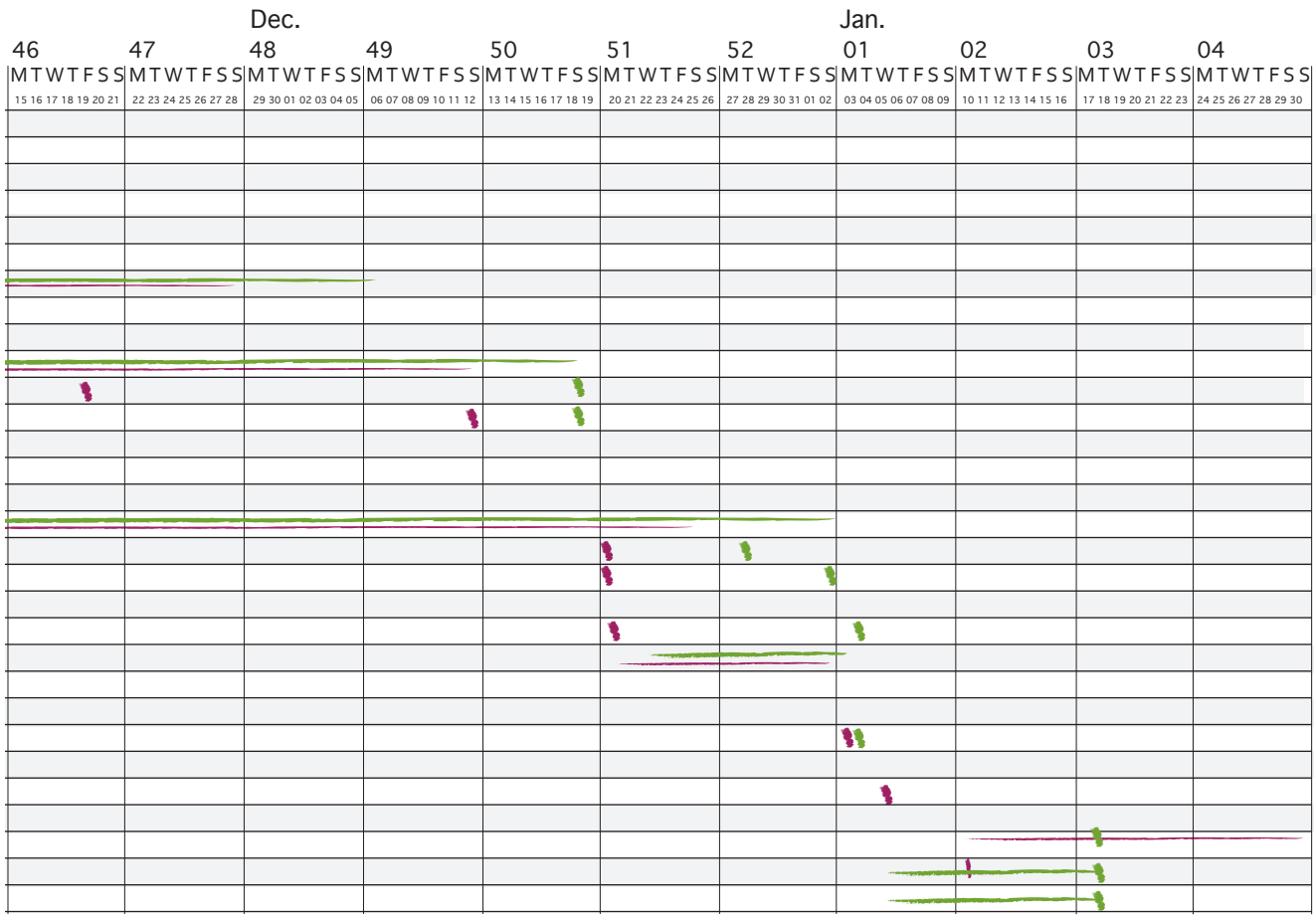
[100] Own photos

Appendix

Appendix A

Gant chart showing the different periods for the project.




Dec.
Jan.
46
47
48
49
50
51
52
01
02
03
04
M T W T F S S
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30 01 02 03 04 05
06 07 08 09 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30 31 01 02
03 04 05 06 07 08 09
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29 30

Appendix B

Diagram beams [Ahler 2002, p. 273]

X - akse	Y - akse	Limtræ	**Tungt erhverv - last**
Spændvidde	Lastopland	Styrkeklasse L 40	**Bjælker**
m	m	Type b / h = 185 / h	**Træprofil**

1	2	3	4	5	6	7	8	9	10	11	12	13
233	266	300	400	500	600	700	800	900	1000	1100	1200	1300

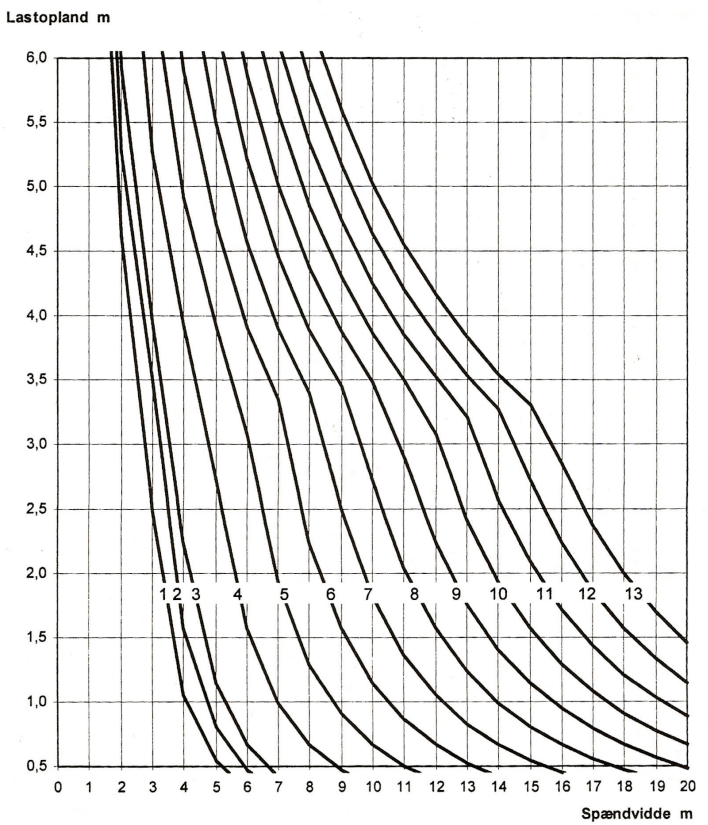


Diagram pillars [Ahler 2002, p. 292]

Tungt erhverv - last	Limtræ	X - akse	Y - akse
Søjler	Styrkeklasse L 40	Søjlelængde	Lastopland
Træprofil	Type b / h = 185 / h	m	Etage - m^2

1	2	3	4	5	6	7	8	9	10	11	12	13	14
200	233	266	300	333	366	400	500	600	700	800	900	1000	1100

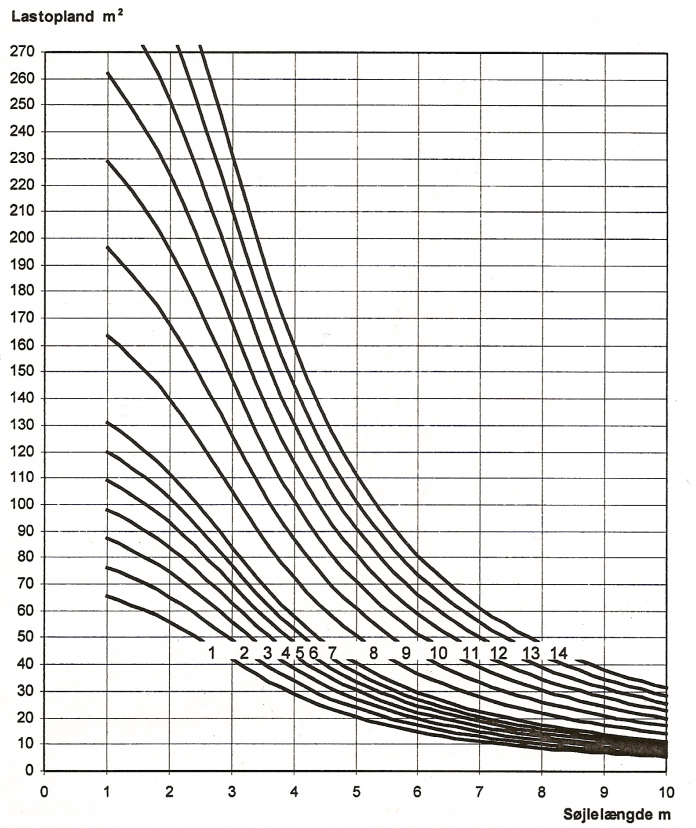
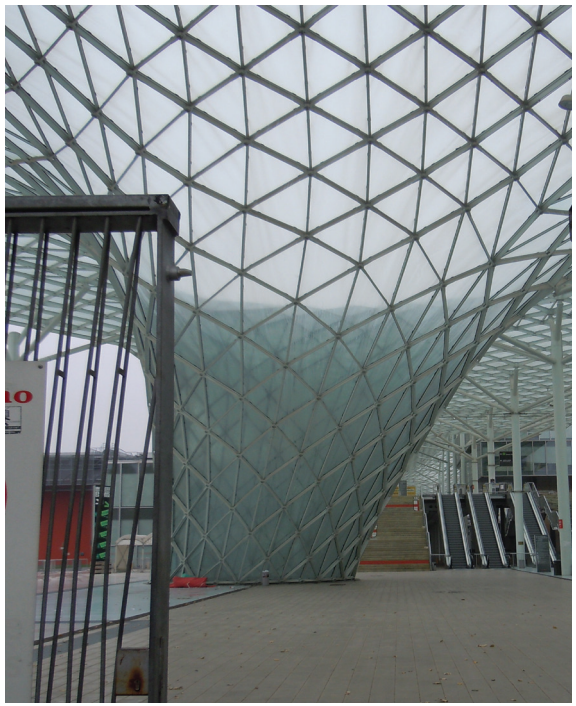
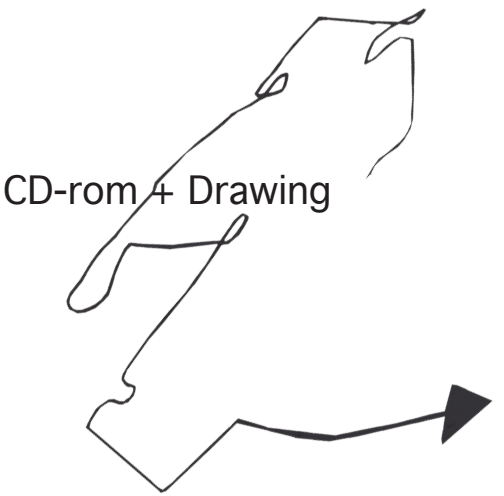


Photo montage -research trip to Milan, November 2010.



[100 - Photo montage]


CD-rom + Drawing