Art House
MSc4 - Ark 33
AAU Architecture & Design
Krista Svike
May 2012

FORMALITIES

TITLE PAGE

Aalborg University
The Faculty of Engineering and Science
Architecture and Design

Group: MSc4 - ark33

Architectural supervisor: Peter Lind Bonderup
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/Krista Sviķe/

SYNOPSIS

This project is concerned with designing art/ culture/ education center in the area near Rīga historical center. The territory used to be an harbour and it still contains remains of industrial environment. The place has a great potential of becoming a green, future focused environment and the project takes the urban development plan of Andrejsala competition as a base.

FORMALITIES

CONTENTS

FORMALITIES

INTRODUCTION

The development plan is suggesting a placement for different functions in Andrejsala territory like apartments, shops, offices, hotels and art/ culture/ education. It also suggests the open areas for public and private use and a waterfront promenade placement. My idea is to work in the northern part of Andrejsala territory and choose one of the building volumes that is suggested for culture as a starting point.
The building will contain art/ culture/ education as its main functions and it will represent three main approaches- learning, creating and representing. For learning the bases and get an insight in art work there will be established an art school for children and adults. For the artists and designers to have a place where to create there will be designed studios spaces. For presenting the art work to public and potential customers there will be establishes two exhibition halls. Finally to make building more appealing for the people working there and others an cafe will also take place in the building

FORMALITIES

METHODOLOGY

In the project there will be used Integrated Design Process as a method in the designing process.
The process is concerned with going through different designing phases so that two disciplines architecture and engineering are presented equally. There will be selected componets from architecture and engineering starting from problem statemet untill the final delivery material submittion.
[Knudstrup 2004]

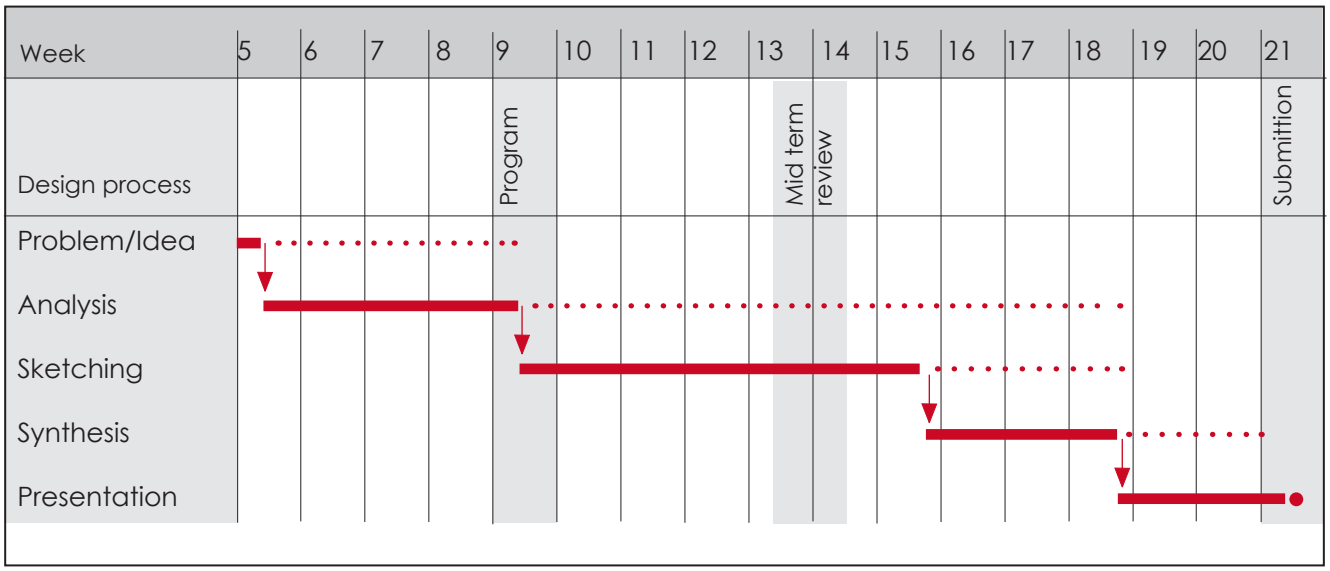
Analyses phase:
Topography, site analyses, municipality plans, site relation to the city, further development plans, traffic, predominant wind directions, sun, functions, room program, solar heating analyses, indoor environment.

Sketching phase:
Design parameters linked to technical demands.

Synthesis phase:
Final decisions leading to a final product.

Presentation:
Delivery material (report, CD, models, drawings, presentation).

There will be used falloving tools:
Pencil drawings, phusical models, 3D computer models, calculations.
[Knudstrup 2004]



Illu.:1 Design process through the semester based on the IDP map [Knudstrup 2004]

AREA

[Illu.: 2 Andrejsala1]

[Illu.: 3 Andrejsala2]

FROM PAST TO FUTURE

Historically Andrejsala (Andreja-island) was developing as an island. Only around 1910 the island merged with the land and became as it is now a peninsula. The territory used to be a port but nowadays it is partly closed and waiting for the transformations. The surface of the peninsula is quite large approximately 369000 m^2. [Andrejsala 2006-3] Now Andrejsala is populated by artists, musitians and all kinds of creative people. The old buildings in the territory are used for holding different events, concerts, performances and festivals. There are also a few museums established for the visitors like Latvian Museum of Naïve Art, Power Generation Museum and Civil defense Museum. [Andrejsala 2006-4] The atmosphere is really creative and established by open minded and artistic people.
Andrejsala is also a part of UNESCO world heritage listed sites - protection area boundary of Rīga Historic Centre.

TOMARROW

[Illu.:4 Andrejsala3]

TODAY

[Illu.:5 Andrejsala4]

YESTERDAY

[Illu.:6 Andrejsala5]

[Illu.:7 Andrejsala6]

[Illu.:8 Andrejsala7]

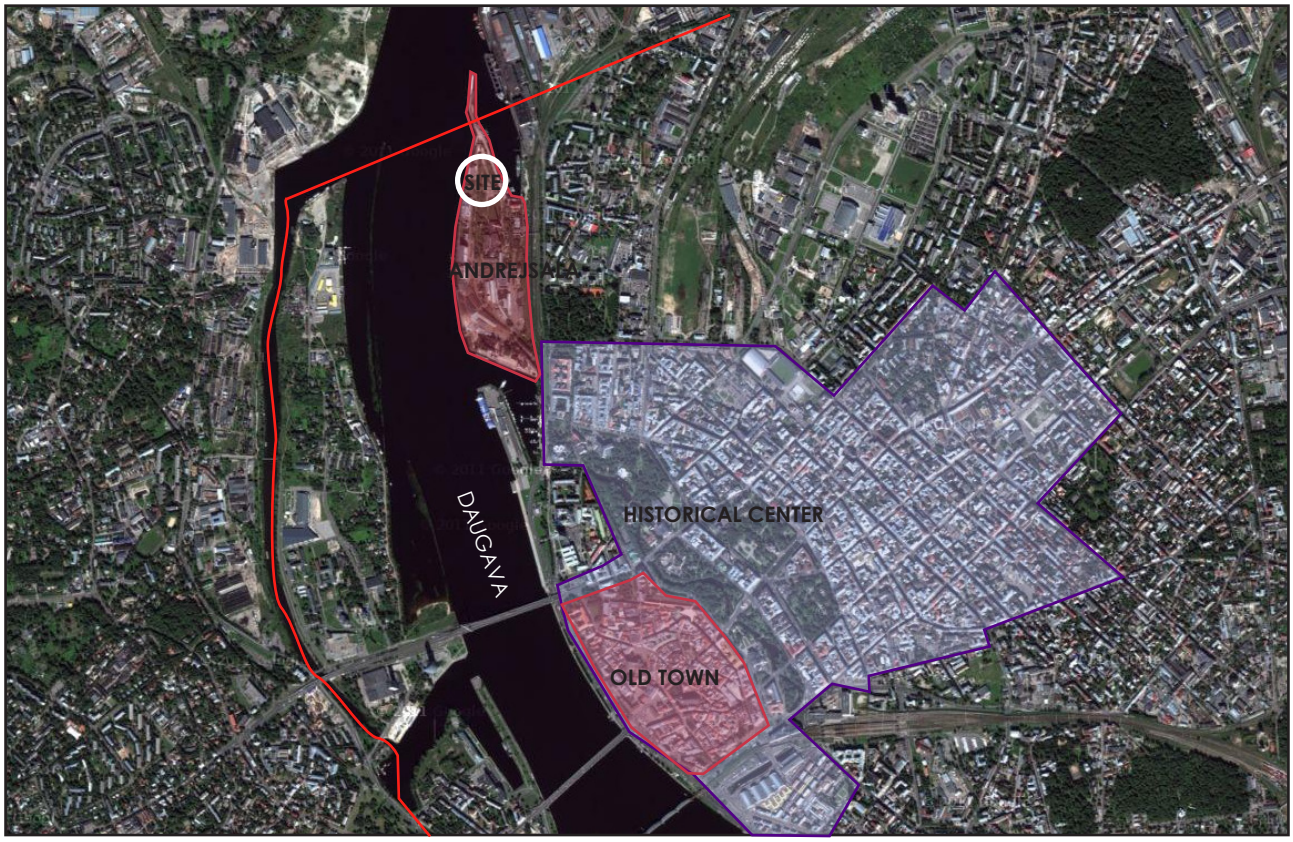
[Illu.:9 Andrejsala8]

[Illu.:10 Andrejsala9]

AREA

LOCATION

In the map there is shown chosen site location in the Rīga city and placement in the Andrejsala territory.



UNESCO world heritage listed sites - protection area bondary of Rīga Historic Centre

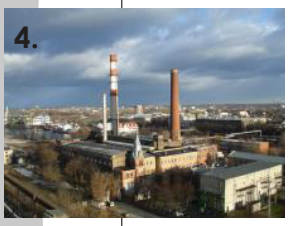
[Illu.:11 map]

AREA

LANDMARKS

The old grain elevator

City Yacht Club



Former building of the Thermal Power plant

The Riga port silo

Railway

Latvian Museum of Naïve Art

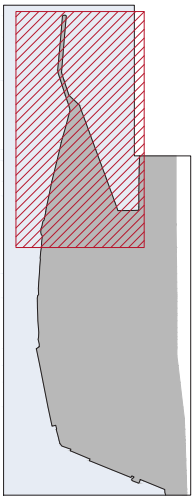
There is shown a map of Andrejsala and the landmarks that lays there.

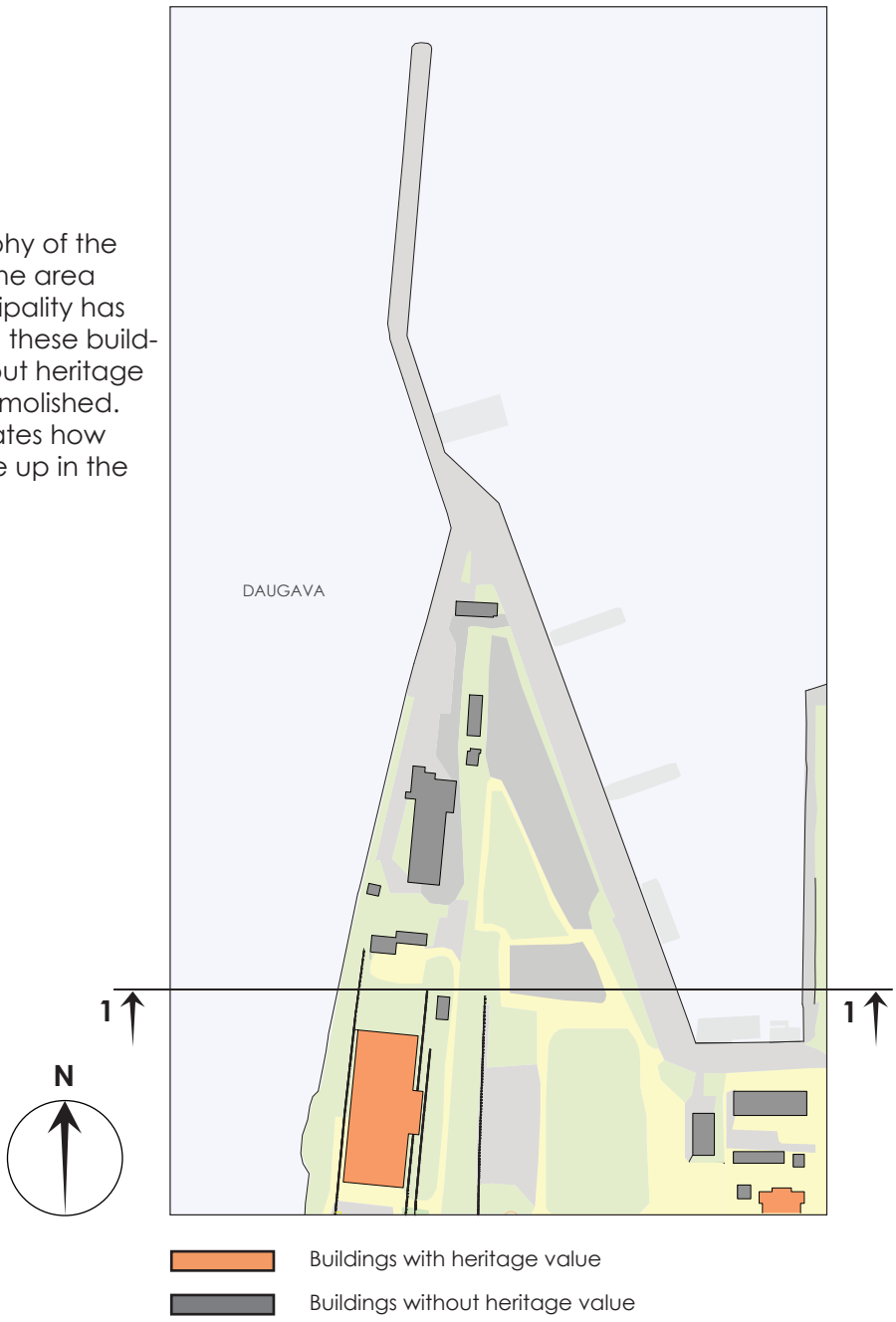
[Illu.:12 2.]
[Illu.:13 4.]
[Illu.:14 6.]
[Illu.:15 7.]

AREA

TOPOGRAPHY

There is shown the existing topography of the site area. Some of the buildings in the area have heritage value and the municipality has proposed to preserve and renovate these buildings. There are many buildings without heritage value which means they can be demolished. The urban development plan regulates how the territory could evolve and shape up in the future.



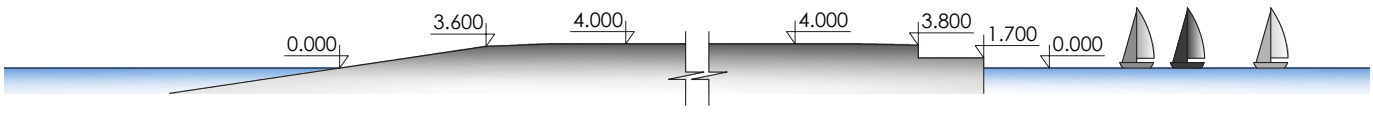


Topography of nort part Andrejsala territory

[Illu.:16 Topography]

CROSSECTION 1-1

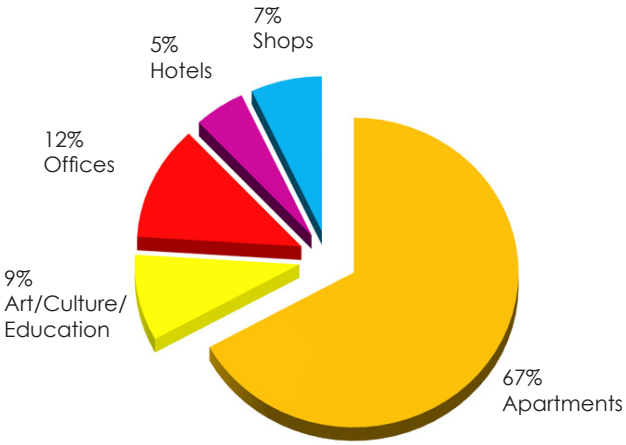
Allowed building heights until 6 storeys



[Illu.:17 Crossection 1-1]

FUTURE DEVELOPMENT PLANS

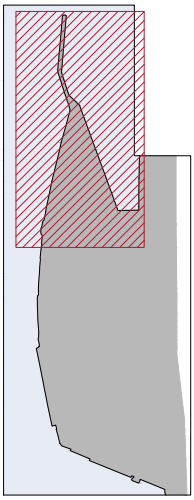
The analyses and the project proposal will be based on the existing urban development plan for Andrejsala territory. The placement of the designed building will be chosen depending on how the functions are distributed in the urban planning proposal.

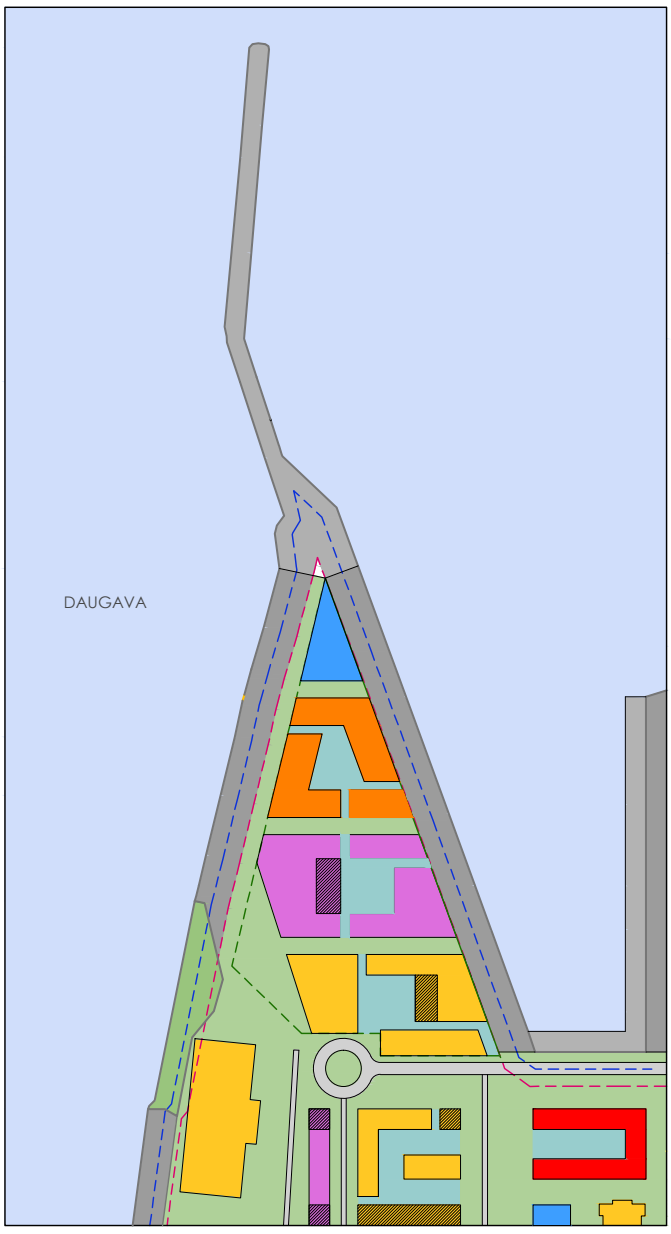


Proposed function distribution in Andrejsala territory

[Illu.: 18 Andrejsala Urban development proposal]

Requested by SIA "Jaunrigas attistibas uznemums" the work with urban planning development plan for Andrejsala started in 2004. The final concept was developed and approved by authorities in Janyary 2008 and now it is a baseline for the building and quarters proposals. It took more than 4 years and participation of many professionals to reach the concept.
The development project was designed by SIA "Grupa 93" and architects studio SIA "Arhitekturas birojs Forma" also architects studio "Office for Metropolitan Architecture" was participating in the discussion. [Latvijas Architektūra #6 2008 p.102]
Many aspects were considered while designing the development plan. Crucial where the questions how will the territory fit into the context and affect Riga old town silhouette. The vision was to create pedestrian friendly environment, to include varied culture focused activities, to include the heritage value and allow the accessibility to river Daugava. [Latvijas Architektūra #6 2008 p.104]
There are developed restrictions concerning important society related questions however it was also important to leave space for more creativity concerning the architectural designs. The development plan has its restrictions but it will still be possible to interpret the concept. [Latvijas Architektūra #6 2008 p.104]
The project is very future oriented especially because it is planned to be realized in time period of 15 years. It is very important when designing to be aware that the concept will be fresh and exciting also after many years. [Latvijas Architektūra #6 2008 p.112]





[Illu.:19 North part of Andrejsala, drawing based on future development plans

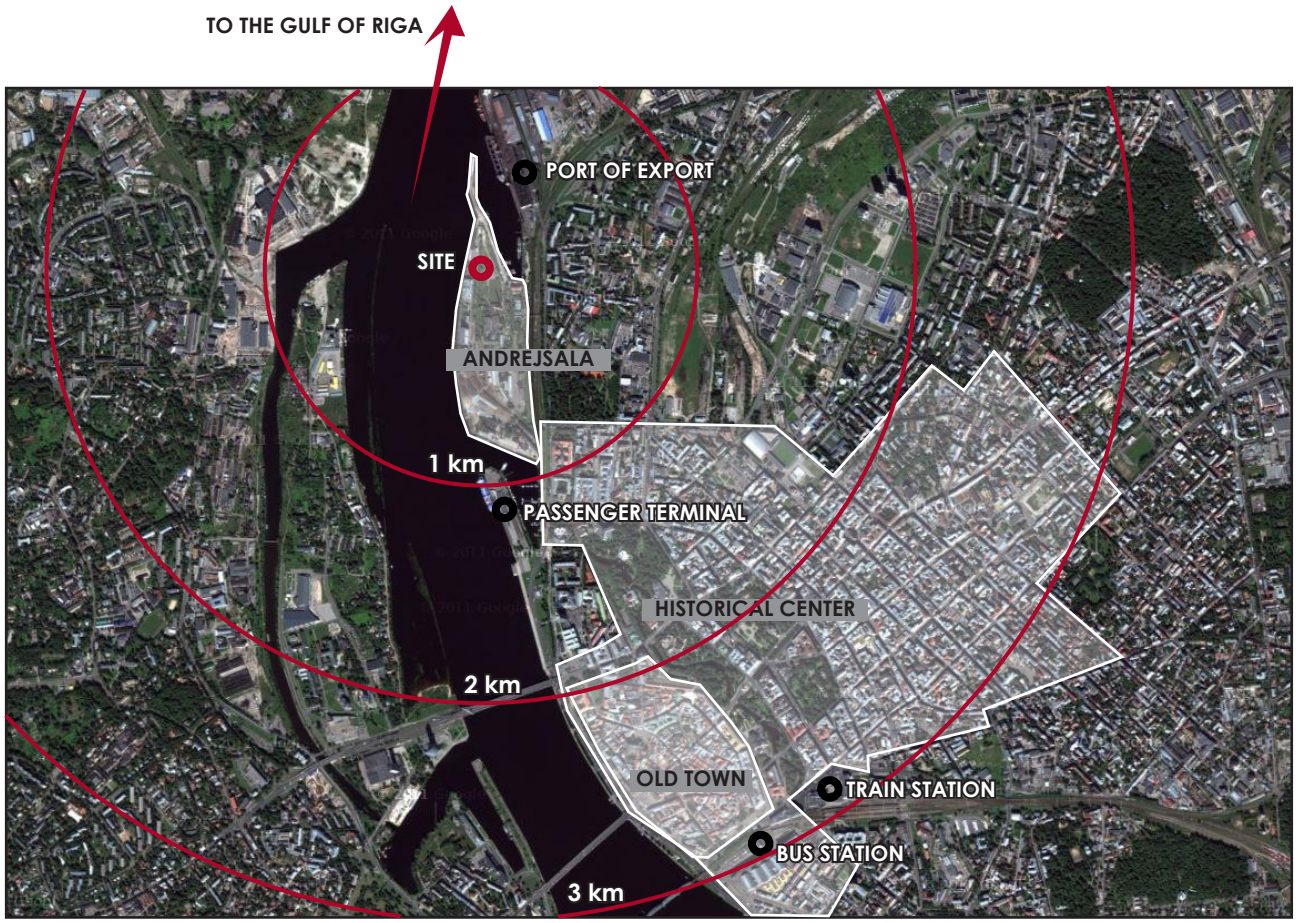
The development plan is suggesting a placement for different functions like apartments, shops, offices, hotels and Art/ culture/ education in the area. It also suggests the open areas for public and private use and a waterfront promenade placement. My idea is to work in northern part of Andrejsala territory and choose one of the building volumes that is suggested for culture as a starting point.

RELATION TO THE CITY

Andrejsala territory is approximately 1 km wide in the longest direction and the building site is located in the north end of it. The whole territory is enclosed by two harbors the port of export and the passenger terminal. The site is located in a walking distance from Riga historical center and old town but also the public transport is well organized to reach the destination rather fast. Train and bus stations are place nearby each other and are located almost on the border of Riga historical center. When looking from other cost of Daugava to Riga old town the view is very significant and Riga is well known by its panorama. All the ferries that are entering Riga passenger terminal are coming from the gulf and when passing Riga border before they can have a view to a beautiful old town, Andrejsala is one of the first things to notice. This means that Andrejsala plays a big role of representing Riga city to sea travelers

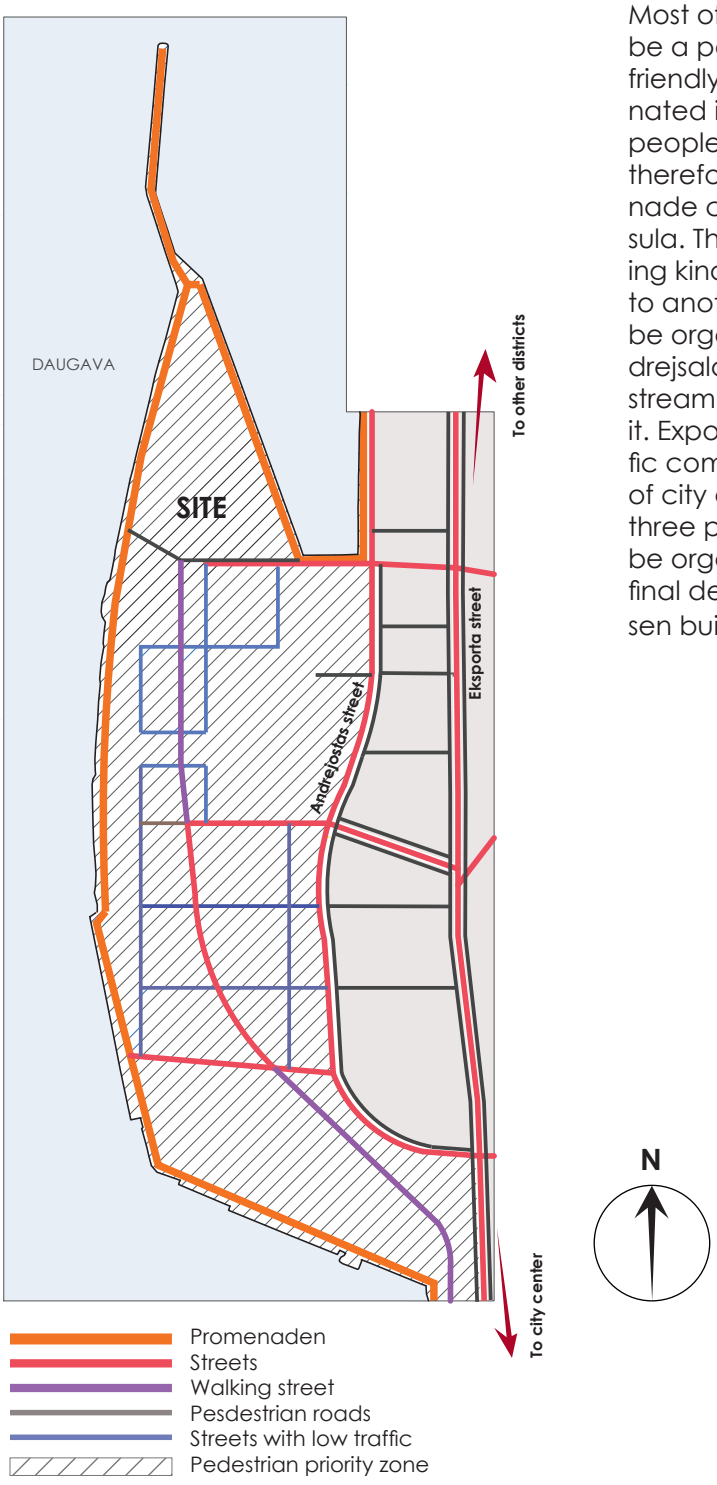
[Illu.:20 Riga Old Town panorama view]

[Illu.: 20a Andrejsala panorama view]



[Illu.:21 Relation to the city]

TRAFFIC ORGANIZATION



Most of the Andrejsala territory is planned to be a pedestrian priority zone and also bicycle friendly environment. One of the goals nominated in the development plan was to provide people with a good access to river Daugava therefore there is planned a pedestrian promenade covering all the river border of the peninsula. There will be a walking street as well leading kind of diagonally from one end of territory to another. Most of the streets in the area will be organized as low traffic streets having Andrejsalas street as a main transport movement stream with few main access roads connecting it. Exporta Street will handle all the heavy traffic coming from Riga center and other districts of city and will be connected to Andrejsala in three points. The public transport is planned to be organized on the Andrejsala Street and the final destination is planned to be near the chosen building site.

[Illu.: 22 Andrejsala, drawing based on future development plans]

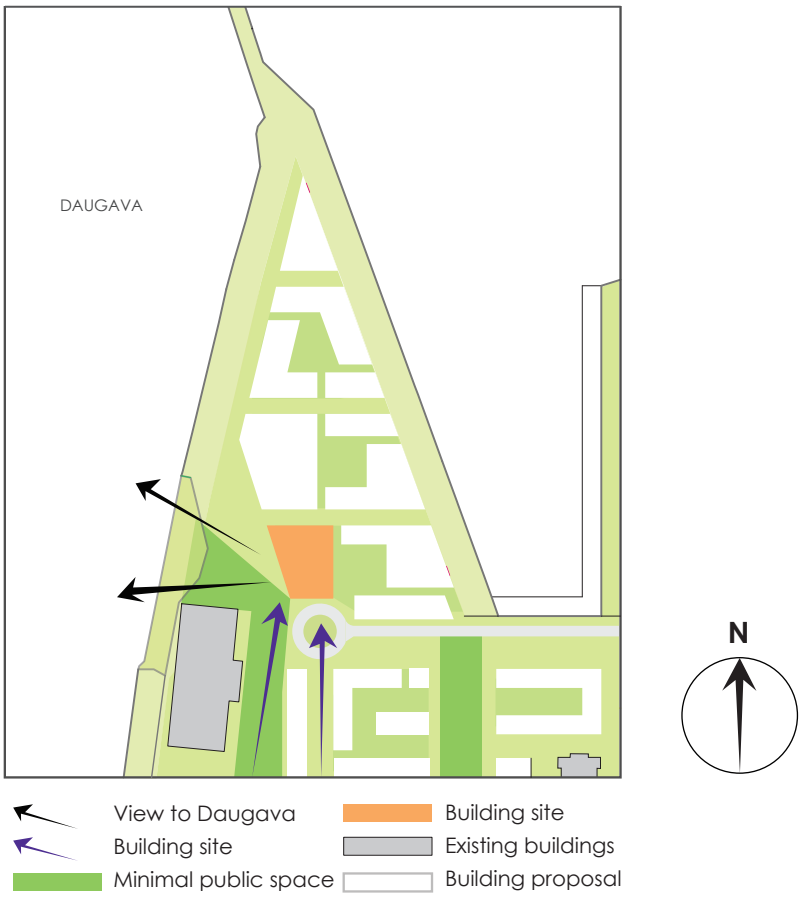
ANALAYSES

ACCESS TO THE SITE

The access from the city centre to the building site is rather well organized. There are five main access roads leading to the chosen site. Two of the roads can be only used by walkers or bicycles and three roads also allow access with a vehicle. The road leading from Andrejsala Street and Exporta Street is planned to have public transport line stopping near the site as well.

[Illu.: 23 North part of Andrejsala, drawing based on future development plans]

VIEWS

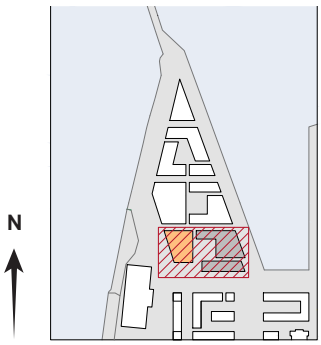


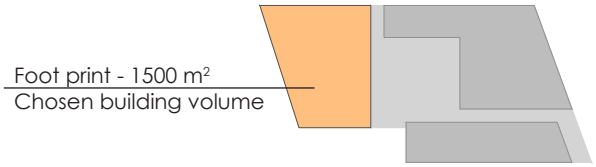
To the west from the building site there opens up an undisturbed view to Daugava and other cost of the river in a distance. From other directions site is planned to be enclosed by buildings, streets and courtyards. There are two main axes leading to the site creating a perspective view with a building site as a destination point. There is shown a minimum public space that is required but the plan is to have it larger.

[Illu.:24 North part of Andrejsala, drawing based on future development plans]

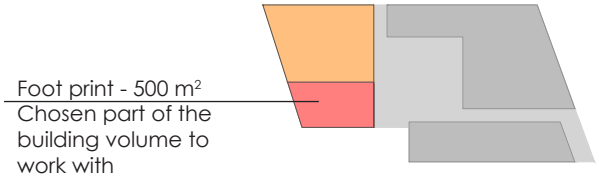
ANALAYSES

BUILDING SITE ANALYSE





+ Greater building volume, more square meters
- Difficult to drag light in the whole volume



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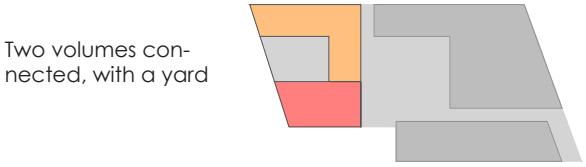
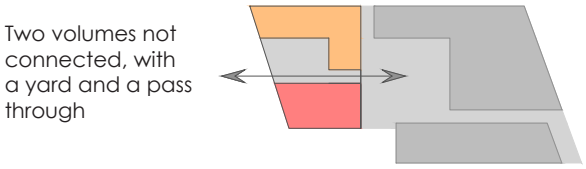
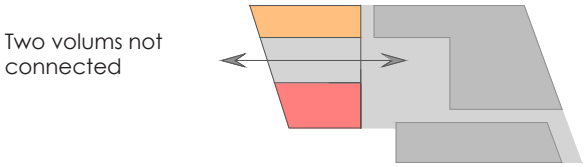


+ Easy to drag light in the volume
+ Semiprivate space between volumes



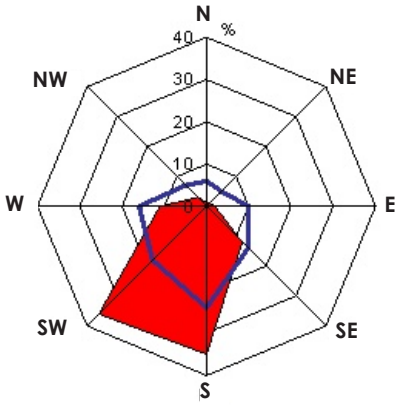
+ Easy to drag light in the volume
+ Semiprivate space between volumes, allows the building function also outside the walls
+ Nearby buildings has better connection to river
- Creates a rather dark space between volumes



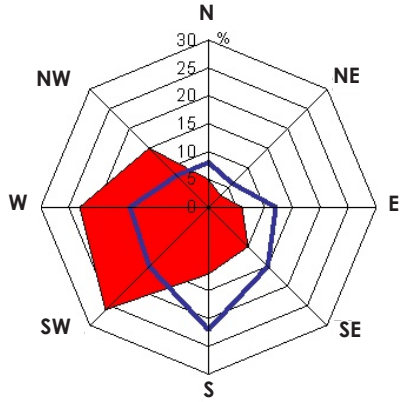
+ Easy to drag light in the volume
+ Provides nearby buildings with a view to the river
Court yard becomes less private but building can still function outside its walls

[Illu.:25 Building site analyse]

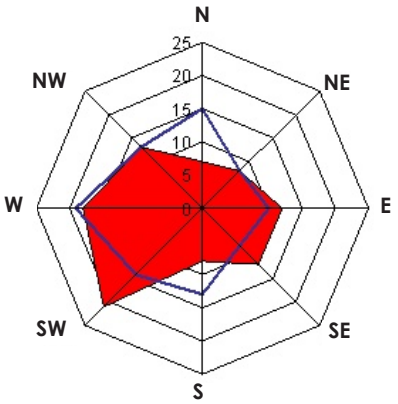
December



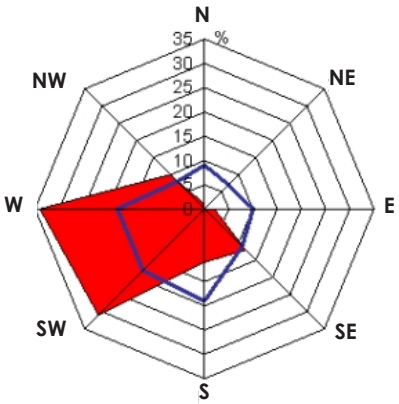
March



June



September



Year 2011

Years average

[Illu.: 26 Wind diagrams for Latvia]

ANALAYSES

PREDOMINANT WIND DIRECTIONS

There are chosen four wind diagrams where each of them represents one season. Diagrams shows wind behavior for Latvia throughout the year. Each is indicating the dominating wind directions in year 2011 and average directions of period of many years.

December
In year 2011 the dominating wind directions in December were South and South/West directions but the many years average dominating wind direction is South direction.

March
In march 2011 dominating wind directions was West and South/West directions where the average march wind direction is South direction.

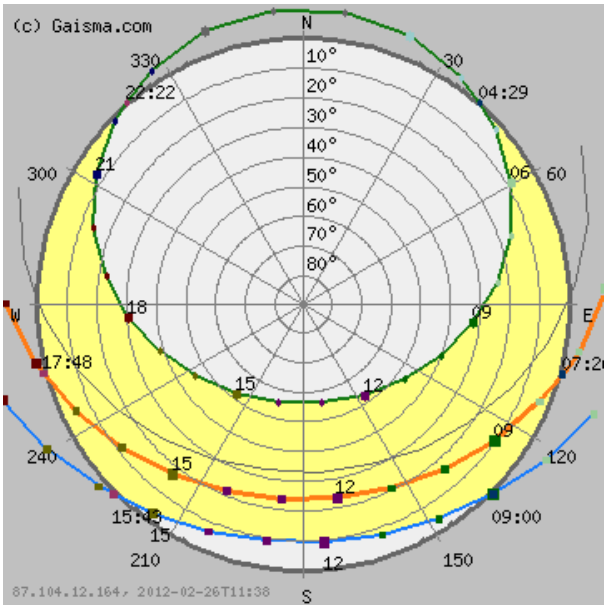
June
June in 2011 shows similar picture to the march of the same year but average june wind directions are West and North.

September
The dominating wind direction in September year 2011 was West direction and the average in many years in September are West, South/West and South wind directions.

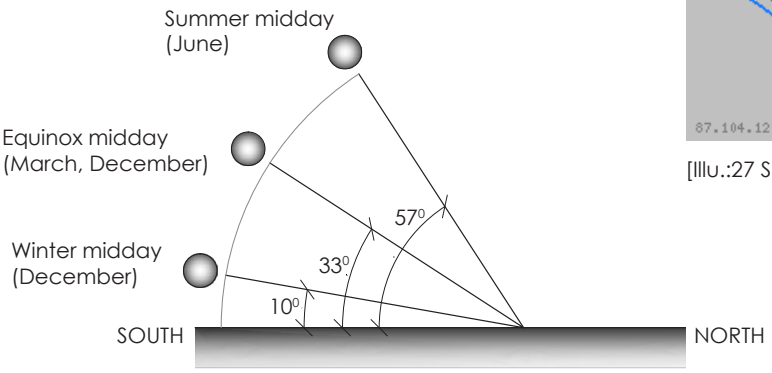
The dominating wind direction of the whole year is South/West direction. Knowing this it can help to design a natural ventilation system for the building and give ides how to avoid too much wind by playing with building volumes. However these diagrams cannot give a very precise result but provide of an overall concept and understanding.

SUN

This project is concerned with designing a public building including offices, art school and exhibitions and the building is planned to be used 13 hours a day. The specifics of the building require considering the positioning of the sun during day and year very carefully. The most important is the balance with the daylight in the building because the functions are requiring enough daylight but at the same time to avoid direct sun light by using sun screening.
The angles for the sun angle diagram are taken from the sun path diagram.



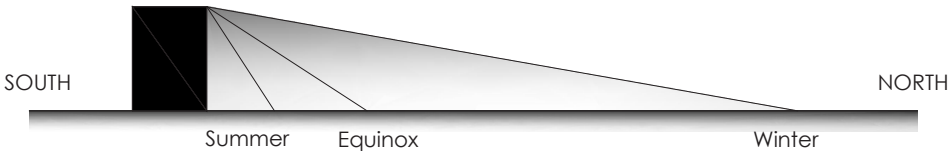
[Illu.:27 Sun path diagram for Riga]



[Illu.:28 Sun angles diagram]

SHADOW

The shadow diagram is based on the sun path diagram and indicates how shadows are spread through the year in midday.



[Illu.:29 Shadow diagram]

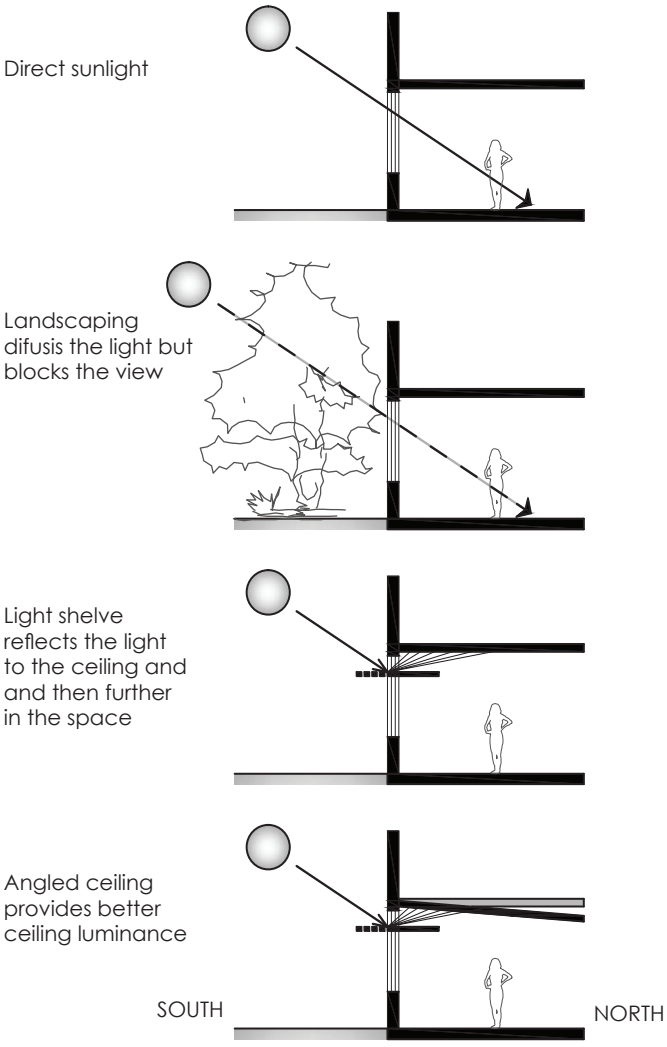
ANALAYSES

DAYLIGHT

From the beginning of human history until today people were and are depended on daylight. Architects and builders, understands the role of natural light in buildings intuitively. Building configurations, orientations and interior finishes are selected to provide sufficient levels of daylight in interior spaces. But there always has to be balance between light and solar heat and those are the factors that have been the biggest challenge for architects of all times.

"… improperly using an ostensibly sustainable source like daylight will lead to discomfort and human inefficiency – a real waste of energy and resources and the ultimate slap to sustainability." [Steffy 2008, p.151]

It is very important to take advantage of the benefits daylight can provide while avoiding the bad qualities. All the aspects related to daylight have to be in balance in order to make the most of the energy source. The most important aspects are maintenance of visual comfort, surface reflectances, volume, surface configurations. [Steffy 2008, p.155]
To provide better visual comfort important is to eliminate direct sun and amount of surrounding luminances. In order to achieve that, different conditions should be established and combined.
Very important contribution to light design is consideration of surface reflectances. Exterior neighboring vertical surfaces, interior ceiling surfaces and also the walls has an influence on daylight efficiency. Recommended ceiling reflectance is 90 or more percent where for wall reflectances is recommended to be 50 percent or greater amount.
Surfaces facing the light source will bring more direct light in the building but also provide with more heat, therefore surface configurations plays a significant role in solar building design. [Steffy 2008, p.155-160]



[Illu.:30 Building configurations diagrams]

SOLAR HEATING

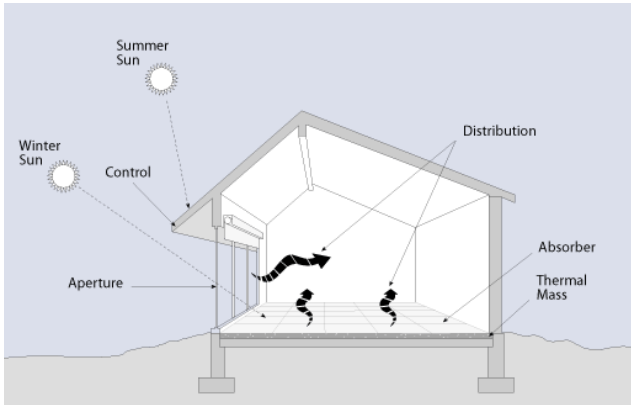
Passive solar heating

Using solar heating means to collect the solar energy, store it and circulate the hot air.

Passive solar energy can be affected by:

- The orientation of building in connection to south
- Objects that cast shadow (trees, buildings)
- Large window areas towards east, south or west
- Unheated glass rooms connected to building
- The minimization of external surfaces
- Thermal mass
- Exterior shutters or louvers
- Natural ventilation
- Solar screening

[Solar heating 2010]



[Illu.:31 Some elements of passive solar design]

Active solar heating

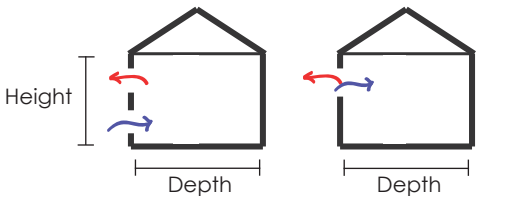
Solar collectors plays the main role in active solar heating systems, solar collectors transfers collected solar energy to inside the building use. There are three types of active solar heating systems domestic hot water system, combined system which employs domestic hot water and space heating and the air solar collector. The first one is used most common where the second one is more advanced; both of them are water based systems. The third system uses air instead of water. [Solar heating 2010]

[Illu.:32 Active solar heating]

NATURAL VENTILATION PRINCIPLES

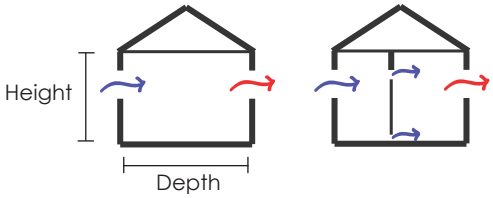
There are shown three main principles of how the natural wind driven forces can be used in the building.

Single-sided two oppening and one oppening ventilation



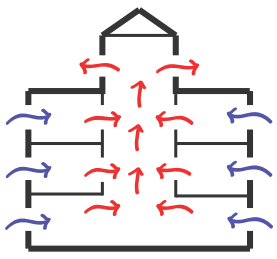
Single-sided ventilation
Natural ventilation principle when opening is only on one side of the room is called single-sided ventilation. This principle benefits of thermal buoyancy wind driving force in winter and wind turbulence force in summer. Single-sided one opening ventilation principle is more effective to a depth of about 2 times the floor to ceiling height due to the fact that ventilated air does not penetrate so far into the room and generates lover ventilation rates. Single sided double opening ventilation principle is more effective to a room depth of about 2,5 times floor to ceiling height. [Heiselberg 2006]

Cross ventilation and Single-sided ventilation with some cross ventilation



Cross ventilation
Natural ventilation principle when openings are in two sides of the room is called cross ventilation. This principle benefits of wind driven force that enters in the one side of the room and exits in the other through a window or door. With cross ventilation principle it is possible to achieve high ventilation rates but there is also a limit of the space. The cross ventilation to be effective, a room depth of up to 5 times the floor to ceiling height is optimal. [Heiselberg 2006]

Stack ventilation



Stack ventilation
Stack ventilation benefits of thermal buoyancy wind driving force and the ventilation openings are placed both high and low. There is used a cross ventilation principle for individual rooms but the air is exhausted through a chimney in one side of the building or through a chimney or atrium in the centre of the building. The width from the air inlet to the air exhaust of 5 times floor to ceiling height is optimal. [Heiselberg 2006]

[Illu.:33 Natural ventilation principles]

CASE STUDIES

[Illu.:34 school]

CASE STUDY

SCHOOL

The same as for the offices light, air quality, thermal comfort and improved acoustics are very important qualities to improve a school environment. However it is as important to create a welcoming and inspiring atmosphere. In the College of Orestad it is done by designing different creative spaces both for studies and relaxation and focusing on the detailing.

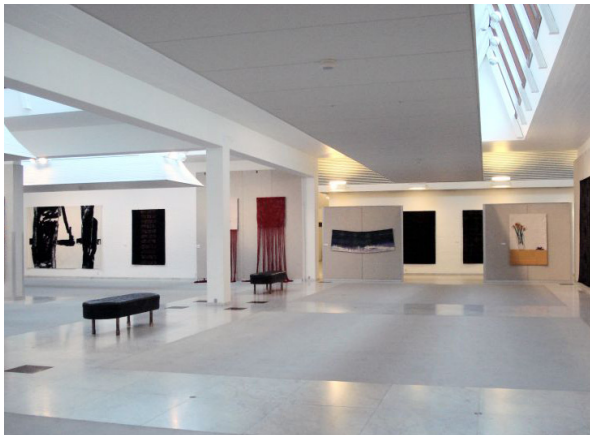
[Illu.:35 Google]

[Illu.:36 Facebook]

CASE STUDY

OFFICE

In an office/studio things like good air quality, room temperature and light conditions are very important to achieve healthy work environment. But not in the least important is the atmosphere in the work place.
A case study of Google and Facebook offices is made to discover how to improve the mood in an office.
Words like inspiring, fun, interesting, surprising, insightful describes the working atmosphere in Google office the best. Employees are being motivated to do their best by creating inspiring environment around them. They have created game rooms to entertain the workers and resting spots to revile the pressure also other activities to keep employees healthy and improve their knowledge. [Boredpanda 2012]
Another exiting work place is the Facebook office which is not that much concentrated on games and fun as Google but also creates an inspiring and creative atmosphere. "The company wanted to reflect the brand's values – creativity, freedom of expression and individuality…" [Swide 2009]
The Google and Facebook offices shows that to achieve healthy and employees friendly work environment besides the technical requirements like air quality, room temperature and light the atmosphere is also very important motivation to improve the quality of work.



[Illu.:37 Art exibition]

CASE STUDY

ART EXIBITION

The case study is made to look at the daylight in the North Jutland art museum. The museum is located in Aalborg Denmark and is designed by Elissa and Alvar Aalto. Exibition halls of the art museum have the roof light as their only natural light source. Most of the floors are covered with white carrara marble and most of the walls are white too. The coverings reflect the diffused natural light and give a bright feeling of the space. [Arcspace 2007]

[Illu.:38 Cafe]

CASE STUDY

CAFE

A case study of a café with long working hours is made to discover what kind of food they are serving and what their focus points are. Indexcafe is located in three places of Riga city. Their goals of success are to provide busy people with fast service, cozy atmosphere and access to internet all day long. Café is open every day of the week from 7.00 to 22.00 therefore attracts people with different work schedules. The possible home delivery saves even more time when the day is in particularly busy. There are three words that describes the best food served in Indexcafe – fresh, organic, homemade. Index café has their own bakery so the meals are always fresh and made from organic products. The menu mainly consists of wok, tortillas, sandwiches, soups, salads, desserts and the main course. As well there are served drinks like Tea, coffee, fresh juices and cocktails.
The Indexcafe shows that when having a café with long working hours it is still possible to serve fresh and healthy food. Home delivery is an extra that can attract more customers. A fast service café can also provide a cozy atmosphere, good food and coffee and a feeling like you are at home. [Indexcafe]

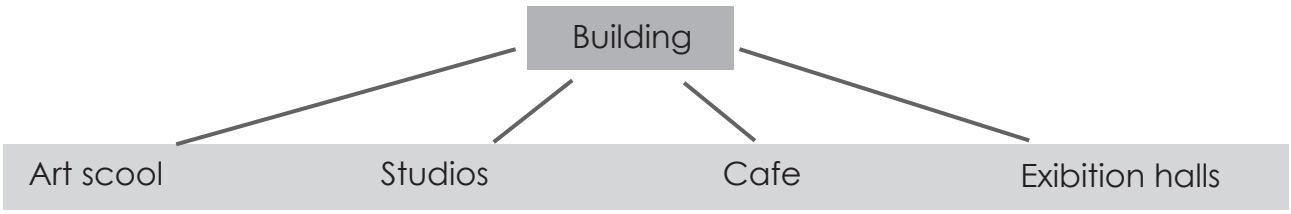
ORGANIZATION

There are four main functions combined in the building. The exhibition and café is open to public where art school and studios are more private. The program of the functions is created after analyzing the needs of each function and will be used as a tool when designing the spaces.
The total area of the building is approximately 2582 m2 from which studios and art school takes up the most space.

ORGANIZATION

FUNCTIONS

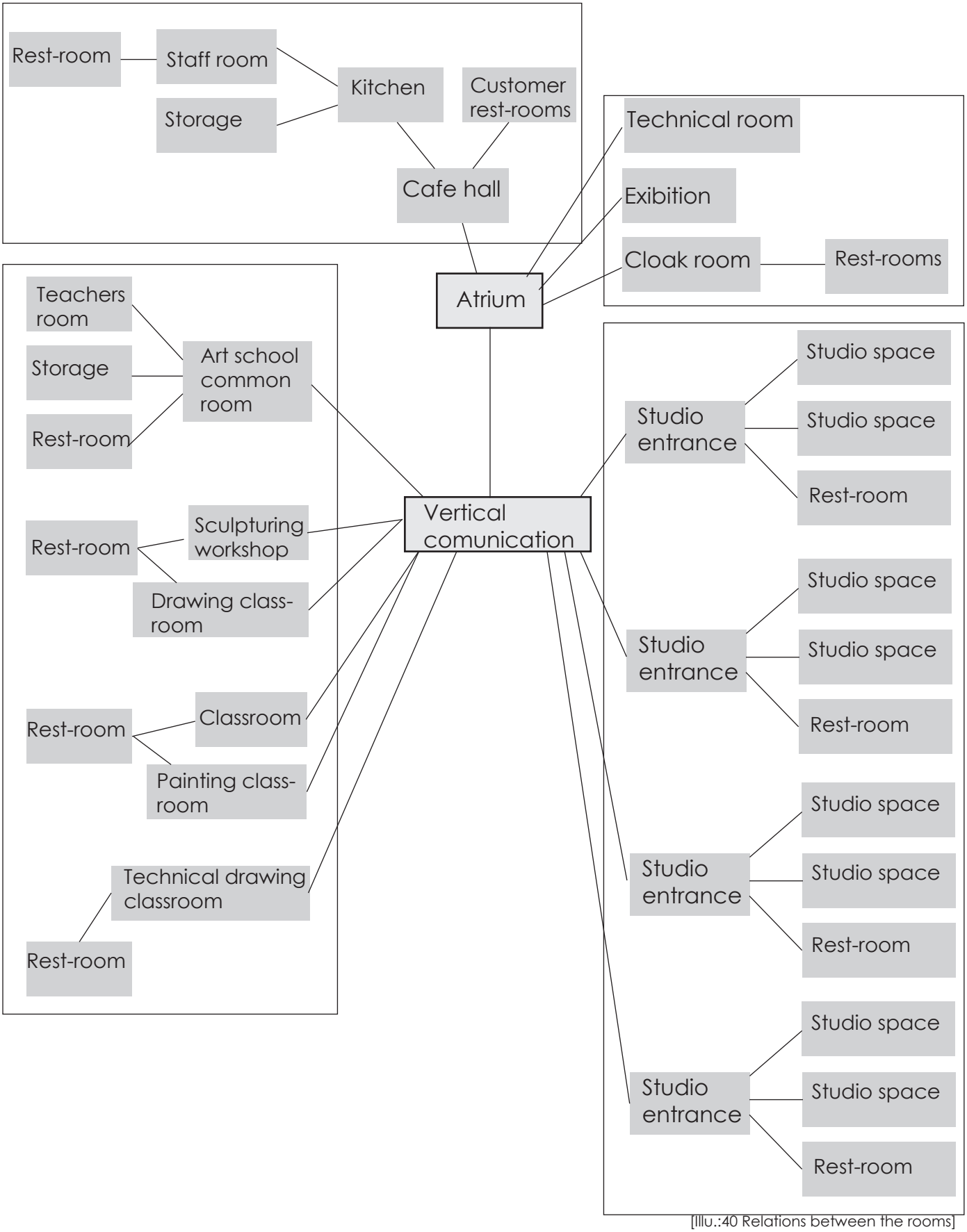
Art/ Culture/ Education



- After-school art classes for children - Evening art classes for adults	Studios for artists, designers, architects	Public	Public

[Illu.:39 Functions]

RELATIONS BETWEEN THE ROOMS AND FUNCTIONS



[Illu.:40 Relations between the rooms]

ORGANIZATION

PROGRAM

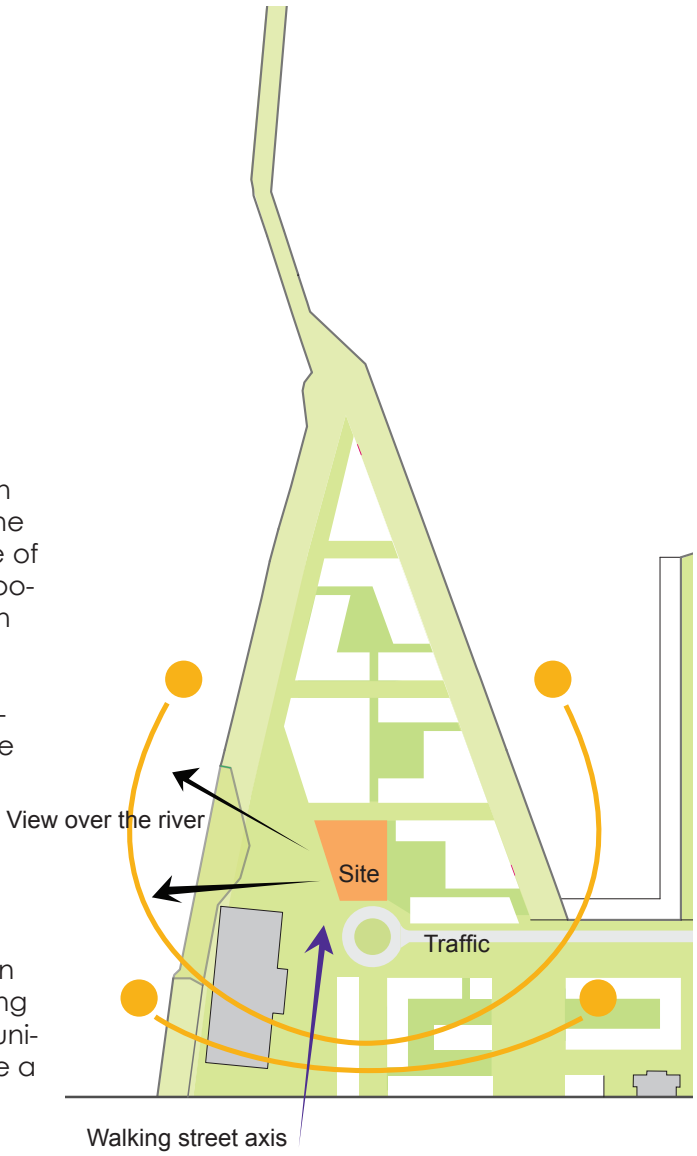
Room	Area m^2	Daylight requirements
ART SCHOOL		
Firts floor:		
- Common space	66.5 m^2	Provide the daylight, screen the sun
- Teachers room	37.2 m^2	Provide the daylight, screen the sun
- Storage	25.2 m^2	Daylight is not required
- Rest-room	8.5 m^2	Daylight is not required
Second floor:		
- Entrance	15.3 m^2	Daylight is not required
- Drawing classroom	95.4 m^2	Provide the daylight, screen the sun
- Sculpturing workshop	67 m^2	Provide the daylight, screen the sun
- Rest-room	8.5 m^2	Daylight is not required
Third floor:		
- Entrance	15.3 m^2	Daylight is not required
- Painting classroom	120.7 m^2	Provide the daylight, screen the sun
- Classroom	42.1 m^2	Provide the daylight, screen the sun
- Rest-room	8.5 m^2	Daylight is not required
Fourth floor:		
-Entrance	11.6 m^2	Daylight is not required
- Technical drawing room	167.7 m^2	Provide the daylight, screen the sun
- Rest-room	8.5 m^2	Daylight is not required
TOTAL:	698 m^2	
CAFE		
- Hall	98.8 m^2	Provide the daylight
- Kitchen	30.2 m^2	Provide the daylight, screen the sun
- Storage	19.4 m^2	Daylight is not required
- Staff room	11.7 m^2	Provide the daylight, screen the sun
- Staff rest-room	8.5 m^2	Daylight is not required
- Customers rest-rooms	15 m^2	Daylight is not required
TOTAL:	183.6 m^2	
EXIBITION HALLS		
- Ground floor exibition	142.5 m^2	Provide the daylight, screen the sun
- First floor exibition	171.4 m^2	Daylight is not required
TOTAL:	313.9 m^2	

Room	Area m^2	Daylight requirements
STUDIO/ OFFICE SECOND FLOOR		
- Entrance	37.4 m^2	Daylight is not required
- Studio space	106.9 m^2	Provide the daylight, screen the sun
- Studio space	48.3 m^2	Provide the daylight, screen the sun
- Rest-room	11.1 m^2	Daylight is not required
TOTAL:	203.7 m^2	
STUDIO/ OFFICE THIRD FLOOR		
- Entrance	37.4 m^2	Daylight is not required
- Studio space	106.9 m^2	Provide the daylight, screen the sun
- Studio space	48.3 m^2	Provide the daylight, screen the sun
- Rest-room	11.1 m^2	Daylight is not required
TOTAL:	203.7 m^2	
STUDIO/ OFFICE FOURTH FLOOR		
- Entrance	37.4 m^2	Daylight is not required
- Studio space	106.9 m^2	Provide the daylight, screen the sun
- Studio space	48.3 m^2	Provide the daylight, screen the sun
- Rest-room	11.1 m^2	Daylight is not required
TOTAL:	203.7 m^2	
STUDIO/ OFFICE FIFTH FLOOR		
- Entrance	37.4 m^2	Daylight is not required
- Studio space	106.9 m^2	Provide the daylight, screen the sun
- Studio space	48.3 m^2	Provide the daylight, screen the sun
- Rest-room	11.1 m^2	Daylight is not required
TOTAL:	203.7 m^2	
OTHER ROOMS		
- Atrium/ entrance	129.2 m^2	Daylight, can be used sun heat
- Rest-rooms	15.2 m^2	Daylight is not required
- Cloak room	23.2 m^2	Daylight is not required
- Technical room	21.7 m^2	Daylight is not reqyured
- Information	12 m^2	Provide the daylight, screen the sun
-Ventilation room 1	13.8 m^2	Daylight is not reqyured
-Ventilation room 2	13.8 m^2	Daylight is not reqyured
-Staircases	343.2 m^2	
TOTAL:	572.1 m^2	
TOTAL:	**2582.4 m^2**	

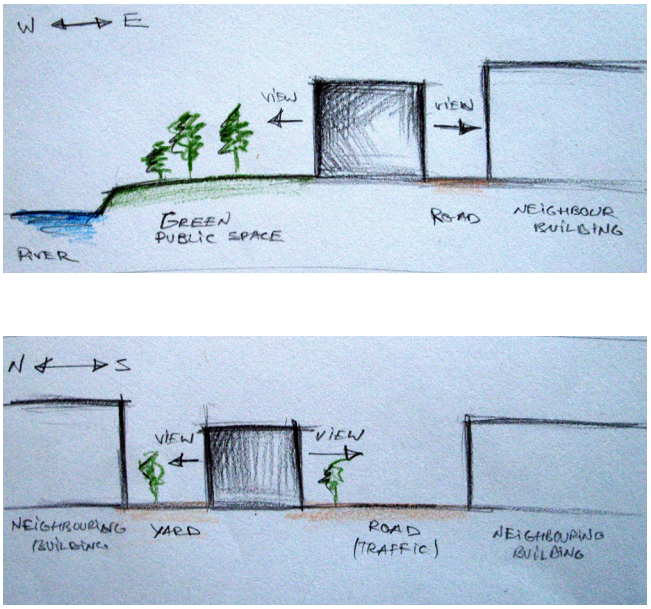
DESIGN CRITERIAS

Area
The chosen building site is situated in the north end of Andrejsala in the area where one of the main streets ends leaving the rest of area free of traffic. There are few criteria referring to the positioning of the site that is to be followed when designing the building.
- Open the building to the view over the river
- Take into consideration the street axes especially the walking street that leads towards the site
- Consider the main flows from the city
- Disassociate from the main traffic
- Bring activity to the yard spaces

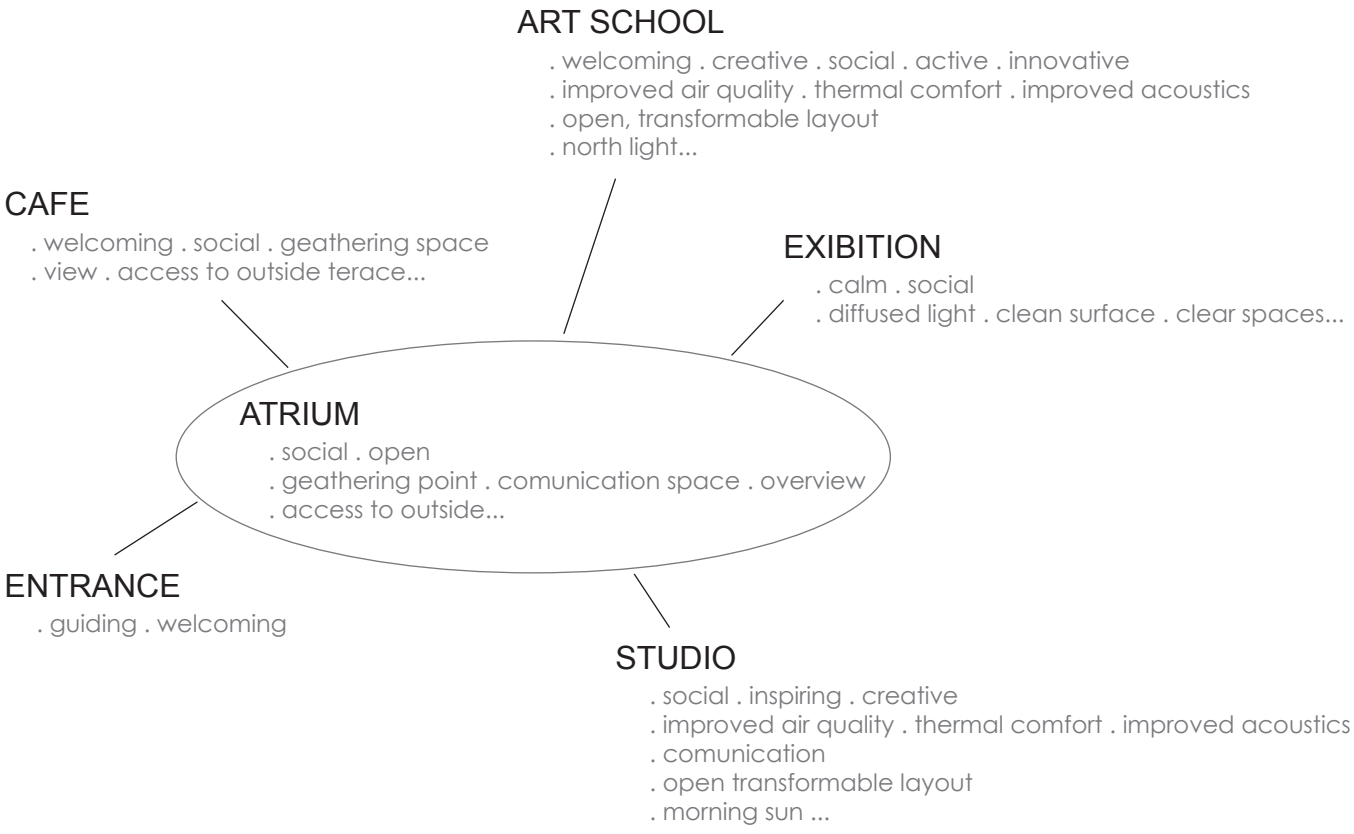
Building
Four different functions are to be presented in the building and a common space connecting them. The atrium should function as a communication between all the floors vertically and be a guideline through the building.
There are several things that have to be considered regarding atmosphere, access, indoor climate, view in each of the spaces.



[Illu.:41 Design criterias]



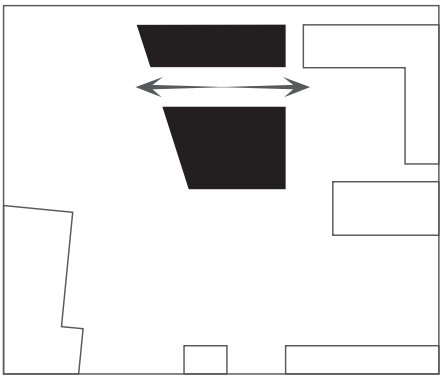
[Illu.:42 Design criterias sketch]



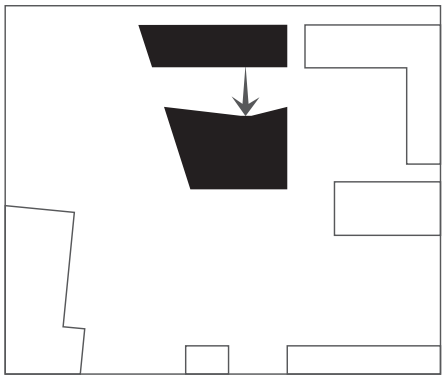
[Illu.:43 Design criterias; building]

CONCEPT

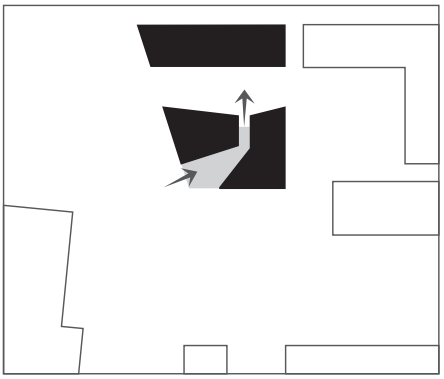
These diagrams show how the building footprint is developed and how it relates to the surroundings.



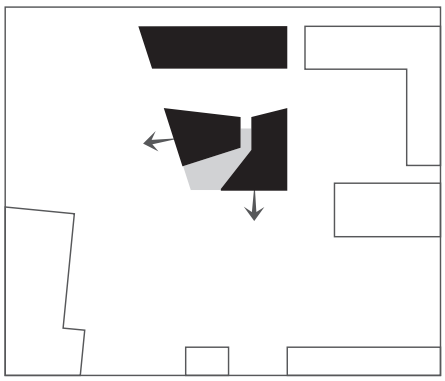
The foot print is based on the volume study following in the process description. The cut through the volume creates a connection between the spaces.



Angled walls to the north shapes the yard space and points to the north entrance emphasizing it.



The pass through (atrium) continues the walking street axis into the building. It connects the building to the other volume. The space created divides the building vertically and is a transition space between the volumes.



Orientation takes full advantage of the location emphasizing the main directions towards the view over the river and towards the street axis leading to the city centre.

[Illu.:43 Concept]

PROCESS

The design process is describing the development of the project in a chronological order.

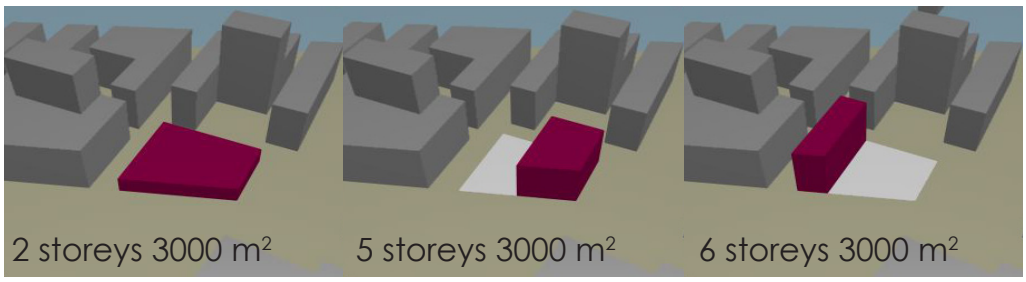
[Illu.:43a Process]

PROCESS

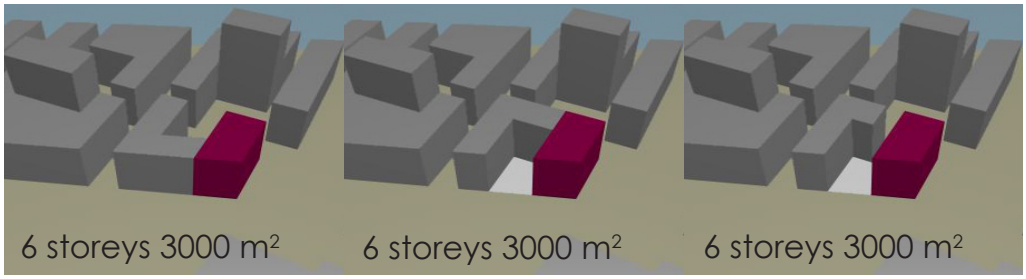
DEVELOPMENT; PART I

The idea was to choose one of the suggested sites/ volumes from the development plan which is suggested to hold a culture/education function. The volume study is made to investigate different volumes according to following criteria: light in the building, outdoor semipublic spaces, fitting to the development plan lines, connection between public spaces, and height relation to context.
Initial plan was to design a building with a foot print area around 500 m2. Since the whole area is approximately 1500 m2 large, it has to be divided. The division is splitting up in two volumes, one to proceed with in more detail where other would be solved in a concept level. The first thing that has to be considered is if the two volumes should be connected. To bring more light in the volumes it would be a good idea to create a court yard. When dividing the volumes close by buildings could benefit from better connection to the river side. Wider distance between the volumes would create an axe connecting court yard to the river and give other buildings a better overview. The maximum allowed height in this area is 6 storeys therefore it is used as a maximum height for the volume study.

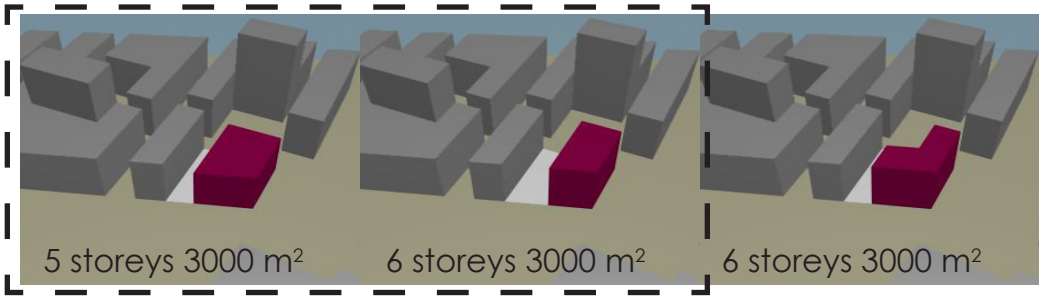
The chosen volume to work with is 5 to 6 storey height building volume located in the south part of the site which fulfills the criteria. The energy consumption for the 5 storey height volume with total floor area of 3000 m2 is: heating - 44.8 kWh/m2 per year. Where the energy consumption for the 6 storey height volume with total floor area of 3000 m2 is: heating - 51.9 kWh/m2 per year. ("Month average" spreadsheet is used for the energy calculation and the calculation does not take into account windows).



Light in the building	No	Partly	Yes
Outdoor semipublic space	No	No	No
Fitting to the development plan lines	Yes	No	No
Connection between public spaces	No	No	No
Height realation to context	No	Yes	Yes

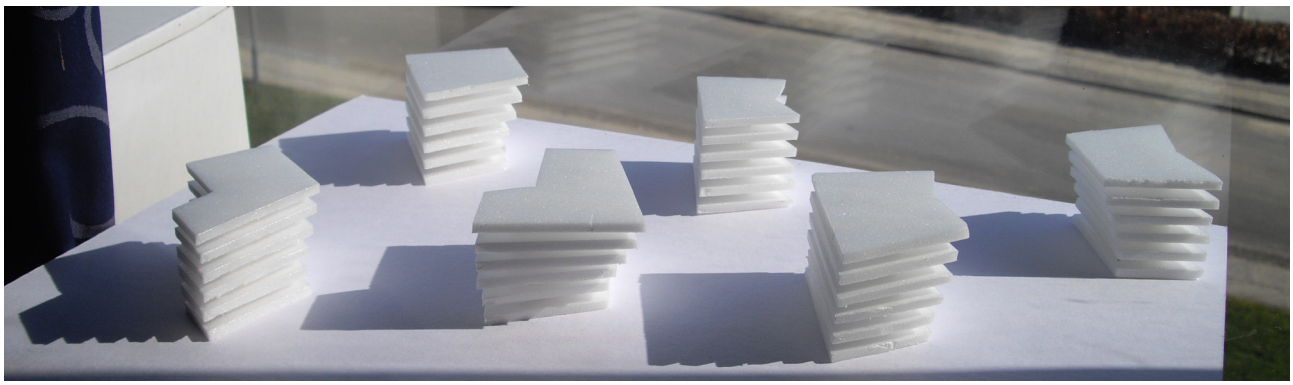


Light in the building	Yes	Yes	Yes
Outdoor semipublic space	Yes	Yes	Yes
Fitting to the development plan lines	Yes	Yes	Yes
Connection between public spaces	No	No	Yes
Height realation to context	Yes	Yes	Yes



Light in the building	Partly	Yes	Yes
Outdoor semipublic space	Yes	Yes	Yes
Fitting to the development plan lines	Yes	Yes	Yes
Connection between public spaces	Yes	Yes	Yes
Height realation to context	Yes	Yes	Yes

[Illu.:45 Volume study]

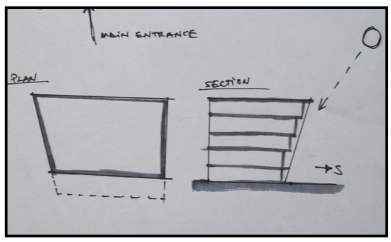


[Illu.:46 Volume study2]

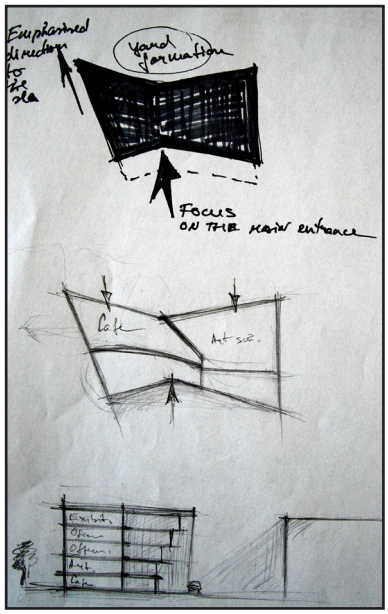
PROCESS

DEVELOPMENT; PART II

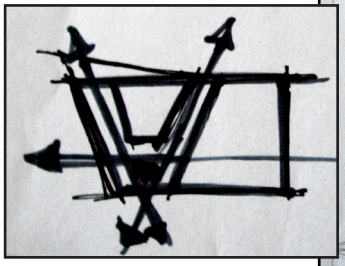
The designing of the building volume starts with creating a study of volumes with the same height but slightly different shape while still keeping the development plan lines. Each volume has different focus points like emphasis on the entrance, formation of the yard space, the positioning of the entrance. Some of the volumes are angled so building screens the sun creating its own shadow and refusing necessity of cooling in the summer time (illu.:46;47).
The development of the layout starts with creating the axis through the building emphasizing the most important directions and visual connections. The placement of the entrance is in focus. The obvious flow refers to having the entrance from the south but at the same time this would create a back and front side of the building which is not wished. The entrance from the north could bring more life to the yard space while still keeping the visual connection from south through the windows (illu.48; 49; 50).
The plan of the ground floor has the horizontal connection but it lacks the communication between the floors vertically (illu.).



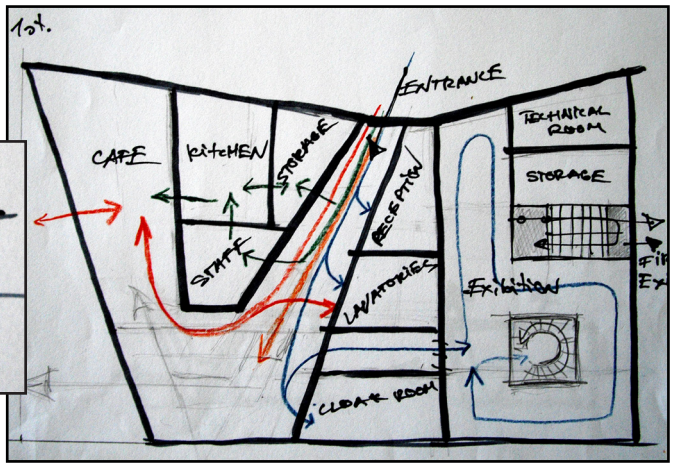
[Illu.:47 Sketch 1]



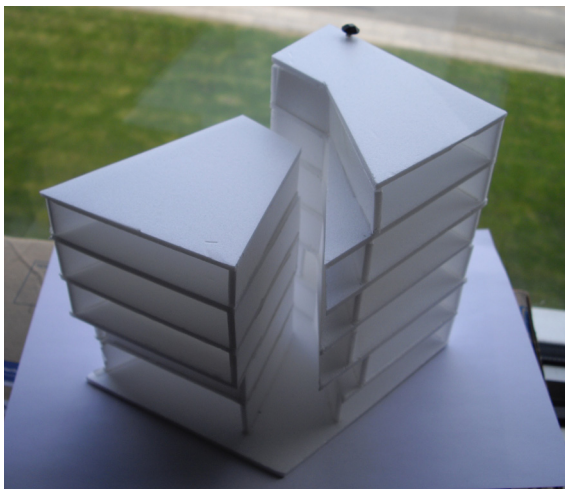
[Illu.:48 Sketch 2]



[Illu.:49 Sketch 3]

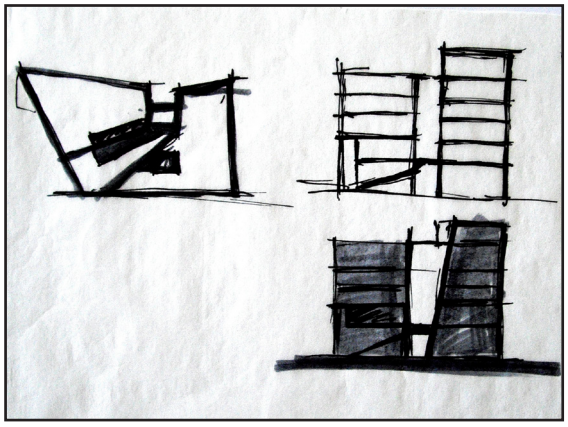


[Illu.:50 Sketch 4]

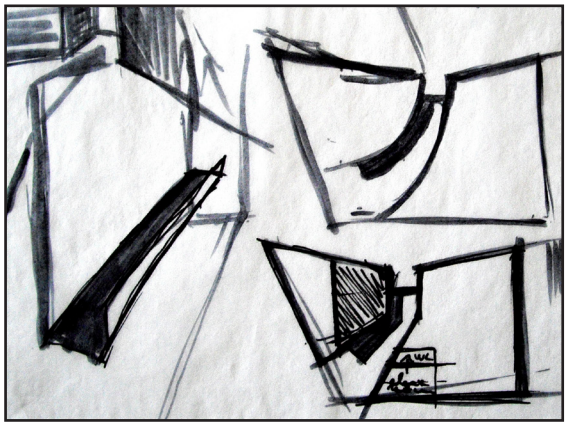


[Illu.:51 Model 1]

[Illu.:52 Model 2]



[Illu.:53 Sketch 5]



[Illu.:53a Sketch 6]

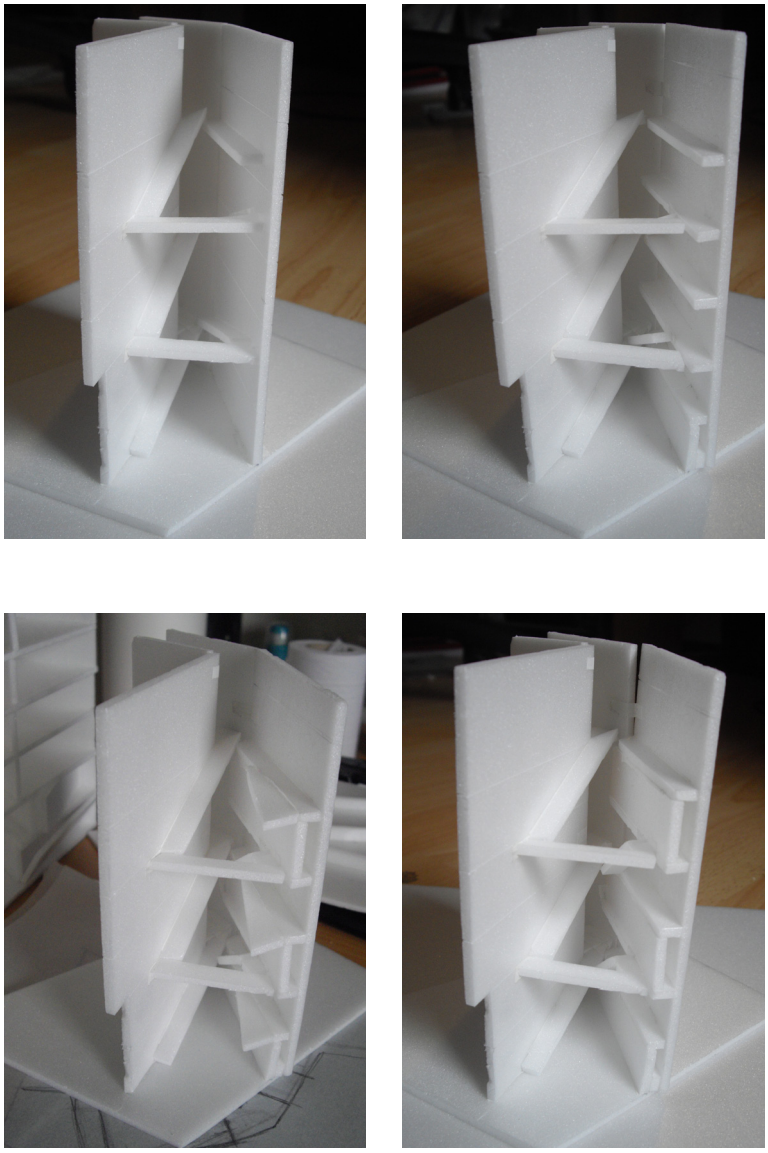
PROCESS

DEVELOPMENT; PART III

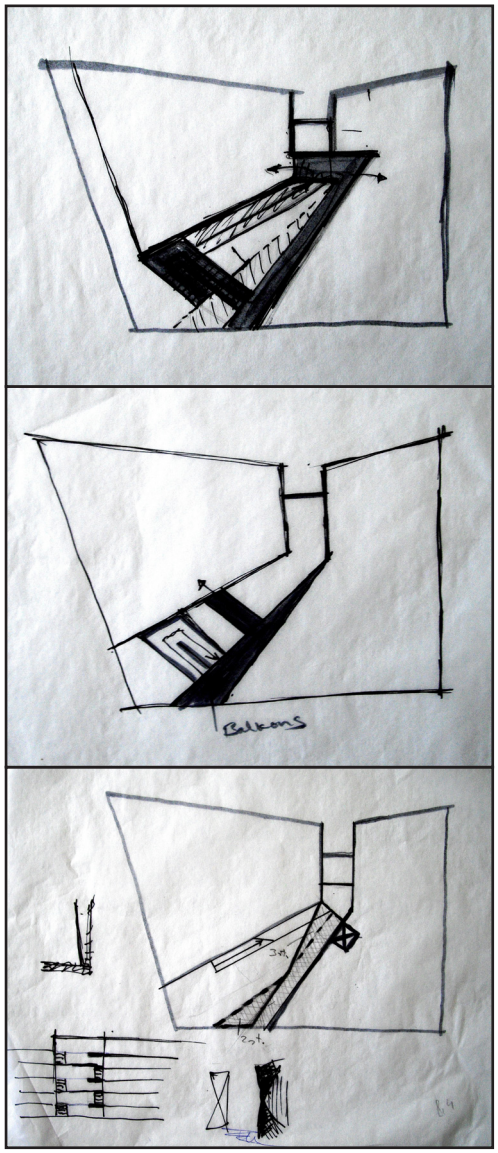
The development of the project continues with focusing on the vertical connection in the building. The work with crossections, 3D and paper models results with creating a vertical and horizontal connection. The developed atrium space continues the walking street axis in the building and connects to the yard space. This cut through is forming two volumes with different heights, focus points and also is dividing the functions. One volume opens up towards west where other opens to the south and city center. The volume facing west holds café and art school functions where the other volume holds the exhibition and studios as well the common building functions.

DEVELOPMENT; PART IV

In the next step the connections between the floors are made. A study of staircases is made in order to find out the best way to create communication in the building. The placement of access balconies is investigated when having them in each floor, in every second floor, shaping differently in every second floor. Also it is considered to have each of the volumes with different room height but that makes it more difficult to create the connections. The elevator makes the task more difficult due to it has to stop at every floor and have an access to the both of the volumes.



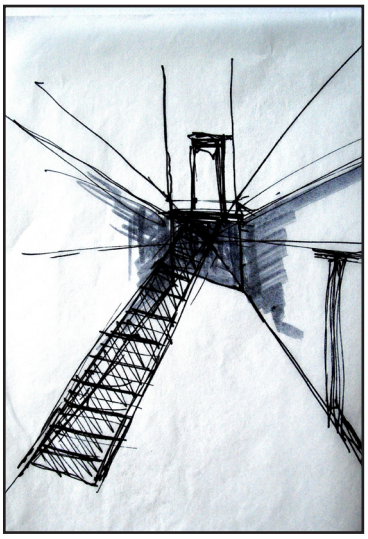
[Illu.:54 Model3]



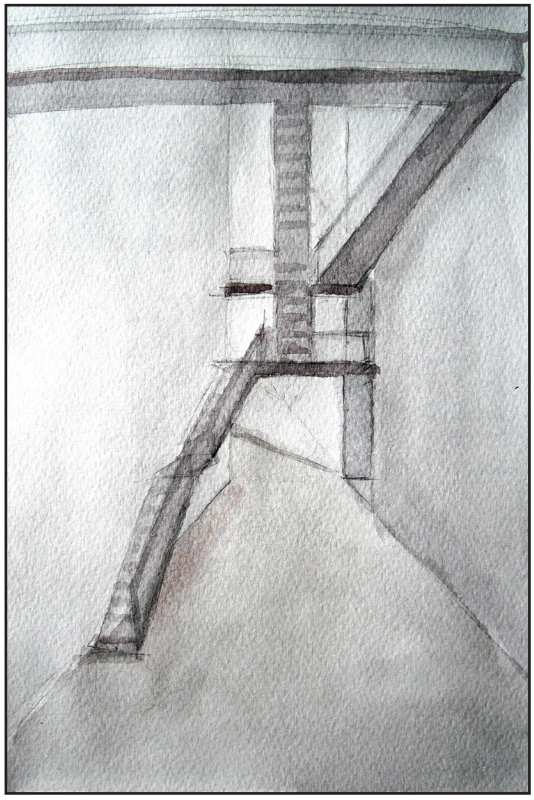
[Illu.:55 Sketch 7]

The solution chosen to continue working on is having platforms in one side of the atrium that are placed in each floor therefore the elevator can reach every level. There is an access balcony in every second floor only in order to escape unnecessary spaces that will not be used and create more clear concept of communication. The staircases form an obvious flow yet exiting movement through the heart of the building. The inspiration for the atrium space is coming from the "Kiasma Museum of contemporary art" designed by Steven Holl architects.

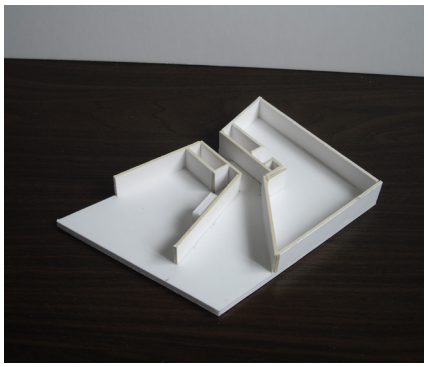
[Illu.:57 Kiasma museum of contemporary art]

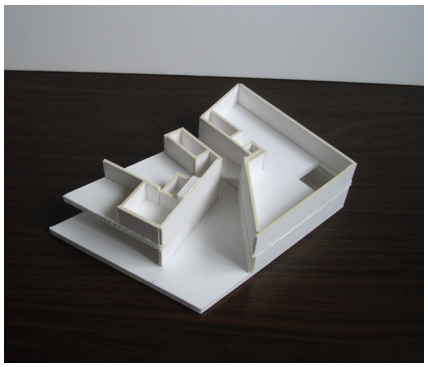


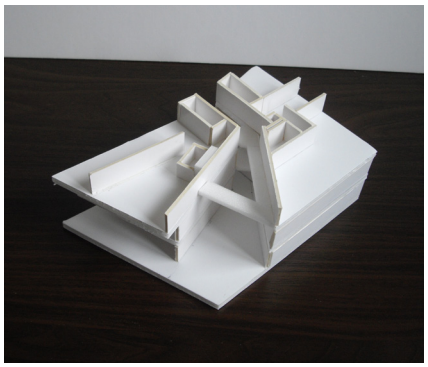
[Illu.:56 Sketch 8]

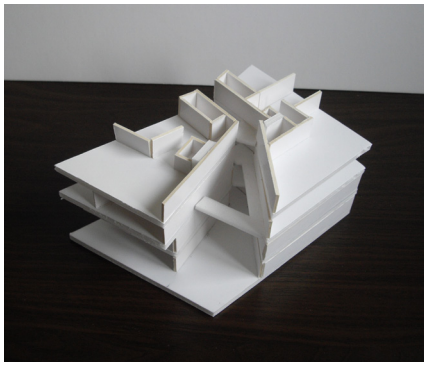


[Illu.:58 Atrium]







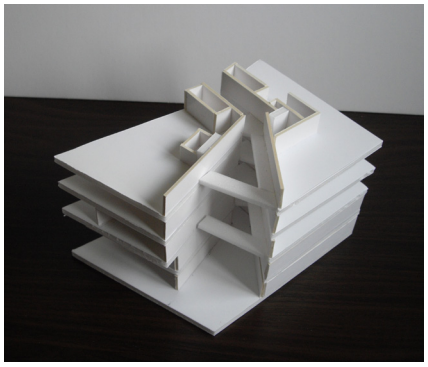


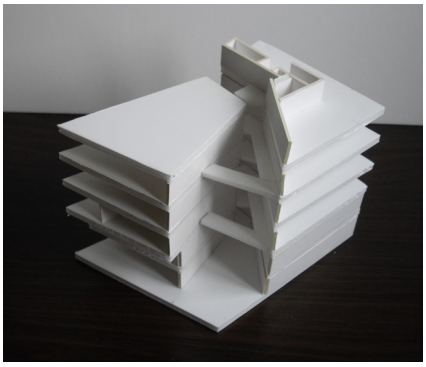
PROCESS

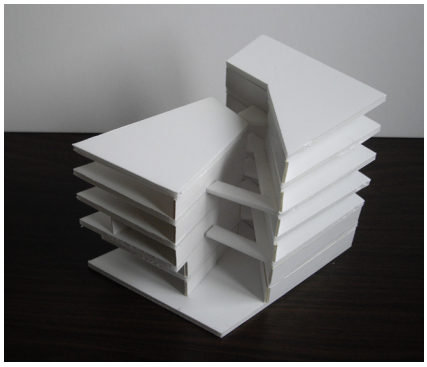
DEVELOPMENT; PART V

At first the layouts where designed so they were too crowded creating many closed spaces and losing the initial sense of direction. Thru the designing process of the plans they become cleaner and lost all the unnecessary borders finally coming across a concept of flexible and clear layouts. The idea was to form each of the spaces with its individual qualities and provide them with resources to serve the function.

In order to create more volume for the café the double high room is created along the outer wall. This lets to drag more light into the café space and connects it to the atrium space. Art school is placed to benefit from the diffused north light and have a view over the river. The spaces are shaped during the process from more closed rooms to an open space with light partitions. During the development process of the studio spaces the goal is to escape dark corridors while still having the rooms relatively separated. The exhibition space is being developed from complicatedly shaped rooms and awkward corners into simple shapes and clean surfaces. Since two of the exhibitions rooms are place one above another the idea about connecting them vertically is investigated.





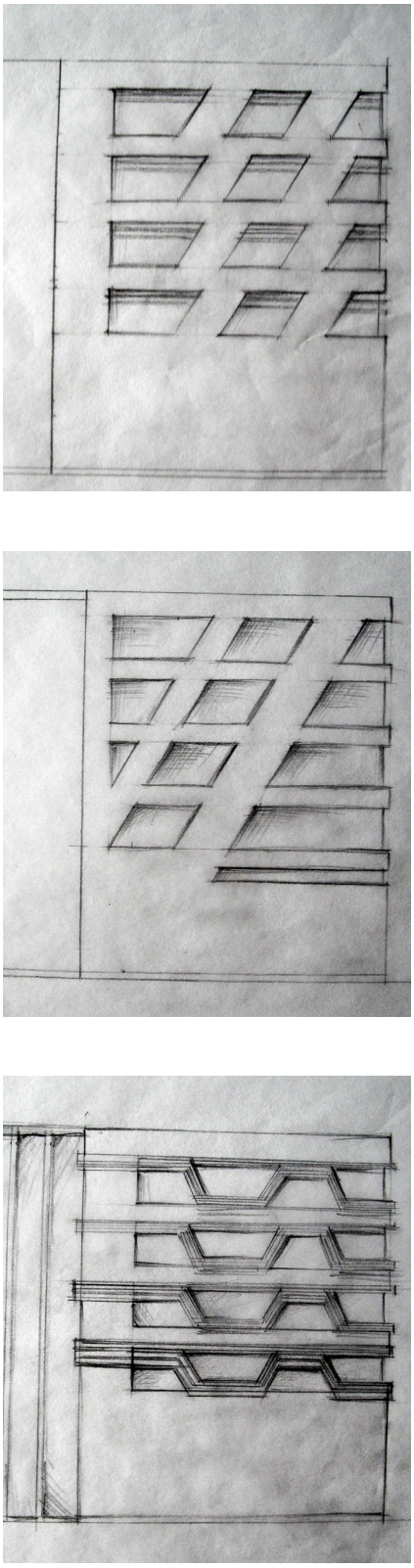


[Illu.:59 Model 4]

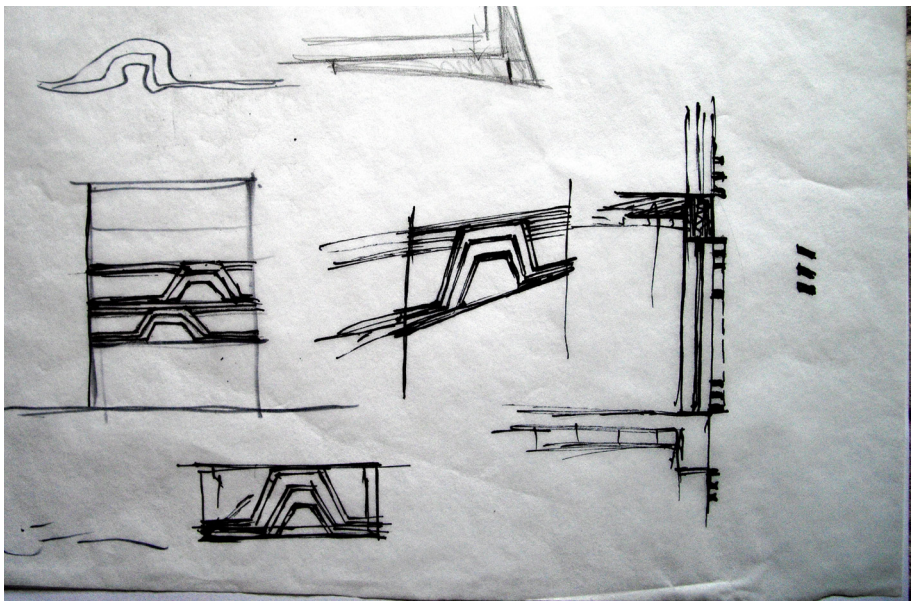
PROCESS

DEVELOPMENT; PART VI

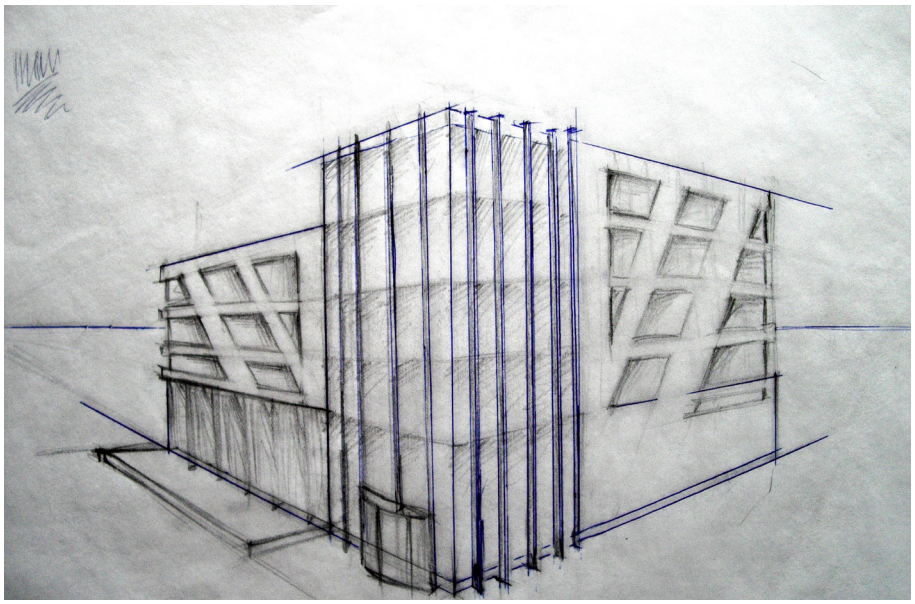
When designing the windows following aspects are being considered – natural light in the spaces, view, heat loss, solar gains, and architectural expression. At first 2.5 m high window lines are investigated to creating lines emphasizing the horizon. Due to much solar gains and heat losses the windows are divided into smaller ones creating different architectural expressions. The angled lines gives a movement to de facades but horizontal lines helps to keep the expression clean. Even reducing the window areas it does not help so much with overheating in summer therefore different kinds of shading are investigated. Fixed shading is a more creative solution and has many possibilities but the adjustable one is helps to improve the indoor climate. For the atrium space fixed external shading columns are created to help screening the large glass surfaces. Columns create different architectural expressions depending on the view point.
For the exhibition space some horizontal and narrow windows are designed to drag some sun rays into the spaces creating different atmospheres.
The windows are developed forewords by reducing the height to 1.5 m and shortening the width where it could improve the quality of the indoor spaces.
The spaces are to be naturally ventilated in the summer time therefore part of the window area is designed to be opened. The proposed ventilation principle is cross ventilation so there is a small gap in the partition walls to allow the air pass through.



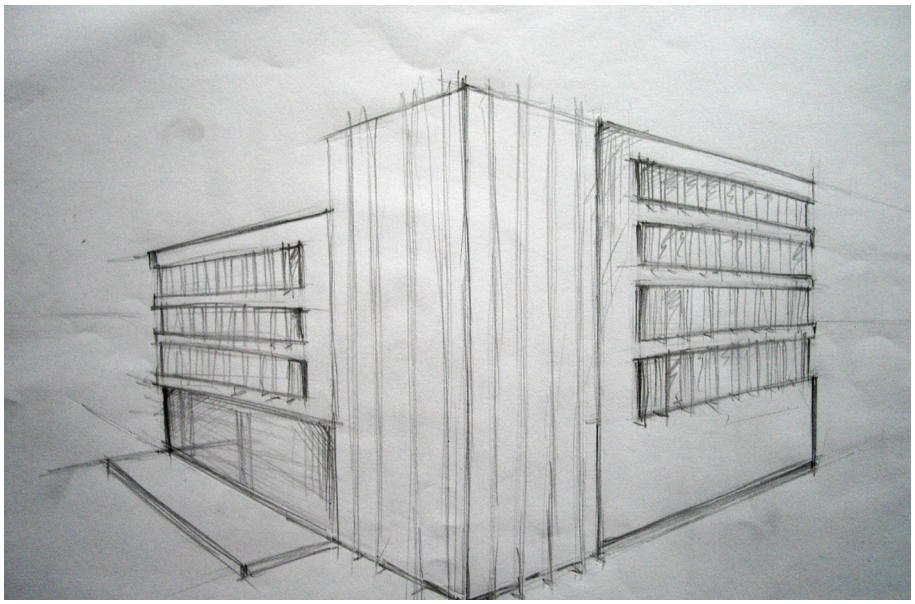
[Illu.:60 Facade sketches]



[Illu.:61 Shading sketches]



[Illu.:62 Facade sketches2]

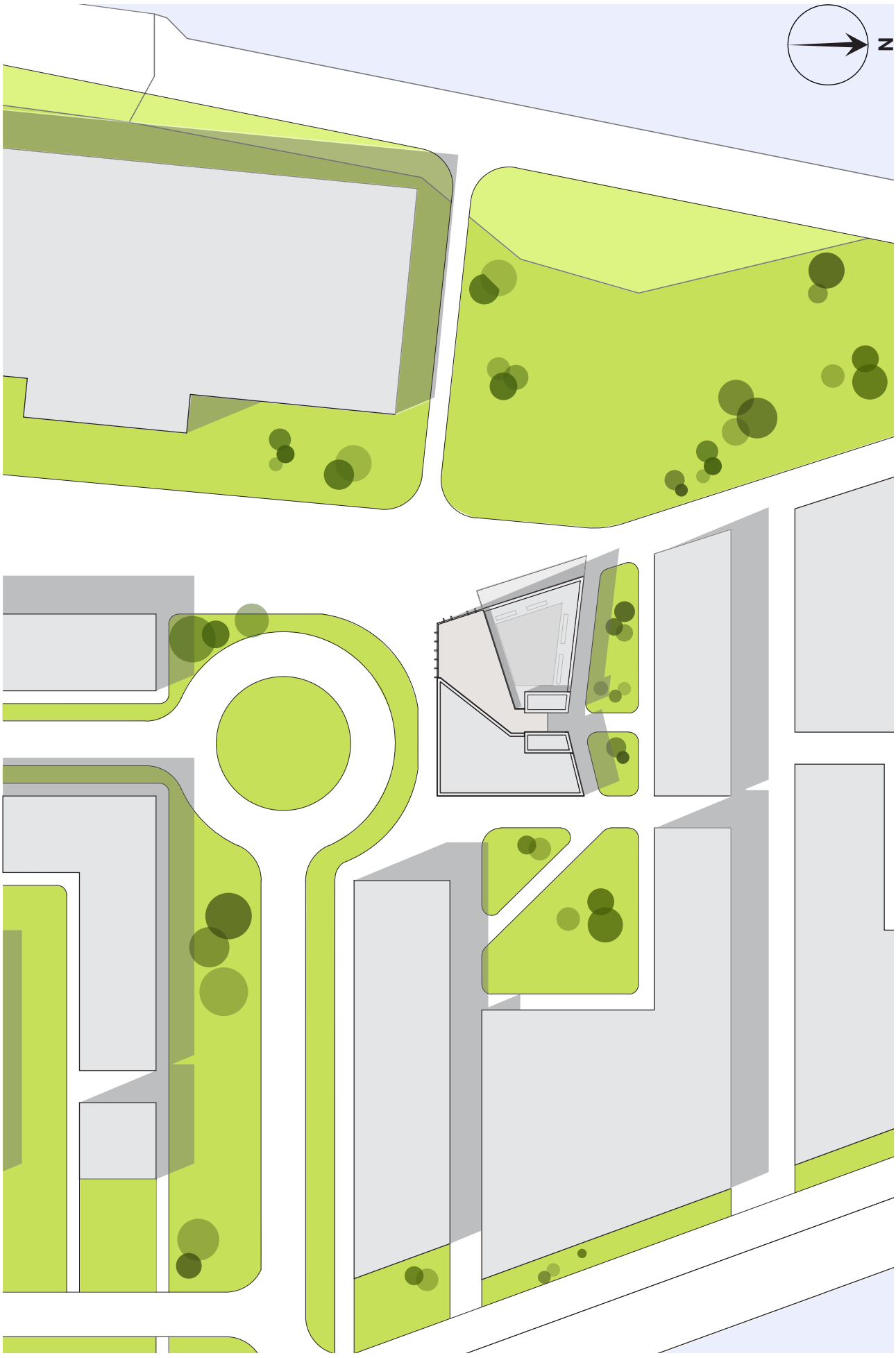


[Illu.:63 Facade sketches3]

PRESENTATION

MASTER PLAN

There are several roads leading towards the building. When approaching the building from the walking street the placement of the atrium creates a visual connection through the building and the position of the south entrance drags one in to continue the obvious flow. The path from the river promenade is leading directly to the south entrance. When approaching the building from north the obvious choice is the north entrance which is emphasized but more closed space that opens up in the building towards the walking street. The building is distanced from the main traffic by closing the first two floors towards south. The building follows the development plan lines but creates its own individual expression.



[Illu.:64 Masterplan]

FLOOR PLANS

Ground floor

The ground floor is very much closed to the south and east and open to the west and south west direction. This is done in order to close building to the traffic and open up the main flows. Functions that do not need natural light like exhibition, technical room, cloak room and rest rooms are placed to the east. Exhibition has a vertical connection to the exhibition room on the first floor. Café and belonging rooms are facing west and benefiting from the view. Café storage has an entrance from the outside for the deliveries and the staff room has an separated entrance from the atrium. The flow of the staff meets up in the kitchen and continues out in the café hall. There is a summer terrace outside the café hall created to bring more liveliness to the area and create a cozy atmosphere in summer evenings.

To fulfill fire regulations there is one closed staircase for each of the volumes respectively fire compartments. The fire escape staircases are leading directly to the outside in north.

First floor

On the first floor there is placed the second exhibition hall. This hall differs from the one on the ground floor with a different atmosphere due to narrow horizontal windows placed near the ceiling and allowing some natural light in the space.
First floor is where the common space and teacher's room of the art school are located. There is also a room for storing the art and installations.

The art school is placed in the four floors in the west volume where the studios are placed in four floors in the east volume. This is done in order to divide the functions while letting them meet in the atrium space.

Second, third, fourth and fifth floor

On the second, third and fourth floor to the west there are placed art school classrooms. The layout of these floors is flexible; the spaces are divided by a use of light partition walls partly transparent. By lowering the height of the restrooms it is possible to pass the light through the whole space even until the entrance creating one undivided space. Technical drawing and painting classrooms requires the most space where other rooms can be more compact.

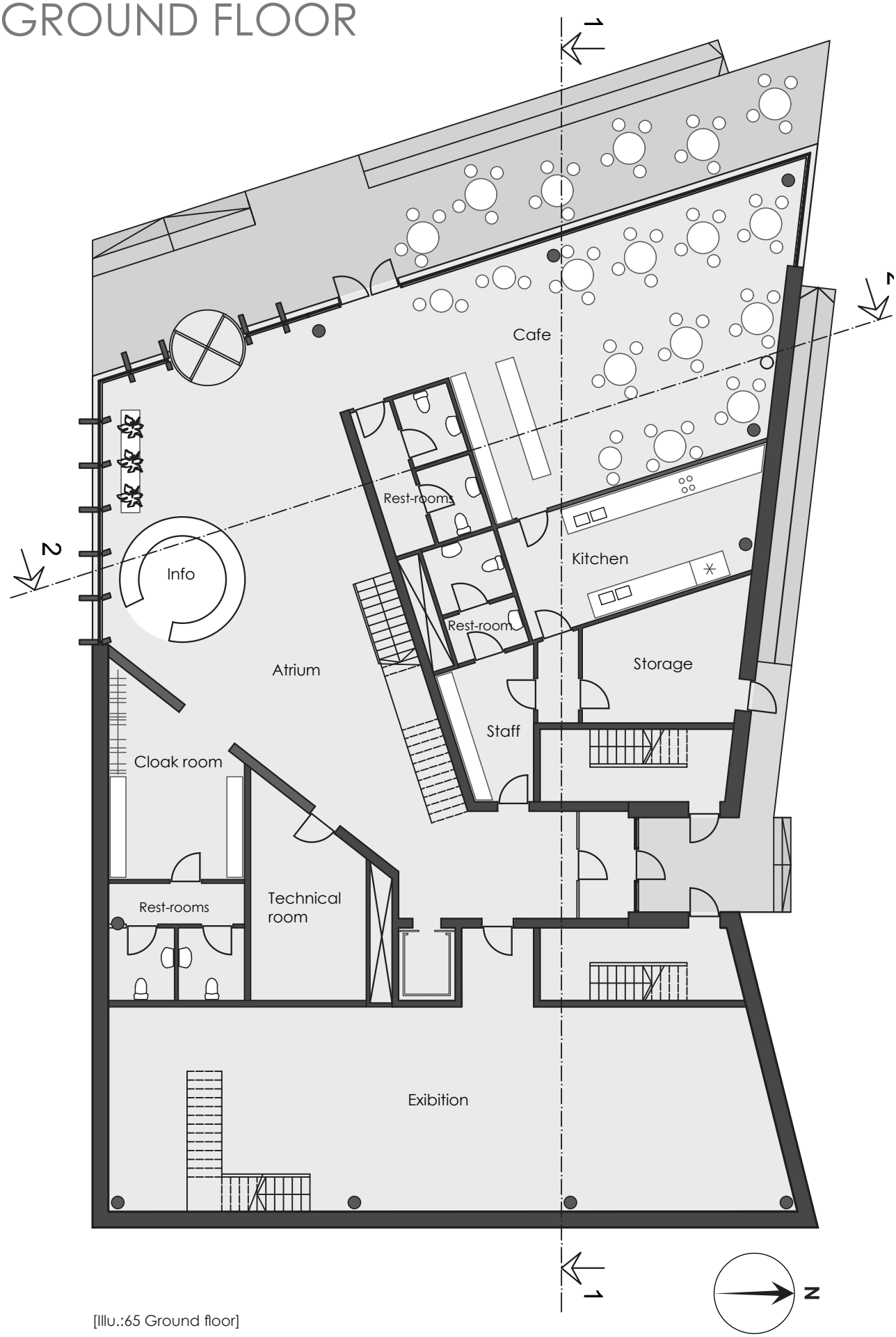
From the second until the fifth floor to the east there are designed studio spaces. The layout of the studio spaces is designed to be as flexible as possible. There are light partition walls partly transparent separating spaces. Due to a relatively flexible plan layout the studio can be organized accordingly to the needs of any company profile. Each company can be quite creative with the design and use of the rooms. The spaces are provided with a great level of daylight and the positioning to the morning sun can be motivating for the employees.

There is a terrace on top of the west volume designed for a public use. The roof top of the east volume is perfect for placing the solar cells facing south.

Technical rooms

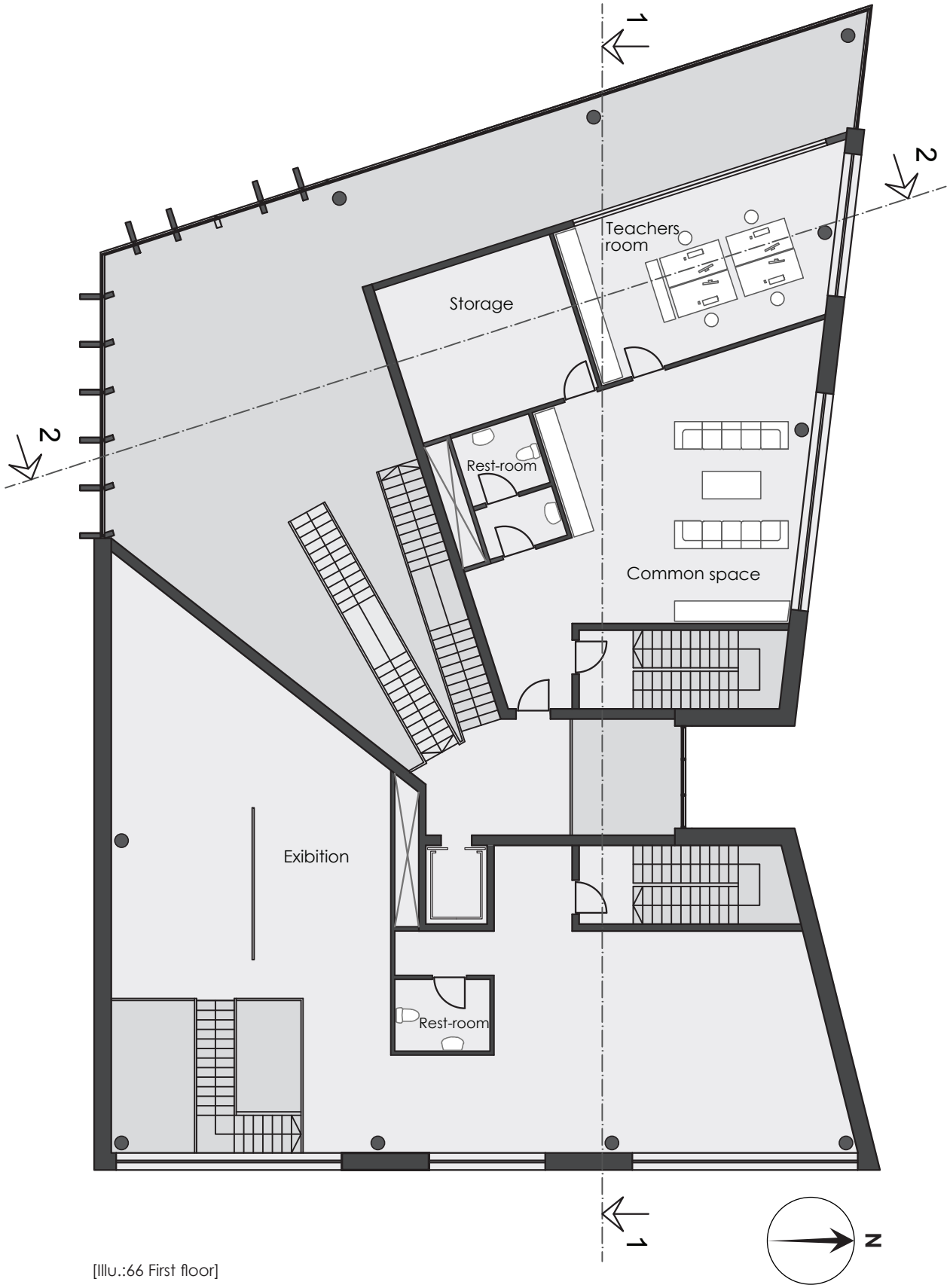
Regarding positioning of technical installations there is designed a technical room on the ground floor next to one of the service shafts. The vertical pipes are placed in two service shafts each serving one of the volumes. The horizontal pipes are located in the suspended ceiling. There are one ventilation unit serving each volume and they are located on top of each of the fire escape staircases in closed rooms.

GROUND FLOOR



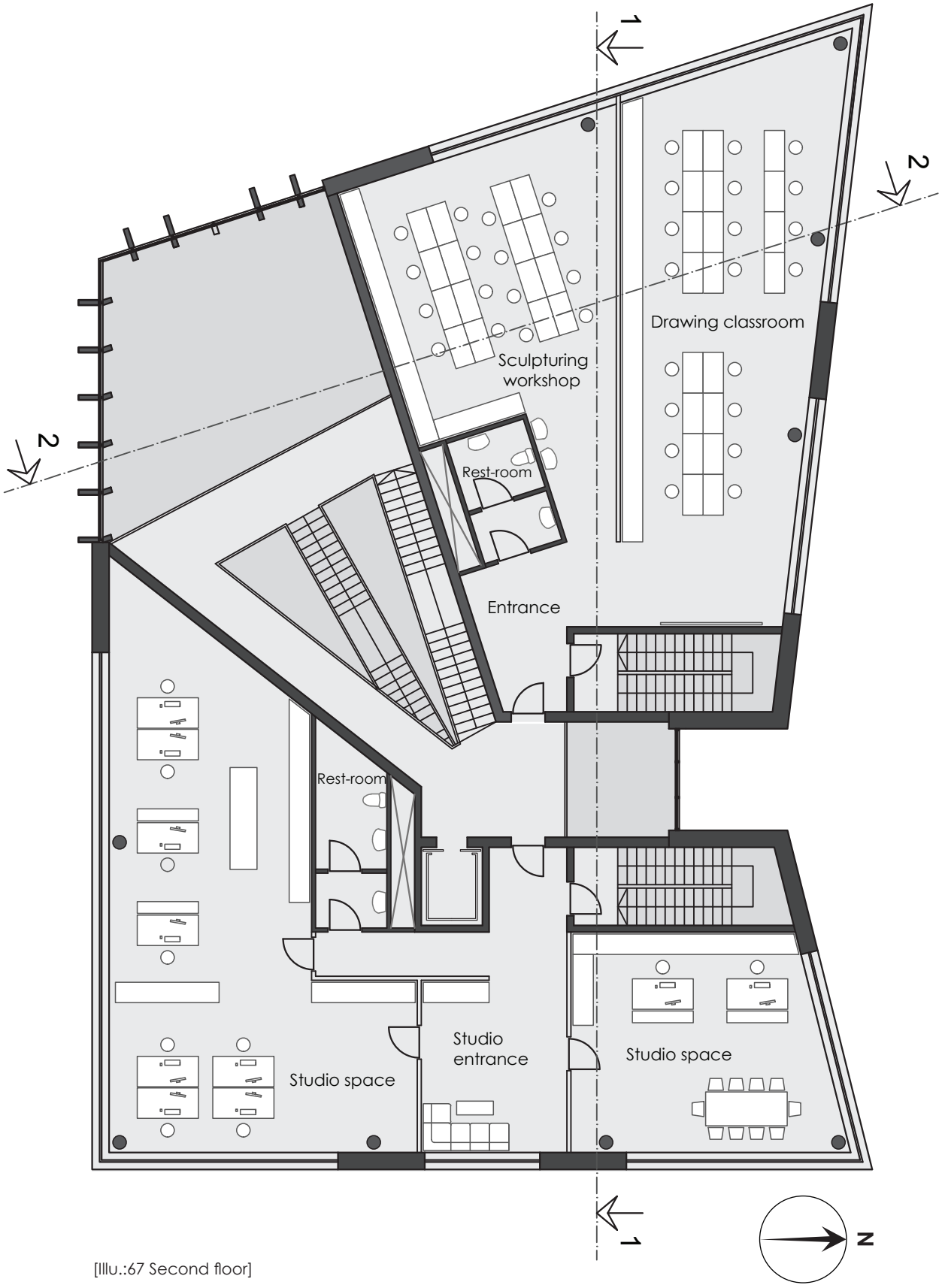
[Illu.:65 Ground floor]

1ST FLOOR



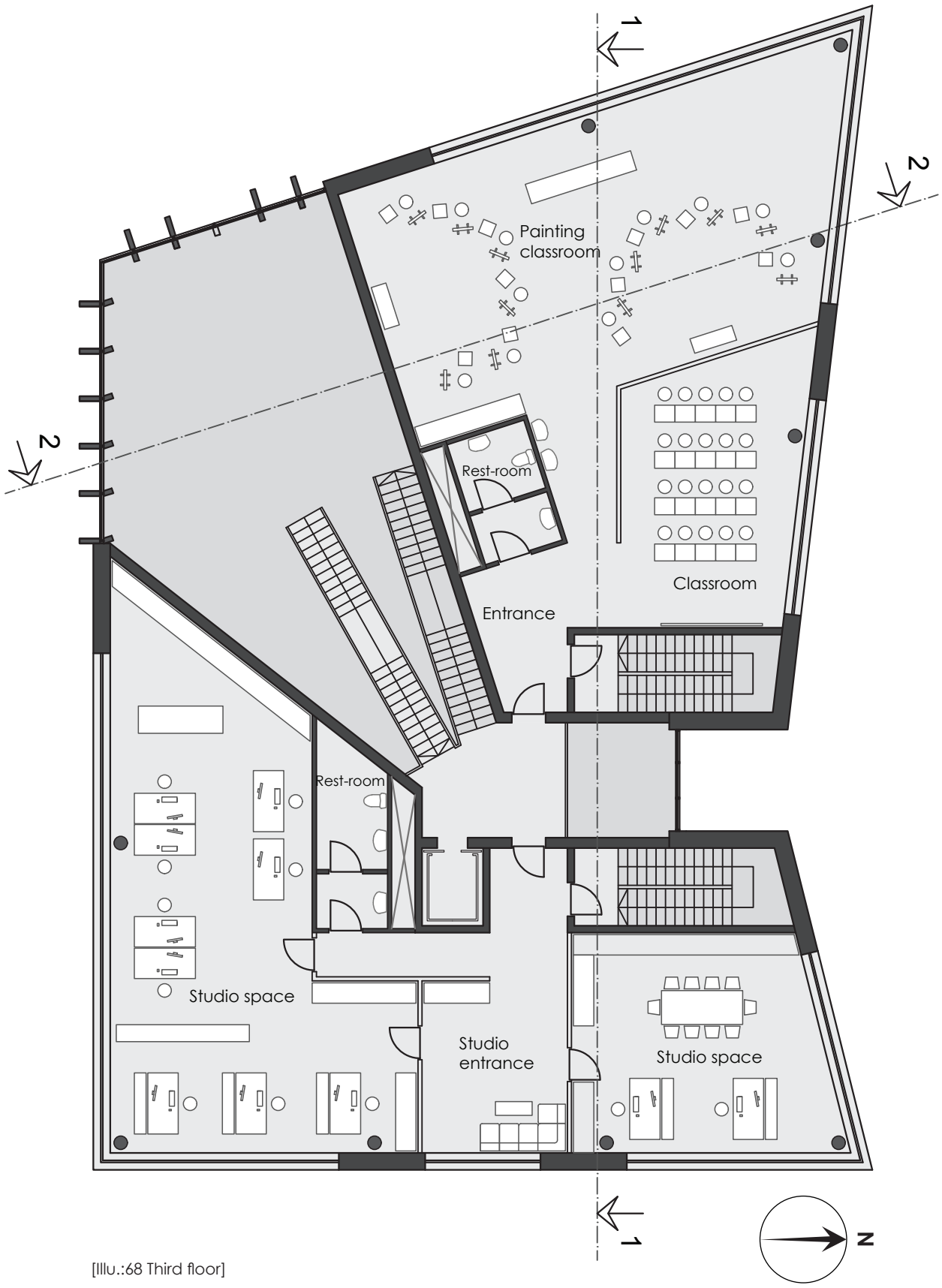
[Illu.:66 First floor]

2ND FLOOR



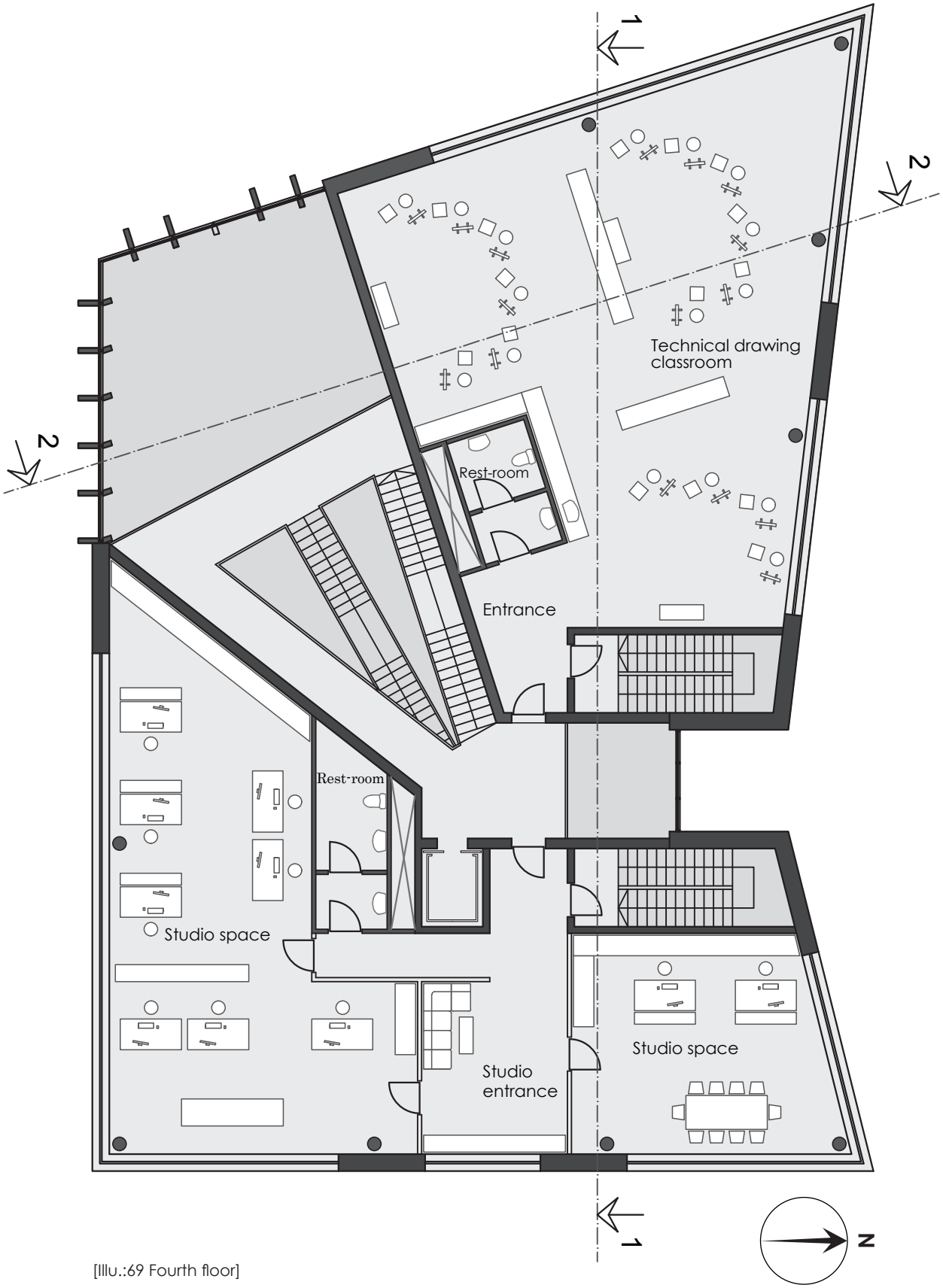
[Illu.:67 Second floor]

3RD FLOOR



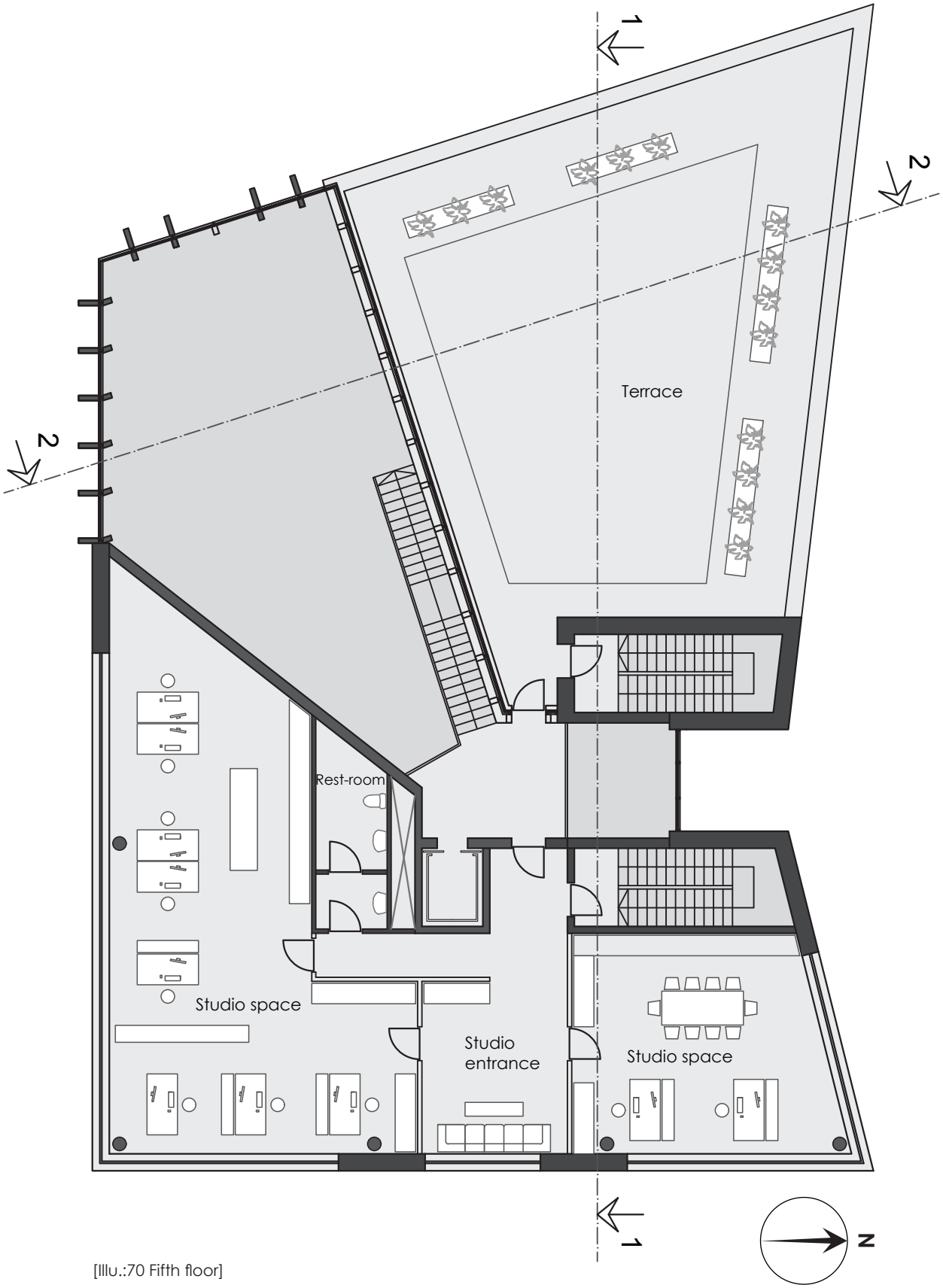
[Illu.:68 Third floor]

4TH FLOOR



[Illu.:69 Fourth floor]

5TH FLOOR

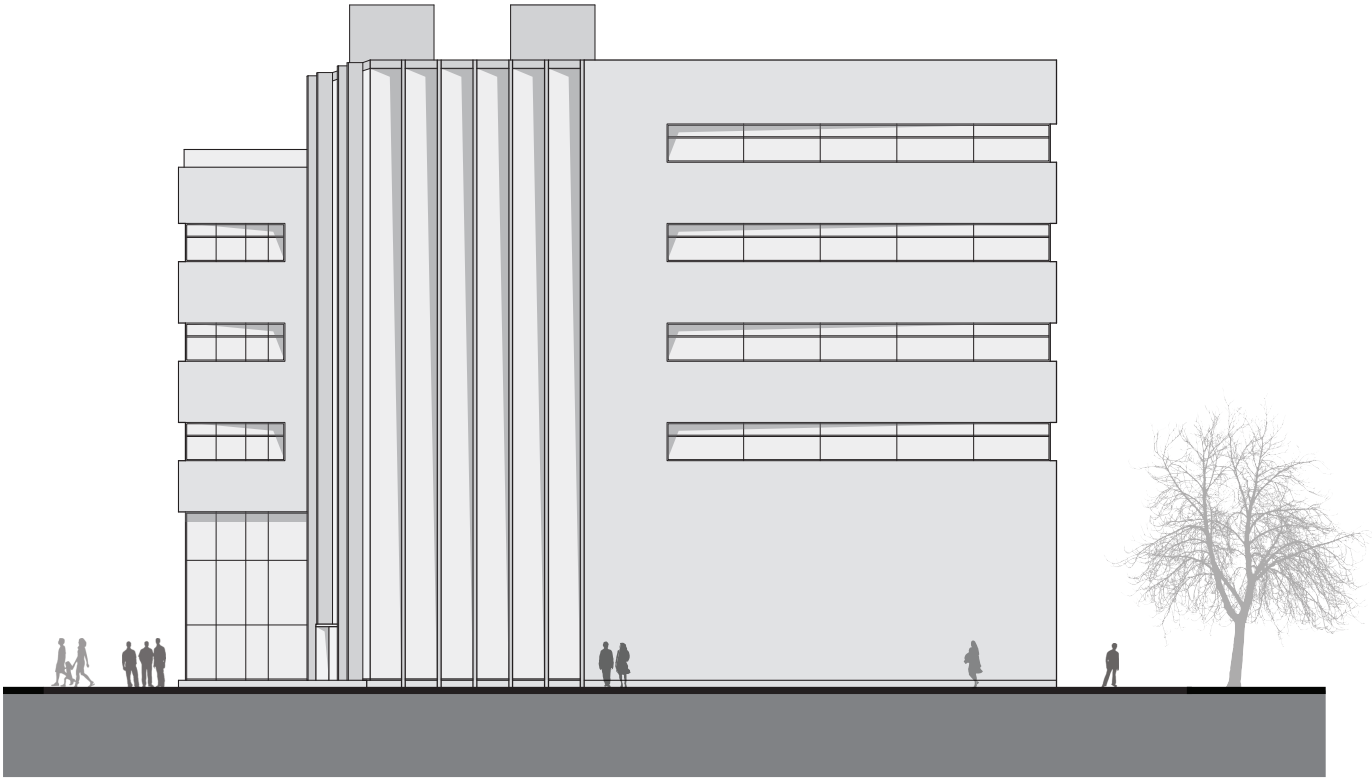


[Illu.:70 Fifth floor]

VISUALISATION

[Illu.:71 Visualisation]

FACADES



[Illu.:72 South facade]

[Illu.:73 North facade]

[Illu.:74 East facade]

[Illu.:75 West facade]

SECTIONS

[Illu.:76 Section 1-1]

[Illu.:77 Section 2-2]

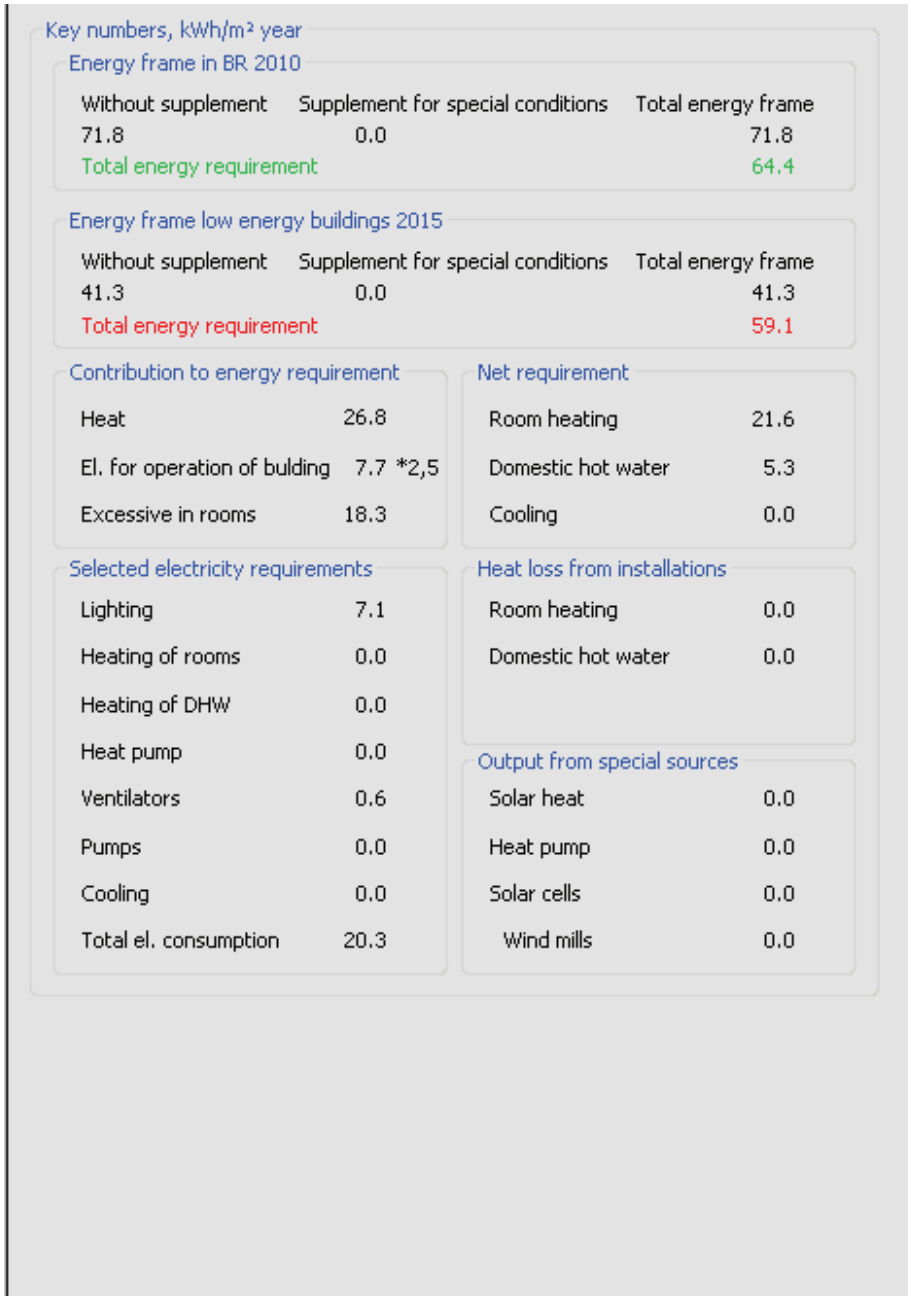
ENERGY CONSUMPTION; BE10

To find out if the building meets the Danish standards for low energy building a simulation in BE10 is made. The building is very much exposed to the south increasing the possibility of overheating during the summer therefore the case is rather challenging.
First the building envelope is being insulated to reach as low u – values as possible. The heat, electricity for ventilation, domestic hot water, lighting and equipment is included when finding the total energy consumption.
During the designing process BE10 is used as a tool. The most complications appear due to the large glass surfaces therefore window areas are being reduced. The heat loose through the windows is large and there is a problem with overheating during the summer. To reduce overheating internal and external shading devices are used. The external shading devices are set to be adjustable so in winter the heat could be let in the building but in the summer screened.
Also to reduce the energy consumption the natural ventilation during summer is increased.

Total energy requirement that should not be exceeded according to BR10. For offices, schools, instututions etc.	
Building regulation	71,3 kWh/m^2 per year + 1650 kWh year / heated floor area
Low energy building 2015	41 kWh/m^2 per year + 1000 kWh year / heated floor area

BR10 low energy class 2015

Mechanical ventilation - 0.3 l/s pr. m^2 (BR10 7.2.1)
Indoor temperature - 20^0 C
DHW use of 100 l pr. year pr. m^2



Key numbers, kWh/m² year

Energy frame in BR 2010

Without supplement	Supplement for special conditions	Total energy frame
71.8	0.0	71.8
Total energy requirement		64.4

Energy frame low energy buildings 2015

Without supplement	Supplement for special conditions	Total energy frame
41.3	0.0	41.3
Total energy requirement		59.1

Contribution to energy requirement

Heat	26.8
El. for operation of bulding	7.7 *2,5
Excessive in rooms	18.3

Net requirement

Room heating	21.6
Domestic hot water	5.3
Cooling	0.0

Selected electricity requirements

Lighting	7.1
Heating of rooms	0.0
Heating of DHW	0.0
Heat pump	0.0
Ventilators	0.6
Pumps	0.0
Cooling	0.0
Total el. consumption	20.3

Heat loss from installations

Room heating	0.0
Domestic hot water	0.0

Output from special sources

Solar heat	0.0
Heat pump	0.0
Solar cells	0.0
Wind mills	0.0

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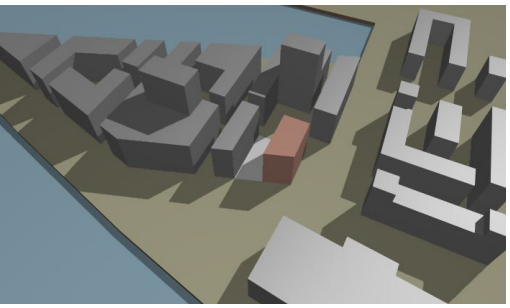
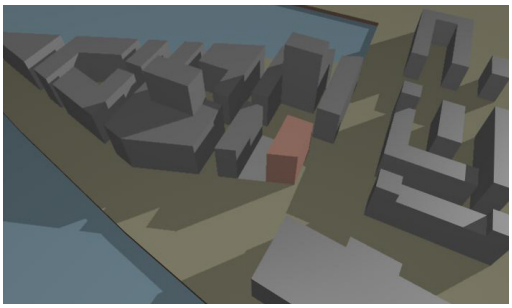
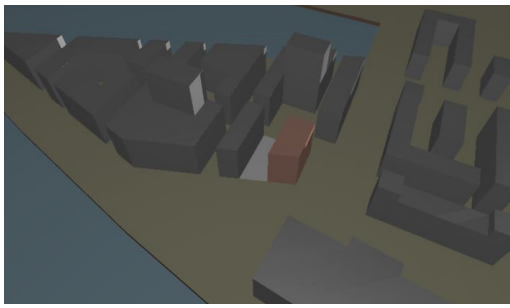
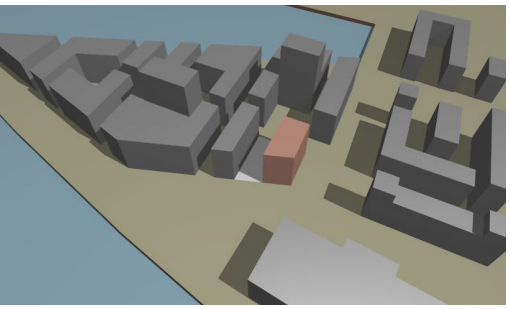
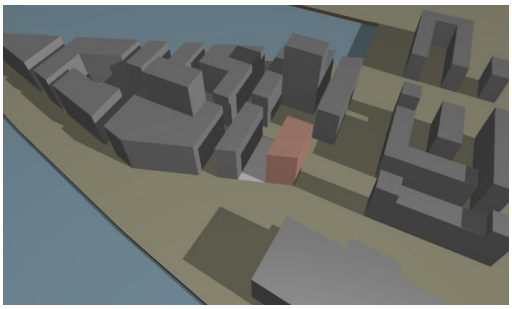
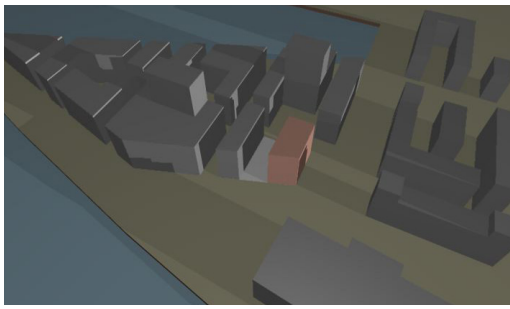
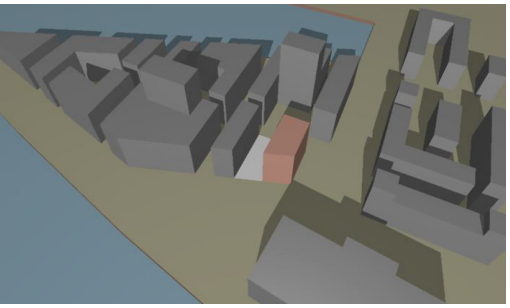
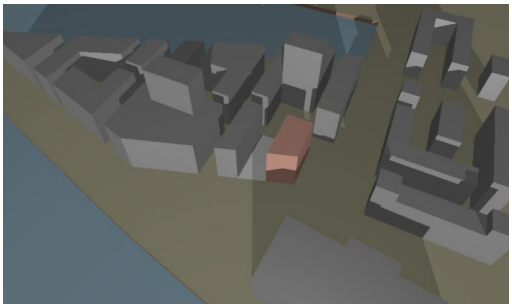
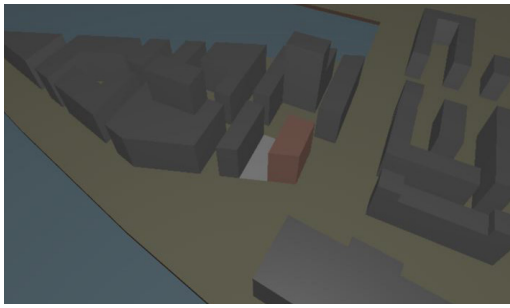
LIST OF ILLUSTRATIONS

APPENDIX

APPENDIX

CONTEXT SUN STUDY

Summer solstice	Equinox	Winter solstice
		
June 21 9.00	March 21 9.00	December 21 9.00
		
June 21 12.00	March 21 12.00	December 21 12.00
		
June 21 16.00	March 21 16.00	December 21 16.00

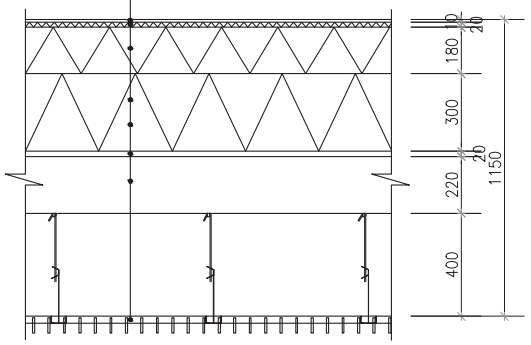
[Illu.:78 Context sun study]

APPENDIX

BUILDING COMPONENTS

Flat roof

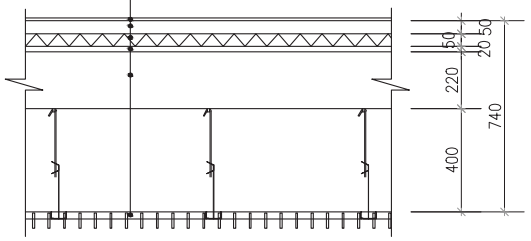
Rubberized bitumen roof covering	10 mm
PAROC ROB 80t insulation	20 mm
PAROC ROS 30g insulation	180 mm
PAROC ROS 30 insulation	300 mm
Vapour barrier	0,25 mm
Cement mortar layer	20 mm
Reinforced concrete slab	220 mm
Suspended ceiling	



[Illu.:79 Flat roof]

Storey partition

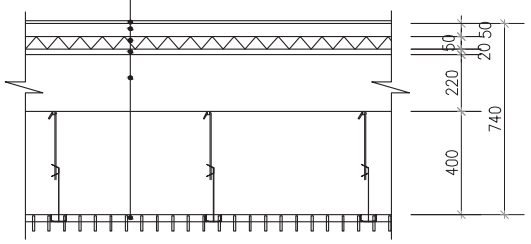
Laminate flooring	12 mm
Concrete slab	50 mm
PAROC SSB1	50 mm
Cement mortar layer	20 mm
Reinforced concrete slab	220 mm
Suspended ceiling	



[Illu.:80 Storey partition]

Floor on the ground

Laminate flooring	12 mm
Concrete slab	50 mm
PAROC SSB1	50 mm
Cement mortar layer	20 mm
Reinforced concrete slab	220 mm
Suspended ceiling	



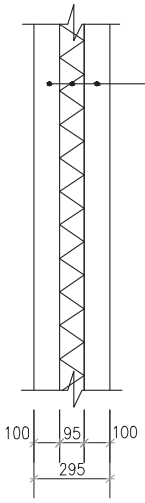
[Illu.:81 Floor on the ground]

U - values:
Roof: 0.07 W/m^{2}K
Floor on the ground: 0.085 W/m^{2}K
External wall: 0.11 W/m^{2}K
Window: 0.65 W/m^{2}K (Enersign 2011)

Line losses for foundation 0.03 W/m^{2}K
Line losses for windows 0.033 W/m^{2}K (Enersign 2011)

Loadbearing internal wall

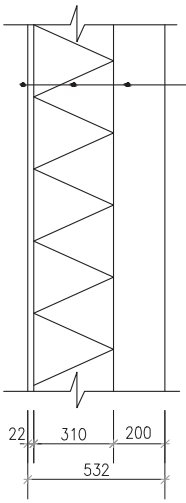
Interior finish	100 mm
Acoustic insulation	95 mm
Concrete	100 mm



[Illu.:82 Internal wall]

External non loadbearing wall

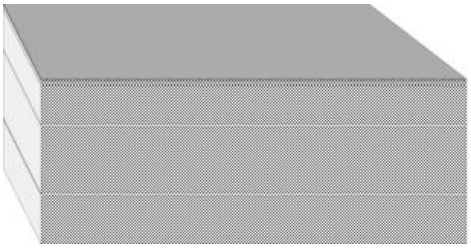
Interior finish	22 mm
Insulation	310 mm
Concrete	200 mm



[Illu.:83 External wall]

Construction name **Flat roof 2**

UP



Temperature	Outside	Inside
Ambient	20,00 °C	20,00 °C
Surface	20,00 °C	20,00 °C

The calculation of the surface temperatures is based on the U-value. For this reason they show the character of an average value for the whole surface. Local temperatures can deviate considerably.

DOWN

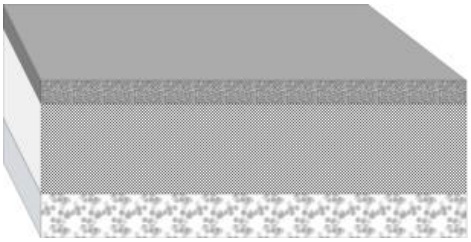
Construction type **Intermediate floor**

	Material	Thickness [m]	Lambda [$^{W}/_{mK}$]	R [$^{m^2K}/_{W}$]
R_{se}				0,100
1	Bitumen felt/sheet	0,010	0,230	0,043
2	PAROC ROB 80t	0,020	0,038	0,526
3	PAROC ROS 30g	0,180	0,036	5,000
4	PAROC ROS 30	0,300	0,036	8,333
5	Vapour barrier	0,003	0,330	0,009
6	concrete slab	0,220	0,740	0,297
R_{si}				0,100
		0,733		**14,410**

R = $\sum R_i$ = **14,210** $^{m^2K}/_{W}$ **R_T** = R_{si} + R + R_{se} = **14,410** $^{m^2K}/_{W}$ **U** = $^{1}/_{R_T}$ = **0,069** $^{W}/_{m^2K}$

Construction name **Ground floor**

INSIDE



Temperature	Outside	Inside
Ambient	1,00 °C	20,00 °C
Surface	1,00 °C	19,72 °C

The calculation of the surface temperatures is based on the U-value. For this reason they show the character of an average value for the whole surface. Local temperatures can deviate considerably.

GROUND

Construction type **Ground floor**

	Material	Thickness [m]	Lambda [$^{W}/_{mK}$]	R [$^{m^2K}/_{W}$]
R_{se}				0,000
1	Concrete, Reinforced (with 1% of steel)	0,100	2,300	0,043
2	PAROC GRS 20	0,400	0,035	11,429
3	Sand and gravel [1900 kg/m³]	0,200	2,000	0,100
R_{si}				0,170
		0,700		**11,742**

R = $\sum R_i$ = **11,572** $^{m^2K}/_{W}$ **R_T** = R_{si} + R + R_{se} = **11,742** $^{m^2K}/_{W}$ **U** = $^{1}/_{R_T}$ = **0,085** $^{W}/_{m^2K}$