SENTINEL IN THE HEART OF HELSINKI

By Myrup**Rahmberg**Kaae

ABSTRACT

This master thesis takes its basis in the open competition for a new central library situated on the water front at the Töölönlahti bay area in Helsinki.
The urban district consist of highly cultural and diverse buildings which the new library, consecutively with the expansion of the closeby park and dwellings, should interlink and form the new heart of Helsinki.

The project finds its starting point from the primordial instincts of the human and forms a clash between new and old. Conceptually, the building finds its footing in the depiction of the cave - a robust, protective sanctuary - that attract passing Finns from the adjacent plaza.

The interior forms a wide network of variating flows and creates a miniature society - a city in a city - where life unfolds between solid, sturdy volumes and the voids between them, giving life to squares, streets and niches. The library offers a creative milieu where users have the chance to be inspired, share and learn by others. It is a transformation of the traditionally library, that gives its users the right appurtenances to be an active producer in a vast and sharing community.

COLOPHON

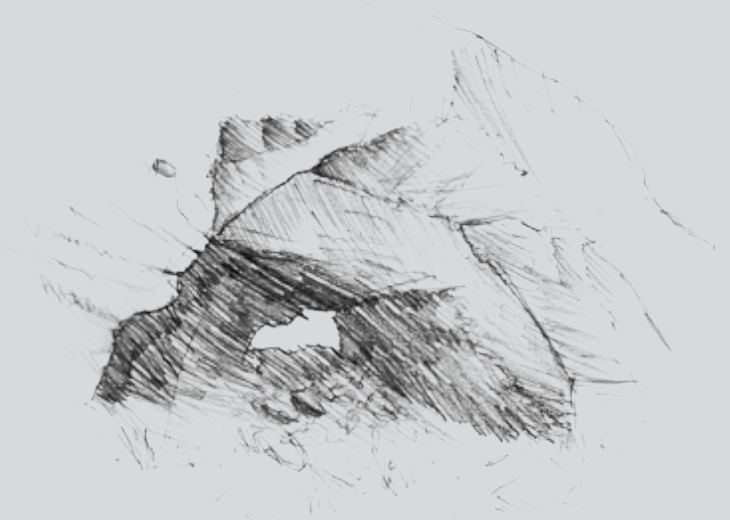

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Fig. 1.1 Sneak Peak

CONTENT

PROJECT OVERVIEW

INTRODUCTION

The thesis takes its basis in an open competition by the City Of Helsinki regarding a new city library. The project originated in the devolpment of the Kamppi-Töölölahti area in the 1990s.
The people of Helsinki proclaimed - through a public debate - the need for a new library to match the scale of the city; a place for culture and literature.

The Töölönlahti bay area accommodates the site for the centrally placed library. The area is currently under heavy development by cultural buildings, dwellings and an expansion of the large bay and park. The central library should be the heart of the area and create cohesion between the mixed buildings in the area.

The library breaks tradition and creates a combination of personal cultivation, culture and entertainment. A vivid and flexible meeting place; a place to learn, inspire and share.

These cultural activities culminates in a dynamic entity comprised by new technologies, library collections for all ages, stages, offices and clients. As a part of the digital age, technology becomes a great supplement to the physical form of literature. The new technology brings undreamt-of quantities of material, which can be integrated with the traditional library collection, without taking up vast amounts of squaremeters.

METHOD

INTEGRATED DESIGN PROCESS

The iterative work flow of the integrated design process (IDP) secures continuous interactions between research, experimentation and investigations; and is thereby an approach which generates the numerous design iterations required to make a sustainable project. IDP is therefore assessed as the suitable methodology for this project.

Program
Integrated design process by Mary Ann Knudstrup [Knudstrup; 2004] takes its offset in *Problem/Idea* that is the initiative description of a problem. The following *Analysis* contains a collection of empirical and phenomenological registrations.

The outcome of the program is a framework of design parameters, statements and aims for the following *Sketching* phase. The framework sets boundaries for the sketching in order to separate ideas for further developments. Different models, drawings and software programs are used to further evolve the concept.
A combination between the analysis and the competition demands results in a vision and project values.

Process
The essence of the sketching phase is to gain an evolved understanding of ideas and principles by evaluating them through drawings, models and simulations. From these evaluations, new knowledge emerges and thereby new iterations originates, which then again are evaluated. An idea has to go through an evolution of numerous iterations in order for it to fulfill all the requirements of a sustainable project. The result of the evolution is a final concept, which is the base of the following *Synthesis* phase.

During the *Synthesis* phase the project reaches its final expression. The final calculations and documentations are done during this phase, and the final adjustments are made.

Presentation
The final design is exhibited through various visual and written materials of posters and a report. Physical models also assist the oral *Presentation* as well as other media in order to make a point.

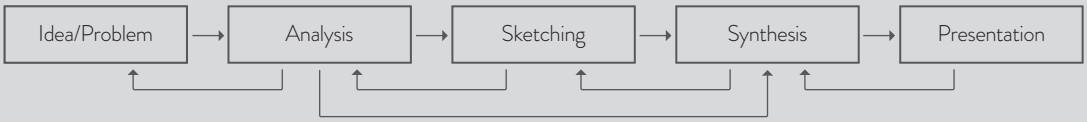


Fig. 1.2 *Integrated Design Process*

COMPETITION DEMANDS

THE HEART OF THE METROPOLIS

This project takes basis in the open international competition *The heart of the Metropolis* held by the City of Helsinki and is about the design of a new central library.

Metamorphosis
Today the library is in a transformation phase where the physical medias are losing their meaning. The library is not merely a facility dedicated to storage and distribution of books and other physical medias.
In pace with new technologies the physical media is beginning to compete with immaterial medias (the Internet). What is essential is the content, rather than the form.
This does create a challenge for the traditional library, as it is primarily senior elders who use it; it emphasizes the importance of the change that is about to happen and thereby gives the library importance to people of all ages.

The starting point for the central library is freedom, equality of the users, openness, self-initiative and self-development.
The ultimate purpose is to support peoples active citizenship and the skills it require, and give access to reliable information and recreation. The library should create an environment for learning, skills and personal cultivation.
This influences the traditional reading rooms which is still needed, but not in the same degree. The need for "half quiet" spaces for group work and meetings is gaining increaing popularity due to the need for networking and cooperation with external parties.

The vision for the city library is to create a catalyst for ideas and thoughts, and through sharing of knowledge, skills and stories to create a new civic society. The pledge of the library is to:

"[...] guide to the source of knowledge, stories and spiritual stimulation. The library offers, just like an excellent guidebook, poignant facts, enticing stories, inspiring ideas and building blocks for new experiences. The services are always served in a form that is easy to perceive and straightforwardly clear. For your very own needs and listening to you." [The Heart of the Metropolis, 2012, p. 13]

The clients' needs to create things themselves, to publish and participate, will increase. They will have the opportunity to change their roles from passive media users to content producers.

Dynamic Entity
The central library forms a combination of personal cultivation, entertainment and culture, creating a vibrant and versatile meeting place where the user is in focus. The library is more than a traditional library; it is a dynamic entity contained of the physical spaces themselves as well as technology, library collections, staff, cooperation partners and clients; it is especially important to make use of the benefits new technologies brings, giving the library new methods of exposing literature and information digitally.

Overall does the competition look for a central library, that:

- *Responds to the challenges set by the city scape-wise unique location, and adjust to the urban fabric and blocks of Töölönlahti*
- *Is high quality and timeless architecture*
- *Forms a symbolic and significant building that resonates with society as a whole and expresses the operational concepts of the building in an intriguing way*
- *Offers a functionally high-quality and technically and spatially flexible framework for cutting-edge and adaptable library operations*
- *Is eco-efficient*
- *Is technically feasible*

ROOM PROGRAMME

SPATIAL OVERVIEW

MAIN LOBBY
1150 m²

- *Lobby functions*
- *Public toilets*
- *Public services*
- *Meeting and lounge area*
- *Stage*
- *Pop-up info spots*

EVENT SPACES
1570 m²

- *Cinema*
- *Multi-purpose hall*
- *Furniture and stage prop storage*
- *Lobby areas*
- *Back stage*
- *Living laboratory*
- *Library exhibition space*
- *Rentable exhibition space*
- *Exhibition spaces, local storage points*

EXTERNAL SERVICE
840 m²

- *Café*
- *Restaurant*
- *Public sauna*
- *Bookstore*

COLLECTION AREA
2780 m²

- *Library collections area*
- *Fixed client-service point*
- *Interactive spaces*
- *Lounges, oases*
- *Quiet areas*

LEARNING & DOING
2040 m²

- *Children's World*
- *Workrooms [for visitors]*
- *Personal office area [for visitors]*
- *Music recording and video studio*
- *Digital-physical workshop, fab lab*
- *Listening, viewing and games room*
- *Teaching, group work and meeting spaces*

STAFF FACILITIES
430 m²

- *Office facilities*
- *Staff lounge*
- *Changing and washrooms*
- *WC's*

LIBRARY LOGISTICS
480 m²

- *Library collections storage*
- *Returns automate room*
- *Library material handling*

SERVICE SPACES
710 m²

- *IT and other equipment areas*
- *Building managements monitoring*
- *Server room*
- *Cleaning facilities*
- *Building maintenance store*
- *Service and loading area*
- *Distribution substation*
- *Technical spaces*

Fig. 1.3 *Room Program*

PROGRAM
TÖÖLÖNLAHTI, HELSINKI

Fig. 1.4 Toolonlahti

FINLAND

THE LAND OF A THOUSAND LAKES

Finland is the Nordic country located most to the east, bordered by Russia and Estonia to the east and Norway and Sweden to the west. After almost 700 years as a Swedish colony and the following 100 years as an autonomous part of the Russian Empire, it could declare its independence as a sovereign nation in 1917. The massive foreign influence is still evident in Finland's culture and architecture.

Landscapes and their unique features is important to the Finnish culture. All larger cities are situated in the southern part and along the coastline, leaving the main part of the country deserted in beautiful nature scenes. Water is a dominating element in the country's nature.

European Roads

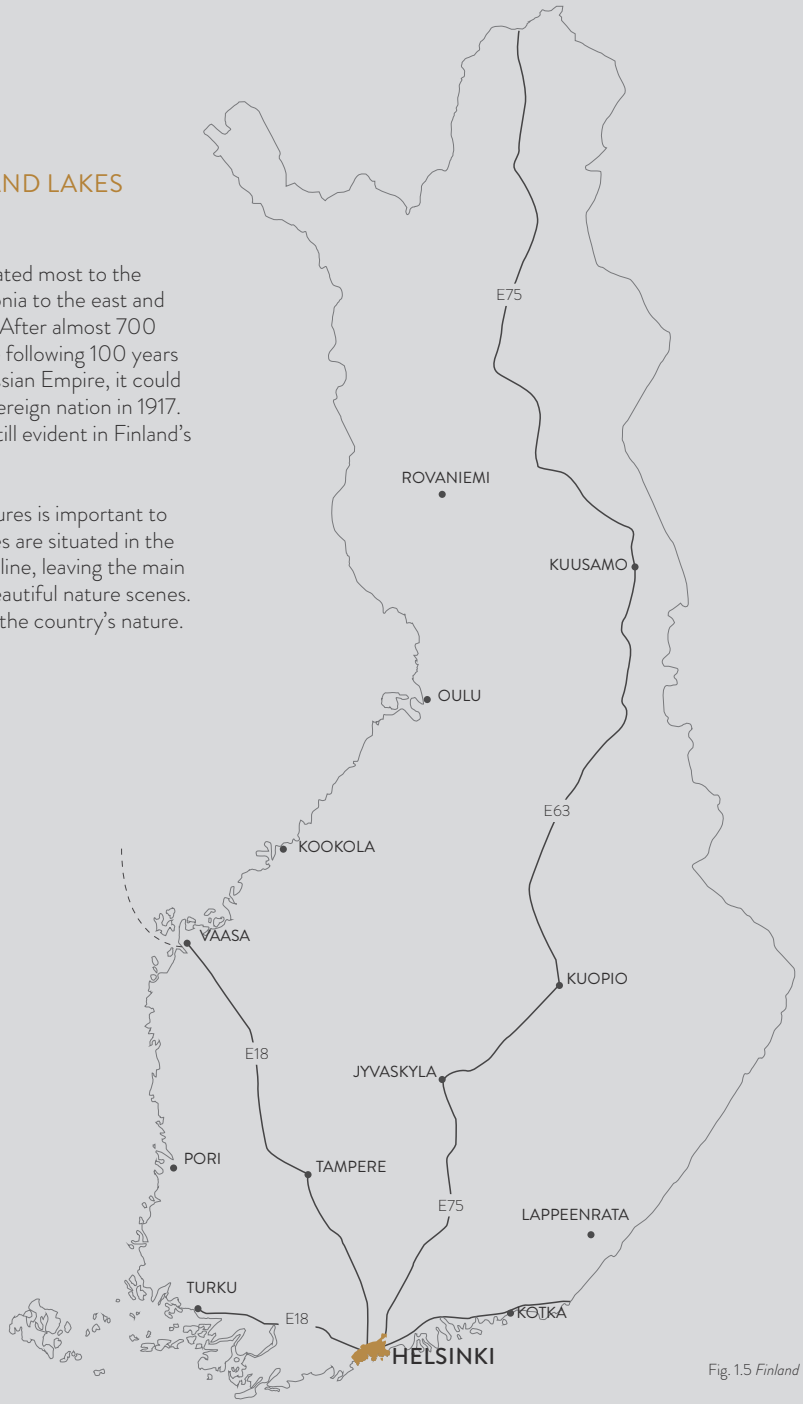


Fig. 1.5 *Finland*

180 000

180,000 LAKES & ISLANDS
The large amount of lakes and islands have given Finland the nickname *Land of a Thousand Lakes*

2.2 mio.

2.2 MILLIONS SAUNAS
Finland is famous for its excessive use of Saunas. Their love for the sauna can be compared to the Brits love for a pint

5.4 mio.

POPULATION
Even though the country area is a total of 338,424 km^2 the total population is only 5,421,827

16 pers/km^2

POPULATION DENSITY
With 16 persons pr. square kilometer, the population density in Finland is one of the lowest in Europe

HELSINKI

The Russian and Swedish rule have put their mark on the city; from cuisine, design, customs and of course the architecture.
In between the jugend characterized buildings, green areas infiltrates the city landscape, creating places for sports, outdoor activities and relaxation. This can be seen in the Central Park and a number of forests situated just outside of the city centre. In total the green areas covers one third of Helsinki.

Orbital road
Arterial road

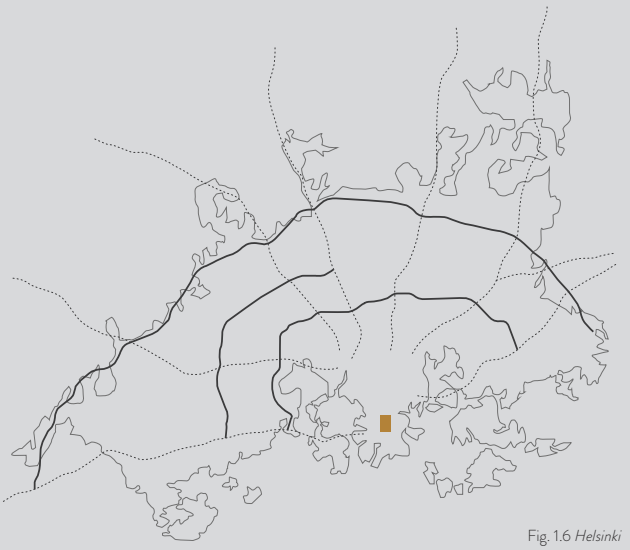


Fig. 1.6 *Helsinki*

600 thousand

POPULATION
The accurate population is 604,380 and a metropolitan population of 1,358,901

1/3

GREEN AREAS
Helsinki consists of great possibilities for relaxation as green outdoors covers one third of the metropolis

TÖÖLÖNLAHTI

The Töölönlahti area is currently going through a large change from an industrial area into an extension of the green oasis in coherence with newly built artificial lakes. The unique context of Töölönlahti features a great diversity and the close contact to every part of the capital truely makes it the heart of the city.

Main road
Site area

1. Finlandia Hall
2. Parliment House
3. Helsinki Music Centre
4. Kiasma Contempory Art Museum
5. Sanomatalo Media House
6. Helsinki Central Station

Fig. 1.7 *Töölönlahti*

MAPPING TÖÖLÖNLAHTI

DISTRICTS AND INFRASTRUCTURE

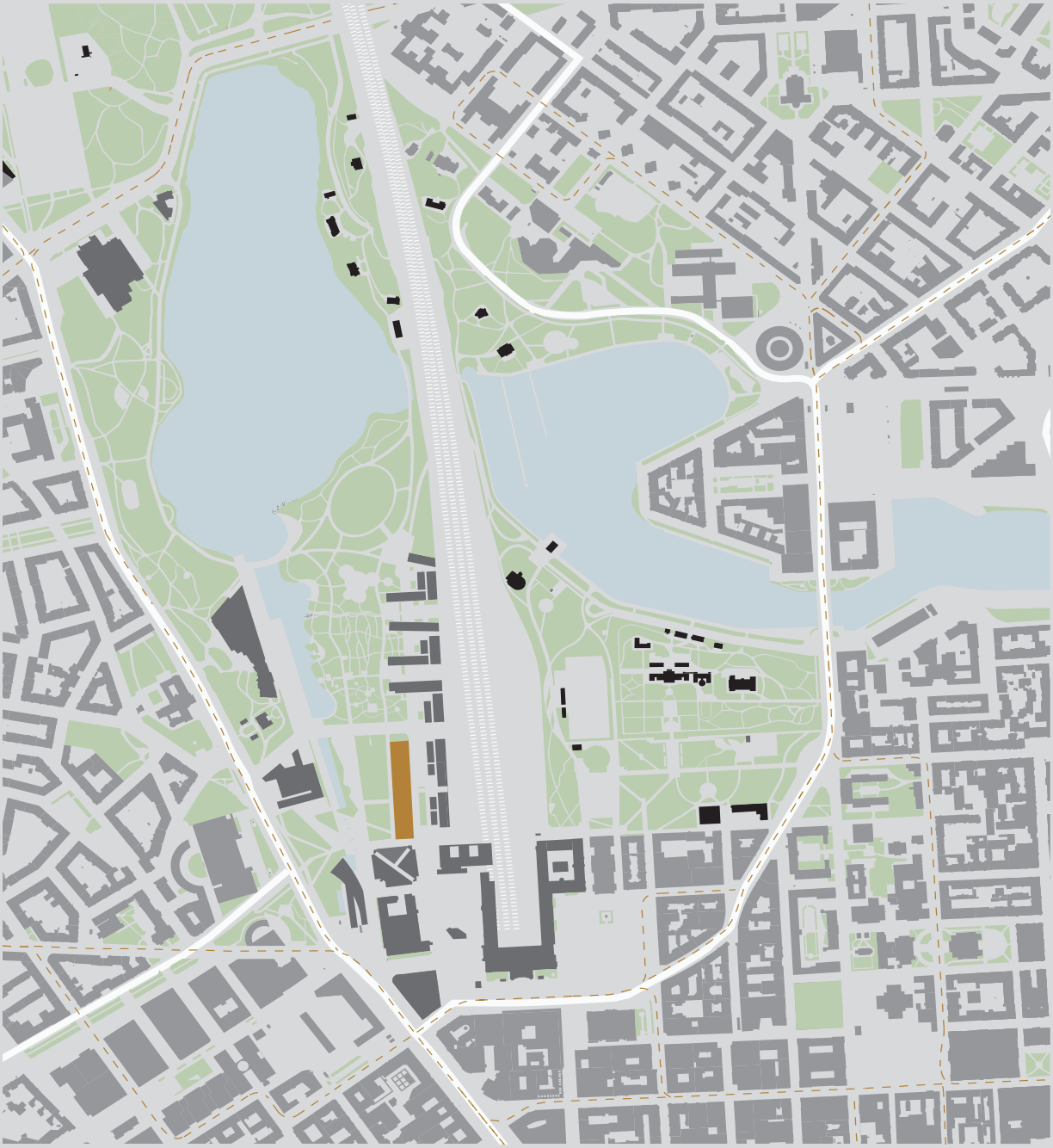


Fig. 1.8 *Districts*

INFRASTRUCTURE

The flow around the city is either by bus, metro or tramcar, and is divided in local and national transport. Tramcars is the main public transport around the city topside, where the metro is subterranean. The main road to the site is Mannerheimintie, which is west of the Töölönlahti. Carparking will be situated in a nearby parking facility.
The site is situated in a low paced area primarily accessible by foot or bicycle. The primary access way is due south in connection with the city centre.

TRAIN

MAIN ROAD

TRAM TRACKS

DISTRICTS

The map is based on the future master plan for the Töölölanlahti bay area and shows how a green wedge will continue from the north of the site area and create a barrier to the train station located south east of the building site. The site is surrounded by parkland and close to water (Töölönlahti Lake). The dense dwelling and commerce area surrounding the park makes this the most visited green spot in Helsinki. The city centre primarily consists of dense city living and shops.

DENSE CITY LIVING & SHOPS

PARKLAND MIXED WITH LARGE SCALE BUILDINGS

INDUSTRIAL AREA

GREEN AREAS

LOCATION

TÖÖLÖNLAHTI

In recent years a lot of resources have been spent to make this area The Heart of Helsinki. The capitals vision of Töölönlahti park is to have a calm oasis for socializing and recreational activities. Water from the existing lake will extend into the city landscape.

Officially, Töölönlahti is a park in the Taka-Töölö districts that occupies the western peninsula. These areas have in common that they are all a part of the Helsinki centre and all desired neighborhoods for the upper class. Töönlahti park is named after the big lake and is a gathering point for citizens, because of its different qualities.

C.L. Engel planned the capital centre in a traditional grid system - known from Barcelona and Manhatten - which is evident in the aerial view of the city. The site is a central point for all infrastructure in Helsinki and most noticeable is the train travelers extraordinary view towards the site when arriving. The passengers very first impression with Helsinki is from Töölönlahti park.

Dimensions of the Site
The building site is 150 meter long and 30 meter wide. According to the competition demands the building may reach a maximum height of 25 meter.

Fig. 1.9 *Kiasma Contempory Art Museum*

Fig. 1.10 *Töölönlahti Lake*

Fig. 1.11 *Termial of Helsinki Train Station*

Fig. 1.12 *Aerial view of Toolonlahti*

Fig. 1.13 *West view of Toolonlahti Bay Area*

Fig. 1.14 *Töölönlahti Bay Area*

NEIGHBOURING BUILDINGS

DIVERSE EXPRESSION

The competition states that the new library should link the existing and future planned buildings together and be the new heart of the area. Through these investigations, of the neighboring buildings, an understanding of style and expression is needed to create coherence.

The Töölönlahti bay area represents a great variety of architectural styles and showcases the architectural progress from new to old.

1 *Helsinki Central Station*

2 *Sanomatalo*

3 *Kiasma Contemporary Art Museum*

4 *Helsinki Music Centre*

5 *Finlandia Hall*

6 *Parliament House*

Fig. 1.15 *Helsinki Train Station*

Helsinki Central Station is the focal point for public transportation in Helsinki and considered a great landmark in the city. The building is clad with Finnish granite and has distinguished features such as the clock tower and statues.

Sanomatalo is a 12 floor commercial and office building designed by Jan Söderlund. It was one of the first glass buildings in Helsinki.

Kiasma is a contemporary art museum by the architect Steven Holl. The building is a soft curved rectangle with a zinc interior combined with red wood and large areas of glass.

Helsinki Music Centre is a concert hall, with a simple exterior and more varied and dramatic interior. It is designed by the three architects Marko Kivistö, Ola Laiho and Mikko Pulkkinen.

Fig. 1.16 *Kiasma Contemporary Art Museum*

Fig. 1.17 *Helsinki Music Centre*

Finlandia Hall is a concert hall with a congress wing. The building is designed by Alvar Aalto in 1971 and is a good example of his *white architecture*.

Parliament House is the seat of the Parliament of Finland, designed by Johan Sigfrid Sirén. The architecture style combines neoclassicism with early twentieth century modernism. The primary characteristics are the simplified columns and balusters.

The many significant buildings near the site, all function as landmarks and hold great national importance for the people. It is a challenging task to create a new contemporary building that speaks the language of the many and pays respect to the existing buildings and surroundings. It makes room for many architectural expressions and does not offer a profound style to follow in the devolpment of the new library.

Fig. 1.20 *Hakasalmen Huvila*

Fig. 1.18 *Sanomatalo*

Fig. 1.19 *Parliament House*

Fig. 1.21 *Finlandia Hall*

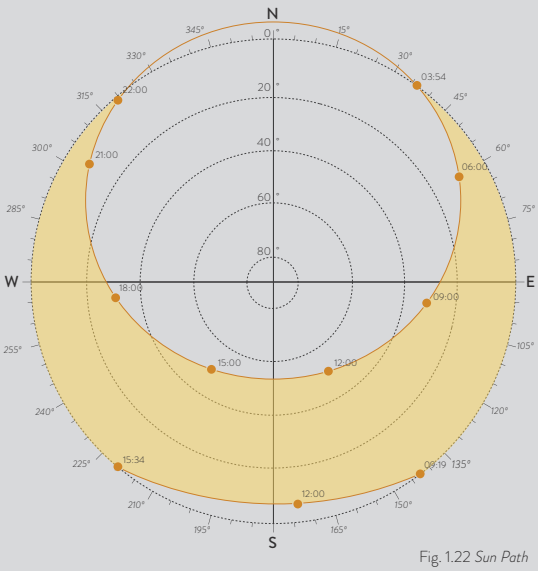


Fig. 1.22 *Sun Path*

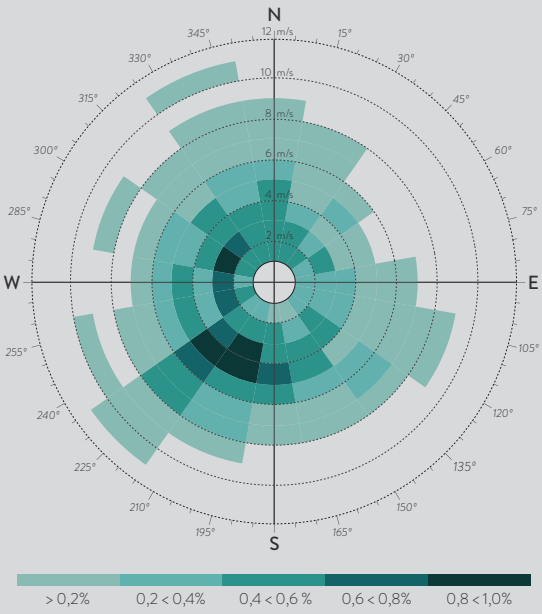


Fig. 1.23 *Wind Rose*

CLIMATIC REGISTRATIONS

TÖÖLÖNLAHTI

Shadow Studies

From an aerial view is it visible that the site is primarily covered in long shadows from the Sanomatalo building during winter. This is a result from the suns low altitude during this season of the year. During equinox, only the southern end of the site is exposed to shadow from the earlier mentioned building. The eastern buildings have minimal impact on the site.

In the summer time, the impact from the surrounding buildings are minimal.

Wind

Data from the wind rose shows a fluctuating wind in every direction, but with a prevailing wind direction from southwest. The high density of buildings protects the site from the dominant winds.

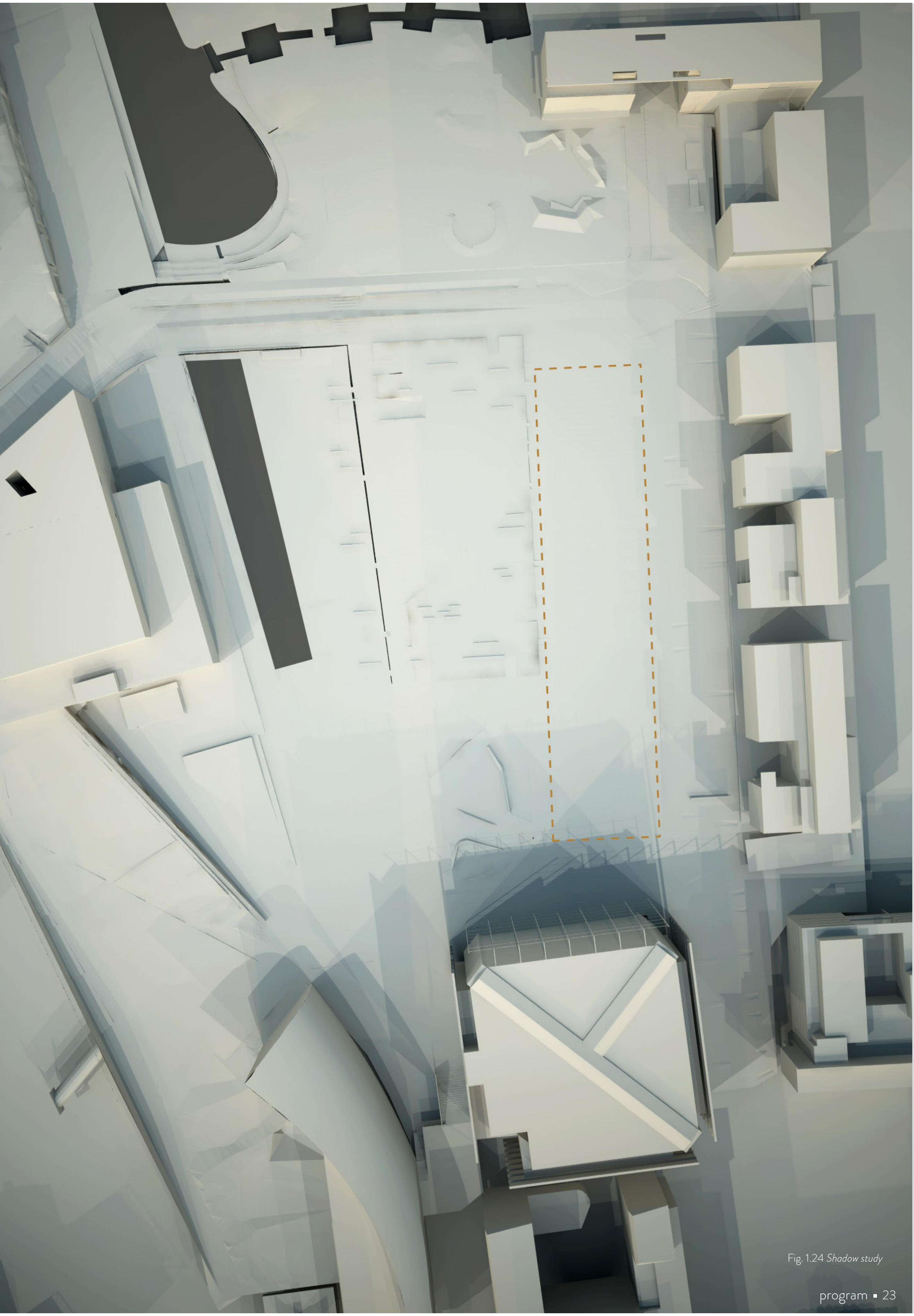


Fig. 1.24 *Shadow study*

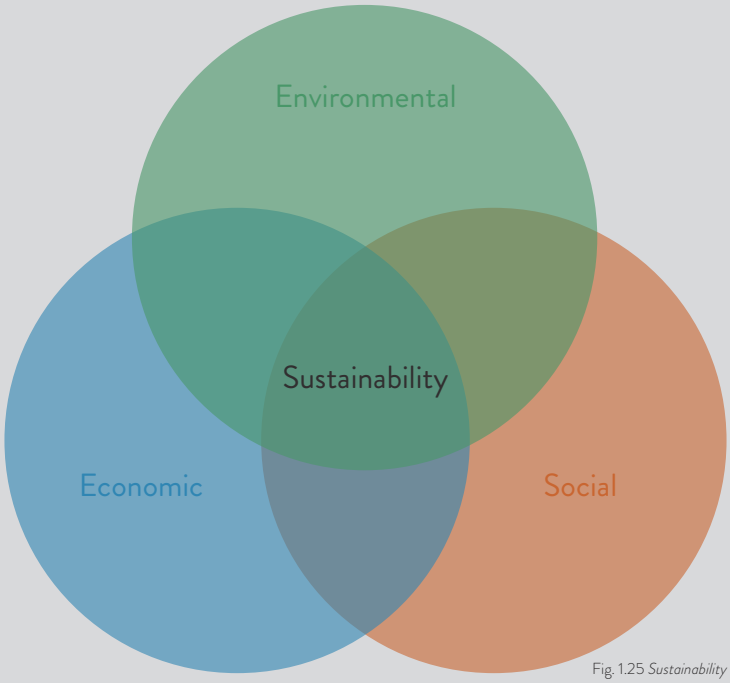


Fig. 1.25 *Sustainability*

SUSTAINABILITY

ARCHITECTURE ♥ ENVIRONMENT

Sustainable architecture strives to find solutions with the least destructive impact on the World's ecosystem. Today, half of the World's energy consumption is used for lighting, heating, cooling and ventilating buildings. Therefore, the building industry is challenged with a great responsibility to embrace the paradigm of sustainability to the mainstream philosophy of architecture and engineering.

In a holistic approach, the term sustainability only exists when there is harmony between the environmental, social and economical aspects. Any renewable building solution must fit the given social and economical context in order to give people incentive to invest in it.

Socio-Environmental Sustainable
The report covers both the environmental and social aspect, but due to the lack of knowledge and experience it leaves the economical aspect out of account. The assignment covers technical and renewable solutions to the degree of showcasing chosen solutions as well as calculations concerning them. It takes the social context of Helsinki and the competition into all considerations during the design process.

Key words

Environmental-Economic
Resource efficiency
Green energy
Improved technology

Socio-Economic
Job creation
Skills enhancement
Local economic impact
Business Ethics

Socio-Environmental
Environmental justice
Health and safety
Climate change
Environmental regulations

COMPETITION DEMANDS

Environmental - Competition Demands
The competition states an objective of a nearly zero-energy building and the energy performance is measured as the total annual primary energy use of the building (E-value). It further states that calculations of the energy performance, must be in accordance with *SRMk D3* of the *Finnish Building Regulation*. The library belongs to *Class 4* of commercial buildings.

The target E-value of the Central Library is a maximum of 180 kWh/m^2

Environmental - Indoor Environment
As a minimum the library must have a good indoor environment in agreement with *Category 2 of Indoor Environment of 2008*. The most important target values are: the thermal requirement in all spaces must be at a maximum temperature of +25 ºC during summer. The CO_2 level must be a maximum of 900 ppm, which includes 400 ppm outdoor concentration.

Environmental - Material Efficiency
The objective is to avoid unfavorable impact on the environment, but never to compromise with the architectural quality. The competition states the wish for calculations in agreement with the carbon footprint of acquisition, production and renewal of raw building materials over the next 150 years, but the report will only include superficial assumptions - if any - on this subject.

Social
Modern libraries have evolved from being a storage and distribution of books, to a forum of learning, working, entertainment and leisure. The clientele vary to an amount where it is nearly impossible to separate target groups from the rest of the population. This means that an continuously increasing need for more and new medias is developed. Furthermore the library must fit the current and future digital age, where much activity exists in cyberspace and many features are accessible from outside the libraries. The social development within libraries are discussed more comprehensively in the paragraph *From Storage to Culture House*.

Fig. 1.26 *Rock Church*

FINNISH ARCHITECTURE

NATURAL MATERIALS & UNCLUTTERED LINES

To get a better understanding of the Finnish culture, architecture and traditions, a brief investigation of these are performed. This will be a helping hand in the development of this project in terms of building techniques, finesse and aesthetics.

Finland has since the 1920s embraced the tradition of modernity and applied it with naturalness – transforming it into harmony with its landscape, geology, climate and light.

The inter-war period's functionalism became popular in the Nordic countries and especially in Finland, where Alvar Aalto was part of the development of the *White Architecture's* expression. One of the distinct features of this style is a more free interpretation of the openings in the facade. The building complex was formed in a free composition reflecting the functions and used horizontal window bands. Finlandia Hall is one of Aaltos most famous buildings, which is a neighboring building to the building site of this project.

The majority of the buildings in Finland are newly built and only 10% remains from the time before the declaration of independence in 1917. The architecture of Finland today can be characterized by the use of natural materials and uncluttered lines.

Fig. 1.27 *Bagsværd Church*

NORDIC TRADITIONS

THE SPIRIT OF THE SITE

The style of Nordic architecture originates from functionalism and developed into Nordic modernism that dominated the Nordic countries' architecture namely in the 1950's and 1960's. The rare ability to capture the essence of the genius loci has made Nordic architecture different to the rest of the world.
What defines the special spirit of the North is a sense of clarity, genuine materials and a unique awareness of light.

Form, Construction and Materials
The form is minimalistic and generally has simple geometries. Often inspired from modernism and houses of namely Le Corbusiers. The same simplicity and honesty is evident in construction methods, which makes it easy to perceive.
The traditional usage of materials are mainly wood, glass, sand and stone from local regions. This direct linkage to the context by authentic materials provides presence and honesty to the buildings.

Nordic Light and Nature
Light and nature have great influence on the spatial perception humans have. Bagsværd church (Jørn Utzon) gives a lucid case, where the extraordinary lighting derives from the curved ceiling. Utzon stayed true to the traditional Danish village church by whitewashing the concrete vault in chalk. The organic shaping was inspired by clouds and makes the ceiling reflect daylight into the room through openings facing north. Interiors are made from wood; one of the most popular materials in Nordic architecture. Other strong advocates of this philosophy is Alvar Aalto and Gunnar Asplund.

THE LIBRARY

FROM STORAGE TO CULTURE HOUSE

Libraries must adapt to the development of the digital era, in order to maintain its importance in the world. As information technology is experiencing its golden age, everything surrounding it evolves equally fast: e-books, social medias, reading habits, public forums, etc. It is difficult to predict every single aspect of this development, but none the less necessary to rethink the roll of libraries in the future.

From Connection to Collection

Initially libraries were storage houses of valuable collectible books only accessible for the upper class. Books were handwritten rarities that were chained to bookcases and sorted into categories, meaning that the readers interests and passions was reflected from where the reader sat. Libraries have since then matured into a value-free forum for any citizen. This development have flourished since the democratic revolution of the Age of Enlightenment, when the *Open Access* would let anyone borrow books despite gender or status.

The Identity of Libraries - A Symbol of Freedom

Libraries have persisted as one of the last sanctuaries in society, because the core values have survived. Libraries honour peoples *Right to Know*, which in essence means that it must be independent, value-free and without hierarchy. Everything must be free of charge and there must rule an atmosphere of respect and moderate behavior.

"A quiet haven in a sea of urban noise"
[Greenhalgh, Worpole and Landry, 1995, p. 51]

A Culture House

This evolution is visible both in the basic concept of the library, but also on the interior design. The stringent layout with book shelves is fading out and opening up for a more spacious and flexible plan. A part of the adjustable plan design is the separation into zones. The zones can be categorized into three different moods: quick, service and immersion.
The quick zone is in coherence with the entrance and will mainly be used by people with small errands or pick ups and book reservation. In the service zone it is possible to get help finding material but also reserve work rooms. In the immersion zone, one can find the peace and tranquility needed to concentrate on academic or personal interests. The zone division will also help to focus on the different user groups according to their learning ability.

The flexible plan makes it possible to adjust the activities to the current user group. This is visible in Seattle public library by Rem Koolhaas, where the top floor original was designed to have book shelves.

The Seattle library was also the start of the new era of library buildings, which where a combination of experimental interior layout and have the wish of being seen and remembered, e.g. the black diamond (by SHL) in Copenhagen, Sendai Médiathéque (by Toyo Ito) in Sendai and Aberdeen University library (by SHL) in Aberdeen.

Fig. 1.28 *Main Branch, Seattle Central Library*

Fig. 1.29 *Sendai Médiathèque*

VISION

A central library combining personal cultivation, culture and entertainment. Transforming the traditional library into a dynamic entity supplying medias of the past, present and future.

Input
The Internet makes it easy and fast to trade information, and as a result of this, people are becoming more prone to share and eager to learn. The overwhelming activity evident on social medias speaks a clear language of a rapid development to further dissolve our private sphere. The next step must be to embrace this, and give visitors the possibility to give knowledge back to the library and other visitors.

Renaissance
Collection

The Age of Enlightenment
Collection + Lending

19th to 20th Century
Collection + Lending + Activities

Ending of 20th Century
Collection + Lending + Activities + Digitization

21st Century
Collection + Lending + Activities + Digitization + **Input**

VALUES

NATURE

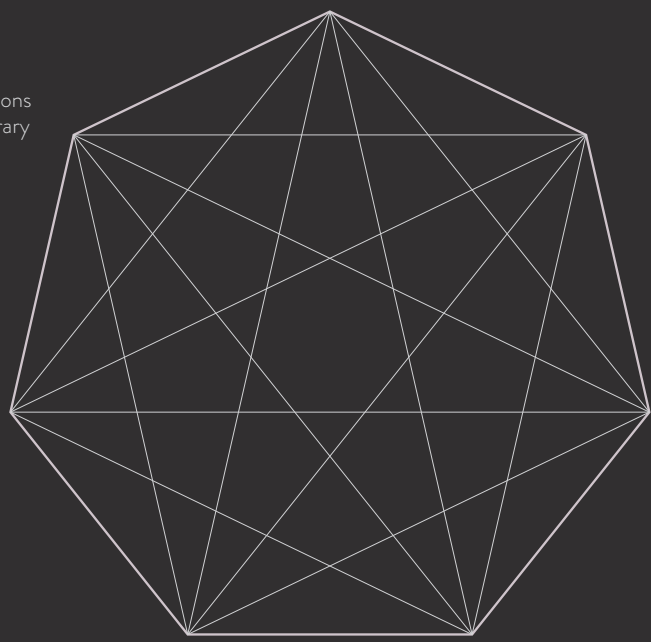
A core value in the Finnish culture is the untouched environment that gives the country its scenic landscapes

DYNAMIC ENTITY

A term where many diverse functions coexists in harmony within the library

SUSTAINABILITY

Socio-Environmental



INPUT

A milieu where citizens have the opportunity to share their competences, knowledge and broaden their horizon through others

LIGHT

Light plays an essential role in the design of the architectural environment

THE THIRD PLACE

Described by Ray Oldenburg, the *Third Place* is informal meeting places and social havens.

LOW ENERGY

Class 4 - Commercial Buildings:
Energy performance Danish building standard 2015

Class 2 - Indoor Environment:
Hours >26°C: 100h
Hours >27°C: 25h
CO_2 pollution of 900 ppm
(400 ppm outside)

Fig. 1.30 *Values*

CONCEPT

Humans have a natural curiosity to explore and perceive. How they move and understand spaces varies from one person to another. The statement is that architecture will always come in short when predicting spaces for unpredictable people. Instead we propose a network of transformative spaces that allows for a dynamic interaction between architecture and humans.

There is huge potential in the connection between this unpredictable behavior and the most primordial type of refuge – the cave. A cave inhabits undefined functions in a non-organized layout, which had ancient humans retreat to it, adapt to its means to find their own space.
In order to awaken this curiosity generated by the humans instinct, the concept is a modern abstraction of the primordial cave, which maintains the framework of fluent spaces in a non-linear sequence.

THE CAVE
PRIMITIVE, YET VISIONARY

Fig. 1.31

PRINCIPLES

Fig. 1.32 *Principles*

Fig. 1.33

PRIMORDIAL NEEDS

DESIGN PARAMETERS

The three most primitive preconditions of life - Refuge, Water and Light - are elements found in nature long before architecture began. They each hold great qualities and the wish is to gather a broad audience around these basic needs.

Refuge Requires Reason

The meaning of refuge is to physically and mentally retreat into a safe environment. In primordial times humans took refuge from the dangers in nature to survive, but today our refuge has rather become a matter of achieving mental solitude. Modern refuges are the sanctuaries away from a busy life. Ray Oldenburg calls this *The Third Place*; an informal meeting place away from work and home [Oldenburg; 1989]. Oldenburg argues that *Third Places* are anchors in our community. Here creative interaction evolves because the presence of occupants are controlled by their desires and not obligation.

The Element of Life

Water is maybe the most powerful determinant in the aesthetically experience of any space, because of its appeal to everyone. Writings by Roger Ulrich narrates the significantly positive effect, elements of natural environments have on people; and in particular water. [Ulrich; 1984]. The sound is calming, the feel is sensual and the shapes are attractive.
As a tenth of Finland is covered by water, it is an inevitable part of Finnish identity, and thereby a vital part when gathering this nation.

Light

Good daylight is important when humans need to feel comfortable. A luxmeter can to some degree tell us if a room receives enough daylight for a given function, but architecture demands more than merely an empirical approach when designing a room. Light and darkness are bound together like chaos and cosmos, and the beauty of a space evolves from the poetic formations shaped between the two. It addresses our body and mind, and it evokes feelings and our perception of a room.

> *"I sense light as the giver of all presences, and material as spent light. What is made by light casts a shadow, and the shadow belongs to light." Louis Kahn*

The direct sun light from cave openings are dramatic and scenic. The ever changing light reveals different parts of the arbitrary geometry. Some parts never gets lit, but is a indispensable part of the caverns mystery.

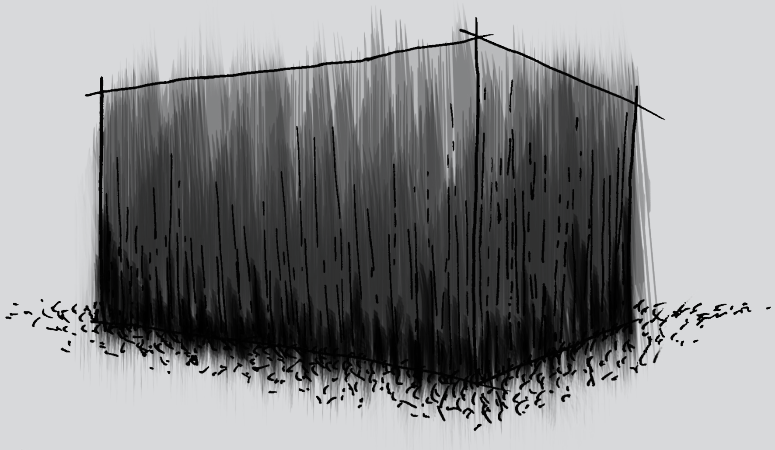


Fig. 1.34 *Force of Gravity*

FORCE OF GRAVITY

INITIATING FORM STUDIES

The concept appear as a massive, closed rectangular figure, which gives the building character, substance and gravity. From this boulder, diverse sized pieces are excavated from its mass, creating openings and inner volume.

To emphasize the buildings vastness it meets flat with the ground, as if it rises from the ground. At the entrance a culmination of all three primordial needs appear and will later appear separate or in combination as you move through the building.

The figures processing have been inspired by the Japanese architect, Sou Fujimotos, and his design of The Final Wooden House.

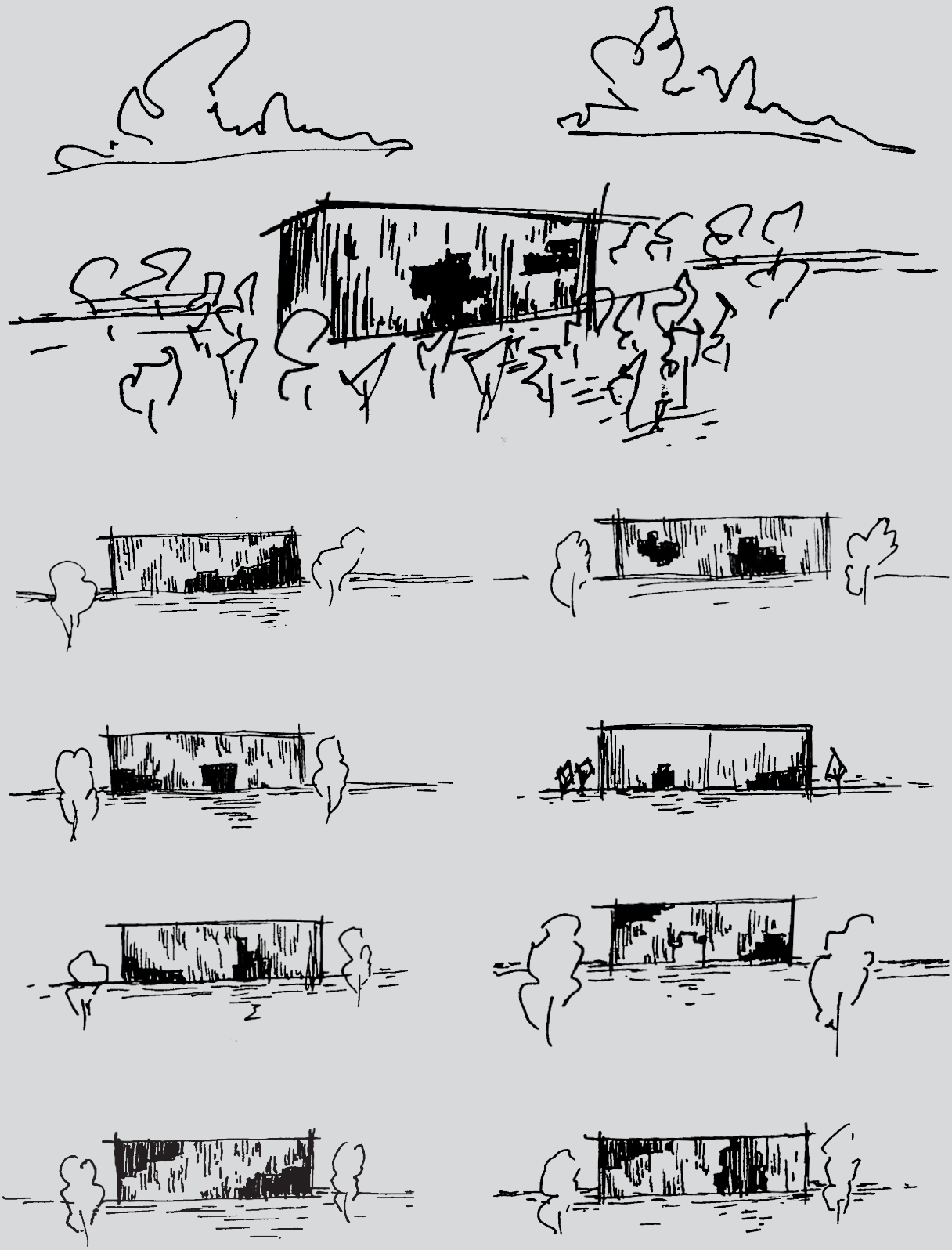
FINAL WOODEN HOUSE

BY SOU FUJIMOTO

The final wooden house is a small bungalow made entirely from large, oversized timber beams. Each beam compose as floor, wall and ceiling which creates a large cohesive structure. In the void between the timber, small pockets of space appears which usability can be interpreted by the user.

The principle behind this design, its sense of gravity and spatial qualities have been an inspiration for the progression of the inner volumes and establishment of openings in the project.

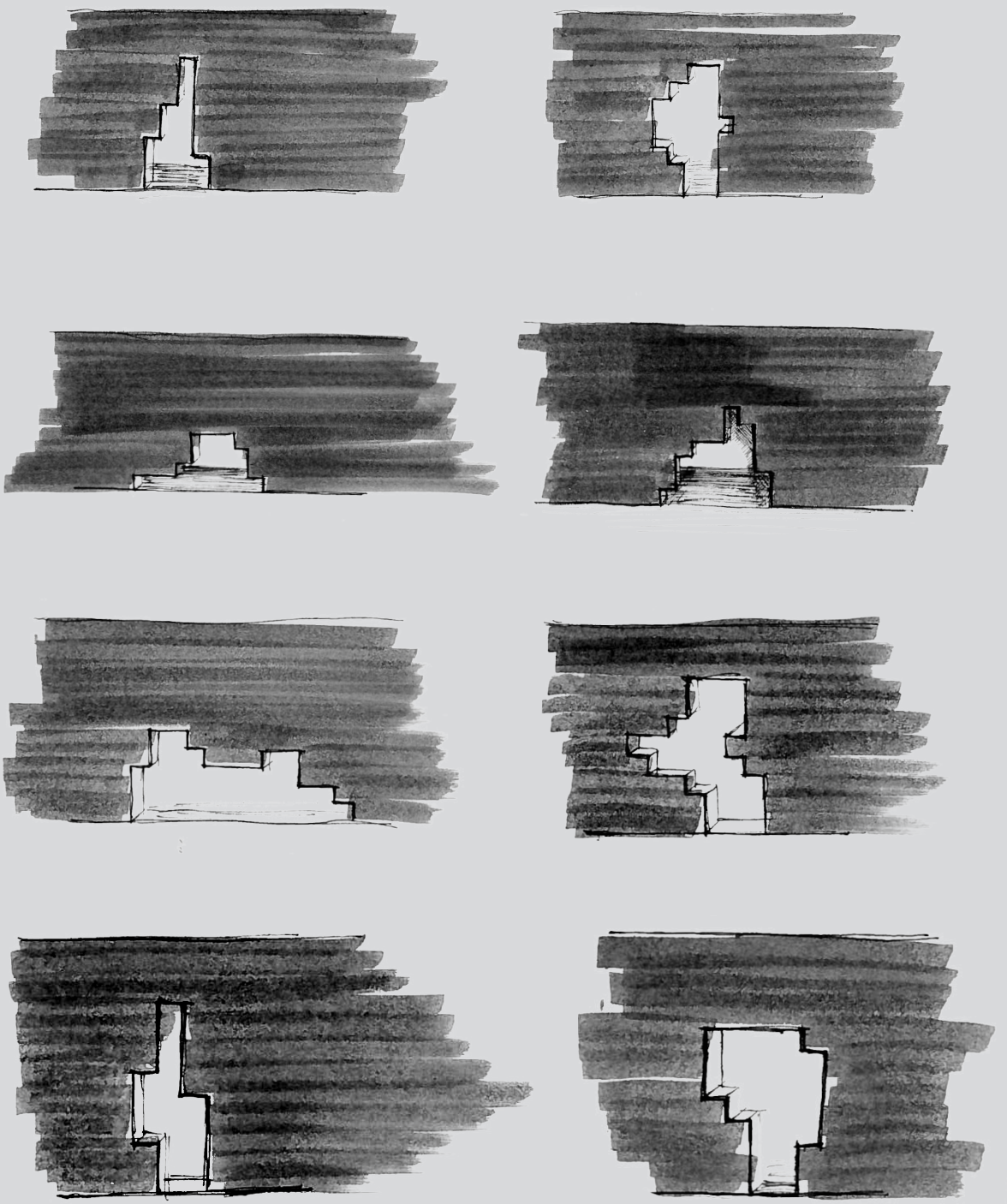
Fig. 1.35 *Final Wooden House*



ABSTRACT FROM INITIATING SKETCHING PROCES

Destroying the solid

Fig. 1.36 *Sketches*



ABSTRACT FROM INITIATING SKETCHING PROCES
Arrival

Fig. 1.37 *Sketches*

Fig. 1.38 *Salk Institue*

WATER

GUIDING ABILITY

The immediate appeal and familiarity have made architecture and water partners for life. Occasionally the water speaks of the poetry arising when nature meets culture.

A narrow strip of water enhances the symmetry of the Salk Institute and guides the orientation towards the Pacific Ocean. Louis Kahns elegant use of water adds presence to the space between the monumental buildings. The approach is simple but powerful.
It is natural to link the building to Töölönlahti bay area through water. Besides guiding, water is extremely diverse in function and expression.

WATERFALL

ROARING POWERS

Mother Nature is the best artist as seen on Icelands Seljalnadsfoss. A constant stream of roaring water stages the intimidating strength of the natural element.

The following process seeks to make way for water to affect all of our senses. Examinations revolve around shape and flow of the water in order to take advantage of the transition water has as being both raging, subtle and everything in between.

Fig. 1.39

Fig. 1.40 Can Lis

LIGHT

ILLUMINATING MATERIALS

Under the right circumstances light has a powerful and almost overwhelming effect. Other times, the physical boundaries lets the light tell subtle stories of materials.

Nordic architectural traditions are famous for the awareness of light, and especially the reflective light from north. More rarely - but successfully - some architects manages to use the qualities of direct sun light, as seen in Jørn Utzons residence in Mallorca, Can Lis, where sunlight beautifully exposes the rough texture of the sandstone wall. Light needs to enter dark surrounding for it to have this particular effect. Still in touch with Nordic traditions, the agenda is to use the direct sun light to display the sturdy materials found in Finland.
Another part of the light strategy is to stage the fascinating light phenomenons found from the creeks and openings in caves.

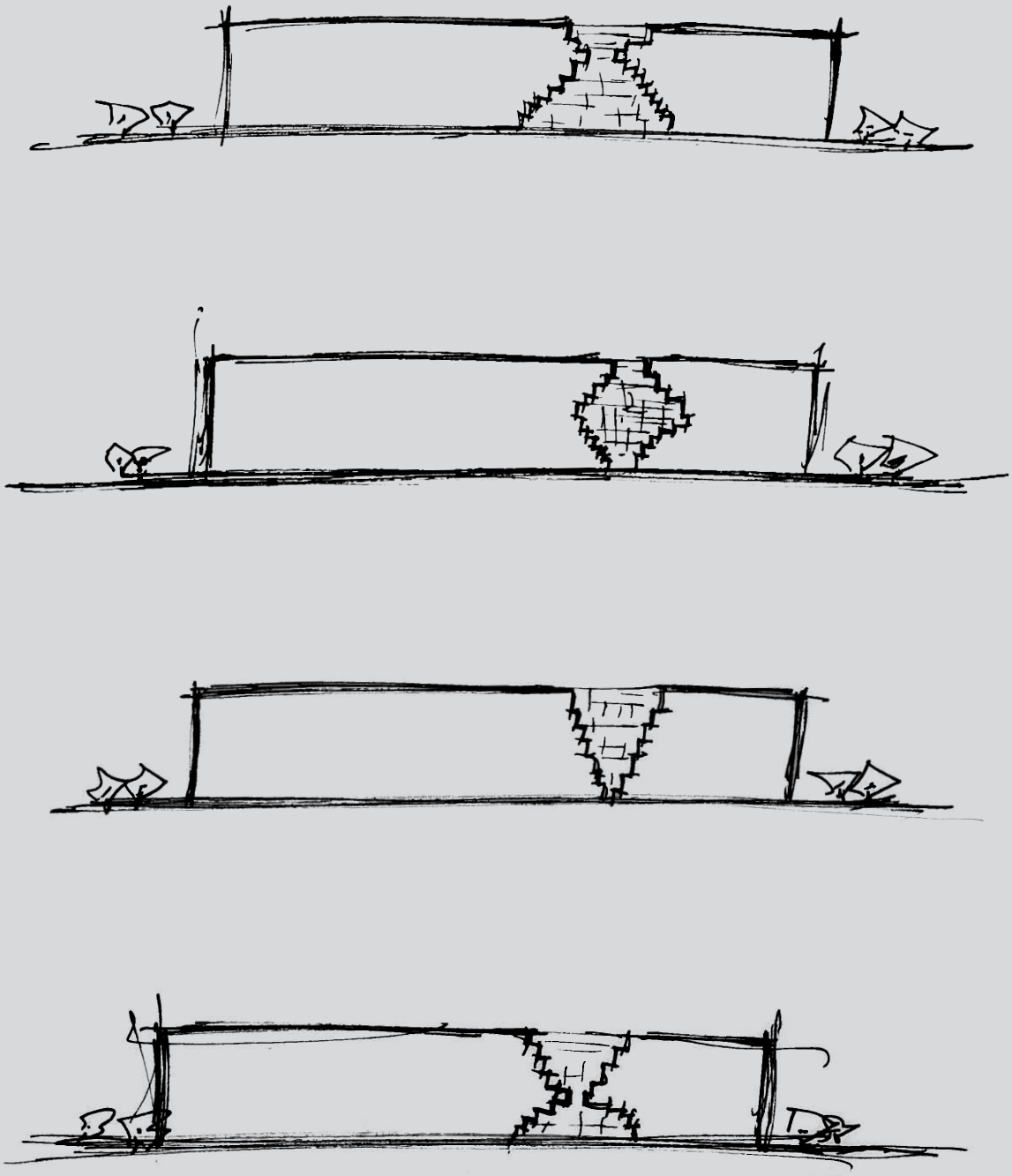
PICTURESQUE

IN THE SPOT LIGHT

Direct sun light immediately turns into a volume when entering the emptiness of caves. The human gives a sense of the enormous scale of this breathtaking phenomenon captured by Stephen Alvarez on his world wide travels.

The image shows how the cave expands underneath the hole and marks the lights direction. What causes this picturesque effect is the relationship between the concave interior space and the opening. The focal points on the following form studies seek to find this balance to imitate this effect.

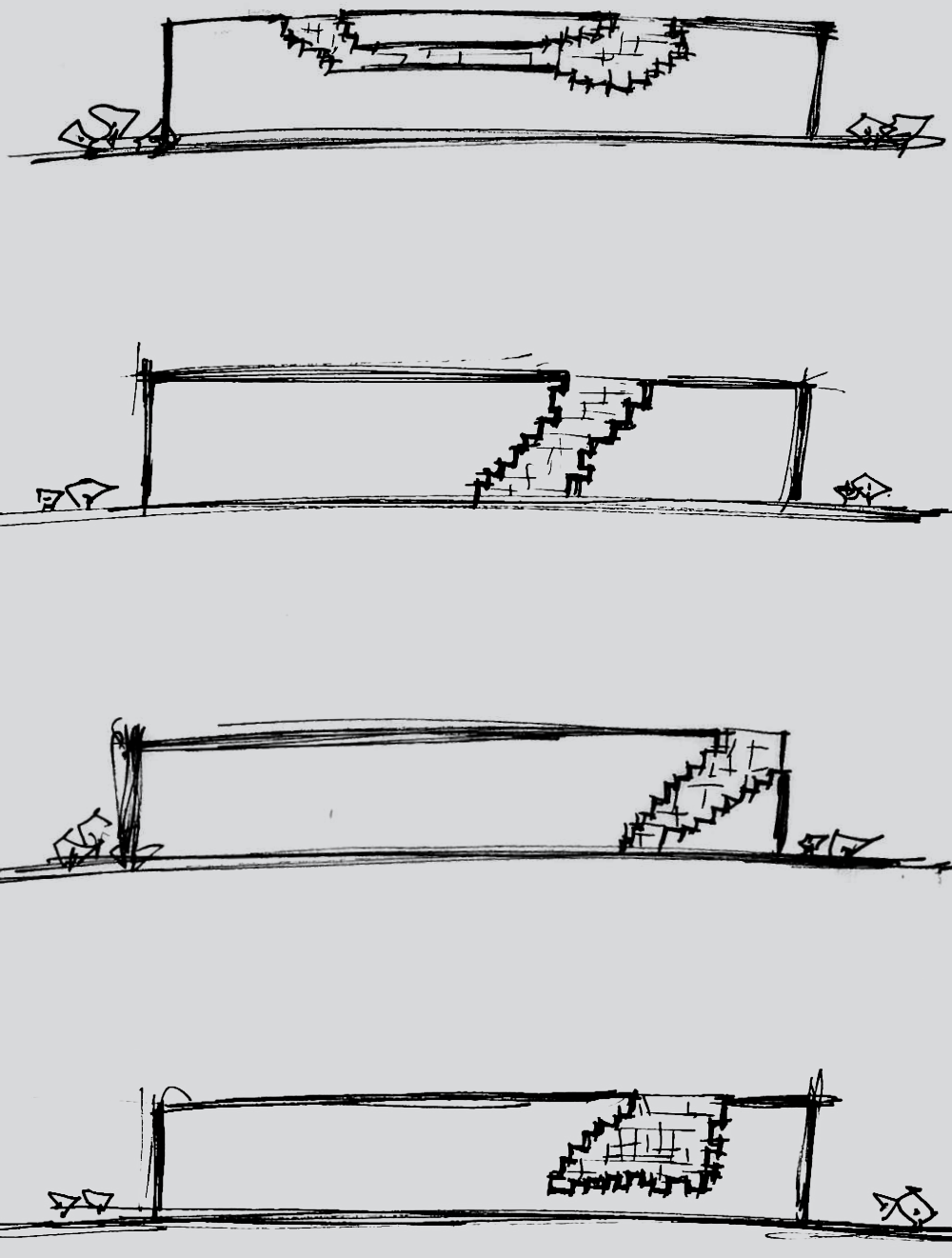
Fig. 1.41



ABSTRACT FROM INITIATING SKETCHING PROCES

Light openings

Fig. 1.42 Sketches



ABSTRACT FROM INITIATING SKETCHING PROCES

Light openings

Fig. 1.43 Sketches

PROCUREMENT

GENERATORS OF THE BUILDING

A series of design generators have paved the way of the building and results as the final design. The generators tells the story of the libraries functions exteriorly and interiorly.

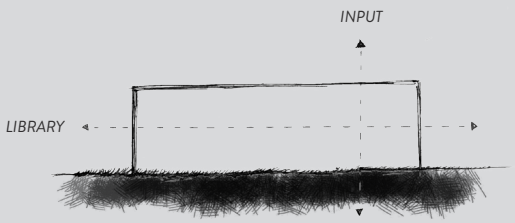


Fig. 1.44 Axis

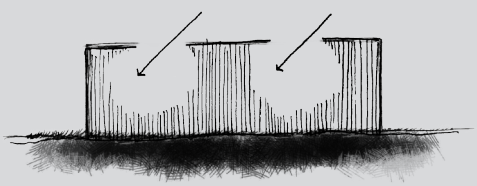


Fig. 1.45 Light & Darkness

Zones - Guiding Partitions
The competition states a lot of different room functions, which in general can be divided into three main service areas: Input, library collection and external services.

These three categories are used as an overall scheme for determining the placement of the buildings functions. A vertical axis is placed near the southern perimeter that penetrates the building mass and creates the room for the input service. The entrance will also be placed in correlation with this service, which puts the visitor in this certain environment from the start.

The horizontal axis will create the zone for the library functions and will take up multiple floors in the northern end of the building.

Work-related rooms have been prioritized to be near the few openings in the facade and roof, while others - which is not dependable on daylight - stay in the dark and makes use of electrical lighting.

The external services, which have opening hours beyond the libraries normal service time, are all placed near ground level or in near proximity to create accessibility. The library can thereby close off their functions, while others can continue unaffected.

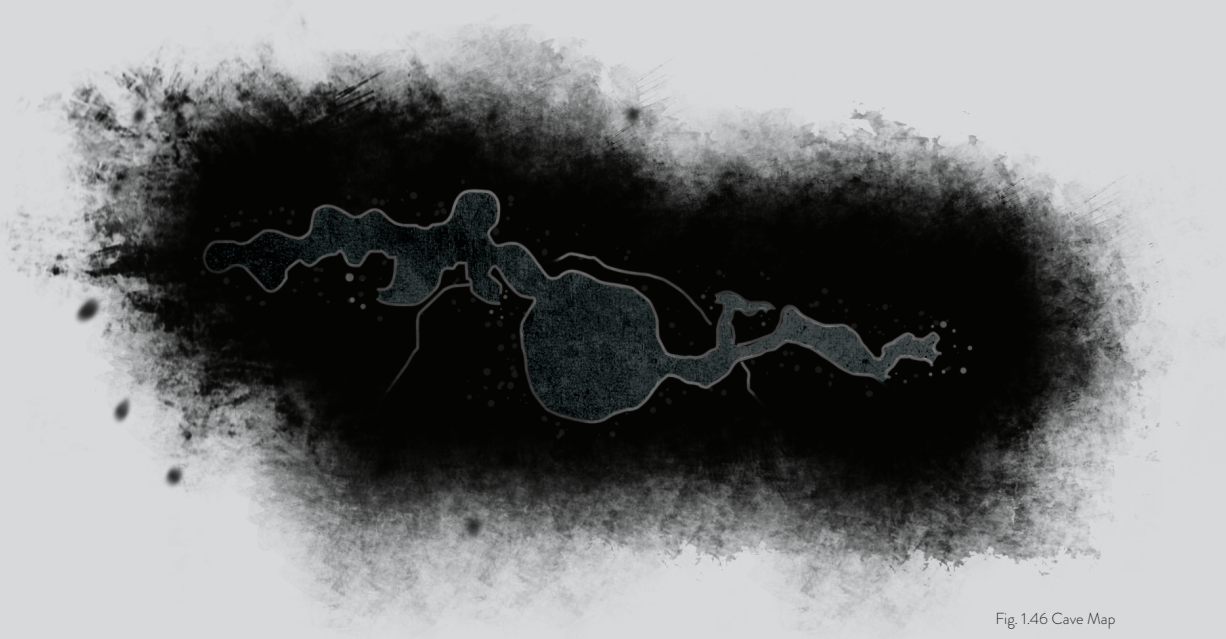


Fig. 1.46 Cave Map

INTERNAL FLOW

DISCOVERY, MYSTERY AND ADVENTURE

The buildings internal flow is based on the complex spatiality known from caves. The basis for the progression and exploration of this subject is based on inspirations from cave maps.

Variating flows creates a miniature society, a city in a city, where life unfolds and plays out between the different urban volumes - squares, streets and niche - while still being part of the totality of the building.
The idea is that, the activities occurring between each room is as important as those that happens inside the rooms. A more active, inspiring and lively milieu emerges, that supports the desire to learn and exchange knowledge.

The flow in the building establishes, through its changing vertical and horizontal paths, spatial complexity cohesive with the cave and its diversity.

It is a building consisting of radically open squares to small narrow niche, where everything is connected in a network of variating flows, that creates the right setting for a dynamic structure that encourage social interaction, sharing and immersion for its large user group.

URBAN

SCATTERED FIGURES

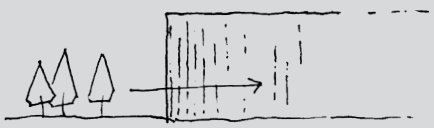


Fig. 1.47 Green Area

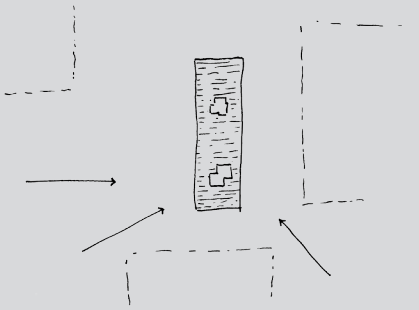


Fig. 1.48 Arrival

Urban context

The neighboring green park is extended into the site and makes a playful scenario by interacting with the solid. The library stands as a boulder in flourishing green and creates cohesion.
Towards the north a large section is removed from the building mass, creating a fragmented wall of glass allowing view to the outside.

Arrival

The entrance is situated in the southern end and address the large plaza, where people mainly arrive by foot. A traffical center - of car parking, train and bus station - is also situated in this direction and is giving further incentive for this placement.
The expression of the entrance seems almost fictitiously large and is only divided by minimal mullions to give an illusion of totality. Fragments from the creation of the opening lands in a chaotic manner outside and creates big rectangular figures.

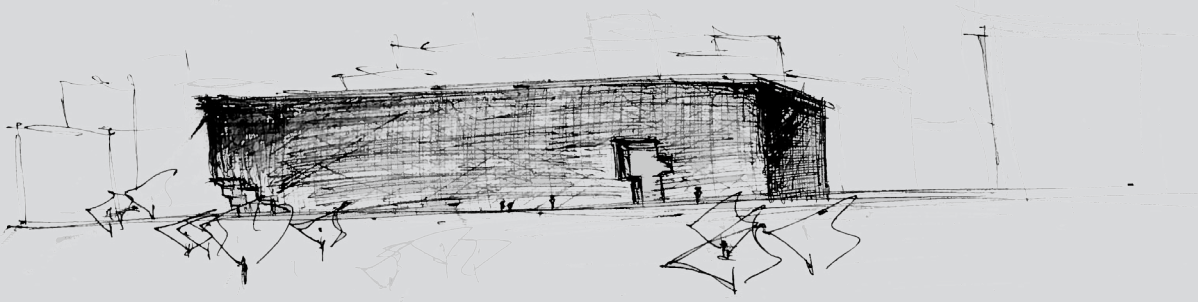


Fig. 1.49 Perspective Sketch

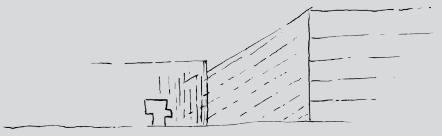


Fig. 1.50 Positioning due to shadows

Positioning
The limited amount of openings in the facade makes the right placement of the building critical. Several parameters concerning light and shadows from neighboring buildings have given the foundation for the right positioning. The massive height of the Sanoma building due south makes it necessary to move the building 6 meters to the north so it wont shade for the atrium and entrance during summer and equinox. The low sun during the winter will cast very long shadows and cannot be avoided.

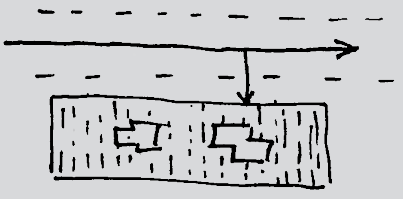


Fig. 1.51Connection to ramp

Logistics
The adjacent street east of the site turns into a ramp connecting to the underground car park. To avoid a visible drop off zone for logistics the ramp is extended to create a secondary path connected to the library. Thereby giving way for an underground drop off zone at the second floor basement. The large storage room is connected to the freight elevator, which gives passage to all floors in the building.

INPUT

SHARE YOUR KNOWLEDGE

The main atrium is centered around intertwining volumes of a five story concave sphere. Guided by curiosity, the visitor can explore the pockets appearing over, under and around these volumes. The interior of it features rooms with professional conditions for visitors free to use, to create and share music, literature, photo, movies and art. This forum of learning, sharing and creating is called Input and is the heart of the library.

Nuances
The point is to expand the human horizon and inspire to join a world of knowledge and share our experiences. Input rooms are orchestrated with large openings toward the atrium to secure transparency for as many people as possible to be part of the creative process. Interior walls are covered in warm colors inspired by sediment textures found in the Finnish nature. When reaching a new story the color changes to a lighter nuance. The reflective red-orange color makes it seem as bonfires are lighting up the *Input* rooms. The reddish colors interplay with the dark exterior compliment each other to further set the primitive mood and clearly separate inside from outside in the labyrinth of the atrium.

Light in the Atrium
The concave sphere secures a lucid contrast between light and darkness as the direct sunlight enters the opening. The rough texture is exploited as the sun hits the walls at different angles, while it leaves a part in darkness and a new part lit up. These lures visitors to move according to circumstances and enjoy a new niche with new qualities and new views.

Four Types
The atrium contains four types of *Input*, and the next paragraph shows each Input type more thorough, by illustrating one particular room which represents several rooms of similar settings. Both for usability reasons the noisiest functions are placed at the bottom, but also in order to leave the top levels to an unspoiled milieu.

1st floor: Workshops
Workshop rooms features big open spaces with multiple workstations for visitors to have much mobility to when building. Workshops for wood, metal and painting are part of this Input experience. In addition to the wood and metal tools, the rooms will have a milling machine and a 3d-printer. The placement is at the lowest level of Input that has the broadest hallways, given the huge objects and heavy machinery which requires much manoeuvre areas. In addition the rooms gives the highest noise level which is in track with the strategy of lowering noise levels as rising to the top.

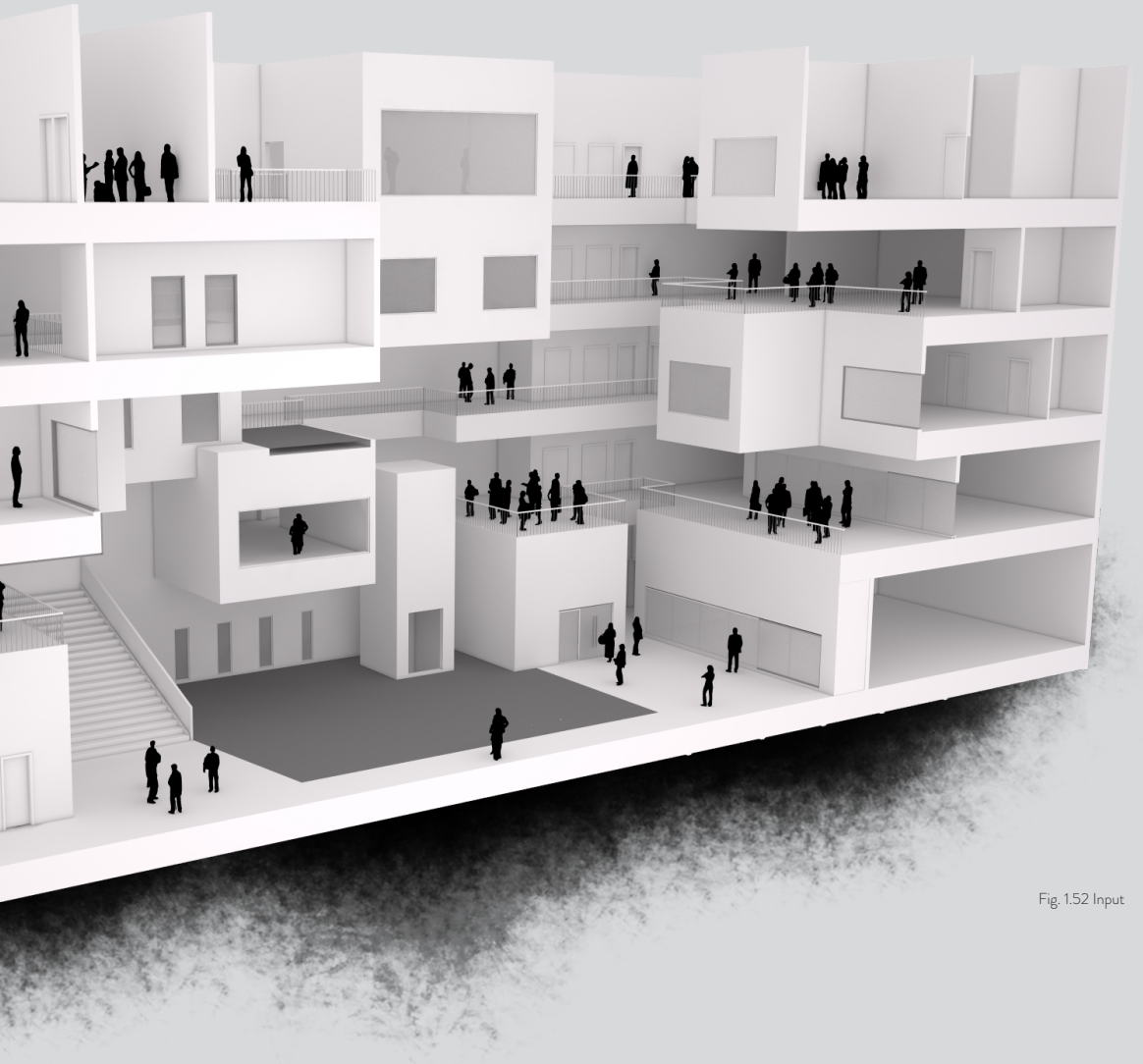


Fig. 1.52 Input

2nd floor: Music
The second floor consists of music rooms in different sizes. The diversity in room size support a large span of musical genres from large orchestras to small indie rock bands. A few rooms is also designed with recording studios to publish and share with the other visitors. A large stage area also belongs to this floor and is a casual meeting space for others of similar interests.

3rd floor: Film and Photography
The third floor is a space for film and photography, which match each other in technical equipment. Digital editing, dark rooms for photography and processing are all tools available and creates the right setting for this type of work.

4th floor: Art and literature
Art and literature is situated on the top floor and gives space to reading, painting, clay sculpting etc. Most rooms are oriented towards the running water and create a soothing, inspiring and calm atmosphere. A small reading room spans one and a half storey and gives an unspoiled view to the falling water leaving the visitor to immerse in a book or writings.

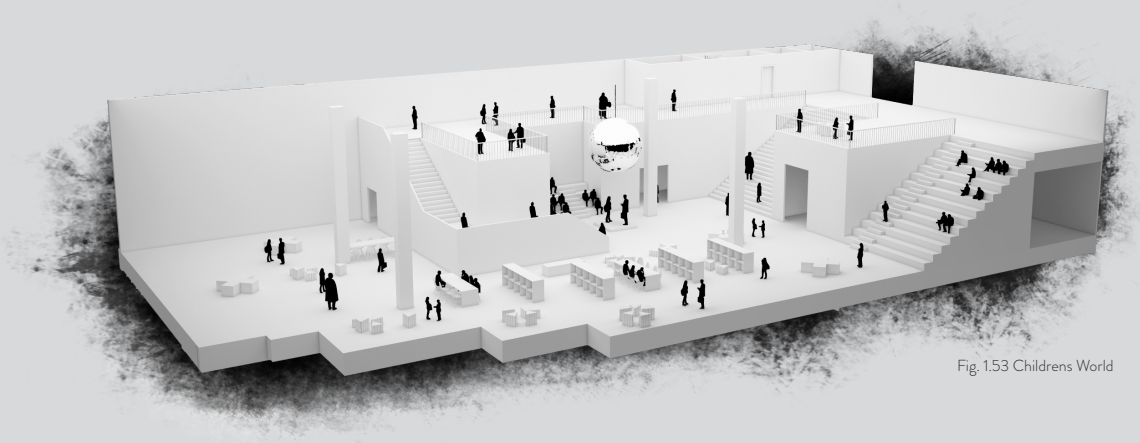


Fig. 1.53 Childrens World

CHILDREN'S WORLD

PLAY AND LEARN

The central library wants to complement the few cultural opportunities for families with children by offering a secluded place for this user group inside the library.

Children's world is an open and flexible room which support the many activities, offerings and the book collection from the library. It is situated in the northern end of the building with a large fragmented window towards the newly created park area.

The room is build up in a landscape like setting with large, wide stairs spanning up to the floor above, which functions as reading areas and a tribune for a small open stage. The stage is placed in a corner of a surrounding platform from the floor above.

It has been important to create a very open and temporally room, so the children and appurtenant workers can create and shape new spaces that support reading, play, work and thinking.

The liveliness of the room can be followed from a large reflecting sphere hanging above the stage area.

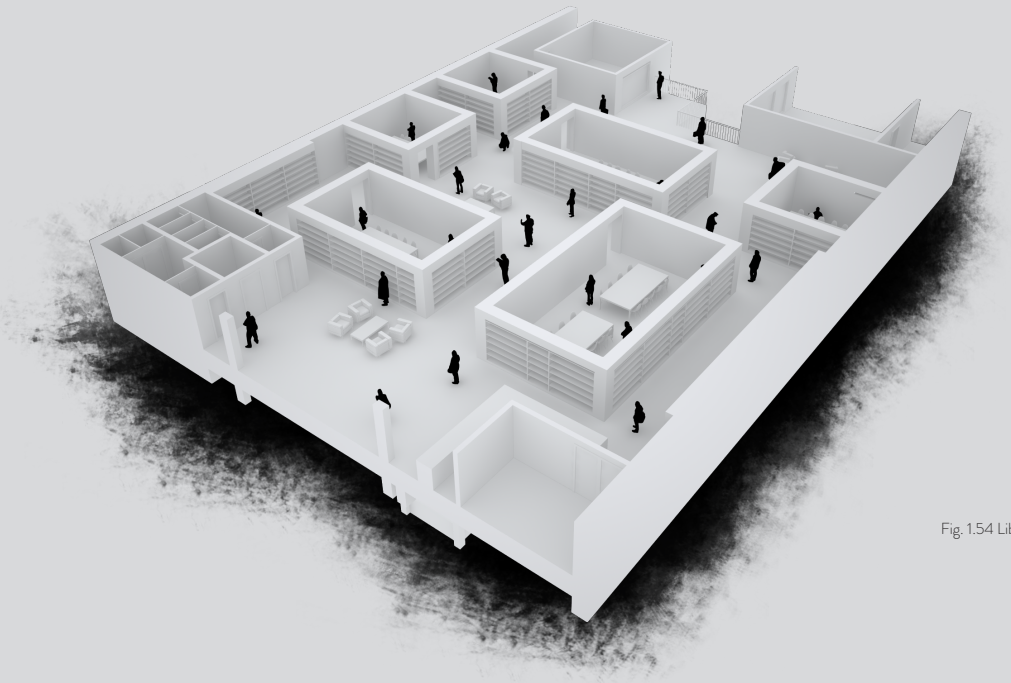


Fig. 1.54 Library

THE LIBRARY

EXPLORATION

The library collection is created in a combination with the libraries reading areas and creates a calm oasis for the many users on the second and third floor. The atmosphere changes from a fast going, lively pace from the Input area and dilutes into shifting walkways and interludes.

The variating volumes from the atrium continues into the book collection area in a more dense arrangement, which creates reading niches for individuals and smaller groups. The volumes functions as closed group rooms for larger groups of people, who needs to talk more extensively, without disturbing the surroundings.
Bookshelves are integrated into the walls of the rooms and stands as a furniture. The books are lit by a slender slit in the ceiling oozing with light, blurring the physical frame of the room and lets it continue endlessly upwards.

The halls shifts and turns in a labyrinth manner, constantly creating new views and lures the user into new and unknown territory, they might not have visited. The lack of a direct pathway through divide and scatters the users in multiple directions and spreads the noise over a larger area and makes the movement seem less intrusive. The paths finally fades into singularity near the end and leads to a space of immersion, the reading hall.

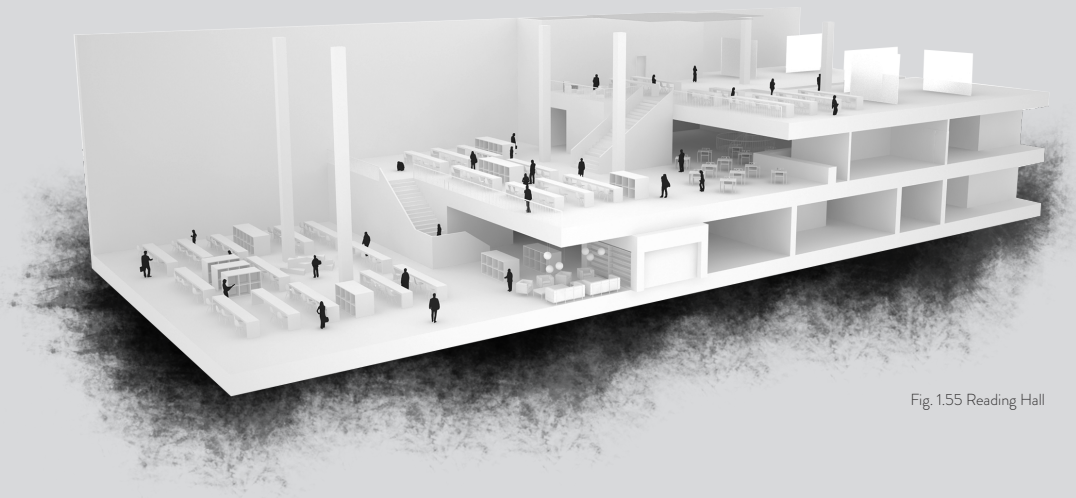


Fig. 1.55 Reading Hall

READING HALL

INTERLUDE AND IMMERSION

The experience is overwhelming when entering the reading room from the dark maze of bookshelves surrounding. This experience is caused by the combination of the vast volume of the room and the dramatic light coming from the skylight.

Ascending through the room the light is intensified, simultaneous as the volume of the room becomes smaller. The trickle of water is the first encounter when reaching the top of the floor and transforms the mood and function of the room as it becomes exhibition space.

The room has seating for approximately 400 people, which is spread over three floors. The seating orientation is towards the skylight, to give the experience between light and darkness when working, but also give the user the possibility of seeing the people entering the room from the group rooms. On the second floor the cafe peaks out from under the deck and interacts with the reading area.

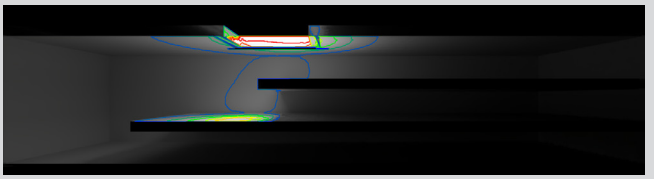


Fig. 1.56 Skylight size 64 m²

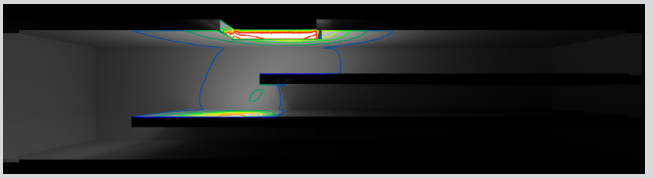


Fig. 1.57 Skylight size 81 m²

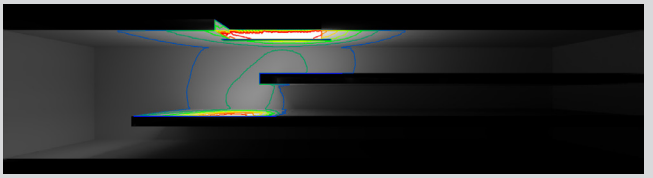


Fig. 1.58 Skylight size 100 m²

The reading hall has been designed according to several parameters. The conceptual form of the building has made some design boundaries given the closed building envelope.

This has resolved in a design with displaced floor, making it possible for the light to penetrate the room in a higher degree, than having the area in one floor. It has also been important to achieve a high quality indoor climate, specified on light, temperature and the air quality as the main vectors. Different sized have been tested with BSIM and daylight simulation programs.
This ended with a skylight size of 81 square meters; this area was the where light luminance, temperature gain and the right atmosphere occurred.

MATERIALS

ROBUST AND STRONG

The building should reflect a strong, sturdy expression to give the building mass and body. To demonstrate heaviness and volume is the main material dark concrete.

The building mass stands in raw, crabbed concrete with vivid textures aging the building into an inalterable monument. The concrete continues into the interior and accentuate the concept of the excavated mass.

The urban flow continues into the inside and adorn the floor with local tiles in ristijarvi grey stone. Above changes the material in the flooring to a light, matt concrete to contrast the dark walls.
The staircases stands in a different material to symbolize they are human made. They primarily consist of light concrete and matt, dark metal railings.

Fig. 1.59 Materials

FURNITURE

SIMPLE FORMS

The furniture are all of simple form to create coherence to the primitive volumes of the architectural spaces. Small seating furnitures are scattered in the open passage ways creating small informal niches.

The additive aspect of the furniture makes it possible for users to rearrange and design the elements according to their need.

The lighting is also keep expressionaly simple in different sized spheres hanging from the ceiling and down light spots.

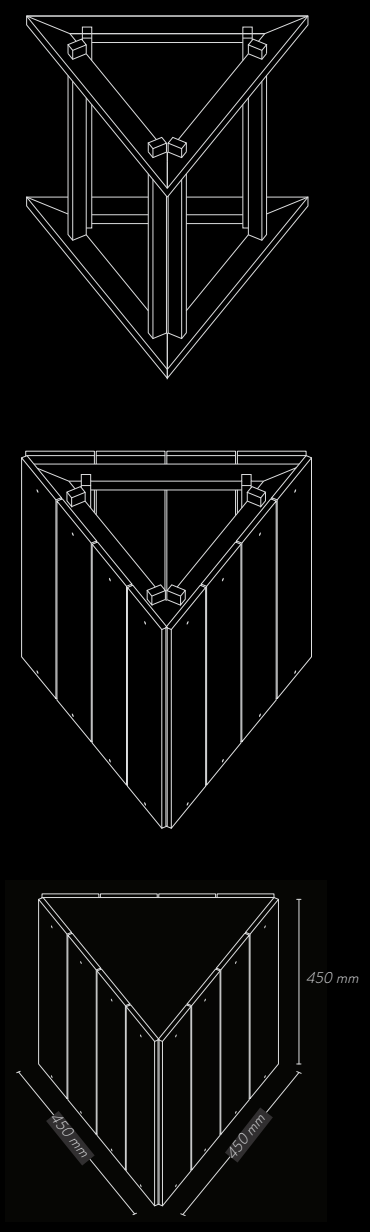


Fig. 1.60 Furniture

ACOUSTICS

A FITTING WORKING ENVIRONMENT

The library consists of large, open rooms which in some cases can create acoustically problematics. The acoustics have not been verified by calculations, but the project have found basis and inspiration in the Danish working environment services publication, Acoustics in open-plan offices.

When designing good acoustically open rooms is it important to take notice of these four categories:

A. The general room is the connection between function and work environment where movement, visual noise and sound zones can be taken into consideration

B. The build is the rooms outer boundaries - proportions, angles and materials

C. The solid element is room dividing structures, like stationary furnitures and screens

D. The Lose element is choreographed furniture

These 4 categories have created the basis for designing and arranging the rooms and their acoustic differences:

A. The library have in general been divided into different noise zones to match the function of the rooms. In the book collection area are small informal areas created for low to medium sounds nuisances from smaller group meetings. The book cores consists of closed volumes for larger groups and louder discussions.
The reading hall is primarily for individual work and gives a lower noise level.

The Input area thrives in a more lively environment with sudden encounters and chit chatter in the halls. In a combination with the waterfall and work milieu stands the atrium as a loud traffical axis of noise contributing to the scenographic room.

B. The overall simple volumes contribute a bit to the rooms acoustically qualities, whereas angled walls would have given a negative effect. Furthermore is the raw, uneven expressional surface of the concrete walls part of enhancing the absorption level of the material.

C. Throughout the storeys are several stationary shelving units positioned as room dividers, creating small reading niches. Each shelving unit is equipped with sound absorbing function to give a better acoustic environment.

D. Flexible and movable furniture is a big deal for the library and gives opportunity for the visitors to create their own workplace in calm, immerse surroundings or vivid and loud spaces. Some of these places are already choreographed in the design of the library e.g. in library collection, where these niches happens between the book shelves.

COLUMN DIMENSION

FUNCTION AND AESTHETICS

To make the large free spans needed in the cinema and multi hall, columns had to be implemented in the design. The columns are placed in a 18x8 m grid.

The estimated worst case scenario is the column with the largest free height. The calculation have been visualized in the diagram below, where the values that fulfill the needed load is below the line. To follow the basic concept of the building the optimal dimension is a quadratic column, 600x600. A quadratic column will be perceived equally from all side, in contradiction to a rectangular, and have a sturdy expression.

Even though the load and free height of the columns is different the ratio is comparable, the same dimension is used to the other columns.
Columns are dimensioned to handle the pressure of 2.08 MN. The specified calculation can be read in the appendix or the excel sheet on the enclosed disk.

	500	520	540	560	580	600	620	640	660	680	700
500	1.17	1.25	1.33	1.42	1.51	1.60	1.69	1.79	1.88	1.98	2.08
520	1.25	1.34	1.43	1.52	1.62	1.71	1.81	1.91	2.01	2.12	2.22
540	1.33	1.43	1.52	1.62	1.72	1.83	1.93	2.04	2.15	2.26	2.37
560	1.42	1.52	1.61	1.73	1.83	1.94	2.05	2.17	2.28	2.40	2.52
580	1.51	1.61	1.72	1.83	1.95	2.06	2.18	2.30	2.42	2.55	2.67
600	1.60	1.71	1.83	1.94	2.06	2.18	2.31	2.43	2.56	2.69	2.83
620	1.69	1.81	1.93	2.05	2.18	2.31	2.44	2.57	2.71	2.84	2.99
640	1.79	1.91	2.04	2.17	2.30	2.43	2.57	2.71	2.85	3.00	3.15
660	1.88	2.01	2.15	2.28	2.42	2.56	2.71	2.85	3.00	3.16	3.31
680	1.98	2.12	2.26	2.40	2.55	2.69	2.84	3.00	3.16	3.31	3.48
700	2.08	2.22	2.37	2.52	2.67	2.83	2.99	3.15	3.31	3.48	3.65

Fig. 1.61 Column Table

INDOOR CLIMATE

BSIM & BE10

To verify the quality of the indoor climate we used the simulation tool Bsim. The program as earlier mentioned been used to calculate critical rooms instead of the entire building. The critical factors in our building is a high people load and large room volumes. Bsim would also verify the skylight design by adding climatic parameters in addition to light illuminance as the first design parameter.

The target values for the indoor quality have origin in the Danish demands and also the design program given by the competition. Temperature wise our aim is a maximum of 25 h over 27 degrees and 100 h over 26 degrees, air pollution is set to a top value of 900 ppm.

Our thesis to design energy sufficient building with a dramatic light effect, rely on the internal heat gain to compensate for heat gain from the sun.

Building components
Because of the high internal load, the criteria for the transmission loss is more flexible. This results in a more narrow wall and slim roof the graph (fig. 1.62) shows the optimal u-value for the wall, orange line, and the energy frame illustrated with the dark line.

Optimal u-values

Wall: 0,16 W/m²K
Roof: 0,1 W/m²K
Floor: 0,1 W/m²K
Basement wall: 0,1 W/m²K

Windows:
g= 0,4
u: 0,9 W/m²K

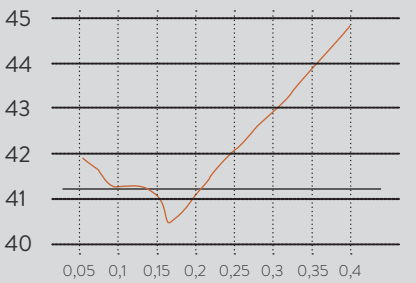


Fig. 1.62 Optimal u-value, outer wall

BE10
The energy aspect of the building as been calculated in Be10, with a target value for the 2015 demands at 41,1 kWh/m² per year. Because the opening hours of the building exceed the 45 h, a supplement for special conditions is added. The energy for the extra opening hours is added, raising the demand to 87,1 kWh/m² per year. The building fulfill the energy frame for the Danish 2015 demands, performing at 86,3 kWh/m² per year.

It would be possible to reach a lower energy class, by the use of renewable energy sources, solar cells being the obvious choice. For our building the needed amount of solar cells to reach the energy frame for 2020 would approximately be 450-500 m². This solution would have a large impact on the architectural expression of the building, by disrupting the clear concept that surrounds the building design.

Simulation
To support the thesis, simulation was made in the two rooms with biggest volumes, the reading hall and the children's world, concurrent with a calculation for the entire building in Be10.
The rooms have different direct illumination, where the reading room has a skylight and the children's world has a glass facade facing northwest.
Both rooms have the same ground area but the variation lies in the room height, detailed earlier (p. 64, 66).

The first studies were centered on reaching the demands regarding overheating. On a account of the limited amount of windows, mechanical ventilation is the only solution. The optimal ventilation control solution for rooms with a large variation of people load, is a VAV (VariableAirVolume) system.

READING HALL

The difficult aspect in this simulation is the people load. Given the estimated of 5000 visitors a day an estimate load for both rooms have been set. Furthermore different people load scenarios have been set, one to find the optimal average ventilation rate for a full year, and another to stress test the room on a single day.

The people load is a show in the diagrams, where with a ventilation rate of a 2,6 m^3/s it is possible to reach the temperature demands in the reading hall.

Reading Hall

Area ..... 1080 m^2
Volume ..... 13500 m^3
Window area ..... 81 m^2

	NORM	STRESS
h > 26°	80	104
h > 27°	16	30

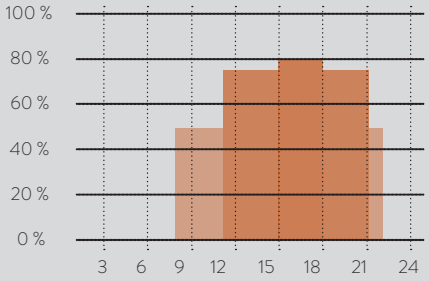


Fig. 1.63 Normal people load, Reading Hall

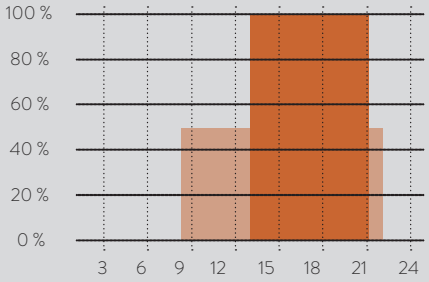


Fig. 1.64 Critical people load, Reading Hall

Temperature [10 ·°C]
The temperature his a max at the load peak, which is to anticipate in a stress test. There is a small over heating, but it is a single instance because the overall year temperature does not exceed the demands.

Air change [100 · h]
The graph illustrates the maximum ventilation rate for the system, this would indicate that the ventilation rate was to low, but the overall year results indicate other vise.

CO^2 [ppm]
As seen on the graph the air pollution does not exceed the maximum demand of 900 ppm.

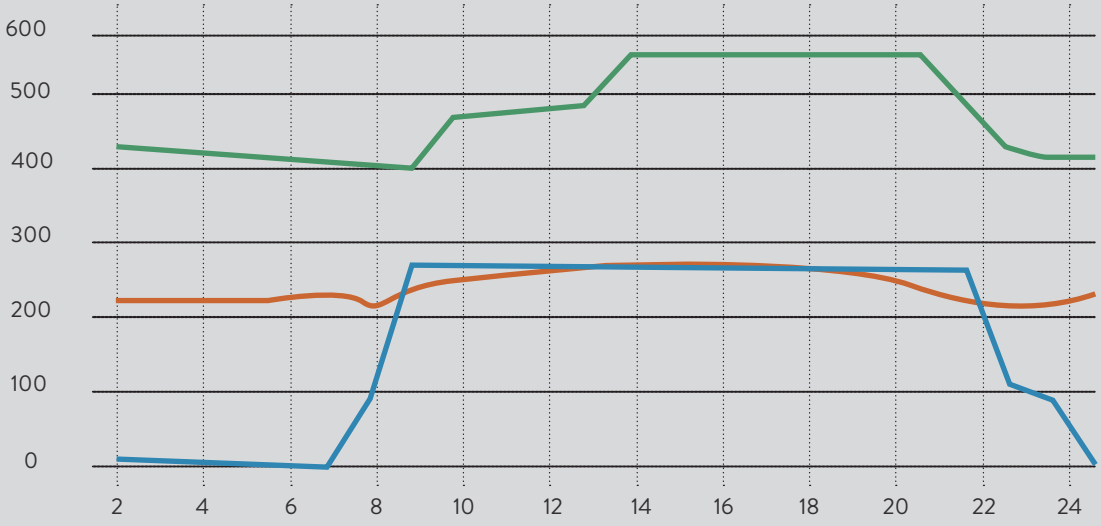


Fig. 1.65 Reading Hall, Diagram

CHILDREN'S WORLD

The people loads for the children's world have been dimensioned to fit the target group, thereby having a low load in the late hours near closing time.

The needed ventilation rate to reach the temperature demand is 2,4 m^3/s.

Children's World

Area	1008 m^2
Volume	7800 m^3
Window area	193 m^2

	NORM	STRESS
h > 26°	70	132
h > 27°	9	32

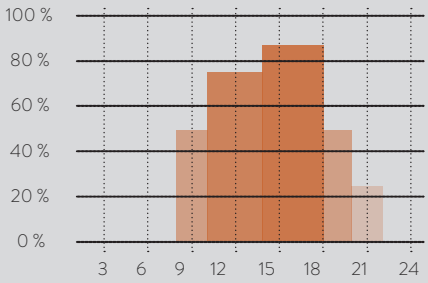


Fig. 1.66 Normal people load, Children's World

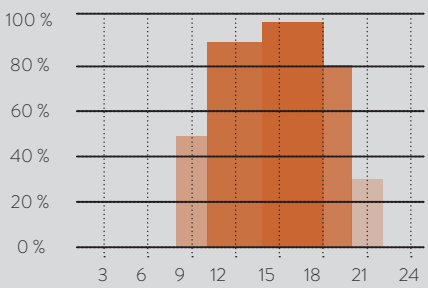


Fig. 1.67 Critical people load, Children's World

Temperature [10 ·°C]
The temperature is influence by the same parameters as in the reading hall, given similarities of the rooms, resolving in the same conclusion.

Air change [100 · h]
The air rate is higher in the children world compared to the reading hall. The larger air rate is need because of the lower ceiling height and it also assumed the user to have a higher level of activity.

CO^2 [ppm]
The graph states the air pollution to not exceed the maximum demand of 900 ppm.

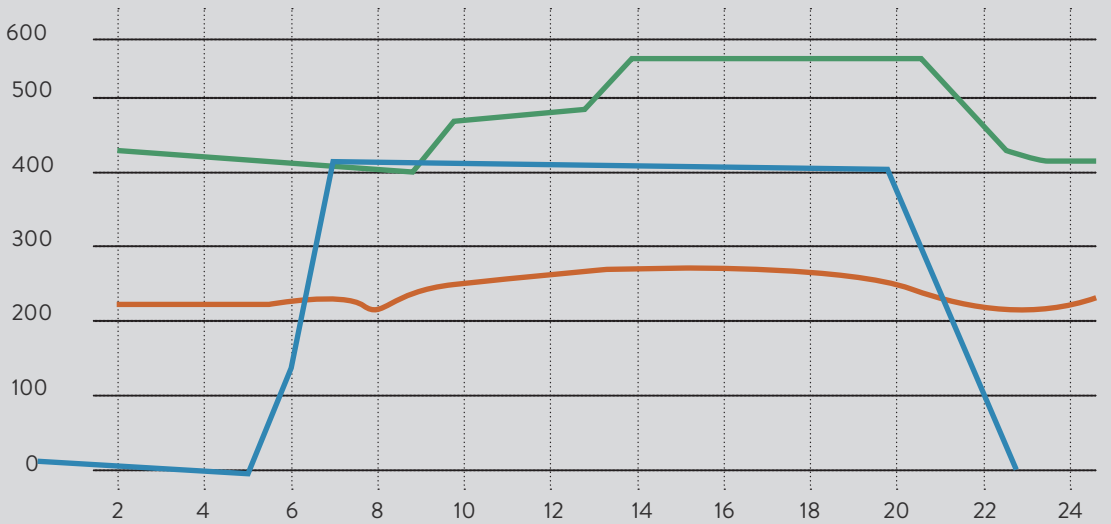


Fig. 1.68 Children's World, Diagram

PRESENTATION
SENTINEL

URBAN FEELING

SCATTERED FIGURES

The urban milieu is interpreted as a place for the excavated mass from the library, spread in a chaotic manner. The pathway from the entrance twists in the tall grass near the surrounding plaza. Large, rustic tiles merge with the grass in diverse sizes and vanish incomplete in the distance.
To protect and emphasize the large green areas in the existing surroundings around Töölönlahti bay area is it important that the landscape have character, that have a surprissing, vigorous and adventures character.

Several detached elements of the library are distributed in near proximity and acts as playful and artistic supplements to the building and general area. The elements also functions as recognizable parts of the insides aesthetics, which prepares and elures the visitor.
The elements are hollow and have a secondary functions as the in- and outlet for the ventilation system.

Fig. 1.71 Scattered urban figure

Fig. 1.72

Fig. 1.73

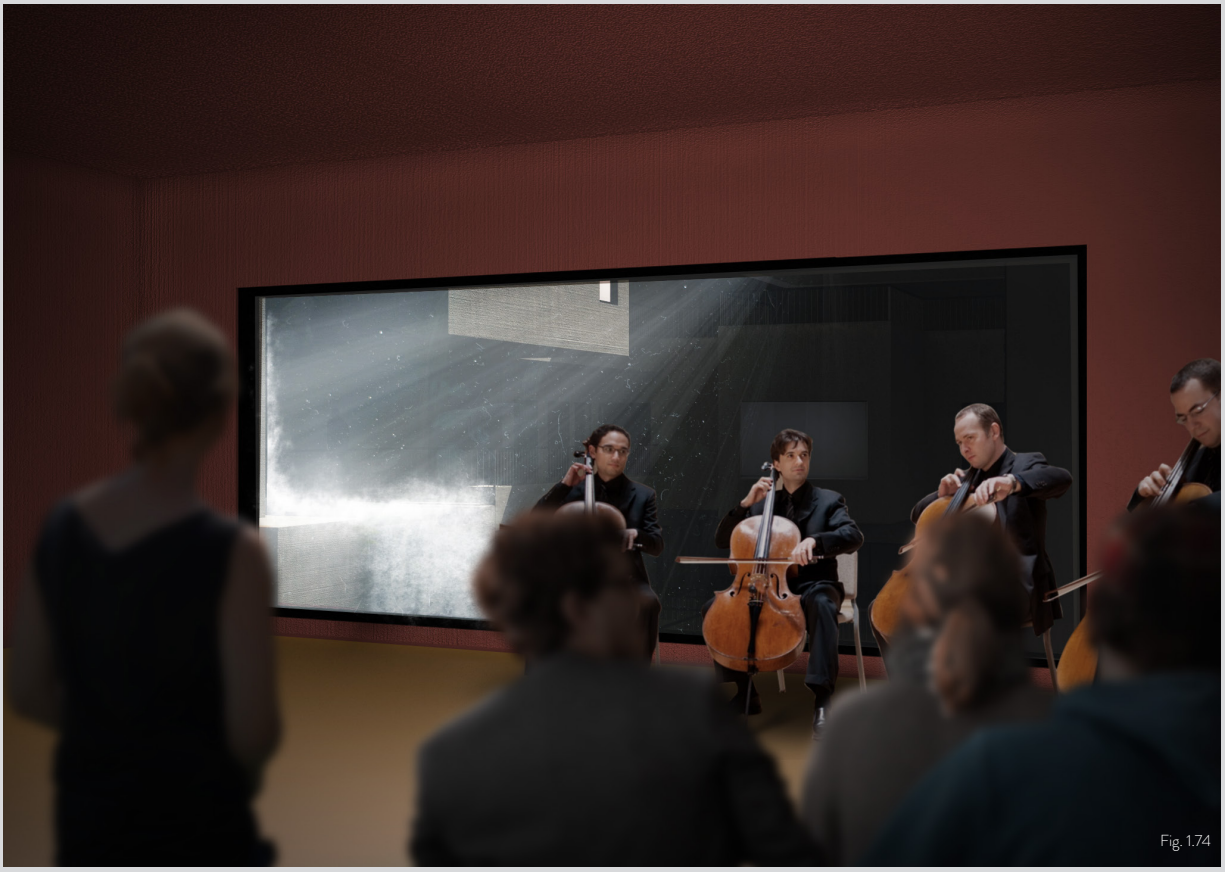


Fig. 1.74

Fig. 1.75

ATRIUM

WATER, LIGHT AND REFUGE

The scenic lighting reveals the chaotic internal composition and tells of the tangible materials. As light culminates with falling water it leaves the interiority in picturesque settings, and lures visitors to explore the voids between the massive concrete volumes. Participate in a collective process of creating new knowledge, or find space for immersion and enjoyment.

CHILDRENS WORLD

UTOPIA

The mood is different from the rest of the library as reflected light and enormous room height speaks of an openness, and leaves children with plenty of space to learn and play. The amphi layout from outside is resembled in the interiority of the children's world, and the views to Töölönlahti park adds a strong connection to nature.

Fig. 1.76

READING HALL

GUIDING LIGHT

From the dark and dense library collection is the visitor met by a large open reading hall. Oozing light from the skylight guides the visitors on the climbing stairs towards the final act of the library. Trickling water sends calming vibration to the area, while readers are quietly working.

Fig. 1.77

THE CAFÉ

ENJOY A CUP OF COFFEE UNDER THE WATER

The café is placed in the transition between reading areas and serves coffee in an atmosphere of dancing rays of light from the overhead water. The spiral stair secures an unspoiled view to the basin, and divides the two zones.

Fig. 1.78

LIBRARY NICHES

CALM OASES

The library collection fades into reading areas and interludes, creating a calm, secluded atmosphere. Slender slits lits up the books and makes the volumes seem continuing into the light and above to the next floor. The setting is dark with few spot lights defining the work spaces of the room.

Fig. 1.79

EXHIBITION

SHOWCASING

The room is divided into a grid of movable walls that leaves it flexible for diverse scenarios. The top floor is an exhibition forum from visitor, to visitors. It is here the creations and pieces made in the Input axis are displayed and shared to the public.
The first lake are marks the beginning of the room and the creek guides visitors through the axis to the following lake. Walls and pillars disappears into what seems as a never ending height.

Fig. 1.80

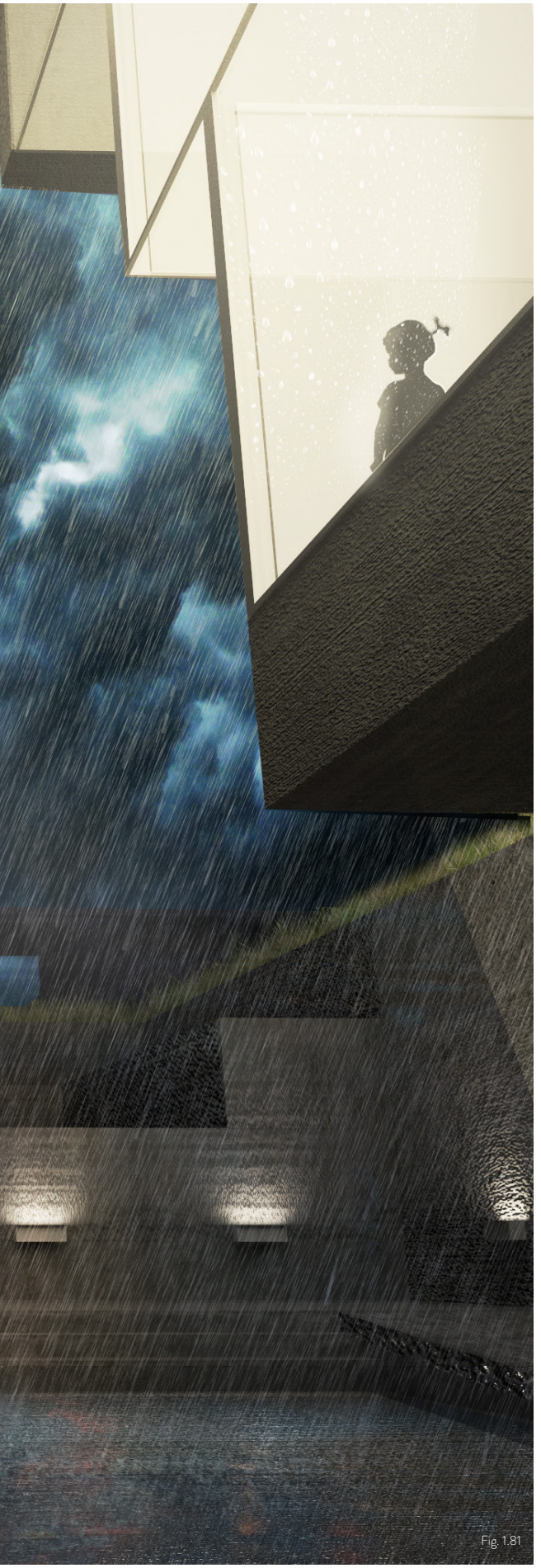
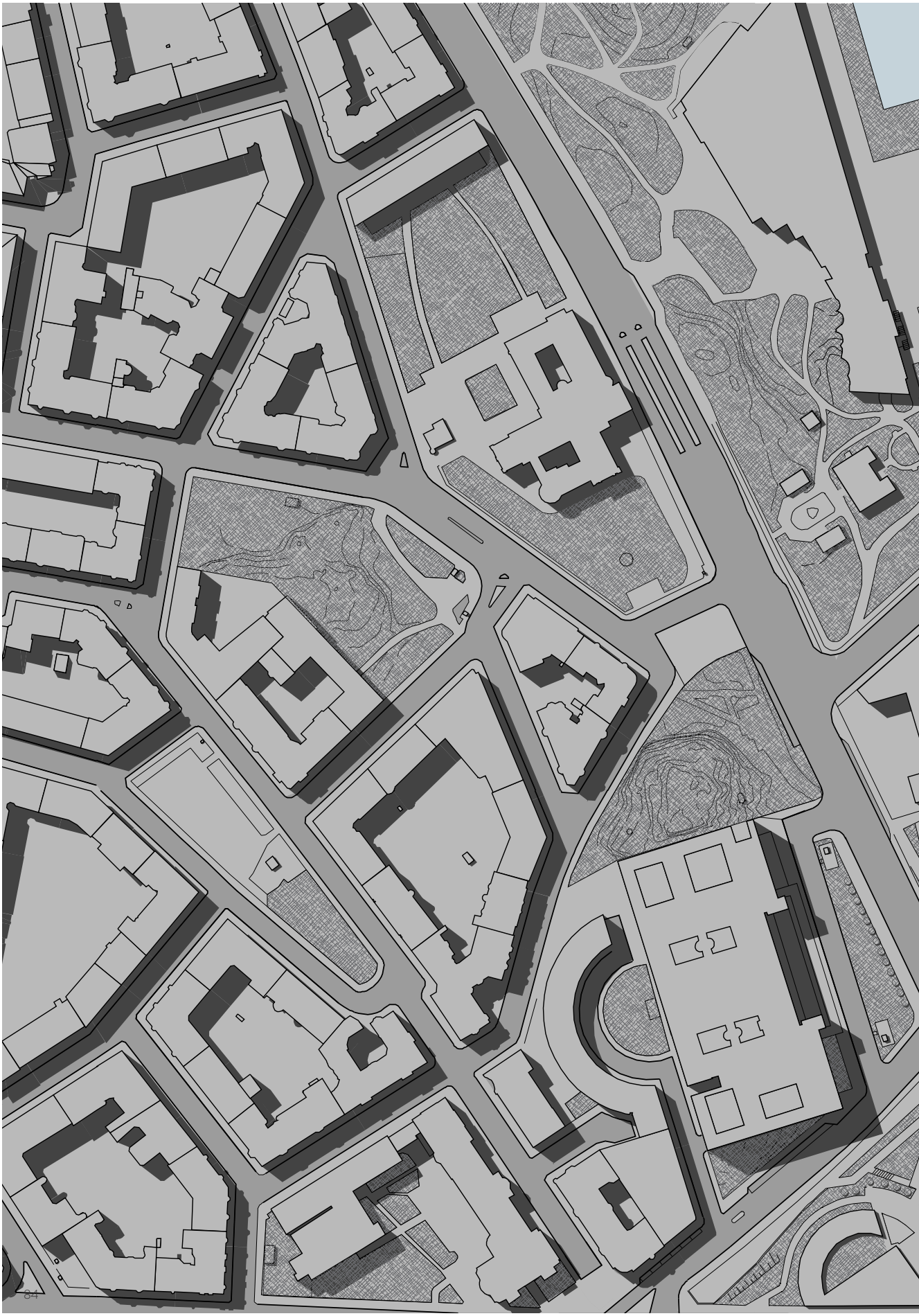


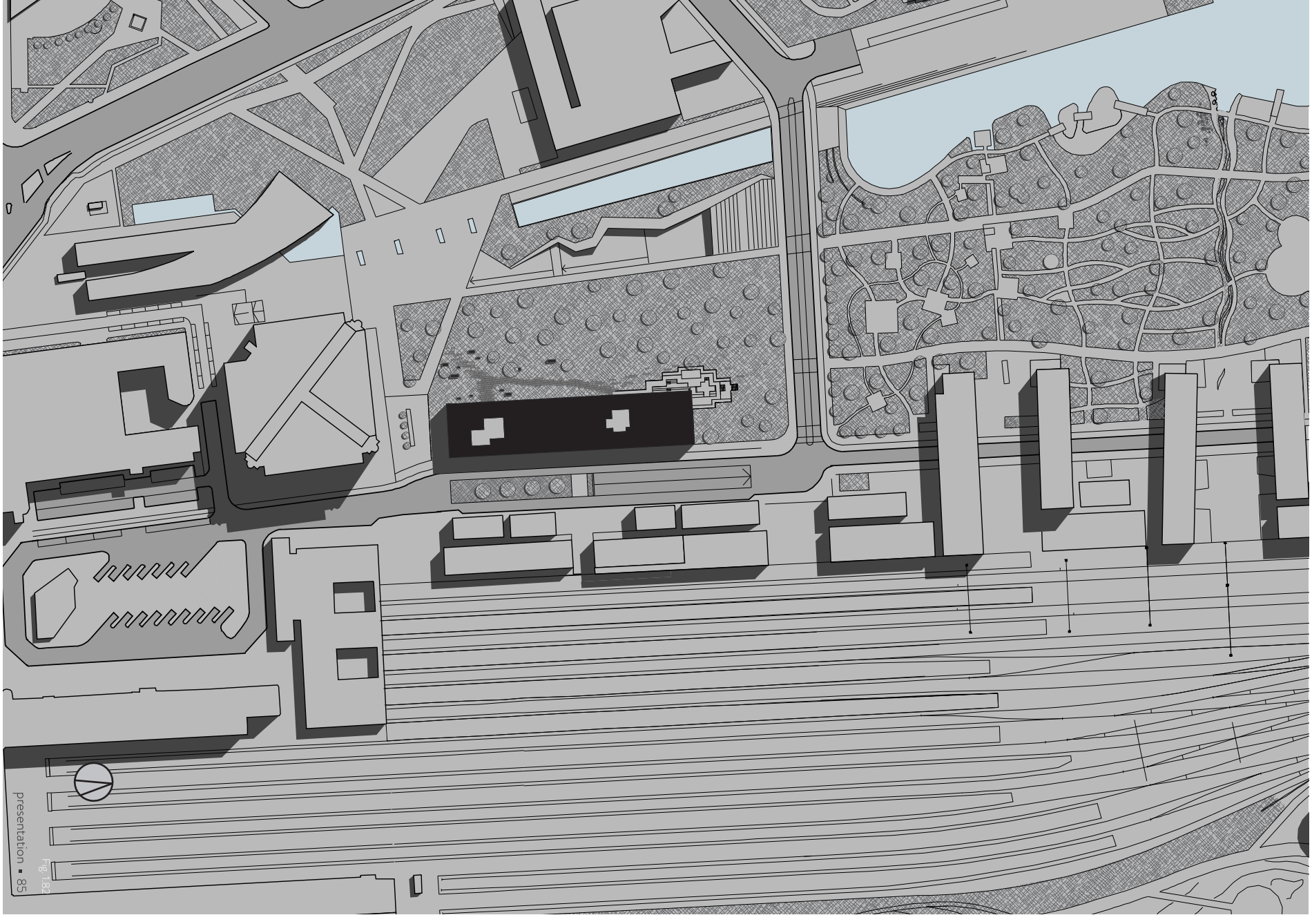
Fig. 1.81

URBAN POCKET

INTERTWINED PATHWAYS

On the near edge of the library, towards the newly build public park area, is a pocket dug out of the urban fabric. The space created stands as an extension of the existing plaza continueing down under the soil.
The pathway down is a journey through small, narrow ramps and stairs that merges into larger spaces for interlude. The large network of ramps and stairs culminate at the bottom and creates a larger plaza in front of the entrance to the cinema.





LOBBY

- *Restaurant*
- *Kitchen*
- *Book store*
- *Information*
- *Book return*
- *Multi Hall*
- *Children's world*

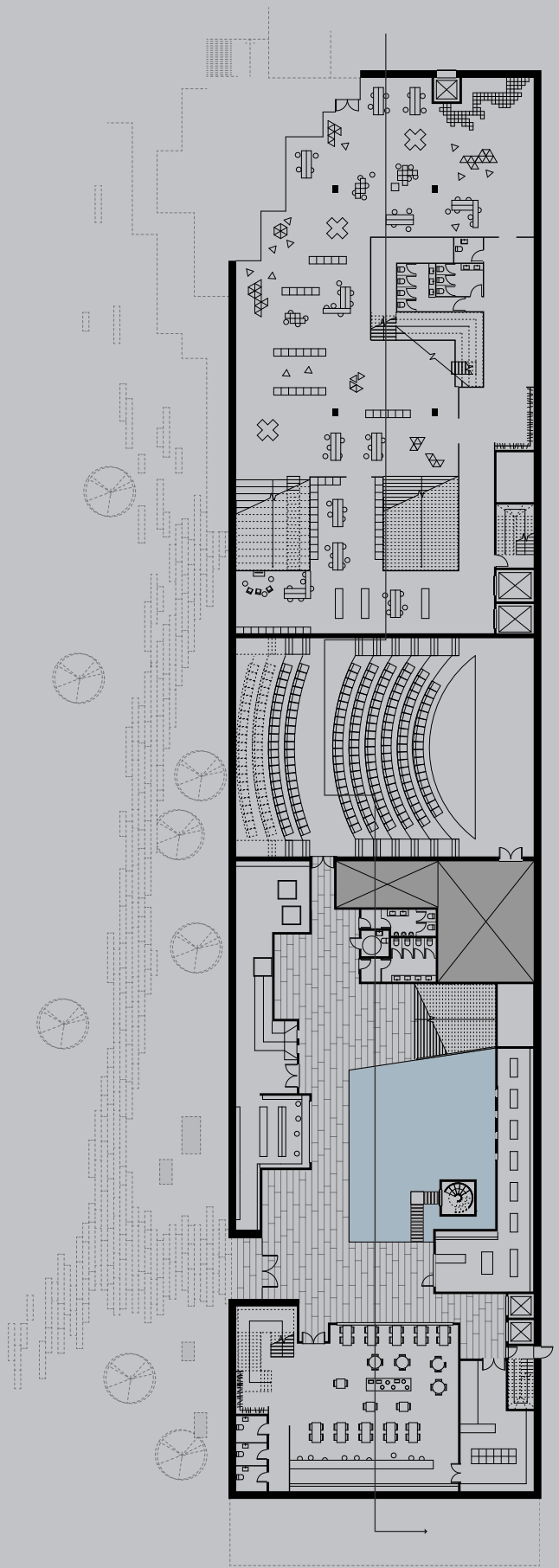


Fig. 1.83

1ST FLOOR

- *Conference room*
- *Input, Workshops*
- *Video and gaming*
- *Children's World*

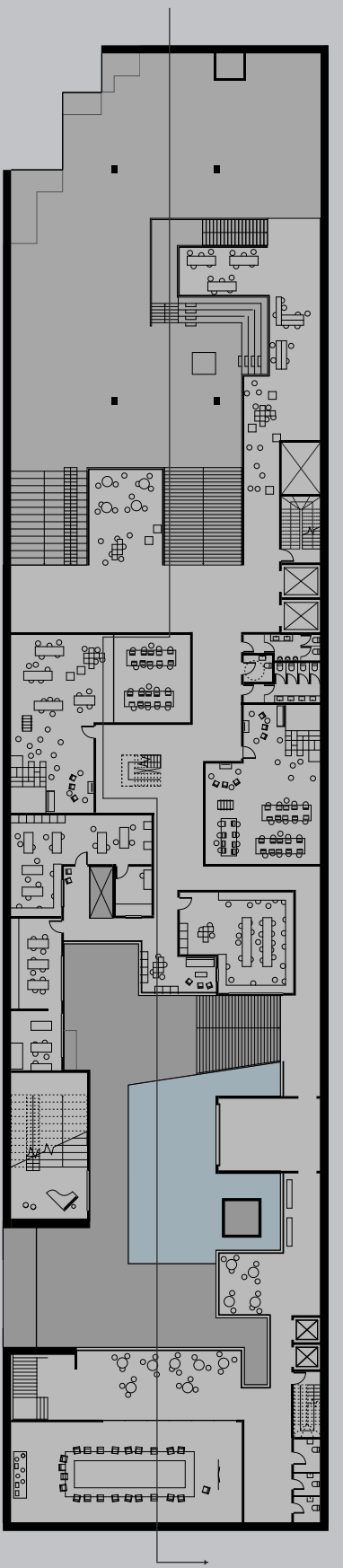


Fig. 1.84

2ND FLOOR

- *Office*
- *Input, Music*
- *Teaching rooms*
- *Group rooms*
- *Service*
- *Reading hall*

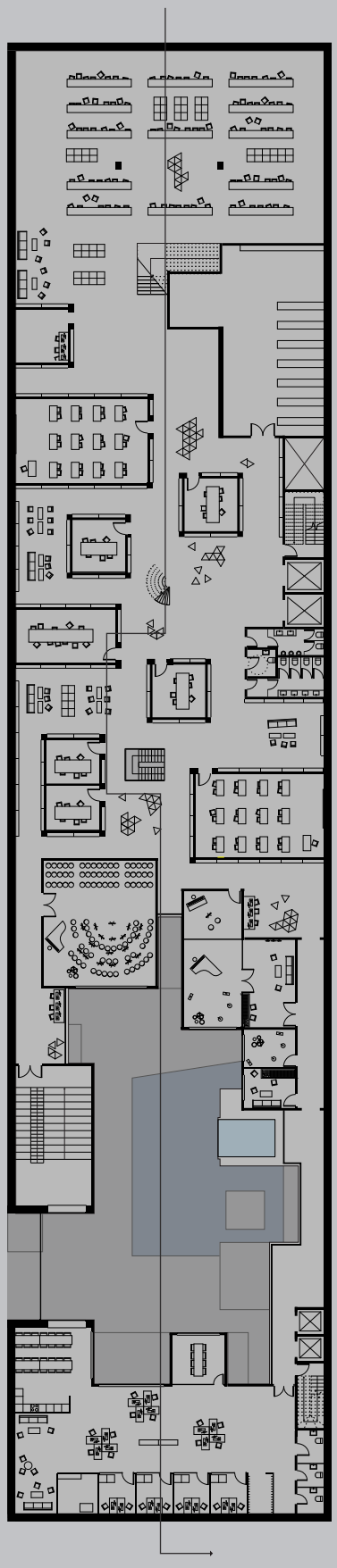


Fig. 1.85

3RD FLOOR

- *Input, Film & Photography*
- *Group rooms*
- *Teaching rooms*
- *Group rooms*
- *Reading hall*

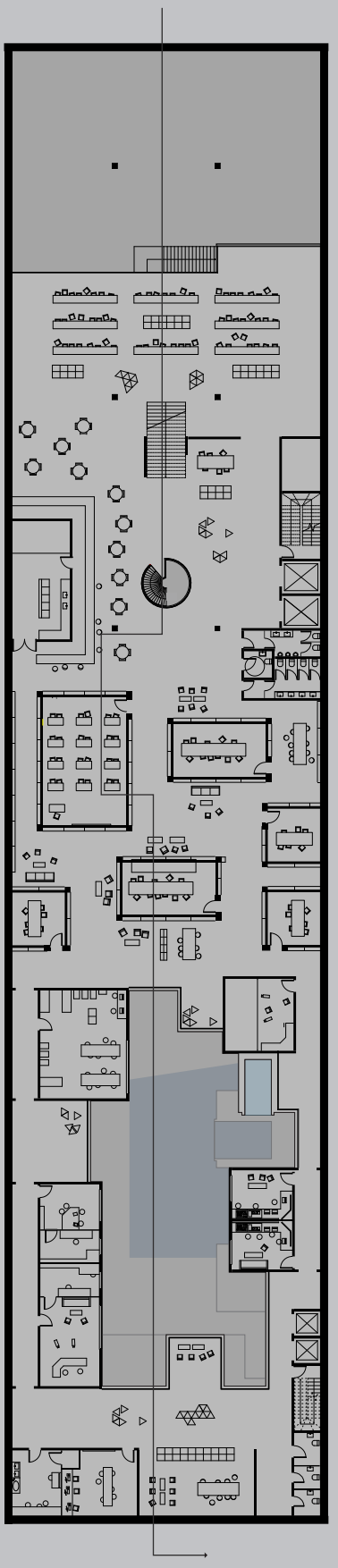


Fig. 1.86

4TH FLOOR

- *Input, Art & Literature*
- *Reading auditorium*
- *Reading room*
- *Exhibition*
- *Exhibition office*

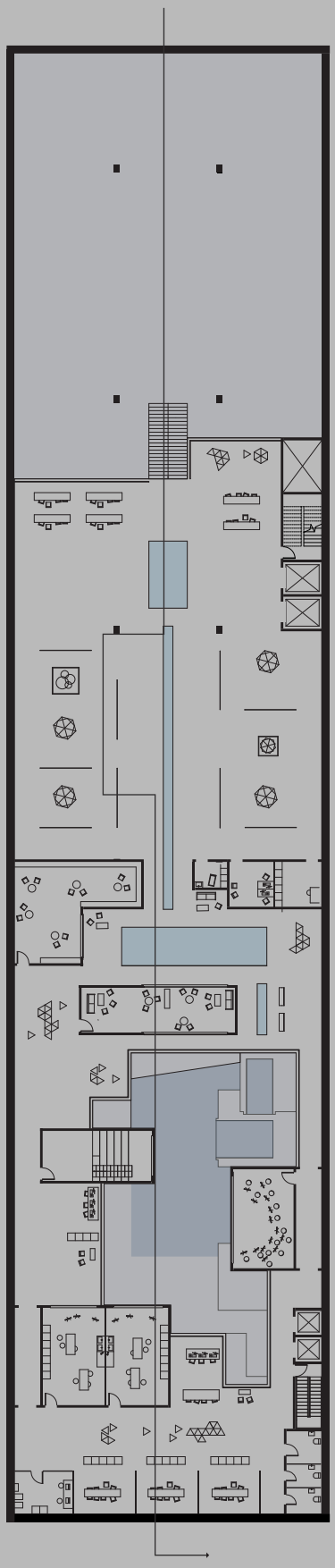


Fig. 1.87

ROOF

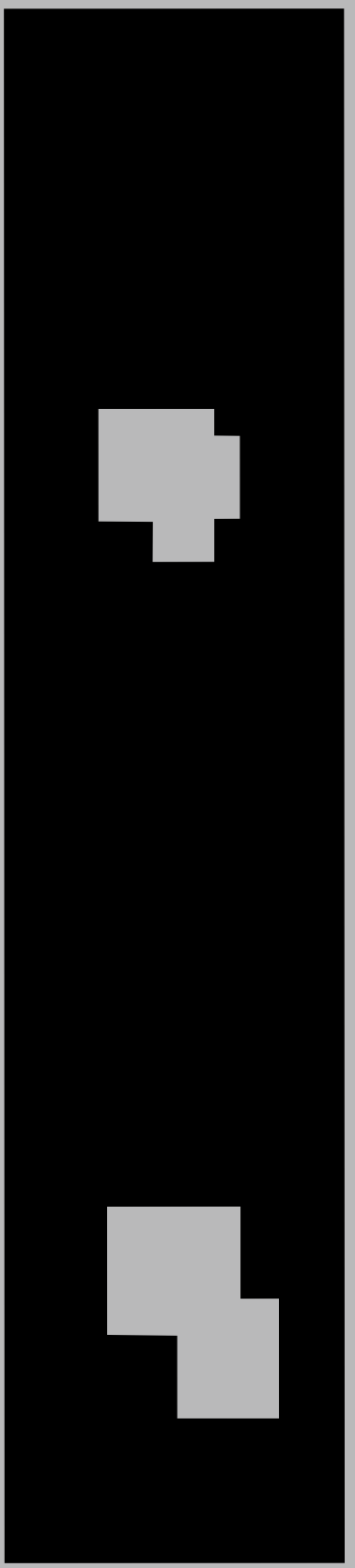


Fig. 1.88

-1 BASEMENT

- *Sauna*
- *Technical room*
- *Multi Hall*
- *Prop room*
- *Cinema*

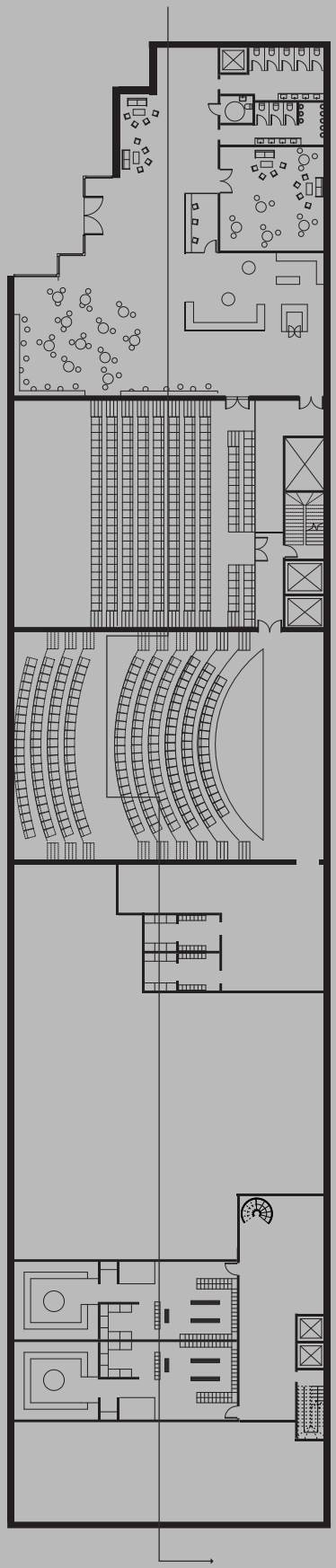


Fig. 1.89

-2 BASEMENT

- *Technical Room*
- *Storage*
- *Drop Off Space*
- *Cinema*

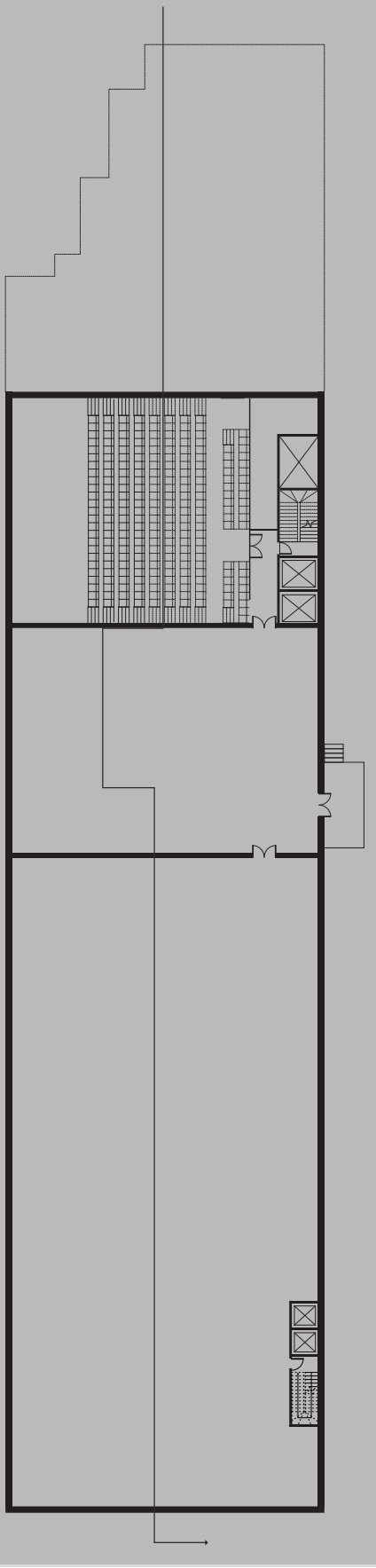
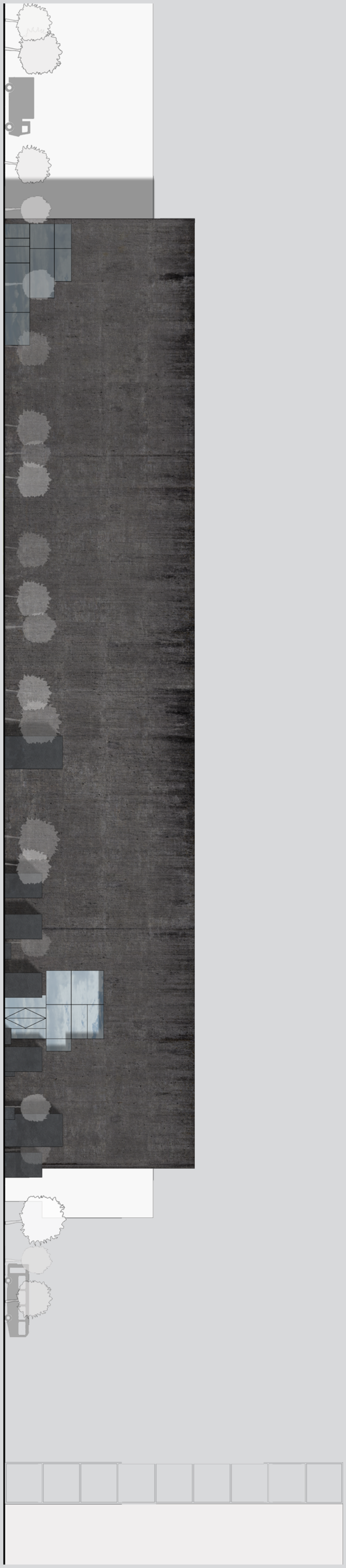


Fig. 1.90

SECTION 2:
CHILDRENS WORLD &
READING ROOM

SECTION 3:
ATRIUM

Fig. 1.91



WEST FACADE

Fig. 1.92

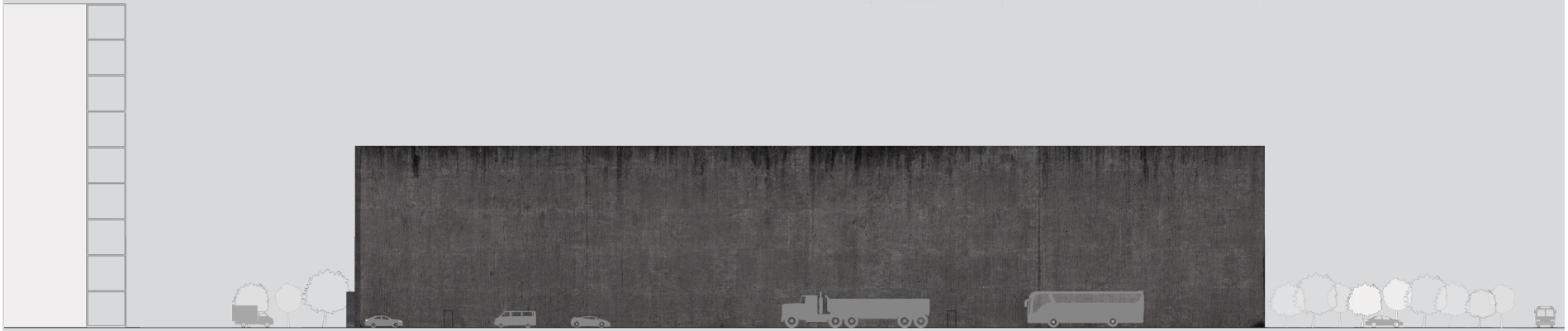
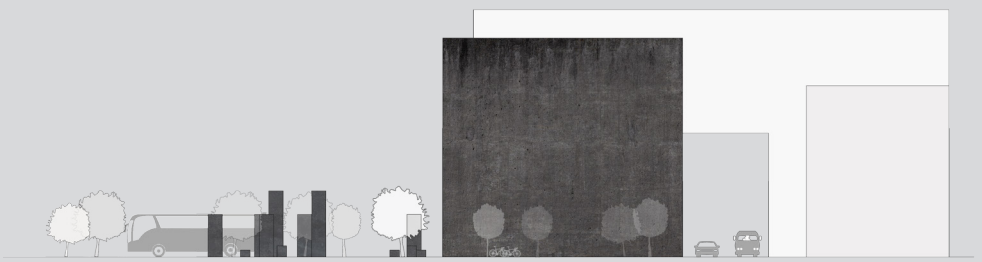


Fig.193

EAST FACADE

NORTH FACADE

Fig. 1.94



SOUTH FACADE

Fig. 1.95

FIRE PLANS

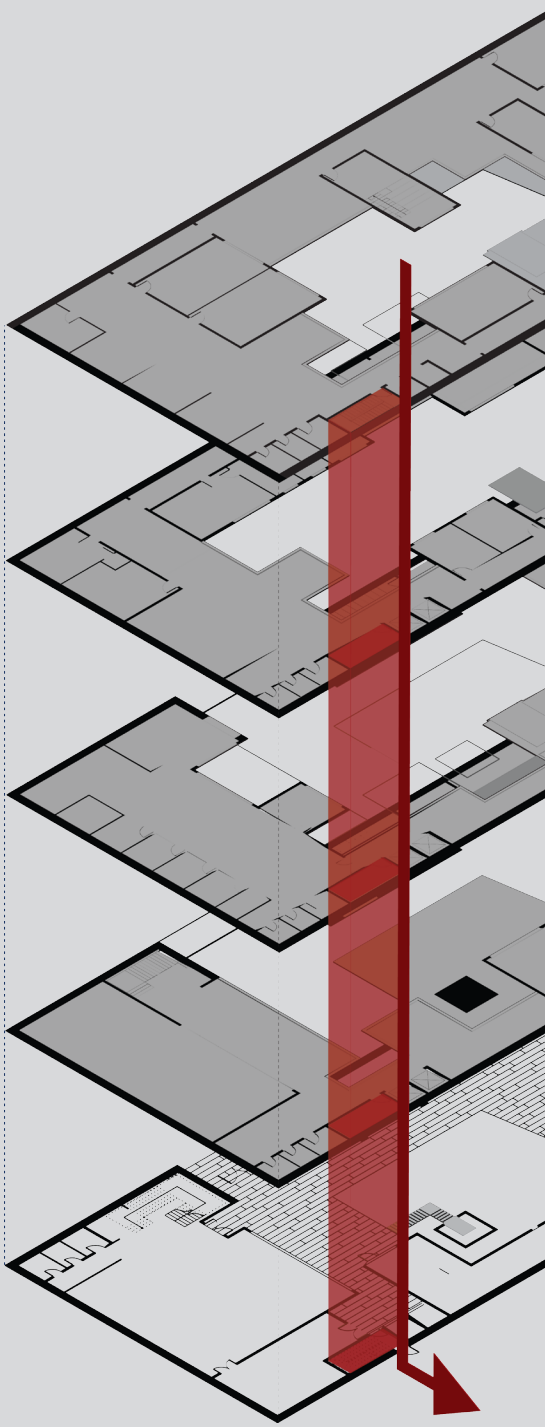
IN CASE OF FIRE

The fire plans have been formed after the basis of having large, open plans with opportunity for small and large common areas on the hall ways.

The building is equipped with a range of active protection measurements. Sprinkler systems are installed in the building and ABA with additional warning system, so visitors are notified early in the case of fire.

The large fire escapes are situated near the elevator cores and have a direct exit to the out doors. The cinema and multi hall share a common fire exit beside their own entrance.

The fire department have opportunity to reach the building from the adjacent roads to the east and north.



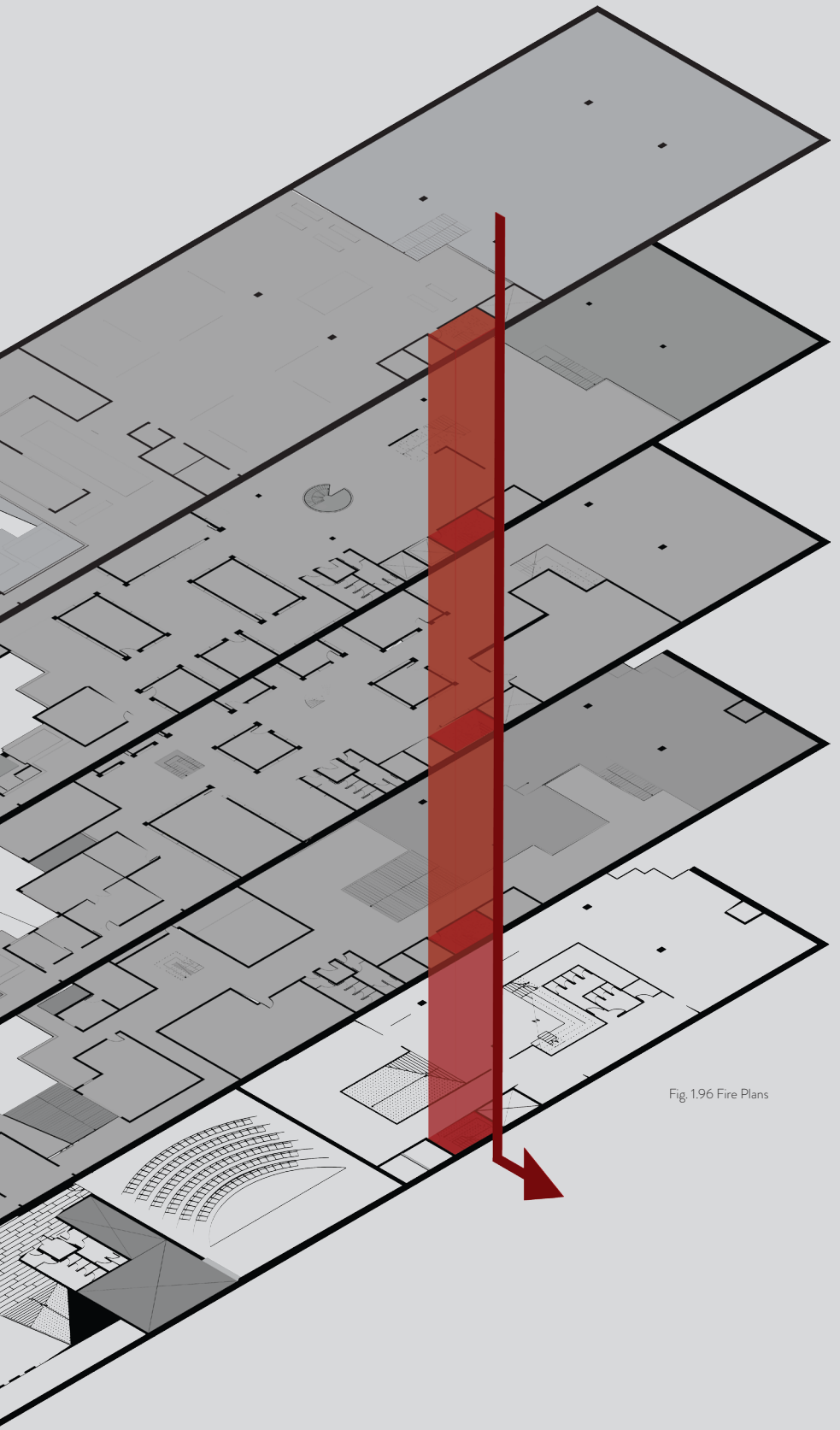


Fig. 1.96 Fire Plans

Fig. 1.97

CONCLUSION

THE ADVENTURE MEETS ITS END

In a look back to the beginning of all architecture, the project finds inspiration in the concept of the cave. The basis evolves around three primordial needs - refuge, light and water.

It is an avant-garde approach which takes the common mentality of daylight strategies to its limit . Openings are strategically placed according to working zones, while other zones are left in the dark and dependable on electrically lighting. In the few rooms with openings to the outside, a scenographic setting is achieved only to be emphasized further by the dark surroundings and raw material use.

The project reviews the future usage and services of the library and suggest new ways for its users to contribute new knowledge and material to be shared. Through the service named Input, the daily passive consumers gets opportunity to become active producers. In a vertical structure, transparent and warm colored interiors creates open and creative volumes for learning, inspiration and sharing.
It becomes a pathway that creates the foundation for the rest of the building with flexible and differentiated spaces, a wilderness of intertwined paths and unforeseen adventures that could lead to informal meetings.

The journey is scattered to the urban fabric where niches, views, plazas and interludes emerges. The urban plan consist of variating fragments, seemingly coming from the creation of the cave and intertwined tiles fades into the untamed grass.

Besides the unique exterior appearance the building performs according to the Danish building regulations for 2015 with a reasonable indoor climate.

The building stands as a monument in cultural surroundings, only giving glimpses of the interior setting, luring bypassers to take the adventure through dark passages, illuminated plazas and hidden sanctuaries.

REFLECTION

A LOOK BACK

On Sketching and Models
Drawings and physical models was without a doubt the most important communication tool in the design process. The remaining collaboration of hand sketches and models bears witness of the numerous iterations a design proposal goes through. Every idea evolved from these medias, and every argument was settled through it. As good as a drawing is to quickly produce and develop ideas, it is difficult to perceive all spatial relations. Future developments must strive to still use drawing and physical models, but implement digital models sooner in order to gain a richer understanding.

On Digital sketching
3D models played an important role in grasping knowledge of the site. The site was visited one time during a three day study trip, which gave us a much different understanding from how a 3d-model shows. It was a great media to gain knowledge of the intertwining volumes and its problems.

On Scale
After a while it was clear, that with the time in hand and the scale of the competition, parts of the design proposal would be neglected. This is mainly due to the lack of experience with projects of this scale. We underestimated the time frame for producing. The next step would be to lower our ambitions or chose a smaller project.

On Sustainability
The point of departure was focused on creating a zero energy building, but we took a radical change towards an avant-garde approach. This choice was based on our ambition to developing our personal competences, which we found would be best served by uncompromisingly examen the concept to its limit. We could go through a series of compromises to fit the concept into following our intentionally vision of a zero energy building. This would leave us with more knowledge of the same knowledge we have learned during the last four and half years, but not gain us any new knowledge or competences.
Adding renewable solutions - such as solar cells or windmills - would blur the clear architectural expression we wanted. Having said that, renewable solutions have immense value when they are integrated in a harmonic way. As mentioned the time frame in relation to the scale, did not leave us with enough time an resources to do so, and this would definitely be another point to further develop.

On miscellaneous
In the beginning of the thesis, we worked on another concept, after a few weeks we changed concept to the cave. The experiences learned is to early on be bold, and choose another direction instead of forcing an idea to work. Some ideas have a bigger potential than others and we believe the cave have a lot more to offer than what we touched this time around.
The semester taught us the importance of visiting a site to understand the scale and mood of a place. It definitely showed us the importance of constantly sketching. Partly to minimize misunderstandings, and partly to explore which ideas evolve from a series of drawings. It has been a steady going process with numerous ideas that appeared and disappeared through the design development.

LIST OF ILLUSTRATIONS

Not mentioned figures are our own illustrations

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Fig. 1.40 (1972) Can Lis, Mallorca, Spain [Photography] Jørn Utzon
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[2013, 17/05/2013]

APPENDIX 1

SUSTAINABLE TECHNIQUES

UTILIZING THE ENVIRONMENT

To obtain a zero energy building there are many goals and targets to meet. In this section a brief description of these strategies and technologies will be explained and used in the following process. In order to reach the lowest energy consumption the design must merge with a technical aspect.

Reduce Heat Loss
To energy optimize the building it is important to design a compact and air tight building envelope. This is a matter of making the right choices when designing the joints between different building parts, such as windows, doors and walls to reduce the cold bridges.

Cold bridges occur when joints between building component are not constructed correct, which allows heat to escape and cold to slip in.
The insulation properties can be described by a u-value, which is very important when aiming for a low energy building. Furthermore is it important to obtain a good ratio between the building envelope and volume. Every room should also be divided into different zones after the rooms indoor climate demands.

U-value
The u-value (transmissions coefficient) describes a materials insulation ability or a composition of multiple.
The lower a u-value, the better the construction is to preserve heat, and thereby reduce heat loss. It is important to focus on building components such as the envelope, windows, doors and foundation.

Passive Solar Design
In passive solar building design the building, in terms of windows, walls and floors are made to collect, store and distribute the solar energy to the room. It is called passive as it does not involve any types of mechanical or electrical devices, contrary to active solar heating.
To obtain the best possible output it is key to design the building to its local climate. This should be considered in the window placement, glazing and orientation, shading, thermal insulation and thermal mass.

Thermal Mass
Thermal mass is a passive technology that describes how the mass of a building can provide stability to the indoor climate against temperature fluctuations. This will be apparent when the outside temperature changes through the course of day, a thermal mass within the building envelope of the house can balance the daily temperatures fluctuations, since the thermal wall accumulate thermal energy when the surroundings are higher in temperature than the mass and releases the thermal energy back when the surroundings are cooler.
However, if the thermal mass is dimensioned too small it will maintain a high temperature during night and affect negatively on the indoor climate.

Ventilation
Ventilation can be divided into three groups - natural, mechanical and hybrid.

Natural Ventilation is the venting of the house that happens through windows, doors, venting openings and leaks. It is driven by the natural forces such as wind, pressure and temperature.
There are two types of natural ventilation: wind driven and thermal buoyancy driven.
Wind driven ventilation is driven by pressure differences on different facades. Moving from over pressure to under pressure.
The basic ventilation principles are:

Single sided ventilation is when there only are openings in one of the facades of the building. For this principle to function the rooms length should not be more that two times of its height.

Cross ventilation will occur when a room has openings in more than one of its facades. It will be most efficient in rooms no longer than five times of its height.

Thermal buoyancy is driven by differences in the density of the air inside and outside of the room. The change, in the air density, primarily caused by temperature differences, will force the warmer air to rise upwards because of its low density, thus creating a vertical air stream.

Mechanical ventilation is venting of a room or building by electric devices. They can help prevent heat loss and will in that sense be more energy efficient compared to natural ventilation. This type of ventilation is also easier to control by the user.
Natural and mechanical can also be combined, which is called hybrid ventilation.

Hybrid ventilation utilizes both natural and mechanical venting based on the needs of the building and the outdoor climate. The system will adapt on the basis of the outdoor conditions and control the use of mechanical ventilation. A heat exchanger can optimize the system by transferring energy from outlet air to inlet air.

Solar cells
Is an electrical device that converts the energy of the light into electricity. The placement of the solar cells have a great impact on how they will perform, where especially orientation and possible shadow influences are important to take notice of. The optimal position is directly south and at an angle of 54°.

APPENDIX 2

TECHNICAL CALCULATION

LOADS

Snow Load [S]
μ_i= Snow load shape coefficient = 0,8 (DS 410, p 26)
s_{ad}= Design value of exceptional snow load on the ground = 4,06 kN/m^2
s_k= Characteristic value of snow on the ground at the site = 2,03 kN/m^2
c_e= Exposure factor = 1
c_t= Thermal factor = 1
$S=\mu_i\, c_e\, c_t\, s_k$ =0,8·1·1·2,03kN/m^2 = 1,63kN/m^2

Snow load determined for (DS 410, p 38)
persistent / transient design situations
$S=\mu_i\, c_e\, c_t\, s_k$ = 0,8·1·1·2,03kN/m^2 = 1,63kN/m^2
accidental design situations
$S=\mu_i\, c_e\, c_t\, s_{Ad}$ = 0,8·1·1·4,06kN/m^2 = <u>3,25kN/m^2</u>

Dead load [G]
h = material thickness [m]
g = gravitational acceleration [m/s^2]
ρ_m = material density [kg/m^3]
$Q=\rho_m \cdot g \cdot h$

Example calculation:
Construction part, reinforced concrete
h = 0,3m
ρ_m = 2400 kg/m^3
g = 9,82 m/s^2
q =0,3m·2400 kg/m^3·9,82 m/s^2 = 7,07kN/m^2
Specified dead load calculation can be found in excel sheet.

Total dead load for two floors and one roof, <u>24,8 kN/m^2</u>

Live Load [Q]
Category b, <u>2,5 kN/m^2</u>

Load combination , we presume live load to be the dominate.
$1{,}0 \cdot G + 1{,}5 \cdot Q + \psi \cdot S = 1{,}0 \cdot 24{,}8\ kN/m^2 + 1{,}5 \cdot 7{,}5\ kN/m^2 + 0{,}6 \cdot 3{,}25\ kN/m^2 =$ <u>38 kN/m^2</u>

Load on the column

loadarea
4,5m·13,5m = 54m^2

total load
38 kN/m^2·54m^2 = 2004 kN = <u>2,04 MN</u>

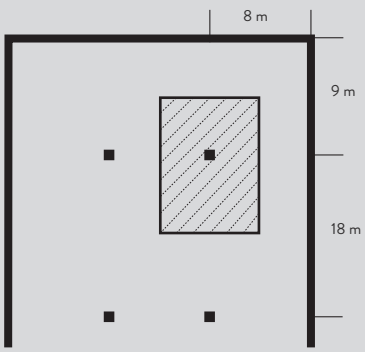

Fig. 1.98

COLUMN CALCULATION

We dimensioned the column placed in northern part of the building because we estimated it to be the worst case due to its maximum free height. The column is going from the basement to the roof but the highest free height is inside the reading hall, 14 m.

l_s =28m
Concrete:
f_{ck} = 35 MPa
f_{cd} = 21,2 MPa
Reinforcement:
f_{cd} = 550MPa
f_{yd} = 423 MPa
E_{sk} = $2 \cdot 10^5$ MPa

estimated column dimension
600x600

The working load of the column is found with

$$N_{Rd} = \sigma_{cr} \cdot A_c (1 + \alpha \varrho)$$

where,
σ_{cr} = Critical concrete yield
A_c = Concrete cross section area
α = Module of elasticity relation between reinforcement and concrete
ϱ = Reinforcement relatiton

First the critical concrete yield is found

$$\sigma_{cr} = \frac{f_{cd}}{1 + \frac{f_{cd}}{\pi^2 E_{0cr}} \lambda^2} = \frac{21,2}{1 + 1 \cdot 10^{-4} \cdot 161^2} = 5,87 \text{ MPa}$$

given

$$\lambda = \frac{l_s}{i} = \frac{28000}{173} = 161$$

to determine if the estimated dimension is correct these assumptions is needed

$$1)\ \sigma_{cr} \cdot A_c (1 + \alpha \varrho) \qquad 2)\ \sigma_{cr} \cdot A_c + f_{ycd} \cdot A_{sc}$$

1) 2,18 MN 2) 2,45 MN

$$\varrho = \frac{A_s}{A_c} = \frac{804}{600 \cdot 600} = 0,0022$$

α = 15 (tabel value)

2,04 ≤ 2,18 OK!