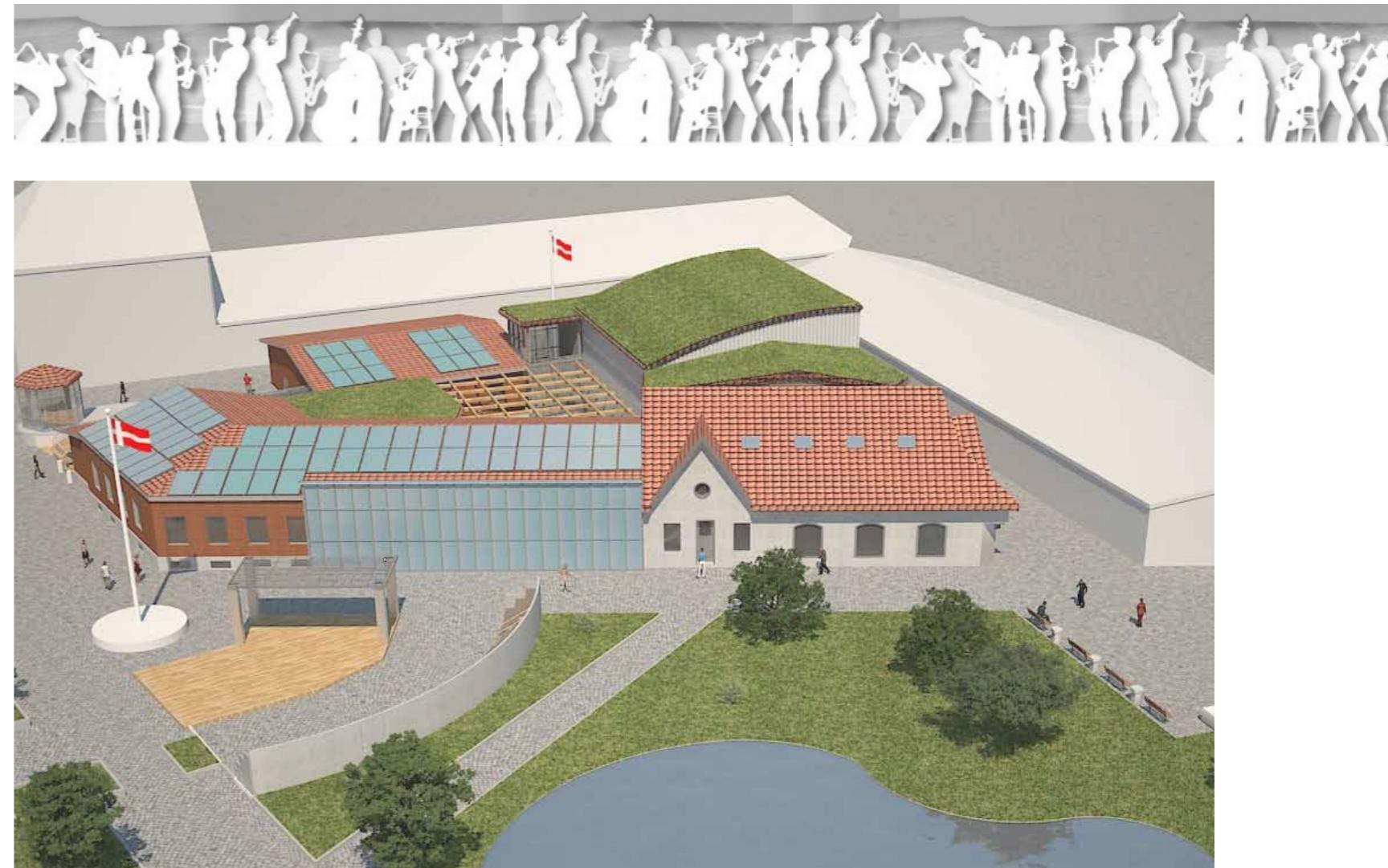


Adaptive Re-Design
Nordhavn Music centre
Farnaz Akbari

Master program -Design for sustainable development
Chalmers Technical University(Göteborg Dec 2011)



Acknowledgement

This report is my master thesis for the conclusion of my Masters programme at the department of architecture in design for sustainable development, Chalmers University of Technology Göteborg, Sweden. I wish to thank all people who's help in creating this thesis is greatly appreciated.

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**Farnaz Akbari
Gothenburg, Jan 2012**

Adaptive Re-Design **Nordhavn Music center**

Master program -Design for sustainable development
Chalmers Technical University(Göteborg Dec 2011)

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Abstract

This Thesis studies the process of Re-design in vacant industrial buildings in Nordhavn , Copenhagen from **the perspective of a adaptive re/design strategy based on sustainable development principles, and reduced energy consumption.**

Project start with main research question: **Is it possible to adaptive re-design vacant industrial buildings with sustainable principals?**

The overall goals of project are investigate how sustainability could connect buildings from past time to present by creating a dense neighborhood for cyclists and pedestrians, social sustainability with creating a spaces for musical activities, Re-design new functions to change the vacant character of area and crime prevention effect, attract the life and activity in site with creative business , small scale enterprises, workshops, studios, Keep the long history of people and strong identity of this site so preserve the high limit buildings to support the character of area.

Adaptive re-design uses as a strategy to develop industrial buildings to new function and new design, prevents demolition ,re-development and keep the character of industrial buildings.

My aim is redesign buildings without losing the character of existing constructions to revitalize the buildings and their surroundings. Instead of throw-away approach to old industrial buildings, adaptive re-design offers sustainable buildings with existing infrastructure and materials.

I believe that the research, case study and Design could be used as a method to adaptive re-design of buildings according to the sustainable lifestyle to create great and comfortable spaces for occupants.

The end product is a new music Centre in Nordhavn. So the result is to re-design a complex of warehouses to a music centre. Emphasizing the importance of simple solutions, maximum insulation, attention to acoustic rooms, controlled ventilation and passive solar design, are the priorities.

Keywords: -Adaptive Re-design, sustainable development, Vacant Industrial buildings, Acoustic



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Chapter I

Introduction



1.1 BACKGROUND OF STUDY

WHAT

The goal of my master thesis is to investigate how sustainability could connect past time buildings to present and the belief is that the design could be used as tool to refurbishment of a building according to the sustainability principles to create great and comfortable spaces for different generations . The master thesis will be a part of “NORDHAVNNEN - THE SUSTAINABLE CITY OF THE FUTURE” project in Copenhagen,Denmark.

Motivation/Background

My idea grew out of sustainable building part C studio when we transformed an old industrial warehouse to an office building with considering sustainable issues. I found that there are a big number of buildings in harbour areas which have an enormous potential to transform and use in new function.



Intec House, Brighton - Before Refurbishment



Intec House, Brighton - During Refurbishment

WHAT IS SUSTAINABLE BUILDING?

During study in Chalmers I realized that Sustainability is an issue of great importance for society and for building sector because:

- 50% of material resources taken from nature are building related
- Over 50% of national waste production comes from the building sector
- 40% of energy consumption in Europe is building related

STARTING POINT OF PROJECT

In conservation studio I found that most of the buildings have built by now and in future we need to refurbish them and for the first time, refurbishment projects are held in the same regard as new build. While traditional refurbishment focused on preservation, the next generation of projects will seek to preserve in a sustainable manner. This means;

- Applying fundamental science (energy, water, light, sound...)
- Developing new products and techniques
- Incorporating the impact of the user into design (www.sustainablerefurbishment.com)

WHY CHOOSING THIS AREA?

In one of the lectures in Chalmers I found that there are a lots of sustainable projects in Copenhagen and I found more about these projects in www.denmark.dk. One of the Scandinavians largest metropolitan development project is development of Nordhavn. It will be a district of small islets close to the waterfront and a diverse, mixed city with room for everyone. As an urban development project, Nordhavn spearheads efforts to improve climate conditions and show how cities can help reverse climate change without losing out on quality of life, welfare and democracy. (Will Copenhagen still be wonderful in 2015, www.denmark.dk)

So I decided to find a building or a complex of buildings in this area and refurbish and renovate it in sustainable way which I learned during master studies. Now I have enough love, courage, trust to my ability, and I need to support, perseverance and patience. I contacted to offices and companies which involved with Nordhavn development projects.

ONLINE RESOURCE-ARCHITECTURE OFFICE- STAKEHOLDER



NORDHavn COMPETITION WINNER'S DEVELOPMENT PROJECT



In 2008 there was a competition for Nordhavn future development plan and more than 180 companies all over the world participate in competition. The winners are a composed team of Cobe, Ramboll, Slet and Polyform.

The owner of project is CPH city and port development. Their plan for development of Nordhavn is consist of 6 themes.

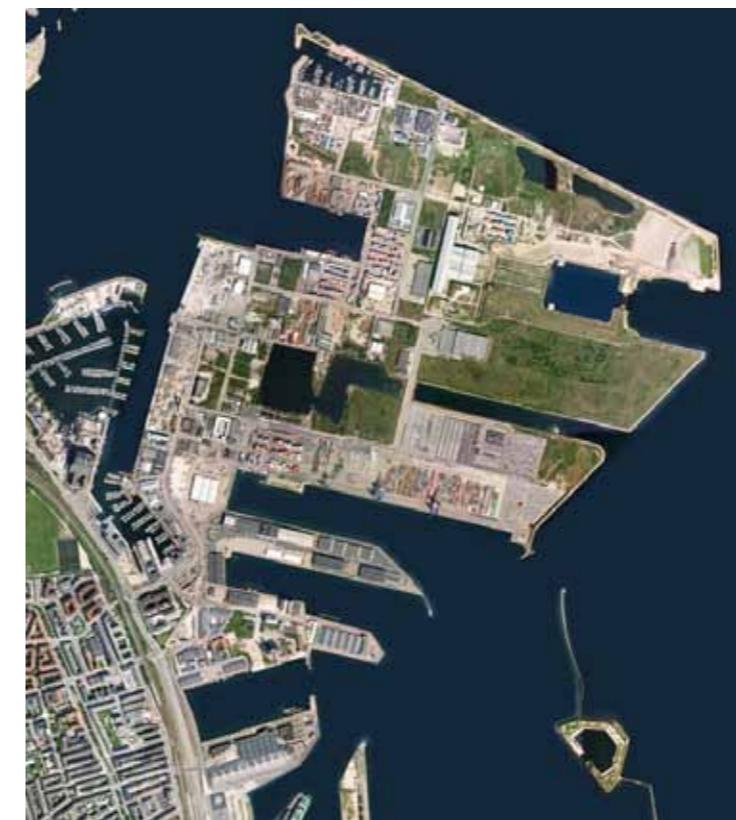
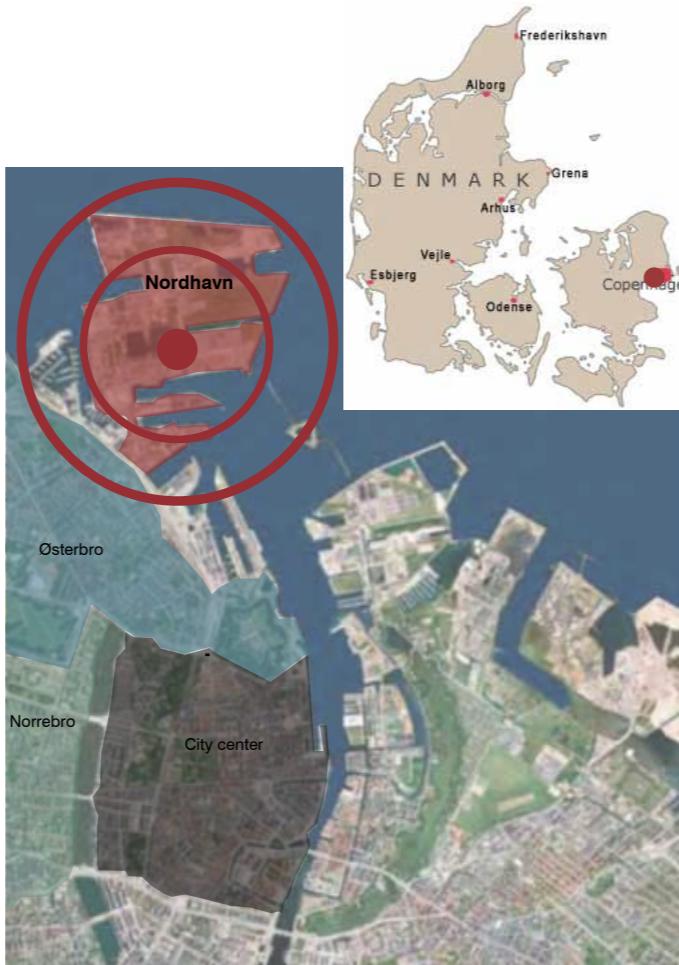
The Sustainable City of the Future
(Pics: The booklet Nordhavn urban strategy November 2009)



NORDHavn

I became more interested to project and visited the site and I found in current Nordhavn :

- Harbour
- Industrial area
- Copenhagen's Container Terminal
- Quays used by cruise
- A number of warehouses
- Container repair workshops
- Sale of ship's provisions
- The S-train station (Nordhavn station)

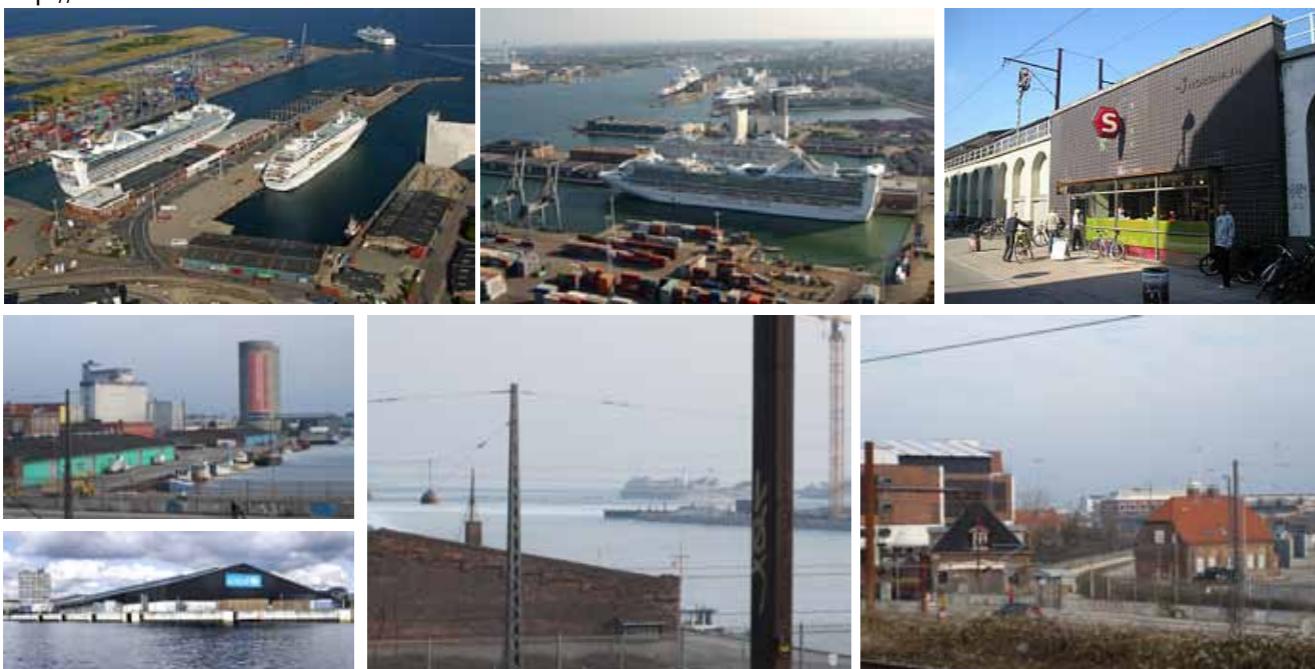


MY DREAM:

By finding a new way of designing and refurbishing, the aim is to contribute to a greater quality of life, more comfortability in the old buildings. I wish to contribute to a greater understanding between architects and the users. This project is a kind of testing for me to prove that how far is it possible to refurbish in sustainable manner. The main issues I will consider in investigating and design are using renewable energy resources for heating and cooling, using reused and recycled material, notice to climatic limitations-very cold weather at least 5 month- in architectural design, water and waste management, considering noise and odor pollution, social sustainability.

<http://www.cphx.dk>

<http://www.cobe.dk>



AIM:

The value of the investigation will be to find a way of sustainable refurbishment in the present which is adaptable to future changes. I hope the result of this project could be of value for students, researcher, inhabitants and everyone who related to build sector or only interested to sustainable future Architecture.

DESIGN:

By gathering information and using different tools, I will try to show a real picture of my idea. The next step will be to apply that knowledge into the development of a strategy and a re-design. My idea needs different methods to show; analyzing, diagrams, drawings, illustrations, a theory part including: Environmental studies, Materials, Workshops, internship, interviews, model-making, sketching and writing.

I will work in different phases using these tools trying to investigate, define and solve the problems that have been formulated.

HOW

DESIGNING THE PROCESS:

Successful design process experiences:
 This is my second master thesis in architecture field so I have several different experiences.
 I divided design process to different steps and I followed all steps. Now I am going to use that process layout and add more steps to improve it. In this way I will feel secure during design process in my master thesis. I made the steps for each weeks but it would be flexible and I will revise it each month if some steps lost.

DESIGN:

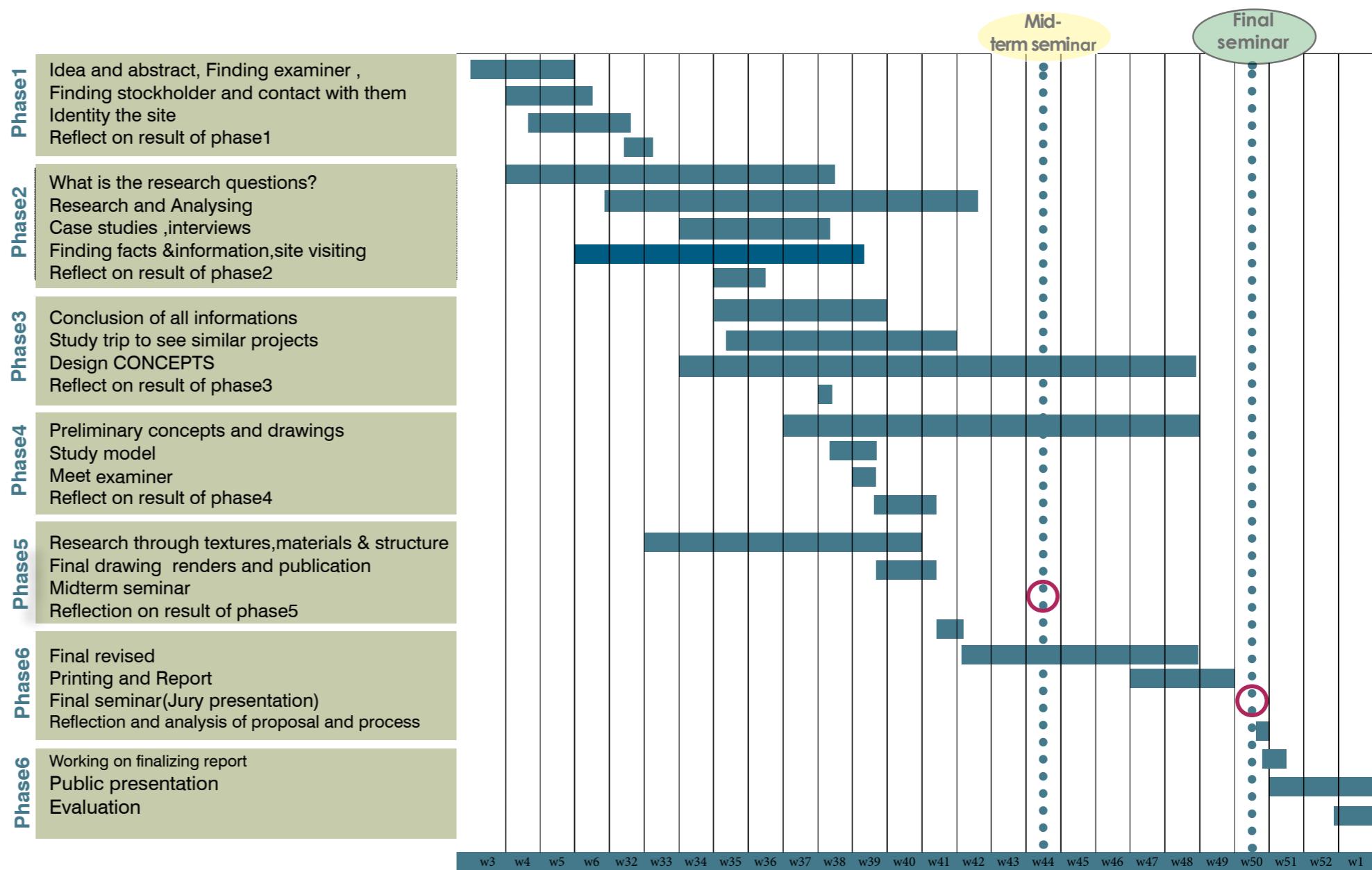
In order to show and strengthen my idea and to create my vision I need to go through the phases presented in my project plan, always going back to my core idea and redefine it after each phase. Designing a strong concept, based on the idea, in the form of illustrations and models will be the tool and would also help me to show and explain the idea to others.

A framework is needed to control the time and steps, "am I on time?", but the schedule has to be flexible so that changes can be made during the process.

The phases will overlap each other, but there will be time while I focus on each specific step. I start from the end, to make sure that I have enough time during the last weeks. The finishing step would be 2 weeks before final seminar. Each step will contain half design and half research. Also there is enough time for study trip, visiting friends, sport activities, watching movies ...

I will try to contact different stakeholders like Advisors, Organizations, Municipalities, Architectural offices, Researchers...

Smaller presentations each two weeks in last two month are needed.



*1 Handbook of sustainable building an environmental preference method for selection material for use in constructing and refurbishment. James & James science publisher1996

*2 www.sustainablerefurbishment.com

*3 Will Copenhagen still be wonderful in 2015? www.denmark.dk



1.2 THIS THESIS...

The aim of the project is to investigate how adaptive re-design Industrial buildings with sustainability principals. To achieve this goal the method is research and design.

In the research part I will start by introduce the Nordhavn project and the competition winner project for Nordhavn development then I will define theories. Adaptive design theories ,sustainability principals ,objectives and benefits of each ,and then I will discuss a case study.

The design part will start with a site analysis according to environmental and social issues. Documentation of existing buildings and showing the original drawings, photos of site and buildings existing conditions help me to decided about which kinds of re-design is more sustainable and adaptive for these buildings .Then through lessons I learned in research and Examples and case study part I will try to re-design a complex of warehouse in Nordhavn area in Copenhagen.

I have work on 3D modelling system in Revit to investigate which part could be change or add new venue or maybe turn down some parts, and also I will study about acoustic and go through acoustic details, the last part is about material and which is more sustainable and could use to redesign buildings or could change the material of some parts. But the things is important keeping the character of buildings and doing less intervention in adaptive re-design process.

1.3 The Problem area

Virtually old industrial harbour has a derelict factory, or vacant warehouses. These structures can quickly become havens for transients and drug dealers and attractive nuisances that lure children into their dens of trash and debris. Those who live near the squalor of vacant properties suffer adverse impacts on their sense of community,

Overall quality of life, and property values. Vacant properties often contain an array of conditions (illegal dumping, leaking sewage, and fire hazards) that pose serious threats to public health and safety ².

Vacant Industrial harbour buildings

"In the 60's and 70's harbour areas and their waterfronts were not much appreciated in many European cities. They were neglected and considered problematic. E.g. Hamburg, Geneva, Copenhagen, Amsterdam. Quite often they were cut off from the city's most frequented neighbourhoods by vast infra structural bodies and barriers". (Nordhavn København , e-architect website)

During the nineteenth and twentieth centuries, transportation systems changed from river and canal transport to railway and motorway network, so a large numbers of riverside and canal-side factories,warehouses and railway building becoming redundant. Relocation of industry and commerce to be near the new transportation arteries led to the considerable amount of renovation and re-use of redundant riverside, canal-side and dock side buildings in recent years. (Nordhavn København , e-architect website)

1.4 Current design strategy in refurbishment of industrial buildings

Advances in industry and commerce together with society 's constant demands for improved interior environment for both work and leisure, have led to large number of building becoming out dated, redundant or obsolete and this, in turn, has provided a vast number of buildings suitable for renovation and conversion to new uses.

Also the quality of these kind of buildings are suitable for re-design them. In majority of cases the new accommodation will be available in a much shorter time.

Building renovation and upgrading including maintenance repair ,restoration and extension are major component of construction activity, accounted for just under half of the construction industry 's total output for last two decades. Building owners and developers have, in recent years understand the potential values of vast stock of old, redundant and obsolete buildings as a means of providing, through their renovation and re-use high quality " accommodation more quickly and in low cost than the alternative of new construction. There has also been a significant change in attitudes favouring conservation and recycling of resources, especially in recent years with efforts to reduce the use of fuel and carbon dioxide emissions and develop a more sustainable way of existing buildings . (*The Revitalization of Vacant Properties , J.M. Schilling*)

QUESTIONS WHICH I START TO INVESTIGATE

- 1- What is the sustainable refurbishment?
- 2- How much changes is possible according to sustainability in existing building?
- 3- How could be renovating in present which is adoptable for future?
- 4 -What kind of regulations are there for sustainable refurbishment?



Research question

The main body of thesis project started by researching different subjects related to refurbishment, transformation, renovation, conservation... And from these terms I was able to form my research question:

CONSERVETION
EXISTING BUILDING
VACANT BUILDINGS
REFURBISHMENT
PRESERVATION
ADAPTIVE RE-USE
ADAPTIVE
RE-DESIGN
INDUSTRIAL BUILDINGS
REVITALIZATION
RENOVATION
PRVITALIZATION
RE-DESIGN
TRANSFORMATION
RESTORATION

Is it possible to **Adaptive Re-design** vacant **industrial buildings** with **Sustainable** principles?

1.5 Approach for the thesis

The method which I used in this project is consist of three main sections



Chapter ==

Literature review

2.1 Definition and potential of industrial area

Main reasons to renovate vacant industrial buildings

Harbour areas have a strong characteristic identity and atmosphere; the traces of labour and usage ; the proximity to the water; the large spaces of basins and long stretched quays. Today - due to re-location and modernization of harbour activities - these areas offer great opportunities for development of new neighbourhoods .(J.M. Schilling and Naomi Friedman,*The Revitalization of Vacant Properties*)

There are many reasons that provision of modern construction through renovation and re-use of existing old buildings are preferable to construct a new building. Where we wishes to provide a modern accommodation and a suitable existing building is available in right location should consider carefully that renovation and re-use of building may well be a more viable means of providing accommodation than choosing a new construction.Because old industrial buildings help define the character of our communities by connecting us to the past.

The cause for the renovation are generally because of the coming of new technique, the changes of industrial structure, the rapid development of economy, as well as the population explosion of the city .(Michael Stratton, *Industrial Buildings Conservation and Regeneration*)

Benefit of refurbishment instead of demolishing

In most European cities there is a vast stock of vacant buildings, many of which are getting to the end of their useful life. Demolition is an option but refurbishment is a more environmentally friendly and sustainable option, according to the architectural value, materials use, neighbourhood disruption, waste disposal, etc.

However old buildings can use large amounts of energy and provide poor internal conditions for occupants and generally not meet current requirements or expectations. Common environmental problems are high heating demand, poor lighting, poor ventilation, solar penetration and glare, poor control of heating and cooling, etc.

"Refurbishment to upgrade a building, improve comfort or reduce energy consumption, can be an ongoing process whilst occupation continues, or at the other extreme, stripping the old building back to its essential structure and rebuilding"(Christopher A. Gorse,David Highfield *Refurbishment and Upgrading of Buildings*)

There are total two refurbishment approaches. One is seen from the alteration to land use aspect, it is usually renovated into residential, commercial, open space, and multiplex improvement. The other is seen form reusing primary building aspect, which includes demolishing, alteration and repair. In reality, these different approaches are applied flexible.(Deng yuan yuan and Chang jiang ,*The Transformation of Old Industrial Buildings*)



Pic 2:

Vacant/Abandoned industrial building.

the building has reportedly experienced several fires and has numerous hazards such as open floors and areas that have been vandalized by persons seeking scrap metal and fixtures



Pic... A sample project of re-design



Pic... A sample project of reparation

In practice, the adaptive re-design of old industrial buildings can not only choose one specific approach. Several types of reformation approaches will be adapted at the same time. The different quarter has specific emphasis.

From adapting re-design point of view, there are three main approaches:

1. *Reconstruction*

2. *Alteration*

3. *Reparation*

“Reconstruction” is to demolish the primary industrial buildings and pull down productive equipment, then build new constructions and facilities. The main reasons for reconstruction are the primary buildings and facilities have been abandoned, or are in inefficient conditions. And they cannot satisfy the development demand of the city and economy and will be replaced by new constructions with higher utility value, such as commercial center, office building, resident, entertainment facilities, green open space, street extension, and public facilities and so on. At the same time, the improvement of environment and increase of economic benefit are also included.”

“Alteration” is to refine part of primary constructions and facilities in old industrial area, and transform to other functions. Adapting this approach is based on the constructions and facilities are in good condition and with some utility value, or have historical and cultural value. Part of function, construction and utility of buildings will be reformed to improve public or entertainment facilities.”

“Reparation” is to reinforce and repair the industry constructions and facilities in old industrial area, and continue the primary utilities. Old facilities are out of date and constructions are deteriorating, and new techniques have replaced traditional ones.

They will be renovated to satisfy new demands. Generally, reparation is the best way to save investment”. Derek Latham- *Creative reuse of building*, Volume2.p46

2.2 From adaptive re-use to adaptive re-design

What is Adaptive Re-use?

"Adaptive re-use is the act of designing a new function for buildings. It is often described as a process by which structurally sound older buildings are developed for economically viable new design. The recycling of buildings has long been an important and effective historic preservation tool. Adaptive re-use developed as a method of protecting historically buildings from demolition." (Austin 49)

Industrial Buildings are especially suited to adaptive re-use because of their large, open spaces, their architecture, as memorial from the industrial age. Adaptive re-use should be the preferred strategy for an industrial building when no other industrial option is available. And could be consider over demolition and redevelopment. There are countless reuse options available for industrial buildings.

"Some of the more popular re-use are of industrial building to museums, art studios, live-work units, offices, residential units, schools, retail, and increasingly more are combining several uses together". (Sophie Francesca Cantell 2)

Importance of the Adaptive Re-use of Industrial Buildings

Preserving industrial buildings is an important part of maintaining the historic industrial character of a community.

"Industrial complexes and buildings are impressive architecturally, both in their size and muted decorations. They were built with practicality in mind – production, efficiency, and sometimes safety of employees. The majority of early American industrial buildings from the eighteenth and nineteenth centuries are remnants of anonymous and vernacular architecture serving a functional purpose rather than a theoretical one. The factories designed by Frank Lloyd Wright, Walter Gropius, and Albert Kahn may indeed be exceptions, but the nineteenth century factories designed and built by craftsmen are the ones most in need of protection and new life". (Sophie Francesca Cantell 5)

A successful adaptive re-use project can bring redevelopment, heritage tourism, and new life into a community.

"Cities need old buildings so badly it is probably impossible for vigorous streets and districts to grow without them. By old buildings I mean not museum-piece old buildings, not old buildings in an excellent and expensive state of rehabilitation—although these make fine ingredients but also a good lot of plain, ordinary, low-value old buildings, including some rundown old buildings".

(Jane Jacobs , *The Death and Life of Great American Cities*)

Benefits of adaptive re-use

Adaptive re-use is a process that changes a disused or ineffective item into a new item that can be used for a different purpose. Sometimes, nothing changes but the item's use.

The adaptive re-use of a historic building should have minimal impact on the heritage Significance of the building and its setting.

First question is why the building has heritage status, and then pursue development that is sympathetic to the building to give it a new purpose through re-use.

The most successful built heritage adaptive re-use:

1. Best respect and retain the building's heritage significance
2. Add a contemporary layer that provides value for the future

Sometimes, adaptive re-use is the only way that the building's fabric will be properly cared for, revealed or interpreted, while making redesign of the building itself. Where a building can no longer function with its original function, a new use through adaptation may be the only way to preserve its heritage significance.

Social benefits

Keeping and redesigning historic buildings has long-term benefits for the communities that value them. When done well, adaptive re-use can restore and maintain the heritage Significance of a building and help to ensure its survival. Rather than falling into disrepair through neglect or being rendered unrecognizable, heritage buildings that are sympathetically recycled can continue to be used and appreciated.

Communities increasingly recognise that future generations will benefit from the protection of certain places and areas, including heritage places.

The value of our lifestyle is raised not just from the memory of heritage buildings, but from their adaptation into accessible and usable places.

Environmental benefits

When adaptive re-use involves historic buildings, environmental benefits are more significant, as these buildings offer so much to the landscape, identity and amenity of the communities they belong to.

Economic

There are several financial savings and returns to be made from adaptive reuse of historic buildings. Embodied energy savings from not demolishing a building will only increase with the predicted rise of energy costs in the future.

(Adaptive Reuse: Preserving our past, building our future Department of the Environment and Heritage, 2004)



Adaptive re-design approaches

In this project the term adaptive re-design used instead of adaptive re-use in a absence of real owner and employer, so the role of architect in such projects is re-designer.

According to the which role it plays in the society, economy and culture, the adaptive re-design of old industrial buildings need more attention. Old industrial architecture is treated with greater caution and a friendlier approach.



pic.Derek Latham- *Creative reuse of building*, Volume2.p46

"According to examinations of renovation projects people have more attention to the sustainability of the culture context, the realization of spatial use and art appreciation, but not to post-transformational conditions" (Deng yuan yuan and Chang jiang ,*The Transformation of Old Industrial Buildings* p 179).

So improvement of the quality of a building during the re-use process deserves greater concern. The trend of adaptive re-use is combined with sustainable development; here, technical renovation, which emphasizes the improvement of old architectural environmental representation, is highly regarded.

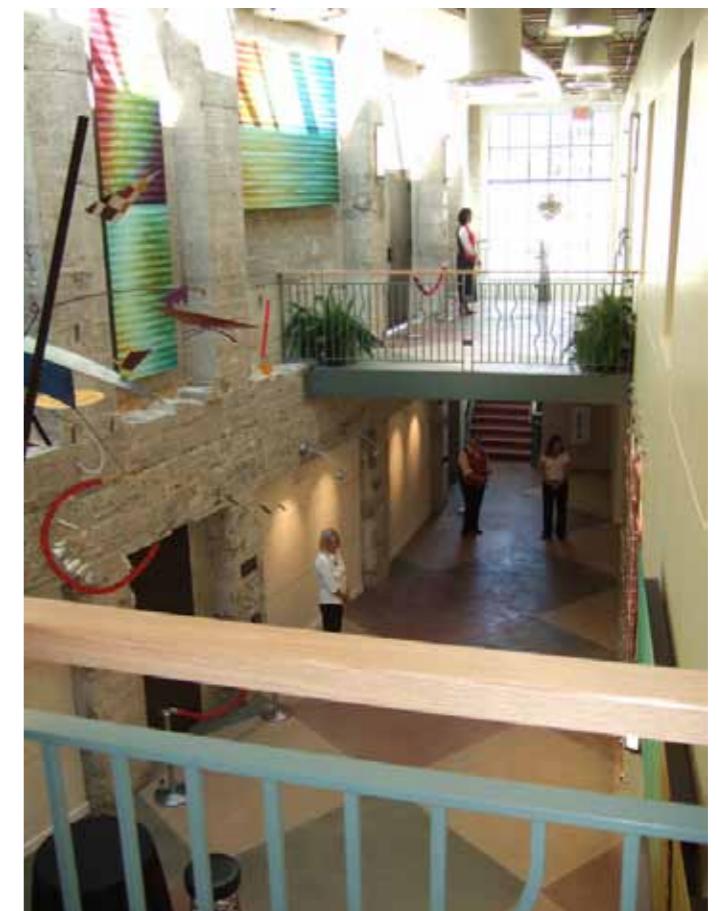
Considering the estimation of the value and significance of architecture, one important index is its potential for sustainable development. If the reduction of energy consumption of old buildings can be realized in the process of perfecting their interior functions and exterior image, the re used buildings would be of greater significance.

"From ecological development aspect, In industry district, infrastructure is mainly to satisfy the requirement of industry production. Normally, there has little green space, and the current circulation has great limitation. The government uses the opportunity of reforming old industrial zone to promote infrastructure construction and provide more public facilities, such as green open space, and satisfy new needs, which are brought by functional alteration"(Deng yuan yuan and Chang jiang ,*The Transformation of Old Industrial Buildings*)

On the other hand the old industry will be transformed to be new cleanly one. At the same time, with new functions being complemented, the old industria areas becomes a complex used district, and provides more job opportunities to social population.



Before
Existing link between two buildings



After
Skylight internal street as lobby



Before
Old church on a wheel to move new site



After
Morgan hill community playhouse

photos from Gtrue studio



Definition and principals of Industrial buildings

The reformation for old industrial buildings is neither to rebuild a new district, nor to simply repair the former physical environment. That needs to introduce comprehensive renovation by synthesizing multiplicative reformation approach.

The reformation includes the inheritance and development of traditional culture to:

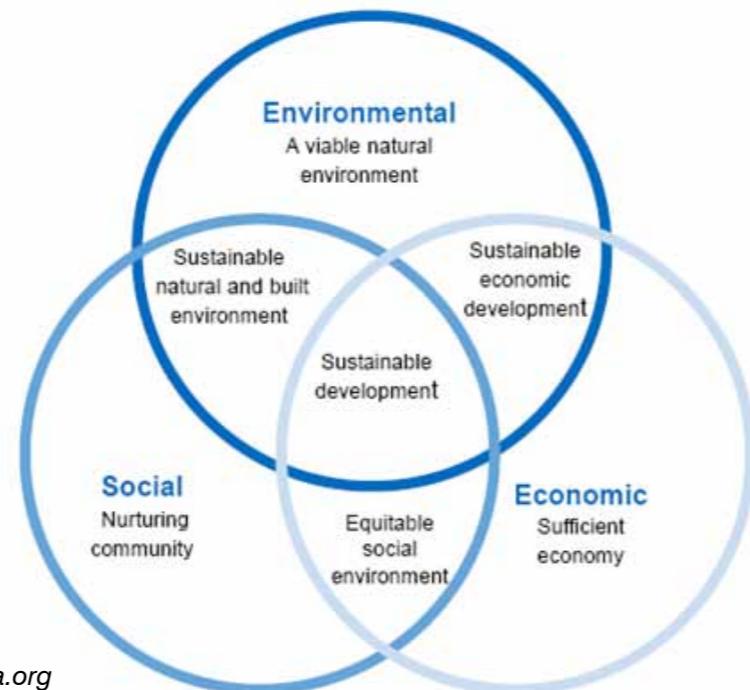
- Maintenance historical image of industrial civilization
- Takes innovative ideas to create new utility value
- Promote the sustainable development for the society, economy and environment.

The adaptive re-design for old industry buildings is under guidance of following principles.

2.3 RE-DESIGN FOR SUSTAINABLE DEVELOPMENT

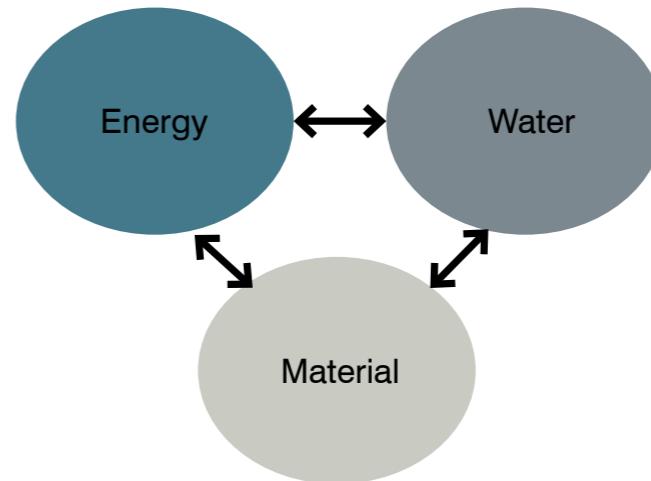
In the views of economic sustainable growth and environmental protection, the renovation should treasure what the industrial buildings have accumulated. Such as the memorable buildings and landscape, specific activities and atmosphere, framed-well infrastructure, remain-good construction buildings etc. Big efforts should be made to reserve and reuse the valuable resources in the buildings. In addition, the redesign planning should meet the needs generated by urban expedition and structural transformation.

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. In this sense sustainability is a holistic concept dealing with simultaneous environmental, social and economic sustainability.



<http://www.ciria.org>

In sustainable-building analysis, stress is put on three most important “flows” through a building, i.e. *Energy*, *water*, and *materials*. The idea of conservation is true for energy as well as for water and materials .So the role of these three components are important in the process of building planning, construction, use and decomposition (not demolition).



In a sustainable-buildings strategy, we can find all the elements of energy efficient and Environmentally-friendly buildings. In addition, stress is put on promotion of quality, which includes:

- Quality of the indoor environment;
- Quality of the residential area;
- Quality of building materials.

In analysing buildings from a sustainable point-of-view, we put attention on the present and future protection of energy, water and land resources. Use of renewable and recycled sources is promoted, because the life cycle of a building as a whole and its elements can be closed: renewable are renewed by nature; recycled products and materials get a second life and become an input product for the next final product. Selection of materials is performed with the least environmental impact taking into account the complete lifetime. Quality of life, indoor life and life in the residential area, are considered to be strongly connected with the quality of the environment.

The idea of sustainable buildings can also be transformed to thermal modernization processes. It is characteristic that among energy-efficient buildings, there are a lot of new trends which consider the energy aspects from different points of- view. Utilization of renewable and wastes in extreme cases leads to self-energy sufficient buildings. These buildings do not require energy to be supplied by external sources; the energy is produced and used at site. It could be said that they are the best option for environment. However, self-energy sufficient buildings need usually high-tech systems, which can be unfeasible from the economic point of view; the embodied energy in systems and their elements can be high; and extraction of raw materials and production of building materials and systems can cause environmental pollution. *Directive of the European Parliament and of the Council on the energy performance of buildings, COM(2001) 226 final, 2001/0098 (COD), 2001.*

2.4 Embodied energy and sustainability

In the case of sustainable buildings, the details of energy consumption and the environmental effects of the building are performed using a Life Cycle Analysis (LCA). LCA considers the energy and environmental effects of the buildings, its systems, elements and materials starting from the extraction through production and use to the end-use. Embodied-energy analysis is a very important part of the consideration.

One of the main environmental benefits of reuse buildings is the retention of the original building's "embodied energy".

The CSIRO (the Commonwealth Scientific and Industrial Research Organisation, is Australia's national science agency) defines embodied energy as the energy consumed by all of the processes associated with the production of a building, "from the acquisition of natural resources to product delivery, including mining, manufacturing of materials and equipment, transport and administrative functions.

By redesigning buildings, their embodied energy is retained, making the project much more environmentally sustainable than entirely new construction.

New buildings have much higher embodied energy costs than buildings that are adaptively reused. In 2001, new building accounted for about 40 per cent of annual energy and raw materials consumption, 25 per cent of wood harvest, 16 per cent of fresh water supplies, 44 per cent of landfill, 45 per cent of carbon dioxide production and up to half of the total greenhouse emissions from industrialised countries".

The Australian Greenhouse Office notes that the reuse of building materials usually involves a saving of approximately 95 per cent of embodied energy that would otherwise be wasted⁷.

2.5 Re-design Energy efficiency goals

Apart from the traditional energy-saving measures such as: improvement of the building envelope; modernisation of heat sources and ventilation; introduction of automation and heat metering; improvement of other installed equipment; there is a need to introduce environmentally-friendly energy technologies to achieve further significant reductions in energy consumption in the building sector.

"Going towards sustainable-energy buildings, we can consider a methodology of several steps towards energy conservation and environmental protection in buildings.

The first is focused on standard methods of energy efficiency, which are economically Feasible. The second one supports the energy-savings measures, which are beneficial to the environment. The third one tries to find equilibrium between present and future energy needs and environmental requirements, whilst saving energy resources and keeping a clean environment for future generations. We can classify three types of buildings according to the appropriate steps mentioned above:

- Energy-efficient buildings
- Environmentally-friendly buildings
- Sustainable buildings

Energy efficiency in buildings is the first necessary and fundamental step towards sustainable-energy buildings.

Energy-efficient buildings

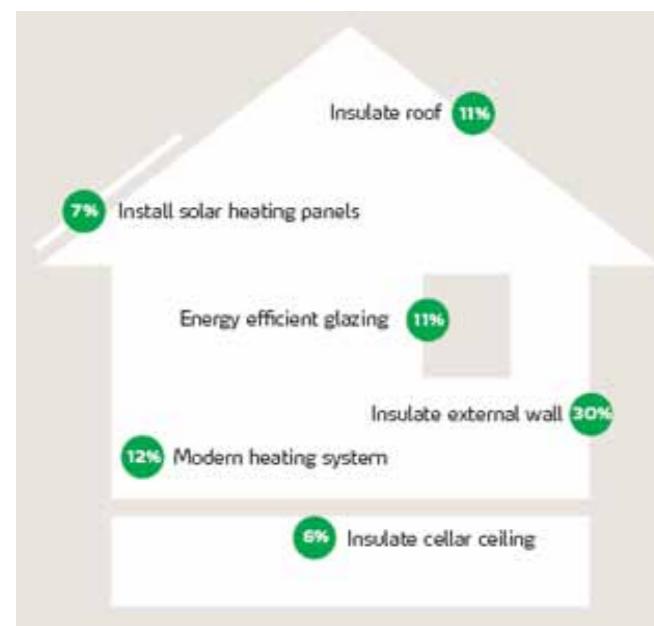
Energy-efficiency measures can often be developed specifically for old buildings, which need to be refurbished, and for new buildings before the construction process. However, many ideas and issues are common for new and old buildings.

Energy efficiency is made to be introduced by energy requirement building standards. The average annual energy requirement for space heating is described in the form of thermal-energy consumption coefficients for space heating expressed in energy [kWh] per square metre of heated area (or cubic metre of heated volume) per year.

Anink D, Boonstra Ch, Mak J. *Handbook of sustainable building*. London: James & James Ltd.;1998.
Towards sustainable-energy buildings Dorota Chwieduk 2002

2.6 ENERGY IMPROVEMENT IN EXISTING BUILDINGS

Existing buildings are responsible for 40 % of the energy consumption and almost 25 % of the manmade CO₂ emissions in the EU. This energy waste has to be addressed in order to slow down global warming.



Thermal imaging to identify leaks

On a thermal image, warm objects stand out well against cooler backgrounds making it very easy to map the following:

- The building's thermal bridges
- Walls without or with poor insulation
- Draught problems
- Leaking windows
- Leaking roof constructions



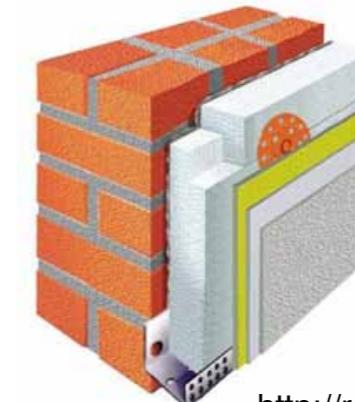
Thermal insulation of the external walls

The original external walls have mostly been retained, and internal thermal insulation employed to improve thermal resistance. Because of preserving brick facade so we should add insulation to walls from inside. EPS boards have been used to cover the external walls; the surface is to be done later. Cold bridges and thermal bridges should be treated carefully, to assure the air tightness of the thermal insulation of the external walls, and ensure that no cold bridges or thermal bridges remain.

- Lowering heat cost up to 50%
- Reducing CO₂ emission
- Stopping of condensation
- Improving of living comfort:
- Elimination of draughts
- Elimination of cold bridges
- Preventing of mould and fungi growth
- U value of 0.27 W/m²K easy-to-achieve

Benefits:

- The surface will clean,
- The damaged parts repair,
- Water-repellent coatings applied to keep moisture from getting into the interior space
- Durable plastic sheeting was laid
 - 1- Around the external wall foundation
 - 2- The building's hot water pipes to help dry the foundation and reduce heat loss caused by moisture



<http://rgbs.ie/>

No insulation in too many existing buildings

In many existing buildings, there is no insulation at all or only 25-50 mm. Today, insulation thicknesses of between 300 to 600 mm are used in new low energy buildings and between 175 and 350 mm in new standard buildings.

Adaptive re-design of the envelopes of old industrial buildings Most of the external walls of old industrial buildings are non-load-bearing walls, made of red bricks or cinderblocks. If they are to be renovated, measures can be taken to reduce heat transfer.

A highly effective method is to add thermal insulation materials to the external walls.



Air tightness

Infiltration occurs when outside air enters a house uncontrollably through cracks and openings. Proper air tightening can significantly reduce heating and cooling costs and create a healthier indoor environment.

Proper air tightening can significantly reduce heating and cooling costs. On this picture the gap between the wall and the window has been sealed.

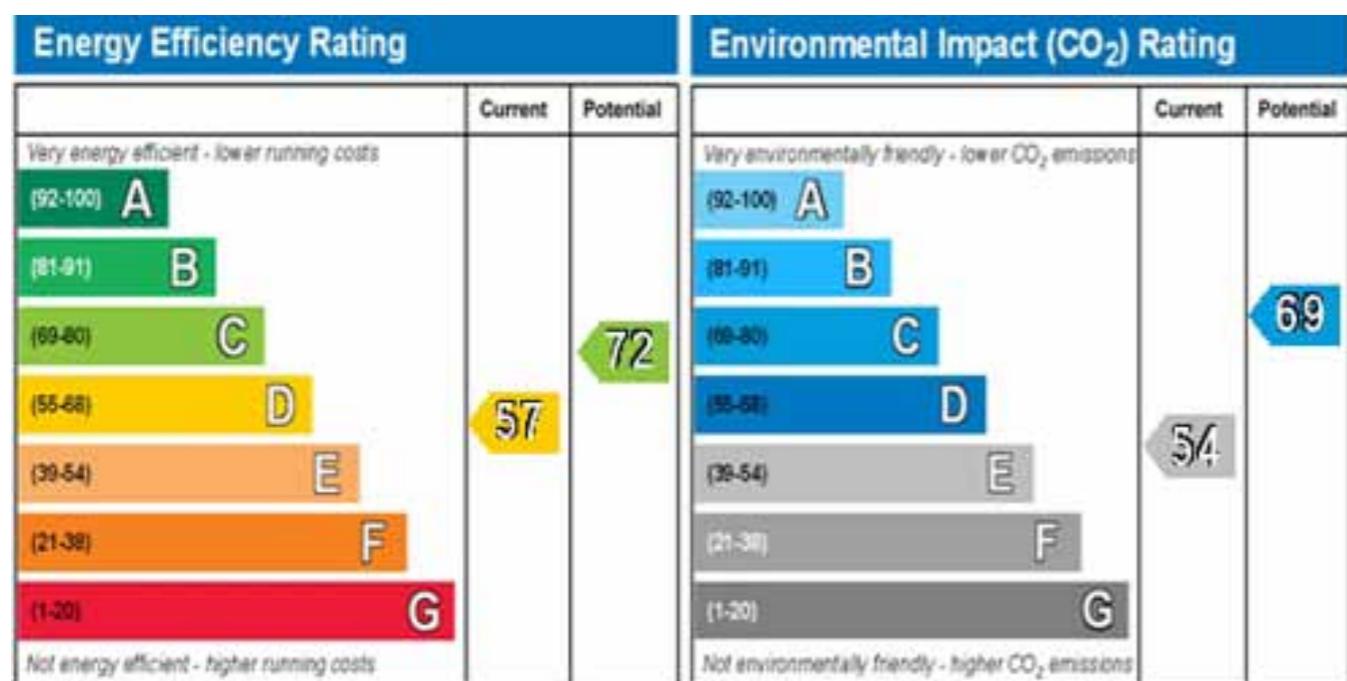


Energy performance certification

It is also possible to acquire recommendations for energy renovation of existing buildings by having an energy certificate prepared.

When a building is constructed, sold or leased, an energy performance certificate must be made available by the building owner to the prospective buyer or tenant, as the case might be.

An energy performance certificate makes it possible for consumers and businesses to compare and assess the energy performance of the building. The certificate is accompanied by recommendations for cost-effective improvement of the building's energy performance making the certificate a useful tool in identifying the possibilities for energy improvements.



Window and doors

a window replacement is often a very significant part of an energy renovation, but it is important to ensure that the new windows are installed properly.

Therefore, it is important to select windows and doors with great care:

- The glass must consist of two or preferably three layers of energy glass
- The frames must be designed to limit the loss of energy in the joints between the glass and the frame
- The joints between the frame and the walls must be sealed with suitable materials
- The bigger the frame area, the higher the energy loss. This means that a few big windows are a better solution than many small ones and bars should be used with great care
- Today, there are windows on the market with a total U-value of only 0.70 – 0.85 W/m²*K. These windows are much more energy efficient than traditional windows
- Doors that are not of glass should include insulation in their core and thermal bridges should be avoided to the extent it is possible



A new and energy friendly window (on the right) next to a traditional window. The frame of window to the right is constructed in glass fiber and composite.

If energy conservation technology is not applied in the buildings, the doors and windows will account for about 50% of the total energy consumption. Most doors and windows of old industrial buildings are not energy efficient, and occupy large shares of the walls. There are three main methods for energy conservation in adaptive re-use of industrial buildings:

1. To abate permeation,
2. To cut down heat transfer,
3. And to reduce insulation.

The workable approaches include fixing double glass doors or auto doors to reduce energy loss at the entrances, using sealing materials to improve air tightness and reduce permeation, employing hollow glass windows or insulated aluminium alloy windows to reduce heat transfer, applying heat reflecting coated hollow glass and low-E glass, and installing shading devices. When all the above have been implemented the natural lighting potential of the windows should be addressed.

Therefore, the original window frames were retained and the original glass was exchanged for hollow low-energy conservation glass. An additional window was installed inside the windowsill. The interspace between the two windows form a buffer area, which improves the heat retention of the external windows and enhances the air tightness of the envelope.

Example: Osram culture center
Nørrebro, Copenhagen, Denmark

Completion: 2009

A very attractive energy and indoor climate renovation of a former industrial building, now in use as a cultural centre as part of a neighbourhood renewal project.



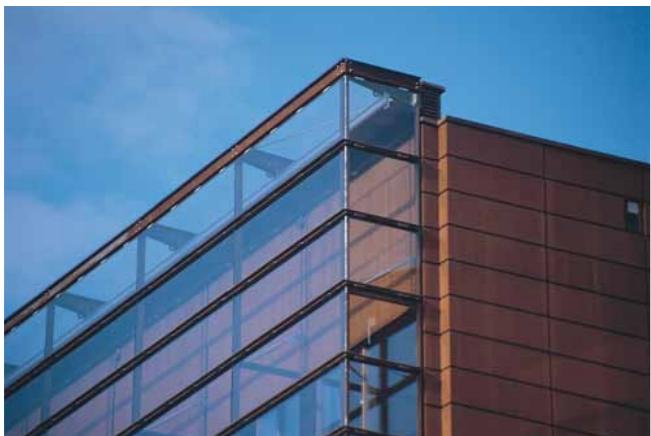
<http://www.activehouse.info/cases/osram-culture-centre>

The double-skin curtain wall system

Can be classified into two types, according to its ventilation structure:

The “closed-loop system” and the “open loop system”.

The ventilation space between the two walls of the double-skin façade system permits air circulation, which reduces the temperature difference, so the temperature of the inner wall is close to room temperature.



Baltic Square Tower Helsinki, Finland



FIH (Finance for Danish Industry) – Copenhagen, Denmark

In winter, double skin functions as a buffer space, reducing heat loss; in summer, the air enters through the openings at the top and the bottom, flows into the double skins, and functions as a passive cooling system. Also, the double skin façade walls improve the soundproof effects greatly. If it is not advisable to change the external walls of the building; outdoor shading systems can be added to the south and west façades of a building. “Experimental data has demonstrated that outdoor shading systems work more effectively than indoor ones, and air conditioning loads can be reduced by 16%~29%, so that shading control systems are increasingly used as cooling systems. New outdoor shading systems can not only keep out light and reduce energy consumption effectively, but also increase the aesthetic value of the buildings, so that they are suitable for transforming old buildings”.

Transforming Roofs

The roofs of a building are greatly influenced by the environment.

A large proportion of thermal radiation is absorbed by the roofs, which has direct impact on the indoor climate environment.

Architects, while considering waterproofing, have traditionally ignored the thermal insulation of roofs. So in order to block heat transfer in roof transformation, new thermal insulation such as extruded polystyrene can be applied in the insulation layer of the roof.



<http://mnroofing.com/images/dormers.gif>

A thermal insulation layer can be installed under the roof to reduce the heat conducted through the roof boarding to a minimum, while wind pressure and heat convection removes the hot air in the inter stratification.

Because of the great depth of industrial buildings, the natural lighting from the windows will be insufficient, so that dormers can be installed to increase the natural lighting.

The shape of the dormers should be designed to correspond to the court, and the natural ventilation effect can be enhanced by a combination of open able dormers and the court. In addition, solar panels can be installed on roofs to reduce energy demand from the grid.



“Solhuset” - Denmark’s most climate friendly nursery
Completion: November 2010

When not used for solar panels the remaining roof surface has been planted with sedum – a hard wearing plant, which not only encourages biodiversity, prevents water run off and provides both sound and temperature insulation, but also helps to cool the photo voltaic panels. Water evaporating from the planted roof helps to cool the panels, which work more efficiently at lower temperatures. It’s a simple, effective and attractive solution.



Room extension

It is one of the methods in renovation and re-design of existing buildings when we need more space or need to connect new functions or separate buildings to each other.

This modern extension by French architecture firm Atelier Alassoer, connects between two buildings: the main house and an old outbuilding. It serves as a living room with a total floor space of approx. 61 sq. meters. The new extension, with its contemporary style and choice of materials, fits in harmony with the existing traditional stone houses.



<http://www.busyboo.com/2009/11/24/home-extension-op/>

Renewal of heating and cooling systems

Old heating systems such as old oil and gas boilers use significantly more energy than new systems. So, if a building has an old boiler, it is reasonable to replace it either to a new preferable condensing boiler. It should be considered whether the heating source can be changed to a less polluting one.

Solar Energy

To reduce CO₂ emissions and optimise energy performance, it was necessary to consider the building as a whole, not just the sum of its components. Energy efficiency was incorporated into the very design of the building and the available natural resources, such as sun and wind, were to be exploited to a maximum. For instance, windows were from the start considered as energy contributors. They are

placed strategically to allow for solar heat gain and optimum natural ventilation; and different types of windows are used for North and South facing installation.



http://ausInderin.blogspot.com/2010_10_01_archive.html



Green Adaptive Reuse

There is a great opportunity to extend the sustainable practice of adaptive reuse by preserving energy and resources through green design. Currently, sustainable design is most widely publicized for its applications to new construction. It is, however, an important strategy for adaptive reuse. Increasingly, practitioners are combining sustainable design with adaptive reuse of historic buildings creating the field of green adaptive reuse. This combination makes sense since the premise of adaptive reuse is more sustainable than greenfield development since the infrastructure and materials are already in place.



Adaptive re-design and Low Energy Consumption Design

All these methods demonstrates that adding energy conservation devices to improve the environmental performance of adaptive re-design of old industrial buildings is workable. The key is how to install reasonable and appropriate energy conservation devices when re-design the appearance and the interior space of the building.



Michael Stratton described the values of the industrial buildings and the rationales for renovation industrial buildings in his book "Industrial Buildings Conservation and Regeneration". The principles to evaluate the potential of the industrial buildings have been formulated in the study. Hence they are the crucial criteria of the feasibility to the study buildings, which will be applied to evaluation.



Some good examples of adaptive re-design in Nordhavn industrial area.

The central point of the adaptive re-design projects is its low energy consumption concept. As interpreted above, it is not an isolated design phase which lags behind the structure and space re-design, but it is part of the uniform concept of the adaptive re-design project. The wooden structure adopted in the structure transformation is recyclable; the court, lighting shaft and sun lounges in the space transformation utilize wind and solar energy passively. It has been proved that the energy consumption of the architecture could be dealt with from the perspective of planning and design.



This industrial building renovated and re used and now it is an exhibition for one of the famous Danish furniture factories. It is located near the project site.

Summary

The Lessons Learnt

From all these theories and examples I found that when you start to adaptive re-use of industrial vacant buildings there are many challenges you are face with, many regulatory and financial barriers. Issues range from contamination to historic preservation design review .

However there are countless tools and motives available to use in the adaptive reuse field, and increasingly they are mechanism specifically to aiding the growing industrial conversion movement.

Lessons can also be learned from the research studies, which reveal unique design approaches. The adaptive reuse process will continue to evolve and become less regulated as innovations become more trend and the reuse of buildings becomes a more integral component of revitalization strategies. It is neccesary to value the aesthetic, historic, revitalizing, and sustainable advantages of adaptive reuse.

The adaptive re-use and renovation planning demonstrates the importance of low energy consumption. It is necessary to avoid the disadvantages of nature, employ recyclable energy passively, and reduce energy consumption in architecture.

This is not the unimportant attitude and standpoint that architects have to insist on in old industrial building transformation programs.

Protective measures should be taken as far as possible without making major changes; of course, to avoid possible further damage, should be to increase the protection and maintenance of costs.

Chapter



3.1 Case study and recommendations

There are numbers of cases were Adaptive re-designed successfully all over the world.

I chose Mejeriet Lund project and I had study trip there it is located in Lund,Sweden and this project has many similarities with the buildings which I redesign in thesis project, I got so much inspiration from that project and I talked with one of the project architects ,Joanna Heilig and a musician who play there Hans Ödman.We talked about the acoustic problems in rehearsal rooms ,corridors ,small foyer and the spaces missed in the project. Totally studying this project gave me some good lessons on how successful redesign the industrial buildings and I tried to place every function in music centre according to the mejeriet experience and how much space each place need.

Introduction

History of building

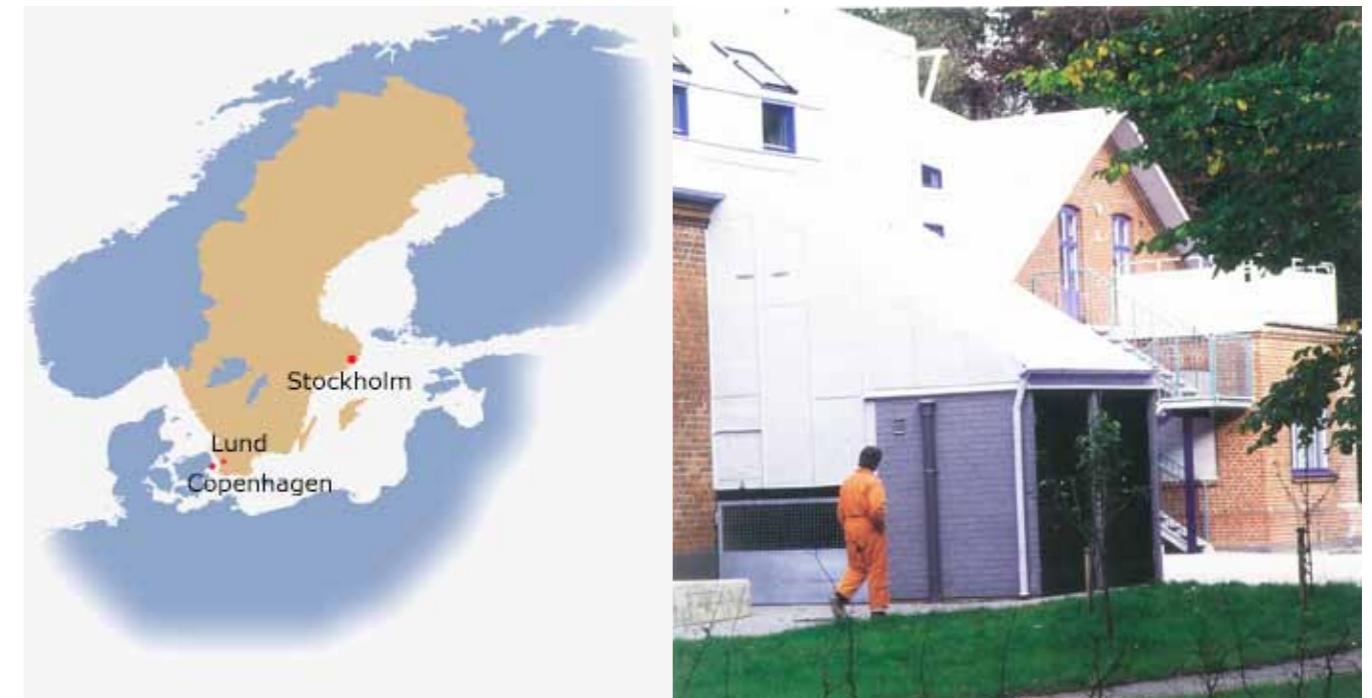
Located next to the city park in the southern part of the Lund center, old dairy had over 120 years old. Until the late 1960s there was a dairy association with a large dairy and cheese production. During the 40 – 50 century the factory was one of the largest in country.

The whole production was stopped in 1968 and moved to Malmö and the property became empty. In February 1986 began the extensive renovation that transformed the former dairy plant into a musical and cultural center. Before redesign and transformation the property was then in very poor condition. The ambition of the Association Kulturmejeriet, architects and artisans has been to preserve the building's period features and thus recall the original dairy machinery. The meeting between the old and new elements has been an exciting environment occurred.

The acultur house Re-built because of a need. Many young people and musicians needs to experience concerts, dance, exciting film, art and theater but also of learning to play an instrument, play in bands, arranging concerts and festivals. The house is in constant change and that is how it should be.



Project name:	Location:	Completion date:	Original use(s):	New use(s):
Lund Kultur Mejeriet	Lund, Sweden	1987, Sep	Old Dairy	Music and film center



Pic: Arkitektur magazine Dec 1987



Pic:<http://www.kulturmejeriet.se/>



The Project Description



Windows in this part of building(adminestration) saved and just repaired ,Bricks in facade have been kept from original building and just renovated some parts,but new roof added to building



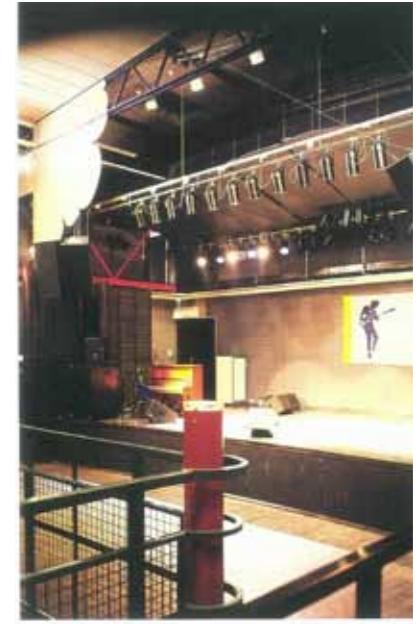
Cafe and bar in connection with auditorium with removable wall accessible from deck which added to buildings and also from main entrance



View of project main entrance under the new canopy and stair for second floor of concert hall access all the roofs in picture redesigned and added to existing buildings



Siting place for audience in music hall all designed with simple details and it is appropriate for young people and jazz music





Covering space in front of rehearsal rooms with a glass corridor



Auditorium and big stairs to sit audience around the table during the concert



Space for parking in back yard for musicians and staff



Staircase to back stage and connection between new and old brick walls



pictures taken in Mejeriet kulturhus on October 2011



Main entrance from inside and desk for buying ticket and enter to foyer

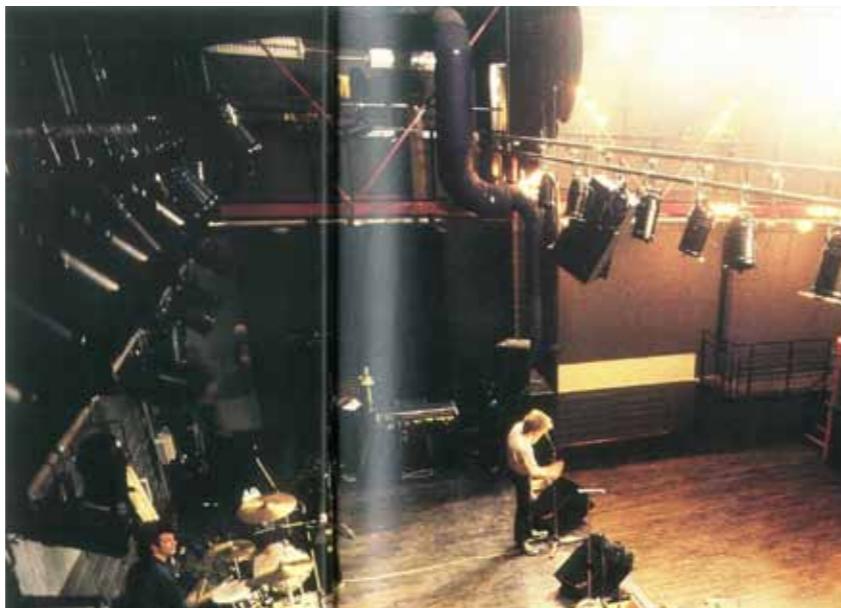


Corridor between main entrance and Cafe ,different levels need a lift for disabled



Balcony area in concert hall to fix lighting , accesses for technical acquiresments and also for audience

Pic: Arkitektur magazine Dec 1978
The capacity of Black box and scene is not sufficient for some performance.



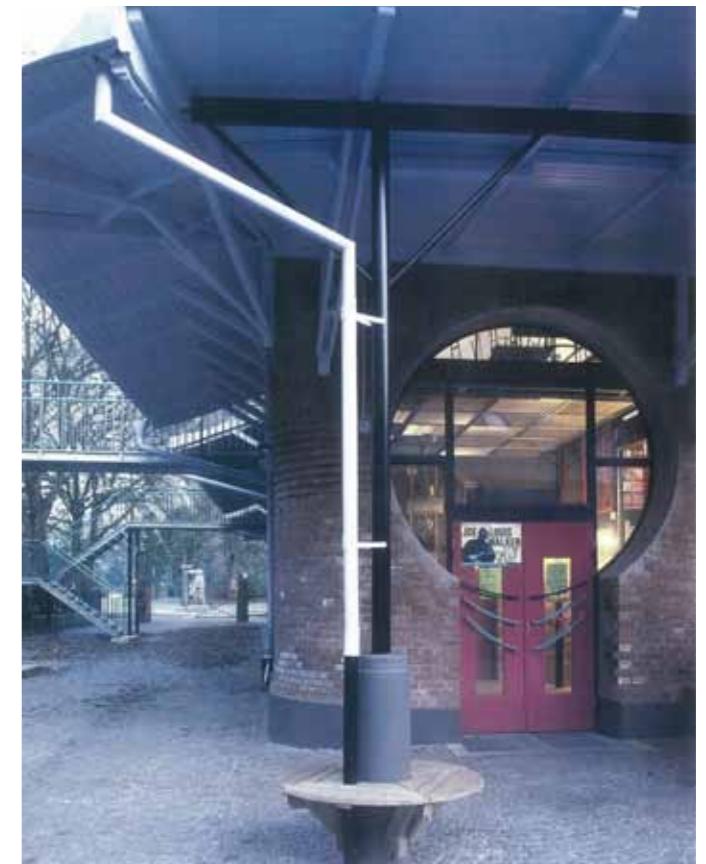
Open space in front of buildings use for outdoor music performance in summer time and in transforming building because of difference in inside level with outside so they add a wooden deck to buildings. Now people could sit in yard and artist play on deck.



<http://www.flickr.com/photos/bjaglin/708425536/>

Redesign a old mejeriet

Main entrance door is located in Back side of buildings where in past time the big milk countiners were located and in re-design of building they use the existing circular halow in wall as a entrance door. The main concept of redesign project was to keep all existing elements of buildings as much as possible and combine them with new simple details. They tried to redesign and re-use the old mejeriet in a very low budget, so when we consider all the limitations like money, the social context of re-design time and existing walls and floors this project is successful, and still response to need of society.



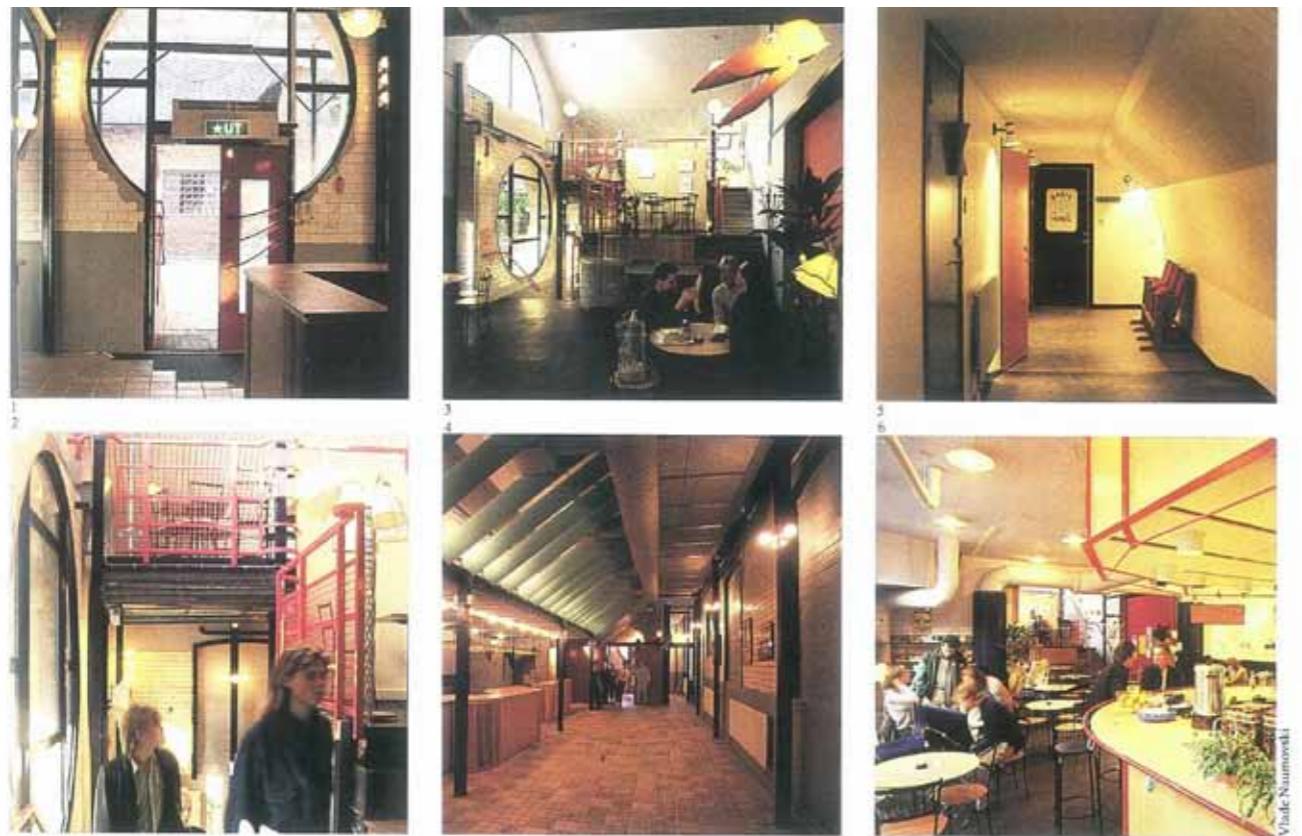
Pic: Arkitektur magazine Dec 1978

3.4 INTENTIONS

Mejeriet is a venue for rehearsals, music and film, located in an old dairy building in Lund, Sweden. The Mejeriet in Lund is a culture center that is internationally known especially for its excellent concert stage and his unusually diverse and exciting concert programs. But the house offers more than that. There is also a theater, cinema, music tuition, rehearsal rooms, a cafe with a stage, lab, workshop, youth project, Big trace and more.

It is an adaptive re-design project and compare with the how long ago renovated and transformed to new usage it is successful. music clubs, Folkets Bio and cinema Södron are some of new functions in old industrial building.





3.5 ACTION

Pics: Arkitektur magazine Dec 1987

Opportunities:

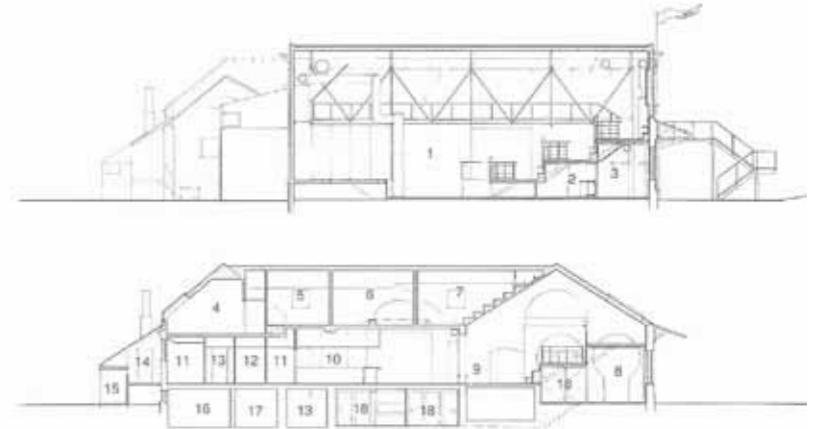
- Combination of new modern elements with old existing elements of mejeriet
- Symbolic usage of remaining materials which had not structural purposes
- Spatial feeling in all rooms and spaces are obvious despite having a complicated floor levels in existing buildings
- Simplicity in design
- Having multi- purpose spaces
- Using maximum from minimum facilities
- Considering connection between cafe and Atrium

Problems:

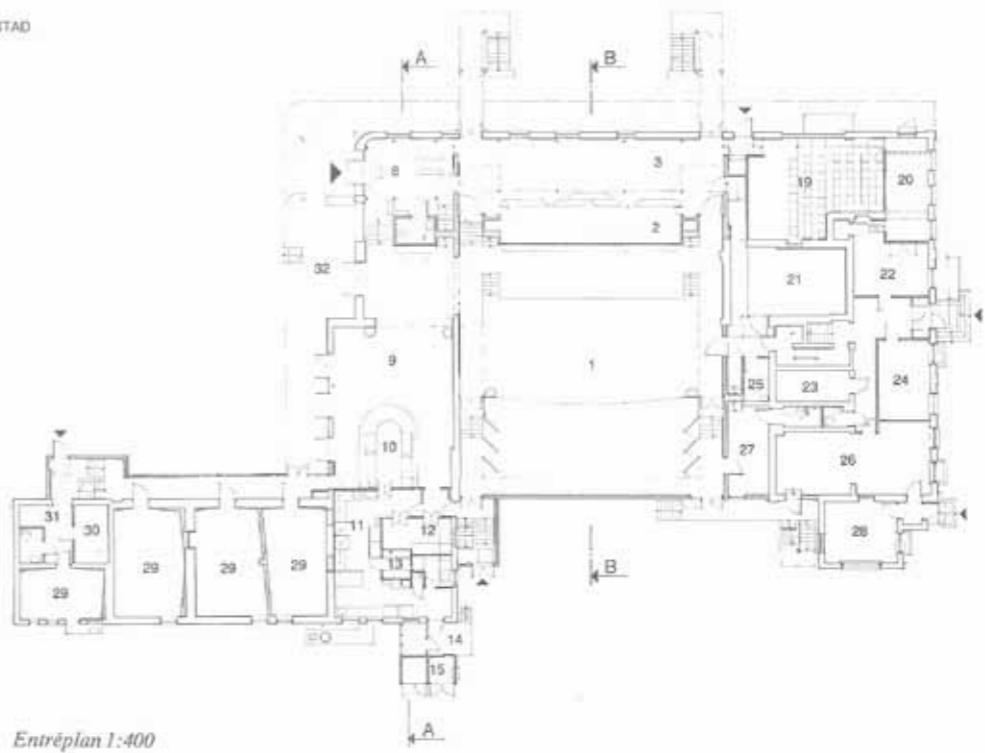
- Lack of room for more interaction between artists
- Needs to have a bigger scene
- Unusual entrance
- Acoustic walls and doors
- More space for administration
- Cafe and bar as a core of music centre could connect other parts
- Separate exit and entrance for artists
- More space for summer out door performance



1. STORASALEN
2. GARDEROB
3. FOAJÉ
4. FÖRENINGSEXPO
5. HUSETEXP
6. FLAKTRUM
7. ARBETSRUM
8. VINDFÄNG
9. CAFE
10. SERVERING
11. KÖK
12. DISKRUM
13. FÖRRÅD
14. LASTKAJ
15. SOPRUM
16. PERSONALRUM
17. OMKLÄDNING
18. TOALETT
19. FOLKETS BIO
20. PROJEKTORUM
21. STOL- OCH VARDEFÖRRÅD
22. FILMKONTOR
23. FOTOLAB
24. FOTORUM
25. STÄDRUM
26. VERKSTAD
27. SCENVERKSTAD
28. MUSIKRUM
29. REP-RUM
30. ELCENTRAL
31. KAPPTRUM
32. TERRASS



Sektioner 1:400



Entréplan 1:400

Pic: Arkitektur magazine Dec 1987



The Lesson learnt

- The importance of recognising the contribution of industry architecture to the identify of industrial harbour buildings and opportunity these assets bring to promote and enhance the overall value of cultural heritage to both occupants and citizens
- The need to respond creativity to the difficult challenge of restoration and conversion to sustainable new uses in organisational and financial terms-involving as in the case of Mejeriet,the municipality and local musical organisation to support the implementation of project
- The opportunity to both apply traditional techniques and construction materials alongside the use of new technologies in a way that both respect and identity of industrial historical buildings and enables their successful adaptation to new uses.
- Recycling an existing building
- Conserving embodied energy
- Saving useful materials from the landfill
- Reviving under utilized resource
- Alternate to sprawl & greenfield development
- Preserving the human history

2.6 EXAMPLES

EXAMPLE 1

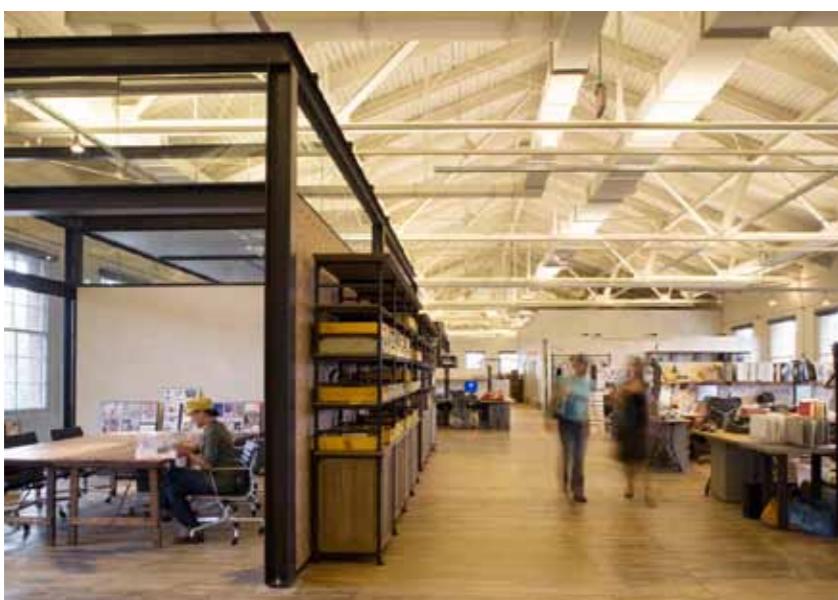
Project name:	Location:	Completion date:	Original use(s):	New use(s):
Urban Outfitters Corporate Campus	Philadelphia Pennsylvania USA	2006	Naval shipyard	Corporate headquarters

Project Description

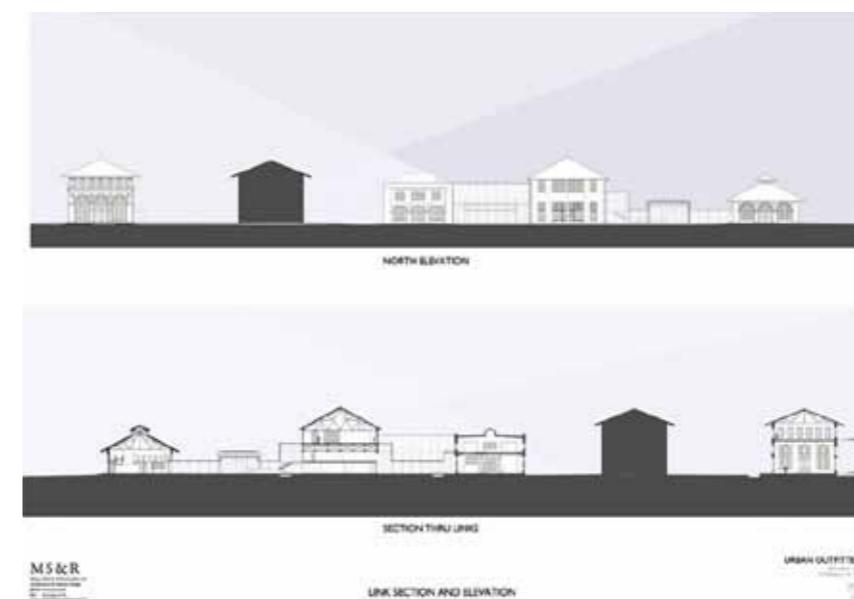
History of building

"The Philadelphia Naval Shipyard National Historic District is comprised of 263 contributing buildings, structures, and objects. Its history starts in 1872 when the land was established as the Naval Shipyard and used as a major ship construction and repair facility. During the early 20th century, the Yard functioned as one of the nation's major Marine Corps receiving stations and later served as a training facility. In 2004, the 1,000-acre National Historic District was master planned for redevelopment an evolution from public ownership to private use".

When Urban Outfitters, first considered the site, the existing structures were dilapidated. Despite the decay, the soul of the Navy Yard attracted them to reuse. The new owner purchased five historic buildings and reused them.



Site plan and situation of five buildings in ship yard



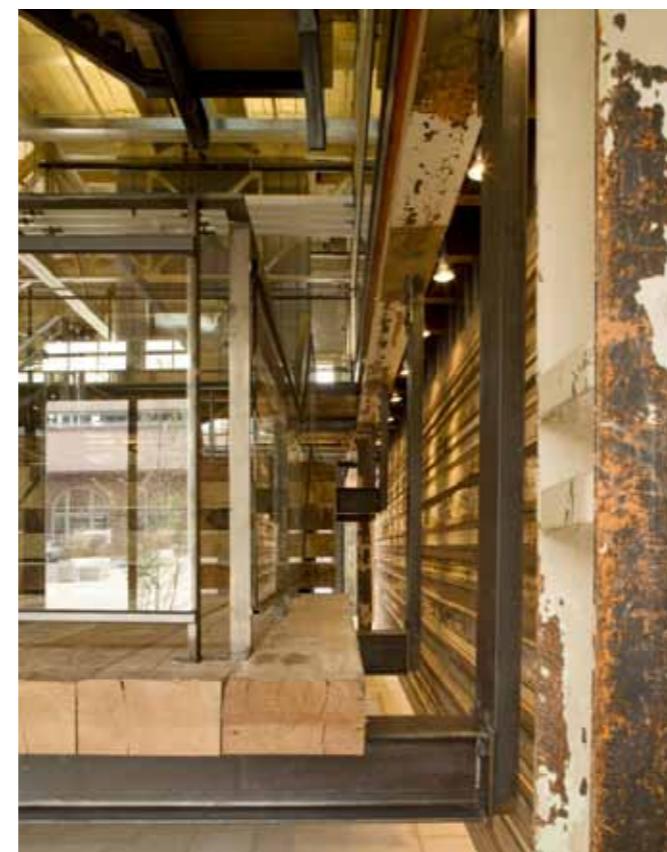
Sections

Pics:by Lara Swimmer and www.Arch daily.com

Adaptive Re-Design Nordhavn music center//Farnaz akbari //Master thesis 2011

Instead of only transforming the five buildings by applying layers of plaster to decades-old structures, the project's architect embraced the site's industrial identity, incorporating its distinctive character into his plans and preserving as much as possible. The result is an inspiring layering of history, where oil spots and iron gates coexist harmoniously with open studio spaces and quirky staff lounges.





Pic:www. Archdaily.com

Benefits anticipated through the Adaptive re-design of this project:

- Create an environment that embodied the essence of Urban Outfitters and its retro-chic merchandise.
- Rather than stripping the shipyard buildings clean, they decided to preserve the scars, which the Navy had inflicted through a century of improvised modifications and expansions.
- Old paint remained on the walls and ample material was reused
- Stairs were fashioned from wooden beams
- windows were removed, re-glazed, and reinstalled
- Sandblast the steel beams in one of the buildings, then allowing the metal to rust until it turned a perfect shade of orange.
- Every office and studio has a design that allows the imagination to flourish
- In all five buildings, employees work in light-filled interiors with open layouts
- Most of the furnishings are custom-made and contain recycled material (tabletops crafted from salvaged wood, for instance).
- They didn't want it to feel like an office building. They wanted it to feel like a workshop
- Turning derelict industrial sites into vibrant public spaces
- Staff satisfaction
- Attract new talent
- Employees from different divisions literally sit next to each other

<http://www.archdaily.com/92989/urban-outfitters-corporate-campus-meyer-scherer-rockcastle/meyer-scherer-rockcastle-urban-outfitters-headquarters-2/>

2.6.1 Intention

Urban Outfitters Corporate Campus, designed by Meyer Scherer & Rockcastle transformed four "dilapidated" historic buildings in Philadelphia's Navy Yard, into an award winning adaptive reuse headquarters. "The Anthropologie, Free People, and Urban Outfitters retail brands' design studios and offices are housed within each building. A campus commons and services' offices are efficiently shared among the different divisions of the company. This project received a 2010 AIA Honor Award for Architecture".

Urban Outfitters, a clothing and housewares retailer, was the first major non-ship building corporation to move to the Navy Yard. The design including building documentation and renovation was completed within 23 months. Using the Federal Historic Preservation Tax incentive Program, the client invested over \$100 million in the 285,000 square-foot project.

The buildings once operated to produce naval vessels, alternating between construction, repair, and even discarding deactivate ships. The design centers on utilizing the factory characteristics of the buildings industrial materiality, open volumes, and access to daylight to reuse the buildings' major function from production to creativity.

"The synthesis of four measures art, culture, economy, and environment results in the transformation from a public, production based yard to a private, creativity based one".





2.6.2Action

Re-design campus is successful because:

- It mirrors Urban Outfitters' brands
- Notice both the history of the Yard and company culture, blending the old and new
- leaving traces of the past to inform future generations.
- Accessorised with a few exquisite decorative flourishes
- It is exactly what the fashion retailer was seeking for its unified corporate campus
- Urban Outfitters' pioneering move has positively impacted the entire Navy Yard. A new creative district, with top advertising agencies, graphic designers, and photographers, is growing around the retailer. New coffee shops and restaurants serve workers and visitors alike. More than 4,000 jobs have been created in the Yard.

EXAMPLE 2

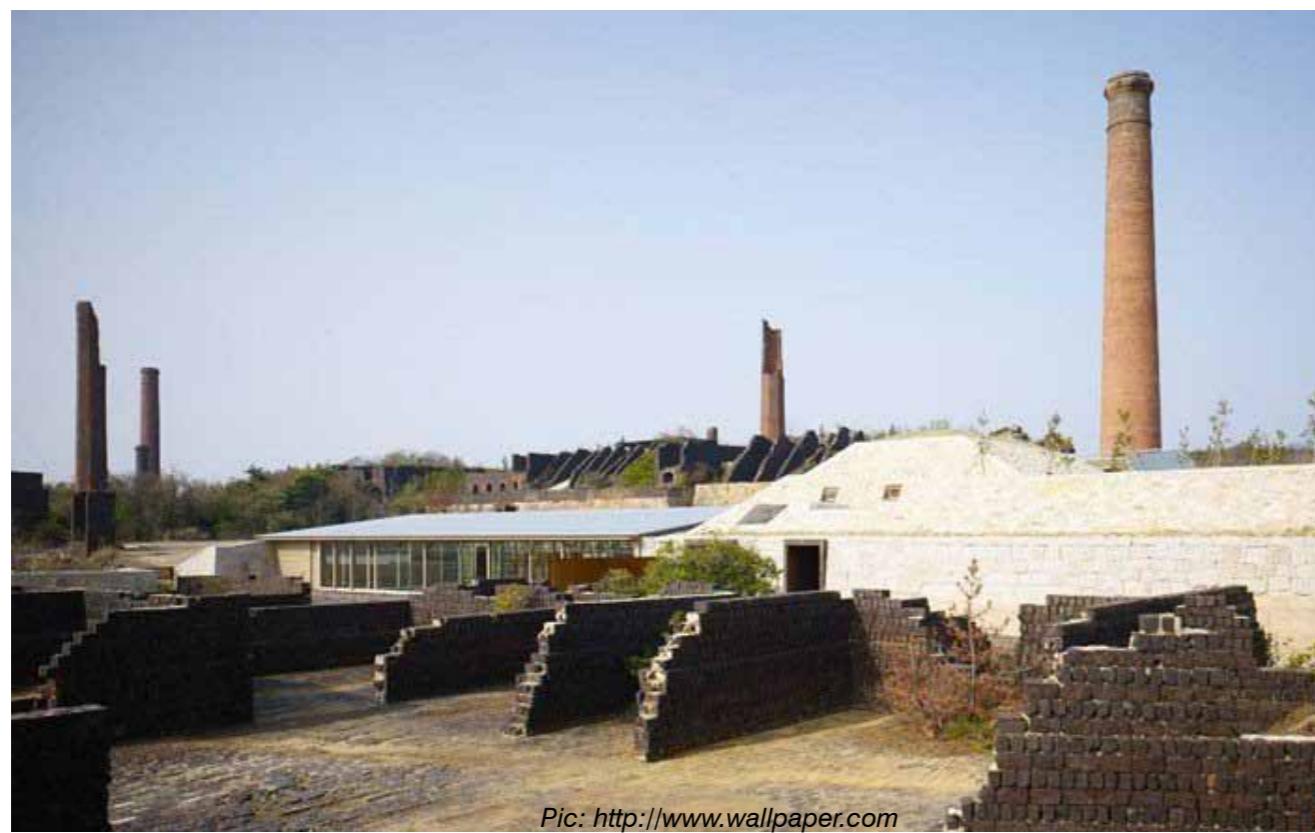
Project Name:	Location:	Completion Date:	Original Use(s):	New Use(s):
Inujima Art Project	Inujima Island, Japan	2003	copper refinery	art museum

Project Description

History of building

Opened in 1909 using local funding, the copper refinery was one of many that were built on islands in the Seto Island Sea. The island locations were chosen both for their resources as well as a way to minimize pollution and provide convenient transport of the raw materials.

Due to a massive plunge in the value of copper, the refinery shut down after only 10 years of operation. Because of its groundbreaking role in Japan's industrial development, the Inujima refinery site was designated in 2007 as "Story 30 in the "33 Heritage Constellations of Industrial Modernization" by the Japanese Ministry of Economy, Trade and Industry.



2.7.1 Intention

"The Inujima Art Project revitalized the area while at the same time raise awareness about the issues surrounding industrialization". Before re-use the site use as a medical waste dump.

Using recycled elements from the site to renovation of galleries

Preserving much of the old refinery, smokestacks, and grounds as historic ruins to encapsulate the gallery.

Using solar, geothermal, and other natural energies in museum as a way to minimize its burden on the environment.

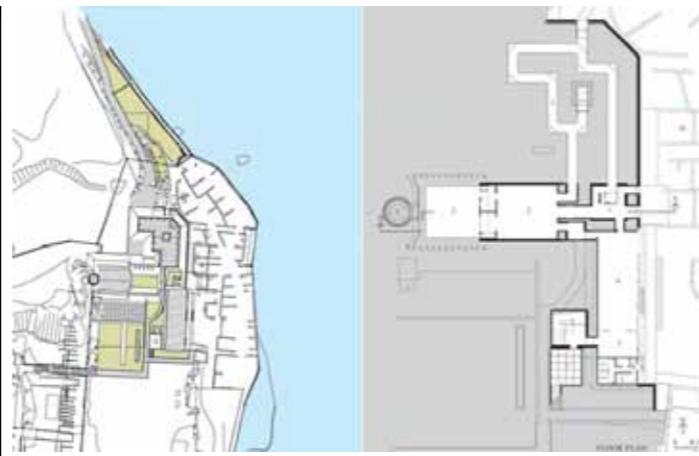
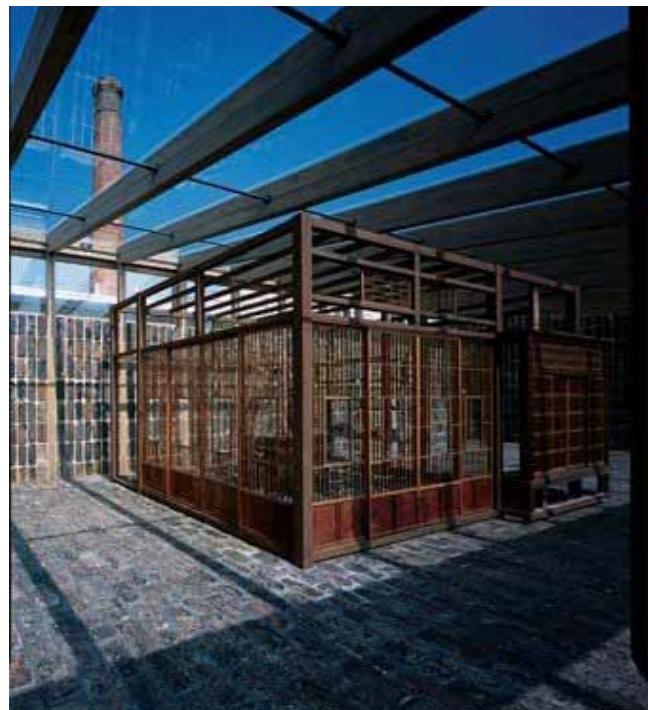
Using the natural cooling effects of the earth in galleries for the buried portion of the building and the existing smokestacks to pull fresh air in from the bottom and release old air out through the top.

Need for electricity only in emergency lighting conditions

Having passive lighting, heating, and cooling system

In Earth Gallery (under ground corridor) a single skylight by nine mirrors extract the day light.

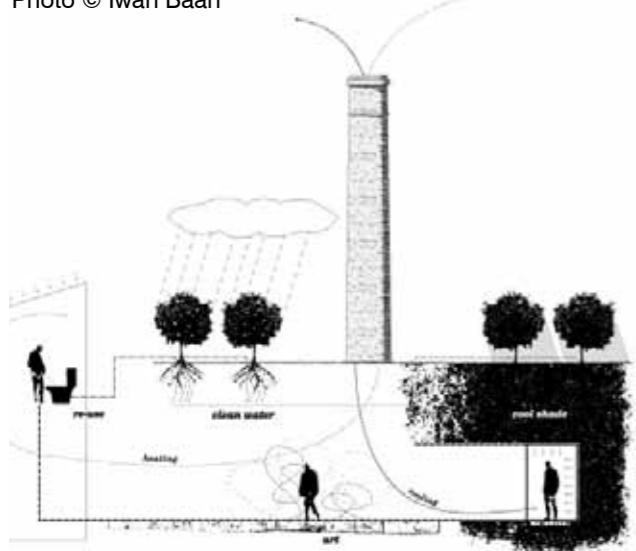
<http://adaptivereuse.info/case-studies/sugar-warehouse-loft/>



From a distance could be seen the six enormous brick smoke stacks in various stages of decay. Only when you arrive can see the low-slung glass and white stone building. The entire complex is a large passive heating and cooling machine that uses the 98 foot tall smoke stack adjacent to gallery to suck air out of the complex. The galleries themselves provide all the heating and cooling.



Photo © Iwan Baan



<http://inhabitat.com/reclaimed-factory-makes-fascinating-statement-on-sustainability/2/>



Pics: <http://www.wallpaper.com>

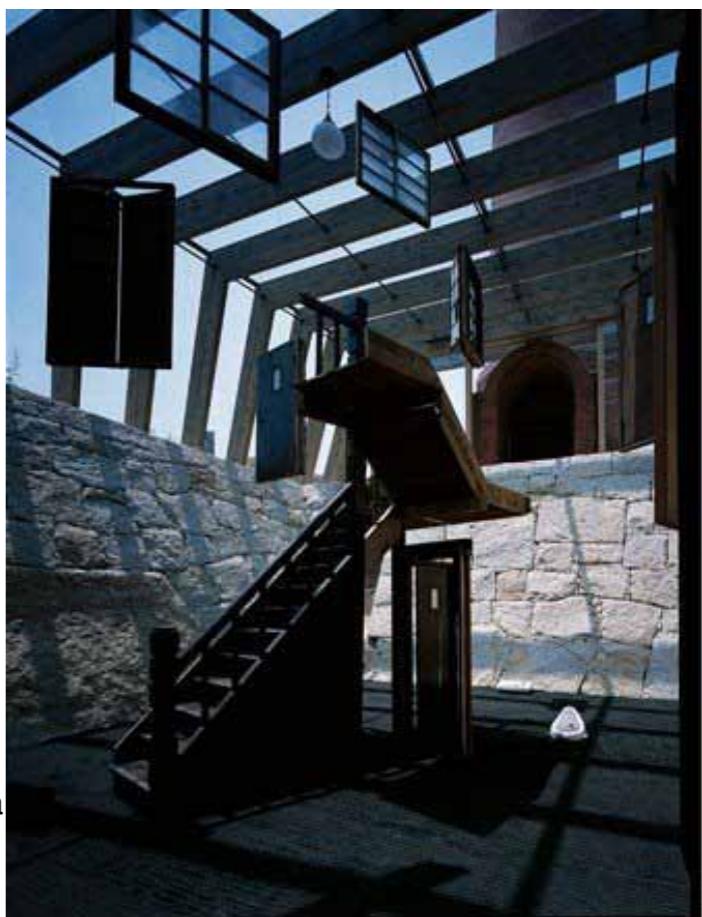
2.7.2 Action

In each side of center of complex there are a gallery, Earth Gallery is in one side and a Sun Gallery to the other.

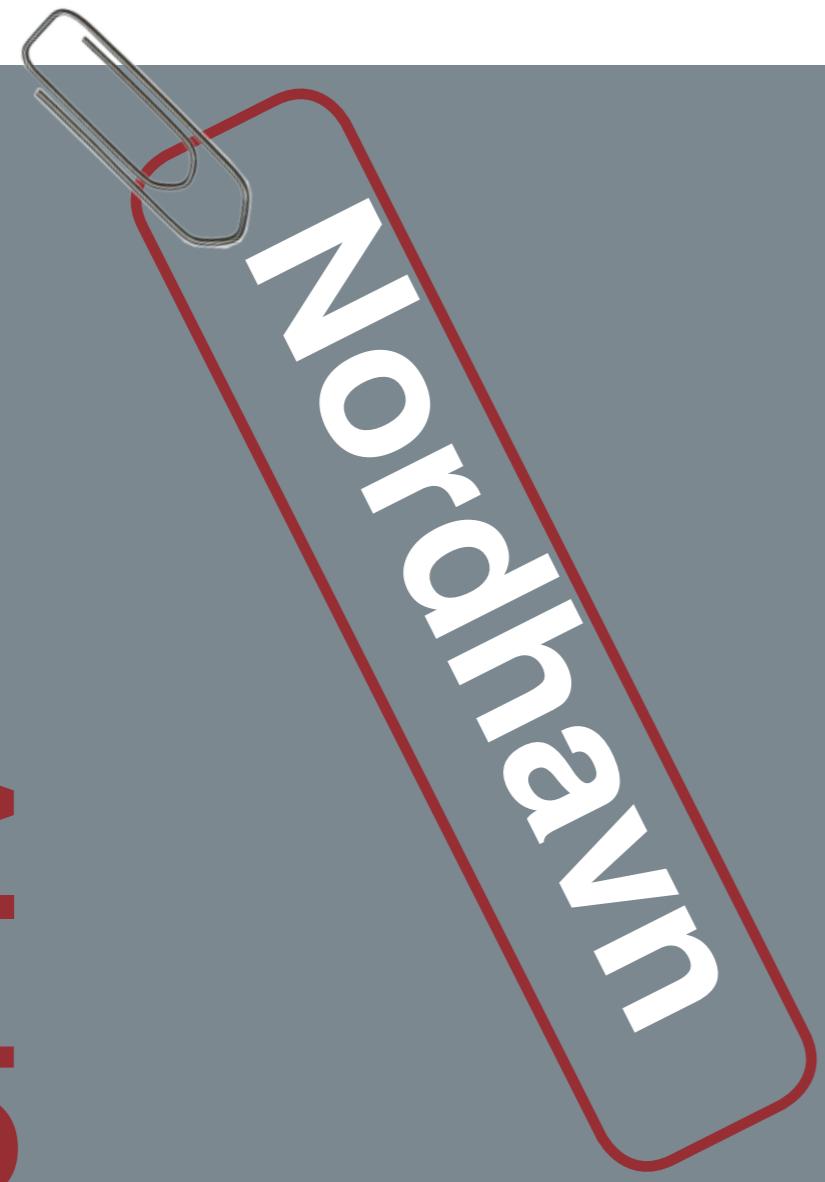
The Earth Gallery is a 262 foot-long hall with walls made from 1/2 inch corrugated sheets that absorb the sun's heat and transfers it to the rest of the building. The turning hall has mirrors at the corners to reflect daylight down its passages.

The Sun Gallery and Chimney Hall provide the bulk of solar heating on colder days, and the entire system is controlled by simply opening and closing doors and internal windows.

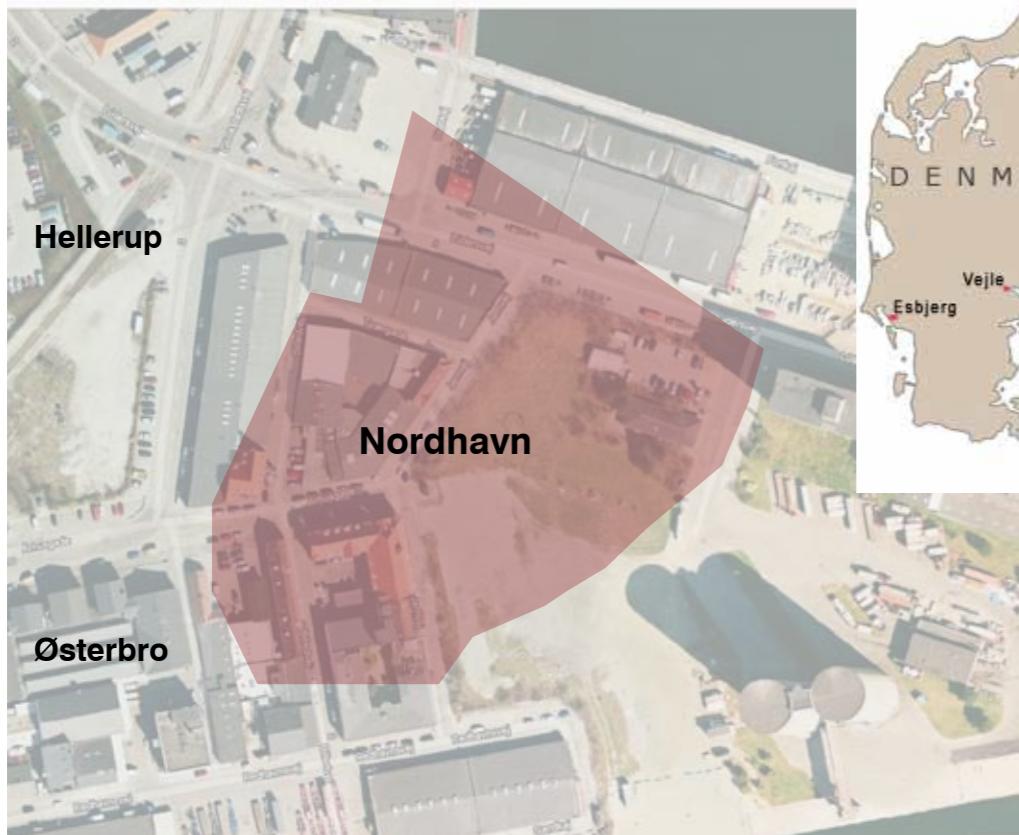
The water systems of project are also sustainable. Waste water is filtered on-site with a plant-based water purifying system and then used to irrigate orange and olive trees.



Chapter IV



4.1 History of Nordhavn



Nordhavnen 1928, south view. In the foreground: Langelinje and Amerikakaj

Nordhavn, is a Harbor area at the coast of Øresund in Copenhagen, Denmark. It covers an area of more than 2 km².

Nordhavn came into existence at the end of the 19th century. Like other large areas in the harbour of Copenhagen it was reclaimed in order to meet the requests for more space made by a growing harbor industry and increasing shipping trade. The areas that are now to be developed grew up over a period of 40 years (ca. 1890 – 1931).

In addition to a ferry harbor, a fishing harbor, a small craft harbor, carriers, ship chandlers and scrap dealers Nordhavn has also in the course of time housed several important concerns like Nordisk Film and Riffelsyndikatet(music festival).

Nordhavnen was constructed on reclaimed land. Its history reflects the changing needs for space and transport and different building styles of a century. The first part of Nordhavn dates back to the 1880s. About half of the area is currently used for harbor-related activities, whereas the rest is unused.

The history of Nordhavnen is the basis for the development of the new city district. The traces of history provide a great potential for creating a new city district with an identity all its own and will therefore be important in the development of the new district.



Nordhavnen 1948, Langelinje and Amerikakaj in the foreground



Nordhavn 1967, Svanemøllehavnen in the foreground



The images of the current situation Nordhavn København

4.2 Nordhavn

Nordhavn is Right on the Øresund coast, the entrance to Port of Copenhagen and next door to Denmark's largest marina. Located between Hellerup and Langelinie. With Østerbro for its neighbour, and close to the City.

CPH City & Port Development's largest harbour-related areas are situated in Nordhavn, and the development of this city-section-to-be is one of the Corporation's greatest challenges. Altogether, Nordhavn may house close to 50,000 people and provide jobs for 30,000. Initially, 2,000 dwellings are being planned (200,000 square metres) and 200,000 sqm of business buildings.

Nordhavn districts covers 200 hect ares, i.e. a little less than 100 acres. The development of Nordhavn will be effectuated on the basis of a planning competition to be launched in 2008. A central point in the planning process is the creation of a robust master plan which is spacious enough to accommodate the basic infrastructure and a sustainable development, but which also lays out the lines for the first phase.

<http://www.cphx.dk>

The surrounding area

Almost all industrial areas along the harbor are currently changing into mixed-functions areas. The harbor basin has become a blue recreational space at the heart of the city, and the harbor area has the potential to become the 'blue commons' of Copenhagen, for the benefit of the city's residents and visitors.

Now the turn has come to Nordhavn to continue this development, with water as the all-pervading element that frames the public life in this district.

Water on three sides

Nordhavn has water on three sides; its fourth side borders on a regional road, a railway area and the Østerbro city district. Nordhavn will be an integral part of Copenhagen and must therefore be connected with the rest of the city both physically and visually.

Blue and green district

Nordhavn has exceptional landscape qualities that provide potential for conversion into fantastic recreational facilities.

The water in and around the harbour provides unique experiences in terms of the magnificent views of Øresund and the possibility of close contact with the water. This enormous potential must be used in the new district. The natural landscape at the northern end of the Harbor is a large-scale landscape space characterised by open areas with self-grown shrubs. Owing to the lack of management, the landscape seems unfinished and 'in the making', but it is also a habitat containing a wide variety of flora and fauna.

Pic from The booklet Nordhavn urban sterategy November 2009

Urban design issues

Issues inside Nordhavn harbour

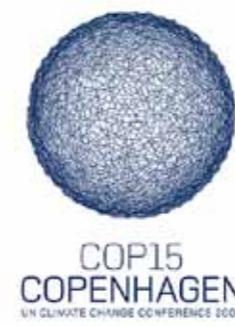
- The infrastructure is lagging and physical environment is poor
- The building condition is deteriorative and lack of reasonable utility
- The open space and public facility is lacking.
- The circulation system is weak and parking space is insufficient Impact to the context area
- The site is inharmonic with its contextual area in terms of land use, building form and circulation system
- The site is isolated from the surrounding area because of the single function and the lack of attractions
- The frontage of Nordhavn harbour is lack of integration and is not friendly to the surrounding area
- The site provides a good chance for enriching the social activities of its surrounding area

4.3 Sustainability in Denmark

In this study I focused on energy and sustainability matters and in next part I will investigate about sustainability issues in Denmark specifically.

Environmental sustainability in Denmark

The climatic conditions in Denmark are challenging and for many years the Danish building codes have given priority to indoor climate and energy as well as daylight optimization. Since the 70th there has been a strong tradition for energy conscious construction – to build one building in Denmark they effectively build two, as buildings have an outer and inner shell. Durable and traditional materials are integrated in Danish buildings in innovative ways. Also there is a strong tradition for optimising buildings in their context – relating to scale, climate, geography, landscape and urban setting.



Social sustainability in Denmark

"In Denmark sustainability is not changing habits by force. Instead Danes strive for developing techniques, that make their habits sustainable and they adapt design to an economical and environmental sustainable life style – the objective is to create an attractive urban environment in comfortable cities – the intention is to secure democratic and accessible structures for all, with a point of departure in political systems and social ethics".



Economical sustainability in Denmark

In Denmark there has always been a well-established concern with regards to the consumption of resources in the building tradition, as the Danish architectonic tradition is anything else than extravagant. The ability to create architecture from or rather through restrained means is typical for Danish Architects – to make use of the relatively few resources at hand in a reasonable, but also artistically harmonious way has always been the basis – simplicity, rich and sense of economy rank above wealth, which make (economic) sustainability a basic parameter in Danish Architecture.

<http://www.visitdenmark.com/international/en-gb/menu/mice/news/csmp/csmp-future-of-industry.htm>

the Green Lighthouse at the University of Copenhagen energy-efficient buildings in Denmark



ARCHITECTURE 2.03. DECEMBER - 28. FEBRUAR 2010
BÆREDYGTIG ARKITEKTUR I DANMARK SUSTAINABLE ARCHITECTURE IN DENMARK
architecture_20_udstillede_projekter.pdf

4.4 Nordhavnen today

At present Nordhavn is a harbor and industrial area housing Copenhagen's Container Terminal and quays used by cruise liners. There are also a number of warehouses and logistic concerns, container repair workshops and sale of ship's provisions. Furthest to the northwest are Fiskerihavnen (the fishing harbor) and Copenhagen's Fisketorv (fish market).

Today, most of Copenhagen Harbors traditional activities are situated in Nordhavn, including ferry berths, a container terminal, marina, and industrial companies.

The S-train station (Nordhavn station) is located at Nordhavnen close to the city district Østerbro.



main entrance by pedestrian



View of Nordhavn from Nordhavn train station



Redhavnsvej street view Fences were drawn all around the industrial zone



Nordhan project main car entrance

Cultural heritage in the harbor

Nordhavnen bears clear evidence of its origins as an industrial harbour with various small- and large-scale harbour environments. The area's structure is simple and rational, which is reflected in the traffic structure, the plots and the buildings, all of which are basically laid out and organised in a right-angled grid. This is a highly distinctive feature that helps give the area its special character.

Existing buildings and environment

The current buildings at the site are representative of the idiom of harbours: high silos mixed with warehouses and industrial buildings. Among these buildings are rationally designed metal and concrete structures such as cranes, chutes, transport rails and covering structures.

The largest industry still active in Nordhavn is the container harbour, whose tall cranes can be seen from much of Copenhagen. The area around the Århusgade street and the fisheries harbour are special local environments.

The densest town structure is to be found in the part of Nordhavn closest to Østerbro and the rest of Copenhagen, whereas the development will be divided up and gradually become more open before it finally ends in salt marshes and wetlands towards the northeast. Nordholmene Urban Delta will give Copenhageners the possibility of combining city life and close contact with nature, with light, air and the sea. Today, a section of Nordhavn plays an important role in the operation of container carriers and cruise liners.

"Warehouses provide strong clear spaces, generally with scale and span increasing the younger the structure. Modern warehouse now require large spans with high ceilings over a single floor, but older storage buildings are ideal for studios, administrative offices, or can also be used for retailing companion goods." (Copenhagen: Life at the harbour /website)





PFA pension office one of the new constructions in Nordhavn



Dong energy building as a symbol in Nordhavn



AP pension office and S train bridge, Main road toward Nordhavn is under the bridge

The Nordhavn area is dominated by shipping and industry; it is the home of the Copenhagen Container terminal and has quays for visiting cruise liners. Apart from this there are a number of storage and logistics activities, e.g. the UN world storage facility for emergency aid, repair yards for containers, and marine-store dealers.

Furthest to the northwest you will find the fishing harbour and the Copenhagen Fish Market. Part of the Nordhavn area, Kalkbrænderihavnen ('the lime kiln harbour') was developed by CPH City & Port Development and PFA during the period from 1999 to 2005.

In Kalkbrænderihavnen several of the buildings have been designed by the Utzons (of Sidney Opera fame). Denmark's largest marina, Svanemøllehaven ('the swan mill harbour') with berths for 1000 boats, is situated next to the Nordhavn area.

Nordhavn København MAXINQUAY Architects: morePlatz

4.3 Nordhavn competition winner's development project

Place: Northern harbor, Copenhagen, Denmark

Client: Copenhagen City and Port Development, Denmark

Program: Structural plan for the northern harbour

Size: 200 ha

Status: 1st prize in international competition in 2008

Team: COBE, SLETH MODERNISM, Polyform and Rambøll



Pics : COBE, SLETH MODERNISM, Polyform and Rambøll

In 2008 it was a competition for devevelpment of Nordhavn between 180 offices from all over the word. A team composed of the firms COBE,SLETH,pilyform and Ramboll are the winner of competition.The areas in Nordhavnen comprise about two million square metres and are owned by the CPH City & Port Development.Their plans for future of Nordhavn are: Danish Architects COBE, in collaboration with SLETH MODERNISM, Polyform and Rambøll, are currently developing the largest urban transformation project in Scandinavia. With 200 ha, Copenhagen's Northern harbor is today used as harbor, but expected to be transformed into a new Copenhagen neighborhood within the next 40 to 50 years. Fully developed, it will provide the living environment of 40.000 residents. And 40.000 people will work there.

"With the postindustrial landscape as a starting point and guideline, a series of new canals are dug out. While respecting the cultural heritage of the harbor, the canals add new qualities to the plan in several areas: they improve livability as well as commercial value, they act as a tool for feasible phasing, and they give a sense of place in the vast Nordhavn area. Strong emphasis is put on bikes and public transportation. An elevated metro loop paired with express bike lanes tie the area together. As well as being a strong visual and recreational element, the combined metro/bike system will reduce car journeys to 25% of the total traffic in the area faced with climate change as a result of modern way of life, the urban development of such vast territories implies great responsibilities on the makers of new cities. "Nordholmene" applies a holistic view on ecological sustainability in all aspects of the development. Local solutions regarding energy, water and waste management are paired with a regional outlook on sustainability, incorporating region-wide networks."



Competition winner's outlet Model

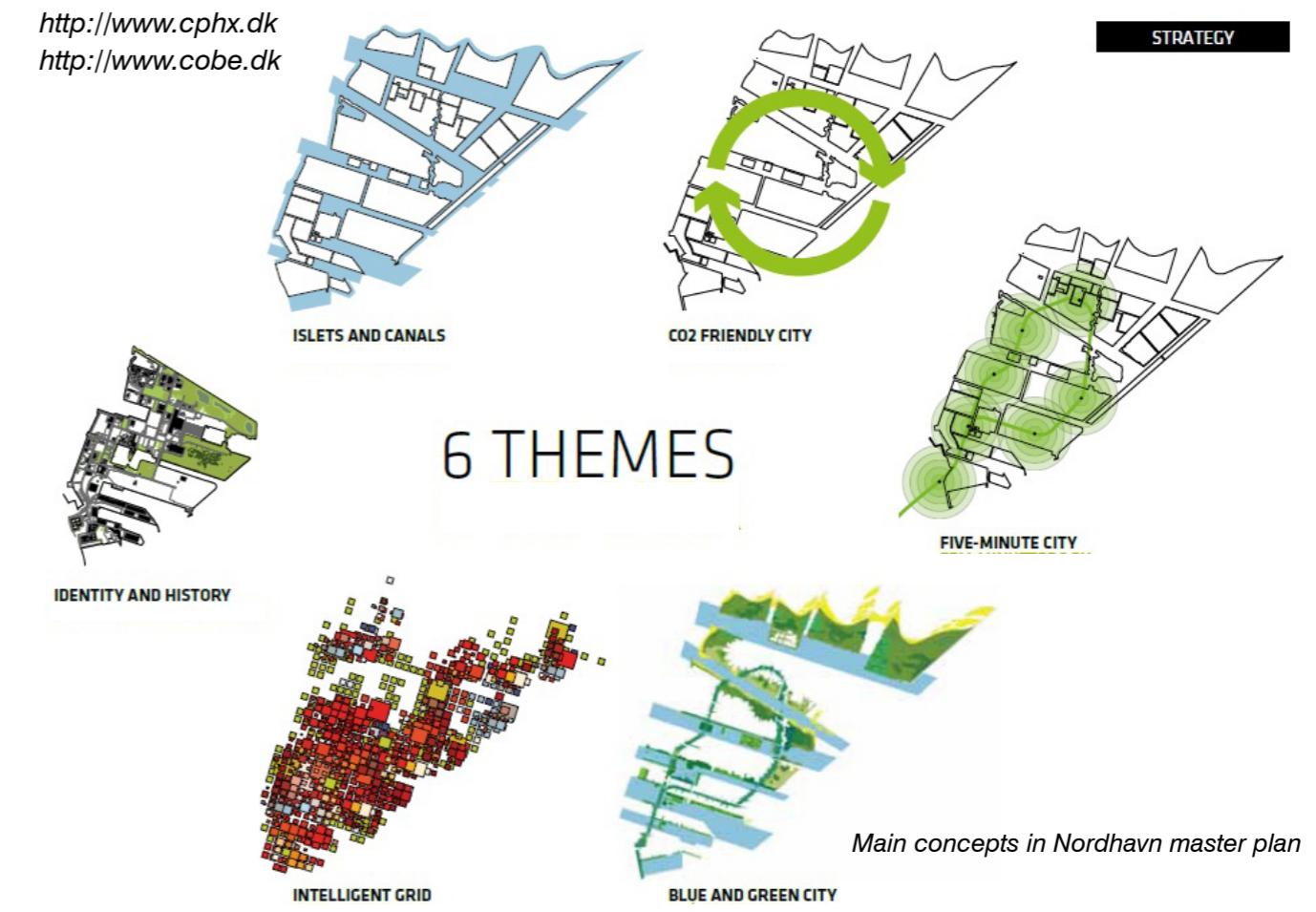
The sustainable city of the future

The new city district of the future will be dynamic and vibrant. Sustainable urban development is integrated into all aspects of Nordholmene Urban Delta – green traffic, environmentally friendly energy sources and social diversity.

The idea is to split up Nordhavn into small, independent "islets", each featuring its own identity. The islets will make Nordhavn a whole and connect to the rest of Copenhagen. The city district will be designed as a dense and low city with characteristic towers, like Copenhagen in general. It will be a mixed city with green traffic, focusing on short distances to public transportation, green areas and public institutions, so that pedestrians and bikers are given high priority. The many green areas will be connected to the "blue" urban spaces of the district, giving citizens a wealth of options as to activities and experiences involving both land and water. City and harbor will be seen as a whole, a visionary environment worthy of Copenhagen's new city district on the Sound.

"The sustainable water-born town of the future. In the course of the near 50 years, Nordhavn will be developed from being an Industrial area into a sustainable urban neighbourhood. The vision is the creation of a dynamic and sustainable city section that makes use of existing historical building heritage and the great possibilities connected with new construction. Stage one of the new construction will start in the area close to the Nordhavn station from 2011. The intention is to extend the public bus service at Nordhavn, and eventually add a Metro." CPH city and port website

<http://www.cphx.dk>
<http://www.cobe.dk>



Description of design concept in winning project

The location of Nordhavn is unique in that the area has traditionally acted as a mediator between the historic city center and the city border of the ocean. This concept of the mediator is one of the defining factors evident in the winning design. They have organised the development area into small islets and town entities, creating a hierarchy of wide channels and separating the town islets with slim channels. In this sense, there is a gradual transition from dense city to the vast open sea and the concept of the mediator is preserved.

"Nordhavn is characterized by very wide harbour-basins. When the harbour is not filled with ships, the landscape and the ocean are sucked into your view and you get a spatial experience of that often includes colossal shipping warehouses and cranes as well as the vastness of the great open sea." (*The booklet Nordhavn urban strategy November 2009*)

Of course, the harbour is also experienced on a smaller level and this often results in a contrast of scale. Because of the wonder that this contrast of scale generates, COBE has decided to preserve the open views as well as many of the existing industrial building structures. COBE has stated that they might keep a building because it can be worked with (as in it can be easily renovated or built on top of) but it will mainly be selected to preserve history and life in the area. "It must not become too polished. It must still be raw, cool and angular."

our grandchildren's generation will, in 50 years from now, probably not be familiar with an industrial harbour. Building structures provides us with important stories. We need to select them, preserve them and use them in future city development", says Dan Stubbergaard from COBE enthusiastically.

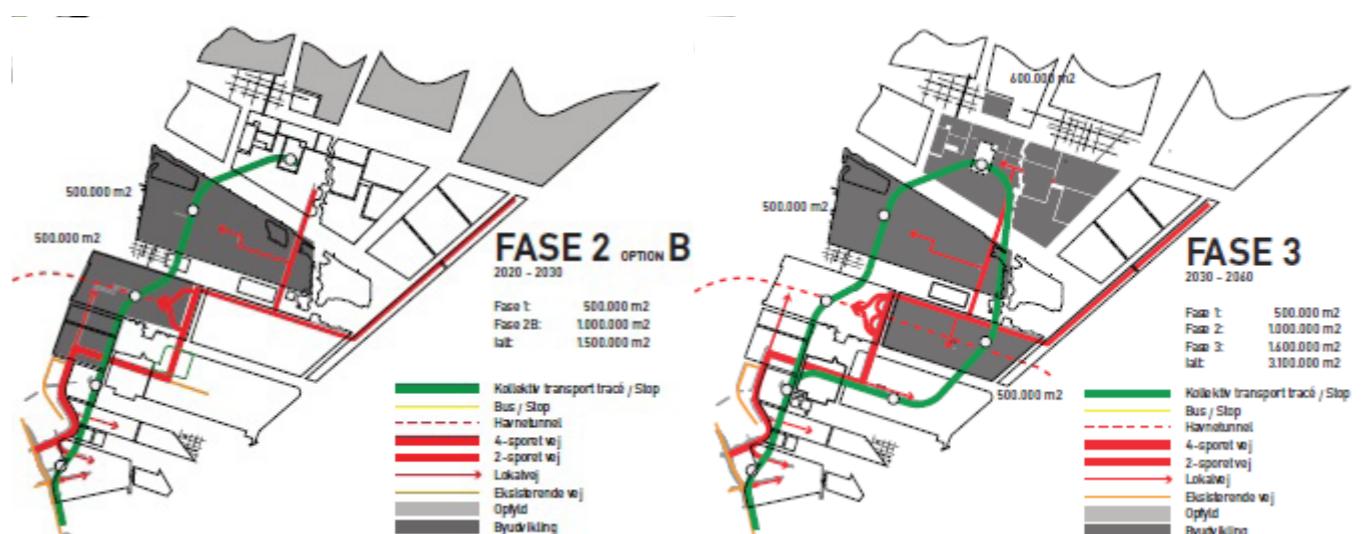
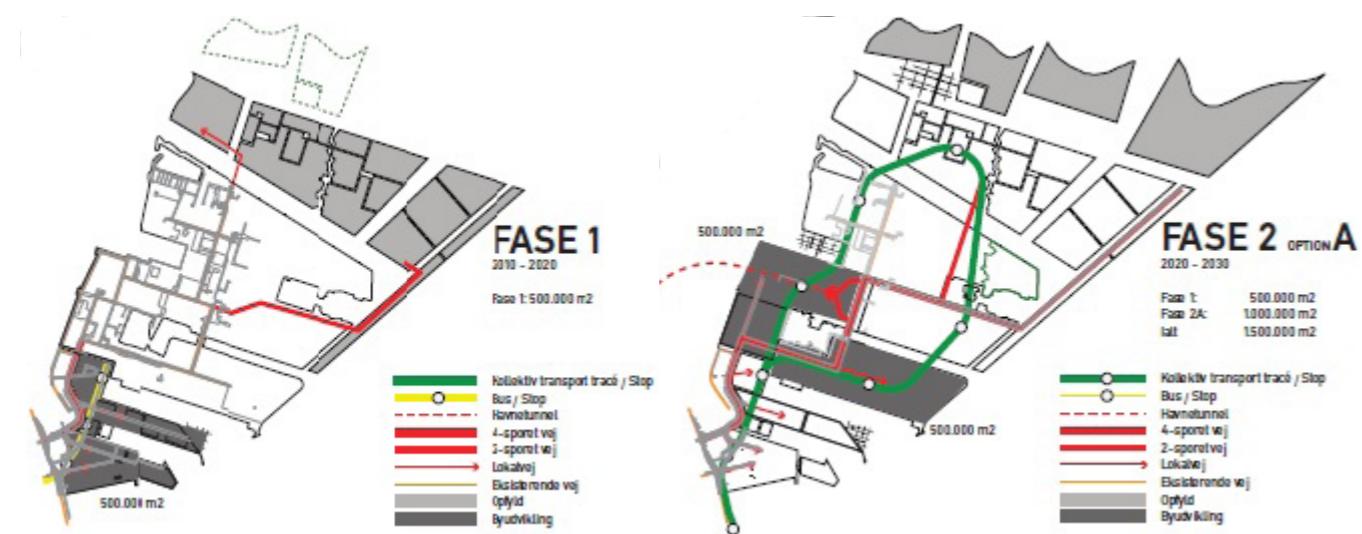
In addition to the preservation of a historic feeling and a contrast of scale, keeping old building structures can have other advantages: "Old buildings push the structural grid and make it less rigid. And a lot of things are given to us completely free. We gain another organization of space and a surprising set of city spaces, which we do not have to design from scratch or reinvent. Our designs become far less predictable than if we were working with a blank slate".

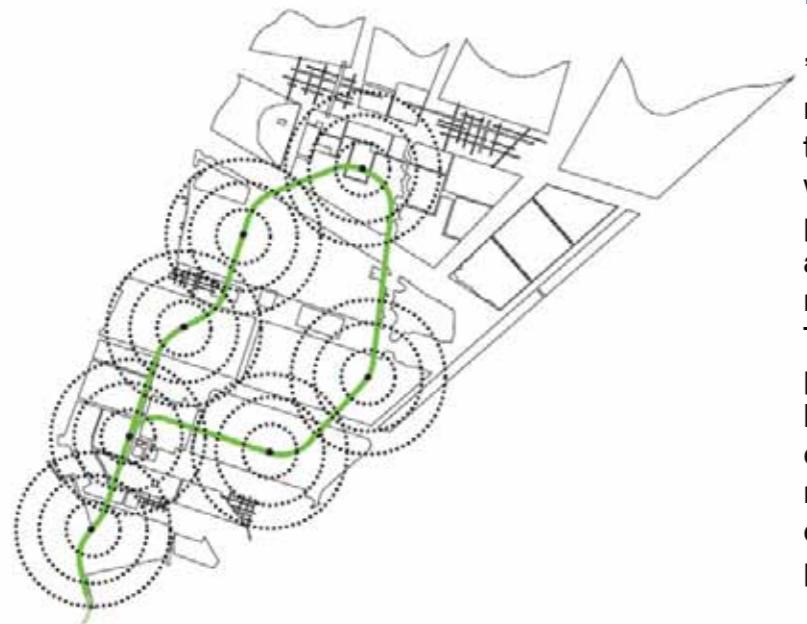
The booklet Nordhavn urban strategy November 2009



The location of new building zones is specifically based on the current structure and division into plots of the harbour area. This means that new buildings can be developed without conflicting with existing buildings and activities.

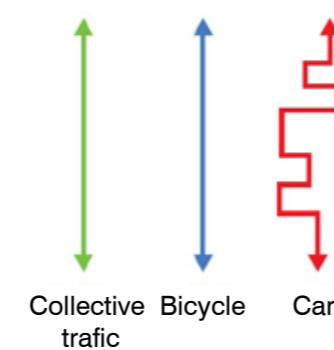
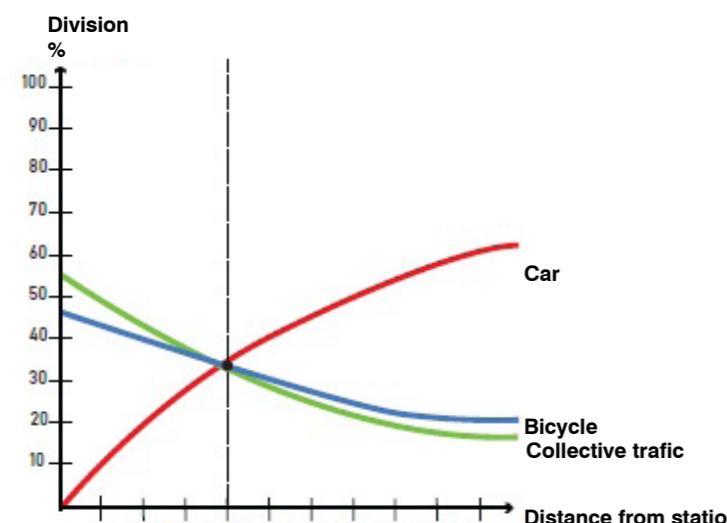
Henrik Nowak, RAMBØLL talks about Nordhavn as a green city. In Nordhavn you will find a variation of green zones. There is always a green area just around the corner: from local pocket parks, promenades and green urban spaces to open coastal expanses, beaches and large scenic areas.





Transportation in Nordhavn future plan

"There are plans for an overhead metro railway to connect Nordhavn with the rest of the city. The overhead railway will also function as roof for a super-bicycle path, which – without rain and obstacles on the road – should make it easy to be a cyclist. The overhead railway and the bicycle path together constitute "the green loop", which will be a key transport element on Nordholmene, and which represents a conscious effort to render the sustainable means of transport visible in public space."



<http://sustainablecities.dk/en/city-projects/cases/copenhagen-life-at-the-harbour>

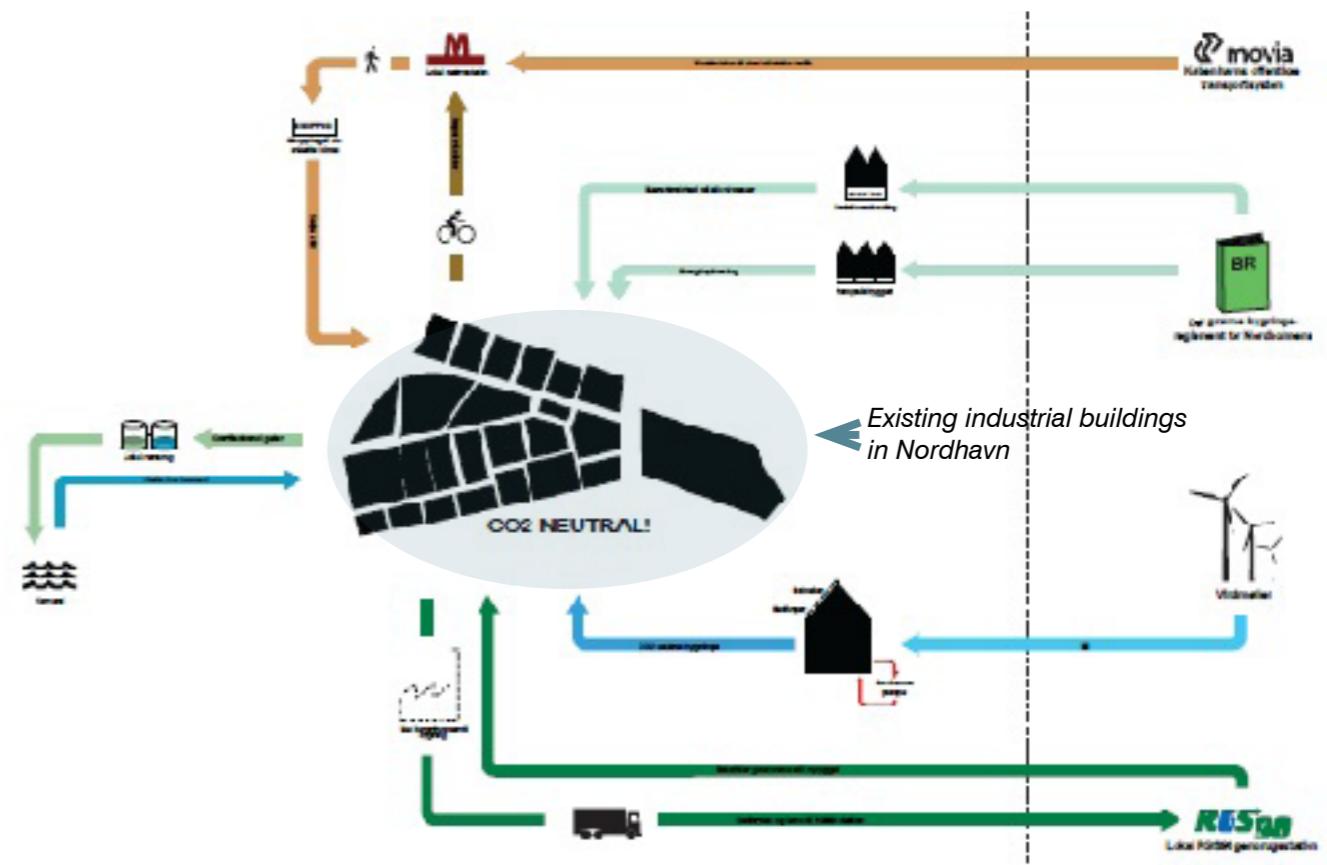
New energy forms on Nordhavn

"Sustainable forms of energy and a focused effort to reduce carbon emissions play a substantial role in developing a whole new town quarter.

It is also part of the plan to gain energy from a series of alternative sources, wind turbines for instance, from biomass fuel extracted from sea lettuce, which can be grown in the waters around Nordhavn and from geothermal heat pumped up from the interior of the earth.

Furthermore all houses are going to be low-energy houses, where for instance waste water is to be used in the water closets.

Also existing buildings can be refurbished to give good internal comfort conditions, especially in summer, with low energy consumption using a mixture of best practice and innovative measures. With innovative solutions rooted in the project from the very beginning, "Nordholmene" makes use of geothermic, heat pumps for storing energy produced by local wind turbines, and alternative energy sources namely "sea lettuce", a fast-growing algae absorbing CO₂ channeled from a nearby power plant, for producing heat, ethanol and electricity."



Chapter IV



Furnitures
New light Roofs
flooring
Ramps

Design Strategy

Urban interaction
Spaces
Courtyard Ideas
Edges Surface
Entrances Fire Exit
Acoustic

4.1 Design objectives

Incorporating new design within a Industrial framework can be complex. The low ceiling heights of many warehouses and factories, constructed in the late nineteenth century, make them functionally obsolete for industrial and several new uses today. In addition, the placement of columns in many buildings can cause a design challenge. Concrete slab floors can be difficult to reconfigure. Old wiring and plumbing will likely need to be removed. Features, such as the roof and windows, can often by repaired rather than replaced. The windows of many industrial buildings, however, were altered in the 1950s when windows were bricked in and air conditioning installed in an effort to control separation and shrinkage of textile thread due to humidity and dryness. The addition of extra stories to the exterior can often be problematic if the project is undergoing design review. Solutions include building an addition that is not visible from the ground, although this depends upon the building's roof type. Some large complexes can be difficult to adapt since it might have too much space and too many structural problems. In some rare instances, the adaptive re-design of an older industrial building may not be feasible due to unworkable structural problems or other factors. In addition, there can be concern over how to determine circulation and accessibility.

The occasions where the adaptive re-design of an industrial building is avoided are rare; instead, there are many design opportunities associated with such projects. Factories, and especially mill buildings, are highly adaptable. Their short spans, masonry construction, simple detailing, and large windows results in naturally lit interiors with unique features.

Overall, the vernacular craftsmanship of industrial buildings is of a higher quality than most current construction.

Many wall and floor surfaces are already left exposed, which can save costs if that is part of the design aesthetic. Foregoing the excavation and construction of a new foundation, can save money and prevent that risk.



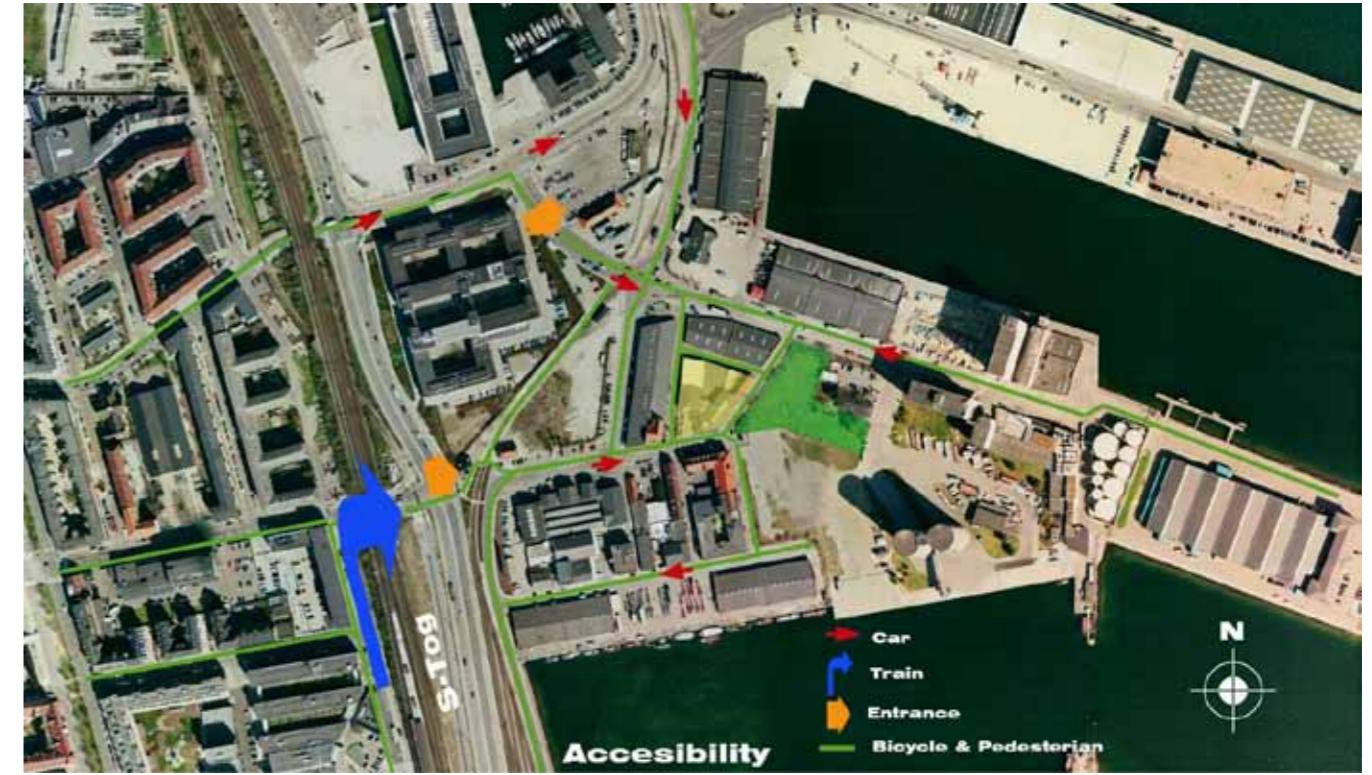
4.2 Site analysis



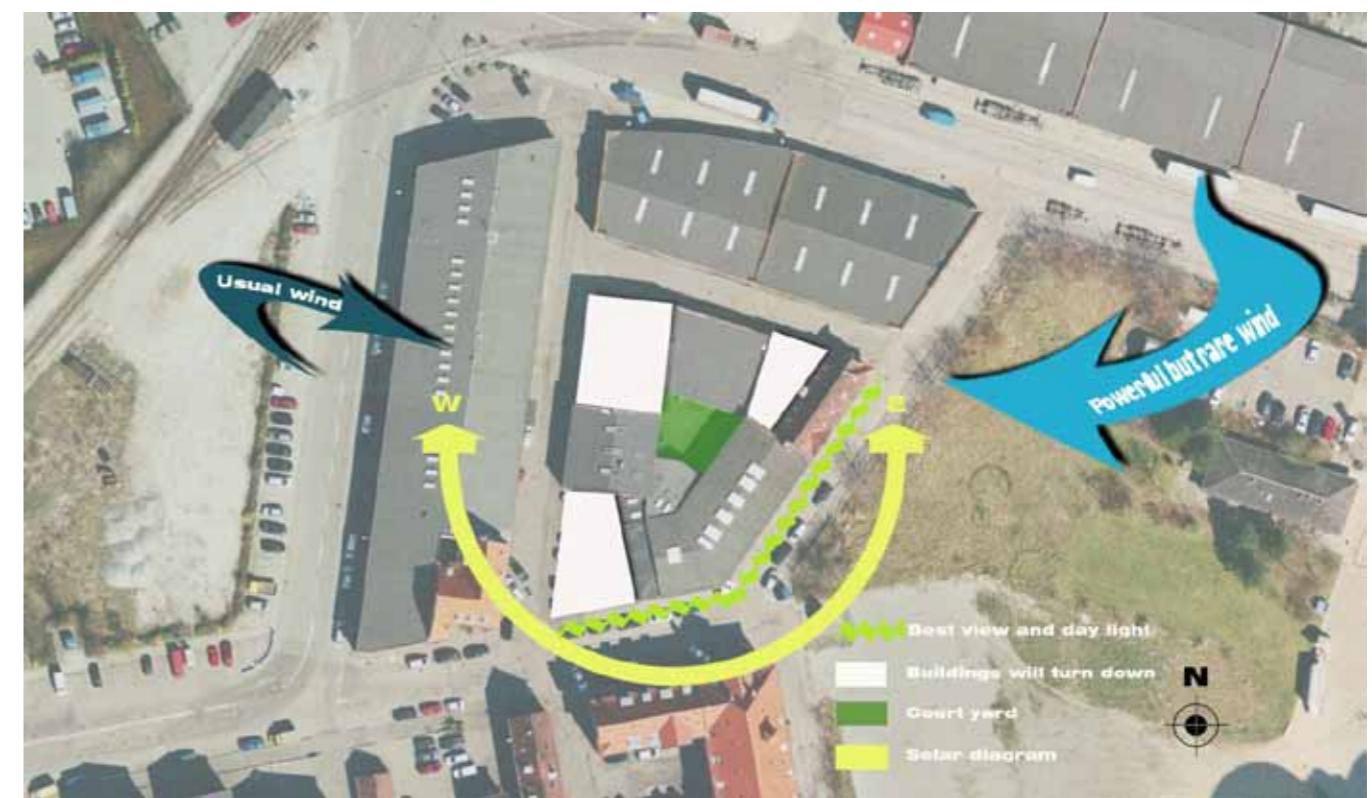
current condition of industrial occupancy in Nordhavn



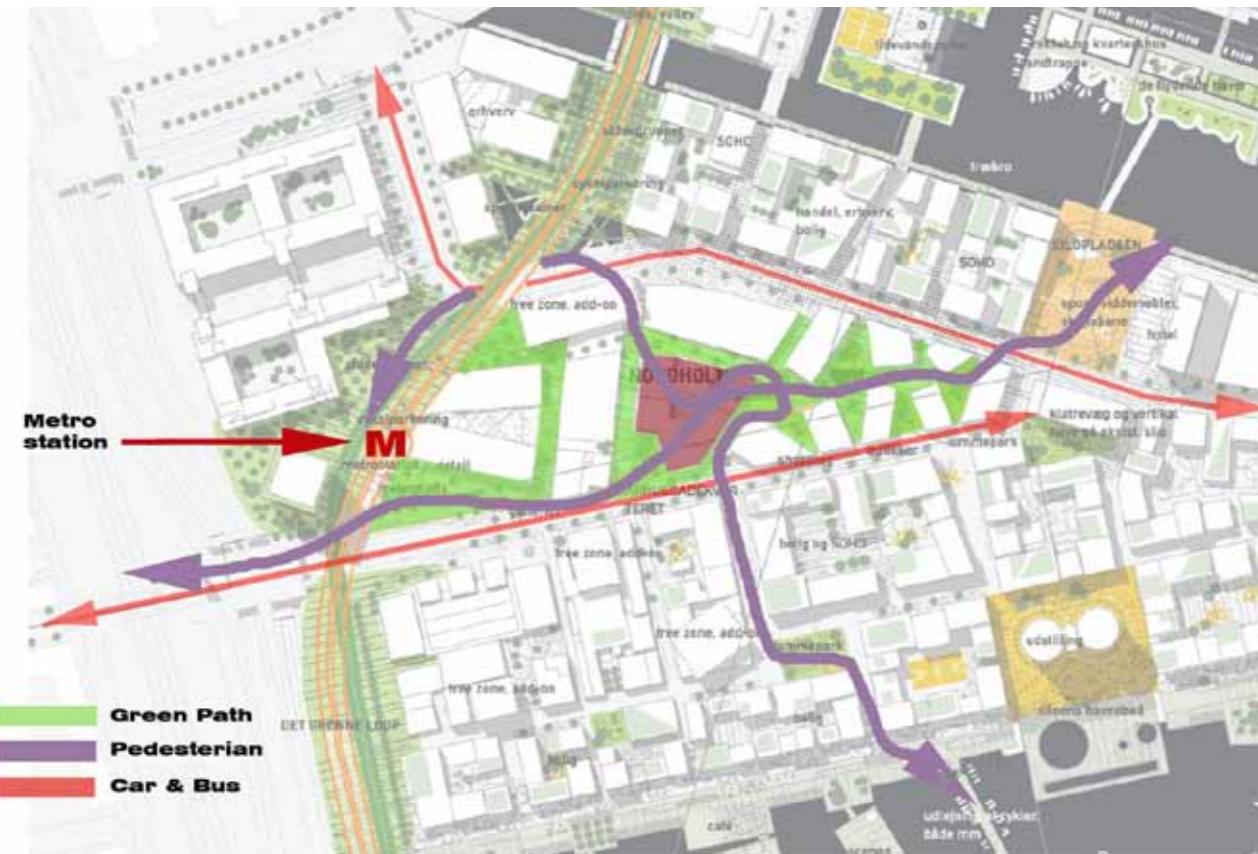
Accessibility Analysis



Climatic Analysis



New infrastructure



4.3 Proposal solution for Nordhavn music centre

Analysis of wine project for development of Nordhavn and this site

4.3.1 Needed to change hands

The aim of design is providing vacant industrial buildings for new owner and new uses. Buildings changes because their users and their needs do changes. These changes should response to the buildings structure, elements and fittings. So we can separate building's elements to "long life" and "loose fit".

Long life elements

In this project the long life elements form the core and main function buildings and which are unlikely to change. Here the entrances for different users design and depend on pattern of occupation.

"The perception of life expectancies for different elements is a key to creative part of redesign, and it is the answer of why changes have occurred to this buildings. The life expectancy depends on the quality of the material used, its specification, and the design of details by which it interacts with other material". So for example we can increase longevity of timber by impregnation with preservatives or resist insect attack and unexpected growth. This timber will still be subject to a regime of soaking and drying out heating and cooling. Timber needs to remain as stable as possible we can improve the situation further by detailed design.

For example we can raise the baseplate timber above the ground by placing it upon a solid foundation of stone, and we place a damp-proof membrane of mortar and tar between the stone and timber then we will prevent the water from the ground soaking the timber. For roof above this timber structure we can place a rainshield of lime wash on the outside and warm living environment for people or animals on the inside.

This prolonged life depends on that of the damp proof membrane and the continued maintenance of limewash and these in turn depend upon the continued use of the property. Add insulation externally; constant heating systems internally; a vapor barrier to prevent the damage from any inside; then gently ventilate as a guarantee so that when any of other materials, or details fail to some degree the effect upon the timber will be minimised until the problem is noticed and fixed.

Loose-fit elements in this project

The elements in building that need to be conserved are obvious. So what remains falls into the loose-fit category. Perhaps windows and doors, plaster surfaces, architraves and base boards and sometimes light fittings comprise loose-fit elements. So the loose-fit features are likely to include the following:

- Their life expectancy and degree of integration to be decided in individual cases.
- Need for additional accommodation
- Circulation changes: fire escapes, lifts (may only for disabled access)
- Improved insulation or ventilation: air conditioning or ventilation maybe achieved through a comprehensive system, hidden or exposed
- Improve lighting: rewiring and relamping existing luminaires.

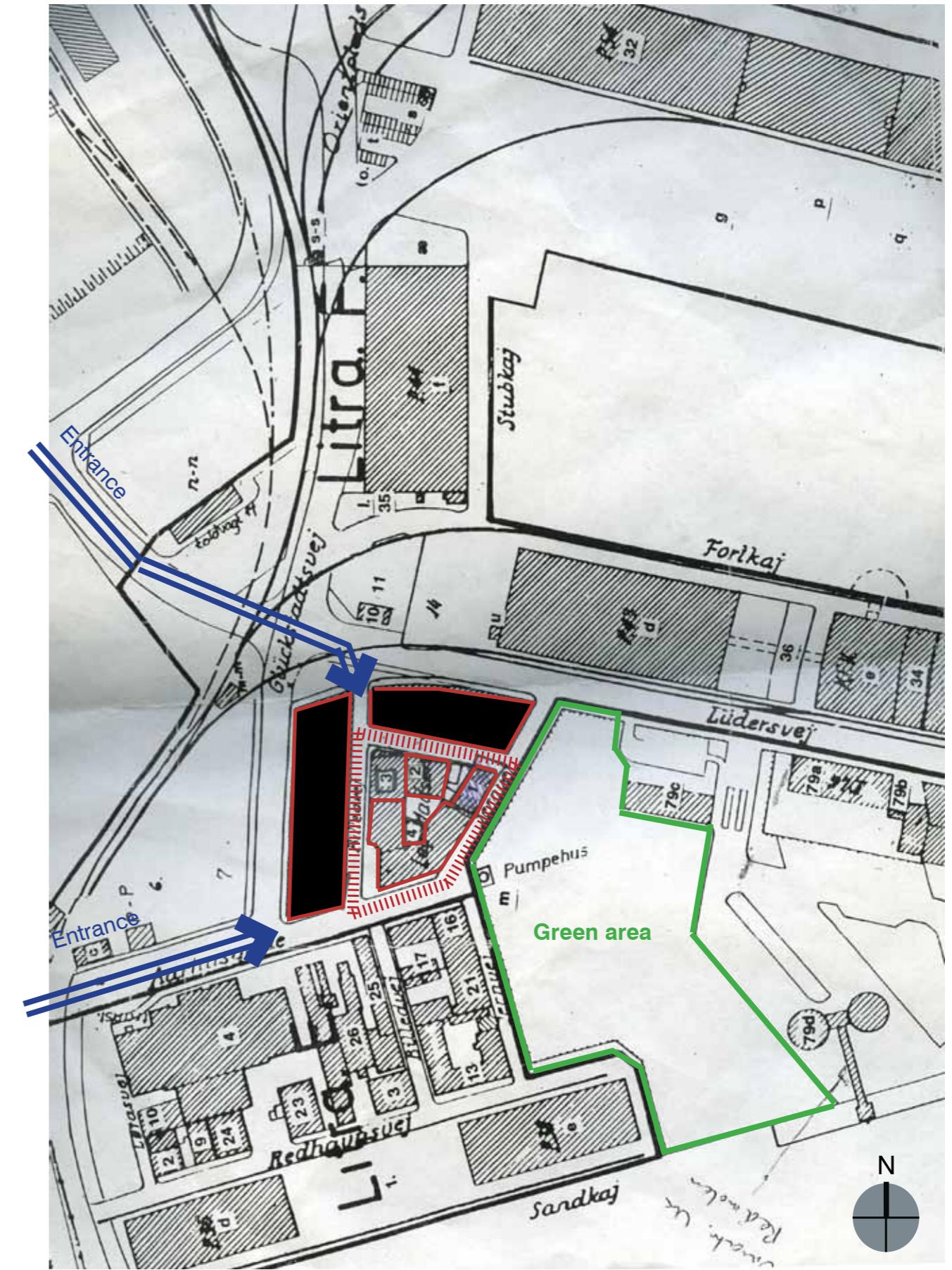


4.3 Existing Buildings

All the picture of old drawings in this part belong to COBE architectural office in Copenhagen. Dates under the drawings shows that they were drawn in May 1943.

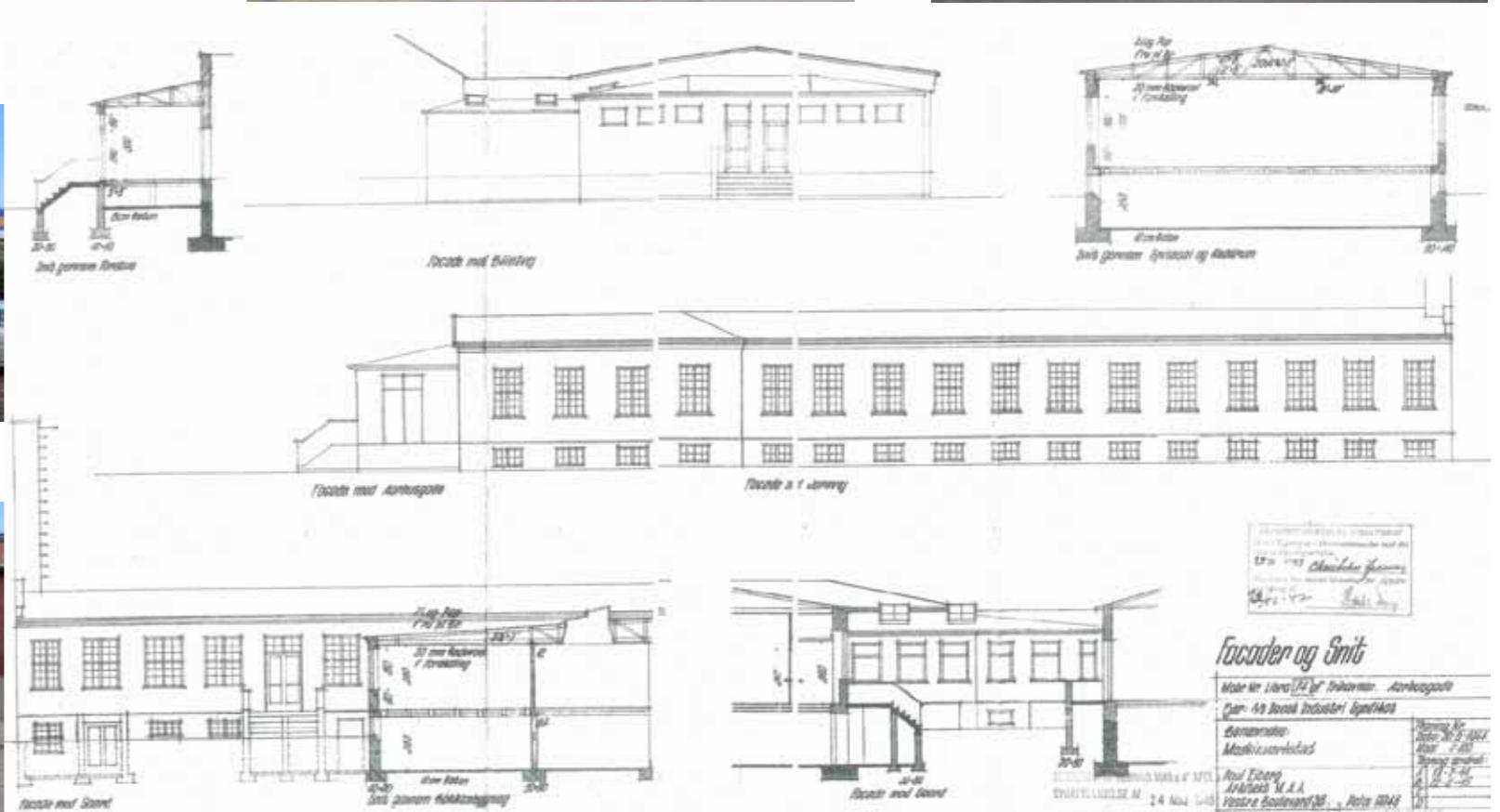
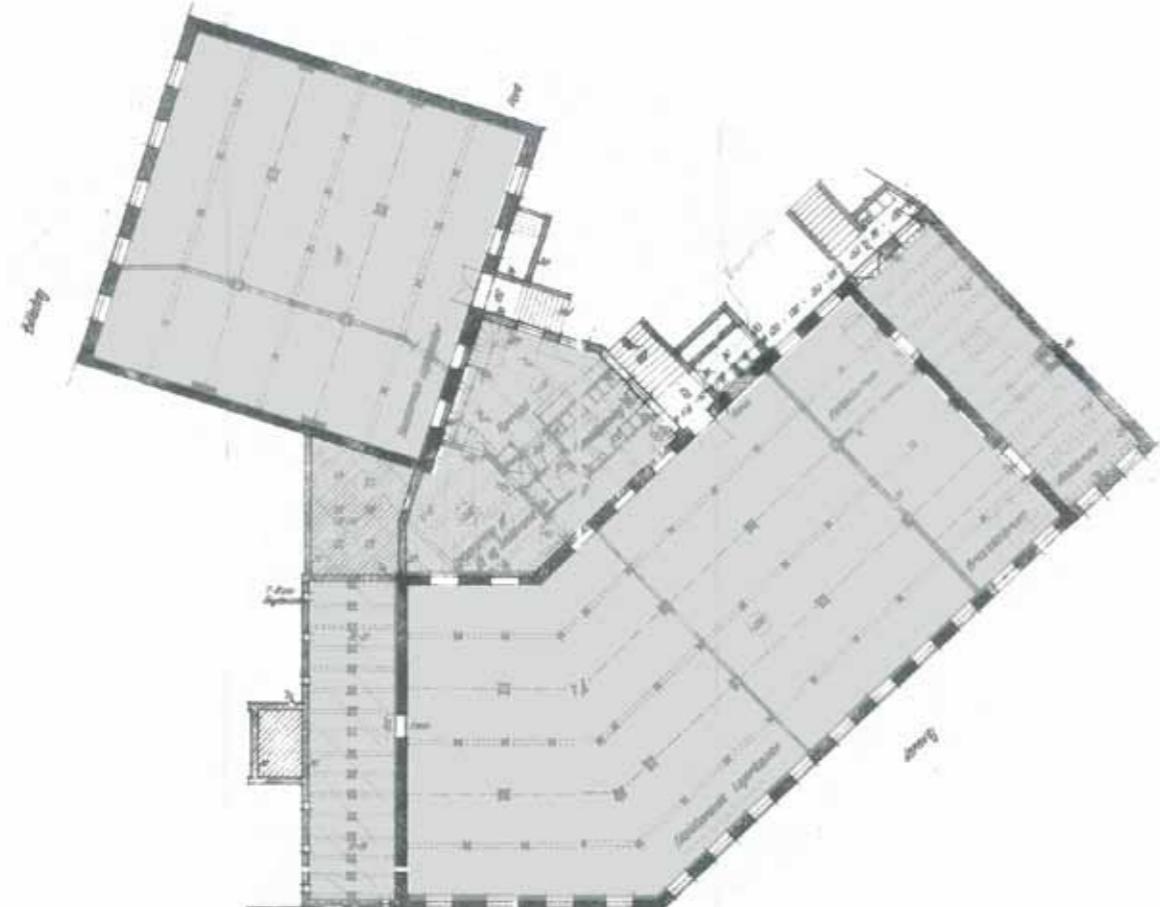
Here, I first studied the drawings of existing buildings, then compare the drawing of each buildings with photos which I take recently, so I found that some parts of buildings changed and renovated during the time. Now all the buildings are vacant and some of them use as a storage for old and useless materials.

As you can see in photos during the time some parts of facades and inside the buildings renovated and repaired, but it is obvious that there was not any plan for renovation or restoration of whole property.







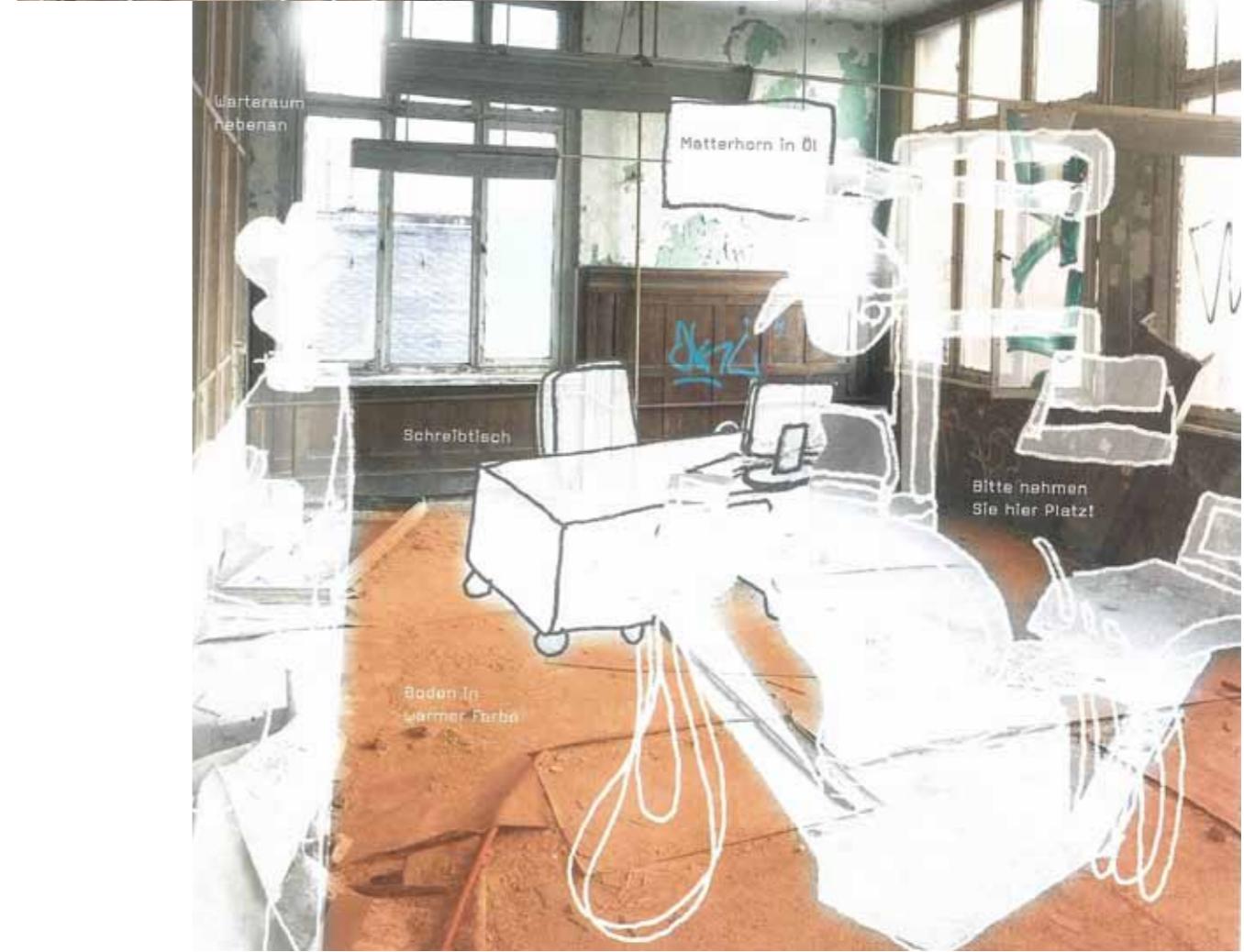




View of west street



View of site from top of the siloes



The goals

- Creat a dense neighborhood for cyclists and pedestrians
- Social sustainability with creating a spaces for musical events with different form of ownership
- To avoid a monotonous area that only live a certain times of day,different functions merge into each other possibility to enjoy activities through the day and crime prevention effect
- Attract the life and activity of area Creative business , small scale enterprises, workshop Studios will help the awareness of area
- Keep the long history and strong identity of this zone so preserve the high limit buildings to support the character of area

4.5 Design Strategy

Green Adaptive Re-Design

There is a great opportunity to extend the sustainable practice of adaptive re-design by preserving energy and resources through green design. Currently, sustainable design is most widely publicized for its applications to new construction.

It is, however, an important strategy for adaptive re-design.

By combining sustainable design with adaptive re-design of existing buildings we could create the field of green adaptive re-design. This combination makes sense since the premise of adaptive re-design is more sustainable than Greenfield development since the infrastructure and materials are already in place.

1. Object

Some parts of existing buildings are available to use for new functions. Although all parts need to re-design but there are some limitation, for example in the height of roofs for some activities like auditorium, it is necessary to add new entrances and fire exits.

2. Approach

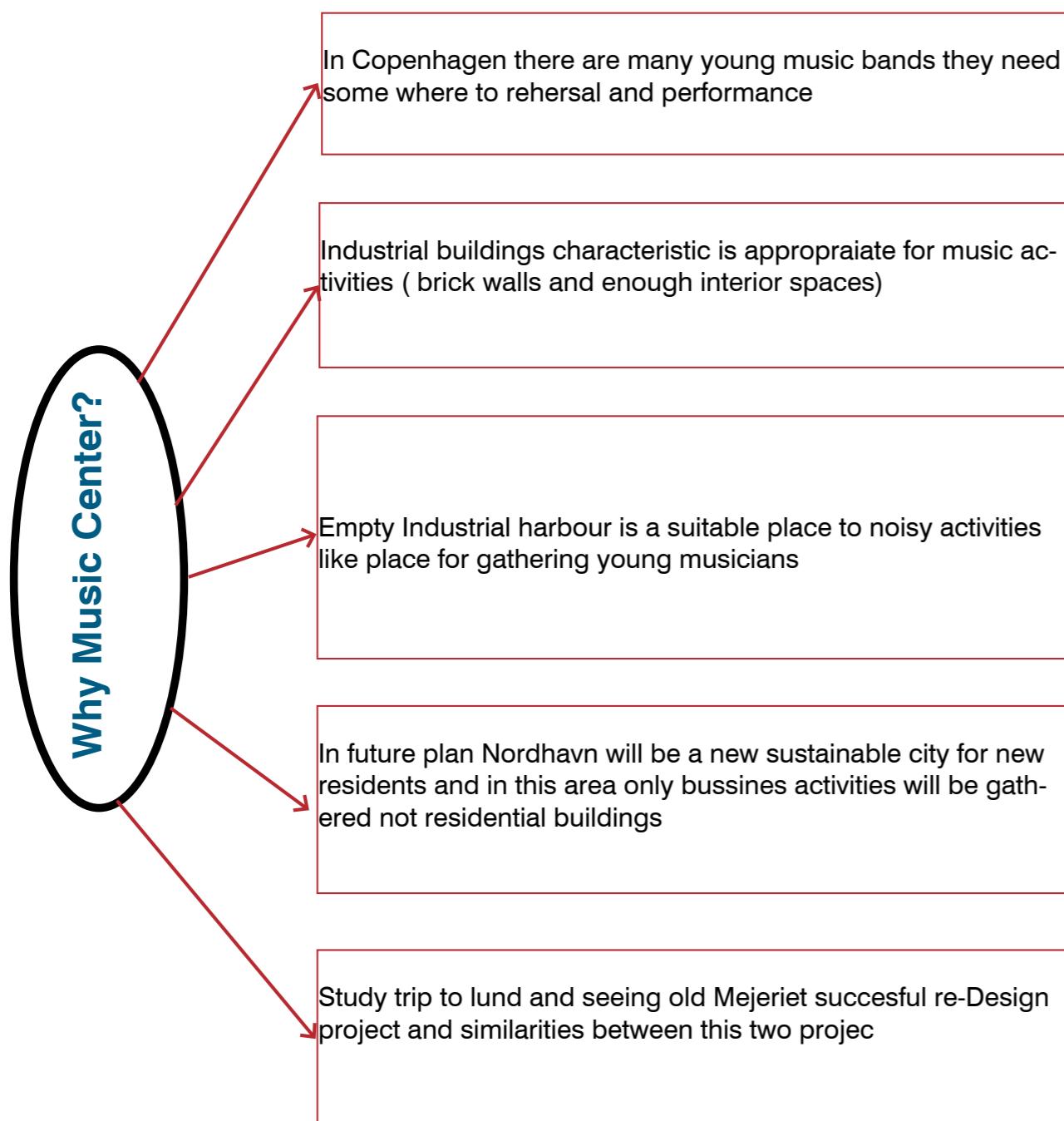
Adding Roof, Surface, Passage, areas, Facade, new structure for new functions are strategy and new approach for re-design.



4.6 Finding a new use for the buildings

Understanding the user's requirements

The main reason to re-design these buildings is demand of a government agency (Bo og Havn) to use these existing properties as a part of regeneration programme. So I should recognise the user's needs at the beginning to reduce the likelihood of future change after completed. Although my aim is refurbishing these buildings with enough scope and flexibility to survive in future changes.



Additional internal space needed

Aside from providing new functions for buildings like rehearsal and practise rooms, for performance had to create extra space. It needs at least 8 meter high for screen ceiling and backstage will be in two floors for artists comfort.

Saving 4 Brick buildings and turn down parking and car repair buildings

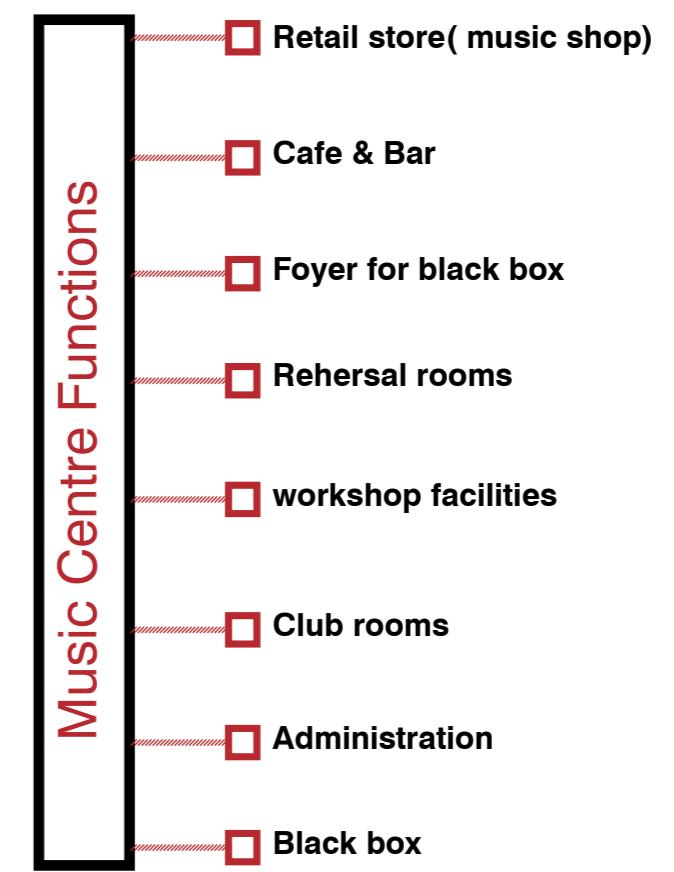
To decide about which buildings have to save and which can be demolished I considered how much this building had effect on memory of people. so I kept the buildings which people worked in them for long time and had a memory about them, buildings 1, 2, 3 and 4 according to long life and loose fit principals should be kept and use their material but others seems added to other old brick buildings later and the material in walls and roofs demonstrate they were temporary buildings, so I decided to demolish them and design new functions instead. Some parts of spaces between buildings will be considered for outdoor activities and work with urban context.

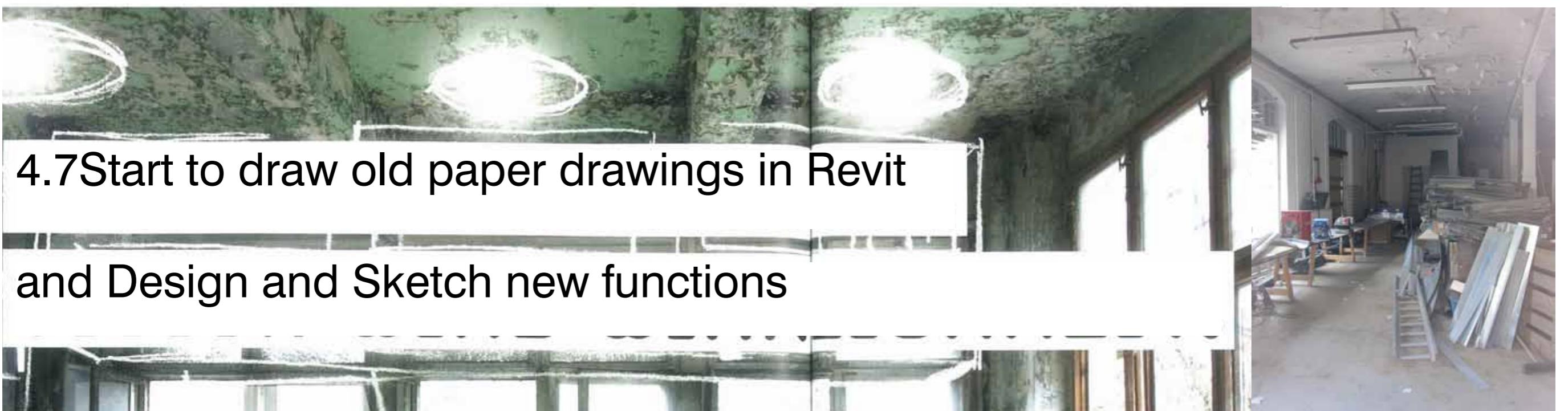
Allow for future change

The project to be undertaken will have an assumed life span. This could vary from ten years for a simple refurbishment or emergency repair, to more than a hundred years when repairing the fabric of an ancient monument. The normal life of a new building is between thirty and sixty years.

The building's story

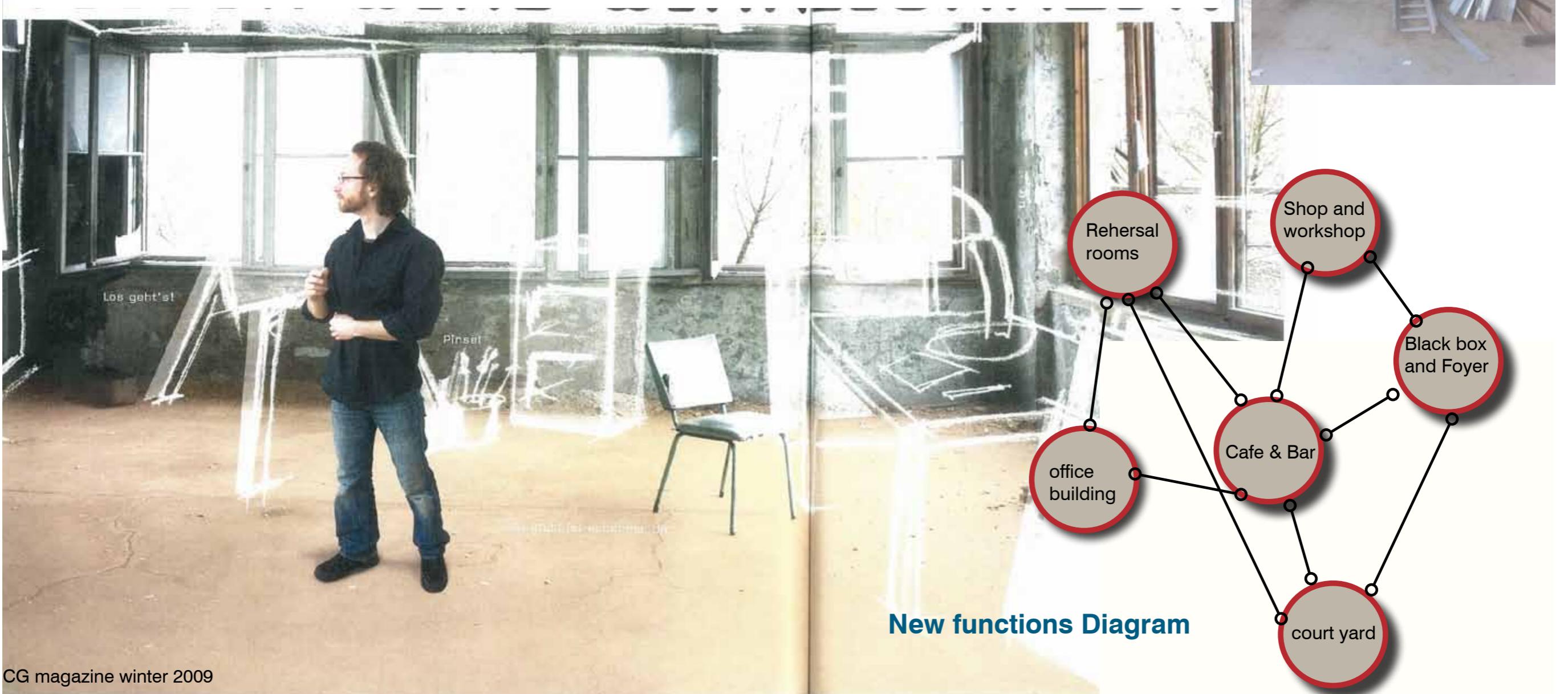
When starting work on old buildings it is obvious that study about both of that building and that place should be taken into account. It is important that historical analysis and investigation is undertaken without forgetting that it is not only the building itself which is important but its surroundings.

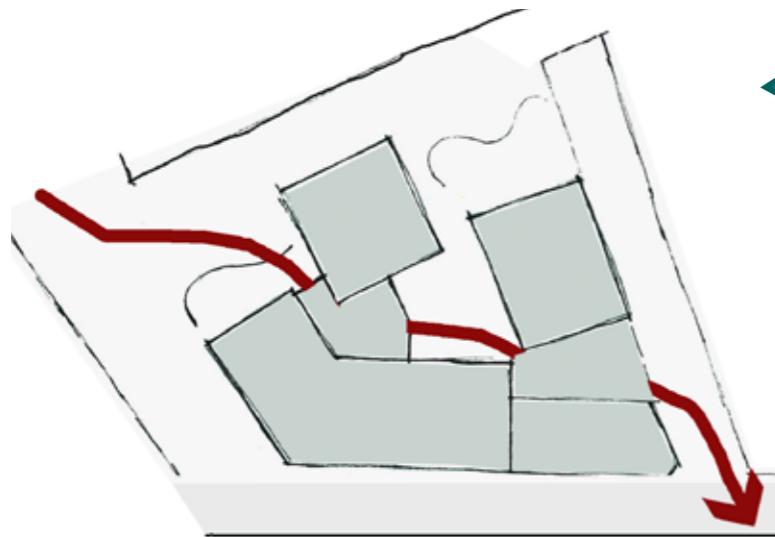




4.7 Start to draw old paper drawings in Revit

and Design and Sketch new functions





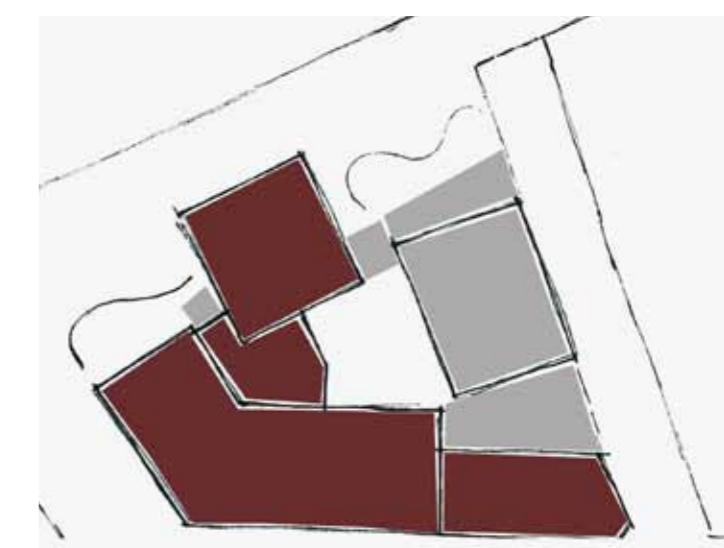
>Main concept: Passing through lights



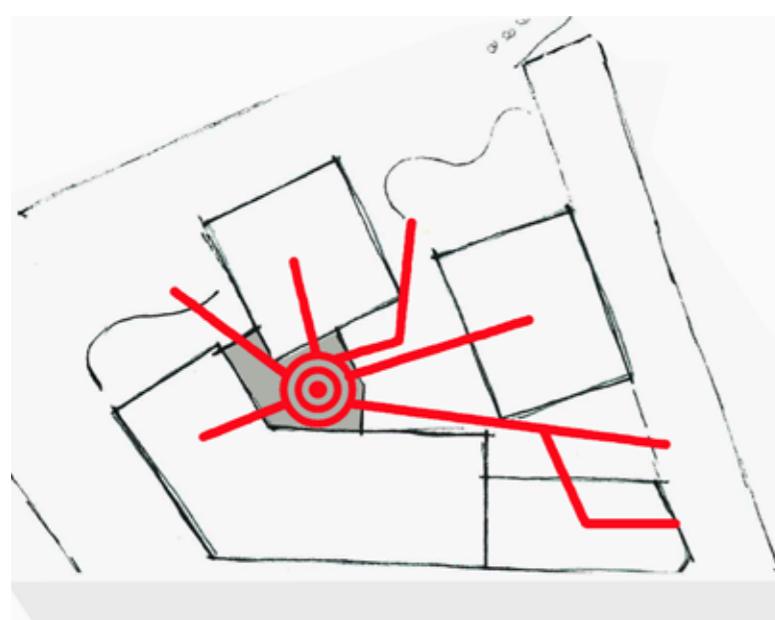
Placing different function and their connections



Bring Green and open spaces inside and between buildings



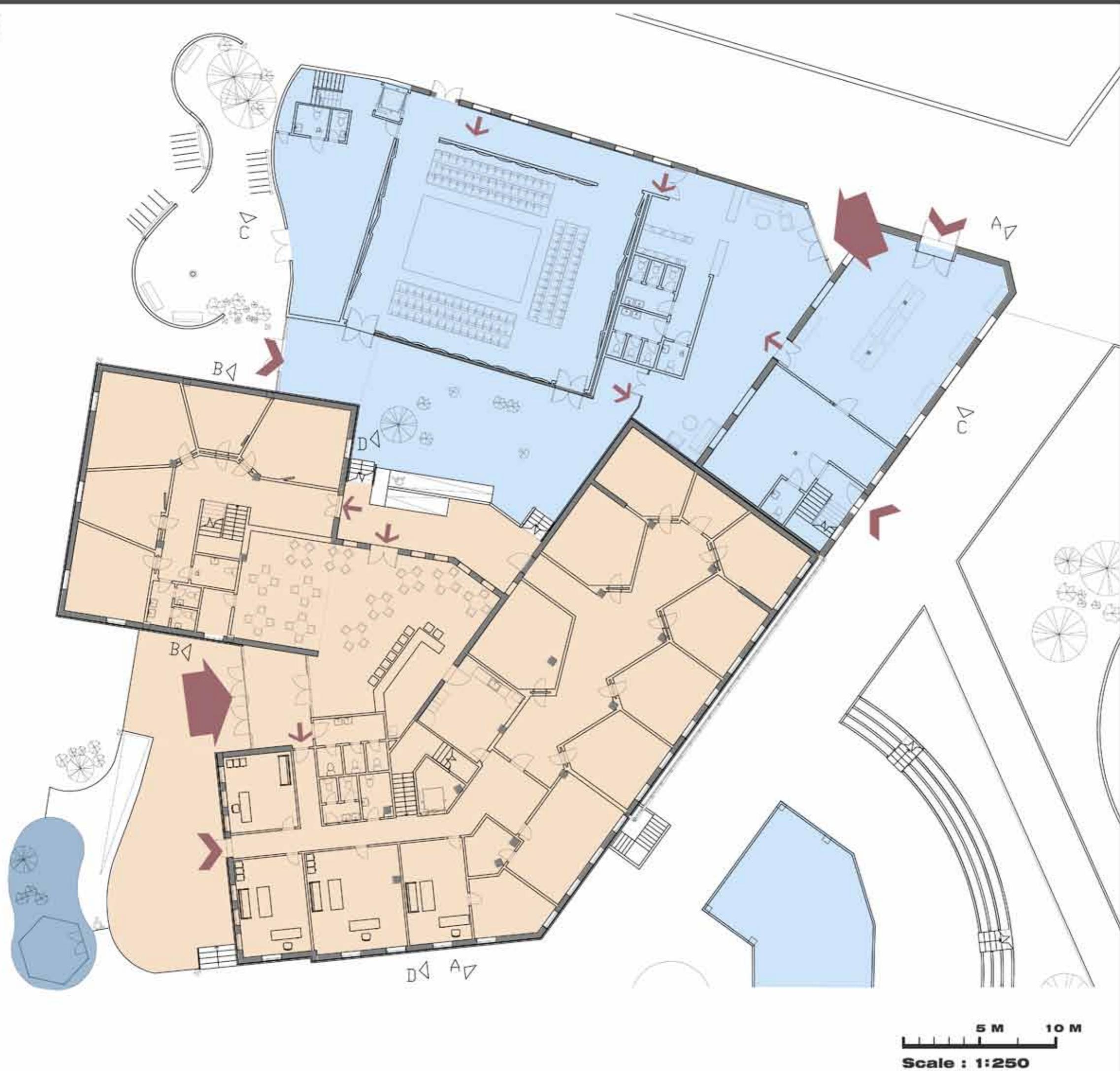
Save the building according to the memory of people and need to new constructions



Central core idea and connect all functions to each other

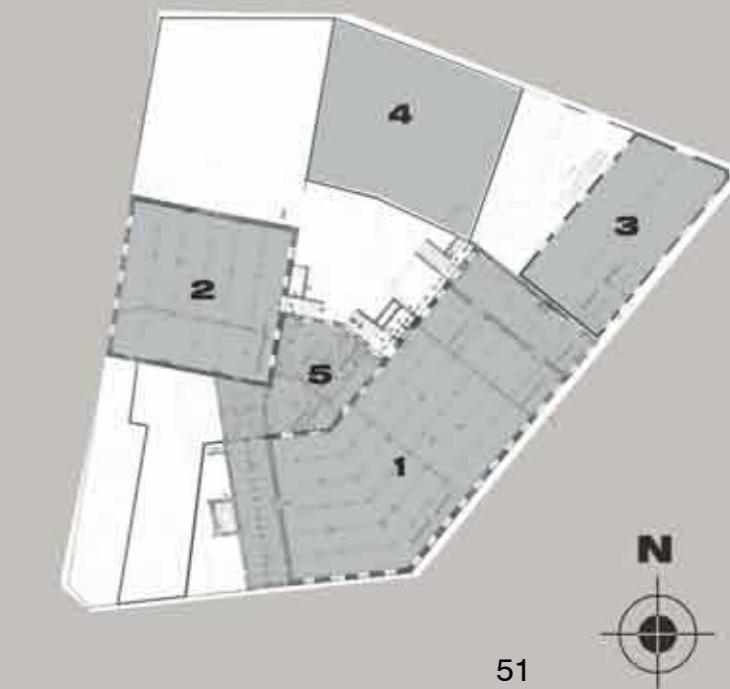


Sustainable principles:
All the new roofs are green roofs and getting energy from sun using PV panels



Project name:
Adaptive Re-design of a
complex of warehouses to a
Jazz music centre

Ground floor plan Analysis



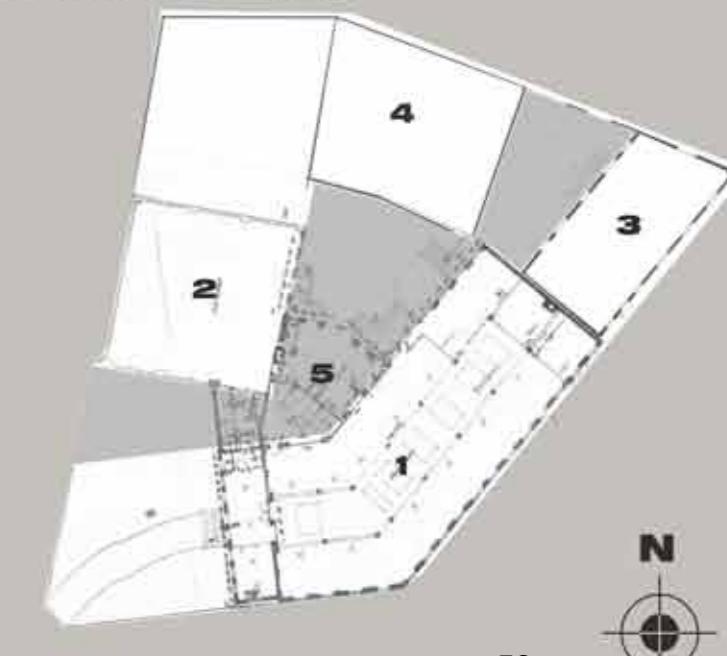


- Main Entrance
- Second Entrance
- Interior access
- Orange Interior-Artificial light
- Yellow Exterior-Day light
- Passing through light

Project name:
Adaptive Re-design
Nordhavn music centre

Ground floor plan Analysis

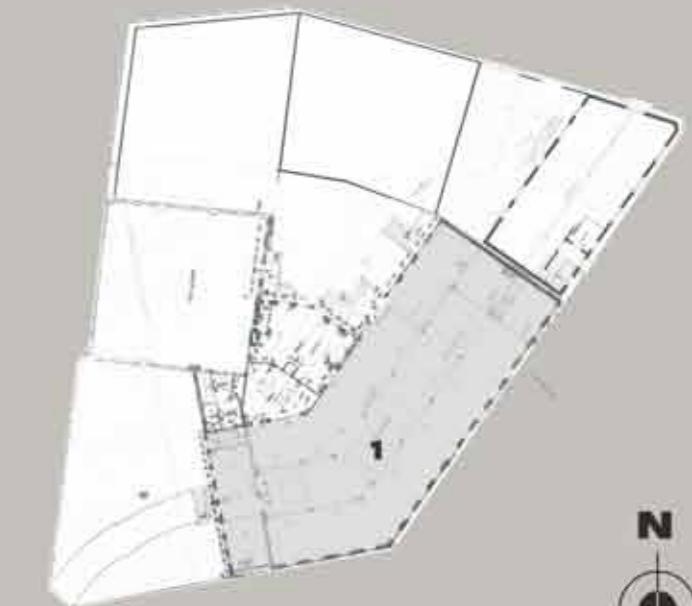
Defining space with light

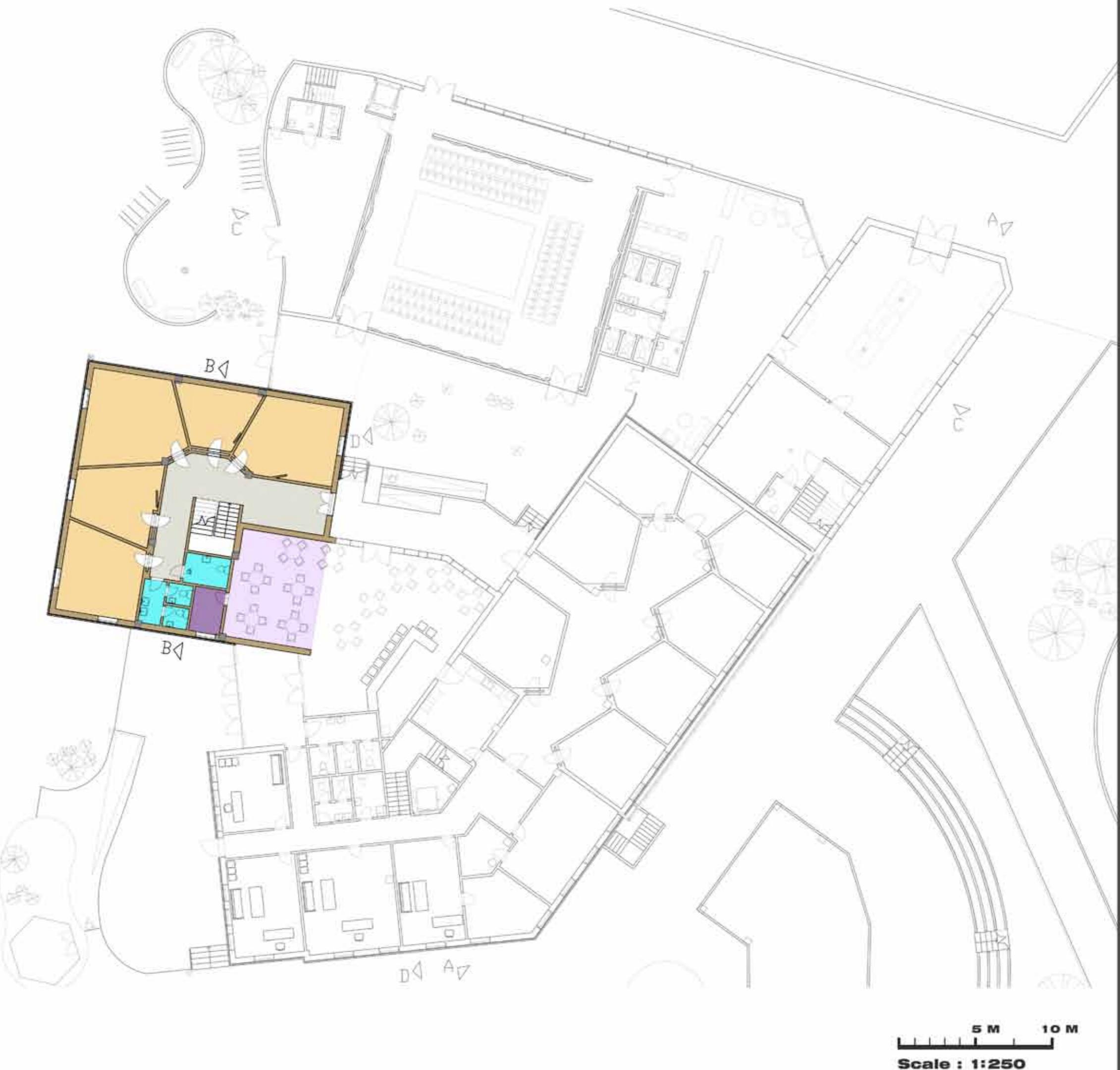




Project name:
Adaptive Re-design
Nordhavn Music Centre

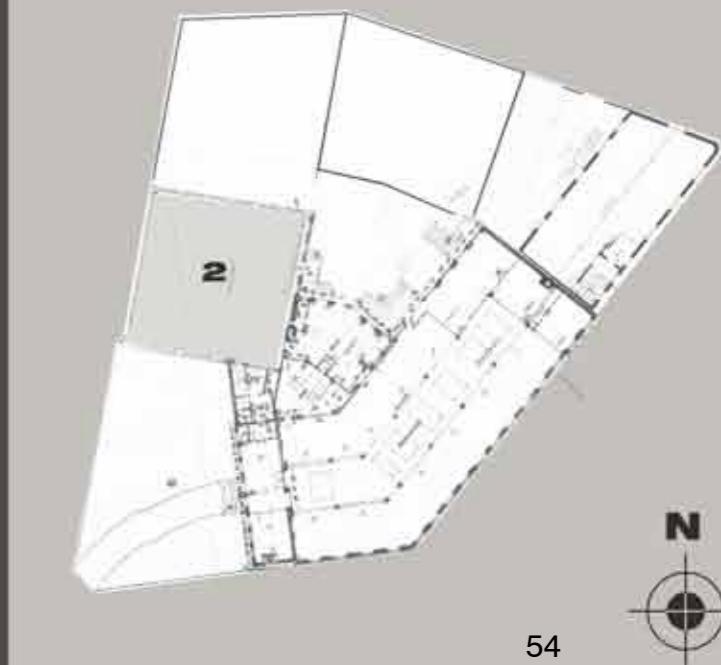
Plan: Building No. 1

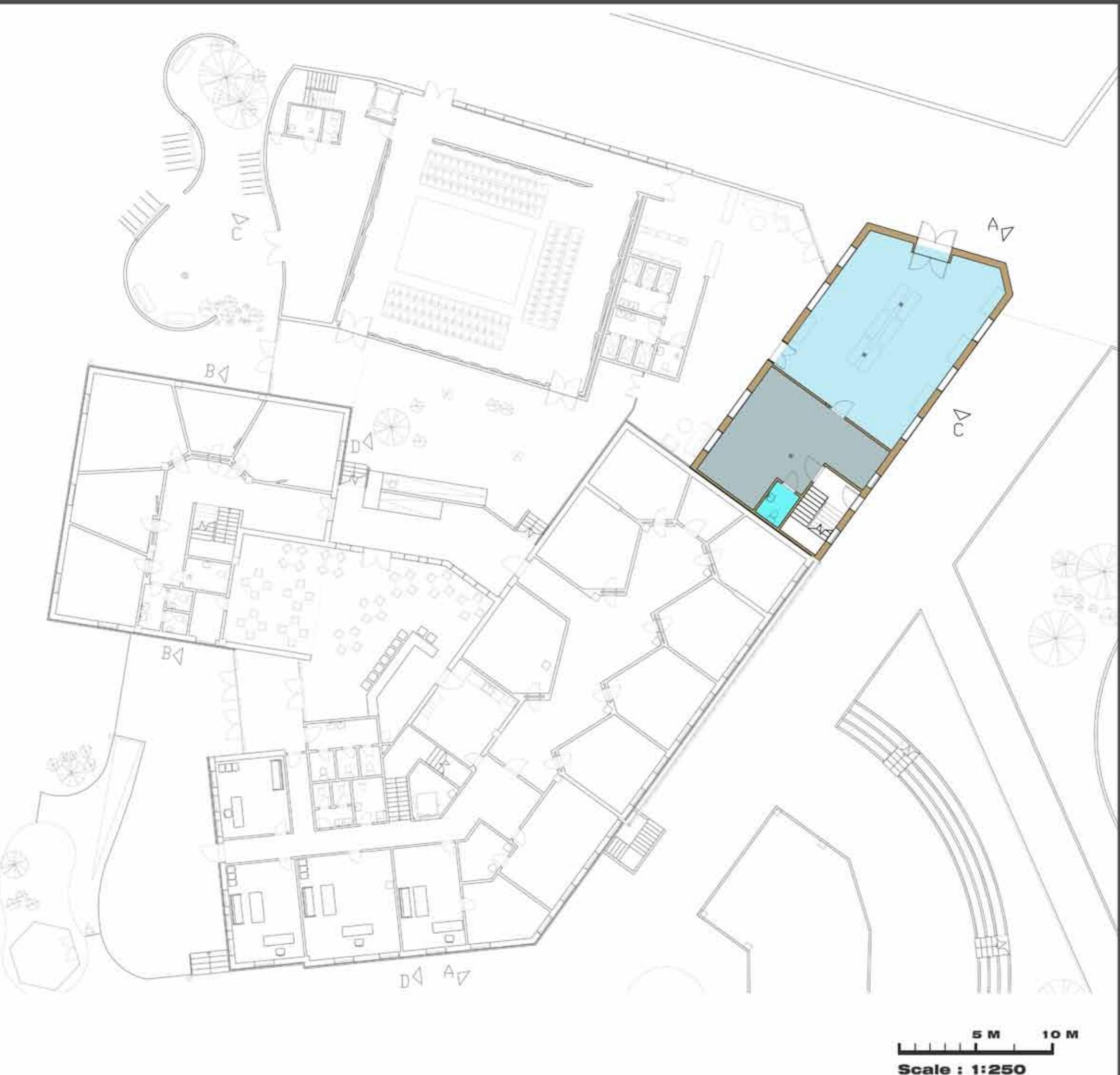




Project name:
Adaptive Re-design
Nordhavn Music Centre

Plan: Building No. 2

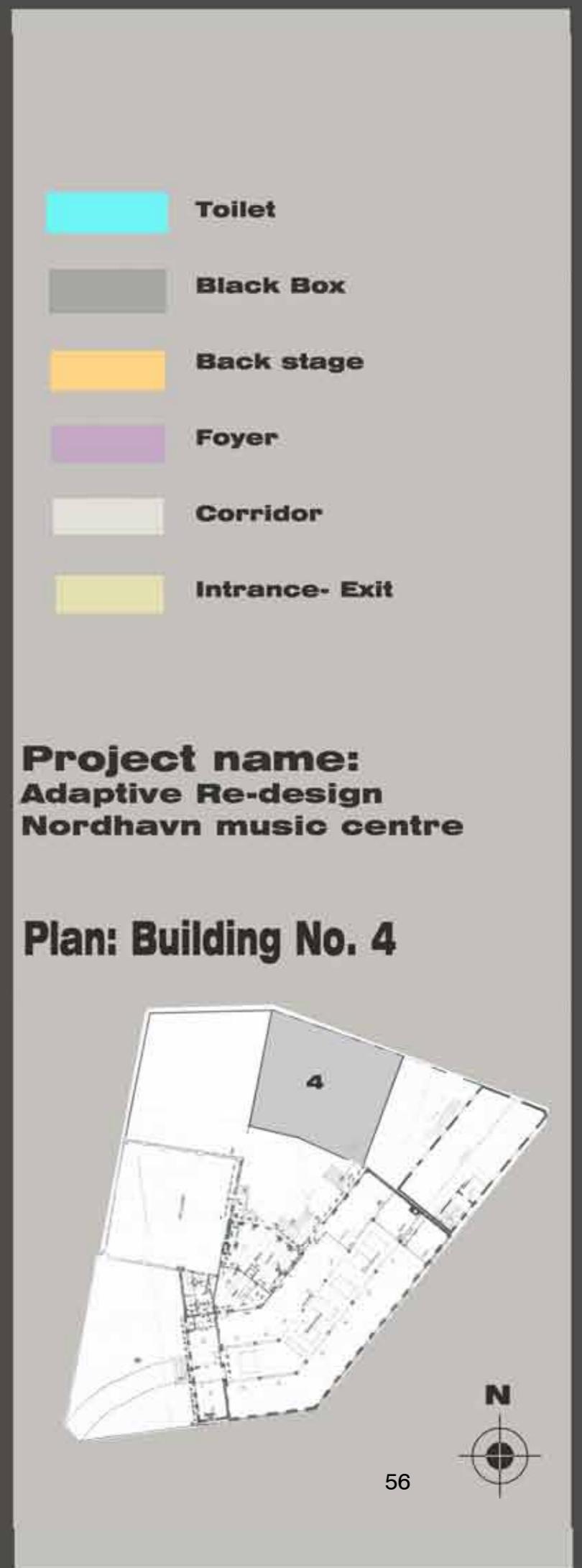


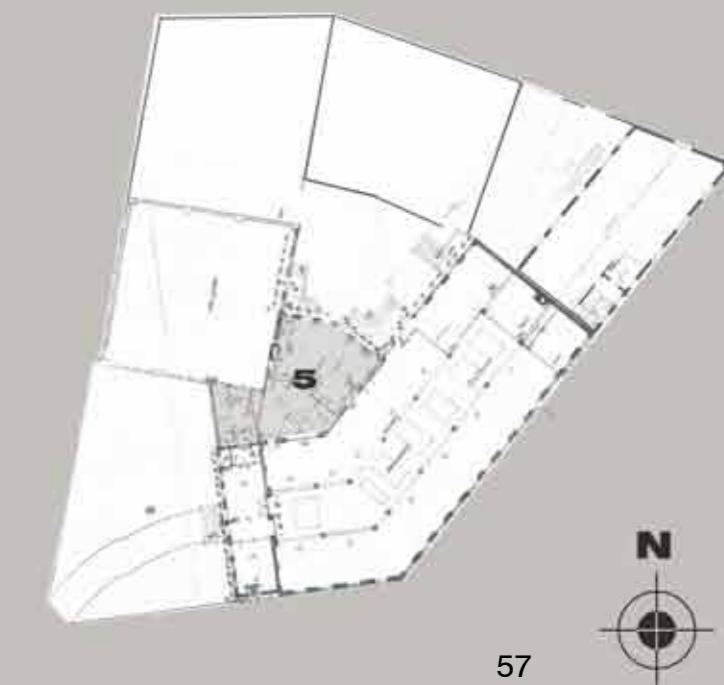
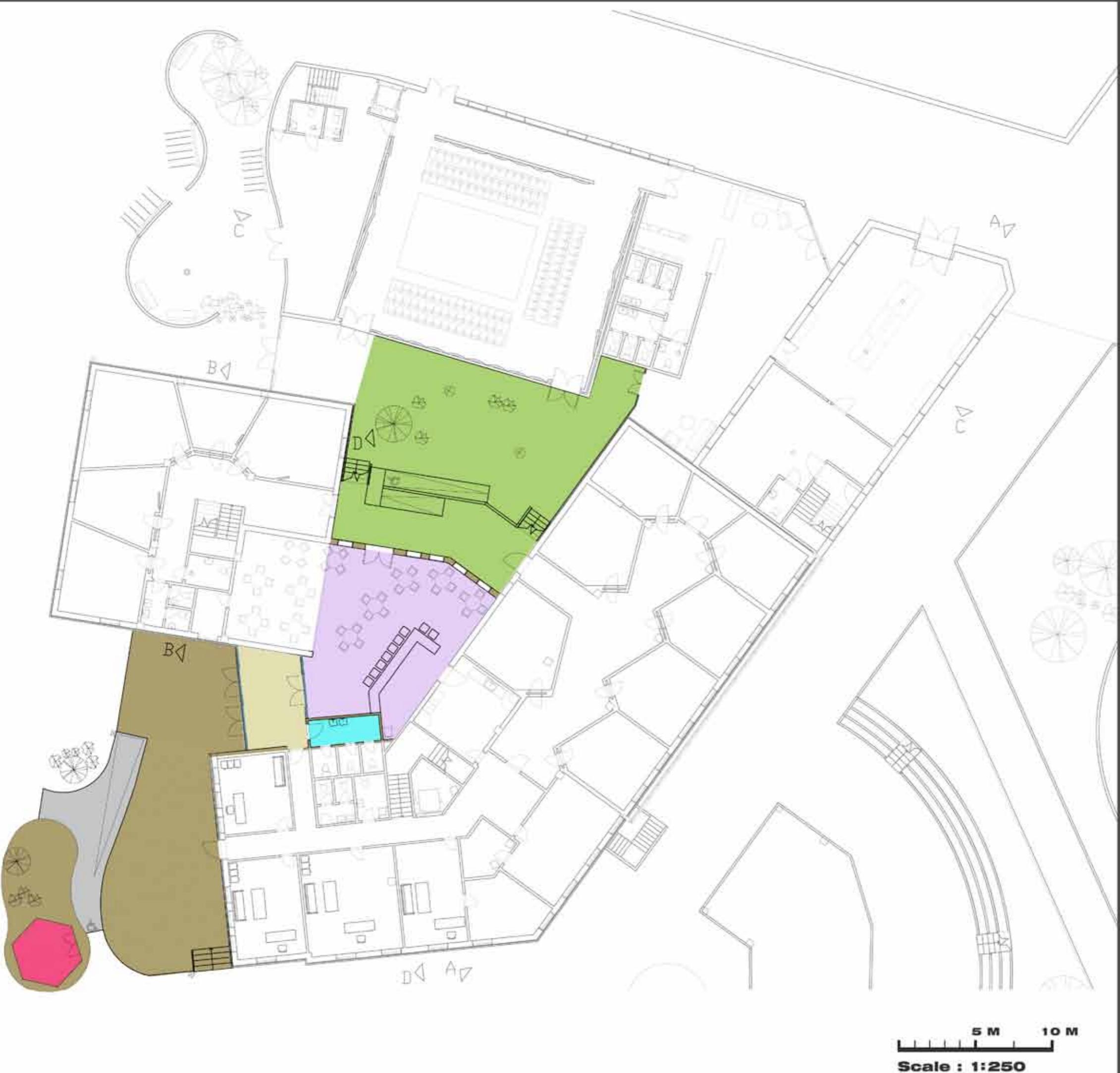


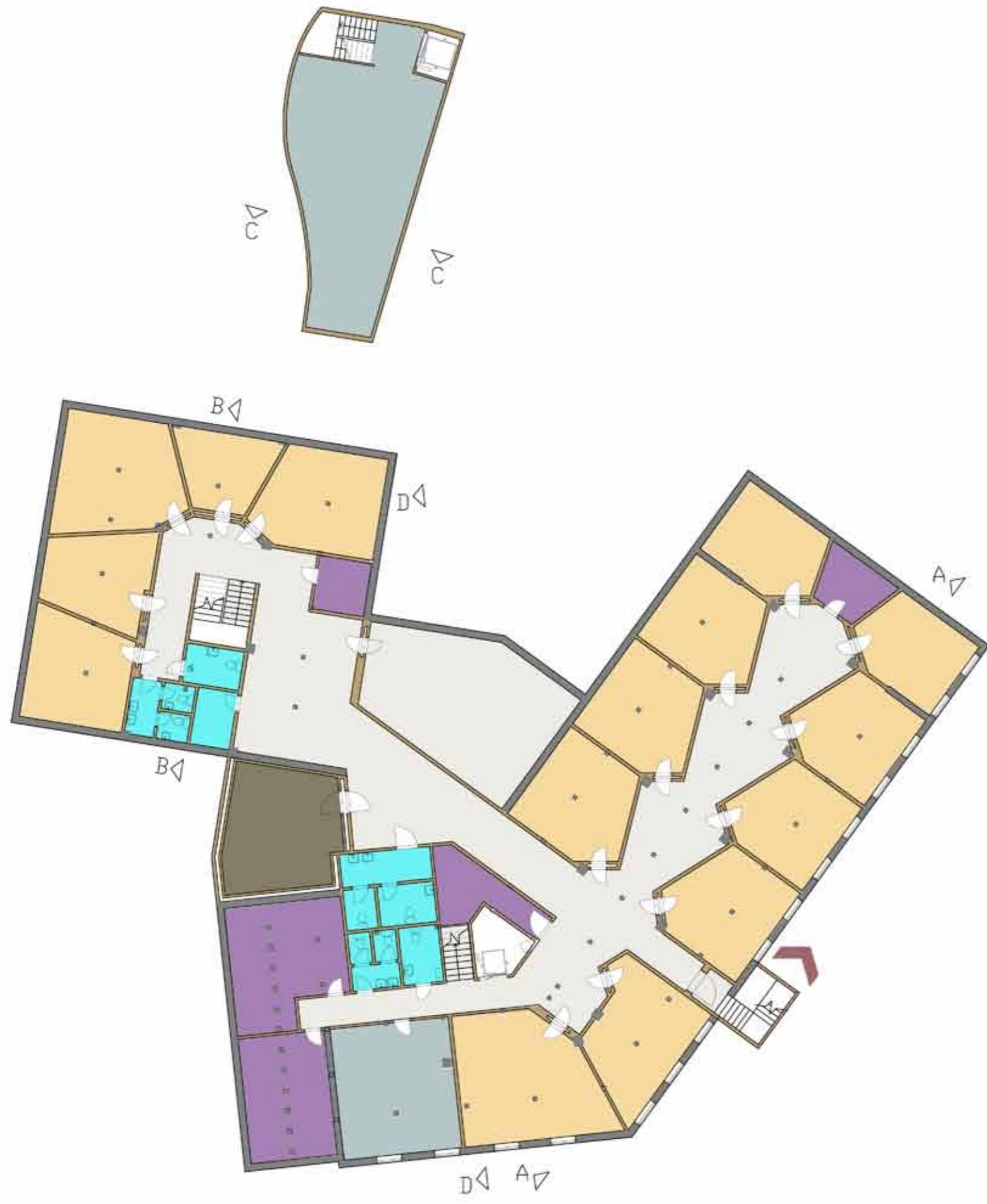
Project name:
Adaptive Re-design
Nordhavn music centre

Plan: Building No. 3









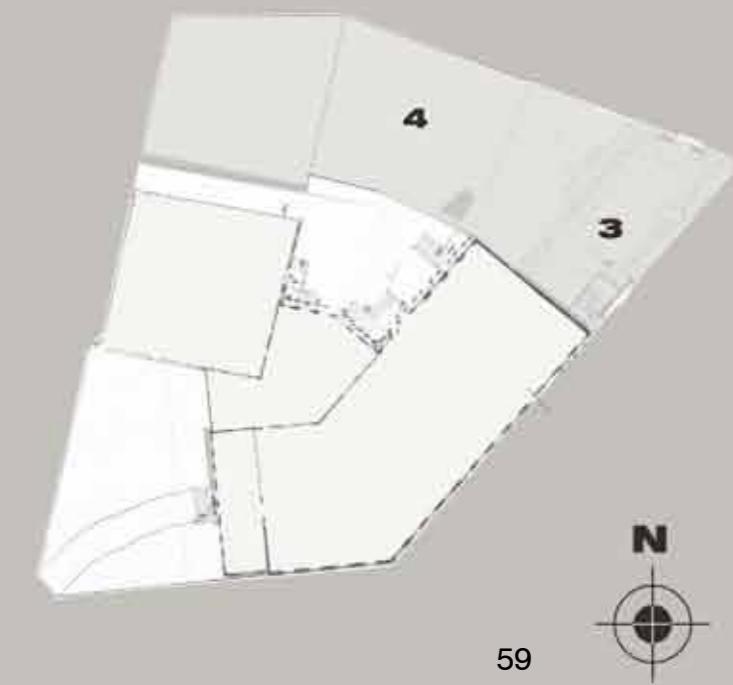
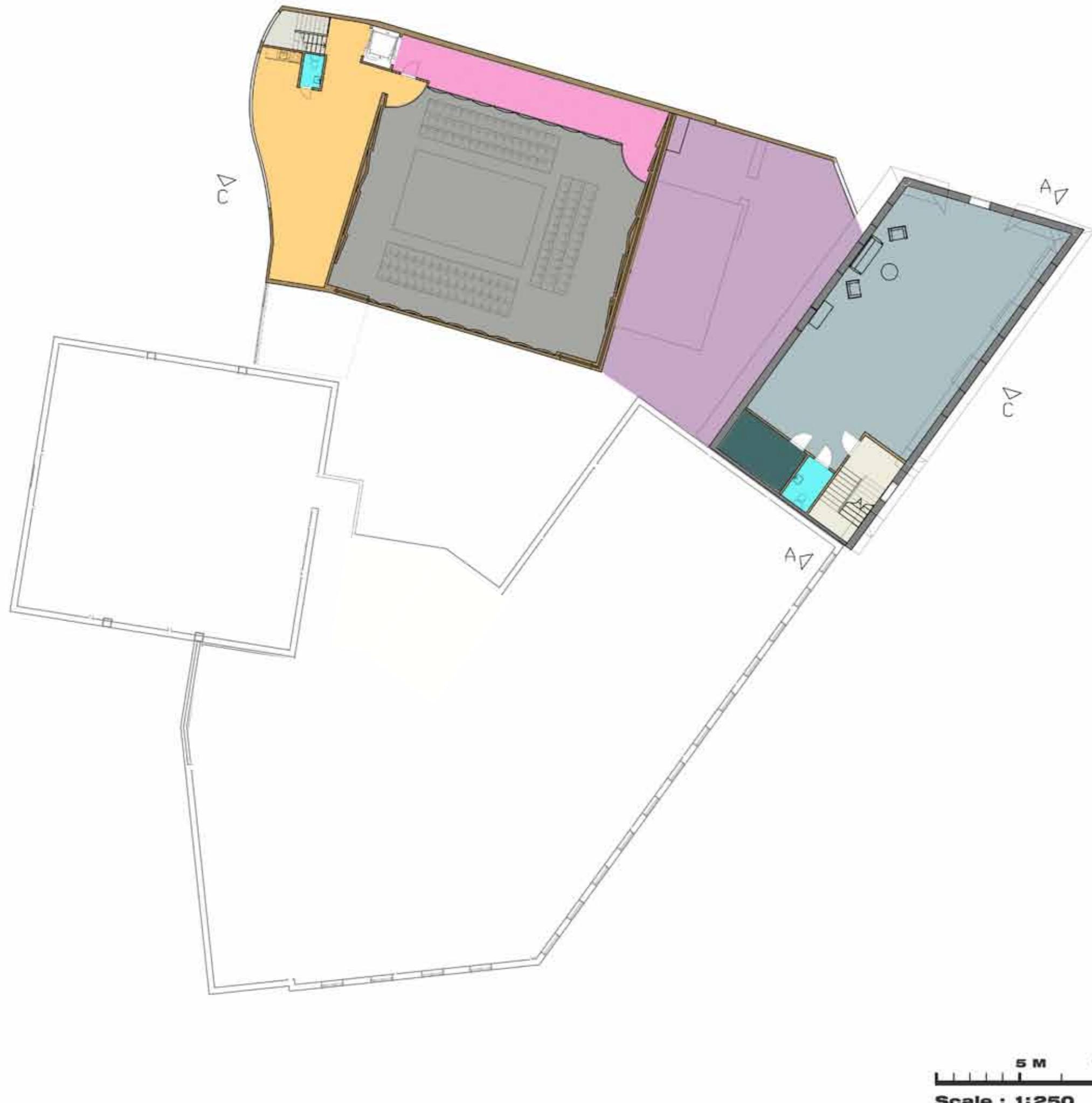
5 M 10 M
Scale : 1:250

- Toilet
- Rehearsal room
- corridor
- Engine room
- Storage
- Record room
- Existing walls
- New walls
- Fire Exit

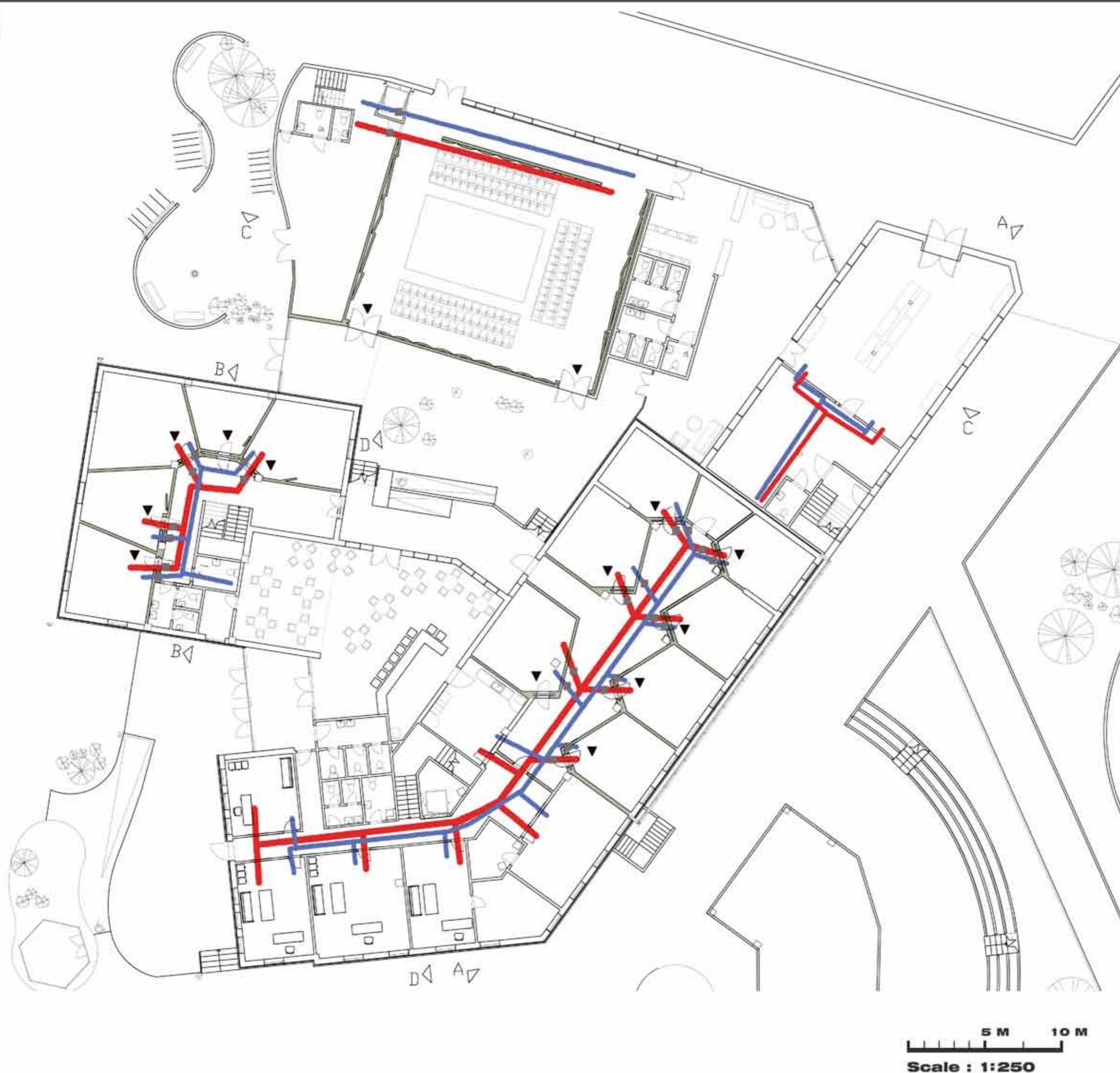
Project name:
Adaptive Re-design
Nordhavn music centre

Basement plan: buildings 1,2,5





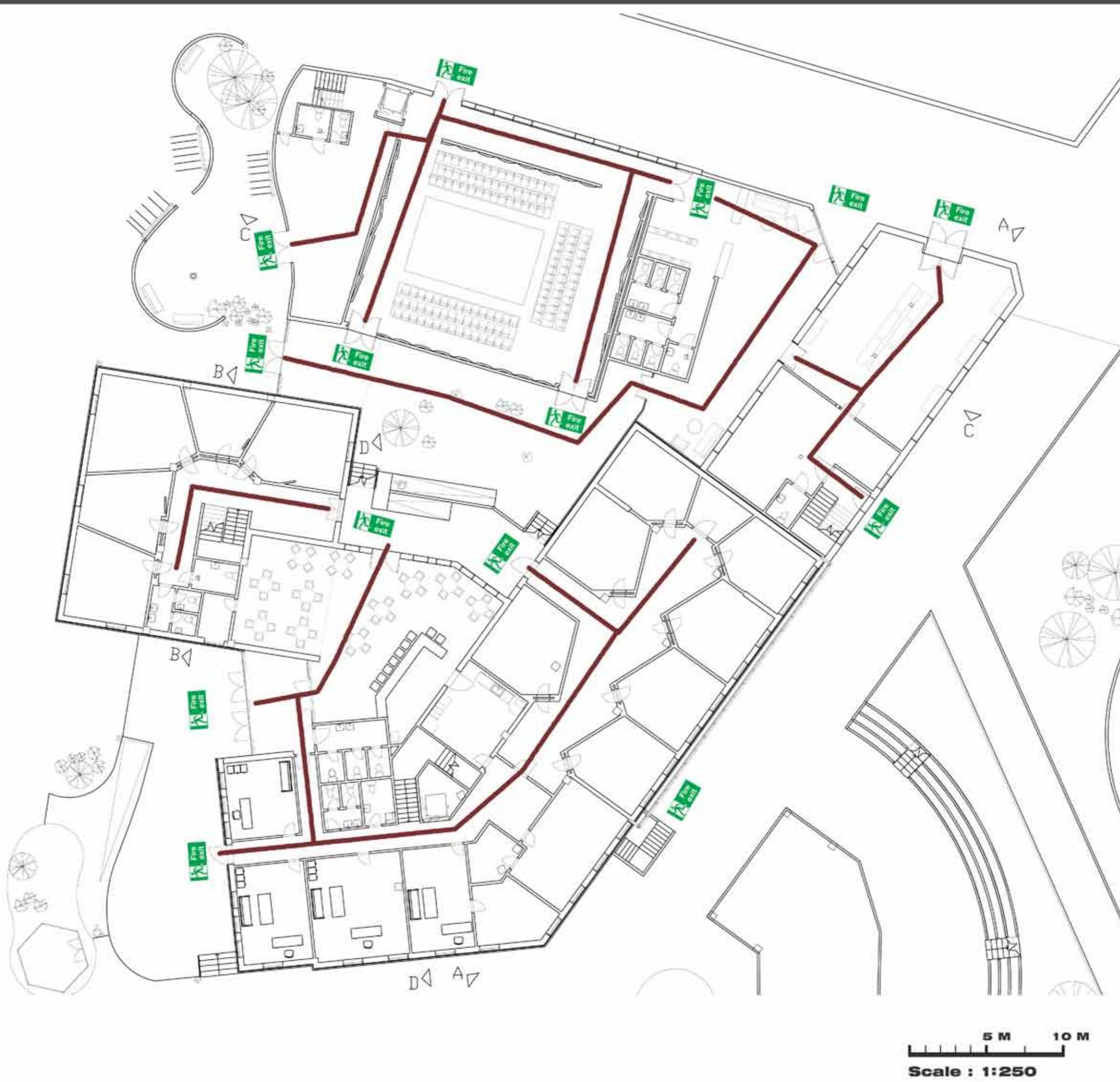




Project name:
Adaptive Re-design
Nordhavn music centre

Acoustic Plan: Air flow





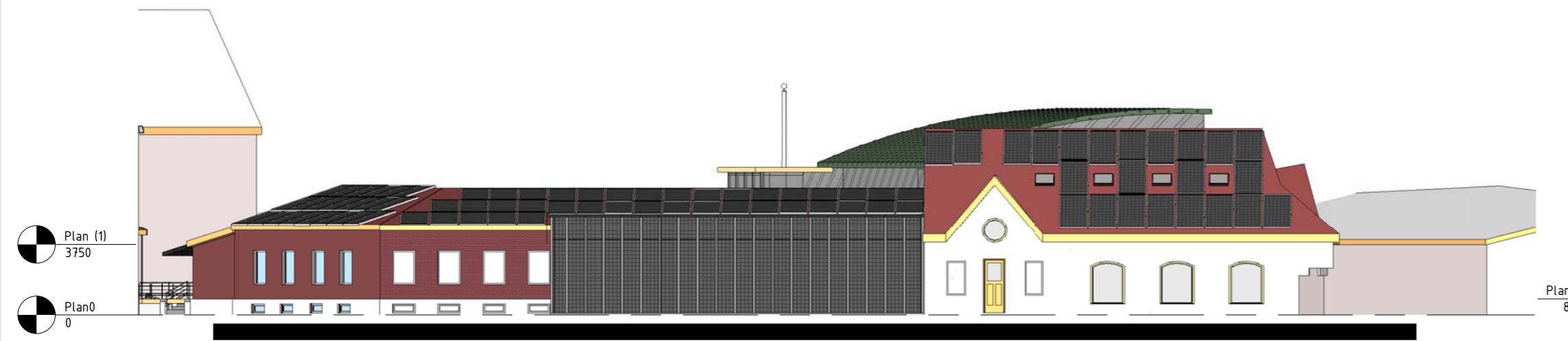
Project name:
Adaptive Re-design
Nordhavn music centre

Fire Exit Plan



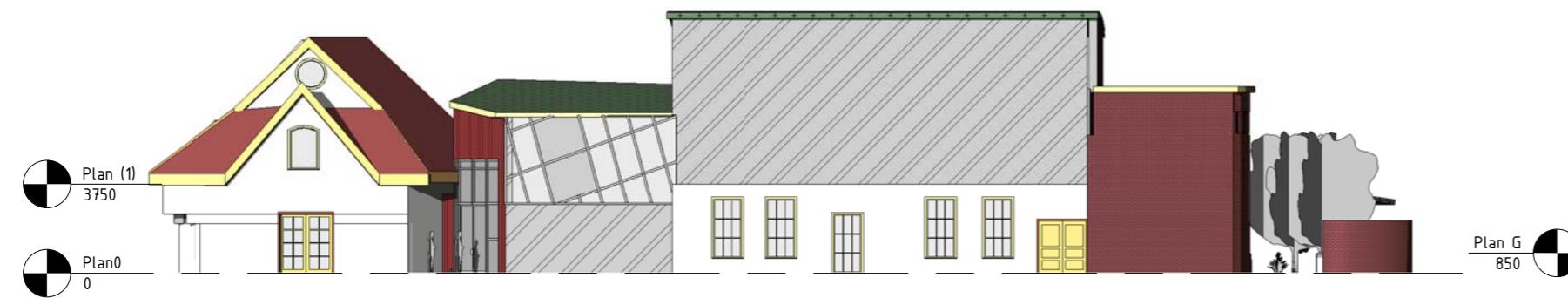


1 South Facade
1 : 250



2 North Facade
1 : 250

5 M 10 M
Scale : 1:250



1 East Facade
1 : 250

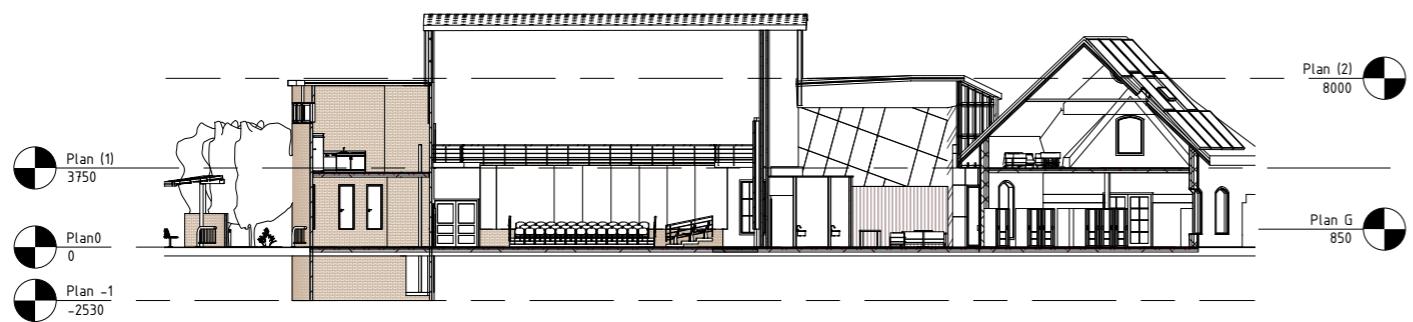


2 West Facade
1 : 250

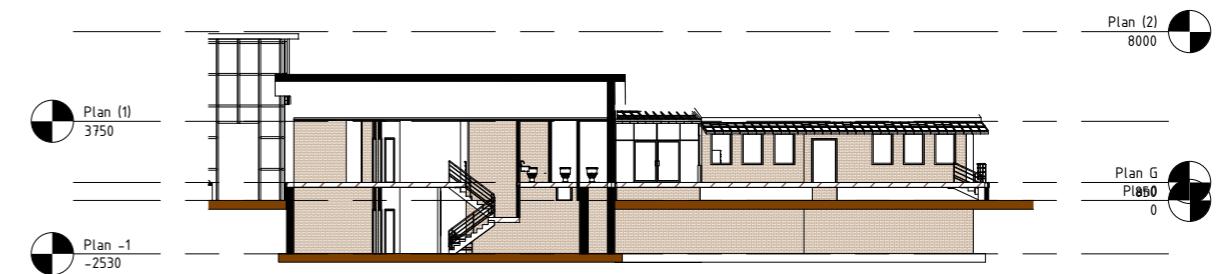
5 M 10 M
Scale : 1:250



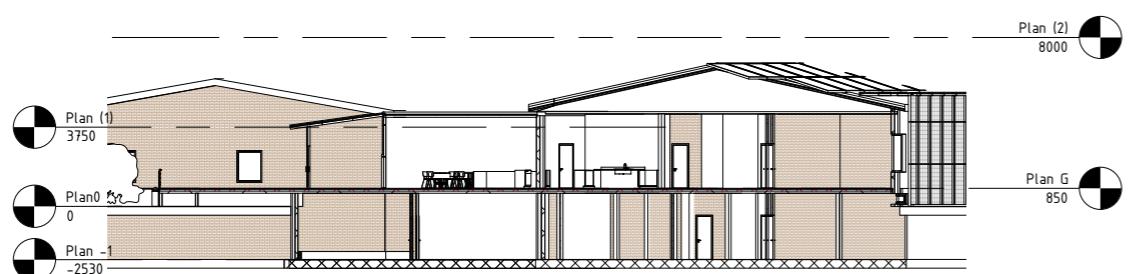
3D section 2



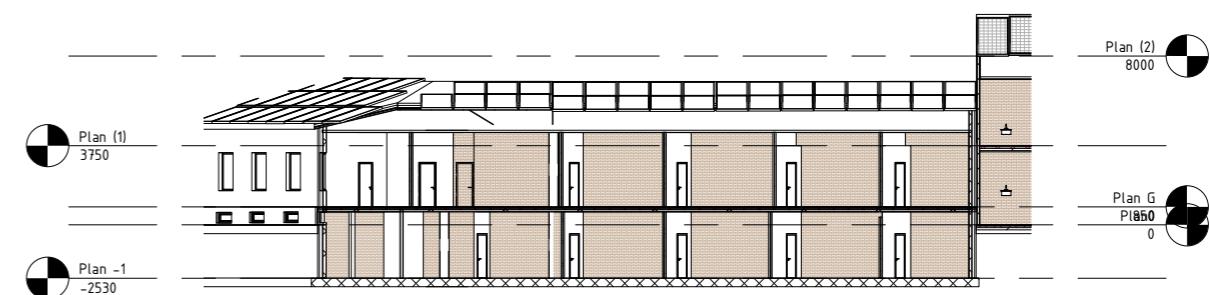
Section 2
3
1 : 250



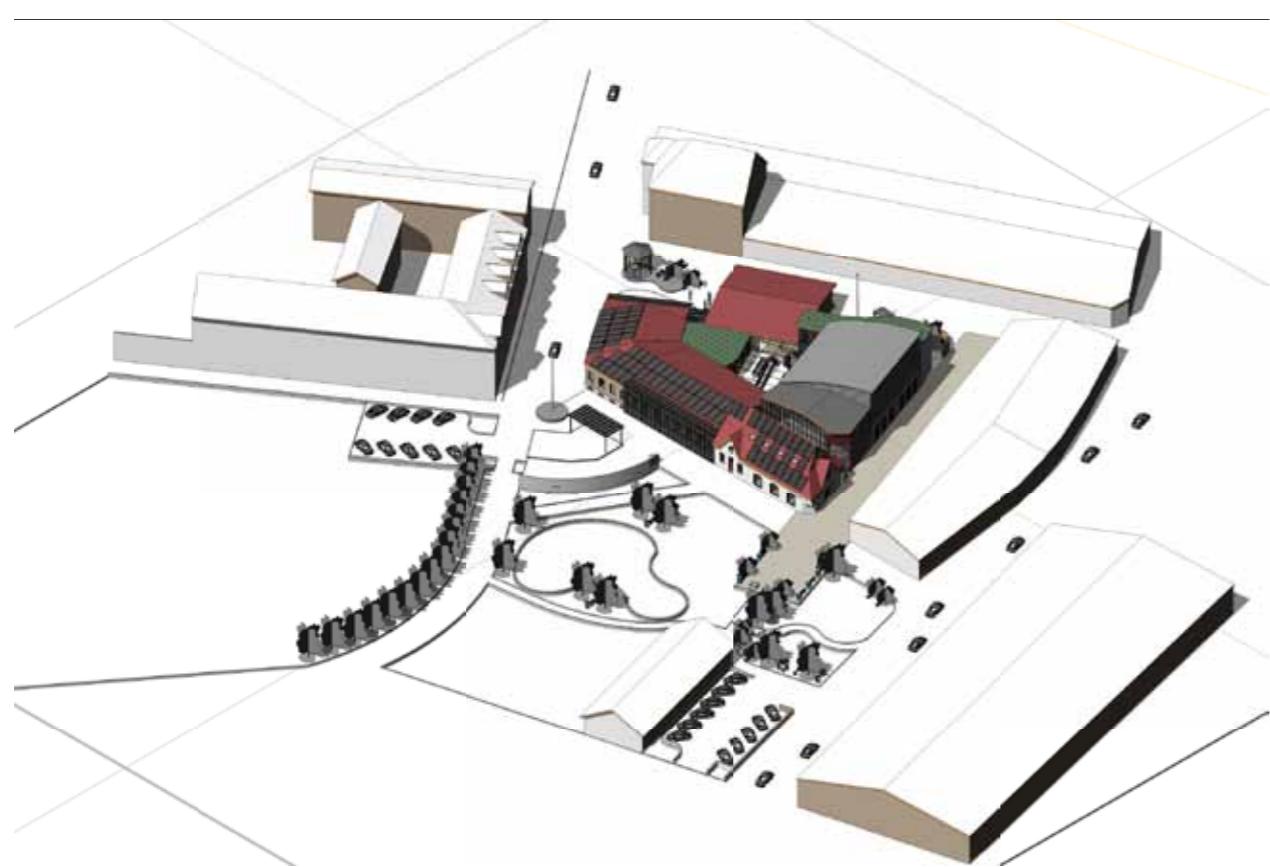
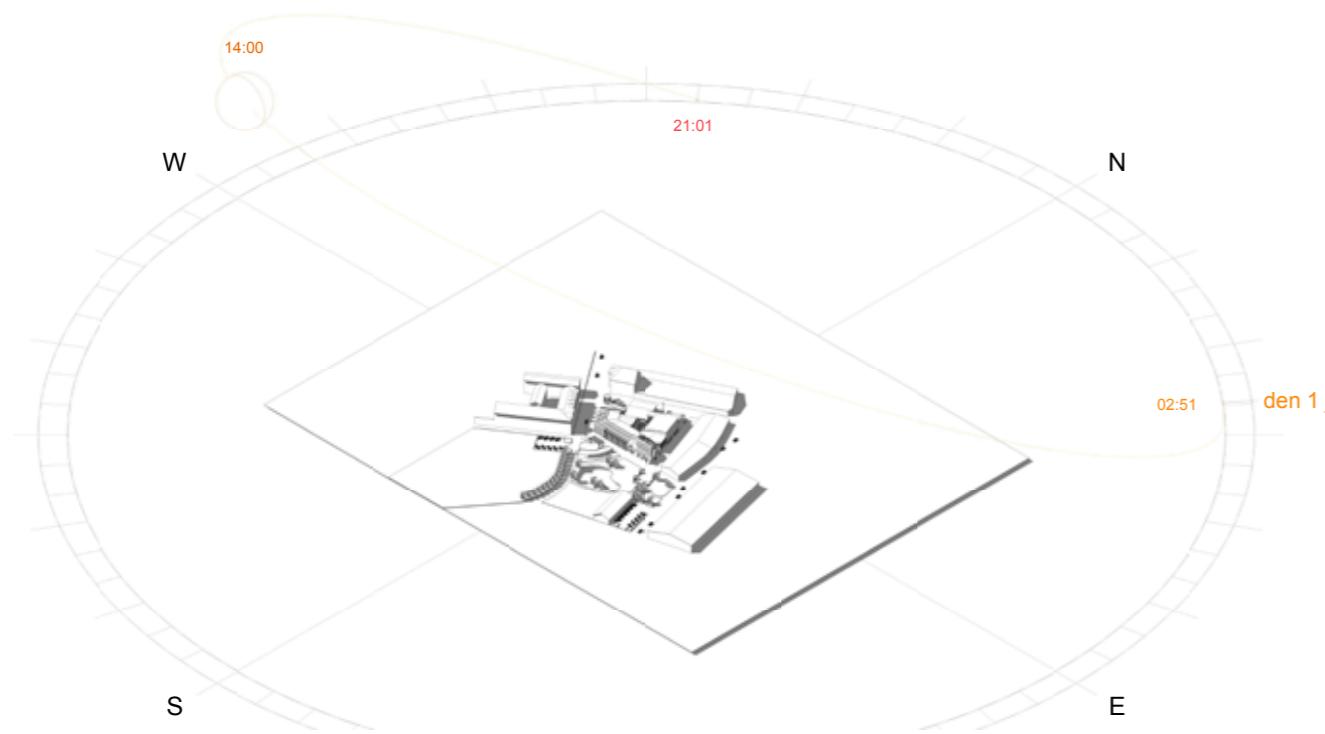
Section 1
2
1 : 250



Section 4
5
1 : 250



Section 3
4
1 : 250



Adaptive Re-Design Nordhavn music center//Farnaz akbari //Master thesis 2012





Adaptive Re-Design Nordhavn music center//Farnaz akbari //Master thesis 2012





Adaptive Re-Design Nordhavn music center//Farnaz akbari //Master thesis 2012





Adaptive Re-Design Nordhavn music center//Farnaz akbari //Master thesis 2012



Room acoustic

Shape of the room
Finishes
Floor materials
Ceiling materials
Suspended reflectors/ resonant absorbers / diffusers

Sound Isolation

Outdoor barriers site noise
Nearby buildings
Wall, Floor, Ceiling constructions
Background noise(HVAC system)

Mechanical system noise

Air duct and pipe treatment (lining,mufflers,laggings)
Noise from air outlets(coordination with

Electronic sound system

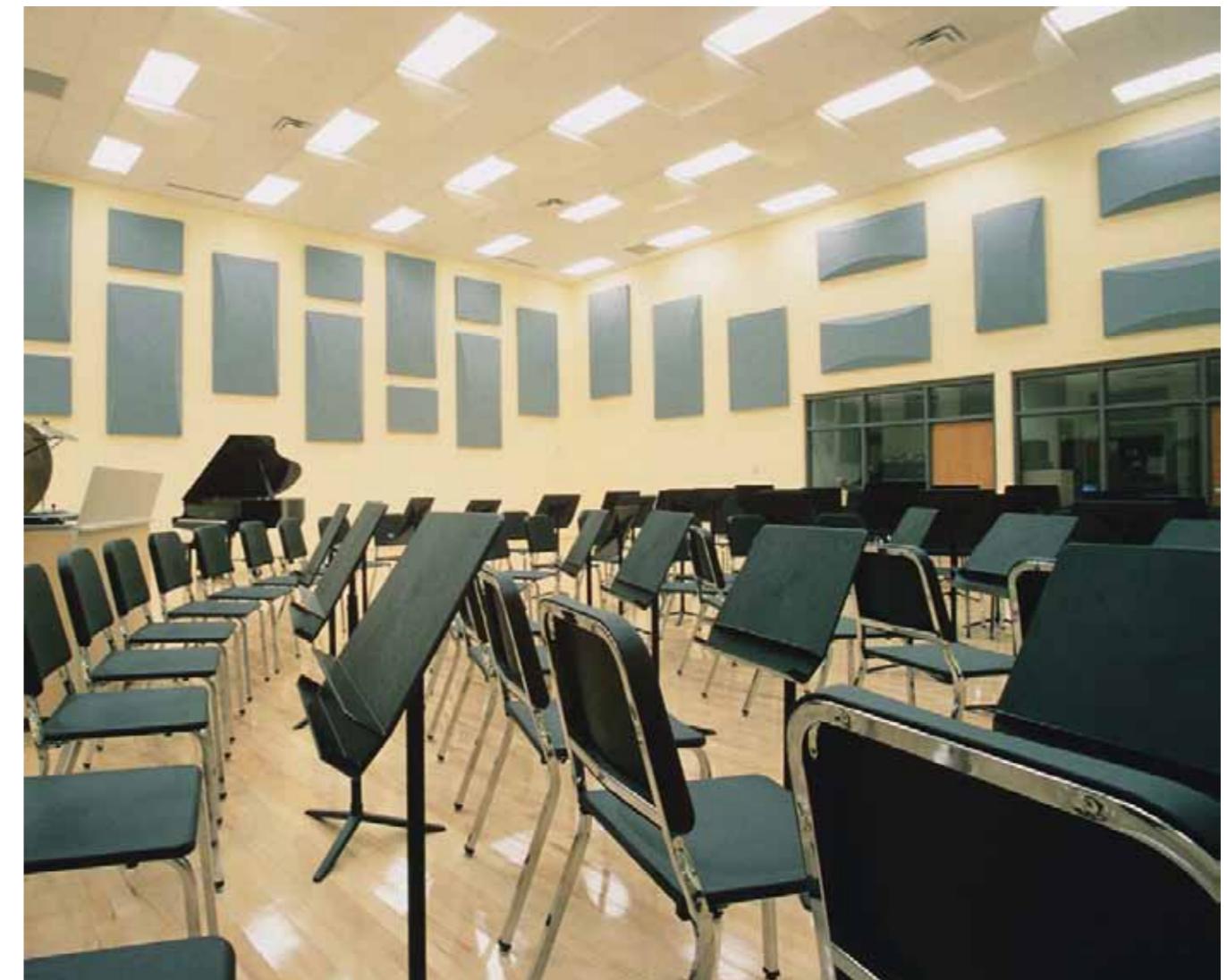
System compatibility with room acoustic
Loud speaker

4.8 Acoustic

From case study I found that most of the acoustic problems in rehearsal rooms related to low frequency sounds (110-120dB). In the case of sounds of multiple frequency(speech,music or noise)the coloration of frequency spectrum of the sound will be modified by the presence of the screen because the lower frequencies will be diffracted to a greater extent than the high frequencies.

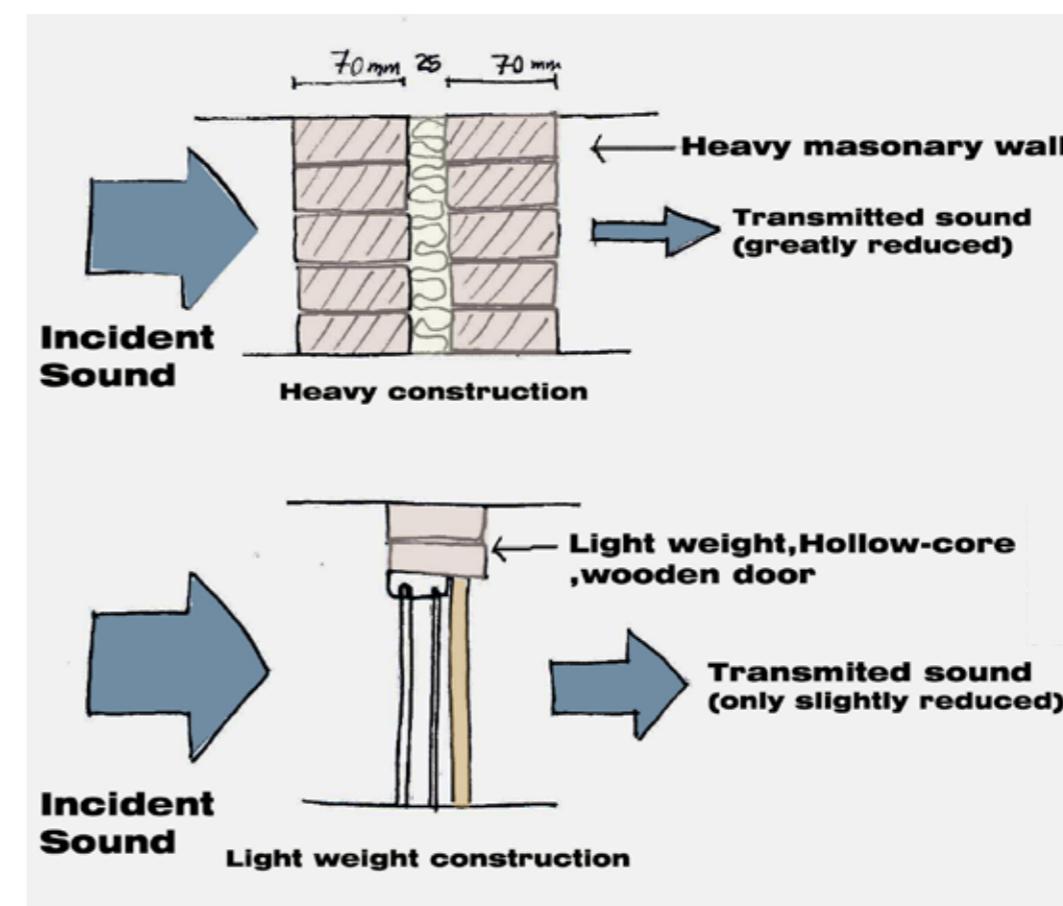
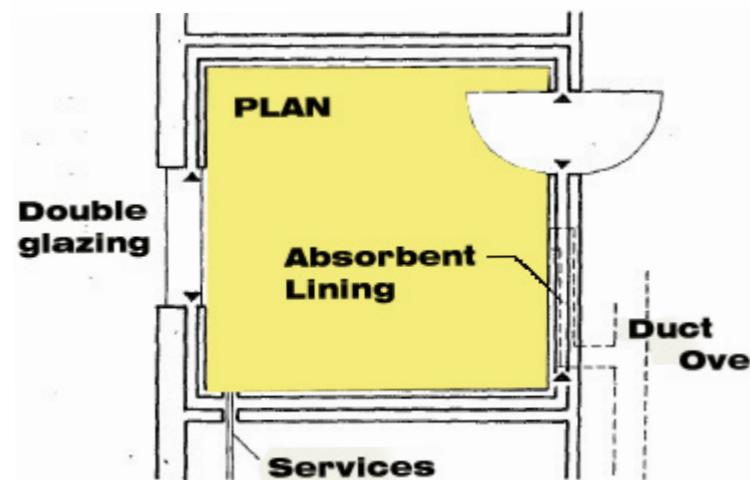
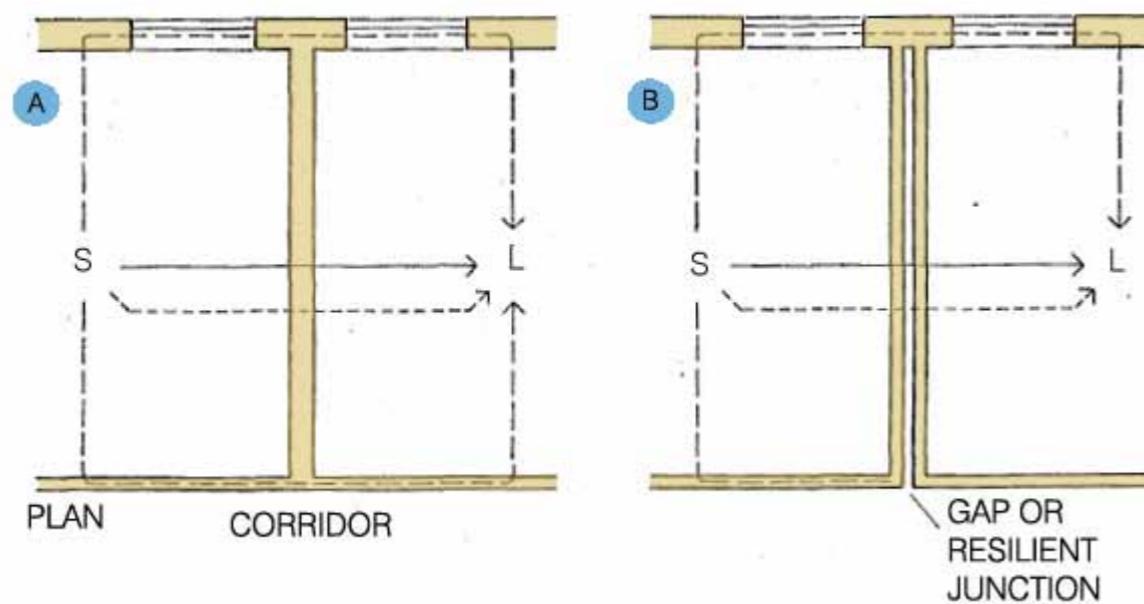
Also "Reverberation" is a familiar phenomenon in large rooms containing few sound absorbing materials,such as auditoriums,where reverberation can be heard lasting five or more sounds.

The ear is less sensitive to the lower frequencies, this kind of discrepancy is excessive.so we should always obtain insulation values relative to octave frequency bands and preferably third octave bands.

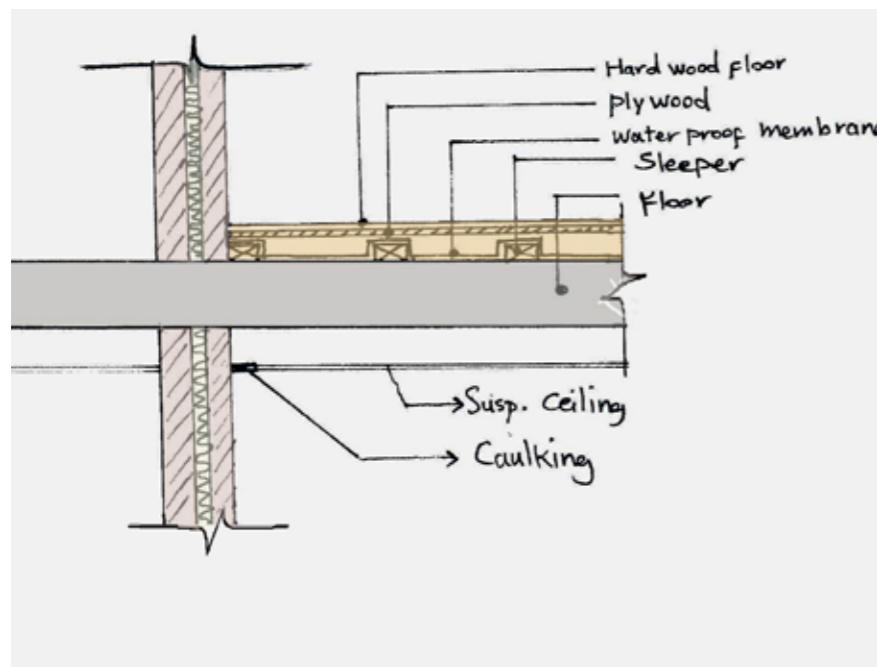


From the test in average insulation values which I found in (Design for good acoustic and noise control book) to increase for example, the average insulation value of a 225 mm brick wall by only 5 dB its thickness has to be doubled so it is necessary to use other methods to improving sound insulation like:

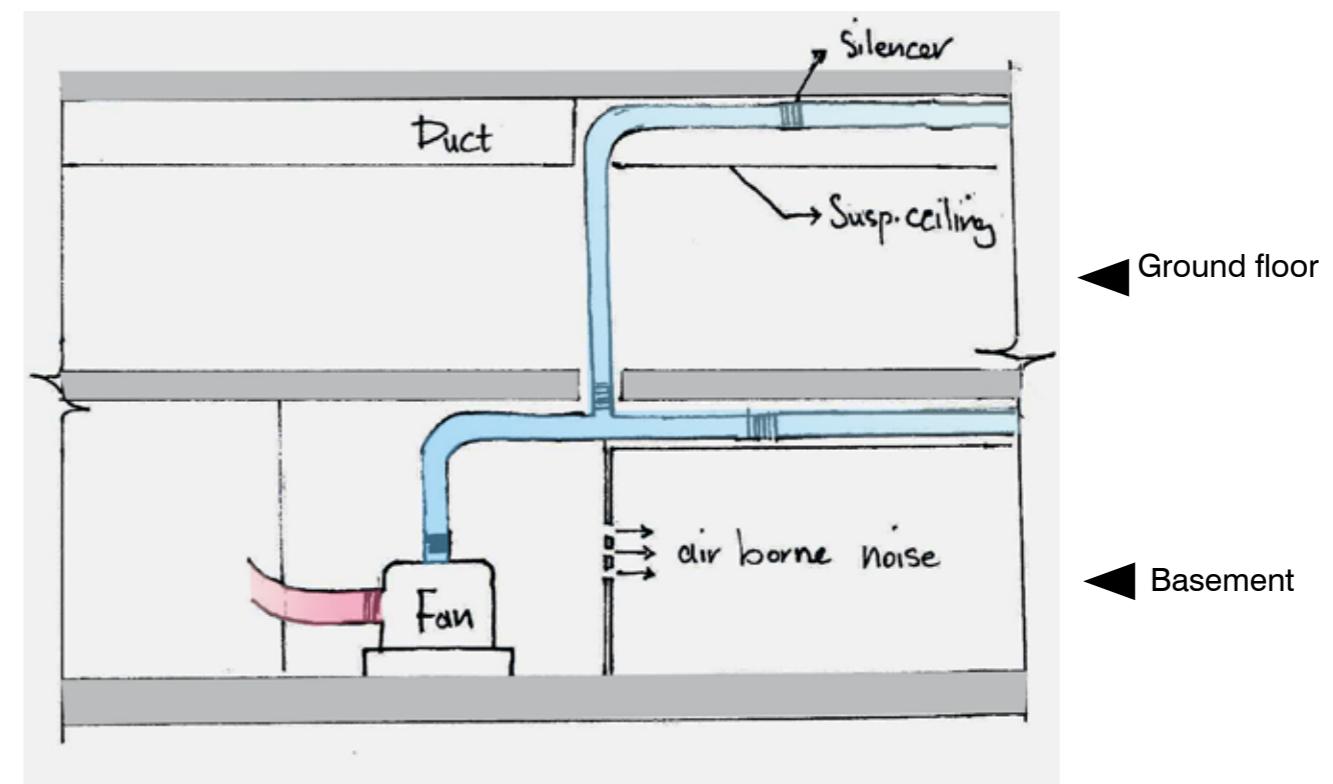
1. Double-leaf construction(using two leaves with a cavity between instead of dividing two rooms by a single homogeneous partition)
2. Windows and doors should sealed by visilant beads,sound levels close to the windows will be determined by the insulation value of glazing.
3. To decrease the ventilation noise should cover all the ducts with sound absorbing lining and where fans are associated with such vents they should be located at the external end of the duct because fans are themselves a source of noise,so to prevent a exchange of noise between rooms,irrespective of the direction of air movement of the ducts between rooms should be lined with sound absorbing material,the transmission of ventilation plant noise and external noise into the ventilated rooms.



Comparing Light and Heavy constructions according to Acoustic



Ducts with small cross sections are more effective noise attenuators than those with longer cross sections. Therefore when a duct is too short to provide satisfactory reduction of noise added attenuation can be obtained by dividing the duct into a number of smaller lined duct or by using prefabricated attenuator units, called Silencers. In auditoriums the duct openings should be as far as possible from the listeners because noise levels close to the ducts exist greater than at the distance from the grille.



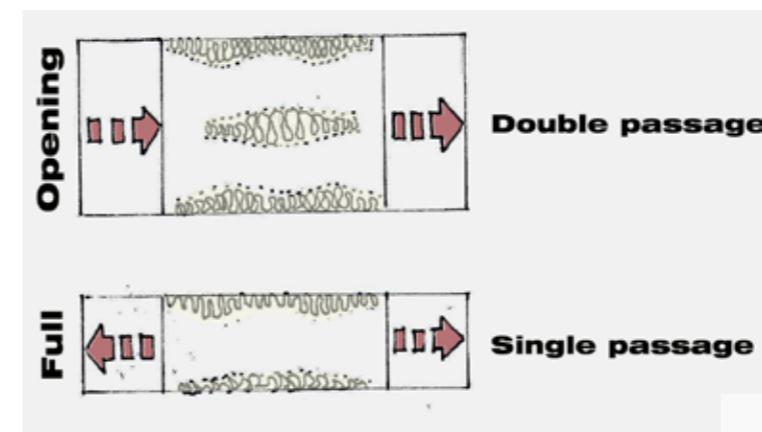
Noise – reducing components:

There are three principal noise producing parts of system:

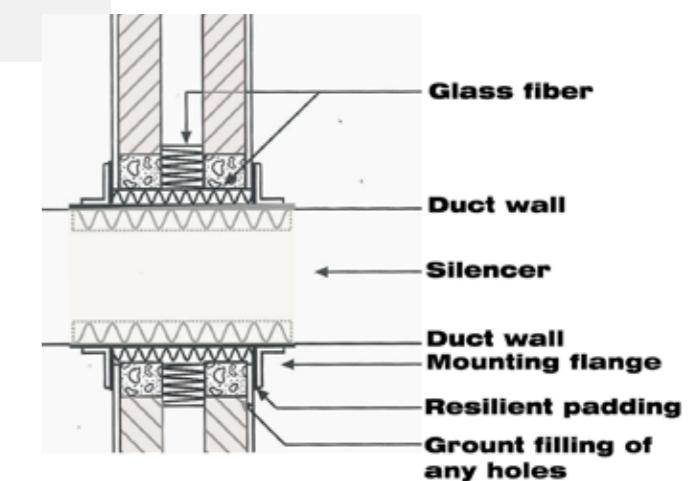
- 1) The central mechanical equipment
- 2) The supply and return ducts
- 3) The supply and return grills

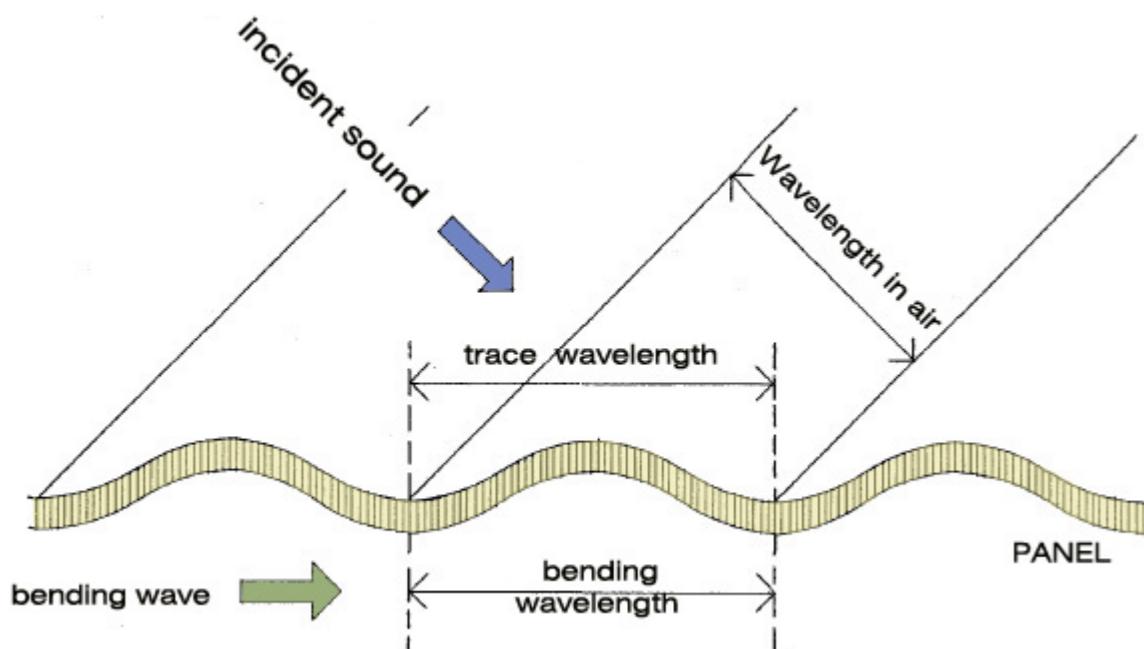
To control ventilation and air conditioning noise from noise sensitive rooms or floors the equipments will be installed in basement floor. Additional methods to reduce noise in rehearsal and performance rooms are:

- 1) Absorption of noise in duct wall linings
- 2) Reduction of noise by means of bends
- 3) division of noise into several branches of duct system
- 4) using heavy-gauge metal for duct
- 5) Acoustical separation of ducts from walls and floors



Pic: Silencer section and how divide the noise to two part and decrease the amount of noise



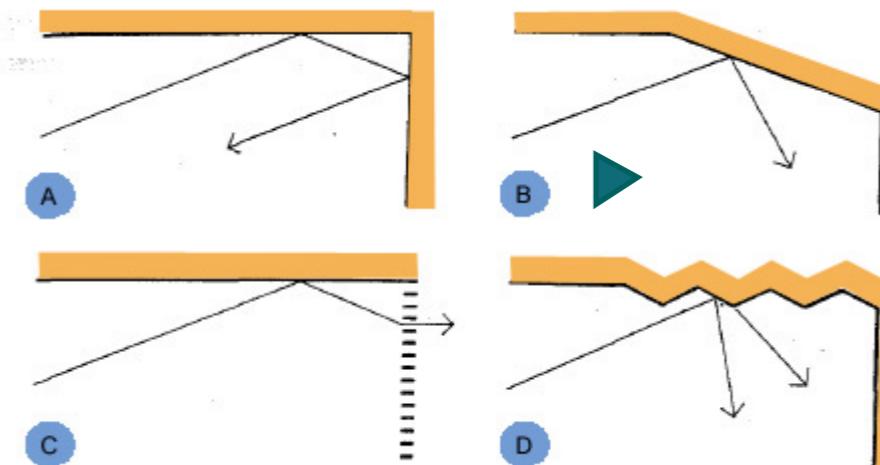


Diffusion

Sound diffusion can generally be defined as the scattering and redirection of sound caused when sound comes into contact with acoustically reflective surfaces. Diffusion of musical sound is necessary so that the music can be clearly heard from all points in a facility. The ornamentation, columns, and plaster work in historic theaters, for example, provide many angled, acoustically reflective surfaces which result in excellent diffusion.

Absorption

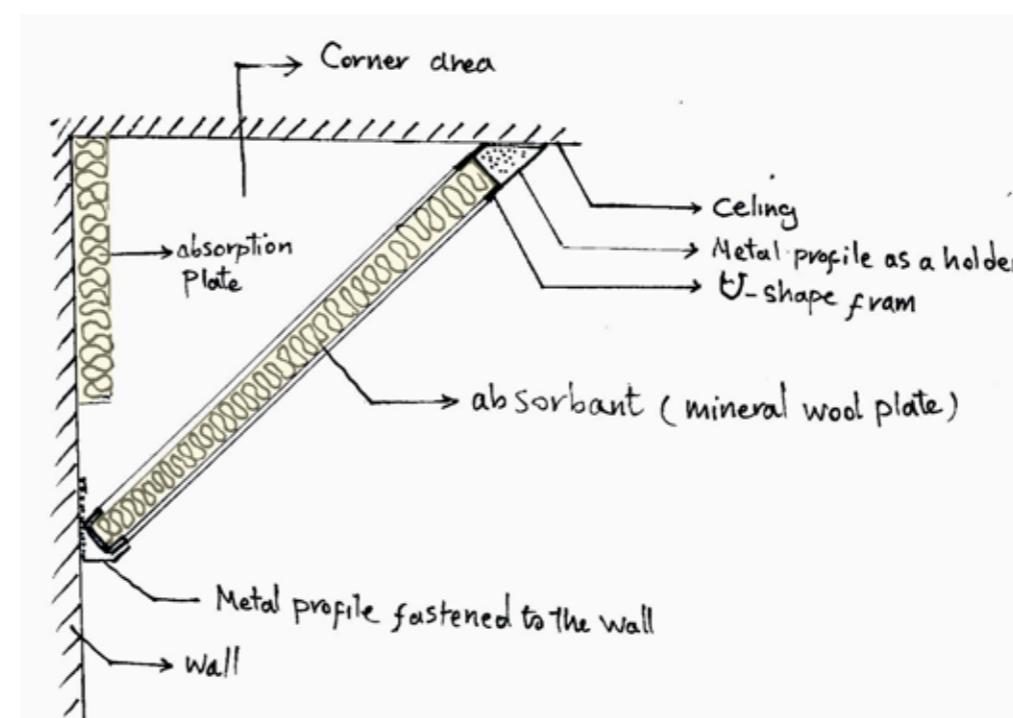
Sound absorption can generally be defined as the reduction of sound energy that occurs when sound comes into contact with various surfaces and materials. When sound strikes a hard, dense surface, such as a gymnasium floor, there is nominal absorption. When sound comes into contact with thick, fibrous materials, such as acoustical panels, a great deal of sound energy can be absorbed, and less sound is reflected back toward its origin.



To prevent the reflection of sound, towards the source the corner can be modified in any of three ways shown in Pictures

- B: it may be made other than a right angle
- C: one surface maybe made absorbtive or
- D: One surface maybe made dispersive

Absorbent or dispersive treatment, if used for this purpose, must be taken right into the corner as shown.



In each Rehearsal rooms corners should be protected with absorbent material to prevent passing noise from next room, this is an acoustical system for damping and absorption of sound in rooms to provide a sound damping even at low frequencies like 50 Hz, and improve speech comprehension in the room by reduction resonance time.



Untreated rehearsal room

- Parallel walls create flutter echo.
- Carpet, drapes, and upholstery absorb only the higher frequencies.
- The remaining lower frequencies become overpowering, reverberant, and indistinct.
- Loudness is excessive and nearly impossible to control.



Rehearsal room treated only with absorber panels

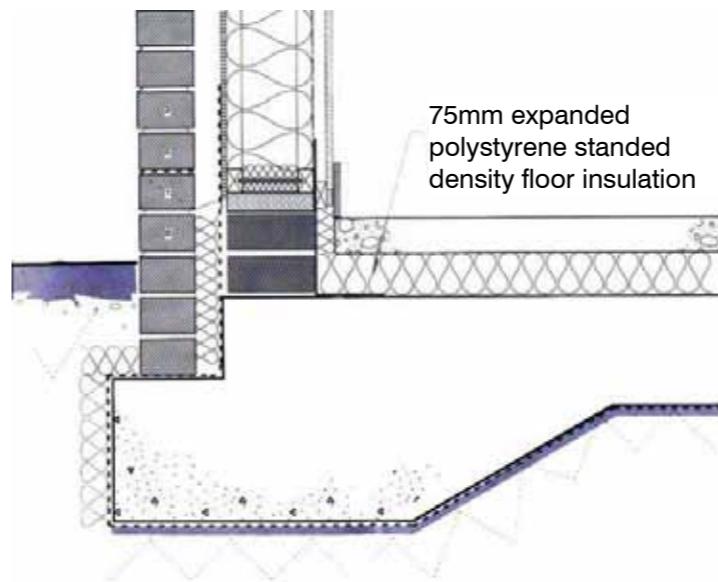
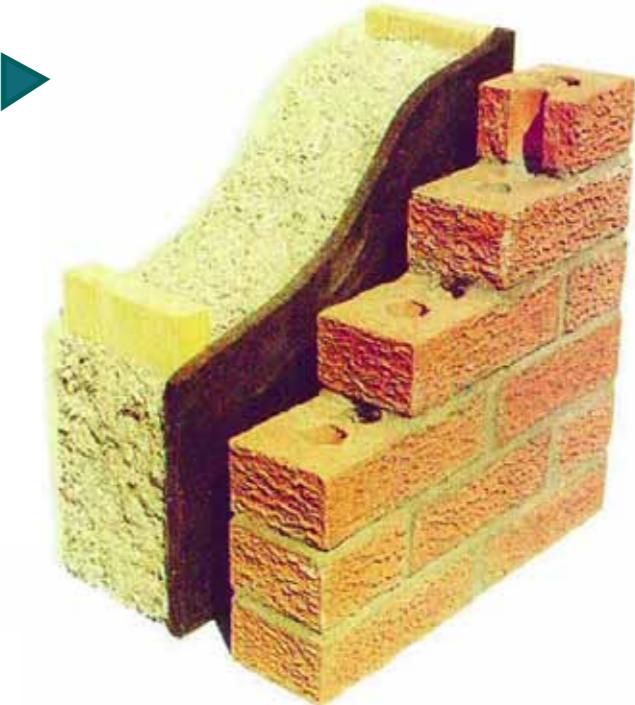
- Panels absorb high and low frequencies, reducing flutter echo and boomy sound.
- Loudness is also reduced, but overall acoustics are unbalanced.
- Lack of diffuser panels severely limits sound reflection, which adversely affects ensemble.



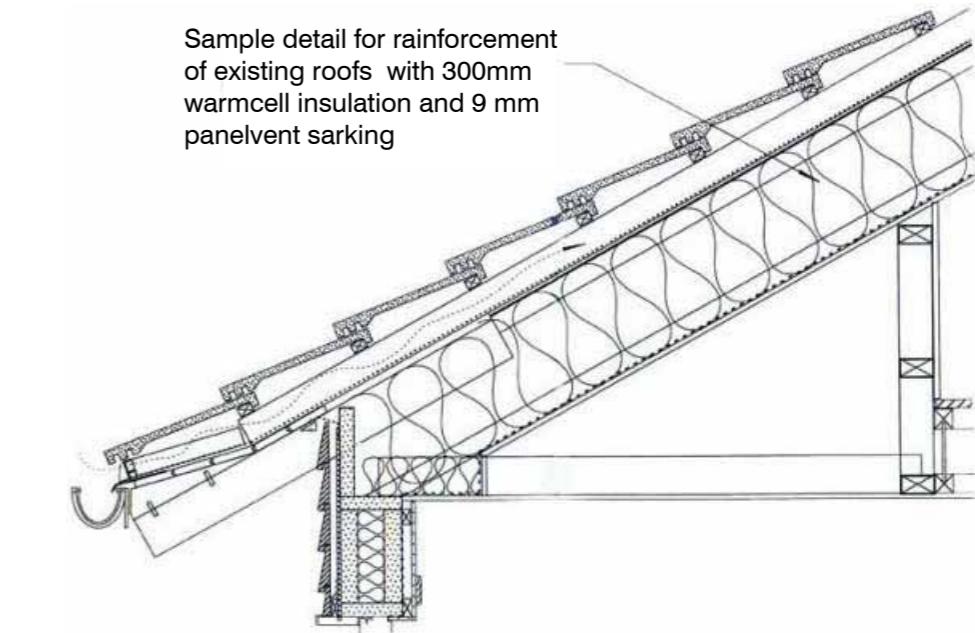
Rehearsal room treated with absorber and diffuser panels

- The ideal combination of absorber and diffuser panels creates an acoustically balanced environment
- Flutter echo, excessive reverberation, and boomy sounds are eliminated.
- Loudness is controlled and balanced over the full audible range.
- Performers hear themselves and others.
- Instructors hear balance with accuracy.

Brick wall with enough insulation to reinforcement of existing walls and also new acoustic walls



75mm expanded polystyrene standed density floor insulation





MARINE GRADE PLYWOOD



FOME GLASS
 $\lambda=0.05 \text{ W/mk}$



CONCRETE
(Skanska AB betongfabrik)



GRAVEL

GROUND FLOOR MATERIAL

TRIPLE GLAZED WINDOW
Low-E and Argon Gaz with Aluminium frame
 $U \text{ value}=1.1 \text{ W/m}^2\text{k}$



CURRAGEDET CANTINER
 $\lambda=46 \text{ W/mk}$



LARCH TIMBER



INTERNAL WALL MATERIAL



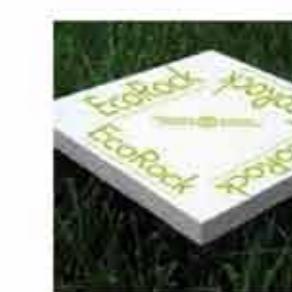
WOODEN PANEL
 $\lambda=0.13 \text{ W/mk}$



RECYCLED DENIM
 $\lambda=0.04 \text{ W/mk}$



VAPOUR BARRIER



ECO ROCK DRYWALL INTERNAL CLADDING
contains no gypsum.



CERAMIC PAINT
(*Super Therm*)
 $\lambda = 0,015 \text{ W/mK}$

FAÇADE MATERIAL

STEEL ROOF SHEET
 $\lambda=46 \text{ W/mk}$



GUTEX ULTRATHERM
Insulating, Rain tight, woodfiber
 $\lambda=0.043 \text{ W/mk}$



CELLULOSE FIBER INSULATION
(Ekofiber AB, Kolinge, southern Sweden)
 $\lambda=0.039 \text{ W/mk}$



PERMO FORTE
Water proof membrane for the roof.
Thickness 0,6 mm



Steel structure

ROOF MATERIAL

Chapter V



Sum up

Summary

In general, most abandoned industrial buildings functioned as workshops for certain types of industrial production. Due to their prior single function, it is necessary to improve the interior of old buildings to meet the need for comfort when they are re-design into offices museum cultural and public buildings.

As a result, the adaptive re-design brings with it relatively high energy consumption, a function of the new forms of human activity.

From the perspective of sustainable development, in order to improve the environmental representation of old buildings, certain elements must be taken into consideration, such as:

- Reducing energy consumption in re-design projects
- Upgrading interior conditions
- Increasing the health index

Accordingly, the envelope, walls, roofs, windows and doors have to be considered comprehensively in the re-design process.

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- 27 Design for good acoustics and noise control J E Moore