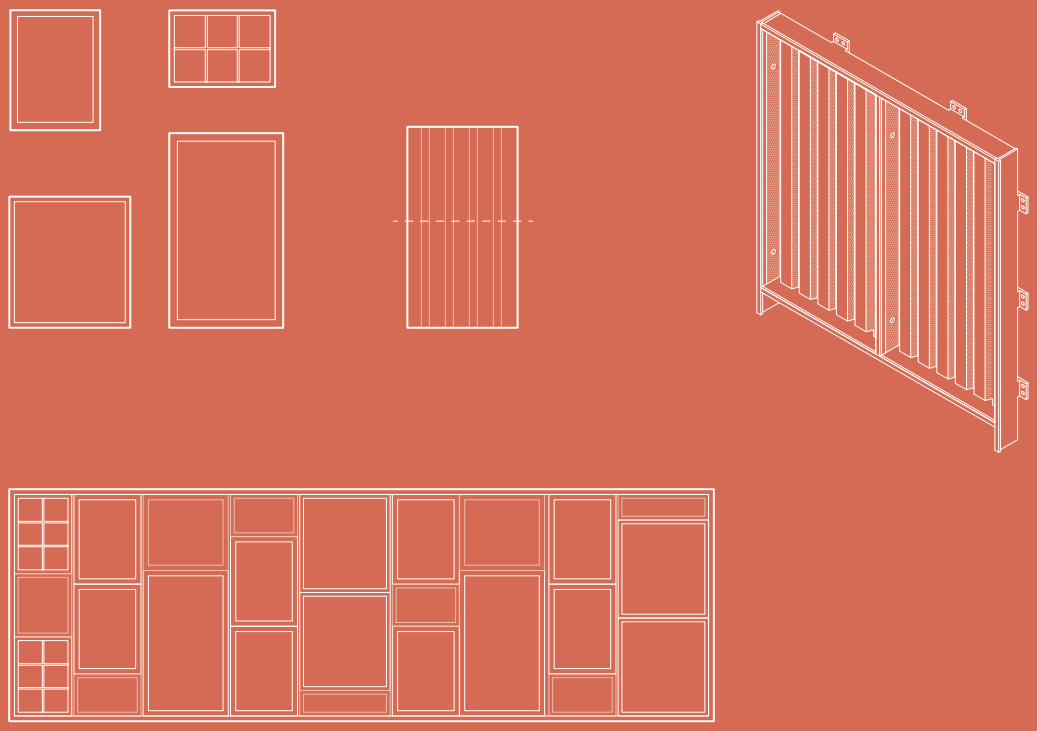
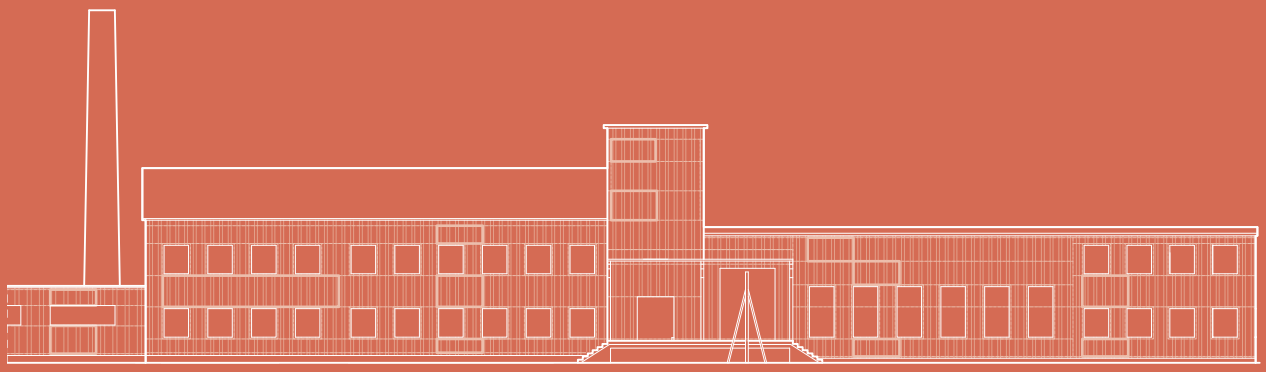
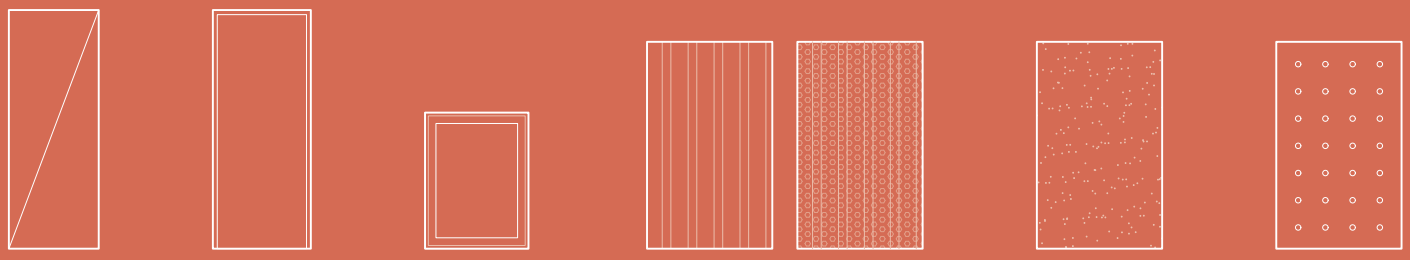
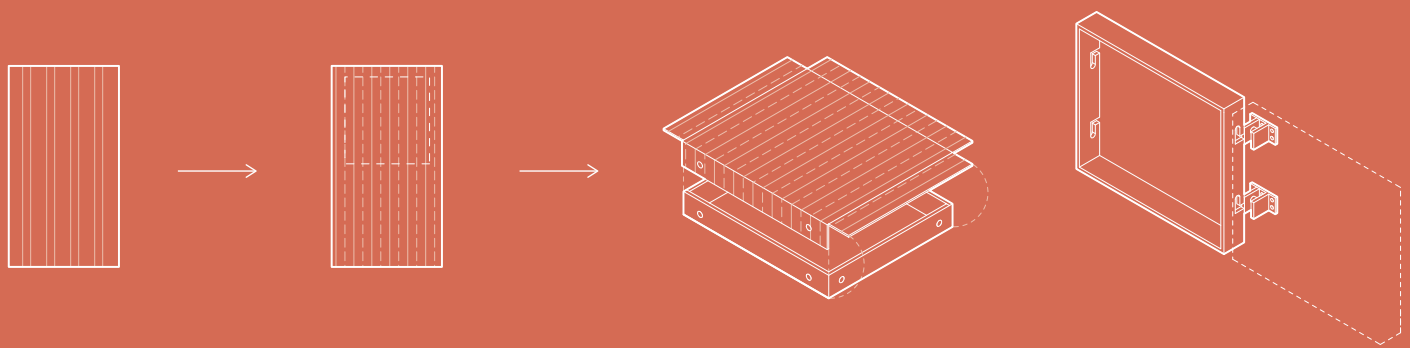
Architecture of reuse









Exploring a prolonged life cycle of materials
through an adaptive transformation

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LUND UNIVERSITY

LTH; Faculty of Engineering
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Architecture of Reuse

Exploring a prolonged life cycle of materials through an adaptive transformation

AAHM10: Degree Project in Architecture

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ARCHITECTURE OF REUSE

Exploring a prolonged life cycle of materials through an adaptive transformation

Take, make and waste. Our society is trapped in a linear economic system where we extract raw materials, process them into products and as they have served their purpose they are reduced to waste. This unsustainable mentality seeps through to all things consumable, from fashion and cellphones to kitchen counters and buildings. In Sweden, the building sector is responsible for 40% of all produced waste. Despite our desire towards sustainability, we demolish buildings long before their due date and sustain a practice in which not even new and still functional products are spared from the waste bins. Instead of feeling apathy towards this detrimental practice in which our field finds itself, another approach is to educate ourselves in sustainable building methods we personally believe in.

This thesis explores transformation and material reusage, strategies that are often seen as separate programmes but are closely interlinked from a circular perspective. The project investigates the abandoned CEPA-building situated in Västerbro, an industrial area in Lund that is subject to an urban renewal project in the coming years. As the area is demolished and developed into a new residential neighborhood, this thesis proposes an adaptive transformation of the former metal industry building into a mixed use public building housing a youth center, re:makerspace and flexible rental facilities for coworking and commercial activities. The building acts as an explorative testbed to gain knowledge on circular techniques, values and tools. *How do we encourage a prolonged material life cycle through architecture?*

Content

“The big global problems are [...] brought about by our linearly organized economic system, in which we extract, use and discard raw materials. Take, make and waste.”

(Material matters, 2019)

— 01. Background

SUMMARY OF CHAPTER

The background to this project is a concern over our dysfunctional relationship to resources in today’s society. Our linear economic system fosters a ‘take, make and waste’ culture which is also reflected in our treatment of buildings and their materials. In this chapter, I will go into the issues behind this thesis, such as our relationship to resources, the role of the construction industry and a curiosity of the tools we as architects have for a more sustainable architecture practice. In addition to the environmental incentives, the project is also grounded in a personal interest in an *’architecture of time’* - design that revolves around existing buildings, structures or materialities.

Photo by Ruslan Khadyev

RESOURCES & MENTALITY

Our linear economic system is relying on a continuous exponential growth, and in order to maintain it we have to consume in greater and greater quantities. We extract raw materials, process them into products and when they have served their purpose they become waste. The waste is incinerated to produce heat or added to landfills, and new virgin materials are extracted in order to tend to our ever consuming society.

With mass-production, technology and the cheap labor of low-income countries it is cheaper to produce new products than repair the old. We have moved from a mentality of 'wear and repair' to 'wear and tear' and nowadays 'wear and throw'.

That mindset seeps through all things consumable - from fashion and cellphones to kitchen counters and buildings. As if our resources were unlimited.

> ***"[...] we live in a world where we globally use almost double the amount of resources earth is able to regenerate. And yet, our consumption keeps rising."***

(Lendager & Pedersen, 2020)

Photo by John Cameron

THE BUILDING INDUSTRY

The building industry is responsible for 40% of the produced waste in Sweden. Despite a desire towards sustainability, we demolish buildings long before their due date and sustain a practice in which not even new and still functional products are spared from the waste bins. Material has little value in the grand scheme of construction - it is cheaper to throw away all overstock material during constructions compared to the cost of storing, handling and transporting it.

The waste is produced through new construction, demolitions as well as renovations. In the book *'Återbruk av byggmaterial'* (2022), Strand Nyhlin & Åfreds share the unsustainable reality of refurbishments, where offices are renovated 15-20 times during their lifetime resulting in almost new material being continuously torn out.

There is no signs of the wasteful practice slowing down, according to Lendager & Pedersen (2020) we are set to triple material extraction in 30 years and triple waste production by 2100 - concluding that *"if we stand any chance of averting climate catastrophe, we must start with buildings - and stop conceiving them in the same way we have for centuries"*.

Image: Demolition of a building
Photo by Kirill S

> ***“In a reuse project, I have to think backwards, present and future in time. In other projects, the focus is almost only on the present. ”***

(Kim Tångfeldt in ’Återbruk av byggmaterial’ 2022)

ARCHITECTURE OF TIME

The topic of material and building reuse is interesting to pursue not only due to its environmental incentives, but from an architectural perspective. I personally find that architecture that is rooted in existing buildings or materialities often benefits with an additional layer of complexity and richness. Something happens as you *’get time into our architecture’* as Søren Nielsen (2022) from Vandkunsten expressed during the 2022 Lund Architecture Symposium, describing how a future sustainable approach to architecture focused on transformations and refurbishments could result in a new type of architecture. An architecture that cannot be designed from a blank sheet of paper, that is *’much more relaxed, full of mistakes’*, quirkiness - and more human. Buildings that reflect us.

I believe that the same notion applies to reused materials and elements, which I delve further into on page 33. In this project I wanted to explore both transformation and reuse - which are often seen as two separate programs but are in fact closely interlinked. From a circular perspective, it is important that we also evaluate the possibilities of preserving and reusing our existing buildings and their structural framework in order to not limit the architecture of reuse to solely revolve around superficial layers. Could this combination of programs result in new architectural expressions?

Photo by DLKR (2020)

TOOLS OF THE ARCHITECT

It is impossible to look at this topic without reflecting on the role of the architect. As a young architect about to enter the market, it is easy to feel an apathy towards this detrimental practice in which our field finds itself. I personally believe that we have to actively take responsibility in ending the wasteful cycle of our industry - and an approach to this could be to educate ourselves in sustainable building methods we personally believe in.

That is why I wanted to delve into the topic of material reuse and circular building techniques in my thesis project - to explore the tools we have as architects to care for our existing resources. I will go into further detail on these tools and techniques in the following chapter and throughout the project.

> ***How can we be part of increasing the perceived value of our resources? What tools do we have for a more sustainable architectural & construction practice?***

Image: Materials waiting for a new use.
Photo by Malmö återbyggdepå.

AIM & RESEARCH QUESTION

My aim with this project is to explore how architecture can encourage a prolonged material life cycle.

This will be investigated through the implementation of material reusage in an adaptive transformation of a former industrial building. The building will act as an explorative testbed to further educate myself in techniques and tools of reusage - to gain an understanding of their potentials and restrictions.

— 02. Reuse

WASTE AS A RESOURCE

This chapter is presenting an alternative, circular, way of approaching materials. It explains underlying concepts to material reuse such as circular economy and architecture, as well as 'shearing layers' - the understanding of the building as a set of components that evolve in different timescales. What is the situation in the Swedish construction industry, what difficulties do we have when it comes to implementing reuse and what are the areas that we as architects can improve? The chapter goes through some of the tools and techniques that can be applied to material reuse, such as design for disassembly, composition, material value shifts through upcycling and storytelling, and presenting architectural, design and programmatic references on the various tools.

Photo by David Hofmann

GLOSSARY

Reuse — In this thesis *'Reuse'* is being used as an equivalent word to *'Återbruka'* [swe] - a collective term for recovering, repurposing, down- or upcycling existing material as an alternative of it being reduced to waste.

Reuse/ Recover/ Redistribute — To reuse a compontent or material for the same function without or with few modifications. *E.g. to redistribute existing roof tiles to the roof of a new building.*

Repurpose — To reuse in another function.

Recycle/ Downcycle — End-of-life materials that are recycled as raw material in the production of a new product. *E.g. crushing concrete and re-cycle as filling material.*

Upcycle — Reuse after redesigning, upgrading or transforming building materials into a new constellation or function.

Refurbish — Renovate a building or space, through e.g. alterations, modernisations, 'cosmetic' renovations or repair work.

Adaptive-/ Transformation — To change the form, configuration or properties of an existing building for a need or a purpose.

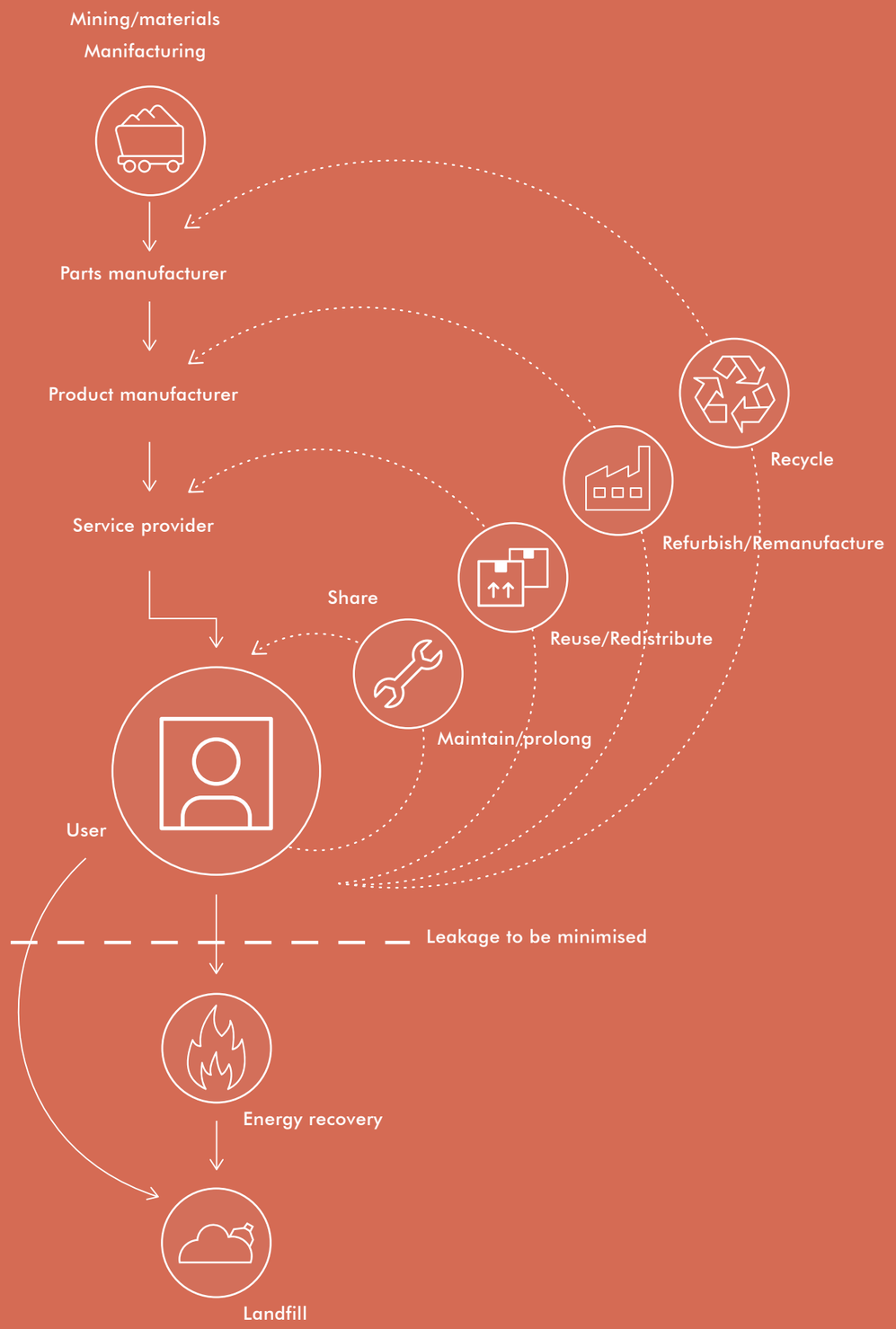
Circular economy — An economic system that give incentives to reusing materials, rather than scrapping them and then extracting new resources.

CIRCULAR ECONOMY

When discussing a *"circular economy"* today we refer to a system with a restorative and re-generative effect rather than the current linear *"take-make-waste"* economy. It is a system that gives incentives to reusing resources rather than scrapping them and then extracting new materials. Circular economy applies on many levels - from the implementation of renewable energy in the energy sector to excluding toxic recycle-impairing chemicals through product design or elimination of waste through changes in the construction industry.

As per Ellen MacArthur's (2022) definition there is also a social dimension - a circular economy should generate a growth with positive benefits for the entire society, not just a selected few. In the book "Solution" Lendager & Pedersen (2020) points out how waste production is directly proportional to demographic and economic development. The higher your income is - the more waste you are likely to generate. Therefore, it is extremely relevant for an affluent country such as Sweden to examine and reprogram its current resource system.

> ***"The goal of the circular economy is to design systems and societies without waste, to recycle materials and add the smallest possible amount of limited resources and fossil energy to the process as possible."***
>
> (Lendager & Pedersen, 2020)



Technical cycle of resources / Based on diagrams by Ellen MacArthur Foundation and Lendager & Pedersen (2020)

CIRCULAR ARCHITECTURE

How can the circular philosophy be implemented in architecture and construction?

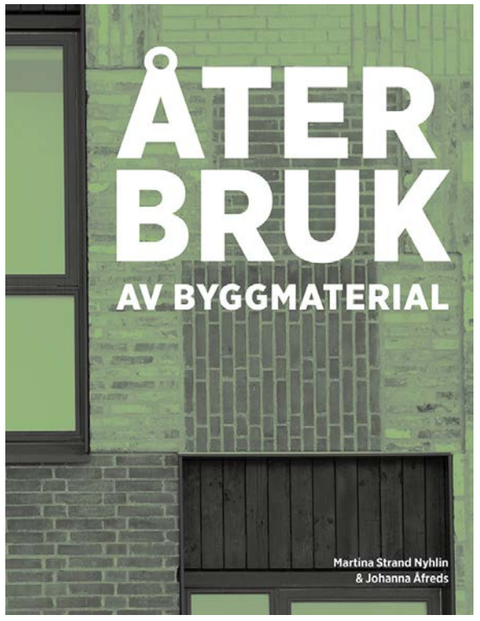
- ⟶ **Repairing, maintaining** & **renovating** existing buildings and components.
- ⟶ **Reuse** the existing resources.
- ⟶ Give resources a new use, through **upcycling** components or **refurbishing** existing buildings or structures.
- ⟶ Design material & components to be **long lasting** & capable of easily enter into a new lifecycle.
- ⟶ Design buildings for **disassembly**, so elements can be reused or recycled at the end of its lifetime.

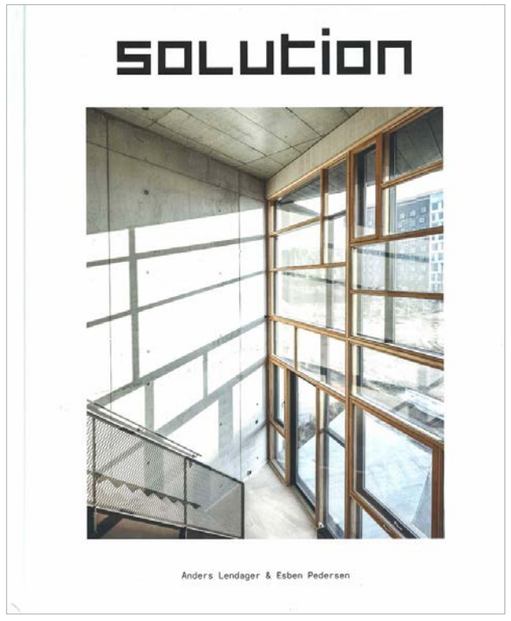
Strategies according to the Ellen MacArthur Foundation (2022) and Lendager & Pedersen (2020). The latter authors bottles it down to:

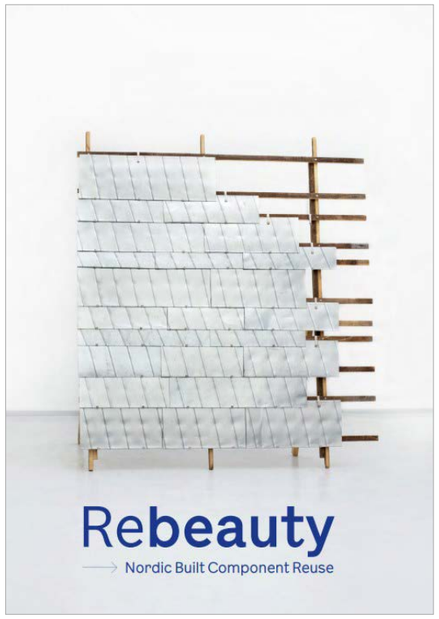
> ***"We must design from waste and design waste out of the system"***

They also voice the difficulties to implement these strategies as the contemporary architect is limited to decisions concerning the purely aesthetic and functional dimensions of a building, with the investors, developers and engineers dictating the actual framework of the project.

Structural changes are needed in order to take circular architecture into practice, with design being adressed earlier in the process.







Book recommendations on circular architecture & reuse. The bottom two are available online as open source documents.

> ***"The difficulty with prescribing reuse is that the architect can not know exactly which components will be on the market when construction starts."***

(Trans. from Swedish; Björkman & Kardell, 2021)

THE ARCHITECT'S CHALLENGES

What are the limitations and challenges of working with reuse as an architect in Sweden today? According to Björkman & Kardell's interview study (2021) with architects, sustainability managers and research institutes there is currently no large-scale reuse of building materials and components in Sweden, with few examples of projects where the framework, frame complements or fixed furnishings have been reused.

They identify the following barriers for reuse in the Swedish building industry:

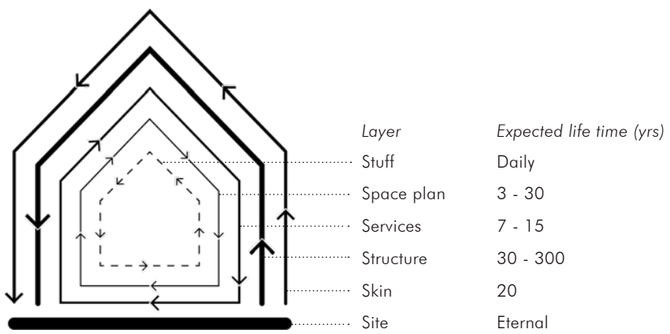
- Lack of knowledge
- Lack of quality and guarantee systems
- Lack of warehousing and logistics
- Lack of recycled materials

Many of the barriers are natural consequences of an industry where demand has not existed and therefore the knowledge, providers and processes have not been built up.

Some of the measures and tools the study suggests could promote and increase the use of reuse materials:

- **Knowledge** & developing new mindsets
- Introduce and plan for reuse from an early stage in the process
- Longer involvement and participation of the architect in projects
- **Flexibile designs; resilience to variables**

In this thesis I concentrate on the two last points as these are measures that I can address and improve as a student. They are important in order to be able to design qualitative, compelling examples of circular buildings in Sweden that can in turn further develop our resource processes.



Based on diagram of lifetime layer-structured construction by Stewart Brand.

LAYERS & LIFECYCLES

An important concept for reusage and circular architecture is the understanding of the building as cyclic layers. The architect Stewart Brand elaborated Frank Duffy's concept of shearing layers in his book *'How Buildings Learn: What happens after they're built'* (1994). The concept views buildings as a set of components that evolve in different timescales.

Foundation (100+ years)
The foundation is difficult to access, but has a long life that can endure several buildings.

Structure (50+ years)
The load-bearing elements act as the spine of the building and are naturally difficult to access or replace. Its lifetime is often longer than most buildings survive, so it has a potential to be reused in another building or at site.

Facade (30+ years)
Due to its exposure to the weather, it is natural that the facade cladding undergo change or renovation during the building's lifetime.

Services (7+)
The technical systems that keep the building functioning. The building risks being demolished early if the outdated systems are too deeply embedded to replace easily.

Partitions (10+ years)
The interior layout needs to be flexible in order to adapt to the occupants' changing needs.

Things (1+ years)
The things we keep inside our buildings; tea cups, decorations, furniture etc.

Based on interpretation by Guldager Jensen et al (2019).

> ***The project is exploring design methods that extend the lifespan of layers and materials through reuse and circular transformation techniques.***

The lifespan of a building and its elements are limited if the layers that need to be replaced more often are not separable from other layers or are difficult to access. *Design for disassembly* is a technique that addresses that aspect, more information on that follows on the next page.

Designing with a flexibility for future changes and needs can also further extend the lifespan of the building's elements. This is, as an example, explored in this project through a flexible interior wall system for a commercial use since these sort of interior layers are replaced as often as every three years due to the change of tenants.

The project is primarily targeting the layers that are more frequently replaced, investigating suitable solutions that can extend their life cycle, while looking to preserve the existing layers with a longer life span such as the structural system and foundation. Generally when implementing reused materials to a building one would look to reuse them in their current shearing layer or, if its performance is impaired, move it to a layer where there are lower demands on its function or it is less exposed to prevent further deterioration.

10 TECHNICAL DESIGN RULES FOR DISASSEMBLY

From 'Rebeauty – Nordic Built Component Reuse' (Manelius & Nielsen, 2017)

1/ Reversible fixations (mechanical) enable disassembly without damaging components.

2/ Separability of building parts and component members and constituents. This generally disqualifies composites, glued, cast, or other chemical connections.

3/ Hierarchical assembly according to component lifetime. Enables minimal interference in components with longer lifetime when exchanging others.

4/ Accessibility to fixations. Enables disassembly without damaging components.

5/ Parallel assembly. Enables local exchange of single components.

6/ Manageable size and weight of components. To enable changes and disassembly without crane-lifts.

7/ High generality of components (modularity, homogeneousness and uniformity). To increase reusability.

8/ Minimum of mechanical degradation, such as cutting, carving, and penetration. To minimise waste and increase component reusability.

9/ Orthogonal geometries, as opposed to skewed or curved. To minimise waste and increase possibility of component reuse.

10/ Minimal number of component types and parts. To ease processes of disassembly and of resource mining.

DESIGN FOR DISASSEMBLY

Dfd (*design for disassembly*) refers to reversible design solutions that ensures that you can easily disassemble, replace and reuse components of a design as they wear out or change function. The technique itself is not solely applicable to projects involving reused materials - it is rather a precondition for future reuse and adaptations.

> ***"Today buildings are statically welded, glued and cast together. By designing for disassembly future buildings will be flexible and function as material banks"***
>
> Guldager Jensen & Sommer (2019)

It is not a new technique - a historical Swedish example of dfd is the timber house that was designed to endure being disassembled and moved. In *"Building a circular future"* by 3XN, Guldager Jensen & Sommer (2019) suggest the following strategies for reversible connections:

- Use **screws, nuts and bolts** instead of non-reusable nails to avoid damaging the material.
- Use **common and similar fasteners** to easier identify the different types of fasteners used and fewer tools needed for deconstriction.
- Use **easily dissolvable binders** (e.g. water based) instead of glue and sealants to avoid damaging the material when separating it.
- Use **lime mortar** instead of cement in masonry, as the latter can not be disassembled.

“It is pleasurable to press a door handle shining from the thousands of hands that have entered the door before us; the clean shimmer of ageless wear has turned into an image of welcome and hospitality. [...] Through impressions of touch we shake the hands of countless generations.”

(Juhani Pallasmaa, The Eyes of the Skin: Architecture and the Senses)

WEATHERING

There are also soft values connected to material reuse, besides the overwhelming environmental incentives. One of them being patina - an aesthetic quality created by the traces of time certain materials collect over the years.

In ‘*On Weathering: Life of buildings in time*’ Leatherbarrow & Mostafavi (1993) asks - ”is weathering only subtraction, can it not also add and enhance?”. They write about the romantic appreciation of aged materials, on which the subtraction and addition of traces, residual deposits and weathering creates a present form of a past life. How the building and its components take on the qualities and experiences of the site and its activities. Søren Nielsen (2022) also describes this attraction to the aged while displaying a photo of a rusty metal shed, expressing that “you can’t make this in your sketch block or computer, only one thing can make this composition and that is time”. Age, and its inherent traces, is a quality of existing materials that new products cannot triumph.

Reusage tools such as ‘*storytelling*’ that Lendager group utilizes (see page 38) might feel rather conceptual - but its purpose is to cause a value shift by sharing the mute materials’ history; a mental reprogramming towards a care for materials. By making the users aware of the past of the materials in the building a new appreciation is awakened. In the beginning of my research I was perplexed as to why the reused materials were so often made highly visible in circular projects and was curious if it was an effect of the variation in available materials or a conscious choice. While it surely can be a mix of the two, the more I study and empathize with the architecture of reuse

Photo by Kelly Sikkema

I understand that it is a very conscious grip - a display of pride and fascination of materials with past lives.

Is this fascination not about the 'right' kind of aging? Of course, some materials have better conditions for an appealing patina - virgin materials such as wood, metal and brick. These materials also happen to be ideal for reuse due to their long lifespans and maintenance possibilities, unlike many of today's "maintenance free" components consisting of inseparable synthetic layers. Many of our contemporary components are the result of a quest to create materials and buildings that do not show their age, an 'ageless' but inhuman perfection. It is interesting how material reusage could shape an alternative architecture that does the opposite - emphasizing time and imperfection.

But it is important to stress that the aesthetic quality of patina is only an additional value that can be achieved through material reuse. It is not, and should not be, the main purpose for us to practice reuse. It is not difficult to imagine a future where we no longer have access to the qualitative, appealingly aging materials and components we have today. How do we apply 'storytelling' to contemporary materials that bear no - or unattractive - traces of time?

Creations by the Rave Review. Photo (left) by Märta Thisner; (right) from Editorialist (n.d.)

UPCYCLING

The exclusive Swedish high fashion brand **Rave Review** is a great example of the tool of *upcycling* - to transform existing materials into a new constellation or function, and through that cause a shift in the material value from potential waste to a sought after product.

Their upcycled clothing is based on a formula of combining used fabrics that are commonly available on the market (e.g embroidered bed sheets) and with more rare or specific fabrics, resulting in compositions of different style eras and materials.

This model of deconstructing and combining common with particular, nostalgia evoking, materials is an interesting model to apply to architecture as an opportunity to transform products that are not in the condition to be reused for its former function.

The Eames ESU shelf. Photo from Miljögården (n.d.)

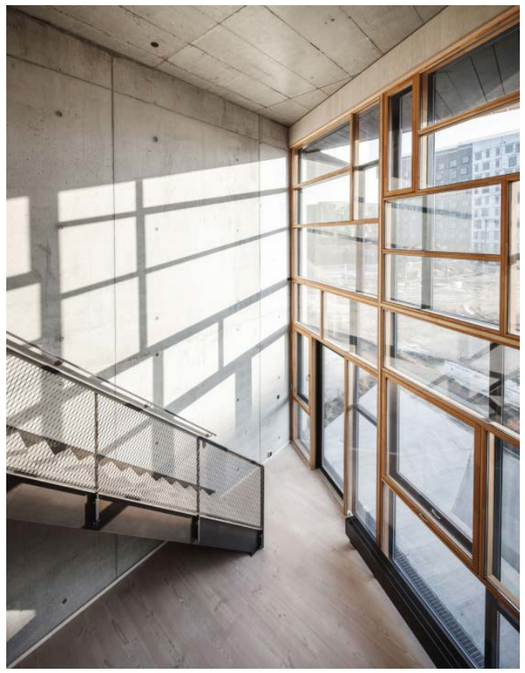
The Memorian chest. Photo by Folkform

COMPOSITION

Composition is an important and interesting challenge when working with material reuse and an ever changing supply of materials. There are different methods of designing with inhomogeneous materials. One strategy is to apply materials within a framework, similarly to the personalizable *ESU storage unit* by the architects **Charles and Ray Eames** - although not constructed of reused materials it combines different kinds of materials, textures and colors. Thanks to the variation, the relatively strict framework is perceived as playful and can be composed to a calm or expressive character.

Another way of relating to a mixture of materials is to create very specific and lively compositions like that of the Swedish design duo **Folkform**. Their masonite chest *Memorian* is made from recovered Masonite from the 1930s, 50s and 2011, combined into intricate and unique compositions of art.

The two methods are both applicable to the architecture of reuse based on the context, availability of materials and the desired expression and function.



Apartment entrance in the Lendager group's Upcycle studios. Photos by Rasmus Hjortshøj

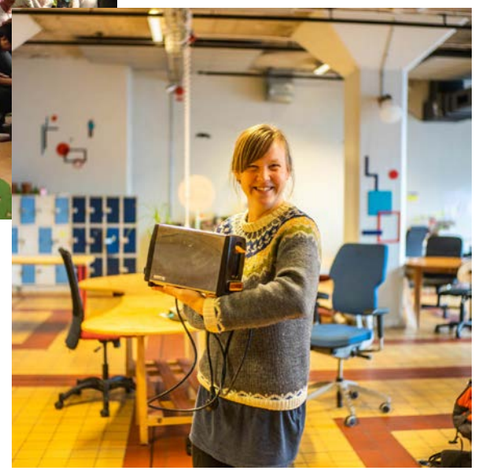
STORYTELLING

The Danish architecture, strategy and material innovation company **Lendager group** is at the forefront of material reuse within architecture in Scandinavia. The company works with the tool of '*storytelling*'. The founder, Anders Lendager describes an architecture with a new narrative - letting the materials and surfaces tell the story of 'what they were before they became a new design object' (Fritz Hansen, 2021).

An example of this is their townhouse project *Upcycle studios* in Copenhagen that is built from recycled concrete, repurposed double glazing and discarded flooring boards. The upcycled concrete is made from 1400 tonnes of concrete waste from the construction of the Copenhagen metro. The concrete is casted with a raw expression and left bare in the apartment instead of being painted or clad in gips.

The concept of the houses are relying on the story of the material reuse - creating new homes from waste with histories.

The creative workshop of ÅterSkapa. Photo by SYSAV



A repaired toaster with owner. Photo by Malmö Repair cafe

PROGRAMMING

One can also encourage and lift the values of reuse through the program - to design and propose facilities for circular communities. An example of this is **Retuna Återbruksgalleria**, a shopping mall and educational center in Eskilstuna that houses shops and services with sustainable and circular philosophies, as well as a recycling center that reconditions unwanted products and sells in the mall's stores.

A local initiative in Skåne within the reuse community is **ÅterSkapa** - a workshop in creative re-use and upcycling for kids located at Kretseum in Hyllie. They host educational workshops for schools and drop in art days where families are invited to create things with their collected industrial waste products.

Another initiative in Skåne is the **Repair Café Malmö** which is a non-profit organisation that helps people in the region to extend the lifetime of their everyday things and devices. They are encouraging a 'repair culture' in Sweden by hosting learning events in Malmö and Lund where people help each other to fix broken products.

Social gathering by the rocket furnance. All photos & diagrams by Vandkunsten Architects

INFORMALITY

Project: Hal 7 Makers' corner
Architects: Vandkunsten Architects
Location: Musicon, Roskilde (DK)

Activity: Transformation/Re-use
Program: Workshops & meeting place
Date: 2016-2017

Hal7 is a former industrial building in Musicon, Roskilde, housing a local maker community, a youth maker space and a meeting place for mentally vulnerable citizens. The danish architecture firm **Vandkunsten Architects** transformed the building on a tight budget, with 90% of the material reused being repurposed. The project is an example of an informal and relaxed architecture of reuse composed by discarded shipping containers, repurposed sport hall flooring and reused and upcycled windows and doors. The architects have implemented dfd principles to the design which makes it possible to rearrange the space over time. The architects were heavily present in the building's process, adapting the principle drawings during construction to meet the available materials found by the contractor.

Re-used materials & objects

Assorted windows

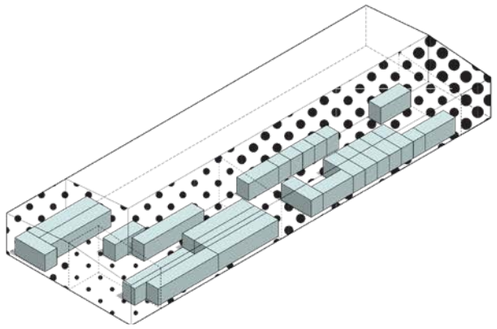
Shipping containers

Flooring from a sports hall

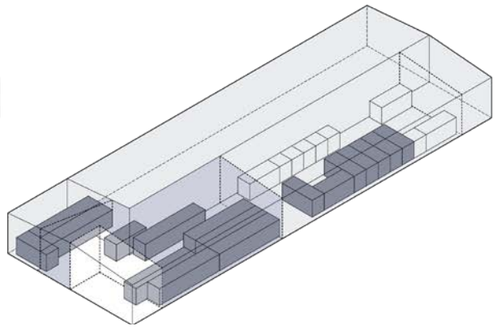
Doors

New materials

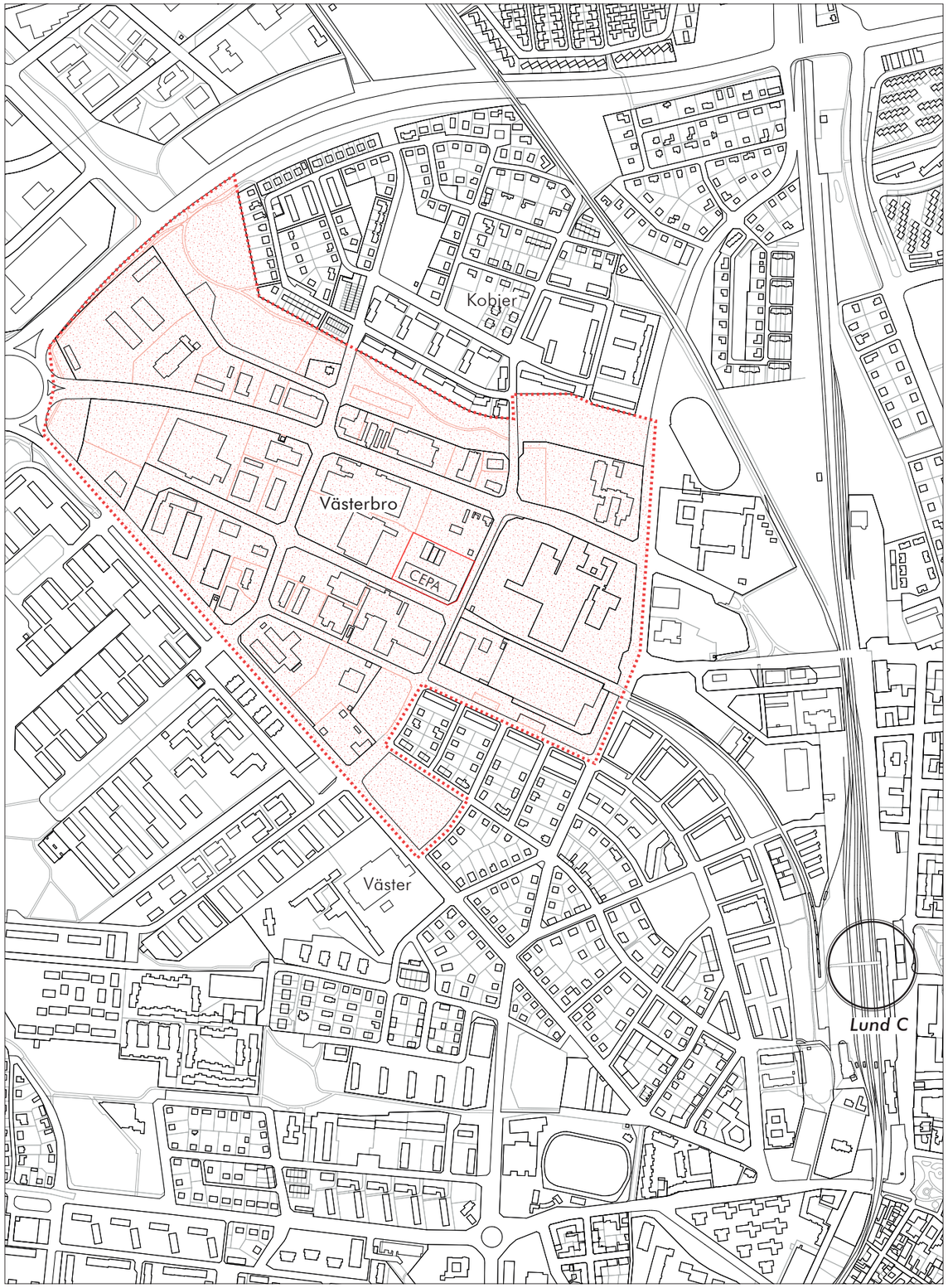
Polycarbonate panels
Wooden structures
OSB/plywood sidings
Papergranulate insulation



- Loud zone
- Medium noisy zone
- Low noise zone
- Quiet



- Climate zone 1, open space
- Climate zone 2, 17 °C
- Climate zone 3, insulated and heated to 21°C
- Climate zone 4, orangery



Context plan 0 100 200 500m

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— 03. Västerbro

THE INDUSTRIAL TRANSFORMATION

As our cities grow, we see an increasing trend of their industrial areas being relocated and transformed. The area in which this project is located, Västerbro, is facing such a change. Many of its industrial buildings are assumed to be demolished as the area is transformed into a mixed used residential neighbourhood, with a huge amount of material at risk of becoming waste. Although a number of buildings and structures have been identified as culturally and historically valuable, their future seems bleak as the area is privately owned by property developers. This means that the few buildings that may be preserved will play a heavy role in communicating the history of the area, one of which may be the CEPA building.

How do you preserve the area's industrial history and material identity? Could reuse be a tool for this?

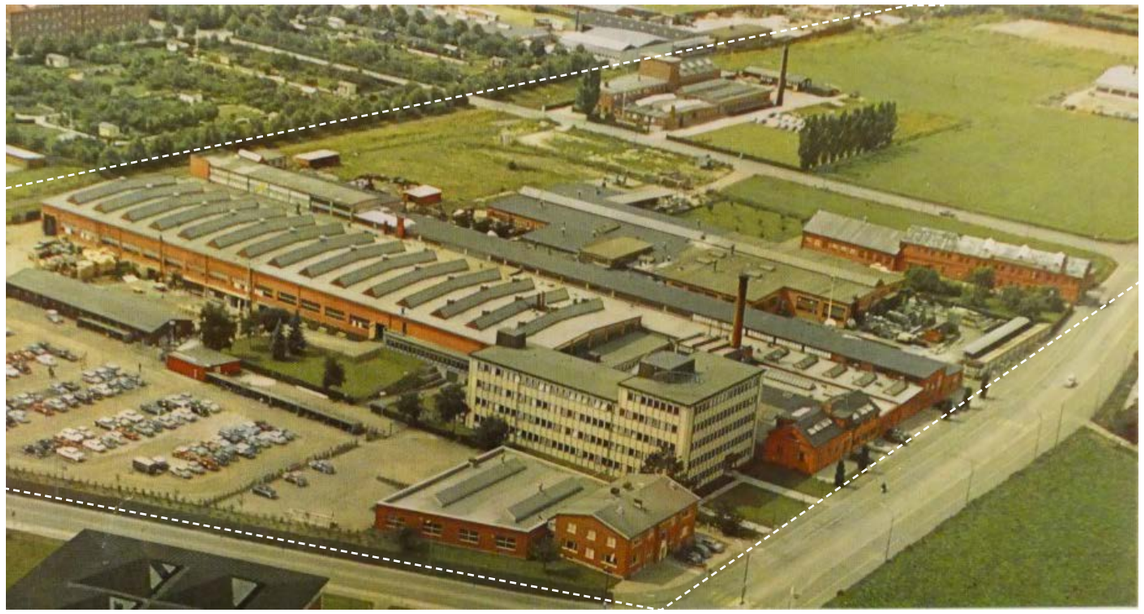


Photo from Kulturportal Lund, taken (approx.) 1962. Öresundsvägen to the right & CEPA-building in the back, area still dominated by farmland.

Satellite image of the area today. Photo from Google Earth

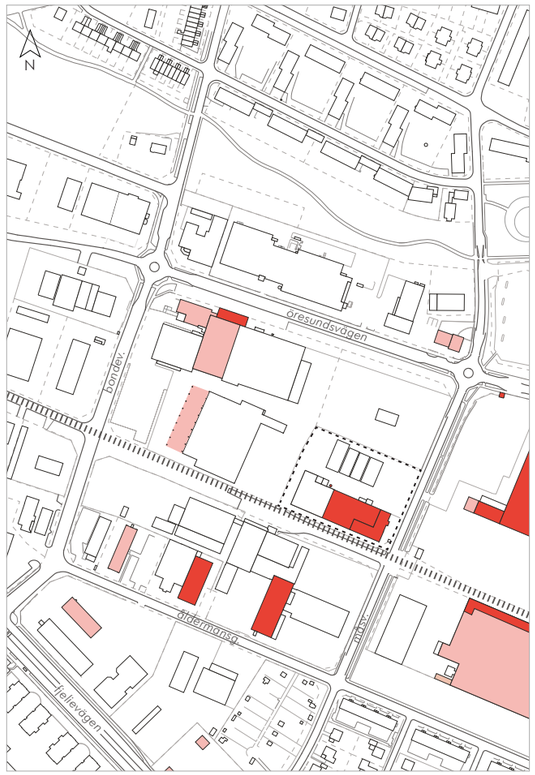
HISTORY & PRESENT

The area of Västerbro was prior to the recent name change referred to as *Oresundsvägens industrial area*. It is characterized by large industry buildings built during large parts of the 1900s. The area started developing in the 1930s with Skofabriken Standard and the reactivation of the industrial railroad Bjärredsbanan in the 1940s, with an accelerated development at the end of the 1960s up until 1980s when the last industrial plots were sold.

Today the area consists of large industrial properties, dominated by the packaging and metal industry, commerce and offices buildings as well as smaller workshops and craft companies, such as the still active Lunds Snickerifabrik (established in 1946). Activities of a more public quality are limited to a design school and health center. The area is surrounded by residential areas along its outer edges and is located only 1,5 km away from the Lund central station.

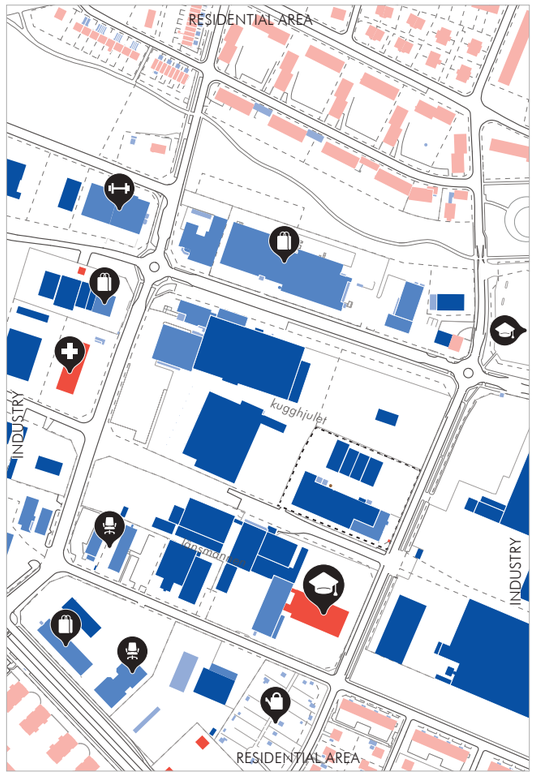
Lund municipality has performed an preliminary antiquarian investigation, suggesting that there are some cultural-historical valuable buildings in the area, one of them being the CEPA building.

Preliminary antiquarian survey (Lunds kommun, 2019)



- *cultural-historical valuable building or part of building*
- *buildings part of a cultural-historical valuable environment*
- *cultural-historical valuable bjerredsbanan's route*

Typologies



- *industry*
- *commercial and office facilities*
- *public function; design school & health center*
- *residential*

Mobility & ground conditions

- *park land*
- *soft ground; grass or foliage*
- *hard ground; asphalt or concrete*
- *bike path*

Industrial structures

Parasitical solutions

Fences & hard materials

Pride > Private

Closed facades / big doorways

Layering

Material palette

Shapes born out of rationality

CHARACTERISTICS

The area is characterized by large industrial building volumes, hard surfaces, fenced plots and enclosed facades, and can be perceived as desolate and introverted. The former industrial pride in the area that the large CEPA sign makes one associate with is replaced by a more anonymous production.

The materials present in the architecture are dominated by brick and sheet metal. Many of the buildings have been added upon over the years, resulting in a collage-like architecture. Ventilation and service ducts parasitically meander along the rooftops.

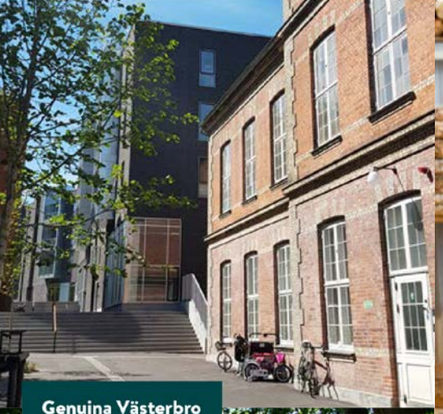
Despite the inhuman scale of the buildings and hard materials there is something attractive with the industrial architecture. It has a notion of quirkiness and imperfection, with layers added over time that are so overly rational that the building becomes surprisingly honest and readable.

CURRENT VÄSTERBRO

The current volumetry of 'kvarteret kugghjulet' in Västebro, with the CEPA plot in dashed.

FUTURE VÄSTERBRO

Illustration by Fojab arkitekter (Planbeskrivning Kugghjulet 1 & 2, Lunds kommun 2021)

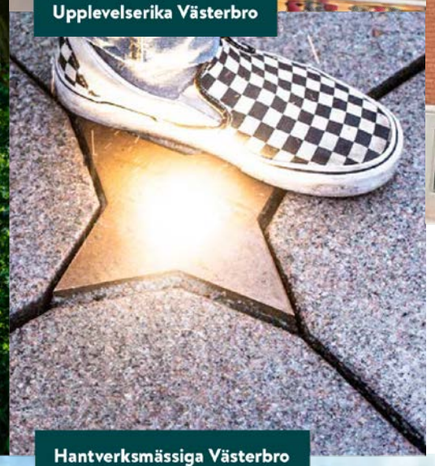


Genuina Västerbro

Upplevelserika Västerbro

Entusiastiska Västerbro

Uttrycksfulla Västerbro



Hantverksmässiga Västerbro

The five values of Västerbroprogrammet and collage illustration of the area as a 'mixed district with vibrant city life, high architectural design and a varied roof landscape'.

VISION VÄSTERBRO

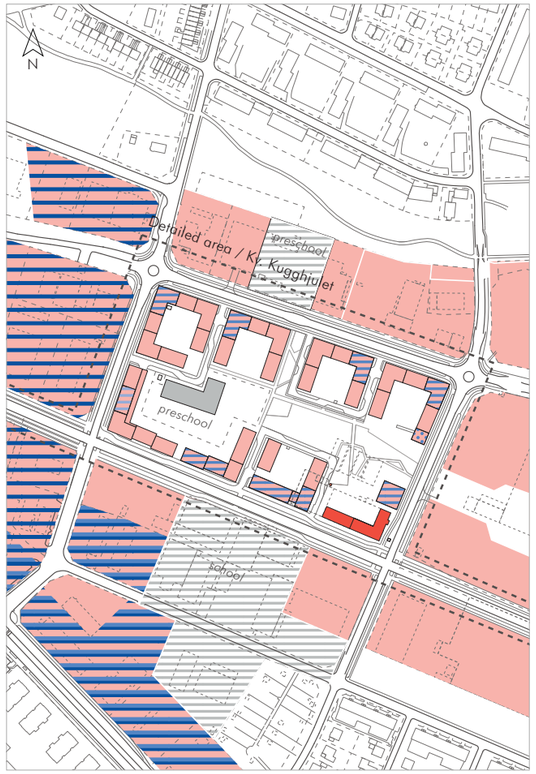
Lund municipality and the property owners' plans for Västerbro became public with the publication of *Västerbroprogrammet* in 2019. The document (Lunds kommun, 2019) describes Västerbro as a natural extension of Lund's inner city to the northwest. In the coming years, the area will be transformed from an industrial area into a mixed residential neighbourhood of dwellings, commercial and verksamhets premices, preschools, school, nursing homes and new parkland. Through a new road, Västra esplanaden, the area will be connected with Lund C with a high accessibility for pedestrians and cyclists.

Västerbroprogrammet describes an area that is characterized by its industrial history, but in illustrations similar to that on the previous page, no traces of preserved buildings can be seen other than a part of the CEPA building.

However, in the plan description for Kvarteret Kugghjulet (Lunds kommun, 2021) mentions material reuse as a sustainable alternative to building with new materials:
"It is suggested that facade bricks or other building parts can be preserved in the event of demolition and reused on site, thus reflecting the history of the site" (transl. from Swedish).

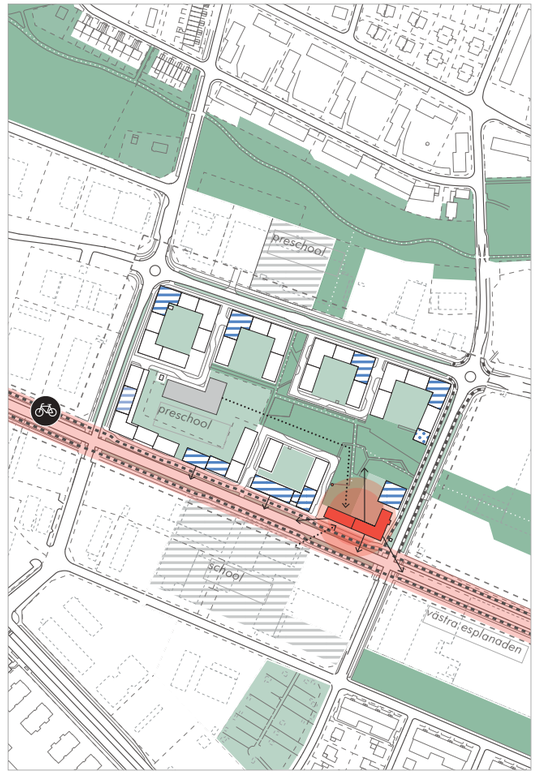
Illustrations from
Västerbroprogrammet
(Lunds kommun, 2021)

Future typologies



- *industry*
- *commercial and office facilities*
- *public function; the cepa building*
- *residential*
- *school and daycare*

The strategic position of the CEPA-building

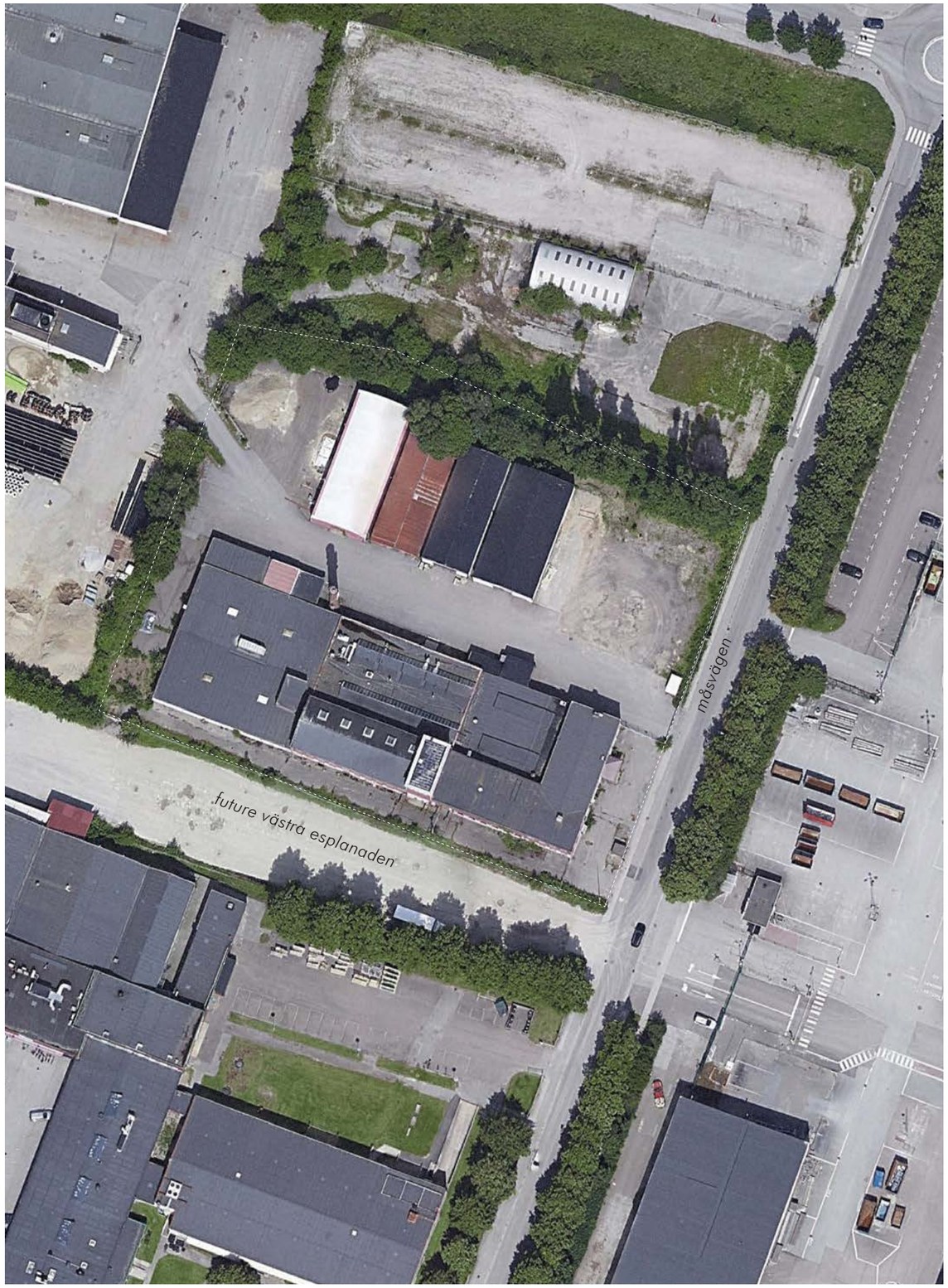


- *park land*
- *courtyards*
- *public function; the cepa building*
- *main street; västra esplanaden*
- *commercial facility on the ground floor*
- *elderly home*

FUTURE KVARTERET KUGGHJULET

In Kvarteret Kugghjulet, where the CEPA-building is located, 800 homes, ground floor commercial premises, parkland and a preschool are planned. Lund municipality has expressed an interest in preserving and transforming the CEPA-building, or parts of, into a flexible cultural center for children and youth. They are currently (2022) investigating the condition of the building and the possibilities of fulfilling the program.

If preserved, the CEPA building would hold an important position in the new neighbourhood - being the first visible building of the block as you travel from the center, acting as a reminder of its industrial past. The building could also serve as a connector between Västra esplanaden, and its potential street life, and the neighbourhood parkland that connects to Qvantenborgsparken in the north and a new park towards east. The parklands surrounding the building could be imagined to be frequently used by children and youth from surrounding schools and preschools.



Site plan 0 10 20 50m

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— 04. Test bed

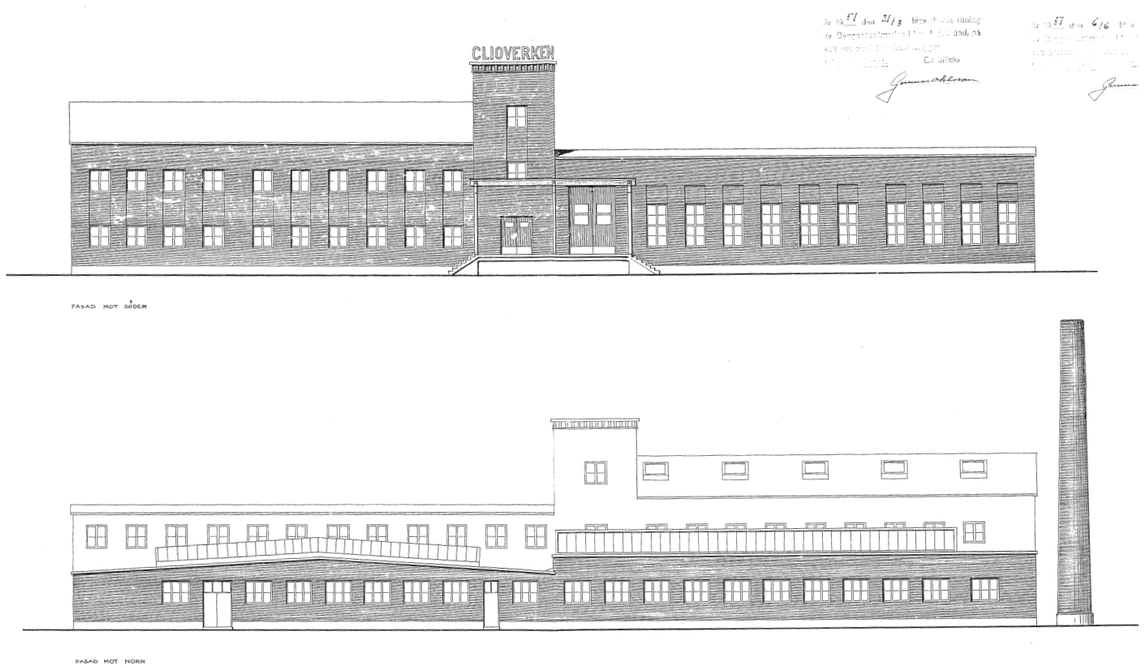
THE CEPA BUILDING

In this chapter we will zoom into the CEPA-building, that is acting as the testbed of this thesis. As previously mentioned, Lund Municipality has shown an interest in preserving and potentially transforming the building.

The building has been abandoned since 2013 and due to vandalism and an arson attempt in 2021, the building has been blocked-off. Unfortunately, I did not get permission from the property owner JM to enter the building, but I have visited the site and area multiple times. Thanks to archival drawings, 250+ photos from the photographer Calle Bergendorff, video material from urban explorers and archive photos from CEPA's CEO Lars-Göran Håkansson, I have been able to gain a clear picture of the building and its qualities.

Satellite image from Google Earth

The building in 1983, photo from Lunds kommun (n.d.).



Elevations from the 1950s with an addition of a two storey building,two workshop halls and the chimney, available in Lunds kommun's ritningsarkiv.

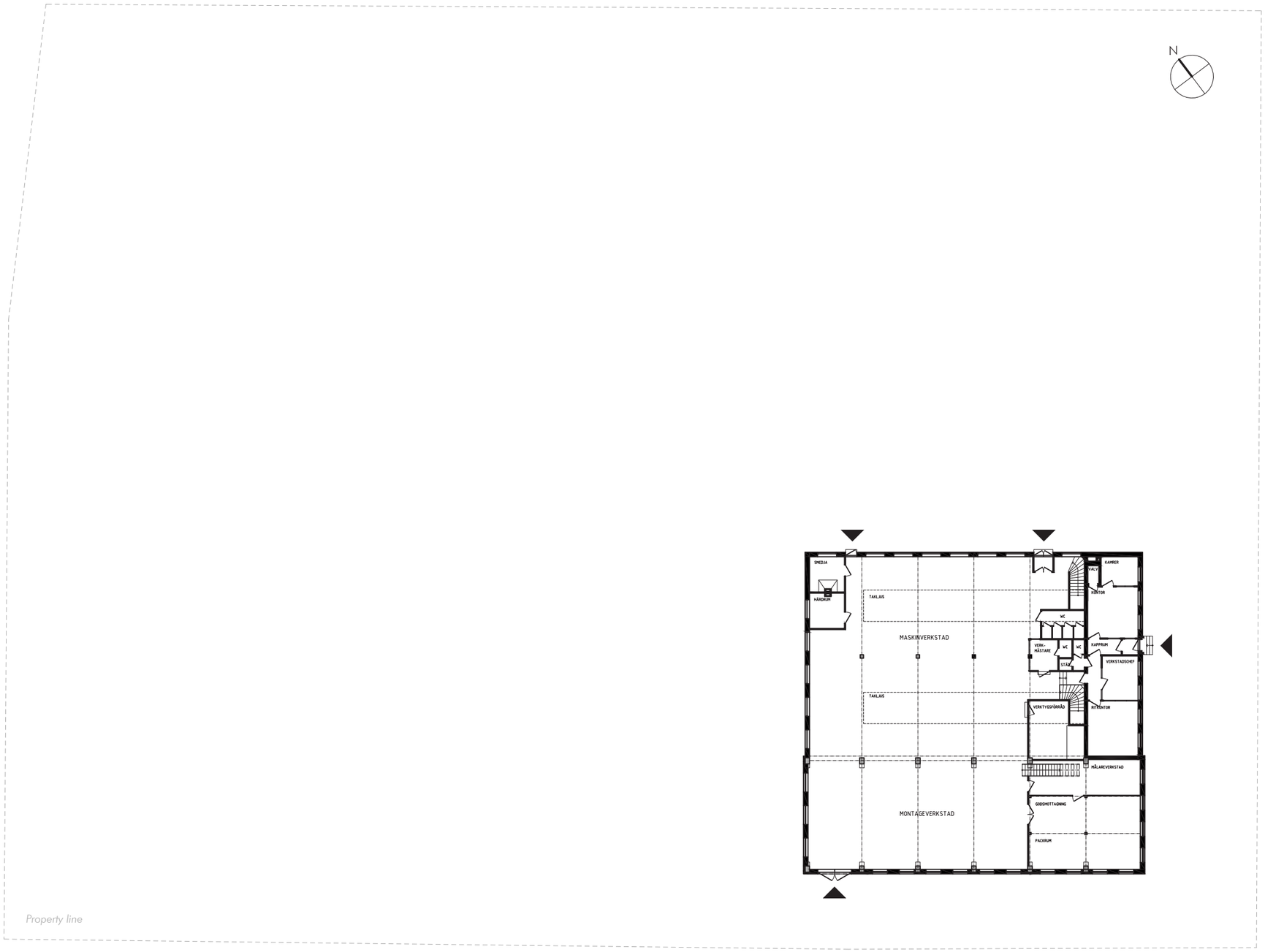
THE CEPA BUILDING

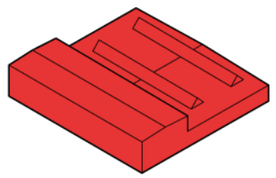
The original part of the CEPA-building was drawn in 1943 by the architect J Ludv. Nilson, containing a large machine hall, an assembly workshop, administrative facilities and a lunch room for 50 employees. It was owned by Clioverken, a company specialized in producing metal products such as engine spare parts and cogwheels. The factory was taken over in 1965 by Scandinavian gears, and in 1983 sold to CEPA-Stålpressnings AB who, as the previous owners, also worked with metal processing.

In a cultural-historic inventory carried out in the area, the CEPA-building is highlighted as a representative of Lund's now lost heavy industry, especially since it adorns one of Lund's few preserved industrial chimneys.

The building has been left abandoned since JM bought the building from CEPA in 2013, and has fallen subject to continuous vandalism and recently, arson attempts.

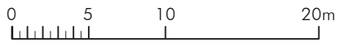
In the following pages, I illustrate how the building has been altered and added upon over the years, constantly being adapted to the needs of the industrial programs.

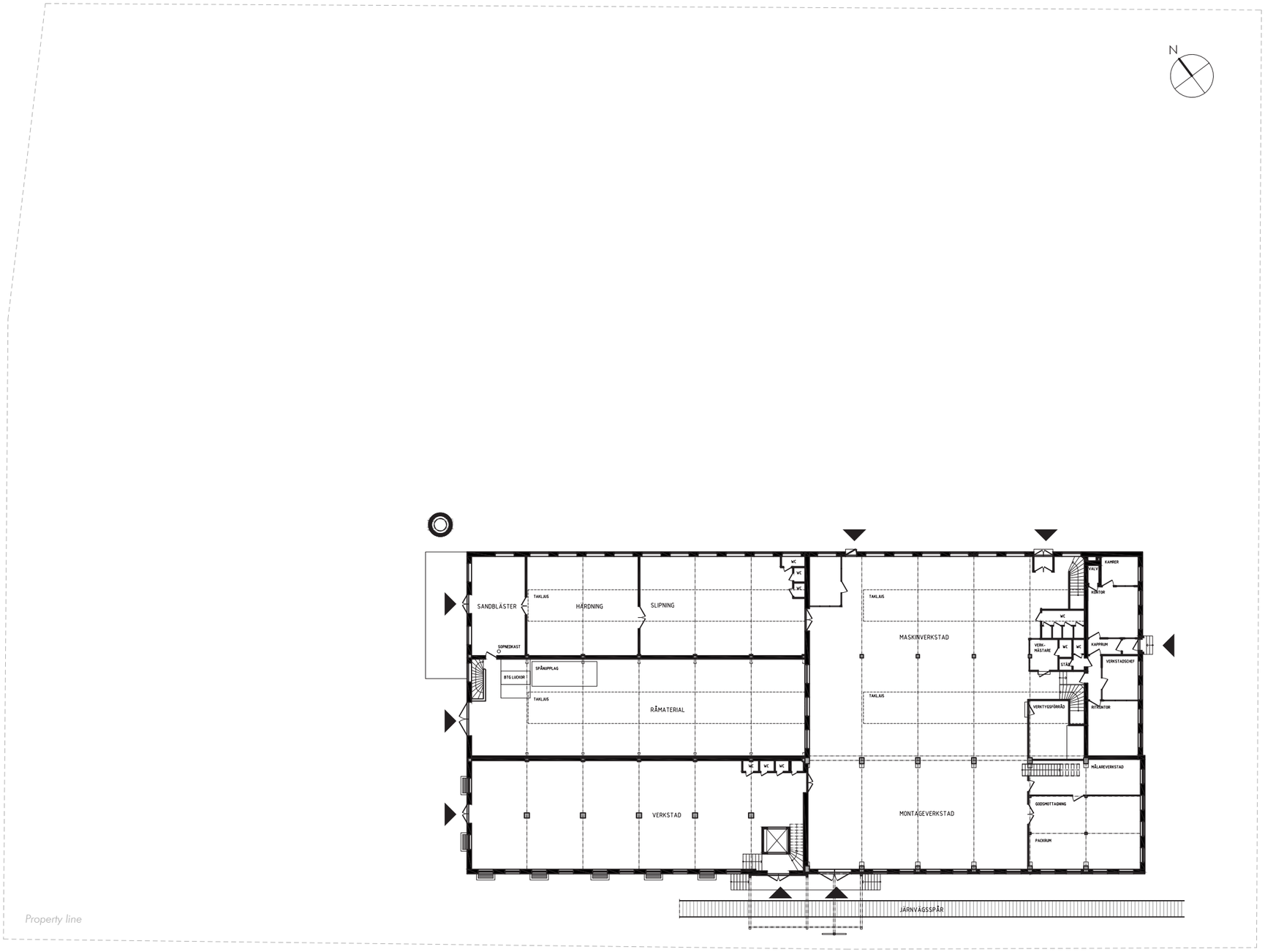


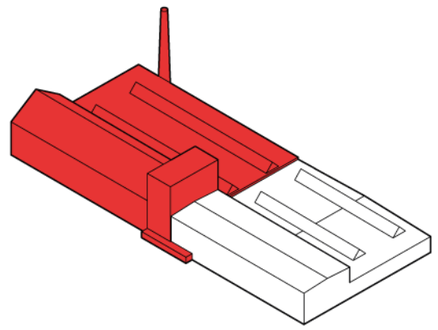


GROUND FLOOR PLAN, 1940

Based on plans from Lund municipality's drawing archive.



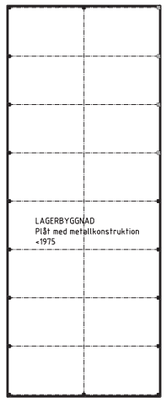


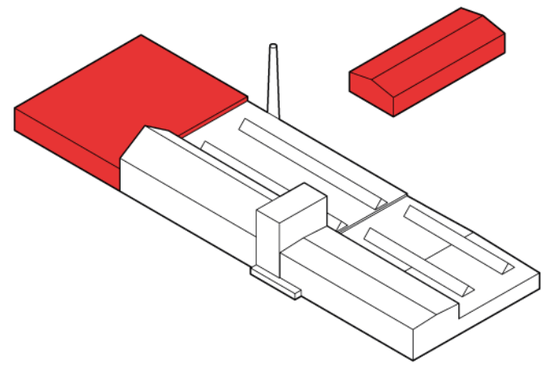


GROUND FLOOR PLAN, 1950

Based on plans from Lund municipality's drawing archive.

0 5 10 20m

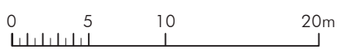


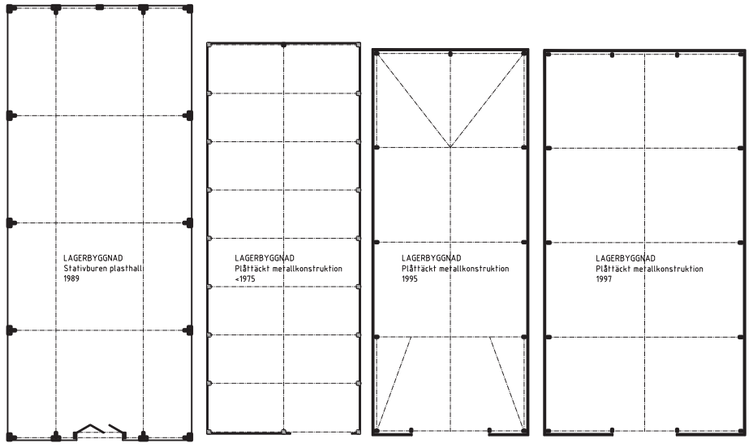


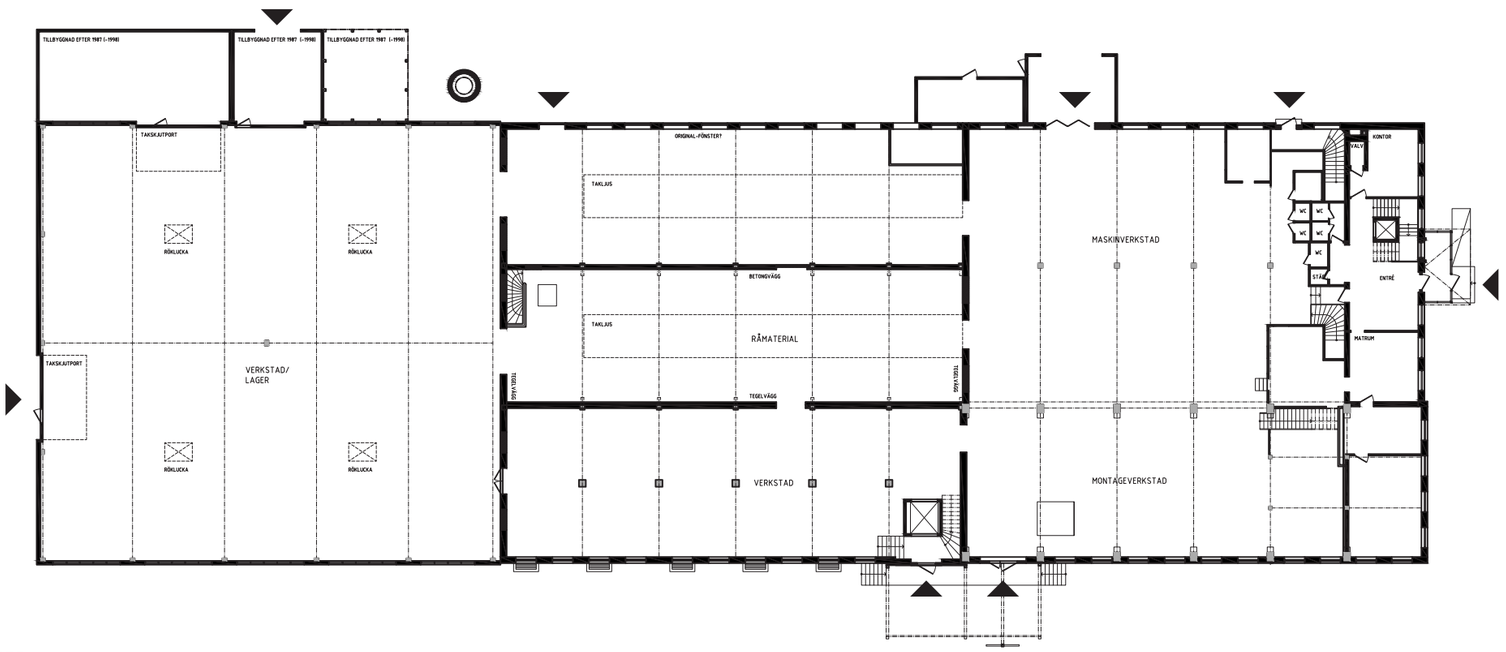
Property line

GROUND FLOOR PLAN, 1987

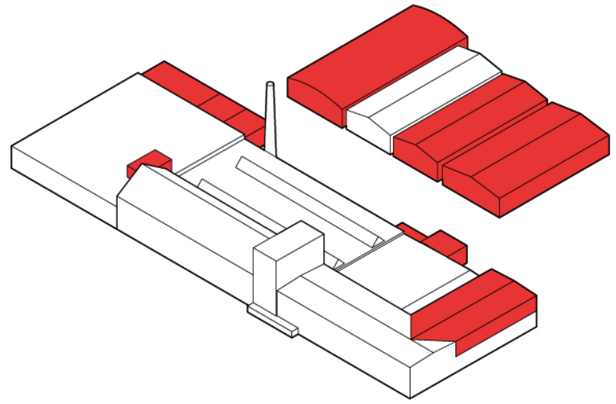
Based on plans from Lund municipality's drawing archive.





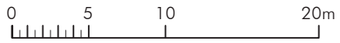


Property line



GROUND FLOOR PLAN, 2022

Based on recent photo and video documentation of the building.



Interior landscape and colors from the time the building was in operation. Archive photos from CEPA brochures (approx. years 1983-2011).

1. Sheet metal clad facade facing south. Damage from a fire last winter (2021) on the second floor of the machine hall.

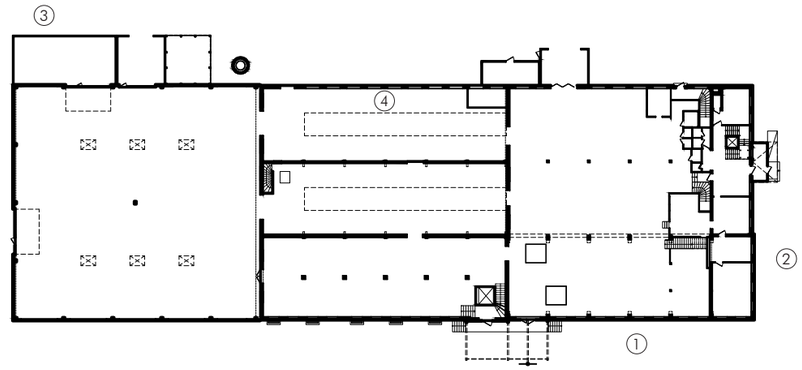
2. The former office section with the 1998's second storey addition.

3. View from west of the chimney and the numerous small additions.

4. Intact rooflight on the roof of one of the workshop halls.

Brick facade hiding underneath.

Display added after 1983



EXTERIOR

The exterior of the CEPA-building is since sometime after 1983 clad in corrugated sheet metal. Underneath hides a modestly detailed red brick facade. The building is experienced differently from each direction - the side towards the future Västra esplanaden street is tall with a variated roofscape, whilst the opposite side facing the future park land is experienced as flat and low.

In the detail plan of the area Lund municipality have proposed the following alteration regulations for the building's exterior:

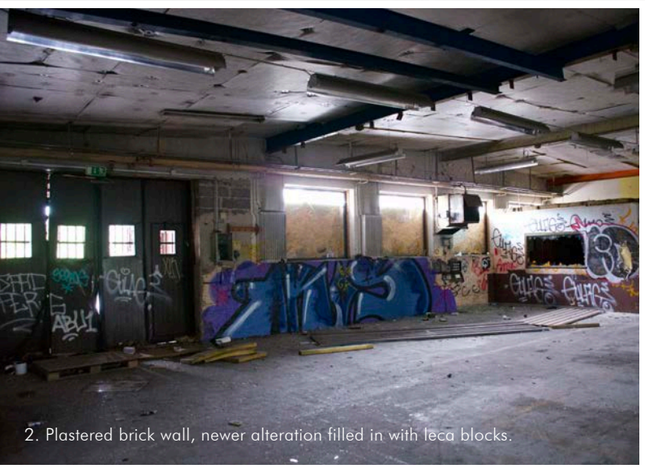
- *The facades of south and east buildings from 1945 & 51 & chimney must not be torn down, and the brick should be preserved.*
- *The size of the windows and their interrelation are qualities that must be preserved.*
- *The character with the loading dock and traverse must be preserved.*

If altering the building, the following features must be taken into account:

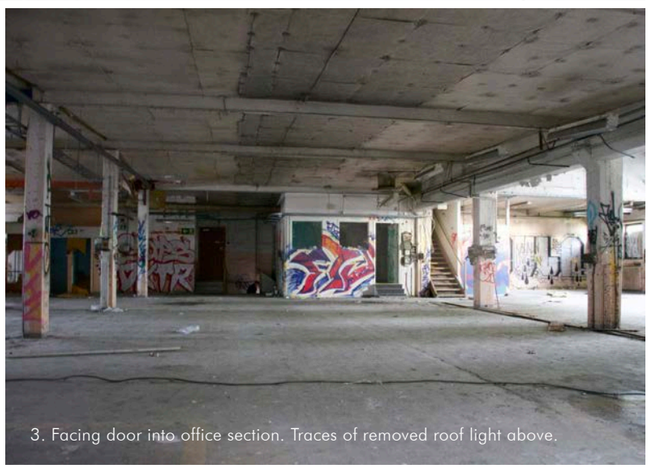
- *The industrial character of few materials and colors in the exterior.*
- *The southern & eastern facades may not be added with balconies or bay windows.*
- *Additions on the roof are not suitable.*

Images 2-4 & 6 by Calle Bergendorff

1. The machine hall; concrete structure and floor, plastered brick by the tall windows. Hole in floor for metalworks machinery.



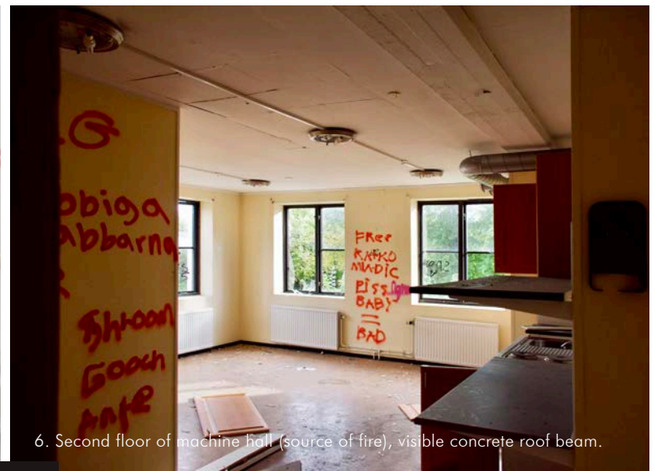
2. Plastered brick wall, newer alteration filled in with leca blocks.



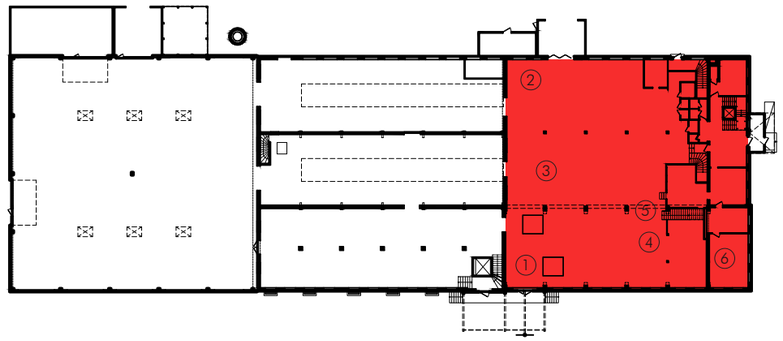
3. Facing door into office section. Traces of removed roof light above.

4. Industrial elements.

5. Wood panel & stair.



6. Second floor of machine hall (source of fire), visible concrete roof beam.



1940'S BUILDING

The original section of the building is constructed by a reinforced concrete structure and metal components. Between the lower construction hall and the office part is a load-bearing concrete wall. The reinforced siporex roof plates in the lower construction hall rests on exposed metal beams.

Qualities

- High ceiling height and light transmission in the machine hall.
- Simple and present concrete structure
- Industrial traces; plug cabinets, beams, lifting machinery
- Large industrial wooden lattice windows, potentially original.

Restraints

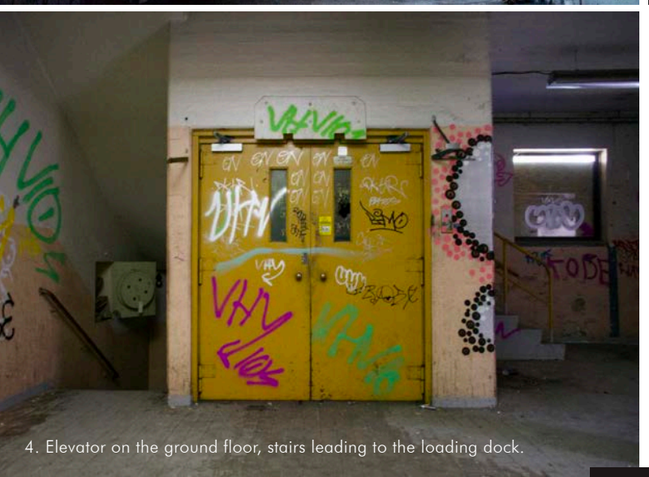
- Dark and deep space (image 2 & 3) with a lower ceiling height due to the removal of original ceiling lights (removed after recurring problems with leaking roof, source prev. owner).
- No visual connection into the machine hall from the previous lunch room on the second floor.

Images 1-6 by Calle Bergendorff

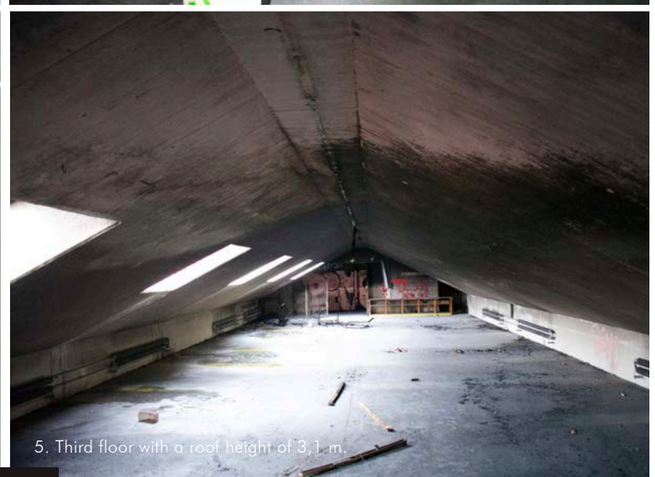
1. One out of the two lower halls, brick wall towards the taller building.

2. Outer hall, original windows to the left, concrete wall to the right.

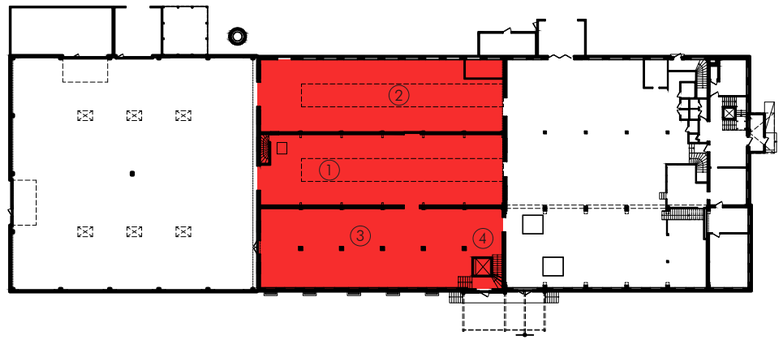
3. Ground floor.



4. Elevator on the ground floor, stairs leading to the loading dock.



5. Third floor with a roof height of 3,1 m.



1950'S ADDITION

The addition from the 50s is constructed by a reinforced concrete structure, similar to the original section, and consists of a three-storey building and two production halls. The wall between the three-storey building and the nearest production hall is made of brick, as are the outer walls, but the wall between the halls is made of concrete. The production halls have ceiling lights and siporex roof tiles that rest on large concrete beams. The roofs in the three-storey section are made of concrete, walls appear to be in concrete or plastered brick.

Qualities

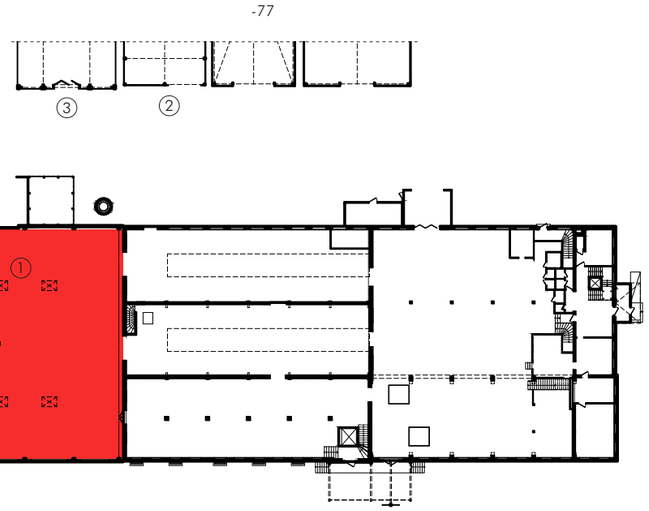
- Beautiful light transmission from the ceiling lights in the production halls
- Interesting industrial details, visually present concrete structure
- Possibly original industrial lattice windows in the outer production hall, newer windows in the three storey section (renovated in the early 90s?)
- Exposed brick facade in the middle hall.

Restraints

- The ceiling light in the southern hall is vandalized (image 1), the northern light is undamaged.
- Slightly claustrophobic third floor (image 5) but well lit.

Images 1-5 by Calle Bergendorff

1. Addition from 1980; metal trusses, concrete floor and walls clad in corrugated metal.



1980'S ADDITION & STORAGE HALLS

The extension from 1987 has a construction that differs from the previous sections - a metal truss structure and cladding of corrugated metal in the interior and exterior. The thinner walls are supported by steel columns and are insulated with mineral wool and plaster - the space was only heated to 10-18 degrees during use. The storage halls are of various ages, the oldest from 1975, the newer ones from 1997 and are, except for one that is covered in plastic, clad in corrugated metal.

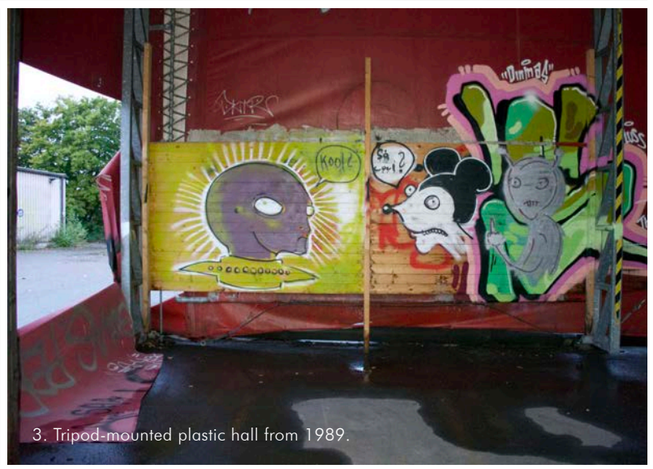
Qualities

- Consists of few materials that appear to be easily deconstructed and reused.
- Beautifully patinated sheet metal in the 1975's storage hall.

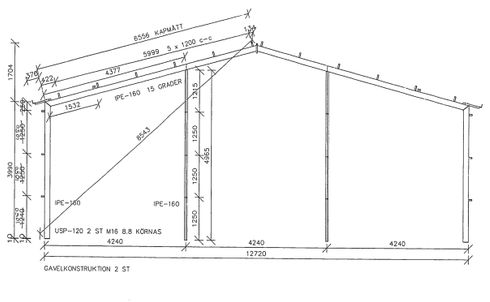
Restraints

- The extension from 1987 is a large, dark space that does not express the same charm as the older sections. This may be due to the fact that it is perceived as more monotonous compared with the variated experience of walking through the other buildings. It is a cheaper and more short-lived mass production construction that does not express the same level of craftsmanship as the brick-clad buildings.

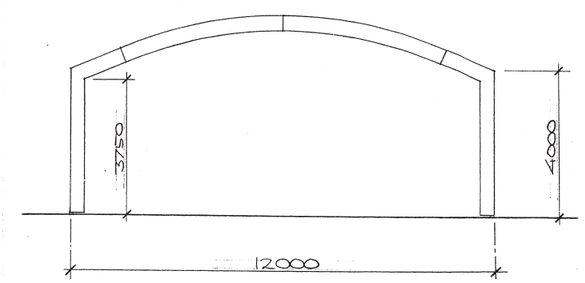
2. Storage hall from 1975, metal construction and steel cladding.



3. Tripod-mounted plastic hall from 1989.



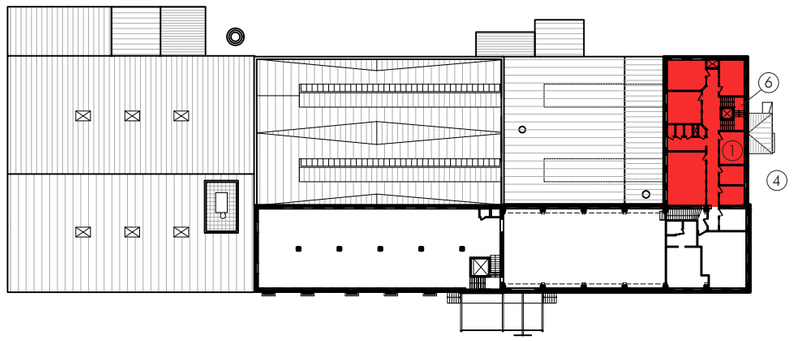
Construction drawing of storage halls from 1997.



Section of plastic hall (image 3). Drawings from Lund kommun's archive.

Images 1-3 by Calle Bergendorff

1. Office room on the second floor 1998 addition. Roof, doors, window and installations appear to be in a good condition.



1998'S REFURBISHMENT

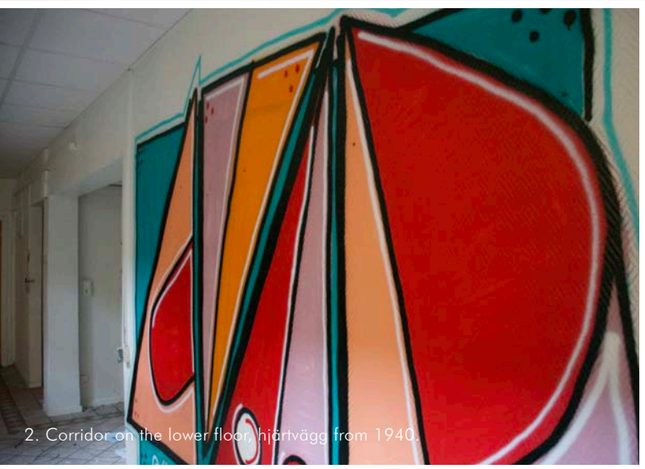
In 1998, a second floor was added on top of the existing office section from 1940, in a lighter construction, possibly wood (no construction information found). An elevator and stairs were installed between the floors. During the same period, or a few years earlier, the floor plan for the lunch room above the machine hall was updated and two office rooms were added below it. The façade was clad like the rest in corrugated metal.

Qualities

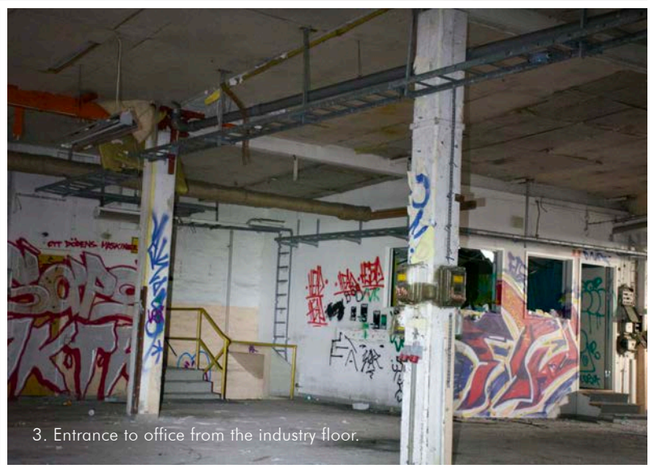
- Ceilings seem to be well preserved, and possible to access installations behind.
- Relatively new doors and windows, bathrooms, radiators.
- Functional room sizes; mix of large & small rooms.

Restraints

- Vandalized; many of the inner glass sections and outer windows are broken.
- Cold, hard floor material - murky brown tiles.
- Facade sheet metal has been removed on some parts of the facade, leaving the layer below exposed.



2. Corridor on the lower floor, hjärtvägg from 1940.



3. Entrance to office from the industry floor.

4. The 1998s addition, visible behind the steel facade.

5. Elevator.

6. Staircase from 1998.

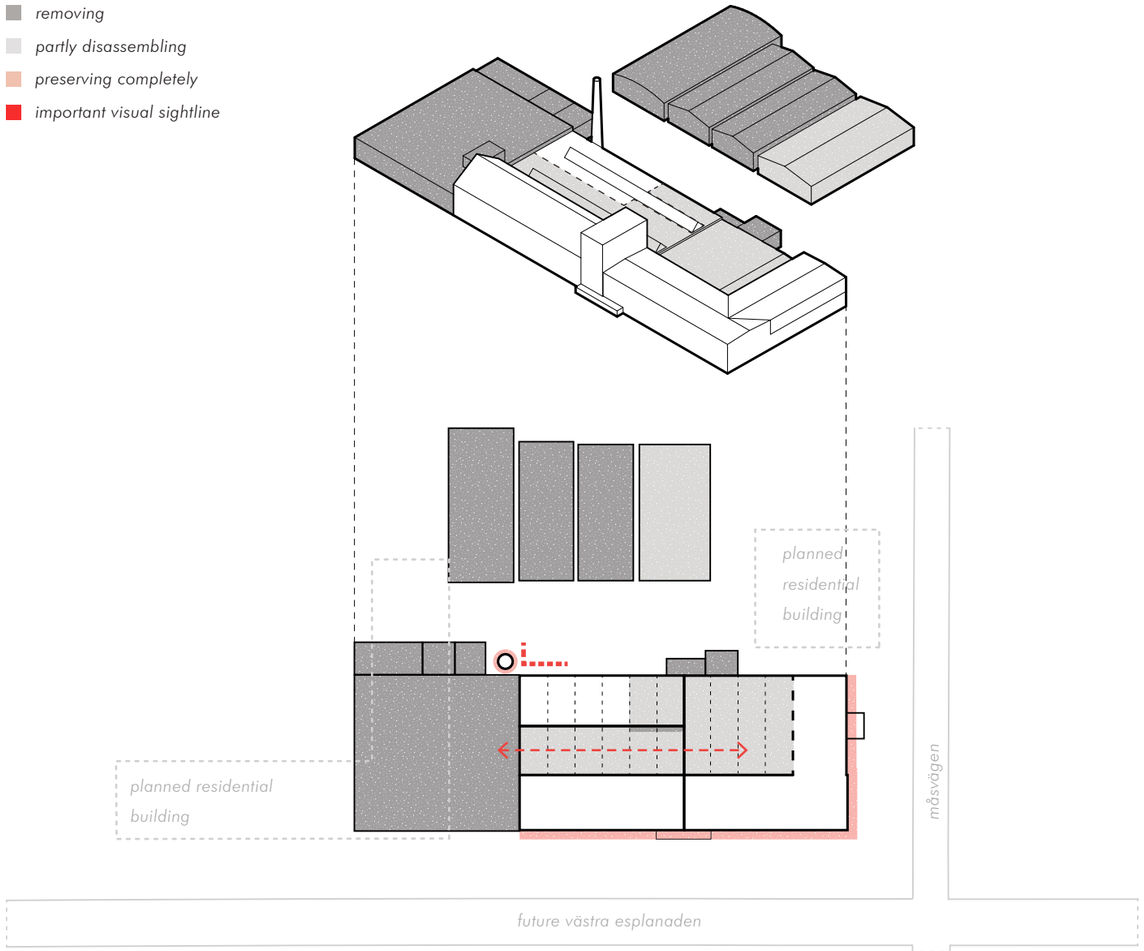
Images 1-6 by Calle Bergendorff

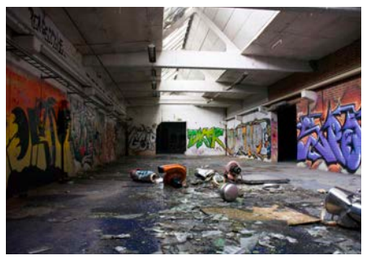
Disassembling truss structure from 1987.

Preserving the chimney & northern facade.

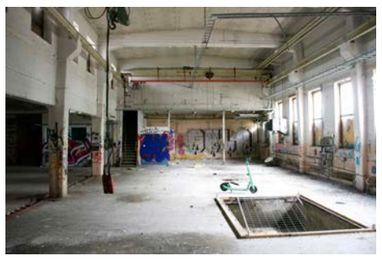
Disassembling the roof in the dark hall.

- *removing*
- *partly disassembling*
- *preserving completely*
- *important visual sightline*

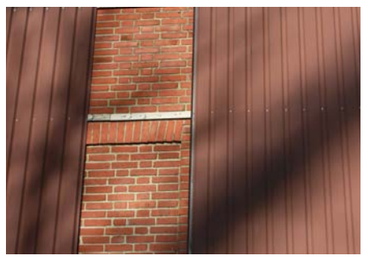




Removing the roof but preserving structure.



Preserving the open quality of the large hall.



Disassembling the corrugated metal cladding.

PRESERVATION ANALYSIS

These are elements I have identified as interesting to preserve, alter or disassemble during a transformation of the CEPA-building.

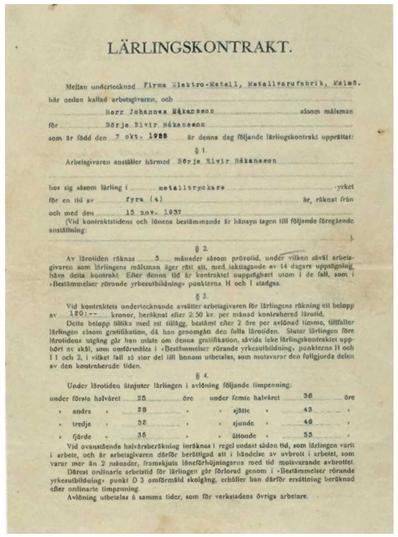
Interesting to keep and/or reinforce

- Brick facade & chimney.
- The open character of the large workshop hall.
- The clear structural system from the 1950s & 40s, e.g. pillars, metal beams, the heavily dimensioned concrete roof beams carrying the ceiling lights.

Interesting to disassemble & reuse

- Disassemble & reuse the sheet metal facade.
- Dismantle & reuse workshop hall from 1987.
- Remove roof of the dark, low hall from 1940 and the middle assembly hall to create a passage between the building bodies, a play with inside/outside. Possibly remove damaged ceiling light.

As both concrete and brick are very durable materials with a long service life, I would avoid tearing down larger parts of the older construction. When I suggest that the roof be removed on certain parts, measures would need to be examined to protect the exposed structure so as not to drastically shorten its lifespan.



LÄRLINGSKONTRAKT.

Mellan undertecknad Firma Elektro-Metall, Metallvarufabrik, Malmö, här nedan kallad arbetsgivaren, och

Herr Johannes Håkansson såsom målsman för Börje Elvir Håkansson som är född den 7 okt. 1988 är denna dag följande lärlingskontrakt upprättat:

§ 1

Arbetsgivaren anställer härmed Börje Elvir Håkansson hos sig såsom lärling i metallsvetsare -yrket för en tid av fyra (4) år, räknat från och med den 15 nov. 1937

(Vid kontraktstidens och lönens bestämmande är hänsyn tagen till följande föreskrifter angående anställning:

§ 2.

Av lärotiden räknas 3 månader såsom prövotid, under vilken såväl arbetsgivaren som lärlingens målsman äger rätt att, med iakttagande av 14 dagars uppsägning, häva detta kontrakt. Efter denna tid är kontraktet oupplösligt utom i de fall, som i »Bestämmelser rörande yrkesutbildning» punkterna H och I stadgas.

§ 3.

Vid kontraktets undertecknande avsätter arbetsgivaren för lärlingens räkning ett belopp av 150:-:- kronor, beräknat efter 2.50 kr. per månad kontinuerligt löneuttag. Detta belopp tillväxer med ett tillägg, bestämt efter 2 öre per avlönad timme, tillfaller lärlingen såsom gratifikation, då han genomgått den fulla lärotiden. Slutar lärlingen före lärotidens utgång går han miste om denna gratifikation, såvida icke lärlingskontraktet upphört av skäl, som omförmälas i »Bestämmelser rörande yrkesutbildning, punkterna H och I 1 och 2, i vilket fall så stor del till honom utbetalas, som motsvarar den fullgjorda delen av den kontinuerliga tiden.

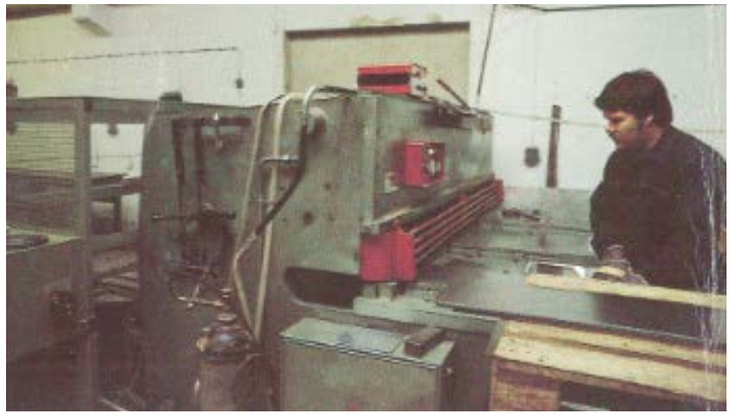
§ 4.

Under lärotiden åtnjuter lärlingen i avlöning följande timpenning:

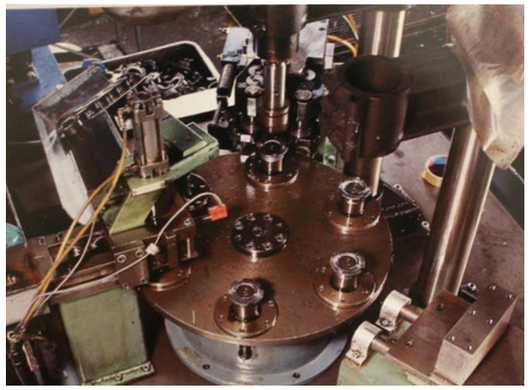
under första halvåret	25 öre		under femte halvåret	38 öre	
» andra »	29 »		» sjätte »	43 »	
» tredje »	32 »		» sjunde »	48 »	
» fjärde »	35 »		» åttonde »	53 »	

Vid ovanstående halvårsberäkning inräknas i regel endast sådan tid, som lärlingen varit i arbete, och är arbetsgivaren därför berättigad att i händelse av avbrott i arbetet, som varar mer än 2 månader, framskjuta löneförhöjningarna med tid motsvarande avbrottet. Därest ordinarie arbetstid för lärlingen går förlorad genom i »Bestämmelser rörande yrkesutbildning» punkt D 3 omförmäld skolgång, erhåller han därför ersättning beräknad efter ordinarie timpenning.

Avlöning utbetalas å samma tider, som för verkstadens övriga arbetare.



Photos from CEPA & Lund kommun. (Top left) Börje's (founder of CEPA) apprentice contract, 1937. (Bottom right) Employees in CEPA's lunchroom, 2008.



Youth craftmanship. Photo by American Welding Society (2016)

Kødbyen, Copenhagen. Photo (top) Martin Heiberg, (bottom) by Edophoto (n.d.)

Repair and craftmanship. Photo from Home furniture DIY (n.d.)

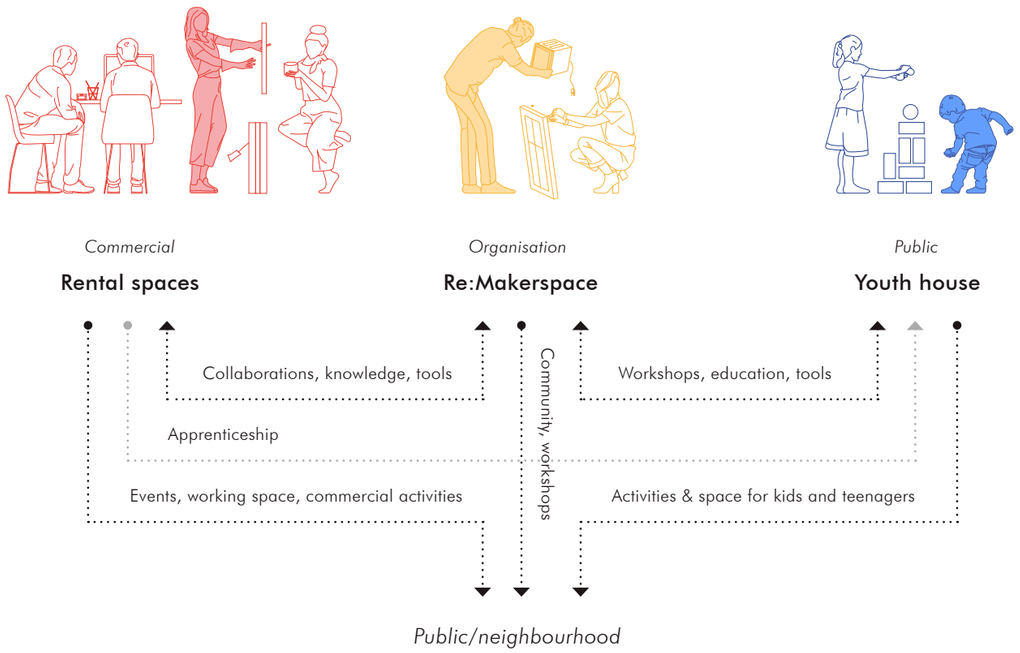
PROGRAM: BACKGROUND

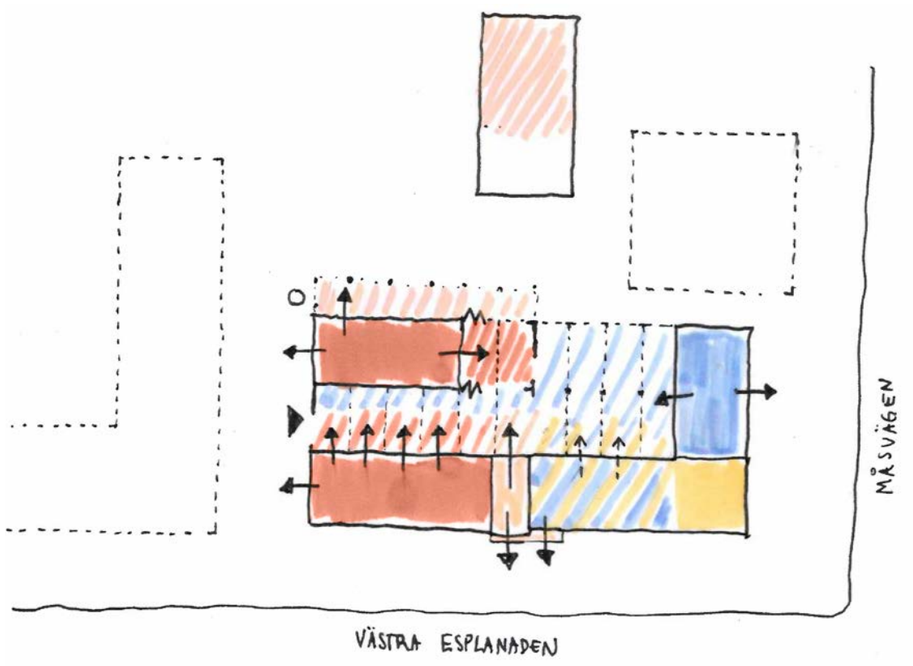
The program of the CEPA-building has during all its active years revolved around metal production; producing products such as cogwheels, engine replacement parts and intricate objects like the Royal Livgardet's helmets.

When I met up with the current CEO of CEPA Lars-Göran Håkansson, who was in his twenties when he helped his father find a "*real industrial building - with a chimney*", I was told the story of his father's journey from apprenticeship, to starting up a metal works company in a 14 m^2 basement and finally purchasing the CEPA-building in 1983.

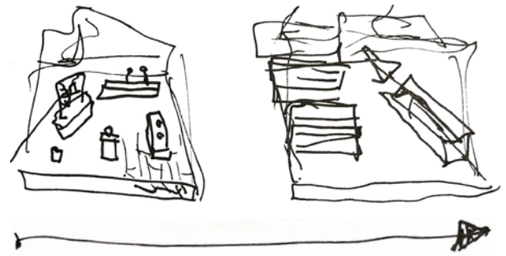
As the former industrial area undergoes its drastic change the CEPA-building has a potential to preserve parts of its social history: the basement-startup and production entrepreneurship, the craftsmanship - to learn and work by hand and an understanding of materials that is passed on between people rather than behind the school bench.

Lund municipality has expressed an interest in housing a '*kultur och fritidsverksamhet*' for youth in a part of the CEPA building, which could pose an opportunity to also embrace these themes in the children's activities. An inspiration for the program has been *Kødbyen* in Copenhagen that are trying to preserve its meat production history by actively facilitating corporate tenants within the field. Also programs such as the *Repair cafe* (see chapter Reuse) and *STPLN (Stapelbädden) makerspace* in Malmö that revolve around craftsmanship and material knowledge. Housing public and semi public activities in the building and its surroundings could strengthen the area's new identity and culture, with a possibility to connect to the area during its early development.





Sketch: programmatic distribution.



Commercial and rental space flexible for change

PROGRAM

The program is a mix of public, semi-public and commercial activities. Lund municipality would own the building and run the public youth house, renting out space to the makerspace organisation with a reduced rent in return for activities open for the public and leasing commercial & coworking spaces to generate an income from the building.

Youth house for kids and teenagers

Daytime activities & workshops.
Open day time/afternoons 10-18:00 + weekends with Re:maker.

- Crafts and creation related to the industrial history and reuse (material knowledge)
- Socializing / children & youth activities
- Outdoor space connected to park
- Placemaking. *E.g building outdoor furniture or spaces at site with reused materials.*

Re:makerspace

Makerspace with membership and open evenings/ workshops. Evening time 18-21:00 + weekends.

- Workshop space, machinery & courses
- Focus on reparation, upcycling & reuse
- Craftsmanship, prototyping & test-production

Commercial/rental spaces

Flexible space for renting out to coworking/small scale businesses + a rental event space.

- Promote activities that relate to the history of the area. *E.g small-scale manufacturing, repair, start-ups.*
- Flexible program: open for change as the area develops. *E.g first phase: introverted or noisy activities, second phase: extroverted commercial activities and coworking spaces.*

— 05. Resources

MAPPING MATERIALS

Since the CEPA building is located in an area where many industrial buildings are expected to be demolished, it will result in a specific type of material database with large amounts of metal materials and industrial components. In a way, reuse can be seen as a new version of building with 'local materials' - where each project becomes a result of the available materials at the specific location and time.

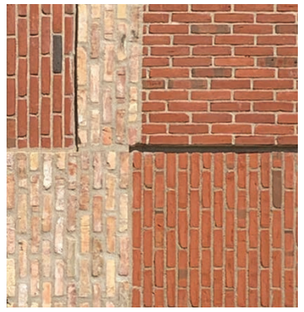
This chapter goes through some of the common building materials and components found in Sweden, and the potential they could hold of being reused. It also demonstrates how I mapped materials in this project, based on availability and distance from the site. Finally, I present a survey of some of the materials that are available and could potentially be reused in the existing CEPA building.

Cut concrete blocks (Nielsen, 2017)

Photo from Sustainable in steel (n.d.)

Photo by Joel Hügli

Oak timber. Photo from Genbyg (n.d.)



Brick sections. Photo by M. Strange

Facade of roof tiles (Nielsen, 2017)

POTENTIAL OF MATERIALS

In order to map and prescribe materials in a reusage project, one must first gain a basic understanding of our common construction materials and their potential for reuse. There are certain products and components that are simple to reuse today and others that are more complicated - identifying these can help set the level of complexity of the project, or indicate a need to explore new ways of reusing or handling the material.

Concrete

Concrete is responsible for a large portion of the industry's climate emissions, while having a potential for a long service life. It is most ideally reused in its entity, through renovation or building onto. It can also be cut into concrete blocks to use for different purposes, but in some tests it has not proven to be that economically or environmentally successful (Nielsen, 2017). A large part of demolition concrete is crushed and used as landfill or road base, but it can also be used in the production of new load-bearing concrete to replace virgin ballast of natural stone (Strand Nyhlin & Åfreds, 2022). As moving the heavy material requires many transports one should consider whether it is possible to reuse and process on site, but also weigh the transports' carbon dioxide emissions against the saving of virgin material.

Steel

Steel is recycled today by melting scrap pieces into new steel. It is relatively easy to reuse, thanks to the standardized dimensions of beams and profiles, and can be reused in load bearing constructions. As long as it doesn't rust it can have an almost eternal life. It is advantageous to use steel with a known history of age and the load it has been subjected to, e.g. by sourcing it directly from a building.

Sheet metal

Steel -, copper -, zinc - & aluminum plate [*swe: plåt*] is durable and fully reusable with a service life of up to 100 years. It is easy to reuse facade and roof sheet metal to other buildings as long as it is not damaged. It is easy to cut, customize and repaint. Tin sinks are also very suitable for reuse, being of higher quality than today's products and often found in standard sizes.

Wood

Wood has a long life span - there are wooden houses that have survived for hundreds of years - and as long as it is solid and healthy it can be reused just like new wood. Glulam, KL and solid wood structures that are mechanically assembled can be disassembled and assessed for reuse in a new construction. Wooden flooring (click model & solid parquet) can be disassembled, sanded and laid again. End-of-life wood products such as pallets or doors can be recycled as wood-based board materials.

Brick

Brick is another product that is easy to reuse and can save up to 96% of climate impact (Strand Nyhlin & Åfreds, 2022). Bricks assembled with lime mortar (used before the 50-60s) can easily be separated and cleaned, whilst contemporary concrete mortar is difficult to remove without damaging the brick - but there are new methods for dismantling these too. Another technique is to saw out the brick in larger sections. Roof tiles are another product that can be reused for facades.

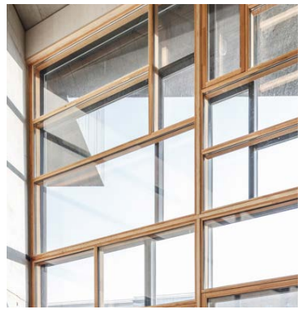


Photo by Rasmus Hjortshøj

Brick of window panes (Nielsen, 2017)

Reused rubber floor (Nielsen, 2017)

Toilets at Malmö Återbyggdepå

Upcycled cable trays (Nielsen, 2017)

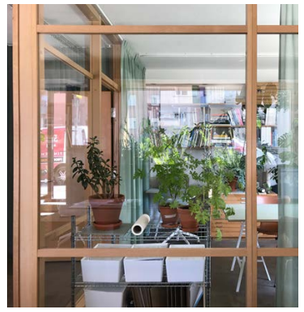


Photo by Theory Into Practice

Glass

The industry deposits approximately 30,000 tonnes of glass/year, according to Strand Nyhlin & Åfreds (2022) we could save at least half of it through reuse. Common glass products are windows, facade glass and interior glass sections. Windows are often replaced prematurely, but could be reused in other buildings or shearing layers. The main problem with reusing windows is meeting the energy performance standards of new constructions. The Lendager group passed the u-value requirements through adding a second layer of windows (see first image above). Another alternative is to place the windows with a lower performance in a building with a lower energy requirement, or using them in the interior.

Plastic floor

Reuse of plastic floors is possible, but with some caution of potential toxins in the plastic and its adhesive. It is easy if the floor is assembled in tiles, e.g. click laminate flooring. However, the floor is often glued in public environments and therefore difficult to reuse in its entirety - but there are examples of upcycled products made of plastic floor granules.

Plaster

Can be disassembled in its entirety during demolition and reused. There are examples of 'new' plaster made from 100% reused leftover plaster collected from construction sites. One challenge of reusing plaster is that it is often varnished.

Rock wool

Can be fully reused, an example is the companies Rockwool and Ragn-Sells who collect used rock wool and remelts it into new products

Glass wool

We do not have a functional national system for recycling glass wool in Sweden, but it can be reused as long as it is dry and packaged.

Installations

Installation contains a lot of steel with a high climate impact. In the book *Återbruk av byggmaterial* (Strand Nyhlin & Åfreds, 2022) Bengt Dahlgren lists pro-ducts that are well suited for reuse: ventilation channels of metal, cable trays, toilets, basins, radiators and parts of components, e.g. appliance cabinets being filled with new installations. One should consider the lifetime of the reused in relation to modern more efficient installations.

Interior products

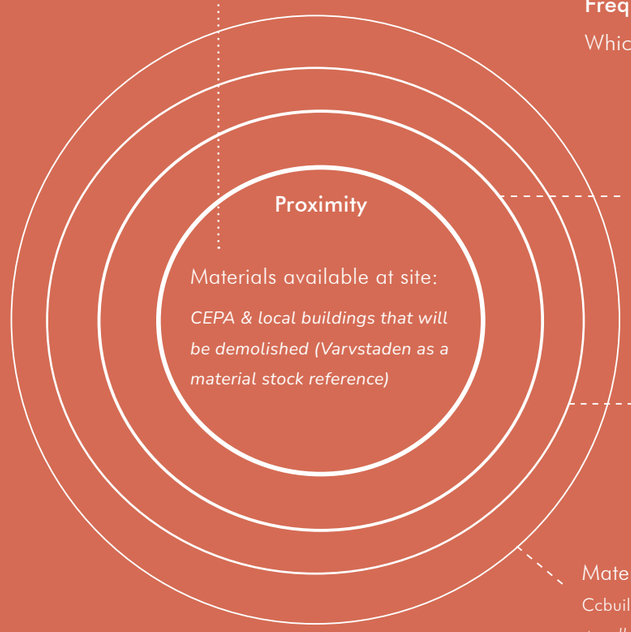
Reuse of office furniture and fixtures is becoming more frequent. Common products being reused are doors, glass partitions, windows, partition walls, suspended roof components, flooring, railings, stairs and fittings.

The most common components being reused in Sweden today are fixed interior products, facade cladding, brick, roofing sheets, wood products, concrete, ground materials and certain installations (Strand Nyhlin & Åfreds, 2022).

Sources:
Återbruk av byggmaterial by Strand Nyhlin & Åfreds (2022)
Rebeauty – Nordic Built Component Reuse by Manelius (ed) & Nielsen (2017)
Solution: circular buildings by Lendager & Pedersen (2020)

List resources at site

Identify layers that can be preserved or reused (e.g structure, stairwells, corrugated metal)



Frequency/quantities

Which materials are more common?

New materials

When reused materials are not available or can perform the function, applied where it can strenghten the possibility to reuse materials. E.g the framework for reused components.

Potential: Research of materials with a high potential & quality of reuse. ⟷ **Properties:** Design - what properties and functions are required from the material?

MATERIAL MAPPING

This is a summary of how I mapped the materials implemented (and not) in the project. The process was by no means linear, as I in order to design had to understand the available supply - but to research relevant material needed to know their future function.

External material sources:

Regional / *Malmö Återbyggdepå*, which is run by Sysav and the City of Malmö, sells and receives used construction materials in a warehouse open for private and company customers.

Denmark / *Genbyg* is Denmark's largest construction market with used materials, located in Amager. All products are photographed and listed in their online shop. They have an in house design studio and carpentry workshop where they produce design concepts and products with reused materials.

National / *CCbuild* (centrum för cirkulärt byggande) is a circular network that among other services runs an online marketplace for reusable and circular building products.

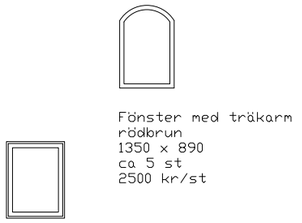
Mapping

1/ Listing available materials at site

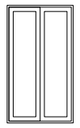
2/ Surveying *Varvstaden's* public online database of reusable materials in buildings that will be demolished in the area as a reference of the type of materials derived from an industrial area.

3/ Visiting *Malmö återbyggdepå* and photo documenting products and their measurements, interviewing staff, CAD-registering readily available as well as 'particular' pieces.

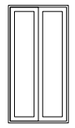
4/ Registering potential products, their quantity and measurements from *Genbyg's* online shop.



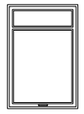
Fönster med träkarm
rödbrun
1350 x 890
ca 5 st
2500 kr/st



Fönster med träkarm
rödbrun
1920 x 1080
Ca 10 st
1200 kr/st

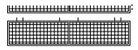


Fönster med träkar
rödbrun
1920 x 980
Ca 5 st
1200 kr/st



Fönster med träkar
blå, öppnas fr undersida
1700 x 1150
Ca 5 st
1000 kr/st

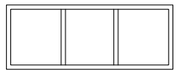
* Fönster med träkarm
1250 x 950
dubbelglas, vit, persienner
Stor mängd från
fönsterrenovering (120> st)
500 kr/st h o v hängda



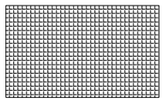
Metallgaller (hatthyllor?)
grått
2000 x 400 ca 55 st
2000 x 250 ca 5 st
Nya

E130 Brandklassade fönster
vit ram, trä
1100 x 1100
Ca 3 st
300 kr/st

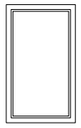
Interiört fönst
ljus träram, dj
1545 x 570 mm
1 st
500 kr/st



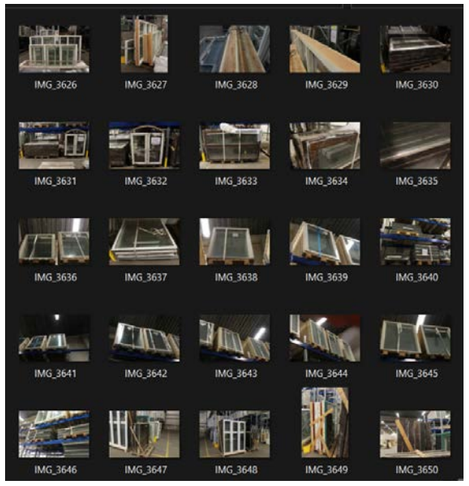
Fönster m träram
vit
2720 x 1050 mm
2 st

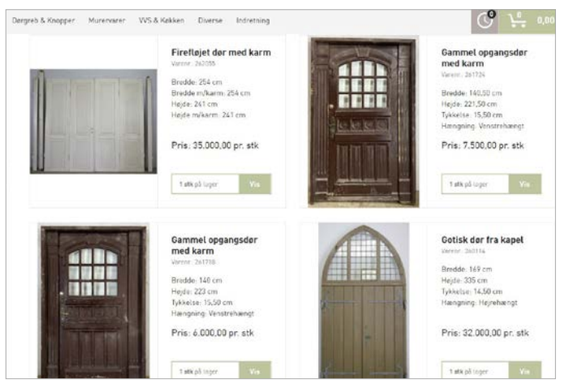


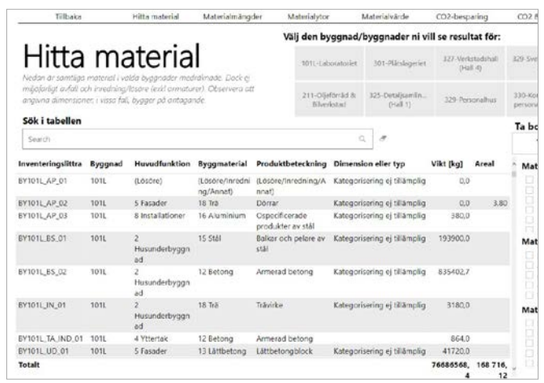
Halkmönstrad aluminiumplåtar
diverse storlekar?
minst 2 st på MÄD



Fönster med alu.ram
"Guld"/ockrafärg, persienn
1130 x 1930
Ca 10 st
2500 kr/st
Nya, hög energiklass?







Function and material

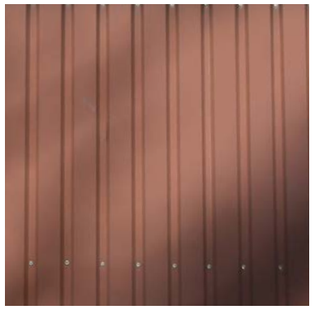
Researching materials with a high potential and quality of reuse. Listing the new design elements, their desired function and what material qualities they need. Matching them with materials, noting if you need to take size variation/availability etc in consideration, which in the end impacts the design and its composition.

Photos to the left (top to bottom)
1. Some of my CAD registered products from Malmö återbyggdepå.
2. Listing of Malmö återbyggdepå's common products
3. Product documentation through photographs
4. Products in the 'exclusive doors' category on Genbyg's website
5. Varvstaden's rather abstract Material database

The material

These were some of the aspects I had to take into consideration as I was looking at potential materials to reuse:

- ⟶ *What is its original function and lifetime-layer category?*
- ⟶ *Can it be reused in its original function or with minimal alteration?*
- ⟶ *Does it require design additions (e.g. needing to add a second layer of used windows to reach an acceptable energy standard)?*
- ⟶ *New function in another lifetime-layer category - upcycling/downcycling.*



1. Corrugated sheet metal

Large quantities of corrugated sheet metal from the building and storage hall's facades. Approx 2000 m² from 1987-98. 279 m² from 1975 in poor/ patined condition.

2. Siporex roof slabs

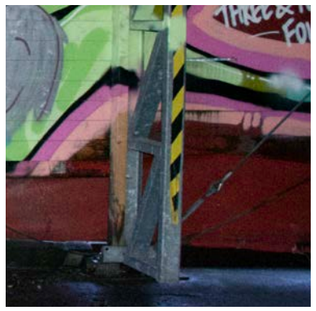
Reinforced lightweight concrete from the 1940s & 50s presumedly produced in Dalby. Composed of finely ground sand and cement with a life span of 40-70 years due to its porosity. Unlike so called 'blåbetong' Siporex does not emit radon.

3. Concrete

Concrete foundation of the 1987's addition as well as removed concrete flooring.

4. Ventilation ducts

Exterior ventilation ducts of varied dimension, ages and conditions, material: hot-dip galvanized sheet steel



5. Metal beams

Metal structure components from storage halls. Trusses from 1989 (photo), no information. Metal beams of varied dimensions from 1997, e.g. IPE-180 in spans of 5 & 4 m, IPE-160 in 4,5 m.

6. Metal trusses

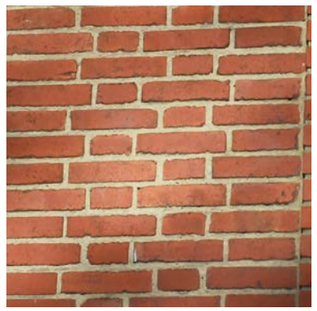
Metal trusses from 1987, 4 pcs á 2 x 14m, 2 x 13 m. Surface treatment: blasting, zinc phosphate alkyd, alkyd lacquer

7. Windows

8 x windows in the 1987s addition, metal profile. H= 1060 mm L= 4400 mm (6 pcs) & 3500 (2 psc)

8. Interior components

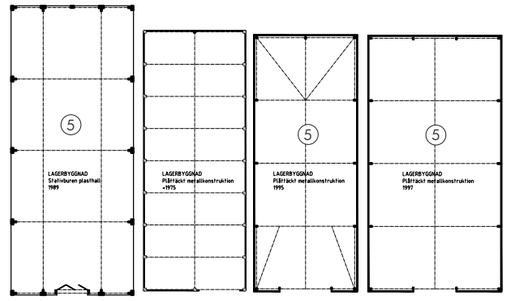
Interior products such as doors, toilet porcelain (minimum 5 pcs sinks and toilets), windows.

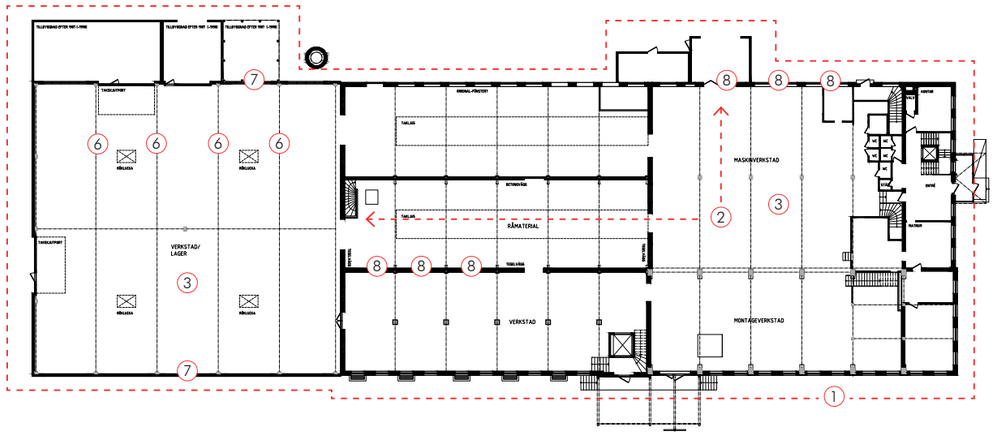


9. Bricks

A small quantity of bricks from 1940 & 50 where walls will be opened up, most likely attached with lime mortar.

RESOURCES AT SITE





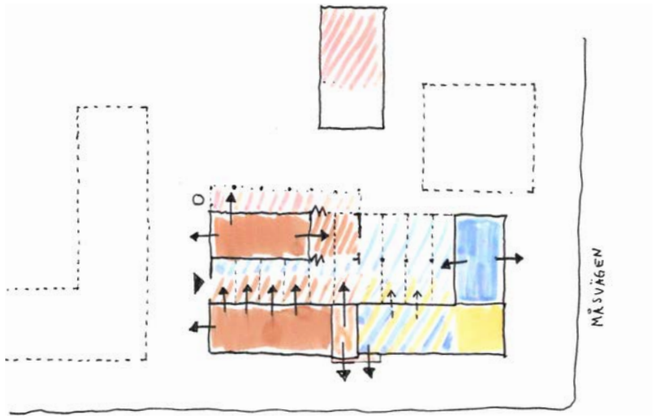
Images 2-8 by Calle Bergendorff

— 06. Design

EXPLORATIONS

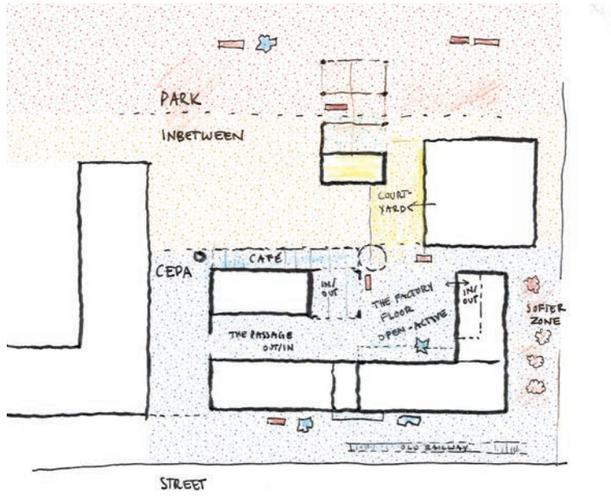
A very important part of the project has been to actually test material reuse in design. Partly through looking at the building as a whole - what would a reuse of the existing building and structure look like, what does the programs require from it and what kind of spaces can be created? But also by zooming in on specific layers of the building, such as how the existing corrugated metal sheets could be reused for a new facade.

In many of my tests I have tried to show different techniques of reusage (design for disassembly, flexibility, storytelling) but also different kinds of expressions. This is to show that reuse does not necessarily have to result in a specific kind of aesthetic. I have deliberately focused on carrying out several different tests and reflecting upon them instead of perfecting one design, so they should be seen as just that - experiments, that can be taken further and improved.



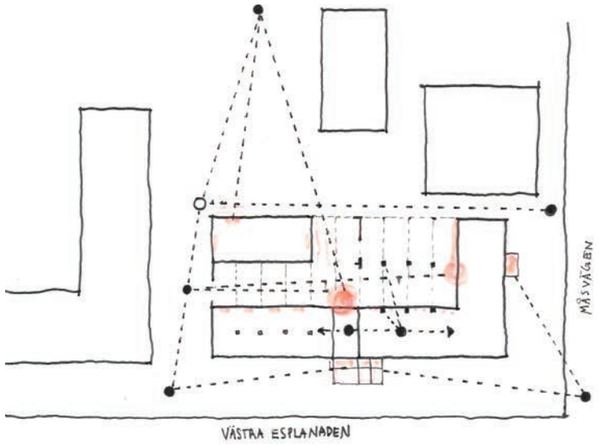
- *youth center*
- *re:maker space*
- *coworking/commercial*
- *entrances/extroversion*
- *shared/public*

Program



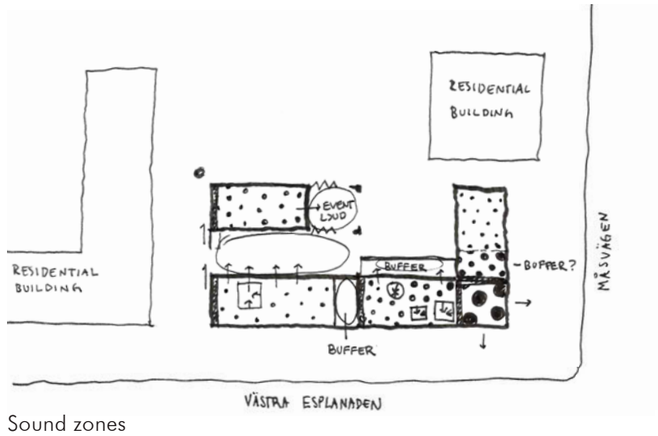
- *parkland*
- *inbetween zone*
- *industrial/cepa*
- *industrial elements*
- *park elements*

Outdoor zones



- *entrances*
- *sightline*
- *point of view*

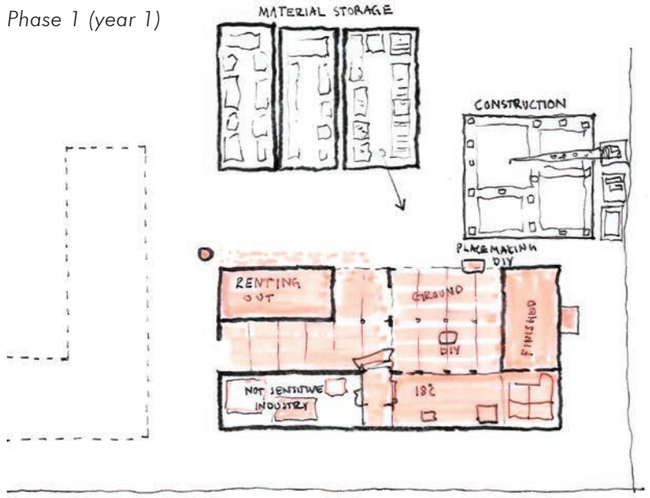
Important sight lines



- *loud zone*
- *medium noisy zone*
- *low noise zone*
- *buffer zone*

Sound zones

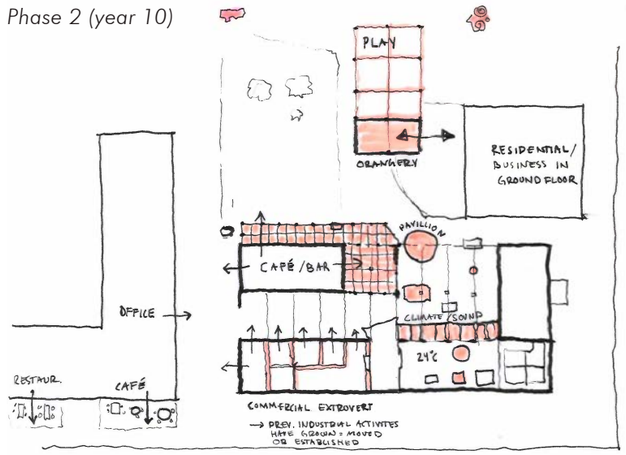
Phase 1 (year 1)



- *transformed/constructed*

Transforming the existing building. Focus on the youth part & event space to build a connection to the place and bring in revenue. Introverted activities (production, prototyping) in the commercial facilities.

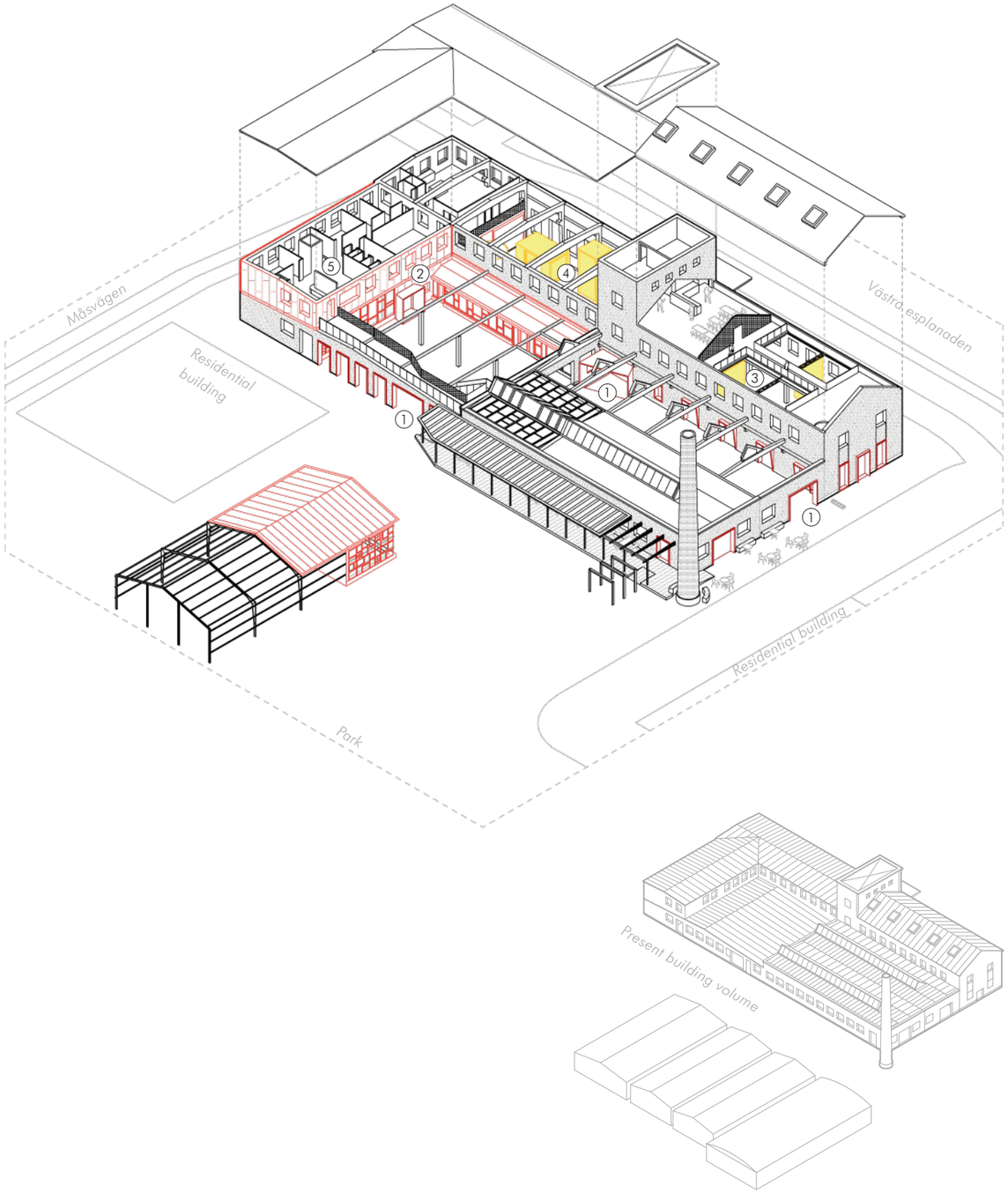
Phase 2 (year 10)

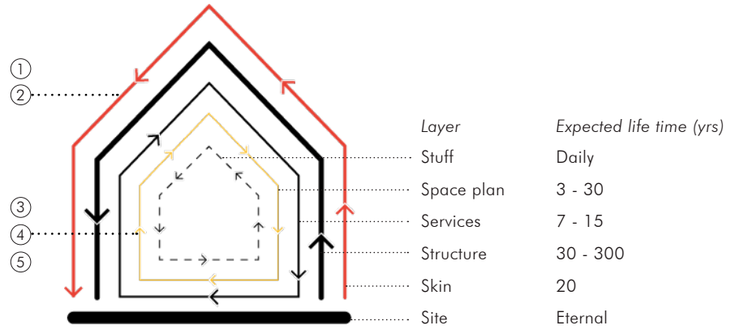


Adding built elements that could be participatory built over time. Eg. the orangery by the machine hall, could be built with involvment of youth/makers. Benifical for re-use: time to collect and alter producs

IMPORTANT: Saving material from the first phase, stored in organised manner.

Construction/additions over phases





DESIGN STRATEGY

Fundamental principle: Implementing material life prolonging techniques such as dfd, spatial flexibility and upcycling.

1 / Entrance & portals

Showcasing where walls have been opened up & the entry into a new space

- Clear & inviting entrances, penetrating into the existing building.

2 / Courtyard facades

- Reused metal facade with an industrial appearance.
- Transparent orangeries with reused windows showing where the space was once open/ visually connected.

3 / Interior flexible structure

Spatial division, acoustic border, storage/exhibit

- A flexible and intuitive modular system, to encourage continued use and adaptation.
- Explore an interior structure with design for disassembly principles.
- Possibility to personalize, dress up & down as an office/commercial tenant.

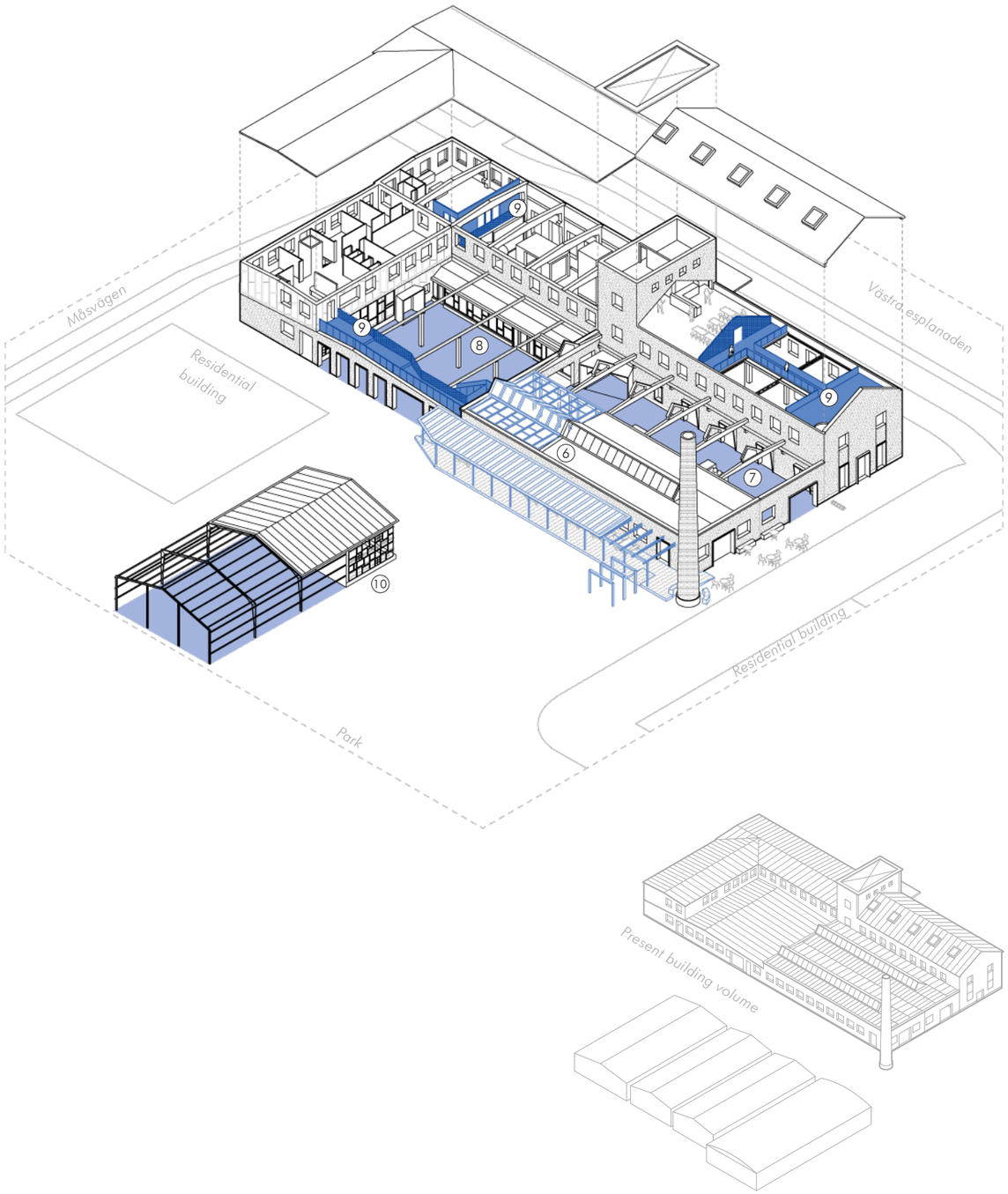
4 / Machine hall

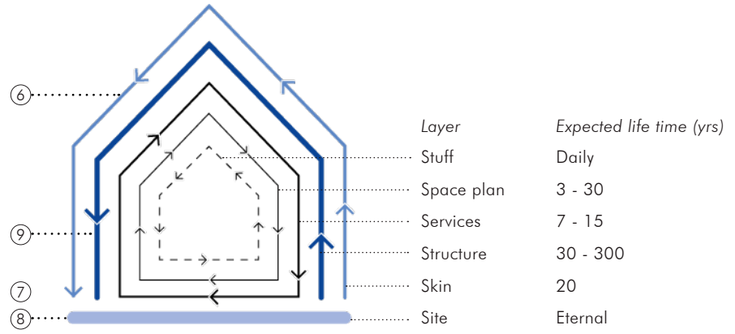
Volumes as 'space machines'

- Tool storage, work spaces/labs
- Open work spaces
- Social zones
- Exhibition of reuse & re:maker materials.

5 / Interior of Youth house

Former office space, renovated in 1998. Smaller changes, making it more child accommodated by adding softer surfaces, social corners and playful elements.





DESIGN STRATEGY

A play with the inside-outside relations by opening up and covering spaces within the structure.

6 / Event space & terrace

Flexible space for events & commercial activity

- Possibility to prepare food (café, bar, events)
- Connection to basement and recycling room
- Covered outside space, possibility to close off.
- Public terrace towards park

7 / The Passage

Colorful inviting outdoor space

- Connecting to commercial facilities.
- Area for teenagers to hang out.
- Exhibition wall.

8 / The Courtyard

Open unprogrammed outdoor space

- Play with indide/outside relation

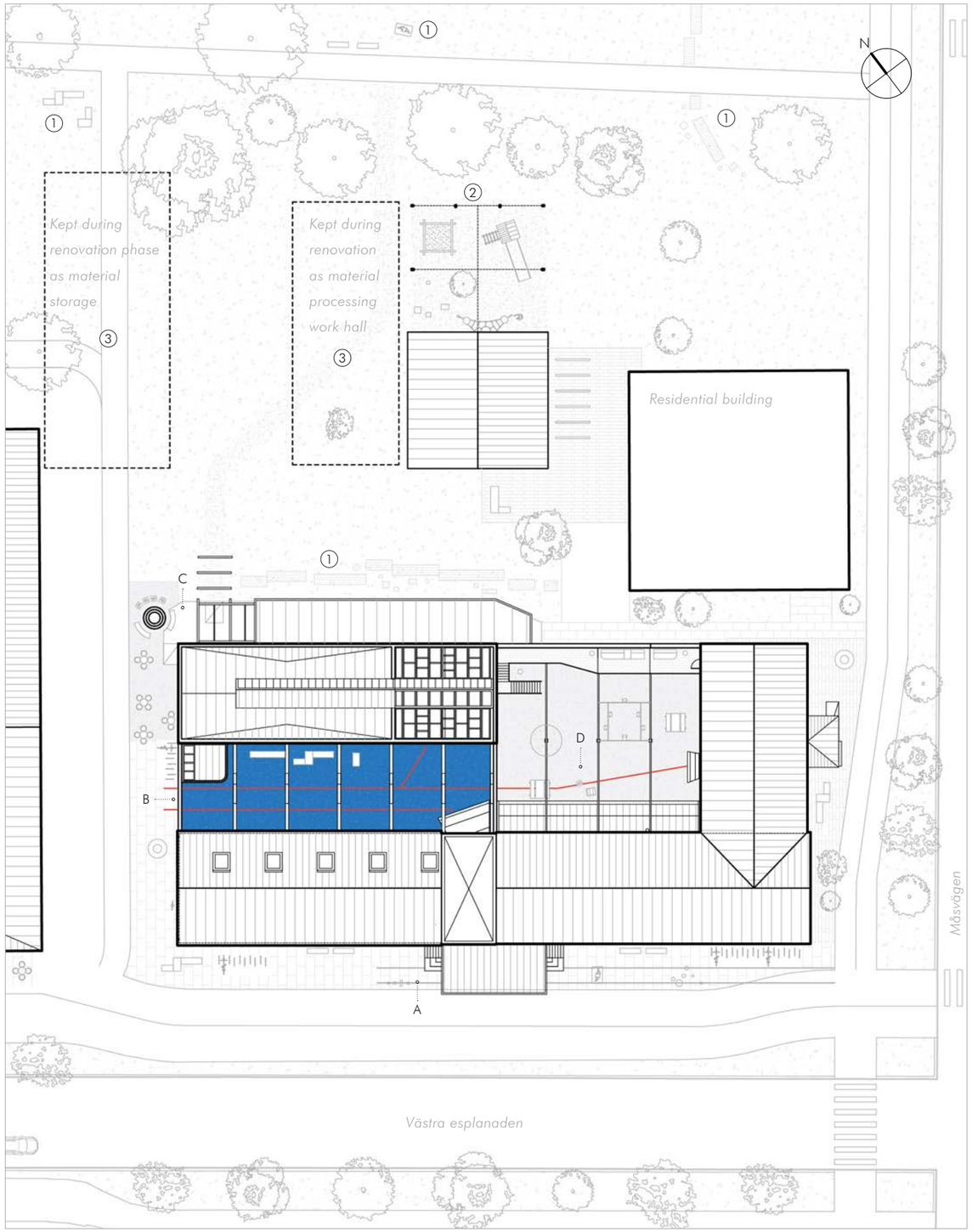
- DIY zones for participatory design with reused materials

9/ Viewing platforms

Parasitical platforms for an enhanced experience and overview of the building's different spaces.

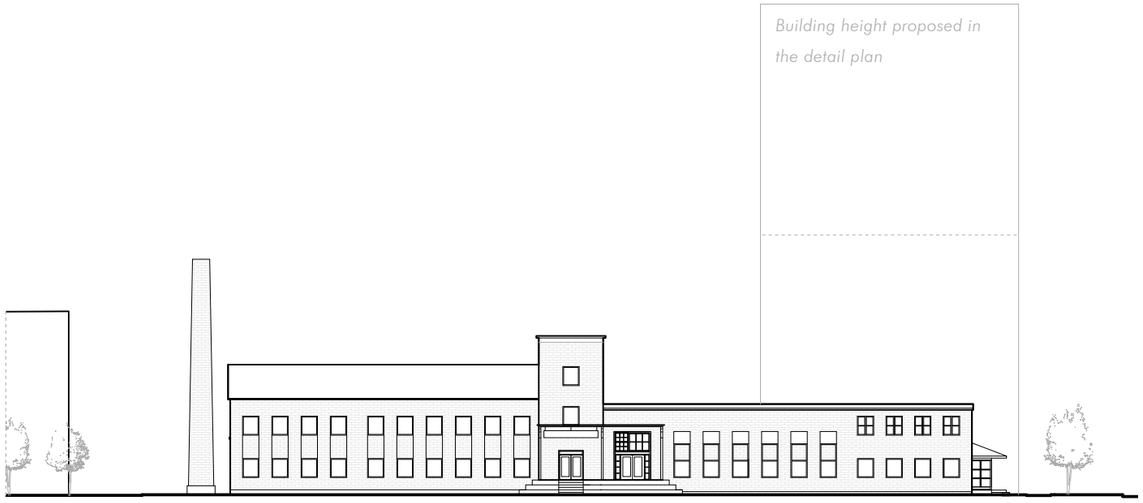
10 / The Storage hall

- Used for material storage during the main construction phase.
- One part turned into a neighbourhood orangery felleshus.
- The rest used as a playground, park hangout, BBQ & meeting space.



SITEPLAN

1. Industrial park elements
2. Playground
3. Existing storage halls



Context elevation

Scale 1:500

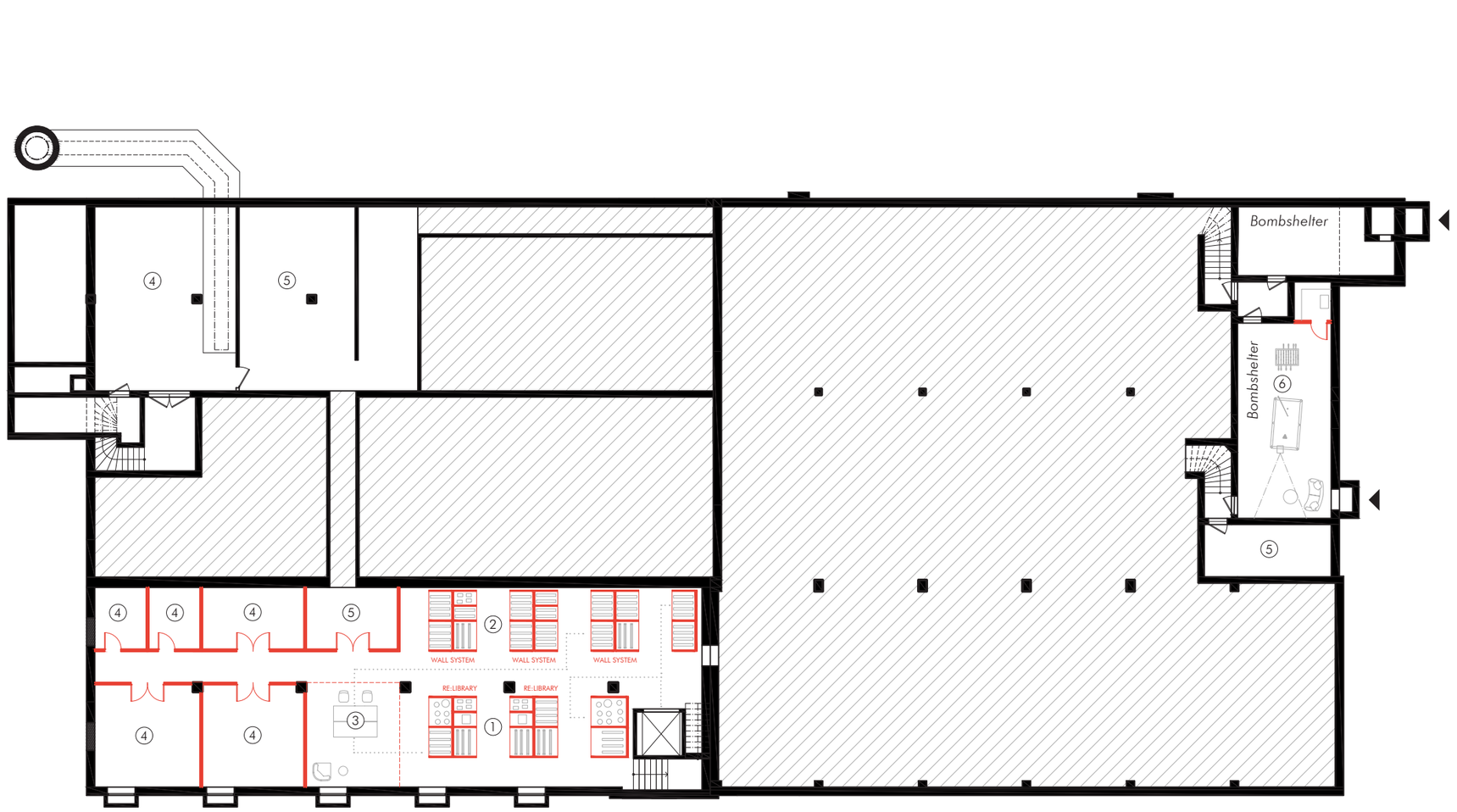
0 5 10 20m

A. Storytelling of Bjärredsbanan.

B. Information system & drainage

C. Storytelling of CEPA's past.

D. Reused wood flooring.

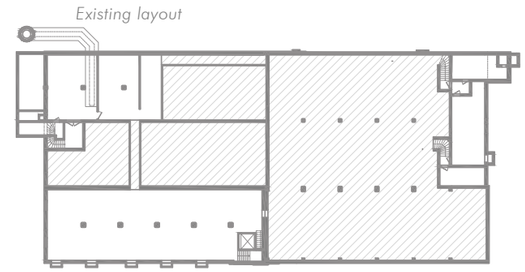


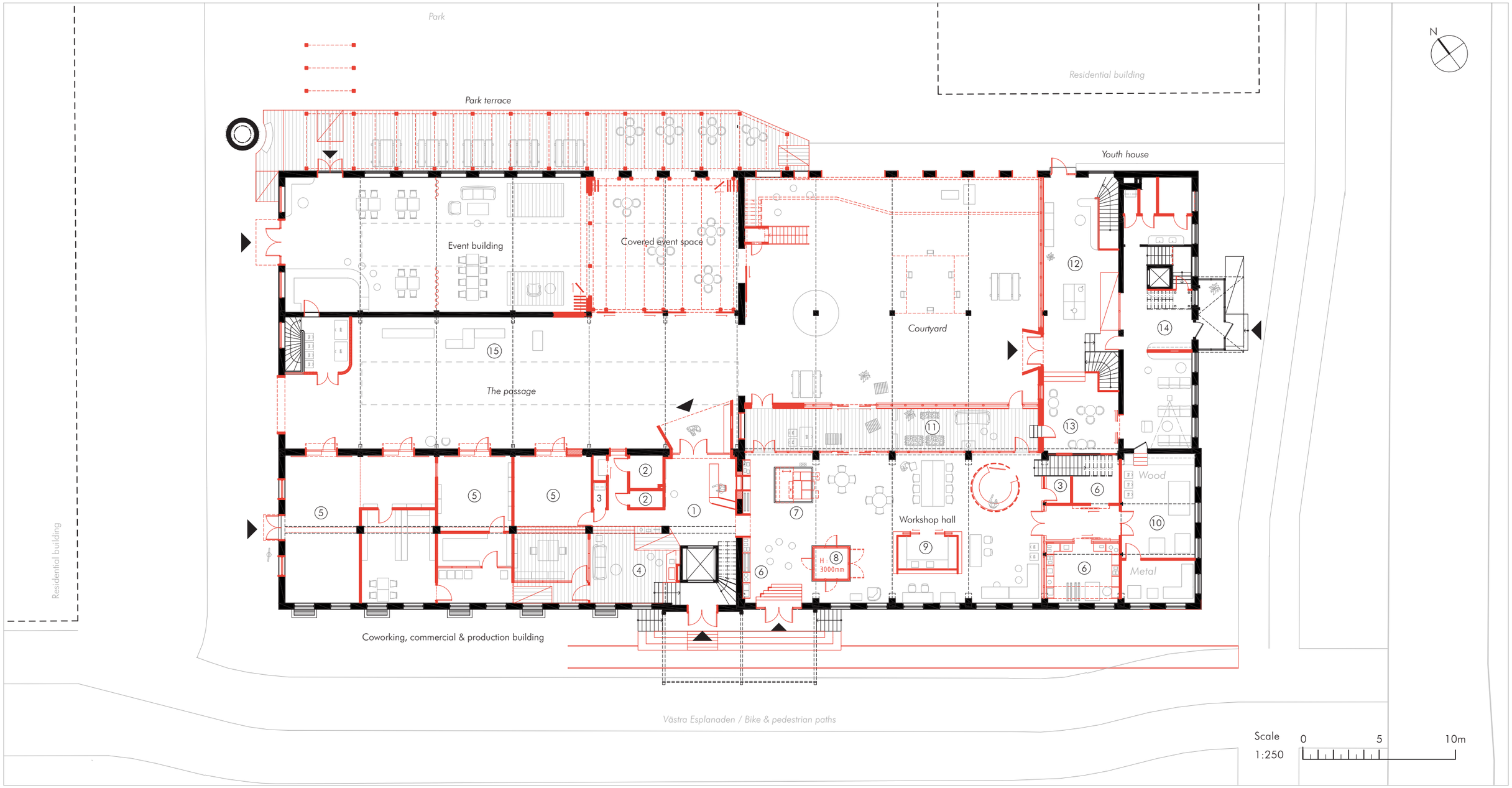
Scale 1:250 0 5 10m

BASEMENT

1. Library and storage of reuse materials
2. Catalogue of flexible wall system components
3. Assembly & adjustment area
4. Storage rooms for office and commercial tenants
5. Technical room
6. Youth center game room

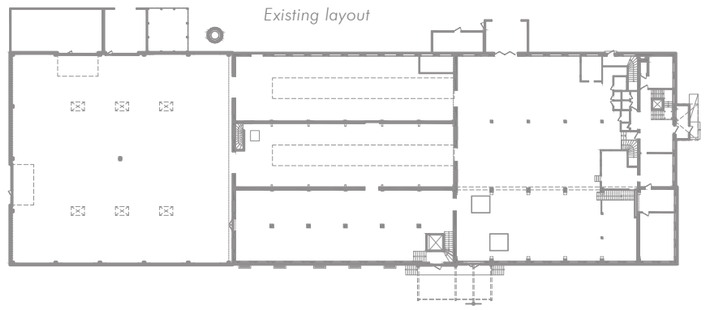
Existing layout



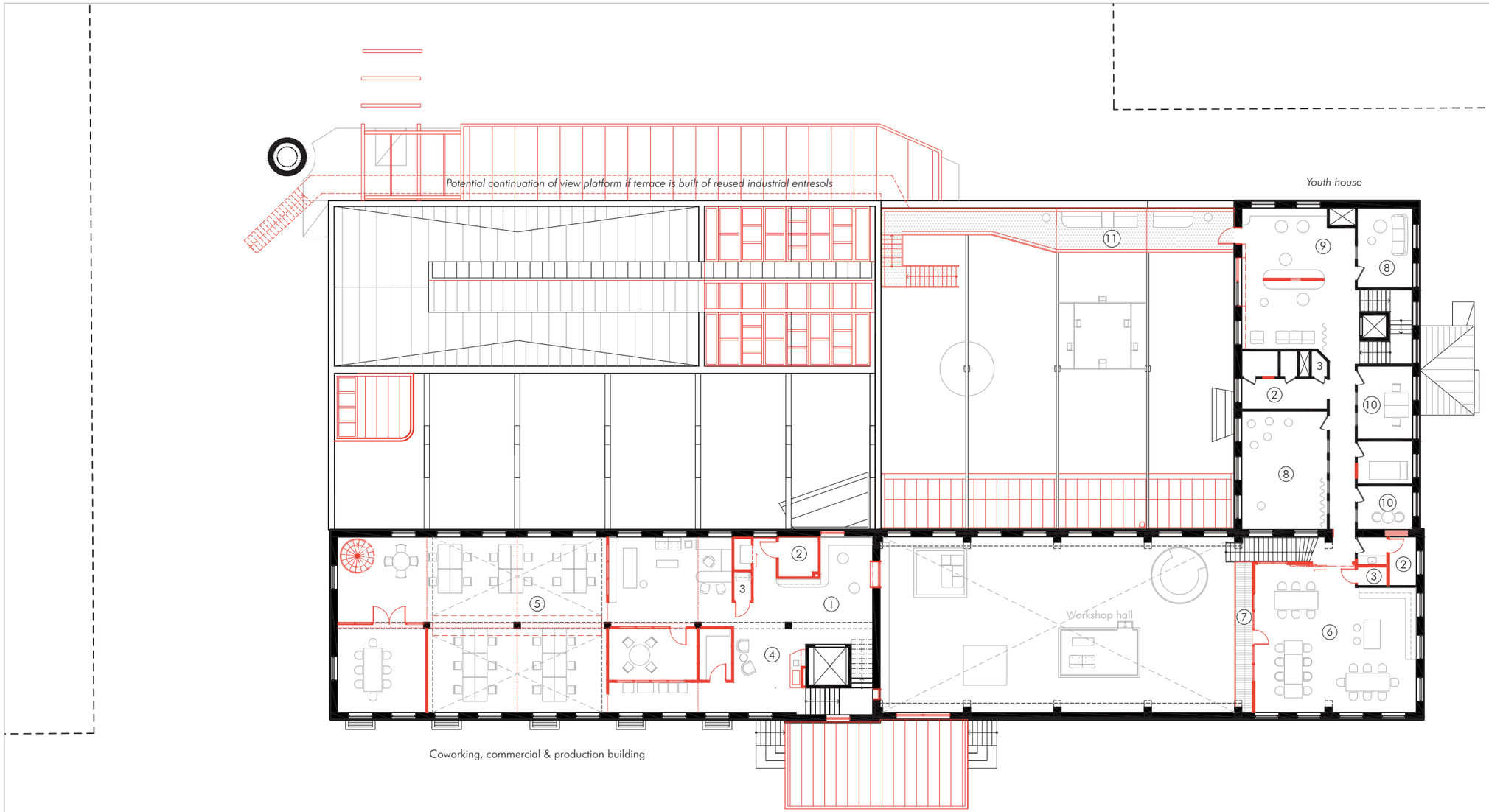


GROUND FLOOR

1. Entrance/information
2. Wc
3. Cleaning room
4. Lounge/ 'fika' corner
5. Commercial & studio spaces
6. Material storage & library
7. Youth tools
8. Greenhouse lab
9. Maker tools
10. Machine room
11. Climate- & social zone
12. Active orangery
13. Social study
14. Youth street entrance
15. Art wall & teen zone

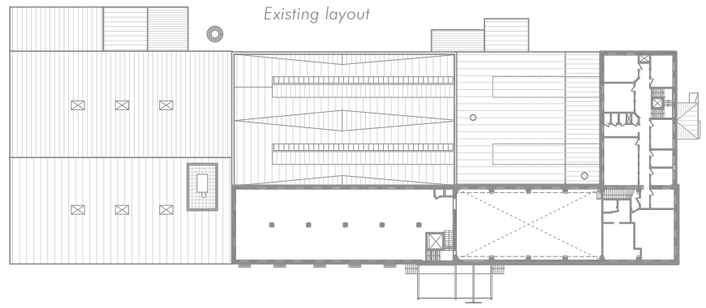


Architecture of Reuse

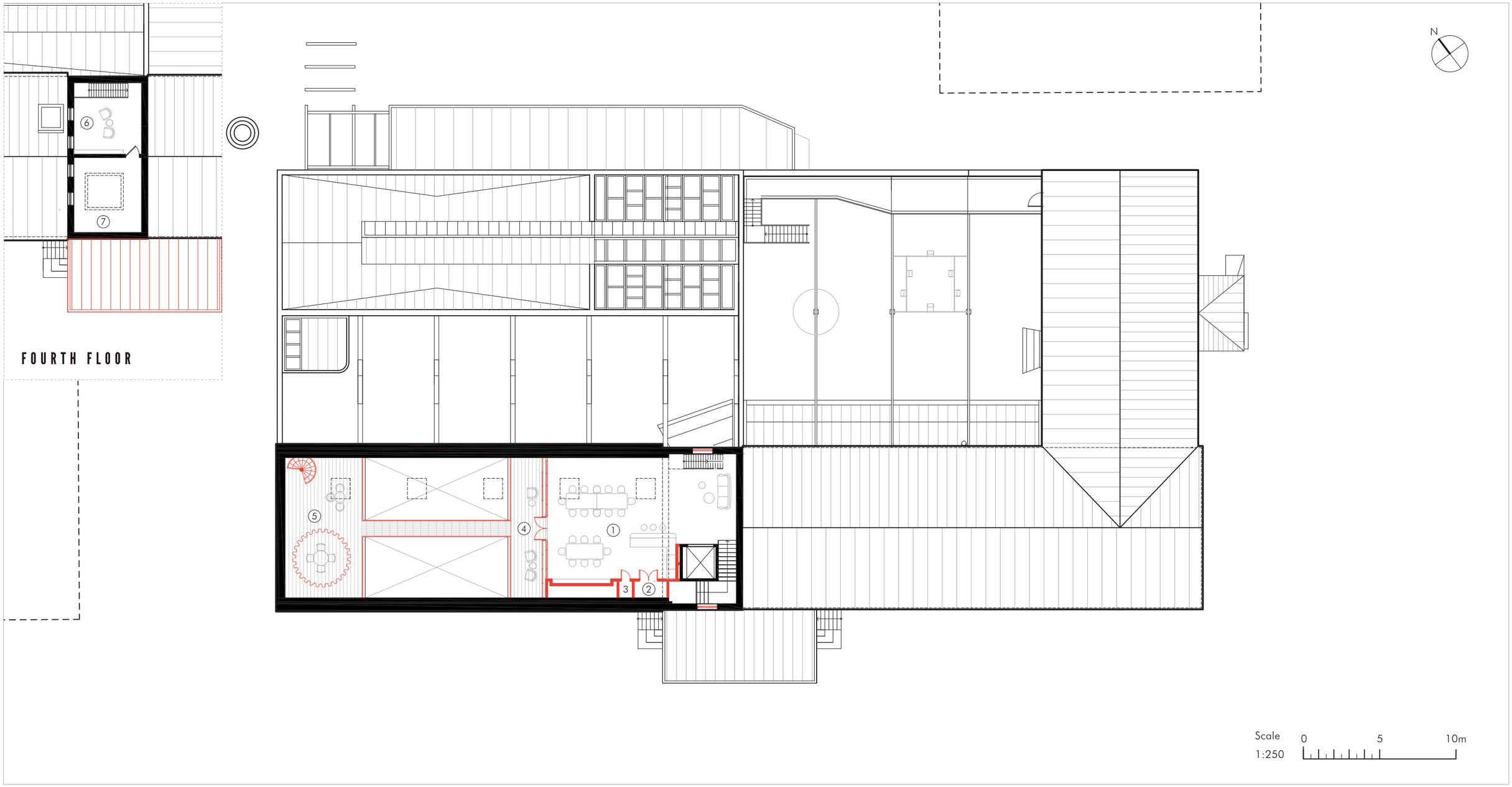


SECOND FLOOR

1. Lounge & cloakroom
2. Wc
3. Cleaning room
4. Coffee corner
5. Flexible coworking space
6. Lunch & gathering room
7. Viewing platform
8. Activity room
9. Book & boardgame library
10. Administrative room
11. Sun & viewing platform

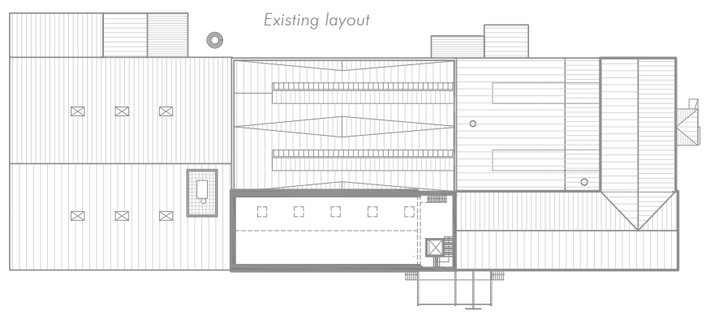


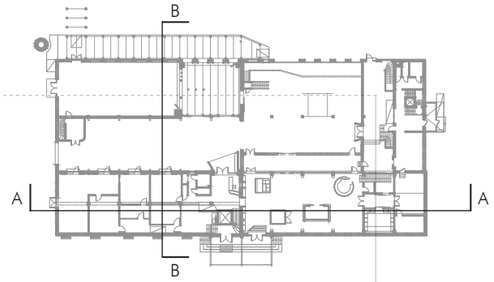
Architecture of Reuse



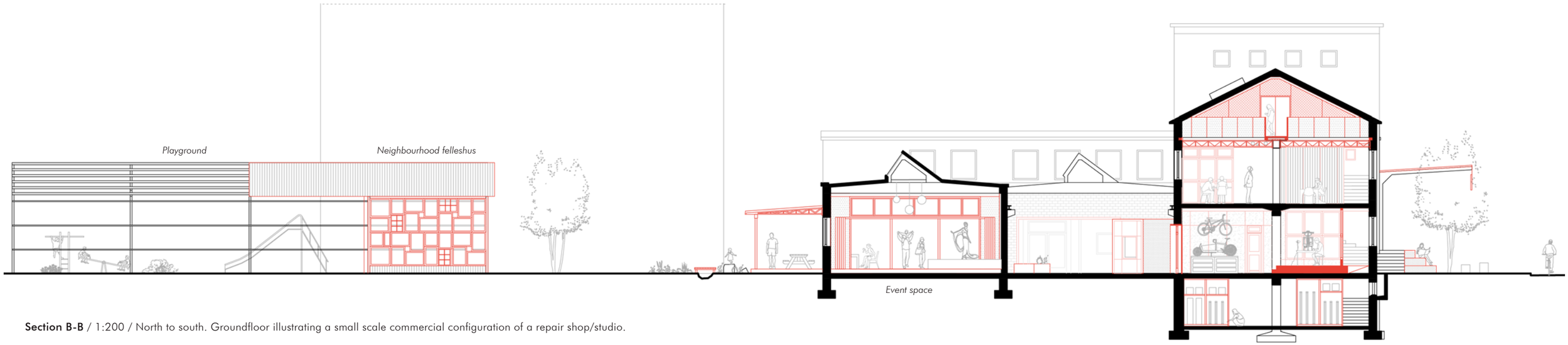
THIRD FLOOR

1. Lunch & gathering room
2. Storage
3. Cleaning room
4. Viewing platform
5. Workspace
6. Solitude room & library
7. Elevator service room





Section A-A / 1:200 / West to east. Groundfloor illustrating a flexible coworking configuration.



Section B-B / 1:200 / North to south. Groundfloor illustrating a small scale commercial configuration of a repair shop/studio.

Scale 1:200 0 5 10m

Elevation facing South / 1:400 / Entrance seating stairs in perforated metal, reused window section opening up into the workshop hall.

West / 1:400 / Event hall by the chimney, and passage into the courtyard.

East / 1:400 / Reused metal facade (see composition test on p.131)

Elevation facing North / 1:400 / Side towards the park - roofed terrace by the café/event hall, viewing platform above the courtyard.

Elevation through passage / 1:400/ North facing courtyard facade - orangery connected to workshop space and commercial passage.

← New double door in aluminium on wood, 3-layer energy glass. Available in 1 pieces. Price 6000 DK/pcs.

→ Double door in wood from 2020. Available in 3 pieces. Price 5800 DK/pcs.

Photos from Genbyg

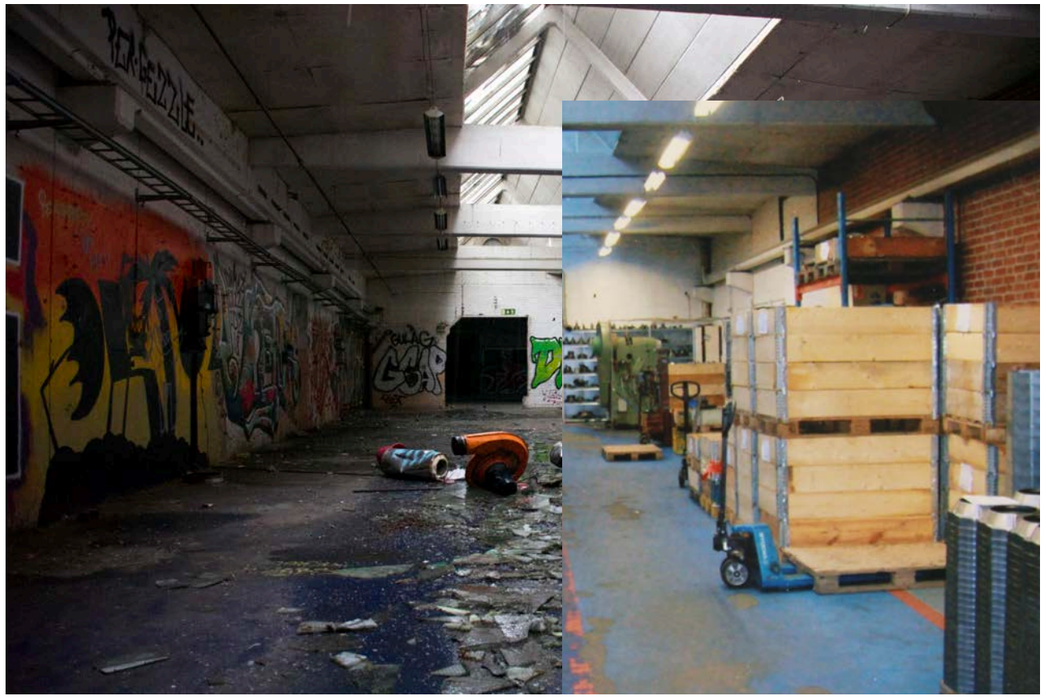
← Glass door from a condominium in Amager. Available in 11 pieces. Price 1800 DK/pcs, in single glass so would need alterations for thermal purposes if used outdoors. Suitable for indoors.

→ Special object: swing doors with an upper window with curved iron bars. From a danish school. Available in 1 piece, price 14000 DK.

EXAMPLE OF DOOR OPTIONS

Based on stock at Genbyg. When using an older, less thermally optimized door - see door solution in the ground floor plan drawing by (5). Adding sliding doors on the inside as an additional climate border during cold days or off hours.

If used indoors the original color and weathered surface can be kept, if used outdoors it might be preferred to paint all doors in one color for an uniform appearance and surface protection, e.g linseed oil.

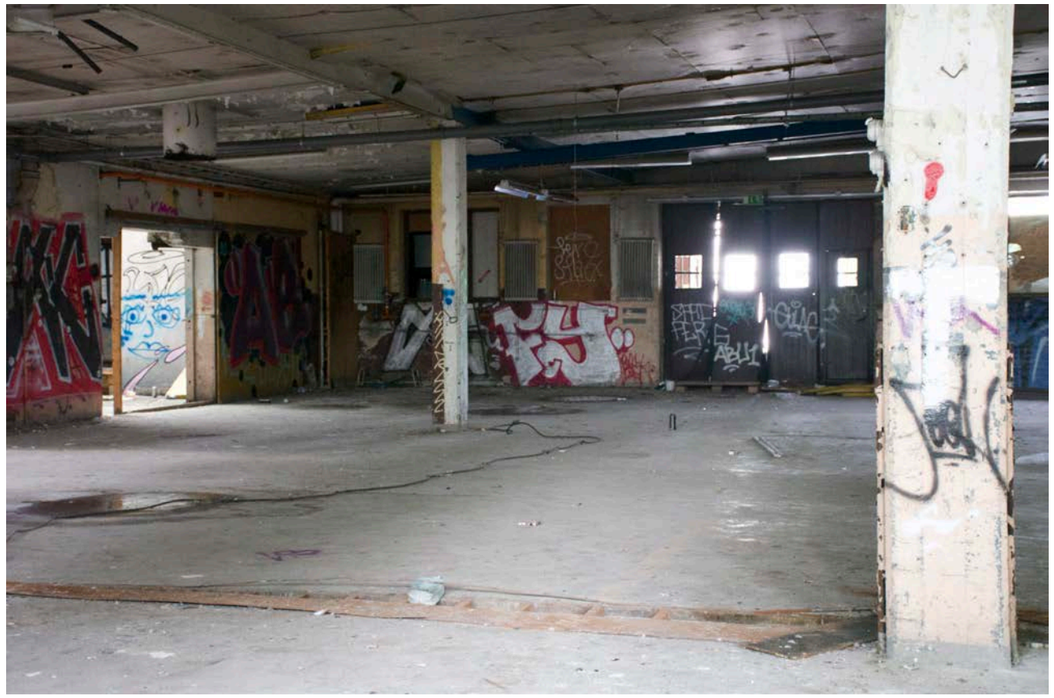


The passage in its current condition and at time of use (2008). Photos by C. Bergendorff & CEPA Steeltech.

Visualization: The passage being used for an evening event with shopfronts to the right.

The present north side of the building, photo from Lunds kommun.

The former ‘backside’ as an opened up & inviting entrance to the courtyard.

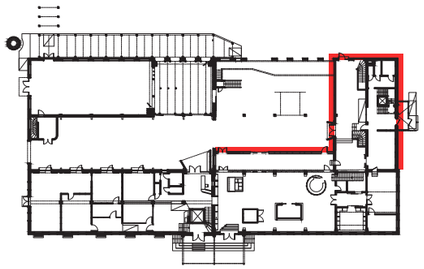


The 'couryard' in its current condition, photo by Calle Bergendorff.

The courtyard in use by the youth house and maker community.

The machinehall in its past and current condition, photo from Cepa Steeltech & unknown (n.d.).

Large volumes referencing the hall's past machines and new visual connections between the buildings.



FIXED SYSTEM: FACADE

Typology: Facade system
Reuse: Corrugated steel plates, windows

Origin/age: Site / 25-45 yrs
Expected lifespan: 100 yrs
Circular principle: Dfd

What/why

As parts of the former office building's facade is damaged and the layers underneath might need maintenance I investigate a new design for the facade that will be easier to maintain or recycle in the future.

Materials

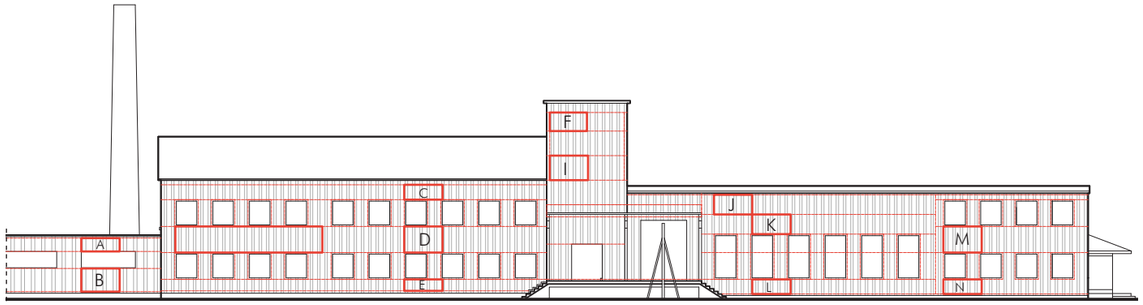
Corrugated steel plates, used windows and a framework made of new or overstock metal.

Lifecycle

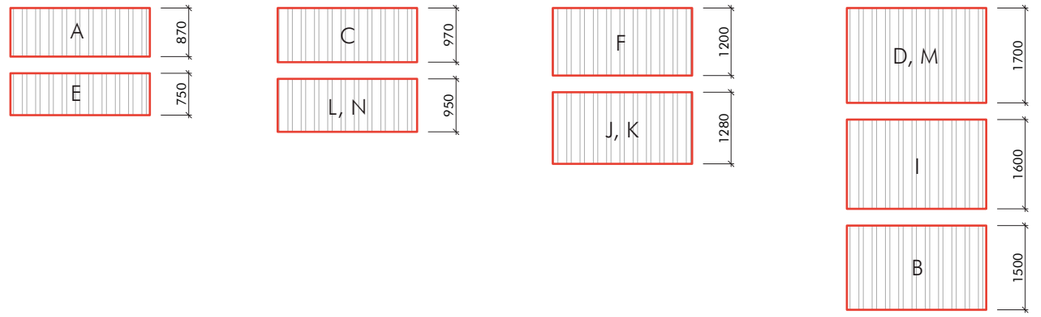
Both of the facade systems are constructed using the dfd method in dimensions that are possible to handle without heavy machinery - making it easy to replace or maintain damaged plates. The selection of windows for the glazed part should be so that they still have a long shelf life.

Reflection

Investigating one strict composition with a relatively direct material reuse and one patinated facade where the material is more processed. From an economic point of view (time & labour) LG Håkansson from CEPA suggested that it would make more sense to tear the sheet metal down and remelt it in comparison to disassembling it. I wanted to explore a design where the material is reused at site without transport or the energy loss of remelting it.



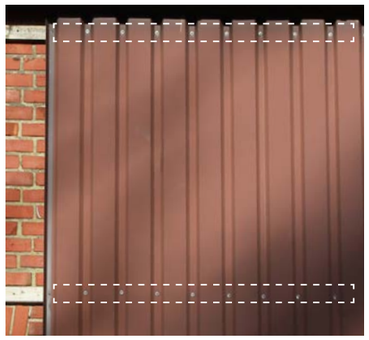
Example: Plate sections possible to extract between attachment rivets



Corrugated sheet metal at site *(estimates)*

Where (facade)	*Amount*	*Age/condition*
Main building (1940, 50, 87)	1340 m^2	approx 35 years (1987) / good
Office addition (P02)	114 m^2	approx 24 years (1998) / good
Storage halls, newer	560 m^2	approx 25 years (1997) / good
Storage hall, old	270 m^2	approx 47 years (1975) / poor or patinated, rusty
Area 'new' (reused) facade system: 150 m^2		

Facade plate from 1987, irreversible rivets

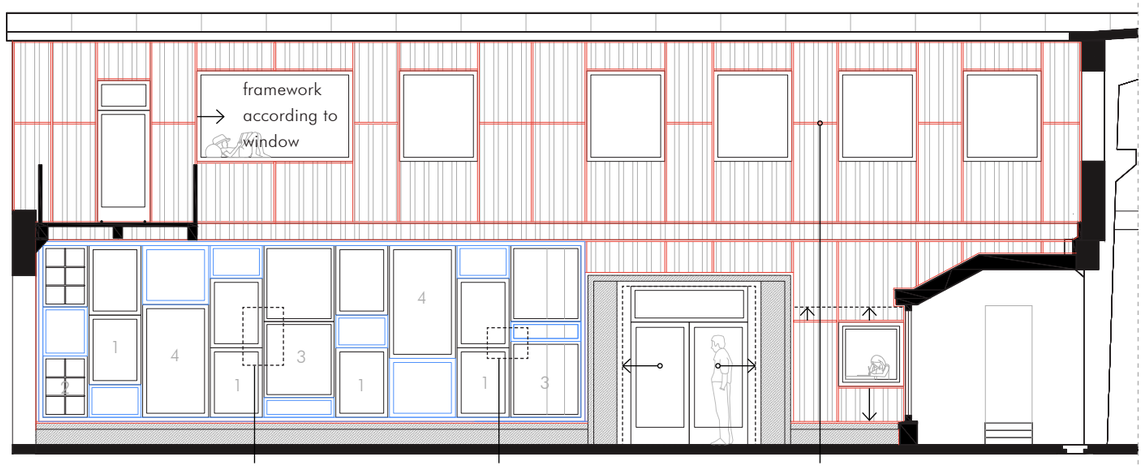


Facade plates from 1987 & window framing

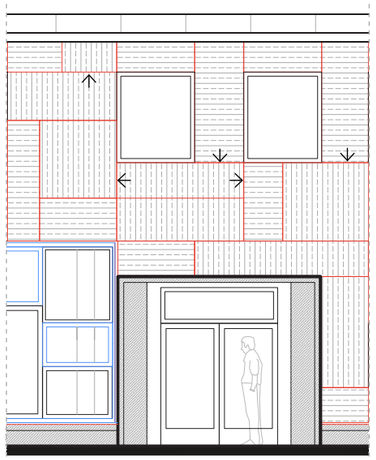
Facade plates from 1975, worn condition

A. Framework system of corrugated plates

B. Casette system of flatrolled corrugated plates

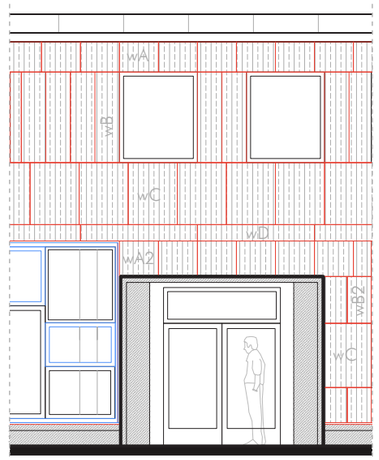


facade framework
customized windows
←↑ *flexible width/height*



Large plates, max dimensions is determined by the size of the rolling machine.

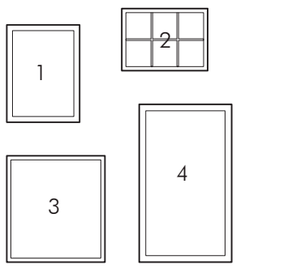
↑ *plates lining with windows, calmer express.*



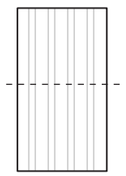
Facade divided into a composition of four different plate widths.

wX *common plate width, varying height*

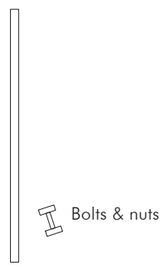
Flatrolling the corrugated plates at site for a rustic imperfect surface texture, source Purnomo Guruh (2020).



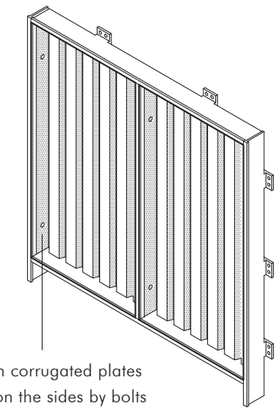
Reused windows, wide & narrow widths to mimick the facade grid.



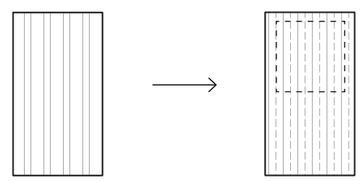
Cut & painted plates of former facade



New metal framework



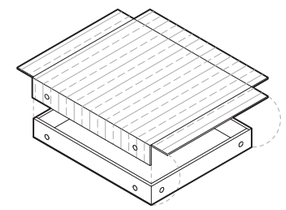
Frame with corrugated plates attached on the sides by bolts

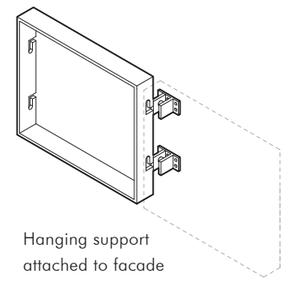


Corrugated plate of former facade

Cut & surface treated flat rolled plate

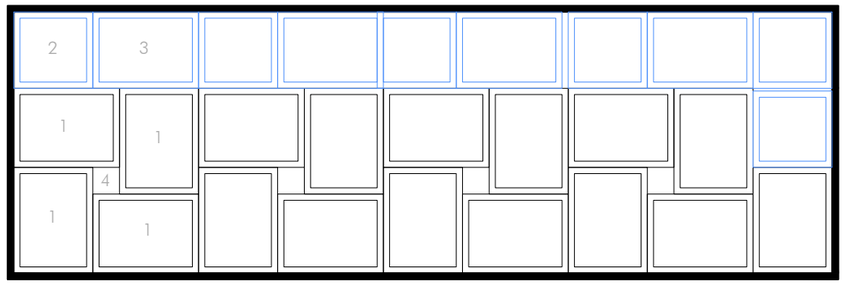
Reused material reversibly attached to metal frame with bolts



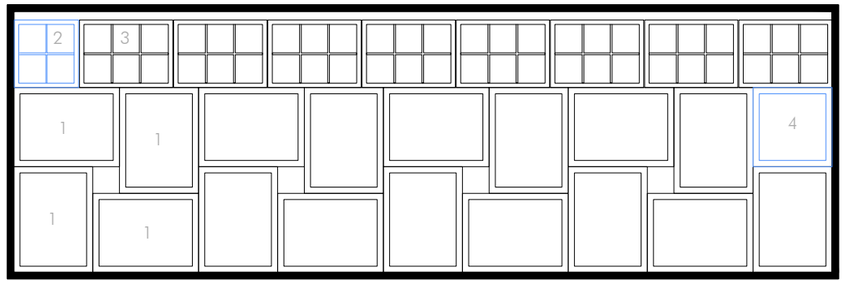


Hanging support attached to facade

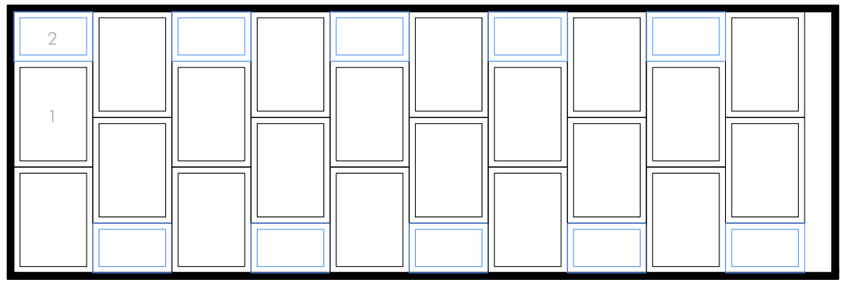
WINDOW COMPOSITIONS



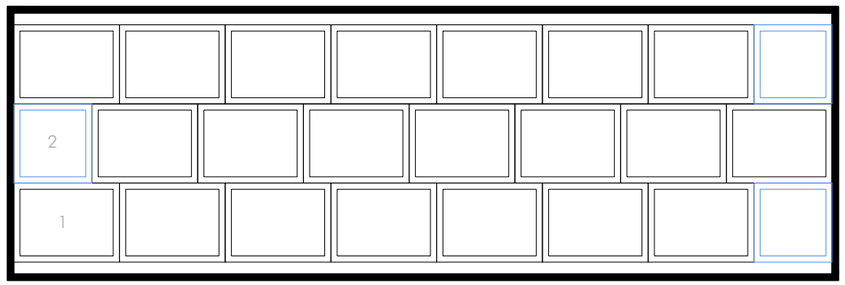
Possible with only one window size; cutting (1) into (2) & (3). (4): colored glass block or ventilation grate.



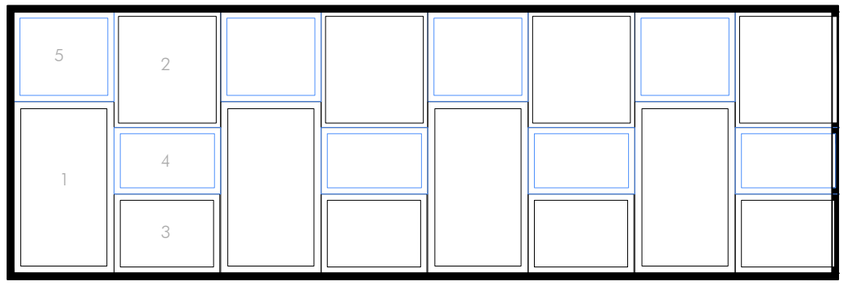
Dynamic version of right side composition.



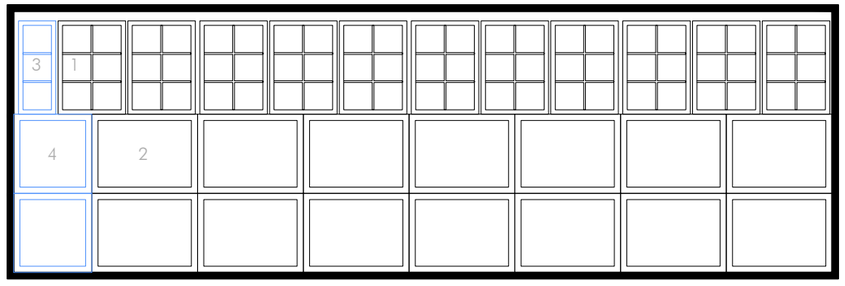
Calm & symmetrical composition with only two window sizes. Possible to create (2) from (1).



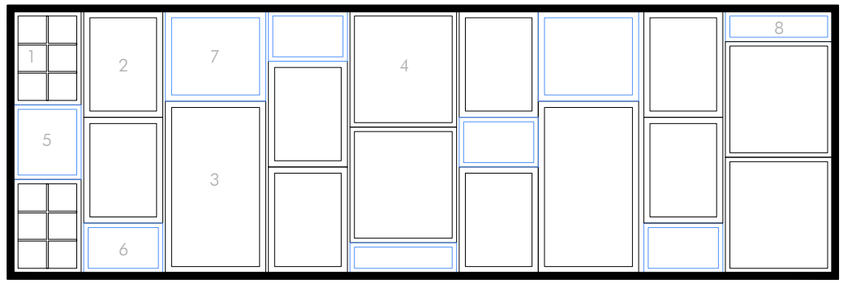
Horizontal version of composition above; less dynamic due to offset not being at mid point.



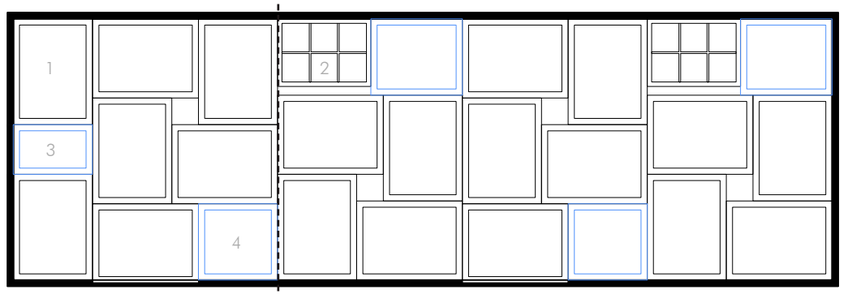
Calm composition using more of the large size windows. Possible to create (4) from (2) and (5) from (1).



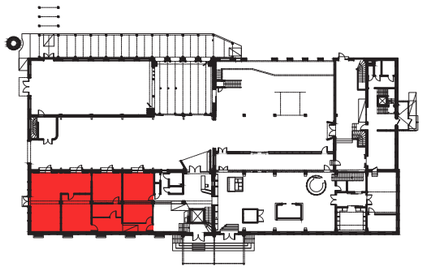
Symmetric but less interesting composition due to relation of the top portrait & lower horizontal windows.

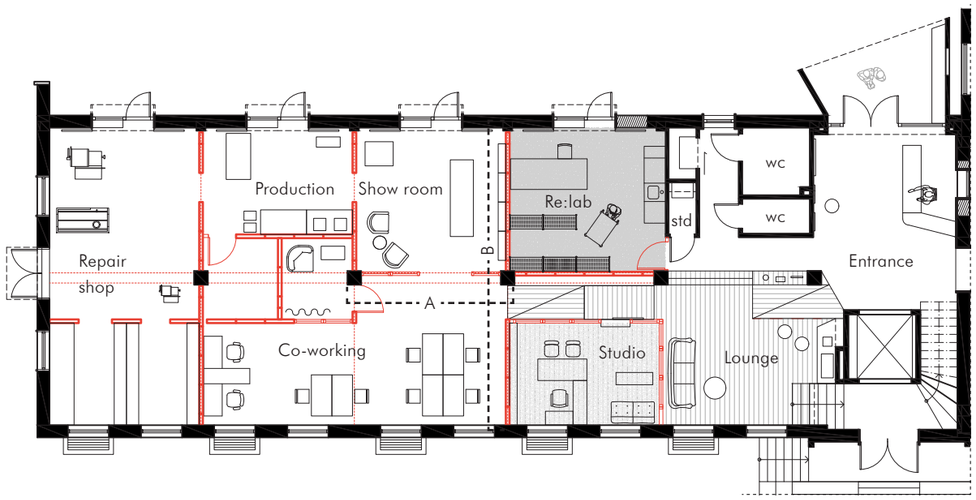


Interesting composition with a window diversity. Drawback: many customized window sizes needed.



Chaotic composition test. Possible to repeat the first section for a calmer expression.





Phase 1 / Ground floor: Flexible shared plan - small startups/studios/production spaces.

FLEXIBLE SYSTEM: INTERIOR WALLS

Typology: Modular wall system
Reuse: Doors, windows, corrugated sheet metal

Origin/age: Site/MÅD / -
Expected lifespan: - yrs
Circular principle: Upcycling

What/why

Commercial renovations are wastefully executed as often as every 3 years. I propose a flexible wall system that makes the building more resilient for change, with a possibility to alter the layout as the program changes.

Materials

The core of the modules is made out of end of life fire doors, the corrugated metal is from the existing facade - perforated if possible without damaging the integrity of the plate. The windows are from a miljonprogrammet window renovation (reference product from Malmö Återbyggdepå, large quantity).

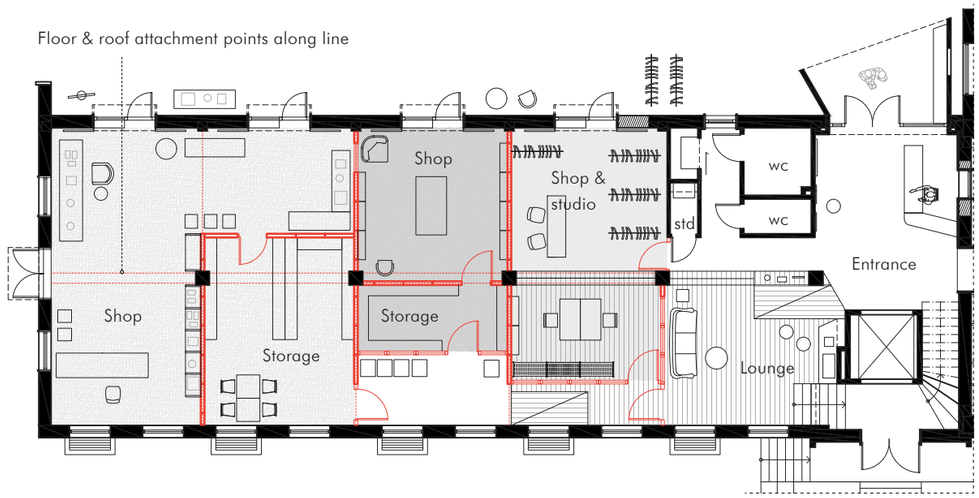
Lifecycle

Windows that are not usable outdoors can get a prolonged life inside. The surface material of metal is not damaged as easily. The module is possible to maintain - separatable components, replacing additional surface materials. Its life expectancy is relying on it being simple to use and alter, as well as being aesthetically interesting. Should be stored in a clear and use-encouraging manner.

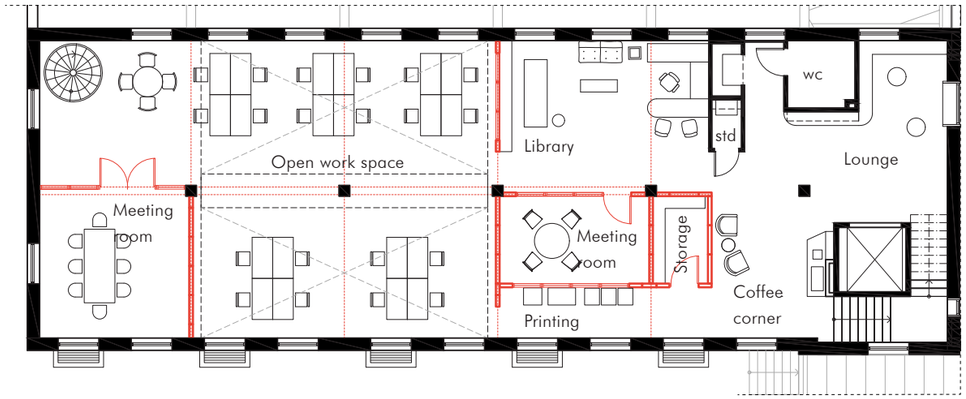
Reflection

Out of the tests this version seemed the most usable - components in easy-to-handle sizes and a composition that can be either formal or playful.

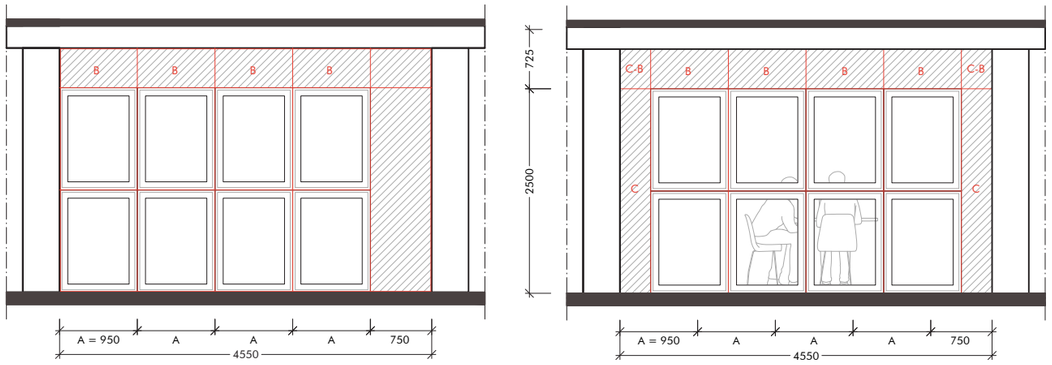
Floor & roof attachment points along line



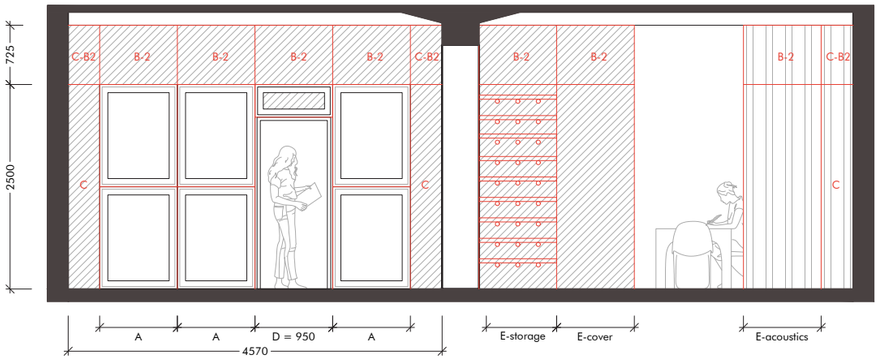
Phase 2 / Ground floor: 'Conventional' plan - extroverted commercial businesses and studios.



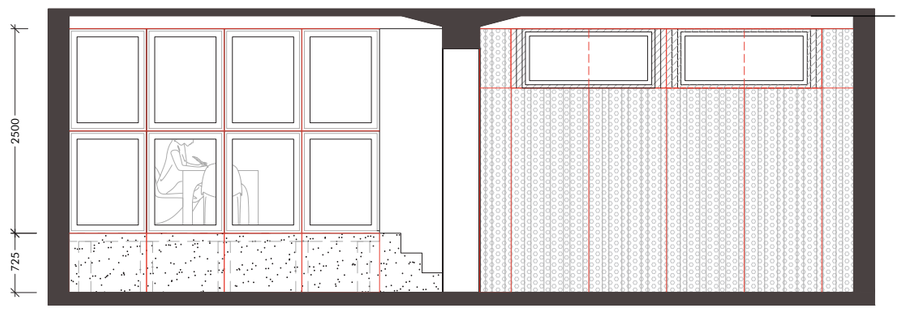
Second floor: Office and coworking plan.



Elevation A-A, testing component sizes.

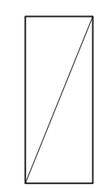


Elevation B-B, testing a glazed meeting room & room dividers

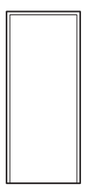


Test of variation or playfulness within the system.

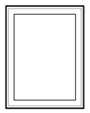
Personalized with other windows that fit within the frame



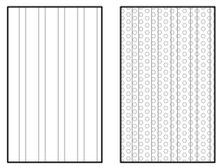
Filling: repurposed interior fire doors
EI130, size 825x2040 mm



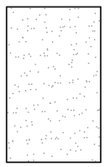
Reused door, standard & common size 900x2100 mm



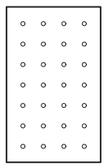
Reused windows from million program renovation (large quantity) 1250x950 mm



Acoustic panel: corrugated metal from the facade. Perforated if possible (acoustics)

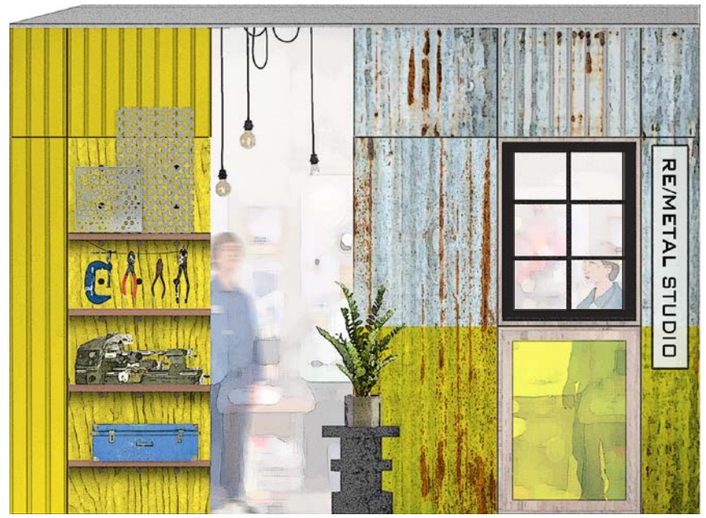


Possible to reversibly attach other materials to customize.

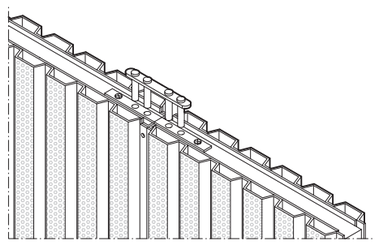


Intuitive shelf system. Surface: reused plywood. Holes: cut up metal pipes

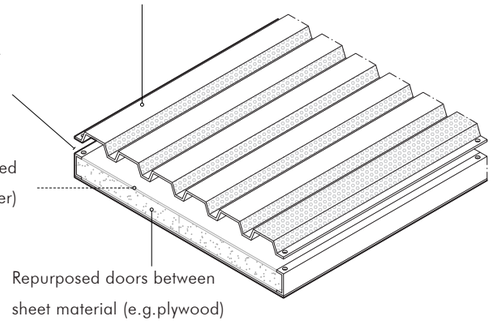
The system's potential aesthetics in a more formal office environment.



Potential aesthetics for a more weathered and playful style.



Attachment between panels



OUTTAKES

Here are some of the configurations tested for the flexible wall system. The main problem for most of them was the dimensions of the building (wall to wall width and roof height) and window frames. I consciously chose to stick to the particular window size and not change to a more compatible size since it represents the reality of reusing materials and buildings - to work with what you got.

Horizontal window frames

+ By flipping the windows horizontally instead of vertically you can add an extra row of windows and thus get more glazed area.

- The wide proportions of the windows in relation to the width between wall and pillar results in a very small opening for a door.

- The assembly will become heavier and more hazardous when stacking three windows on top of each other.

- The composition feels a bit compressed when the windows are only stacked by two.

Asymmetric window composition

+ An interesting aesthetic with the pattern of the windows and clear composition with a base and upper section.

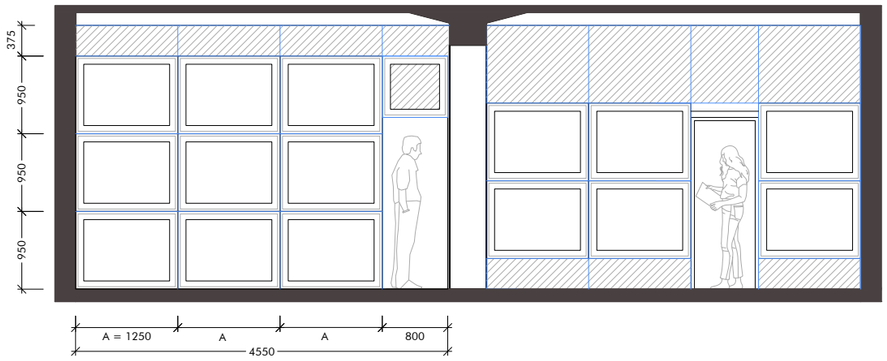
- Not as intuitive, requires some afterthought when composing and a lot of patchworking. The irregular window system would work better in a fixed system rather than this flexible one.

Frame system

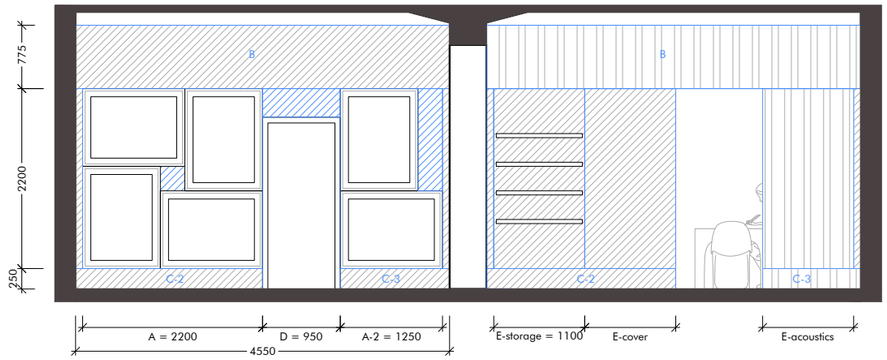
+ Uniform and intuitive, could be arranged as a framework that you slot windows or wall panes into.

- Due to the dimensions of room & windows the frame ends up incredibly thick (15 cm) which results in a rather heavy appearance.

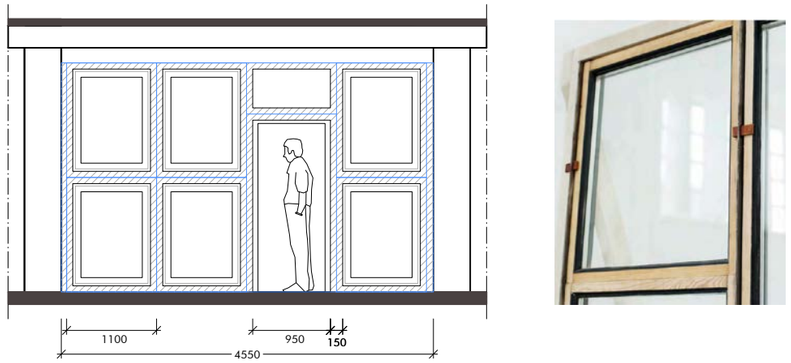
Horizontal window frames

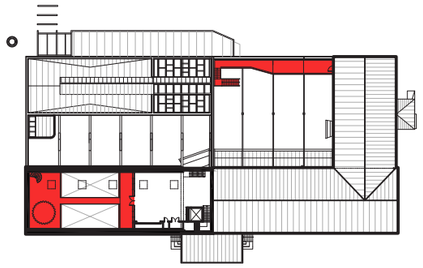


Asymmetric window composition



Frame system / Example of attachment by Vandkunsten architects (Nielsen, 2017)





EXPERIENCE: VIEWING PLATFORMS

Typology: Elevated platforms
Reuse: Ventilation ducts, metal fence, metal beams

Origin/age: Site / 20-30 yrs
Expected lifespan: 15-100 yrs
Circular principle: Upcycling

What/why

Elevated platforms that offer the user a view of the industrial space - indoors as well as in the courtyard. The fully clad metal railing mimics the language of overdimensioned ventilation ducts climbing on the industrial buildings in the area.

Materials

The platforms are resting on the existing structure with a supporting structure made of beams from the newer storage halls. The floor could be composed of perforated metal plates used in industries such as floor grilles or anti-slip diamond plate. The sides are clad in flat rolled steel ventilation ducts - preferably as big sheets as possible to avoid a too disorganized appearance. Reused metal fence from the site is used as a contrast; on the south side of the outdoor platform and by the lunchroom.

Lifecycle

The condition of the ventilation ducts should be investigated - still functioning components should primarily be reused for their original function. For the platform that is outdoors, a protective coating should be investigated to keep it from rusting, and should be constructed by ducts originally made for outdoor use.

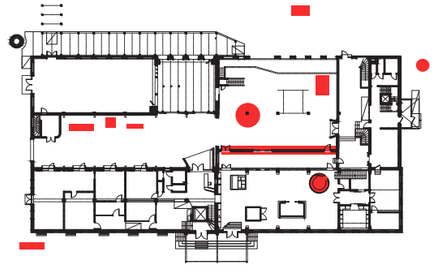
Viewing platform and passage in the coworking space. The service ducts are a visible element.

Ventilation ducts at site.

Trusses avaliable at site.

Metal fence at site.

Mimicking the parasitical appearance of ventilation services.



PARTICIPATION/DIY

Typology: Furniture, pavilion
Reuse: Materials available at site & the area's demolishing

Origin/age: -
Expected lifespan: - yrs
Circular principle: Reuse

What/why

Different zones where the communities of the building can build things with reused material, to encourage 'placemaking' and a change in attitude towards our resources. This could be outdoor furniture, indoor pavilions or new components to the flexible wall system.

Materials & lifecycle

Materials saved from demolished parts of the CEPA-building and the neighbourhood. Some of the materials or construction methods could be suggested by the architect, to trigger creativity and to spread the knowledge of circular building techniques such as dfd.

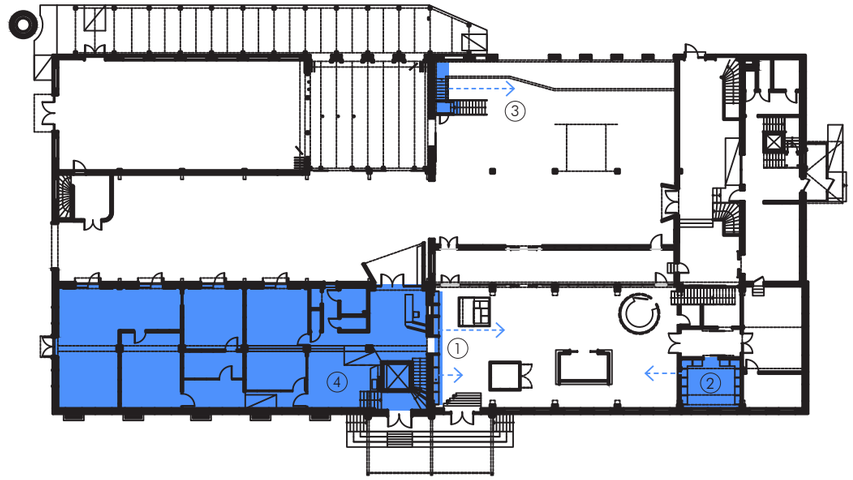
Reflection

The location of the material storage is important - it should be in a close proximity to where it is intended to be used. In the design I am proposing a full storage wall in the machine hall that showcases the available material, as well as space in by the machine rooms, basement and a small storage in the courtyard. The storage space is somewhat limited due to the building's size, but perhaps spreading the materials out and visibly catalogue them could inspire more use compared to storing everything in a huge storage hall.

Youth house activity of placemaking: casting reused concrete with old metal objects from the area.

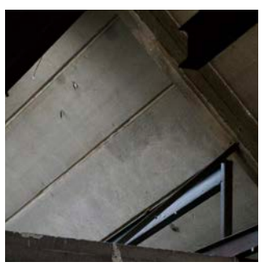
Material storage:

1. Library wall
2. Machinehall room
3. Courtyard
4. Basement



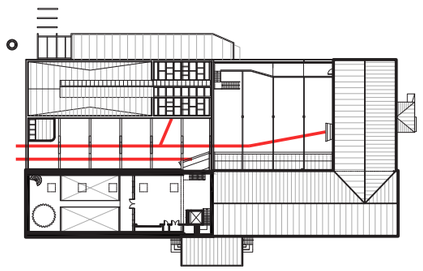
Decorated reused concrete.

Concrete from site.



Siporex plates from site.

Aged metal items. Photo by Jonathan Borba



FUNCTIONALITY: SIGNAGE/DRAINAGE

Typology: Floor signage
Reuse: Drainage system, floor grills, steel

Origin/age: Genbyg/ - yrs
Expected lifespan: - yrs
Circular principle: Reuse

What/why

An information system on the ground that mimics the old floor markings in the industrial building. Visitors can follow the engraved signs to find their way to the e.g. youth house or event space. It additionally works as a drainage system to collect rainwater from the exposed concrete floor.

Materials

The drainage system could either be new overstock products found at distributors such as Malmö återbyggdepå or Genbyg, or reused in good condition. The grills could be easily reused as long as they have similar dimensions. The metal used for the ground and engraved signs needs further investigation, e.g. looking into common metals types & components used on the ground in industries.

Lifecycle

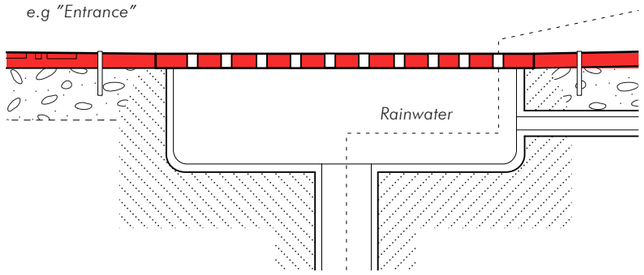
The system must be constructed in such a way that it can be replaced and maintained, as the plumbing system has a shorter lifetime than the metal grates. The engraved signs must be easy to detach and replace. The metal and grates should be painted in a durable non toxic paint (since it might contaminate the rain water), will need maintenance due to the wear and tear.

The past colors of the machine room.
Photo by CEPA Steeltech

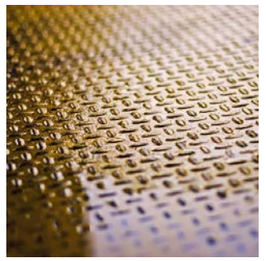
Engraved metal sign attached with screws e.g *"Entrance"*

Painted reused drainage system and grate

Cut and painted repurposed metal

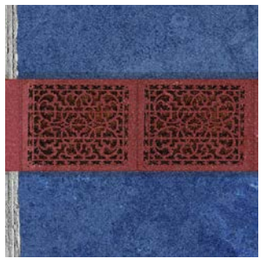


Section of system

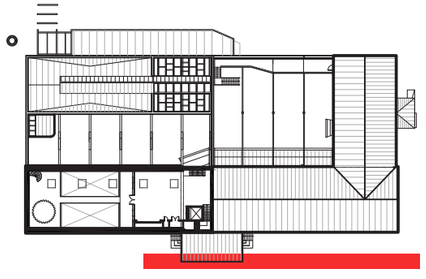


Metal resilient for floor use.
Photo by Tim Mossholder

Drainage system from Genbyg



Alternative well of valve grills



STORYTELLING: GROUND

Typology: Ground material
Reuse: Concrete, siporex roof slabs, steel beams

Origin/age: Site / 35-82 yrs
Expected lifespan: <100 yrs
Circular principle: Recycling

What/why

Outdoor flooring of recycled concrete, with metal "rails" that refer to the old Bjärredsbanan that once stopped outside the building. Attachment points are added for the possibility of installing street furniture or art.

Materials

Steel beams in a condition not suitable for direct reuse can be downcycled as ground decoration. Optimally metal that was made for outdoor/harsh use, e.g galvanized or coated.

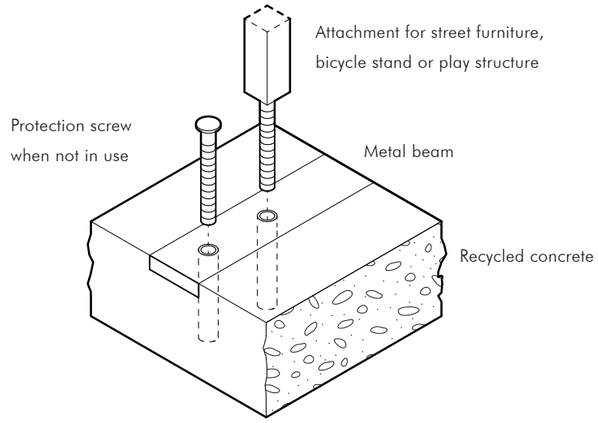
Lifecycle

Concrete floors can be expected to last a hundred years or more, so it is important to investigate how the decorative metal beams are integrated so they dont' cause an exaggerated harm to the material.

Reflection

This is an example of storytelling, not in the classical sense of letting the material tell the story of what it previously was - but allowing reused materials of the site convey the history of the area. The reused concrete expresses the previously rough, hard materiality of the outdoor surfaces and expired metal beams, or ideally - train rails, references bjärredsbanan that was once located next to the building.

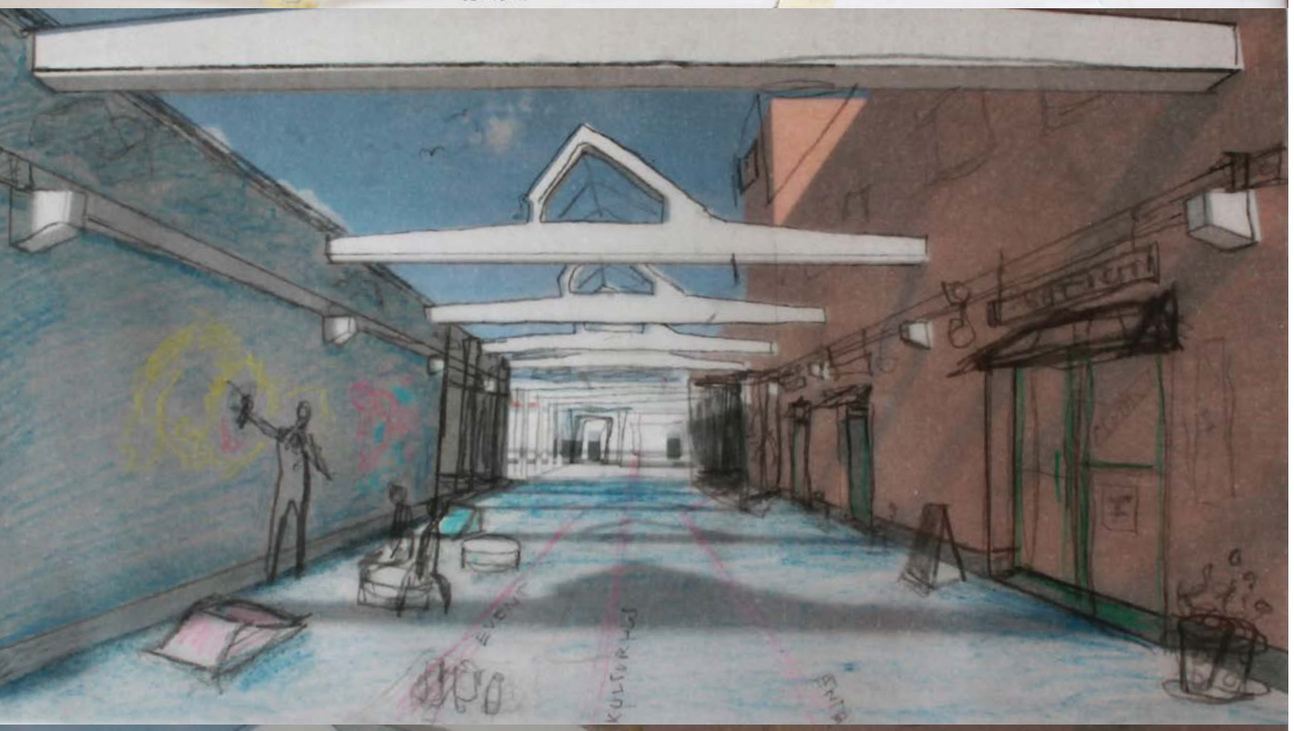
Traces of the Bjärredsbanan, now gone.
Photo by Ingrid André



Concrete from the site.

Siporex plates from the site.

Metal beams from the site.



— Reflection

SUMMARY

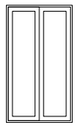
A short summary of what I have tried to accomplish during the project:
1) Investigate tools and values of reuse; patina, storytelling, flexibility, composition, participation, functionality.
2) Investigate specific materials with a potential; context specific, commonly available or based on their appearance or function.

Secondly, testing them; *what appearance could these tools and materials result in? How do you compose them? What are their limits? What are suitable techniques (design for disassembling, modularity)?*

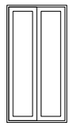
In this chapter I will share some of my thoughts and reflections from the project. Some are of a more personal nature, reflecting on this particular project, and others are more general on the architecture of reuse.

Fönster med träkarm
rödbrun
1350 x 890
ca 5 st
2500 kr/st

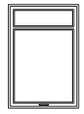
* Fönster med träkarm
1250 x 950
dubbelglas, vit, persienner
Stor mängd från
fönsterrenovering (120> st)
500 kr/st h o v hängda



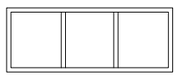
Fönster med träkarm
rödbrun
1920 x 1080
Ca 10 st
1200 kr/st



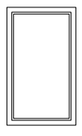
Fönster med träkar
rödbrun
1920 x 980
Ca 5 st
1200 kr/st



Fönster med träkar
blå, öppnas fr undersida
1700 x 1150
Ca 5 st
1000 kr/st

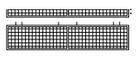


Fönster m träram
vit
2720 x 1050 mm
2 st



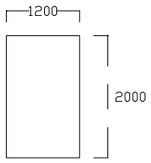
Fönster med aluram
"Guld"/ockrafärg, persienn
1130 x 1930
Ca 10 st
2500 kr/st
Nya, hög energiklass?

E130 Brandklassade fönster
vit ram, trä
1100 x 1100
Ca 3 st
300 kr/st



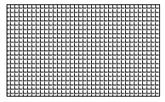
Metallgaller (hatthyllor?)
grått
2000 x 400 ca 55 st
2000 x 250 ca 5 st
Nya

Malmö återbyggsdepå:



Brandskyddsskiva GLASROC
2 mm tjock
700 kr/st

Glasblock
190x190x80
lådvis
olika glasytor
10kr/st
överskott, nytt

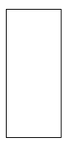


Halkmönstrad aluminiumplåtar
diverse storlekar?
minst 2 st på MAD

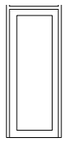
Rockfon ljudabsorberande
skiva (undertak)
Stenullsskiva
1200 x 600 x 20 mm
50kr/skiva
Ny

Interiört fönster
ljus träram, djup
1545 x 570 mm
1 st
500 kr/st

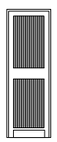
Interiört fönster
ljus träram, djup
1545 x 645 mm
3 st
500 kr/st



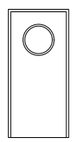
Grå metalldörr
hål för lås
900x2100



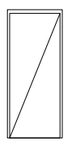
Brandklassad glasdörr
säkerhetsglas
svart, trä?



Quirky dörr
Teak-liknande bets
Linjerat glas
2100 x 720 mm



Blå ytterdörr
2100 x 990 mm



Innerdörr brand EI130
vit, 35 db
Dörrblad 825x2040
Bladtjockl 40 mm
karm ca 40x90mm
1000kr/st på MAD
men rivning- gratis?
större mängd, ca 15+

Many of the mapped materials did not make it into the project due to time constraints.

A NON-LINEAR PROCESS

I experienced that the design process of this project was more time consuming compared to that of a regular school project. It was not like the process of designing with new materials - drawing what you want the building to look like and then prescribing materials. To even begin with the design I needed a basic understanding of reusable materials and components and their potentials. But I also needed to know what to look for during the research - what new function the materials should hold, so I also needed a design.

I had to continuously shift between designing and figuring out if it was possible to achieve with reused materials, and if so - find the right materials and research methods of reusing them. Sometimes it was the other way around - finding a material with a lot of potential and drawing it into the project. The materiality of the building became present much earlier on than it normally does in my projects.

I can absolutely see why the process of implementing reuse in real architecture projects is more time consuming, and that the architect would need to be present in the project for a longer time. But I also think, or hope, that the process will become faster once you have a fundamental knowledge about reusable materials and their availability, and developed and familiarized with different tools of reuse.

A storage wall made out of metal ducts.

PROPERTIES & AWARENESS

Although the process was overall slower, I experienced that the limitations of reusage also in a way made the design choices faster. E.g that I was restricted to particular sheet sizes when reusing the metal facade. I felt more creative, as I had to research the materials and details so thoroughly it was easy to come up with and add additional functions. A signage system that is placed on the ground to mimic the old floor lines could also include reused drainage for the hard ground. Implementing reuse also had the effect of resulting in softer zones of inside/outside as the reduced energy standard of the facade windows encouraged me to implement climate zones. Instead of making a facade of double layered windows I explored a widening of the gap between the two window layers - creating a space, orangery, in between. Working according to the material's abilities instead of forcing it into something it is not. (Unless it concerns the endearing patina of weathering...)

I reflected a lot on why I made certain choices in the project. Partly because of the transformation format but especially from a perspective of resource preservation. Sometimes I ended up in a conservative spiral of "is this necessary"? Should you remove something that is reasonably functional? As an example I chose to preserve most of the walls on the second floor of the Youth house since it was the most recently renovated section. But it still felt strange to make that choice - as if I am not creative enough to do something new there. It is often obvious to preserve the really old, or the right type of old, but the half-old? It is almost as if you need courage to preserve the moundane.

My mantra during the design process was: what can be kept? Can the material be reused in its original function? *How will the 'upcycling' of transforming a material affect its value and lifespan?*

As an example, the storage wall in the sketch on the top of the page is composed of metal ducts. Would that be an upcycling (new value) or downcycling (reduction of value) of the components? Had it been made out of ducts that can no longer be used due to damage and the alternative is discarding them, then yes - it would have been an upcycling from waste to interior elements. But what if it was made out of fully functional ducts? The concepts of up- and downcycling can be a grayzone. From a lifespan perspective one could claim that the ducts could still get a long, or perhaps even longer, shelf life in an interior. But one could also say that you would spend more of our scarce resources to transform or adjust the component for this new function. In reality you would also have an economic dimension to the question - is the alteration worth its cost and time?

I think these are questions that I will learn to navigate around over time and in each specific project and its material situation.

Roof clad in metal to give the appearance of a metal structure planted on top of the beams.

The concrete roof kept as it is and visibly showing where it has been cut away.

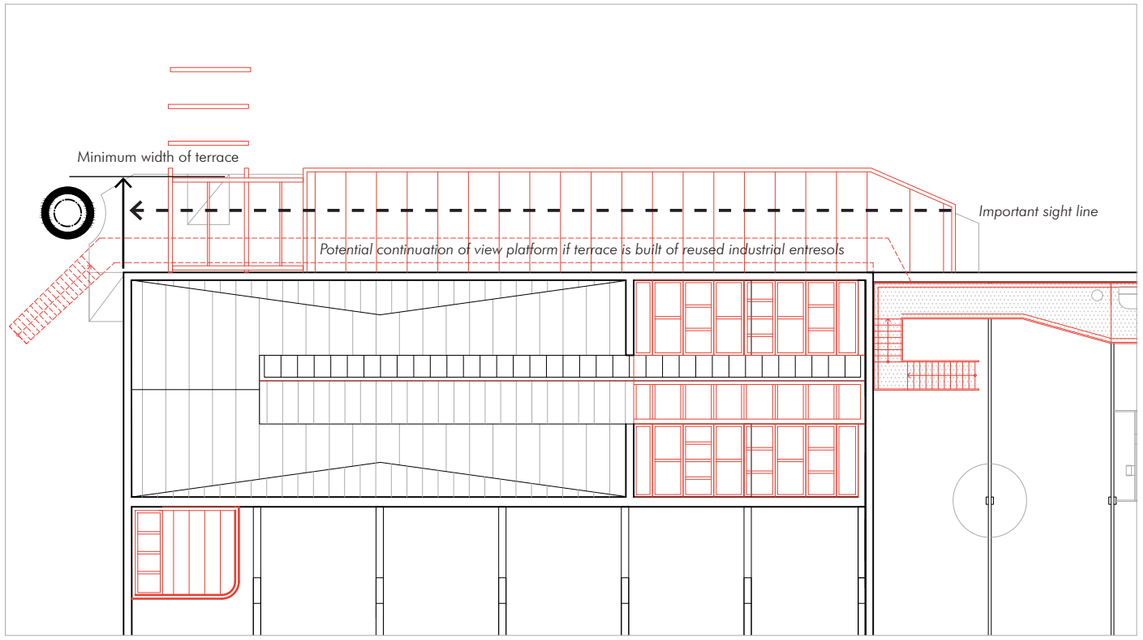
HONESTY

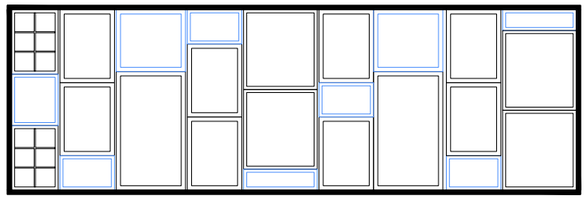
Another thing I came to reflect on during the project was structural honesty. The aesthetics of planting new structures within the shell of the old in many industrial transformation projects appealed to me. An interesting parasitic architecture. But I could not motivate tearing out all of the concrete flooring and structure only to add a new one (besides all the other aspects that made that approach unsuitable). I settled on opening up a part of the roof on the second floor to make the room more generous and create a visual connection to the otherwise isolated lunch room.

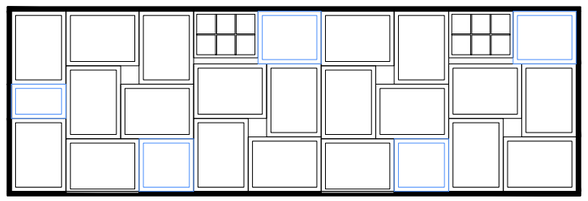
At one point I explored the possibility of cladding the existing roof in reused metal to give it the parasitical aesthetics. As if a metal volume had landed on the structure. One part of me thought that it is genius to preserve the existing but disguising it as new. To prove that the old (materials, structures) can achieve the same expression and architecture as the new.

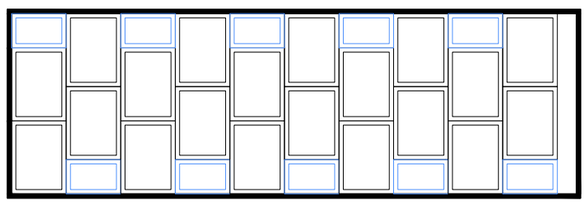
But I also have this ingrained thought of it being dishonest. Almost like a fuskbygge! In the end (-rather quickly) I decided on the natural approach within our field, and kept the original structure exposed and showcasing where the roof had been cut away. Even the metal platform made out of flattened ventilation ducts is mimicking its former function - being honest about its origins. I do find this solution just as beautiful (if not more) but the exploration posed many interesting questions to which I have no answers.

They also arise as I implement old materials (e.g. windows) to the building - how do you tell the original-old and new-old apart? Should reuse look like reuse?









A library of compositions.

FLEXIBILITY & EVALUATION

An important aspect of reuse is flexibility. I tried to implement that in my project by proposing different compositions or adding notes where the design could fluctuate (e.g the park terrace being made out of reused trusses - or an industrial entresol system). When designing with materials that fluctuate and constructions that start long after the drawings are made, prescribing certain rules to the design could be an important tool. Or perhaps having a plan A and B so the design is recilient for different material supplies.

That implies that the architect would need to spend a lot more time on the design - but we we would perhaps over time build up a library of solutions to pick from whenever the material stock changes. Finding reliable material sources like for example a house in the area that is about to do a window renovation so you have some constants in the formula is also very helpful.

To summarize my experience with reusage, I have listed of some of its potentials and restrictions:

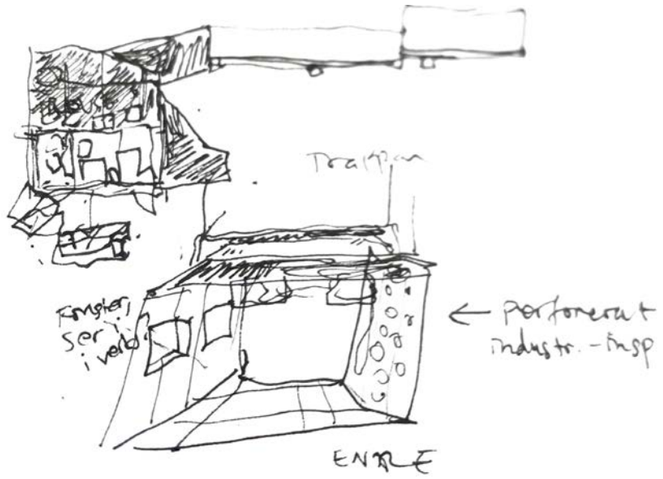
Potentials

- Deepened material understanding & appreciation - quality architecture
- Creativity & problem solving - an ‘architecture of variables’
- A naturally ‘relatable’ architecture
- Softer zones & inside-out-architecture

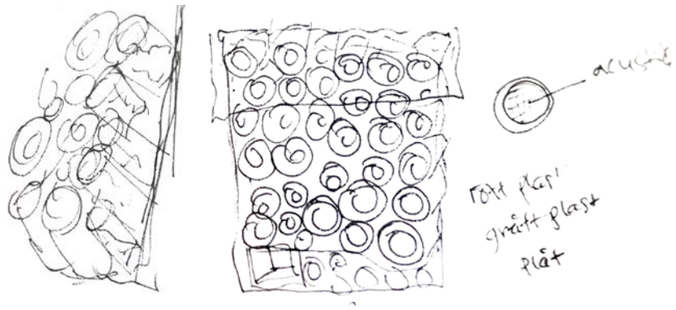
Restrictions

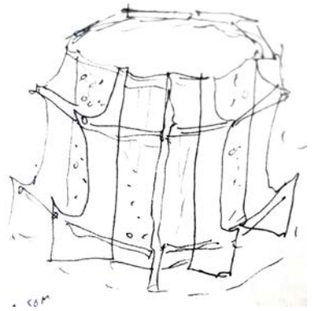
- Requires an extensive research/awareness of resources available
- A longer & more complex design process
- Design is limited to what is available
- Harder to achieve an ‘uniform’ style in large projects

A recycling room that would have been at the site with the materials visible & highlighted. A 'sibbling' facade of the main building - same material, different composition.

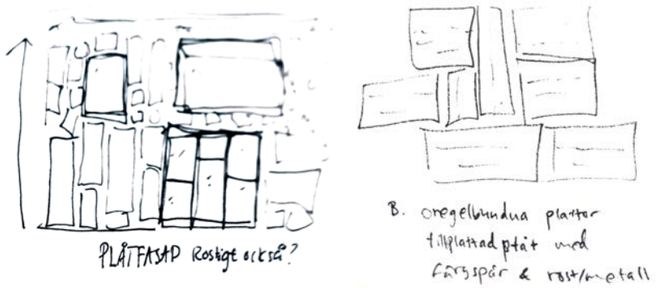


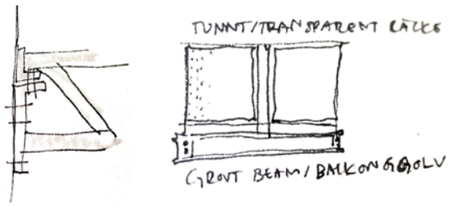
(Top) The recycling or material storage room connected to the courtyard viewing platform. (Bottom) Entrance sketch.

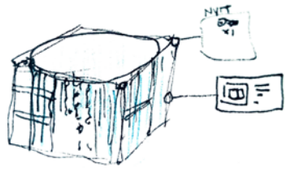




Storage/shelf pavilion, could not find a suitable reused material for it.







A DIY pavilion where the structure is welded by the maker collective and the hanging garlands are made by the youth.

PROJECT FORMAT & THOUGHTS

Towards the end of the project I felt a bit scattered, I had been zooming in so much on all the different corners of the project and keeping track of materials - and didn't know how to present it all. It felt fragmented and - a lot. Although many parts of the project are very thought out, the overall design would probably have benefited from some more time - to have been pushed further.

I wanted to make a more experimental 'testbed' project to get to test and explore as much as possible and therefore did not want to tie myself up into too strict of a concept in advance. But it also made it difficult to keep track of the whole of the project. My experience of previous school projects is that we usually only have time to produce a clear concept and a "whole", but rarely go as much into detail as I wish. So it was very satisfying to finally be able to do it now.

Overall, I enjoyed the 'testbed' format of the project. An attitude of testing things until the time runs out. To familiarise with existing tools but at a new site with its own spatial and material constraints. It was a great learning tool and made the process more enjoyable.

All that time spent on research, including the thoughts and details I did not have time to include or produce for this project, is something I can bring forward with me in the future and my professional life. It made it feel very meaningful. In a way, I think this project has helped me embrace an important attitude that is vital when you work with reuse - a dare and desire to further explore materials.

> ***Reuse is not a style – it is a method, and a necessary tool in our strive towards a more sustainable practice.***

DISCUSSION

Reflections after the final presentation (May 24 2022). Guest critics were Gunilla Kronvall and Jesper Magnusson, and examiner Tomas Tägil.

An architectural style?

In the discussion following the presentation, Gunilla Kronvall raised the question - *is reuse an architectural style?* My response is no, although reusage has certain prerequisites that may result in particular expressions, I have throughout the project tried to present different appearances reusing the same materials - conveying that reuse does not have to look a certain way. You can compose reuse in a formal, uniform manner. You can also express a relaxed, informal style, deliberately making it look 'reused'. Gunilla highlights the danger of reducing reuse to one style - a short term 'trend', similarly to how new constructions can be seen mimicking the varied window style of Lendager's reusage projects. I agree. Through decades, our profession has developed a craftsmanship in making materials express the architecture we desire. That is something we need to develop again, with reuse. Reuse is not a style - it is a method, and a necessary tool in our strive towards a more sustainable practice.

The future of reusage in Sweden?

The project mainly reflects on what I as a young architect can learn to be able to practice material reuse in the future, but I will also try to reflect on the industry I have only just dipped my toes into. In neighboring countries such as Denmark, we have offices like Lendager and Vandkunsten that are designing large-scale and holistic reusage projects that have shaken the industry and its processes to life. In Sweden, I have a hard time finding a counterpart, recycling is most often seen as small-scale tests in a large construction. One project that has been mentioned for its reuse is Selma Lagerlöf's center, a massive new concrete building with recycled furniture, designed by the resourceful White Architects office. It symbolizes quite well where we are today in terms of reuse in Sweden.

During the discussion, Jesper Magnusson asked - *what is required for us to be able to carry out reusage projects? How does our role need to change?*
An example is, like the Lendager group, to expand our competence and business models - they have a material innovation department that specializes in reused materials. To avoid having to wait and rely on specialist professions to develop, we ourselves can take on that role. Magnusson also mentions that the model of building in-house *[swe: bygga i egen regi]* could suit reusage projects due to its nature of longer involvement and increased control as architects, which I fully agree on. That type of construction model could reduce many of the current restrictions of reusage.

So, who will take the first big leap in our industry? This is an incredible opportunity to gain a leading role of material reuse in Sweden - a technique that will become increasingly important and common in the future.

How could the project be taken further? For example, by developing an in-depth toolbox - but that would perhaps require real-life experience and additional dimensions such as finance and construction processes to make it actually useful. Or maybe the aesthetics of reuse, exploring the nuances between the two drastic expressions of 'weathered' and 'formal' that I presented. But I think this will be done naturally in the industry as reuse is applied more. Another continuation would be to further expand the library of compositions, by e.g. testing reuse in more situations, shearing layers and contexts. What would the design process look like with a new building?

For my part, there is no doubt about what I want to do as a next step of this project - applying and continuing to develop my knowledge of reuse in real life projects.

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