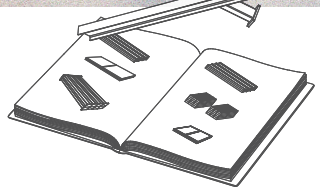

After-Care

Catalogue of Dismantled Materials
Repurposed In a New Building Context.

Master Thesis. Lovisa Wennberg. 2026. MPDSD. Building Design and Transformation for Sustainability.
Chalmers School of Architecture + Department of Architecture & Civil Engineering

Examiner: Carrie Bobo Gibbs
Supervisor: Mikael Sonnsjö

CHALMERS
UNIVERSITY OF TECHNOLOGY

AfterCare
Master Thesis 2026
Author: Lovisa Wennberg
Institution: Chalmers School of Architecture + Department of Architecture & Civil Engineering
MSc Architecture And Planning Beyond Sustainability
Profile: Building Design and Transformation for Sustainability
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Abstract

The building sector has focused strongly on improving sustainable production processes, but has cared far less about the later lifecycle stages of demolition and material aftercare. As a result, the sector remains far from achieving cradle-to-cradle resource flows and continues to be a major contributor to national greenhouse emissions.

This thesis has explored how architects can engage with demolition processes and establish more sustainable resource flows when on-site preservation or transformation is not politically convinced. Rather than opposing new construction, the thesis has investigated how demolition and new construction can be linked to create circular material flows. The thesis practically explored this in the context of Gothenburg through a mapping exercise of a school building scheduled for demolition. The materials found during the mapping were later transferred to a new food court building at Södra Älvstranden in Gothenburg, an area that awaits large-scale transformation and new construction in the coming years.

Through a resource mapping method, the thesis has developed a catalogue of reusable components from a donor building and further applied them in the design of a new architectural project. To connect material lifecycle endings to beginnings, the thesis has proposed a design-driven approach to care for materials previously seen as waste. It aims to move architectural design beyond the early stages of a materials lifecycle and has investigated ways to work simultaneously across both the early and later stages.

The thesis has found it beneficial to use resource mapping to reduce building waste. The method provided a clear framework for the design process, in which form necessarily followed availability. It successfully achieved the aim of caring for materials previously considered waste. The project also covered clear challenges in providing for the full construction requirements of the new design. There was a clear challenge in reusing materials categorised as in-between layers, as they were porous and difficult to dismantle without damage. In future investigations, mapping a conceptual donor as a resource for a new building design would benefit from a larger mapping exercise, perhaps using waste from several demolition projects that provide a larger database, and thereby increase the reuse opportunities.

Student Background

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MSc Architecture And Planning Beyond Sustainability

Educational Background

MSc Architecture and Planning Beyond Sustainability
Chalmers University 2023-2026
Bachelor of Fine Arts in Architecture
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KV Konstskola 2019-2020

Work Background

Architectural Intern/Junior Architect
Sunnerö Arkitekter, Autumn 2025
Architectural Intern
Lendager Group, Autumn 2024

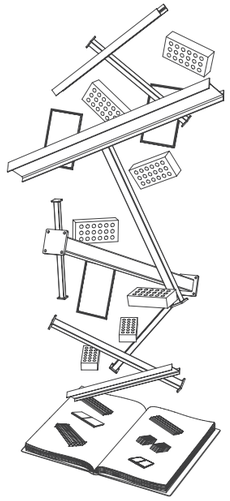
Introduction

First Act

Second Act

Third Act

Introduction



Context And Discourse

The first chapter provides background and a problem description for the project. It sets the framework for the thesis by outlining the research questions and delimitations, and by explaining the aim of the research.

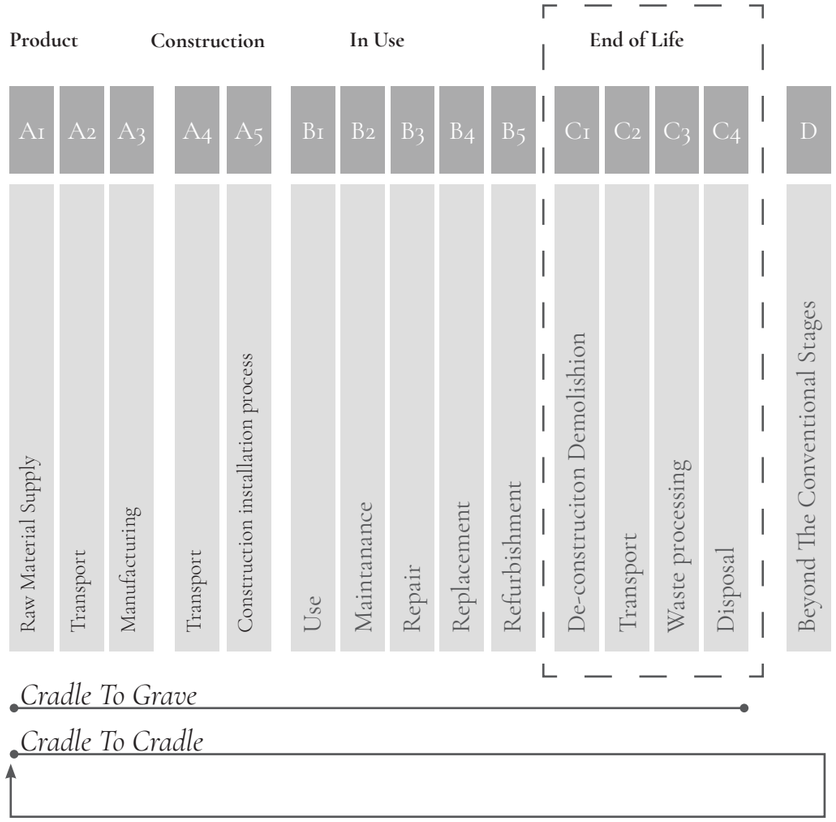
Theory

The theory chapter presents research on resource mapping as a phenomenon and on its use in the local context of Gothenburg, including existing tools used today to examine the method. The chapter also provides information on reference projects and research that have found creative new ways to work with reuse, including a closer look at the reuse of brick, a main material in the donor building and an important focus for finding reuse solutions.

Methodology

The methodology is structured into four main steps of: Mapping, Disassemble and Reassemble, Material Transfers and New Design. Together, they introduce a set of architectural tools used to examine and apply the theoretical methods into design work.

Life Cycle Stages



Background And Problem Description

The building sector accounts for two-fifths of the total national waste produced each year, which has increased by 50 % since 2014 (SCB, 2025). Due to more sustainable production methods, the amount of hazardous waste has decreased, yet 45% of total building waste is not recycled (Boverket, 2025.).

Studies from SCB and Boverket highlight an important issue where the industry is actively developing more sustainable production methods (stage A1-A3 in the left figure). However, this commitment does not extend equally to the later stages of a life cycle. There is a strong focus on efficient ways to produce and maintain building materials, but far less attention is given to demolition and aftercare (Boverket, 2025.). This further advances the issue of not reaching cradle to cradle material flows and reducing waste.

In the field of architecture, there are many great examples of transformation and reuse projects that preserve building structures for cultural, or resource-efficiency reasons. However, these projects are often limited to buildings that have already been decided valuable enough to keep. We tend to value the preservation of structures with clear cultural or aesthetic significance but are far more accepting of demolition and rebuilding when a building is perceived as lacking such qualities. (Díaz-Andreu. 2017)

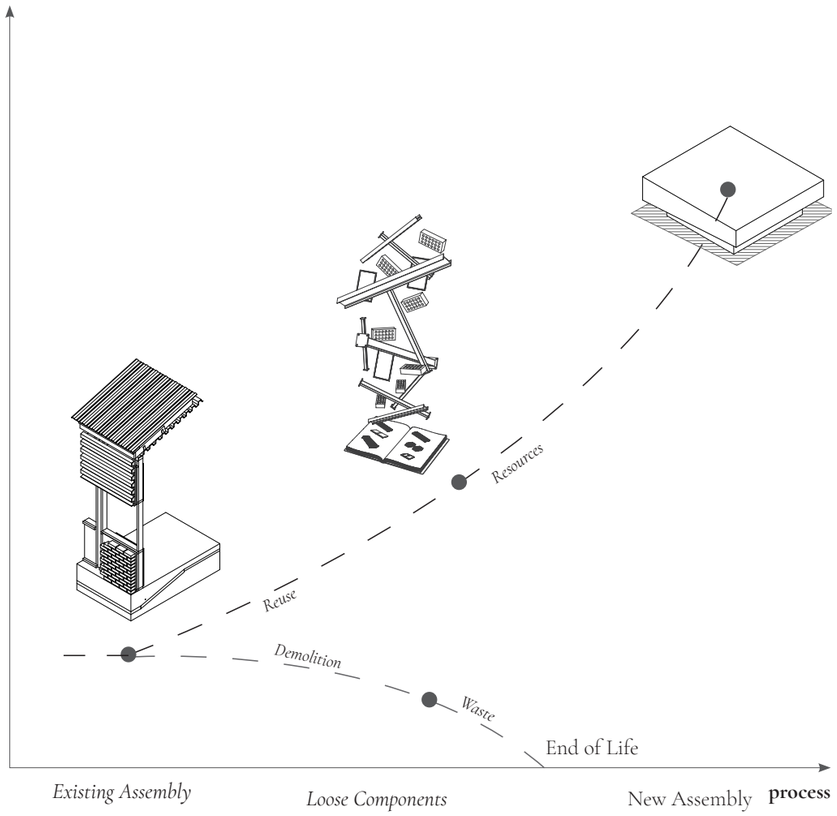
In several cases in Gothenburg, it is evident that even cultural value is not always a strong enough argument to save a building from demolition. Demolition decisions are instead frequently based on function, technical condition, or economic considerations. As a local example, this is visible in the well-debated case of Valhallabadet, (Roos, 2024) as well as in the less publicly discussed case of the number of school buildings across the Gothenburg area (Svensson, GP 2025), which are being closed and threatened with demolition for the above reasons.

Material value alone is not a strong argument in the decision-making of demolition. This raises an important research gap of how architects might intervene in a demolition process to promote sustainable resource flows. When transformation and preservation are not politically convincing, how can we approach new construction so that demolished materials are incorporated directly into a new project, thereby reducing waste?

Aim

The thesis aims to investigate how architects can actively connect material life cycle ends with beginnings outside of transformation projects. In cases where a building is not politically convinced to withstand, the thesis aims to explore a design process that works with the aftercare of demolished building materials. It further highlights the value of waste materials and investigates whether, through mapping and reuse, it is possible to increase the value we place on building waste by transferring demolished building materials into a new building project.

Value



Research Questions

1. How can resources from one demolished building be intertwined with a new construction process to optimize resource flows?

2. How may the demolished materials of Angeredsgymnasiet be reused and reassembled in a new building programme by the ferry stop at Klippan?

Delimitations

Ownership: The thesis does not address ownership and limits itself to a scenario in which the same actor owns both the donor building and the new construction site, making reuse practically and economically feasible, but it does not discuss the legal practicalities of ownership or economic factors in a broader perspective.

Logistics: The thesis is limited to a conceptual solution for the logistics, transport, and storage of the donor materials, as well as to estimating a timeframe for the material transfer actions. The estimate is based on the municipality's document on the timeframe for Södra älvstranden (Göteborg Stad, 2025) and the demolition of Angeredsgymnasiet (Göteborg Stad, 2025), but remains conceptual.

Mapping: The donor building is a repetitive structure. Instead of mapping the whole building, the mapping exercise is limited to one principal of the building as a representative of the whole. Loose furniture is also not included in the mapping of the building's materials and objects, since the organisation owns it and will bring it to their next location.

Politics: A public debate has revolved around what happens to the current building programme of Angeredsgymnasiet when the building is demolished, and whether the programme should be relocated elsewhere in the city or remain where it stands today. Students and other engaged community members have initiated several petitions to preserve the school for reasons of high social value. For a better understanding of the social importance of the high school, the documentary "Framtiden tillhör oss" can be viewed on TV4 Play. (Tv4, 2026)

The thesis does not aim to neglect the political discussion surrounding the relocation of Angeredsgymnasiet as a building programme, but differentiates between the political decision to demolish the building system and a programmatic relocation. This thesis work is situated within the current premises of the building industry, focusing on demolition in relation to material value, and delimits the discussion of the programmatic consequences of demolition.

Resource Mapping

Resource: *noun: "a stock or supply of money, materials, staff, and other assets that can be drawn on by a person or organization in order to function effectively." (Oxford english dictionaries, 2026)*

Mapping: *verb: " To discover or describe how something is organized, arranged, or structured." (Oxford english dictionaries, 2026)*

Resource mapping is a broad methodology that collects, organizes and presents the availability or lack of resources within a specific context and can be applied in several different fields. The thesis builds on the core theory of resource mapping, but with a particular focus on the waste-material mapping approach developed by Duncan Baker-Brown in his published paper "Resource Mapping. Methodology to develop waste material flows for architectural project planning." (Brown, 2020) and book "The Reuse Atlas". (Brown, 2024) His methodology outlines how identifying and cataloguing available waste resources can inform sustainable material use in architectural design. While the original framework of resource mapping emphasizes mapping materials found in the local context, this thesis adapts the theoretical method to a building-specific context.

Existing Methodologies For Resource Mapping/Inventory

Manual Inventory

Through a physical approach, the inventory collects and tests the quality of materials. The inventory method ensures that the expected reuse matches the actual quality of the materials, but it is a time-consuming process. (Bergström, 2025)

Digital Tools And Organisers

Through applications and networks, materials are gathered on a larger market, where examples of companies that have managed to scale reuse inventories are CC Build and Bruksspecialisten. CC builds functions as a market (CC Build, 2026) while Bruksspecialisten are specialized in the reuse of brick and clay materials. (Bruksspecialisten, 2026)

3D-Scanning and Digital Tools

A third option is to scan a building, where a point cloud is incorporated into BIM software to provide 3D photography of an existing building. The method creates a precise replica of the existing conditions and is used in addition to original drawings, which may not accurately reflect an old building that has changed over time. (Heisel, 2022)

Local Initiative To Resource Mapping

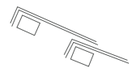
The municipal property management (lokalvårdsförvaltningen) has developed an assessment matrix to evaluate reused materials in the city of Gothenburg. The matrix was produced as part of the research project "Re-circulate" in a collaboration between Chalmers University of Technology, Bengt Dahlgren Architects, White, Wingårdhs, Earthlab, and Göteborgs Stad. It provides criteria for evaluating the suitability and quality of reused materials within construction projects and functions as a general tool for reuse in early design stages. The matrix divides common materials into a colour system of green, orange and red, which reference the general reuse potential of a certain building product. The evaluation matrix may serve as a guide, but it is very general and may not accurately reflect an object's actual reuse potential. (Andreasson, 2021)

Reuse Potential

easy challenging difficult

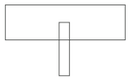
Detachable Construction Techniques for Future Reuse

In the book "Manual of Recycling" by Anette Hildebrandt, detachability is considered highly valuable for future dismantling and reuse of materials. The book discusses a wide range of recycling strategies, but is mainly used in this thesis as a reference for sustainable joinery. In the chapter "Detachable connections and Constructions", Hillebrandt exemplifies several techniques of joinery for future dismantling, where the general topic concerns screwing, clamping and nesting above wet techniques such as welding and casting. (Hildebrandt, 2019) A similar approach may be reviewed in Kevn Pavilion by Superuse (2020) on the upcoming page. Below are a few illustrated joineries described within the Manual of Recyling and found relevant to use within the design work of this thesis.

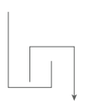


Layering:

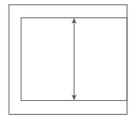
Inserting:



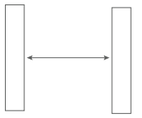
Sliding:



Hanging



Clamping



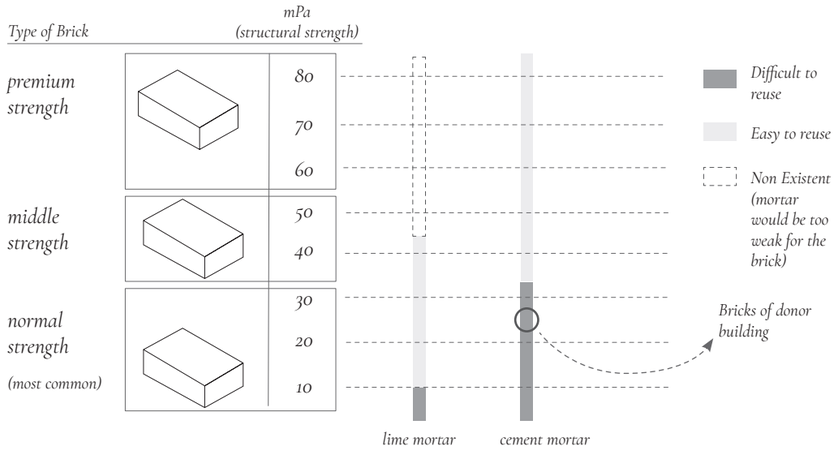
Screwing

Reuse of Brick Combined With Cement Mortar

In general terms, bricks are divided into three categories of structural strength. For the bricks to have a qualitative strength in formation, the strength of the brick must remain lower than the strength of the chosen mortar. The two main mortars found in present buildings consist either of lime or cement. Lime is usually found in buildings constructed prior to 1950, while cement mortar had its peak during the 1970s and 1980s mass production. (Bruksspecialisten, 2026)

In cement mortar formations of brick walls, the mortar stays significantly harder in relation to the brick than lime mortar does, which acts as a softer material. In a disassembling process, this means that bricks that are walled with cement mortar break to a greater extent than bricks walled with lime mortar (Bruksspecialisten, 2026).

The subject building was built in the 1980s, and is thereby assumed to have a brick facade constructed with cement mortar. Removing and cleaning the bricks one by one would result in a reuse potential of ca. 50-70%, meaning about half of the material would remain as waste. One way to minimise the material loss is to accept halfstones as part of the reused end product. (Bruksspecialisten, 2026) A different technique is to disassemble the bricks into sawed modules, where both the mortar and brick are part of a brick module. The technique reduces material loss, but is a significantly more expensive process. The technique can be reviewed in the reference project Resource Rows by Lendager Group in Copenhagen (Lendager Group, 2017).



Reference Projects

Figure 1: photography Varvstaden

Varvstaden, Malmö

Varvstaden employs a material bank to track and quantify building materials from their projects, enabling efficient reuse in future constructions. The approach reduces waste, supports circular building practices, and ensures materials are repurposed rather than discarded. (Varvstaden. 2026) The reference has been used mainly as a methodological reference for storing and caring for demolished building products.

Figure 2: photographer Frans Hanswijk

Kevn Pavilion, Superuse

Kevn Pavilion demonstrates how buildings can be constructed entirely without casting by using “dry assemblage.” Components are mechanically joined, allowing the structure to be easily disassembled and its materials reused in future projects. The architects also work with harvest maps as a methodology, which is of high interest as a methodological reference. (Superuse, 2020)

Figure 3: Photographer Ricardo de Vecchi

Buitenplaats Brienenoord: Superuse

In a similar project to Kevn pavilion, Superuse Studios demonstrates how materials from one building can be specifically reclaimed and integrated into a new structure, showcasing precise and intentional reuse in construction. (Superuse, 2020)

Methodological Approach And Reasoning

1a. Resource Mapping of Donor
The first methodological step applies three architectural tools: physical site inventory, drawing analysis, and physical modelling. Each tool aims to examine a different aspect of the existing building. The physical site inventory assesses the condition and quality of the materials and documents the building's current condition through photography. The analysis of the original construction drawings reveals the structural system and identifies materials and components that were non-visible during the site visit. The physical modelling exposes opportunities and challenges related to the disassembly and potential reuse of the building components and serves as a bridge between research and design investigation.

1b. Mapping New Site
The mapping of the new site applies classical architectural mapping to understand flows, functions and typologies. Volumetric studies of current conditions, as well as an understanding of future scenarios through reading, writing, and drawing, are ways to ensure that the building design can last and host relevant programmes over time.

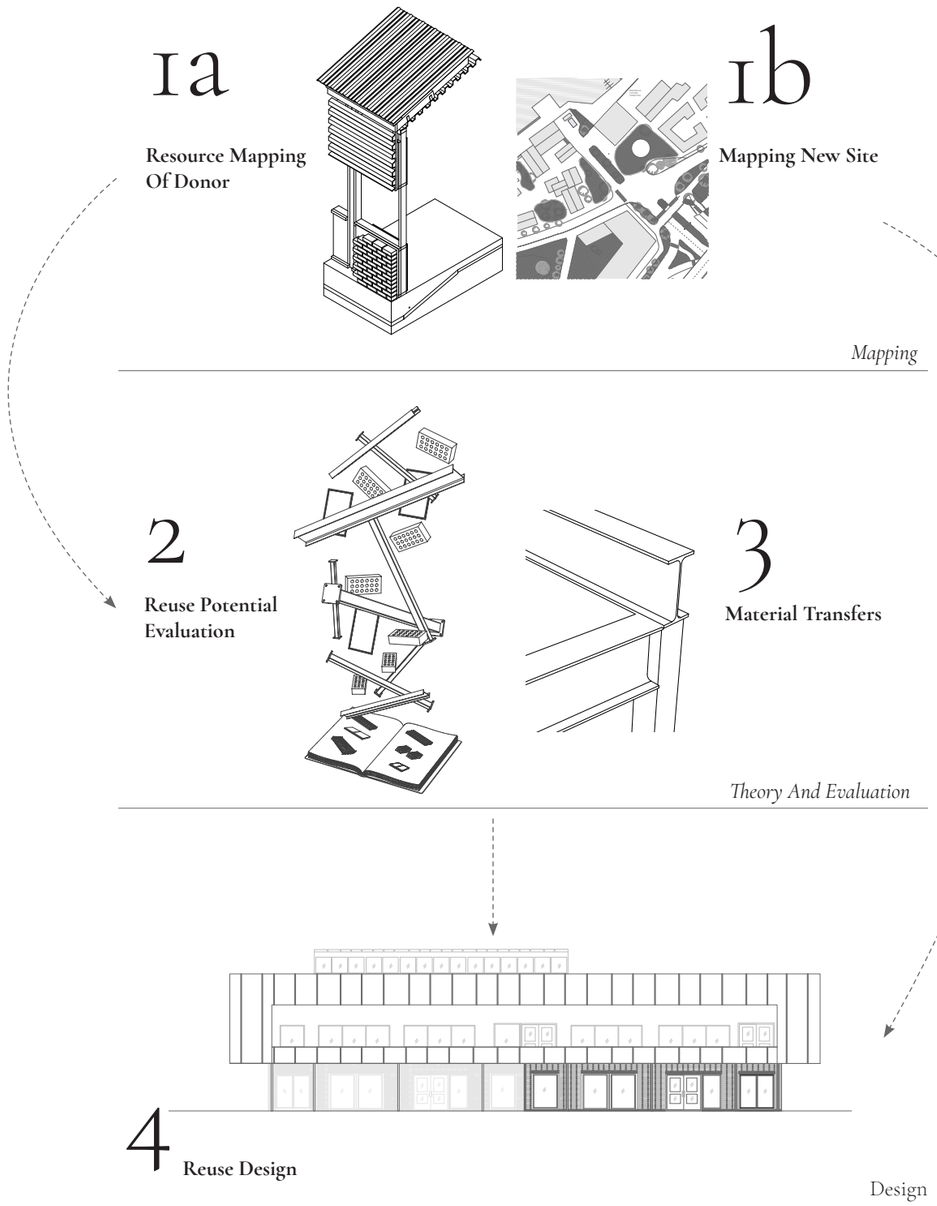
2. Reuse Potential Evaluation
The second methodological step applies two architectural tools: a reuse matrix and reference projects. The reuse matrix is provided by the municipality and serves as a general comparative tool, while the reference projects are studied to examine alternative approaches to material reuse.
The two tools support different understandings of reuse potential and offer analyses that combine a realistic and creative approach. The reuse matrix provides a general overview of the opportunities and challenges associated with the reuse of specific materials. Reference projects identify creative and alternative ways of working with materials that are often considered difficult to reuse. This methodological step provides quite general tools and serves as a conceptual reference guide. For a more precise material assessment, the project requires interdisciplinary discussion with engineers and professionals from the demolition industry. The reuse potential analysis presents itself as part of the material catalogue.

3. Material Transfers

The third methodological step applies four architectural tools: referencing, modelling, sketching and drawing. The tools aim to support understanding of material assembly. The methodological step is not fixed but rather an ongoing exploration towards the last step of design work, differentiated as its own step to highlight the importance of working at the detailed material level already in early design iterations. This step is important because it anchors the new design to the donor building and its available materials.

4. Reuse Design

The final methodological step applies three architectural tools: 3D modelling, sketching, and architectural drawing. The design focuses on material in relation to space, with architectural drawings serving as the main representation of this relationship. The drawings aim to maintain a clear focus on materials and present them in a manner that highlights not only programme, flows, and other classical design values but also material reuse. For example, a floor plan may illustrate a programme, while simultaneously showing the placement of flooring materials. The choice of flooring informs programme placement, and vice versa, highlighting the importance of integrating materials throughout the design process. Form should follow availability.



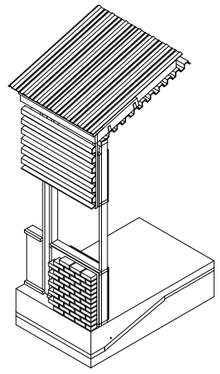
First Act

1a Mapping Demolition

The donor building functions as a repetitive structure. In order to cover the building under the given framework of the thesis, the mapping is made on one principle of the building structure. Out of six almost identical structures, one is examined and mapped in the following chapter. The mapping further understands the building from a material bank perspective, and does not map existing flows and programmatic functions, since these are dependent on the existing correlations of spaces and thereby disappear in the disassembling of the building.

Material Catalogue (Reuse Inventory)

In order to make the mapping of the donor building comprehensible, the Material Catalogue is divided into four categories of building elements. All elements are represented with meassurements and material properties, including a short description on the reuse potential of the element. The reuse potential is described and valued with the reference tool from the Municipality. In accordance with the methodology, the mapping presents elements found in the construction drawings, as well physically seen at site visit.



1b Mapping Klippan

The mapping of Klippan works from a scenario in which it investigates an area undergoing an upcoming transformation. First, it describes the site today in relation to the municipal masterplan. Moreover, the site analysis examines what the site will provide in terms of flows and programme in the timeframe in which the new design project would theoretically be constructed, somewhere around 2030 to 2035.

Donor Building

Angeredsgymnasiet was constructed in 1984 and has, in February 2025, been decided to be demolished due to its condition and size no longer meeting the requirements of the new programme planned for the site. The building currently hosts high school students, a program that will be relocated elsewhere in the city, while the future site will hold a mixed-use programme of a cultural center, higher education and folkhögskola. The demolition decision of the present building is based on a prestudy, stating that the building has exceeded its lifespan, is moisture damaged and lacks cultural value. It also states that demolition is economically more beneficial than renovation alternatives. (Göteborg Stad, 2025)

Notably, the report and prestudy that states the demolished plans does not address any issues of demolition waste. Neither does it consider the demolished materials potential value as resources beyond first hand assessment.

View from the inside coartyard of building 21

Reasoning Behind Demolition

Since the volumes are repetitive structures, building 21 has been chosen as a representative and building principle for the mapping.

21. *mapped building principle*
21-26. *classrooms and supporting functions*
31. *staff and shared spaces with public cultural and activity-based functions*

Technical Standard

The lower parts of the building are in need of renovation for cracks in the structural floor slab, as well problems mith moisture and ventilation in the building envelope.

Economy

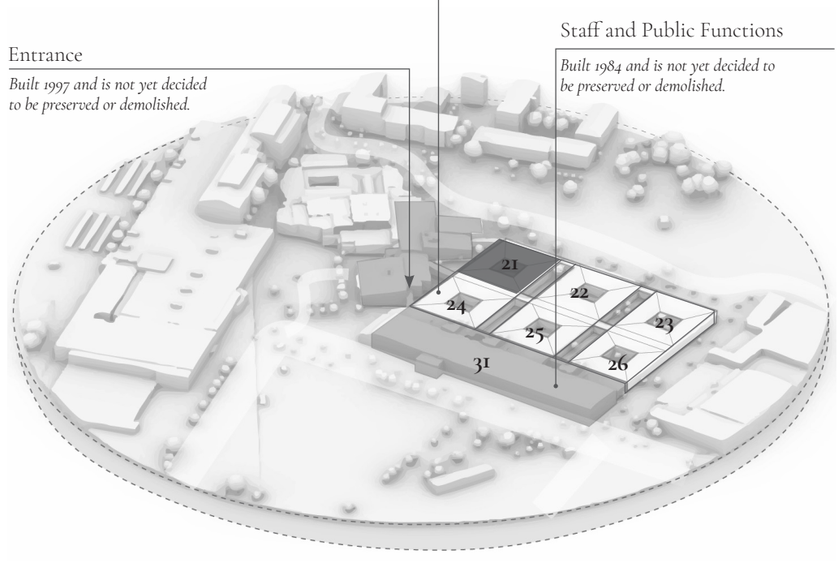
It is argued economically more beneficial to demolish and rebuild, than to renovate.

Programme

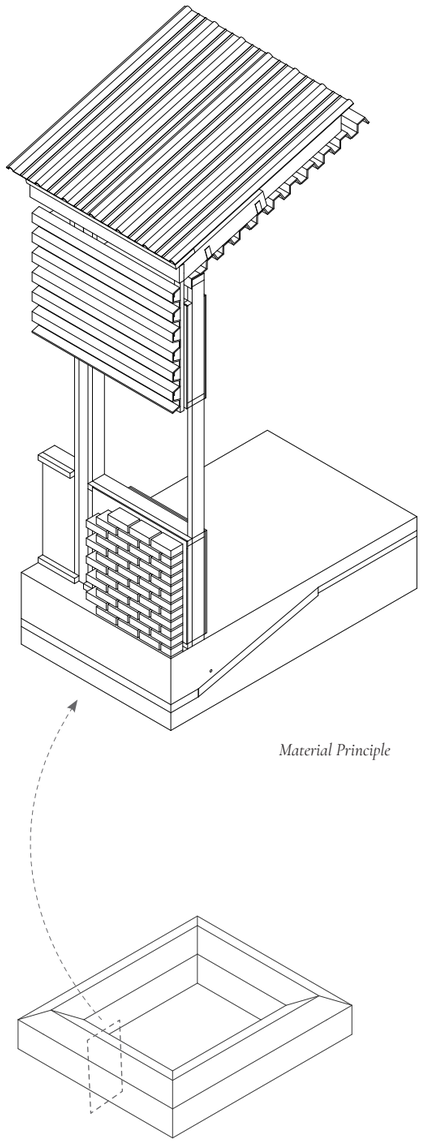
The decision frames that the present structure does not meet the new building programme that will occur at the future site.

Classrooms And Supporting Functions

Constrcuted in 1984. Faces demolition



Mapping Subject
Not yet decided whether to be demolished or preserved
Faces Demolition



Material Principle

Building Volume

Building 21: Material Principles

The donor building is rigid and consists of materials typical of its time. The facade consists of a divided envelope in which window strips connect brick at the bottom of the building with a corrugated steel sheet at the top, that meets a standing seam steel roof structure. The materials appear quite calm and humble, which carries through into the interior. The primary structure consists of steel pillars and beams that, together, form a square building enclosing an outdoor courtyard.

Wall Principle
Corrugated Steel metal/ 120 Brick
Vertical joists 36x58
40 air gap
9 gypsumboard
vertical joists 45x45 (nailed to 120 joists)
45x120 mineral wool (type: RW1303-00)
0,20 plastic foil
13 gypsum board
13 gypsum board

Facade Materials
1. Brick walled with cement mortar
2. Wooden cladding/ Red Steel Sheet
3. Window 1200/1400/600
4. Corrugated Steel sheet (black and pink)
5. Standing Seam Steel sheet (roof)

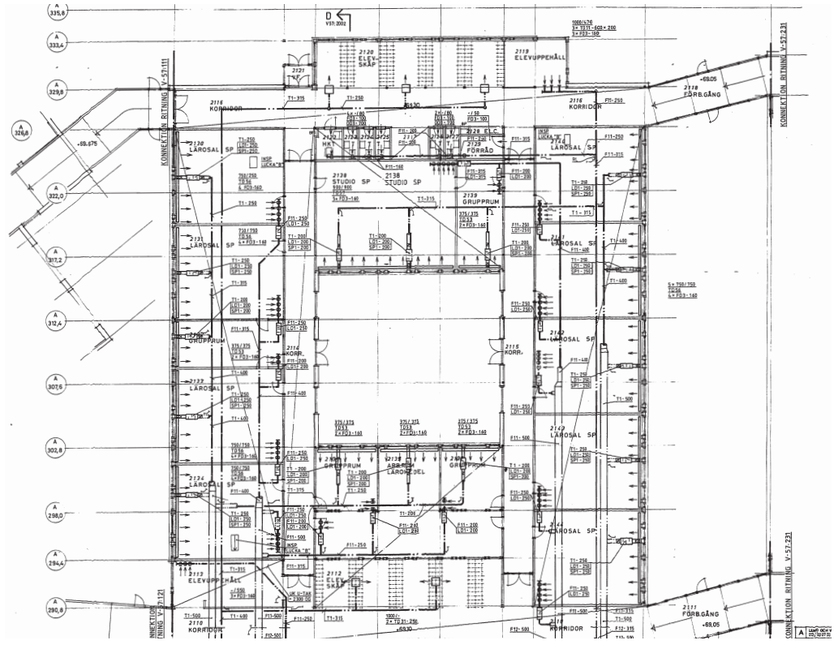


Figure 4: Archive Plan of Building 21, Lund And Valentin Arkitekter 1981

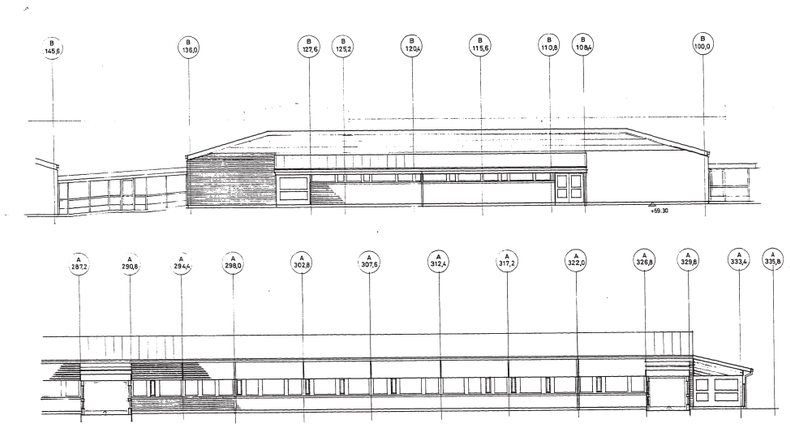
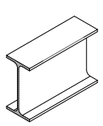


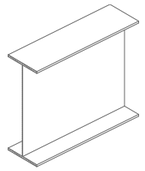
Figure 5: Archive Facades of Building 21, Lund And Valentin Arkitekter 1981

Structural Overview



IPE 200

Steel Beam
stabilizing properties

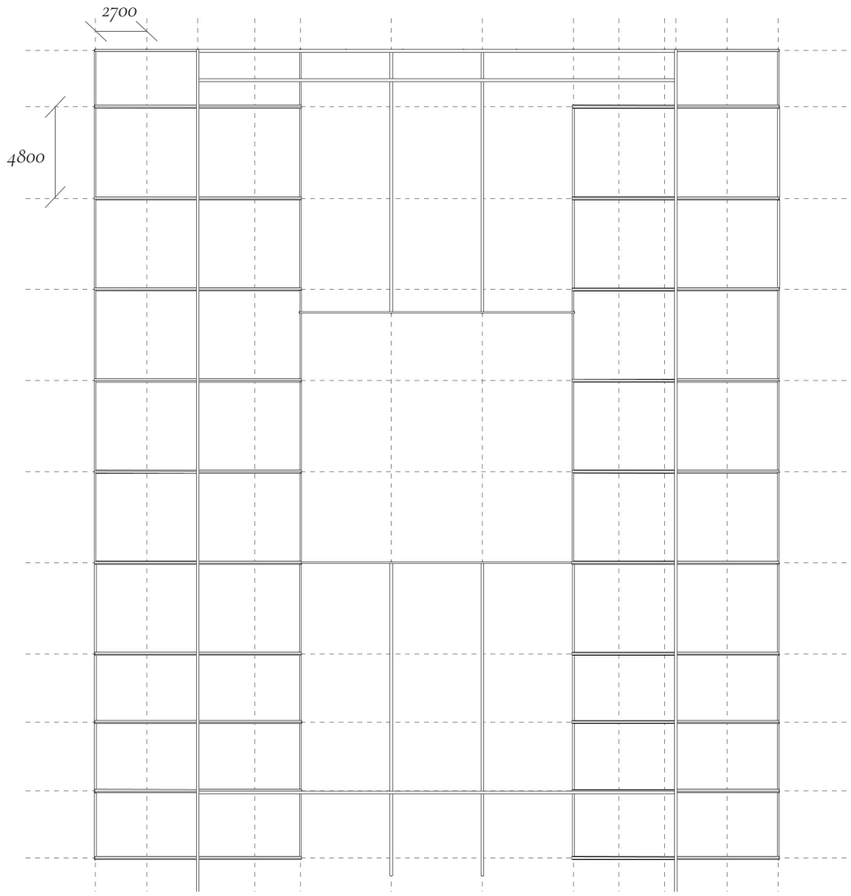


RANA/400/180

Steel Beam
Load bearing properties

Steel Pillar

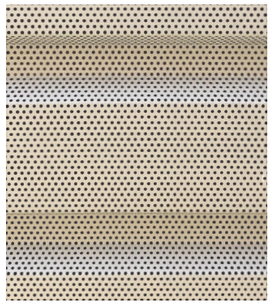
Steel pillar 90x90
Load bearing properties



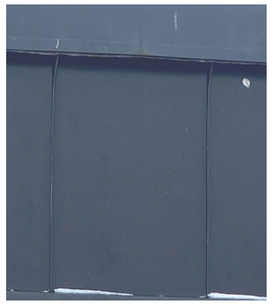
Interior View of Building 21

Physically Collected Samples

2.1 Texture Overview

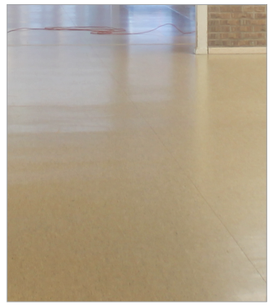


Material: Perforated Steel
Category: 04. Interior
Reuse Potential: Easy



Material: Corrugated Steel
Category: 02. Envelope
Reuse Potential: Easy

Material: Brick
Category: 02. Envelope
Reuse Potential: Challenging

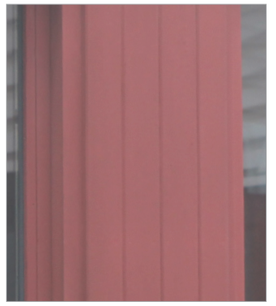


Material: Linolium
Category: 04. Interior Finnishes
Reuse Potential: Easy

Material: Steel sheet
Category: 02. Envelope
Reuse Potential: Easy

Material: Corrugated sheet A
Category: 04. Interior Finishes
Reuse Potential: Easy

Material: Corrugated sheet B
Category: 04. Interior Finishes
Reuse Potential: Easy



Material: Wood
Category: 02 Envelope
Reuse Potential: Easy

Material: Glass
Category: 02. Envelope
Reuse Potential: Easy

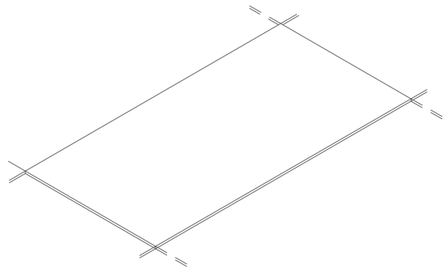
01. Structural Elements

The reuse potential of the primary structure is high in terms of pillars and beams, which are mostly bolted in place, rather than welded. The foundation is of higher challenge, both due to it being casted in place, and its thin casting and poor insulation that has resulted in cracks in the slab.

Foundation

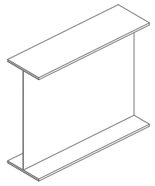
Slab

120 mm thick
Cast Reinforced Concrete
aprox. 12 000 m2
Reuse potential: Difficult

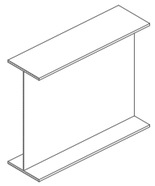


Beams

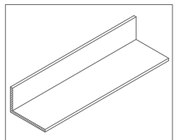
IPE 200
200/5.6 – 100 × 8.5
Steel
54 pcs
RP: Easy



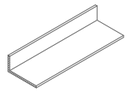
RANA 400/180
400/2.0-180x8
Steel
114 pcs
RP: Easy



RANA 400/150
400/2.0-150x8
Steel
54 pcs
RP: Easy

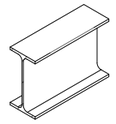


L-beam 80
80x80x8
Steel
RP: Easy



L-beam 150
150x90x10
Steel
RP: Easy

L-beam 130
130x165x8
Steel
RP: Easy



HEA-beam 120
120/5.0-120×8
Steel
24 pcs
RP: Easy

P201-204
90x90x2143
Steel (t=6,3)
18 pcs
RP: Easy

P205
90x90x3228
Steel (t=6,3)
3 pcs
RP: Easy

P206
90x90x3972
Steel (t=6,3)
3 pcs
RP: Easy

P207
90x90x4609
Steel (t=6,3)
3 pcs
RP:

P208
90x90x4712
steel (t=6,3)
8 pcs
RP: Easy

P209
90x90x4604
steel (t=6,3)
18 pcs
RP: Easy

P210
90x90x4609
steel (t=6,3)
2 psc
RP: Easy

P211
90x90x3972
Steel
2 pcs:
RP: Easy

P212
90x90x3228
Steel
2 pcs
RP: Easy

P213
160x80x2789
Steel (t=6,3)
12 pcs
RP: Easy

P214
90x90x2784
Steel (t=6,3)
45 pcs
RP: Easy

P215
90x90x2789
Steel (t=6,3)
16
RP: Easy

P216
160x80x2789
Steel (t=6,3)
12 pcs
RP: Easy

P217-218
90x90x2789
Steel (t=6,3)
135
RP: Easy

P219-220
90x90x3118
Steel (t=6,3)
12 pcs
RP: Easy

P221-222
90x90x2784
Steel (t=6,3)
6 pcs
RP: Easy

P223
120x120x2784
Steel (t=5)
22 pcs
RP: Easy

P224
90x90x2789
Steel (t=6,3)
6 pcs
RP: Easy

P225-226
90x90x2784
Steel (t=6,3)
12 pcs
RP: Easy

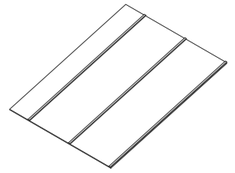
P227
90x90x2145
Steel (t=6,3)
1 pcs
RP: Easy

Exterior view of building 21

Reuse Potential Of Envelope Objects

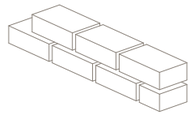
The majority of the envelope components appear to have good potential for reuse where several of the elements can be directly reused with little to none modification. The brick is of largest challange due to its fragility at disassembly.

02. Envelope



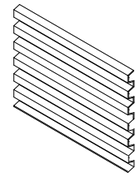
01. Striped Steel Sheet

1200 mm
Steel
Roof
Reuse potential: Easy



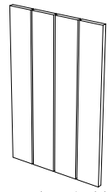
02. Brick

250x120x62
Brick (cement mortar)
Facade
RP: Challenging



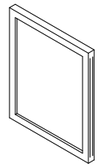
03. Corrugated Steel Sheet

1300 mm
Steel
Facade
RP: Easy



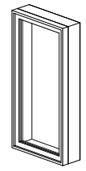
04. Wooden cladding

400x1100
Painted wood
Facade
RP: Easy



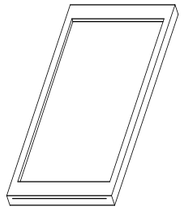
Window 1400 & 900

1400x1100 & 900x1100
Wooden frame, metal cladding, glass
RP: Easy



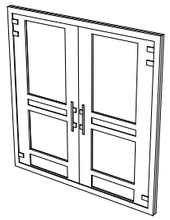
Window 400

400x1100
Wooden frame, metal cladding, glass
RP: Easy



Corridor Window

1300x2100 & 900x2100
Wooden frame, metal cladding, glass
RP: Easy



Double Entrance Door

2060x2100
Wooden frame, metal cladding, glass
RP: Easy

Smooth Steel Sheet

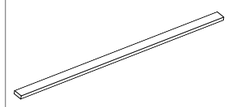
400x100
Steel (red coat)
RP: Easy

Material Meetings of building 21

03. In-Between Layers

Reuse Potential Of Inbetween Layers

Because the materials are hidden between other layers, their exact condition and quality are unknown, making it difficult to determine which layers can realistically be reused. Though on a conceptual level, several of the materials have porous identity, and are therefore expected to be hard to dismantle without damage. The trusses made of more stable wood materials are expected to have a higher reuse potential than gypsum boards and wool insulation.

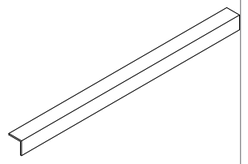


Wooden Stud 120

120x45
Wood
RP: Easy

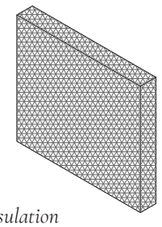
Wooden Stud 45

45x45
Wood
RP: Easy



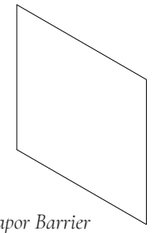
Steel Sheet joinery

80x80x8
L-shaped steel profile
RP: Easy



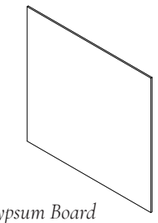
Insulation

870x1200
Mineral Wool
RP: Challenging



Vapor Barrier

0.20 mm thick
Plastic
RP: Difficult



Gypsum Board

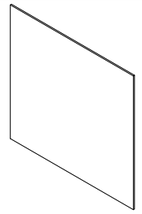
900x1200
Gypsum
RP: Difficult

Interior view of building 21

Reuse Potential Of Interior Elements

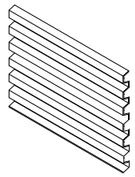
The potential for interior reuse is generally very high. Fixed furniture and plumbing fixtures are expected to be reusable, as are the interior cladding materials and doors. Loose furniture belongs to the school organisation and is therefore not presented as possible reusable objects.

04. Fixed Interiors



Acoustic board ceiling

600x1200
Steel frame.
RP: Easy

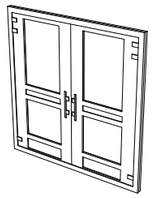


Corrugated Ceiling

1200
Corrugated Steel Sheet
RP: Easy

Flooring

Linoleum
RP: Easy

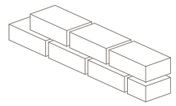


Double Door

2060x2110
Metal frame
RP: Easy

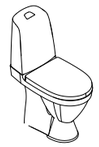
Single Door

910x2110
Steel frame
RP: Easy



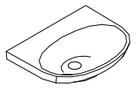
Brick

250x120x62
Brick (cement mortar)
RP: Challenging



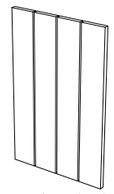
Plumbing Fixture

RWC
Porcelain
RP: Easy



Sink Plumbing Fixture

width: 600
Porcelain
RP: Easy



04. Wooden planks

145 width
Oiled wood
RP: Easy

View towards Älvsborgsbron

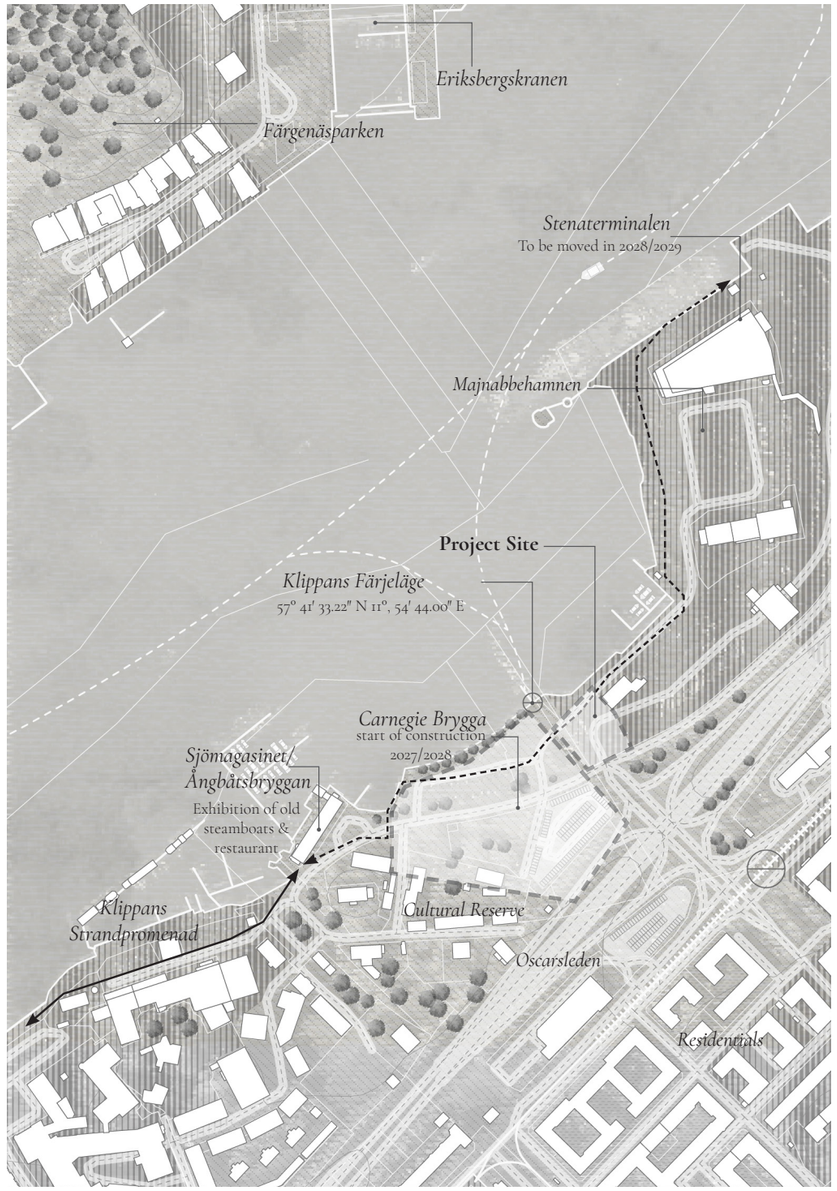
View towards the water

Klippan Present State: An Area In Transformation

The southern riverfront of Gothenburg is currently in an early planning phase, forming part of a long-term urban development vision for the entire Södra Älvstranden area. Within this context, Klippan is identified to function as a strong connector for transport infrastructure, meanwhile supporting cultural activity along the river and extension of Majnabbe. The extended timeline for development suggests the area to develop through active site management, temporary uses, and experimentation over the coming years, allowing the area to evolve alongside present public activity. (Göteborg Stad, 2025) The present conditions of the site manily consist of parking space.

An important strategy proposed for the area is placemaking. Placemaking is a transformative approach in which an area is programmed with a space that can spark life into it. It invites the public to be part of the making of a place, and aims to create identity and a sense of belonging. Järnvågen and Majnabbe have specifically been identified as suitable areas to act as test beds for placemaking design along Södra Älvstranden. Majnabbe in particular offers strong potential due to its mix of cultural activities, relatively low rents, and its status as a mixed-use zone with good access to public transport. (Göteborg Stad, 2025)

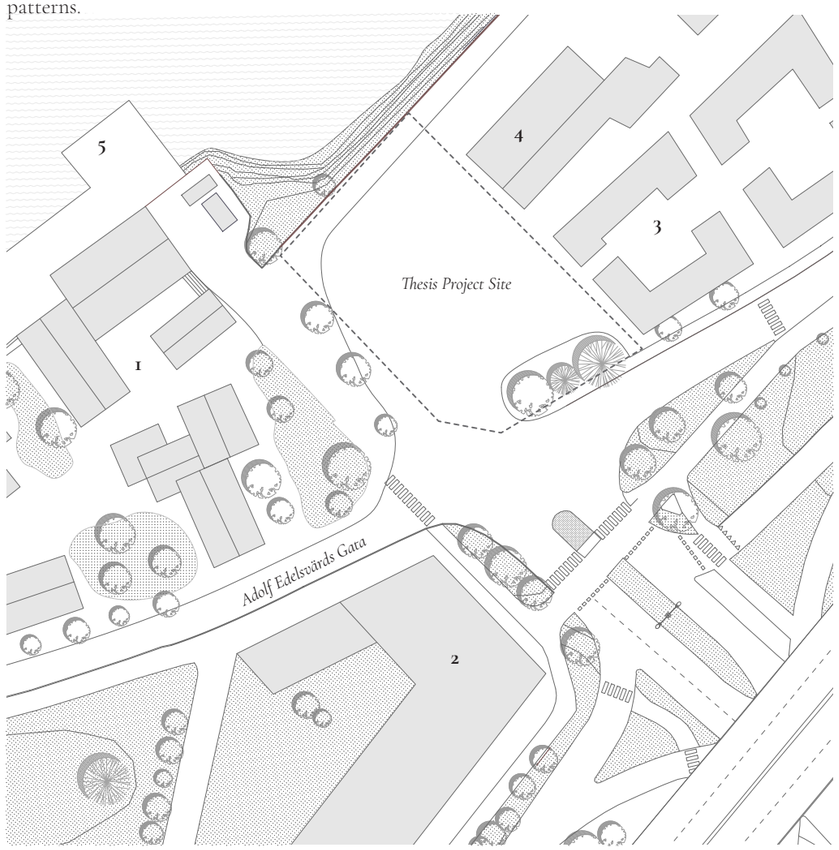
The planning document "Ändring av översiktsplanen Södra Älvstranden" (Göteborgs stad, 2025) also emphasize the importance of reuse in the future development of Majnabbe and the southern riverfront. This focus on circular approaches, makes the site of Klippan in Majnabbe an interesting testbed for the new design.



Södra Älvstranden, Klippan 1:5000

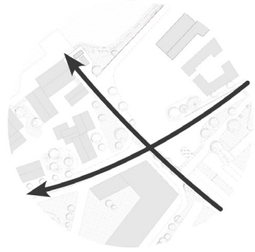
Programmatic Aim

The masterplan (Göteborg Stad, 2025) strongly emphasises the opportunities of the area to connect land with water. It suggests programmatic ideas for houseboats and an extended waterfront of Klippans strandpromenad, which today stops at Sjömagasinet and continues all the way into the city centre of Järnvågen. The waterfront should also enable connections across the river, where the ferry stop and public transport are of high interest to develop in relation to sustainable travel patterns.



Klippan 2035 1.1000

1. Carnegie Brygga: Residentials
2. Primary and Secondary School including kindergarten
3. Residential blocks (Old Stena Terminal)
4. Old customs building. It is not yet clear whether it will remain or be demolished to give space to residential blocks.
5. Klippan Ferry Boat Stop



Flows

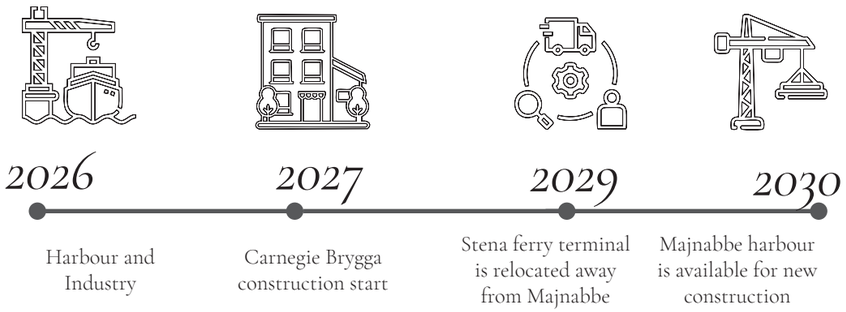
Stena Terminal
Stena Line and its ferry terminal will be moved in 2028/2029 to make space for future exploitation in Majnabbe harbour. The masterplan outlines a wide range of programs to grow in the area, with a focus on preserving existing structures and promoting cultural programs to make it a lively public place.

Barriers

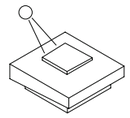
Carnegie Brygga
Carnegie Brygga is a residential project with construction start in 2027. They are the first residential developments in the area and will include a combination of residential units, a preschool, and a kindergarten, forming a full neighbourhood. The school is placed as a new barrier towards the highway.

Green Beds

Green Beds For Flooding Management
The area has a common goal of transforming the neighbourhood into a water-facing area with a riverside walk, similar to the opposite side of the water at Norra älvstranden. This further involves urban design to mitigate flooding risk, with several parks and wetlands planned to handle flooding between the buildings.

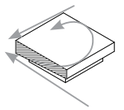


Second Act

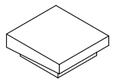


Design Strategies
The design strategies introduce the project in relation to its site and present the main programme and material design strategies that form the concept.

Interior Reuse
The interior reuse covers flooring and vertical cladding. Simultaneously, it presents the materials in relation to the building's programme of an extended food hall.

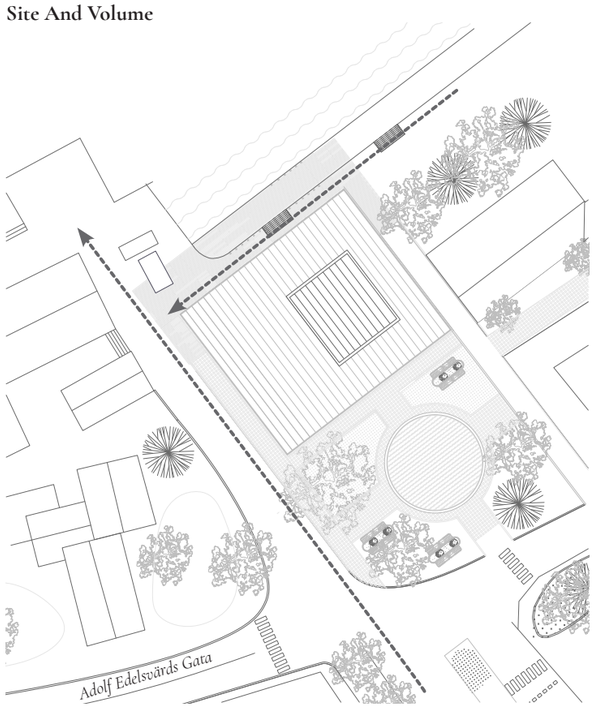


Exterior Reuse
The exterior chapter covers the design of the facades and their design based on available materials.

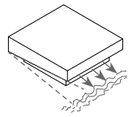


Structural Reuse Principle
The structural principle highlights the investigation of upcycling construction methods to promote a high degree of reuse within the project.

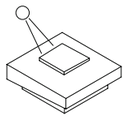
Site And Volume



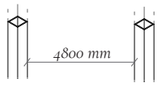
Site Plan 1.1000



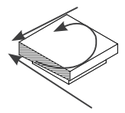
Water-facing



Skylight



Pillar Grid



Supporting flows

The grid pillar system and the spans of the existing steel pillar and beams have set the framework for the new building grid. The common measurement of 4800 has created a clear structure for the volume at Klippan, with a heavier brick ground floor and an overhanging second floor that provides outside shelter close to the ferry stop. The volume positions itself close to the waterfront to activate the water area. The building's location further creates a square on the south side, supporting water flooding management with greenery and natural water care, in the form of a park. The building itself is also designed to grow and open up towards the water, helping direct flows towards that side of the site. On the south side by the park, the building remains rather enclosed, creating a more mysterious impression that aims to spark curiosity while staying calm towards the residential neighbourhood. To avoid a barrier wall, the ground-floor volume takes an irregular shape, with a rounded corner near the bypassing road to invite visitors into the building.

The shape also flirts with the narrative in telling a story about the previous building, where the old courtyard in the donor building is translated into an inverted indoor light yard in the new project. The squared courtyard brings circular flows inside the building and indicates that this is more than just a bypassing place, but rather a place to dwell and be for a while. The skylight design also serves as a lighthouse in the evening hours. When there is activity, the light can be seen from afar, strengthening placemaking at Klippan.

View from North-East

Reuse Logistics

At the Klippan site, the existing warehouse is expected to be emptied in 2029, when the Stena ferry terminal is relocated from the site. Instead of demolishing the building, as discussed in the area's future plans, the project proposes to use the empty building to store the dismantled materials from Angeredsgymnasiet while they await reuse construction. All materials require testing for load-bearing capacity and safety hazards before being transferred to the new project, and therefore require access by third-party actors during the material transfer. The warehouse building aims to serve as a middle ground for material transfers. However, the exact logistics of storage, tests and transportation need to be further explored and organised across several fields.

Material Treatment

Steel

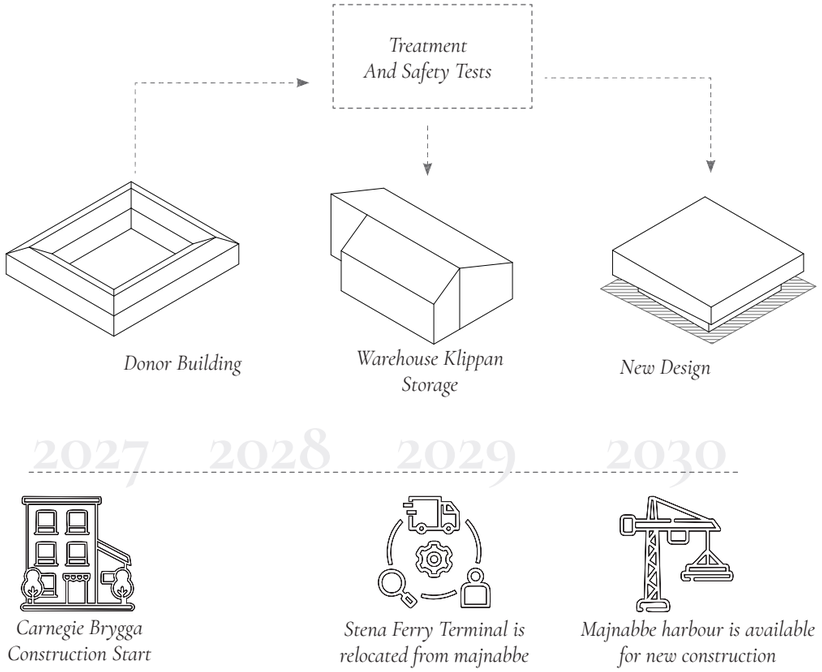
All steel material is treated and painted in a new brown colour range to suit the new identity at Klippan.

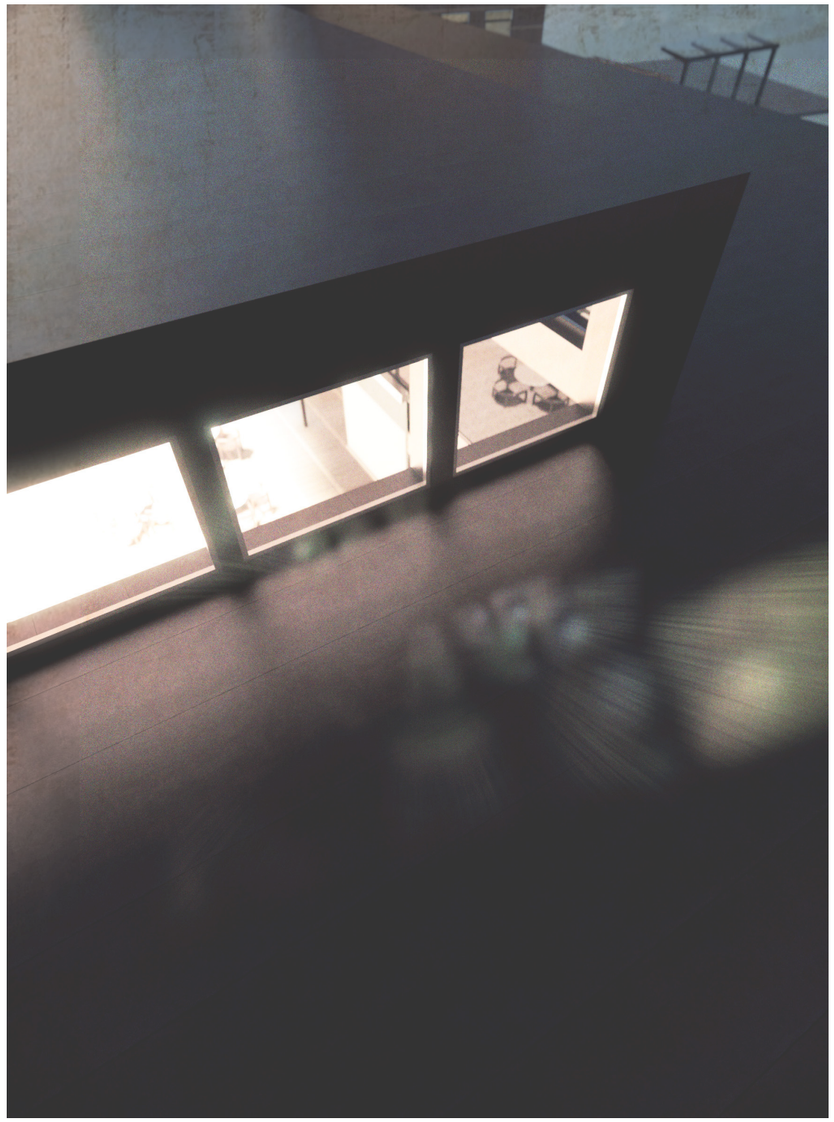
Concrete

The original concrete is in bad condition and can not be directly reused. It will instead be recycled and used as ballast for a new floor slab.

Brick

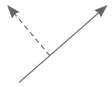
The dissasembly of the bricks results in a large amount of half stones. This will guide the design for the use of brick.





Skylight/Lighthouse feature

Programme Strategies



Flows And Water Facing Activities

The design should answer the upcoming needs of a public transport dwelling, inviting flows inside the building as a by-passing place, rather than acting only a point of destination. It should also support the requested lively waterfront.

Residential supporting functions

The programme should answer the surrounding residential neighbourhood and support a living square through markets, food and event-based spaces.

Material Strategies

Form Follows Availability

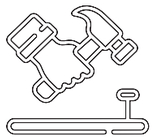
The materials from the donor building set the framework for the new design.

Narrative: Create High Value

The new building design should showcase high value of the reused materials and treat and exhibit them as new materials to fully exclude the idea of them being seen as waste.

Upcycling

When reuse of a certain element is not possible, the design should replace the component with materials that through upcycling can perform in its place. As a very last solution, new materials should be brought into the project.



Dry Assembly

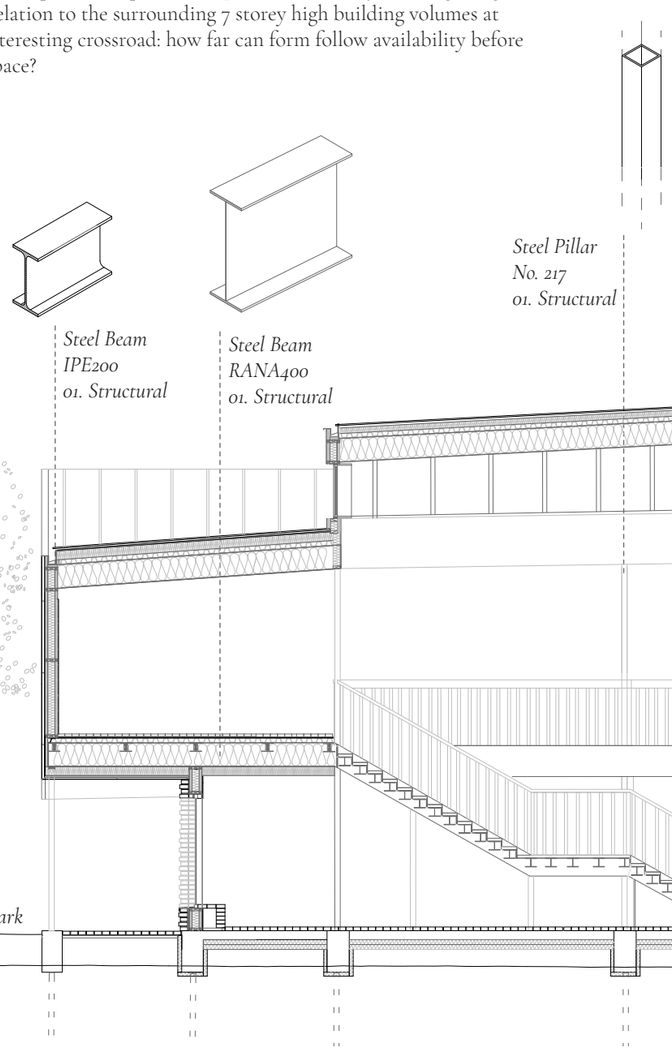
The design should be bolted rather than welded or casted to make sure that the structure can be further disassembled and reused or changed in the future.

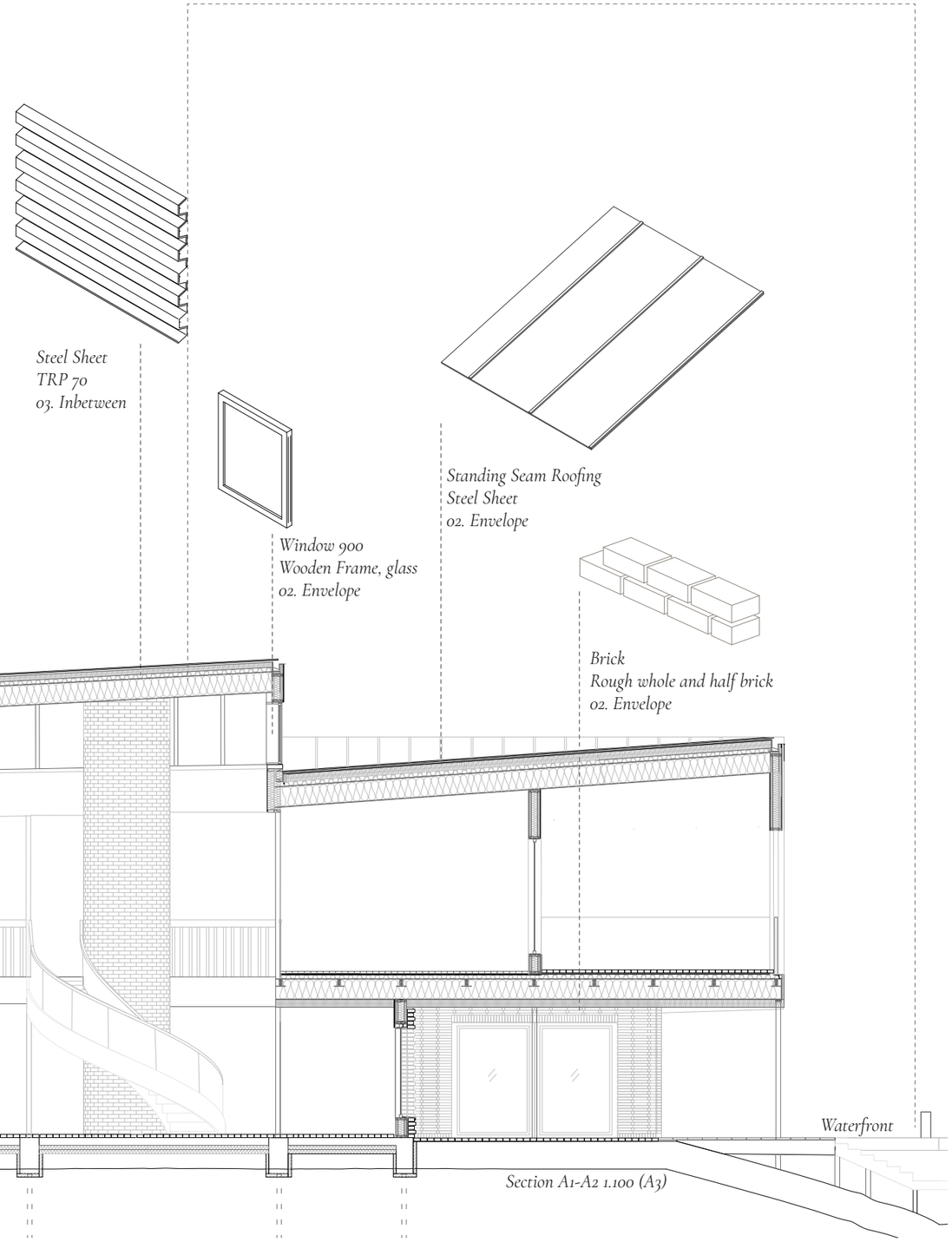
Interior view, first floor

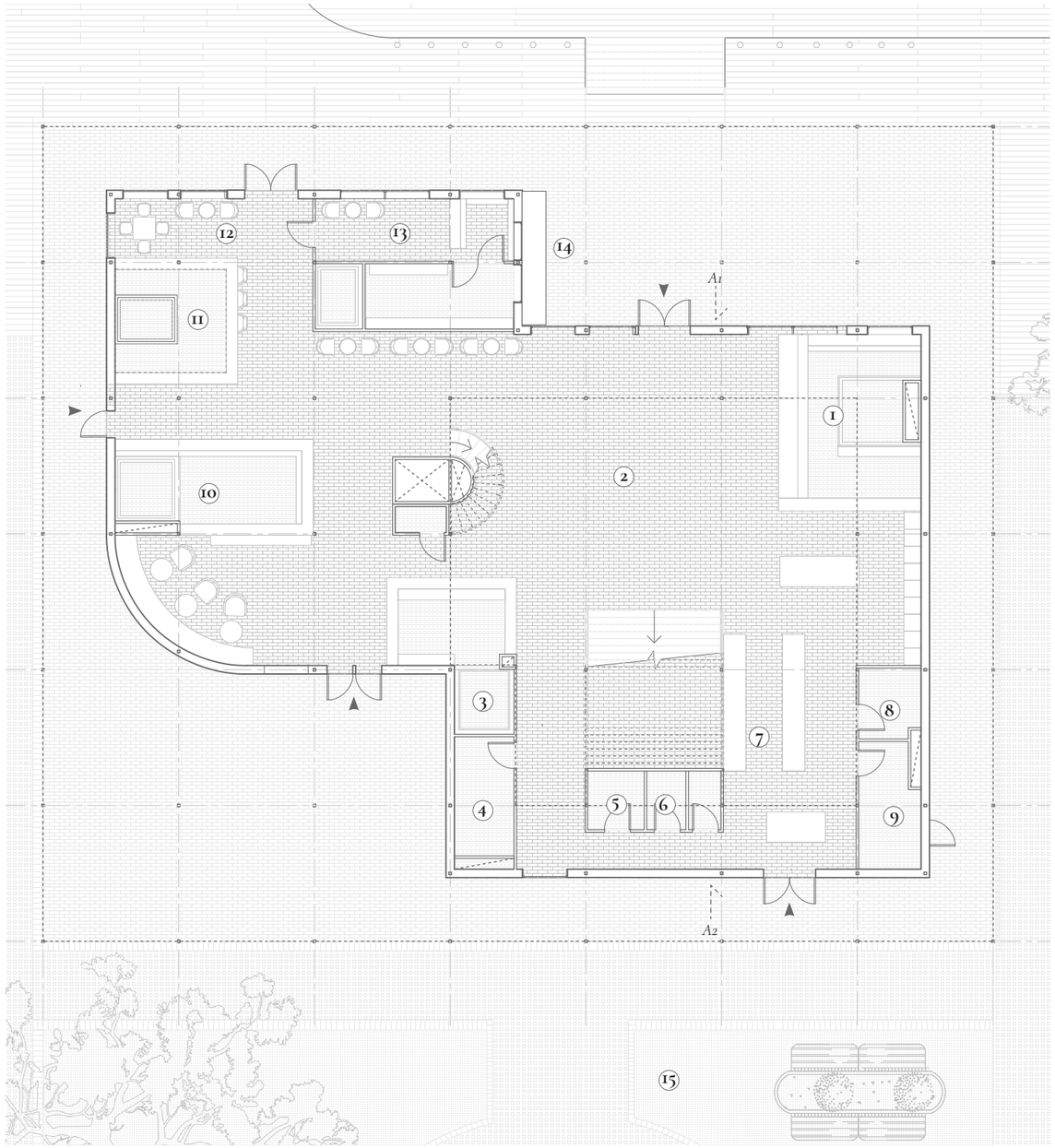
Reuse Overview: How Form Follows Availability

The ceiling height is relatively low due to the donor's original pillar height. Since one of the design strategies followed the idea of dry assembly, the alternative of welding several pillars to achieve a larger height was excluded, and the form had to follow the available materials truly. To create good spaces with low ceiling heights, a double-height space is introduced at the heart of the building.

The stairs are designed to be constructed from the large number of steel beams the donor building provides, which is of great importance in transitioning from a one-storey to a two-storey building. Since the new building project requires an elevator to meet accessibility standards, a new elevator object must be added to the project. The design process has explored whether parts of the elevator shaft could be constructed from reused materials, but due to safety concerns, this seems challenging. Additional ideas for a ramp design have also been discovered but avoided in the final design due to the large amount of space a ramp would require. A one storey building design was not interesting to discover in relation to the surrounding 7 storey high building volumes at Klippan. The process presents an interesting crossroad: how far can form follow availability before it lowers the standard of the new space?







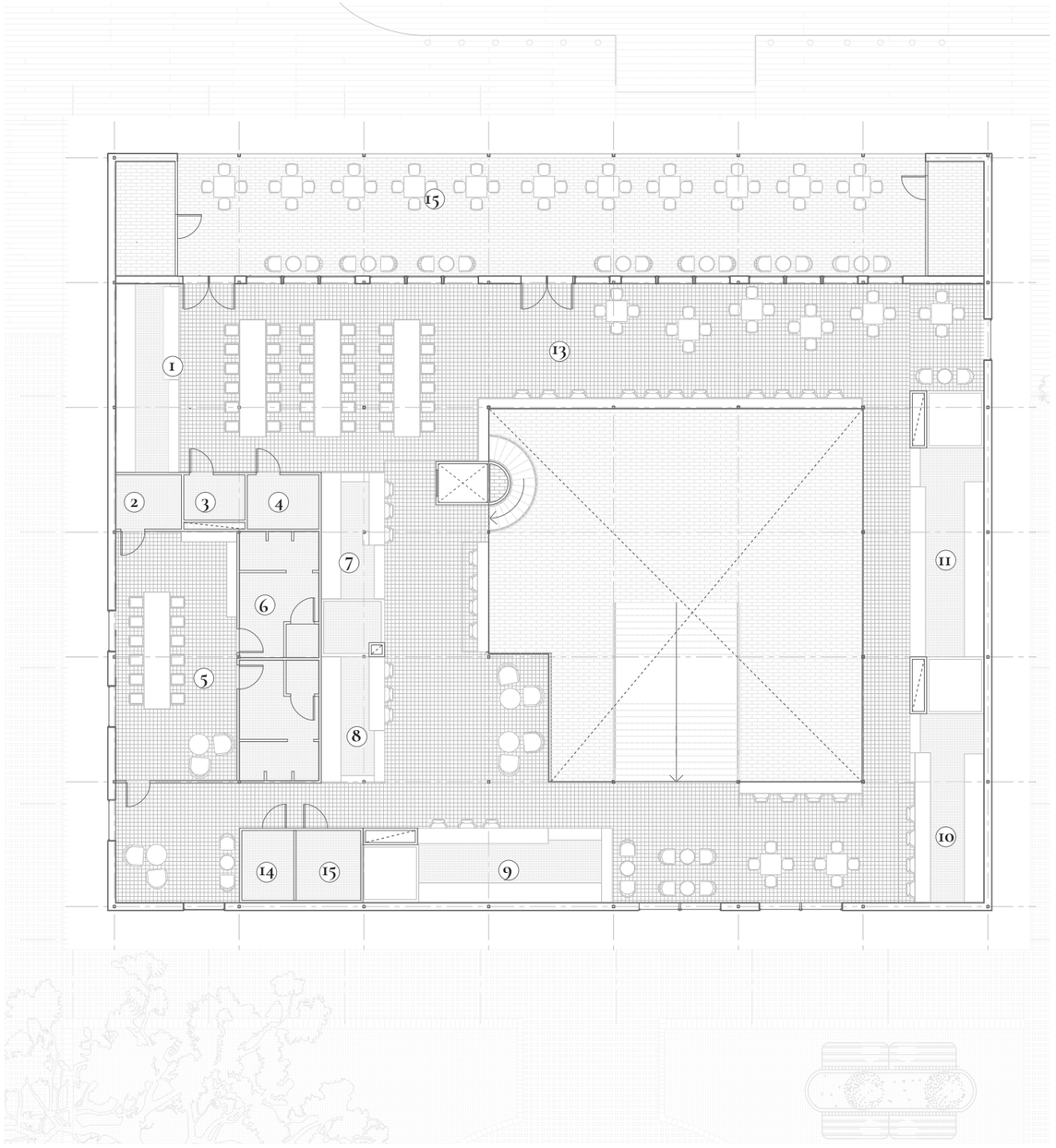
Ground Floor 1.200 (A4)

Floor Materials

Reused Brick
Reused Linolium

Programme

1. Gelateria and Pralines
2. Flexible event space with seating stairs
3. Cheese delicatecy
4. Technical space
5. RWC
6. WC
7. Flower shop
8. Storrage
9. Garbage room
10. Tea and Coffe Delicatecy shop
11. Espresso Bar and Café
12. Indoor Waiting for Ferry
13. Bakery
14. Bike Repair Station
15. Flooding Park



First Floor 1.200 (A4)

Floor Materials

Reused Brick
Reused Linolium
Reused End Grain (Kubbgolv)

Programme

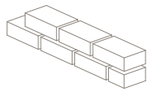
1. Bar
2. Staff RWC
3. Storrage
4. RWC
5. Staff Room
6. Staff Changing Room
7. Restaurant
8. Restaurant
9. Restaurant
10. Restaurant
11. Restaurant
12. Flexible Seating Area
13. WC
14. RWC
15. Outdoor Seating

Interior Reuse

The interior reuse focuses on fixed materials for flooring, ceilings, and wall cladding. The walls mimic the facade, focusing on reused steel sheets and brick. The flooring differentiates according to programmatic function and floor. The first floor features a heavier brick flooring to create a seamless transition to the outdoors, while the upper floor uses a lighter flooring material inspired by the old tradition of assembled wood offcuts. The donor building provides quite a large amount of hidden wood in its construction, and with different measurements of the existing elements, a patchwork of wood cuts is used to cover the floor. In wet zones and restaurant kitchens, where easy cleaning is essential, reused linoleum is the primary flooring material.

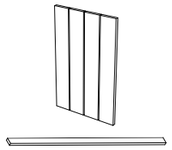
1. Brick

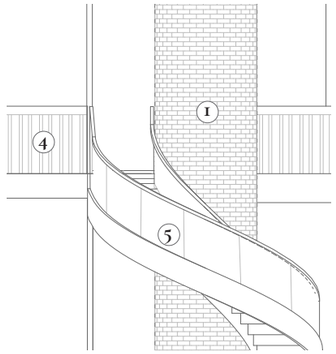
Rough whole and half bricks
02. Envelope



2. Wood

Cut joists and planks
03. Inbetween
02. Envelope
04. Interior





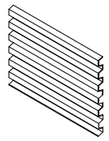
Wall Materials

3. Linolium

Direct reuse
04. Interior

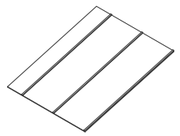
4. Corrugated Steel

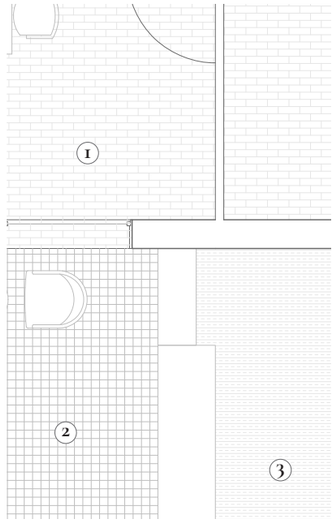
Direct reuse
04. Interior



5. Standing Seam Steel

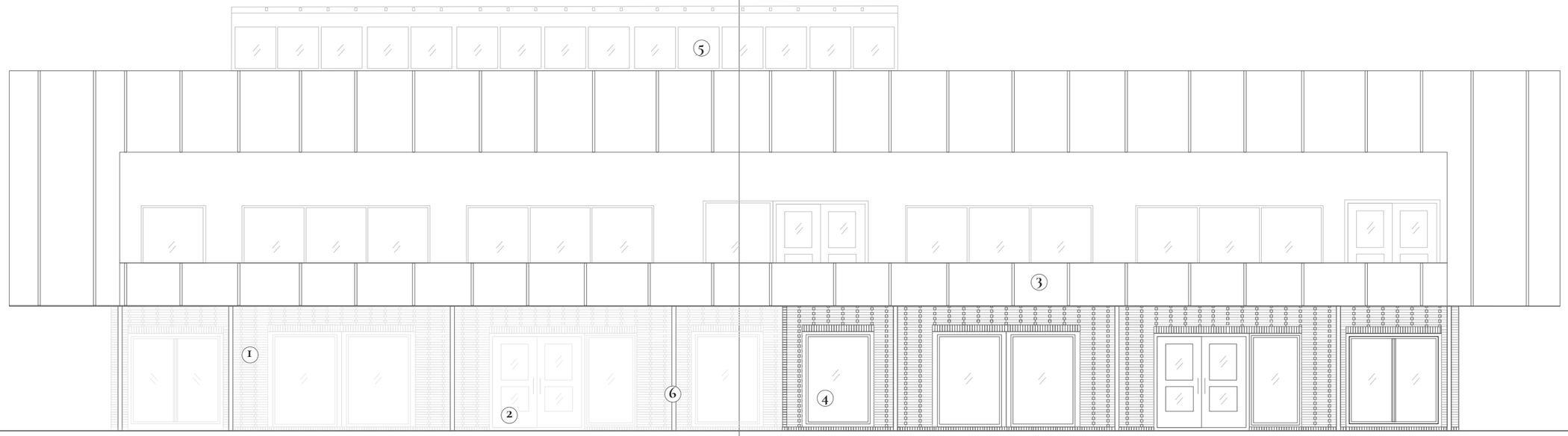
Direct reuse
02. Envelope





Floor Materials

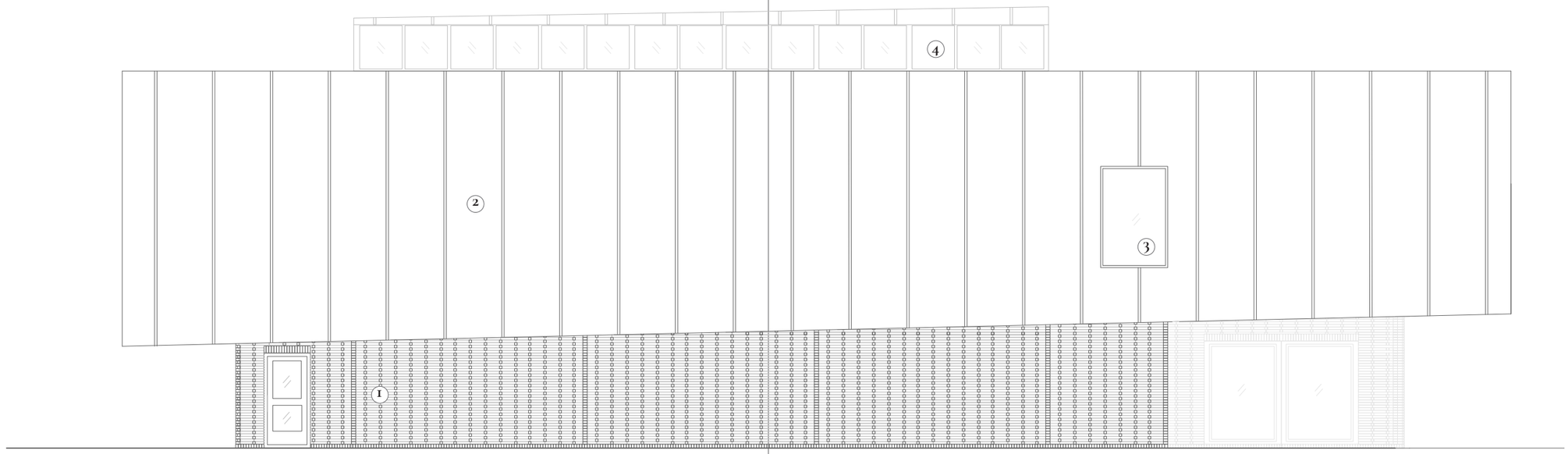
Interior View: Ground Floor



North-West Elevation 1.100 (A3)

Reused Facade Materials

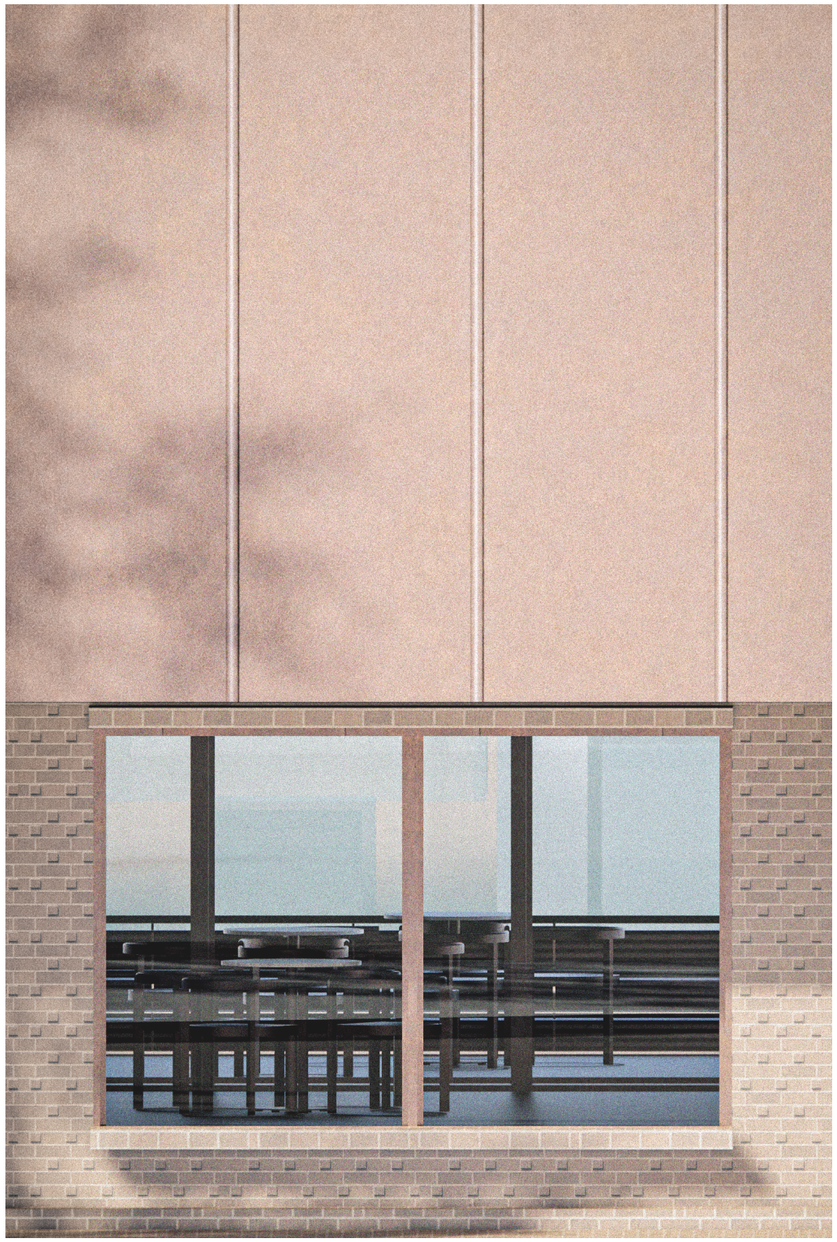
1. Reused Brick 02. Envelope
2. Double Door 02. Envelope
3. Seam Roofing 02. Envelope
4. Corridor Window 1300 02 Envelope
5. Window 900 02. Envelope
6. Steel Pillar 217



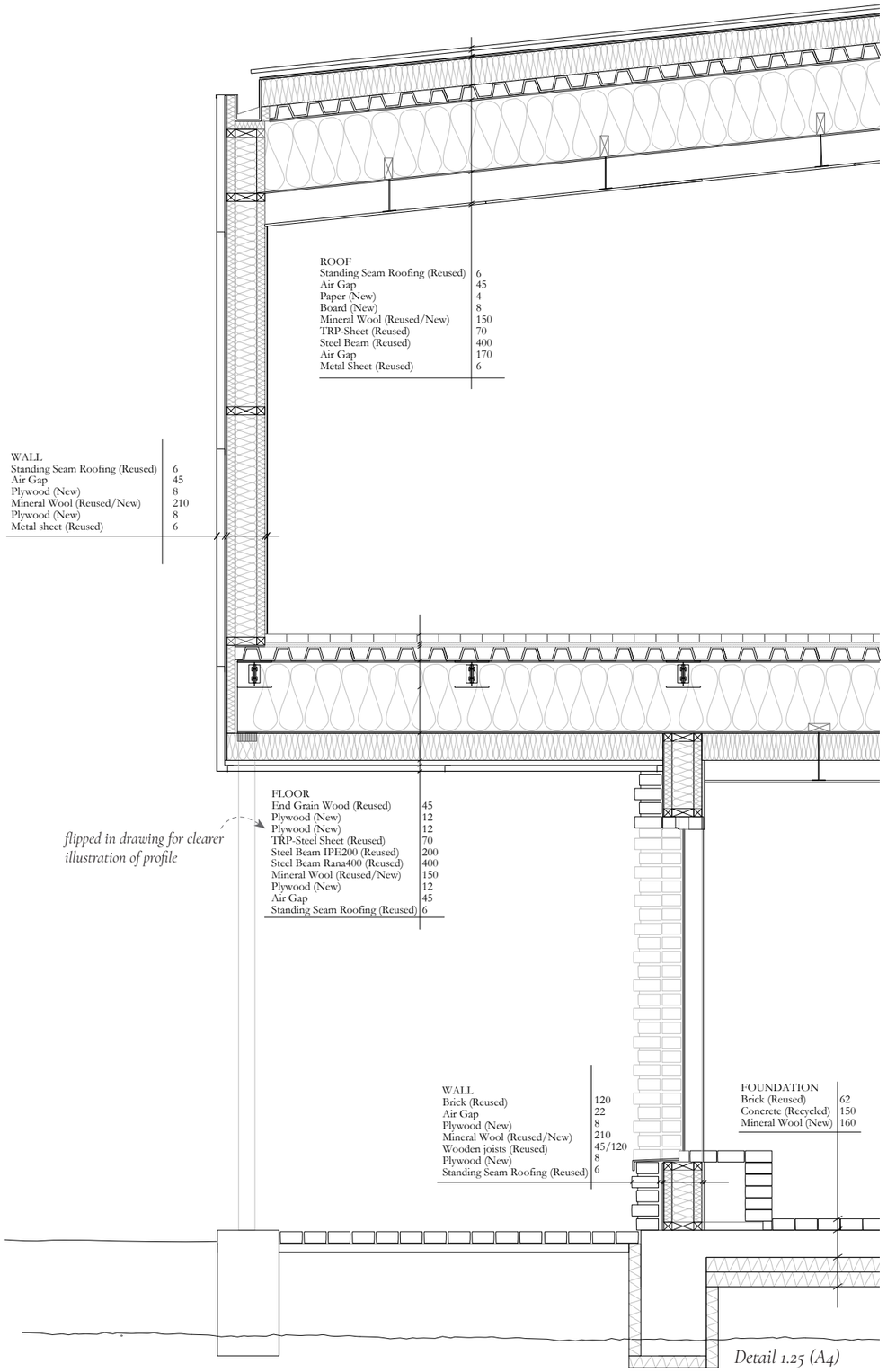
North-East Elevation 1.100 (A3)

Reused Facade Materials

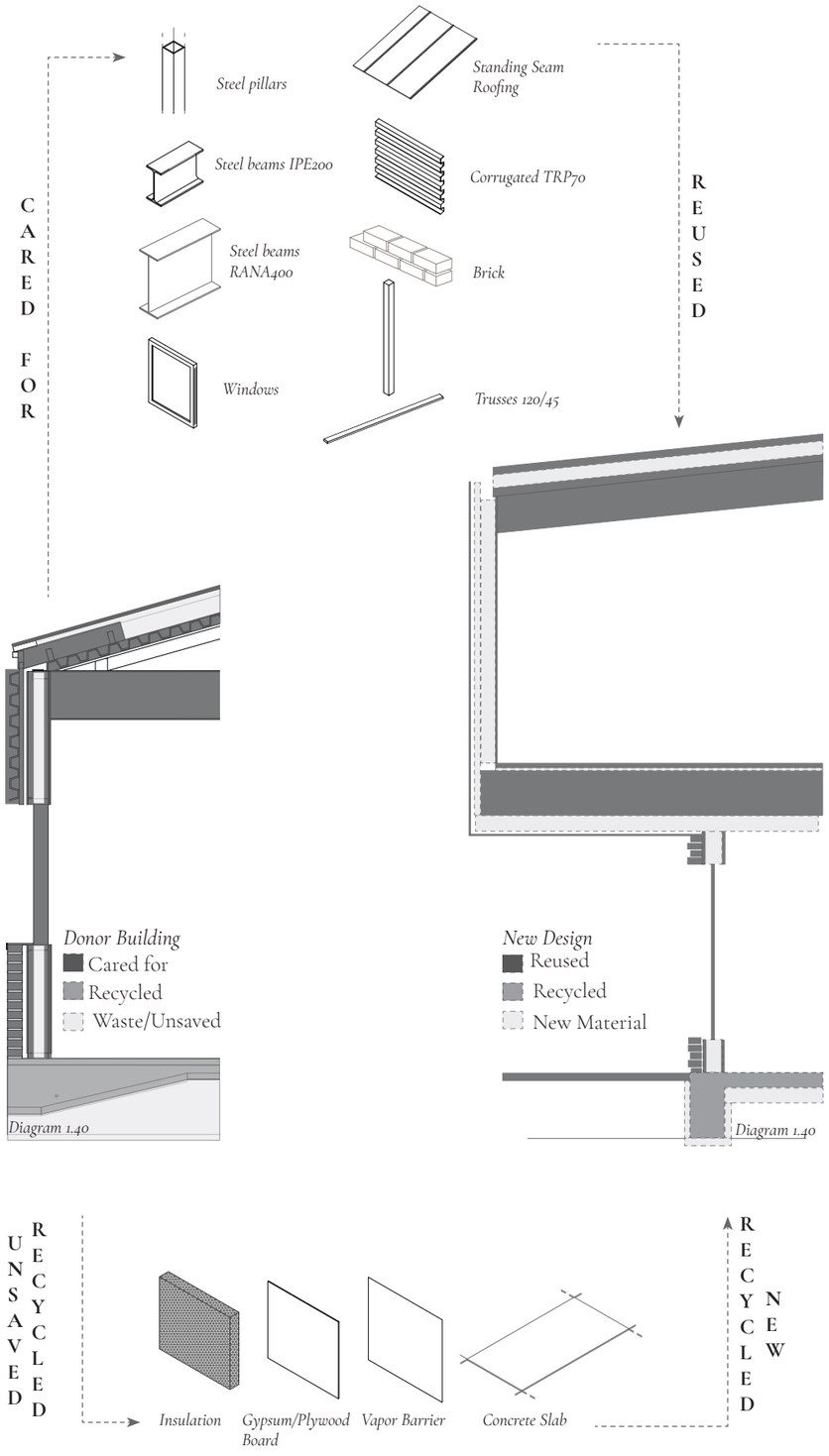
1. Reused Brick 02. Envelope
2. Seam Roofing 02. Envelope
3. Corridor Window 1300 02 Envelope
4. Window 900 02. Envelope

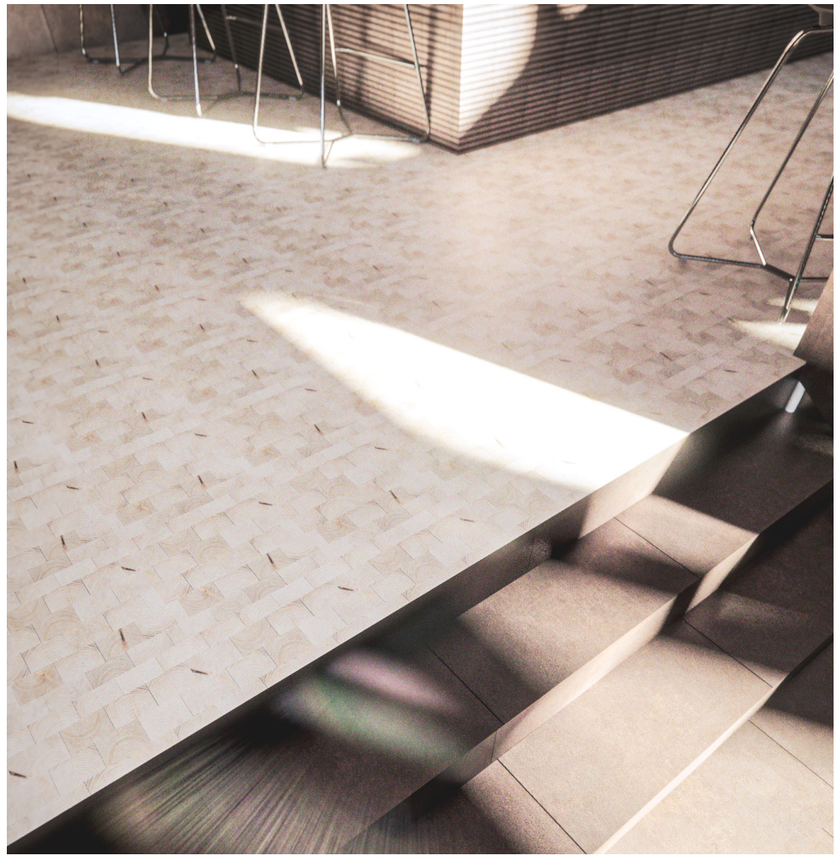


South Facade Textures



Detail 1.25 (A4)





Reused Wood Flooring

Material Transfers Overview

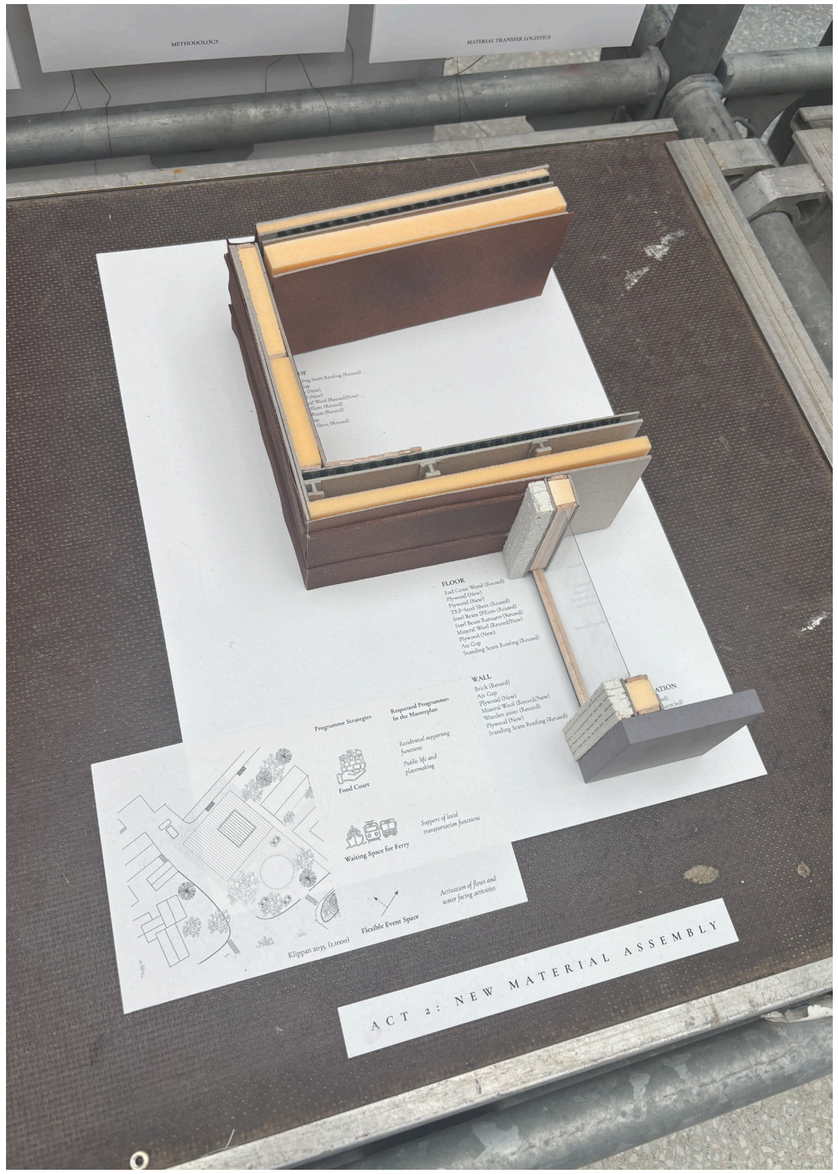
The design strategy follows a general principle of material transfers. The transfer care both for reducing the building waste in the donor building, as well as to increase the amount of reuse in the new design project. Many of the objects are used in their original form with none to small modifications, while other materials are transferred from one category to another.

The decision-making involves a hierarchy in both the disassembly of the old building and the assembly of the new one. The hierarchy follows: Reuse, recycling, and lastly adding new materials into the project. The last step is mostly used when new materials are needed for constructional reasons and when the donor material objects are in too poor condition to be disassembled and reused in a feasible manner. The majority of the new materials belong to the in-between material category.

Material Transfers: Concept Modelling

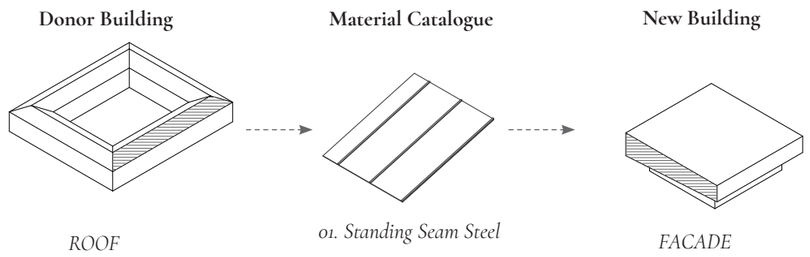
Conceptual modelling was used as a process tool to explore the third methodological step, Material Transfers. Through hands-on work with material assemblies from the donor building and their reconfiguration into new assemblies for the proposed design, the process highlighted both the possibilities and challenges of reusing and rearranging materials. Together with the reference research, this formed the basis for the diagrammatic approach to material transfers shown on the previous page.

Concept Principle of Donor



Concept Principle of New Design

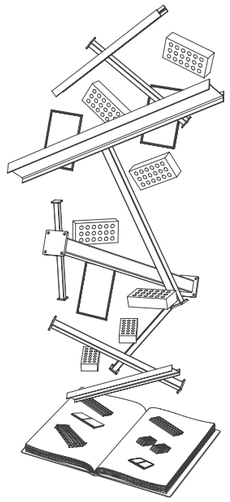
Direct Material Transfers



Reused Brick Flooring

Third Act

Third Act



Conclusion And Discussion

The last act discusses the research questions in relation to the thesis's methodology. It also provides a brief idea of how to continue research on the theme, as well as a summary and conclusion of what the thesis has contributed to.

Summary

The thesis has examined a demolition mapping method of Angeredsgymnasiet and transferred the identified reusable materials and objects to a new construction project of an extended food hall at Klippan in Gothenburg. The method applies a physical inventory and has worked within a scenario where the owner of the donor building and the new construction site is the same actor. The design demonstrates the potential to transfer materials from one building to another, addressing challenges through the main design principle "form follows availability". In some cases, the design needed to depart from the design principles and add new materials to the project to provide a feasible solution that meets accessibility and constructional needs.

Evaluation of Method

The method for mapping a specific building clearly delimits the design choices for the new design, and there have been conflicting ideas about whether to focus on creating qualitative spaces or to let the form follow the material bank. Reuse is of the highest interest in the scope of the thesis. However, it is also considered unsustainable to build a new building that lacks spatial quality and does not withstand the test of time, a main reason why buildings are demolished in the first place. The thesis has, in the end, found it important to work simultaneously on spatial quality and material reuse to ensure they strengthen each other rather than oppose one another.

A clear example of the above emerges in the decision about the building's volume and number of floors in the new design. The donor building of Angeredsgymnasiet is a one-storey building and provides neither stairs nor an elevator for reuse. Meanwhile, the site at Klippan requires a taller building with several floors, given its relationship to the surrounding tall building volumes of Carnegie Brygga. Stairs are designed from several of the steel elements provided by the donor building. Still, an elevator is far more difficult to solve without introducing a new element to the project. In this case, a conflict arises between material ecology and spatial quality, with the design moving in a direction that prioritises the qualities of space at the new site. Using materials from only one donor building limits architectural possibilities, whereas a method that draws on material banks from several projects could have offered a better opportunity to achieve both higher reuse and spatial quality. The method for mapping a building as a single donor clearly encounters an interesting limitation here.

On the other hand, the method offers a significant opportunity to guide spatial narrative. The existing materials, including their original assembly, set a framework for ceiling heights and sparked the idea of a double-height space and a light yard. Instead of viewing the restrictions of the pre-conditioned materials as limitations, they support spatial guidance, where the design aims to flirt with the narrative of spatial inversion of the donor. This could, of course, be done in several ways, resulting in a more or less direct storytelling outcome. The aim of this project, though, was to truly create high value from something that had previously been seen as waste, and by presenting the donor materials as if they were new while assembling them in a way that reveals their history, the value directly increased. The idea of assigning storytelling properties to a material object is one way found to be relevant for promoting reuse, which further answers the thesis research questions: "How can resources from one demolished building be intertwined with a new construction process to optimise resource flows?" and "How may the demolished materials of Angeredsgymnasietbe reused and reassembled in a new building programme at Klippan?"

Architectural Vision Versus Reuse

A key insight from this project is that architectural vision has a stronger influence on design decisions than I expected. By combining resource mapping with the needs of the site, the project became a two-storey building that integrates reused materials rather than forming from them. Instead of form following availability, the resulting design is a balance between the materials available and the architectural vision for the site.

This shows that reuse is not only limited by technical issues, but also a question of design priorities and values. We can either push reuse to its full extent and learn to like a more fragmented, patchwork architecture, or integrate reused materials within the cultural and aesthetic frameworks we are set within. This project has chosen the second approach, aiming to demonstrate how reuse can be combined with a broader architectural vision. At the same time, current cultural expectations and aesthetic trends may also be a key reason why reuse remains so difficult, raising the question of whether we may need to accept a broader range of architectural aesthetics in the future.

Continous Work On The Theme of Reuse

This thesis examines a single case within a delimited scenario, and it would be important to continue investigating the mapping of demolition on a larger scale to enable reuse across a wider range of projects. Physical inventory provides insight into material quality and works well in early design stages, which is what the thesis is about. Though since it limits the amount of mapping one can perform within a given time, a similar resource-mapping at a larger scale would benefit from considering a combination of physical and technical tools.

Architects could use initiatives such as CC-build and other large reuse organisers much more extensively in the future, and support efforts to address the limitations of time-consuming mapping that yield project-specific, narrow material banks. The organising parties also provide a market for reused materials, which economically encourages owners of demolition projects to map their buildings for reuse.

Conclusion

The thesis states at the very beginning that we tend to value what we care for, and if we start caring for what has previously been seen as waste, there is a strong sense of optimism in working with reused materials forward. Increasing materials re-use also moves us further away from the prejudice about what reuse looks like and gives the architect an important role in showcasing how reused materials can be valued equally luxurious as new ones. The method of direct material transfers between buildings has its limitations. However, it also provides a strong historical narrative for the new design. Knowing where materials come from, the design can create a sense of history before the new construction is even built. We tend to value objects that carry a story, something that the method tested in this thesis has great possibilities to support.

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Figures

Figure 1: Materialbanken, varvstaden. https://www.varvsstaden.se/materialbanken
Figure 2: Hanswijk, Frans. https://www.superuse-studios.com/projectplus/kevn/
Figure 3: Figure 5: Vecchi Ricardo, https://www.superuse-studios.com/nl/projectplus/buitenplaats-brienenoord/
Figure 4: Stadsmiljöförvaltningen. Open data. Elevation Drawings 1982, Lund och Valentin Arkitekter AB.
Figure 5: Stadsmiljöförvaltningen. Open data. Elevation Drawings 1982, Lund och Valentin Arkitekter AB.

Use of Grammarly: The text in this thesis has been reviewed with the tool Grammarly. The tool has had its AI support turned off and has been used as a grammar tool to check spelling and wording. The tool has not been used to generate any sort of new text.