



## Nordhavn 2150

The Nordhavn 2150 Museum celebrates the very area it is located within; documenting its past, present, and future. From its beginnings as a large harbour of trade and industry at the end of the 19th century, to the planned metropolitan development to transform Nordhavn into the world's first five-minute city. The Nordhavn 2150 Museum will house photos and artefacts, to videos and artwork; hosting exhibitions and installations, and educational workshops for schools and adults. The Nordhavn 2150 museum aims to become the area's cultural hub, adapting with Nordhavn's ever-changing landscape.



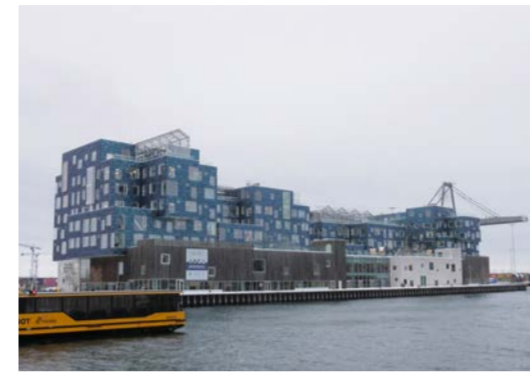
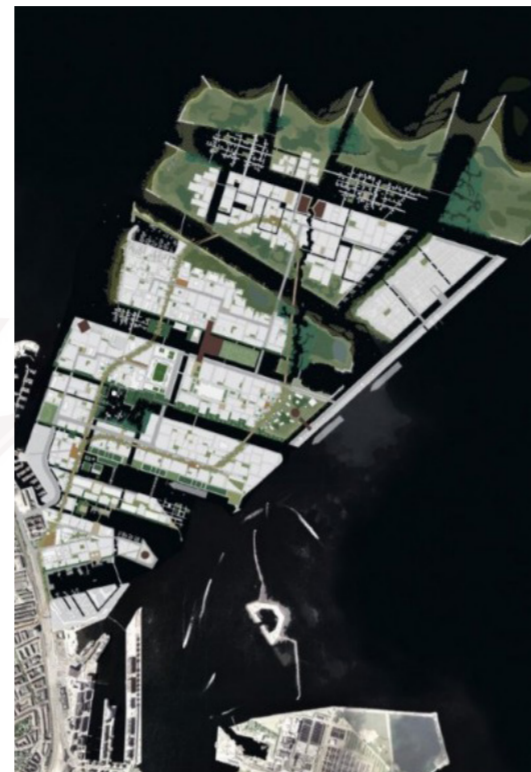
**Created, Evolved, Adapted, & Reborn**



Top: Historic map of Copenhagen from 1886, before Nordhavn was constructed  
Bottom: The Nordhavn Free Port, 1901

### History

The area of Nordhavn was created at the end of the 19th century as an extension to Copenhagen's harbours, accommodating the increasing demand in trade and industry. Starting in 1891, known as the 'Free Port' development, the project was achieved by creating a series of man-made islands, extending out from Copenhagen's mainland, one of these islands being what is now known as Nordhavn. Due to World War I, the expansion was delayed, but soon afterwards the harbour was pushed further, creating Nordbassinet (the North Basin), Redmolen (the Roads Pier), and Sundmolen (the Sound Pier). Up until the 1930s, these areas were gradually shaped with the additions of smaller inlets to create what is now known as Nordhavn. Nordhavn served as a large harbour and industrial port, functioning and catering to Copenhagen's and Denmark's trade needs.



Clockwise: Competition master plan of Nordhavn by COBE, Polyform, SLETH & Rambøll rom 2009, The Copenhagen International School, the Copenhagen Malmö Port (CMP), and the current aerial view of Nordhavn (from Google Earth)

### Present

Inspired by the London Docklands, the area of Nordhavn was first earmarked for redevelopment in the early 2000s, with the transformation beginning in 2008; turning it industrial harbour and port to a bustling new residential and commercial neighbourhood. Helping to visualise this idea are COBE architects, SLETH, and Polyform, with Rambøll as a consultant for the overall development.

As it stands, Nordhavn is home to 6,000 residents, with a mix civic, commercial, and residential buildings, while still being to home multiple maritime activities, with Copenhagen Malmö Port (CMP) and numerous ferry terminals. Nordhavn priorities its pedestrians, cyclists, and the use of public transport over the use cars, a concept that will be pushed further into the areas future developments.



Top: Structure plan of Nordhavn by COBE, Polyform, SLETH & Rambøll rom 2009  
Bottom: Current aerial view of Nordhavn

### Present

The future for Nordhavn puts it at the largest metropolitan development in northern Europe, as it is transformed into the world's first five-minute city. This means that everything from schools and play areas to businesses and recreational spaces and residential spaces are all accessible within a five-minute walk. It aims to allow for a more relaxed lifestyle, without the need for driving. This development aims to bring in 40,000 residents and 40,000 jobs to the area, but the area is already the most expensive real estate in Denmark at £6,710 per square metre – about 20% higher than Copenhagen's average. This makes this development a costly endeavour, but that doesn't take away from the existing architectural merits and quality, especially considering the transformation it has undergone.



# Brief

## Cultural Research - Museum's of Copenhagen

### Museum of Natural History

Compact natural history museum featuring dinosaur & mineral exhibits, plus colorful murals.

### Botanical Garden

National Museum of Natural History's plant collection, the biggest in Denmark

### David Collection

Museum featuring a collection of Islamic, European & Danish early modern paintings & decorative art.

### National Museum of Denmark

18th-century mansion with collections and exhibitions on Denmark's history, people and culture.

### Ny Carlsberg Glyptotek

18th-Fine art museum with antique Mediterranean sculptures

### War Museum (Krigsmuseet)

Military history museum in Christian IV's arsenal from early 1600s, with large weaponry collection

### SMK – Statens Museum for Kunst

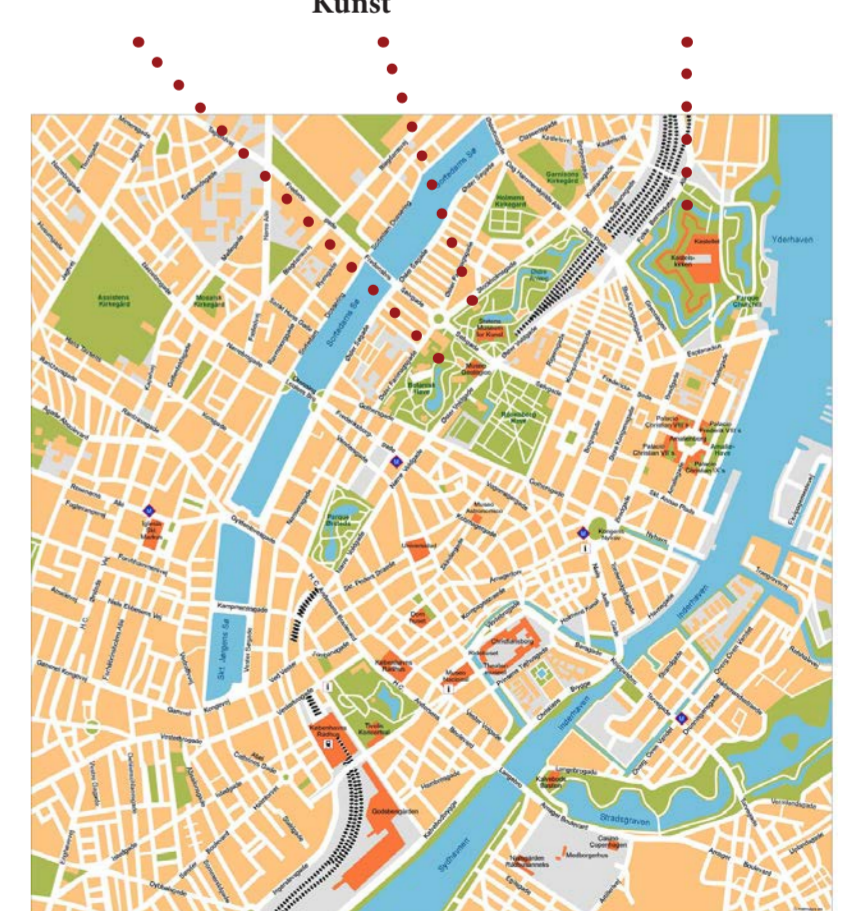
Danish national gallery, with international collections, temporary exhibitions & kids' activities.

### Kastellet

Star-shaped 17th-century fortress with ramparts & a museum, regular host to events & concerts.



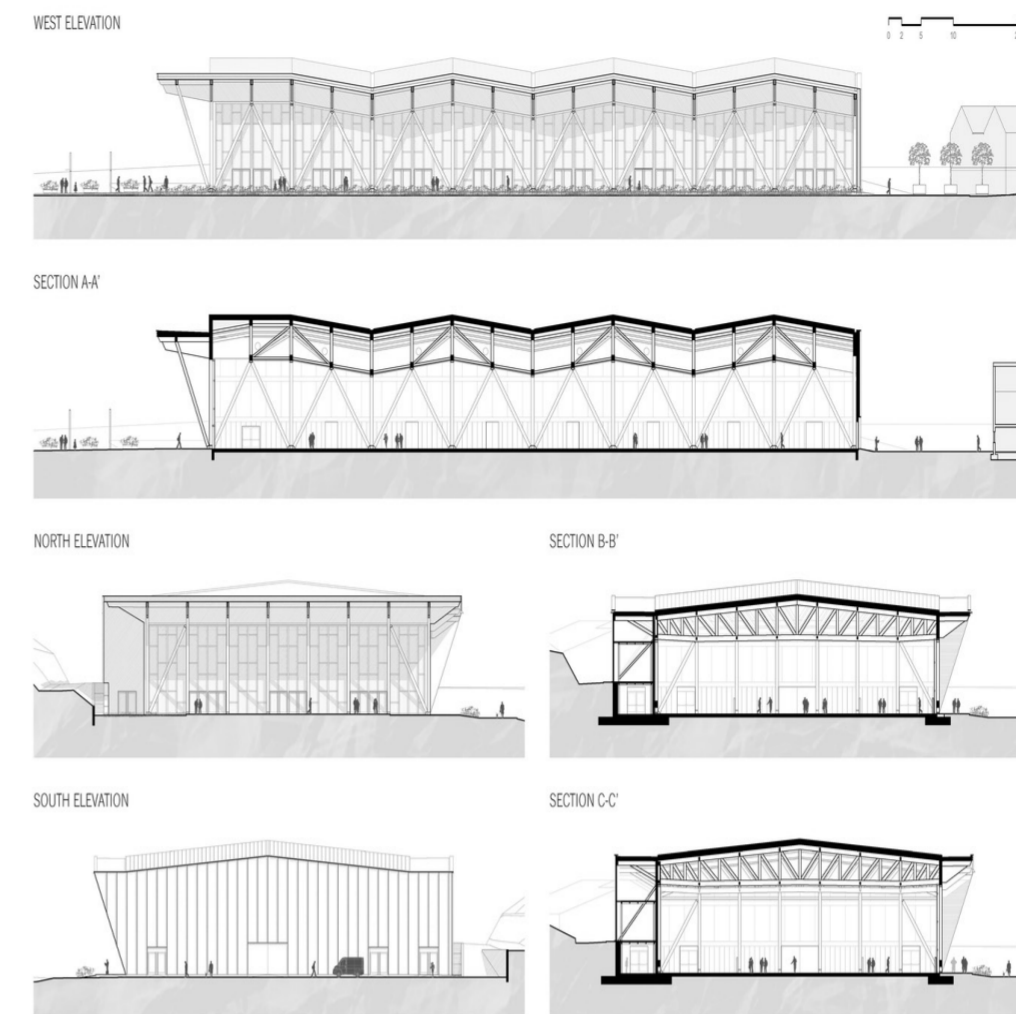
Museum of Natural History      SMK – Statens Museum for Kunst      Kastellet



**Danish National Maritime Museum**  
Bjarke Ingels Group (BIG)



Located in Helsingør, Denmark, The Danish National Maritime Museum is situated within a 60 year old dry dock, one in which ships were once built in. By seamlessly integrating the museum into the docks walls, BIG respects and preserves the history of that very dock, allowing people to experience its exterior space and experience the scale of ships. By adding glass ramped walkways straddling across the two sides of the dock, BIG allows the flow of people throughout the interior spaces and down into the 'subterranean' gallery spaces that loop around the edges of the dock. These glass walkways break up the oppressive and imposing concrete structure and create a juxtaposition from the context in which the museum is situated within. The glass walkway idea is something I want to take forwards in my design; to create a platform in which guests to my museum can look out over the harbour and Nordhavn.

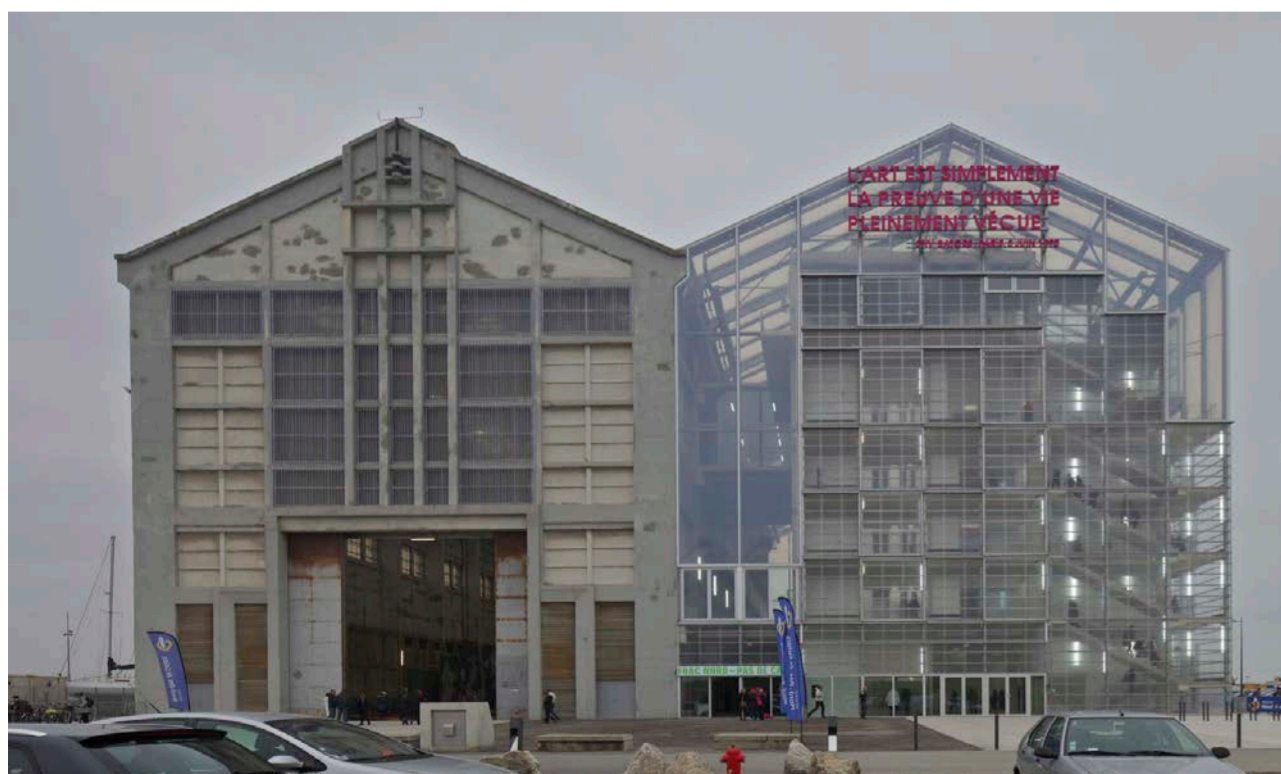


**Project Research**  
Precedent Studies

When looking through past student work for some inspiration on ways to do strategy pages, and also at past 1:20 bay study drawings, I came across someone who referenced the case study seen here.

This is relevant to me, as in previous structural workshops (seen on pages 46 and 47) I was suggested to possibly use a timber truss system as a means of supporting my building, to minimise the thickness a single glulam beam would need to be, in the case of my building. Having now come across this precedent, that uses timber trusses made from glulam, I have a reference to see how it has been achieved. Moreover, the external trusses, will also be applicable when it comes to the structure within the walkway bridge, as that is something that will need to utilise trusses to support its weight.

As I wasn't sure if glulam could still be used in a truss beam, the Cultural Centre in Agordo, Italy has shown me I can use it in a system such as this, which I will now apply into my buildings structural strategy (and bay study).



FRAC Grand Large, by Lacaton & Vassal integrates itself into and with the remains of an old boat warehouse known as the Halle AP2. The design stemmed from the idea of wanting to keep the Halle in its original form and create a new building, the FRAC, attached next door, a duplicate of the Halle. This new building is supposed to juxtapose the old structure, without taking anything away from it. It is this concept that I want to take forward into my project, by keeping the remains of the old ferry terminal structure, and incorporating it into my design, I want to respect the history of site, while at the same time adding it into a structure that plays homage to the area past, but simultaneously symbolises the areas future.

**FRAC Grand Large**  
Lacaton & Vassal

**Congress and Exhibition Centre**  
Studio Botter + Studio Bressan

# Site Climatic Analysis



Site southern boundary and elevation [looking south]

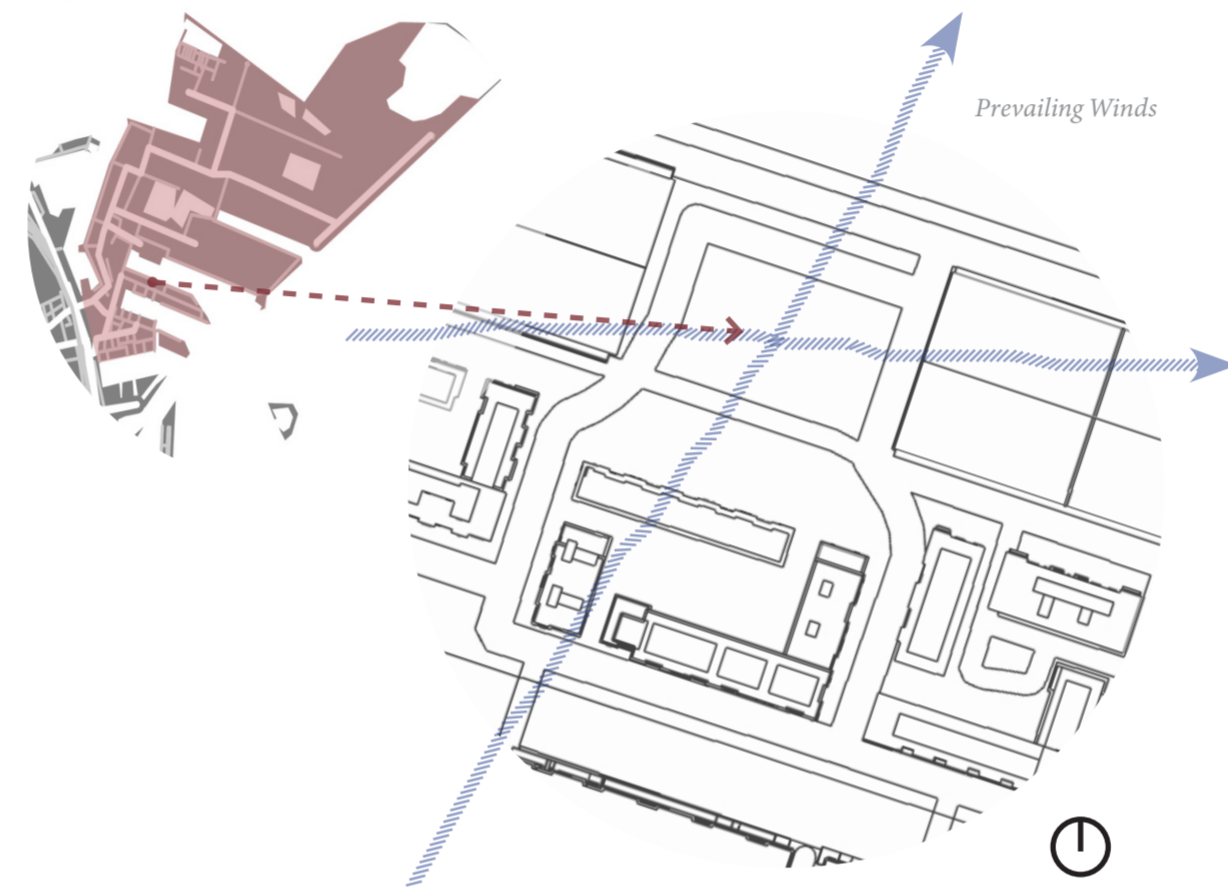


Site northern boundary and elevation [looking south]



Site northern boundary and elevation [looking north]

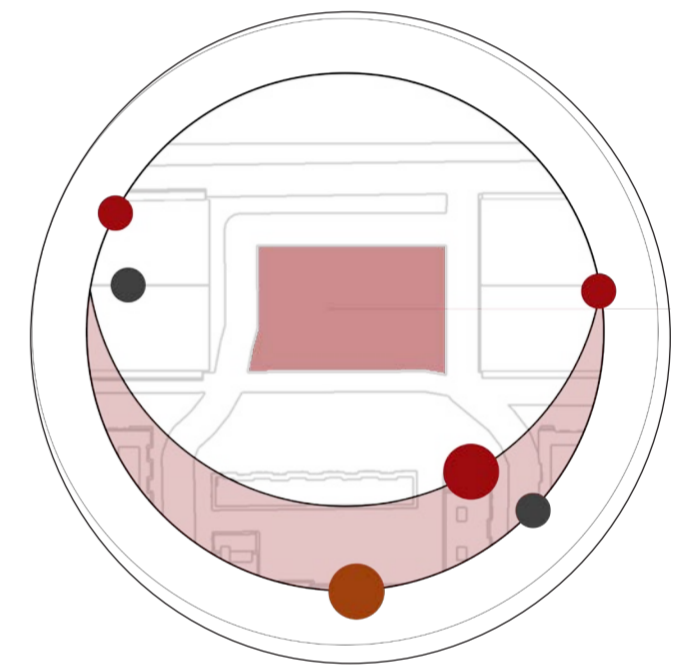
COPENHAGEN  
MARK



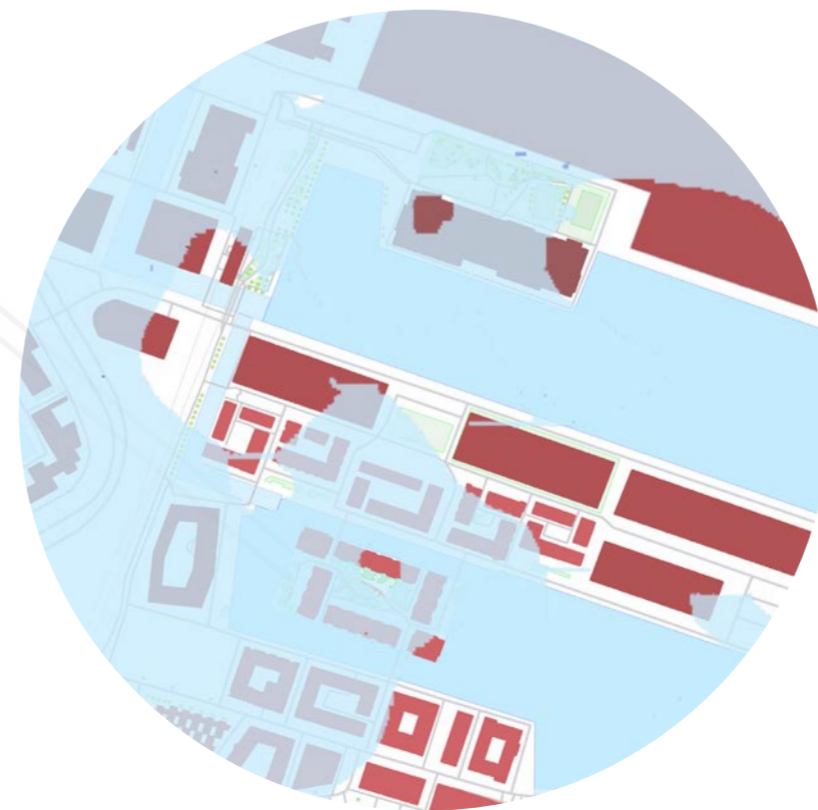
The district of Nordhavn, where the site is located, is a man-made island established in the late 1800s just north of Copenhagen's city centre. The site itself is a former ferry terminal, the remnants of which can be seen with the steel structure on the sites northern border, and sits on a north-easterly, south-westerly angle.

Due to the proximity to the sea, the whole area is at risk of being covered in water if sea levels continue to rise. How much the sea levels may rise depends on greenhouse gas emissions - if they are reduced in line with the 2015 Paris Climate Agreement, there would be an additional sea level rise of 54cm by 2100. If the agreements are not met, sea levels would rise by 74cm in that time. When focusing on Denmark, and Scandinavia, that region is at a heightened risk of sea level rise, not by the melting of ice sheets in nearby Greenland, but by the melting ice sheets in Western-Antarctica. These sea levels rises won't affect Nordhavn in the immediate future, but it is a factor that needs to be considered for the museums longevity.

Demonstrated in maps below, are sea-level rises of 2 metres and 5 metres in the area of Nordhavn.



Sun Paths



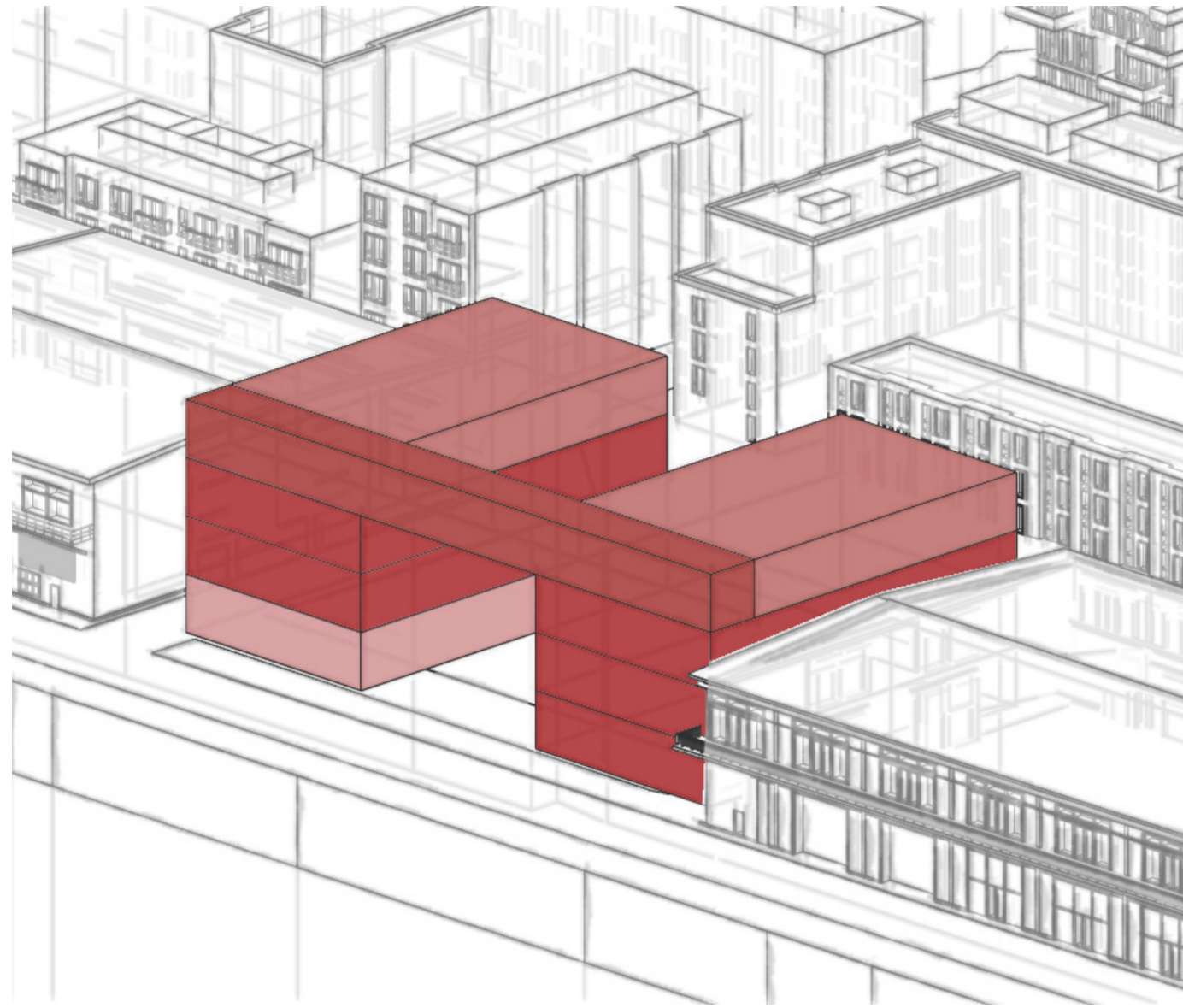
Map of Nordhavn with a rise in sea level of 2 metres



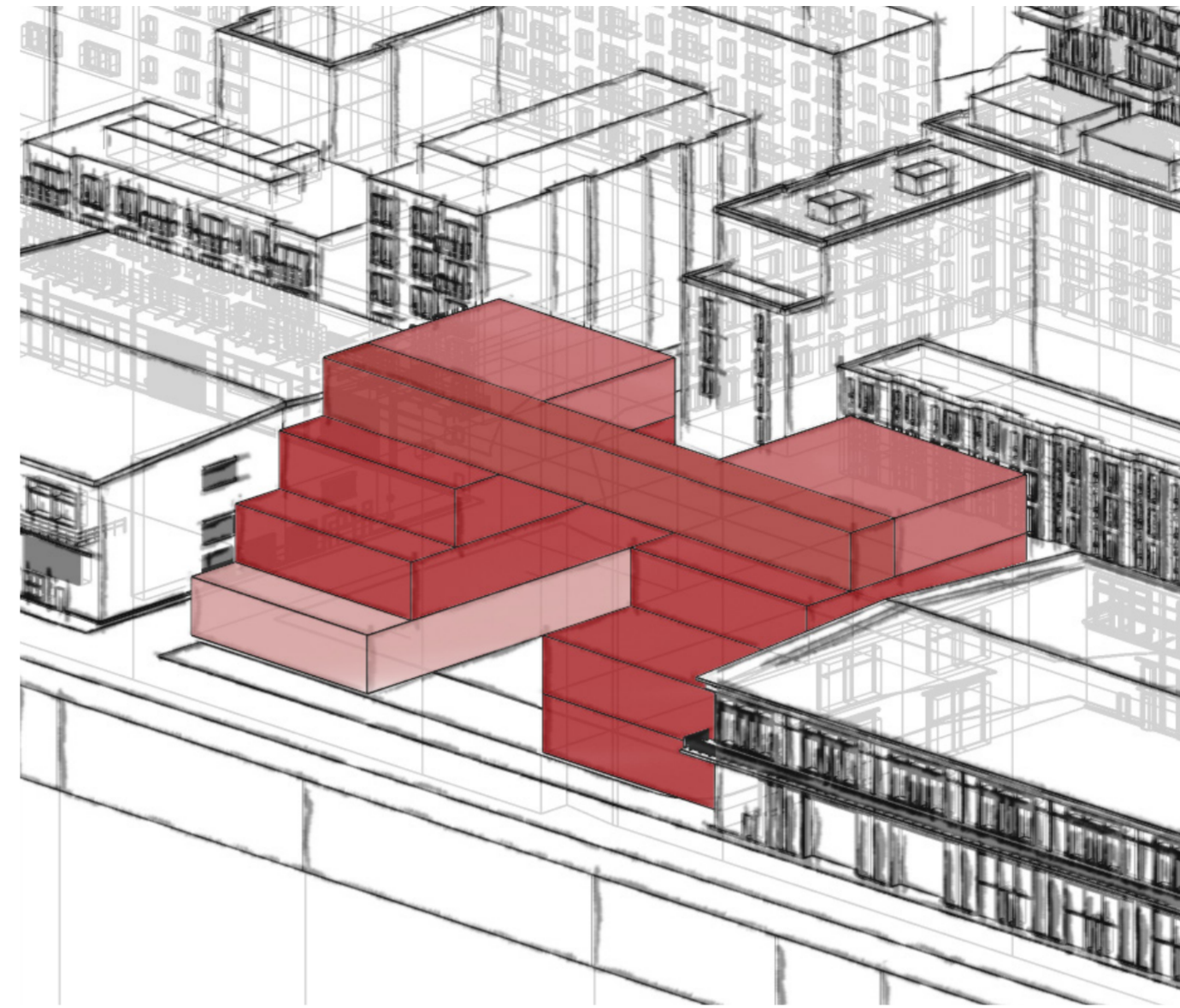
Map of Nordhavn with a rise in sea level of 5 metres

# Design Development

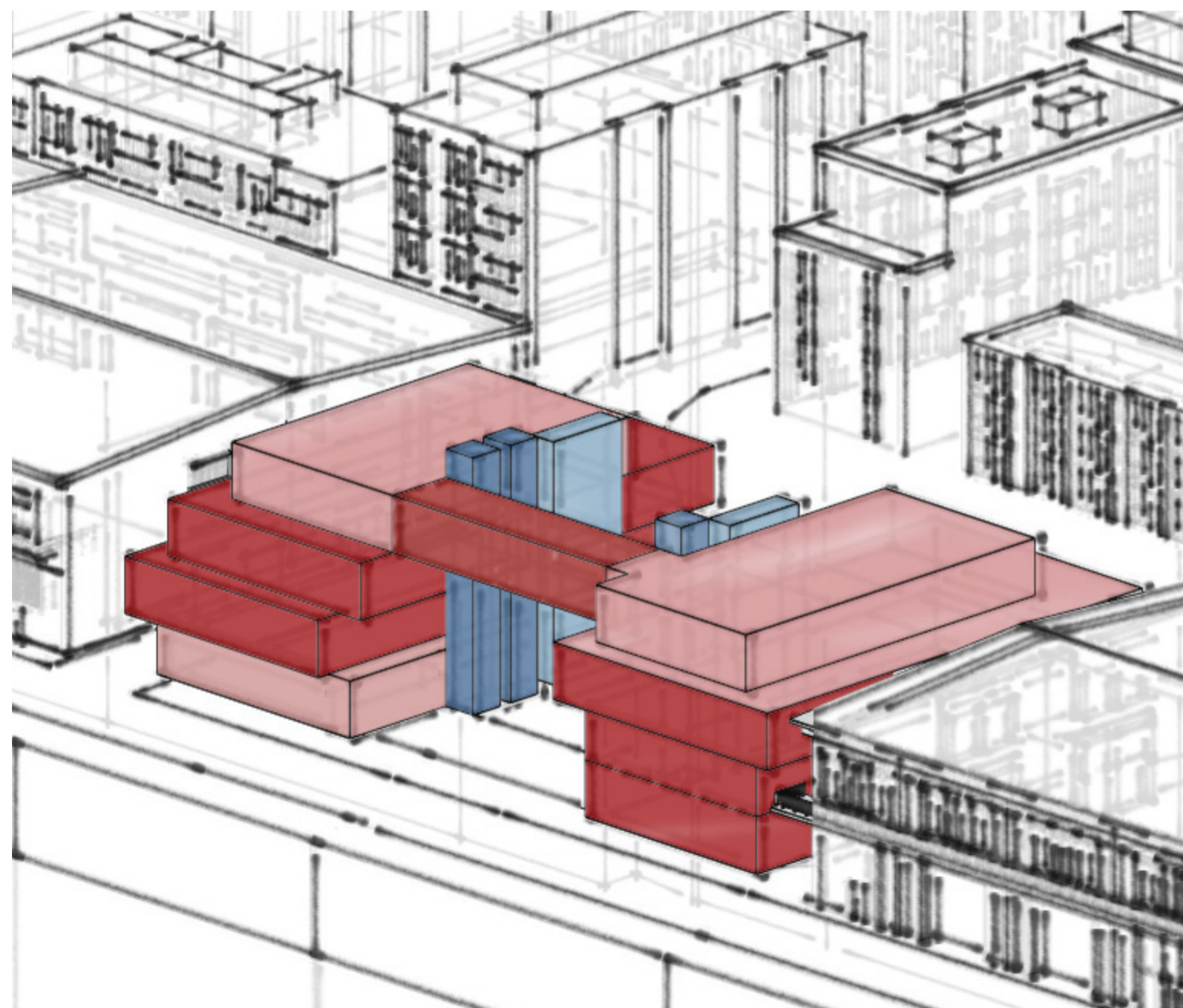
A museum of two halves



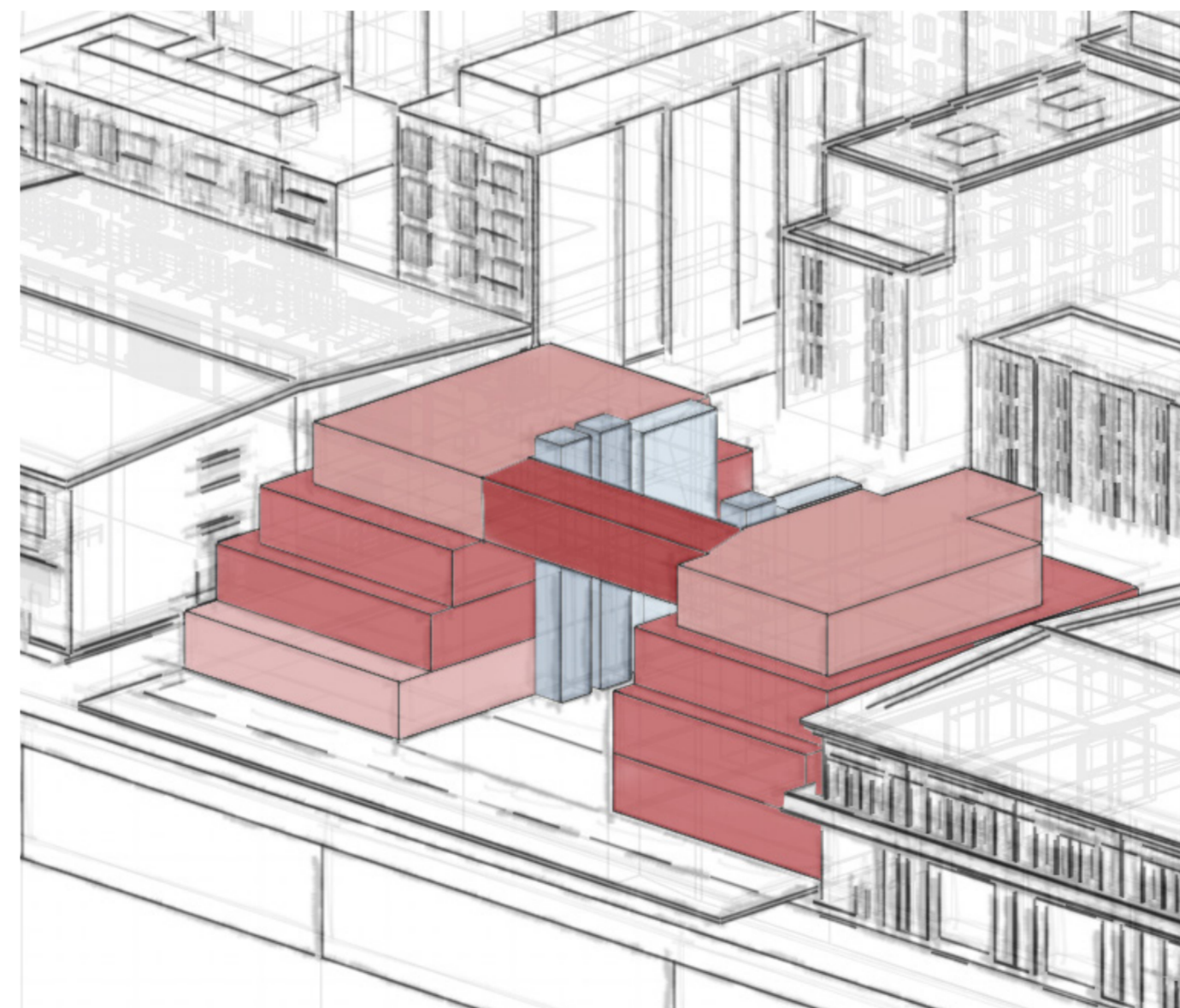
Basic blockwork is created from shipping container inspired blocks, split into two sides, connecting by a viewing gallery and skybridge on the third floor for views out across Nordhavn



That blockwork could then be played around with, creating a more tiered design, gradually decreasing in size through the levels.



I created an experimental formwork where instead of those level changes, the visual difference came from small overhangs between the floors. While I did like this design and the visual difference from previous iterations, I was advised against it by my tutor on the basis that it would be problematic when it came to structural detailing.



Following that discussion, I came to a final formwork that I was happy with, one that follows the first iterations, but adds in differences with staggers and tiers on the side, to create a more interesting form.

- Skybridge / viewing gallery
- Exhibition Spaces
- Café, shop, roof terrace and entrance floor
- Non public access spaces
- Lift Shafts
- Stairwells

# Contextual Aerial View

Isometric



**Internal View**  
Skybridge | Viewing Gallery  
*Two-Point Perspective*



**External View**  
Front Approach [North]  
*Two-Point Perspective*



**Internal View**  
Second Floor Exhibition Space [East Wing]  
*Two-Point Perspective*



**Internal View**  
First Floor Exhibition Space [East Wing]  
*Two-Point Perspective*



**Internal View**  
Second Floor Gallery [West Wing]  
*Two-Point Perspective*

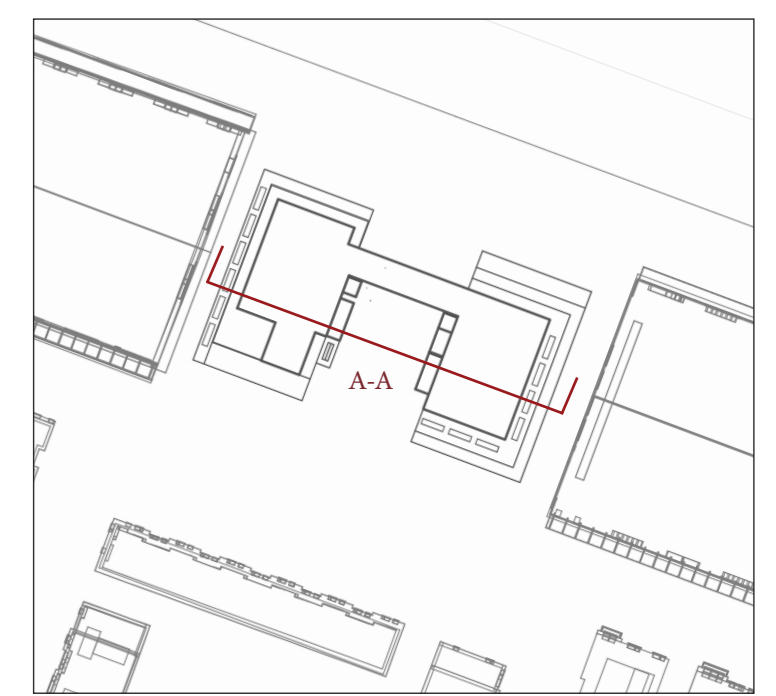
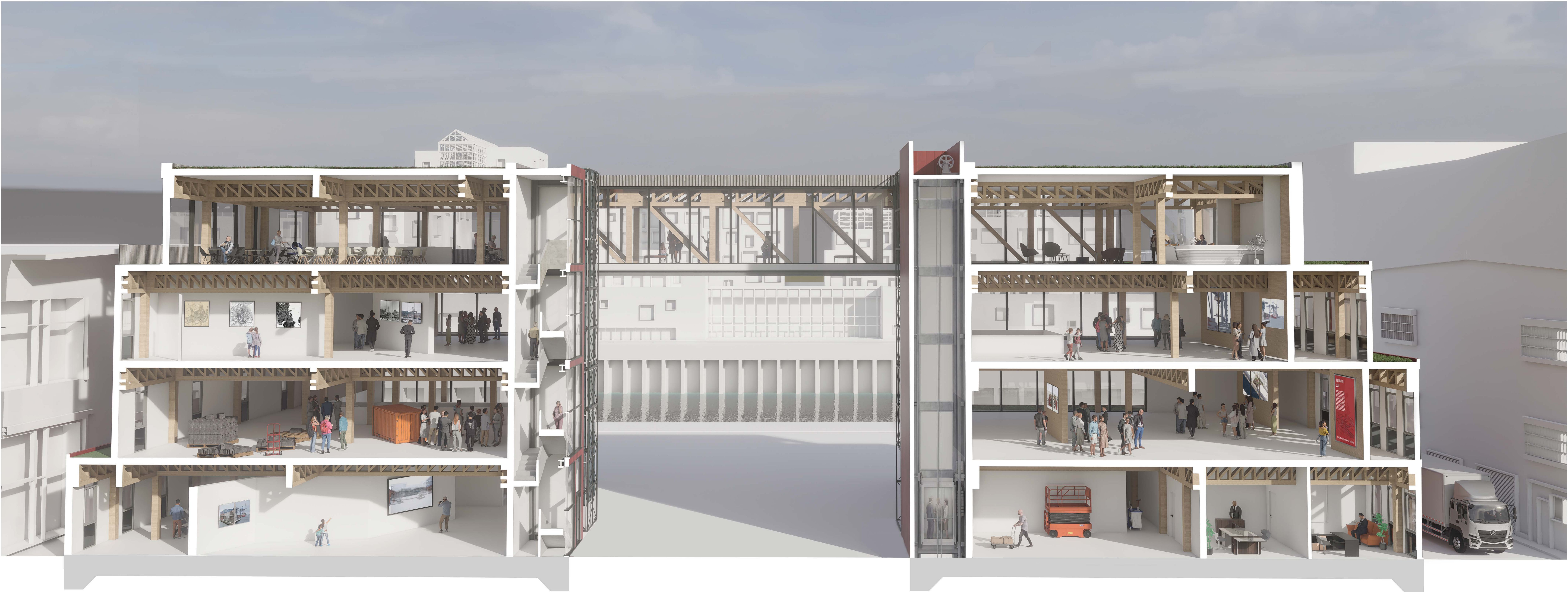


**External View**  
Central Outdoor Space Between Wings  
*Two-Point Perspective*



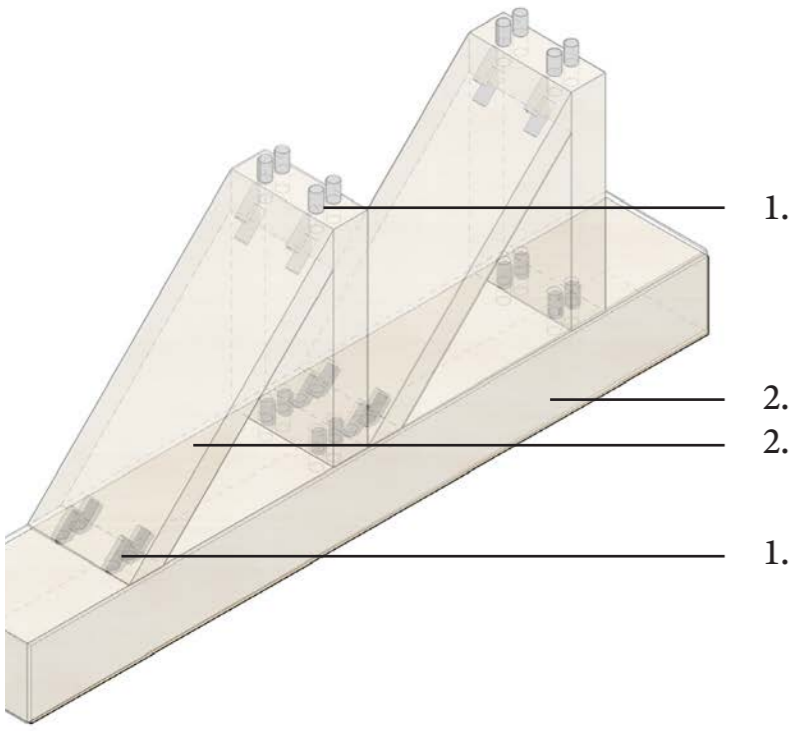
**Internal View**  
Third Floor Entrance | Reception  
*Two-Point Perspective*





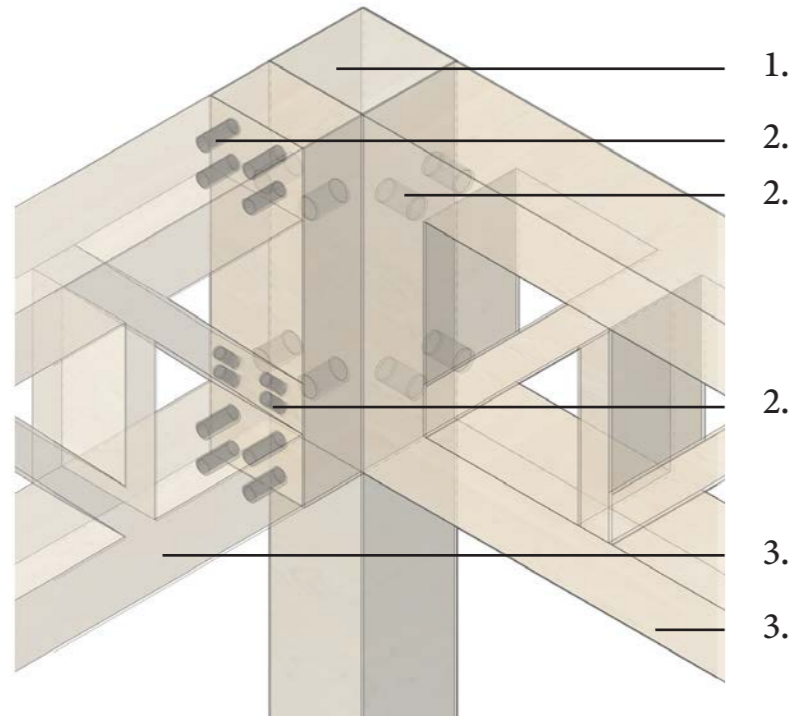
Contextual Plan View  
1:1000

Glulam truss connection detail [1.20]



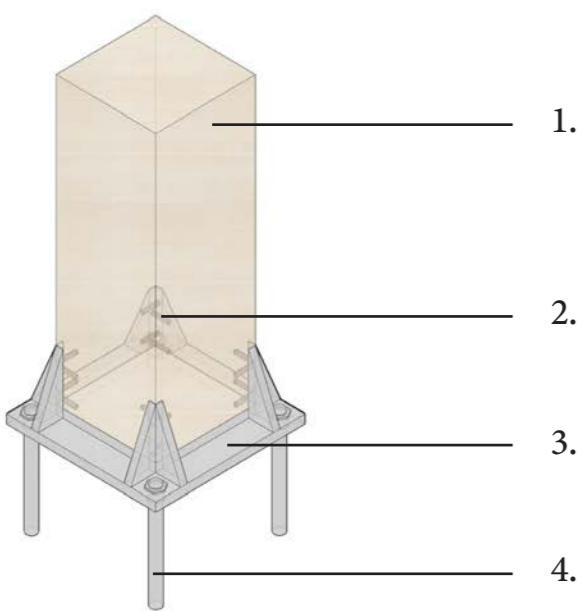
1. Self-tapping steel dowels
2. Spruce glulam truss

Glulam column to glulam truss detail [1.20]



1. Glulam column [300mm x 300mm]
2. Self-tapping steel dowels
3. Spruce glulam truss

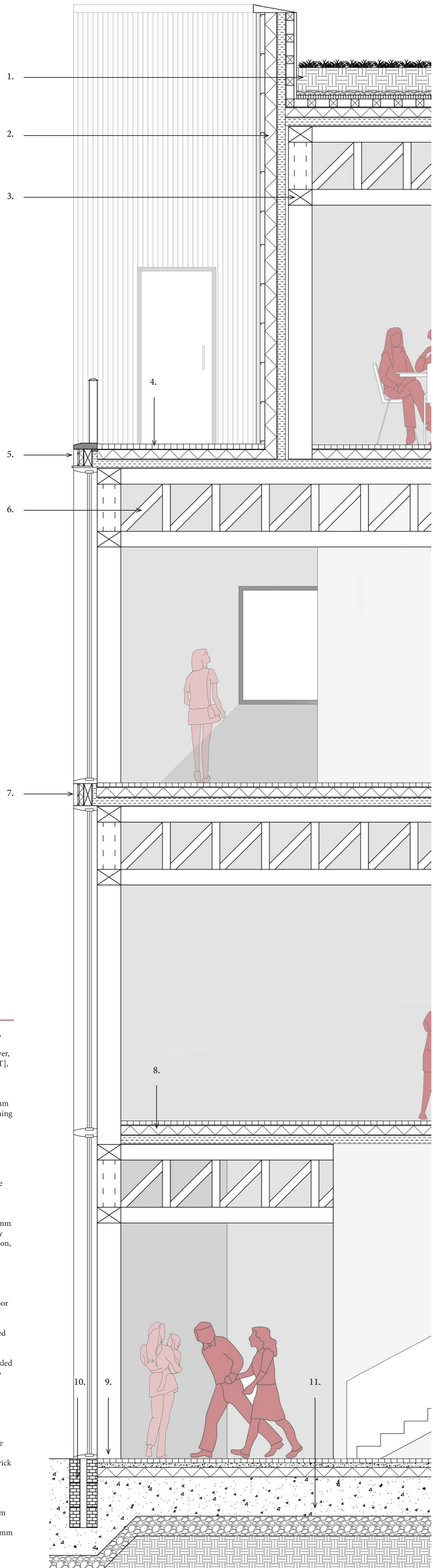
Glulam column to base detail [1.20]



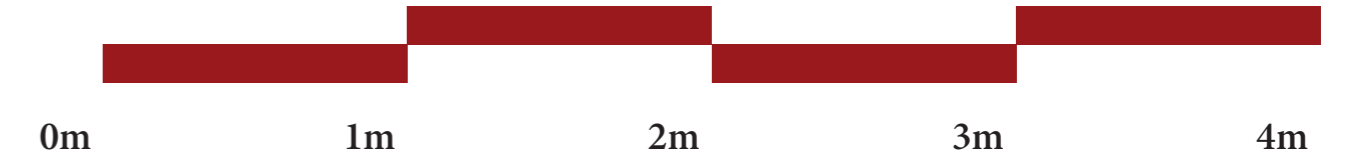
1. Glulam column [300mm x 300mm]
2. Self-tapping steel dowels
3. Welded steel plate
4. Steel anchor bolts

Key:

1. GREEN ROOF - Vegetation, 300mm soil, 50mm aggregate [gravel], filtration layer, 50mm drainage layer and root battier, waterproof membrane, 100mm glulam beam and cavity gap, vapour control layer, 120mm hemp fibre insulation, 110mm cross-laminated timber [CLT], 1000mm glulam truss beam
2. THIRD FLOOR WALL BUILD UP - 50mm red prePATINA ECO ZINC, 60mm cavity gap and wall ties, waterproof membrane, 120mm hemp fibre insulation, 110mm cross-laminated timber [CLT], finishing lime render and paint, 300mm glulam column
3. GLULAM TRUSS CONNECTION - See detail
4. THIRD FLOOR ROOF TERRACE - 70mm black ash decking, vapour control layer and waterproof membrane, 120mm hemp fibre insulation, 110mm cross-laminated timber [CLT], 1000mm glulam truss
5. TERRACE PARAPET - 100mm x 900mm black ash balustrade, 75mm steel floor connection, 50mm prePATINA ECO ZINC, 20mm cavity gap and wall ties, waterproof membrane, 60mm hemp fibre insulation, 100mm glulam beam, 60mm cross-laminated timber [CLT]
6. GLULAM COLUMN TO TRUSS CONNECTION - See detail
7. CURTAIN WALL - Aluminium frame triple-glazing, aluminium floor connection joint, 50mm prePATINA ECO ZINC, 20mm cavity gap and wall ties, waterproof membrane, 60mm hemp fibre insulation, 100mm glulam beam, waterproof membrane, 60mm cross-laminated timber [CLT]
8. TYPICAL FLOOR BUILD UP - 30mm black, grey and white speckled epoxy terrazzo flooring, divider strip, vapour barrier, 120mm hemp fibre insulation, waterproof membrane, 110mm cross-laminated timber [CLT], 1000mm glulam truss
9. GLULAM COLUMN TO BASE - See detail
10. CURAIN WALL | GROUND FOUNDATIONS - Aluminium frame triple-glazing, aluminium floor connection joint, green concrete, 830mm x 130mm brick foundation, cavity gap, 830mm x 130mm brick foundation, vapour barrier and waterproof membrane
11. GROUND FLOOR BUILD UP | FOUNDATIONS - 30mm black, grey and white speckled epoxy terrazzo flooring, divider strip, 60mm underbed sand, vapour barrier, 120mm hemp fibre insulation, waterproof membrane, 500mm green concrete, vapour barrier, 250mm aggregate, soil

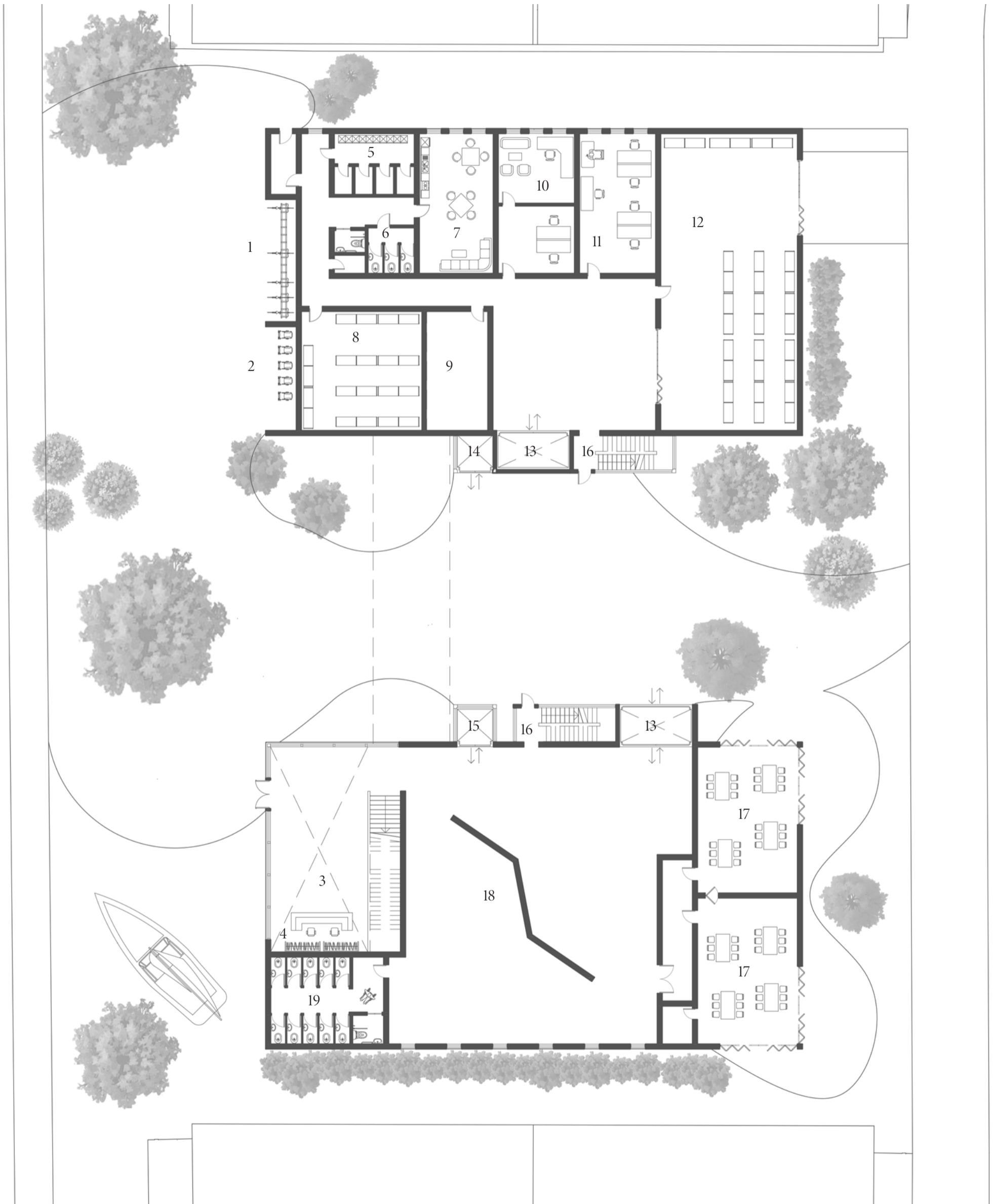


1:25



# Ground Floor Plan

1:250



- 1 Bicycle parking
- 2 Pram parking
- 3 Ground floor entrance & atrium
- 4 Cloak room
- 5 Staff changing rooms
- 6 Staff toilets
- 7 Staff break room
- 8 Archive

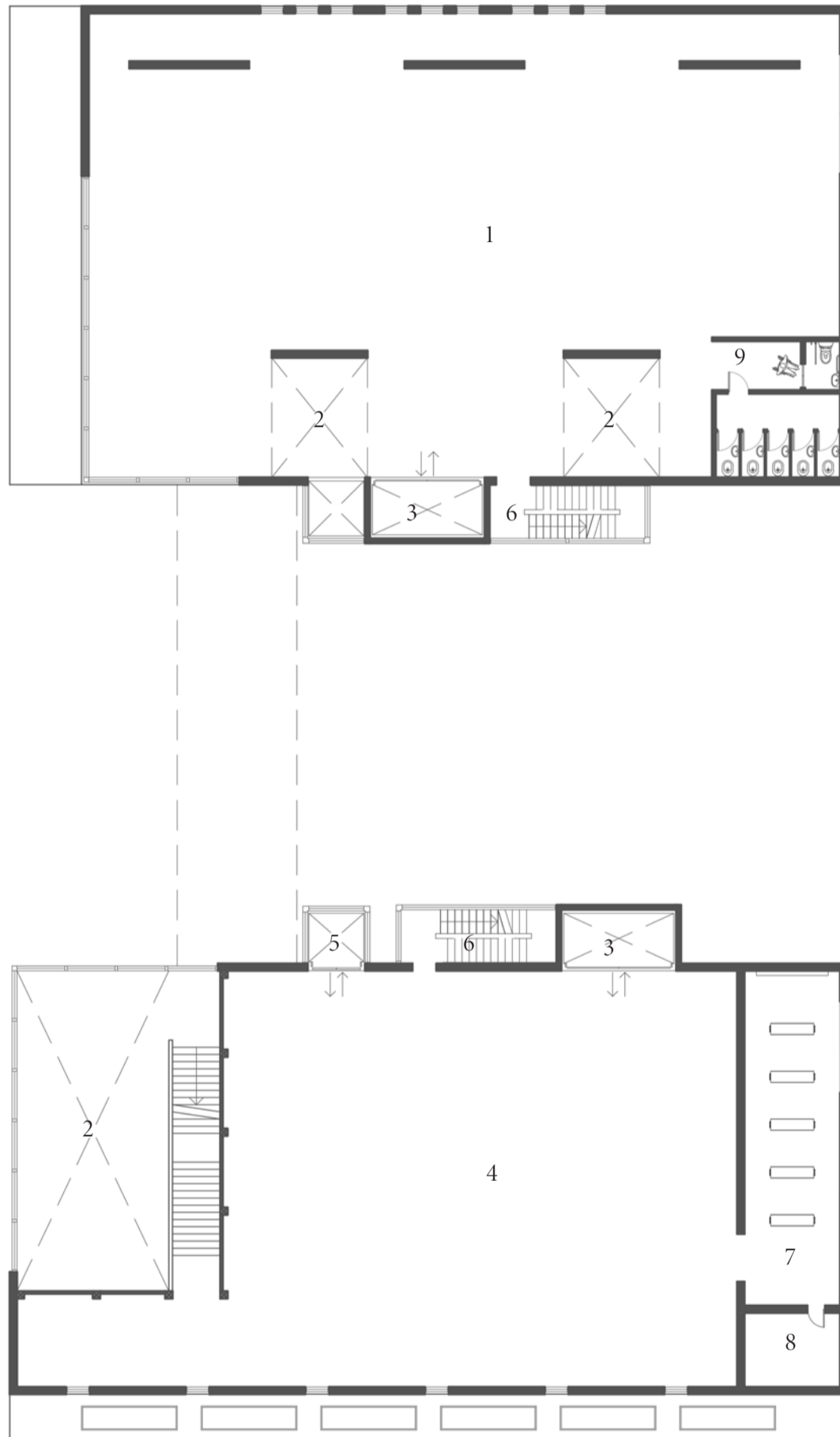
- 9 Plant room
- 10 Curators office
- 11 Management office
- 12 Delivery and storage room
- 13 Service lifts (also for public use)
- 14 Entrance lift (to third floor)
- 15 West wing lift
- 16 Stairwells / Fire exists

- 17 Workshop / educational rooms
- 18 Permanent exhibition space
- 19 Toilets



# First Floor Plan

1:250

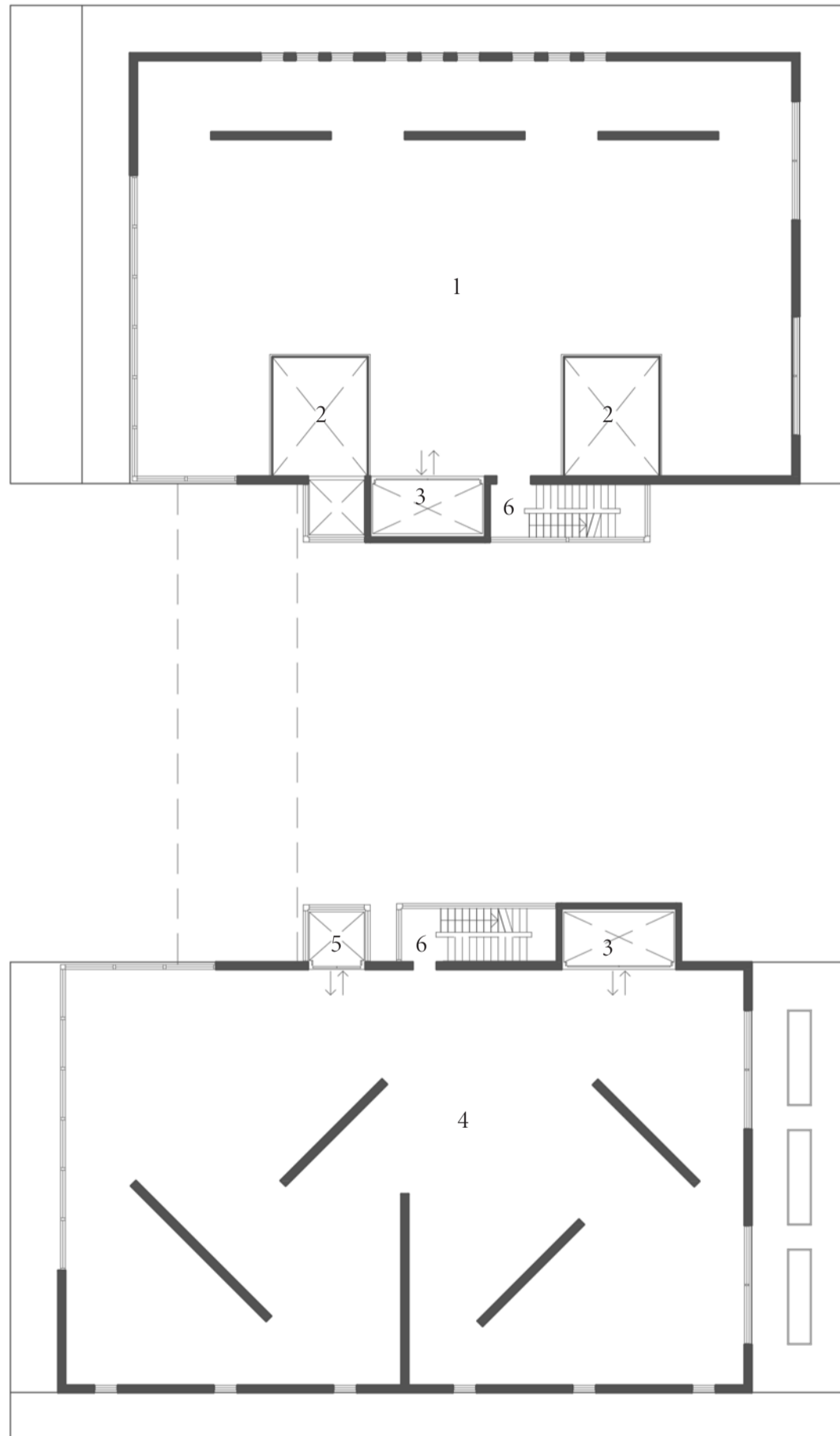


- |   |                                     |   |                           |
|---|-------------------------------------|---|---------------------------|
| 1 | Non permanent exhibition space      | 6 | Stairwells / Fire exists  |
| 2 | Atrium                              | 7 | Small cinema room         |
| 3 | Service lifts (also for public use) | 8 | Storage room              |
| 4 | Permanent exhibition space          | 9 | Toilets & Disabled Toilet |
| 5 | West wing lift                      |   |                           |



# Second Floor Plan

1:250



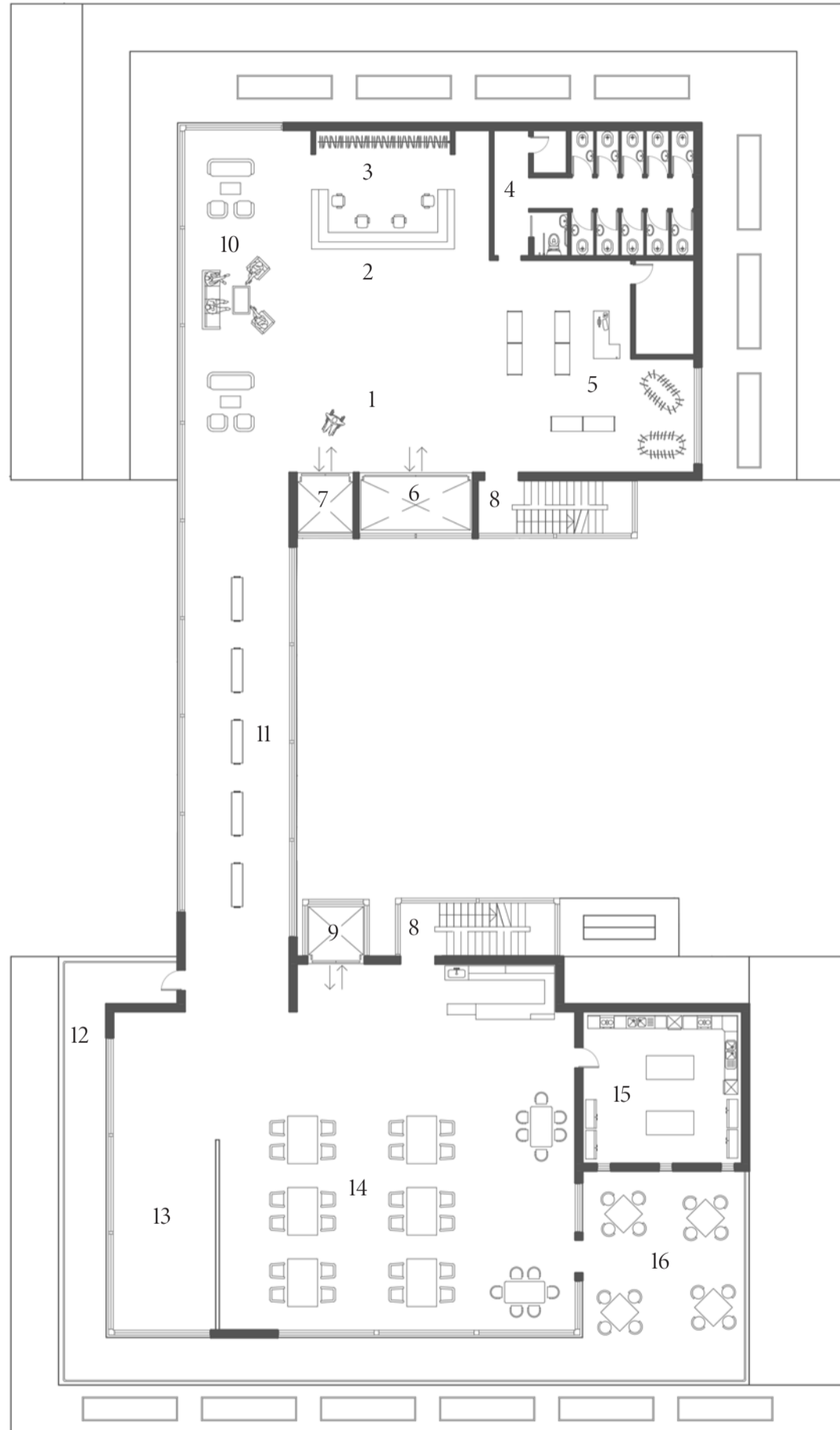
- 1 Permanent exhibition space
- 2 Atrium
- 3 Service lifts (also for public use)

- 4 Permanent exhibition space - timeline of Nordhavn past to future
- 5 West wing lift
- 6 Stairwells / Fire exists



# Third Floor Plan

1:250

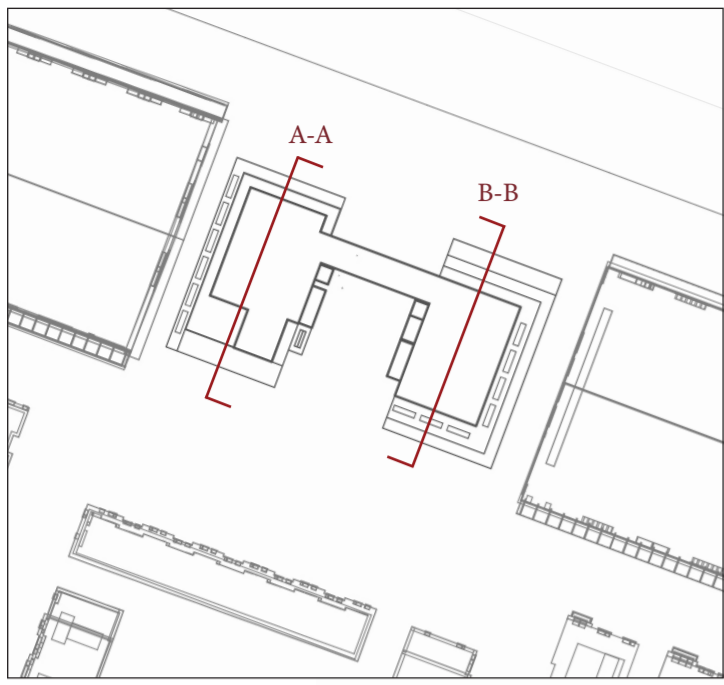


- |   |                                     |    |                              |    |                      |
|---|-------------------------------------|----|------------------------------|----|----------------------|
| 1 | Entrance lobby                      | 7  | Express lift to ground floor | 13 | Children's play area |
| 2 | Ticket desk                         | 8  | Stairwells / Fire exists     | 14 | Café                 |
| 3 | Cloak room                          | 9  | West wing lift               | 15 | Kitchen              |
| 4 | Unisex & disbaled toilets           | 10 | Seating area                 | 16 | Outdoor seating      |
| 5 | Shop                                | 12 | Viewing gallery / skybridge  |    |                      |
| 6 | Service lifts (also for public use) | 12 | Roof terrace                 |    |                      |

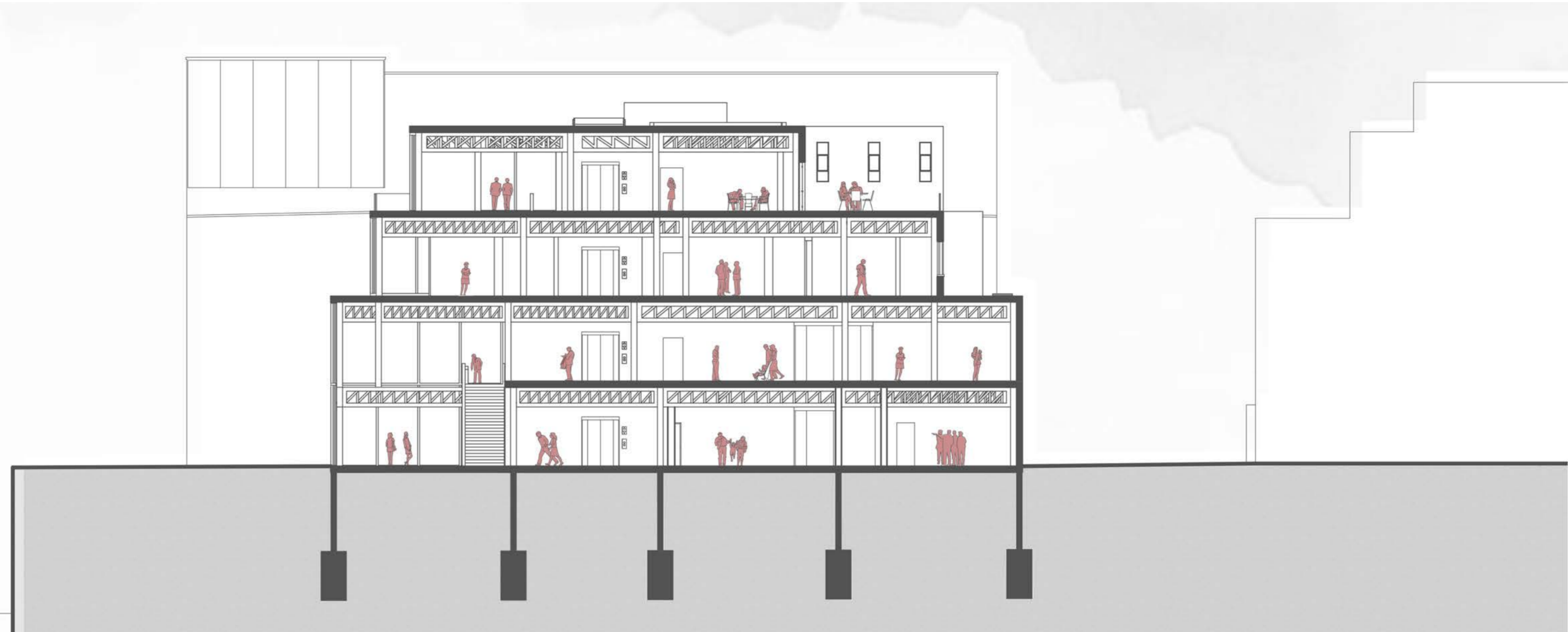


# Longitudinal Sections

1:200



Contextual Plan View  
1:1000



Longitudinal Section A-A  
*West Wing*

5m

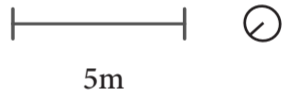


Longitudinal Section A-A  
*East Wing*

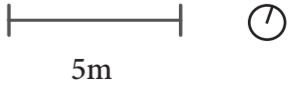
5m



Front Elevation  
North



Rear Elevation  
South





**Titanium Zinc**

Used: 93m<sup>3</sup>

**Composite Cladding Board**  
*(made from recycled wood & plastic)*

Used: 10.2m<sup>3</sup>

**Norwegian Spruce Glulam Beams**  
*(with sequestration)*

Used: 322.93m<sup>3</sup>

**Norwegian Spruce CLT Panels**  
*(with sequestration)*

Used: 322.93m<sup>3</sup>

**Hemp-Fibre Insulation**

**Terrazzo**

Used: 4469m<sup>2</sup>  
44.68m<sup>3</sup>

**Green Concrete**

Used: ~3500m<sup>3</sup>

**Galvanised Steel**

Used: 6m<sup>3</sup>

**prePATINA ECO ZINC - [RHEINZINK]**

Manufactured and sourced entirely within Europe, this zinc has a lifespan of up to 100 years and requires fewer resources for repair and replacement due to its protective coating, which also benefits coastal environments. The full manufacturing process emits 1.85 kg of CO<sub>2</sub> per kg of zinc

**Hyperion Composite Cladding Board**  
[Envirobuild]

Manufactured with 100% renewable energy and made up of 90% recycled materials; a mix of recycled plastic, FSC certified wood, and stone powder. It is manufactured using 100% renewable wind energy, with a 64% less CO<sub>2</sub>e than softwood timber across its lifecycle.

**Norwegian Spruce**  
[BS EN 13381 + BS EN 13501 Rated + FSC Approved]

A widely available and sustainable tree species that can be sourced from FSC [Forest Stewardship Council] managed woodland, whereby the growing and harvesting of materials in carefully managed, suitable timber suitable for glulam beams.

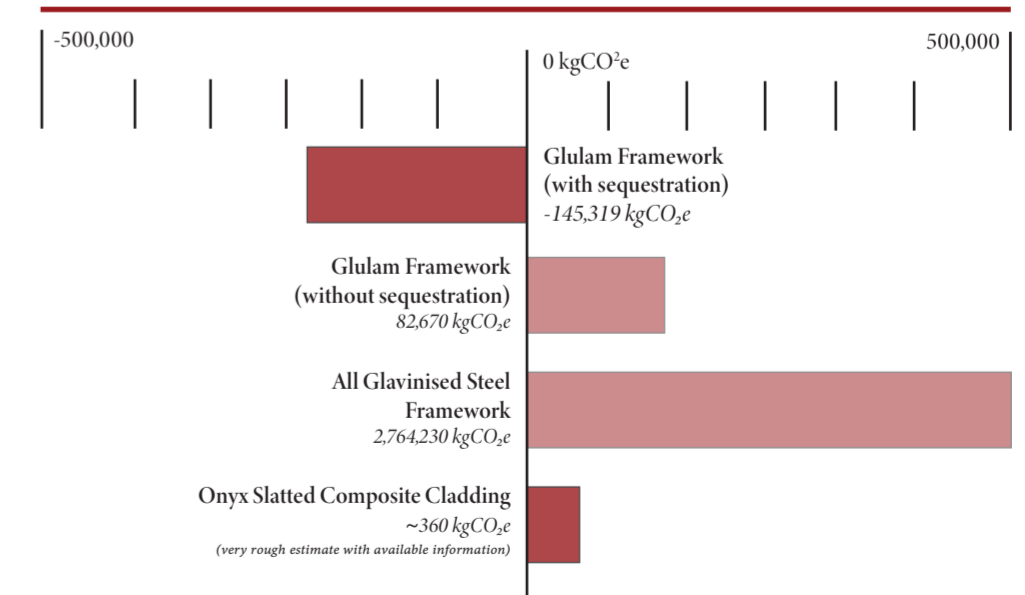
**Norwegian Spruce**  
[BS EN 13381 + BS EN 13501 Rated + FSC Approved]

A widely available and sustainable tree species that can be sourced from FSC [Forest Stewardship Council] managed woodland, whereby the growing and harvesting of materials in carefully managed, suitable timber suitable for the CLT panels.

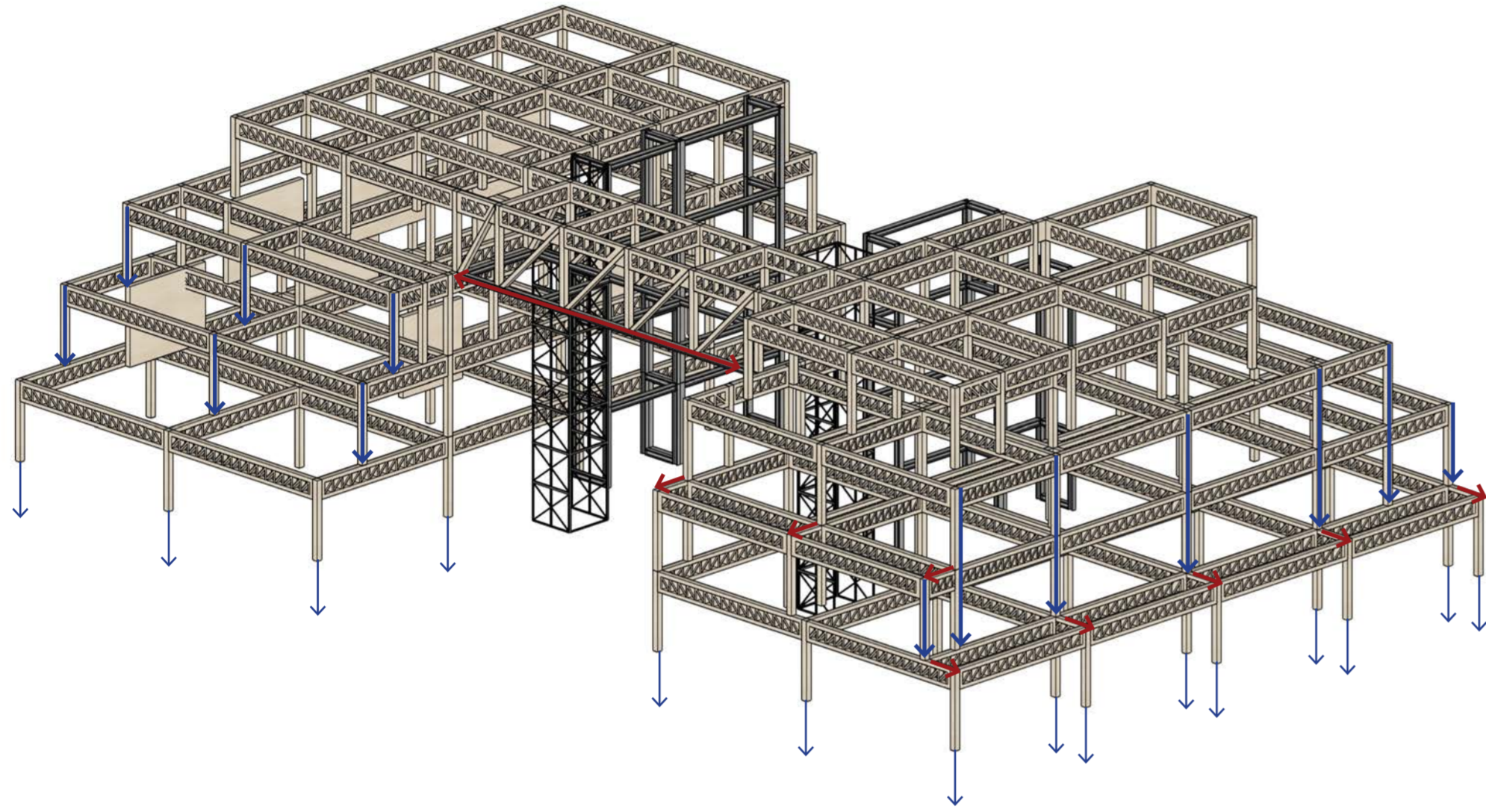
**Hemp-Fibre Insulation**  
[FSC Approved]]

Known for having an extremely low embodied carbon, typically around -1.0kgCO<sub>2</sub>e, and being net-zero due to the CO<sub>2</sub> absorbed during the hems growth

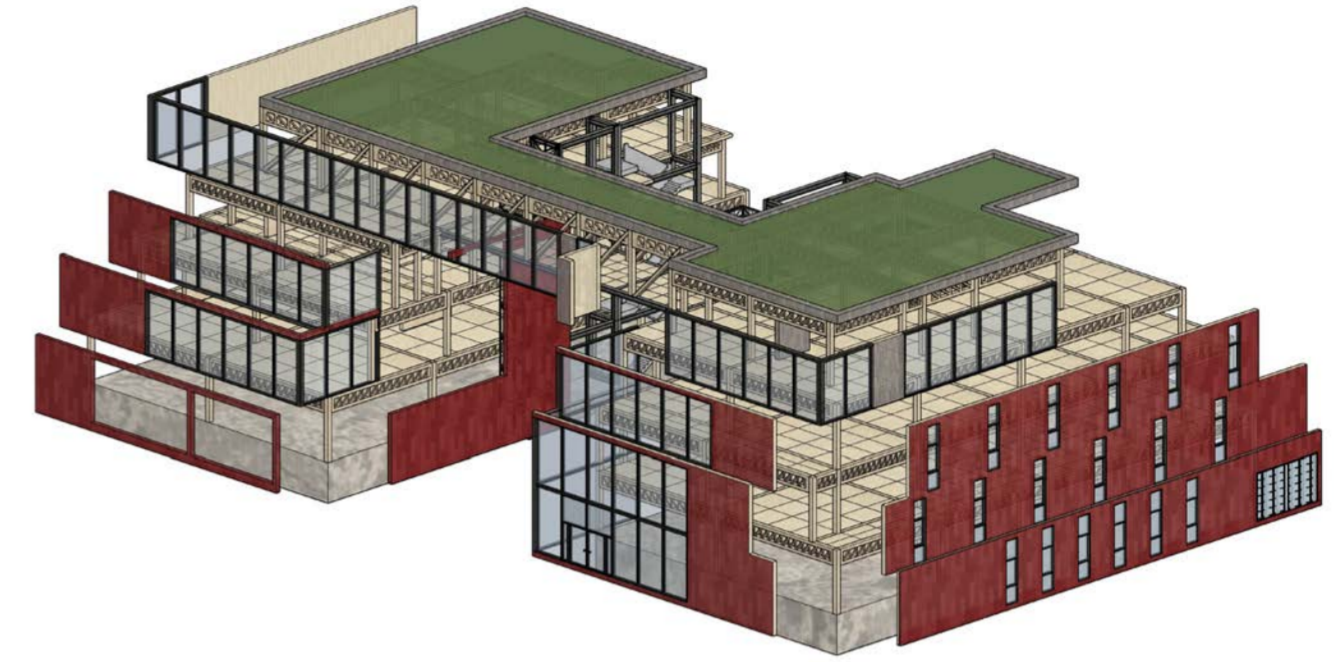
**Embodied Carbon: (in line with EN 15978)**



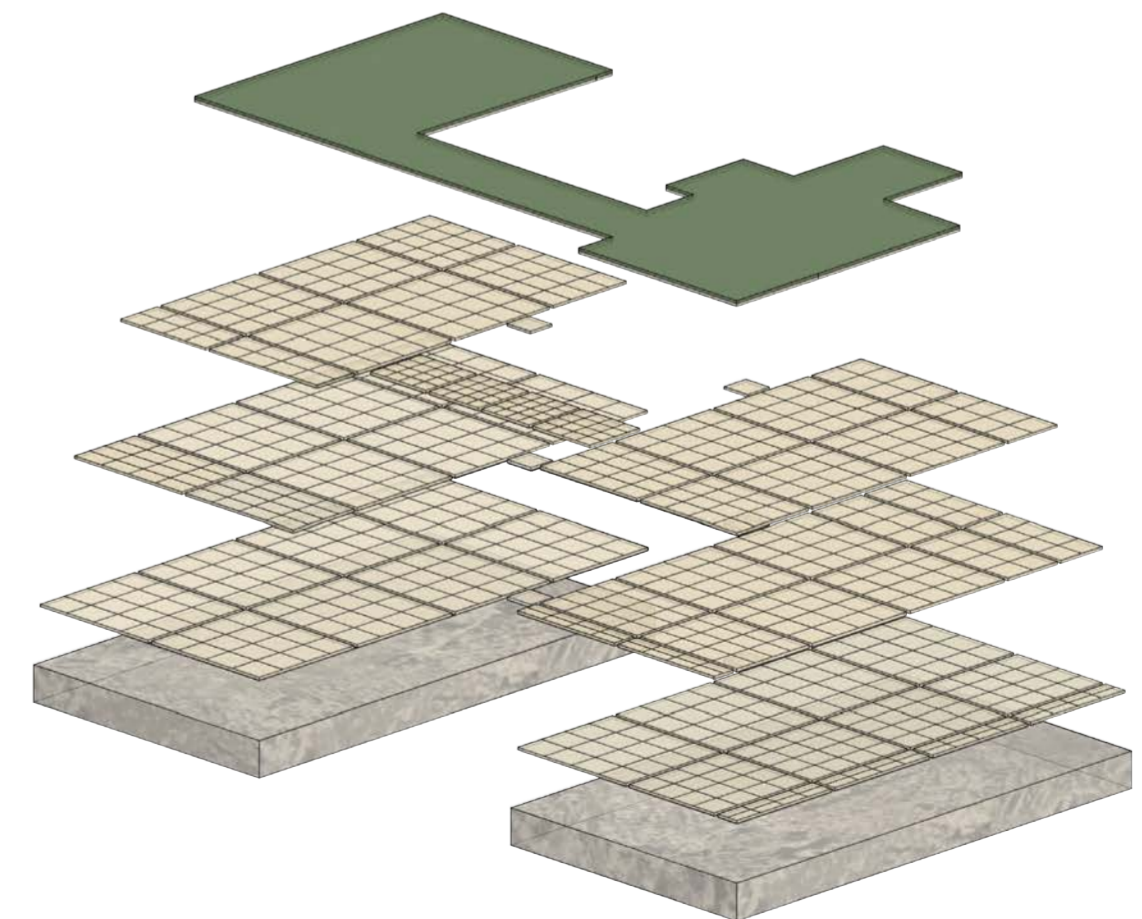
Glulam Structural Framework -  
Isometric [not to scale]



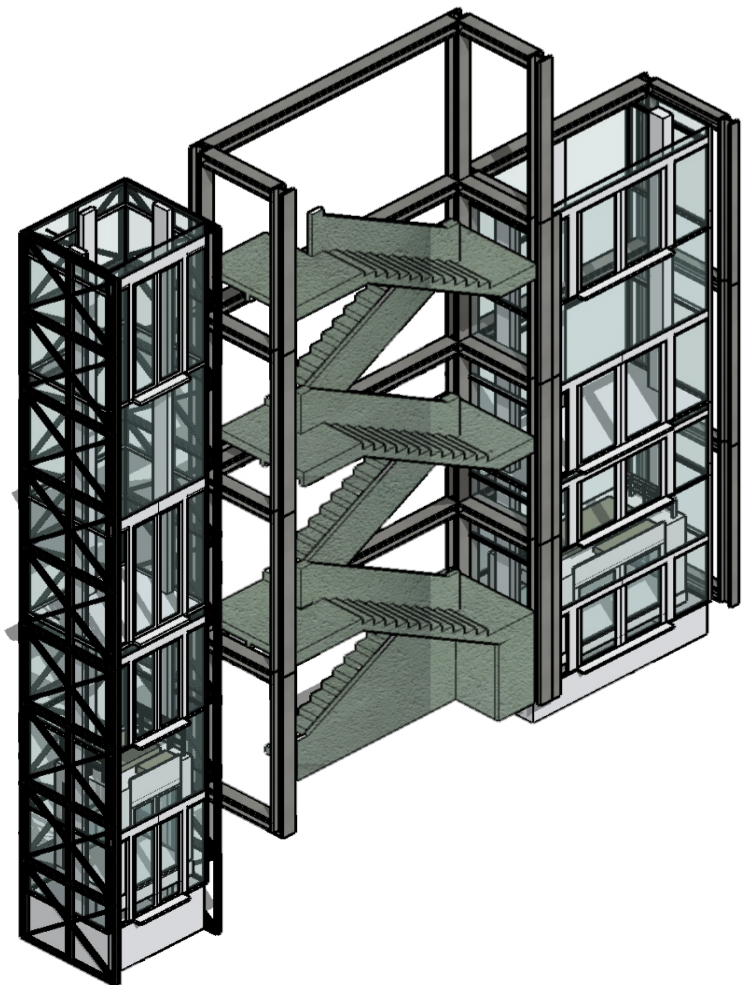
Zinc Cladding + Composite Cladding Board +  
Green Roof Building Skin -  
Exploded Isometric [not to scale]



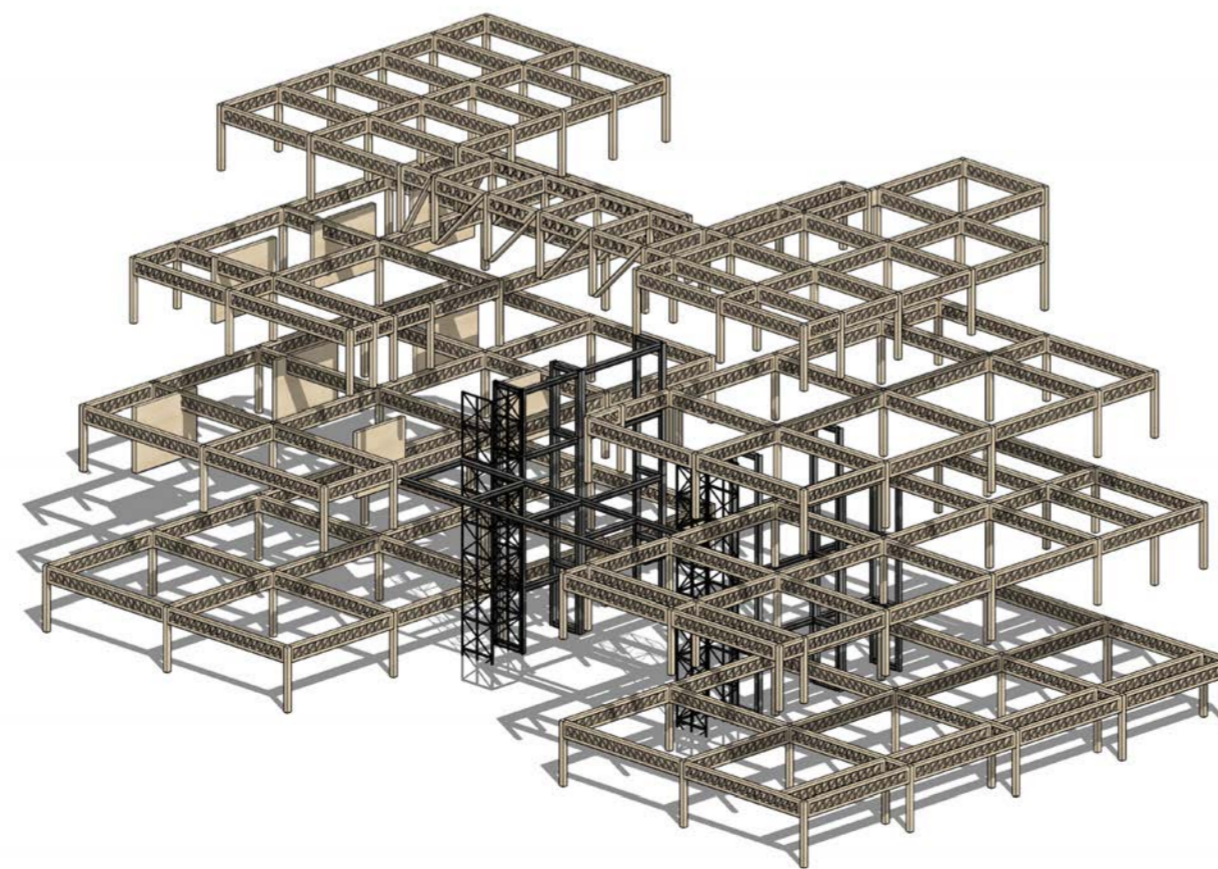
CLT + Greencrete Floorplates -  
Exploded Isometric [not to scale]



Steel Stairwell Framework + Greencrete Stairs -  
Isometric [not to scale]



Glulam Structural Framework -  
Exploded Isometric [not to scale]



# Physical Model

1:200



1:200 massing model made from laser cut 9mm MDF, card and model grass