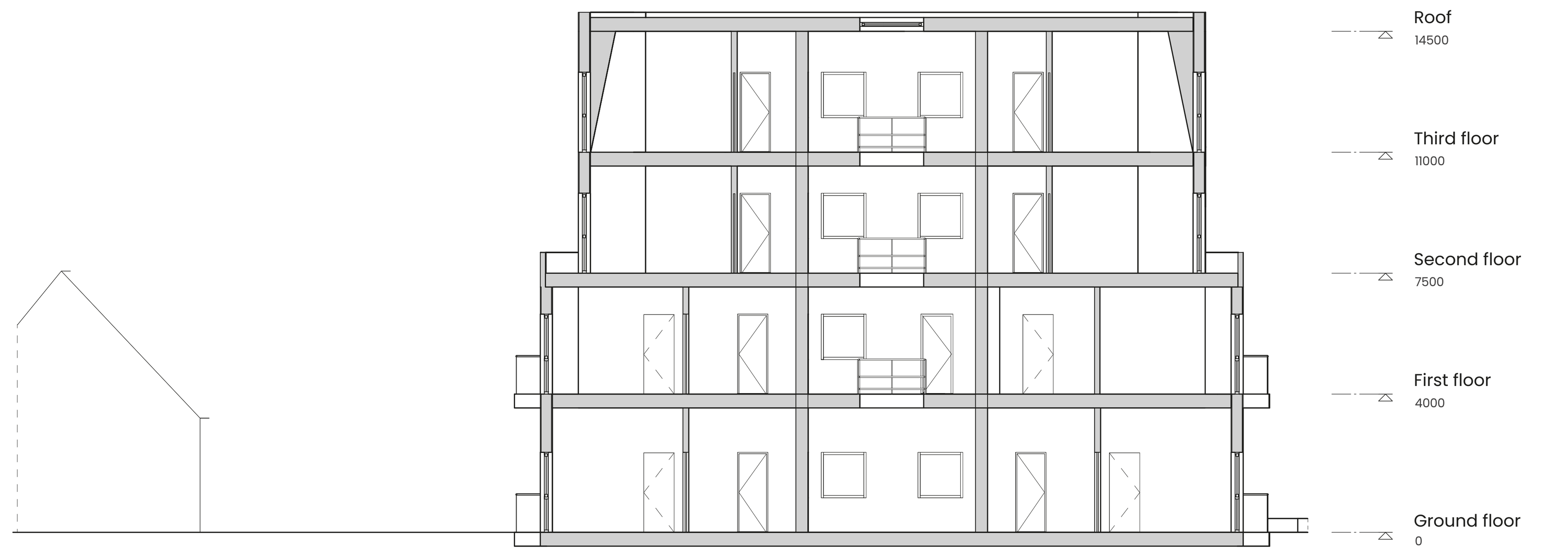
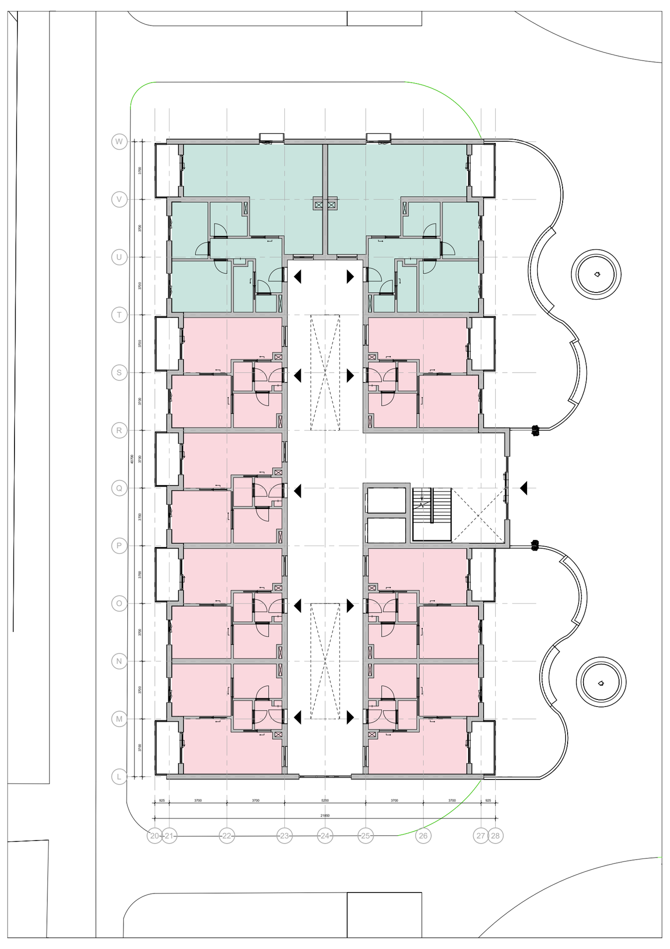
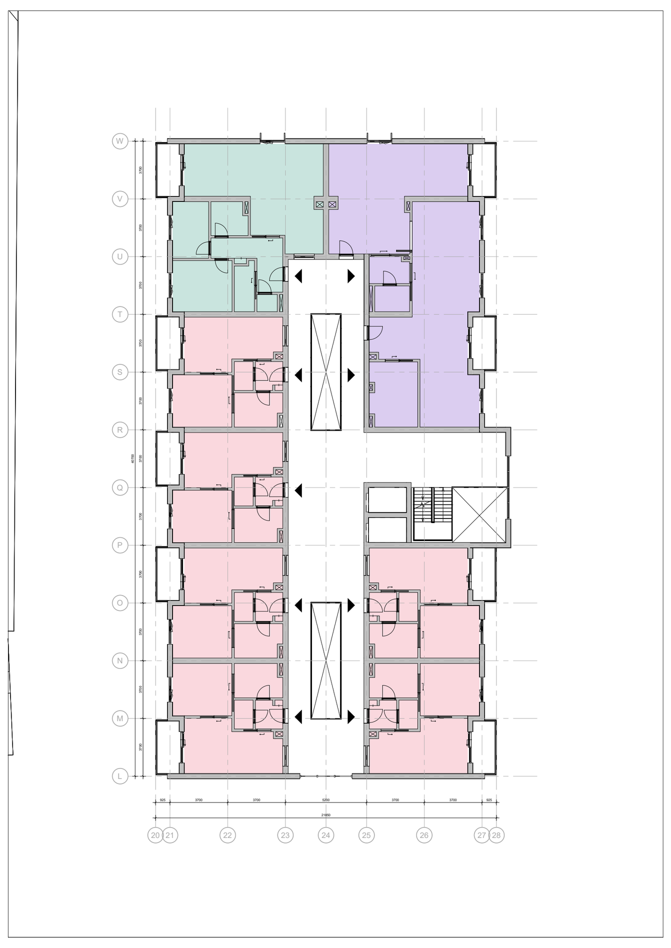
RESIDENTIAL BUILDING



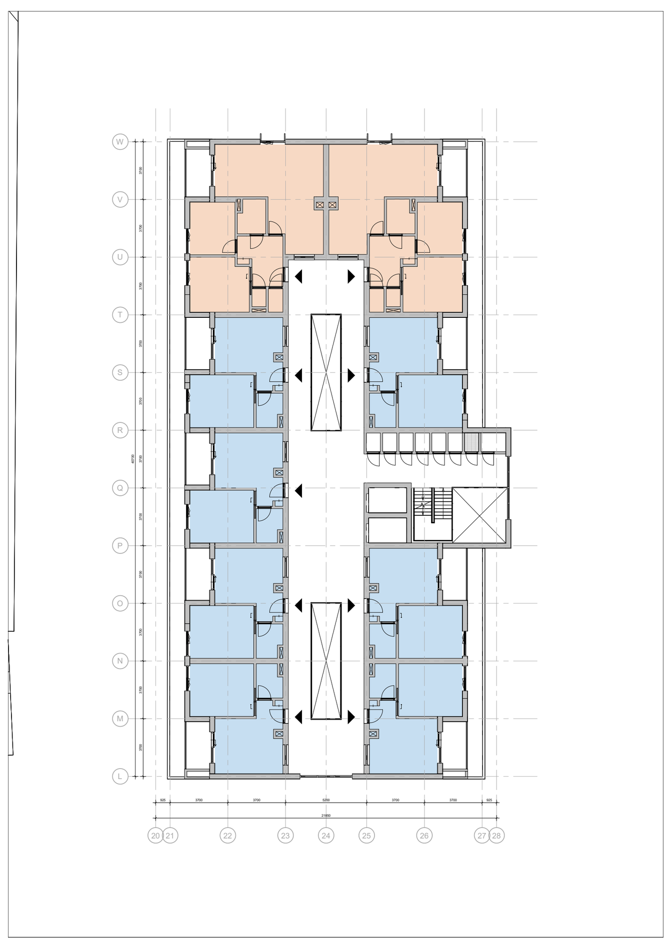
Ground floor



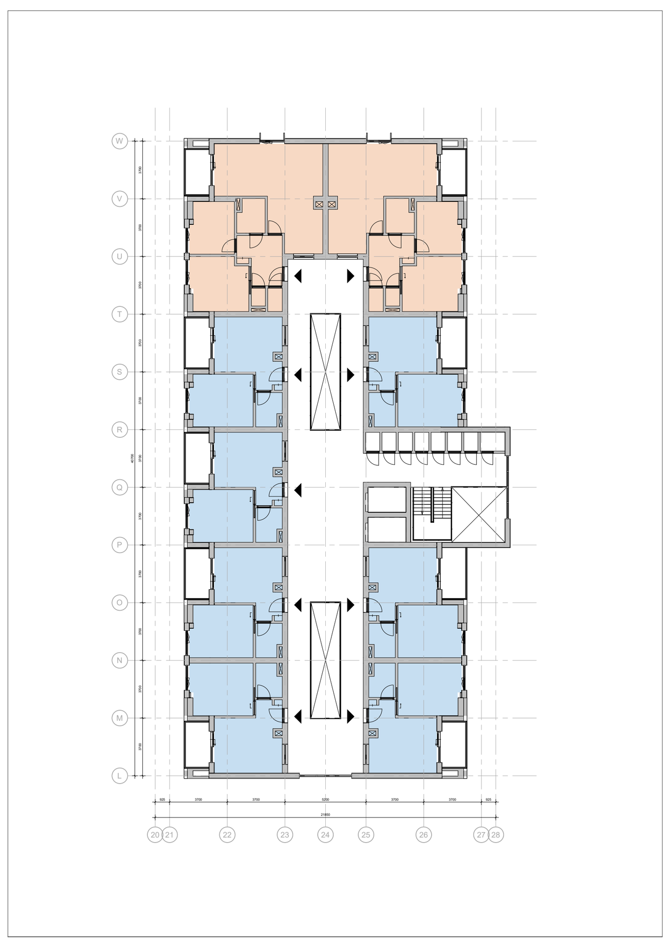
First floor



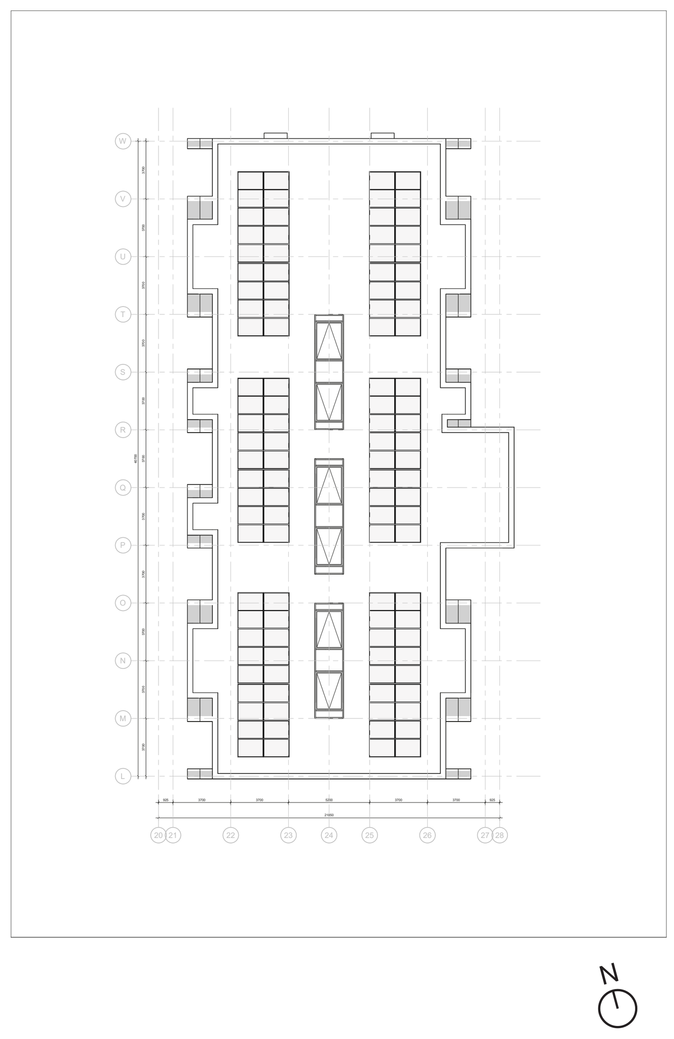
Second floor

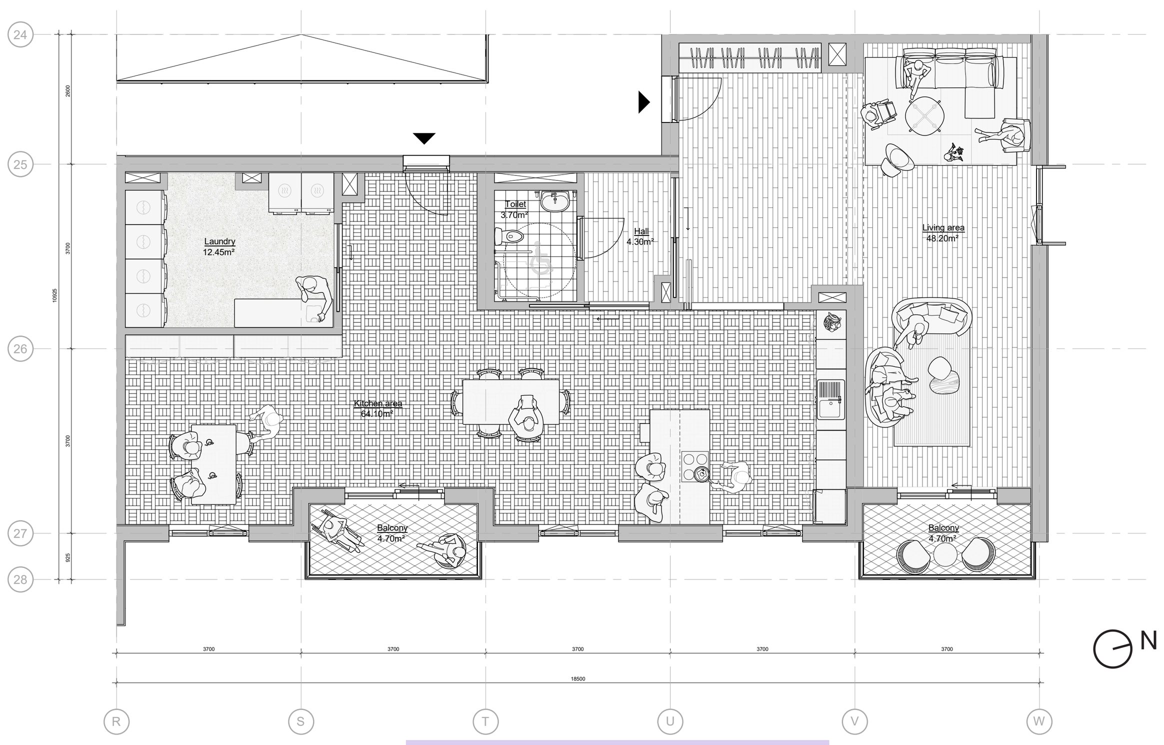


Third floor

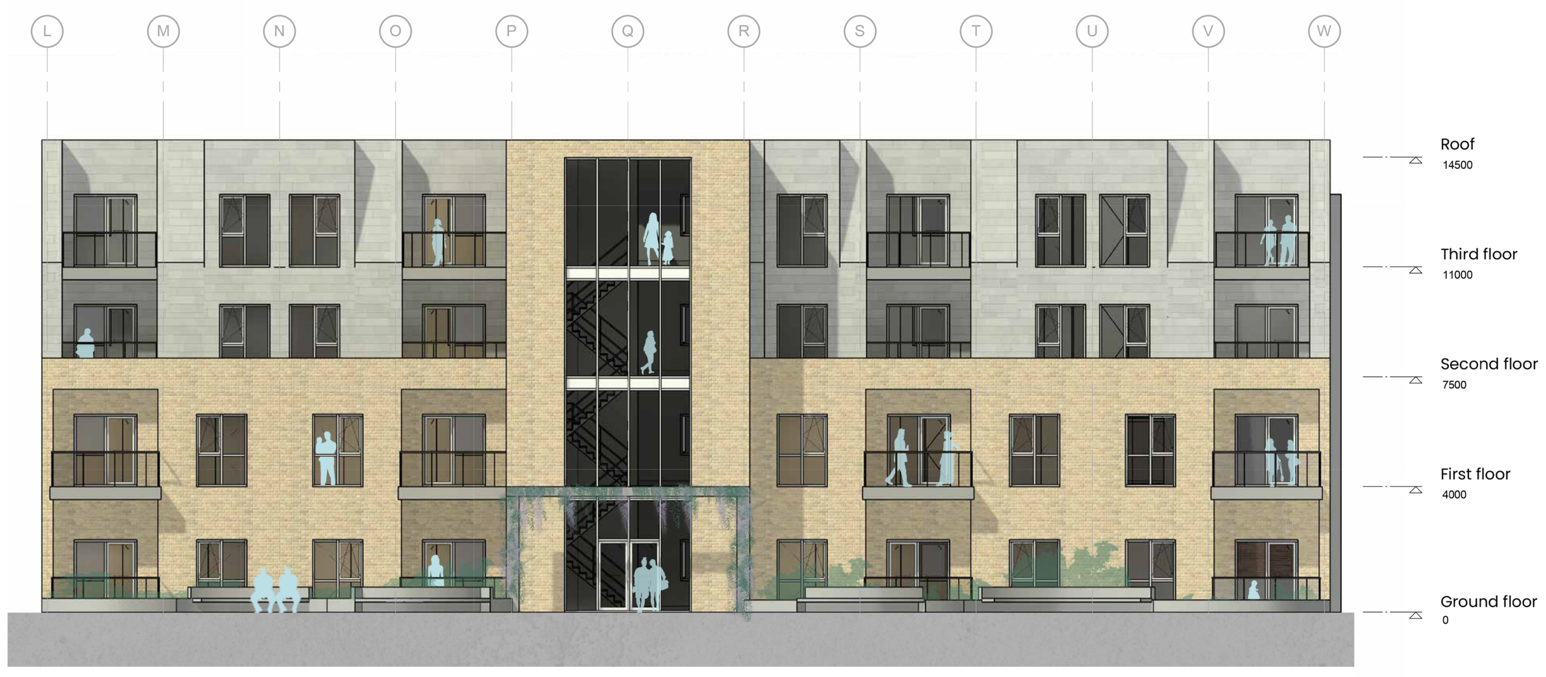


Roof



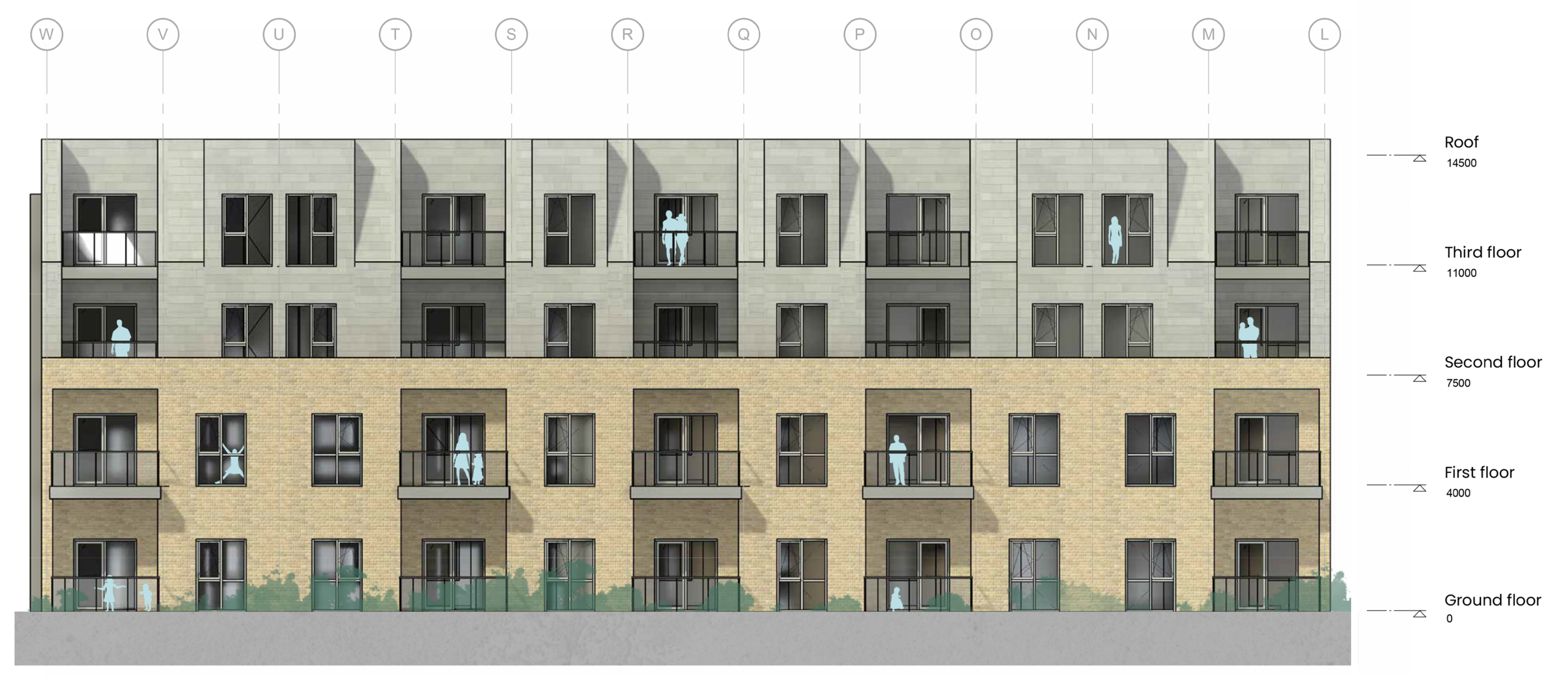


Communal space



East

Type 4 - 90m^2 Type 2 - 50m^2



West

Type 3 - 76m^2 Type 1 - 35m^2

North

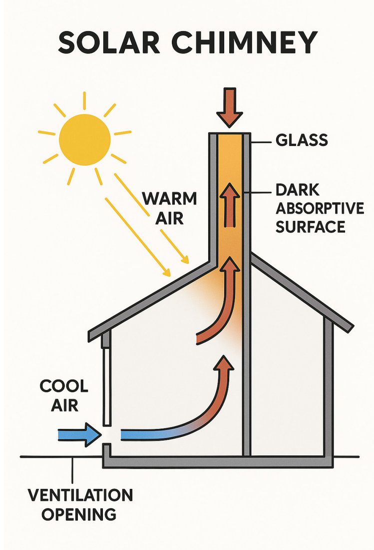
South

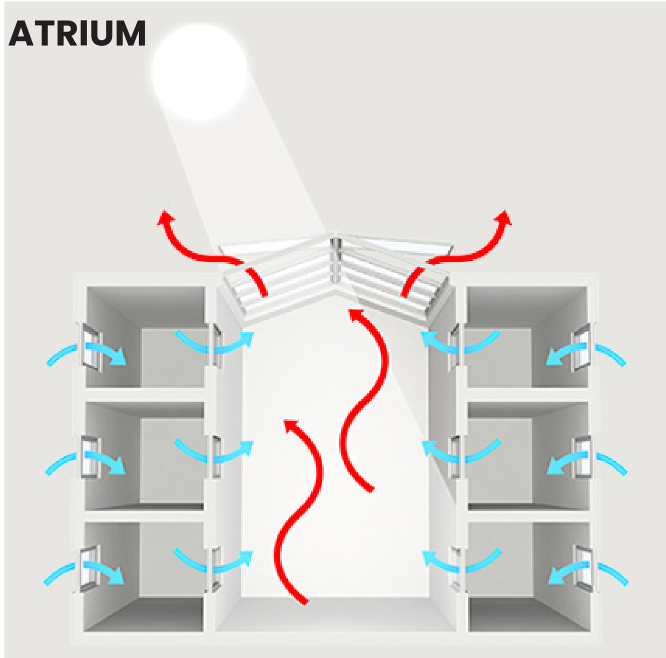
SOLAR CHIMNEY EFFECT

A solar chimney is a passive system that improves indoor climate and air quality by using natural forces instead of mechanical installations. It consists of a vertical shaft that connects interior spaces to the outside.

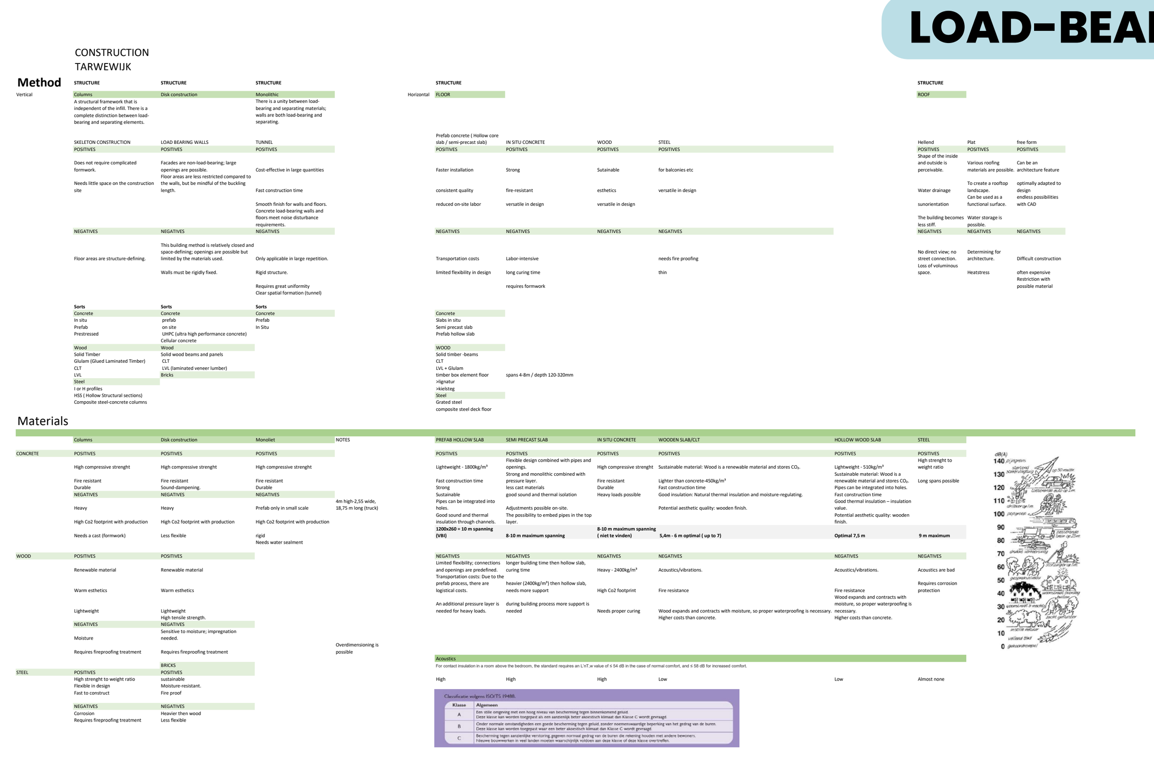
As solar radiation heats the air inside the shaft or atrium, the warm air rises and exits through skylights, creating a natural stack effect. This upward movement draws in cooler, fresh air through lower façade openings, enhancing ventilation.

The result is improved air quality, a more stable indoor climate, and reduced reliance on mechanical systems, supporting an energy-efficient building design.





LOAD-BEARING STRUCTURE



To determine the most suitable structural materials, a material-application matrix was created, comparing options based on sustainability, performance, and architectural expression. This helped relate material qualities directly to the design.

As a result, the residential buildings use concrete for its durability, fire resistance, and acoustic benefits. To reduce environmental impact, recycled materials from on-site demolition will be incorporated. The strict grid layout supports an efficient disk construction system.

SOLAR TUBES

A solar tube is a passive daylighting system designed to bring natural light into rooms without exterior windows.

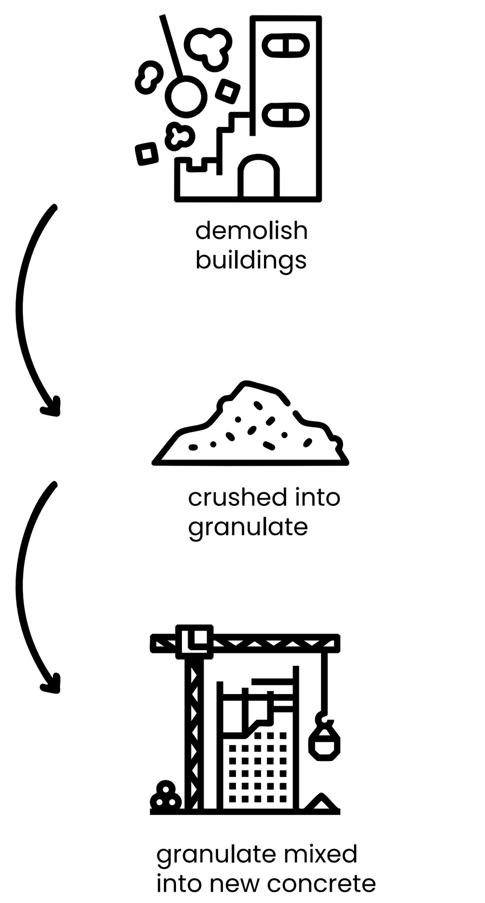
Three key parts: a clear dome on the roof that captures sunlight, a highly reflective tube that channels the light through the building, and a diffuser in the ceiling that spreads the light evenly into the room.

While solar tubes can reduce the need for artificial lighting, especially in deep interior spaces, their application is limited. In this project, the only suitable place for solar tubes would be in the toilets. However, the installation requires roof area, which impacts the use the roof as a community vegetable garden.

Given these spatial and design drawbacks, the disadvantages of solar tubes outweigh their potential benefits in this case, and they will not be implemented in the design.

Key part of solar tube

RECYCLED CONCRETE



Sustainable concrete production requires both material innovation and process adaptation. Since recycling concrete only becomes energy-efficient when the material is sourced within approximately 25 kilometers, the concrete for this project will be produced on site using granulate from demolished buildings. This significantly reduces the need to transport new materials, while giving demolition waste a second life.

By replacing natural aggregates like gravel and sand, the approach preserves raw resources, minimizes CO_2 emissions, and lowers the project's environmental footprint.

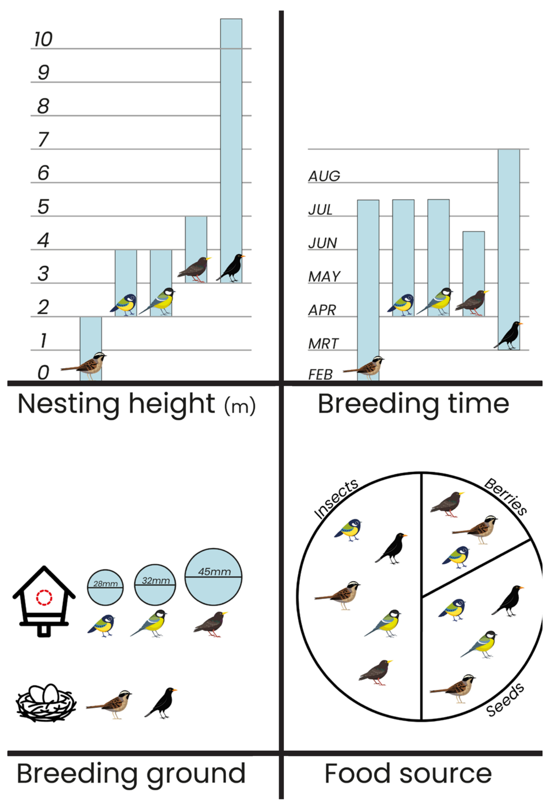
This strategy supports a circular material cycle and reflects a responsible urban development mindset. Symbolically, it also creates a sense of continuity, where fragments of the old site are reimagined as part of the new architecture.

ECOSYSTEM

A well-functioning ecosystem supports biodiversity and fosters a resilient urban environment. In designing the multigenerational housing community in Tarwewijk, a key focus is creating a habitat that attracts and sustains local bird species while enhancing the quality of outdoor spaces.

To achieve this, I explored the most common birds in Tarwewijk using data from Vogelbescherming Nederland, which provides an overview of local bird populations based on zip code. Their tool generates a list of frequently observed species, offering insight into which birds are naturally present in the area and how the design can cater to their needs.

From this research, I selected five bird species to integrate into the plan. These species were chosen based on their prevalence in the neighborhood and their ecological role in supporting a balanced habitat. Each of these birds has specific nesting, foraging, and sheltering requirements that will influence the choice of vegetation, structural elements, and green interventions in the project.

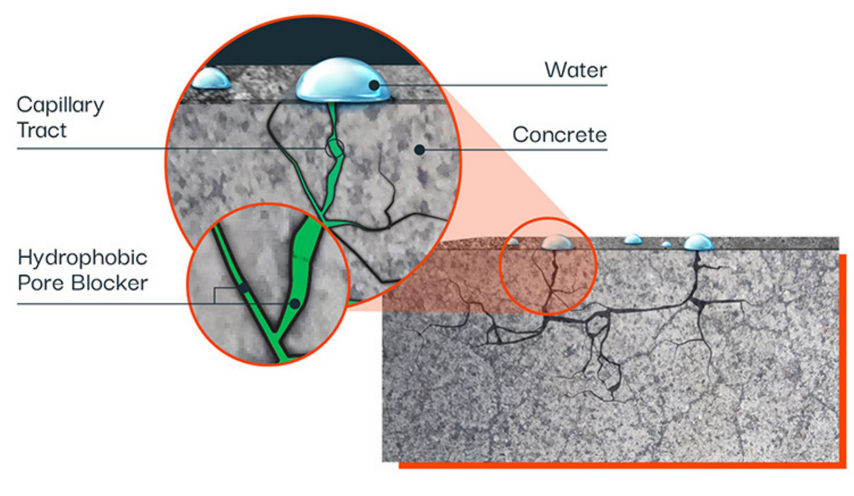


BUILDING TECHNOLOGY RESEARCH

HYDROFOBIC ADMIXTURE

To ensure long-term durability while maintaining sustainability, both the recycled concrete and rammed earth in this project are enhanced with hydrophobic admixtures—additives that repel water from within the material itself.

Recycled Concrete:
Because recycled concrete is more porous than traditional mixes, an integral hydrophobic admixture (e.g. Hycrete Endure WP) is used. Mixed into the concrete at the batching stage, it lines the capillaries internally—preventing moisture ingress while still allowing the structure to breathe. This reduces corrosion, freeze-thaw risks, and eliminates the need for extra waterproofing layers, keeping the material circular and low-maintenance.



Waterproofing concrete

Rammed Earth:
For the exposed rammed earth walls of the community center, a penetrating silicone-based admixture (e.g. Tech-Dry Plasticure) is applied. It bonds with the surface minerals, forming an invisible water-repellent layer that protects against rain, splashes, and erosion, without compromising the natural appearance or vapor permeability of the earth.

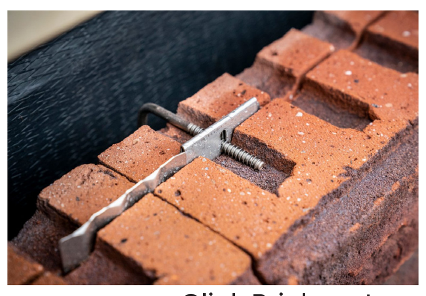
BRICKS

For the bricks research, I explored three distinct types of bricks with various benefits and applications.

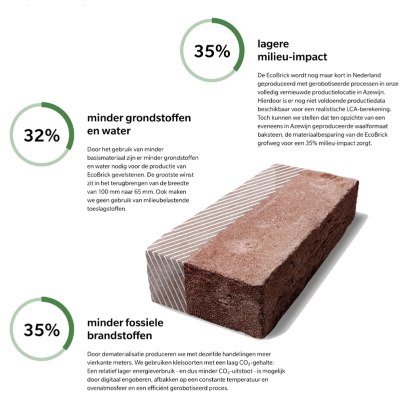
The **Click Brick** system is an innovative solution that focuses on horizontal installation. The bricks are connected using stainless steel clips and cavity anchors, making them removable and reusable. This system stands out for its flexibility and sustainability, as it eliminates the need for mortar, reducing waste during construction and being remountable.

Eco Bricks are designed with a reduced volume, making them 35% smaller than traditional bricks, with a width of just 65mm. The production process requires less energy and fewer resources, contributing to a reduction in CO_2 emissions. Additionally, the efficiency in packaging and transportation helps reduce the environmental impact by allowing more bricks to be transported per load, thereby reducing transport movements, pallets, and coverings.

Langformaat bricks are ideal for certain applications where faster installation is a priority. The longer size of these bricks allows for quicker processing, as they can be easily inserted without the need to adjust the joint thickness.



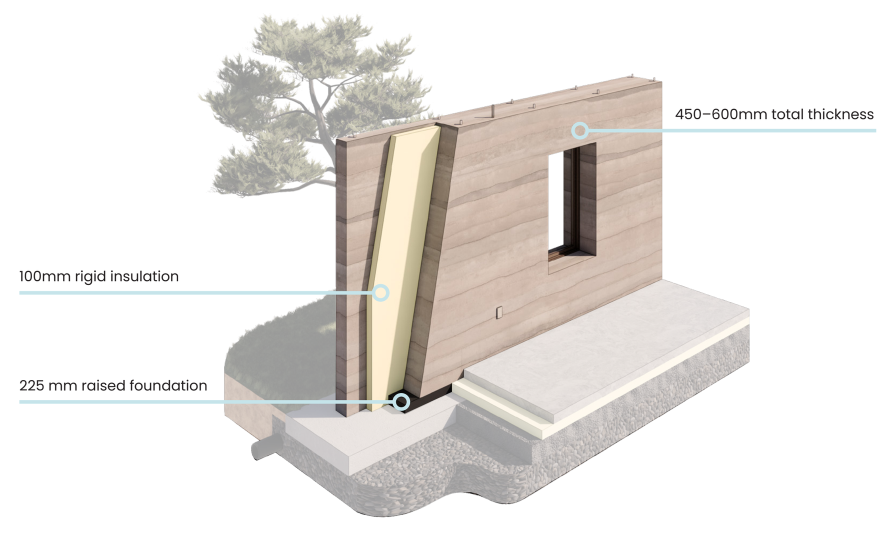
Click Brick system



Eco Brick facts

RAMMED EARTH

Rammed earth is a low-impact construction technique where layers of gravel, sand, silt, and clay are compacted in formwork to create solid, monolithic walls. The soil is often sourced locally, minimizing transport and CO_2 emissions. To ensure durability, walls must be protected from moisture—with raised foundations, roof overhangs, and proper drainage.



Thanks to their high thermal mass, rammed earth walls absorb heat during the day and release it at night, stabilizing indoor temperatures and reducing energy use.

An advanced variation, SIREWALL, adds internal insulation, reinforcement, and vapor control, achieving high energy efficiency (RSI 5.8) while preserving the natural appearance and breathability of earth construction.

DISTRICT HEATING

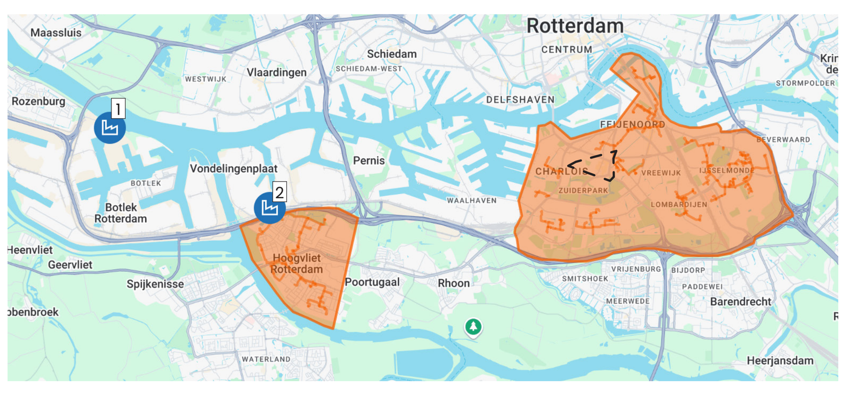
Vattenfall supplies district heating to two areas in the southern part of Rotterdam. One of these areas includes Tarwewijk. The network is already connected to the gymnasium on the design site. This existing connection provides an opportunity to integrate the new development into the district heating system, further expanding its use within Tarwewijk.

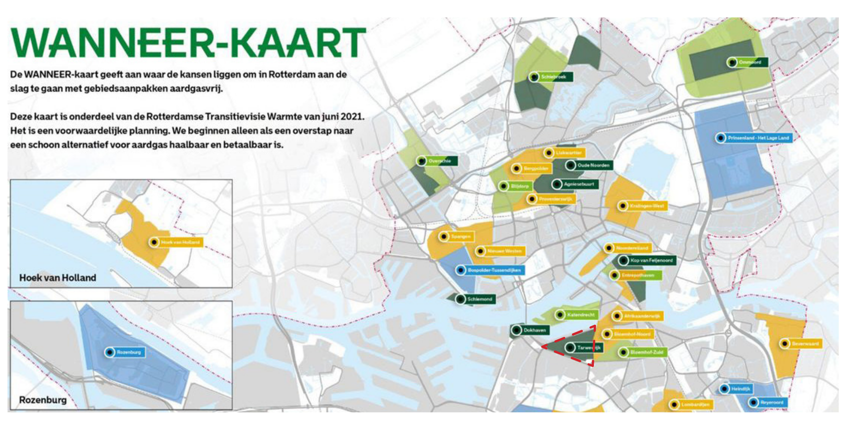
Heat sources:
1. Waste Incineration Plant – At the AVR waste incineration facility (Rozenburg), residual waste is burned to generate steam. This steam is used to heat water for the district heating network in the Rotterdam region.

2. Residual Heat from Industry – Waste heat from the Shell refinery in Pernis is repurposed to supply dirstict heating in the Rotterdam area.

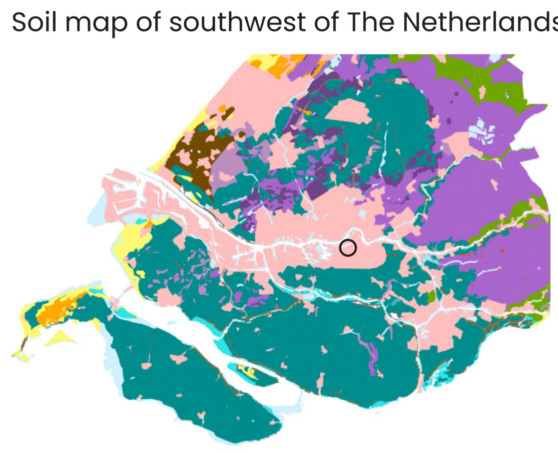
The 'wanneer-kaart' illustrates the phased transition to district heating throughout the whole of Rotterdam. Tarwewijk is part of the group advised to begin a district-wide transition approach before 2025 (dark green). Therefore, connecting to the district heating network aligns with the Municipality of Rotterdam's vision for sustainable energy development.

District heating network Vattenfall in Rotterdam

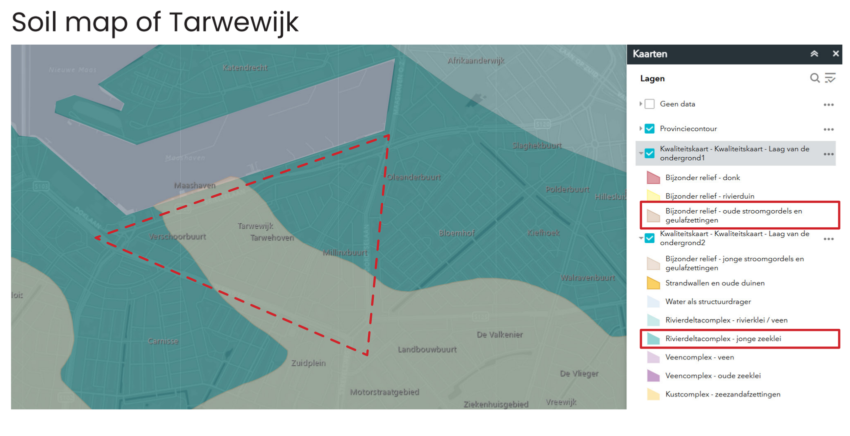




Soil map of southwest of The Netherlands



Soil map of Tarwewijk

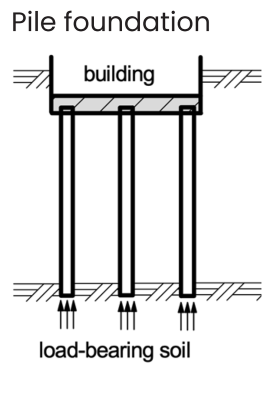


SOIL AND FOUNDATION

The soil of the Netherlands is shaped by centuries of water influence, with low-lying areas dominated by clay, peat, and sand. Rotterdam's subsurface is primarily soft peat and clay, making it especially vulnerable to land subsidence.

In Tarwewijk, the subsurface consists of flow belts and channel deposits (peach) and the river delta complex with young sea clay (turquoise). Due to peat oxidation, soil compression, drainage, and resource extraction, the ground is sinking.

Pile foundation



Because of the soft, compressible soil in Tarwewijk, a pile foundation is the most suitable solution. The weak peat and clay layers lack the bearing capacity needed for shallow foundations, making deeper, more stable support essential for long-term structural integrity.