

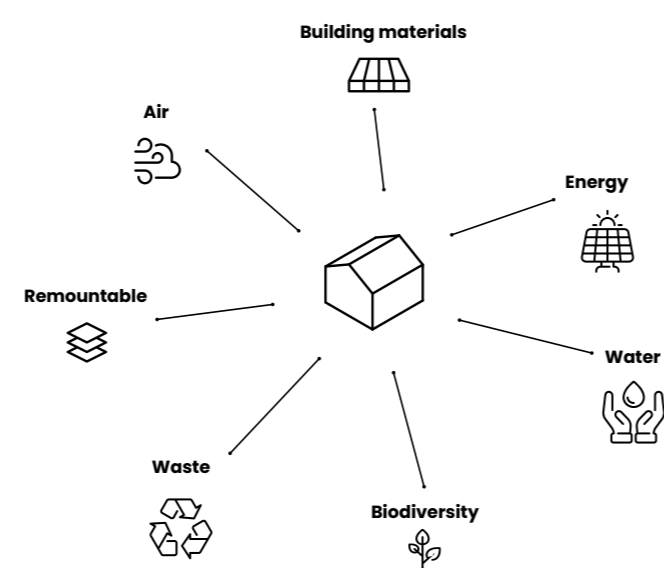
What is a 'no footprint' house?

A no footprint house minimizes its environmental impact through energy efficiency, renewable energy sources, water conservation, sustainable materials, passive design, waste reduction, and green landscaping. Our task was to explore how such a house can be achieved in Rotterdam's urban environment. Despite space limitations and infrastructure considerations, innovative solutions like vertical gardens, rooftop solar panels, and rainwater harvesting systems can make it possible. Green spaces, sustainable transportation, and community involvement are also important. By combining these elements, no footprint houses can contribute to a sustainable urban landscape in Rotterdam.

HOW DO WE DEFINE 'NO FOOTPRINT'?

Architect Vincent van der Meulen from Kraaijvanger discusses the 7x7 principle for achieving a positive carbon footprint in his book "Building with a Positive Footprint." This principle encompasses seven different aspects:

- Building Materials:** Minimizing emissions by using renewable materials like wood or reusing existing materials.
- Energy:** The energy consumption of the building should be fully supplied by green energy sources such as solar panels or renewable energy from the grid.
- Water:** Rainwater should be collected and stored in tanks for use in flushing toilets or watering plants.
- Biodiversity:** Promoting biodiversity in the surroundings, such as through green roofs with diverse native plant species or gardens with ponds to support various wildlife.
- Waste:** Minimizing waste generation and maximizing recycling. Organic waste can be composted in the garden to nourish plants.
- Remountable:** Designing the building in a way that allows for easy deconstruction and reconstruction in a different location.
- Air:** Ensuring good indoor air quality while also addressing outdoor air quality through the use of plants or mechanical filters.

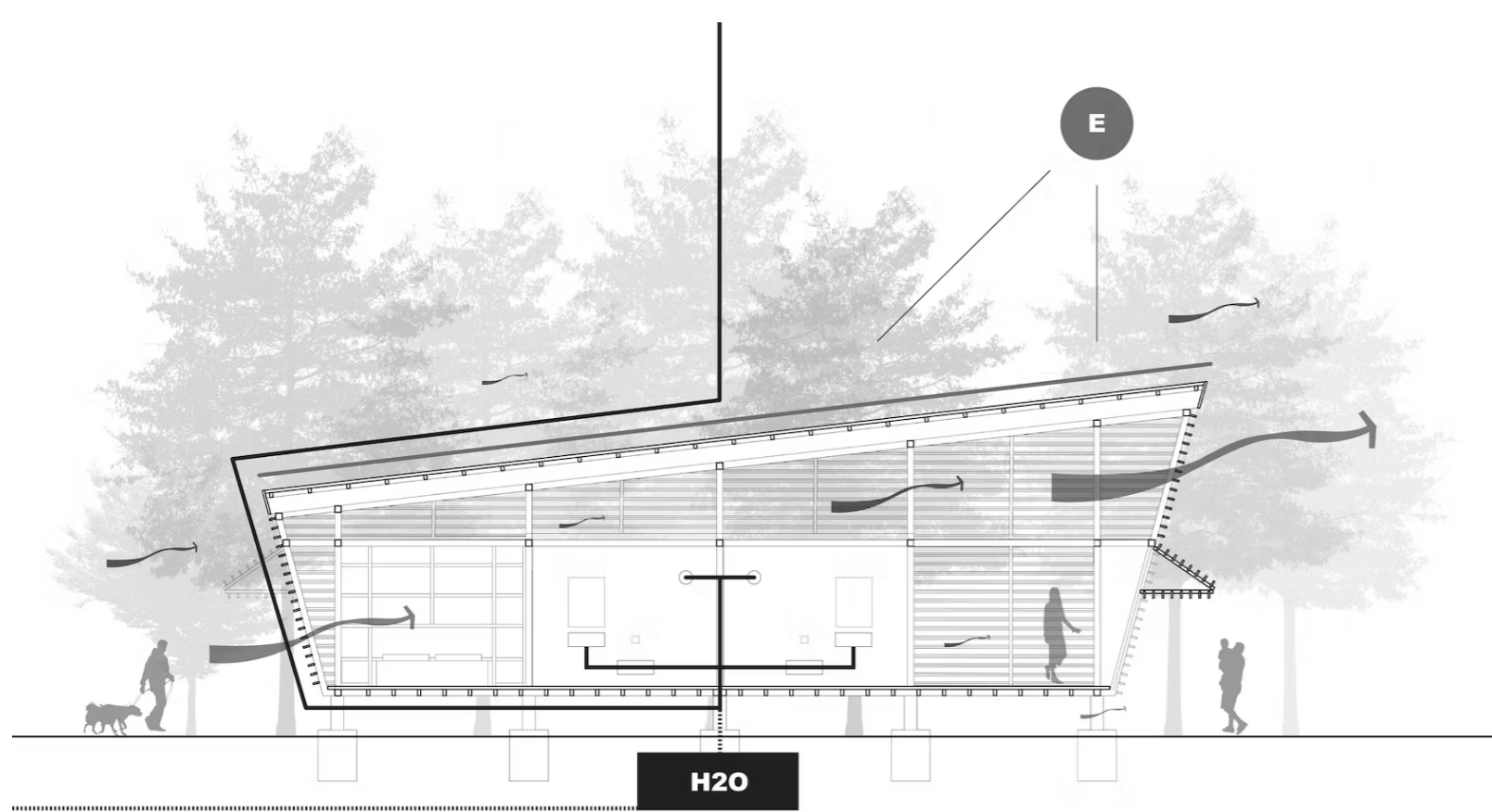


By considering and implementing these seven streams, a building can strive to achieve a positive carbon footprint.

WHICH PRINCIPLES OF THE NFH CAN WE APPLY IN OUR URBAN PROTOTYPE?

Passive climate control techniques are important for energy-efficient and comfortable homes. These techniques are applied in the no footprint house in Costa Rica, such as natural airflow and thermal mass. This approach is also relevant for our urban concept in the Netherlands, where we need to consider the specific climate.

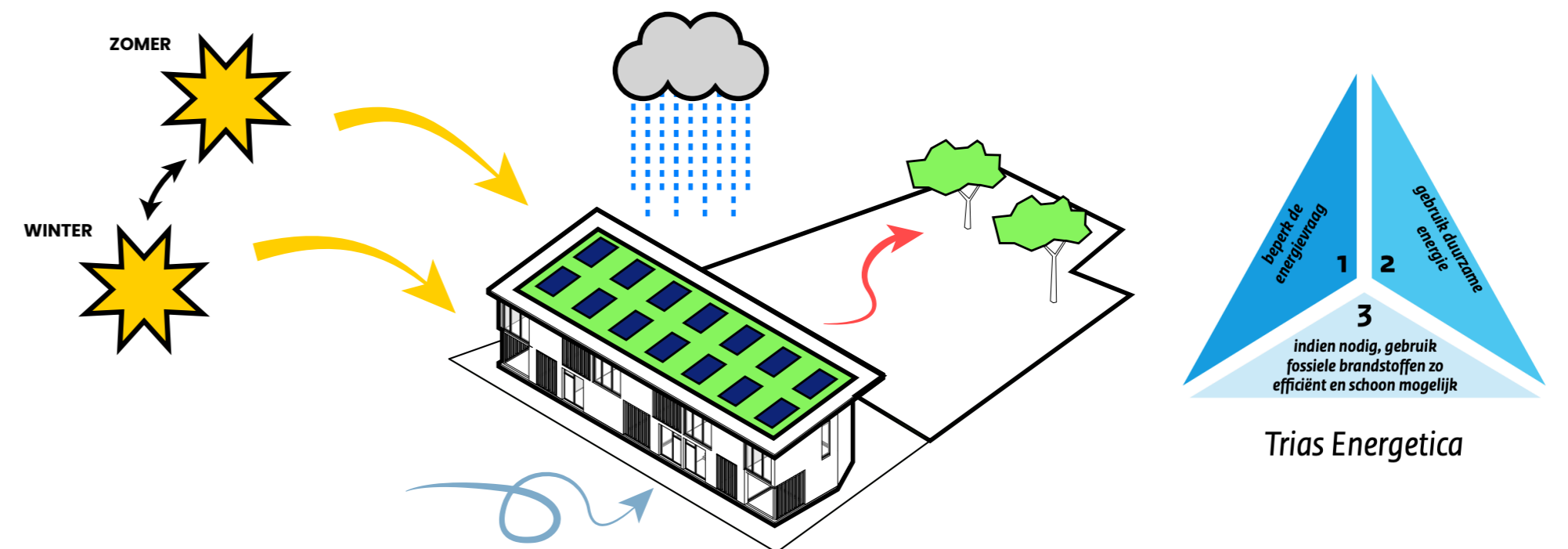
In the Netherlands, we can utilize natural ventilation and thermal mass to allow fresh air and maintain stable temperatures. Additionally, we integrate the house with the surroundings by incorporating green outdoor spaces. We strive for an efficient construction process with pre-fab systems, reducing construction time and waste generation. Our concept focuses on sustainability and customer orientation, providing residents with flexibility in design and materials, allowing them to personalize their homes.



HOW ARE PASSIVE CLIMATE CONTROL TECHNIQUES APPLICABLE IN THE NETHERLANDS?

It is essential to save energy and utilize renewable energy sources. One highly effective method for achieving this is through passive climate control. This system harnesses solar heat and natural airflow for heating, ventilation, and cooling. Here are several climate control techniques:

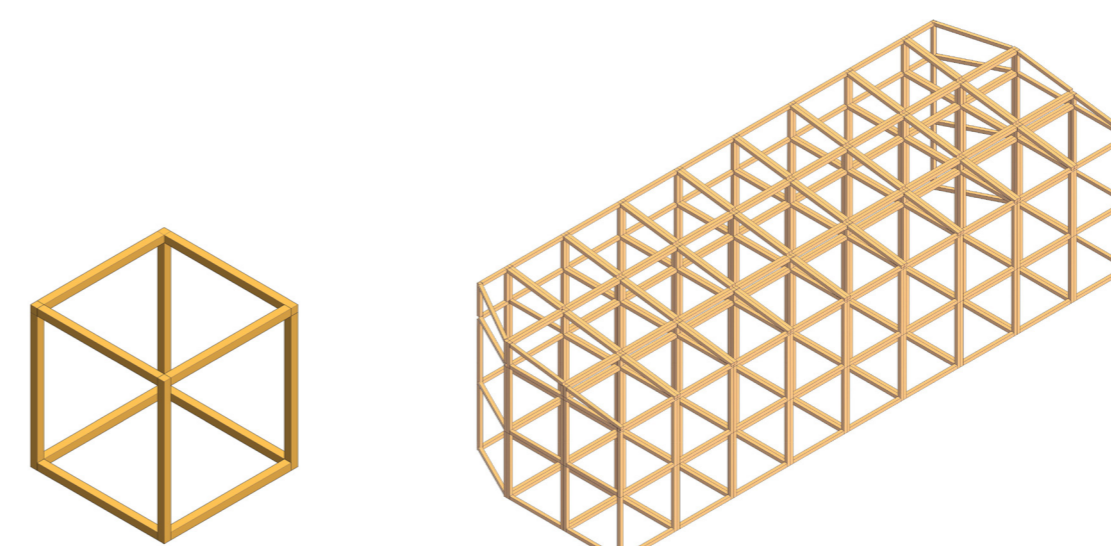
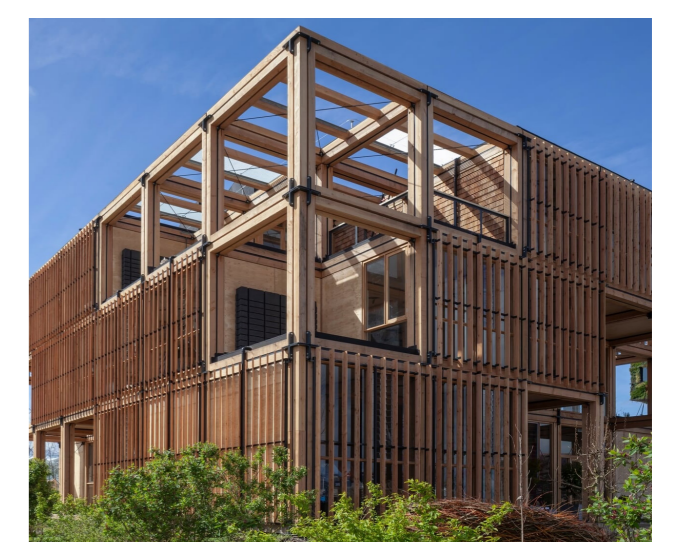
- Passive solar shading:** Allowing the sun to warm the house through windows in winter while using shading devices to block direct sunlight in summer.
- Natural ventilation:** Facilitating natural airflow and the expulsion of warm air.
- Insulation:** Reducing heat transfer and maintaining stable indoor temperatures.
- Green roofs:** Providing thermal insulation, retaining rainwater, reducing ambient temperatures, and promoting ecological inclusivity.
- Use of natural materials:** Employing sustainable and natural materials with good insulation properties, such as wood, clay, and bamboo, to enhance the energy efficiency of buildings.



WHICH BUILDING SYSTEM COULD BE USED TO CREATE A REMOUNTABLE BUILDING WITH MORE THAN ONE LEVEL?

To create a demountable building that can have multiple floors, the concept of the Natural Pavilion will be used. This system is a modular construction method and mostly consists of Dutch-sourced biobased materials. This concept is fully demountable, which means it can be easily disassembled and reassembled in another location.

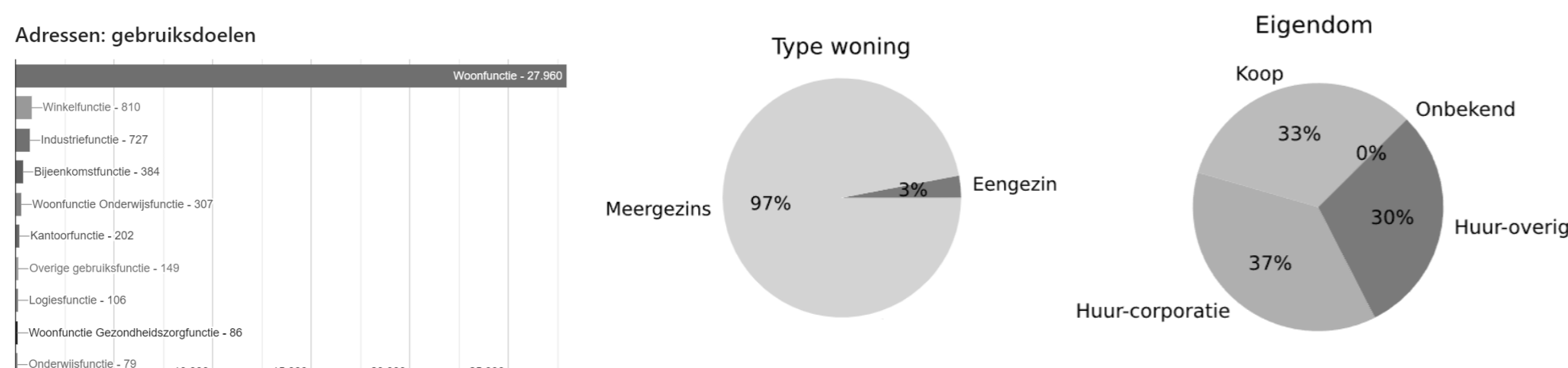
The construction concept consists of two elements. The structure is composed of a framework of wooden beams, and these modules are interconnected using a universal steel connection joint. The modules are then filled with reused and biobased materials such as wooden floors and recycled glass.



TARGET AUDIENCE

To decide which audience we are building the prototype for we first looked at the existing composition of the neighbourhood. The most common age group of residents in the Noord district is between 25 and 45 years old. The distribution of homeowners, housing association rentals, and other rentals is fairly equally balanced. The majority of homes in the Noord district are multi-family dwellings. Only 3% of the homes in this district are intended for individual families.

Based on this information, the target audience in the Noord district consists mainly of young adults and families between the ages of 25 and 45. There is a diverse mix of housing options, including apartments and duplexes. It's important to consider the needs and preferences of this target audience when designing and offering housing and amenities in this district.



HOW CAN WE ADAPT THE PROTOTYPE TO THE VISION OF NEW INNOVATIVE BUILDINGS IN ROTTERDAM?

We have researched specific desires of Rotterdam and identified several important points that are of relevant information for our prototype. **Sustainability:** Minimizing environmental impact through the use of sustainable materials, energy-efficient designs, and promoting recycling and reuse. **Climate Neutrality:** Reducing greenhouse gas emissions by utilizing renewable energy sources and innovative solutions. **Innovation:** Being at the forefront of new technologies and concepts in building design and construction.

The prototype has to align well with Rotterdam's vision. However, it's important to consider the aspect of resilience, which means designing buildings that can withstand the impacts of climate change. Given the rising sea levels in the Netherlands, this is a crucial consideration.

Regarding flexible construction permits, Rotterdam is open to deviating from the standard regulations of zoning plans as long as the proposed deviations align with the city's overall vision and goals.

WHICH MATERIALS CAN BE IMPLEMENTED AT A NO FOOTPRINT HOUSE?

To achieve a no footprint house, we follow the Trias Energetica method. This involves three steps: reducing energy demand through insulation and orientation, using sustainable energy sources like solar panels and heat pumps, and optimizing efficiency while minimizing fossil fuel usage. The chosen construction method is a combination of timber frame (HSB) and cross-laminated timber (CLT) elements, allowing for modular cube construction. Material selection was done using the DCBA method, considering factors like origin, weight, and material efficiency.

The insulation type recommended by the DCBA tool is flax insulation, which scores higher in terms of lifespan, origin, and location. Additionally, we conducted research on other relevant properties of different insulation types. After considering all the pros and cons and using the DCBA method, we have concluded that a bamboo facade is the most suitable cladding option for our project. Bamboo grows faster than hardwood, making it a more sustainable choice. Additionally, bamboo is significantly harder than other wood species, resulting in a longer lifespan. Another advantage of bamboo is its fire rating of class B, eliminating the need for bamboo impregnation.

BAMBOO FACADE



FLAXINSULATION



WHAT IS THE MOST SUITABLE LOCATION FOR OUR URBAN PROTOTYPE?

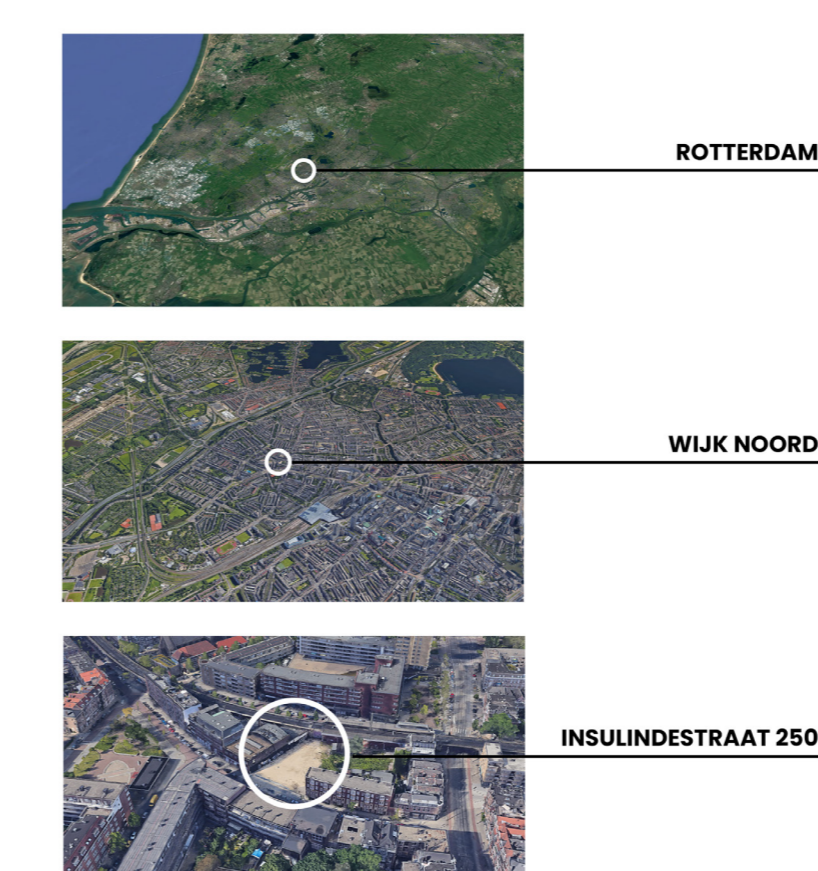
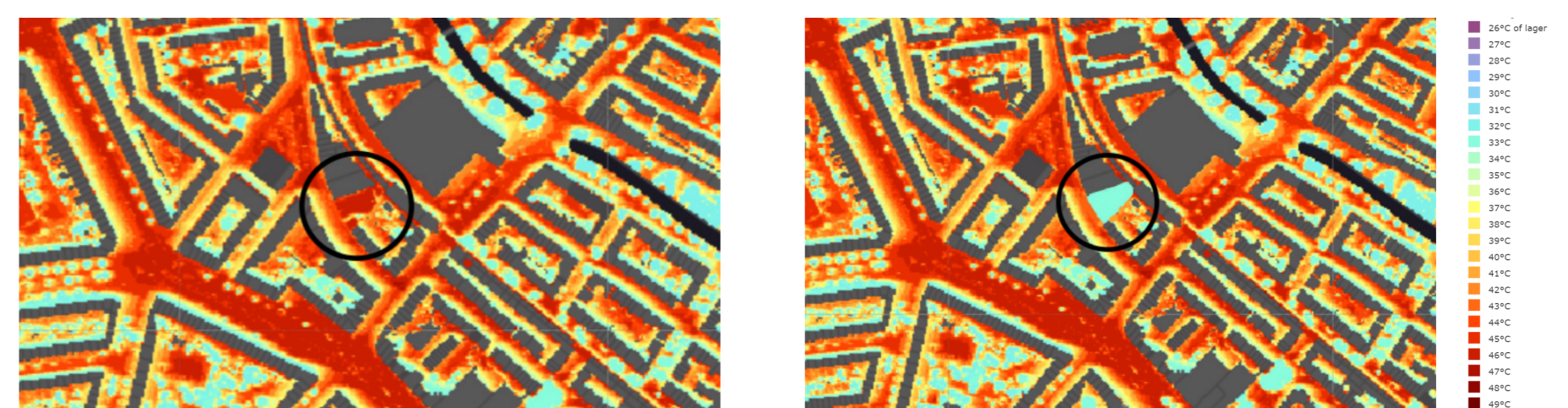
The Plot

We have conducted a search for three suitable plots in the urban context of Rotterdam. Based on the Harris Profile, we have selected the best option, which is the plot located at Insulindestraat 250 in Rotterdam Noord.

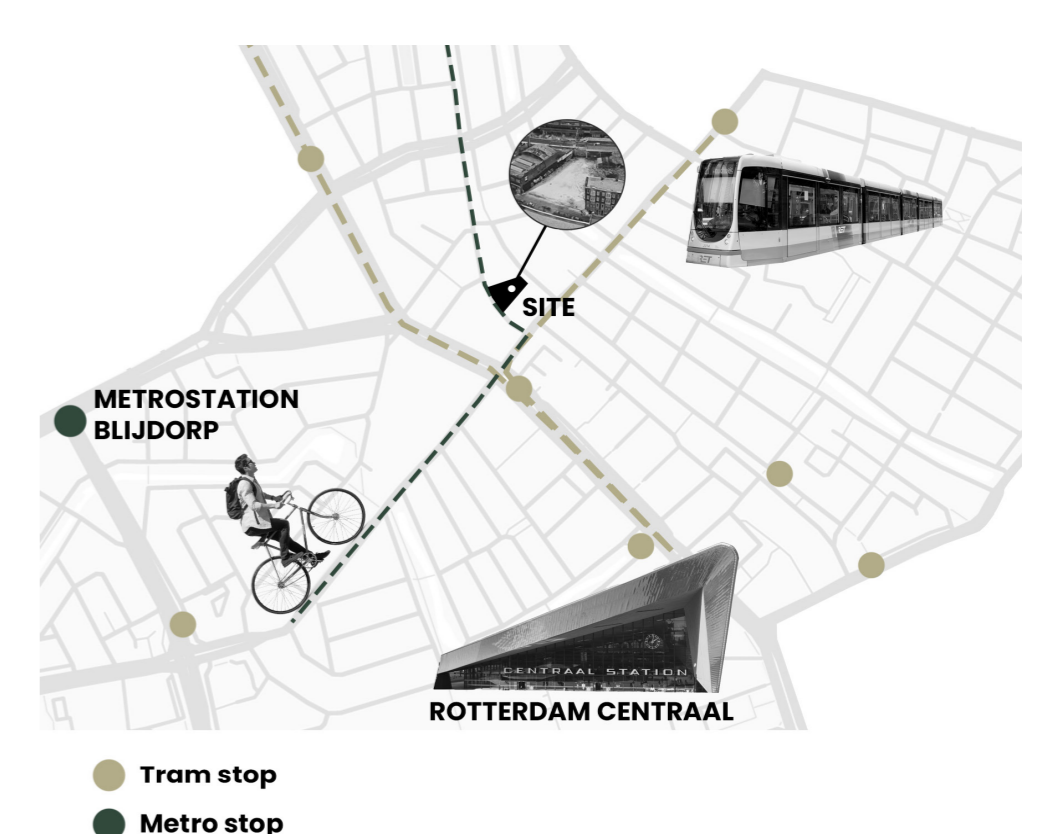
Heat stress

This map displays various temperatures in the surrounding of the plot. The more red a location is indicated on the map, the hotter it is in that area. Residential areas and busy roads, in particular, have the highest perceived temperature.

The plot is circled and has a high temperature, after adding more green and trees we hope to change it to the second image.

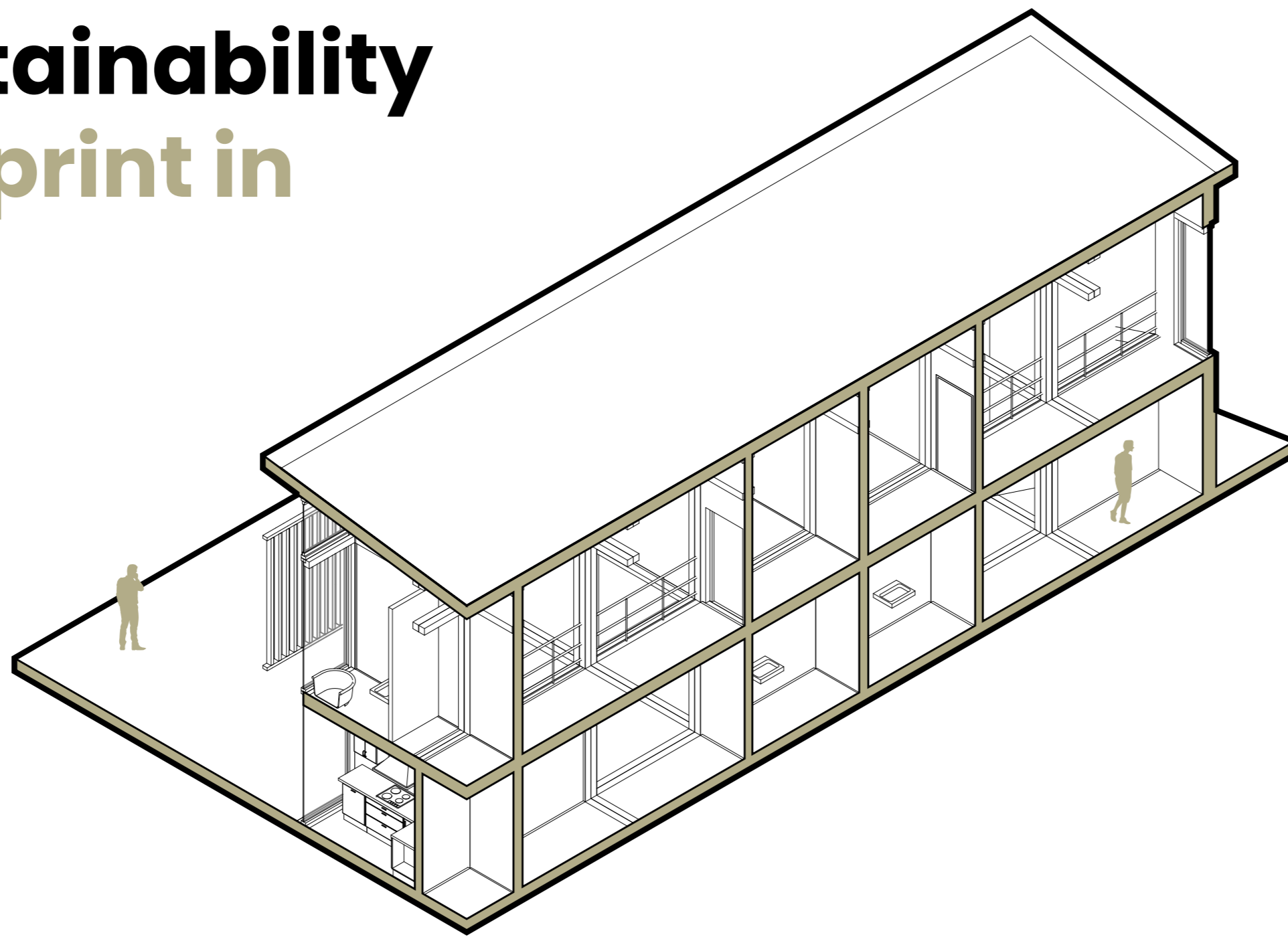


ACCESSIBILITY

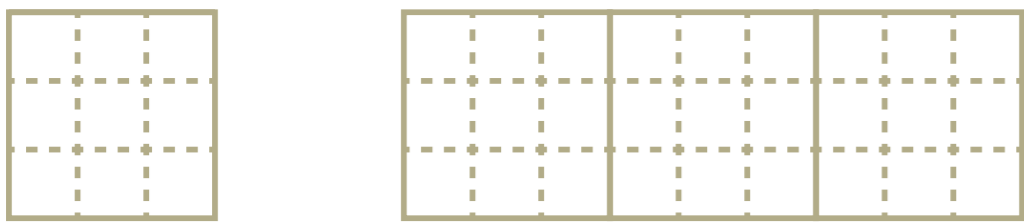


3 X 3 = Sustainability

A zero footprint in Rotterdam



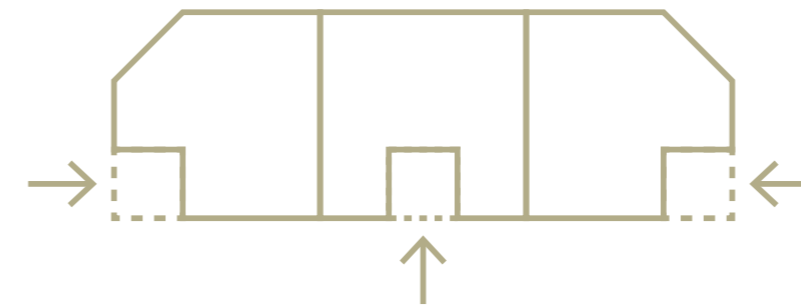
3X3 GRID 3 HOUSES



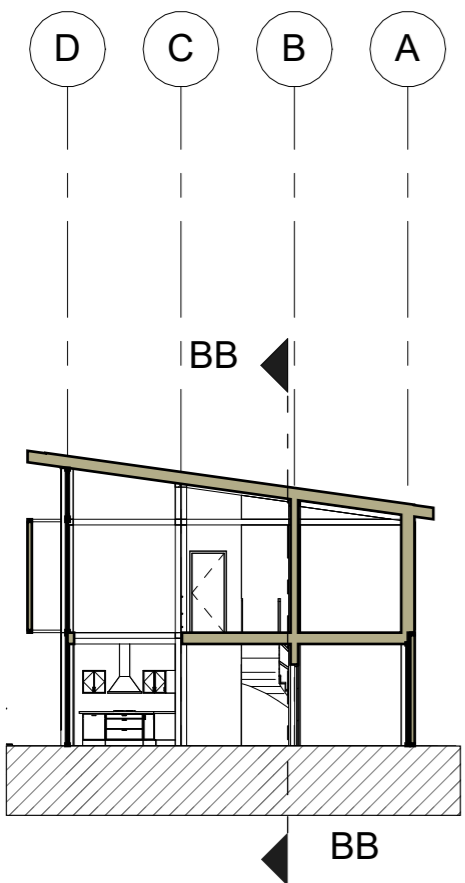
ADJUSTED TO FIT LOT



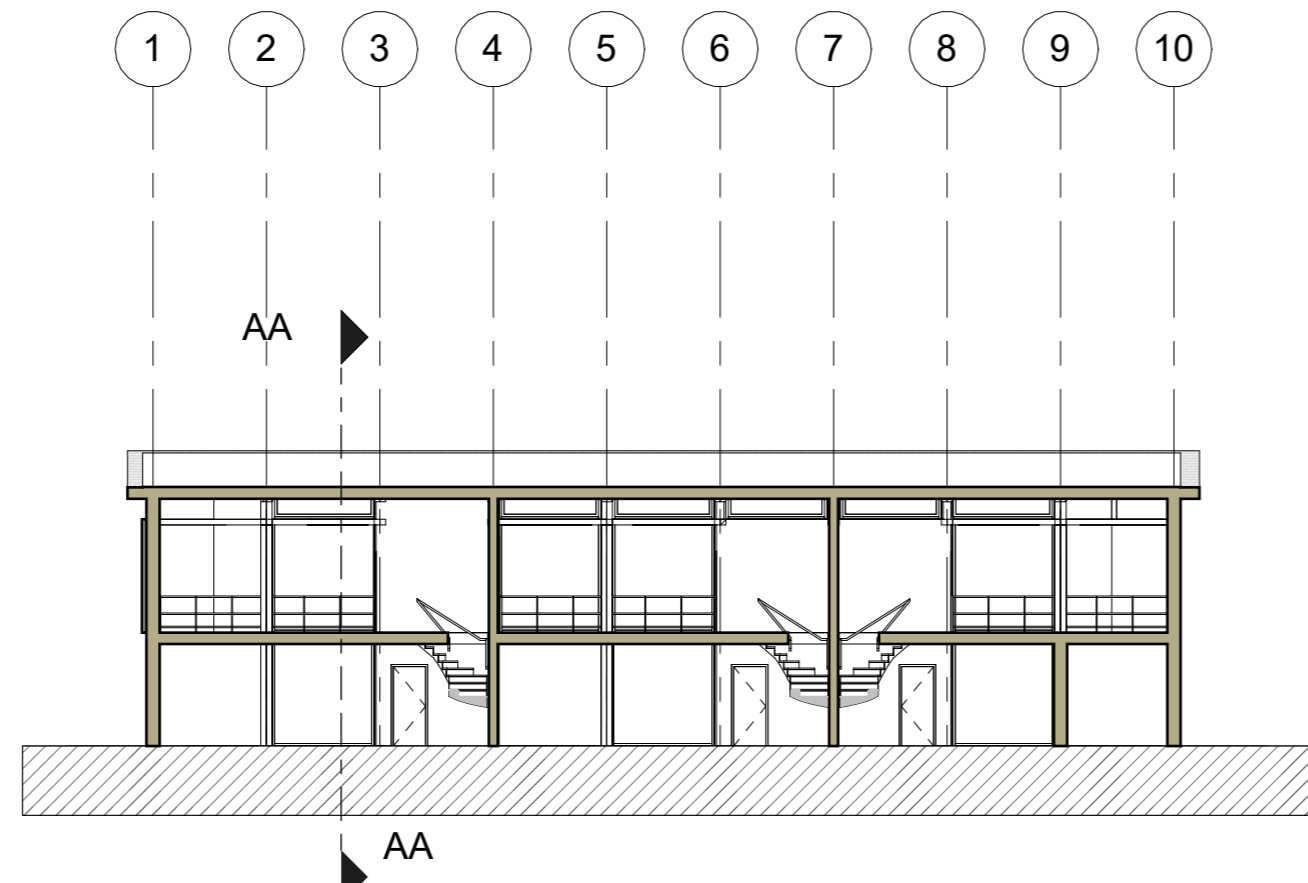
ADDING OUTSIDE SPACES



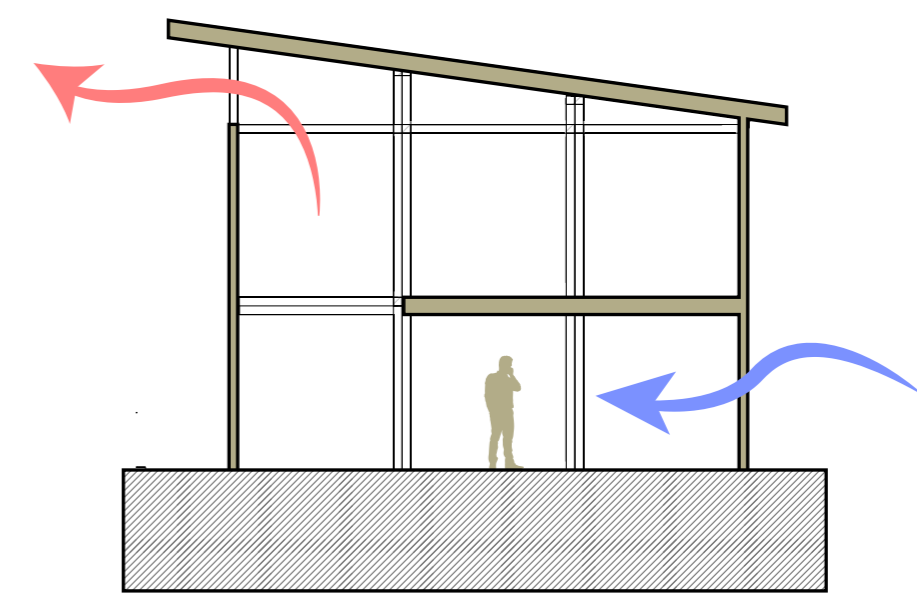
SECTION AA
1:200



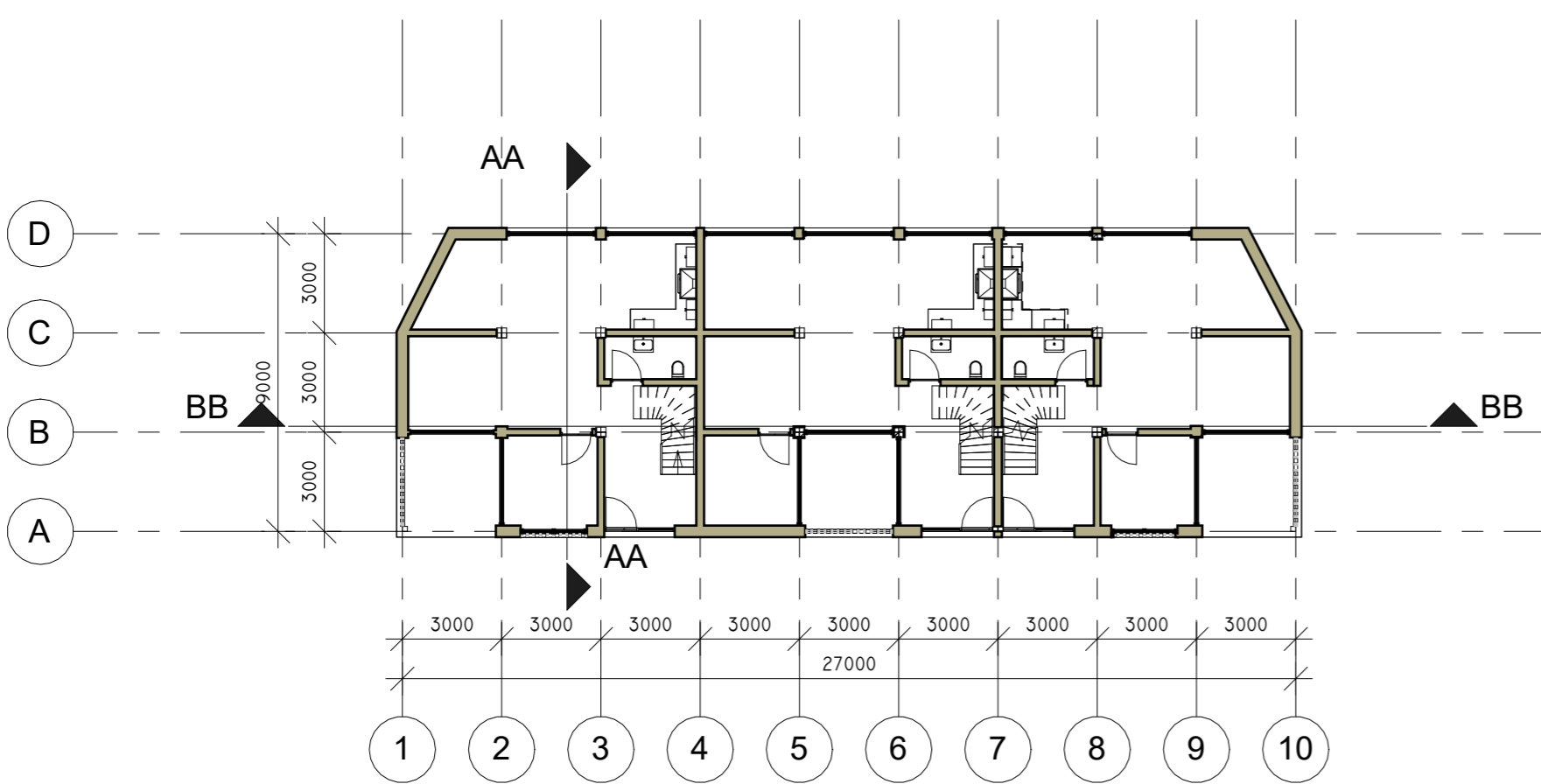
SECTION BB
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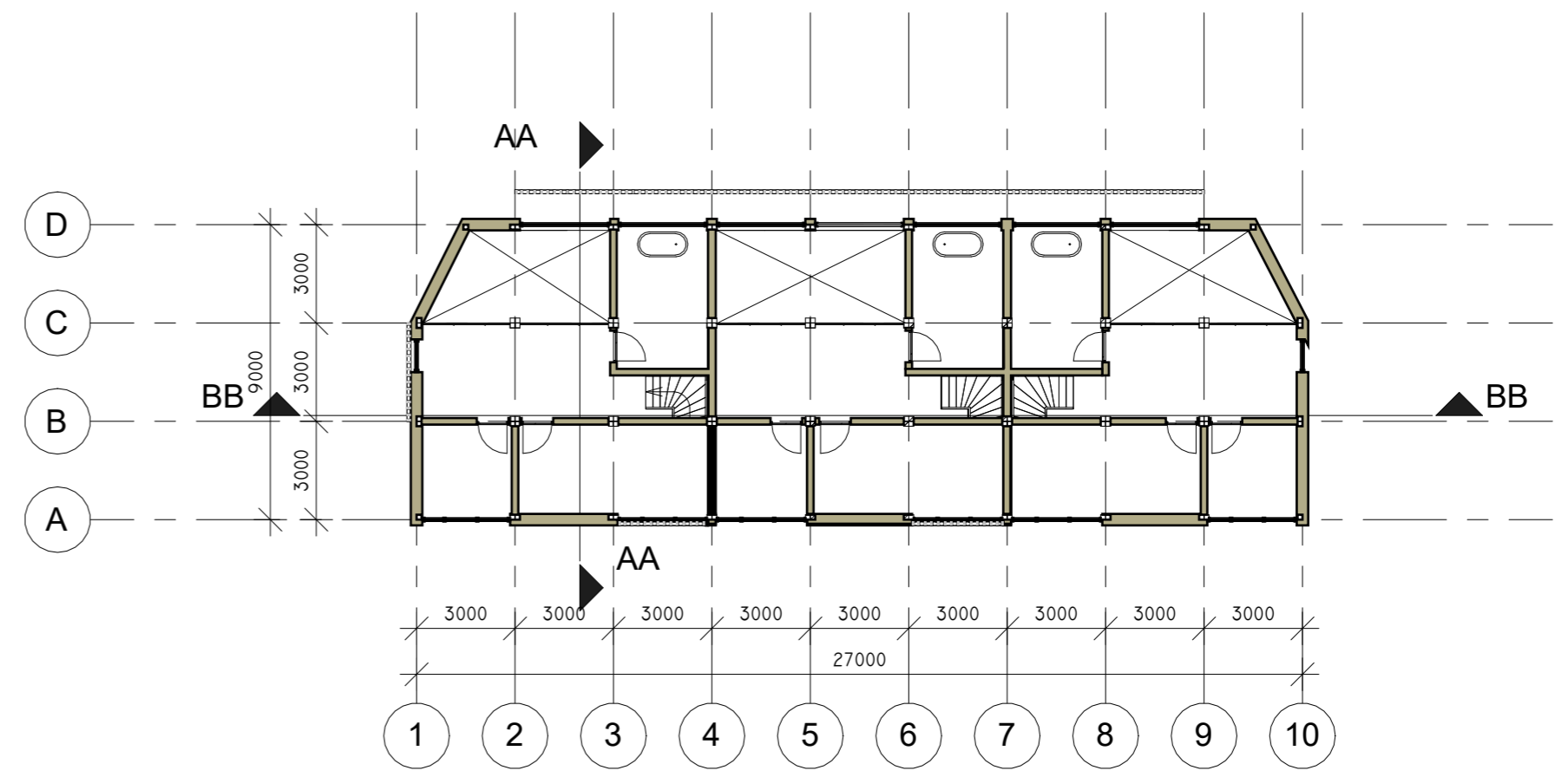
COOLING WITH NATURAL AIRFLOW



Ground floor
1:200

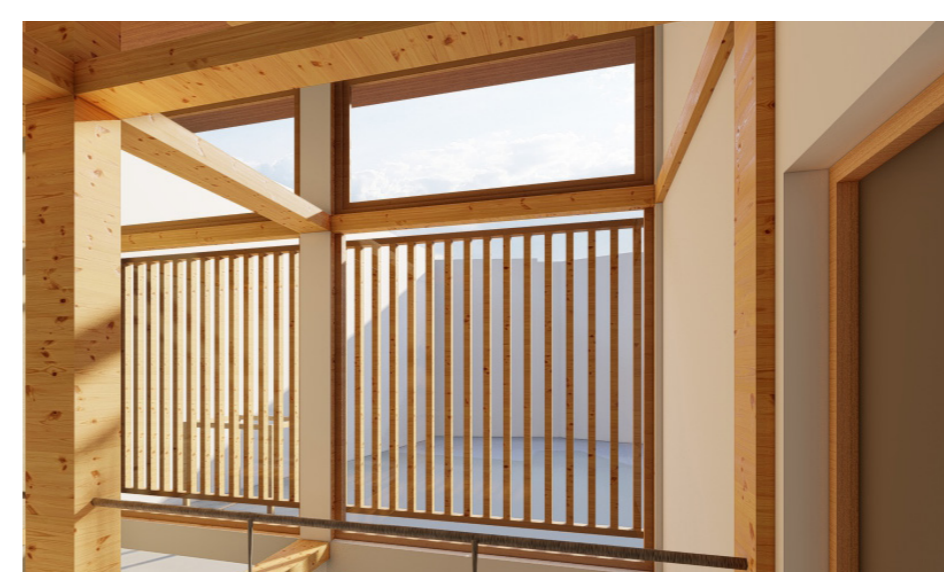


First floor
1:200



3D Renders

We incorporated the aspect of natural integration in our design by utilizing large windows and a distinctive feature where we took a "bite" out of each house. This creates an open space that becomes an integral part of the houses themselves. Additionally, we designed a spacious garden that is directly connected to the houses.



Site view
1:500

