



't Bosbad

Eindhoven, The Netherlands



ARCHITECTURE AND LANDSCAPE

Shinrin-yoku

'Forest bath' is a circular residential building located in a park called Bosrijk in Eindhoven (NL). The design is inspired by the Japanese practice Shinrin-yoku, in which you 'immerse' yourself in the forest, taking in nature using all your senses to calm your body and mind. With a balanced design, subdued aesthetics, use of natural materials, people- and environment-friendly sustainability principles and above all, a strong connection between resident, building and the forested landscape, we turn the project into a modern residential building in harmony with its natural surroundings.

Forest path

The rectangular building is set in a gently sloping landscape in a clearing amongst the trees. Like a path through a forest, a passage runs right through the building. Walking routes from the park connect to this green passage, with the ground being covered in ferns and rainwater flowing into a brook towards the wadi. The light is filtered by flowering and fragrant climbing plants shooting into the air and by the many bridges leading to the apartments' front doors.

The stairs, lift and front doors all open onto this airy internal passage overlooking the grass, clouds and trees surrounding the building. This space allows residents to meet, the houses to be ventilated via the cool and sheltered outdoor space, and flora and fauna to be given a place in the building.

Tree trunk columns

From the outside, you see no real distinction between the different sides of the building thanks to the continuous balconies supported by a colonnade of tree trunk columns. As the image of the tree trunk columns gets intertwined with the image of the trees in the park, the building blends in with its surroundings. Whereas traditionally architectural columns are modelled after trees, in this project we took a more literal approach; the trees *are* the columns. By using real tree trunks as columns, nature can be experienced up close from the outdoor space, the building feels alive. The façade cladding of aged and reclaimed wood, formerly used as river bank protection, adds to this experience.

The balconies and colonnade provide a gradual but clear transition between private and public space, making the use of space in and around the building understandable and pleasant for everyone. Not only do they create a comfortable distance between residents and park visitors, providing the apartments a sense of shelter and privacy, they also demarcate the semi-public passage running through the building. When entering the building you go between the columns and pass underneath the balconies, as it were a classical portico. They make it clear that you enter a different space, an outside entrance hall that belongs to the residents but is welcoming to passers-by.

Like a path through a forest, a passage runs right through the building >



ARCHITECTURE AND LANDSCAPE

Basement



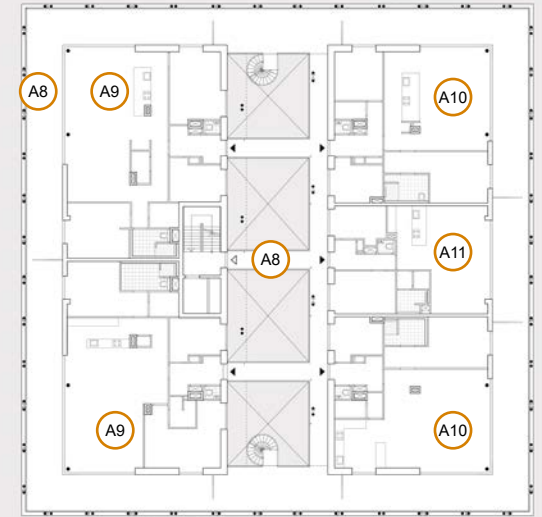
- A1 carparking fitted with charging stations for electrical cars
- A2 collective, easy accessible bicycle parking
- A3 individual storerooms belonging to apartments

Ground level

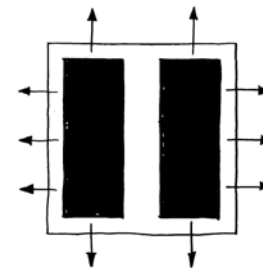
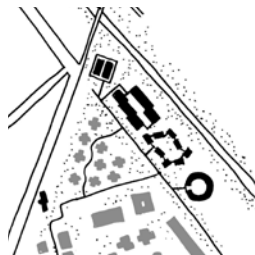


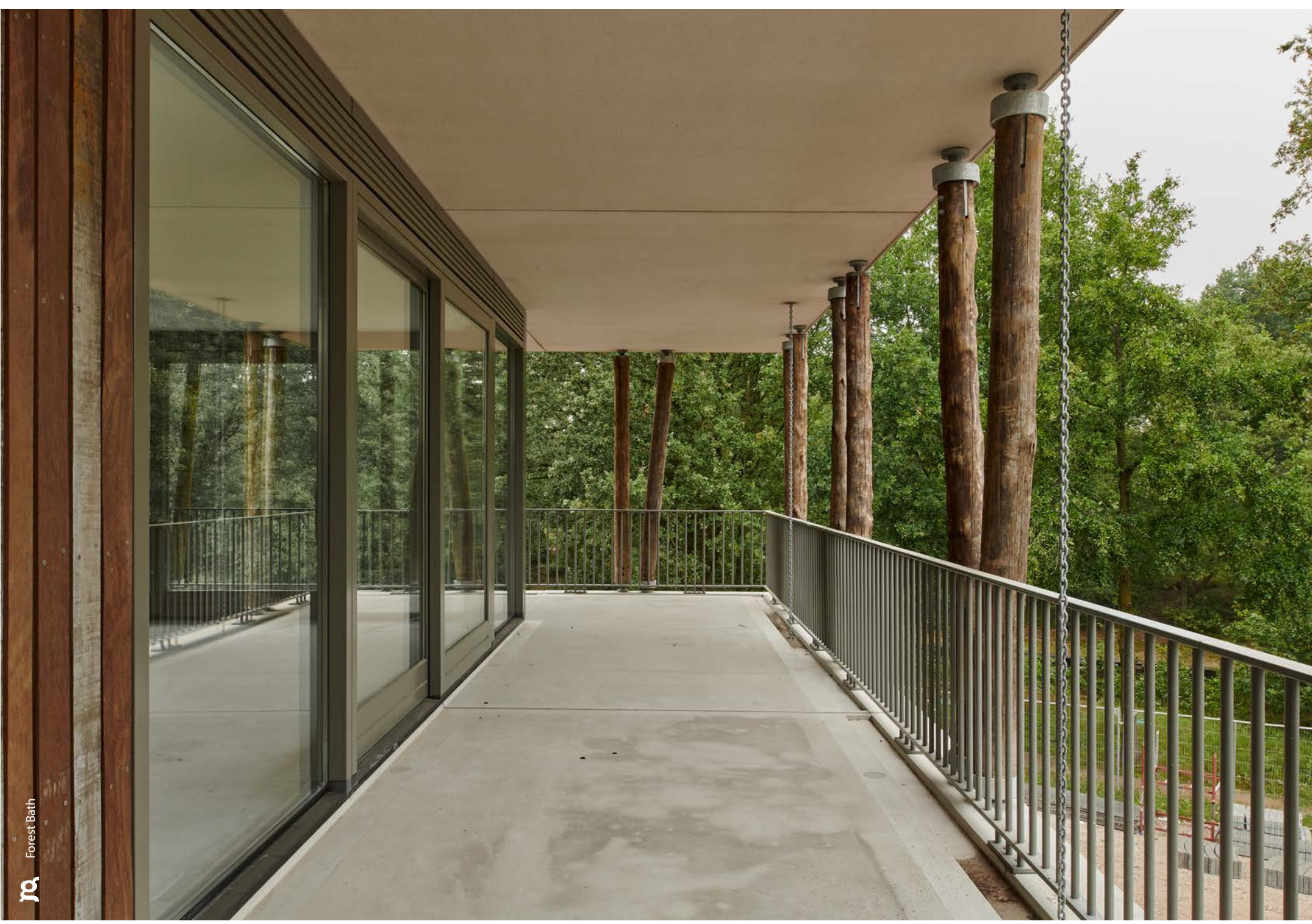
- A4 main entrance
- A5 green passage
- A6 terrace with a step to park
- A7 public footpath through building

Storeys



- A8 gallery, bridges and balconies
- A9 apartment type A 143m²
- A10 apartment type B 113m²
- A11 apartment type C 80m²





WATER MANAGEMENT AND BIODIVERSITY

Nature and water present on the site are treated with care and given a boost where possible. New elements are introduced that promote biodiversity and ensure a balanced water management, enabling the building to become part of the local eco-system.

Biodiversity

The site includes pedunculate oaks, birches, some sweet cherries and a willow. New trees will match these species and some pines will be added on the south side. Some low-branched, multi-stemmed trees such as rowan and hawthorn will also be added. Thanks to the height differences, the clearing in the forest consists of wet and dry parts, making the planting very diverse and inviting to, for example, butterflies, bees, birds, dragonflies and amphibians.

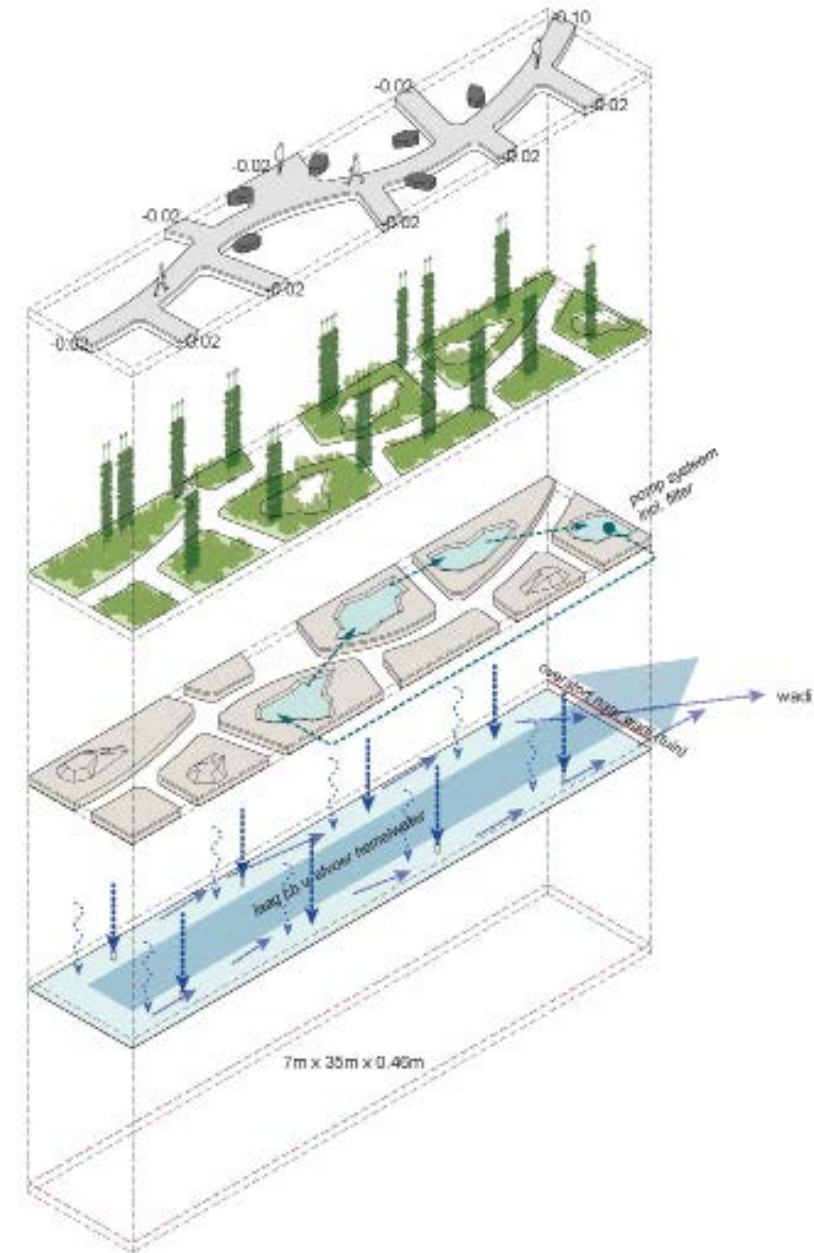
The green passage consists of large groups of ferns interspersed with various other forest and shade plants. Flowering and fragrant climbing plants climb up along cables and nesting boxes for birds and bats will be included on the tree trunk columns.

Sustainable watermanagement

Rain falling on the galleries is directed down through water chains and is collected in water attenuation crates and a small brook in the passage.

Excess water runs out of the passage on the north side of the building and is collected in a wadi. Similarly, water from the balconies is directed to the wadi via water chains. The delayed discharge and collection of water ensures that the sewer system is not overloaded during heavy rainfall and reduces the risk of flooding. Besides its practical benefits, the visible and tangible drainage of rainwater adds to the architectural experience of bringing nature close by.

Due to the compact footprint of the building, there is a lot of unpaved, vegetated soft soil enabling water infiltration and buffering. The many green spaces that surround and permeate the building have a cooling effect on hot summer days and reduce heat stress.

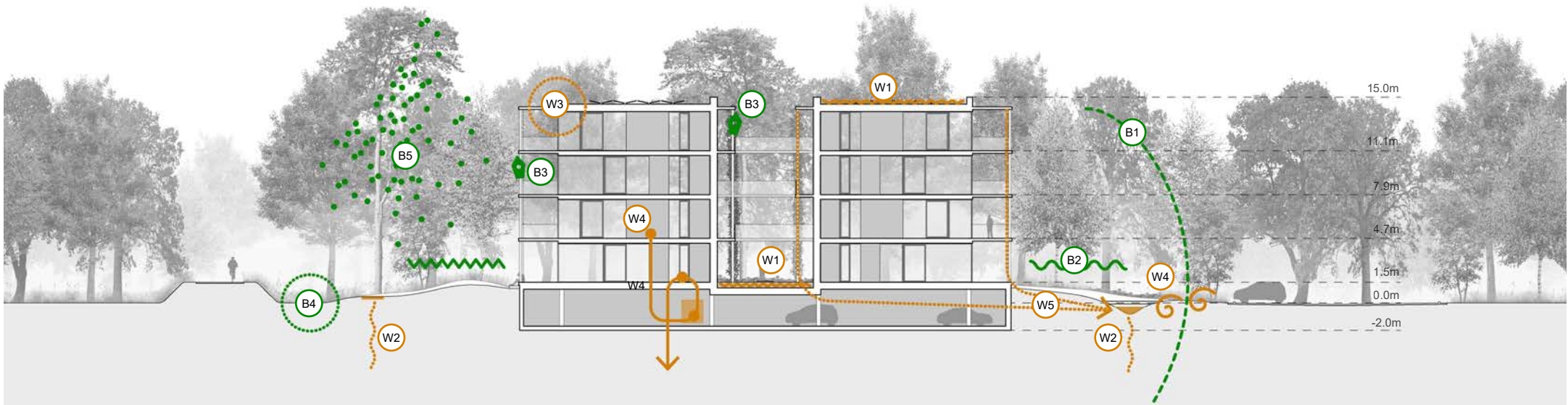


the landscape continues in passage; the floor is covered with forest and shade plants and rain water, running down from water chains, is collected in a brook at the passage (MAAKspace) >





WATER MANAGEMENT AND BIODIVERSITY



W1 rainwater retention on roof and in passage

W2 permeable paving and rainwater infiltration via wadi

W3 geen uitloogbare materialen in het dak en de devels t.b.v. bescherming waterkwaliteit

W4 no leachable materials in the roof and facades to protect water quality

W5 rainwater drainage to brook and wadi

B1 preserve and protect existing trees during construction

B2 undulating terrain: from low with riparian plants to mid-high with flowery grassland

B3 bird and bat nesting boxes on the columns

B4 toxic-free and extensive green management to promote a natural balance

B5 several new trees provide cooling and shade and are inviting to birds, bees, butterflies and other insects





CIRCULAR DESIGN: MATERIAL SAVINGS AND DEMOUNTABILITY

For the application of materials, we followed several sustainable principles. For instance, at least 85% of the weight of the applied materials is circular, meaning it is either re-growable, re-cyclable or suitable for direct reuse. Also, at least 80% of the weight of the applied materials is environmentally friendly, according to the Dutch NIBE environmental class 1 or 2.

Material savings

In addition to using circular and eco-friendly materials as much as possible, we also paid a lot of attention to a smarter and more efficient dimensioning of building elements, thus saving material. For example, by not pouring in sewerage, ventilation and water pipes, thick oversized concrete floors were avoided. In typical residential buildings, this “contamination” with installations causes structurally unnecessarily thick floors. Instead, concrete elements were used for the balconies and pre-stressed “green” hollow-core slabs for the floors. This allowed the floors to be considerably thinner and the project was realised with at least 45% material savings compared to cast-in-situ floors.

Demountable structure and facade: increasing potential for reuse and recycle

A special feature of the building is its demountable nature. For instance, the main concrete supporting structure, responsible for the vast

majority of the total weight, is made of prefabricated components with remountable connections. This way of building makes it possible for separate concrete elements to be repositioned or reused in the future so that their individual lifespan can be extended. The demountable character also makes it easier to recycle after the end of the life span, if necessary.

The facade with aged, used Azobe sheet piling is also fully demountable. Thanks to the demountable construction method, much of the incorporated materials will be available and usable again in the future, making the building an example of circular design..

for reasons of better demountability and reuse/recycle potential, balconies are not cast on to the floor behind but are supported by tree trunk columns >



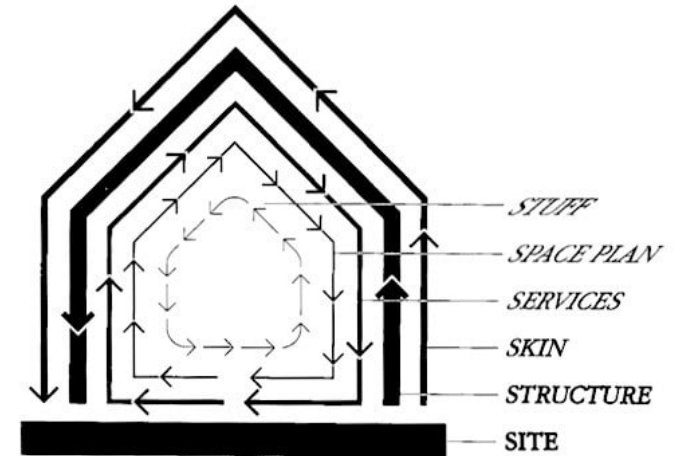
CIRCULAR DESIGN: ADAPTABLE AND FLEXIBLE

Open building

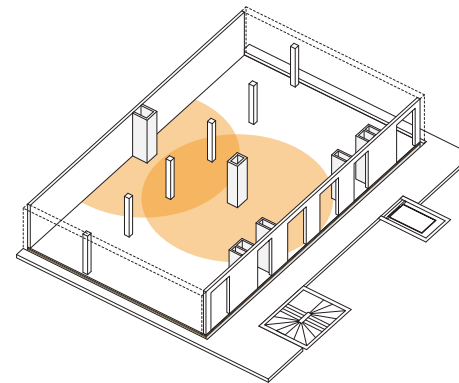
Based on the need for flexibility and adaptability, we opted for an open structure of the building in which interior walls and all the installations (electricity, mechanical and plumbing) are separated from the load bearing structure, so that - in line with the design principles of Stewart Brand - these building layers can be changed separately. This way the more rapidly evolving 'layers' in the building, such as installations and fittings, can be adapted without affecting the 'slower' layers, such as the structure and façade. For example, pipes are not poured into the structural floor but installed in accessible suspended ceilings, party walls and façade finishes are not structural and can be removed without affecting the structure. Instead of having to demolish the whole building, only the necessary layer can be refurbished, replaced or - if there is no other way - remade. Furthermore, the chosen basic structure of columns, large open floor areas, high ceilings and strategically placed installation shafts offer various layout options. This built-in flexibility increases the possibilities for other uses in the future. Adaptability is in the DNA of the building.

Whereas in commercial and industrial buildings the Brands concept and the separation between structure and installations is already more common, this is not the case within traditional residential constructions.

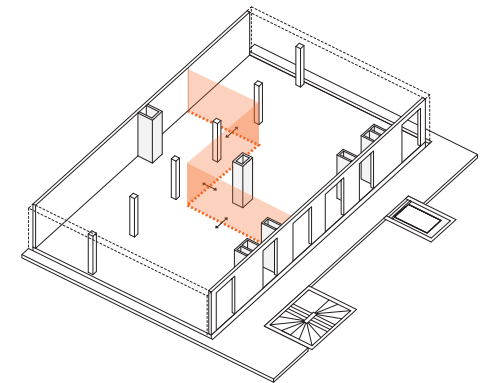
With the project 't Bosbad we proved that also for the housing sector, the necessary steps towards a more circular construction design can be made, also in a cost-effective way. Moreover, with the demountable nature of the structure we took it a few steps further as well.



S. Brand: building composed of several layers of change

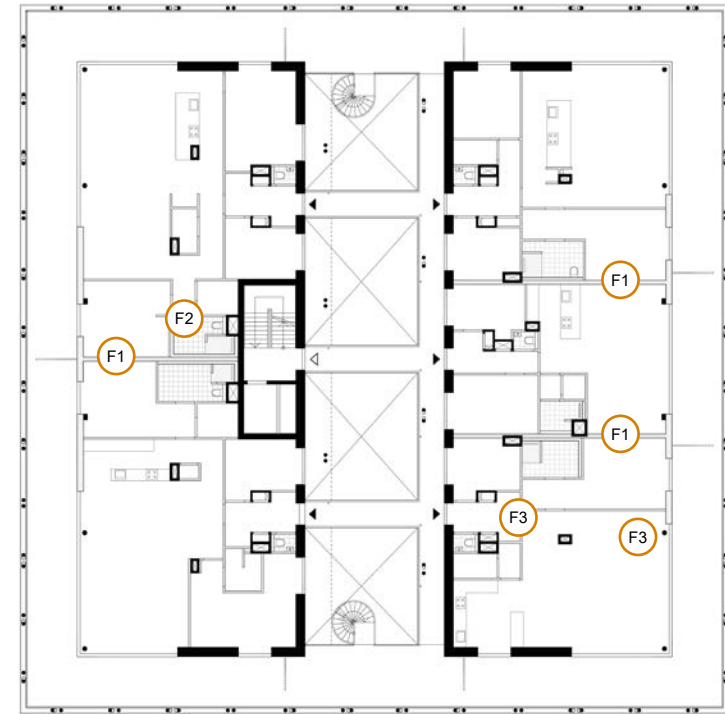


flexibility in service spaces (toilet, bathroom)



flexibility in floor plan layout

CIRCULAR DESIGN: ADAPTABLE AND FLEXIBLE



F1 separating structure from infill: party walls between apartments are non-bearing walls

F2 separating structure from infill: pipes are not poured into the structural floor but installed in suspended ceilings/retaining walls

F3 creating adaptable, open floorplans: columns and installation shafts are the only fixed elements, offering many possible layouts >



Forest Bath

reclaimed wood as facade cladding (wood formerly used as river bank protection)



installations separated from structure



open floorplans: columns and installation shafts are the only fixed elements



CIRCULAR DESIGN: MATERIALS AND FACADE



TREE TRUNK COLUMNS
of cloeziana wood



SMALL TREE TRUNKS
as privacy screens



RECLAIMED WOOD
facades of old sheet piling



DEMOUNTABLE STRUCTURE
in precast concrete



WATER CHAINS
for rainwater drainage



CONCRETE STEPPING STONES
connecting terrace and landscape



CIRCULAR DESIGN: MATERIALS AND FACADE

Use of reclaimed wood

Another important feature is the application of recycled wood in the facade.

In the Netherlands, especially along the smaller waterways, wooden quay walls are often used as borders. These quays are often made of Azobe wood, that are replaced over time due to degradation. After replacement, However, this Azobe wood is still perfectly suitable for other applications in, for example, the construction industry, because of its high durability class and its high degree of fire resistance.

Working with used materials in the design, also meant that the dimensions of the available wood had effect on used sizes and the installation in the facade. Also it had effect on esthetical appearance: some part show the saw cut planes, others show dried vegetation that has grown on the Azobe boards during his 'quay period'. The combination of different qualities has resulted in a interesting esthetical look

This fine tuning was done in close cooperation with the supplier. The facade is fully demountable by means of screw connections.

A source of urban mining

Besides using the second-hand material (the cladding of reclaimed Azobé wood), the building itself is recyclable and can become a source of urban mining. 't Bosbad is designed and built in such a way that building parts can be dismantled and re-used after the building's lifespan. As a result 85% percent of the building materials used in the project can be re-used or recycled. Firstly, by using remountable joints in the prefabricated main structure. Secondly by separation of structural and space bounding elements. And lastly, by positioning the building's installations behind retention walls and suspended ceilings instead of casting them in concrete, as is commonly done. Another advantage of these techniques is that thinner floors could be used, thus saving on materials. We hope future generations will be able to extract materials from our building, thanks to the care which was put into its assembly.

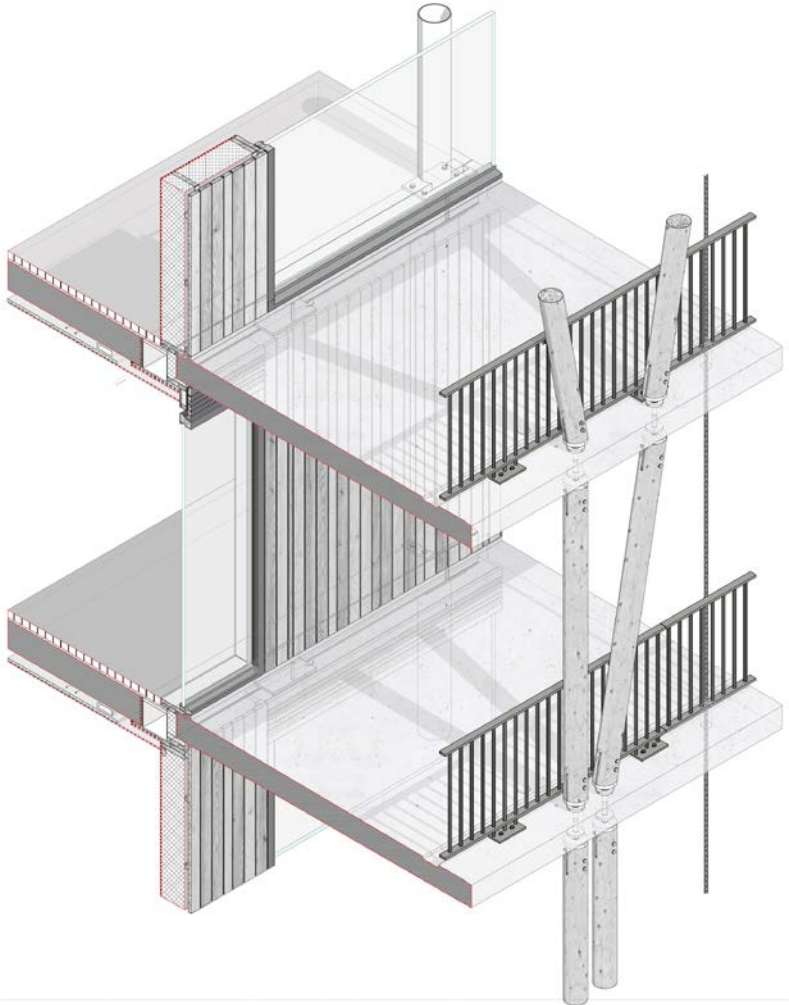


reclaimed wood as facade cladding (wood formerly used as quay wall protection)

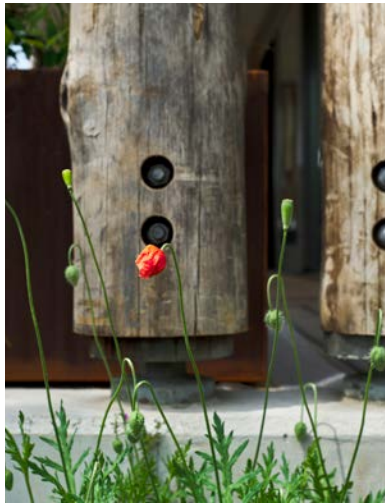


The original gray (with original water vegetation and dirt still on it...) and the saw cut side of the used Azobé wood are interspersed, creating a varied facade image >

CIRCULAR DESIGN: MATERIALS AND FACADE



load bearing tree columns of cloeziana wood supporting the concrete balconies





detail fragments of facade



ABOUT GAAGA

GAAGA is a studio for architectural design and engineering. We aim to create people- and environment-friendly buildings and places. We pay special attention to collective urban housing and to circular design and 'open building'. The studio was founded by Arie Bergsma and Esther Stevelink, both educated at Delft University of Technology.

We are committed to address one of the great challenges of today; the transition to a sustainable way of building and living. In our projects we increasingly focus on smarter and less use of materials and resources, more sustainable construction methods, climate-adaptive building and efficient, multiple use of space.

With a focus on sustainable building, we discover new possibilities in architecture. It inspires us to create architectural designs that are both rational and poetic, bringing together usability, adaptability, reusability, appreciation of natural elements and architectural sensitivity.

GAAGA is located in Delft, the Netherlands. A small, specialized team works at the studio. GAAGA received several awards and nominations.

Our design principles

In our studio we have an open-minded attitude and we like to experiment. This is reflected in the buildings we design, each being different.

Although every design is specific, the underlying basic principles are generic. We have listed them below:

Open Building

We care about designing buildings that are capable of accommodating diversity in use as well as future changes. This provides home-owners and users leeway and it extends the lifespan of buildings. We work according to the 'open building' principles as much as possible. The concept of open building advocates a clear distinction between permanent and changeable parts in a building. It implies taking into account differences in lifespan of building components and separating elements with different life cycles. The trick is to ensure that elements with a shorter lifespan do not determine the overall life of the building.

Circular design

We consider material- and energy-conscious design as an integral part of our work. We think critically about how things are made and are focused on creating buildings that have as little environmental impact as possible. Preferably, we design circular buildings: recyclable and with used or renewable materials such as wood. When using primary, industrially manufactured materials, we increasingly emphasize weight reduction and smarter use of materials.

Human scale

We create our designs based on the notion that architecture can be of great influence on people's well-being. That architecture can contribute to making you feel comfortable and to bonding with a place. We therefore think it is important to design buildings that are functional, recognizable, sensitive and that are based on the human scale.

Participatory design

To understand what future users or other stakeholders think is important for the design, we actively involve them in the design process. This may be in the form of one-to-one conversations or public presentations in which we explain certain design decisions step by step. It also may be in the form of workshops in which stakeholders have direct influence on choices to be made, based on variant studies. We then use the designing process as a method to reach certain decisions. Sometimes a spatial assignment is not clear in advance, in which case design studies can help to clarify the question and visualise the possibilities.

Details and use of materials

Seemingly insignificant things make huge differences in the appearance of a building. Materials and products determine the atmosphere and are also often decisive in the manner of construction and detailing. We therefore pay a lot of attention and care to materials and details, so that the small things match the bigger picture

and a coherent and sophisticated overall impression can be achieved.