



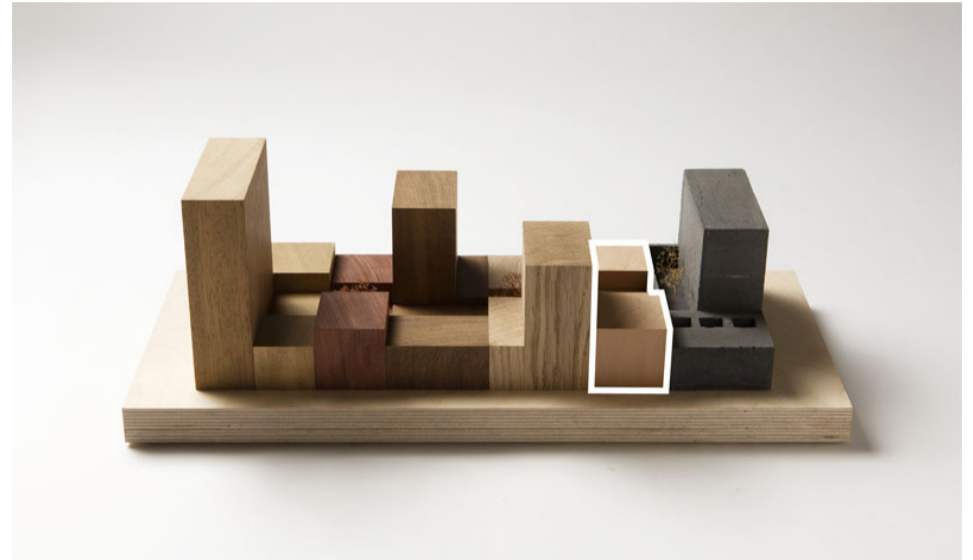
The Azobé wood, formerly used in Dutch quay walls, gets a second life within the facade

CiWoCo 1.0

circular live-work housing block

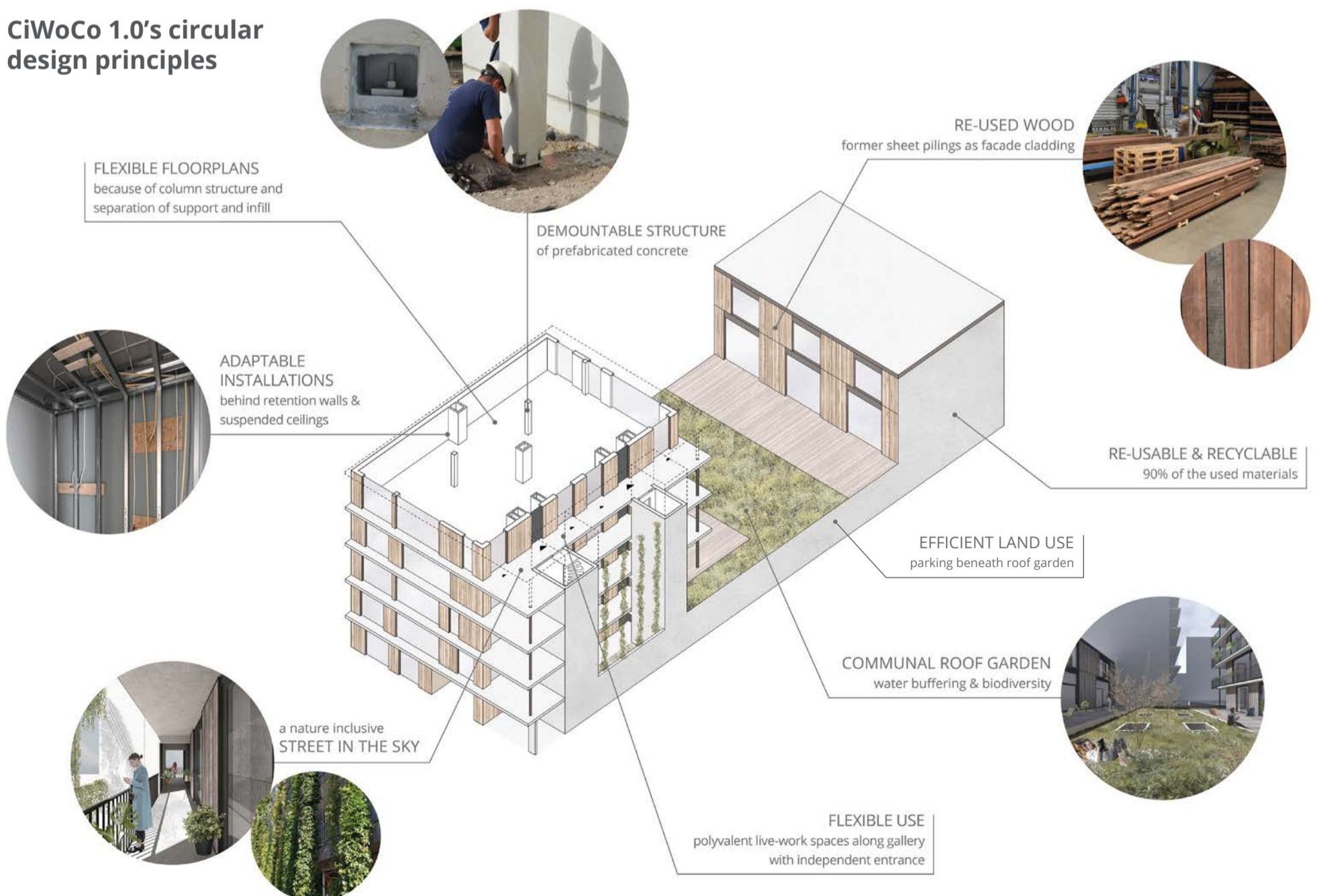


CiWoCo 1.0 is an experimental circular live-work housing block in which the future inhabitants were involved in the design process (<https://www.gaaga.nl/projecten/ciwoco-amsterdam>). It is located in Buiksloterham, a former industrial area in the North of Amsterdam designated as a circular architecture testing ground. It is GAAGA's first realized building in a series of circular and adaptive designs, based on Habraken's concept of "Open Building" and fitting with circular design strategies such as the 10 R's of circular economy of Cramer and the building layer model of Brand. Usually the traditional building process is linear: materials are sourced, processed, transported and installed in buildings, only to later be down cycled or scrapped. For CiWoCo 1.0 though, a circular approach was maintained in all stages of the design and building's lifespan. Resulting in a design with a highly demountable and adaptive character, unconventional building techniques and experimental application of reused materials. By doing so the building can adapt to future changes (both in use and function) without major structural changes and 90% of the used building materials can be re-used or recycled at the end of building life, therefore functioning as a future material bank. Also other sustainability themes, such as energy reduction (almost energy neutral) and biodiversity were applied. With CiWoCo 1.0, GAAGA shows the possibilities and usability of circular design and construction within residential projects, hopefully inspiring and giving others incentive for change as well.



Model of the building in context

CiWoCo 1.0's circular design principles



Participation and social architecture

Flexibility through co-design

The project is realized together with a group of future residents (bouwgroep (NL), Baugruppe (D)), which means that future users and owners were already involved in the design and construction process from an early stage. User-friendliness is an important theme that influenced not just the design but also the design process. The future inhabitants were involved in the design which resulted in customized floor-plans and attractive shared outdoor spaces. The building offers the inhabitants maximum flexibility and enables them to change the set-up in the future.

In particular, the open and flexible design concept of the building fits well in this way of collective housing commissioning, resulting in higher user-friendliness and more freedom in lay-outs for the users. So the circular design principles that have been applied to ensure flexibility and adaptability in future situations simultaneously provided flexibility in the early design phase as well

Sustainability

Working with a 'bouwgroep/ Baugruppe' also helped to realize the many sustainability and circular design ambitions in the plan. It demonstrates the importance of a good client to be able to realize stricter sustainability ambitions than prescribed in regulations. By carefully considering the building's entire lifecycle, a highly sustainable building was created: environmentally friendly, adaptive, and recyclable and with an excellent energy performance (almost energy neutral).

Building layout

Two building blocks are situated around a communal roof garden on top of the parking garage. For the garden design the residents took initiative and its maintenance is done collectively. The garden not only adds to the biodiversity, housing different plants and flowers and integrating facilities for sparrows within the garden walls, it also functions as a water buffer. The four-story block containing eight apartments at one end and the three terraced houses on the other end, are intrinsically different structures, though still they share their appearance: the characteristic element being the cladding of reclaimed hardwood (Azobé) formerly used in wooden quay walls along Dutch waterways.



The future inhabitants visiting the building site

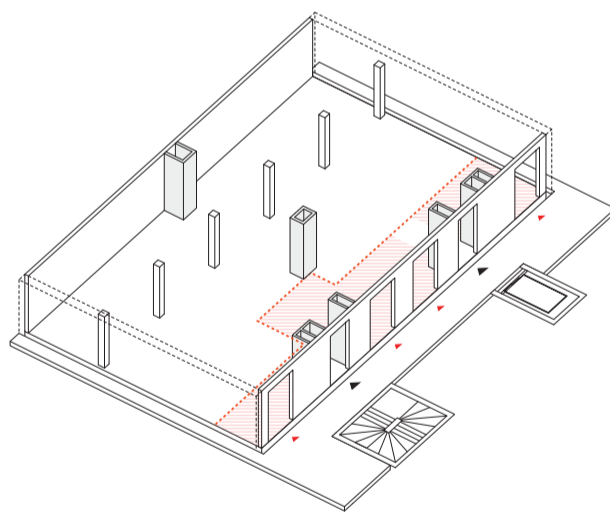


The collective roof garden functioning as a water buffer and adding biodiversity

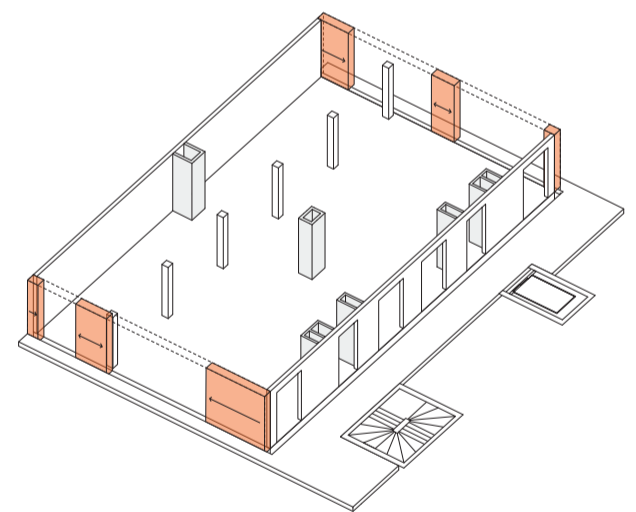
Adaptable and flexible: Flexible floorplans

Communal street-in-the-sky

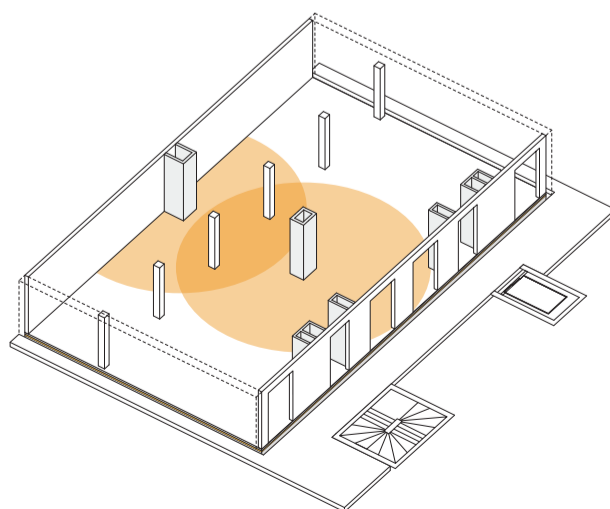
Additional to the strict requirements on sustainability and circularity, the municipality of Amsterdam required at least 20% of the floor area to be working space. Often work spaces are completely separated from the living area and take up the entire plinth and more. To enable flexible use and to make smart use of the limited space available, the workspaces are integrated within the apartments. These flexible live-work spaces are projected next to an adjacent 'street-in-the-sky', for giving access and providing daylight. This wide and green gallery connects the elevator, stairs and balconies to form a lively and lush shared outdoor space. The multifunctional work spaces with their separate front doors along the street-in-the-sky can go from being used as a home based office, to a guest-room, extra children's room, room for elderly parents or a workshop, also adding years in lifespan due to the flexibility of the plan. These polyvalent spaces along the 'street-in-the-sky' promote flexibility and can help to extend the building's life cycle.



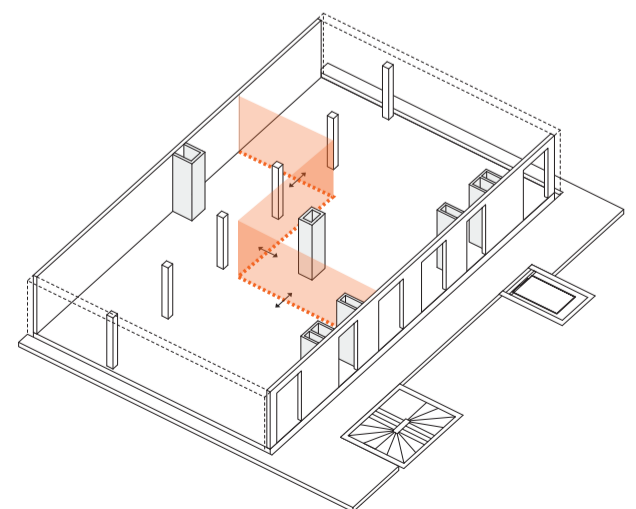
flexibility in program and entree



flexibility in facade openings



flexibility in service spaces (toilet, bathroom)



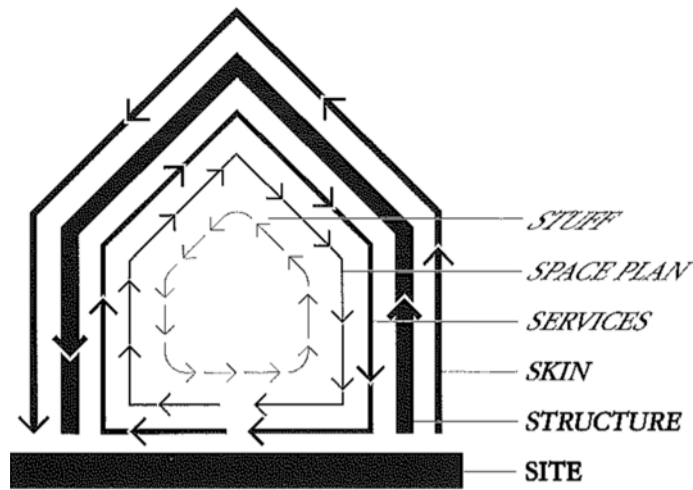
flexibility in floor plan layout

Adaptable and flexible: Separation of building layers

Using principles of Brand

Based on the need for flexibility and adaptability, we opted for an open column 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 principles of Stewart Brand - these building layers can be changed separately.

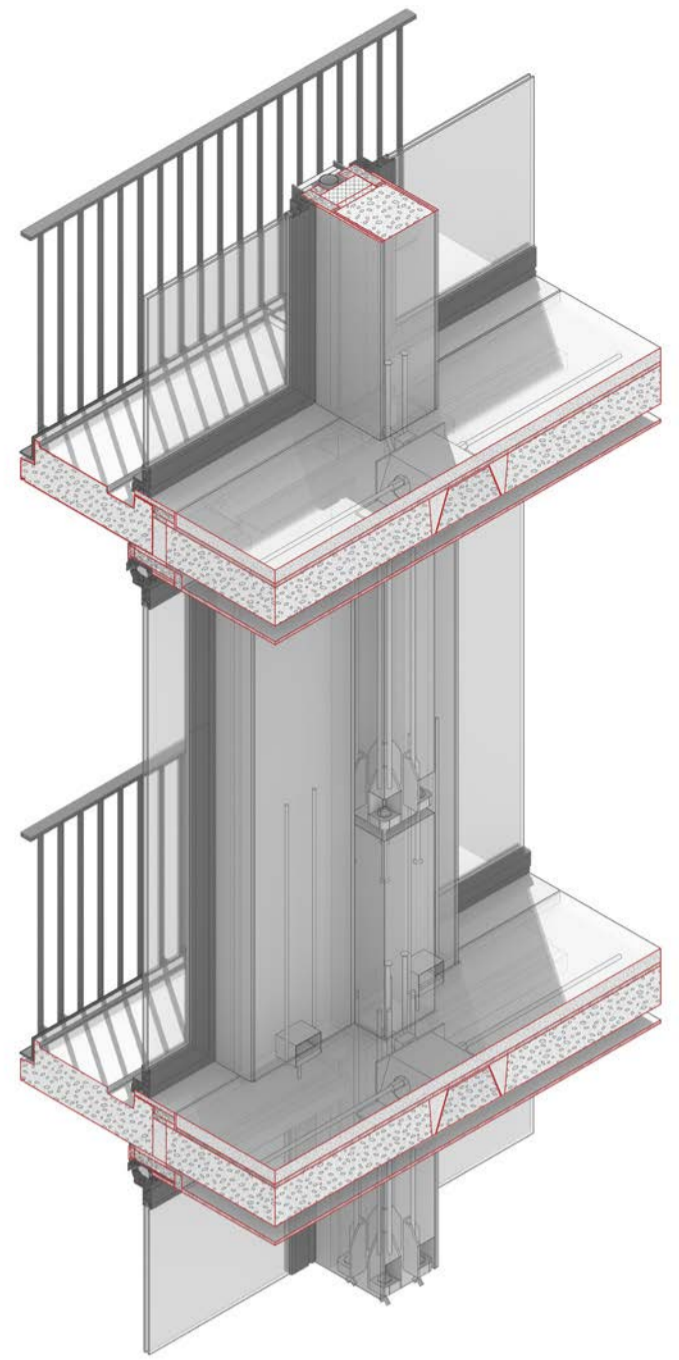
As each layer (installations, structure, facade, etc.) has its own use and lifespan, it is possible to make changes to the different layers separately. Instead of having to demolish the entire building, only the necessary layer can be refurbished, be remanufactured or - if not otherwise possible - be replaced. This way the building makes use of a circular system within its own lifespan. Whereas in commercial and industrial buildings the Brand's concept and the separation between structure and installations is already more common, this is not the case within traditional residential constructions. With the project CiWoCo 1.0 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.



scheme building layers according to S. Brand



The adaptable installations behind a suspended ceiling and false facing wall



A demountable construction with installations behind the suspended ceilings and false facing walls and therefore adaptable.

Demountable structure: increasing potential for reuse and recycle

Demountable structure and facade

A special feature of the building is the demountable concrete load bearing structure. 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. Also the facade with old, used Azobe sheet piling is fully demountable. In total, 90 percent of the materials used have thus become reusable or recyclable.

The demountable construction method also implied working with prefabricated elements in the case of the main load-bearing structure. In this way, the implicit potential of prefabrication could also be fully exploited: fast and economical construction, clean construction site, higher product quality, independent construction and workflows, better labour conditions, etc.

Lightweight and material-efficiency

Because pre-stressed steel reinforcement could be applied in the elements, it was possible to design and produce up to 40 % lighter and more material-efficient than traditional structures. This

way start the circular material flow can already be started in a more sustainable way. Acoustically, this weight reduction was possible due to the layered floor construction with suspended ceiling and floating floor.

Innovation by collaboration

To reach the different goals for a circular and demountable building, GAAGA has initiated various collaborations. An example is the development of the demountable load bearing structure of prefabricated concrete. Together with suppliers Bestcon (floors) and Peikko (connections), the concept was further developed in a joint process. In this way traditional prefabricated concrete walls and floors from Bestcon have been improved and upgraded to become demountable. In the case of the application of Azobe wood in the facades, cooperation was sought with a supplier of second-hand wood.

With the project CiWoCo 1.0, GAAGA has tried to improve building systems in a more circular way, by cleverly combining and improving existing technologies, by initiating, entering into new partnerships and bringing parties together.

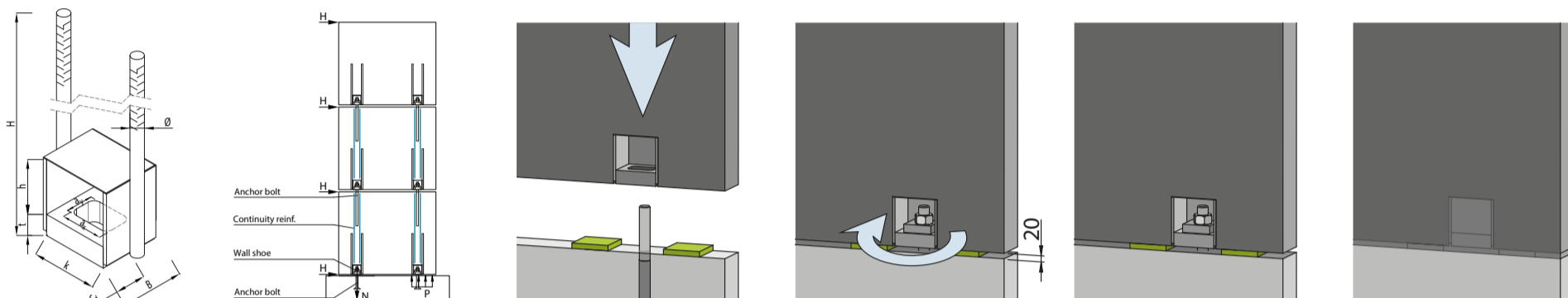




Together with the contractor, structural engineer and concrete suppliers, Bestcon and Peikko, demountable connections were developed for the prefab concrete shell



The connection of the demountable concrete columns



The connection of the demountable concrete elements in detail



The fases in practice: drawing

joining

production

storage

assembly

Re-use and recycle: after the buildings lifespan

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. CiWoCo 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 90% percent of the building materials used in CiWoCo can be re-used or recycled. Firstly, by using demountable 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.



When the old Dutch quay walls are replaced for a new quay wall, the wall and its wood are taken apart and transported to be processed for a second life