STADSATELIER DE VILLE

Circular hub and new BC Materials production site

Bid
28.02.2023

Schenk Hattori - Babini Geysen

EXPERIMENTS IN THE EVERYDAY

Until 2023, the three little pigs in the fairy tale each built a house as a shelter from the big bad wolf. The first built a house of straw, the second a wooden house, and the third a stone house. The wolf wants to eat the piggies, so he threatens the first two to blow up the house, which he succeeds in doing. The piglets flee into the stone house to the third pig. In the end, the wolf also tries to blow down this third house, but fails and the piglets triumph over him. Every house has its shortcomings and even the supposedly better brick house can no longer excel in the time of 2023 because of its CO2 impact and grey energy. We see an enormous need to investigate simpler construction. A way of building that is not only CO2-reducing, but above all uses the advantages of bio-based materials in new dynamic models of building physics. In this way we can reduce our energy consumption and CO2 consumption together.

All piglets can learn from each other. What if we build a house using as few materials as possible, each of whose strongest qualities make it a simpler and stronger building? A house, in the case of the piglets, that consists of a wooden skeleton with different and easier way to re-use elements, masonry and additionally straw-like fibre material. What if they are connected - in a reversible way - to form a new organism with complementary properties, like reinforced concrete used to be? What if inside and outside are no longer clearly defined, but merely depend on where windows or doors are installed? Is it possible that a material can both insulate well and store heat and carry? That would be a fabulous new story for our children.

We understood this call as an invite for research rather than for decision making, an invite to imagine and dream rather than for knowing already. We invested the past few weeks, together with our teams and expert partners, in starting a reflection on what could be a possible future and sustainable architecture for the team of the Stadsatelier, what can redefine our present understanding of a productive building in the context of Brussels. We asked ourselves how we could build something that would be of value to everyone present and, above all, would not have a negative impact on the local conditions. Can we erase the concept of waste or even save carbon during the lifespan of the building or even during its construction phase?

We propose something that lets the wind blow, that collects the sun under its roof, stores heat and controls humidity in unexpected ways, everything natural. We imagine making places with unexpected variations and conditions, not focusing on form, or on physical presence, but on the outcome they have. Places where animals, plants and human are equal, transmutable structures, not designed but an expression of a philosophy of the users, erasing the notion of our modern understanding of building. We propose to do all this in a deconstructible way, imagining another way to compose elements that we collect in the city. Something where the co-existence of bio-based materials and reuse can lead towards an invention of a hybrid construction. We wish to create an environment open to receive meaning from all subjects.

You will find in the following pages a collection of our reflections for this call. The story is not yet linear and mostly, is not yet finished. Experimental ideas were thrown on the table, sketched and tested, impressions of spaces were drawn at once with its daily maintenance and interior climate. We decided to collect a framework rather than a design as we see your expertises and knowledge in different fields of circularity, complementary and fundamental in completing our team. We have drafted a methodology to co-design but also a system that remains open, unfinished and capable to absorb change, that ultimately focuses on how it can both influence and inspire the people that live and use the building everyday.

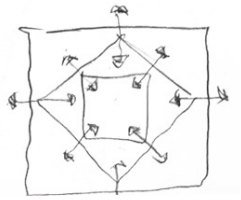
OPEN TO DESIGN

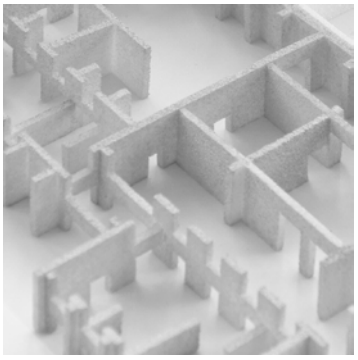
Open typology
Sufficiency is not only about minimizing materials and energy, but also about creating an open typology with spaces without hierarchy. When windows are then added into the walls, areas become interior spaces. This means that you can use the building in many ways, define relationships, migrate ideas and find out how it is most comfortable for the user. If the change of seasons can (but does not have to) also change the use or experience of the building, our humanness can also be reconnected closer to nature. In the research for a typology that could offer freedom and fluidity, we found it appropriate to work with an open, horizontal plan development, unfinished to the limit where the interior and exterior blur. A typology inspired from a natural landscape, no longer obsessing on compactness, which almost becomes irrelevant when the building is temporary and fully demountable. Why not exploit and enjoy these conditions for once? How can we concretize this in a sustainable manner?

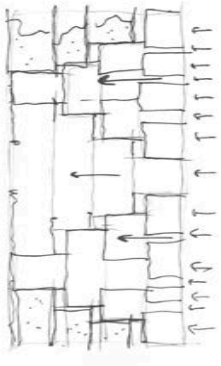
The possibility of reconfiguration for different users, at different times, makes a durable building. When space itself offers variety, the existing possibilities are multiplied. In this case we opted for working with a constructive system that doesn't "close" the design, just yet. For example a vertical structure made of light biogenic blocks can be disassembled without waste at any time, or easily extended - it becomes able to absorb unexpected evolution in use and growth and shrinking of the program. We could even go further and use the flexibility of the construction to consider everything as storage, and that structure (blocks) can be placed there and replaced as time goes, so the architecture is changing over time.

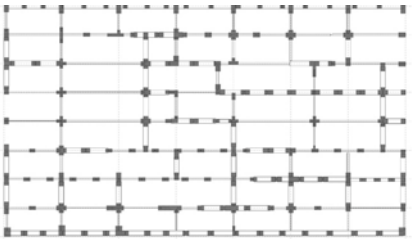
A welcoming system
For us openness in this building is also about its capacity to incorporate not-on-measure second-hand parts, in a collective exercise of circular assemblage. Working with walls or blocks that can easily be adapted on site, contrary to modular prefabrication, allows the flexibility to include the most of repurposed, locally recuperated construction elements and even to leave the design partially unfinished until new parts are sourced.

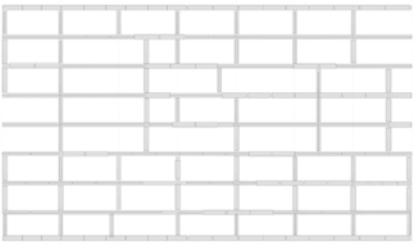
Collective design act
We are interested in an open and shared design process where not only the needs but also the knowledge of each partner is a used as an asset and as a positive contribution to enrich the design. For this we are herewith presenting not a full project, but a design methodology; we have collected a set of constructive tools that will allow to assemble the building together with the inhabitants of the first phase and will still leave open room for reconversion and expansion at any time. The first step in the design, done during the competition time, is to measure, map and reorganise the elements to reuse as structural beams - to create a roof offering multiple possibilities. Then, by cutting and pasting them on the site and tracing walls, we played in imagining what spaces could be generated - a garden, a courtyard, a covered passage for encounters, one large bathroom, an enormously high hall, ... and how by differently clustering programs, various interactions can be derived.

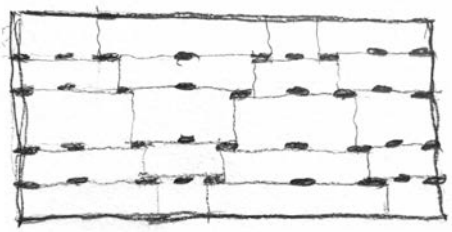


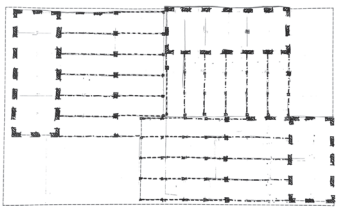


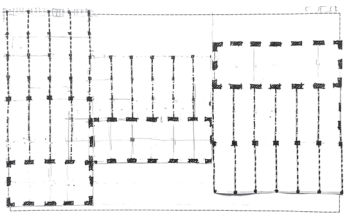


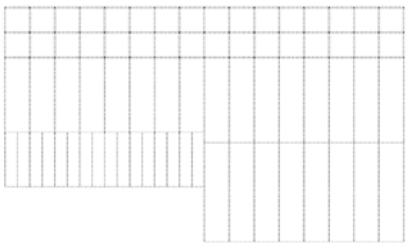


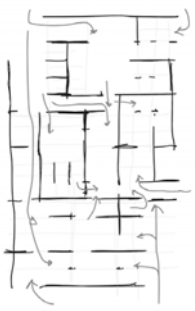












1) Making do with available resources without preconceptions. Older civilization viewed mammoth bones washed from glaciers as elements to create shelter.
2) Some schemes drawn during the process, in the research for a balance between freedom and structural order, already suggesting the shades of possible interactions than can be created.

HYBRID CONSTRUCTION SYSTEM

Vernacular and visionary
We need an appropriate cultural framework to embed the philosophy of responsible construction. We need to create structures that are open to such interpretations by reading the man-made and natural elements in our ancient and human way. To this end, we have studied how to enter it and how to look at it typologically, how it relates to heat and cold, to the principles of air movement, heat movement, light, heat storage, insulation, moisture and smell, acoustics and hearing, taste; the deformation of space, the absent presence of topography, the material of heat storage and insulation, the movement of wood in relation to its environment and its moisture. In general: the hidden properties of bio-based regenerative materials to revive their potential in the challenges of today.

What if the whole thing can seem like something magical, where structural elements seem to be missing and yet remain standing; where things are assembled and made, where smells seduce, where columns have specific figures, where elements are stored, build in or both at the same time, where sounds are softer or harder, where the air is silky, where some spaces smell, and others do not, etc. Depending on the perspective, the project changes its appearance each time, adapting to become a different landscape. So if we were to recalibrate our cultural framework, if we were to maximise ecological and economic benefits, what would we need to do to overcome the potential problems of this kind of vernacular materiality as vernacular construction has the great advantage of being natural, locally available, low carbon and capable of full hygrometric control of indoor air.

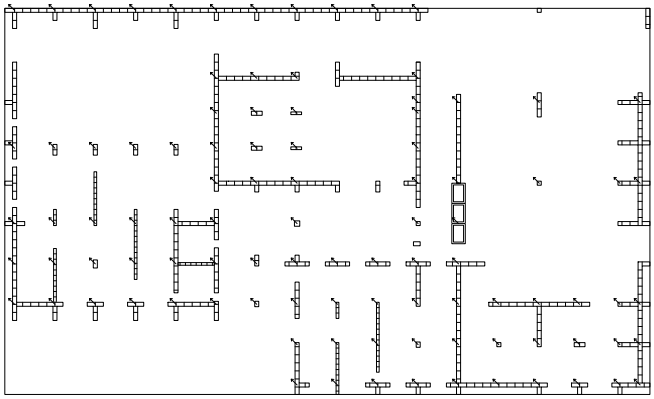
Hybrid construction
The hybrid construction system here proposed fully exploits the combination of the great quantity of second-hand structural elements offered by Democo with new biobased materials. Responding to a programmatic request that focuses on heavy-loads, we choose to organise - in principle - a ground floor building, where the heavy-loads are all distributed directly on compacted ground or on Eurodal plates; first floors and mezzanines can always be integrated for lighter-loads programs (for example ateliers and offices). With these assumptions the only thing left to do is to build a roof. If we use the collection of second-hand members only to distribute horizontal forces, every element can easily be integrated in the roof structure, relieving them from the task of bearing too heavy-loads, which they are not fit for. We decided to combine this with a vertical bio-based constructive system made of blocks - for the clarity and simplicity of the system.

The foundation of the building is made of easily removable concrete blocks - lego blocks - reversibly installed on the perimeter line and under the main structural grid. They are positioned in double rows on a depth of at least 80 cm, so to ensure a frost barrier. In combination, prefab Eurodal plates seem fit to act as foundation for lighter partition walls - allowing for possible future construction and subdivisions to be freely placed.

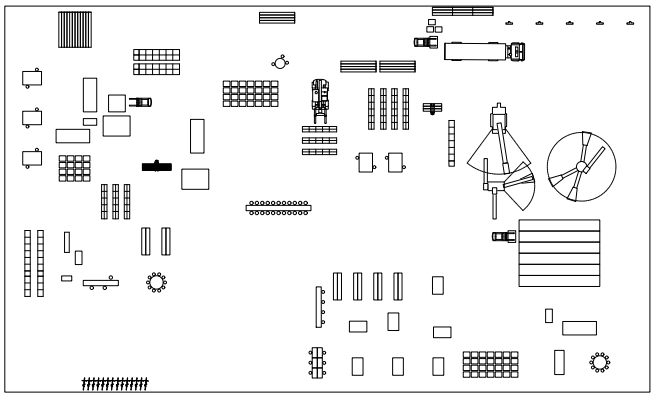
The hybrid nature of the wall construction of the straw-bale blocks (or other bio- or geo-based materials) together with compression bands of recuperated wooden beams or CLT off-cuts, results in a very easy and fast system to construct walls with performant load-bearing capacities. We chose a single material that can do everything. The blocks are laid in a special bond so that they anticipate the presence of divers re-use elements. After a first exchange with our structural experts, we propose pre-stressed straw-bale blocks, plastered on both sides to augment the surface tension and add fireproof and rainproof properties. This extremely minimal stratigraphy excludes all other traditional layers that are often derivated from petrochemical sources, which not only enhances the natural character of the building but also makes it very easy to demount and recycle. Columns can be built in a similar way or made in rammed earth, geo-blocks or wood.

For the roof structure, we assemble the recuperated beams (steel members from the bruCargo Hall, lamellar wood beams from the Pacheco Building and the I-joist beams from the BC materials production hall), reorganised according to the spans they can bridge, in a system that allows for reuse of any type of second-hand element where even steel columns can suddenly become beams. The secondary structure for the roof package can be sourced from re-uses or even produced with wood from the Sonian Wood.

1)



2)

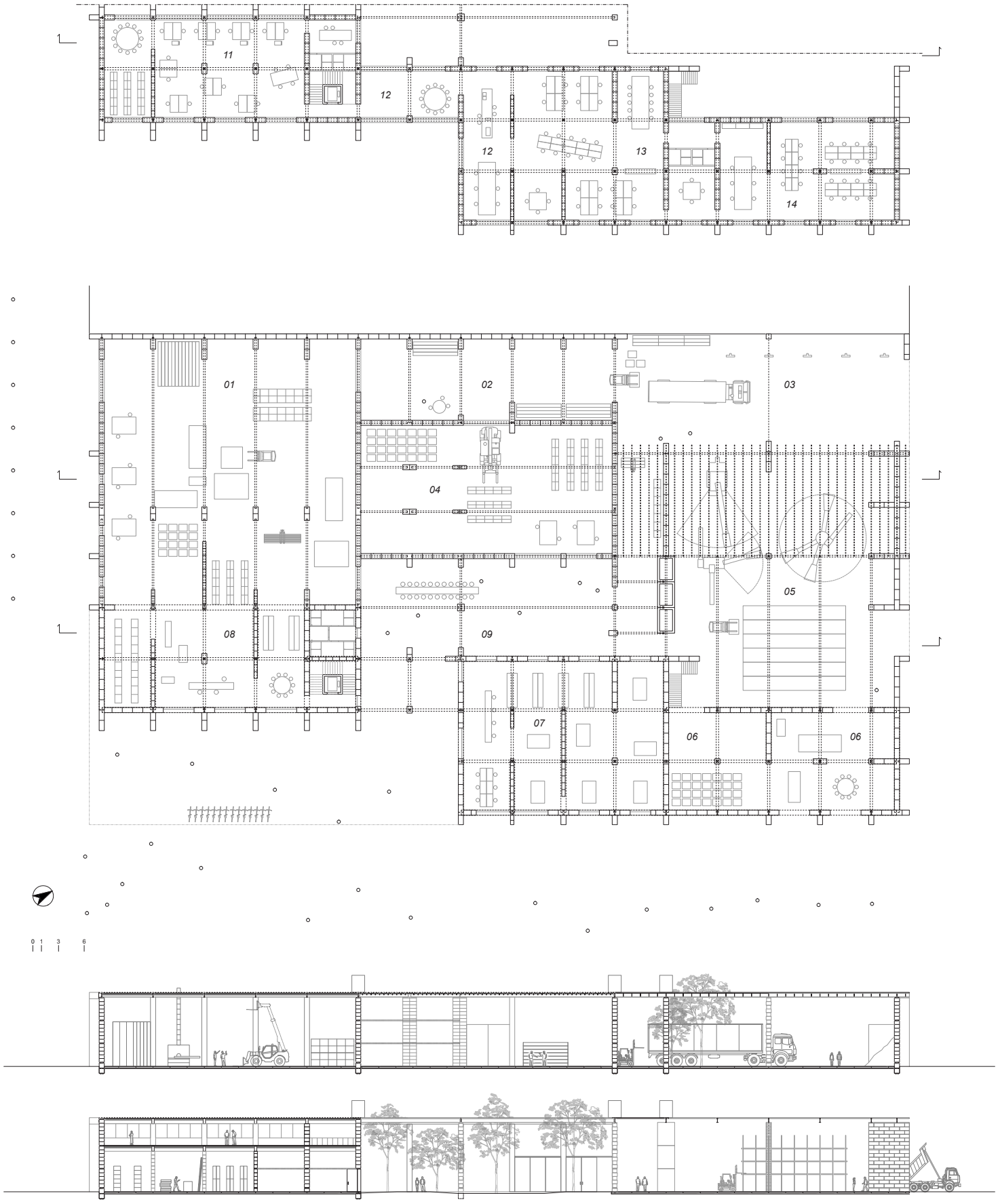


3)

Type	*Origin*	*Dimension*	*Available*	*Used*
IPE 450	*bruCargo*	*2000x45x19 cm*	*9*	*12*
IPE 450	*bruCargo*	*1800x45x19 cm*	*9*	*15*
IPE 450	*bruCargo*	*550x45x19 cm*	*18*	*19*
UNILIN I-Joist	*BC materials*	*1300x40x6 cm*	*33*	*33*
GLULAM WOOD	*Pacheco Building*	*590x120x28 cm*	*138 x 2 (cut in two)*	*176 (590x60x28)*

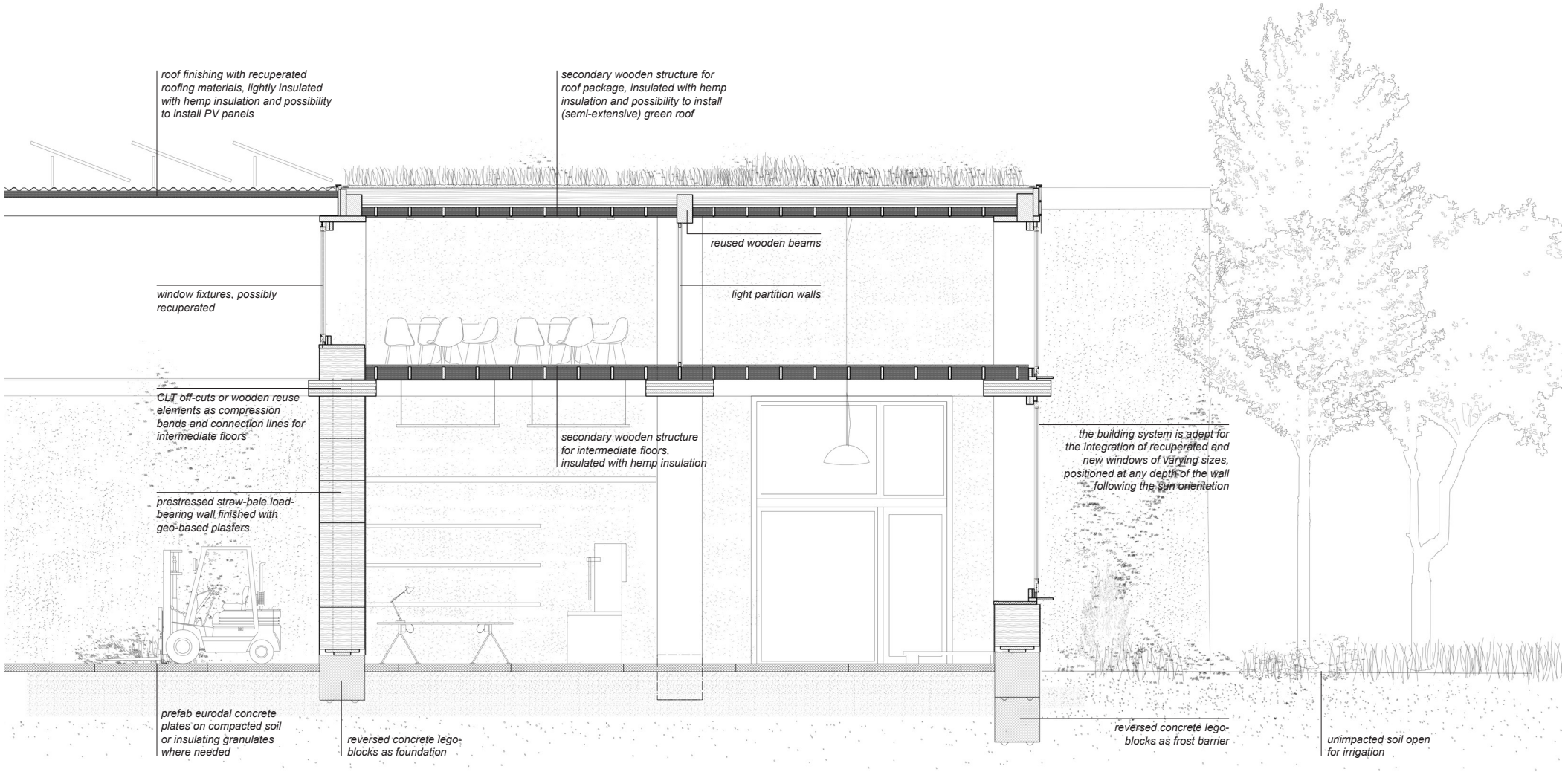
1) Mapping and reorganizing the reused elements into a framework that offers different types of venues, in always different and unique configurations. Acting like a bricoleur, balancing order and freedom.

2) Connecting the dots of the vertical loads with load-bearing lines in a playful manner. How much closure and what sizes of spaces we seek?
3) The result is a continuous landscape of uses.



Ground floor Nr.	Surface	Height	Possible use
01	950 m2	810 cm	big hall for SWC and WOW
02	300 m2	open	shared outdoor storage zone
03	350 m2	open	shared loading and unloading zone
04	470 m2	810 cm	big hall for Democo
05	1000 m2	810 cm/ open	big hall for BC Materials
06	300 m2	510 cm	storage and ateliers for BC Materials
07	430 m2	510 cm	ateliers and tool library for Tournevie
08	300 m2	510 cm	storage and ateliers for SWC, WOW and Natura Mater

First floor Nr.	Surface	Height	Possible use
11	300 m2	290 cm	offices for Circular Hub Stakeholders
12	200 m2	290 cm	zone for shared amenities
13	450 m2	290 cm	offices for Democo
14	200 m2	290 cm	offices for BC Materials


roof finishing with recuperated roofing materials, lightly insulated with hemp insulation and possibility to install PV panels
secondary wooden structure for roof package, insulated with hemp insulation and possibility to install (semi-extensive) green roof
reused wooden beams
window fixtures, possibly recuperated
light partition walls
CLT off-cuts or wooden reuse elements as compression bands and connection lines for intermediate floors
secondary wooden structure for intermediate floors, insulated with hemp insulation
the building system is adept for the integration of recuperated and new windows of varying sizes, positioned at any depth of the wall following the sun orientation
prestressed straw-bale load-bearing wall finished with geo-based plasters
prefab eurodal concrete plates on compacted soil or insulating granulates where needed
reversed concrete lego-blocks as foundation
reversed concrete lego-blocks as frost barrier
unimpacted soil open for irrigation

A PLACE OF PRODUCTION

Understanding the use
The circular hub is first and foremost a place of production with different flows of working people, produced materials, stored materials and goods that all come and go in an efficient manner. Technical networks form the backbone to support the use and life of such an infrastructure.

The program for phase one consists mostly of large halls with high ceilings, ranging from 5.10 m to 8.10 m height, and few smaller spaces. In between, there is a range of possible spaces, slightly lower productive ateliers and slightly more enclosed storage units that can be designed, and clustered through different organigrams.

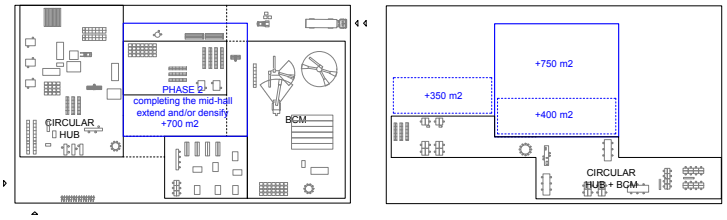
The most simple and functional organisation of the productive program is on the ground floor - easily connected to the logistic dock for daily loading and unloading of goods. The logistic access happens from the service road on the Laeken side, the public and softer access from the future pedestrian passage, which is facing the opposite green area and is accessible from the Anna Boch boulevard. In this scenario we imagine that the South-East oriented zone of the building has a double floor where offices can be located on the first floor, above ateliers, with a view on two directions: one to their respective productive halls and the other to the park.

Technical and functional synergies
Each partner then has a double access, both from the public and logistic passage, and they can place themselves in the constellation, according to their prominent use. For example, Tournevie, Natura Mater and all of the offices have their front doors direclty linked to the public passage. On the other side, the big producers (BC Materials, Democo, Sonian Wood Coop and WOW) share their logistic addres from a joint docking zone facilitating heavy transport. This allows to reduce to the minimal the surface of the roadsis while offering maximum use of it. The service dock could eventually also host shared parking spots. No cargo is needed in the first phase, since all storage and production halls are located at groundfloor.

The technical synergy between places can be maximalized as well - the adjacent production halls all tapping into the same network (water, electricity, aspiration for dust, ...). In the same way, we could imagine that when we add a first floor, the floor package of the offices can collect the technical networks to be efficiently shared between offices and the ateliers below.
The acoustic buffering capacities of the thick straw-bale blocks allows for the proximity of these different spaces, assuring good acoustical comfort in the office spaces. In the same way, the thermal qualities of the straw-bale walls as divisions between spaces make it redundant to define the insulated envelope, accepting the free use of the productive halls (where gates are often open) next to other spaces where more thermal comfort is needed.

We are very fond of an holistic thinking where these kind of synergies can be supported by the most minimal acts and by the use of minimal resources. In this shown case, adding a central courtyard even allows us to imagine one unique central knot for bathrooms, vestiaire and showers, a commonal kitchen, etc. that are shared between the partners.

Extension and/ or densification
The possible second phase of the program can happen both via vertical densification and/ or horizontal extension, depending on the quality and use of the new spaces. The big halls, which are 8.10 m high, allow for a possible split into two or even three venues by the quick addition of a light floor infill or mezzanines. The build-up of the load-bearing walls and columns already integrate the connection points for this. Other areas that are left open in a first phase could also be built to extend with extra high halls.



1) The mat organisation of the plan and the high section allow to build extra surface in a second moment, positioning the extension as it is best for the program to come.
2) The productive hall parts of BC materials are fully reused, integrated in the new.

CRAFTMANSHIP AS AN IDENTITY TRAIT

Showcase of circular craftmanship
With the parties involved, we share an artisanal attitude with care for and celebration of natural geo- and bio-based materials. We imagine here a process where the partners know-how supports the design conversation. The constructive system that we propose is easy to work with and the overall low-tech attitude of the building is ideal for DIY builders that can carry out their own maintenance and future adaptations.

Moreover, the constructive system is thought to easily integrate the materials and expertises of the Stadsatelier partners: we can imagine the straw-bale walls being compressed and tensed with CLT off-cuts and finished with earth-based plasters - these walls then support a primary structure of recuperated steel or wooden laminated beams, locally collected, to be filled in with a secondary wooden structure sourced from the Sonian Wood. And we can go even further in imagining and designing a wholly integrated architecture. The point we aim to make is that the know-how of each of the partner involved can become structurally embedded, and hopefully the building inspires research, ideas and future test cases which can find place in it, in a continuously evolving process.

As a building that fits perfectly into the specific industrial context of the TACT site, but also stands out, the circular hub can itself become the showroom of the collected know-how and craftsmanship of each partner, a place that is also representative experiment for their constant search for innovation.

Against generic spaces
The cultural shift that is bringing more and more interest and attention to craftmanship and local production is also concrete evidence of a parallel transformation in our lifestyle. We no longer want to live in an alienating and fast metropoly, we want instead to experience the flow of time and nature in our daily routine. We don't want to sit anymore in air-conditioned offices, we don't want to commute to production sites hidden in the outskirt of cities to work in dry and anonymous warehouse-type halls. This project can become an example of the positive effect of having hybrid production sites in city centers but also living proof that a more soft and comfortable work environment is possible without compromising in efficiency and productivity. Robustness is not only to be achieved with modular systems, steel or concrete, but also in a building that we are able to maintain ourselves, easily repair and adapt.

In new buildings too often a very large part of the budget goes into the technical aspects to aim at optimal energetic performance. Unfortunately this forces us to cut on the quality of the used materials and the spatial experience. This is why recuperated materials from older buildings often have much better qualities than new ones: massive wood, thick natural stone, decorative elements ... We are not interested in negotiating the tactile quality of the places we work in. Therefore we have researched a scenario where the building envelope's high energetic performance allows for rather inexpensive technical solutions, leaving the possibility, and the budget, to work with more precious, hand-made, tactile materials.

1) Craftmanship as identity trait: Caddis fly larvae repurposing precious metals and stones into a cocoon. (work by Hubert Duprat)
2) Ref: Sverre Fehn, Nordic Pavilion at the Venice Biennale and Aldo van Eyck, Sculpture Pavilion at the Kroller Muller Museum - open but not generic.
3) The calibrated balance of earthy mass and a light lifted structure.
4) Ref: Peter Zumthor, Devon Villa - hand-made rammed concrete on wood.

EACH GARDEN COUNTS

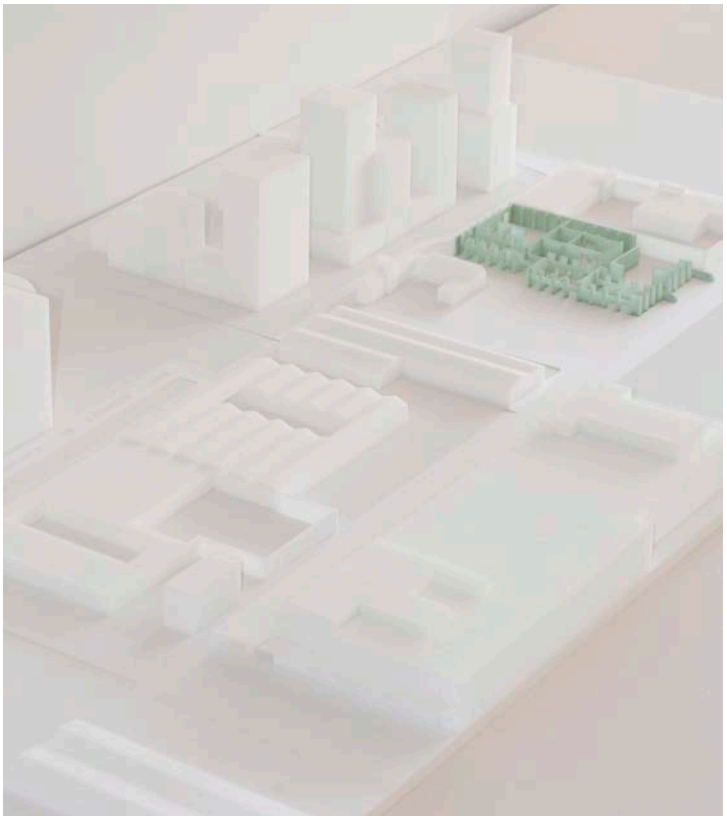
Urban integration
The site of the Stadsatelier is urbanistically extremely simple to analyse, because it bears very little constraints and morphological difficulties, and at the same time very complex to anticipate. It is a neighbourhood in full evolution in the heart of Brussels, carrying major expectations for the future of the area. Even within a short term concession of 30 to 60 years, the building has the capacity of steering the on-going transformation of the neighbourhood in a positive direction. Given the mostly uncertain future constructions in the direct surroundings, we position ourselves with humbleness to carefully understand the prescriptions redacted by experts for the TACT-site. But with a critical attitude we challenge them to do a bit more. Yes! to wall the site, but can we also be generous in showcasing this exemplary productive hub? Yes! to respect the heritage building of the former Sorting Station, but can we take this as a chance to redefine the limit between public and private (and plant a small forest)? Yes! to preserve 10% of unbuilt and permeable area, but how can this have a structural role in restoring the area's biodiversity?

Taking care
To regenerate a seemingly dead ecosystem, a critical mass of super connected green, running throughout the neighbourhood should be created. Each garden, however small, contributes on the urban scale when it works in symbiosis with the bigger whole. We intend to start by keeping at least 15% of the site permeable and vegetalised, already anticipating to meet the future Good Living regulations, which might come into place already during permit phase of the process. This green zone will be planted with species able to continue the phytoremediation process in the soil and, in line with the vision of the neighbouring developments and of Bas Smets' project for the Tour and Taxis site and park, work together for a resilient ecological environment.

Restoring the biodiversity of the site includes also taking care of the living creatures like birds and insects. We already see, for example in the case of the small and accidental swamp opposite to our site, the way in which nature reappropriates our cities and is quickly inhabited by species like the Wagtail (Kwikstaart). Building in an open way, without sealing our soil and digging deep and heavy foundations, also maintains the eventual underground network of root and fungal scapes, consciously taking care of nature that is invisible to us.

With the help of the database of Brussels Environment, the choice of vegetation will be further researched to offer an optimal low maintenance ensemble, making sure to also include diverse native species that can nurture the fauna of the site.

A more natural life
For most of the last five hundred years, 'nature' has been the main, if not the principal category for organizing thought about what architecture is or might be. Living around nature and being able to experience the slow seasonal transformations, the smell of summer rain and the autumnal breeze is a quality that we as humans always embrace. We feel energized after sitting five minutes in the sun sipping our coffee and that is just enough good reason for us to design a building that incorporates these different shades and relations with the outdoor. Walking through a small forest to find the building, to peaceful inner courtyards, protected from wind, through an earthy landscape with mountains of sand and perhaps find somewhere along your walk a hidden greenhouse meeting room.




Yellow Wagtail (Gele Kwikstaart)


Common sparrow


European white birch


Glechoma hederacea


Origanum Vulgare


Plantago lanceolata


Knautia arvensis


Polygo


Marguerite commune


Vinca minor


Calendula officinalis

1) Ref: Lothar Baumgarten, Fondation Cartier garden in Paris. The name, Theatrum Botanicum, is taken from books dating back to the Middle Ages where monks would take inventory of medicinal and aromatic plants.

2) Respecting and challenging the TACT site devlopment.
3) Local flora and fauna to be nourished back in the neighbourhood.

BEGINNING WITH THE AFTERLIFE

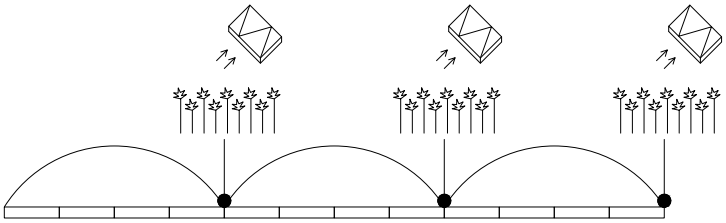
Different strategies

*“Circular thinking not only relies on an intelligence to be deployed at the time of construction, but also on anticipation of the future life of the building, leading to a simultaneous reflection on construction and space and on a new and overarching material responsibility.” **

In this case this reflection seems all the more urgent and useful. Not only is the building meant to last between 30 and 60 years, but there is also the chance of extension of the occupied surface (which means build more at a later stage) and the usual flexibility in program adaptations that a productive building hosting different companies requires. We have reflected on the afterlife circular strategies for this building on different aspects.

The life of the site

Being part of the extended area of the TACT-site, the building plot sits in a prominent and well connected location, but also brings along a potential highly polluted and poor qualitative soil. The rather monocultural and industrial past of the site has heavily impacted this zone and drained its mineral and ecological richness. Asked about what to do with the site before starting to construct, we propose, as an in-between use, to begin by sanitizing the soil through means of phytoremediation, an effective solution for ecological restoration. Planting hemp (a plant with good phytoremeditive qualities) on the plot would not only help absorbing heavy metal pollution from the soil but also offers a source for insulating materials later to be integrated in the building. Produced on site, used on site. It is a rather inexpensive action, that is currently being tested by Democo for the Tannat project in Sint-Jans Molenbeek. If we were to cultivate hemp for a year, it is possible to plant three cycles in that period (typically 70 to 140 days before harvest) generating an estimated amount of 10 tonnes of plant aggregate which can be processed to use it to insulate the roof and floor packages of the building.



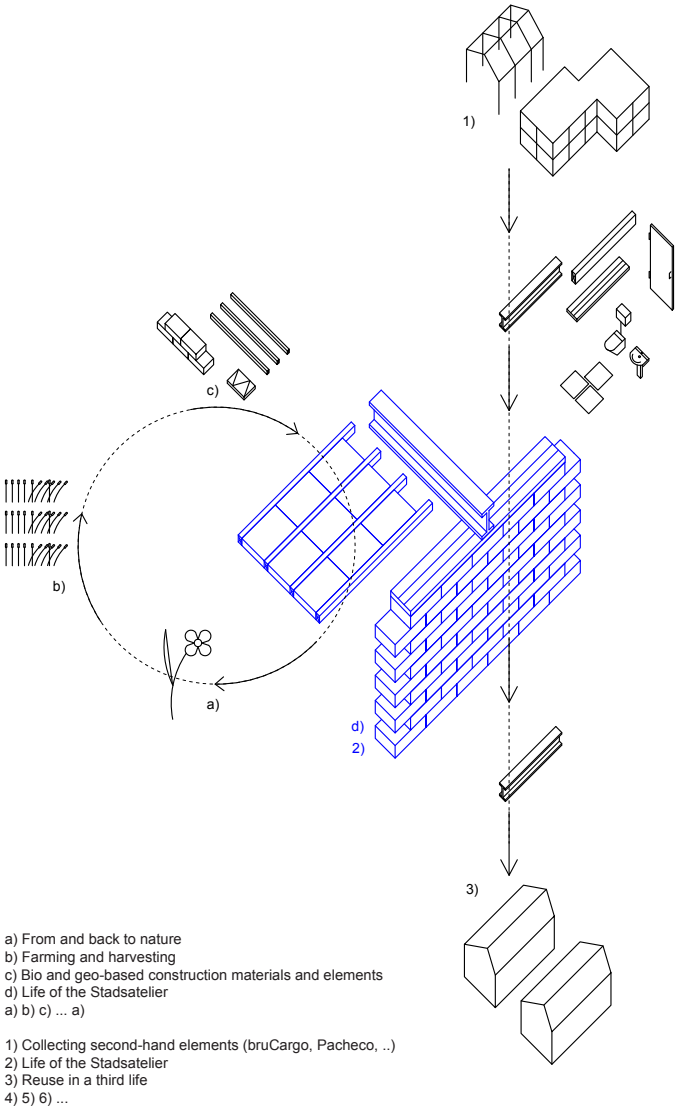
Moreover we intend to connect green zones of the plot to the green belt of Tour and Taxis. A consistent and interlinked green mass can slowly restore the biodiversity of the site on a much larger scale, leaving the plot in much better quality than it was originally found.

Moving on

Using a minimal constructive system facilitates the disassemblage and the afterlife of its parts. Structure, facades and partitions are always the most complex and layered parts of a building. In this case the hybrid constructive system produces an interesting interweaving of cycles which have a different sourcing pre-life cycle and also a different afterlife - materials that join their path uniquely for this one building life. The use of straw-bale structure together with natural plasters and the other biogenic materials allows for a consistent mass of the building to return to nature after its use, while the second-hand elements of the building - carefully assembled in a reversible way - can continue their life to be reused for a third one elsewhere. Within the building envelope, shorter lived fittings are installed. All the elements used will be assembled in a reversible way, to facilitate adaptations works or to take them apart and reuse them when should be needed.

Material passport and building instruction booklet

To facilitate the future deconstruction or displacement of the building, we find important to redact a building instruction booklet while designing together with a material passport. All the elements in the building, old and new, will be mapped and quantified, listing the specifications on their installation, maintenance and the way they can be recovered, recycled and re-used.



a) From and back to nature
b) Farming and harvesting
c) Bio and geo-based construction materials and elements
d) Life of the Stadsatelier
a) b) c) ... a)

1) Collecting second-hand elements (bruCargo, Pacheco, ..)
2) Life of the Stadsatelier
3) Reuse in a third life
4) 5) 6) ...

1) Inbetween use of the soil as productive ground for an estimated period of one year. Hemp, for example, has a rapid growth and can be foraged up to three times a year.
2) Different flows of materials and elements converge for the life of this building. Consciously, a main mass returs to nature, the rest can proceed to a third life, with a minor part alone to be recycled as their functionality should expire.
** Quote from: CHAPTER 3. How to not demolish a building, 51N4E, Ruby Press.*

NEW AND EXEMPLARY

We believe that our proposal has the capacity to reach the scopes of the Circular Charter to its full extent and go even beyond. Together with BC and other experts in circularity we wish to explore these circular aspects in more detail as to make sure to meet all the requirements for the targeted labels, certifications and funding grants. Here below, we point out the strong parts of our proposition in relation to the Circular Charter.

Carbon storing
Can we build a building without increasing the level of CO2 in the atmosphere? Actually, yes. By today's standard, this is not a difficult task. However, we should not be content with merely achieving carbon neutrality. It is necessary, where possible, to consider storing carbon in the building itself.

The balance with negative emissions must therefore be explained: harvesting plant-based building materials does not remove CO2 from the atmosphere, but transfers the sequestered carbon from the arable field or forest into the built environment. Straw, wood or hemp are stored in the building and make room for the renewable biomass. Only then does the carbon content in the atmosphere decrease.

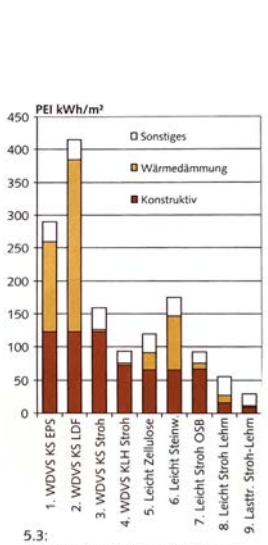
For a good material diet, we recommend:
- a reduction of carbon intensive materials such as glass;
- an appropriate use of "low carbon" building materials such as concrete and glued wood which releases relatively little CO2;
- an extensive use of nearly carbon-free materials such as clay and an increased use of "carbon-negative" materials such as rapidly renewable bio-based materials and, in some cases, solid wood.

A healthy building
The combination of re-use material and geo-based blocks or straw is in fact healthy for the environment and its users. It is a residual product of one of the oldest cultivated plants, and one of the oldest and most proven building materials - often used in vernacular architecture with trass lime - possibly inspiring the building materials of the future.

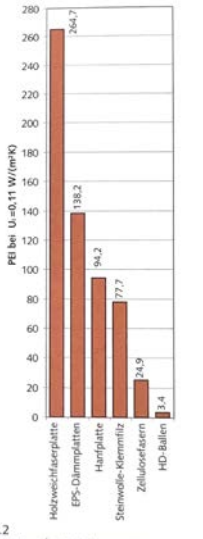
Contrary to cement-based materials, trasslime gains in strength and watertightness throughout the years, thanks to the pozzolanic reaction between infiltrating water and the material 'trass'. This magical material will strengthen the straw bales with its elastic properties, protect the straw bales from moisture, while at the same time adding thermal mass to generate sufficient inertia to the hyper-insulating straw bale construction.

The synergy of Stadsatelier
Following the given list of spatial needs we have done a first exercise on the program distribution, where the emphasis clearly lies on high productive spaces. Office spaces are kept compact and are grouped together so that they can share a maximum of amenities. By understanding the programmatic needs on a more holistic level along with use pattern analysis, the brief of requirements can be made more efficient and leaner whilst promising more potential for everyone.

Hierarchy of materials
We take a very radical stand on this point. As shown before, we focus on an almost full reuse of the available elements for recuperation. Where new materials are needed, we bring in bio- and geo-based materials, with the straw bale blocks as one possible example. We highlight a few specific advantages of straw as a building material, as it is not common knowledge anymore, to share the reason behind our interest in it:
- Straw bales are a residual product from arable farming. It is therefore widely available and relatively inexpensive.
- Straw is a 100% organic material and has the most positive effect on the CO2 footprint.
- A wall of straw is free of toxic substances.
- The energy required to extract, process and transport straw is very low.
- Processing it into structural walls is relatively simple and safe. This makes building with straw bales very suitable for self-build or participatory processes.
- Depending on the design, it is possible to build quickly. Adapting the design to the module of the straw bales can save a lot of time and work
- Thermal insulation is excellent (Rc > 6 m2K/W).



5.3:
Primärenergieinhalte unterschiedlicher Wandkonstruktionen bei einem U-Wert von 0,11 W/(m²·K)



5.2
Primärenergieinhalte verschiedener Dämmstoffe bei einem Wärmedurchgangskoeffizienten von U = 0,11 W/(m²·K).

- The acoustic properties are good (Rw 55 dBA).
- Plastered straw bales have excellent fire resistance (> EI90). However, open fire must be handled with care during construction.
- Extremely durable (service life of over one hundred years). When demolished, no harmful substances are released and only easily processed or reusable raw materials remain.
- In combination with clay or lime plaster, it neutralises odours through ionisation.
- It creates a healthy indoor climate.
- It has good hygrothermal properties as it can absorb a lot of water without losing its high insulating quality.
- It is effective against radiation.
- Contrary to popular belief, it is resistant to pests and fungi.
- It reflects heat, cools in summer and warms in winter.

1) Graphs showing the primary energy content of different wall build-ups and insulation materials comparing systems with straw to other traditional methods.

EXPANDED RESPONSIBILITY

Climate sensitive building
During the design process we found interest in questioning the thin line between comfort and discomfort offered for working settings, when we leave the climatic control “out of control”. We are excited by the idea of a building that could liberate us from the limits of imposing the climatized envelope. The critical step was to research a constructive system able to free the spaces from their dogmatic technical constraints thus offering freedom, expanding the issue of sustainability from a technical into a social and cultural question: what is it that we expect our buildings to do for us?

With an excellent insulating envelope and an intelligent use of stack effect, the energy demand for heating could be 0. Thermal mass should be introduced in the building specifically on the finishes of the wall (either with earth or lime based plaster) so that overheating is mitigating in the well insulated building. In line with the philosophy of reuse, the positioning of window openings and relationships with shaded courtyards should be carefully considered to achieve a truly passive design solution.

As a minimum, the building envelope should achieve the following:
U value roof: 0.1 W/m2K
U value external walls: 0.12 W/m2K
U value floor: 0.2 W/m2K
U value windows: 0.7 W/m2K - depending on recuperated materials

Within our proposal and cost considerations, an 80 cm straw bale wall can already achieve 0.06 W/m2K. On the internal surface, finishes with high thermal capacity should be applied to provide the overall inertia needed.

The construction method also speaks for the heat storage effect. In winter, solar radiation heats up the interior. The heat is stored in the thermal mass. In the evening, the stored heat provides a pleasant radiant heat. As a passive cooling effect, in summer we can use the cold air at night to cool down the thermal mass. To achieve this, the chimneys or openings can be arranged atypically to add a special character.

In our research for a full mass building typology, we were inspired by the experience shared by one of the technical engineers we closely collaborate, which worked on the development of the exemplary prototype 2226 by Baumschlager Eberle Architekten.

Low to zero-tech
Like the flows of materials, energy and water are exchanged between the building and the environment. Energy is recuperated before being shared again between different programs, all tapping into the same loop to ensure minimal loss of energy consumed by the building. Perhaps, with this very special program, and thanks to the insulating capacity of the envelope, certain parts of the building can even be designed as zero tech. Only in the coldest months of the year heating might be necessary for some areas. Redefining the comfort standards to start with, is important in the process of calibrating a more minimal and environmentally sustainable technical installation, thus avoiding over-dimensioning just to beat the 5 hottest or freezing days of the year.

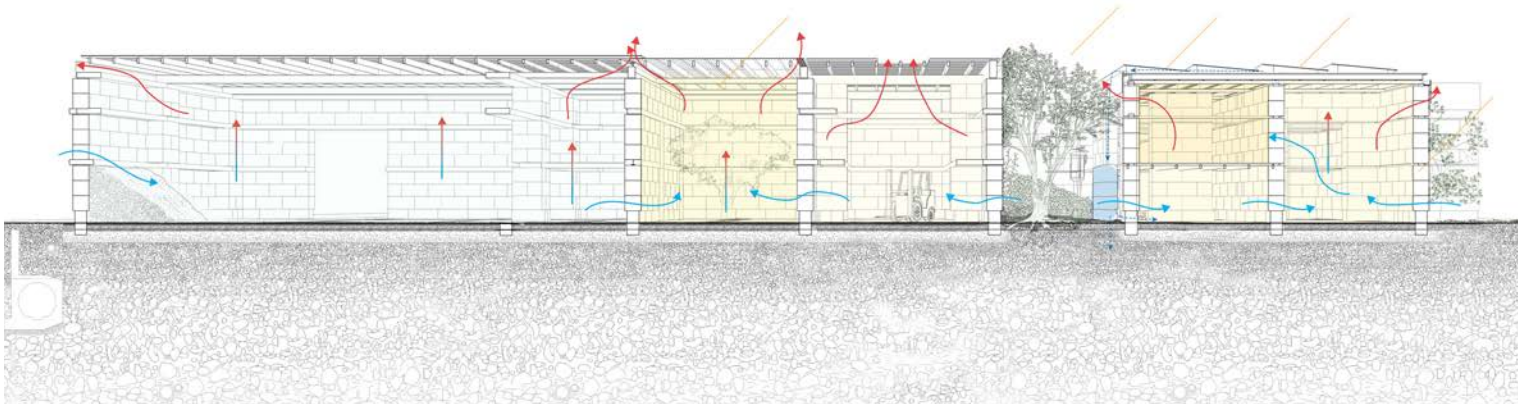
Given these small demands for energy consumption to run the building due to the design decisions we make, we can exclude expensive productive installations such as geothermal. A photovoltaic system can be installed as a vaste roof cover. The electricity could support a minimal heat pump system connected to offices and ateliers as well as (part of) the electric demand of the building. We will research in dialogue with experts, after a better understanding of the productive demand, how we can achieve an energy positive building.

The minimal installation to run the building also has the great advantage to keep a very low operational carbon production, that is the emissions associated with the running of the building and its embodied carbon.

Life expectancy of a straw-bale building
The specific hierarchy of the hybrid facade, between re-use elements and bio-based materials, combined with the proper way to bring them together, gives the building a life expectancy of more than 100 years if the structure and facade are done properly. The distance from the ground and the avoidance of problematic contacts argue for a long life expectancy, since all sides of the building are ventilated. In this sense, there is no separation between the skeleton and the infill. The straw, is light but dense when properly compacted and becomes denser on the surface through the plaster over the years. A restoration or inspection of the plaster should be done every 30 years (which matches the time time concession for this project). The techniques are separate from the whole structure and the integration of electricity and water is done in construction at smart points so that things can always be changed flexibly.

Water management
“A holistic approach to water management can be an emblem for a culture of sustainability.” *

We seek to reuse as much rainwater as possible, or if too much, allow it too infiltrate naturally in the soil. We wish to explore a system that works with gravitational circuits, collecting the rainwater in above ground tanks as to feed the consumers (toilets, maintenance sinks, garden, ...) at ground floor level with minimal need for pumping systems and reducing sewage pipes occupying the soil. We value also the educational aspect of visualizing these networks, encouraging awareness for a sparing use of water resources. As a standard we want to work with water-saving appliances to further reduce the consumption of drinking water.



1) The building cycles of ventilation and water management are kept as natural and low tech as possible to assure a fully functional, productive environment.
2) Ref: Landhouse Heeze, Netherlands, 1944 and still there.

** Quote from: Pfannes, Eva. Paradigm Shift: The City of 1000 Tanks, Chennai, in: The Materials Book, Ruby Press.*