

# GRADUATION REPORT

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Roely Rijkema

MICRO APARTMENTS FOR THE NEW URBANITES

## Woningmarkt Amsterdam kookt compleet over



### 'Huizenmarkt in Amsterdam is oververhit'

De huizenmarkt in Amsterdam toont duidelijke tekenen van oververhitting, stelt De Nederlandsche Bank (DNB) in een vandaag gepresenteerd rapport. Volgens de bank zijn de huizenprijzen alleen in de hoofdstad weer hoger dan voor de crisis.

<https://www.wegwijs.nl/verdieping/longreads/1-februari-huizenmarkt/> (retrieved 16 november 2016)

Een gemiddeld appartement in de stad kost inmiddels 303.000 euro. © ANP

<http://www.parool.nl/amsterdam/woningmarkt-amsterdam-kookt-compleet-over~a4390326/> (retrieved 16 november 2016)

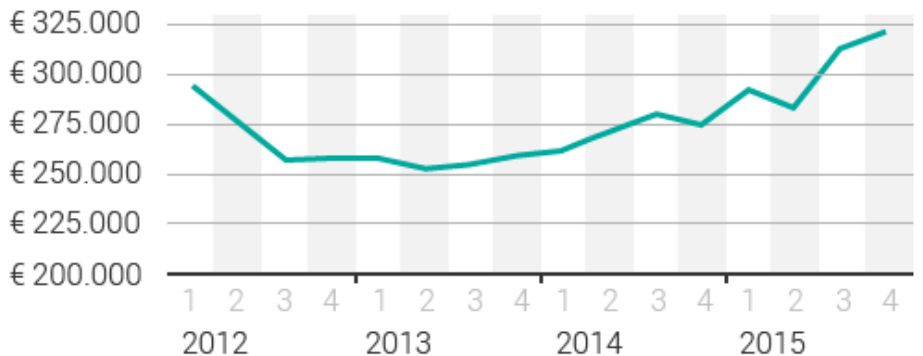
### Het Parool

### Huren vrije sector Amsterdam stijgen steeds sneller



source: <http://www.parool.nl/binnenland/huren-vrije-sector-amsterdam-stijgen-steeds-sneller~a4238705/> (Retrieved on 12 January 2017)

### Huizenprijzen Amsterdam



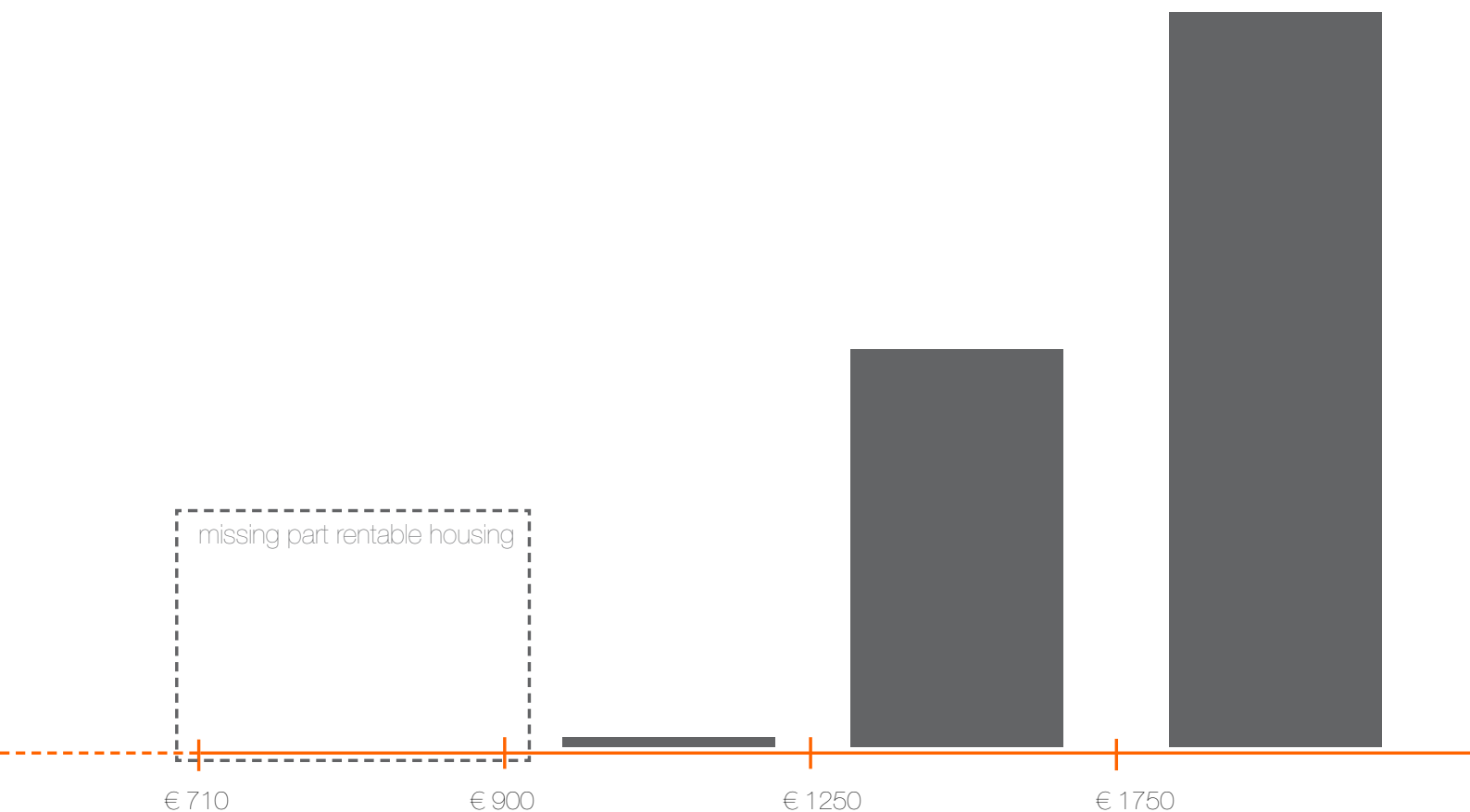
<http://www.ad.nl/dossier-amsterdam/huizenmarkt-in-amsterdam-is-oververhit~a0017daa/> (retrieved 16 november 2016)

## CURRENT HOUSING MARKET AMSTERDAM

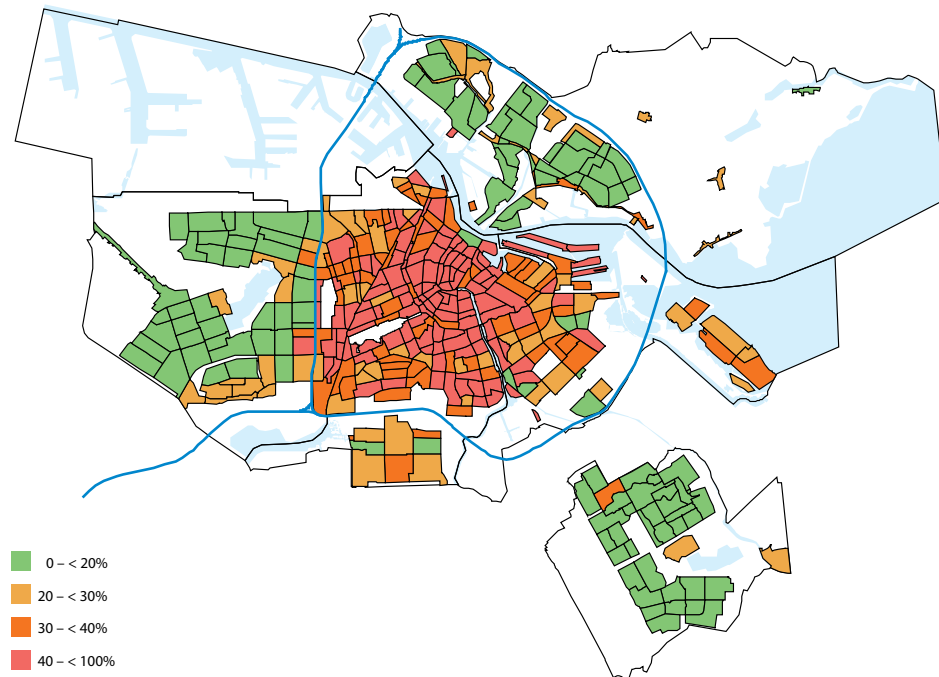
The city of Amsterdam has a lack of affordable housing, the housing prices are exploding. The city needs to be attractive for different groups of people. The prices for a square meter in the city center is around 5000 euro. An average apartment (around 60m<sup>2</sup>) is 303.000 euro. When we look at the rent, an apartment of 75 to 100 square meters will cost as soon more than 2.100 euros per month.

The city needs to be attractive for different groups of people. Eric Brunge of nArchitects, designer of the first micro-apartment building in New York, states; *"It's very important that cities remain affordable. It's not just a question of human right and ethics, it's the only key to a really diverse and vibrant and social and economic resilient city"*.

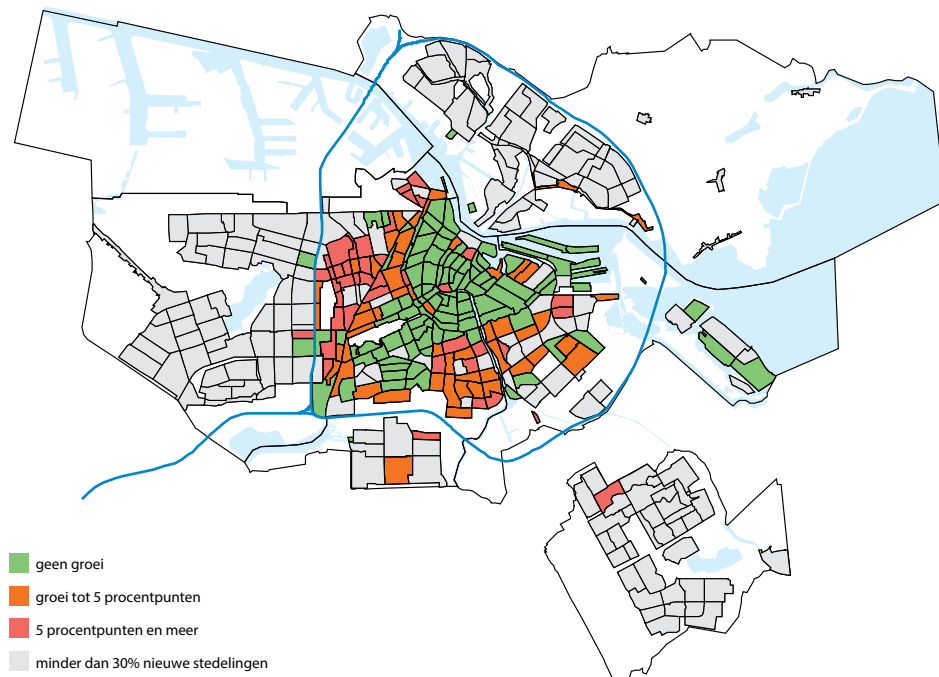
The city of Amsterdam is searching for affordable housing in the inner city, because a diverse range of target groups keeps the city vital.



Number of new urbanites per neighborhood, 2012



Growth of the number of new urbanites per neighbourhood, 2002-2012



## NEW URBANITES IN AMSTERDAM

The group 'Nieuwe stedeling', translate in English New urbanites, is growing in recent years. The municipality of Amsterdam explains them as follow: Persons of Dutch- or other Western origin (excluding Eastern Europe) who come from outside Amsterdam and were 18 years or older when they moved to Amsterdam and are not older than 55 years. This is a growing group of residents in Amsterdam. In the area around the project, the group is more as 40 percent of the population (Janssen M, 2003).

This group has a certain lifestyle; they see the city as there living room, they have a flexible work-and living environment, they see sharing as the new way of owning and sustainability is part of their lifestyle.



The city is there living room, social network close to their home



They have a flexible work- and living environment



Sharing is the new way of owning



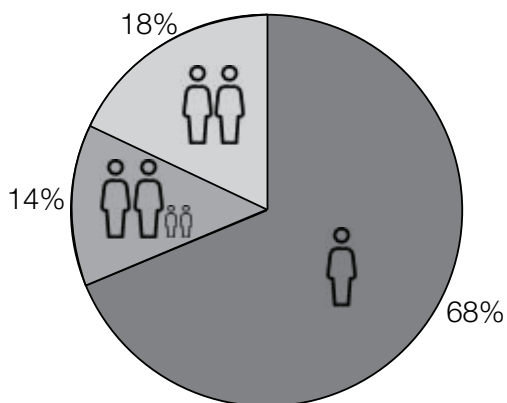
Sustainability is part of their lifestyle



## NEIGHBOURHOOD

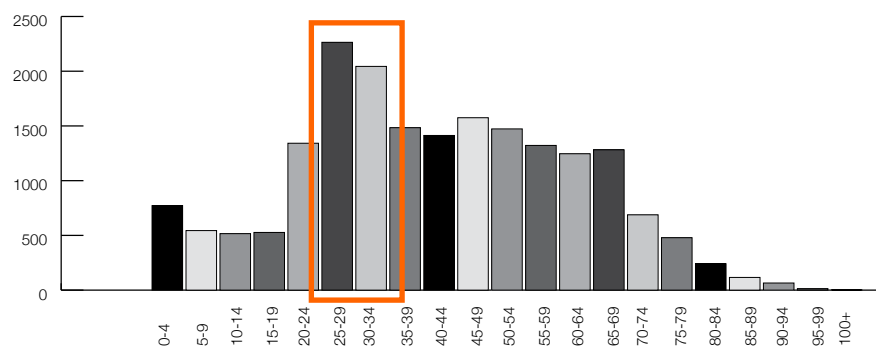
The location of this graduation project is on the west side of the city centre of Amsterdam. In this area, a lot of households (68%) consists of one person. The average home occupation is 1,5 persons per household. By looking at the age of these persons, 26-29 years is most present ( $\pm 2.300$  people, 12%) and 30-34 years is second most present ( $\pm 2.100$  people, 11%).

HOUSEHOLDS (JORDAAN)



Average home occupation = 1,5

AGE (JORDAAN)



Age 26-29 most present

Age 30-34 second most present

## Zijn micro-appartementen in het stadscentrum de toekomst?

<https://vastgoedjournaal.nl/news/17493/57/Zijn-micro-appartementen-in-het-stadscentrum-de-toekomst/> (retrieved 17 October 2016)

## Stad zoekt in 'Tiny Houses' betaalbare woonvormen

<http://hetkontakthardenwijk.nl/lokaal/stad-zoekt-tiny-houses-betaalbare-woonvormen-184904> (retrieved 16-11-16)

### STADS WONEN OP 30M2 OF KLEINER

De opkomst van micro-appartementen

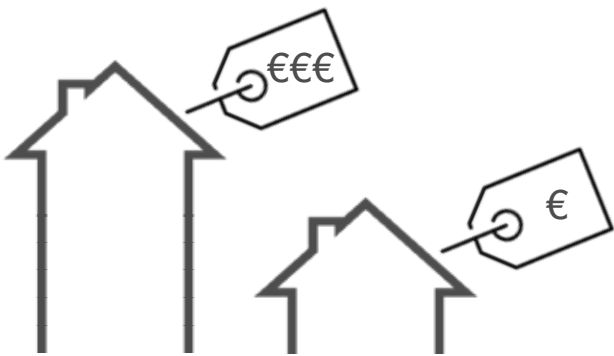


<http://www.residence.nl/interieur/binnenkijken/42645-stads-wonen-op-30m2-of-kleiner/> (retrieved 17 October 2016)



<http://elsevierjuist.nl/12239-2/> (retrieved 17 oktober 2016)





smaller, more affordable



sharing services in the building



sustainable and energy-sufficient



single

or

duo's

## 2 RESEARCH

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The prices of houses in Amsterdam are rising , micro apartment is a solution which I want to research and design in graduation project. Besides this, the growing population of New Urbanites is a suitable target group for these apartments.

The research will be done by analysing existing micro apartments. This is a quantitative study. Case studies are used to explore micro apartments and their amenities. Next to these case studies, a comparable literature research is done. Several articles and magazines are used to get more information about micro apartments and the target group of the building, the new urbanites.

### **RESEARCH QUESTIONS**

1. Which solutions can be used to keep the rent low, but keep the living comfort high?
2. Which smart solutions can be distinguished in micro apartments, in order not to make it claustrophobic?
3. What do the new urbanites need in their apartments or in the building and is simultaneously a valuable contribution to the city?

The main topic for the building is affordable micro apartments. The building will also hold different amenities which the residents share or which are shared with the rest of the city.

### **Method description**

The research will be done by analysing existing micro apartments. This is a quantitative study. Case studies are used to explore micro apartments and their amenities. Next to these case studies, a comparable literature research will be done. Several articles and magazines are read about micro apartments and the target group of the building, the new urbanites.

To get a better idea about micro apartments and their amenities, three case studies are researched. These all three are relevant for the graduation project, this is shortly explained below. After this, the three case studies are explained more precise. Hereby the focus was on the location in the city, the amenities and the dwellings.

### CARMEL PLACE · NEW YORK

nARCHITECTS states that the project is setting a new standard for micro-living. It is a new housing prototype and it has an inventive use of modular construction (source <http://narchitects.com/work/carmel-place/>, retrieved 2 january 2017).

### DE LOFTS 020 · AMSTERDAM

The project is not build at the time this report is made, but it shows a lot of comparisons with the graduation project. The buildings will be built in Amsterdam as a response to the high costs of apartments in Amsterdam. The building will offer small apartments with several amenities on the ground floor. Working and living comes together in this building.

### ZOKU · AMSTERDAM

The architect (Concrete, Amsterdam) explains that ZOKU is Japanese for family, tribe or clan. The hotel is designed for visitors who need a place to sleep and to work for like minded people who want to explore the city and the world. This is one of the reasons I see this hotel as a good case study for the design of my micro apartments, a combination of work and live is made possible in this building. Also the community living in the hotel is an important factor for some design decisions. Besides this, the hotel rooms are small, but have all the facilities you need. The small rooms are a good example of smart solutions.

MICRO-APARTMENTS



*Carmel Place (source....)*



Carmel Place in New York



Carmel Place in New York



glass facade on the ground floor



public gym on the ground floor



communal roof terrace

## PROJECT INFORMATION

	2015
	25-33 m2
	55 apartments
	one or two persons
	€910.77 to €1.423,44

## BUILDING

The Carmel place, also known as My Micro NY, is the winning proposal in the adAPT NYC. This contest was an initiative of the former Mayor of New York. It was a part of the New Housing Marketplace Plan. This plan is made to accommodate the growing small household population of New York. The building is designed with 55 loft-like apartments. The size is between 25 and 33 square meter. The building also has several shared amenities. The architects wanted to arrange a new social network for small households. Hereby they are focusing on the community in stead of the individual residents (source <http://narchitects.com/work/carmel-place/>, retrieved 2 january 2017).

The exterior of the building is repeatable, it exists out of four slices of towers. The towers showing the small dimensions, but not the individual apartments. The architects are stating that the principle can be adapted to several sites, not specific this one in New York. The grey bricks are connecting with the context of the location and legacy of the use of brick in housing (source <http://narchitects.com/work/carmel-place/>, retrieved 2 january 2017).

## LOCATION

The building is close to the East River, next to a small park. It is located in the city centre of New York.





## SHARED AMENITIES



laundrette



storage spaces



working spaces



bicycle storage



lounge



roof terrace



garden (ground floor)

## PUBLIC



gym



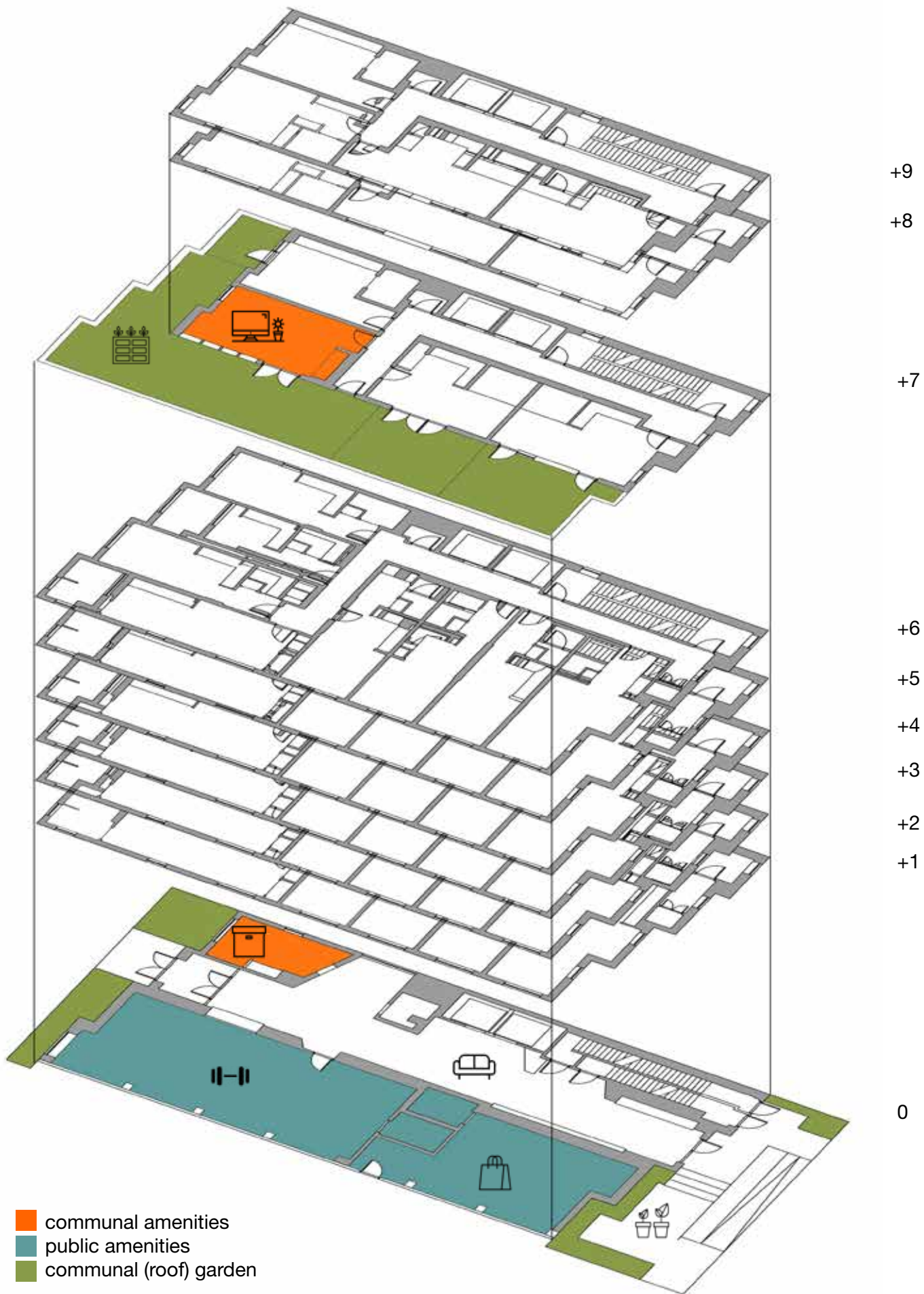
retail

## AMENITIES


The amenities in the building are available to all residents. They are located in the best places in the building. This will attract the residents active to connect to the community. A lobby is connecting the sidewalk on the west with the porch for the residents on the east side. This sunny and over-sized space can be used for several activities. There are also built-in seatings added to the space and a fully flazed gym is visible. The cellar consists of storage and bike storage and laundry for the residents. On the 8th floor more collective activities can be done. Here is a community room and public roof terrace. More communal spaces are dispersed throughout the building. This makes it easier for neighbors to interact.

Next to these amenities for the residents, there is a gym and a store on the ground floor. These can be used by the residents, but is also public for the rest of New York.












## APARTMENTS

-  kitchen (only not in 16m<sup>2</sup>)
-  diner space • workspace
-  living space • bedroom (couch = bed)
-  bathroom

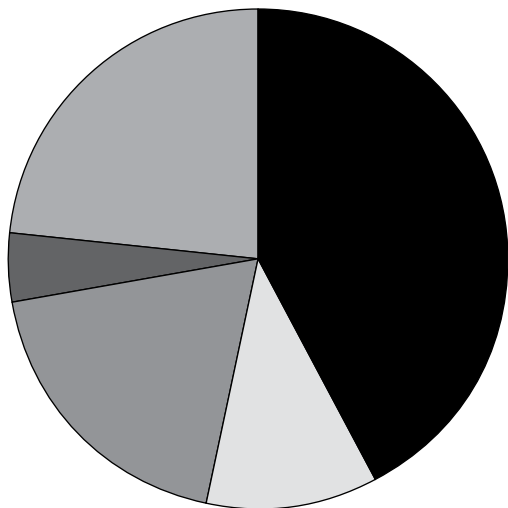
## SMALL SOLUTIONS

-  flexible furniture (storage, coach & bed in 1)
-  extra storage space (also above bathroom)
-  2.95 meter high ceiling
-  2.44 meter tall windows
-  sliding windows
-  Juliet balconies
-  sliding doors

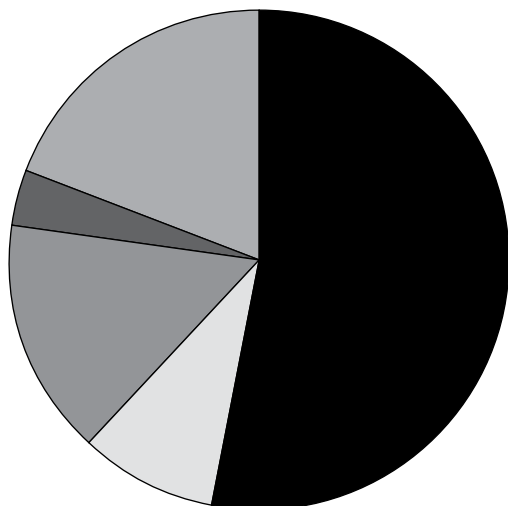
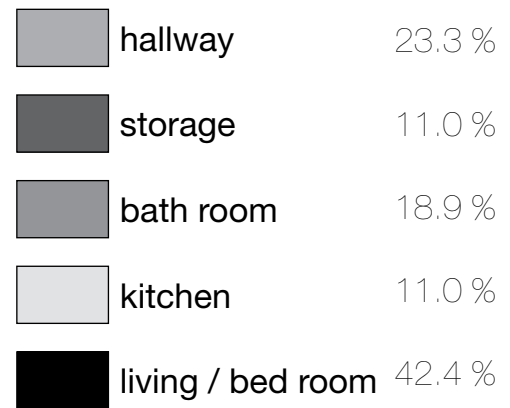
## APARTMENTS

The 55 apartments are divided in rental (22) and market rate (33). Part of the rental apartments(8) are intended for formerly homeless US veterans. There were more than 60.000 applications for the 14 remaining affordable housing apartments. The rest of the apartments are market rate. The rental apartments are provided with furniture. Half of the market rate apartments are including furniture and services. This can be upgraded (source <http://narchitects.com/work/carmel-place/>, retrieved 2 january 2017).

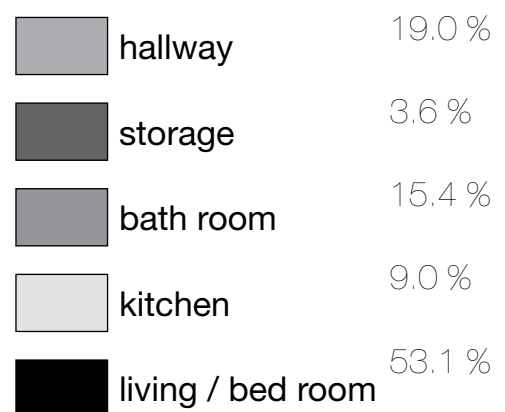
There are five different apartments, which are varying in size and configuration. The difference is mostly visible in the living space. This can differ in depth. The design goal for the architects was to make the interior spacious, comfortable and efficient. Even by using a small footprint. They did not increase the size of the floor, but increased the size of all the other elements of the apartment. The ceiling is 2.95 meters high. The daylight is made possible by sliding windows of 2.44 meters high and juliet balconies. Extra storage space is placed above the bathroom. Besides this, they worked with flexible furniture that integrates a storage, couch and bed in one. Additional furnishing and amenities are provided by a company, called Ollie (source <http://narchitects.com/work/carmel-place/>, retrieved 2 january 2017).



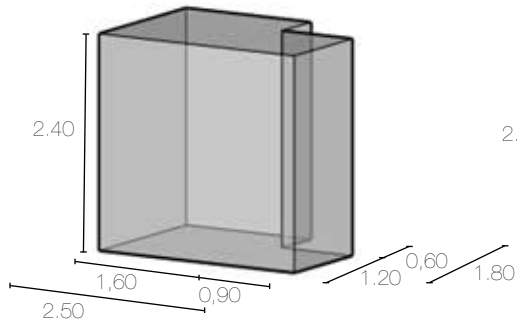
Percentage of functions in the first dwelling



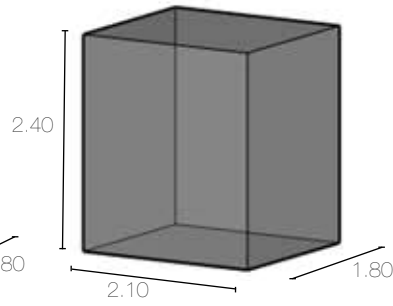
Percentage of functions in the second dwelling



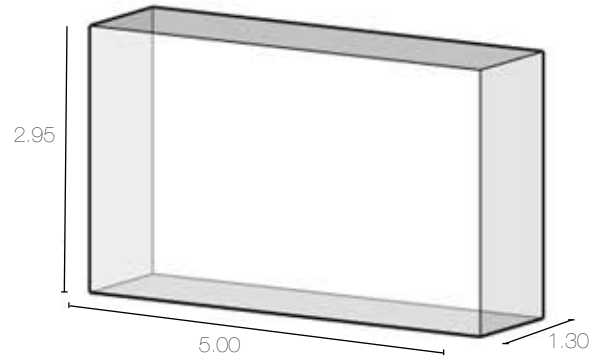
CARMEL PLACE APARTMENT 1 | 28M<sup>2</sup>



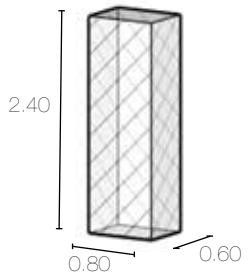
bathroom



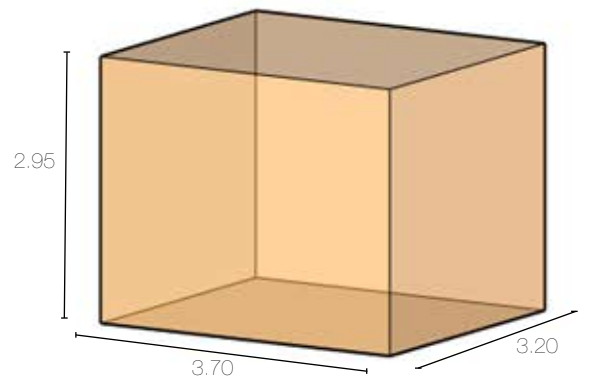
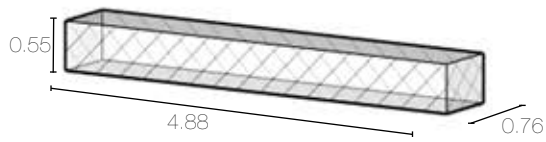
kitchen



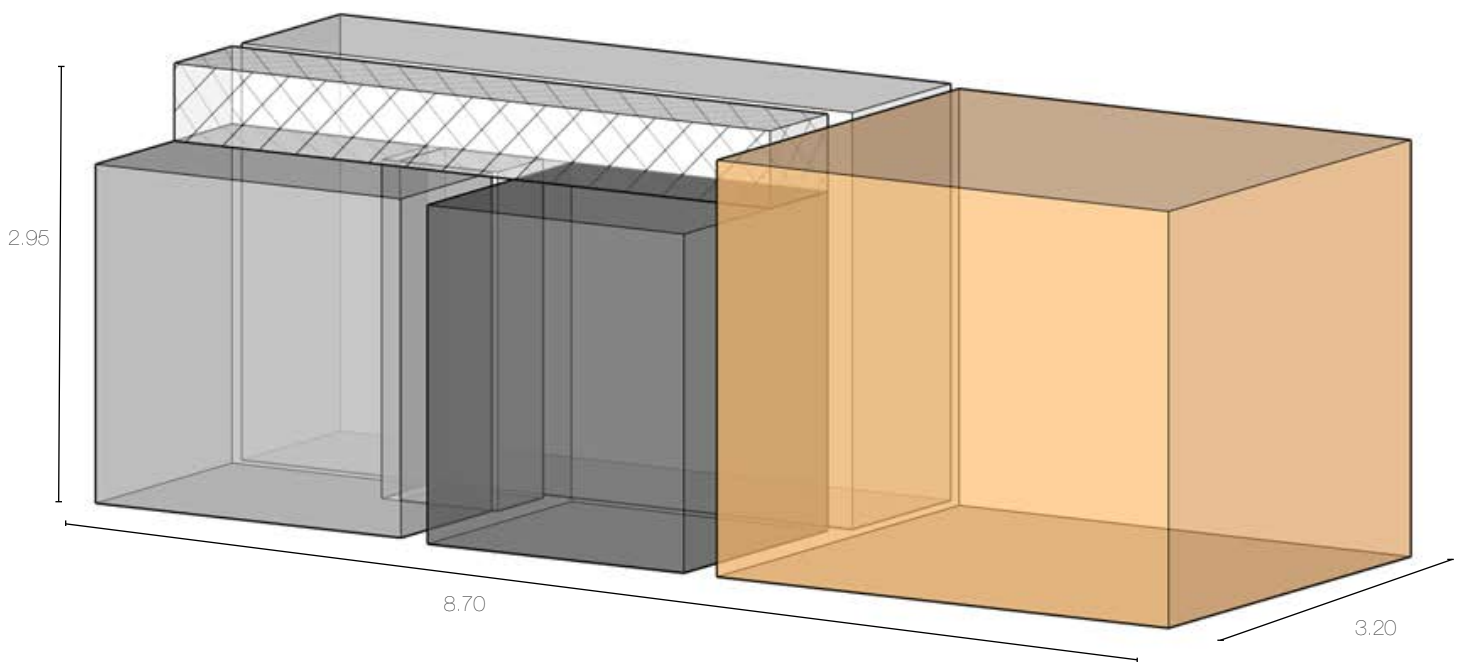
'hallway'



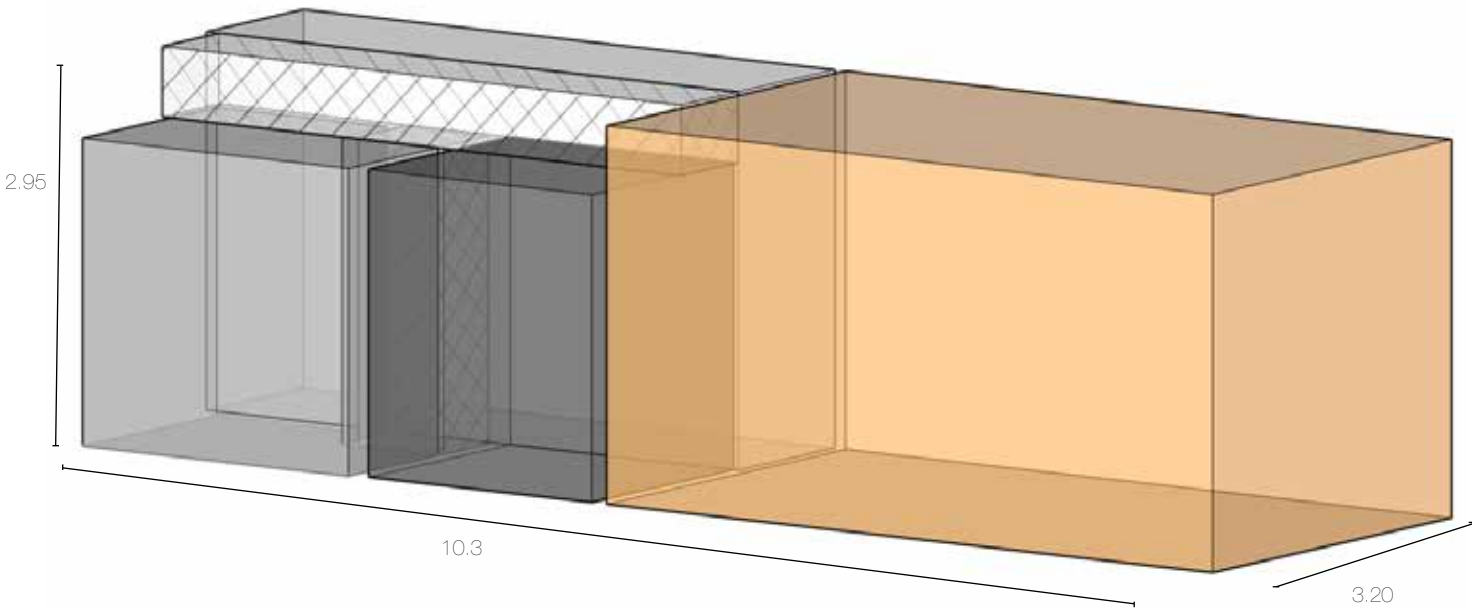
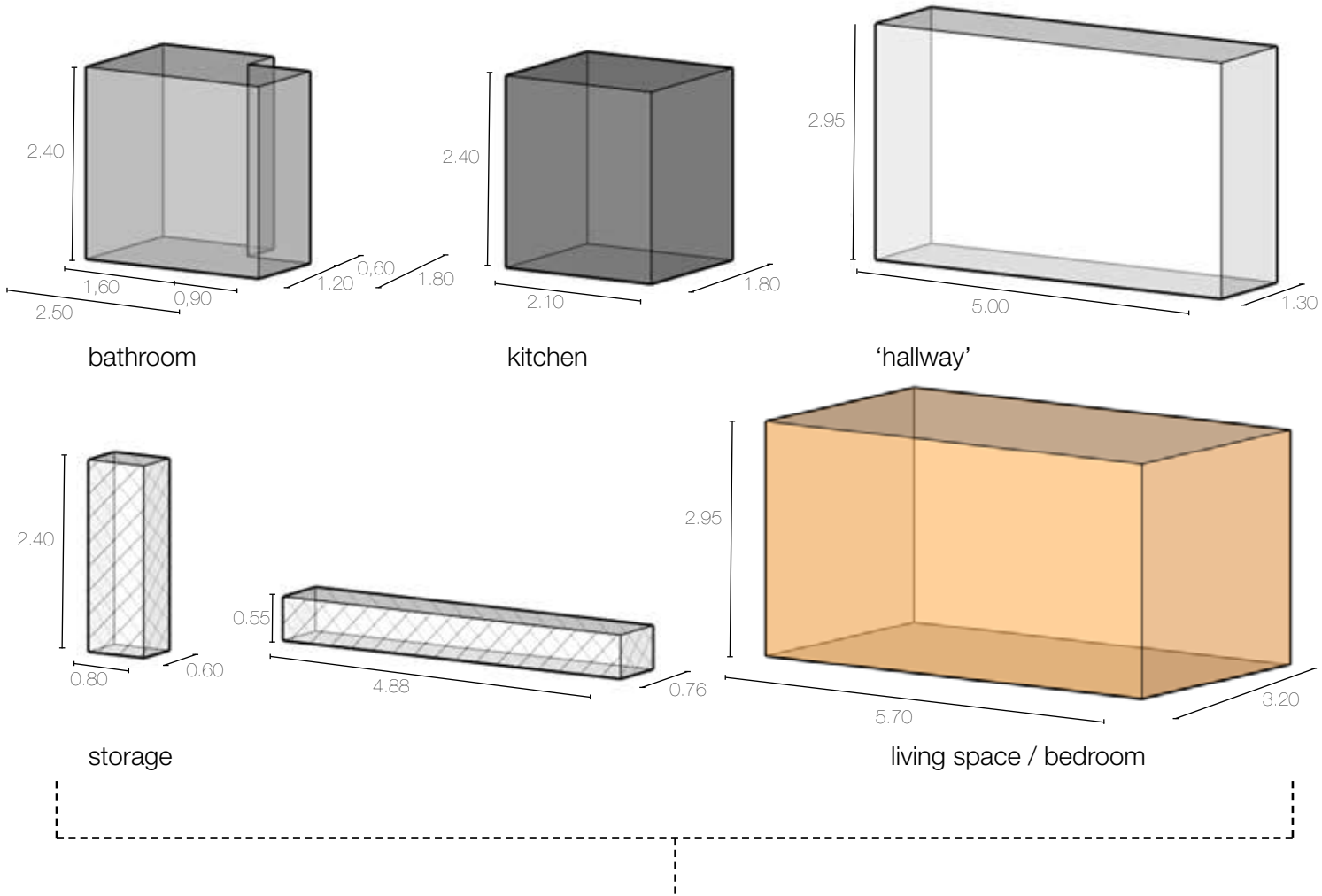
storage



living space / bedroom



CARMEL PLACE APARTMENT 2 | 33M<sup>2</sup>



## SHORT AND LONGSTAY HOTEL



ZOKU hotel





apartment in the ZOKU hotel



'reception' • bar • communal workspace



kitchen for breakfast, brunch, lunch or diner



private meeting space



event space

## PROJECT INFORMATION



May 2016



16, 24, 30 or 46 m<sup>2</sup>



130 lofts



one or two persons



€114,70 to €157,21 per night

## BUILDING

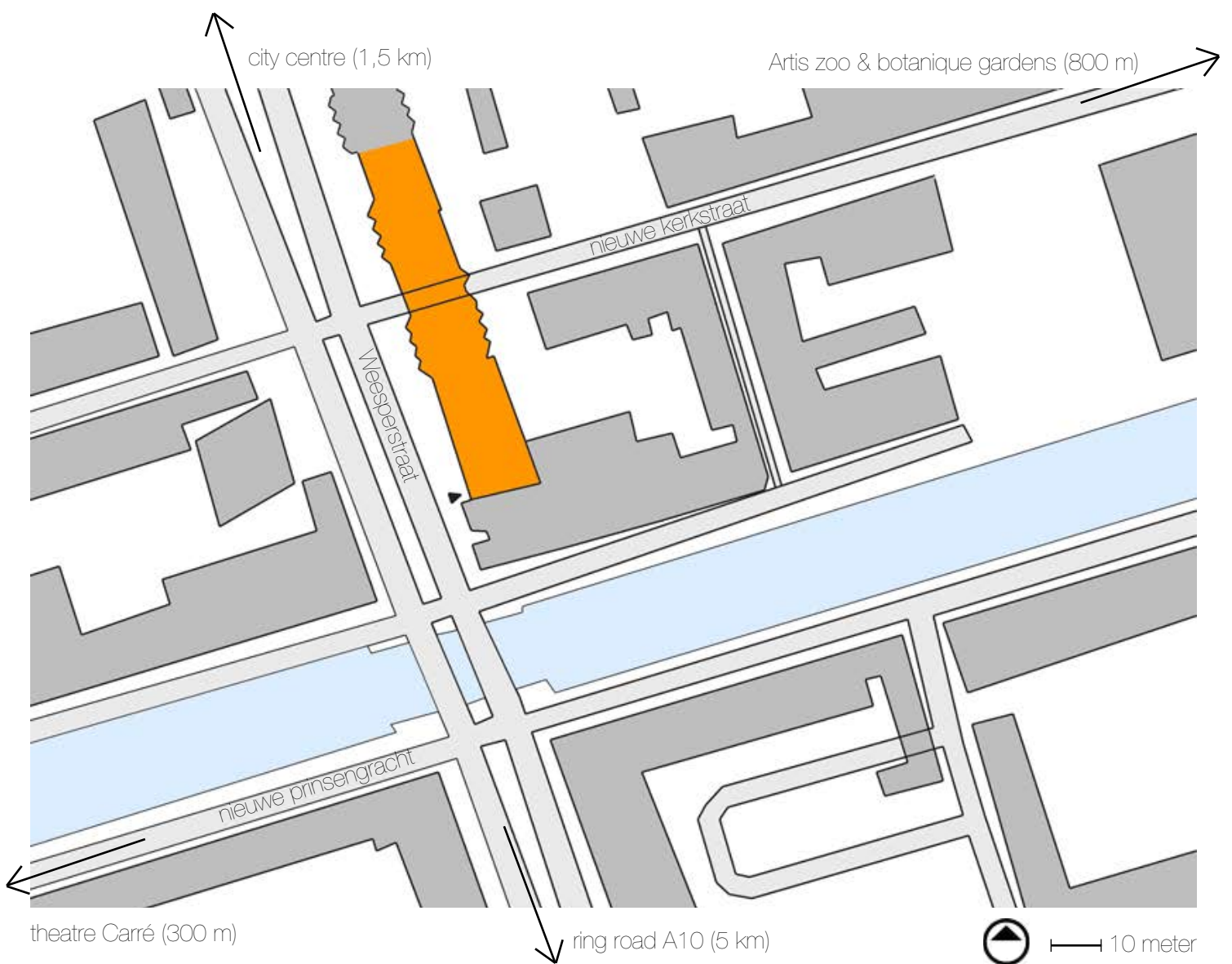
The hotel is situated in an old office building. The building can be divided in two parts. The individual small apartments on the first until the fifth floor and the communal spaces on the sixth floor. Not the bed, but the dining table is the most dominant element in the hotel room.

They use several ways to make the hotel feel like a home and a place to connect with the other visitors. The hotel does not work with hotel employees, but they call them self sidekicks. They have local roots, but are also global orientated. They work at the reception (which is just a informal table), but also behind the bar and arrange the renting of the workspaces on the top floor.



## LOCATION

The building is situated in the area inside the Singelgracht, the old city centre of Amsterdam. The Dam square is around 1,5 km away. The Artis zoo is around the corner even as the theater Carré and the botanique gardens. The ring road is 5 km away.



## SHARED AMENITIES



laundrette



bicycle storage

## PUBLIC



working spaces (small / big, rentable)



bar (also workspace)



kitchen (for breakfast, lunch, dinner)



roof terrace



garden (on the roof)

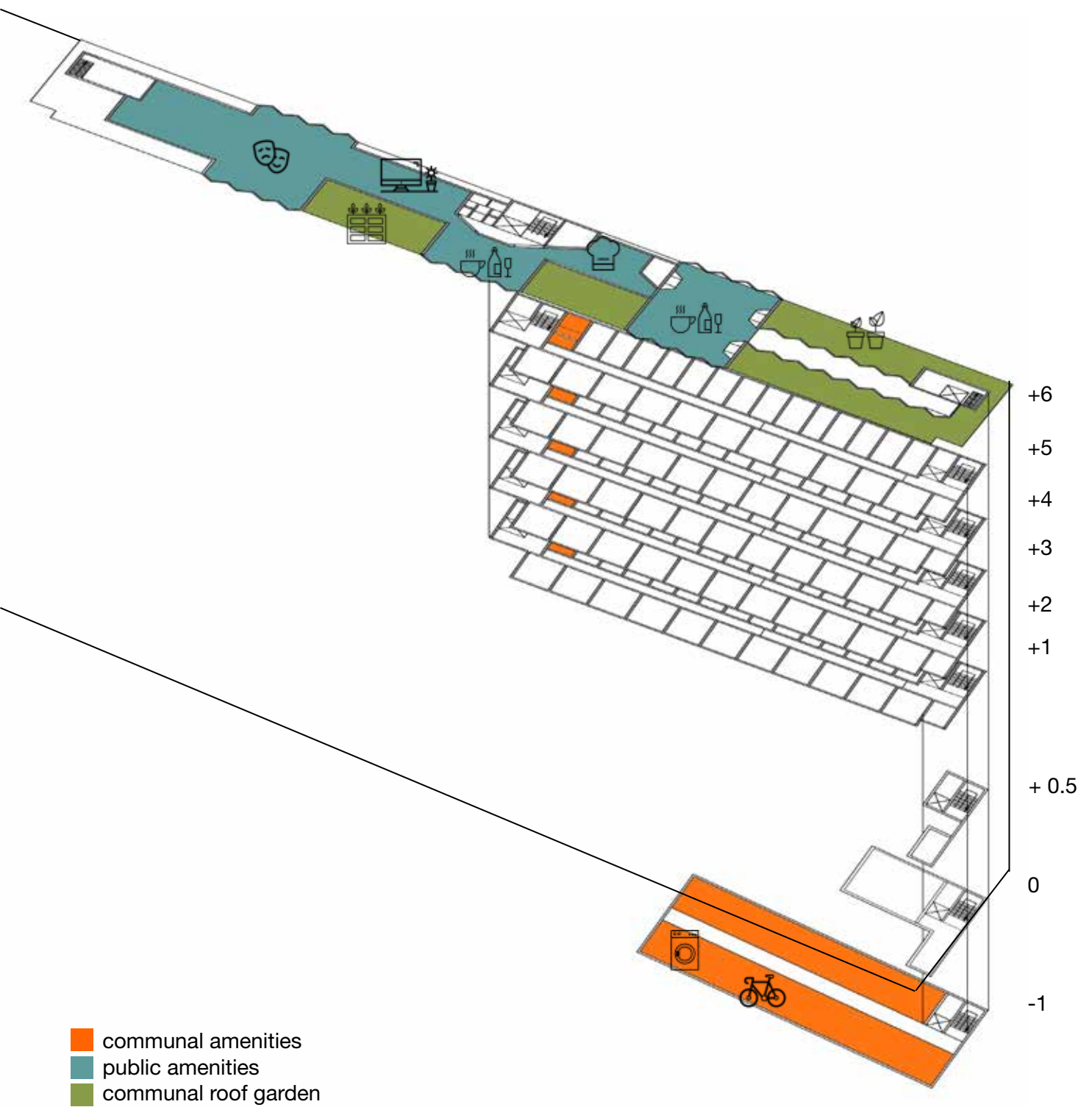


event space

## AMENITIES

On the sixth floor you first pass a long glass hallway before entering the bar. This is a space where people drink coffee or beer, it is also called a living room and library where people work. The big space is divided by storage racks. There is also a space for games or playing music with the instruments placed on the walls. Walking through this area, you find the living kitchen. Here residents and locals can have breakfast, brunch, lunch or dinner. Behind this kitchen is the co-working space. Here the residents or locals can work alone or together. Around this living room, kitchen and working space is a roof terrace. There is also the possibility to rent a private workspace. By passing all these communal spaces, there is an event space.

Besides this communal space, ZOKU offers several services. If the visitor stays longer, the cheaper the services. There is a cleaning service, laundry service, art swap (personalise the wall in your apartment), the office toolbox (printer, TV, notebook, pen, pencils and more to work at your apartment), the possibility for a late check-out, bike renting or extra storage. Besides these services for the apartment, also several services are offered for the workspaces, for example (3D)printing, binding reports, (virtual) assistant to help with extra work, renting of beamers and flip-overs or paper rolls for brainstorming.



## HOTEL ROOMS



bed



kitchen (only not in 16m<sup>2</sup>)



dinerspace • workspace



living space (couch + coffeetable)



bedroom

## SMALL SOLUTIONS



extra storage space (below bed)



high ceiling



big windows



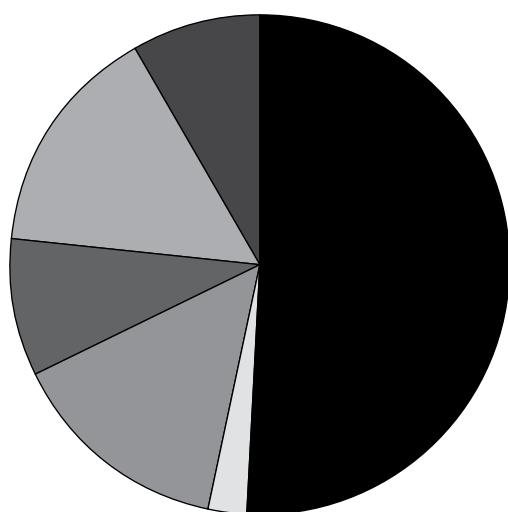
sliding door

## HOTEL ROOMS

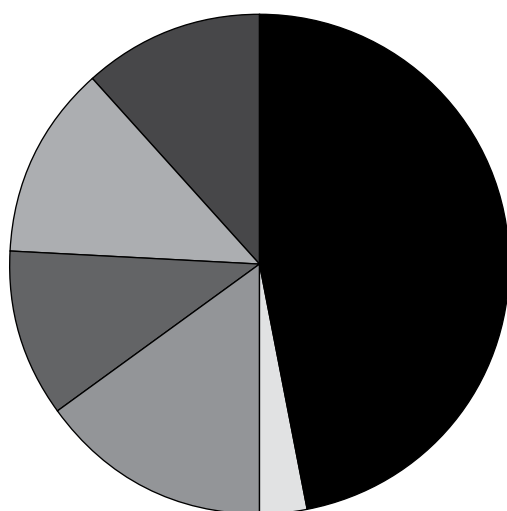
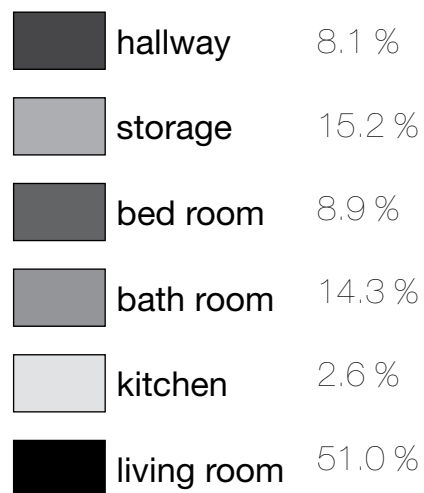
The hotel has 130 rooms, which can be divided in four groups. The loft is 24 square meter, de loft XL is 30 square meter, the loft XXL is 46 square meters and has two bedrooms and the ZOKU room is 16 square meter and does not have a kitchen. Some people stay for just one night, some every Monday night for a couple of weeks or they stay for three months. The hotel wants the people who stay for a while on the same floor.

All the rooms have a king size bed, which is placed above storage space. There is no flexible furniture used. The bed can be shielded from the living room.

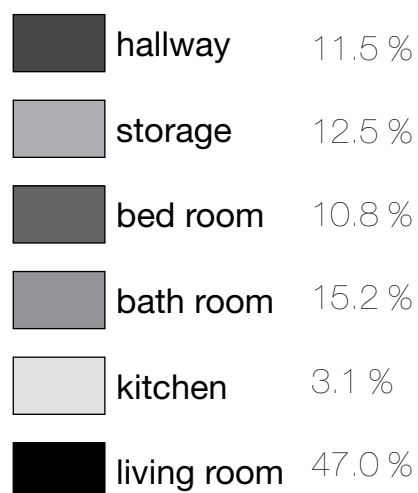
When there is a need for a bigger pan, or the visitor wants to clean the room, this is possible. There is a pantry on every floor which has several items, like a vacuum cleaner, big pans and more. These are all tools which you do not need everyday and uses much space, so the floor can share this. Besides this, the room can be made more personal, with the exchange of paintings. An 'Art Swap' is placed on every floor.



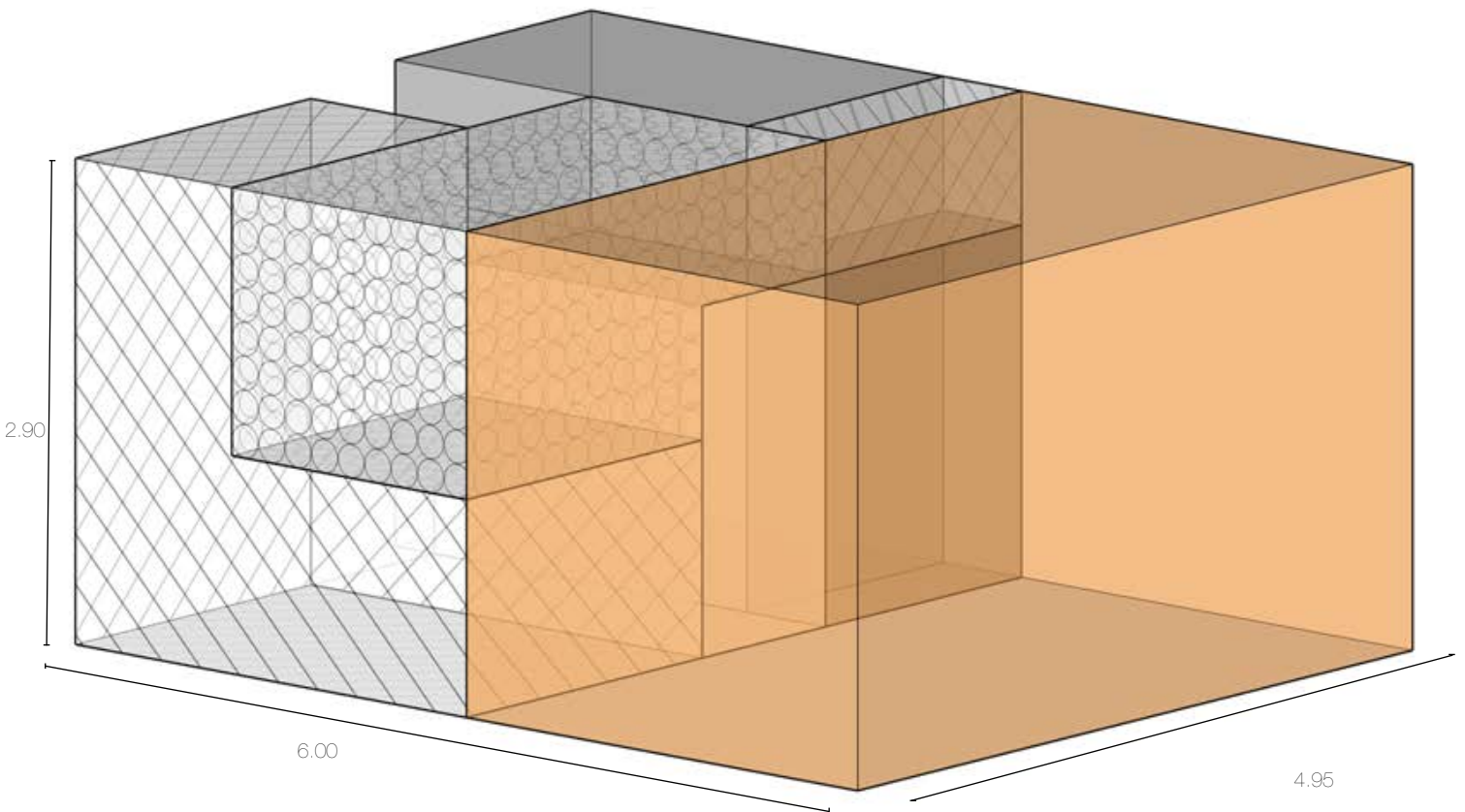
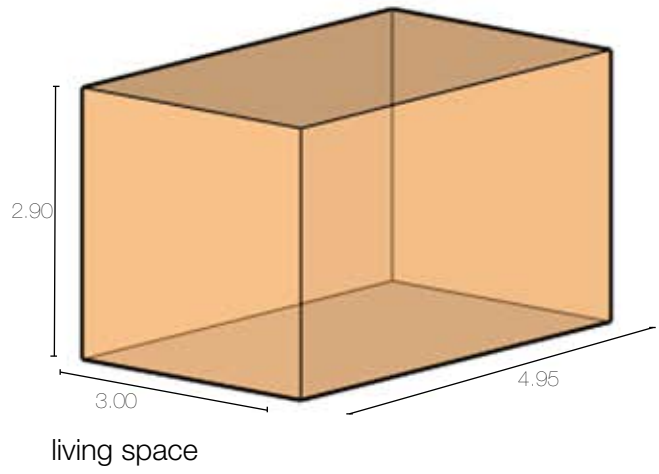
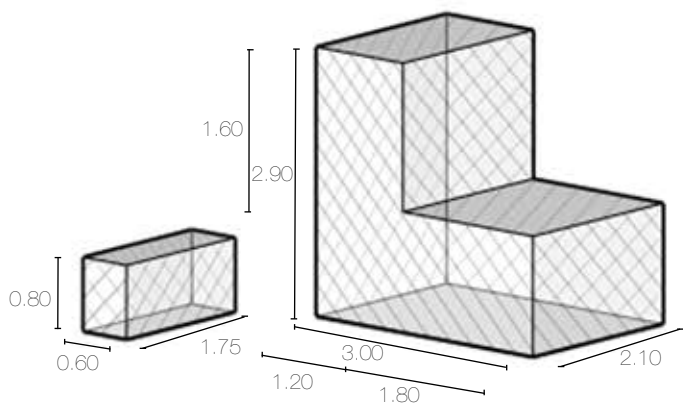
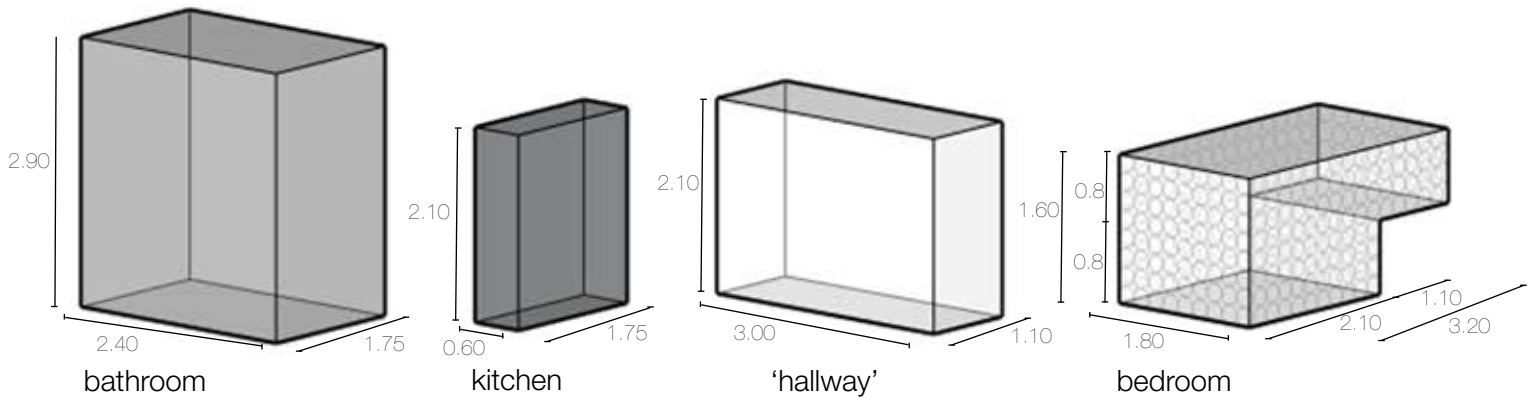
Percentage of functions in the first dwelling



Percentage of functions in the second dwelling

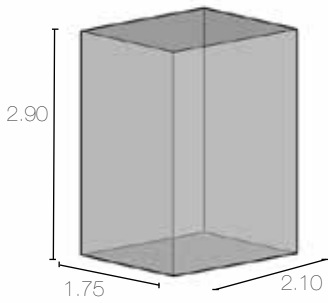


ZOKU APARTMENT 1 | 30M<sup>2</sup>

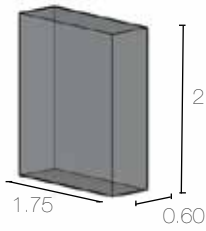




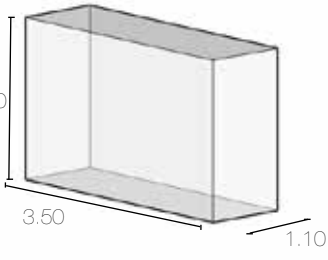
ZOKU APARTMENT 2 | 25M<sup>2</sup>



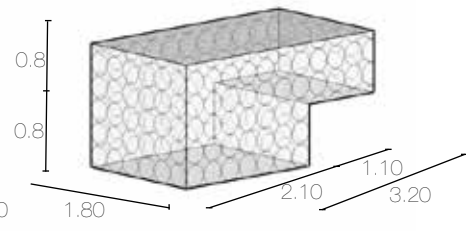
bathroom



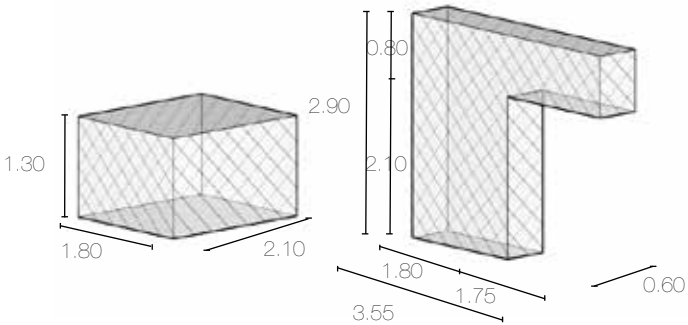
kitchen



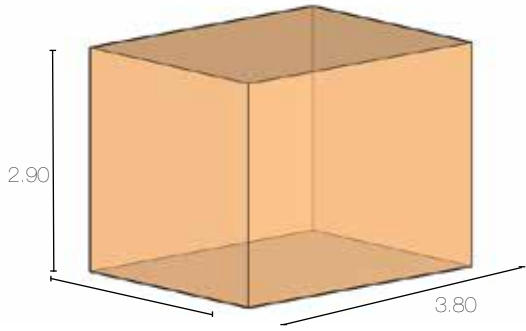
'hallway'



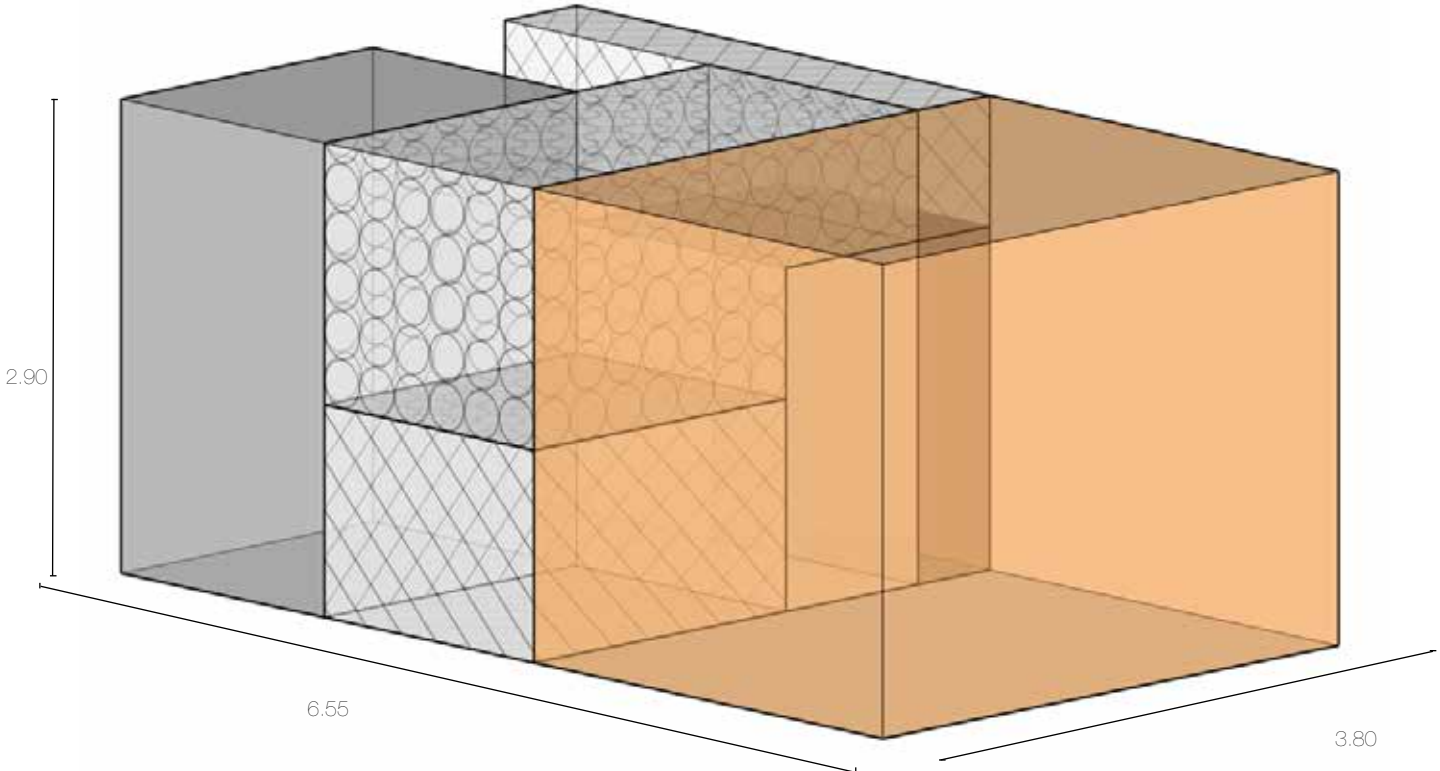
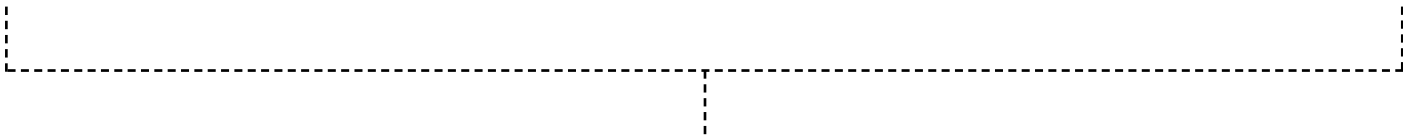
bedroom



storage



living space



MICRO APARTMENTS







dwelling in de Lofts



entrance of the building



communal roof terrace



bar • workspace

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## PROJECT INFORMATION

	2017
	31, 38 or 43 m <sup>2</sup>
	212 compact apartments (studio or 2 rooms)
	one or two persons
	€700- €900 per month

## BUILDING

The building is new built and has 212 apartments with several amenities on the ground floor. The apartments are for one or two persons and have a size of 31, 38 or 43 square meter. The bigger apartments are situated on the corners of the building, these also have a greater view (<http://www.delofts020.nl/de-lofts-amstelkwartier/> retrieved 3 January).

The building is built for ambitious millennials, people with birth years between early 1980s and mid 1990s. The building is a response to the demand for suitable housing for this group. Within the Amsterdam ring, the supply of medium-priced housing for this group is very limited. The designers are stating that the building is offering a perfect solution for the flexible, qualitative high and dynamic lifestyle of the millennials. (source: <http://www.delofts020.nl/>, retrieved 3 January).

To give the building a more international look, the windows are inspired by lofts in New York. (<http://www.delofts020.nl/de-lofts-woningaanbod/> retrieved 3 January). The buildings looks less high because the facade has a raster around two apartments which are above each other.

### LOCATION

This buildings is next to the road-ring of Amsterdam. Next to the water of the Amstel and the Weespertrekvaart. It is easily accessible by public transport. It is 15 minutes by bike to go to the city centre and two minutes by car to the A10. The surrounding area is in development to change into an area with much more dwellings. (<http://www.delofts020.nl/ligging/> retrieved 3 January)



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## SHARED AMENITIES



laundrette



bicycle storage



roof terrace (around 200 m<sup>2</sup>)



parking garage

## PUBLIC



commercial space (groundfloor)



library with work spaces



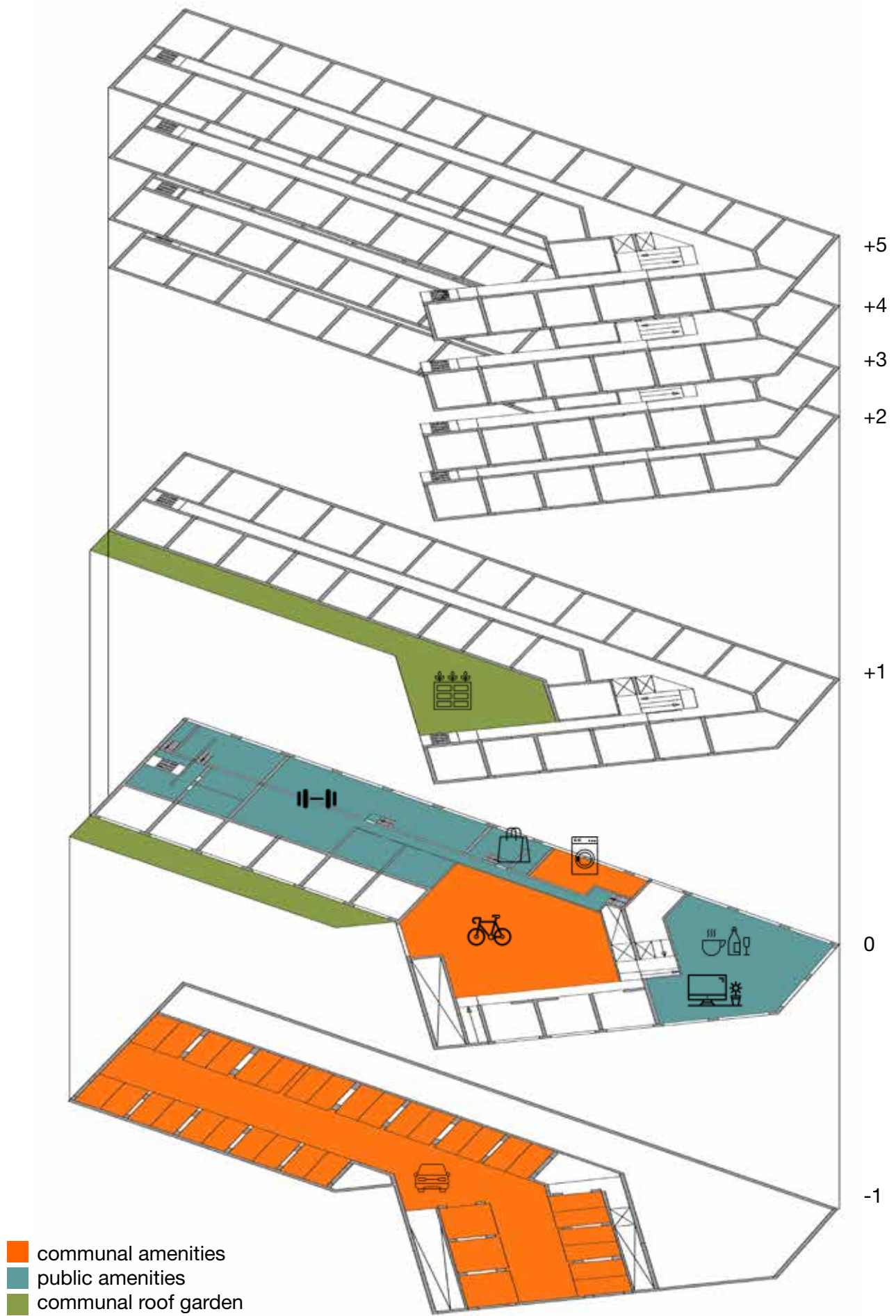
sport - space (yoga, CrossFit)



restaurant (with workspaces)

## AMENITIES

The ground floor of the building has several communal spaces, like a 'livingroom' to meet or study, a library with workspaces and a laundry. There is a room designed as room to do sports, like CrossFit or other activities to relax. On the roof of the building the residents can use a communal terrace (<http://www.delofts020.nl/de-lofts-amstelkwartier/> retrieved 3 January).



## APARTMENTS



bed



kitchen



diner-, workspace (table + chairs)



storage space



living space (couch + coffeetable)



bedroom

## SMALL SOLUTIONS



extra storage space (below bed)



high ceiling



big windows



sliding door



bay window

## APARTMENTS

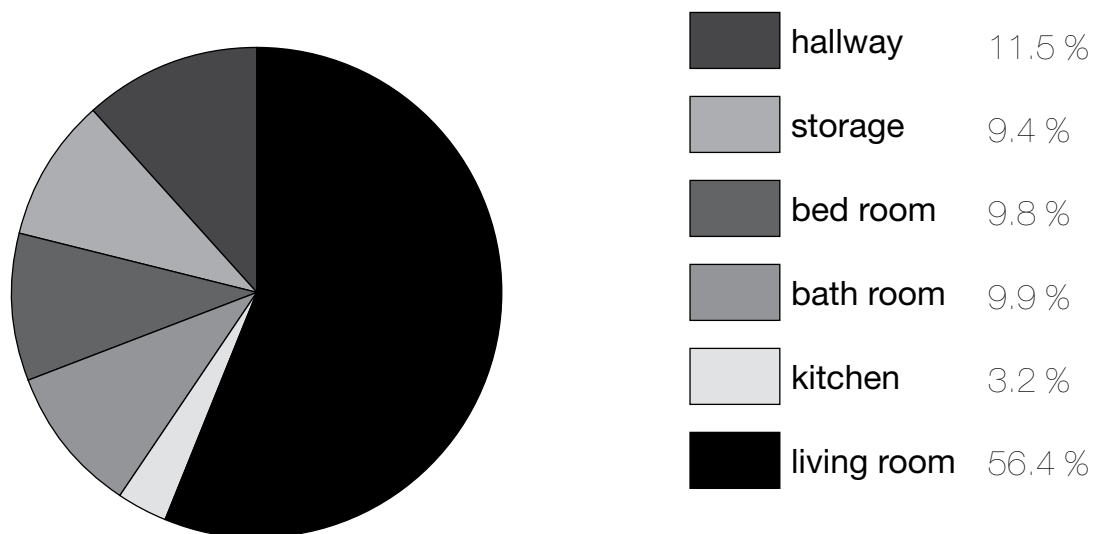
The apartments have a complete kitchen and bath room and the floors and wall are delivered finished. Also window decoration and storage space is present.

There are three types of apartments, all have floor, wall and window decoration, storage space and steel sliding doors. The new resident doesn't have to do jobs in the apartment before living there.

(<http://www.delofts020.nl/de-lofts-woningaanbod/> retrieved 3 january).

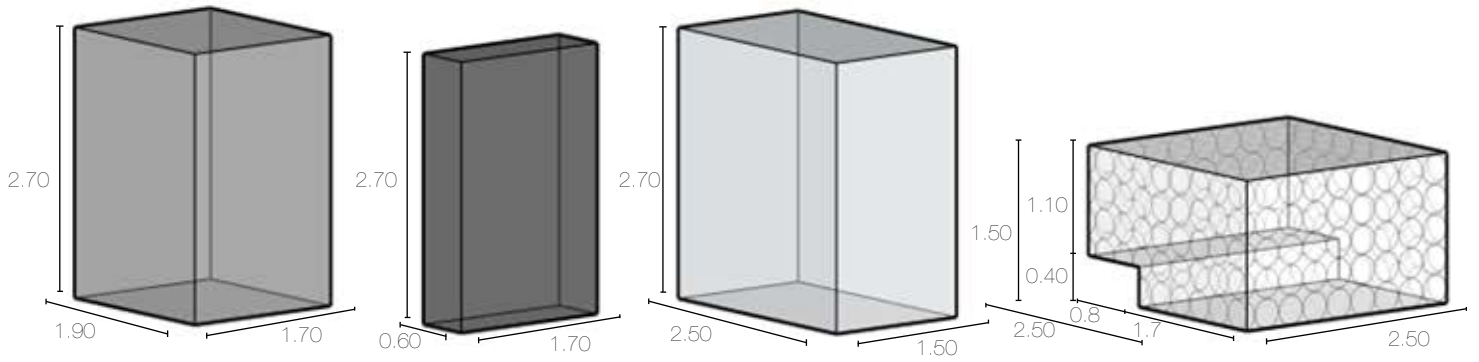
The type which is researched for this report has a fixed stair in the dwelling which is guiding you to the bed located above storage. The kitchen is





Percentage of functions in the dwelling

DE LOFTS APARTMENT 1 | 32.5M<sup>2</sup>

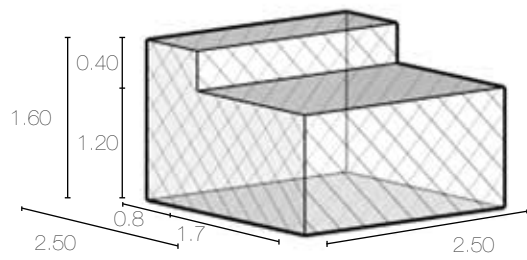


bathroom

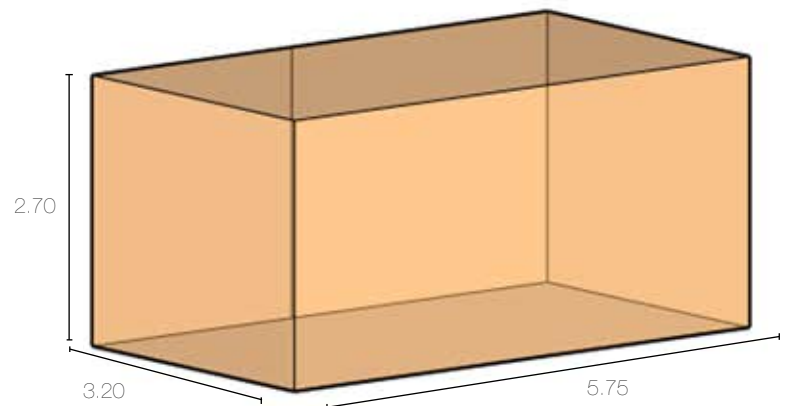
kitchen

'hallway'

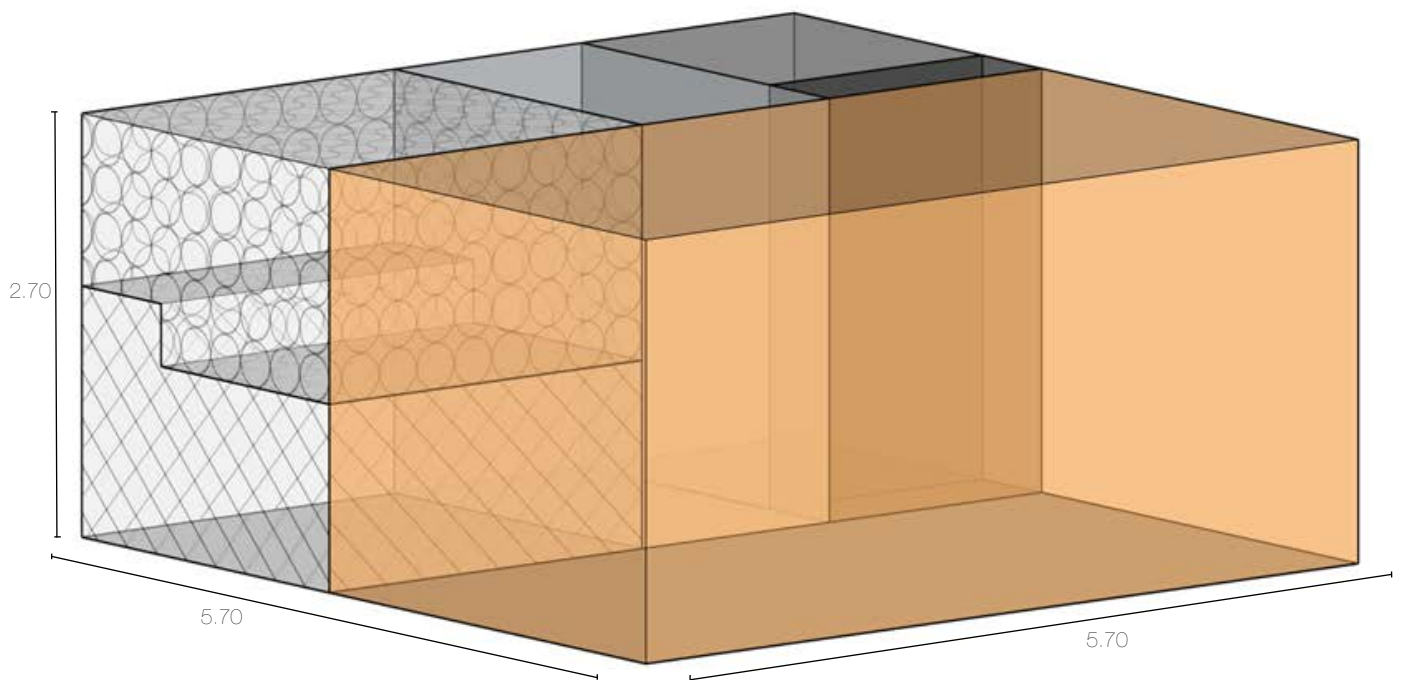
bedroom



storage



living space







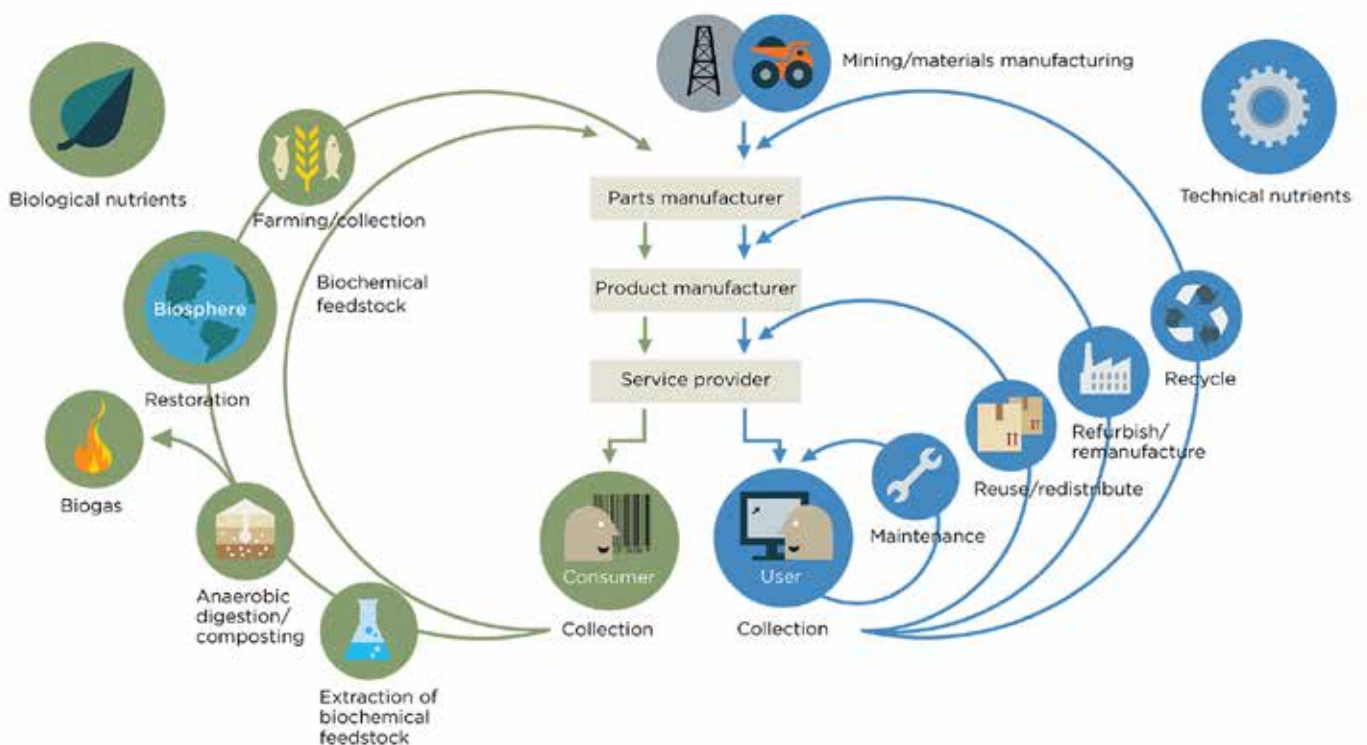


### 3.1 What is circular economy?

The concept of circular economy is inspired by nature and the cyclical manner in which it functions. An example of this is a tree. The tree uses water and nutrients from the soil and solar energy to grow, nourishes other life forms and provides them with oxygen, and its waste gives nutrients back to the soil. This concept is manufacturing not linear but circular (*Ellen MacArthur Foundation, 2012*). Other concepts, like performance economy, natural capitalism and cradle 2 cradle are closely related to circular economy (*Rau T., Oberhuber S. p82*).

The diagram below shows the Circular economy by the Ellen MacArthur Foundation. To keep the products or parts of the products usable for a longer timespan, there are several ways to keep them in the circle, in a biological or technical way.

To understand how circular economy can be applied in a building, three buildings are researched. A text explains every building and the circular solutions applied in the building are assorted. After this, 'products as a service' is explained and the growing appearance of the shared economy. This chapter will end with the application of circular economy in the graduation project.



Circular economy by the Ellen MacArthur Foundation (*Ellen MacArthur Foundation, 2012*)



## 3.2 CASE STUDIES

### 3.2.1. OFFICE ALLIANDER | DUIVEN

The office of Alliander in Duiven is built by Rau architects. The concept exist of keeping and adjusting the existing building in a economical, aesthetic and ecological way. The office has space for 850 flexible workspaces for 1550 employees (Rau Architects, n.d.). The office was separated in six buildings, in the new design these buildings are connect-ed by a big atrium. In the atrium between the buildings, there are designed bridges, a coffee-bar, a restaurant, and spaces to work. By building the office, eighty percent of the existing material is recycled (De ingenieur, 2015).

The building is striped and the foundation and casco were held. The façades were getting new windows and waste wood is used a new material on the facade. Old fa-cade material can be found in the pavements around the new complex. Ceiling ele-ments and toilets are cleaned and recycled. Tabletops are reused as separation walls and the fittings of the lamps are made of cross-sectioned high voltage insulators. Old working-clothes of the office employees are use as cotton fibre insulation material and the chairs in the restaurant are made of plastic bottles. Next to the foundation and the original casco, the building is demountable. These elements can easily be recycled (De ingenieur, 2015).

Because Alliander is a energy-firm, it had big requirements for the energy-use; they wanted to be energy neutral. For this, they using solar-panels on the parking and on the warehouse. In total they have 9500 m<sup>2</sup> surface, which will yield around 1500 MWh per year. Besides this, there are also wind-turbines with heat and cold storage. The atrium will be kept warm with the heat coming from the office by using a small overpressure in the offices. The building in the middle of the atrium is covered with plants to get a cooler and more fresh air and rainwater is collected for the plants, the sprinkler installation and flushing of the toilets (De ingenieur, 2015).

The surplus of energy is shared with the surrounding companies. When building the complex, raw materials and the reused materials are documented in a material passport (De ingenieur, 2015).

#### SMART CIRCULAR SOLUTIONS

- reuse of several products. Namely the foundation, casco, tabletops for interior-walls, facade elements for pavement, steel casco for an extra floor, ceiling-elements and toilets, waste wood for façades, fittings of the lamps, workers-clothes for insula-tion-materials and plastic bottles for chairs.
- all new elements are demountable
- used materials are documented in a material passport.
- flex-working, so no unused spaces.
- collecting rainwater for the plants, sprinkler installation and flushing of the toilets.
  
- solar panels and wind-turbines on parking and warehouse
- heat and cold storage
- green façades in the atrium



*The new office of Alliander, with waterbuffer in front (De ingenieur, 2015)*



*The Atrium with waste wooden facades (De ingenieur, 2015)*



*Solarpanels on the parkings spaces (De ingenieur, 2015)*



*Workspaces in the atrium (De ingenieur, 2015)*



*Bridges between the buildings (De ingenieur, 2015)*

## 3.2.2 TOWN HALL | BRUMMEN

The town of Brummen wanted a semi-permanent location for around 20 years. Rau architects made a design of which the materials can be reused after demolishing the building. The building is a monumental building which is expanded with a u-form two layer building. The function in the building is a mix of team workspaces, open and closed offices and meeting-spaces (De Architect, 2017).

This is the first building of which a material passport is made. By designing the building, the different actors thought about the demountable elements. The valuable raw materials and building elements are taken back by their suppliers and manufacturers after the 20 years of use. At the end, more than 90percent of the design is demountable. Next to these materials, the architects also made the building flexible to divide (Rau Architects, n.d.).

### SMART CIRCULAR SOLUTIONS

- reuse of the monumental villa and gabions of stone of the old building
- passive sunshades
- demountable wooden structure
- c2c facade panels
- c2c floor carpeting / bamboo floors
- counter made of cardboard
- flexible space lay-out
  
- green facade
- three layers of glass
- led-light and presence detection
- maximum daylight in the building
- moss-sedum roof





*Design of the townhall in Brummen (Rau Architects, n.d.)*



*Entrance of the townhall (Rau Architects, n.d.)*



*The atrium in the townhall (Rau Architects, n.d.)*



*Backside toward park (Rau Architects, n.d.)*



*New building around the old villa (Rau Architects, n.d.)*



### 3.2.3 TEMPORARY COURT | AMSTERDAM

The temporary new building of approximately 5,400 m<sup>2</sup> and together with the existing E and F towers, it forms the temporary court. The building will hold a large part of the court cases for about five years. In the meantime, the new permanent resettlement is being developed (DPCP, 2015).

Due to social responsibility, the Rijksvastgoedbedrijf sets high demands on the prevention of waste. As a major selection criterion, the prevention of waste and the maximization of the residual value of the building was important. The winning proposal of DPCP is consistently looking for possibilities for reducing, reuse and recycling of materials on every scale in the entire building. Besides this, they use donor materials as much as possible, which minimizes the waste. At the end of the period of use, the building is completely reusable at a different location (DPCP, 2015).

#### SMART CIRCULAR SOLUTIONS

- total building is demountable
- use of donor materials
- recycling of materials on every scale in the building
- flexible space layout



Entrance temporary court Amsterdam(Cepezed , n.d.).



Court (Cepezed , n.d.).



Lobby (Cepezed , n.d.).



Offices (Cepezed , n.d.).



lobby (Cepezed , n.d.).



### 3.3 Product as a service

Thomas Rau has the opinion that we have to look different toward the ownership of products. By arranging that we no longer have to own products to use them. Only this can ensure that we no longer consume material, but only use them (Rau T., Oberhuber S. p11). In 2010 Thomas Rau started with Sabine Oberhuber the architecture firm Turntoo; The first organization in the Netherlands that focuses on the ideal of the circular economy and the development of business models which ensure that valuable raw materials are no longer lost (Rau T., Oberhuber S. p13).

At the moment, the buyer has to deal with the responsibilities of a problem the producer is making on purpose, without asking for it. The producer is causing this problem as a solution for its own problem; the finality of his earnings model (Rau T., Oberhuber S. p41). Thomas Rau has the idea of making a product a service. In the new economic model the consumer is not buying the product, but is just taking its performance (Rau T., Oberhuber S. p49).

There is already a similar trend in the manufacturing industry, namely servitisation. This is the changing process where service is the foundation of a manufacturing company and businesses are increasingly earning more money with services.

The idea of Thomas Rau is to have long-term responsibilities to stay viable (Rau T., Oberhuber S. p91). On the next page are examples of this 'product as a service'. A note at this leasing process, leasing parts of a building is not possible through the legislation in the Netherlands at the moment. The owner of the building is responsible for the facade. Leasing is a financing model, but this is not possible with all the elements in a building at the moment.



## FACADE

In 2016 the TU delft started a pilot project about leasing a facade. A research team within the faculty of Architecture and the Built Environment is developing a business model for this. In this model, the client is no longer the owner of the building components, but is leasing them from the producer. Long-term service contracts are used for this. The producer is still the owner, so if the consumer does not want to lease anymore, they can take of the elements and they can recycle the product. This business model is optimizing the reuse and recycling of components and materials within the construction industry.



## LIGHT

Thomas Rau is telling in his book 'Material Matters' about the business model called *Light as a service*. He wanted lighting for his architecture office and asked Philips for light. Rau wanted not to pay for the lamps and electricity, but just the service of having light. The architectural office was the first one who get light as a service. Philips was able to install less lamps and thought about technical solutions to reduce the energy requirements to a minimum. The energy bill of the architecture firm was declining with more as 44 procent. Now Philips is promoting this business-model as *Circular Light* (Rau T., Oberhuber S. p89).



## WASHINGMACHINE

Households in Europe are owning more washing-machines than cars. While cars are less standardised than washingmachines. Costumers can choice between a big scala of models and performance, but they have similar components. The use of these machines is much different, a singleperson household is using it around 110 washing cycles, while hotels or laundromats are using it 1,500 to 3,000 cycles a year. A regular washingmachine can be used around 2,000 cycles, while high quality machines can be used upto 10,000 cycles. The breakpoint of these machines are known, this is mostly the motor, the pump, and the plumbing (Ellen MacArthur Foundation). This is something the producers of the washing-machines 'made'. If the machines should life longer, the consumer does not buy a new one and the producer does not get any money anymore.

To change the business model into a concept with the producer as responsible owner of the machine, the 'game' is changing. The consumer is leasing the washing-machine, so he does not have responsibility about the machine anymore. The producer will repair the machine and will replace it when needed. The old machine can have parts which are useful for another machine, so the materials are not wasted. It is optimizing the use of materials, components can be recycled or reused by the producer.



### 3.4 APPLICATION IN THE BUILDING

Research question:

'How can circular economy be integrated in a building which is existing of micro apartments?'

By looking at the graduation project, several elements explained in the paragraphs of this chapter can be applied in the building. The residents of the building see sharing as the new way of owning. The new way of thinking about ownership of products is a good connection to the lifestyle of the residents.

Below is visible which elements of the case studies and the literature is add to the building. Most important, the building is demountable to a great extent. The elements are connected without using glue or equivalent products. The building can be totally rebuilt at a different place, only the foundation is not demountable. This is made out of concrete and can be used as foundation for streets for example. As an addition to this, there is more possible. The materials in the building are not totally clear, if it is possible to reuse materials for this, that would be a good addition.

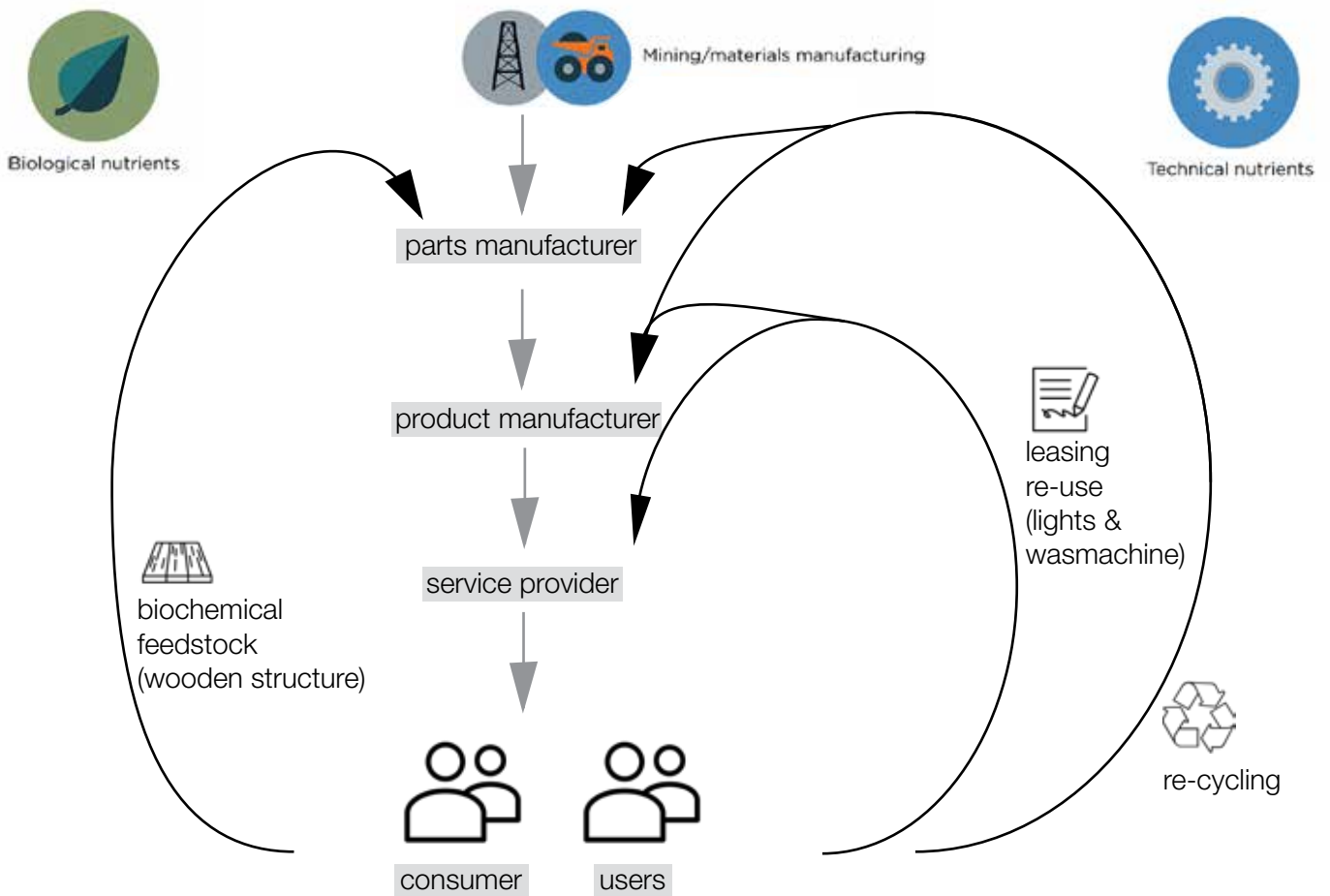


Diagram of the application in the building (own illustration)



## SHARED ECONOMY

There is a new trend the previous years. Products that were owned by the consumer are increasingly being offered as a service today. Especially people around their twenties and thirties seem to attach less to ownership. People want the pleasures, but not the burdens, the care and responsibility for a car or a home. They prefer to choose flexibility, freedom and choice. The sharing of products by services is often also described as the 'sharing economy' (Rau T., Oberhuber S. p94).

In the building is made space to facilitate and promote this shared economy. The target group of the building, New Urbanites, have a life style which is connected to this shared economy. They see sharing as the new way of owning. The shared economy in the building is explained in the two squares below.



### SPACES

The residents of the building all have a small apartment. The kitchen is small, but when you have some friends over or you want to meet people you can go to a big shared kitchen. Less kitchen components are needed when sharing a big kitchen. Besides this, there is also a big communal livingroom for the residents. The spaces will constantly be used, so the components and materials are efficiently in use.



### EXCHANGE

Several objects we all have, we do not use everyday. For example big pans, utensils and vacuum cleaners. By sharing these tools, not all the residents have to buy these and less tools are needed. Besides these 'useful' products, there are more products which can be exchanged. The exchange of books or art is also a possibility. There is a space on every floor where these products can be swapped, called the Swap-Space.

Next to the circular elements in the building, there are more sustainable decisions made. The structure of the building makes it possible to have different lay-outs, it is flexible. There is a green roof on the building which is reducing the water on the streets. This water is also stored and will be used to flush the toilets and use for the washing machines. There are solar panels on another roof to reduce the ask for energy from the energy network in the city. At least, the building will be heated by district heating.



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