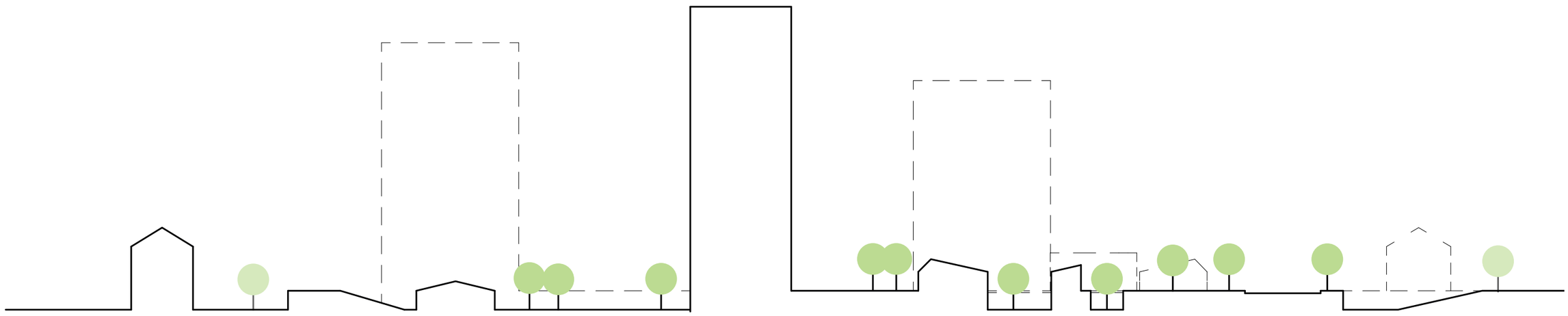
NEW IN OLD

Sustainable transformation of Västra Tropa



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ABSTRACT

Västra Torpa, as an example of the People's Home housing stocks, is one of the first area where the 1940's social housing programs were carrie out in Gothenburg. It is a residential area owned by Bostadsbolaget and was very popular for its functional multi-family apartments as well as the outdoor greenery. However, with the growth of children and changes in modern life style, this area became quite. The commercial centre and the playground is no longer use because of the reduction of population.[1]

The thesis is involved in a research project, ReBo and supported by Bostadsbolaget. With the willing of Bostadsbolaget, the final project is supposed provide about 150 new apartments in different size and with better accessibility. Developed with their requirements, the main purpose of the thesis is to transform Västra Torpa into a sustainable neighbourhood and enable people to live at home for longer.

As it mentioned in LEED[2], a sustainable neighbourhood should be evaluated in the following aspects: Planning, Neighbourhood pattern, Buildings, Transportation, Water efficiency and Energy efficiency. These become the guidelines of the thesis work and other methods are also combined, such as field trip, literature and example study, physical model study and calculations. Different physical models have been tested to increase the building density of the area while maximizing the green ratio, and make it a self-sufficient neighbourhood. A walkable street network is introduced in the area with all the vehicles being kept outside. Charged garage and electric car parking is designed to encourage sustainable transportation. The new housing is designed with solid wood, which could shrink the carbon footprint of the whole area during the life cycle process. Besides, some energy concepts, such as using rain water to the domestic use and solar energy collection, are adopted in order to reduce the energy consumption of the whole neighbourhood.

This thesis focuses on both social and technique issues, and brings into future consideration. It will be presented at Chalmers and become a part of the ReBo project. It will also be a reference for the future development for Bostadsbolaget.

Key Words

Sustainable neighbourhood, green structure, typology, sustainable transportation, solid wood, water efficiency, solar energy

1 Thuvander, L. (2012). Strategies for an Integrated Sustainable Renovation Process: Focus on the Swedish Housing stock 'People's Home'.
2 https://new.usgbc.org/leed

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PROLOGUE

During my architectural education in China, I have experienced a lack of sustainable design in buildings as well as in the life style. Thus, I choose the master program MPDSD – Design for Sustainable Development, in order to focus on sustainable concepts and technical solutions in architecture.

I have always been interested in learning sustainable and efficient methods in house/housing design. After one and half year living and studying in Sweden, rethinking the differences as well as the commons in architectural design between developed and developing countries , I may say sustainability in residential housing is a pressing issue all over the world.

Cities consist mainly of housing and home is a place in which an individual or a family can rest and store personal property. Casual and light-hearted activities take place in and around the living place, such as eating, watching TV and communicating. Along with developments in the economy, society and culture, and hence housing design, more needs appeared in the people's life. It is reflected through many developments: facilities for inhabitants had to be placed near their homes; indoor environment need to be improved for people's comfort while concerning energy cost at the same time; a unique home for people with different background was required while a mix of residents was also necessary to avoid social problems.[1] There are always questions of how housing and living area can adapt to the needs of its inhabitants which changes with time and also with the fast development of the city. New ways of design try to solve those problems and make these development sustainable, for example, social housing for low-income people, mixed function housing, and renovation of existing building and living area.

In my previous study, I have worked on living places for small groups of people, usually a family. For my master thesis I feel it would be even more interesting to implement my knowledge into a neighbourhood presenting social aspects. It will be a big and exciting challenge to try and combine the concept of sustainable building with an existing place for a number of residents rather than one family. Thus, I have talked with teachers and finally found a thesis which can meet my thoughts – a transformation project of Västra Torpa.

1 Analysis of residential development direction, http://www.c-ps.net/trade/content/2008/7/7942.html(23/07/2008)

ReBo and People's Home

The thesis is based on a research project, ReBo. This project focuses on strategies for sustainable renovation of the culturally valuable housing stock from period 'People's Home' i.e. 1945-1960 in Göteborg, Sweden. It is based on assessments of architectural quality; analysis of energy; living quality; and relating to implementation. It intends to bridge gaps between sociocultural, environmental and economic aspects of renovation.

In 1933, Swedish government commissioned the Social Housing Investigation which published in 1945 due to poor housing conditions and this is the start point of People's Home. It is an important period in Swedish history, both political and architectural. During these years, the living areas were often built in the suburbs of the old city centre. The buildings respect its natural neighbourhood. Large open recreation areas and maximum of sunlight in the dwellings were carefully planned. It was also fully concerned of inhabitants' behaviour in daily life which reflected in the function design.

Västra Torpa is one example of the People's Home housing stock and is one of the first areas where the 1940's social housing programs were carried out in Gothenburg. [1] It is a residential area owned by Bostadsbolaget, containing about 600 apartments in mainly three-story buildings. The plan for this area was established in 1946 by N. E. Ericson and E. Ragndal and built from 1946 to 1948. It stands on the eastern part of Gothenburg and attracts people by the location, traffic, high quality green space and the row rent. Västra Torpa came to stand as a model for several neighbourhoods in Gothenburg but it also face the situation of bad insulation, old energy systems and lack of accessibility, as the other housing in the People's Home period. [2] It also lack of mixture of inhabitants since there are only multi- family apartments with two or three rooms and kitchen.[3]

source: http://www.vgregion.se/en/Ovriga-sidor/ReBo/ReBo/

Bostadsbolaget

Bostadsbolaget shows the willing to transform Västra Torpa to make it a sustainable neighbourhood, which becomes an essential support for the thesis. The transformation are expected to match with today's requirements for availability, to enable older people to live at home for longer.

Bostadsbolaget want to provide accomplishing apartments that support the development of the area as a whole, make it even more attractive and sustainable in a long term both from an environmental and social perspective. The apartments are expected to be in smaller size and with better accessibility. For the new buildings,Bostadsbolaget want to have a mix of building height and types as well as a mixture of tenants with different ages and backgrounds which means the housing design should consider different need of residents and create high life quality. Public transport to connect the city and Västra Torpa is also willing to be improved, such as trams and bicycles, to make Torpa an ecological sustainable community.

4

1 Herklint, Mats. (1992). Göteborg : kulturmiljöer av riksintresse. P.114
2 ibid, P.112
3 Thuvander, L. (2012). Strategies for an Integrated Sustainable Renovation Process: Focus on the Swedish Housing stock 'People's Home'.
4 Email with Leif Andersson from Bostadsbolaget

Aim and Scope

Scope

What?
Design a better service system to make it a self-sufficient community. Add new housing blocks with low-energy building standard to make Västra Torpa into a sustainable neighbourhood which can provide people a high quality of life and an meet the needs of the present and also the future.

Where?
Västra Torpa, Gothenburg, Sweden/ Client: Bostadsbolaget.

Why?
Västra Torpa is one of the first areas where the 1940's social housing programs were tried in Gothenburg. It attracts people by the location, traffic, high quality green space and the low rent. However, it faces the situation of bad technique performance, and lack of accessibility, service and mix of residents.
There are around 600 flats in Västra Torpa now and Bostadsbolaget expect to provide 100 more apartments in smaller size and better accessibility to match with today's requirements for availability, and to enable elder people to live at home for longer. They also want to have a mix of building height and types as well as a mix of residents with different ages and backgrounds.
In this case, new apartment are needed to develop this area as a whole, and make it even more attractive and sustainable in a long term both from an environmental and social perspective.

How?
In order to protect its historical and cultural characters while increasing the overall quality, the project will focus on new housing blocks which could help balancing the energy cost, providing more services, and creating activities and communication. It is a big and exciting challenge to combine the new blocks with the existing built environment. An important issue is also to convey the whole sustainable concept to all the residents in this neighbourhood.

Aims

Based on these considerations, the goals which I want to achieve in my thesis will be:

– Describing and analysing the main features of the existing area. Maintain the attractiveness in Västra Torpa and define its values while point out the social, environmental and architectural problems.

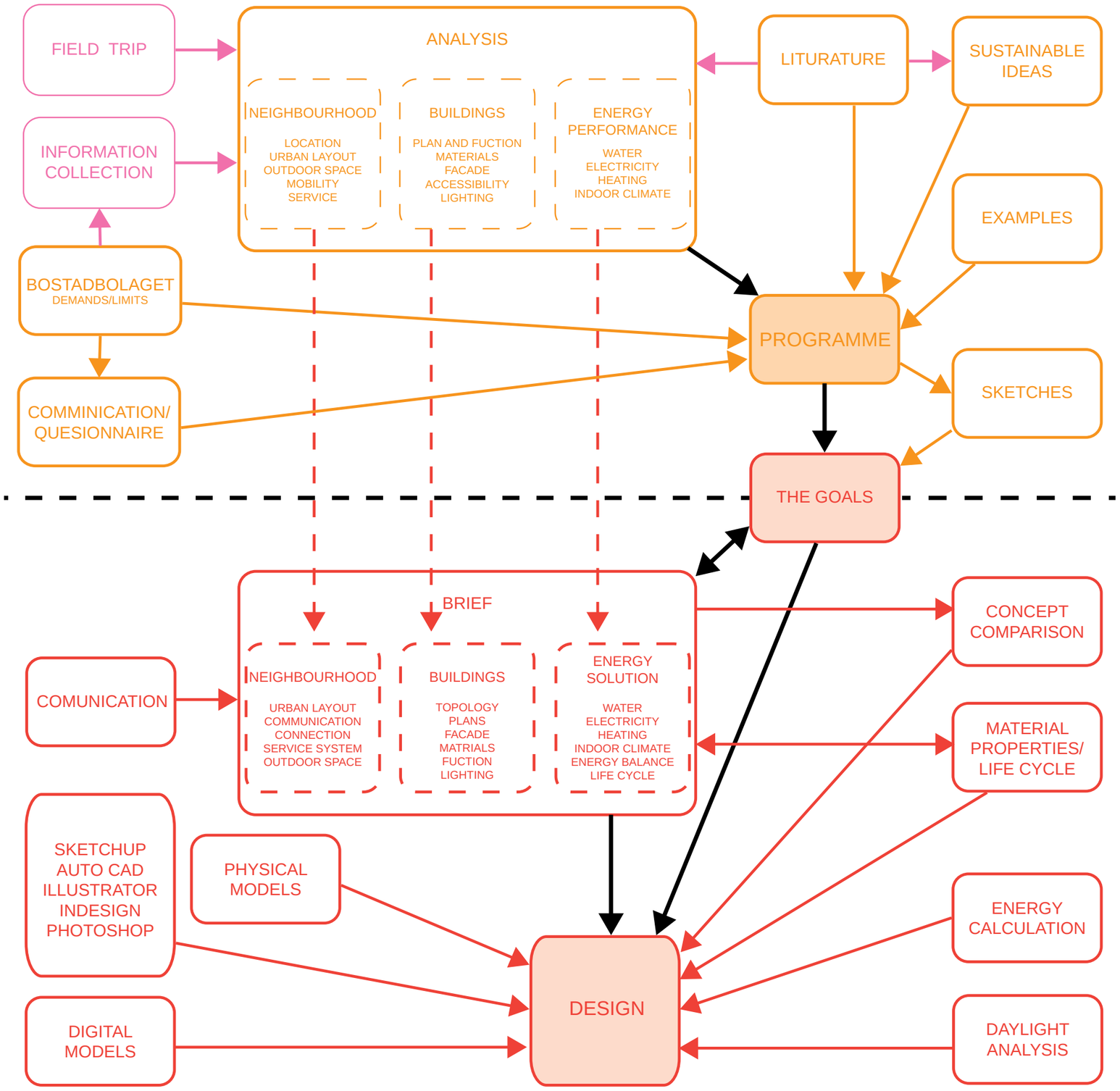
– Working for a real client as Bostadsbolaget, taking their versions for Torpa and developing them into a design proposal.

– Training my ability to carry out design for sustainable building, integrating social, environmental, functional, technical and aesthetical qualities in a design concept.

– Designing and promoting sustainable architecture. Different sustainable approaches such as environmentally friendly materials, spatial flexibility, low energy usage and connection to nature need to be evaluated in order to find the best solutions to focus on.

– Using a diversity of methods and tools, for example, digital and physical models, questionnaires, examples and communication with teachers and client etc.

– Understanding life cycle for buildings.


FIELD TRIP
INFORMATION COLLECTION
BOSTADBOLAGET
DEMANDS/LIMITS
COMMINICATION/ QUESIONNAIRE
ANALYSIS
NEIGHBOURHOOD
LOCATION
URBAN LAYOUT
OUTDOOR SPACE
MOBILITY
SERVICE
BUILDINGS
PLAN AND FUCTION
MATERIALS
FACADE
ACCESSIBILITY
LIGHTING
ENERGY PERFORMANCE
WATER
ELECTRICITY
HEATING
INDOOR CLIMATE
LITURATURE
SUSTAINABLE IDEAS
EXAMPLES
PROGRAMME
SKETCHES
THE GOALS
BRIEF
NEIGHBOURHOOD
URBAN LAYOUT
COMMUNICATION
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PLANS
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MATRIALS
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LIGHTING
ENERGY SOLUTION
WATER
ELECTRICITY
HEATING
INDOOR CLIMATE
ENERGY BALANCE
LIFE CYCLE
COMUNICATION
CONCEPT COMPARISON
MATERIAL PROPERTIES/ LIFE CYCLE
SKETCHUP
AUTO CAD
ILLUSTRATOR
INDESIGN
PHOTOSHOP
PHYSICAL MODELS
DIGITAL MODELS
DESIGN
ENERGY CALCULATION
DAYLIGHT ANALYSIS

Example study

Bifrost - Gothenburg

Neighbourhood and service

Courtyard and rest space

Bicycle stop design

Preschool in the living area

New buildings and communication

New living tower

Connection between the new building and existing building: landscape design

Transformation of existing buildings

Bifrost is a good example of renovation of existing living area in mölndal. New housing in different types were developed to improve the neighbourhood environment, such as high-rise building and houses on the roof. It create a mix of house typology and make the neighbourhood more interesting in urban spaces.

Example study

Gyldenrisparken - Copenhagen

Neighbourhood and service

Connection between the new building and existing building: new structures

Connection between the new building and existing building: new entrance in the same colour

New service in the new building

Gyldenrisparken is an example in Copenhagen. The existing area was built in the 1940s, and the urban space is dull. The new housing create a diversity of private and public spaces.

New buildings and communication

Connection between semi-public space and public space: transparent corridor

Common space in the new building

Common space in the new building

ANALYSIS

Build year: 1946-1948

Apartment: About 600 apartments

Architect: Nils Einar Eriksson

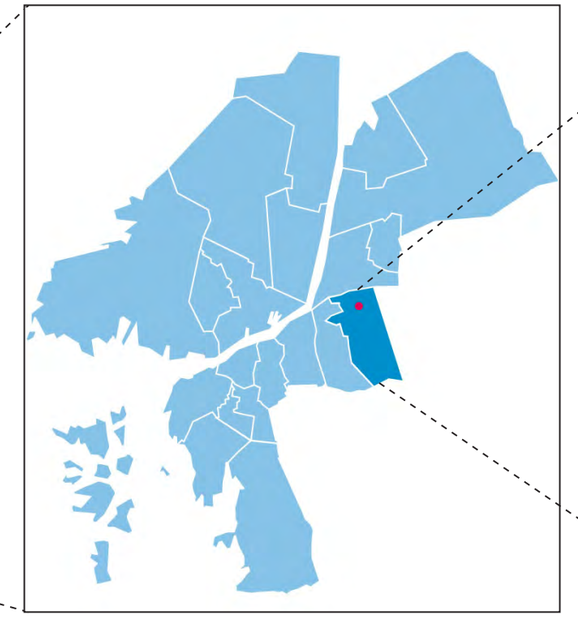
Owner: Bostadsbolaget

Nine aspects are introduced to define the value for the design of ReBo model and they are: General description, Architectural quality, Social quality, Cultural quality, Technical description and performance, Environmental performance, Economic performance and Renovation process quality.

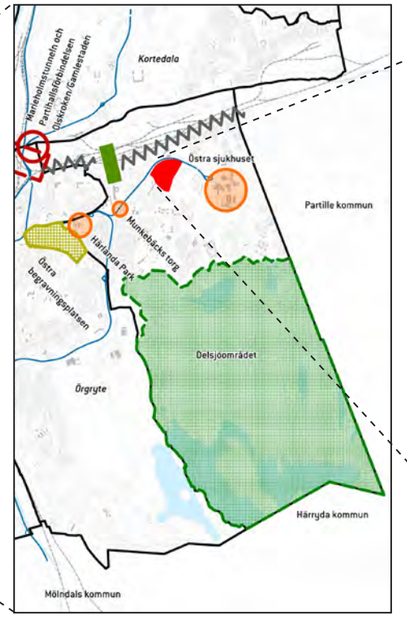
In my master thesis, in order to have a better understanding of Torpa and support my design proposals of providing a better service system and encouraging more communications between residents and also buildings, I would like to focus mainly on **architectural aspects**, both in neighbourhood level and building level, as well as **technical performance.**

Location

Sweden



Gothenburg



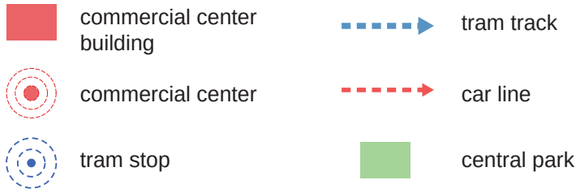
Härlanda

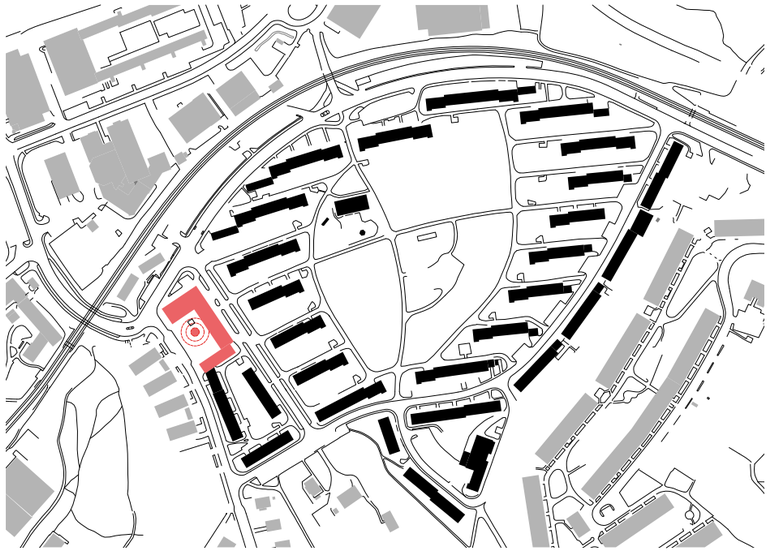
source: HÄRLANDA-Beskrivning av stad sdelen.

Torpa

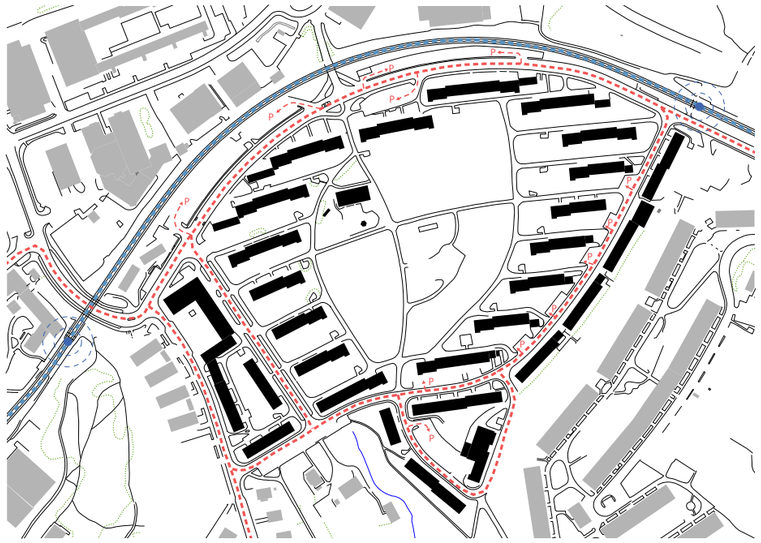
Demarcation

Västra Torpa is a typical Swedish living area of 1940s, located in the northern part of Härlanda, eastern part of Gothenburg. The whole area is a circle shape with buildings around and central greenery. Towards north the area is demarcated by tram tack which provides a convenient transportation between the area and city centre. A commercial centre on the north-west with shops and a restaurant faces to the outside of the area. On the south, there is a lake in the hill which holds a good nature.



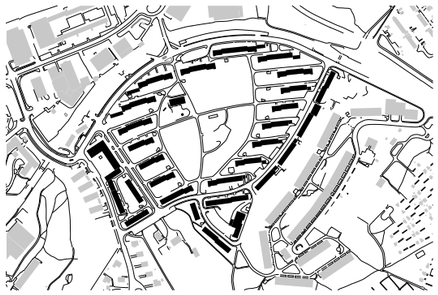


Service



Traffic line

Central park



Urban layout

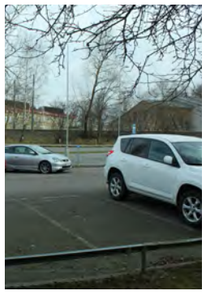
Västra Torpa is the first area where the 1940's social housing, town planning-related and architectural ideas were tested on a large scale. The layout of the building volumes follow the natural topography. The housing blocks are designed around the central park. It is a high standard housing with construction and all the apartments are modern, bright and have well-studied layout with simple but generous connections between rooms. They are lamella houses of 9 meters deep and 3 storeys.

Central park

It is an area of high environmental quality with open green space and alleyways in the middle. A 1.5-story kindergarten in wood stands in the small park. The large green area surrounded by slat housing with carefully crafted details is an excellent example of the future town planning-related and architectural ideas. The central park is an extremely important value of this area which provide an ecological friendly space for leisure and entertainment. However, as the children having grown up and the playground and football ground are no longer in use. The greenery has sometimes grown wild.

Commercial centre

A little commercial centre composing of a small restaurant and stores is standing in the north-western, between the tram stop and the living area. It is the original concept to service all the neighbourhood with this commercial centre. However, compared to some other commercial centres in Gothenburg, such as Guldhedstorget, it does not function well. One reason is the reduction of population in this area. Services around the area, like food stores and restaurants, are not well developed. The most close food store is 5 minutes' drive away.



Mobility

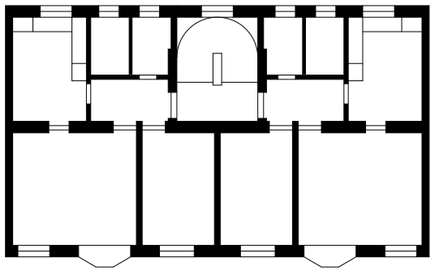
There is not much parking space in Västra Torpa and most cars stops outside the area. The tram stops are very close to the entrance of the area. Cars are not encouraged in the area. Thus, people usually walk around and bicycles becomes a convenient transport. However the area is not well designed for the bicycle stops.

Architectural aspects

Building level

Façade

The housing blocks are divided into two parts by the façade materials. The western part housings are covered with yellow bricks while the eastern part covered with yellow liquor plaster. It increase the diversity of architectures, but both of the two materials are solid feeling. The roofs are gable roofs covered with red clay tiles. All the windows are two-glazed and outward goings openings, and this causes problems of heat insulation and sound insulation. It does not have extensive balconies on the south façade.

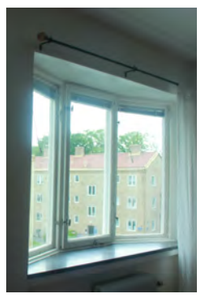


Plans and function

80% of the apartments are two-room flat with kitchen. The housing blocks are designed in the west-east direction and around the central park. It is a high standard housing with construction and all the apartments are modern, bright and have well-studied layout with simple but generous connections between rooms. The plans are square and very easy to furnish.

Entrance and staircase

Besides the one-side flat type, the apartments have also narrow and steep staircases and no elevator which means a lack of accessibility for the tenants, especially for disabled and old people. It has beautiful designed entrance which is glazed and made of wood with scopes of natural stone and is varnished.

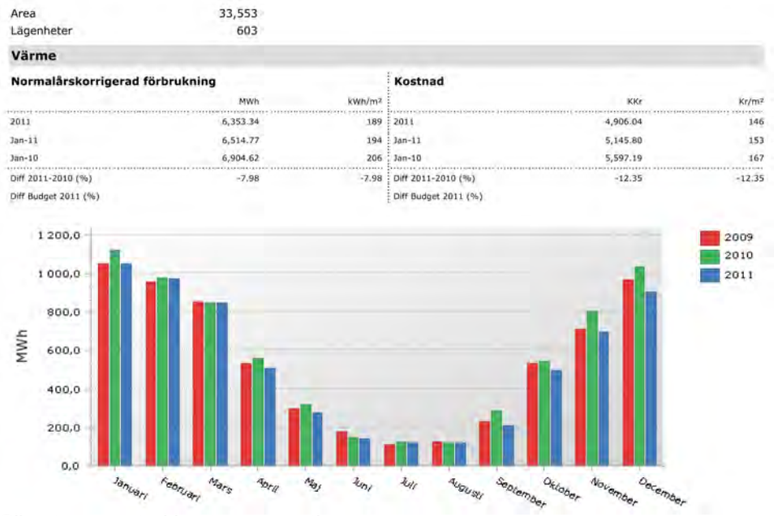


Daylight

All the flats have smooth plastered ceiling mouldings and windows for very room which provides a good quality of daylight. Even the narrow bathroom has direct daylight.

Technical performance

As most of the multi- family buildings in Gothenburg, Västra Torpa is connected to a district heating system. The buildings are heated using radiators and every building has its own heat exchangers for hot water production.
Over the years, several energy saving projects have been performed in Västra Torpa, such as instalment of modern water faucets are installed in the bathrooms as well as in the kitchens, instalment of modern toilets with low water use, room temperature based heat control, temperature and pressure fan control and effective lighting.[1]



Area	33,553
Lägenheter	603

Värme

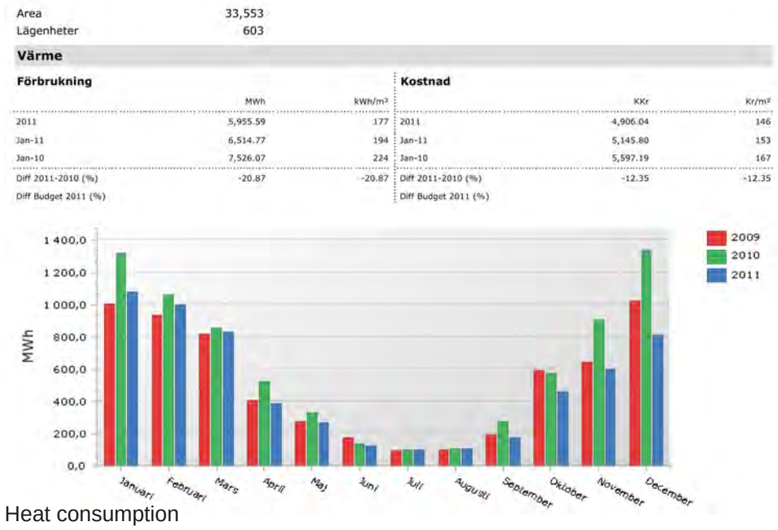
Normalårskorrigerad förbrukning

	MWh	kWh/m²
2011	6,353.34	189
Jan-11	6,514.77	194
Jan-10	6,904.62	206
Diff 2011-2010 (%)	-7.98	-7.98
Diff Budget 2011 (%)		

Kostnad

	KKr	Kr/m²
2011	4,906.04	146
Jan-11	5,145.80	153
Jan-10	5,597.19	167
Diff 2011-2010 (%)	-12.35	-12.35
Diff Budget 2011 (%)		

Climate corrected heat consumption



Area	33,553
Lägenheter	603

Värme

Förbrukning

	MWh	kWh/m²
2011	5,955.59	177
Jan-11	6,514.77	194
Jan-10	7,526.07	224
Diff 2011-2010 (%)	-20.87	-20.87
Diff Budget 2011 (%)		

Kostnad

	KKr	Kr/m²
2011	4,906.04	146
Jan-11	5,145.80	153
Jan-10	5,597.19	167
Diff 2011-2010 (%)	-12.35	-12.35
Diff Budget 2011 (%)		

Heat consumption

Area	33,553
Lägenheter	603

Fastighetsel

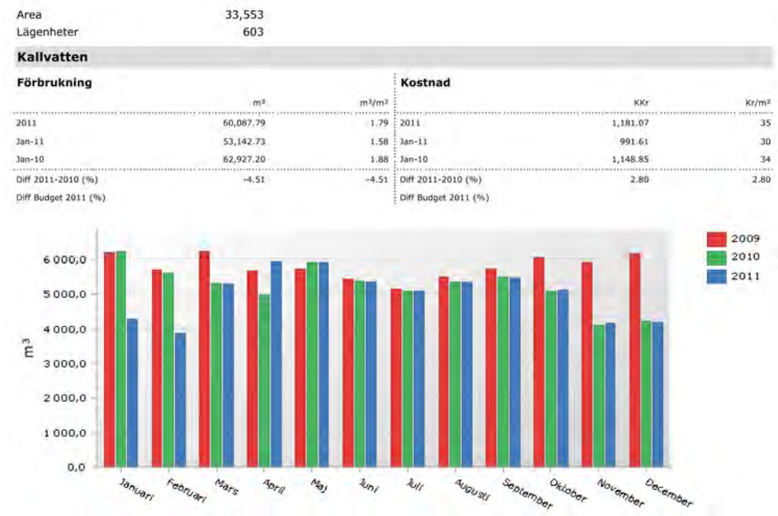
Förbrukning

	MWh	kWh/m²
2011	489.33	15
Jan-11	503.51	15
Jan-10	506.05	15
Diff 2011-2010 (%)	-3.30	-3.30
Diff Budget 2011 (%)		

Kostnad

	KKr	Kr/m²
2011	664.13	20
Jan-11	673.45	20
Jan-10	681.25	20
Diff 2011-2010 (%)	-2.51	-2.51
Diff Budget 2011 (%)		

Electricity consumption



Area	33,553
Lägenheter	603

Kallvatten

Förbrukning

	m³	m³/m²
2011	60,087.79	1.79
Jan-11	53,142.73	1.58
Jan-10	62,927.20	1.88
Diff 2011-2010 (%)	-4.51	-4.51
Diff Budget 2011 (%)		

Kostnad

	KKr	Kr/m²
2011	1,181.07	35
Jan-11	991.61	30
Jan-10	1,148.85	34
Diff 2011-2010 (%)	2.80	2.80
Diff Budget 2011 (%)		

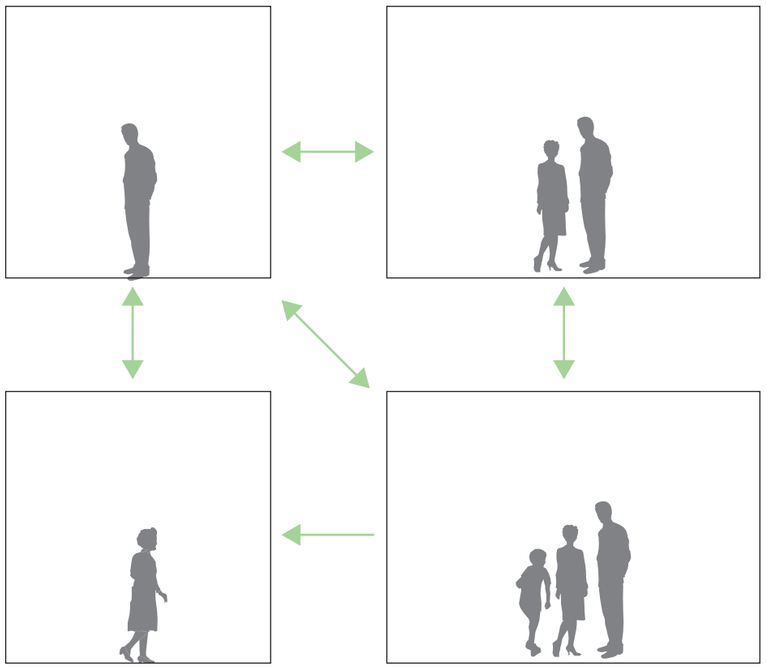
Water consumption

1 Email with Bostadsbolaget

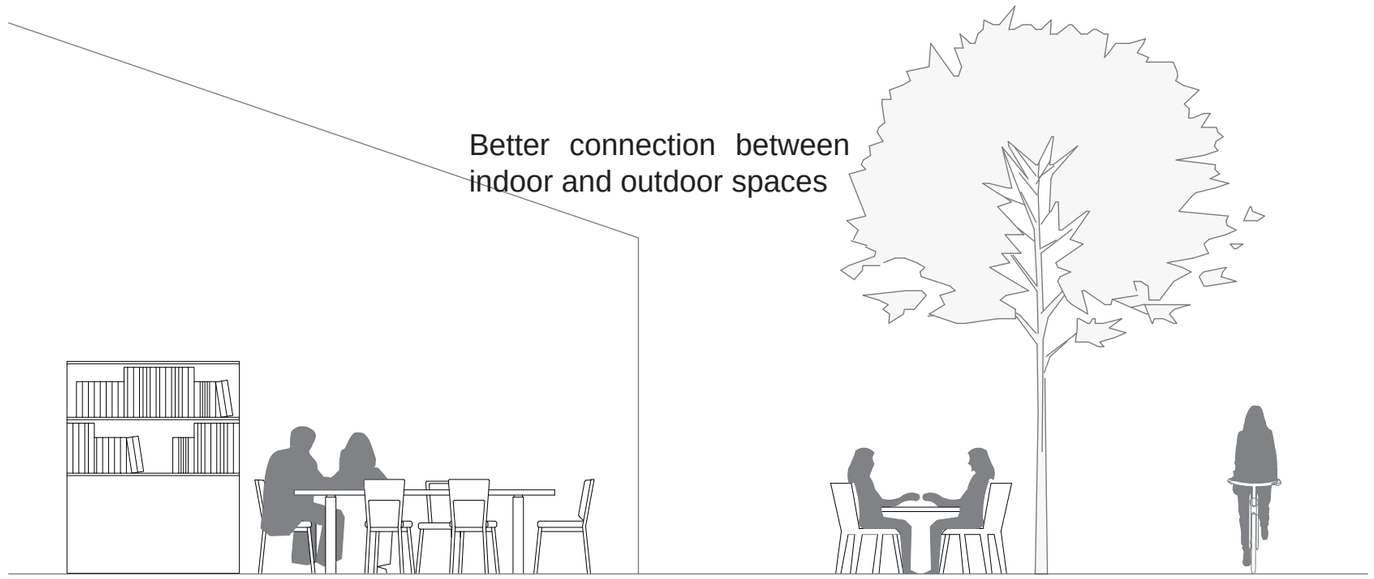
PROPOSALS

Better accessibility

Better service system



Mix of residents and flexibility of apartments

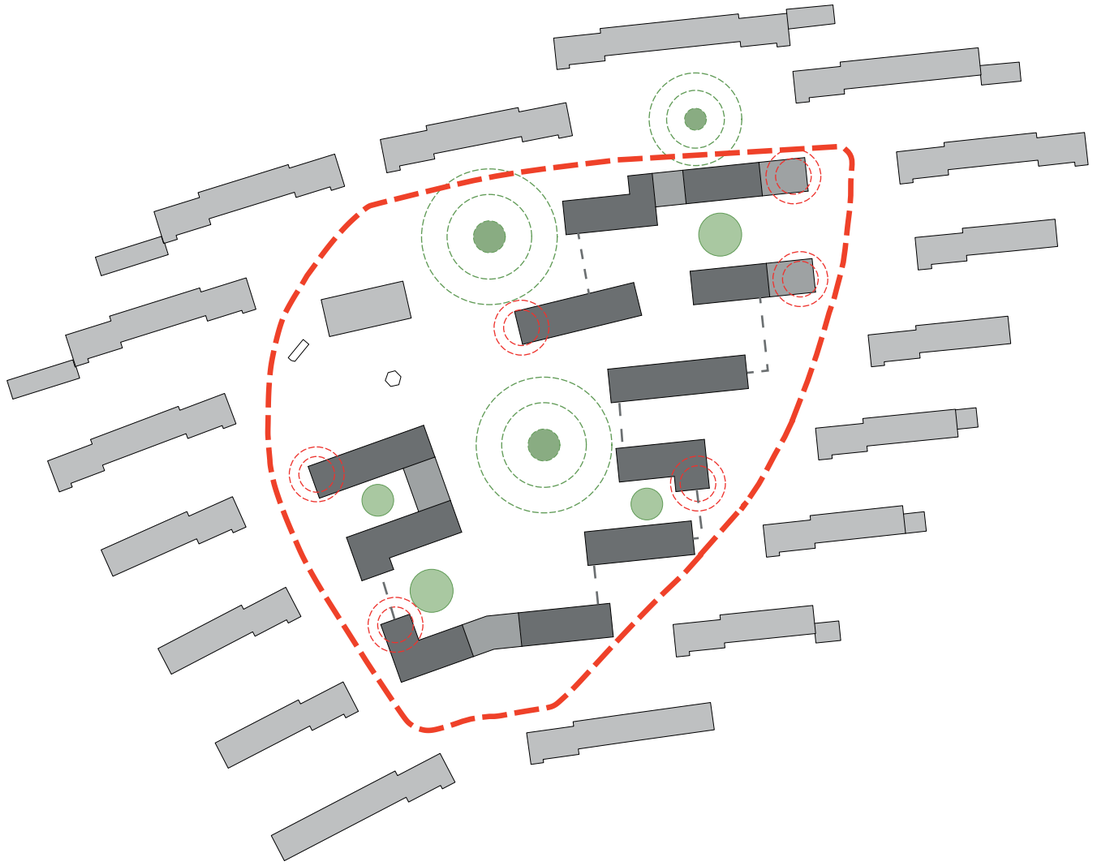


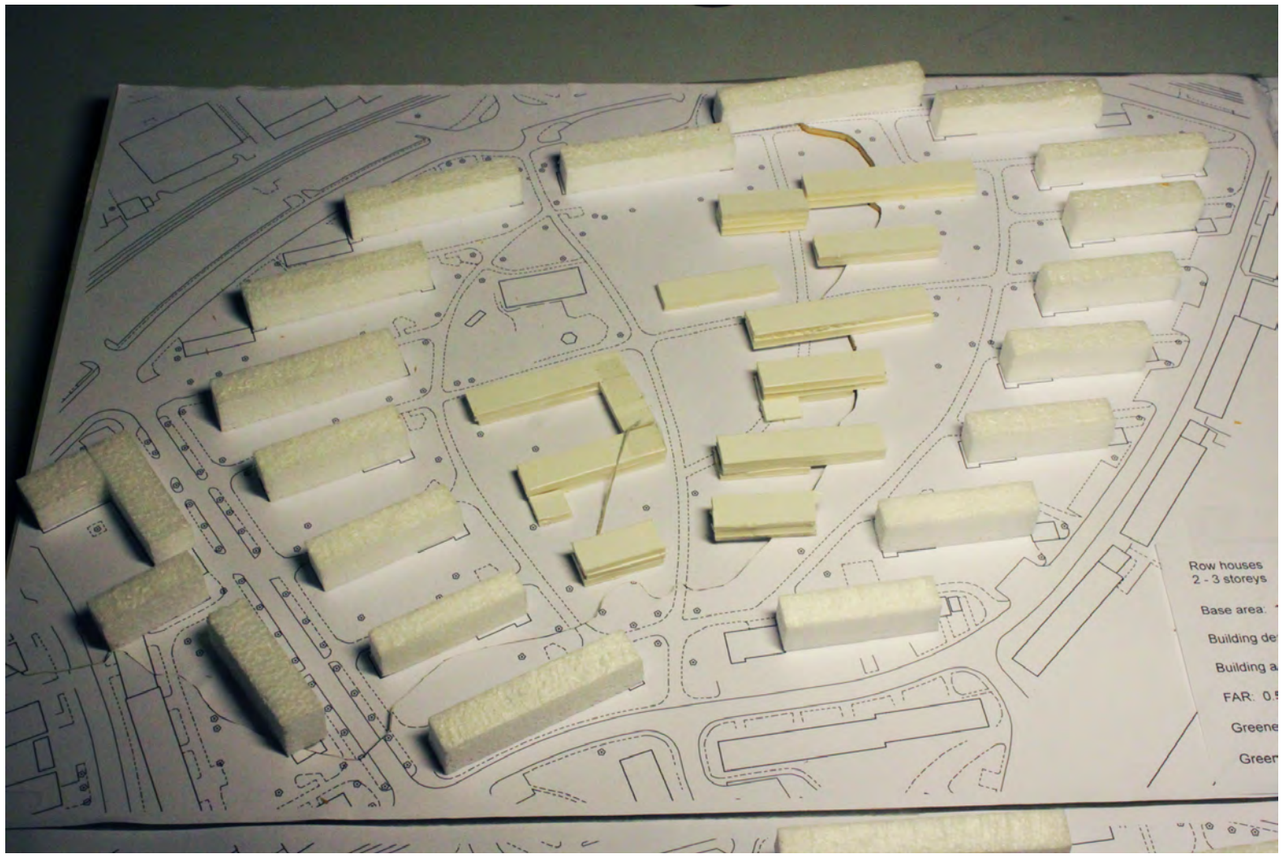
More rest spaces and communication

Sustainable transportation

Physical model study

Concept 1





private/semi-private space

public green space

commercial center/ service center

links of different services

existing buildings

new buildings

pass on the ground floor

Row houses
2 - 3 storeys

Base area: 17090m2
Building density: 20.5%
Building area: 45199m2
FAR: 0.54
Greenery area: 47635m2
Greenery ratio: 0.57

This development creates a similar texture of the existing area in orientation, distance and density.

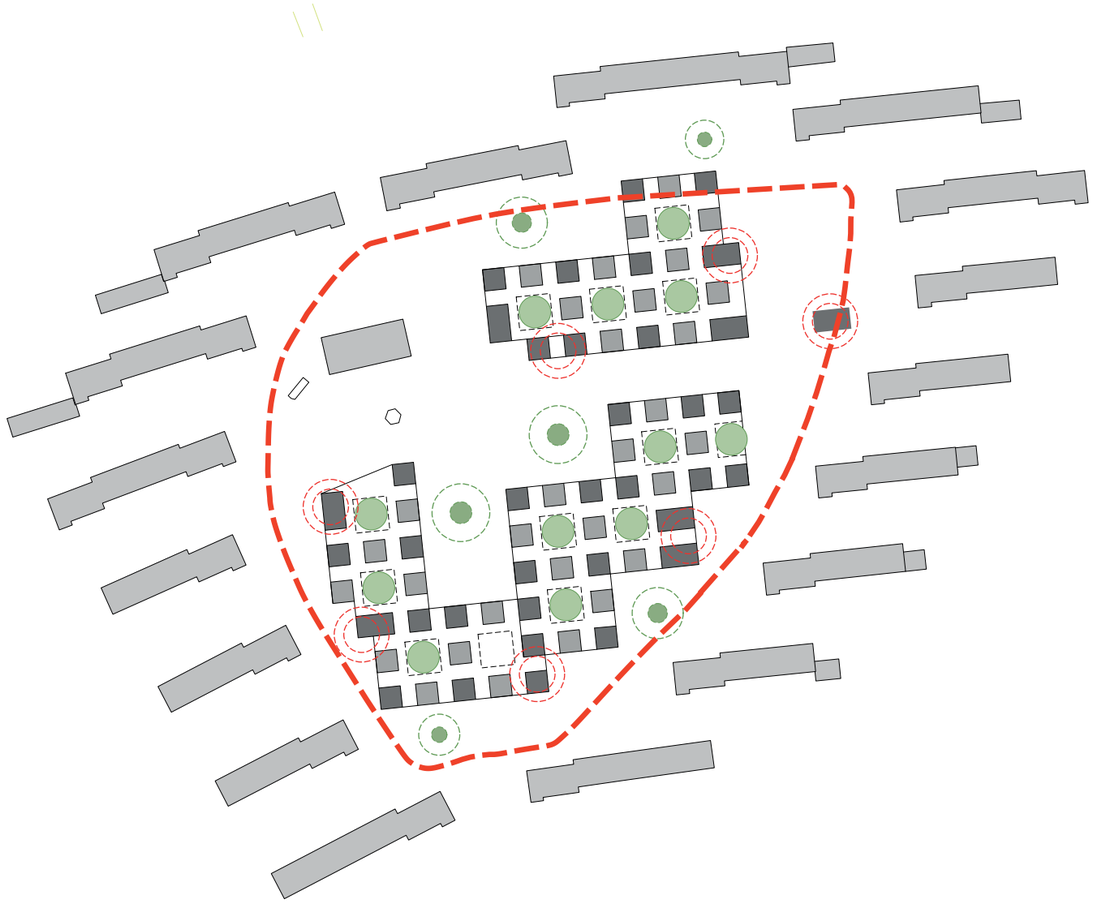
It creates a variety of urban space: more or less open courtyard and public green space.

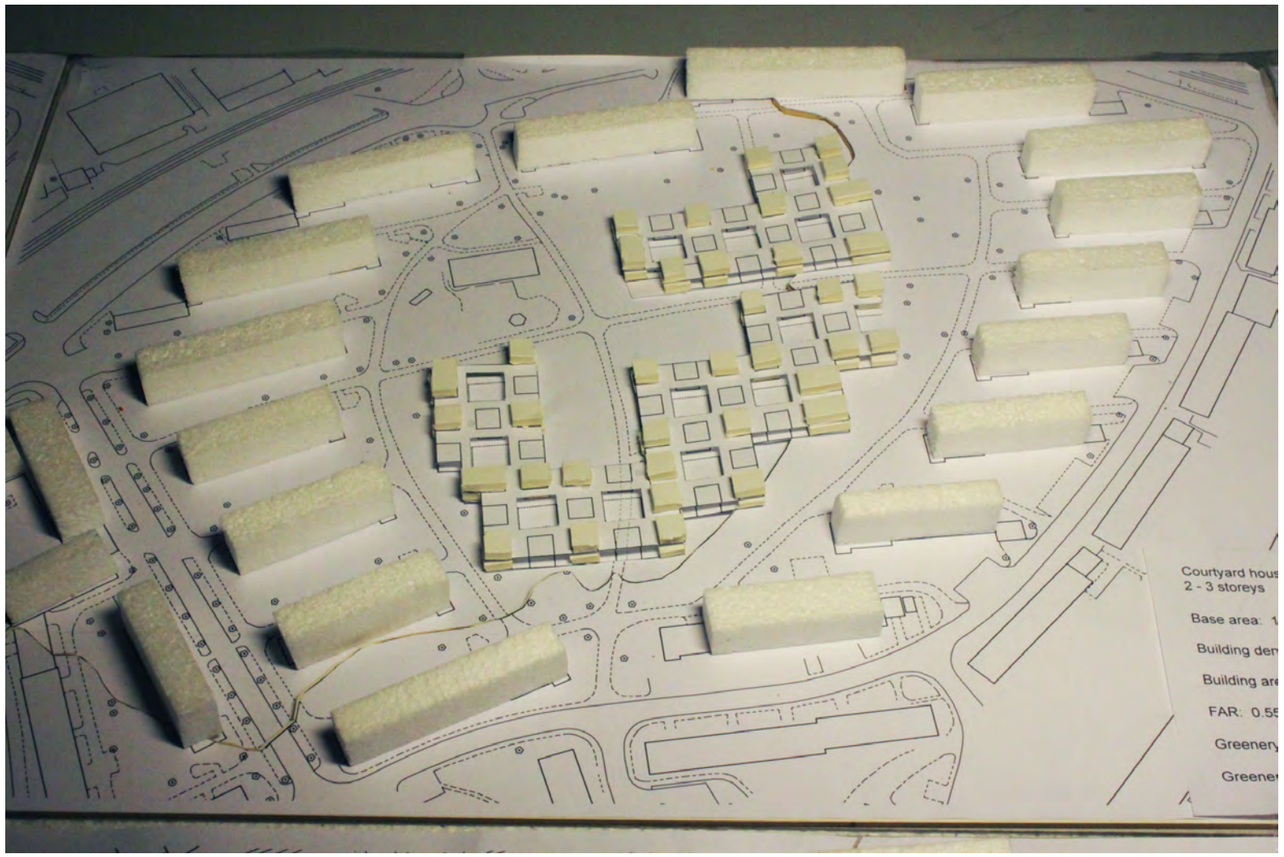
It also creates a variety of flows between the building and public space, and between courtyard and public green space.

This concept is easy to develop service
Centres and easy to connect the new buildings and the existing ones. It will be difficult to add more blocks if the population increases.

Physical model study

Concept 2





private/semi-private space

public green space

commercial center/ service center

links of different services

existing buildings

new buildings

pass on the ground floor

Courtyard houses
2 - 3 storeys

Base area: 14715m2
Building density: 17.7%
Building area: 46237m2
FAR: 0.55
Greenery area: 43721m2
Greenery ratio: 0.53

This development creates a totally different texture with small units and courtyards.

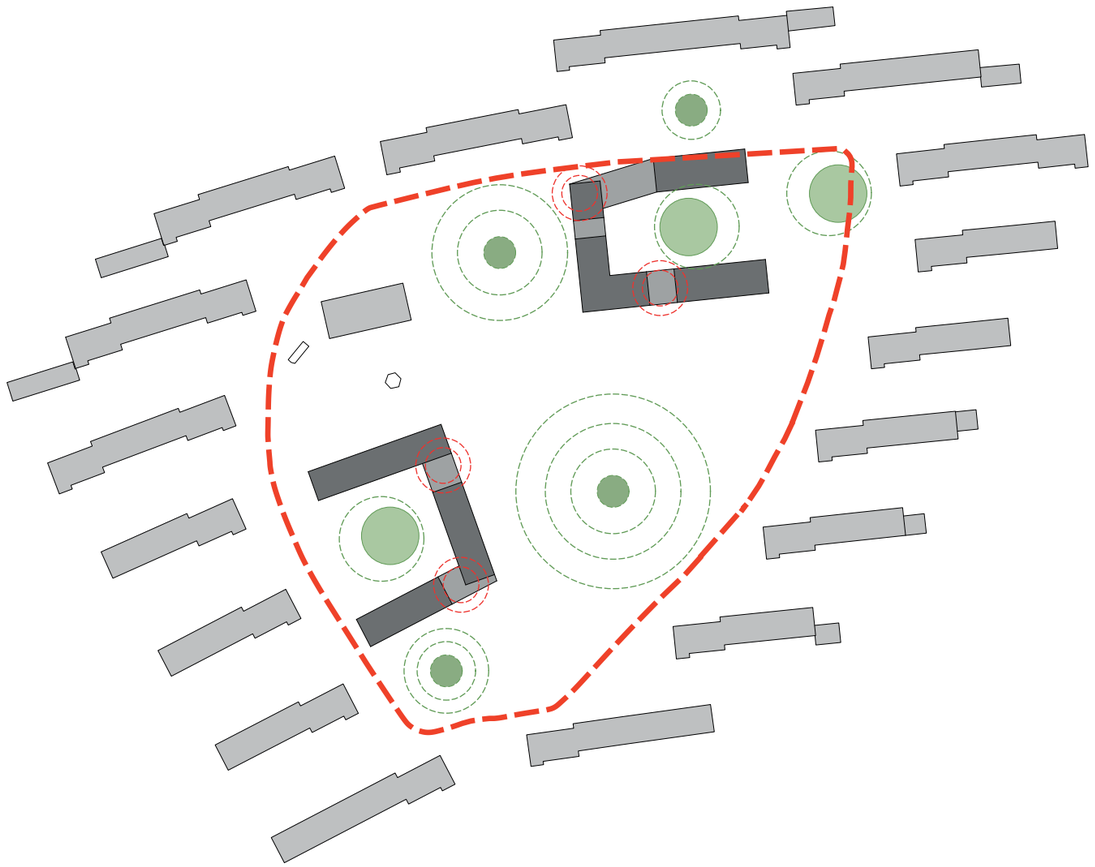
It creates many semi-public courtyard, but leaves only small public green spaces.

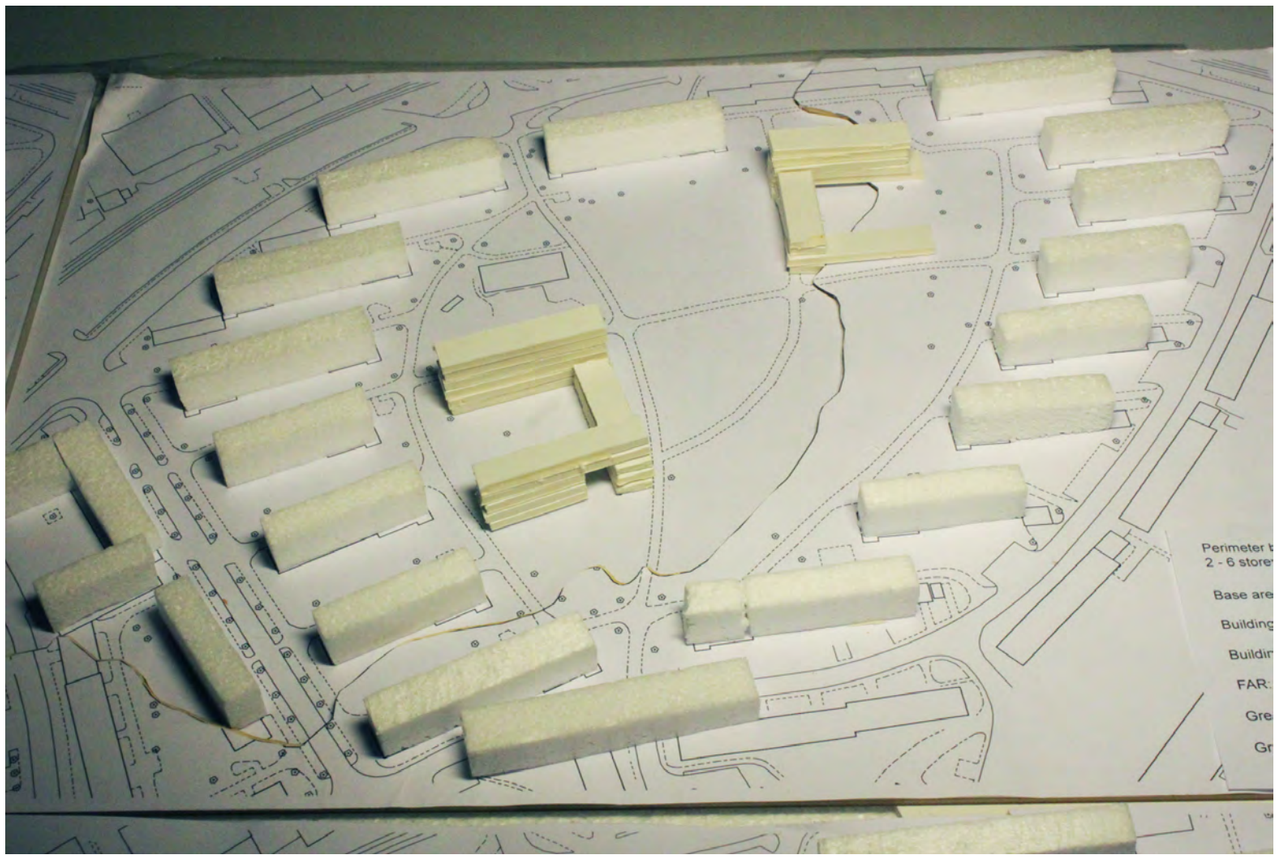
The flows to the public green space through the courtyards provides a possibility of communication.

It is easy to develop service centres but will be difficult to develop the accessibility and difficult to add more buildings in the future.

Physical model study

Concept 3





private/semi-private space

public green space

commercial center/ service center

links of different services

existing buildings

new buildings

pass on the ground floor

Perimeter block- perforated houses
2 - 6 storeys

Base area: 14820m2
Building density: 17.8%
Building area: 46318m2
FAR: 0.59
Greenery area: 49340m2
Greenery ratio: 0.55

The texture in this development is very simple and the scale is a little bigger than the existing buildings.

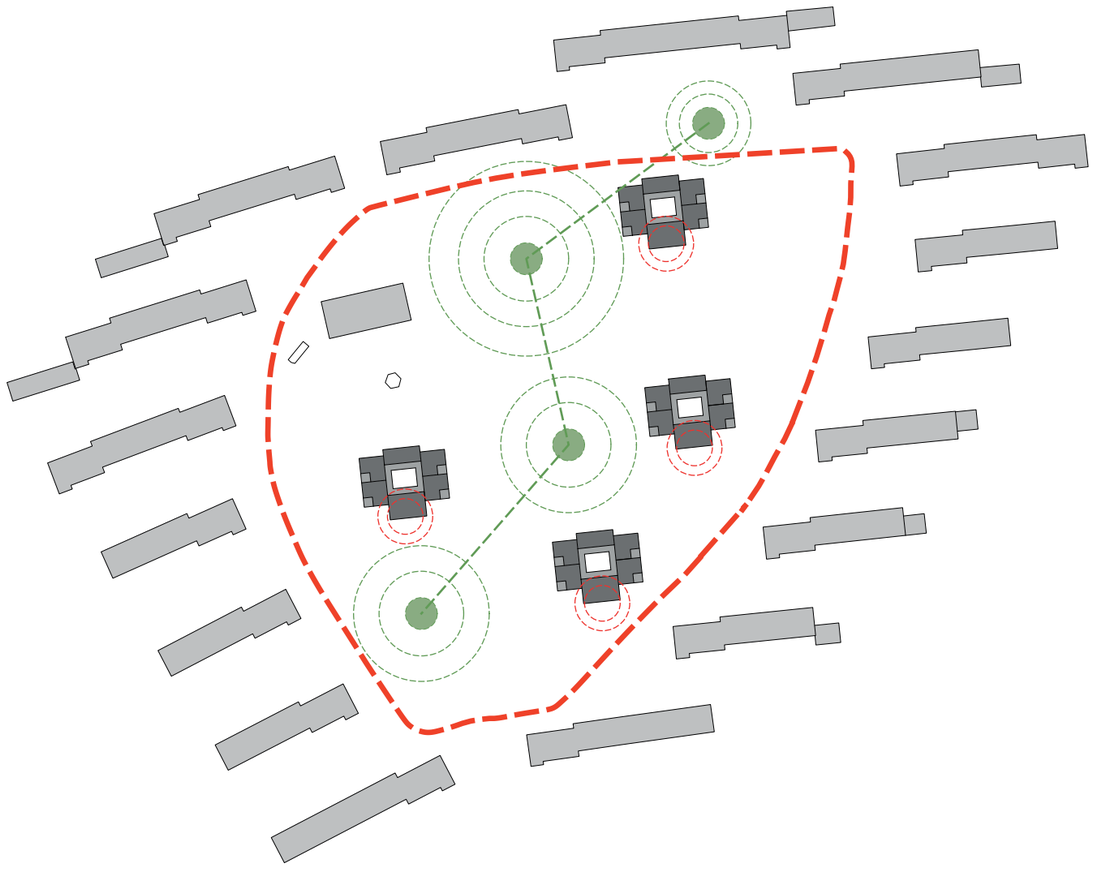
It creates more enclosure courtyard and leaves a big green space.

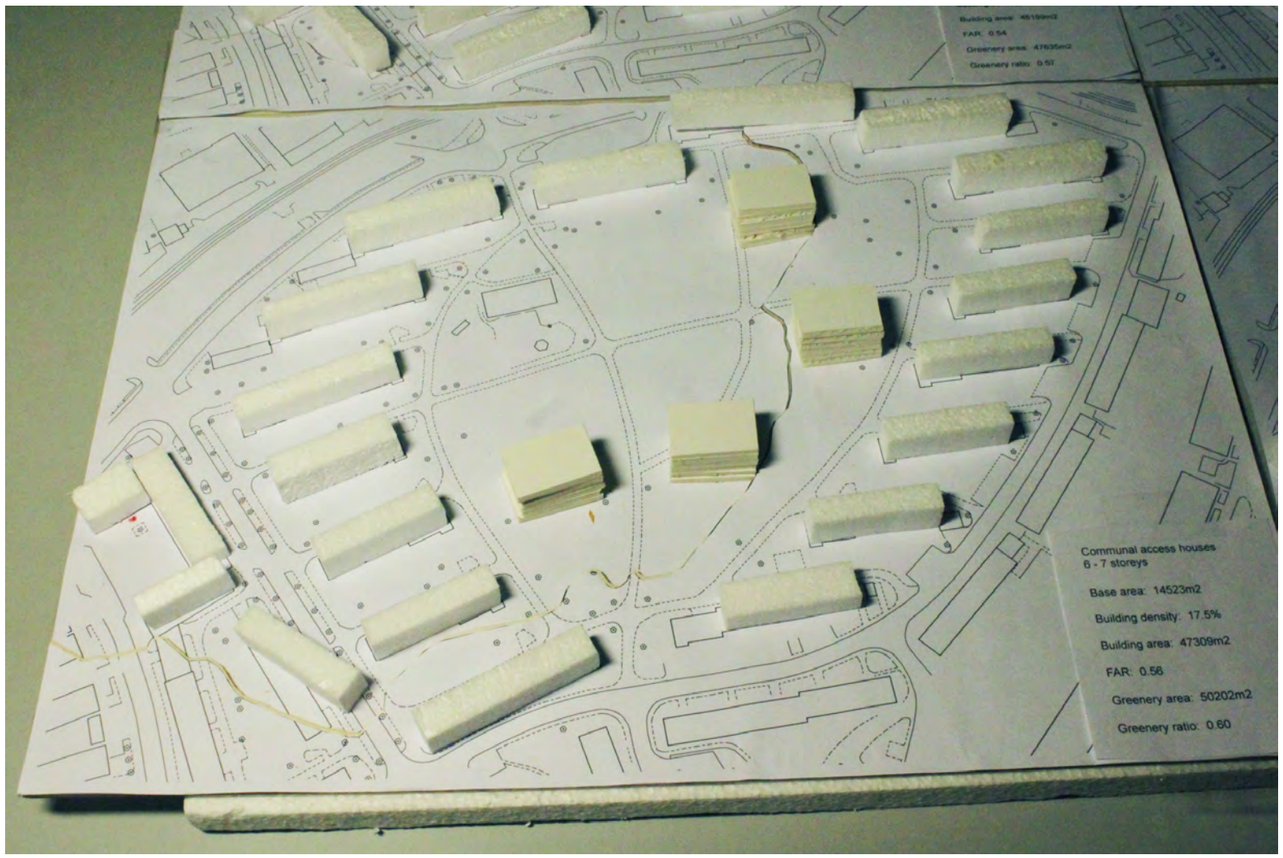
It has a direct access the public green space, but it also creates flows cross the new buildings.

It also has the possibility to develop the services in the perforation. It will be easy to develop more buildings in the future.

Physical model study

Concept 4





private/semi-private space

public green space

commercial center/ service center

links of different services

existing buildings

new buildings

pass on the ground floor

Free standing houses
6 - 7 storeys

Base area: 14523m2
Building density: 17.5%
Building area: 47309m2
FAR: 0.56
Greenery area: 50202m2
Greenery ratio: 0.60

The texture in this development is very different with the existing buildings.

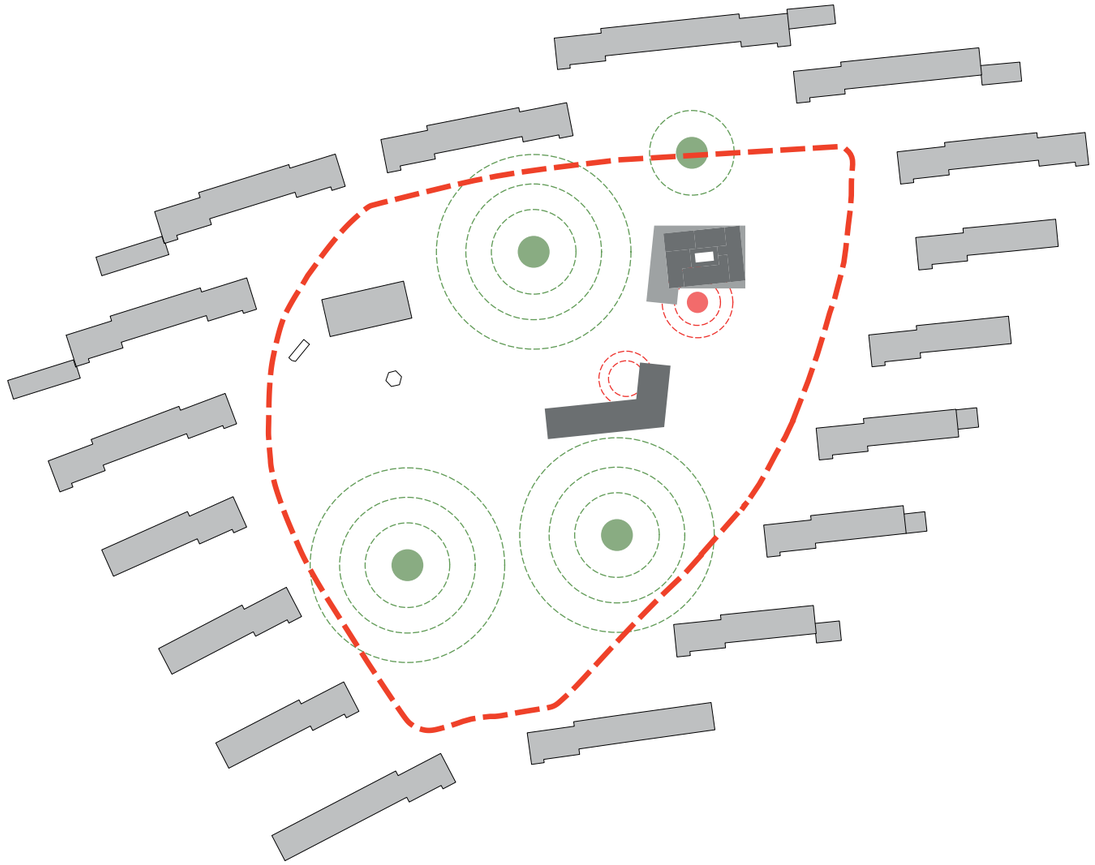
It doesn't create more different urban space but it could create very private Courtyard in each building.

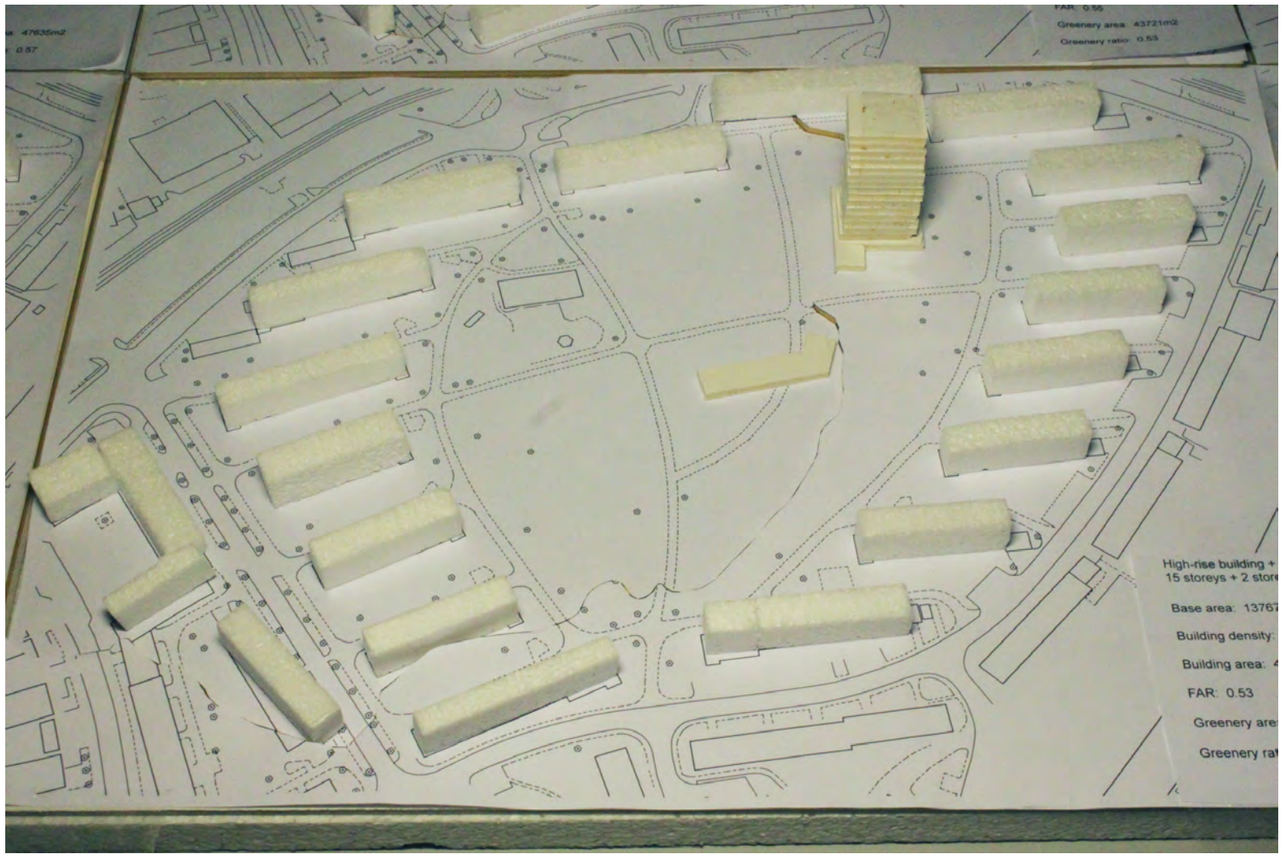
The flows to the public green space is direct and have no communication with the new buildings.

It doesn't has many possibility to develop many services but it will be easy to add more similar buildings in the future.

Physical model study

Concept 5





private/semi-private space

public green space

commercial center/ service center

links of different services

existing buildings

new buildings

pass on the ground floor

High-rise building + Row houses
15 storeys + 2 storeys

Base area: 13767m2
Building density: 16.5%
Building area: 44124m2
FAR: 0.53
Greenery area: 50959m2
Greenery ratio: 0.61

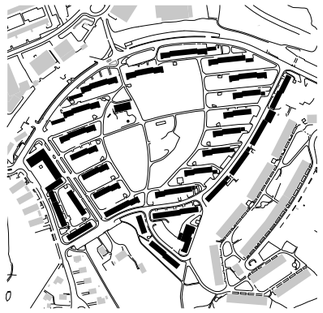
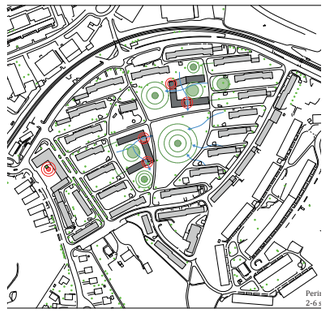
This development creates a symbol of this area and provides a privileged view.

It doesn't create more different urban space but leave a large scale of green space.

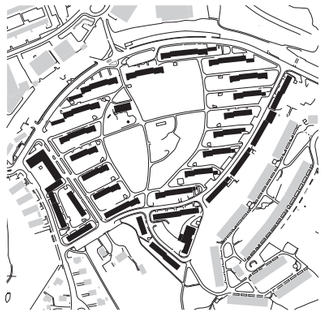
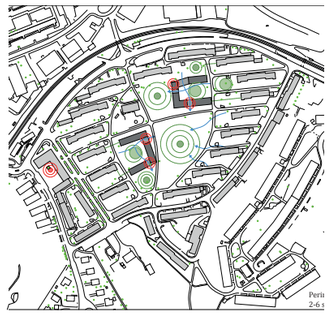
The flows to the public green space is direct and have no communication with the new buildings.

This concept doesn't has many possibilities to develop many services but it will be easy to add more similar buildings in the future.

Quantity comparison

	existing buildings	concept 1 row/twin row houses	concept 2 courtyard houses	concept 3 perimeter blocks	concept 4 communal access	concept 5 high-rise+row houses
						
area of all	83215m2	83215m2	83215m2	83215m2	83215m2	83215m2
storey	3	2	2	2-6	6	16+2
base area	12588m2	17090m2	14715m2	14820m2	14523m2	13767m2
building density	15.1%	20.5%	17.7%	17.8%	17.5%	16.5%
building area	35693m2	45199m2	46237m2	46318m2	47309m2	44124m2
FAR	0.43	0.54	0.55	0.59	0.56	0.53
greenery area	52138m2	47635m2	43721m2	49340m2	50202m2	50959m2
greenery ratio	0.63	0.57	0.53	0.55	0.60	0.61

Quality comparison

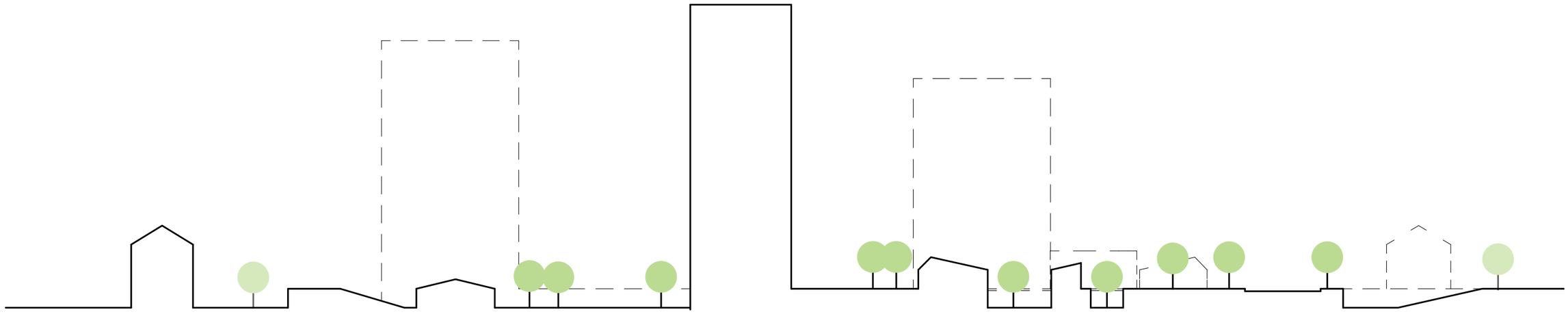
	existing buildings	concept1 row/twin row houses	concept2 courtyard houses	concept3 perimeter blocks	concept4 communal access	concept5 high-rise+row houses
						
green spaces	a lot	6 some	2 little	8 many	8 many	9 lots of
courtyards	only one courtyard	8 many	6 a lot but small	6 some	0 none	0 none
scales	human scale	10 human scale	6 a little small	6 a little heavy	4 too heavy	6 a little high
orientation	only north-south	10 north-south and towards courtyard	4 towards courtyard	4 towards courtyard	4 towards outdoor environment	4 towards outdoor environment
connection	not much	8 similar scale and orientation	2 not many	6 similar orientation	2 not much	2 not much
services	not many	8 very possible to develop	8 very possible to develop	4 possible to develop	2 not much space to develop	2 not much space to develop
development potential		4 not much space to develop	2 no space to develop	6 possible to develop	8 very possible to develop	8 very possible to develop
total		54	36	40	28	31

The quantity of the five developments are compared in building density, floor area ratio and greenery ratio while the qualities of the developments are compared in urban spaces, buildings, services and develop potential, and all the qualities are scored from 1 to 10.

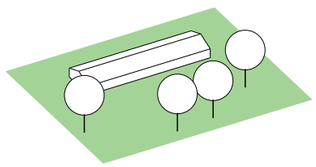
From these calculations, all the developments have its positive but also negative aspects. For example, the row houses increase the density mostly and create a diversity of courtyards, but it took a lot of the green ground. The high-rise building make a symbol of the area and leave as much green space as possible, but it lose the potential of creating more public space in different scales.

Thus, the final project will try to bring most of the qualities from the previous concepts, and combine different building type and urban spaces, providing apartments for different people groups.

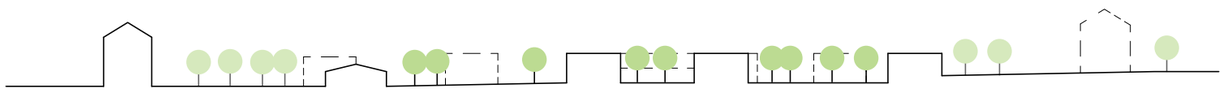
DESIGN

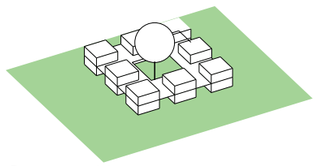


Final concept

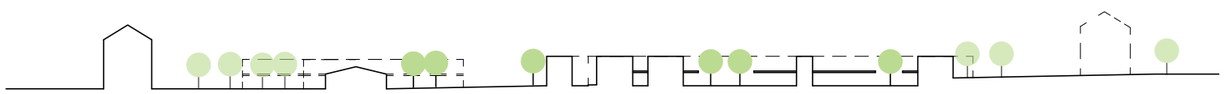


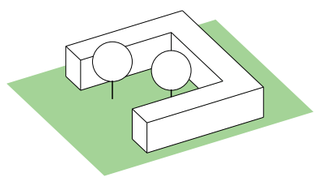
Row house



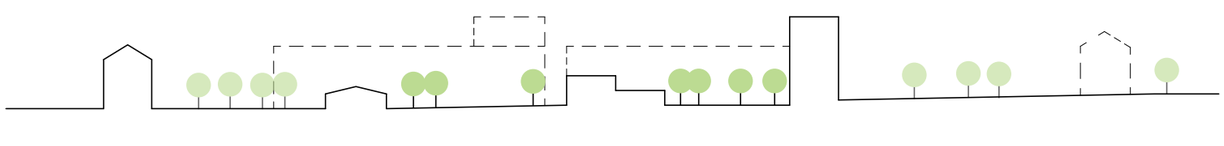


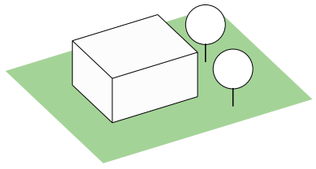
Courtyard house



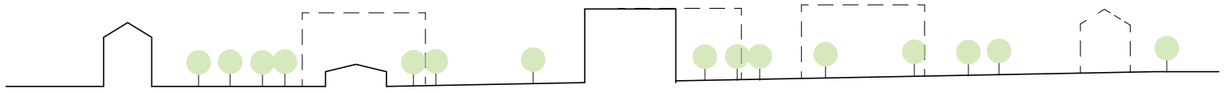


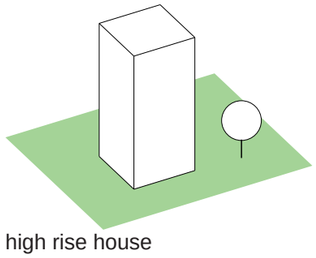
Perimeter block- perforated houses



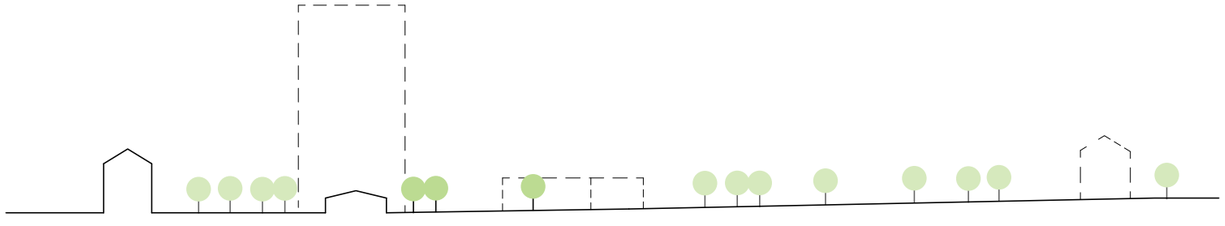


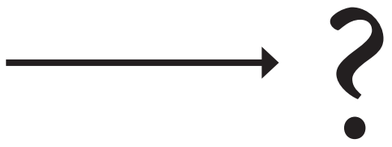
Free standing house





high rise house





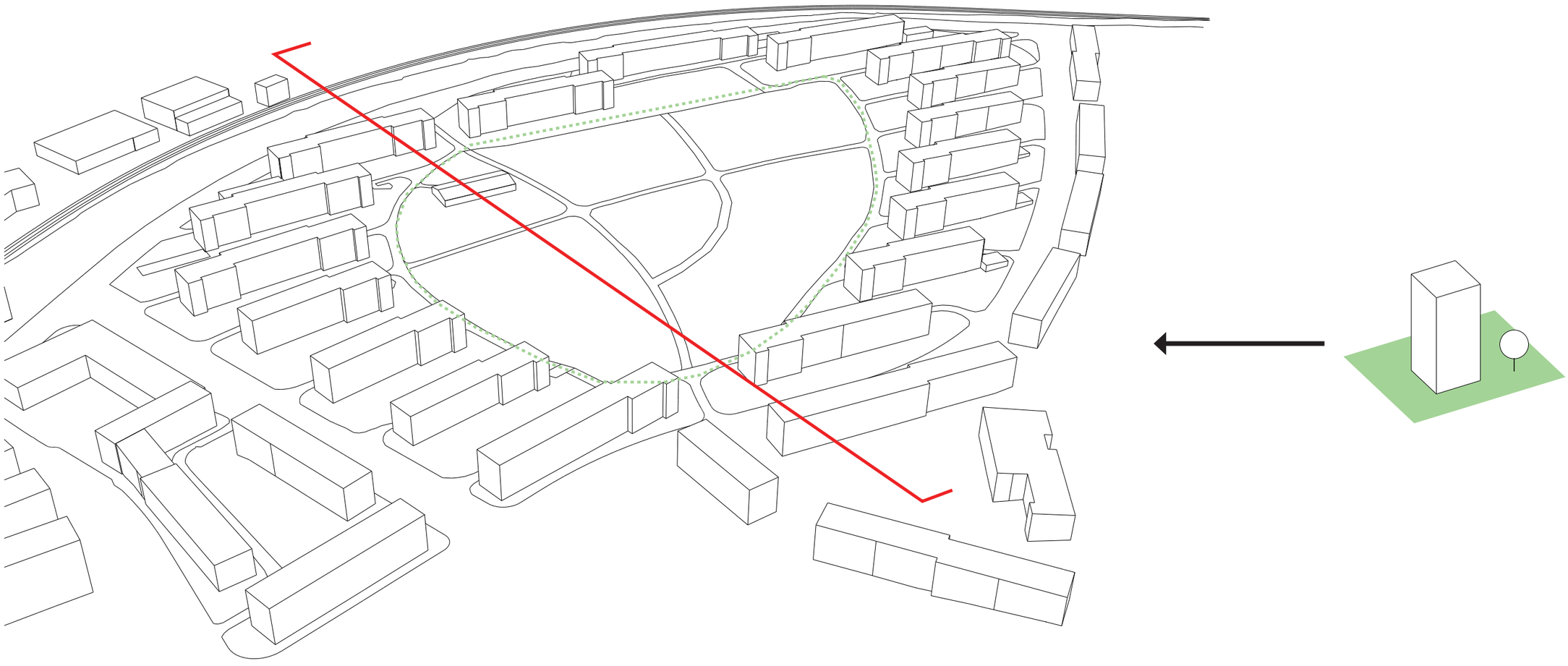
younth

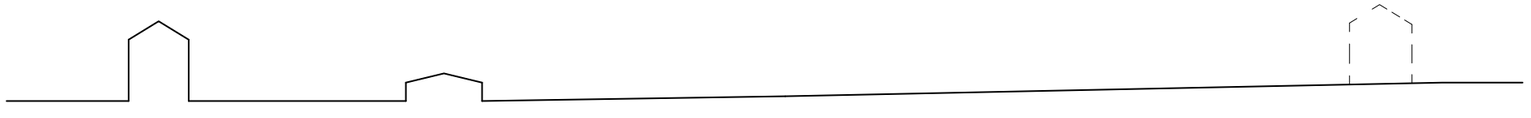
couple

family

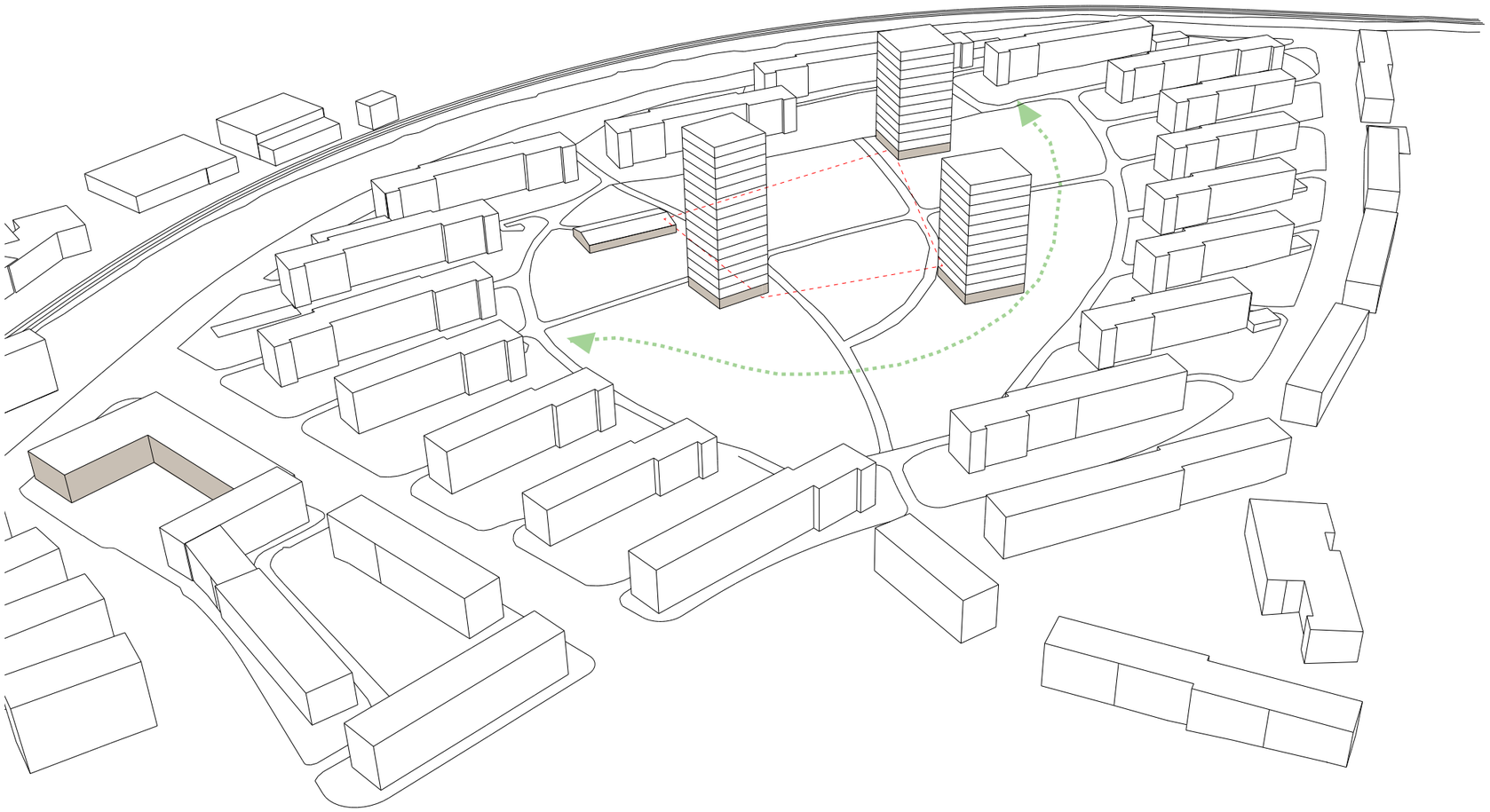
senior person

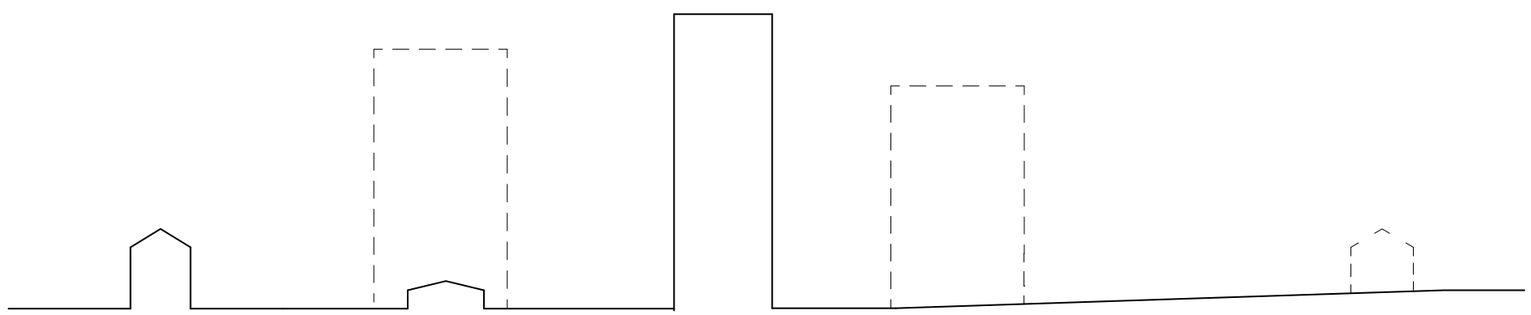
Final concept





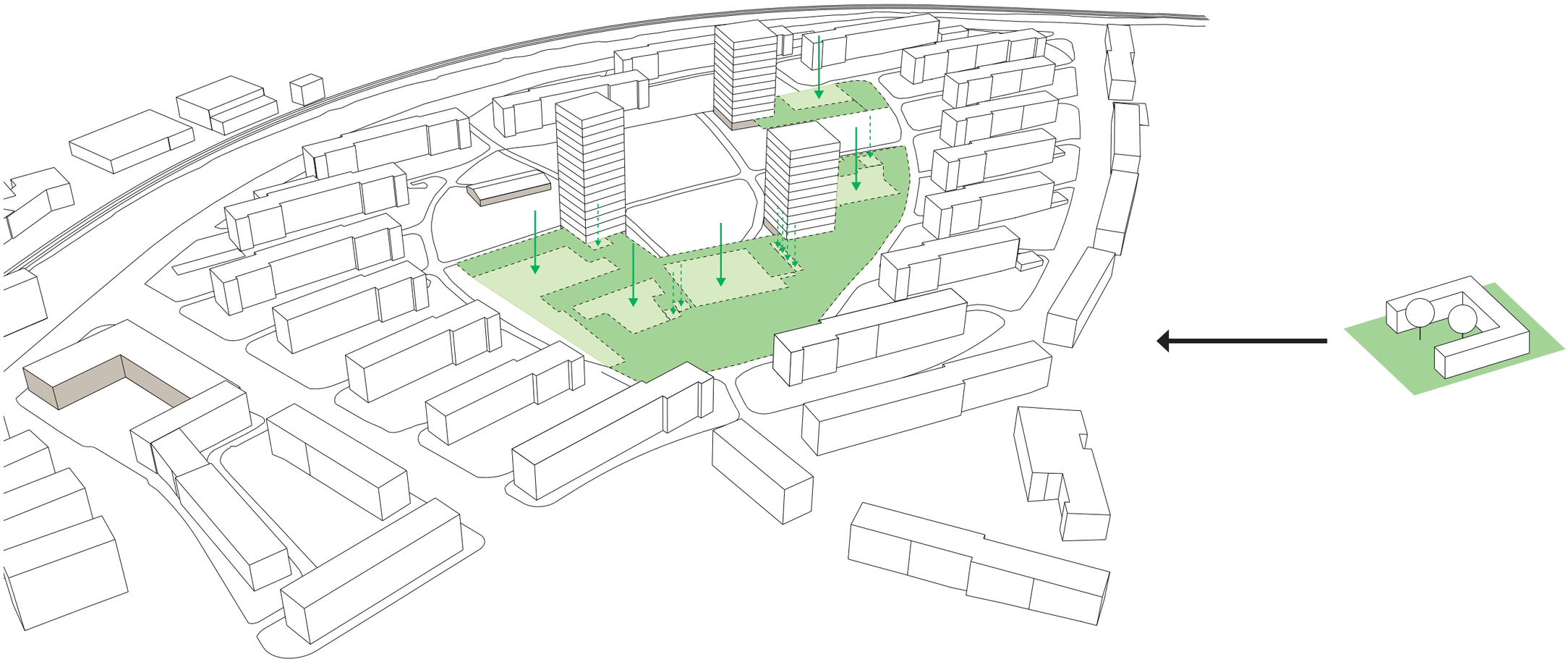
The existing community has very low building density and simple urban spaces. In order to avoid the reduction of population and old population, the proposal is to build more apartments and create a diversity of landscape.

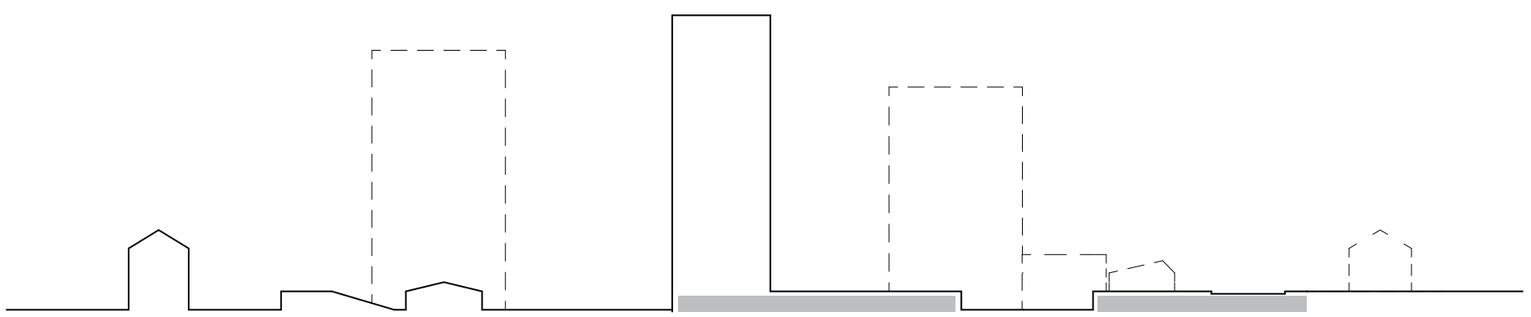




The neighbourhood density is increased by the high-rise buildings. The towers are defined a new central green space and the outside green structure. It also provides an access to the public functions.

Final concept

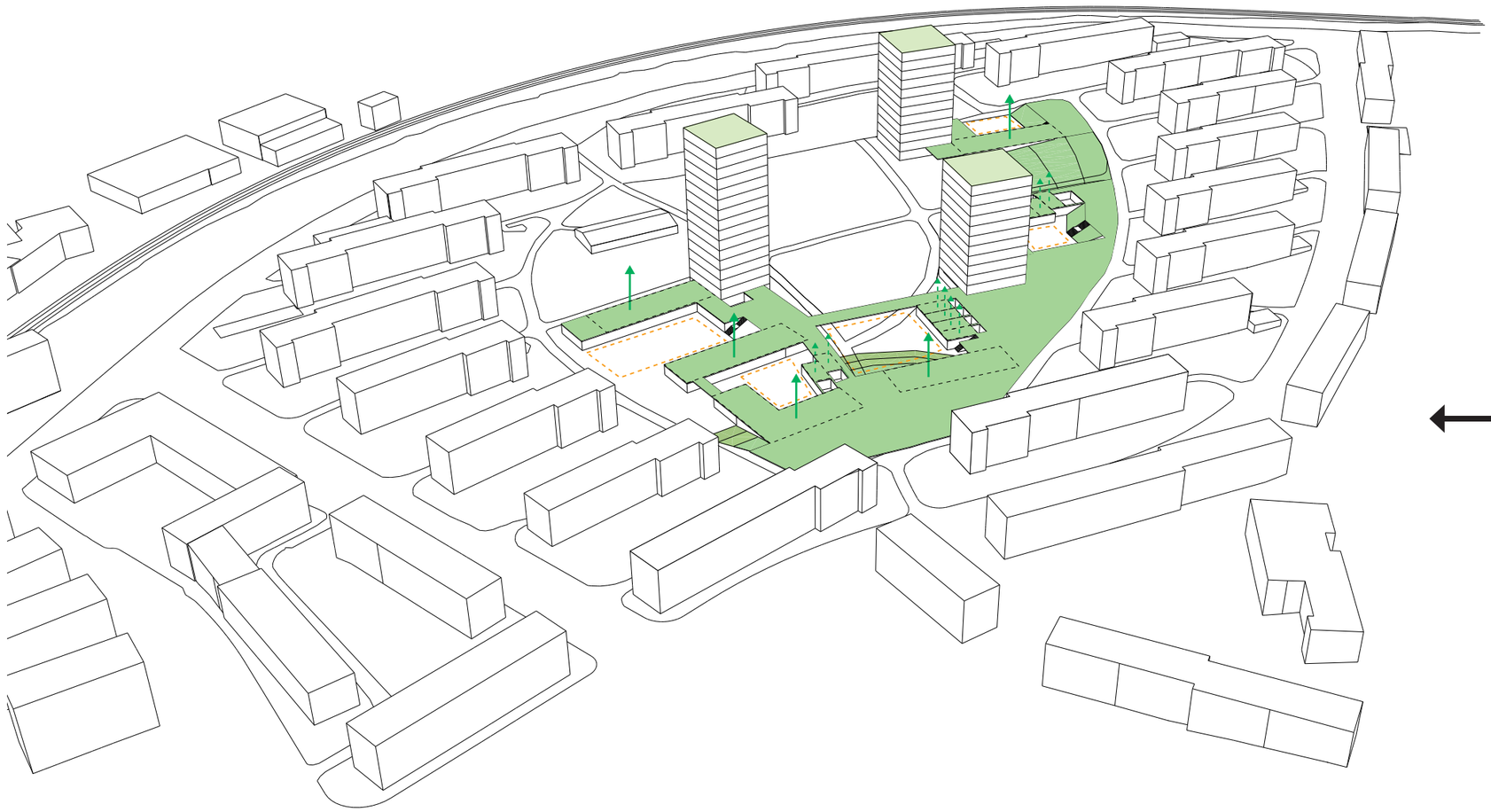


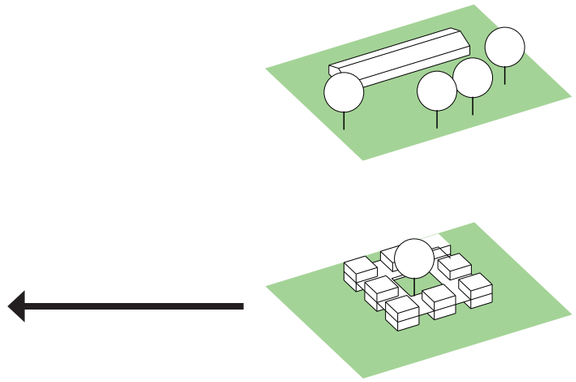


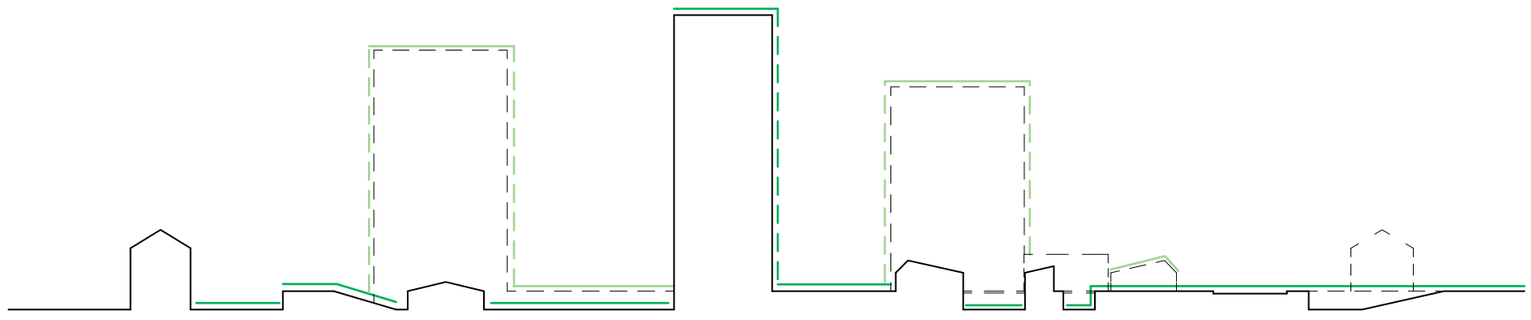
The green link connects the sapces among the high-rise buildings and increases different urban space - public and private courtyard.

public service

Final concept





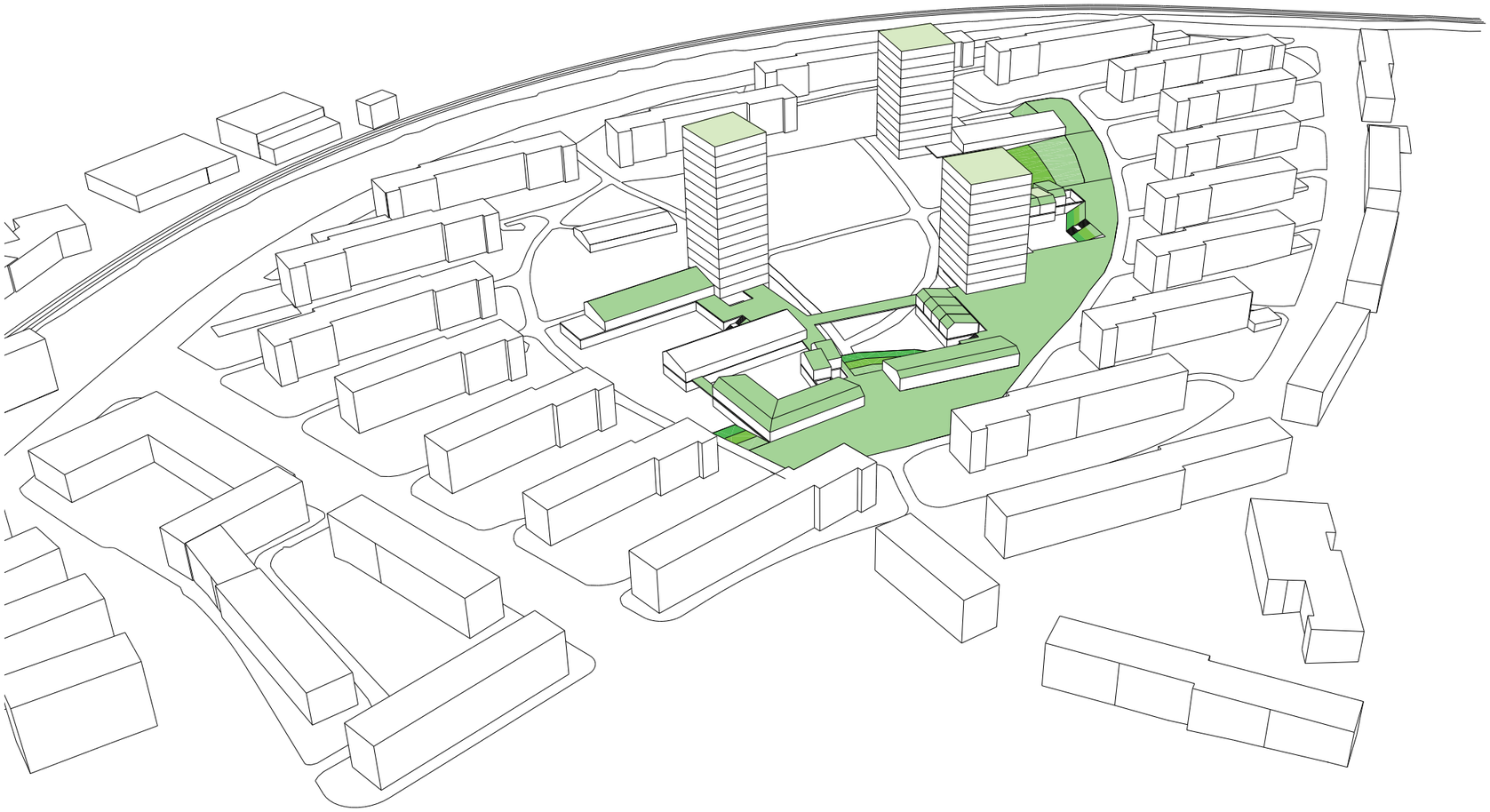


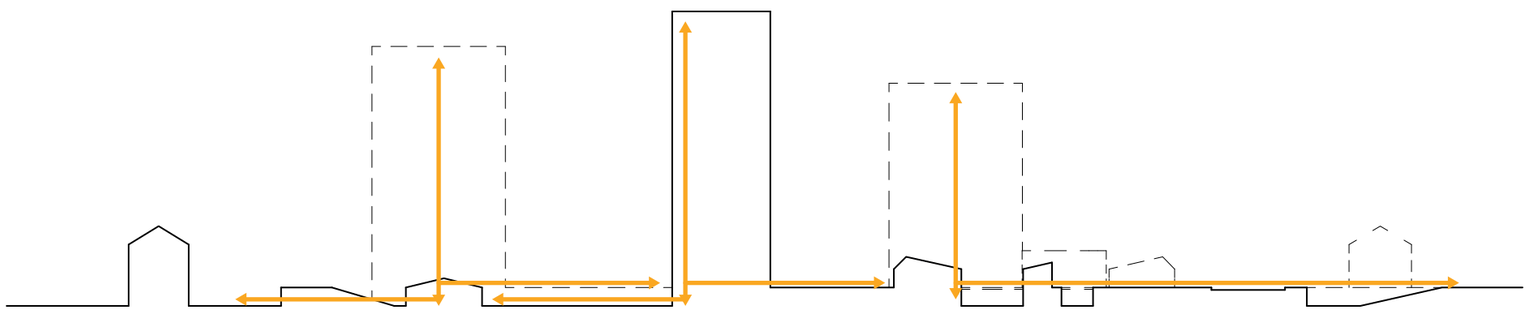
Different building types are added into the neighbourhood by lifting the greenery. It creates a mix of buildings and also more public space in different scale. The mix of housing means that there is a mix of income, sizes and types, ages and life stages, cultural backgrounds, family, society, lifestyle, interests, individual aspirations and preferences for different residential facilities.

green roofs

green facade

Final concept





singles apartment

couples apartment

family house

senior apartment

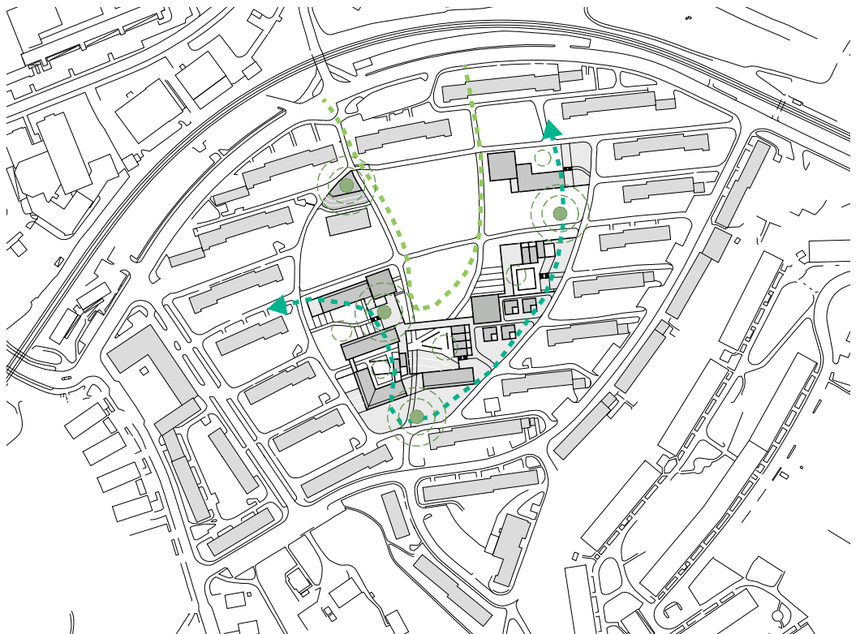
The high-rise buildings provide better accessibility to the roof level and also enable the old people to live longer. The new housing creates a mixed-use system of four different types of residential housing for young and old, nuclear families and singles, families that grow or smaller.

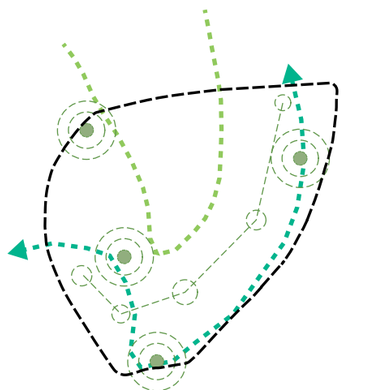
accessibility

Master plan


A
A
food store
football playground
kindergarten
central green space
high-rise building
green roof
row house
library atrium
library
green roofterrace
semi-private courtyard
semi-private courtyard
courtyard house
private courtyard
vegetable garden
electric car parking
high-rise building
green roof
vegetable garden
singles apartments
gallery
private courtyard
courtyard house
sunken plaza
high-rise building
green roof
family house
courtyard house
private courtyard
row house
senior apartments
vegetable garden
indoor garage
N
1 : 2000
FAR ratio 0.57
building density 21%
greenery ratio 0.58

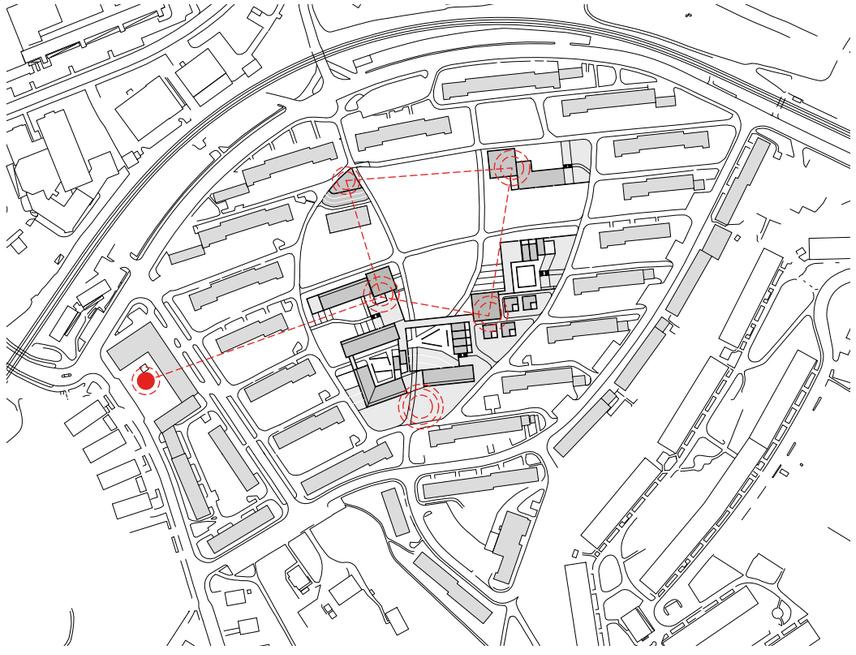
Analysis

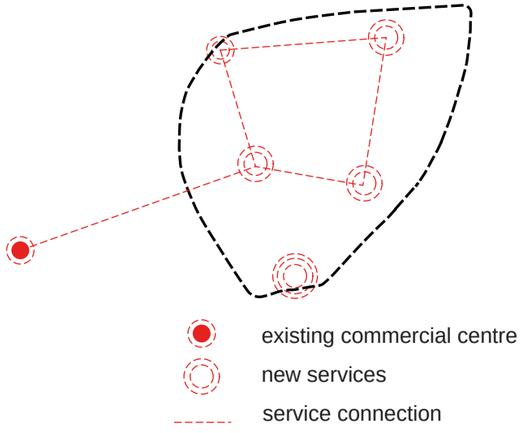




courtyard
public greenery
courtyard connection
public greenery connection
central greenery

Greenery structure

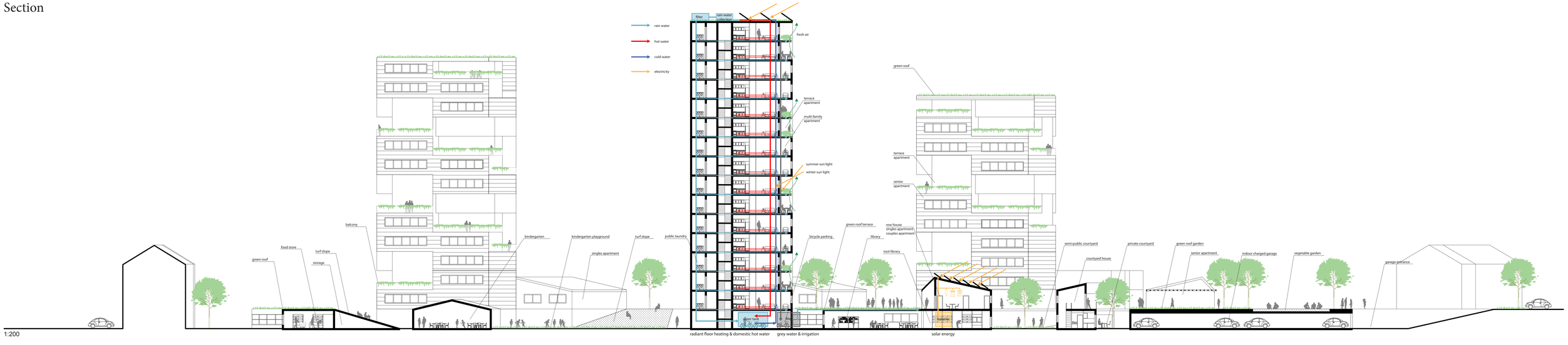




existing commercial centre
new services
service connection

Service centres

Section

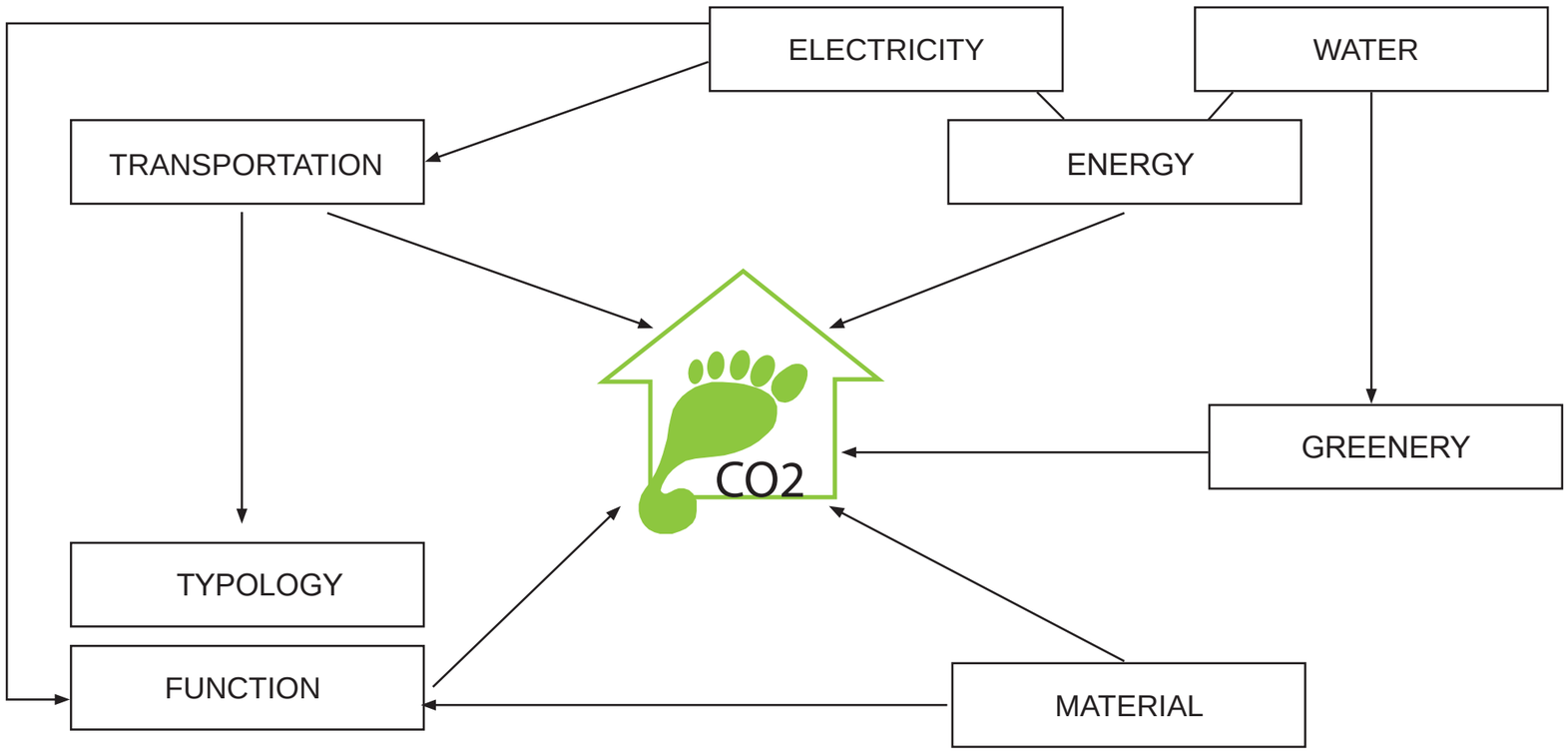


1:200

Sustainability concept

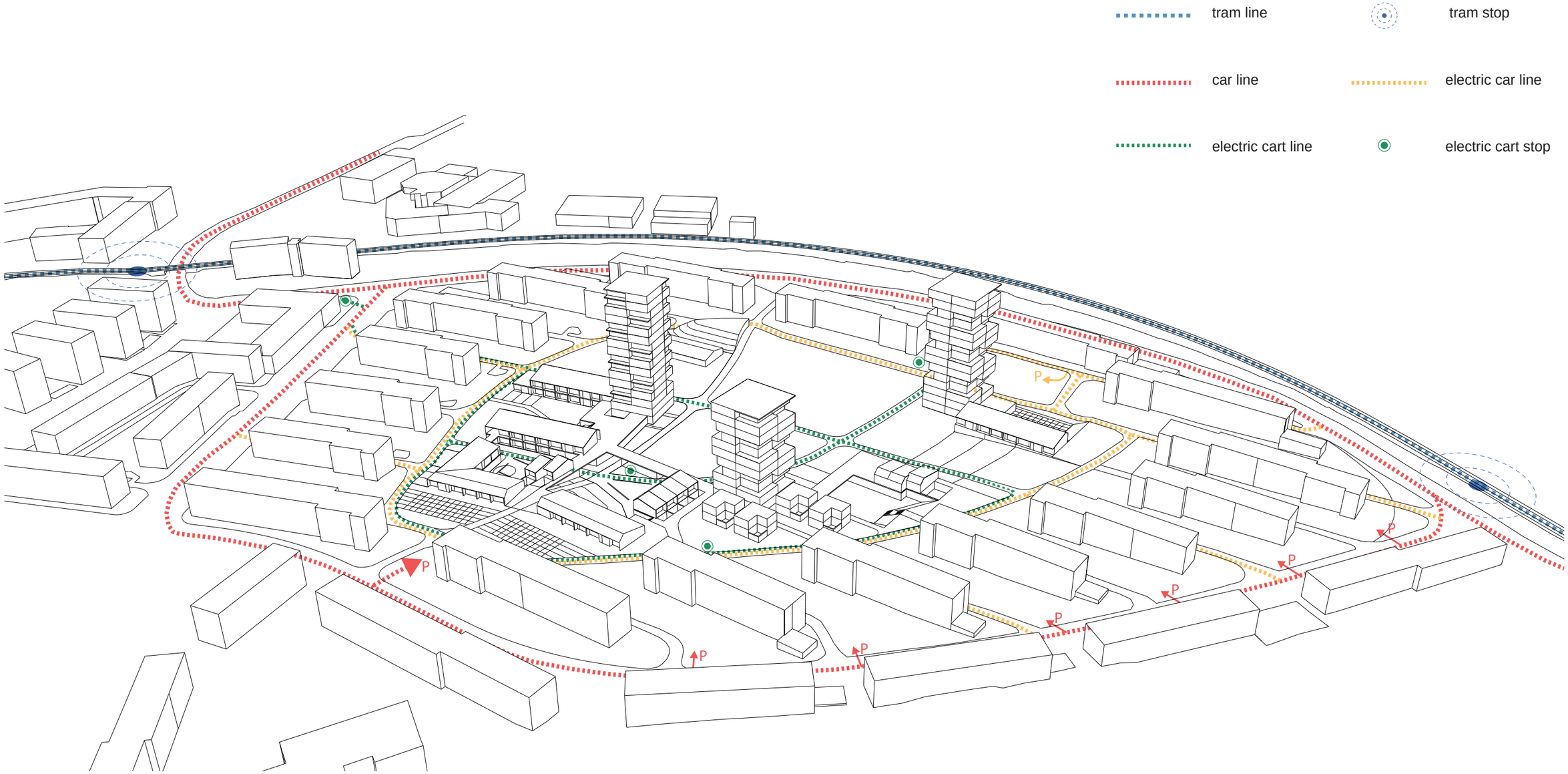
The sustainability concept of this project is to make the new neighbourhood a low carbon footprint neighbourhood. From this point, five ways are considered.

Green roofs and vegetable gardens have been designed to increase the green ratio of the area. Greenery could help absorbing CO2 from daily life and it also provides enough natural outdoor space when more buildings are built.
A mix of function and typology is also important to shrink the carbon footprint by changing the way of life. More services in the area will make the neighbourhood self-efficient and encourage people not use cars for the daily errands. It is also create a mix of people in different ages and background.
Sustainable transportation is another aspect. Less car parking, walkable street and public transportation connected the city as well as inside the community, will all help reducing the CO2 emission from the cars.
The materials are significant in reducing carbon footprint. Solid wood is the main material in my project because most wood product has negative carbon footprint during the life cycle.
Efficient energy use is designed to balance the whole area. The water cycle and solar energy collection will save energy consumption.



Neighbourhood pattern and design

Street network and Sustainable transportation

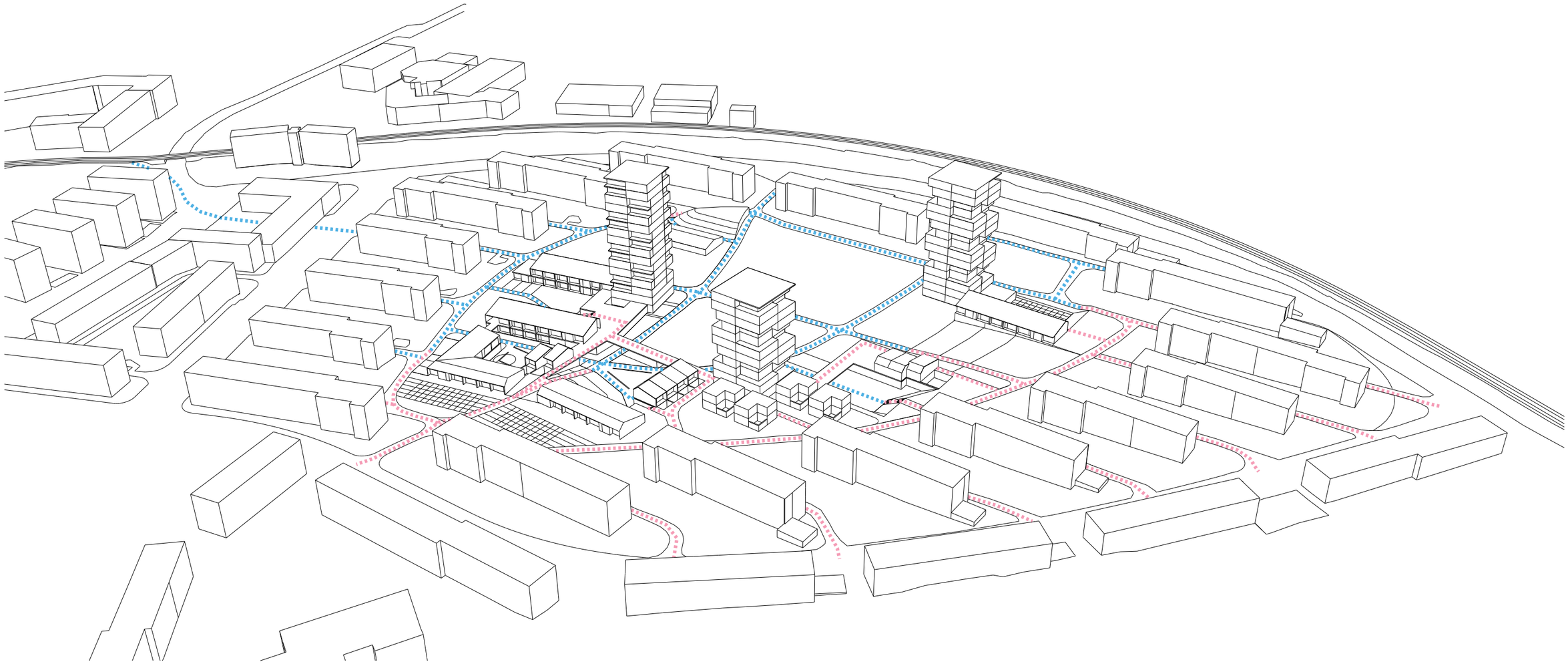


Neighbourhood pattern and design

Street network and Sustainable transportation

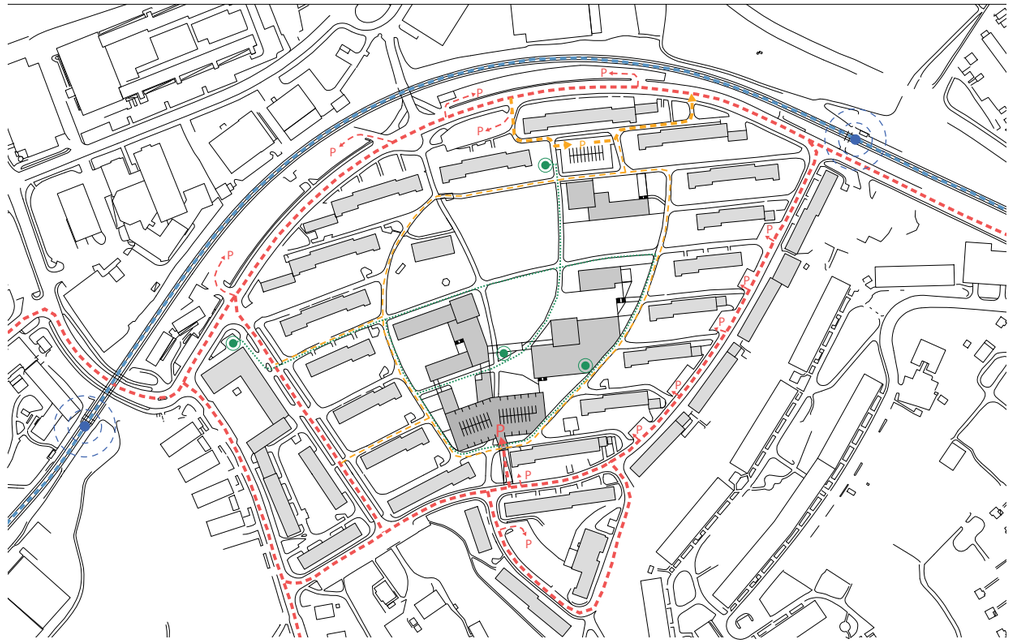
Walking line on the ground

Walking line on the roof

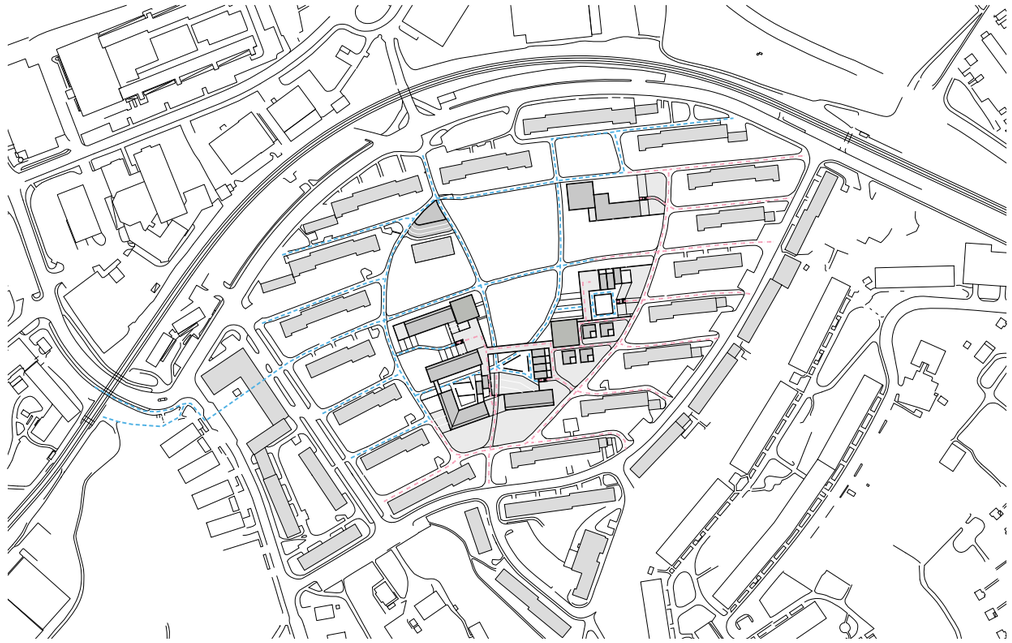


Neighbourhood pattern and design

Street network and Sustainable transportation



Sustainable transportation is encouraged in the neighbourhood. Two tram stops closed this area connected the city. The inside part is opened for the electric vehicles. The electric carts and stops provide an easy way to home. The new structure also provides more outdoor and indoor bicycle stops. A new parking space for the electric cars, as well as a charged garage is designed in this project. Bicycles will be the main transportation inside the neighbourhood.

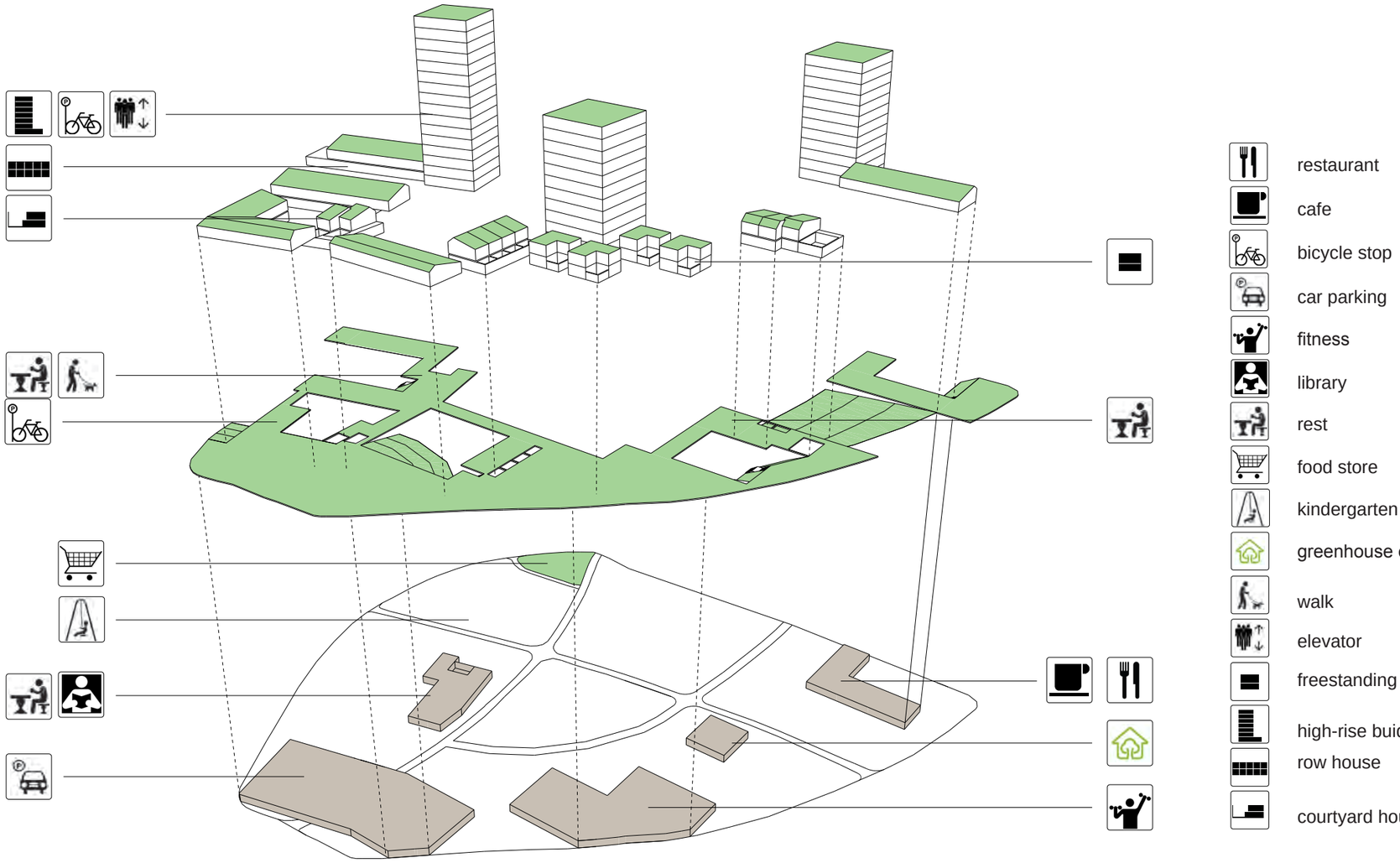


This project keeps the main street network of the ground, and introduces a walkable street on the roof level. This level provides more safe and semi–public spaces for residents to communicate. It also creates some courtyards on the ground. All the vehicles and the parking space are kept outside the area.

Mixed use of service

Urban residential/commercial - multi- story residential buildings with commercial and civic uses on ground floor[1]

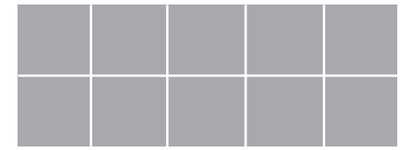
To shrink the carbon footprint of the neighbourhood, this project provides more services than it had before, such as food store, restaurant, café, library and so on. The mix of function reduces distances between housing, work-places, retail businesses, and other amenities and destinations. It could encourage people to do their everyday errands on foot or by bicycle and reduce the use of cars. Those functions create a service network, including the existing commercial centre and could also support the population increasing in this area and make it alive.



1 http://en.wikipedia.org/wiki/Mixed-use_development

Green infrastructure and buildings

Typology



Row house

singles apartment x 54
couples apartment x 8

Freestanding house

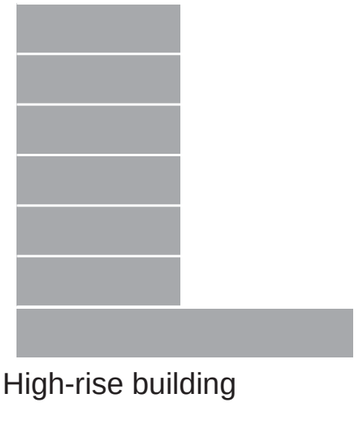
family house x 4

Courtyard house

family house x 3

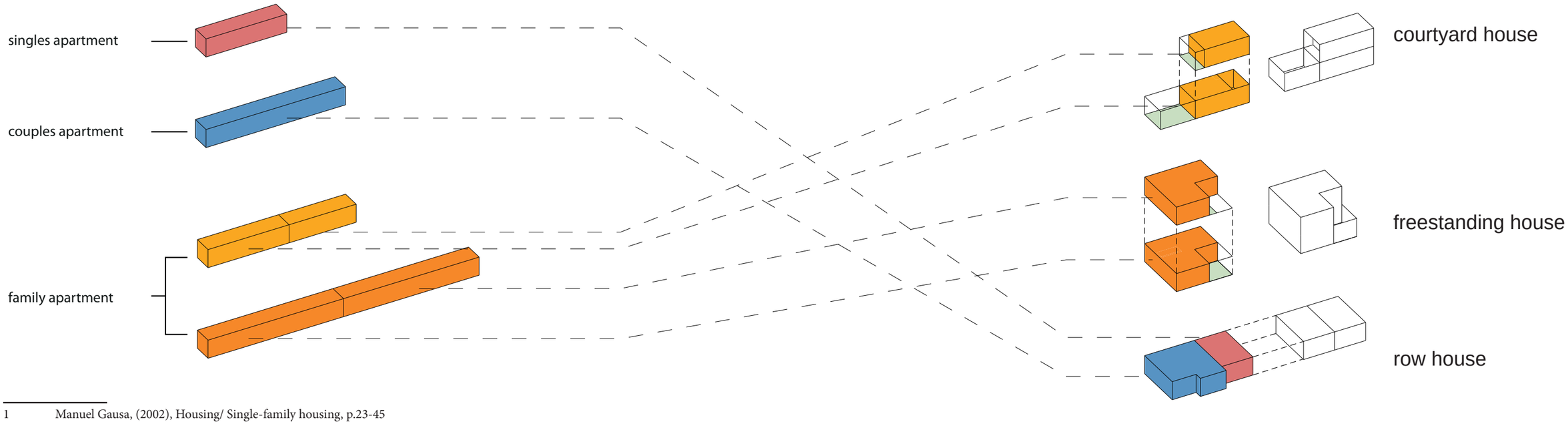
The mix of housing means that there is a mix of income, sizes and types, ages and life stages, cultural backgrounds, family, society, lifestyle, interests, individual aspirations and preferences for different residential facilities. For example, a larger house with several bedrooms and access to private open space would be well received by a small family, while a university student may choose to share an apartment. A bachelor may need a small apartment but an old couple may seek a simple care unit in the retirement village. Similarly, different income groups will not have the same requirement in housing tenure. A mix of residents could bring more interaction and create an efficient community with different culture and thus bring economic development. [1]

This project provides an important alternative to home ownership. In the new Torpa, new types of buildings and apartments are introduced. High-rise buildings, row houses, freestanding houses and also courtyard houses containing 170 apartments are all designed in the same area.



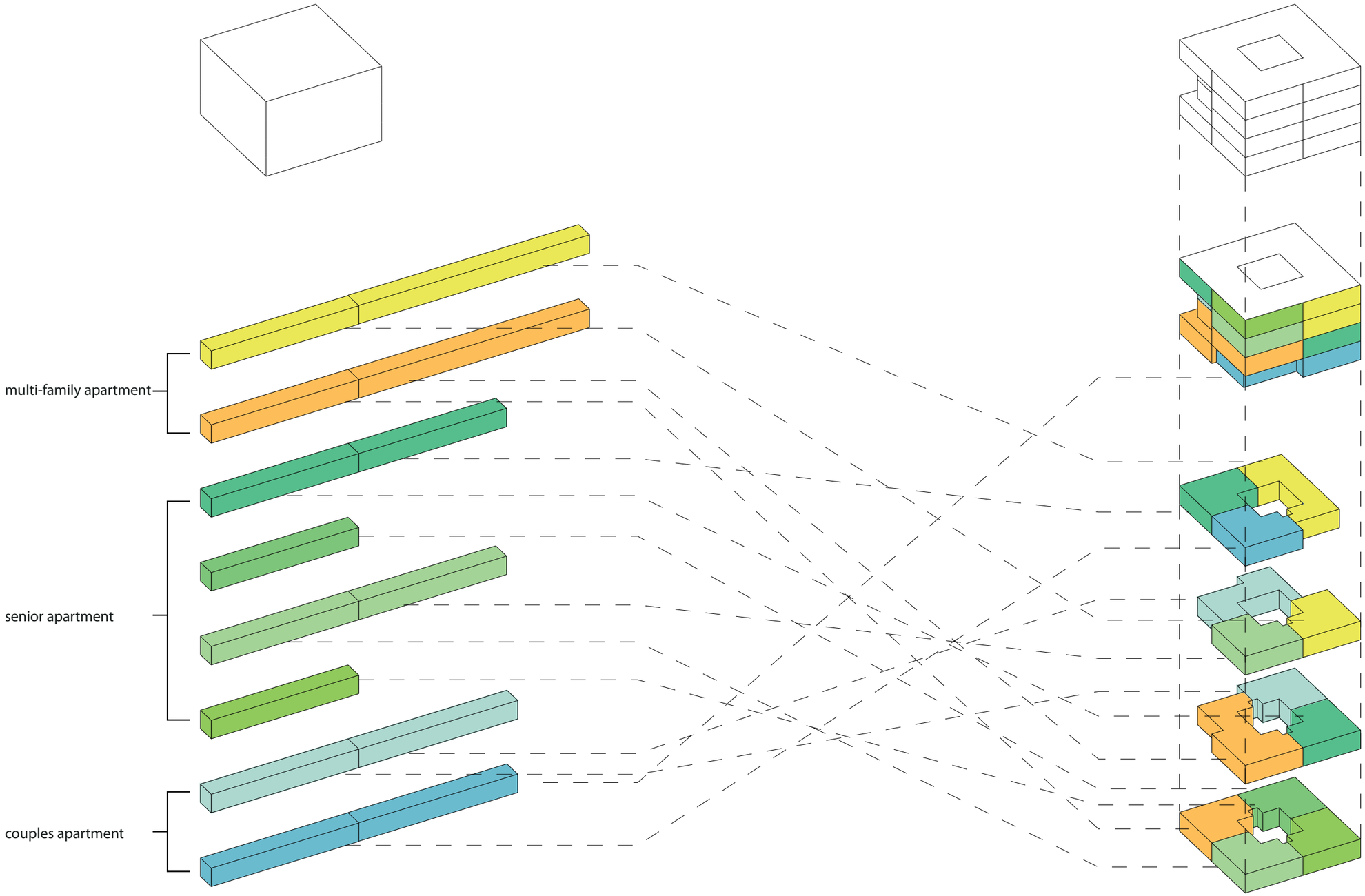
High-rise building

family house x 24
senior apartment x 66



1 Manuel Gausa, (2002), Housing/ Single-family housing, p.23-45

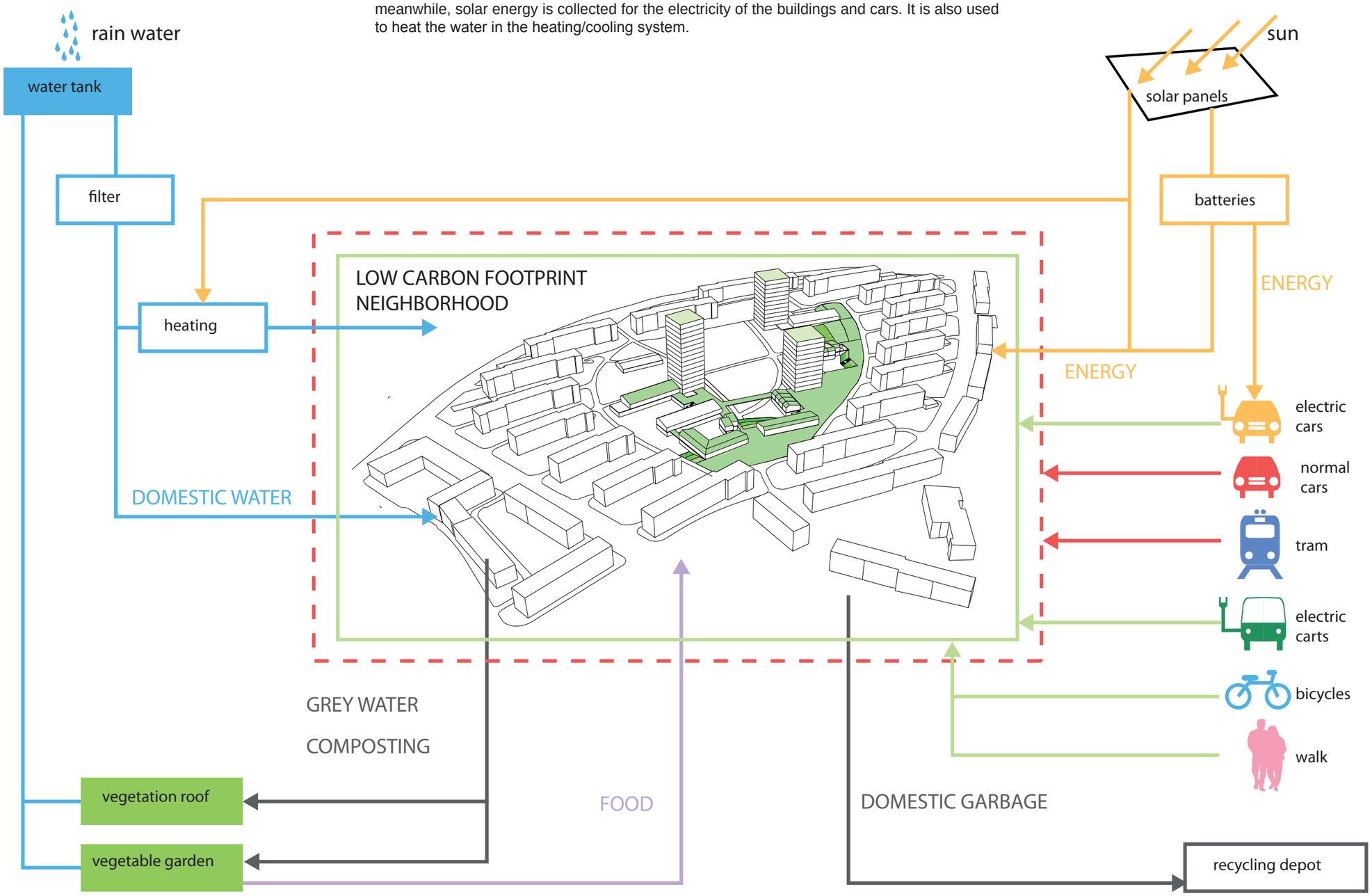
Typologies

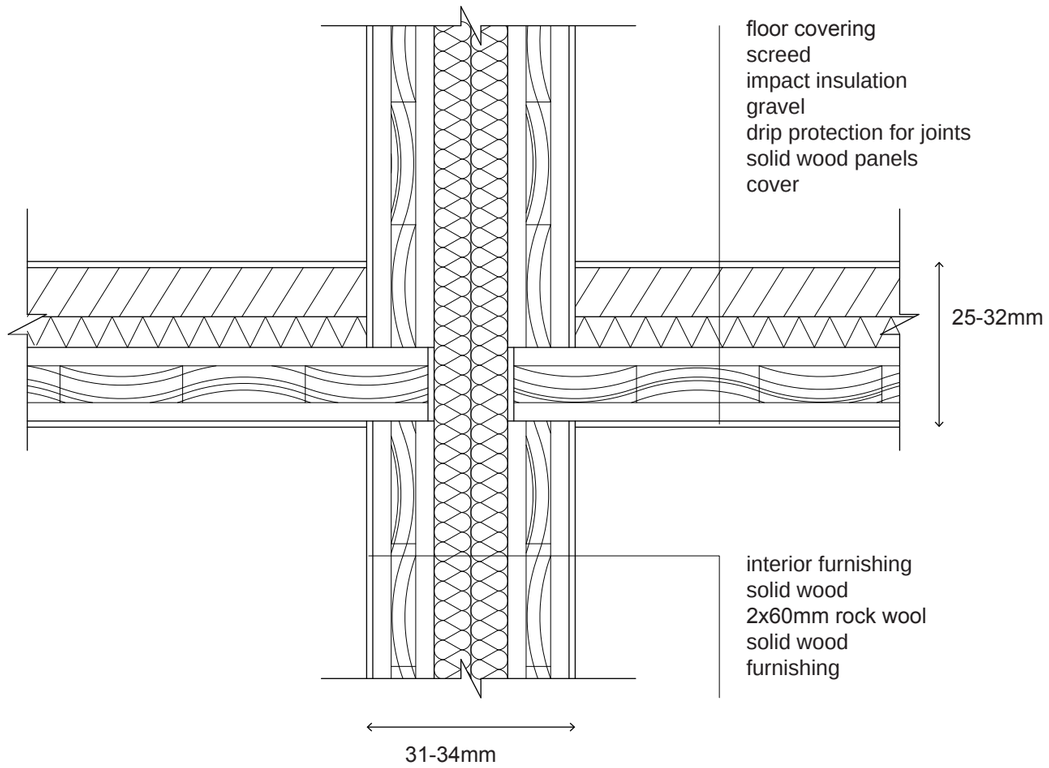

high-rise building unit
multi-family apartment
senior apartment
couples apartment

Energy and material

Energy systems

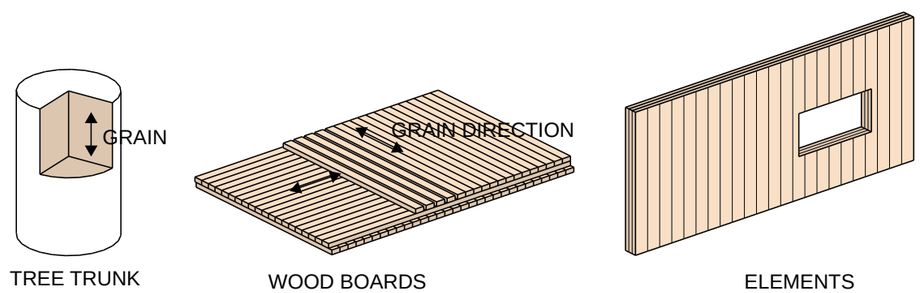
This diagram shows the energy use in the new project. Rain water is collected in the water tank and used in toilets and shower, and also used in heating systems. Irrigation of the green roof and vegetable garden uses the rain water as well as the grey water and compost. In the meanwhile, solar energy is collected for the electricity of the buildings and cars. It is also used to heat the water in the heating/cooling system.





1 Reference detial 1:10

2 Stadthaus, London



3 Reference manufacture process

1 http://www.alexschreyer.net/engineering/how-tall-can-we-build-in-wood/
2 http://blog.emap.com/footprint/2009/07/15/would-you-like-to-live-here/
3 http://www.nytimes.com/interactive/2012/06/05/science/0605-timber.html

Energy and material

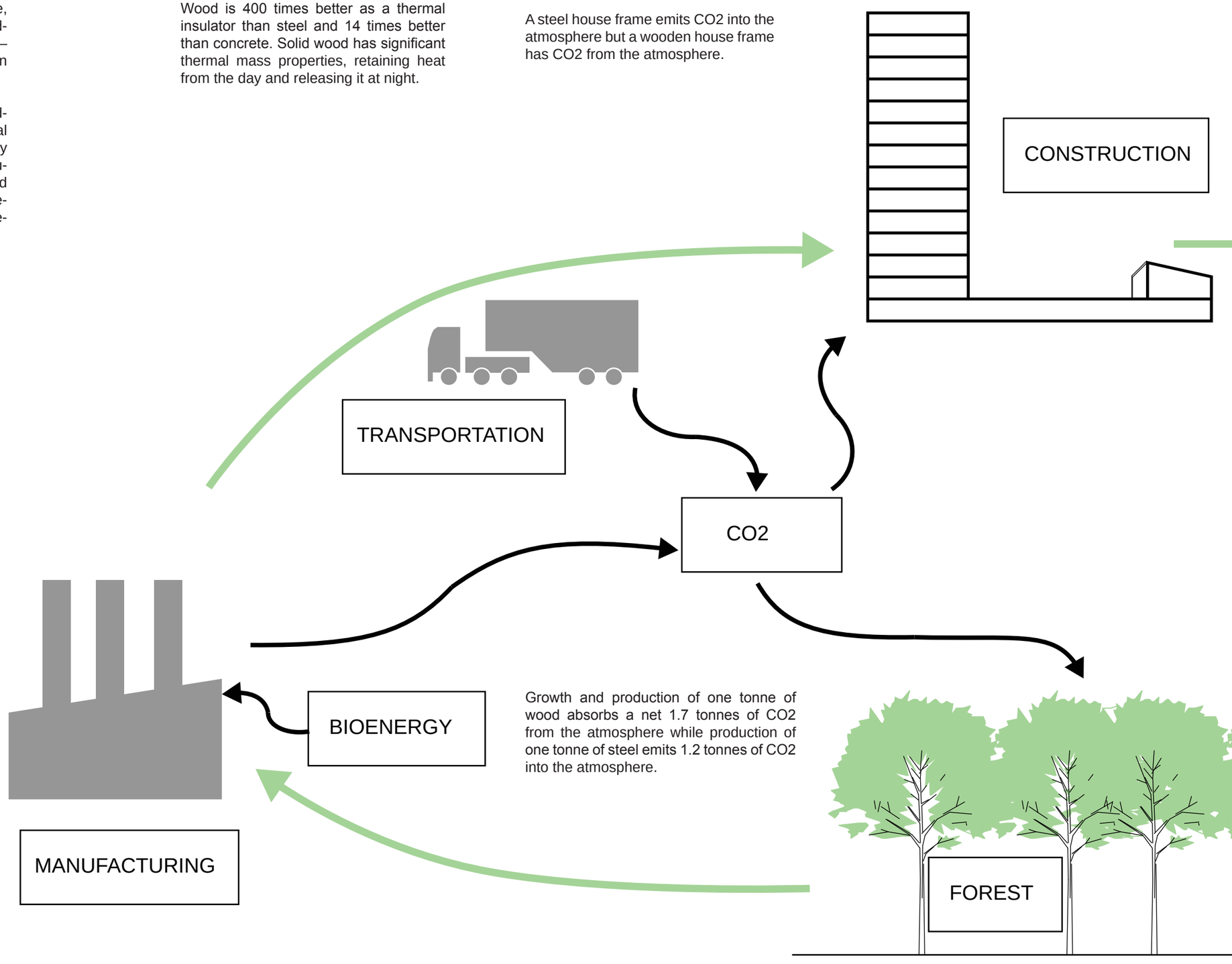
Materials and life cycle

Embodied energy is linked to carbon dioxide emissions. On average, 0.098 tonnes of carbon dioxide are produced per gigajoule of embodied energy. This means that if we can reuse or recycle materials – whether it is aluminium cans, or building materials – we can ‘save’ on the amount of carbon dioxide produced. [1]

Solid wood, as a sustainable material in architecture, reduces embodied energy of the whole life cycle process. Wood is a domestic material in Sweden and it saves energy in transportation. Compared to many other materials used in construction, for example, steel, concrete, aluminium, or plastic, wood requires a minimal amount of energy-based processing. Wood has a good thermal property which could help reducing the energy by heating and cooling. It is also a recyclable material.

Wood is 400 times better as a thermal insulator than steel and 14 times better than concrete. Solid wood has significant thermal mass properties, retaining heat from the day and releasing it at night.

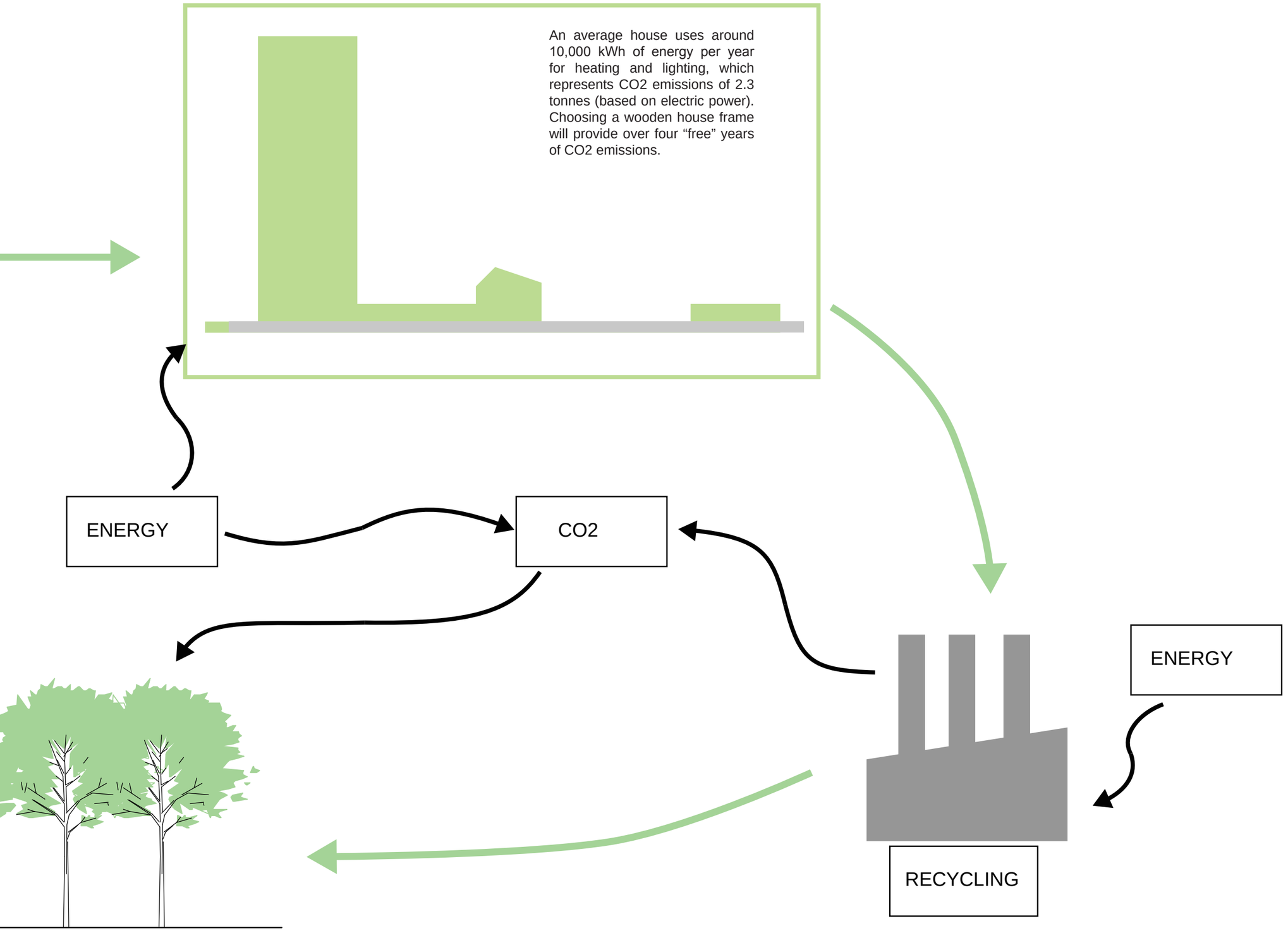
A steel house frame emits CO2 into the atmosphere but a wooden house frame has CO2 from the atmosphere.



Wood manufacturing uses a lot of bio-energy, the products store carbon, and wood products manufacturing is energy efficient. For these reasons, most wood products have negative carbon footprints – their use actually results in net carbon storage.

Growth and production of one tonne of wood absorbs a net 1.7 tonnes of CO2 from the atmosphere while production of one tonne of steel emits 1.2 tonnes of CO2 into the atmosphere.

1 http://www.epa.vic.gov.au/agc/r_emissions.html#embodied-energy/!


An average house uses around 10,000 kWh of energy per year for heating and lighting, which represents CO2 emissions of 2.3 tonnes (based on electric power). Choosing a wooden house frame will provide over four “free” years of CO2 emissions.
ENERGY
CO2
ENERGY
RECYCLING

Sustainability

‘Thoughtful neighborhood planning can limit the need for automobiles and their greenhouse gas emissions. Mixed-use development and pedestrian-friendly streets encourage walking, bicycling and public transportation. Green buildings and infrastructure also lessen negative consequences for water resources, air quality and natural resource consumption.

The character of a neighborhood, including its streets, homes, workplaces, shops and public spaces, affects quality of life. Green developments respect historic resources and the existing community fabric. They preserve open space and encourage access to parks.

Combine the substantial environmental and social benefits, and the case for green neighborhoods makes itself.’[1]

—— LEED for Neighborhood Development

For the purpose of making Torpa a sustainable community and matching future development, I use LEED as my guideline of design and focus on the six aspects: Green structure and city agriculture, Architecture, sustainable transportation, Material, Water efficiency and Solar energy.

Green structure and city agriculture

The project works with the urban spaces, typologies, as well as street network by creating mix-use neighborhood centers, mixed- income diverse, good connections with open spaces and good access to the public service.

Material

A sustainable material in architecture could help to reduce the embodied energy of the whole life cycle process by saving energy in transportation, manufacture and construction.

Architecture

The buildings should increase the aesthetic quality of the neighborhood with different types and levels. The mix of housing means that there is a mix of income, sizes and types, ages and life stages, cultural backgrounds, family, society, lifestyle, interests, individual aspirations and preferences for different residential facilities.

Water efficiency

The water consumption is a important aspect of the sustainable neighborhood. The water recycling of domestic water and landscaping includes how to use the rain water, grey water and also the composting.

Sustainable transportation

Encourage sustainable transportation means reduce the footprint of transportation by creating a good bicycle network and storage, reducing car parking footprint and providing a safe and walkable street network.

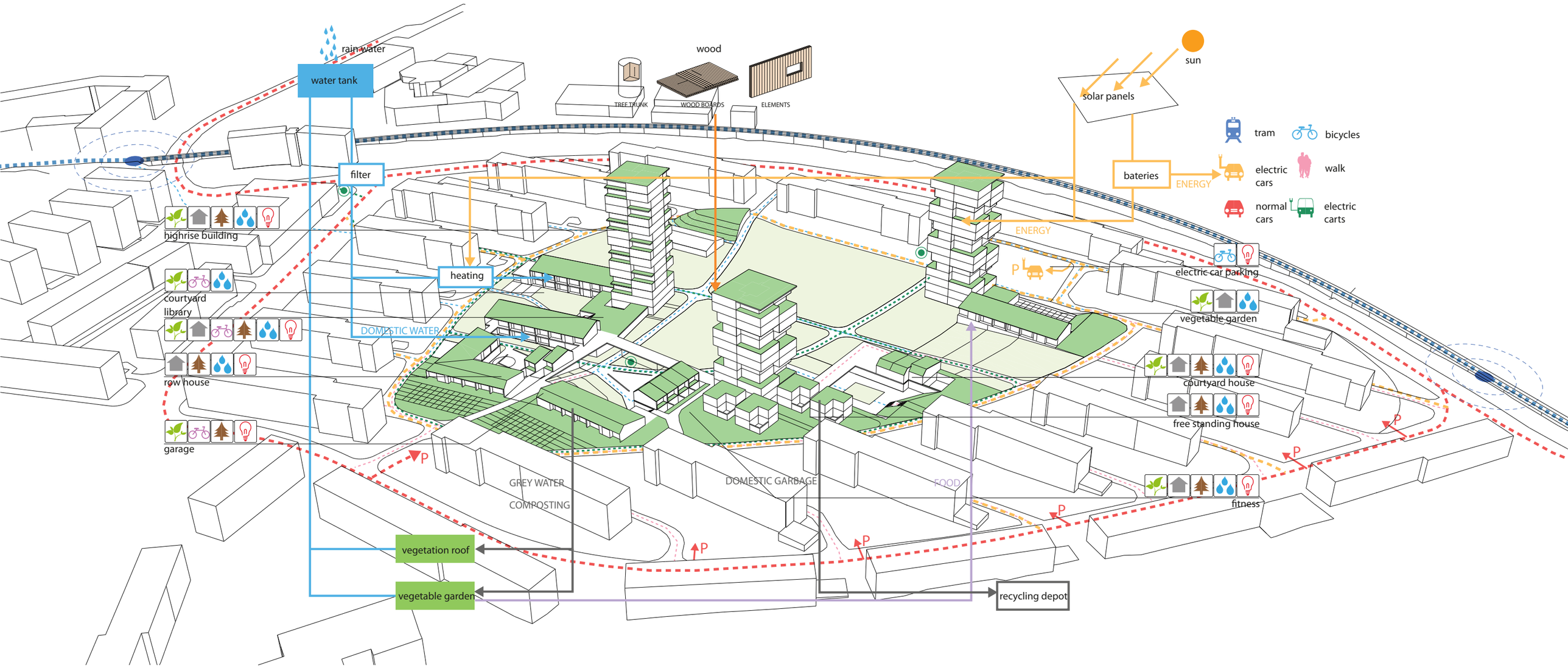
Solar energy

To make the neighborhood energy efficient, energy production should be considered. Solar energy collection could reduce the requirement of electric and heating. Natural daylight is another important issue.

1 http://new.usgbc.org/leed/rating-systems/neighborhoods

					
Green structure and city agriculture	Architecture	Sustainable transportation	Material	Water efficiency	Solar energy
High-rise buildings defined the central park Green balconies Green roofs and second floor path Semi-public courtyard and Private courtyard Vegetable garden for the restaurant Compost transforming biological waste into new soil for the green roof and vegetable garden	Mix of building types: High-rise buildings Row houses Courtyard houses Freestanding houses Mix of apartment types: Singles apartments Couples apartments Family flat Senior apartments	Two closed tram stops Cars are kept outside the neighbourhood Walkable street on the second floor level Charged indoor garage and electric car parking New bicycle stops	Solid wood timbers: Low embodied energy during the cradle to cradle life cycle CO2 absorption Good thermal insolation Good sound protection Domestic material Rammed earth wall: Domestic material Good thermal insolation	Rain water for WC, wash machine and irrigation Rain water for heating/cooling system Low flush taps and shower Grey water for irrigation	Solar panels for electricity Solar collection for hot water Solar shading with the roof design to minimize the need for cooling Maximize the natural light in winter

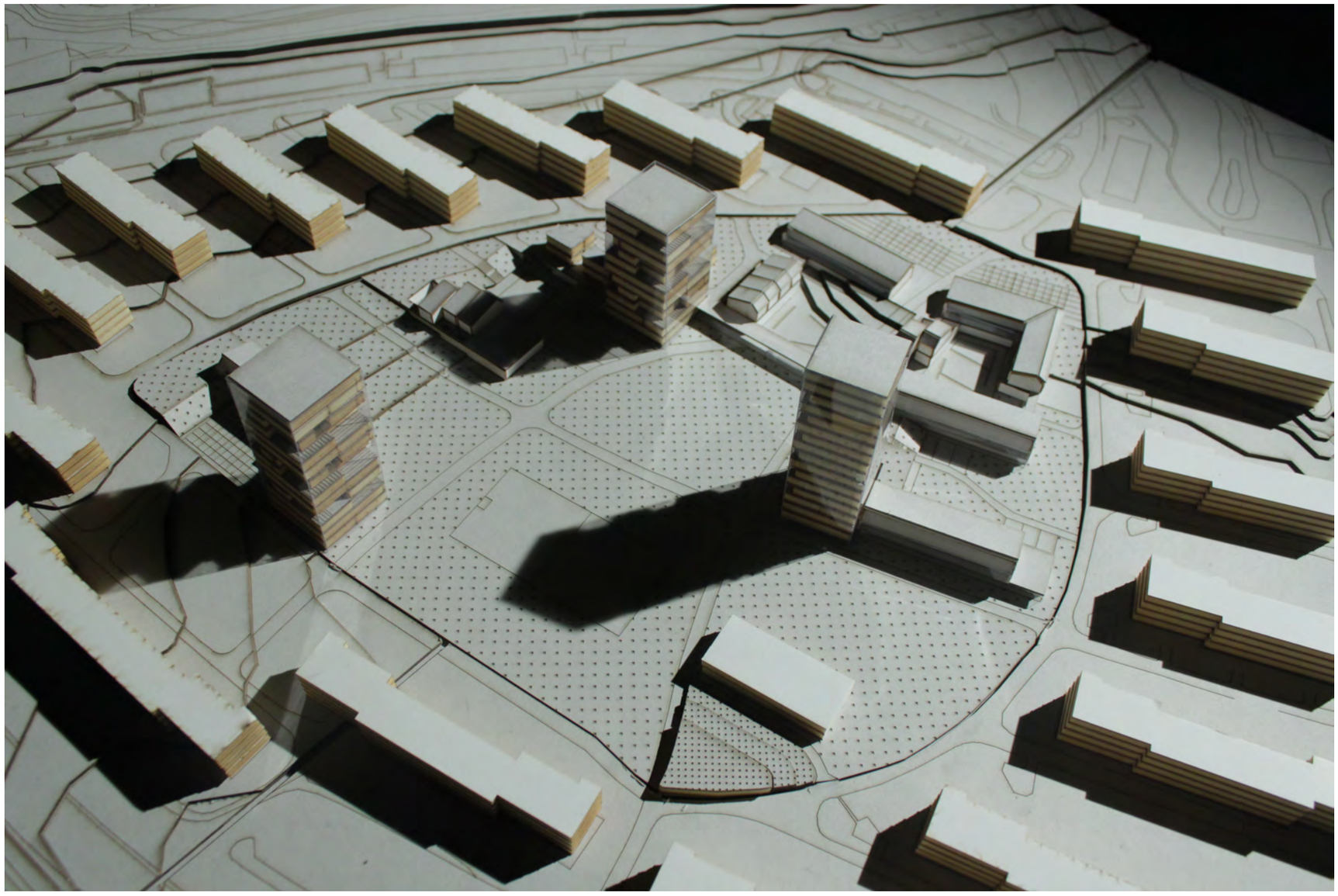
Sustainability



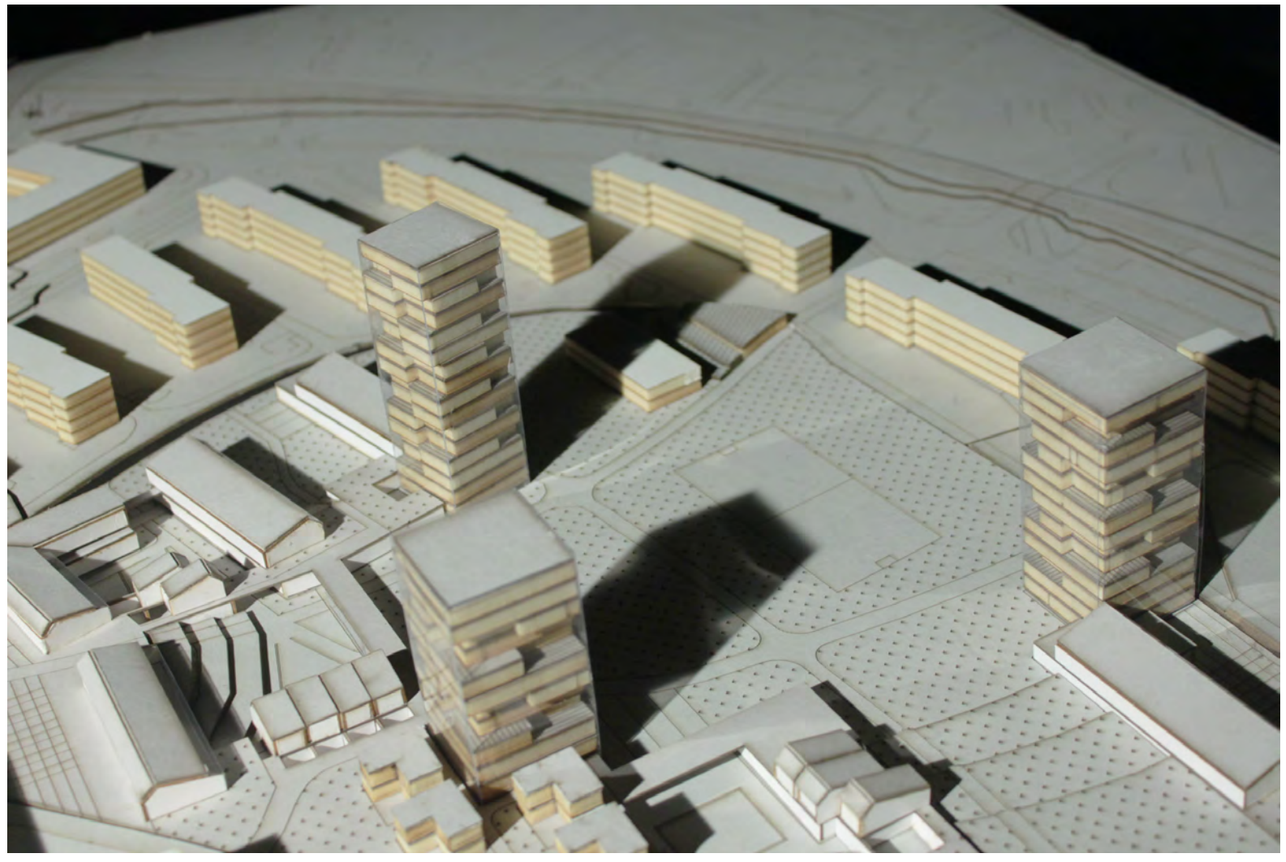
Perspective view and model photos

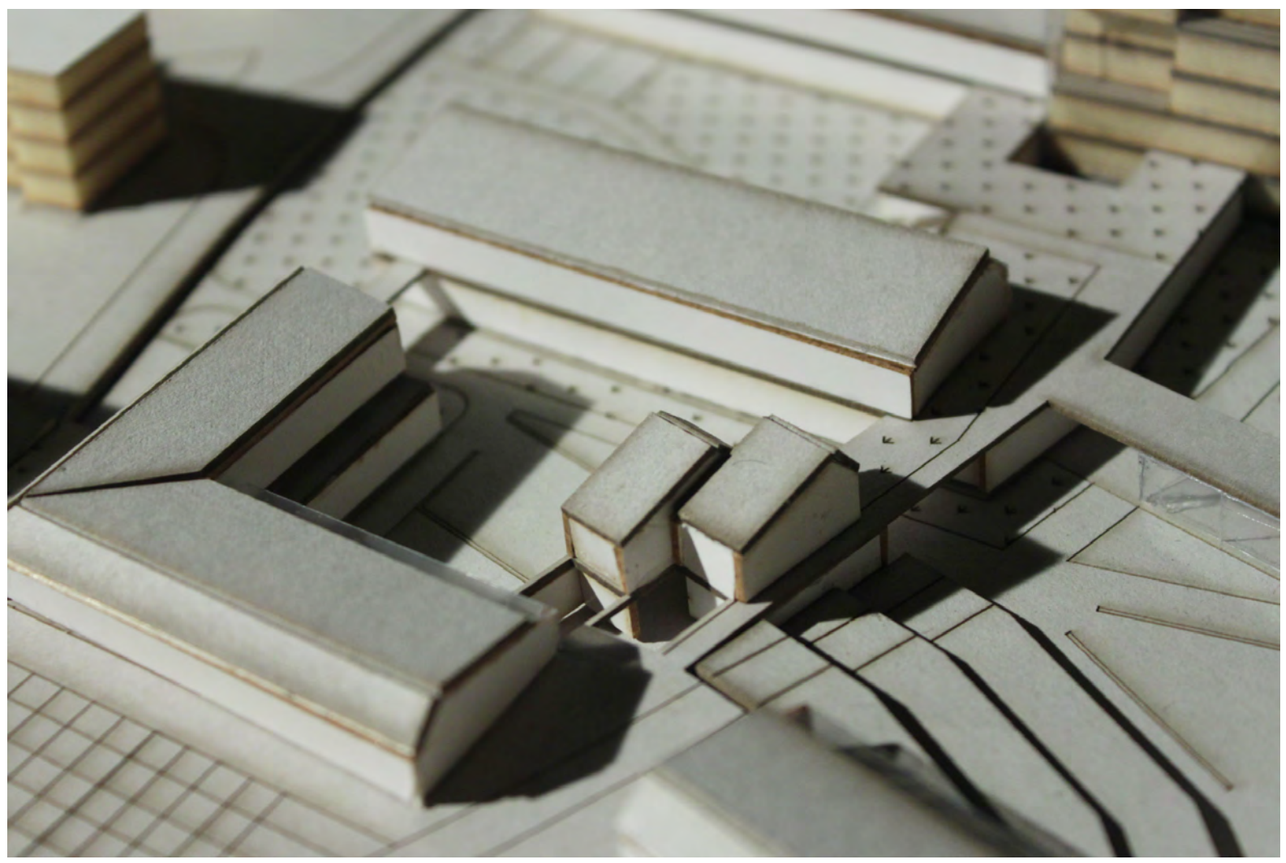
Perspective view and model photos

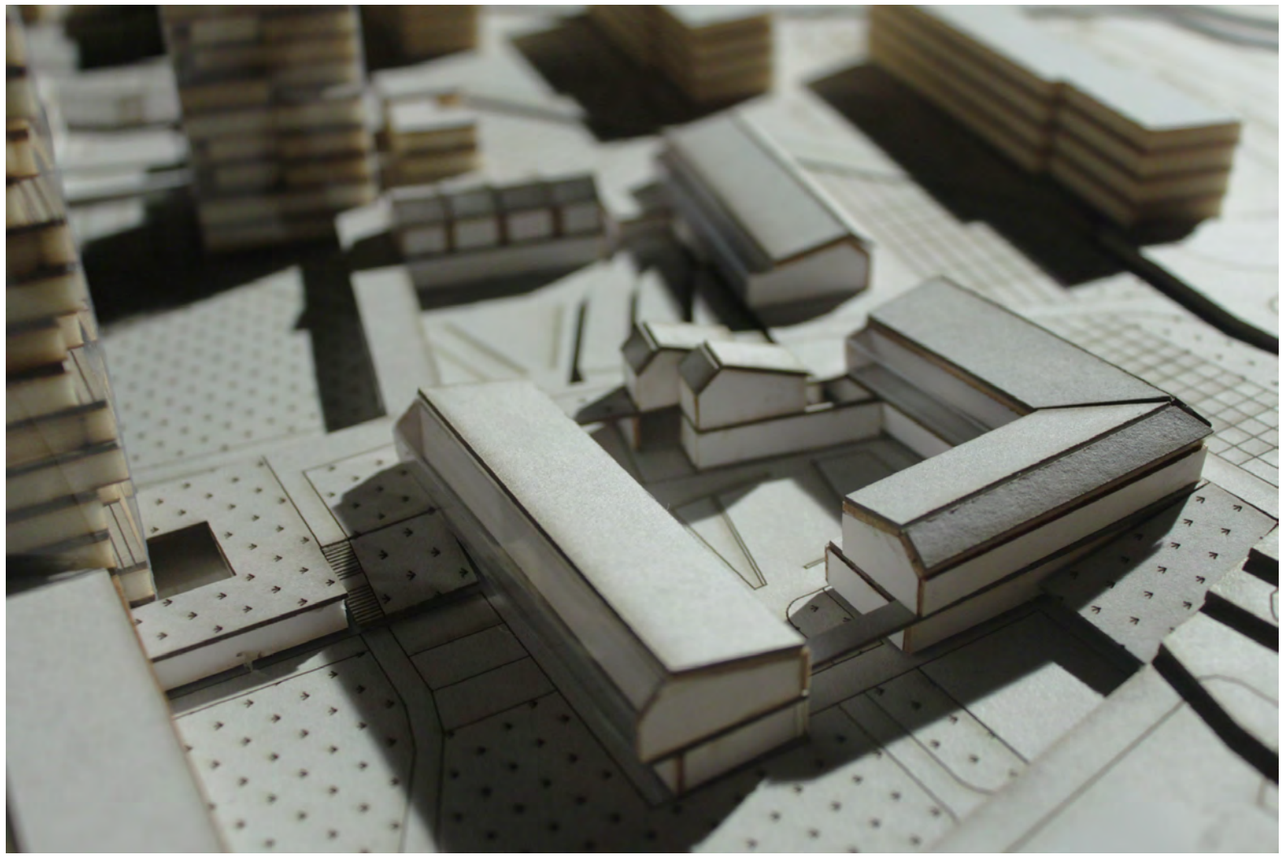
Perspective view and model photos



Perspective view and model photos







SUMMERY

In this project, new housing blocks with low energy concept are added into the existing environment in order to avoid the population reduction and age population, provide better accessibility, more services, more flexibility of apartment and better connection between indoor and outdoor space, and make Torpa into a density, mix-use and self-sufficient community.

For this purpose, LEED is used as the guideline of design and the project focuses on the six aspects: Green structure and city agriculture, Architecture, sustainable transportation, Material, Water efficiency and Solar energy.

In the planning development, the new housing blocks and the green structure has redefined the public spaces. It brings the architectural diversity into the existing neighborhood, and makes a mix of uses and housing types for youths, couples, families and elder people. It does not only increase the density of the area, but also creates more public spaces in different scales and provides a better communicating environment.

Sustainable transportation is encouraged in the neighbourhood. Normal cars are kept outside the neighbourhood and the inside part is opened only for the electric vehicles. The electric cart lines provide an easy way to home. A walkable street on the roof level is introduced to provide a safety network for residents. Besides, more services are implemented, such as food store, restaurant, café, and library. The mix of function could encourage people to do their everyday errands on foot or by bicycle and reduce the use of cars.

Solid wood, as a sustainable material in architecture, is used for the main structure and façade. It helps to reduce the embodied energy of the whole life cycle process by saving energy in transportation, manufacture and construction.

In order to reduce the energy consumption, rain water is collected into the water tank and used in toilets and shower, as well as the heating/cooling systems. Irrigation of the green roof and vegetable garden uses the rain water as well as the grey water and composting from the buildings. In the meanwhile, solar energy is collected for the electricity of the buildings and cars. It is also used to heat the water in the heating/cooling system.

With all these aspects, this thesis transforms Torpa into a sustainable neighborhood which could match today and future’s requirement, and enable people to live there for longer.

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