TU Delft Department of Architecture
BK Bouwkunde

Creating a healthy living community within an old vacant building

P5 Presentation
aE graduation studio
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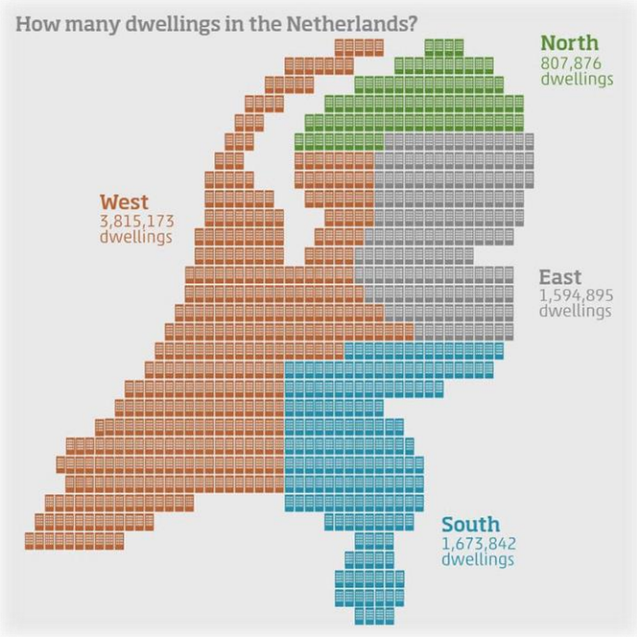
Introduction

Simplicity

Health and wellbeing

Problem statement



Housing shortage in the Netherlands

Problem statement

1 Million home:

- Due to that a group of people - including representatives from the housing and insurance sectors - have presented a plan which will allow for one million new homes to be built in the Netherlands over the coming 10 years.
  - According to the plan, the Netherlands is now short of over 380.000 homes (1)

“Building a 1 million homes in ten years would most certainly require a lot of resources and energy. As a result, it would be far more cost-effective and environmentally responsible to adapt and renovate existing structures.”

Research

According to professors Marja Elsinga and Thijs Asselbergs

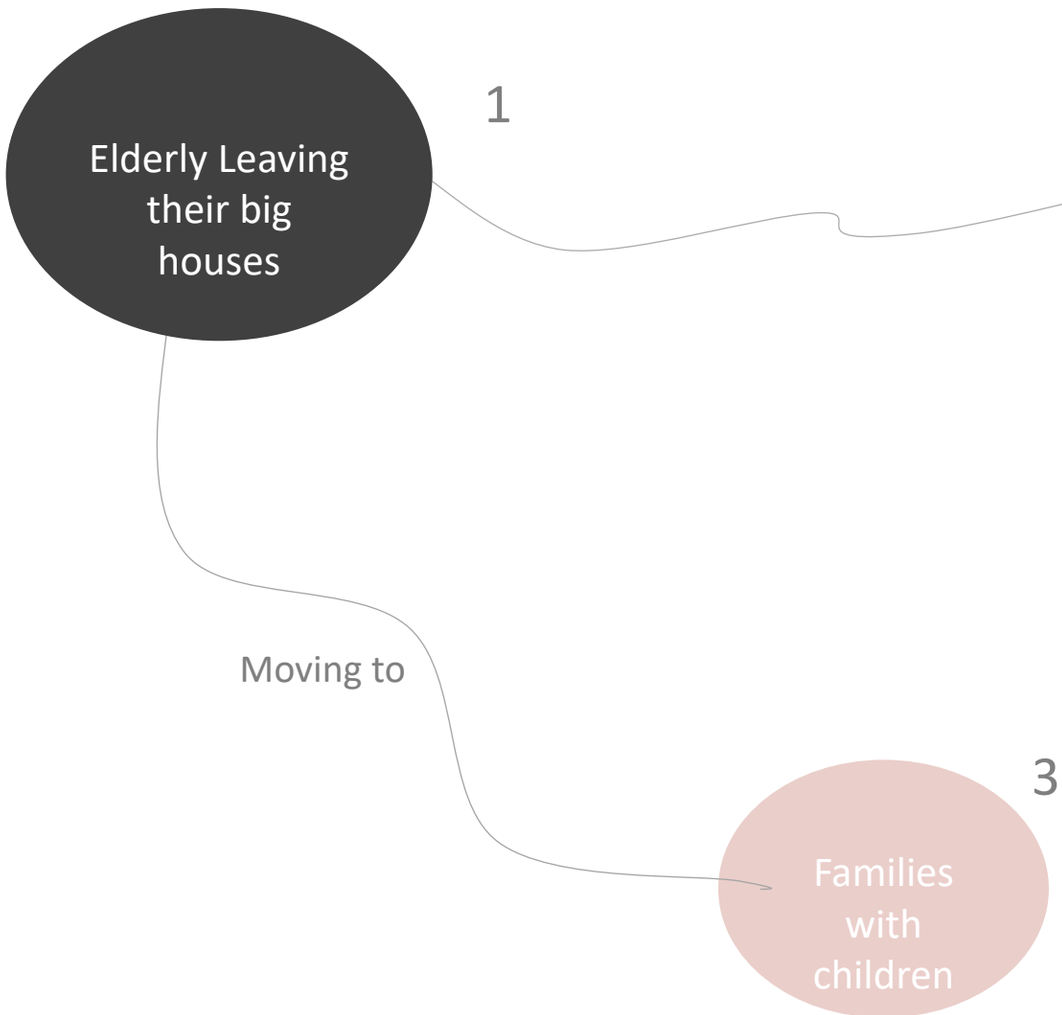
New construction is certainly necessary, but existing space can also be used better, and a critical analysis of the housing system is in order.

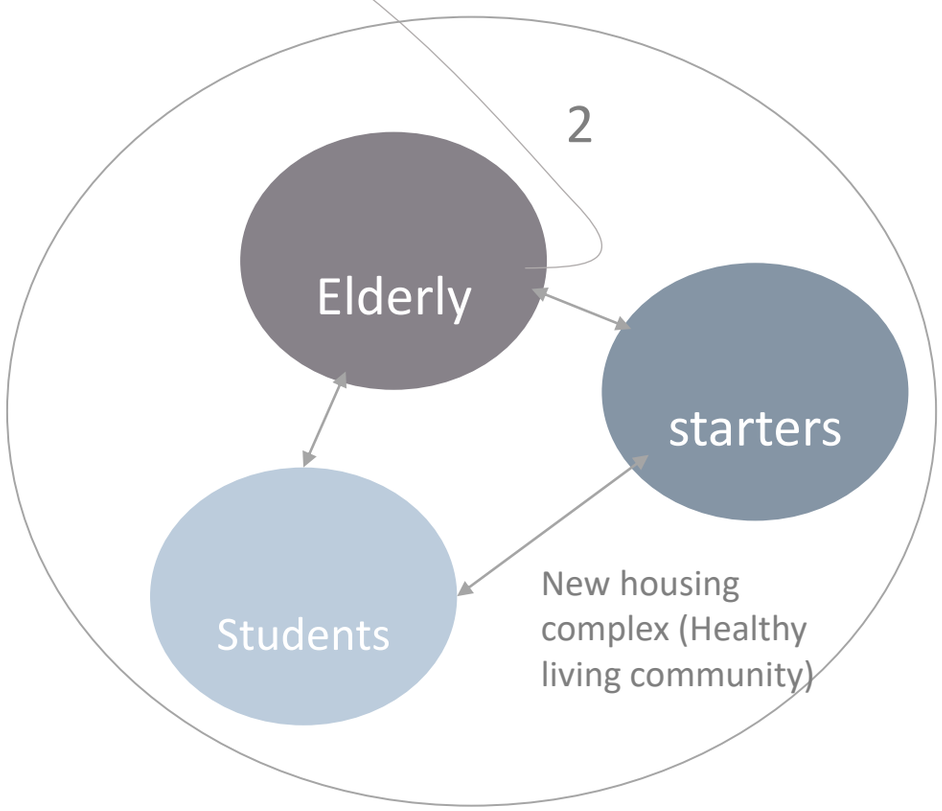
- “Actually, all the cubic meters are already there,”.
- “All kinds of business premises and offices, but also churches and farms can in principle be made suitable for habitation.

Concept

First conceptual idea

Older people staying in large homes is a key factor to housing crisis:
Municipalities:





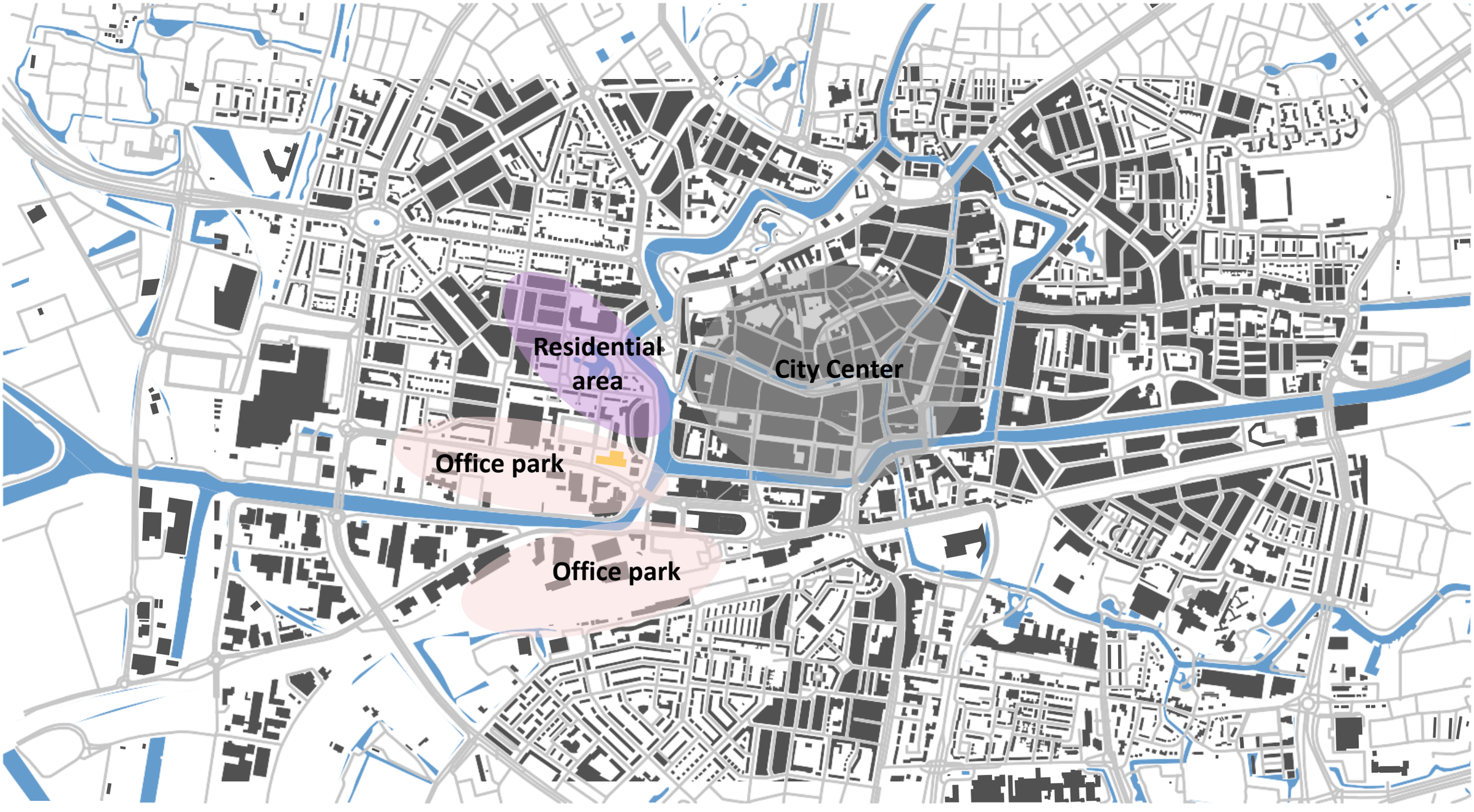
Research

The building

Location: Leeuwarden
Architect: Piet Zanstra, de Clercq Zubli & Partners
Year: 1969-1970
Style: Brutalism
Energy Label: G
Status: Vacant.
7 floors and open GF

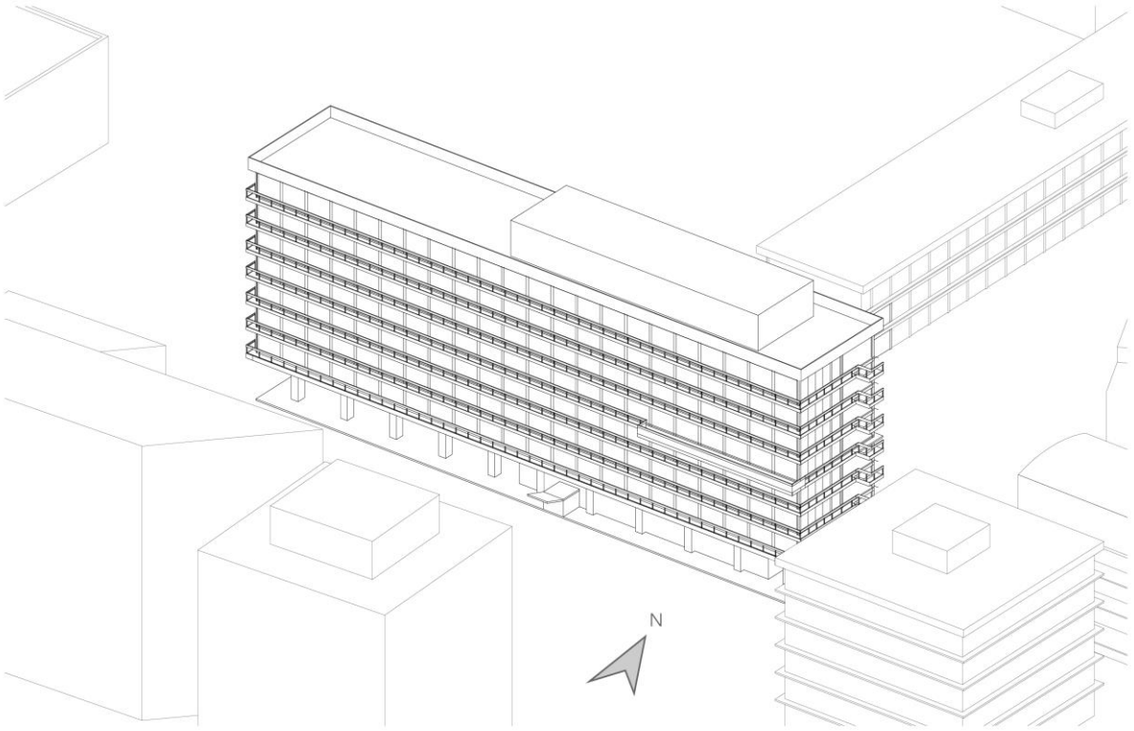
Research

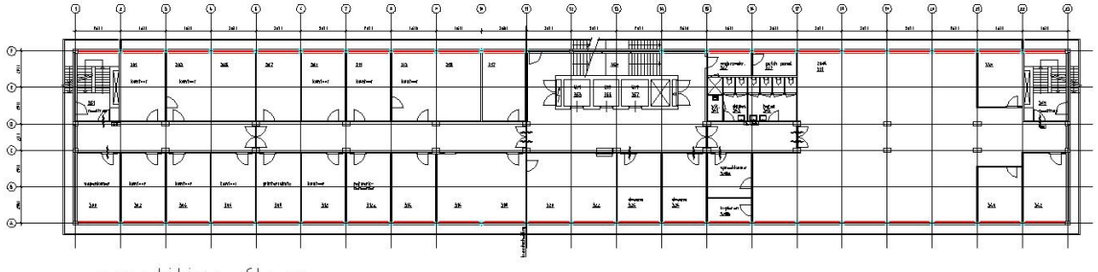
The context



Research

The building





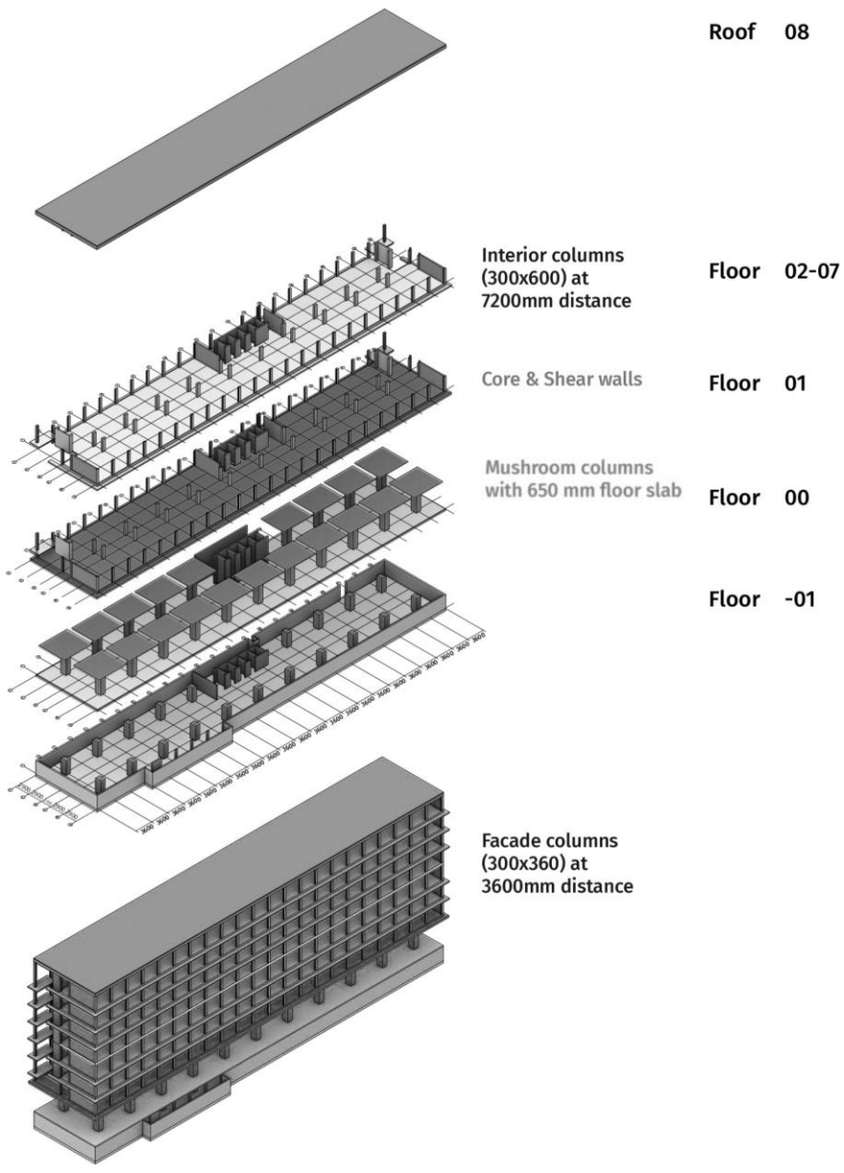
repetitive floor

Pros:

- independent structure
- open adaptable grid
- spacious ground floor

Cons:

- Bad energy performance
- poor insulation
- outdated service system
- lack of natural light



Research

Target group

Students (different backgrounds)(18-30)
-1 or 2 bedrooms
-A total area of 25-45 m2
Low rent
-Housed with fellow students or alone

Low rent

Elderly:
Senior married couples or singles
(Different backgrounds) (+65)
1-2 bedrooms
1 guestroom/ extra bedroom
1 Living room
A total area of 45-75 m2

Low to Middle rent/buy

Starters:
Starters (Young Singles or couples)
(different backgrounds)(20-35)

1-2 bedrooms
1 office/study room
A total area up to 60 m2
Low to middle rent

Program Model

Reasonable rent prices for all target groups based on the area of the house

Students cannot be a nuisance to the elderly

Students & starters contribute 8 to 24 hours of activities with the elderly per month
Ex. Watching sports, meal preparation, celebrating birthdays, emailing, teaching how to use social media

Research

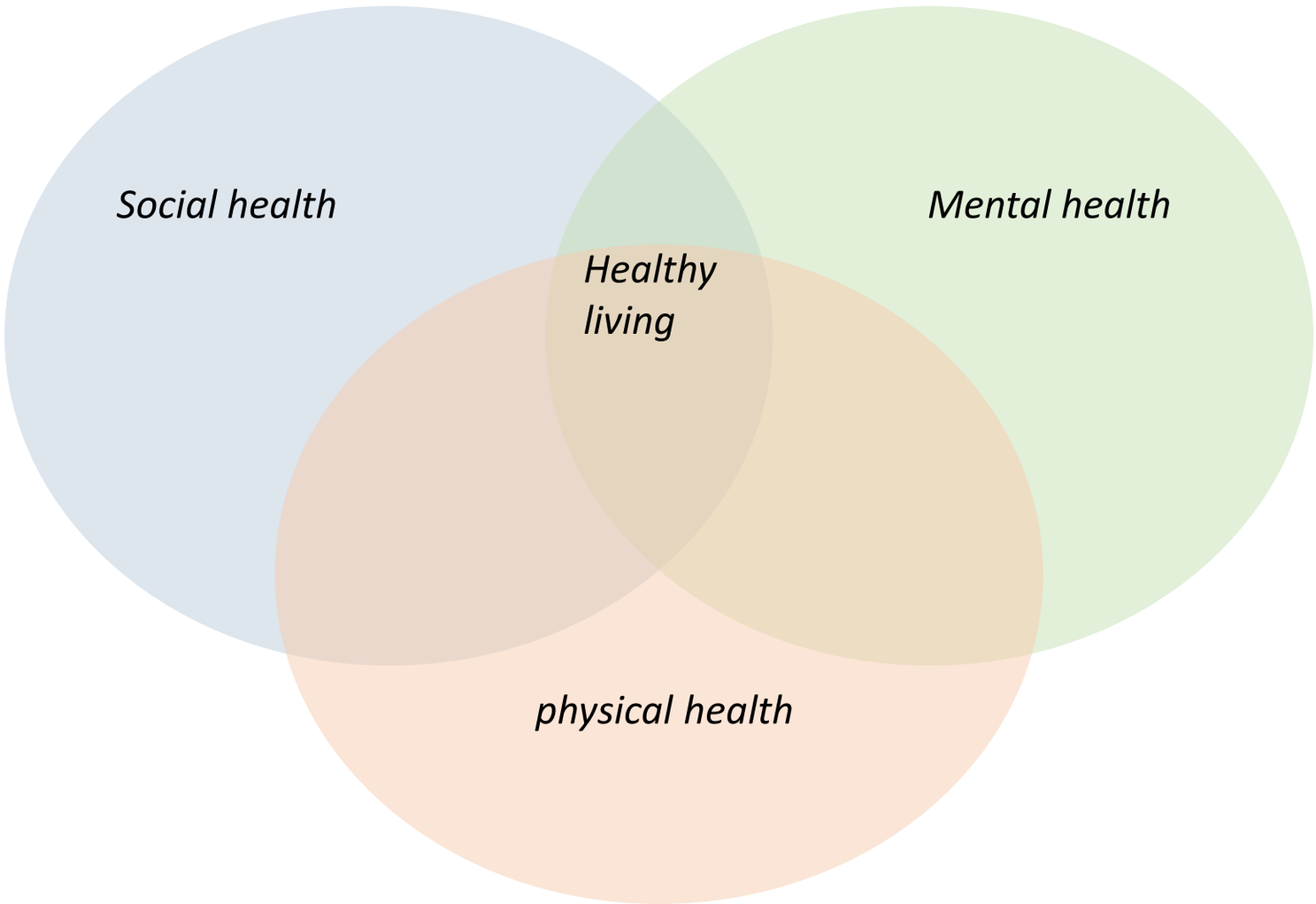
The design approach

The overall design question is:

How to transform an old vacant office building into a healthy living community, with enhancing the health and wellbeing of the target group?

The main objective of the project is

to create a healthy living community that promotes the physical and mental well-being of all its inhabitants, By designing a healthy living environment, the project aims to foster a sense of community and social interaction, while providing access to green spaces and amenities that contribute to a healthy lifestyle. The goal is to create a warm and welcoming atmosphere that supports the needs of all residents and provides a safe and comfortable living environment that promotes a high quality of life.



Research

Target group issues

Loneliness and social isolation

Lack of physical activity

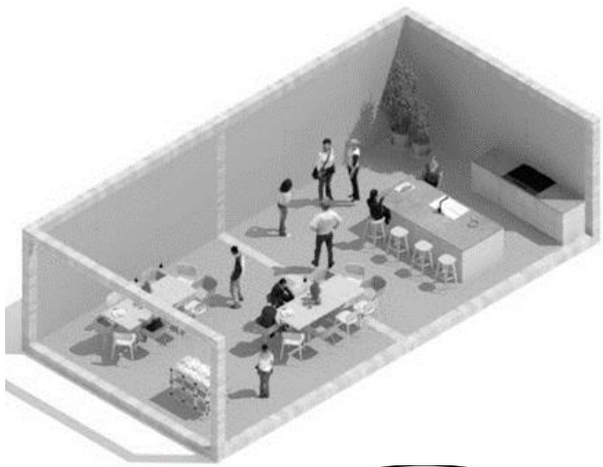
Mental health issues

No Access to healthy food options:

Research

Target group issues proposal solutions

Loneliness and social isolation



Design common areas, such as lounges and community kitchens, spaces with similar interest to encourage social interaction and provide opportunities for residents to meet and socialize with one another

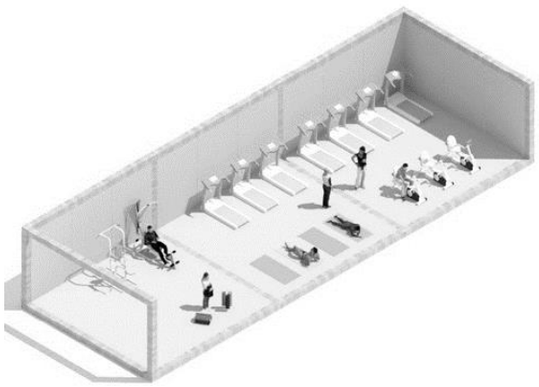
Plan and host regular social events, such as movie nights or game nights, to foster a sense of community and help residents get to know one another.

Create a buddy system or mentorship program to match new residents with existing ones, providing them with a point of contact and a friendly face to help them acclimate to the community.

Research

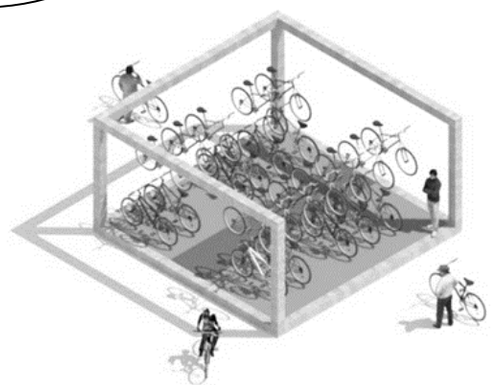
Target group issues proposal solutions

Lack of physical activity



Include exercise facilities, such as a gym or yoga space, on-site to promote regular physical activity .

Design outdoor spaces, gardens or walking paths, to encourage residents to engage in outdoor activities and exercise.



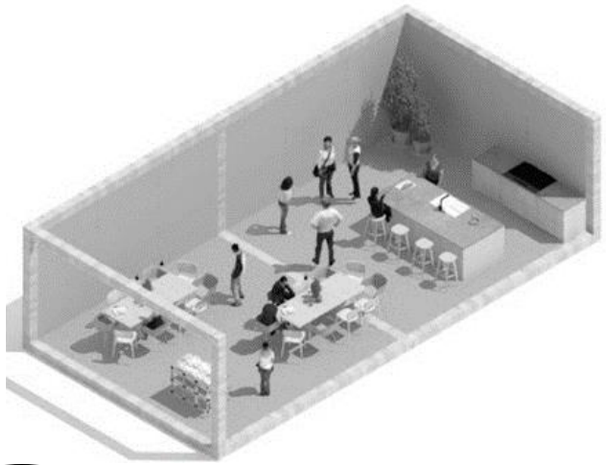
Provide bike storage so promoting physical activity as part of the inhabitant's daily routine.

Incorporate staircases into the design of the building and make them easily accessible to residents, providing an alternative to elevators and encouraging physical activity.

Research

Target group issues proposal solutions

Mental health issues



Incorporating natural elements: The presence of natural elements such as plants, green spaces, and natural lighting has been shown to have a positive impact on mental health. Incorporating these elements into the design of the living community can help reduce anxiety and depression.

Encouraging social connections: Creating communal spaces such as lounges, recreation rooms, and group study areas can help residents to connect with one another and reduce social isolation. This can improve mental health and well-being.

Providing opportunities for physical activity: Physical activity has been shown to have a positive impact on mental health. By providing opportunities for residents to engage in physical activity, such as a gym or outdoor exercise area, the community can help to reduce anxiety and depression.

Incorporating art and music: Art and music have been shown to have therapeutic benefits for individuals struggling with mental health issues. Incorporating art and music spaces into the design of the living community can provide residents with an outlet for their emotions and improve their mental health.

Research

Target group issues proposal solutions

Limited access to healthy food:

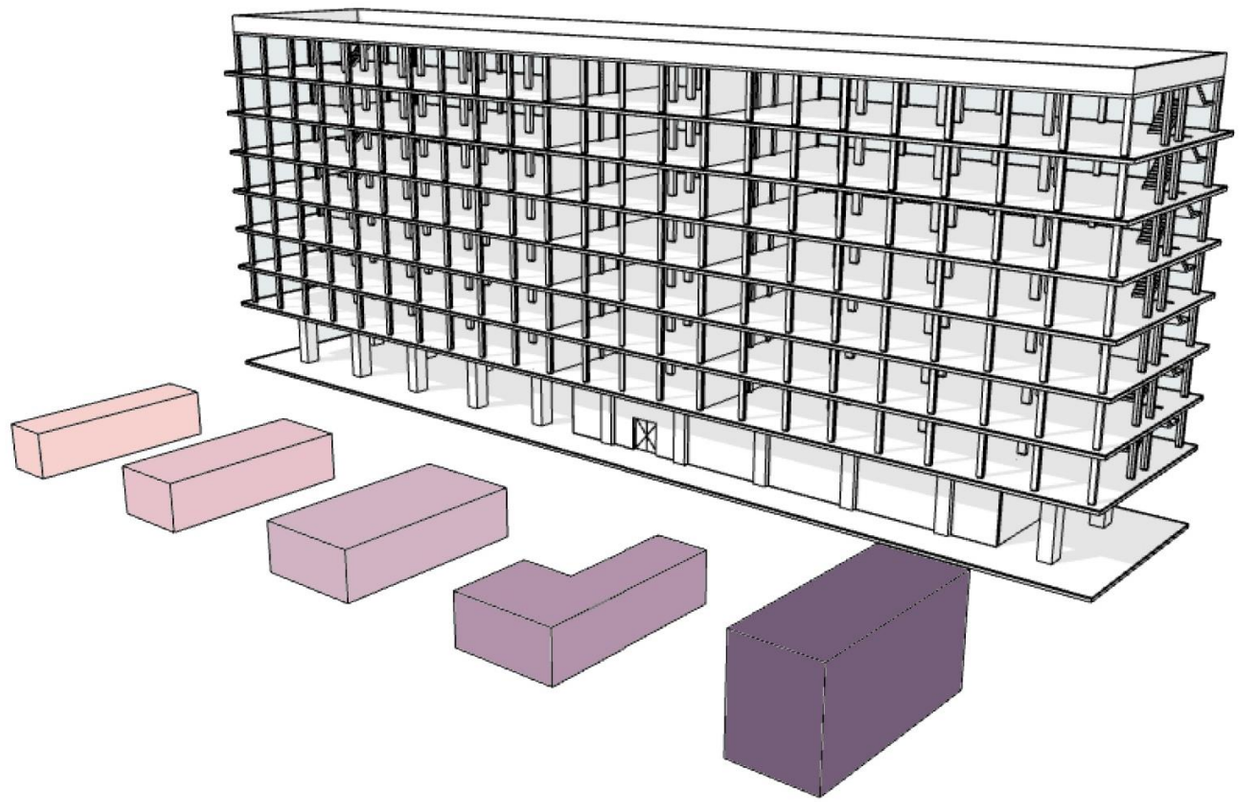
Include a community garden or urban farming area to provide fresh produce and encourage residents to grow their own food.

Partner with local farmers or grocery stores to provide access to fresh, healthy food options at a discounted rate.

Incorporate a shared kitchen or communal cooking area, allowing residents to cook and share healthy meals together.

Concept

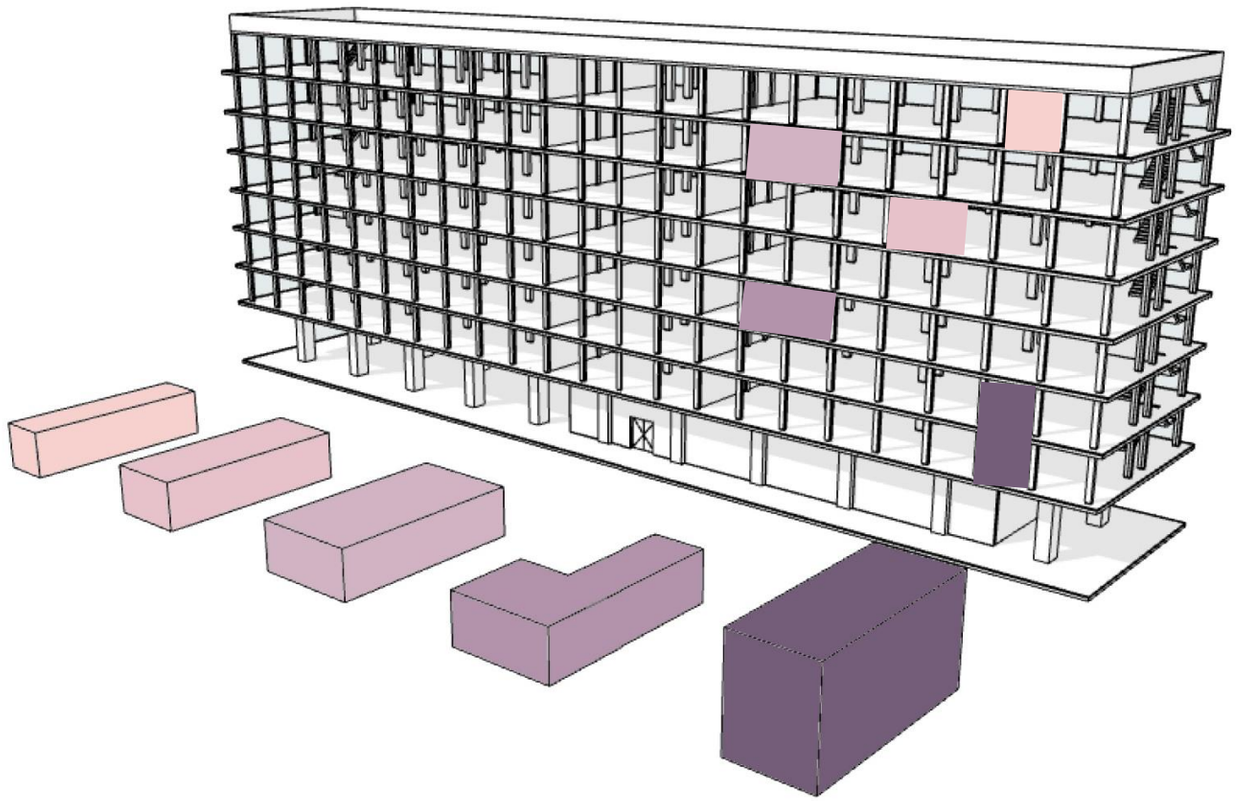
Open building design



Incorporating modular construction with a double skin facade (DFS) can allow for easy changes to the interior layout as the needs of the community evolve over time.

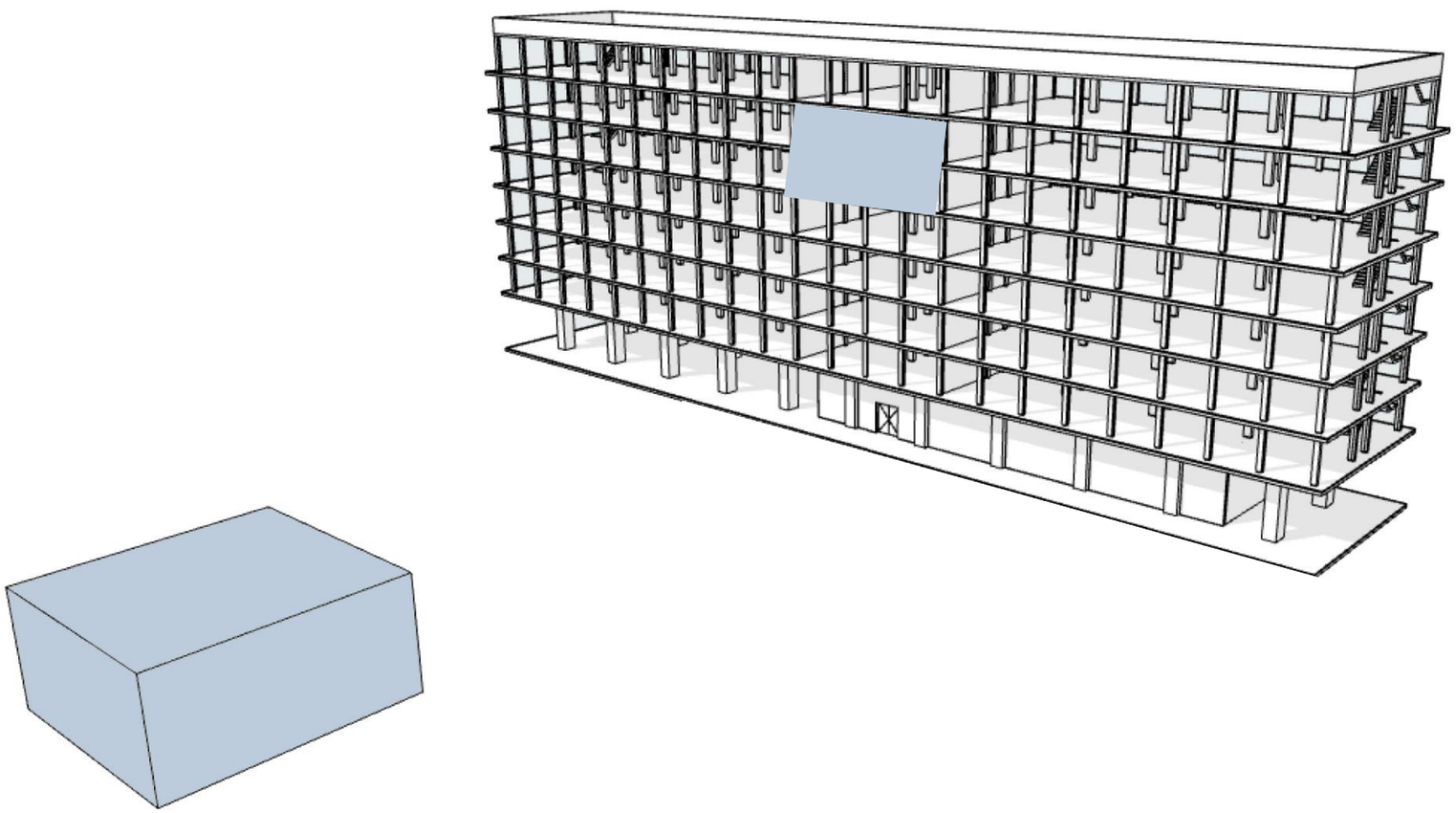
Concept

Open building design



Concept

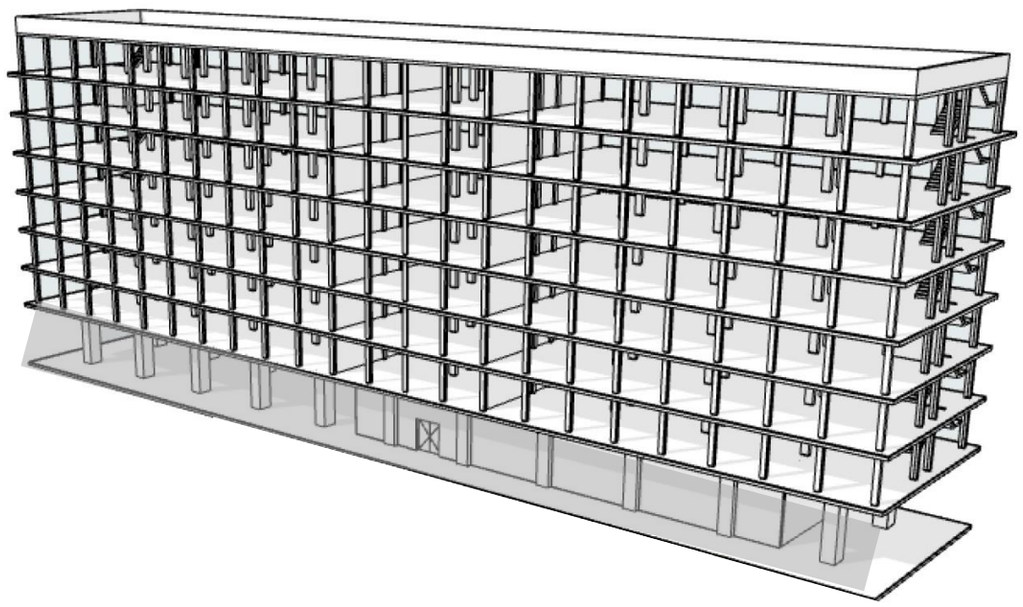
Open building design



The building can also be designed with shared spaces that encourage interaction between residents of all ages, such as communal kitchens, dining areas, lounges, and libraries.

Concept

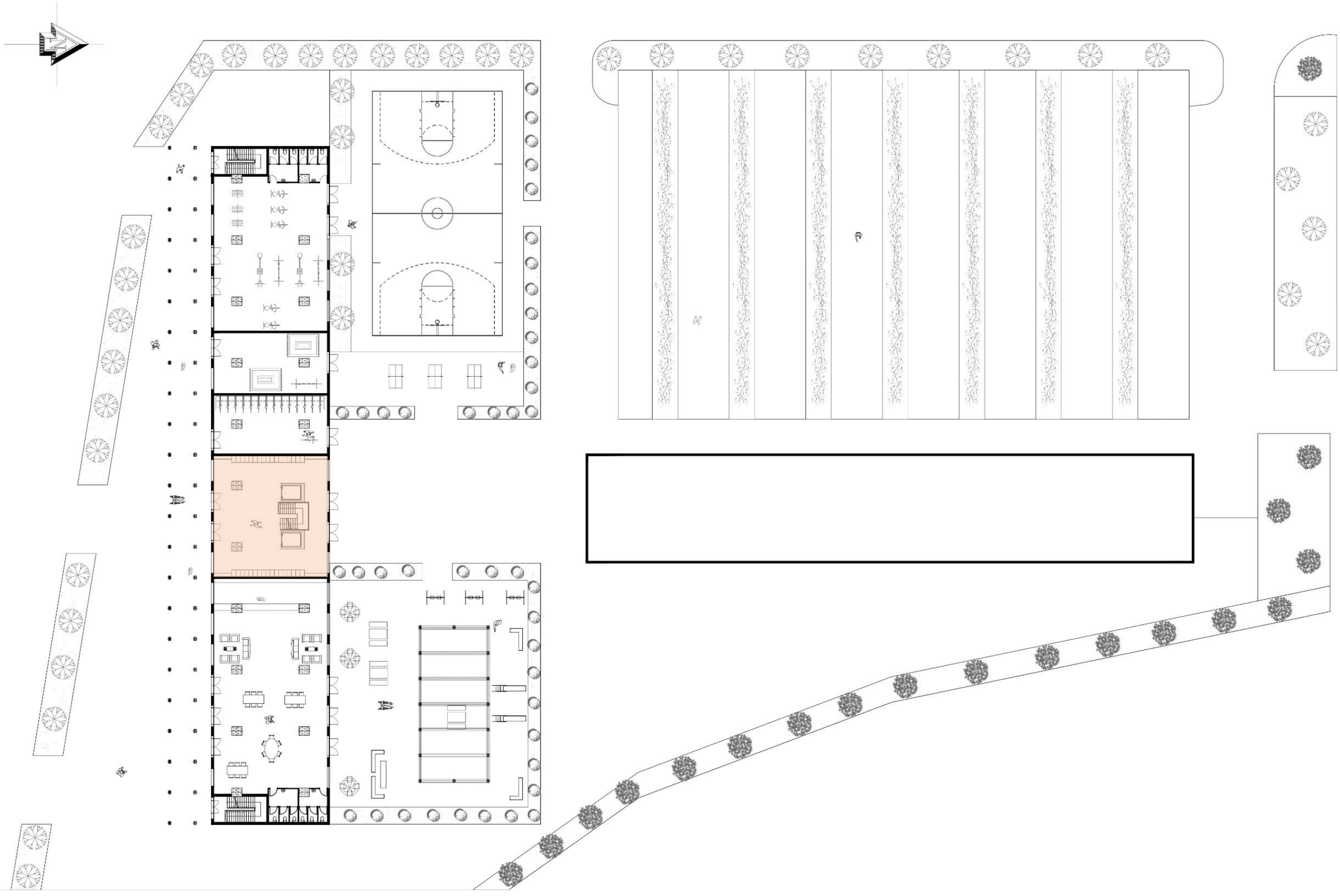
Open building design



Activate the Ground floor

Concept

Master plan design

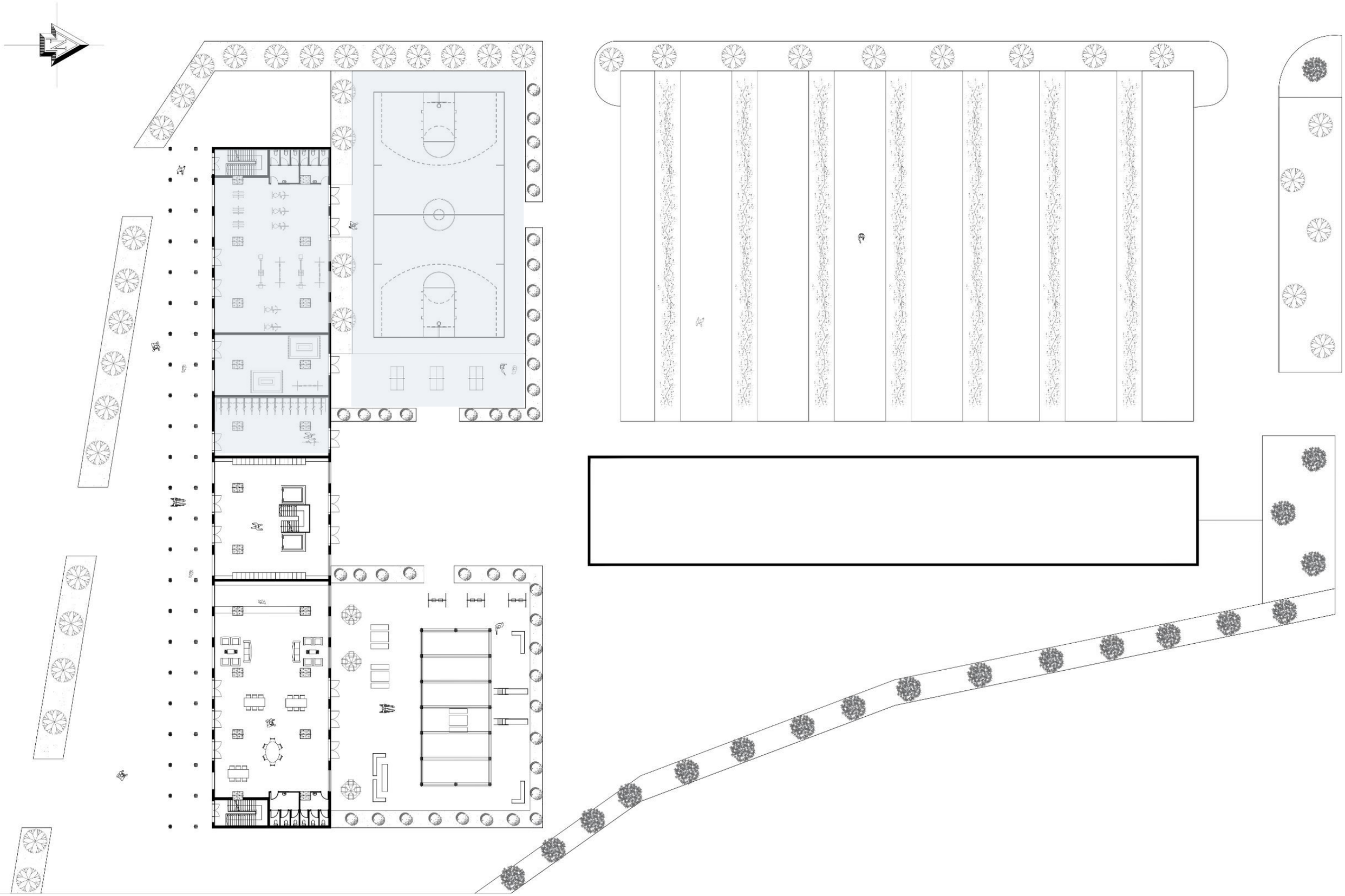


Concept

Entrance

Concept

Entrance



Concept

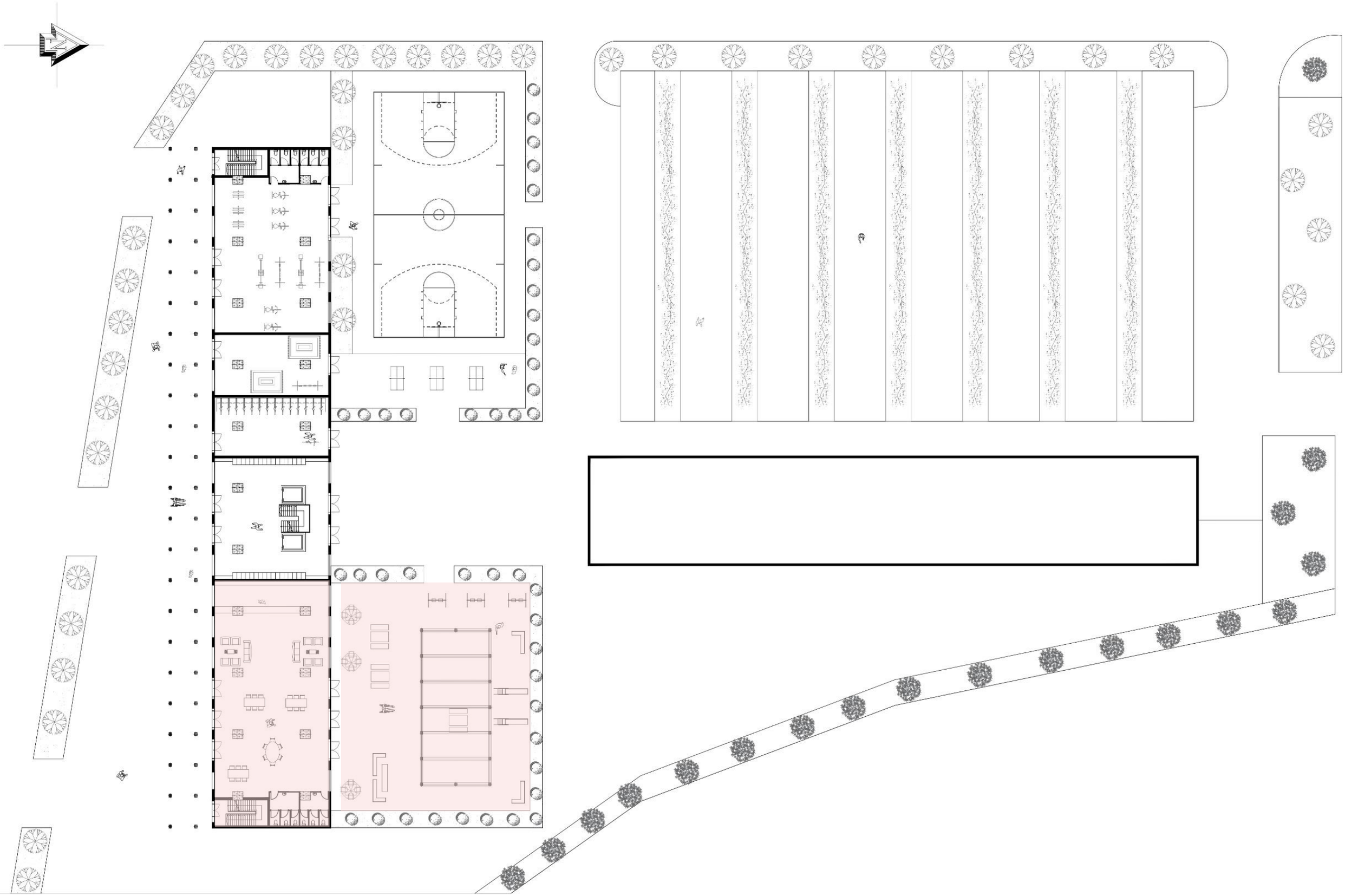
Sport facilities

Concept

Sport facilities outdoor

Concept

Sport facilities outdoor



Concept

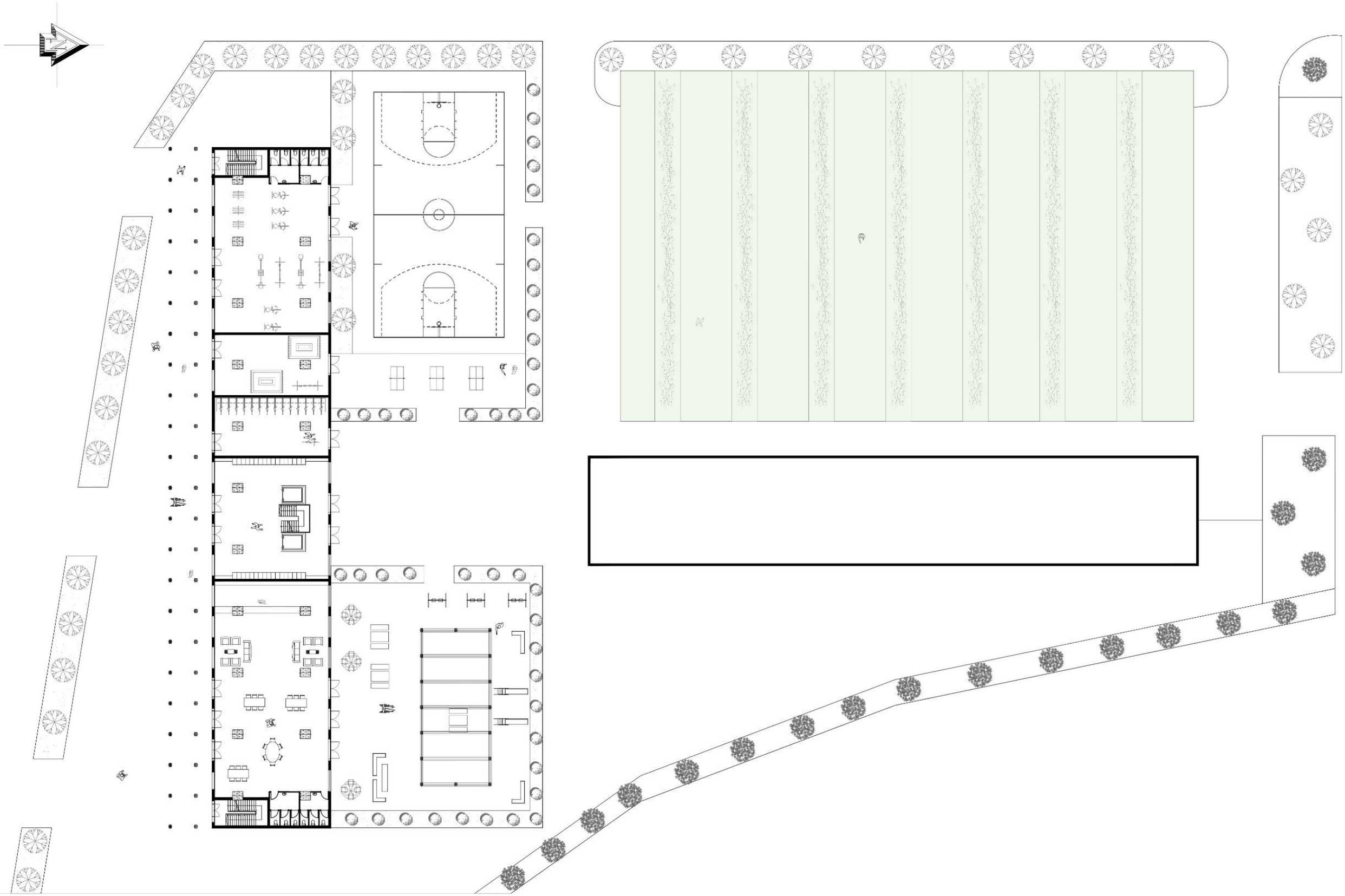
Community café

Concept

Community café outdoor space

Concept

Community café outdoor space



Concept

Urban farming

Concept

Urban farming

The implementation of a double-skinned façade and its influence on health and well-being in intergenerational residential buildings?

Investigating the impact of the double skin facade system and exploring whether the implementation of a double skin facade to an
existing vacant buildings will enhance the health and wellbeing of the building's residents.

Thematic Research Question:

How can a double skin façade (DFS) improve the health and wellbeing of the inhabitants of a building, focusing specifically on access to natural light, ventilation, noise attenuation, and providing social spaces?

Sub-questions:

What is the impact of natural light, ventilation, noise attenuation, and social spaces on the health and wellbeing of building inhabitants?
How can a double skin façade (DSF) improve access to natural light without overheating?
How can a double skin façade (DSF) contribute to building ventilation while improving air quality?
How can a double skin façade (DSF) contribute to building noise attenuation?
What are the specific social spaces provided by the double skin façade, and how do they enhance the building's social sustainability?

Research

DSF and healthy living

Indoor air quality (IAQ) significantly impacts the health and well-being of building occupants, with effects on cognitive performance, productivity, and subjective well-being. Proper ventilation, identification of pollutant sources, and suitable building materials are crucial for improving IAQ and reducing health risks associated with indoor air pollution.

Natural light is essential for human health and happiness, improving well-being, productivity, and cognitive function. Designers should prioritize factors like intensity, wavelength, and color temperature to optimize the positive impact of natural light on well-being, using features such as window placement, glazing type, and shading devices.

Noise attenuation plays a crucial role in promoting health and well-being by mitigating the negative effects of environmental noise. Implementing techniques such as insulation, sound-absorbing materials, and acoustic windows in buildings can significantly reduce the detrimental impact of noise on occupants' physical and mental health.

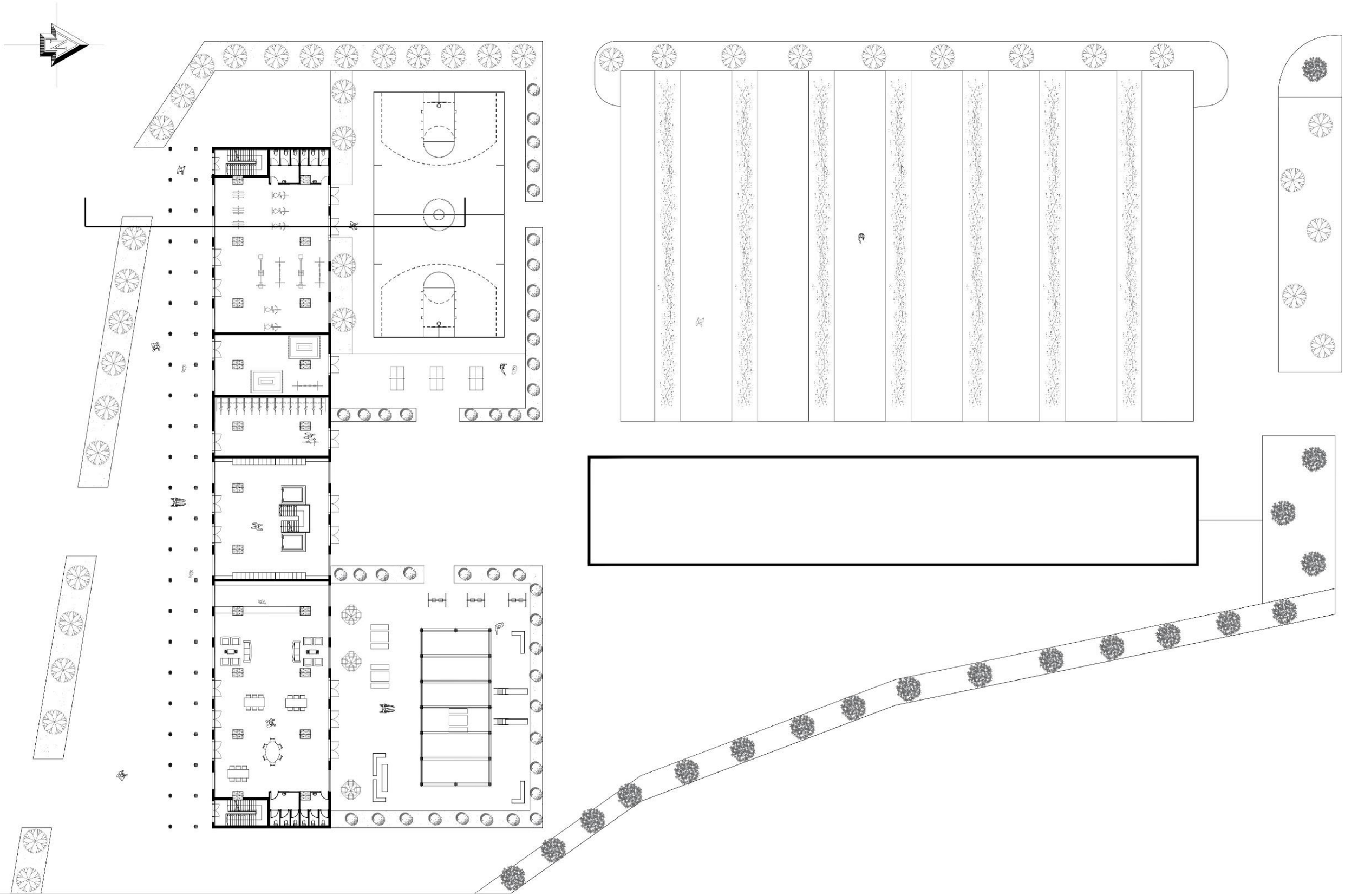
Social spaces in buildings have a positive impact on health and well-being by encouraging social interaction, relaxation, and physical activity. Access to outdoor areas, views of nature, and thoughtful design elements contribute to lower stress levels and greater overall well-being.

Research

DSF and healthy living

Criteria	1	2	3	4	5
1. Natural light:	Amount of natural light entering the building's interior space.	Quality of natural light (e.g., direct, or indirect, diffuse, or harsh)	Distribution of natural light throughout the building	Impact of natural light on the inhabitants' mood, productivity, and overall well-being	
1. Ventilation:	Amount of fresh air circulating through the building's interior spaces.	Distribution of air flow throughout the building	Temperature and humidity levels within the building	Effectiveness of ventilation in reducing indoor pollutants (e.g., CO2, VOCs)	Impact of ventilation on the inhabitants' health, comfort, and overall well-being
1. Noise attenuation	Sound insulation properties of the double skin façade	Reduction in exterior noise levels within the building	Reduction in interior noise levels (e.g., echoes, reverberation)	Effectiveness of noise attenuation in promoting a peaceful and quiet living environment	
1. Social spaces	Quantity and quality of social spaces provided by the double skin façade (e.g., communal balconies, winter gardens)	Accessibility and usability of social spaces for different age groups and physical abilities	Impact of social spaces on promoting social interaction, community building, and overall well-being of the inhabitants		

Design-based research

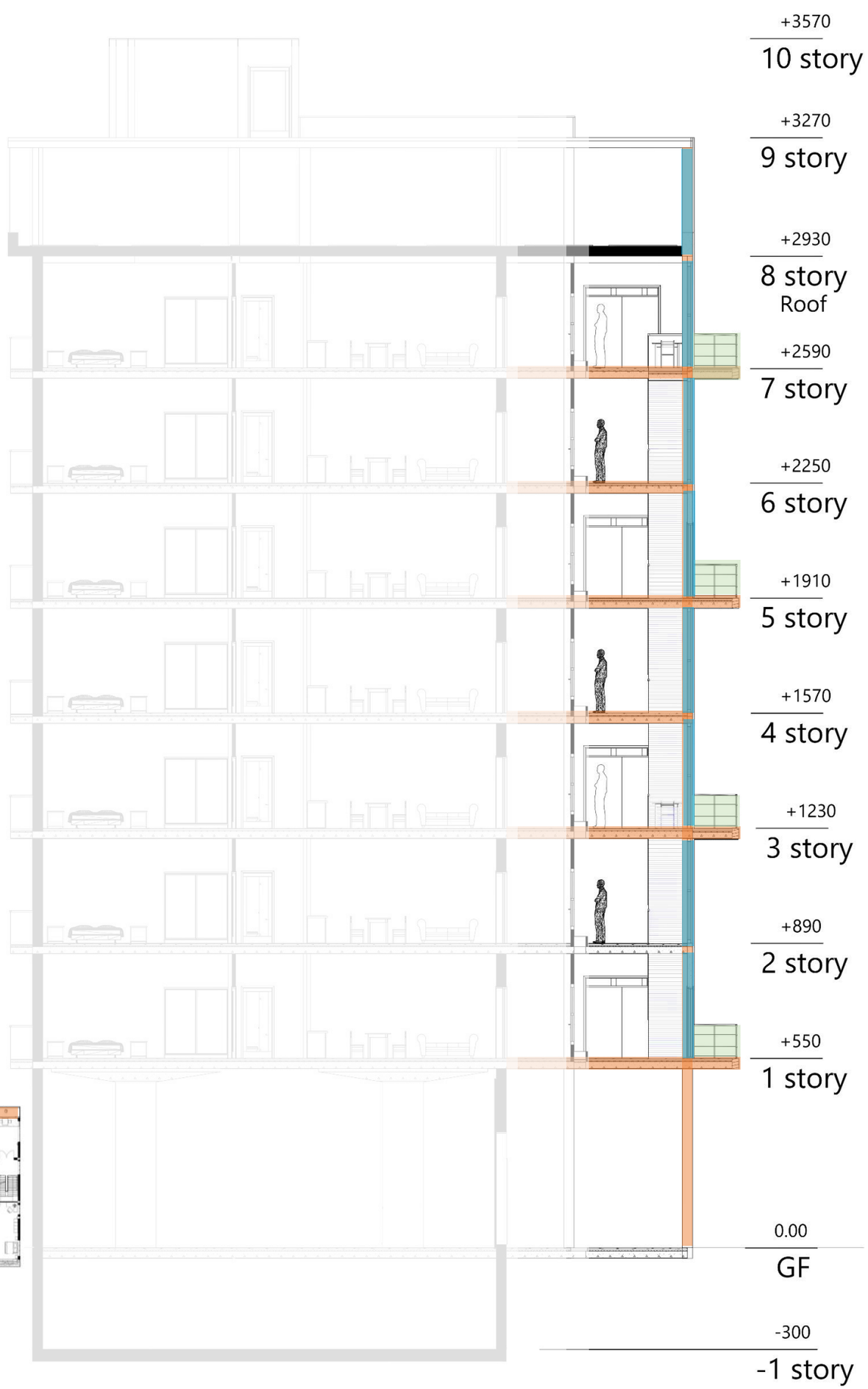


Concept

Double skin façade structure

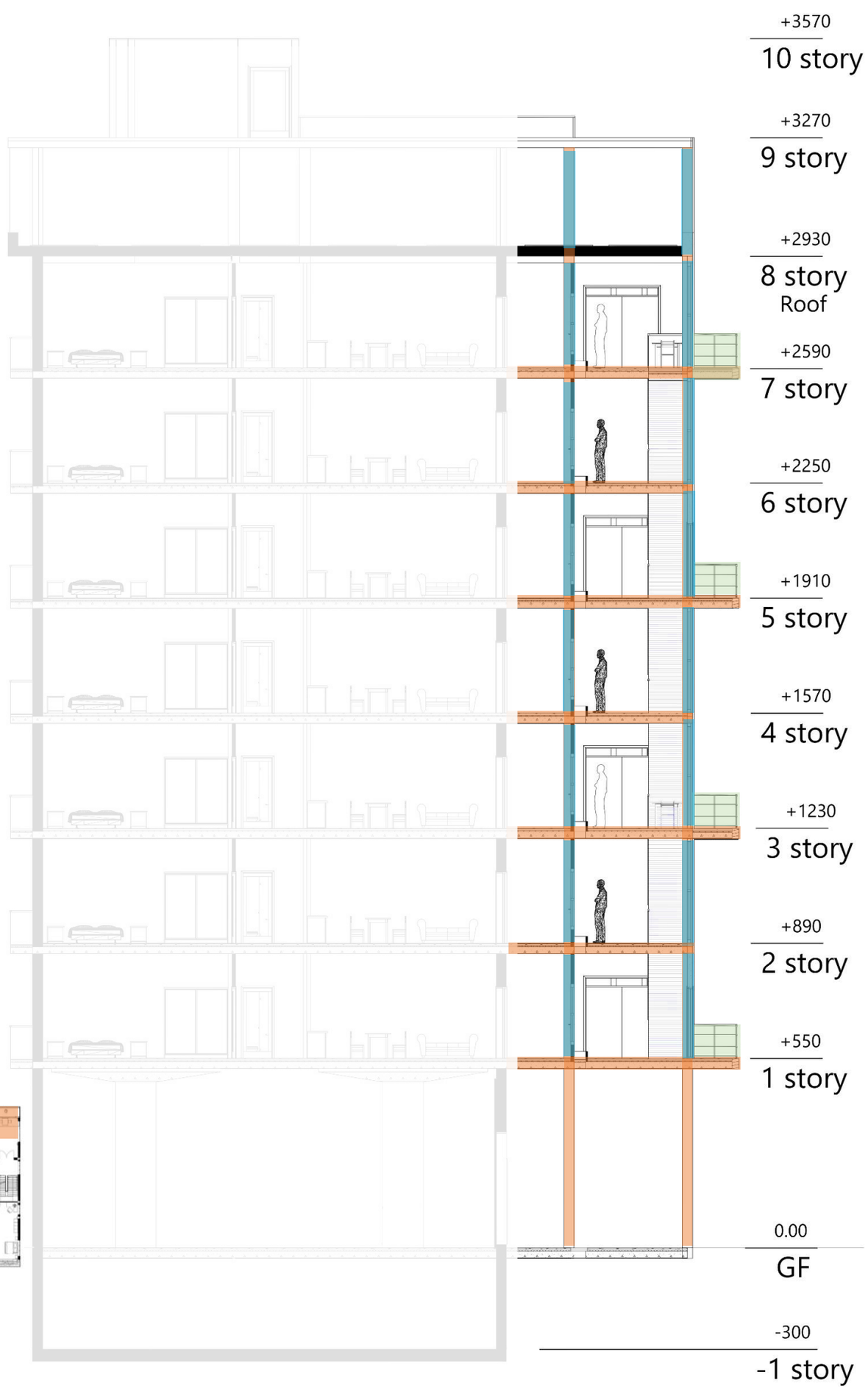
Concept

Double skin façade structure



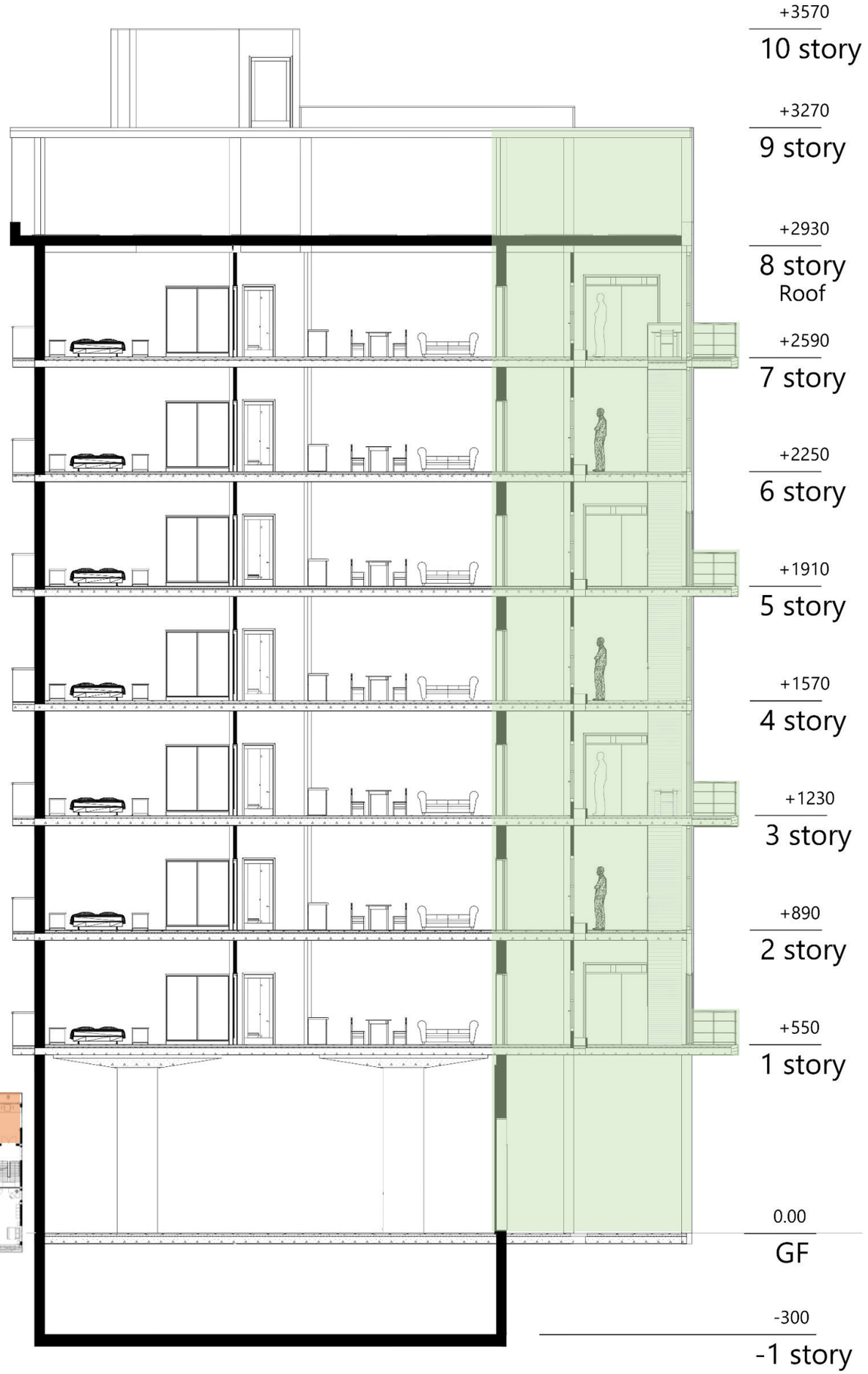
Concept

Double skin façade structure



Concept

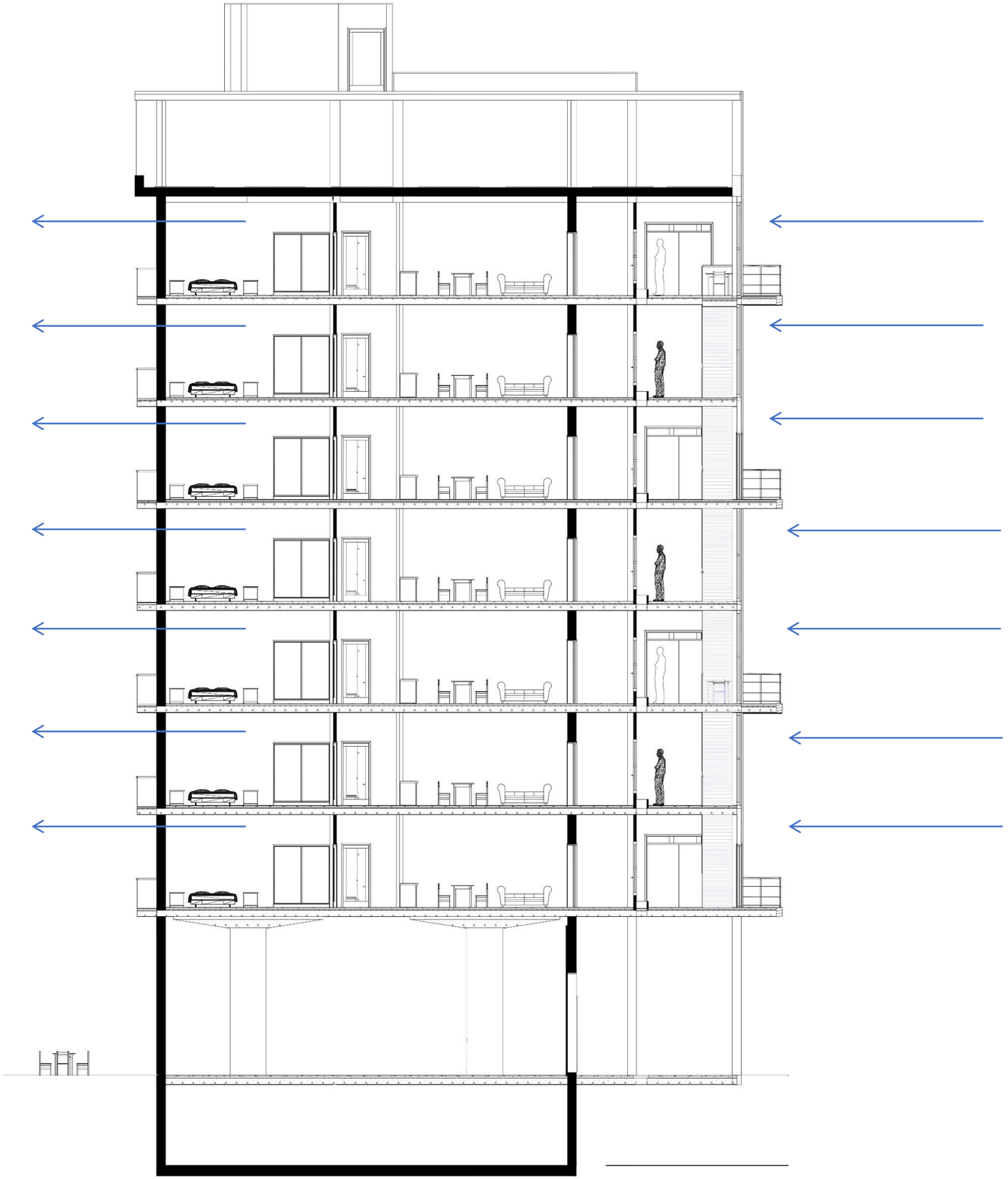
Double skin façade implementation




LUMION

Concept

ventilation

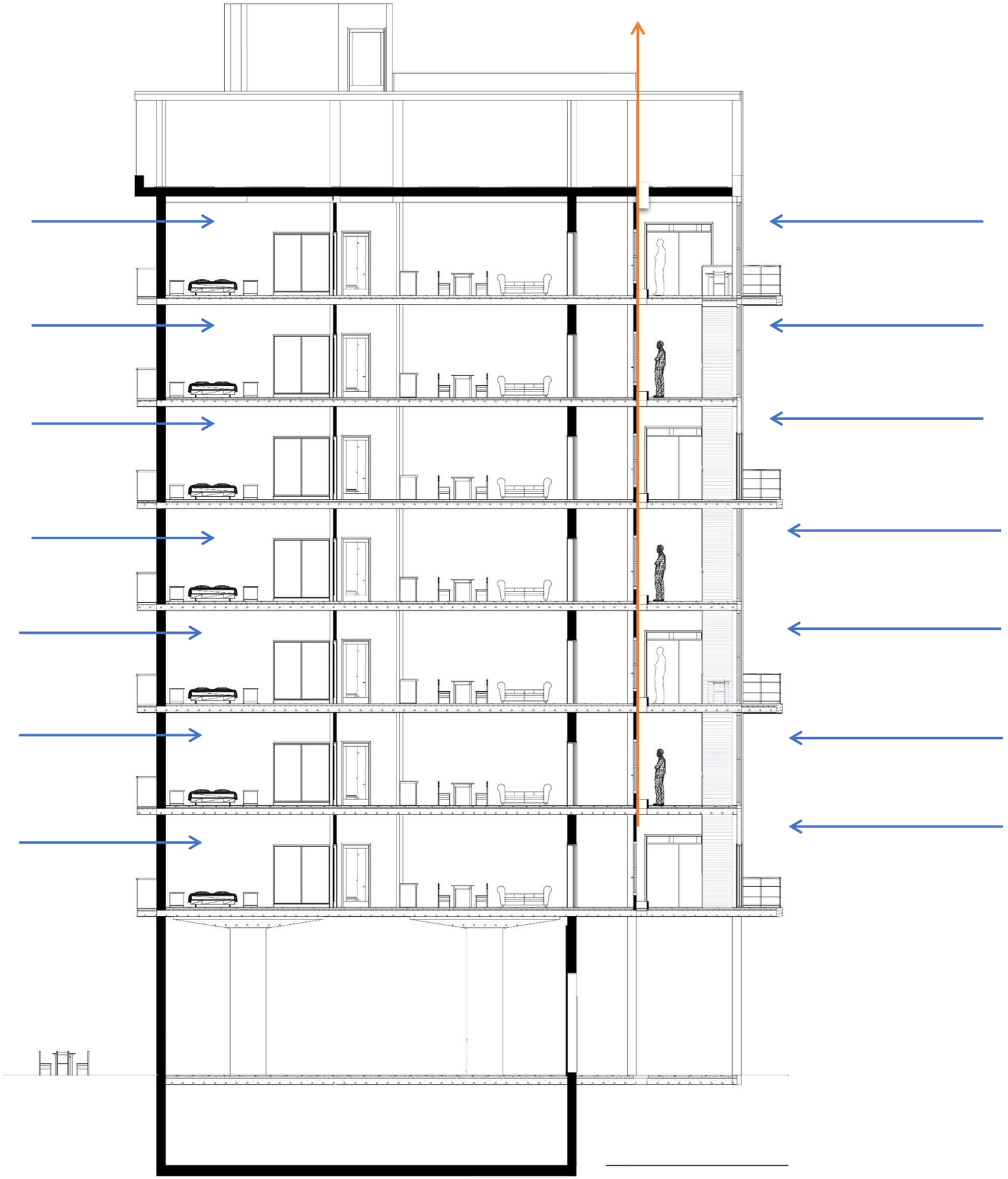


Passive cross ventilation

Summer situation

Concept

ventilation



Low-pressure high-pressure ventilation

Summer situation

Concept

ventilation

Hybrid ventilation System D

Winter situation

Concept

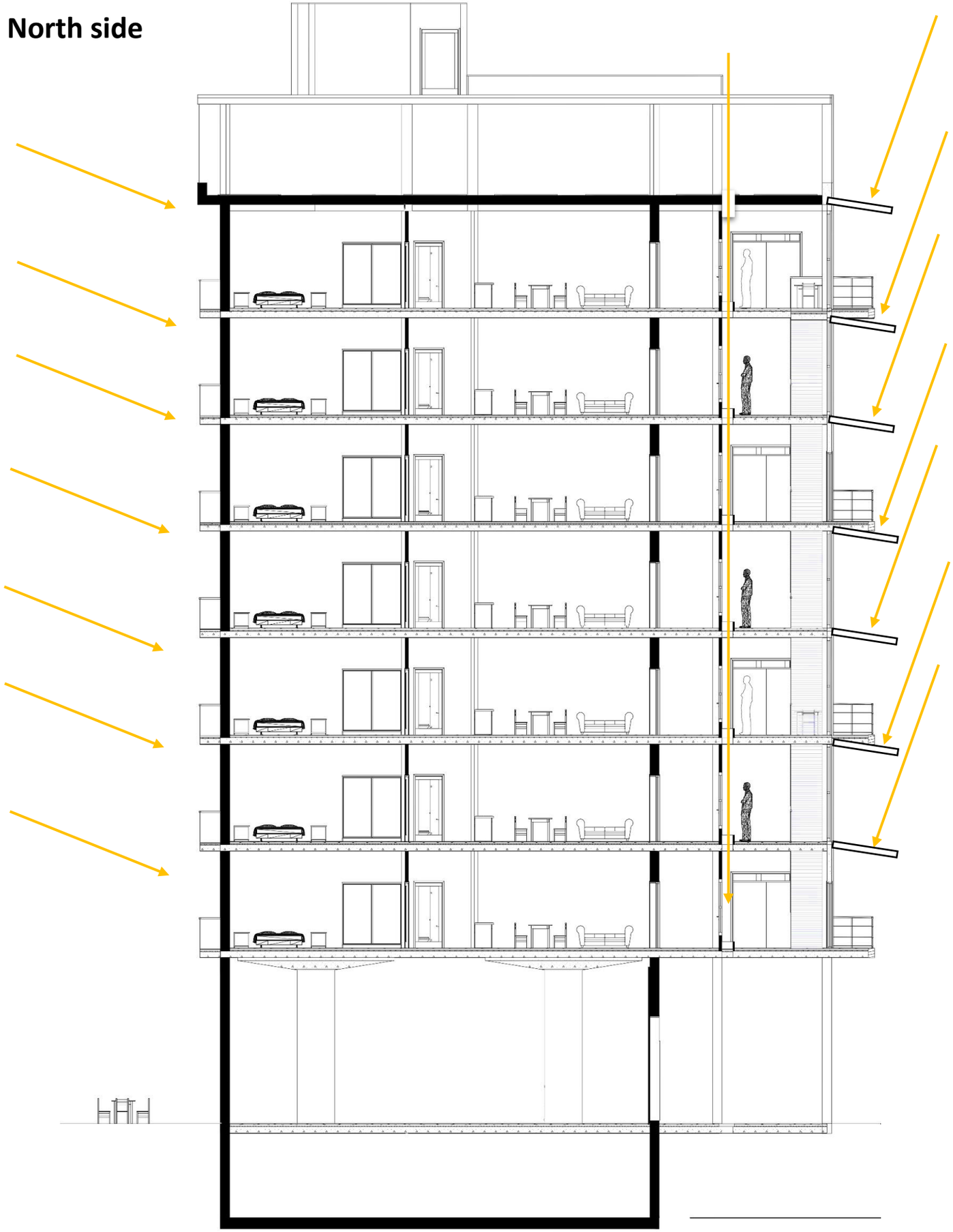
Noise attenuation

Concept

natural light

North side

South side



Sun light

During both the summer and winter solstices, at midday, the sun's angle on the north facade can be around 20 to 30 degrees in the Netherlands

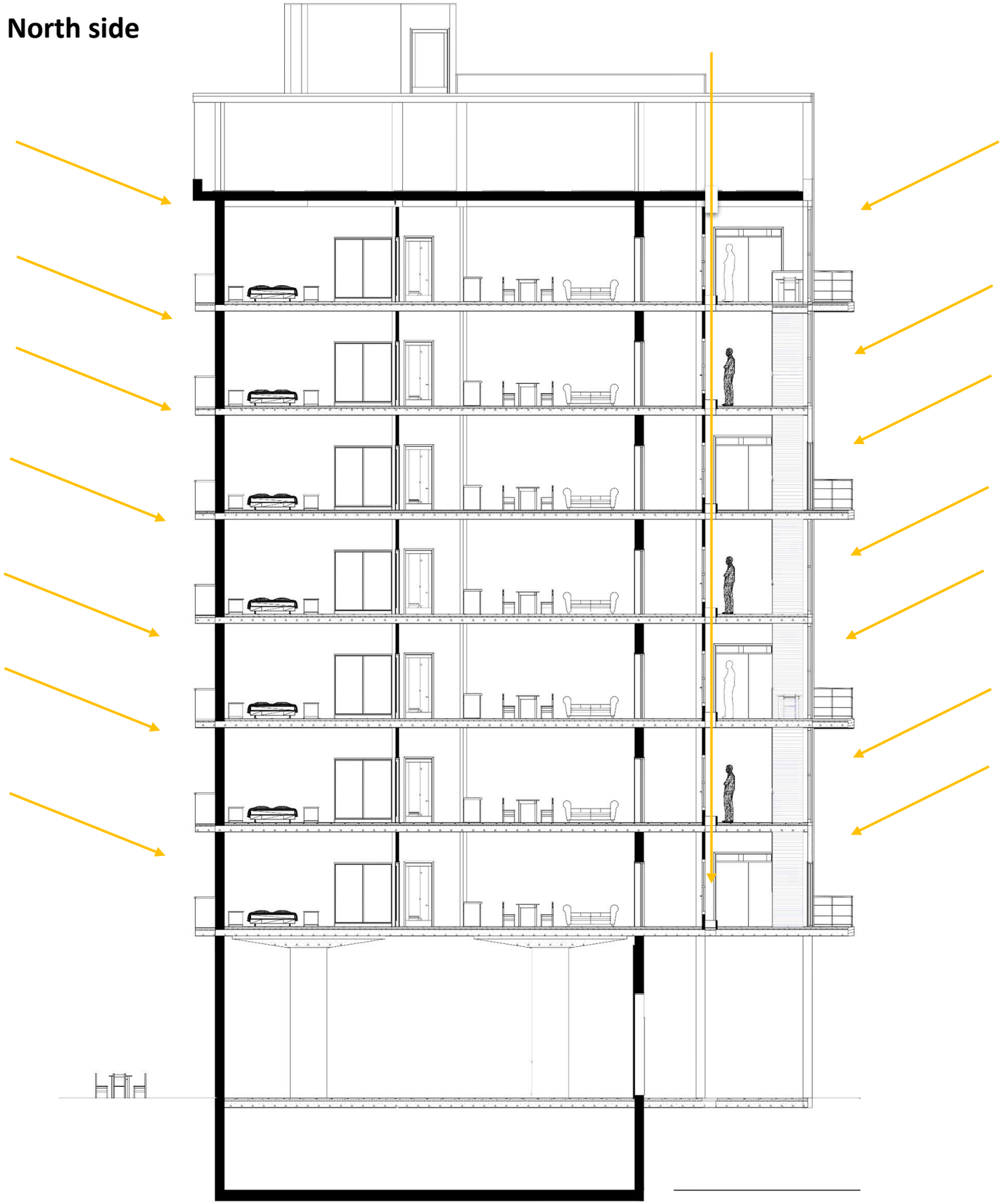
During the summer solstice (around June 21st), at midday, the sun's angle can be around 60 to 70 degrees on the south facade.

Concept

natural light

North side

South side



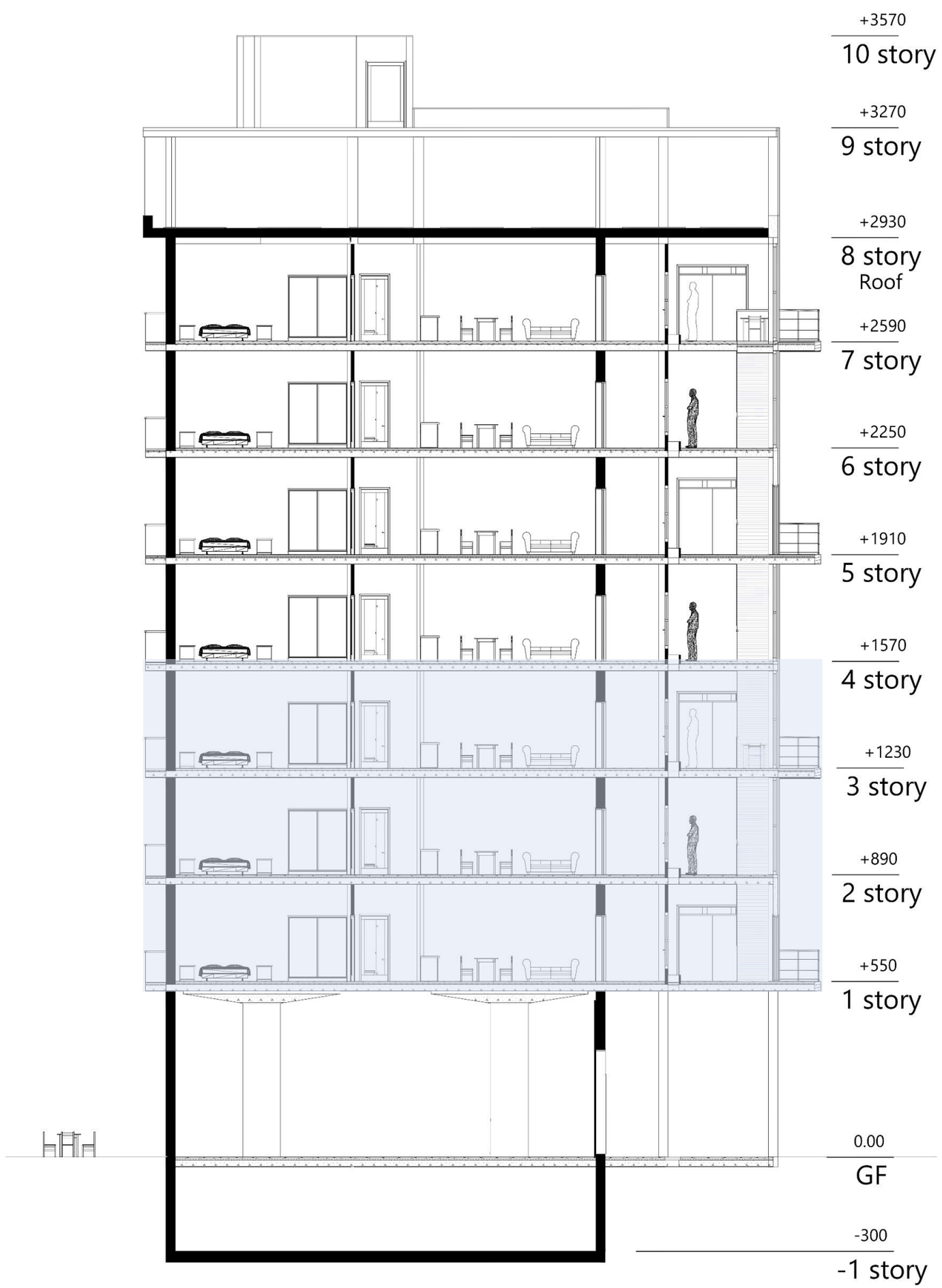
Sun light

During both the summer and winter solstices, at midday, the sun's angle on the north facade can be around 20 to 30 degrees in the Netherlands

During the winter solstice (around December 21st), at midday, the sun's angle can be around 20 to 30 degrees on the south facade.

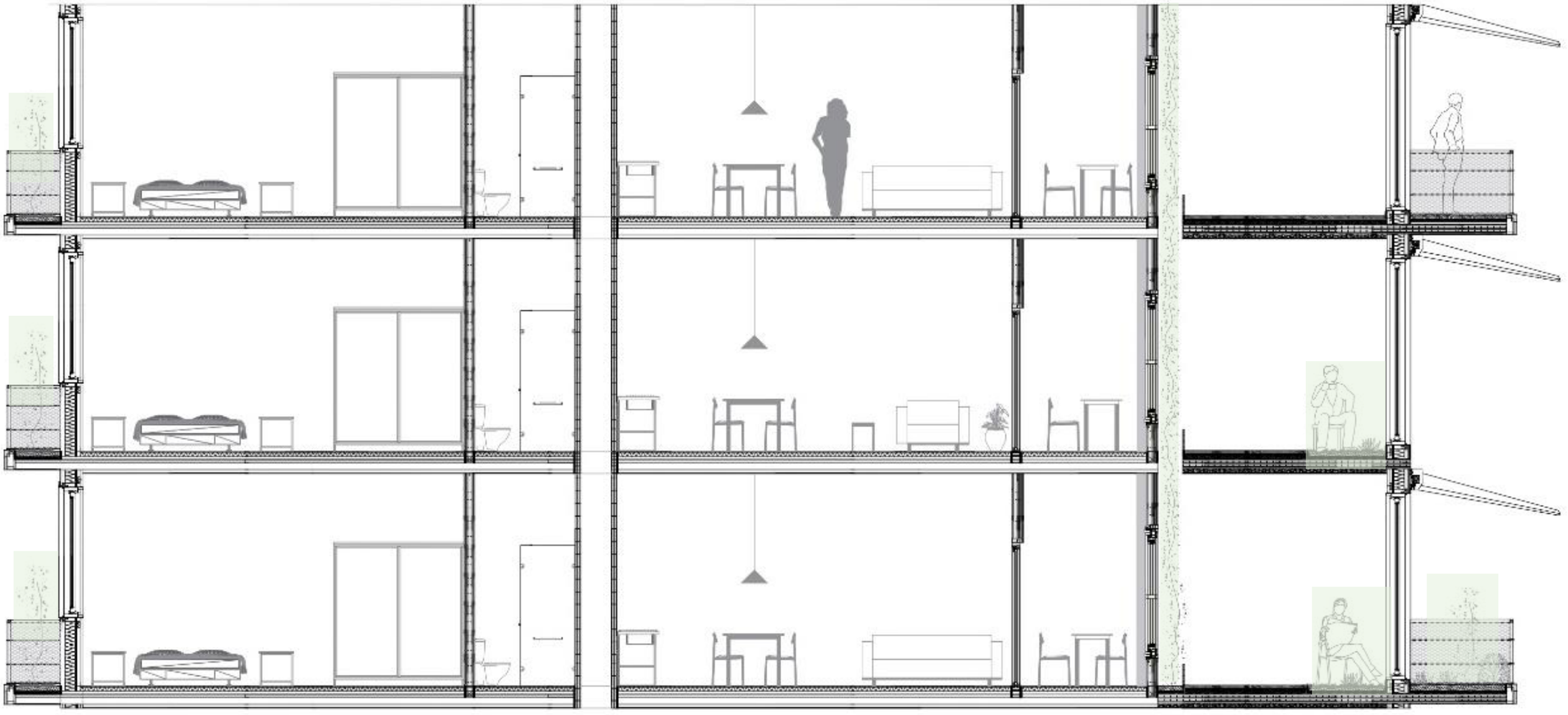
Concept

Social spaces



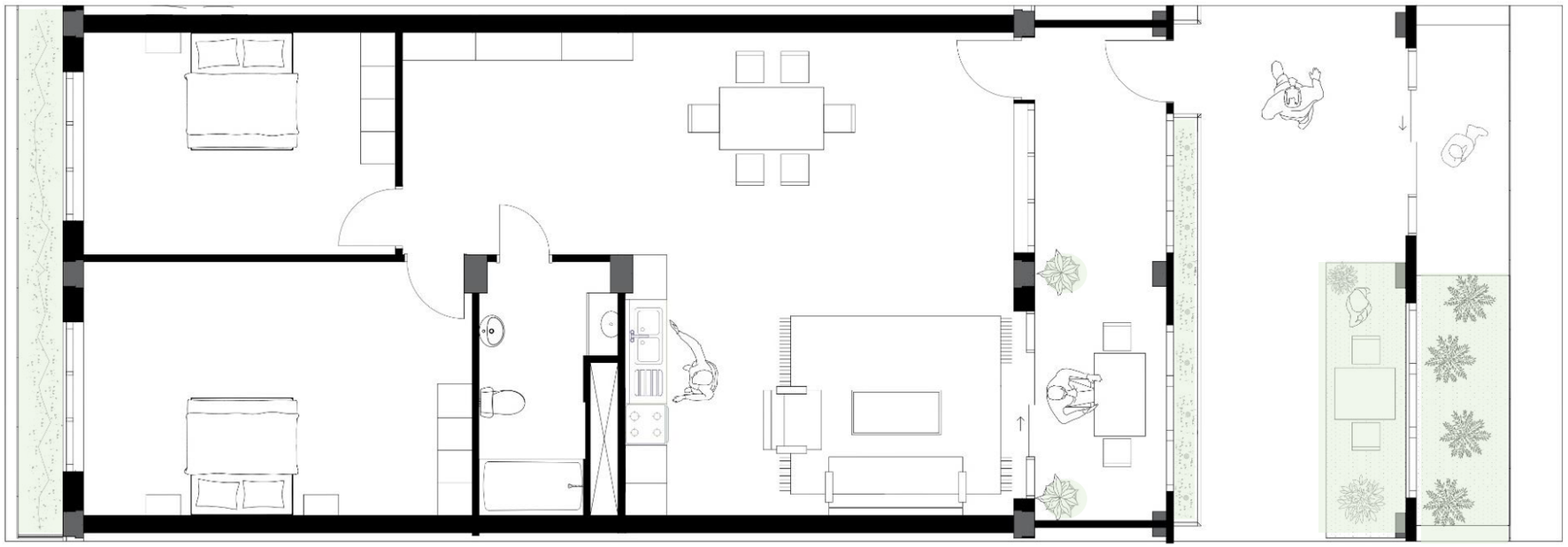
Concept

greenery



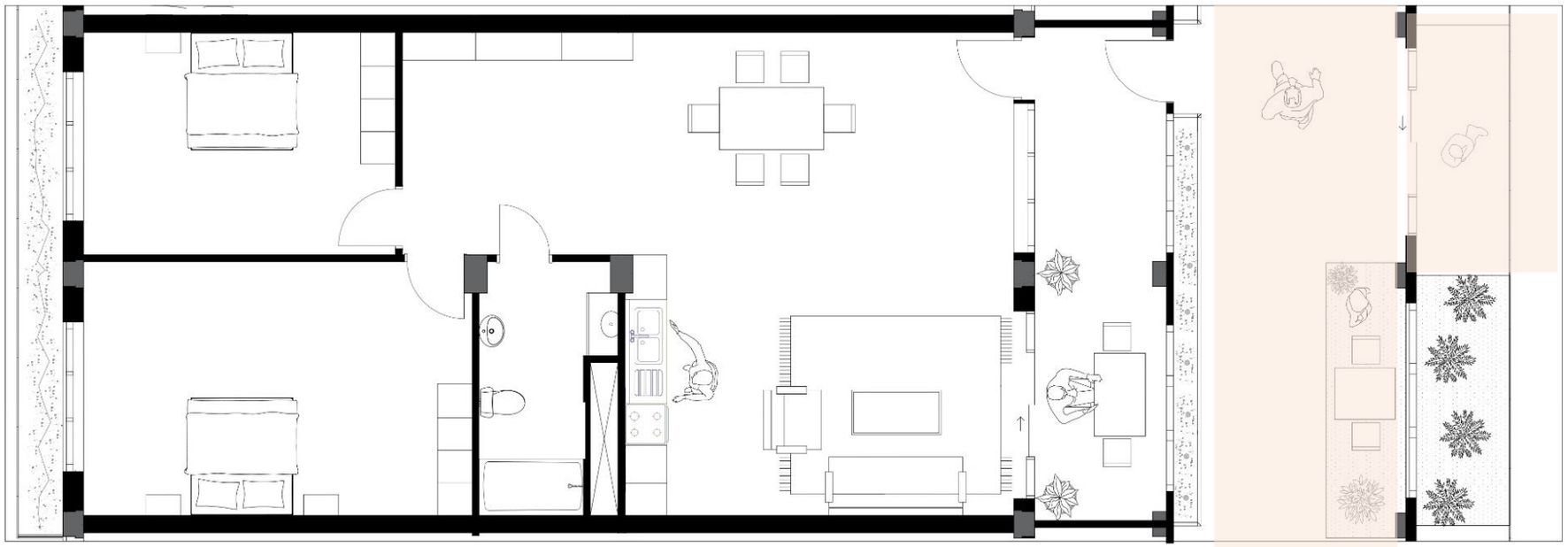
Concept

greenery



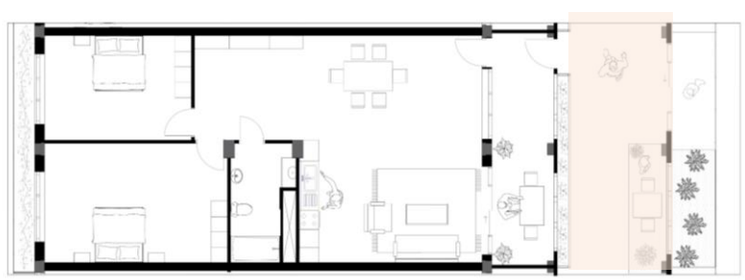
Concept

Social spaces



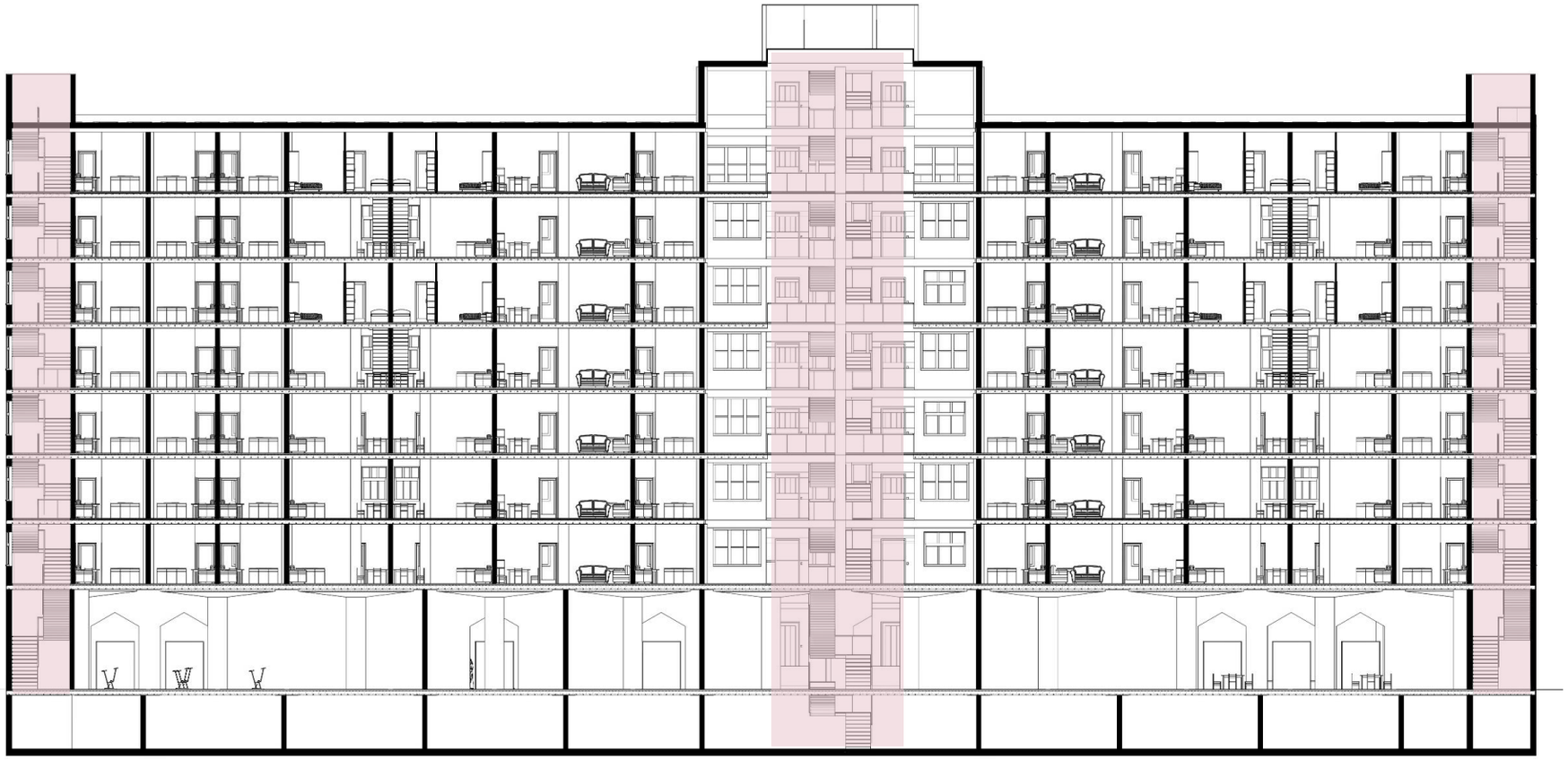
Concept

Social spaces



Concept

Winter balcony



Concept

Circulation

Concept

Circulation

Exposed wooden structures bring natural beauty, warmth, and charm to the spaces. The spacious atrium fills the interiors with sunlight, creating an uplifting atmosphere.

Concept

Central social space, atrium impression

These inviting spaces foster connection and collaboration among residents, cultivating a strong sense of community in a healthy living environment.

Concept

Central social space, atrium impression

Elderly

Students

Starters

Community spaces

Concept

Target group distribution

Concept

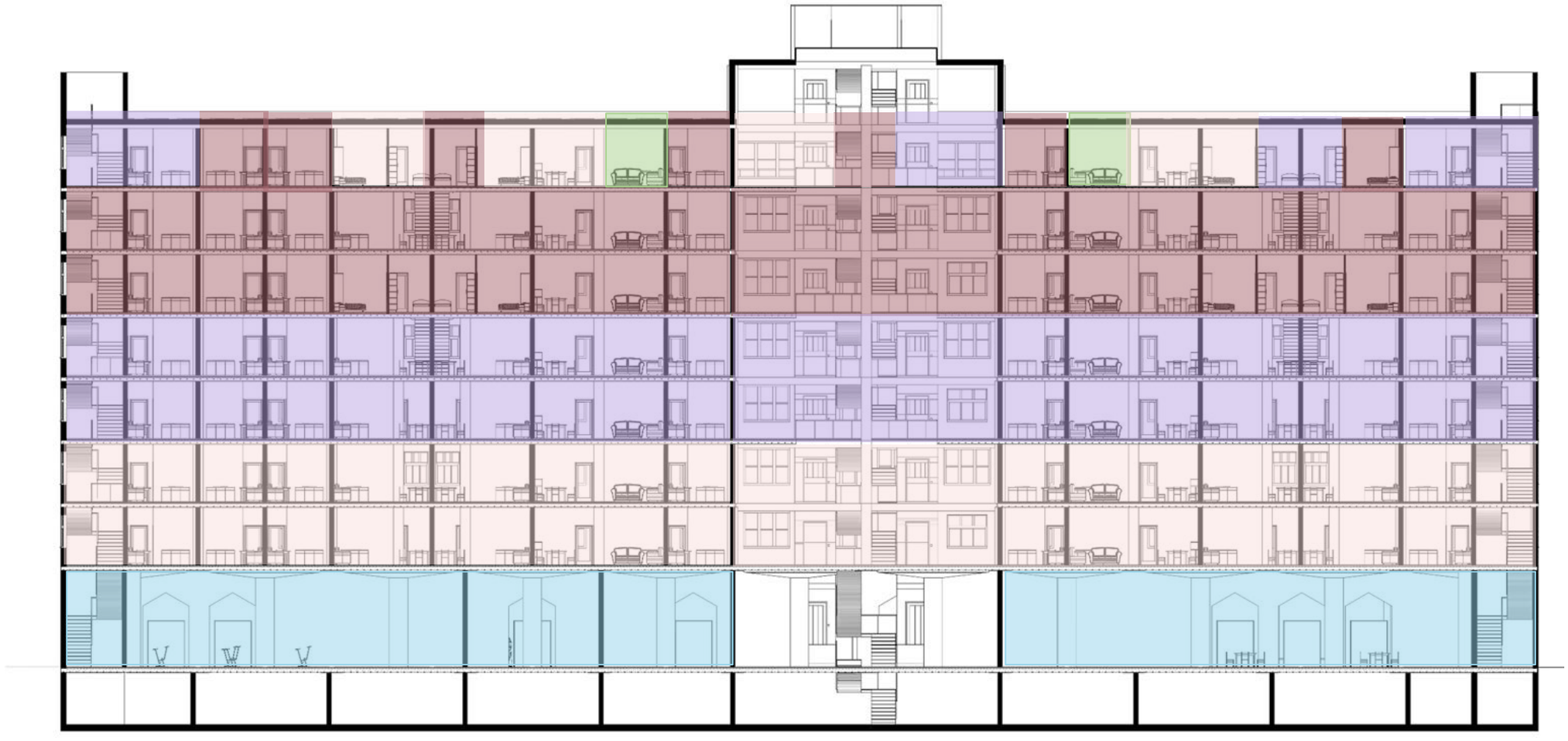
Target group distribution

Concept

Target group distribution

Concept

Target group distribution

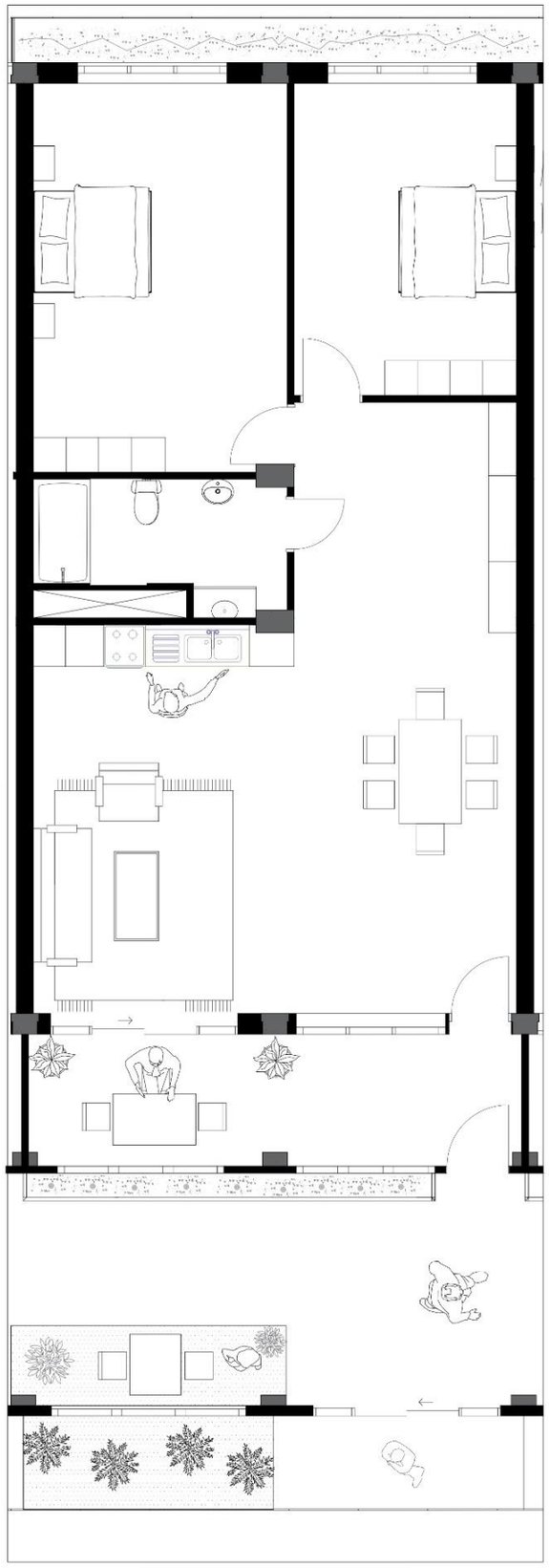


Concept

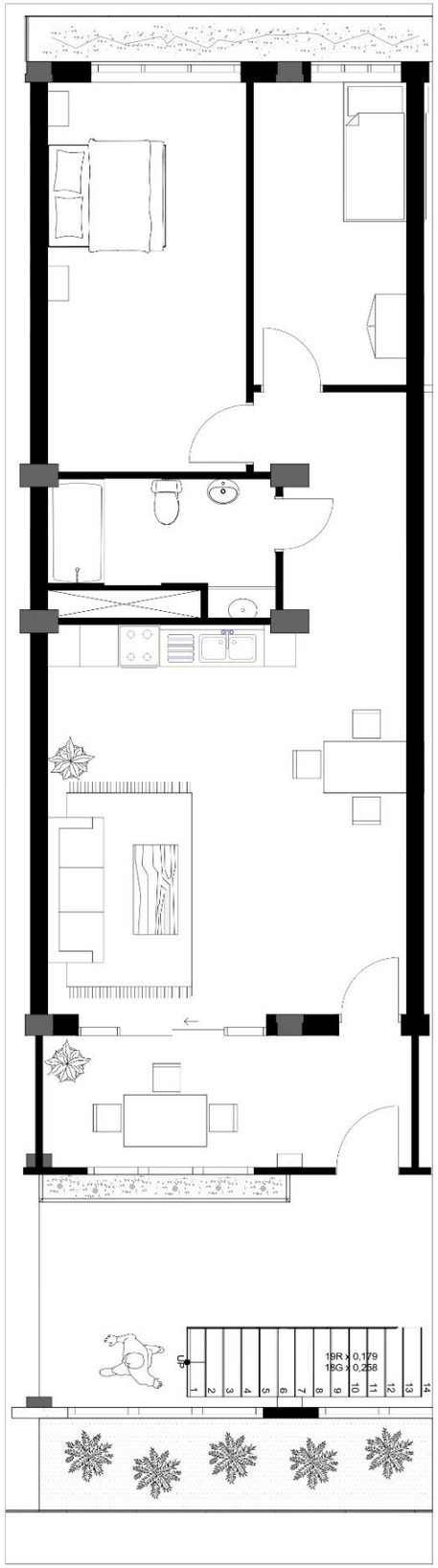
Target group distribution

Concept

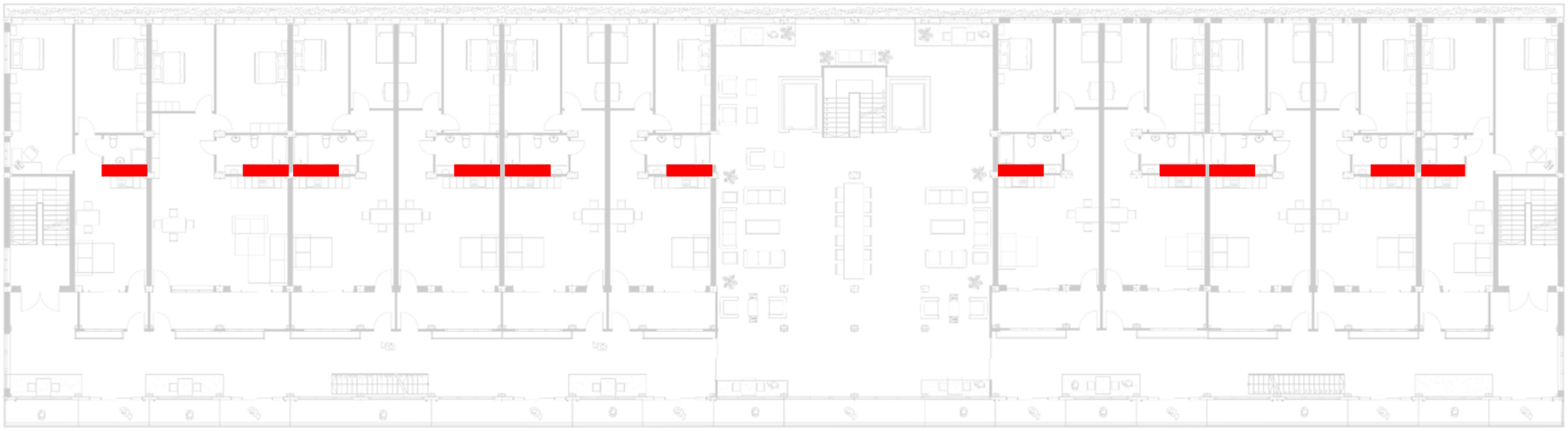
Apartments types for elderly



2 Grid Full length
apartment
110 m2



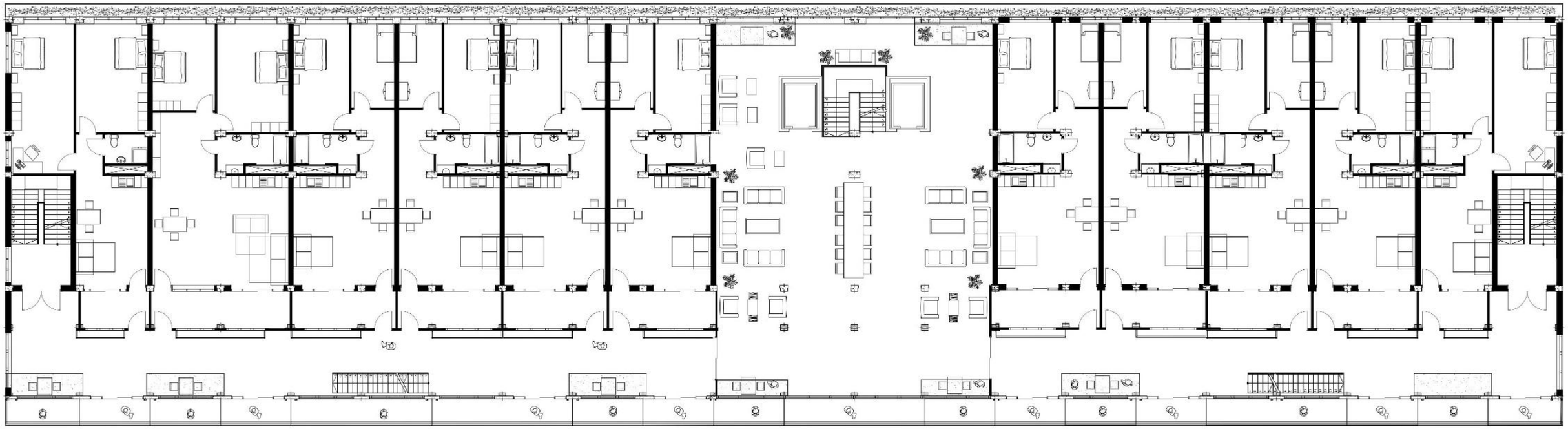
1.5 Grid Full length
apartment
80 m2



1st floor

Concept

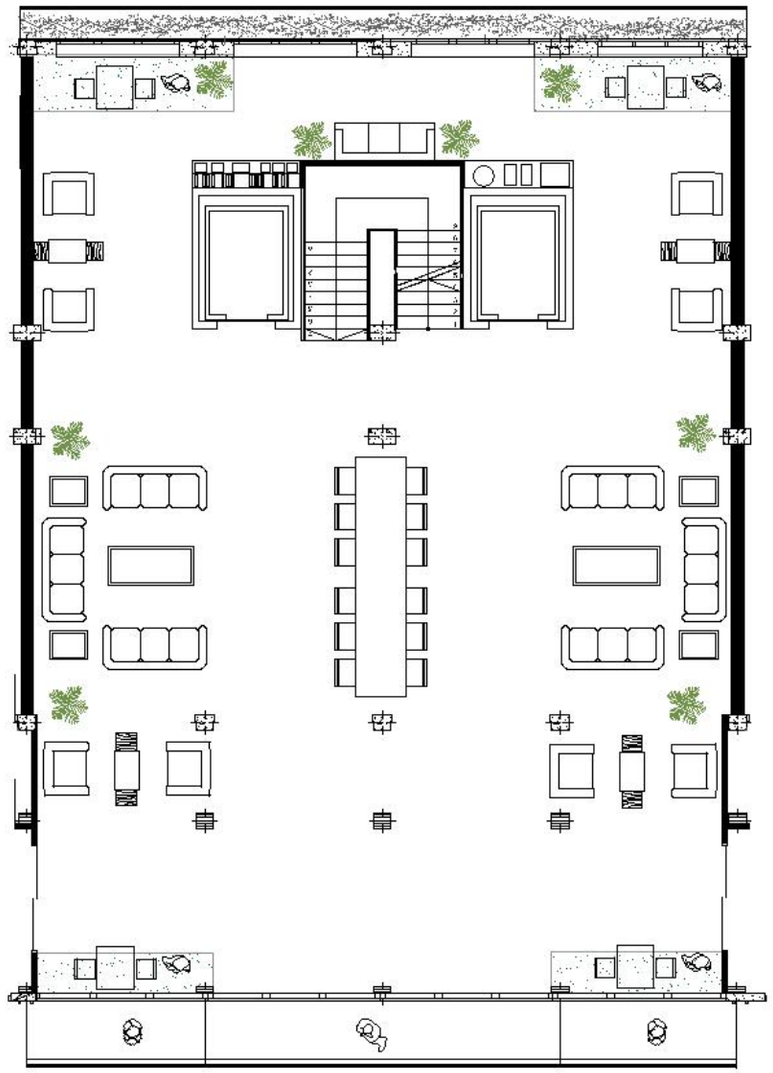
Shafts placing



1st floor

Concept

Floor plans, Elderly



elderly 1st

The social central spaces in the building serve as vibrant gathering areas located at the centre of the building, it has a simple clear layout design.

Communication and social space, it has comfortable seating where elderly meet, greet and socialize, it has comfortable seating areas and board games.

Concept

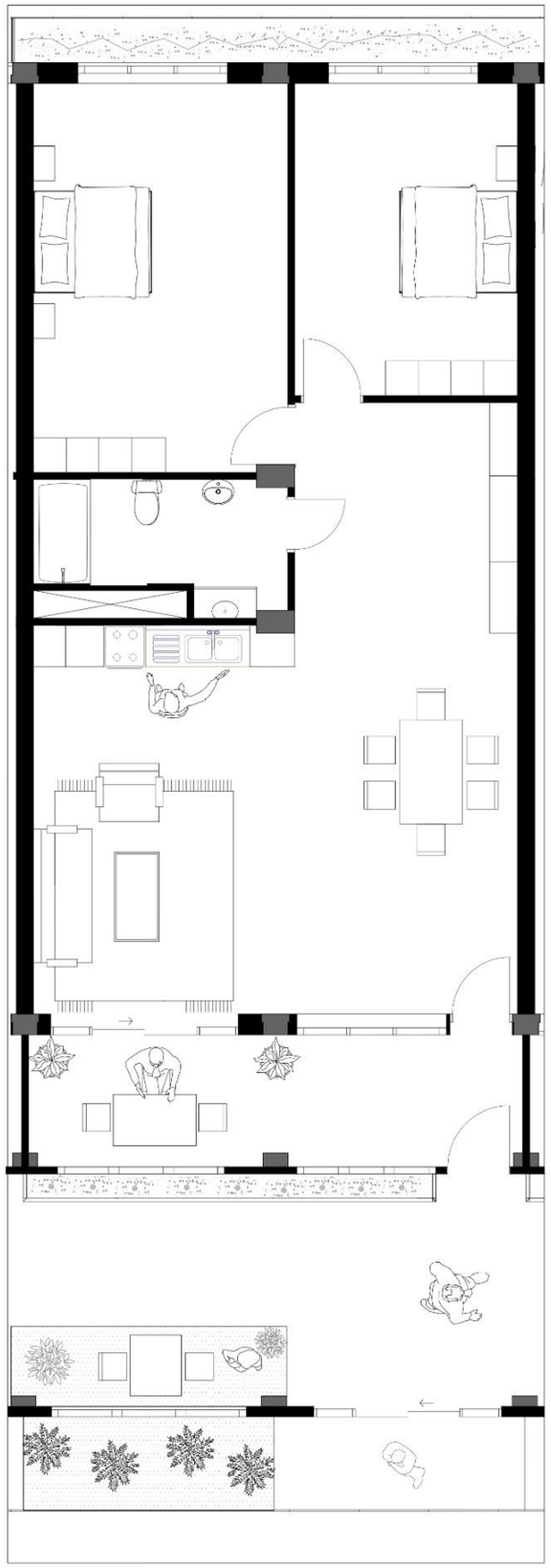
Central social space layout

Concept

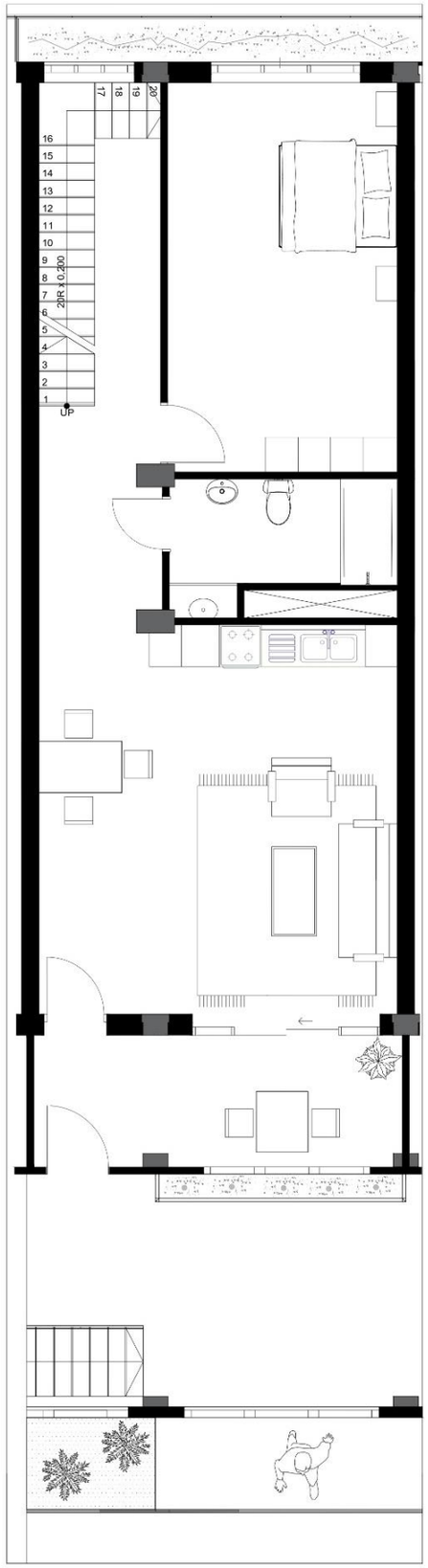
Central social space impression

Designed to be easily accessible, these spaces prioritize the integration of greenery, with plants and vegetation around.

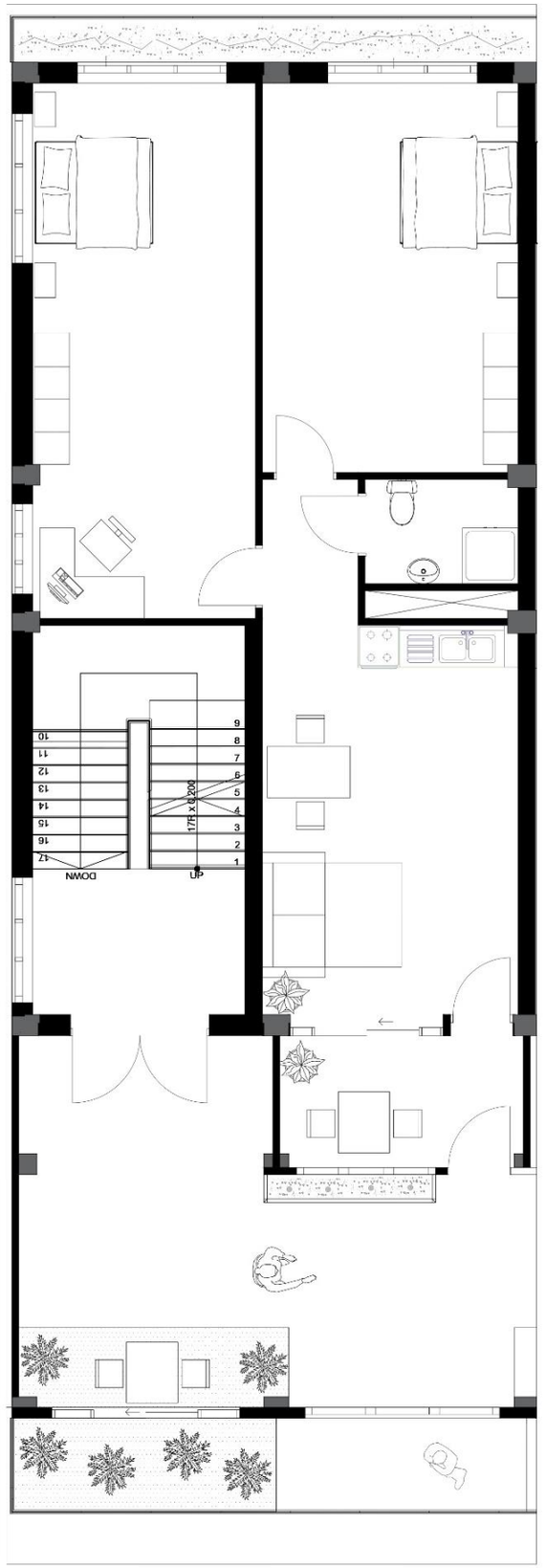
Elderly Scenario Video



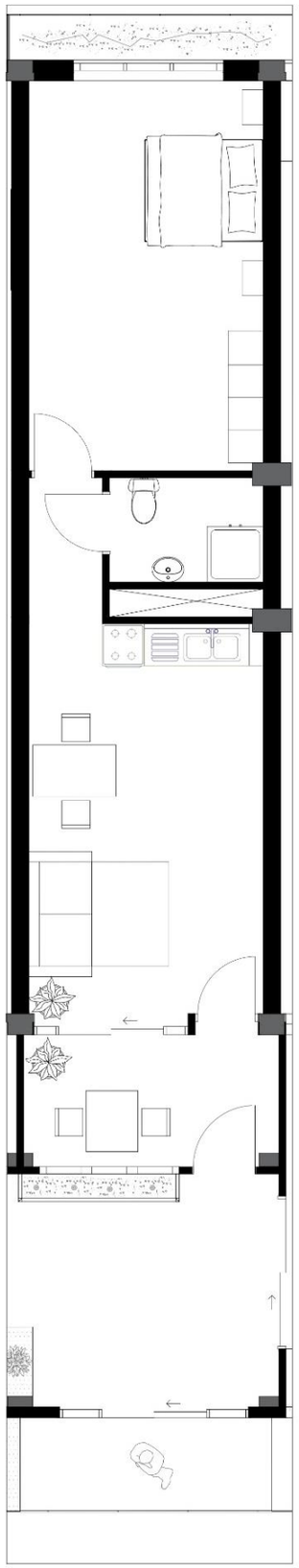
2 Grid Full length
apartment
110 m2



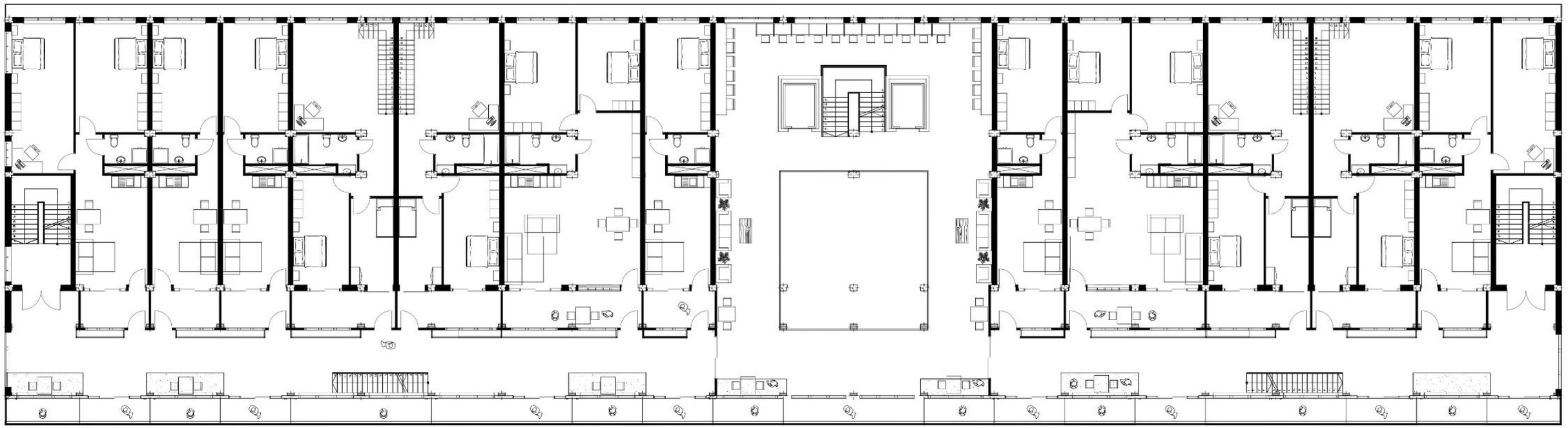
1,5 Grid Full length
Maisonettes apartment
160 m2



2 Grid Full length
corner apartment
80 m2



1 Grid Full length
apartment
55 m2

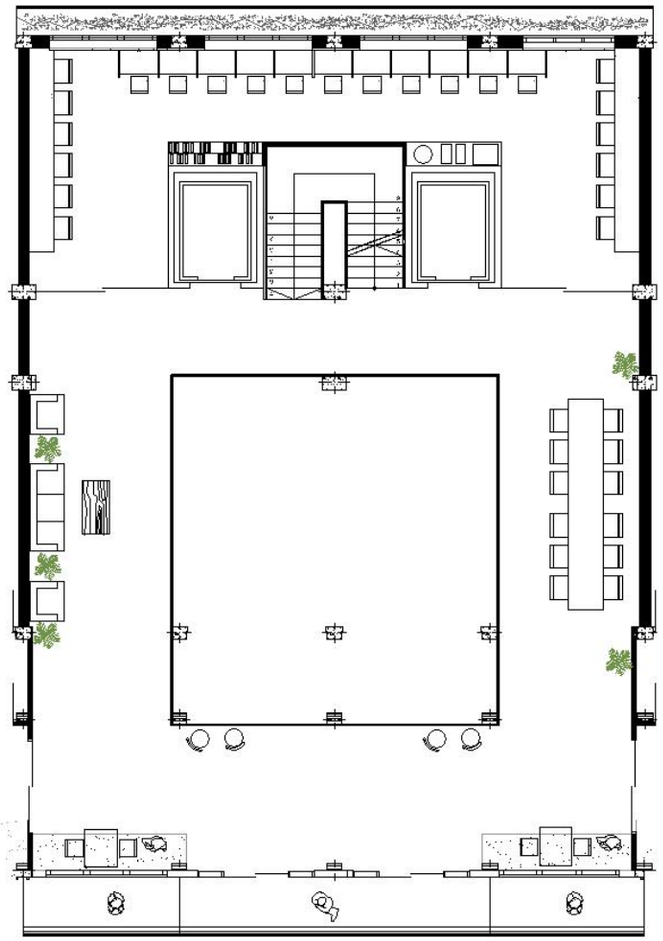


3rd floor

Concept

Floor plans, Starters

Entrepreneurship Center, a place designed to encourage and help new business ideas and startups. It can provide shared office spaces, meeting rooms, and resources for business development.

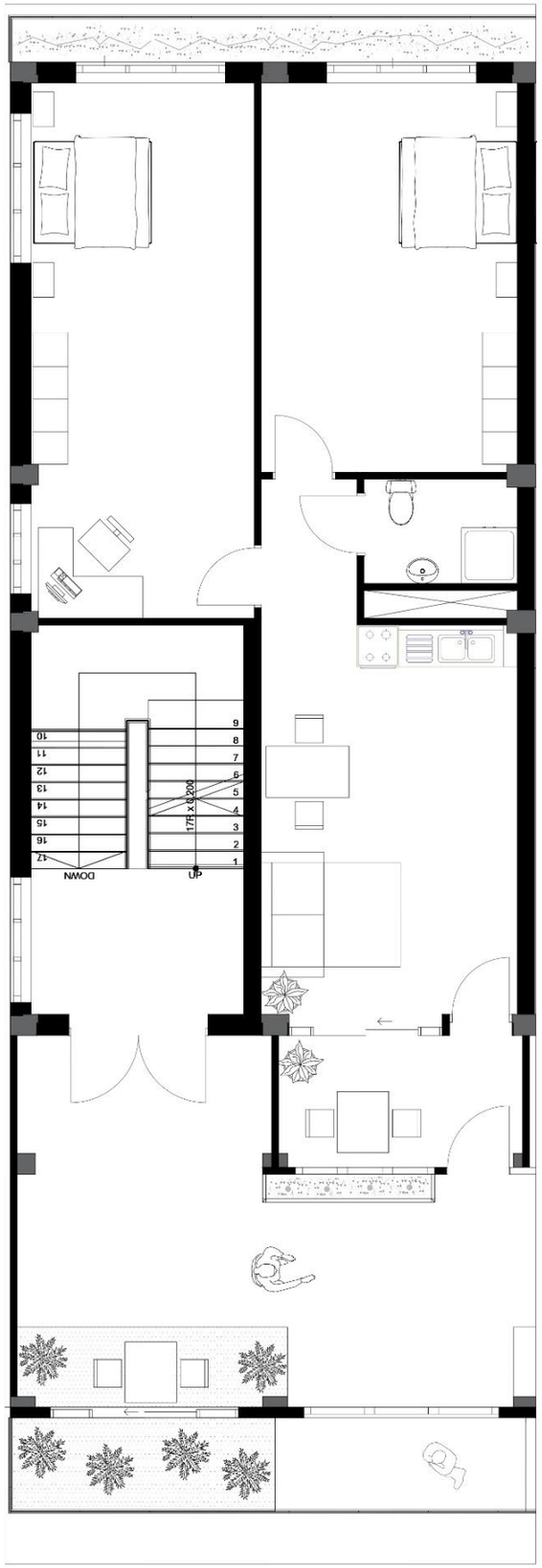


Social space where Starters can chill after a long day at work, have a drink and socialize, they could share experiences and pitch ideas and seek collaborations.

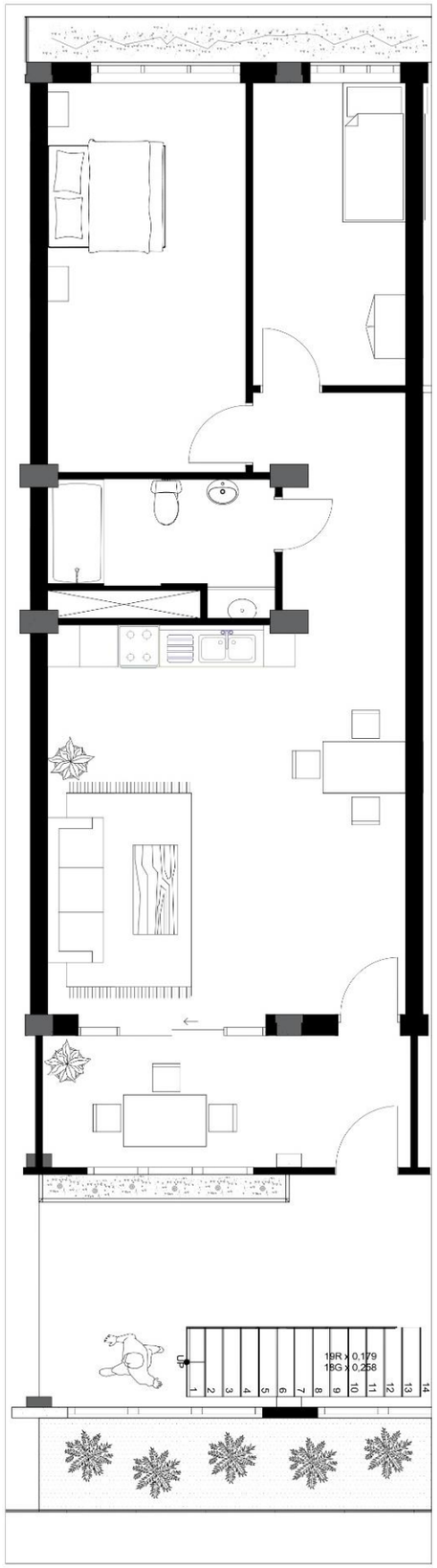
starters 3rd


LUMION

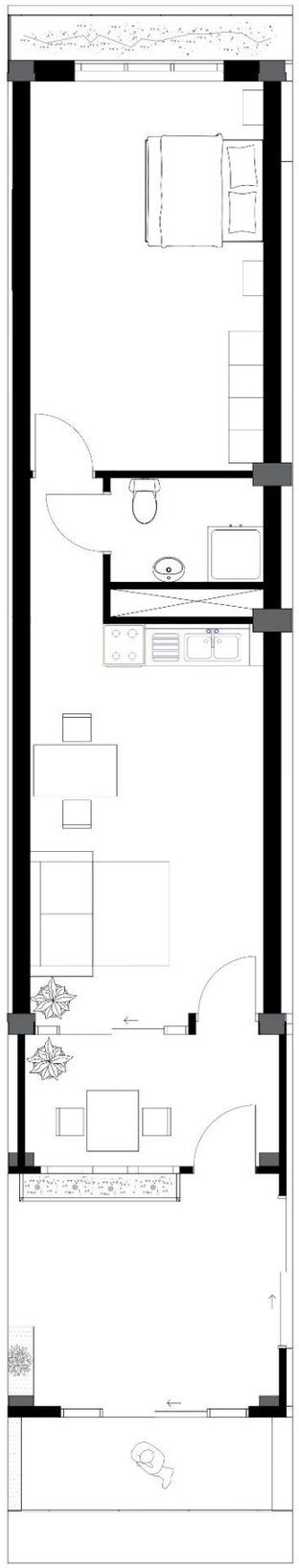
Starter Scenario Video



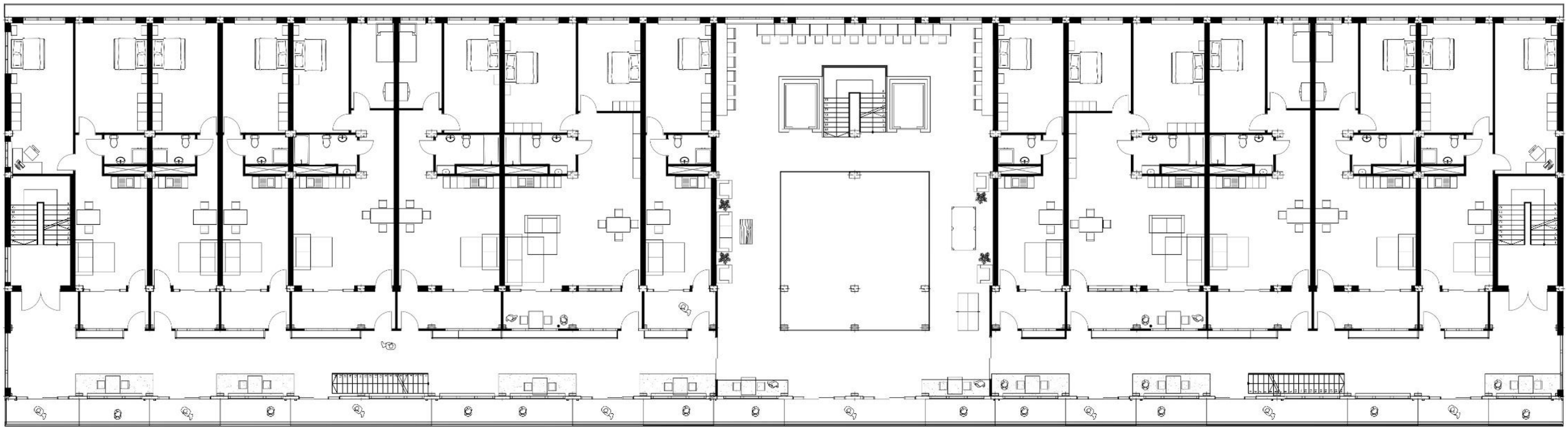
2 Grid Full length
corner apartment
80 m2



1.5 Grid Full length
apartment
80 m2



1 Grid Full length
apartment
55 m2

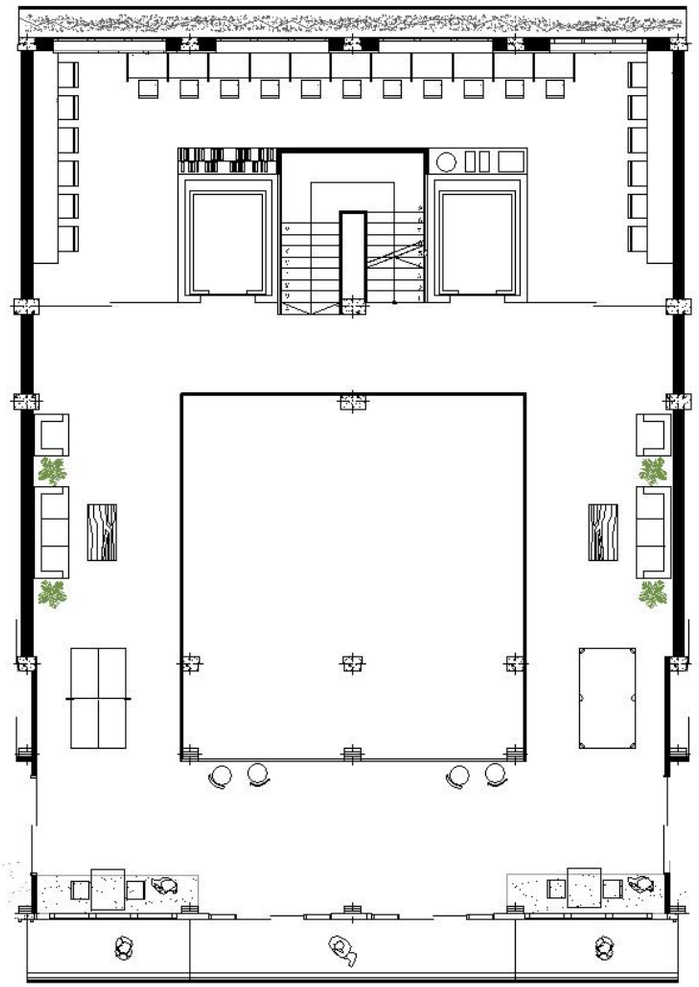


5th floor

Concept

Floor plans, Elderly

Collaborative Study Area: A dynamic and interactive space where students can study together, share ideas, and work on group projects.

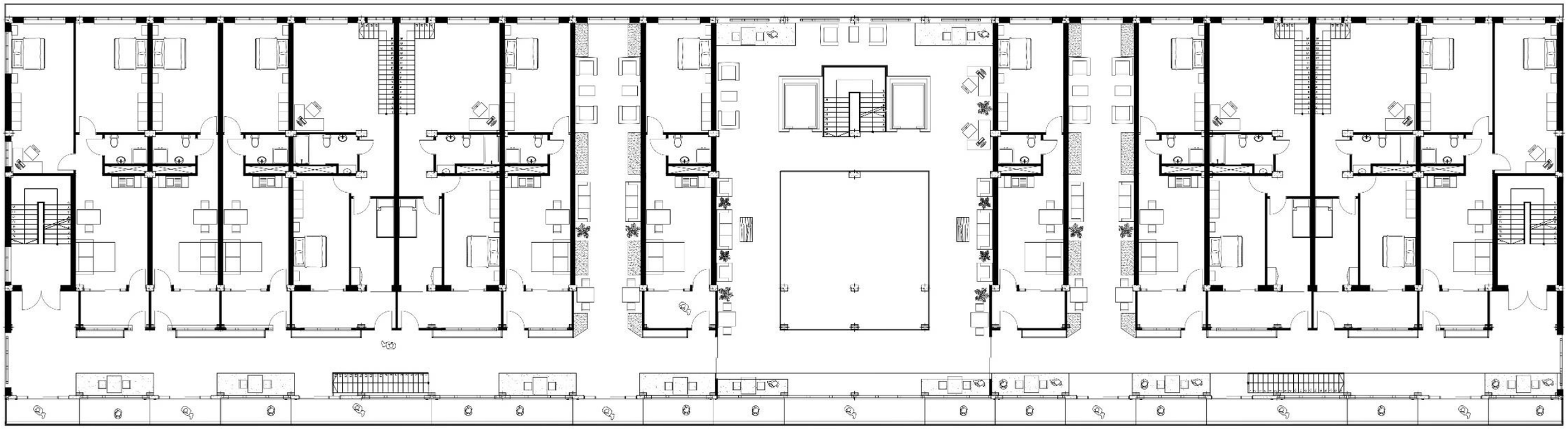


Social space where students can chill after a long day at school, have a drink and a chat with fellow students, the space also has some fun activities to do like table tennis and pool table

students 5th


LUMION

Students Scenario Video



7th floor

Concept

Floor plans, Elderly

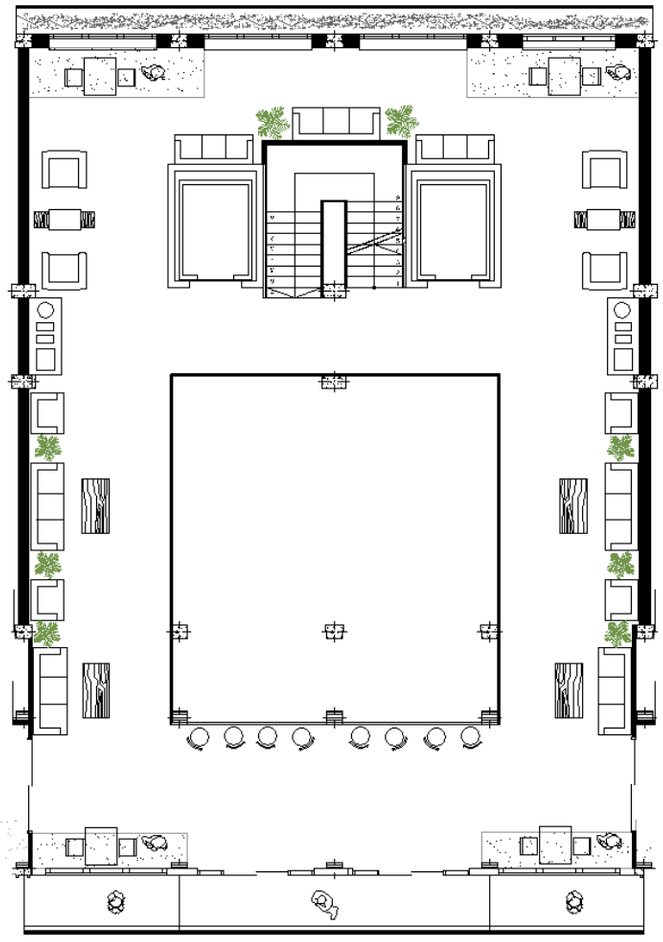
7th floor

Concept

Floor plans, Elderly


UMION

A mixed social space that serves as a hub for all target groups, to come together and engage in a wide range of diverse activities. This inclusive space fosters intergenerational connections and encourages the exchange of ideas and experiences among residents. It can accommodate various activities such as group discussions, workshops, cultural events, and social gatherings.



mix 7th

Concept

Social space, Mixed

Mix Scenario Video

Concept

Façade impression

Concept

Façade fragment 1/20

Concept

Façade materiality

Accoya wood door and windows frames

Accoya wood cladding

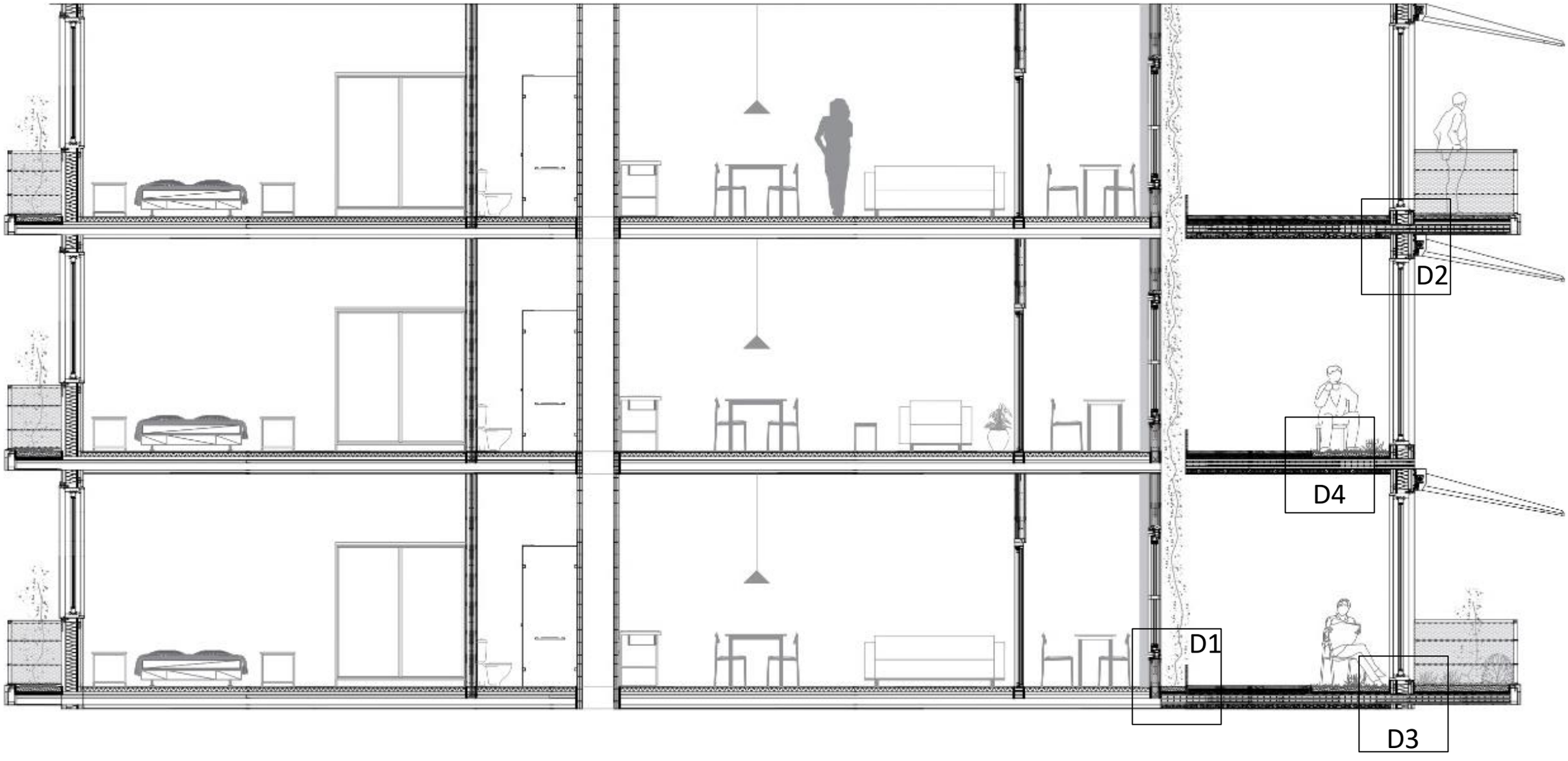
Sun breaker Awning

Vertical plant

Greenery for the balconies

Concept

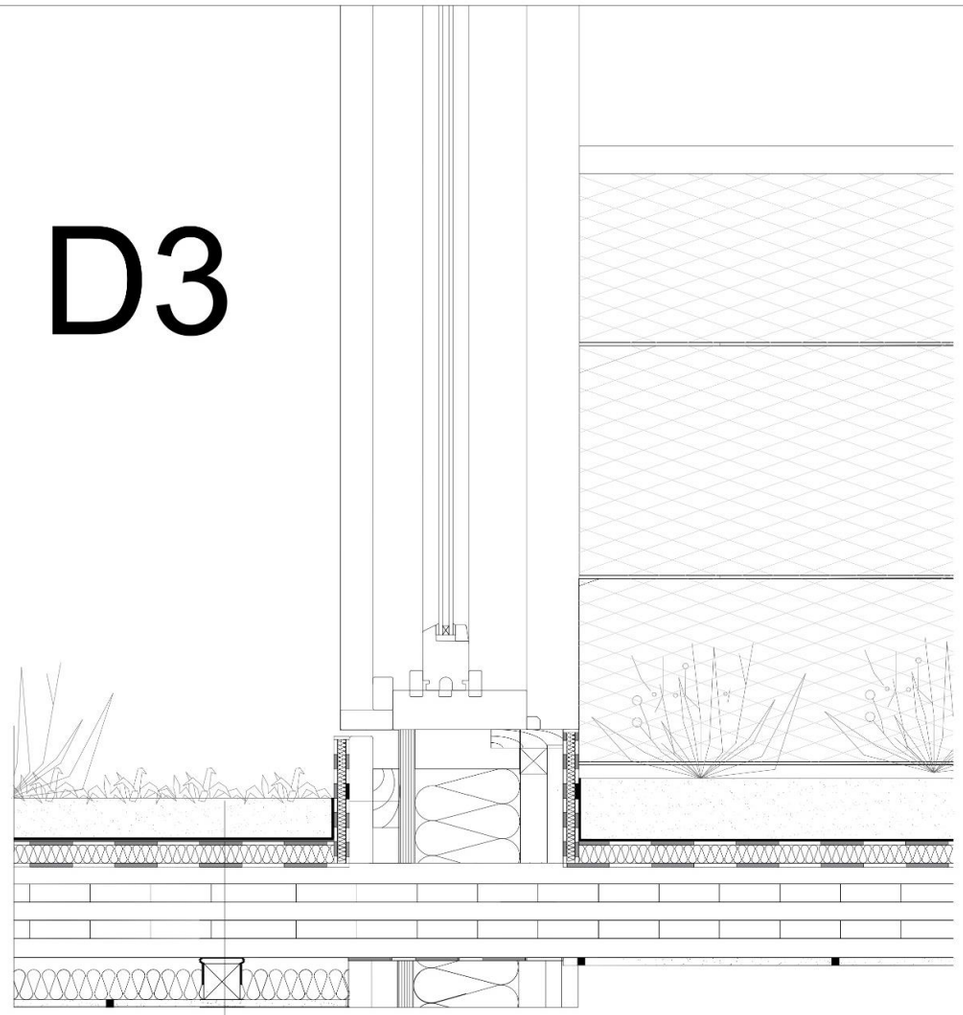
Façade fragment 1/20



Concept

section fragment 1/20

D3

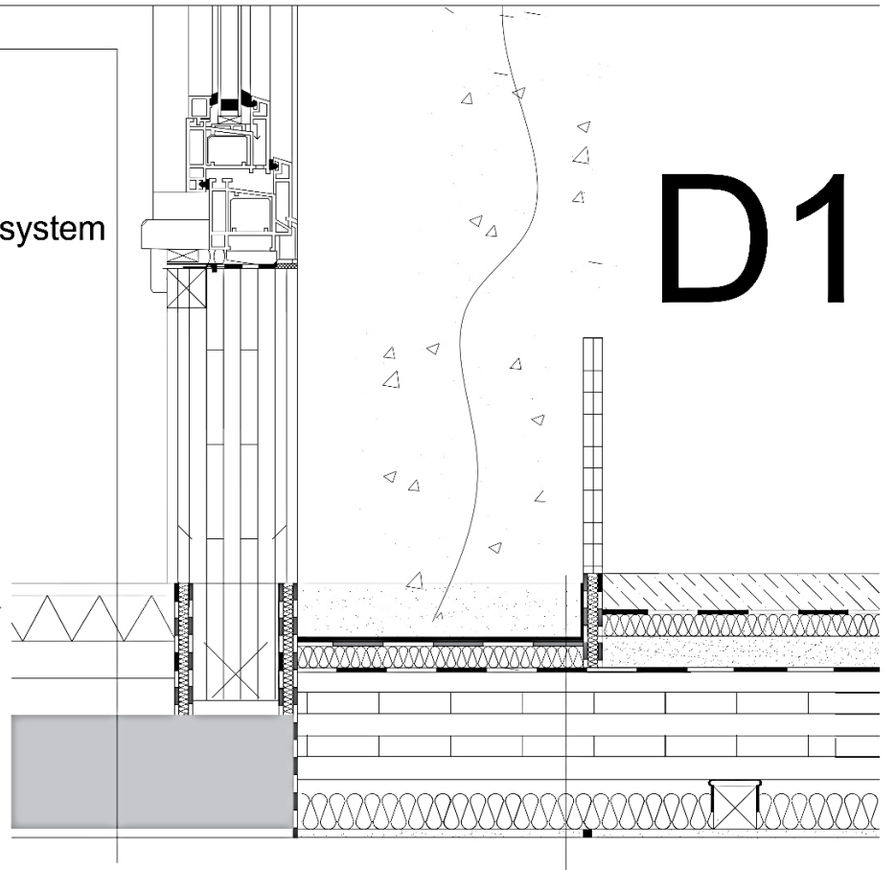


Coconut coir for the plants
Geotextile fabrics 3mm
vapor barrier
Separating layer
Impact sound insulation
trickle protection
Accoya wood
Wood spruce battens on an oscillating bracket
Plasterboard

Concept

Detail 1/5

Floor finish
Fermacell board
Egaline
Variokomp (dry floor heating system
Fermacell board)
Impact sound insulation
PE foil
Screed
Concrete floor slab
Stucco finishing layer



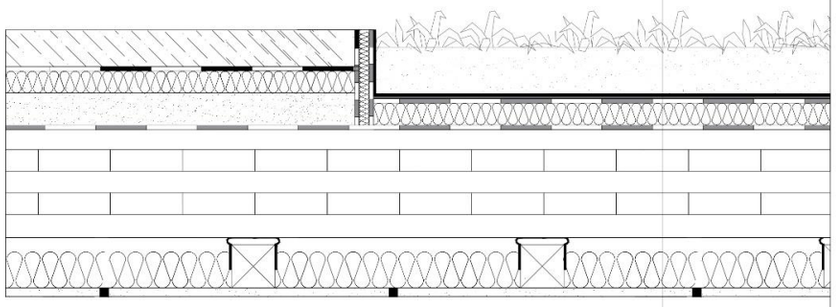
D1

Coconut coir for the plants
Geotextile fabrics 3mm
vapor barrier
Separating layer
Impact sound insulation
trickle protection
Accoya wood
underlayment material
fiber cement boards
Plasterboard

Concept

Detail 1/5

Coconut coir for the plants
Geotextile fabrics 3mm
vapor barrier
Separating layer
Impact sound insulation
trickle protection
Accoya wood
underlayment material
fiber cement boards
Plasterboard



D4

Concept

Detail 1/5

Cement screed with
Accoya wood floor finishing

Separating layer

Impact sound insulation

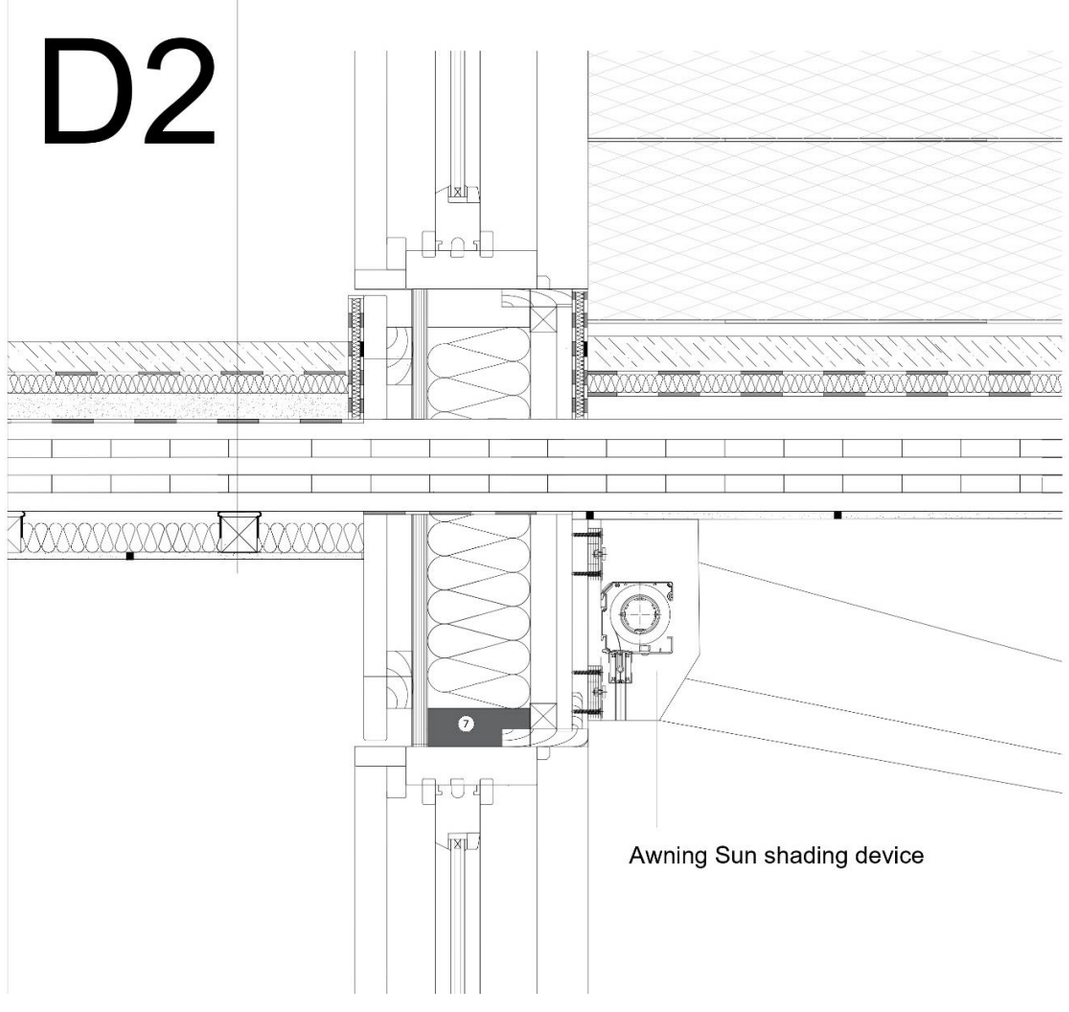
Filling

trickle protection

Acooya wood

Wood spruce battens on an oscillating bracket

Plasterboard



Concept

Detail 1/5

7,2 m

21,1 m

0,6 m

13,5 m

2 m

3,5 m

1,5 m

Greenery (back yard)

Sleeping

bathroom and toilet

Kitchen and living area

Private balcony

Greenery (front yard)

Gallery

Outside balcony

2 Grid Full length apartment
110 m2

Concept

Apartment layout

5th floor

Concept

Floor plan Adaptability

Concept

Apartments adaptability

Concept

Apartments adaptability

The waste hierarchy consists of 3 R’s as follows:

Reduce
Reuse
Recycle

Commonly called the “three R’s” of waste management, this waste hierarchy is the guidance suggested for creating a sustainable life. You might be wondering how you can incorporate these principles into your daily life.

Climate principles

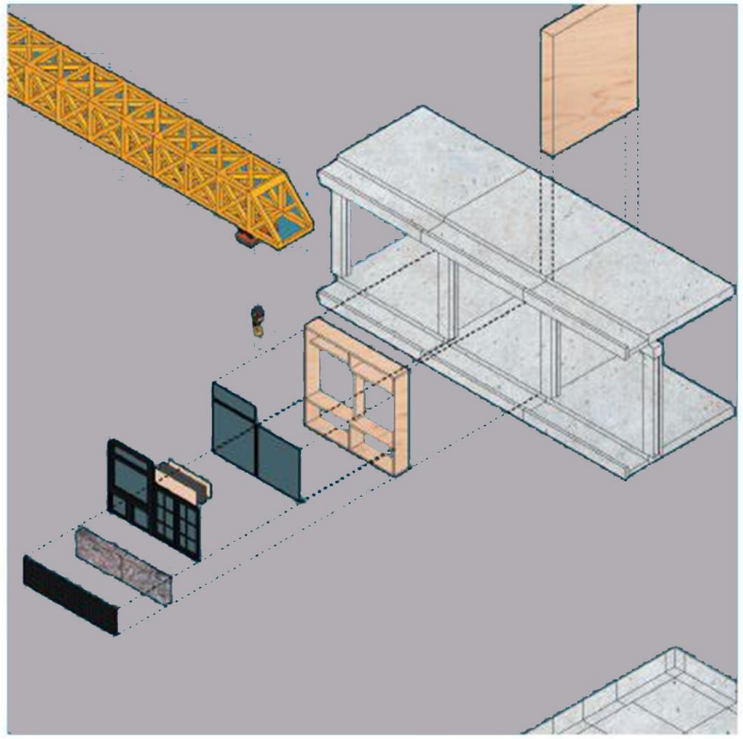
Building performance

Climate principals

Reducing Waste:

using building materials that are locally sourced to reduce transportation emissions and minimize waste such as Accoya wood from Arnhem, Accoya wood is considered to be a sustainable wood product because it is made from fast-growing and renewable sources of wood, such as Radiata Pine and European Beech. The production process also uses wood from sustainably managed forests, which ensures that the wood is harvested in a way that maintains the long-term health and productivity of the forest ecosystem.

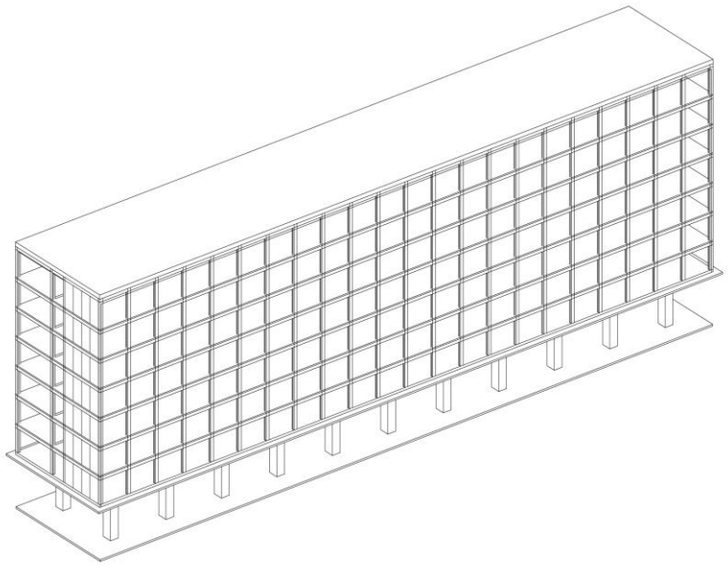
Use	:	Architectural Structures
Applications	:	Beams, columns, flooring, facades and wood trusses
Characteristics	:	Dimensional stability, durability and natural UV resistance, improved insulation characteristics, coatings last longer than on competing products, ICC
Format	:	100% solid Accoya® wood; modified to the core using a non-toxic proprietary acetylation process
Certification	:	Cradle to Cradle Gold certification, FSC® and PEFC™, BREEAM and LEED, The Future Build, Singapore Green Label, Dubokeur, ICC
Guarantee	:	Warranted against rot and decay for 50-years above ground; 25-years in-ground/freshwater



Climate principles

Building performance

Reusing:
To maximize reuse, I am considering salvaging materials from the existing building, such as the concrete floor and structure, glass windows, and steel balustrades. These materials can be repurposed or incorporated into the new building design. For example, the concrete can be crushed and reused as aggregate for new concrete, the glass can be melted down and used to make new glass products, and the steel can be melted down and used to make new steel products.



Climate principles

Building performance

ENERGY REDUCTION MEASURES

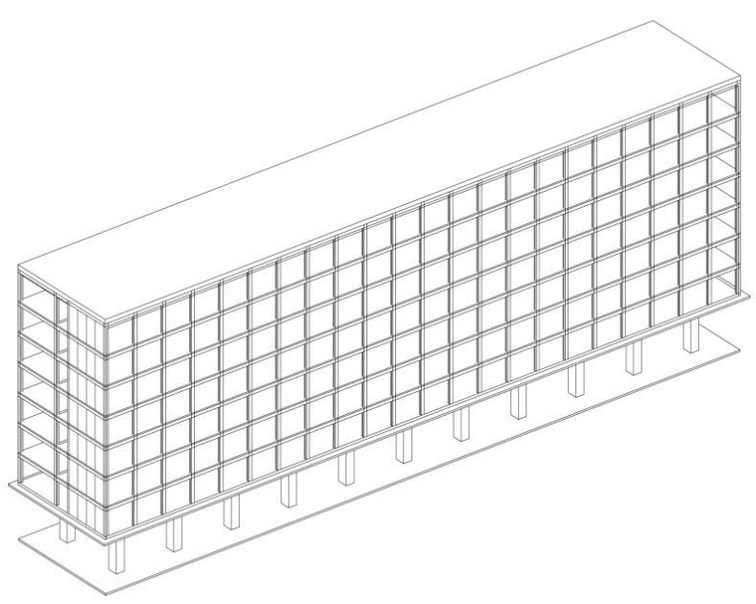
- **Reduce :**
- traditional light to LED lighting
- a flow controller in water taps
- Use Smart System Control
- Use energy efficient plus appliances.
- Apply New insulation
- Windows replacement
- Sun shading.

Reuse:
- Rainwater collection
- Heat recover from ventilation
- Shower heat recovery
- Mechanical ventilation with energy heat recovery

Climate principles

Building performance

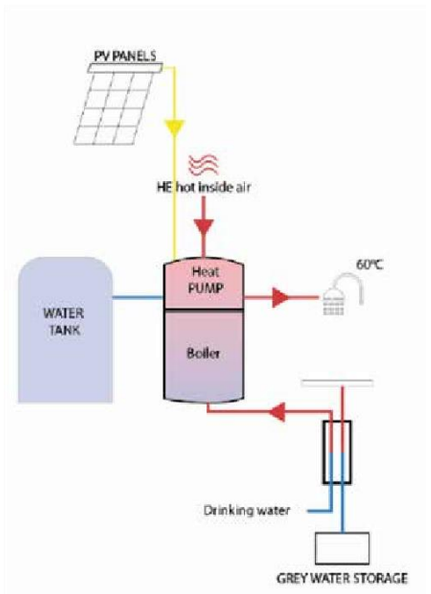
Recycling:
To promote recycling, we can design the building with materials that are easily recyclable at the end of their lifecycle. For example, use materials such as steel, wood, and glass, which can be easily recycled.

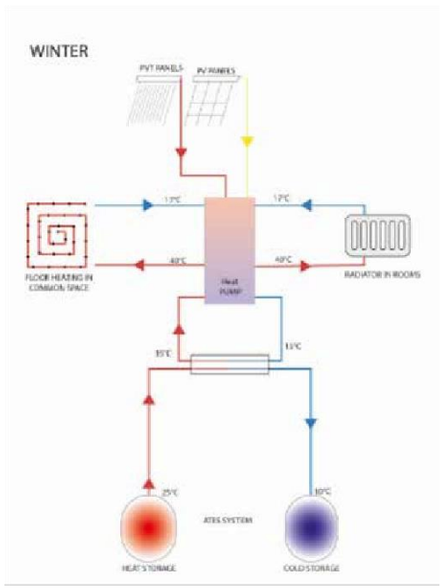


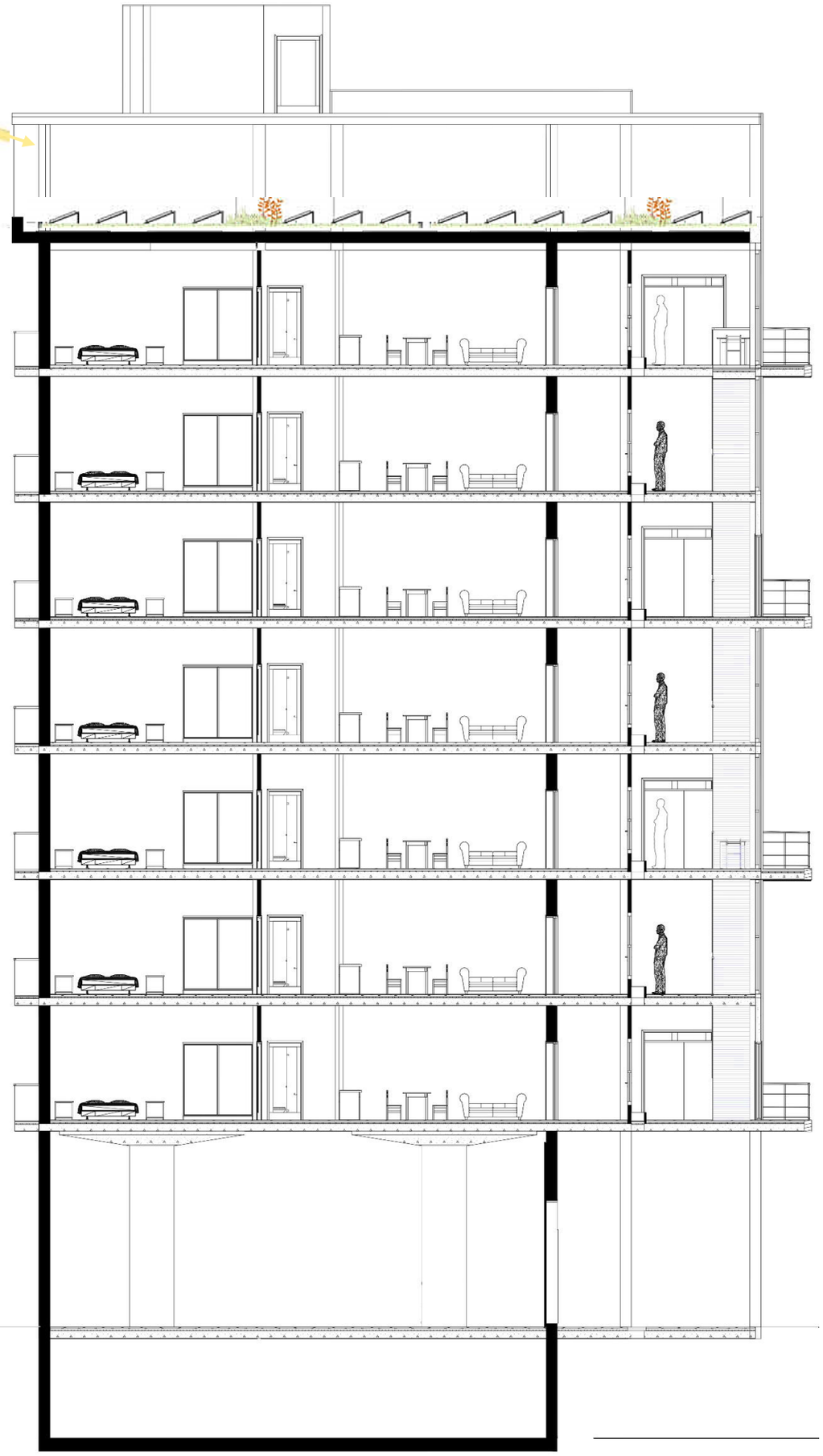
Climate principles

Building performance

Heat pump water-water system ,
Floor heating (winter-situation)
Floor cooling (summer-situation)







Climate principles

Building performance, heating and cooling

Calculating domestic water demand and sewage load

Project:	aE Graduation project	**Variant:**	Tax office
Date:	30/Mar 2023	**Time:**	13:02:33
Name student:	Alaa Alhamad	**Study number:**	

General information:

Number of persons in the house:	200	persons			
Roof surface per house:	1114	m2	Surface to sewer system	80	m2
Type of roof surface:	2	(1=roof tiles, 2=flat roof, 3=vegetation roof)			
Purification of wastewater with heliophyte filter?	0	(0=no 1=yes)			
Heat recovery of drain water from shower?	1	(0=no 1=yes)			
Domestic hot water storage vessel?	1	(0=no 1=yes)			
Presence of solar water heater?	1	(0=no 1=yes)			
Oriëntation of the solar heat collectors?	1	(1=S, 2=SSW/SSE, 3=SW/SE, 4=SEE/SWW, 5=E/W)			
Inclination angle of the solar heat collectors?	15	o (0=horizontal, 15, 30, 45, 60, 75, 90=vertical)			

Water demand per person:

Washing machine	10	liters per day	(normal= 20 l.)		
Bathroom	25	liters per day	(normal= 40 l./watersaving shower head= 25 l./bath= 70 l.)		
Kitchen	10	liters per day	(normal= 18 l./with flowlimiter on tap= 14 l.)		
Toilet	20	liters per day	(normal= 40 l./water saving button= 28 l./Gustavsberg-system= 15 l.)		
Other	10	liters per day	(normal= leakage loss, garden watering, carwash etc.)		
Loss of standstil in tubes					
Total water demand:	75	liters per day/pers	=	27 m3 per year/pers	=
of which domestic hot water	24	liters per day/pers	=	9 m3 per year/pers	=

Aan- en afvoer van water:

	Supply		Drain	
Washing machine	2	(1=rw, 2= dw)*	2	(1=sewage system, 2= heliophyte filter)
Bathroom	2	(1=rw, 2= dw)*	2	(1=sewage system, 2= heliophyte filter)
Kitchen	2	(1=rw, 2= dw)*	2	(1=sewage system, 2= heliophyte filter)
Toilet	1	(1=rw, 2= dw)*	1	(1=sewage system, 2= heliophyte filter)
Other	2	(1=rw, 2= dw)*	1	(1=sewage system, 2= heliophyte filter)

* rw=rain water, dw=drinking water

Rainwater collecting

Amount of precipitation	750	mm/m2/year
Rainwater collection from roof	501	m3/year
Required amount of rainwater	1460	m3/year -
Surplus rainwater (to the sewer):	0	m3/year

Results of flows

Amount of rainwater to use	+	501	m3/year	
Required amount of drinkingwater	+	4974	m3/year	+
Total amount of water required:	=	5475	m3/year	
Amount of wate water to the sewer:	+	2190	m3/year	
Amount of waste water to the heliophyte filter::	+	3285	m3/year	+
Total amount of waste water	=	5475	m3/year	
Energy content of the required domestic hot water	+	100795	kWh-thermal/year	
Losses of the storage vessel	+	548	kWh-thermal/year	
Saving by the solar collector:	-	48885	kWh-thermal/year	

Results of dimensions:

Content of the solar boiler	4734 liters
Surface of the solar collector	94,7 m2
Content of the rainwater tank:	15039 liters
Surface of the heliophyte filter	
• With infiltration and root zone system:	70,4 m2
• With flowing field system:	164,3 m2

Remarks

,,

Amount of rainwater to use 501 m3/year

Energy for domestic hot water 100 MWh/year

Climate principles

Building performance, energy calculation

Calculation of the solar PV energy ouput of a photovoltaic system

Yelow cell = enter your own data
Green cell = result (do not change the value)
White cell = calculated value (do not change the value)

Global formula : **E = A * r * H * PR**

E = Energy (kWh)	253005	kWh/an
A = Total solar panel Area (m²)	1320	m²
r = solar panel yield (%)	19%	
H = Annual average irradiation on tilted panels (shadings not included)*	1250	kWh/m².an
PR = Performance ratio, coefficient for losses (range between 0.9 and 0.5, default value = 0.75)	0,81	

Total power of the system 250,8 kWp

Losses details (depend of site, technology, and sizing of the system)

- Inverter losses (6% to 15 %)	6%
- Température losses (5% to 15%)	5%
- DC cables losses (1 to 3 %)	1%
- AC cables losses (1 to 3 %)	1%
- Shadings 0 % to 40% (depends of site)	3%
- Losses weak irradiation 3% yo 7%	3%
- Losses due to dust, snow... (2%)	2%
- Other Losses	0%

By occupying must of the roof for producing energy through the installation of solar panels

Total energy produced is 253 MWh/year

Climate principles

Building performance, energy calculation

- Based on the aforementioned information,
- Total energy demand is the User related energy (going 100% electrical) + the Energy needed for the heat pump.
- The energy needed for the heat pump ,to produce domestic hot water and heating and cooling demand, can be up to 20 MWh/year
- The average Dutch household needs about 3000 kwh/year for URE, we have about 70 houses in the block therefore the total is 70*3=210 MWh/year
- Total energy demand is 20 MWh/year+ 210 MWh/year= 230 MWh/year
- The maximum generating capacity of the roof solar panels is 253 MWh/year
- That lead us to the new total energy demand after using the generating energy from the solar panels 253-230= 23MWh
- The Building is net zero energy design and produce 23 MWh extra energy annually

Climate principles

Building performance, energy calculation

Thank you!

Overview video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