High Tech Timber

Fill the Gap, Pile it Up

Urban intensification concept on how to add value to existing buildings in city centres using timber

Case study for Jagiellonska 23 building in Warsaw, Poland

Concept by High Tech Timber

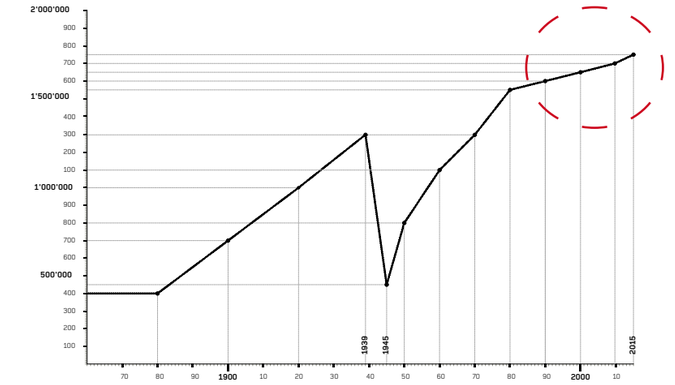
Going back to 1939

... a little bit of history

Before 1939

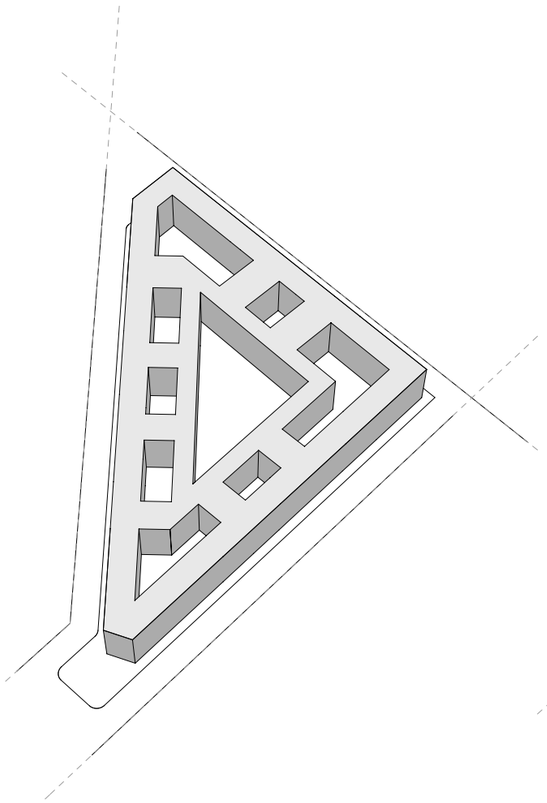
1939 – 1945

After World War II

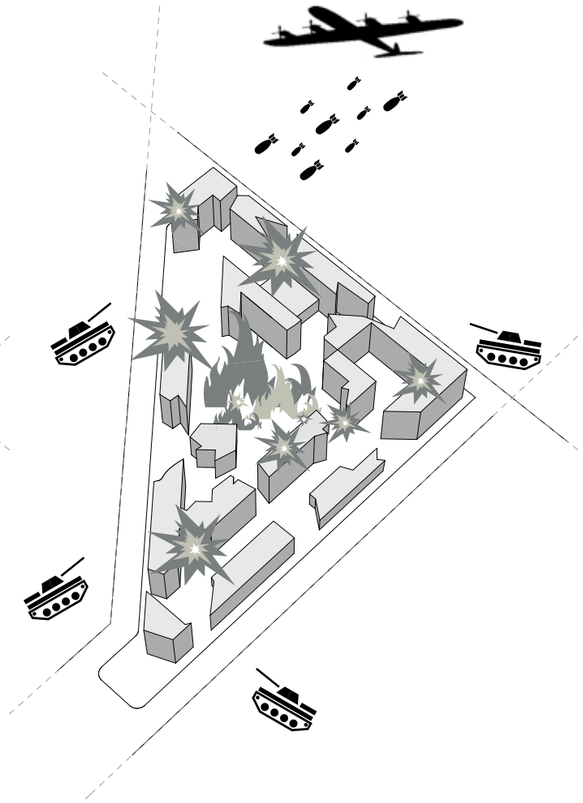


The evolving growth of the population creates housing demand.

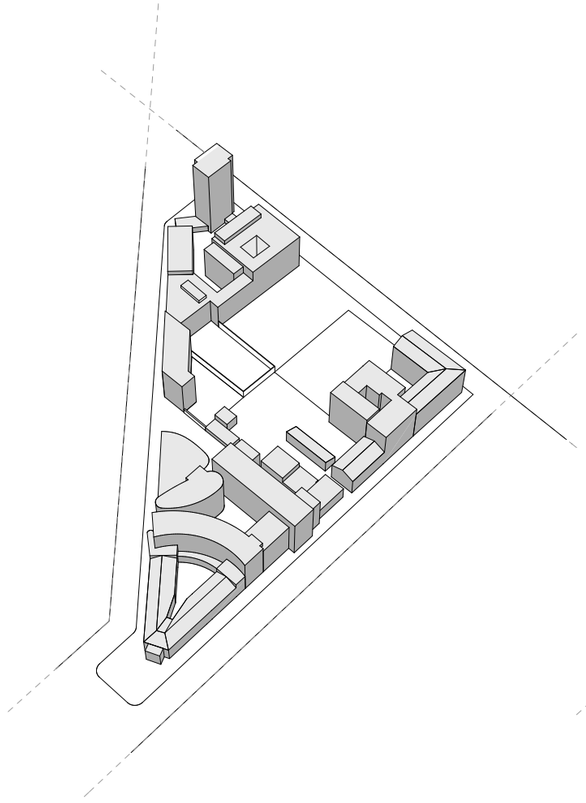
Population growth between the 20th and 21st century



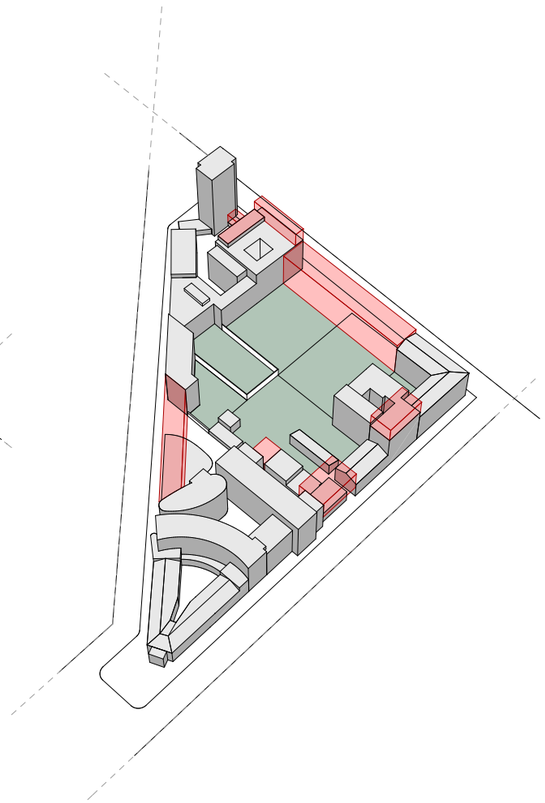
1_19th and 20th century
Warsaw consists of blocks as architypes of the European urban morphology. Consecutive backyards result in high density.



2_World War II
Warsaw is severly destroyed. At the end of the war only 15 % of buildings remained.



3_Today (2015)
Warsaw's population grows and creates demand for living space, especially in the city centre. Ruptures and gaps along the city's roads remain and reflect the fast pace of urban planning.



4_Strategy
To prevent the population moving to the suburbs High Tech Timber proposes using the potential of the ruptures and gaps:
Fill the gap, pile it up!

Why Fill the Gap?

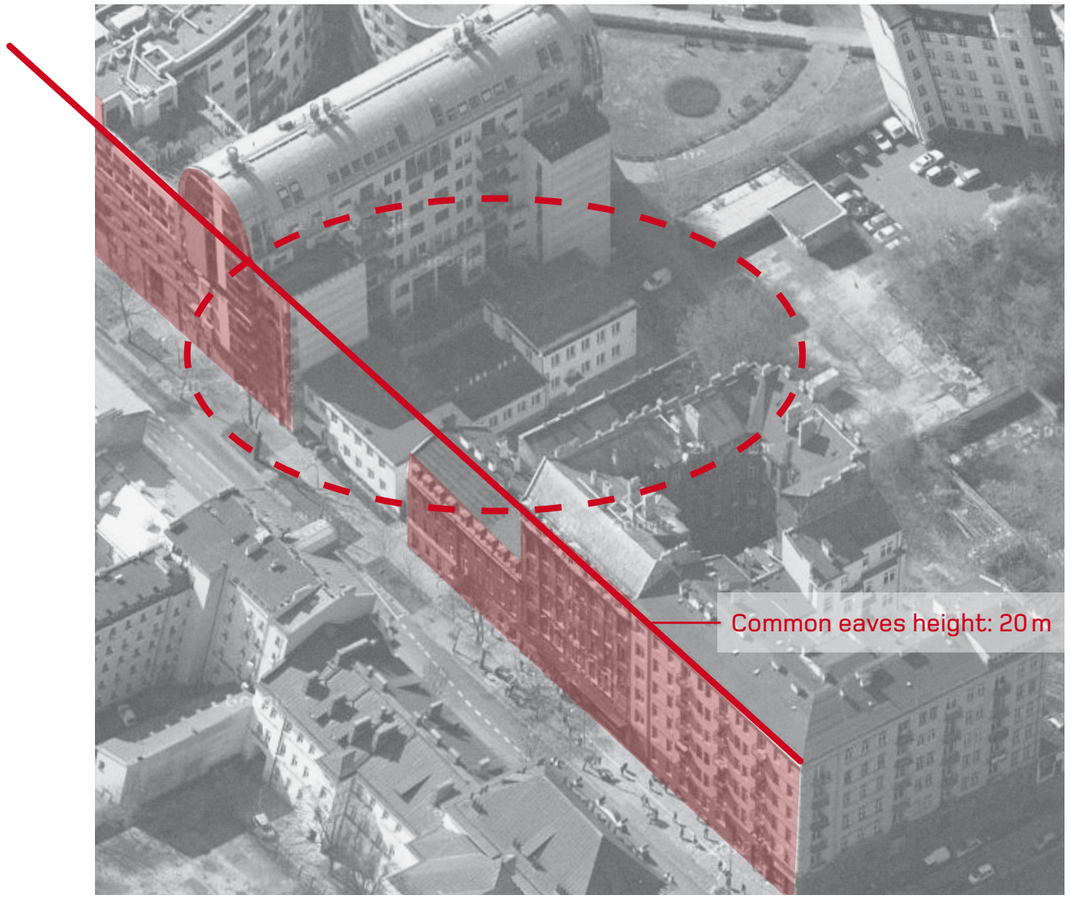
Ruptures in urban tissue

As many European cities, Warsaw is built of blocks with continuous eaves height of 20 m.

However the city has many ruptures and gaps along street frontages due to the destruction from World War II.

At Jagiellonska 23 and 25 there is such a rupture in frontage.

View of Jagiellonska street.

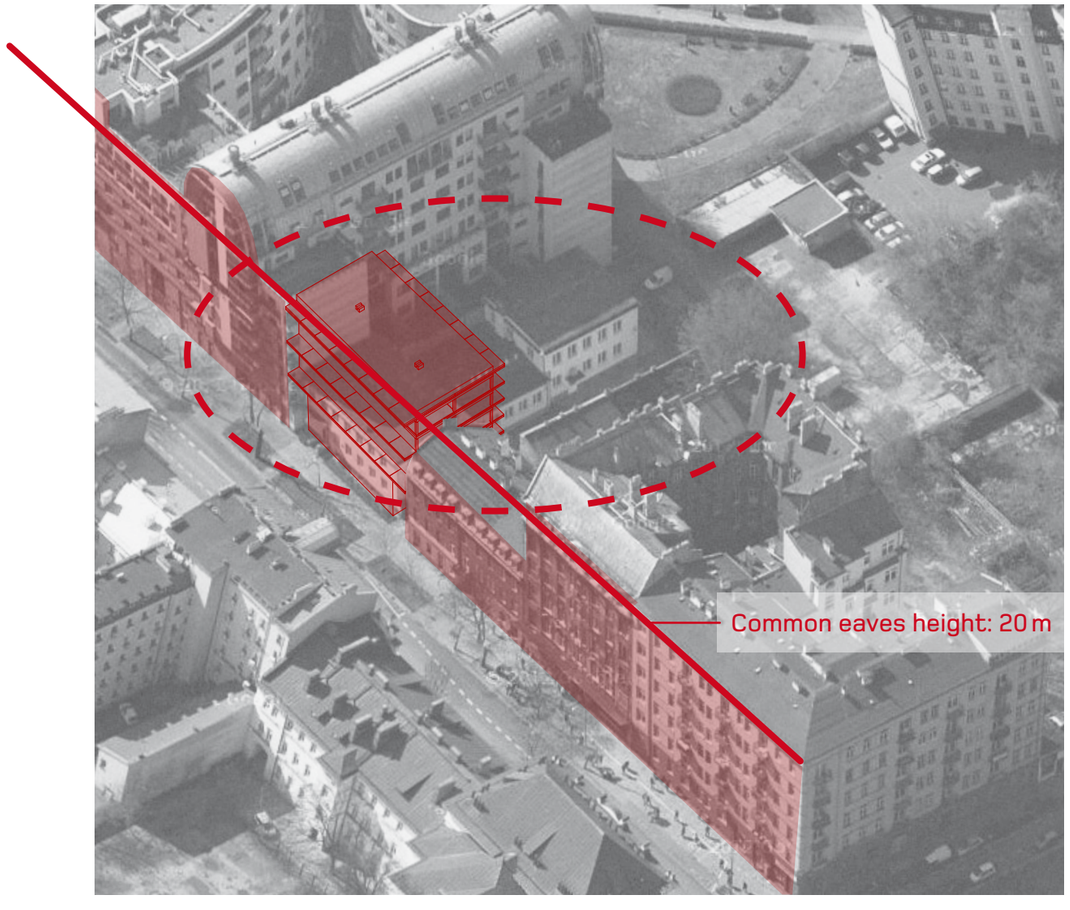


Bird‘s eye view of the Jagiellonska street. The views reveal the possibility of using the space above the existing building at no. 23.

Restoring urban tissue

Filling this gap allows intensification of the inner city by keeping the spatial qualities of the block as archetype of the European morphology:

- Clear separation of private (courtyard) and public space (street)
- Peripheric construction allows maximum density while keeping the courtyard free for recreational use
- The courtyard is protected by a noise barrier
- The continuous frontage and the public function of the ground floor gives the desired urban feeling

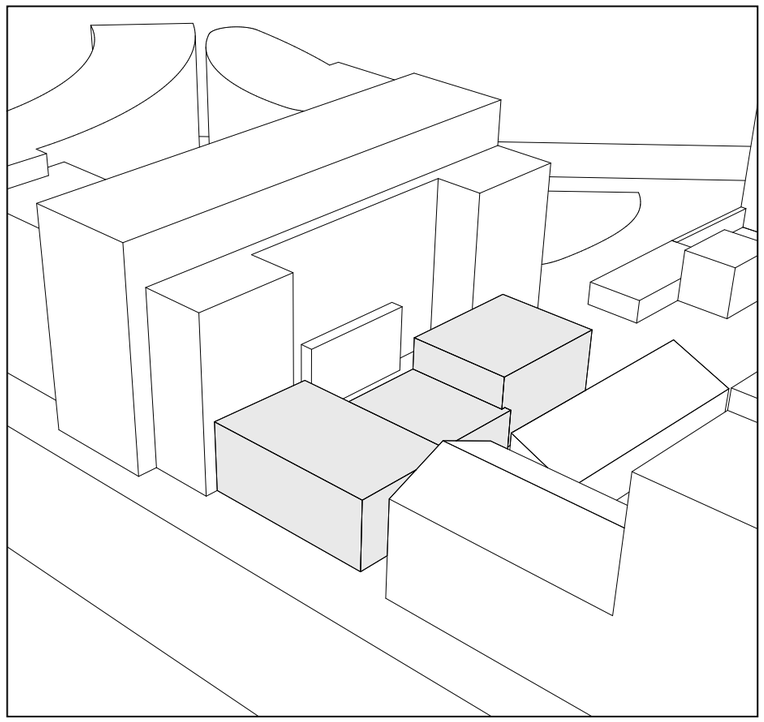


Bird‘s eye view of the Jagiellonska street with the timber pile-up at no. 23: Using the full potential of this site.

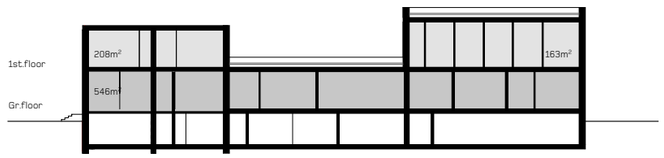
Why Pile it Up?

1. ADDED ECONOMIC VALUE: TWICE AS MUCH NET LETTABLE AREA

Before

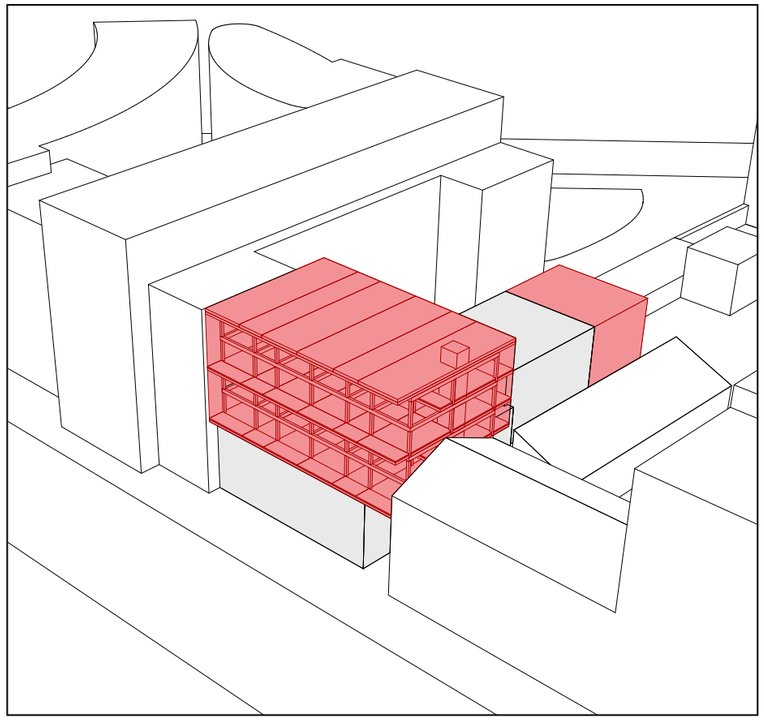


Existing 2 storey office building

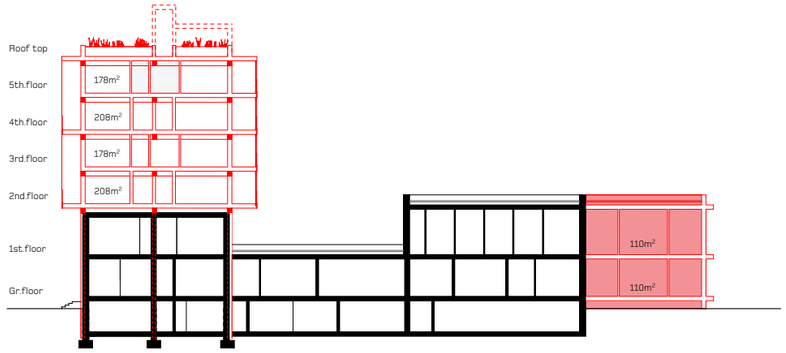


920 m² (100 %)

After



New 4 storey residential pile-up with a roof garden and 2 storey office extention



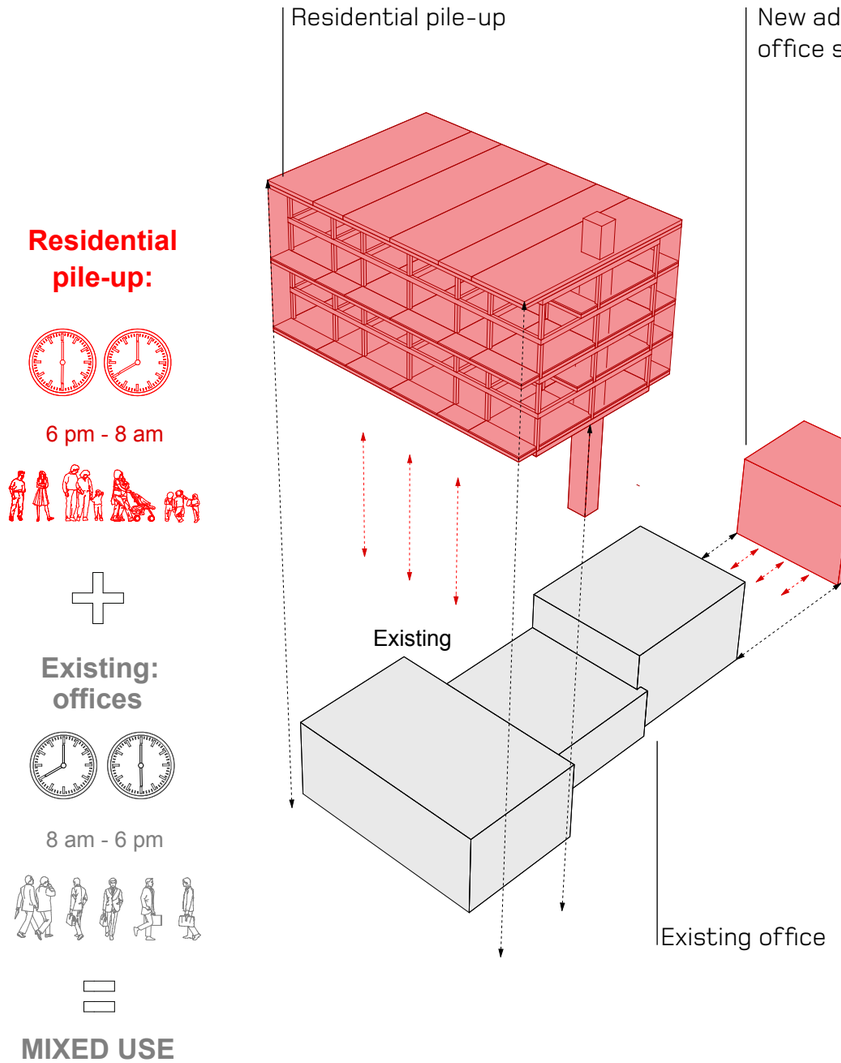
Pile-up + extension
760 m² of new flats
120 m² of new offices space
920 m² of existing office space

760 m² +
220 m² +
920 m² =
1'900 m² | 980 m² (207 %)

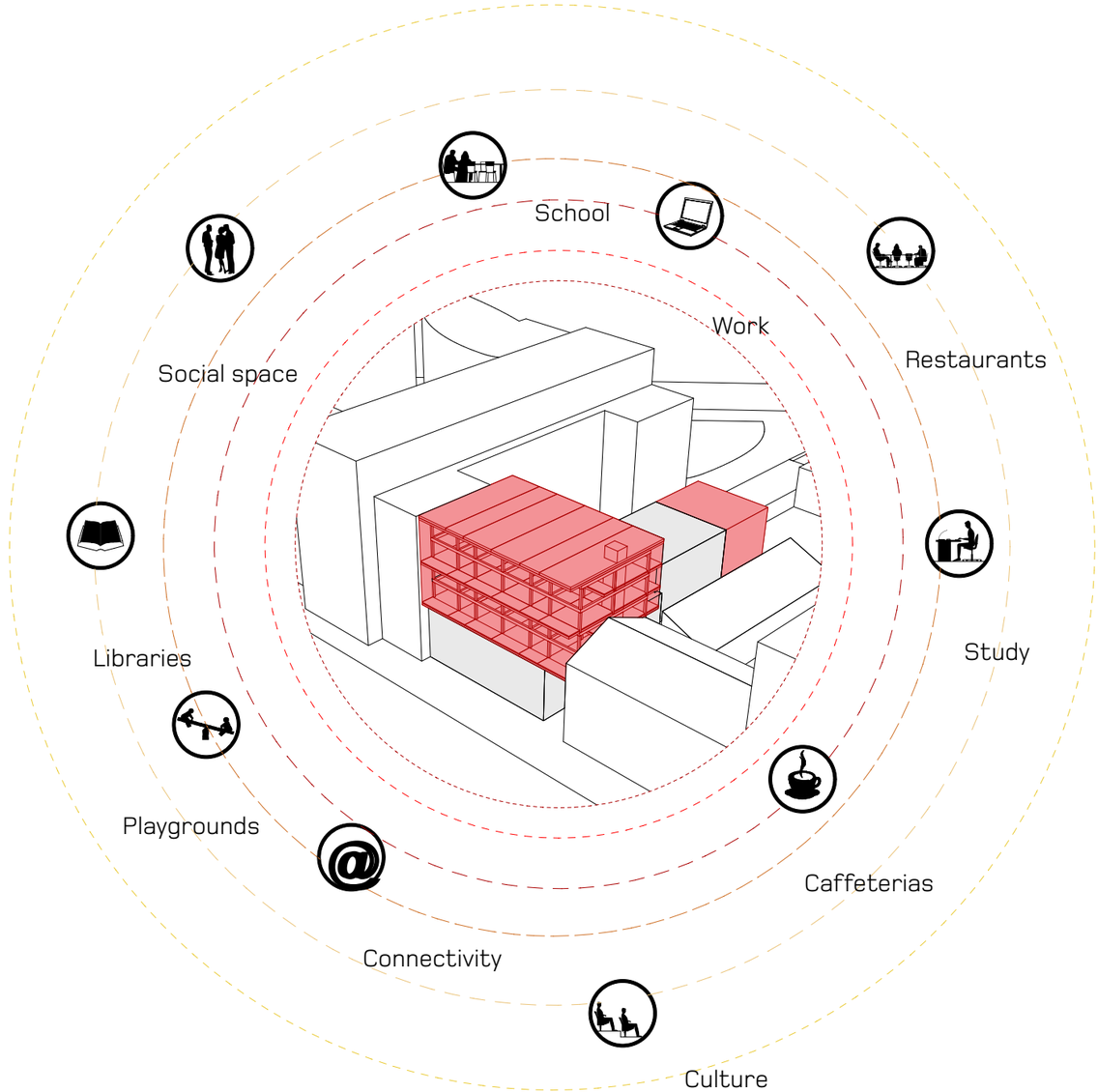
In addition:
- No loss of rental return during construction
- No temporary relocation of tenants
- Exsisting foundations do not require underpinning
- Independent foudation installed

2. ADDED SOCIAL VALUE: MIXED FUNCTION OF THE BUILDING

Combining activities



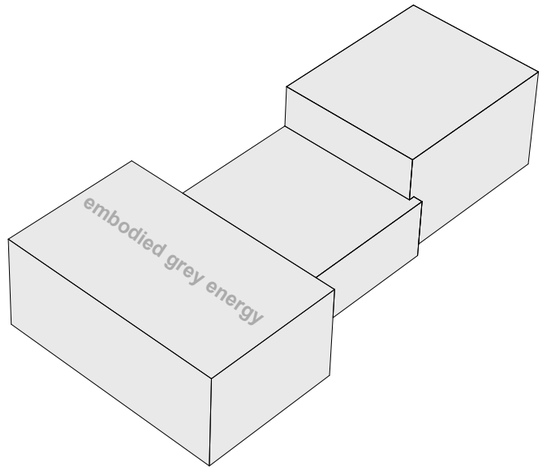
Residential pile-up creates needs for:



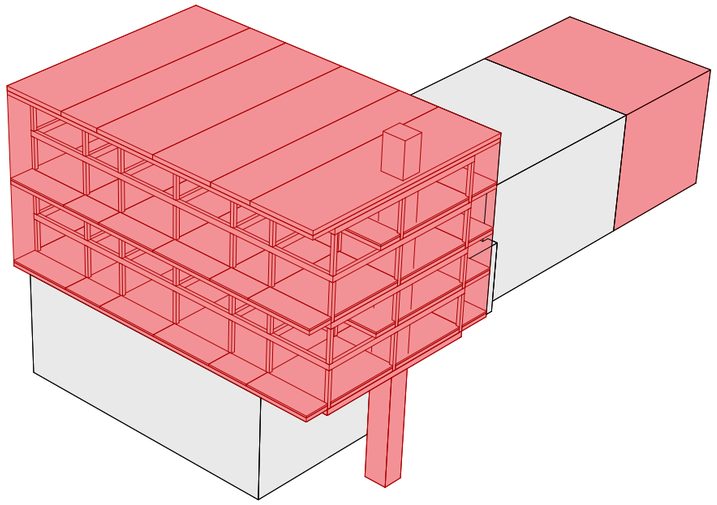
The new mixed use results in...

- Social life around-the-clock (not only from 8 a.m.-5 p.m.)
- Creation of new consumer needs (café, libraries, meeting places, schools, restaurants etc.)
- Potencial for social interaction
- Self sufficient neighbourhood

Life cycle costs

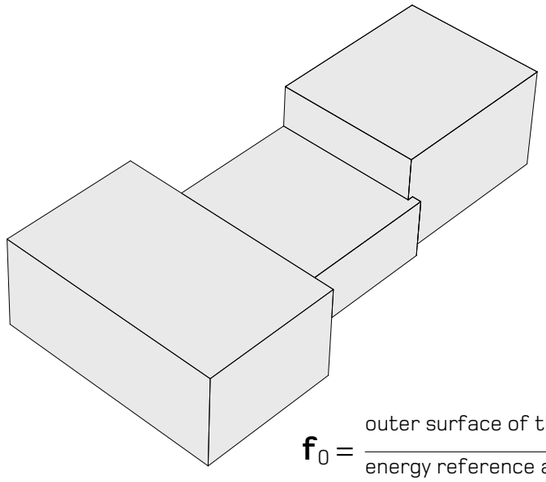


Existing building (socle)
Preserving the embodied energy of the existing building (prolonging the life cycle)



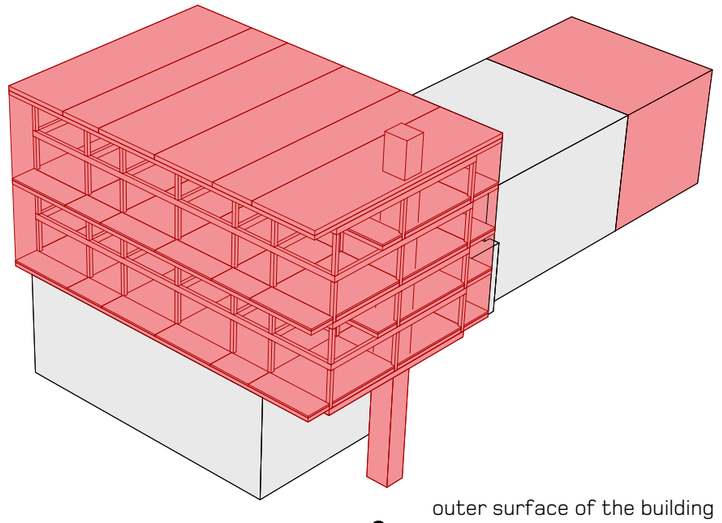
Pile-up and extension in timber
Only little added embodied energy due to the properties of timber (see pages 15-21)

Energy efficiency



$$f_0 = \frac{\text{outer surface of the building}}{\text{energy reference area}} = \frac{2'\,214\ m^2}{1'009\ m^2} = \mathbf{2.02}$$

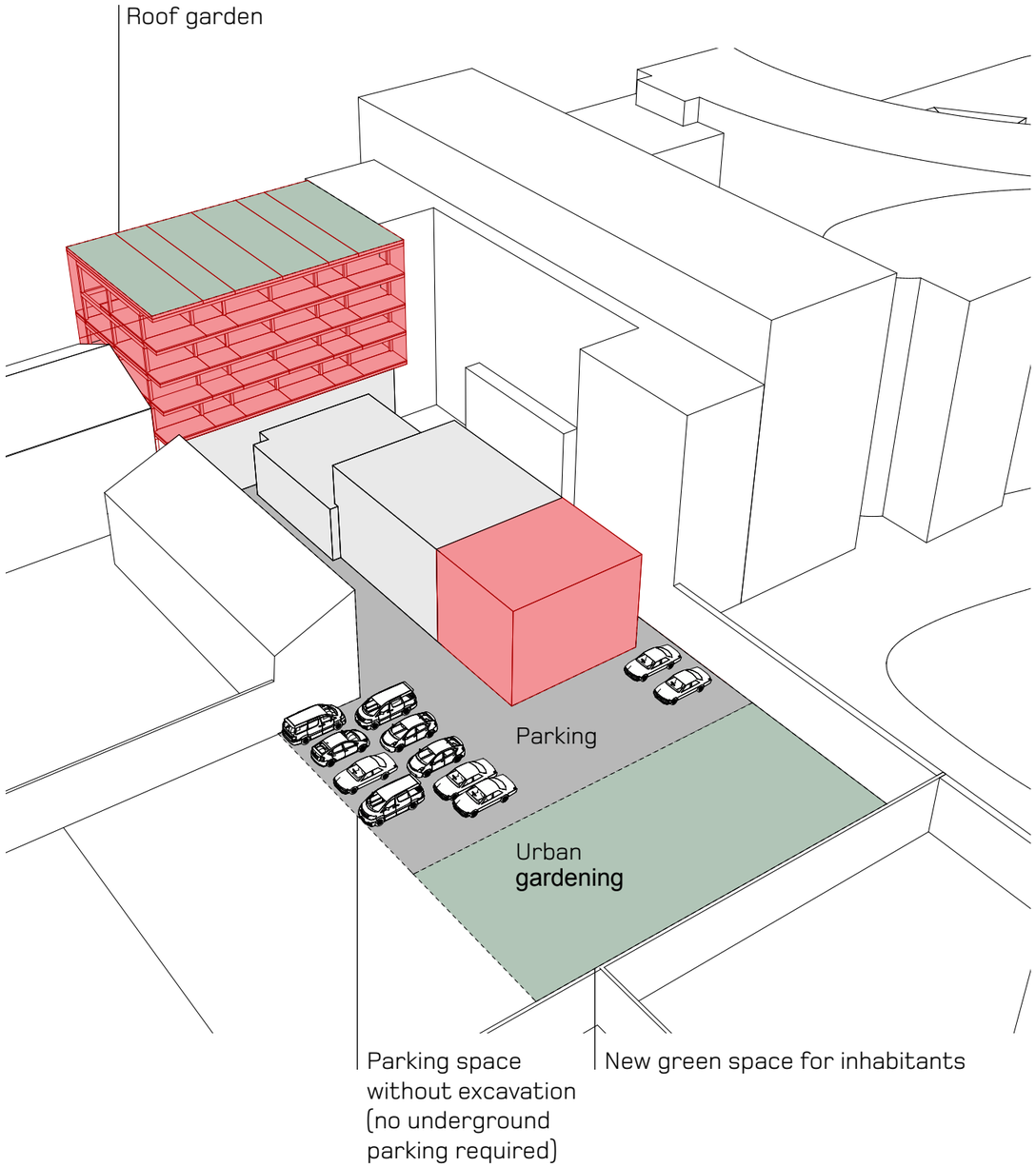
Existing building (socle)
- Low amount of insulation
- Poor relation between envelope and volume (compactness f_0)



$$f_0 = \frac{\text{outer surface of the building}}{\text{energy reference area}} = \frac{3'593\ m^2}{2'301\ m^2} = \mathbf{1.56}$$

Pile-up and extension in timber
- Significantly improved compacity f_0
- Improved insulation (of exsisting and new)
- Lower energy losses/much better energy efficiency (see page 37)
- 1st floor of pile-up insulates the roof of the existing building (double function)

Keeping the common space

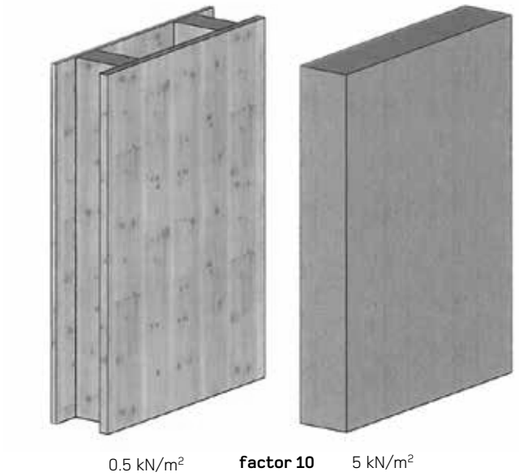


By piling up...
- The existing building is preserved and the specific local identity is kept.
- Familiar surroundings and functions are preserved.
- The footprint of the existing building is kept and new green and parking spaces for inhabitants are created.

Case study for the Jagiellonska 23 building in Warsaw, Poland

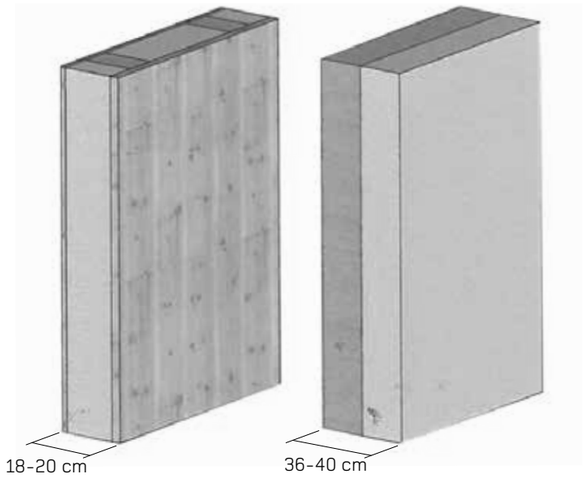
Why Timber?

Timber is a lightweight material



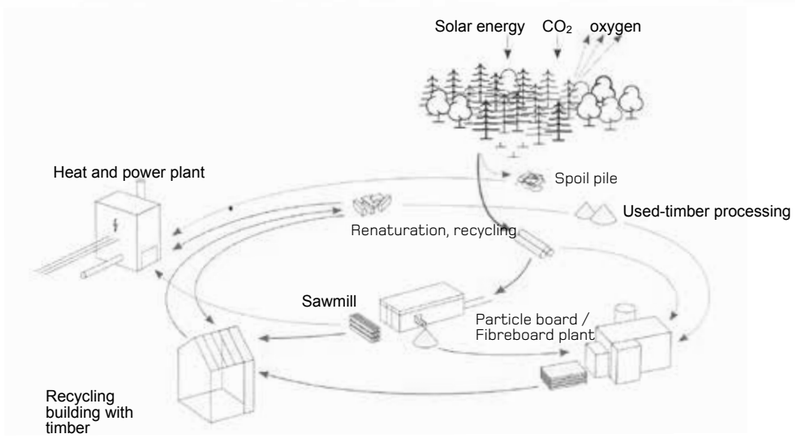
- Timber elements consist of 50% voids, therefore they are 10 x lighter than of concrete or masonry construction
- Micropiles are sufficient to support the load of a timber multi storey pile-up

Timber construction maximises the space



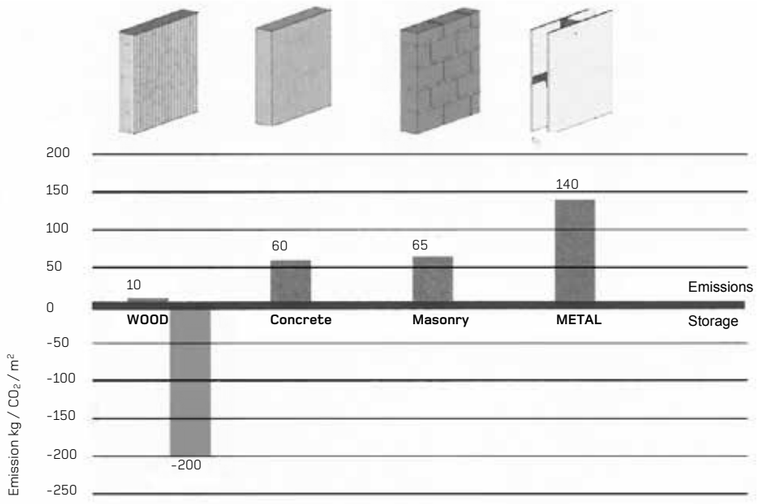
Timber constructions are economically efficient. In timber construction the insulation is integrated in the load bearing element. This results in a gain of net lettable area.

Timber is recycable



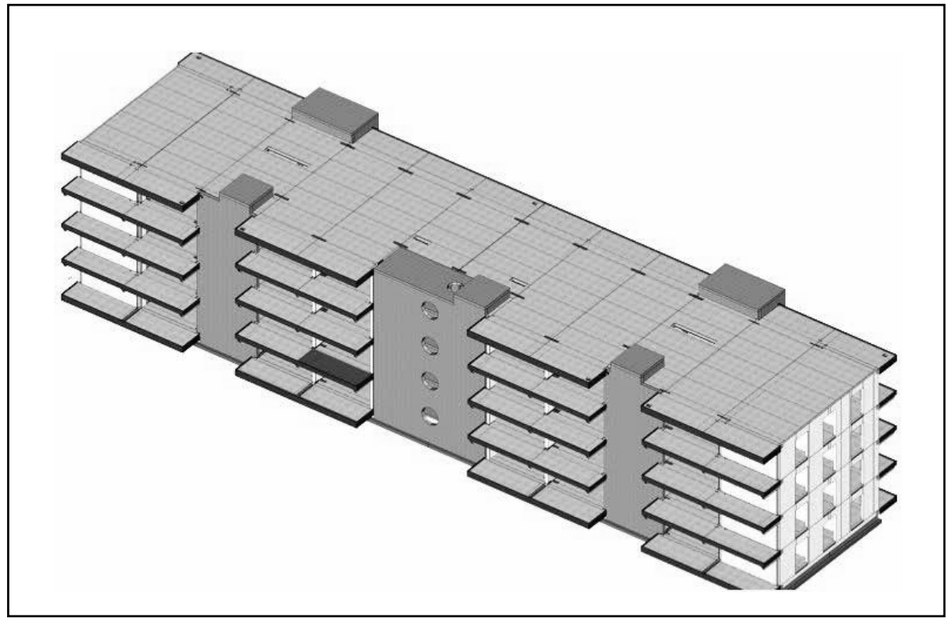
- Wood is a primary renewable product
- Timber and wood-based products can be reused and recycled

Timber is CO_2 negative



The growth of wood binds carbon, while other building materials produce carbon-dioxide CO_2 when they are produced. The result is a substantial reduction of CO_2 emissions in the production and also in a significant carbon sequestration lowering the amout of CO_2 in the amtosphere (it acts as a carbon sink over its use; see page 18).
(KBOB: Ökobilanzen im Bauwesen, Stand 2010)

Early and precise control of costs, due to 3D planning and calculation (BIM).

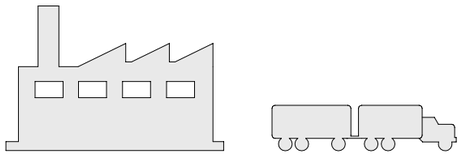


Pre-fabrication under a fully controlled environment in the factory leads to the highest quality.

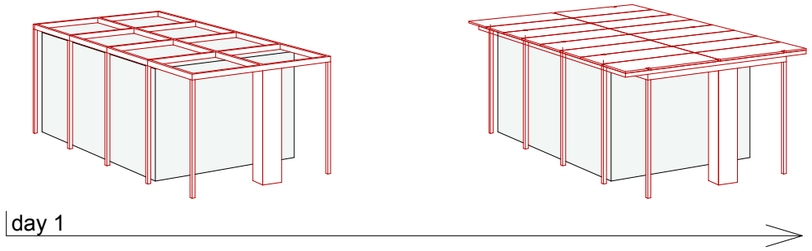
Dry construction system leads to no waiting time.

Shorter construction times lead to earlier rents and earnings.

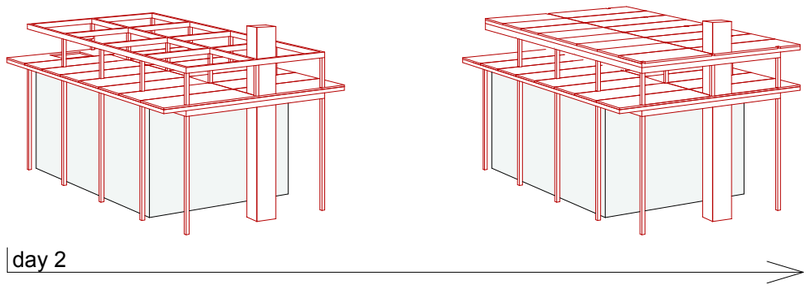
Factory pre-fabrication and transport



Laying the base



1st floor of (new) construction

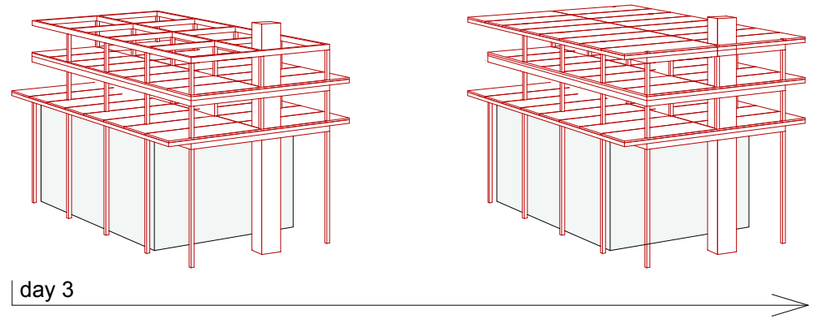


Benefits from pre-fabricated timber construction:

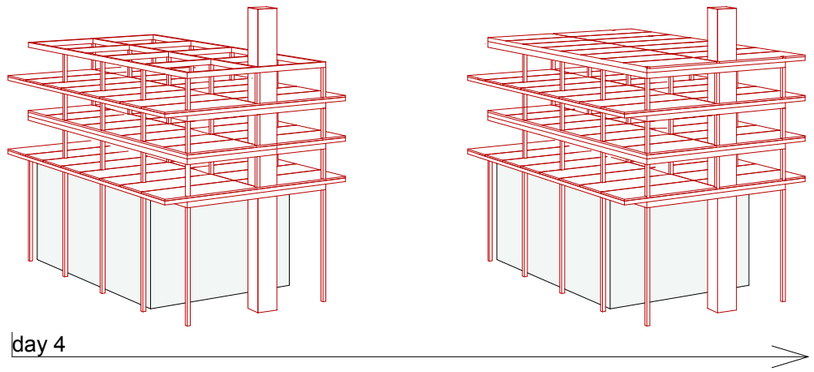
- No interruption of work in the existing offices below
- Significant noise reduction during construction
- Minimal waste

Why timber?

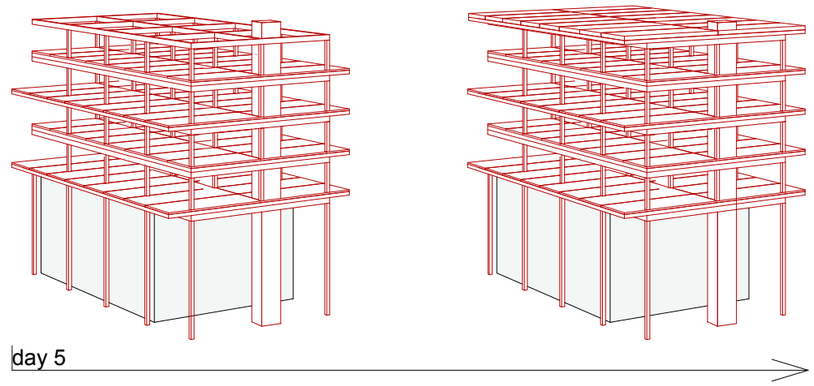
2nd floor of (new) construction



3rd floor of (new) construction



4rd floor of (new) construction/finish



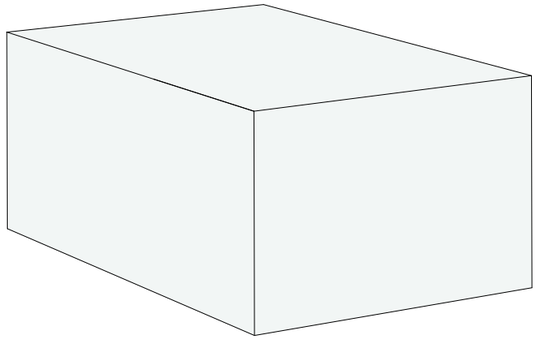
- Immediate full load capacity of the structure due to dry construction method
- Drastically reduced construction time (1 week for the 4 storey structure)
- CO_2 reduction (less deliveries to site)

Case study for the Jagiellonska 23 building in Warsaw, Poland

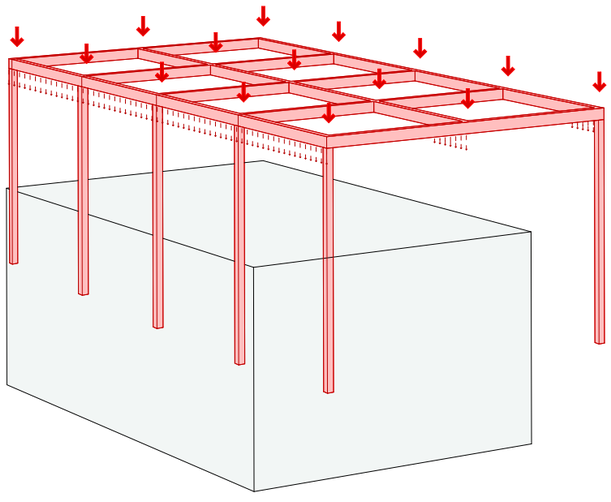
Engineering Concept

1. LOAD BEARING CONCEPT

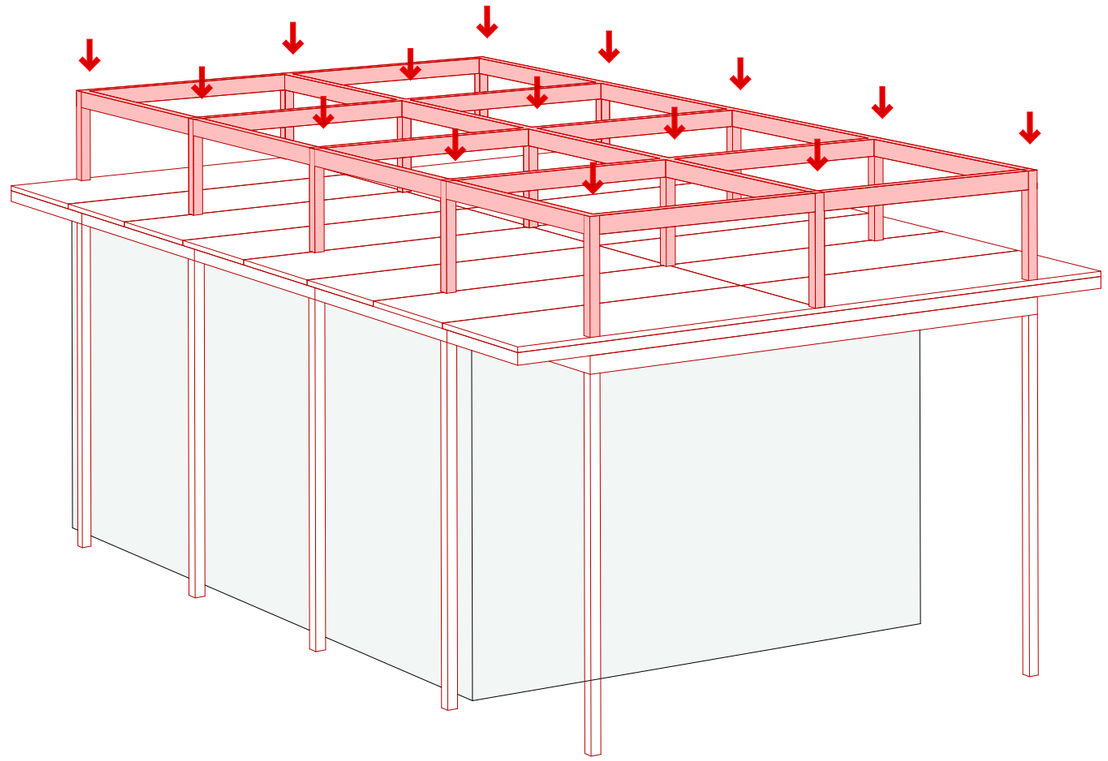
Existing base



Reinforce with added ‚spider like' load bearing structure



Load-distribution concept

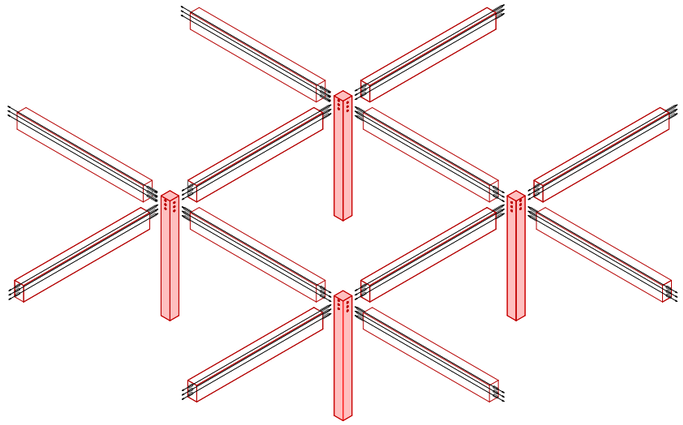


New

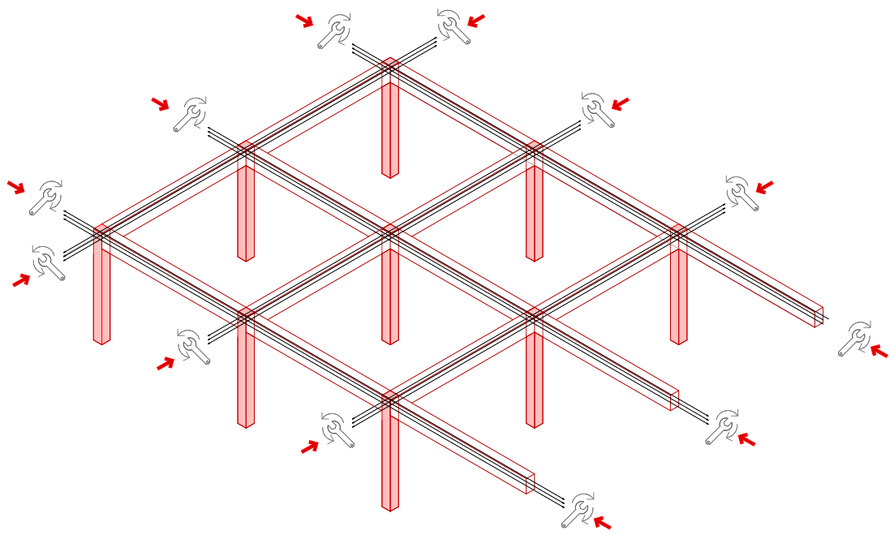
Existing

The Post Tension Timber Frame (PTTF) works similar to a push puppet

Post tension cables run trough beams and columns



After installing the cables the structure works as a unified system

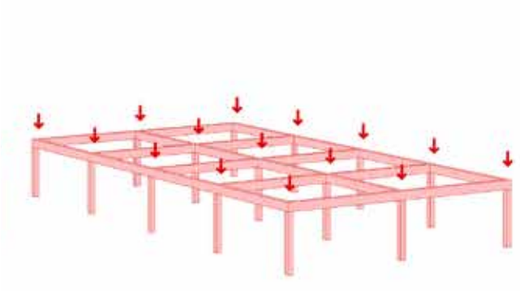


Benefits of the PTTF

- The structure above is self sufficient
- Load bearing walls are not necessary
- Full flexibility for future changes (free floor - no internal columns

Sructure with & without PTTF

With



Without

Reference building with the PTTF system: The House of Natural Resources, ETH, Zurich.

Roof terrace/garden: The vegetation influencees the microclimate (lowers the temperature)

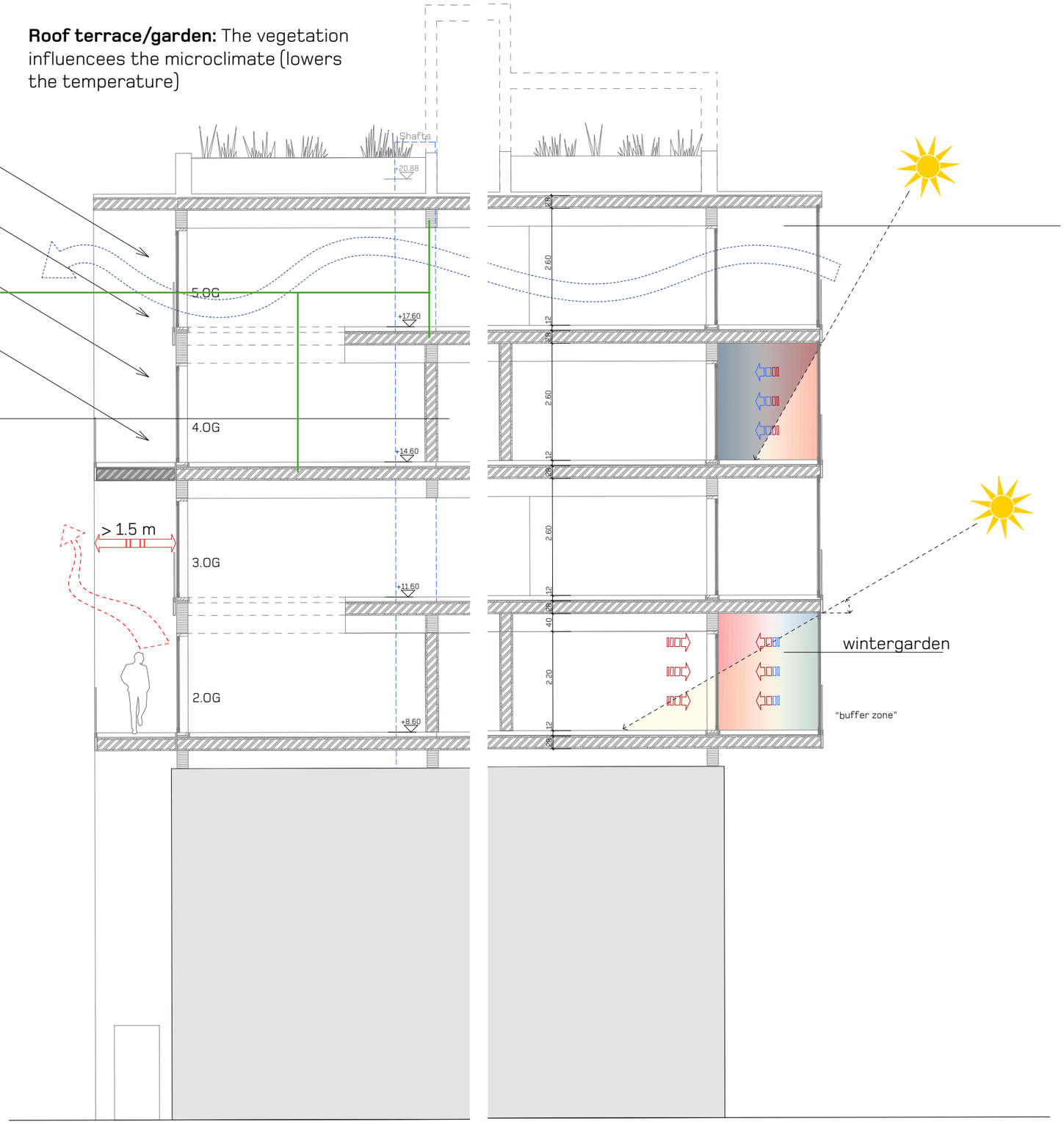
No obstruction to natural daylight from north

Fire safety structural elements:
All structural timber elements are designed to meet R 60/REI 60 requirments according to Eurocode 5.

Fire safety corridors:
The fire escape corridor is lined with non-combusitible boards.

Fire safety
> 1.5m

Due to overhanging balconies fire safety regulations are fulfilled



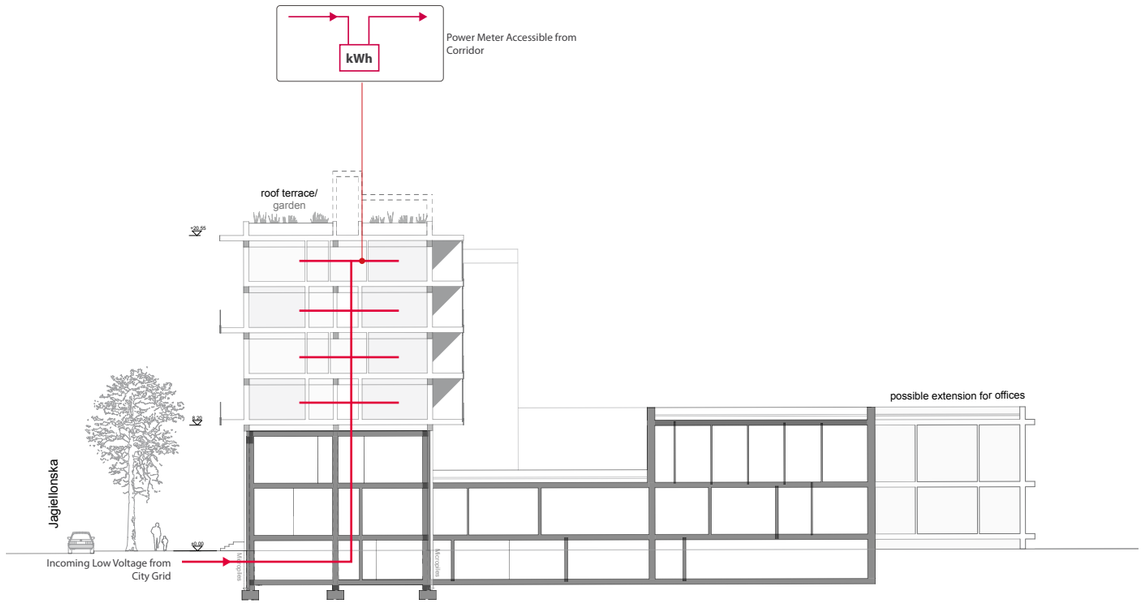
Cross ventilation
The open plan appartments can be cross-ventilated

Angle of sun in summer = 60°
Sun Protection: Overhanging balconies serves as sun protection.

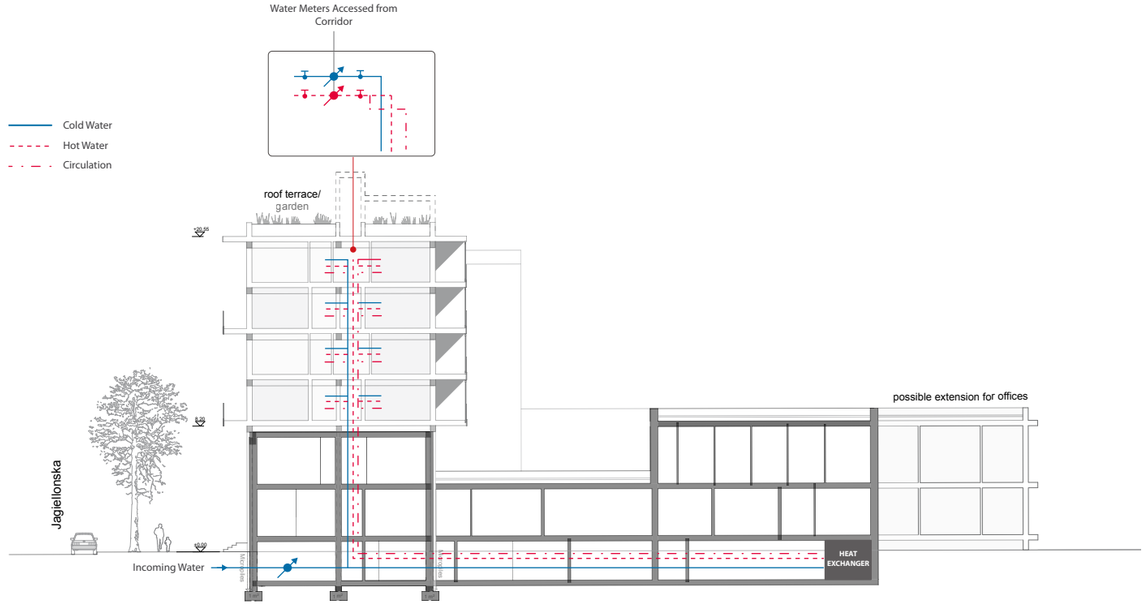
Angle of sun in winter = 30°
Solar impact: During the winter glazing creates a "buffer zone", reducing heat loss and external noise.

4. ENERGY EFFICIENCY: AN INTERDISCIPLINARY LOW TECH SYSTEM CREATES UNSURPASSED COMFORT

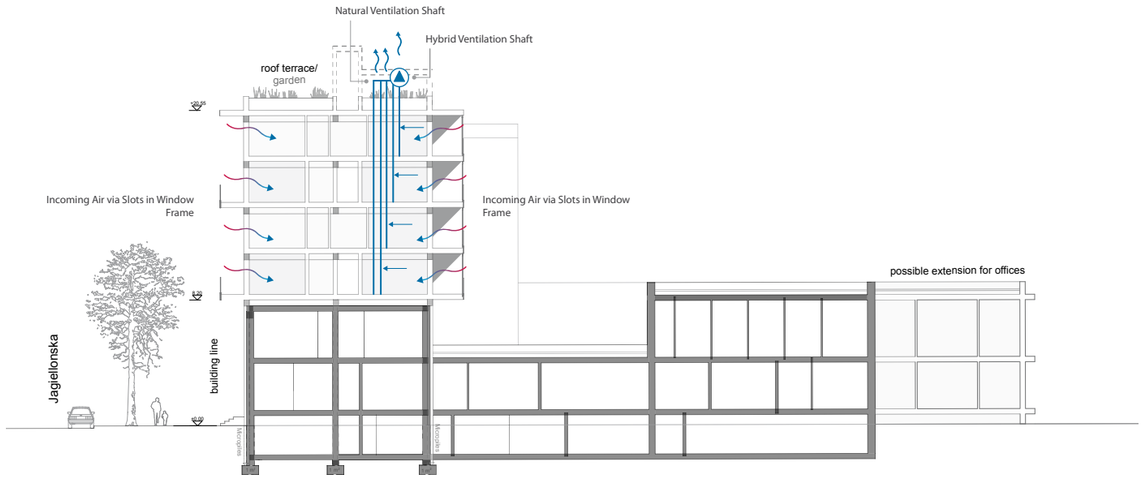
Power distribution



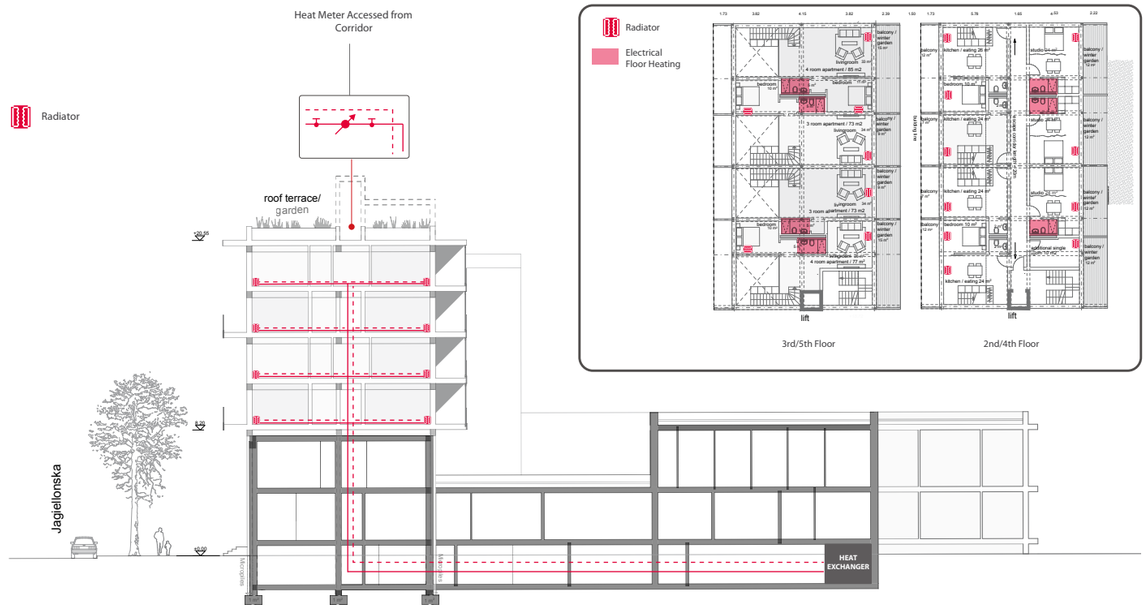
Domestic cold and hot water



Ventilation



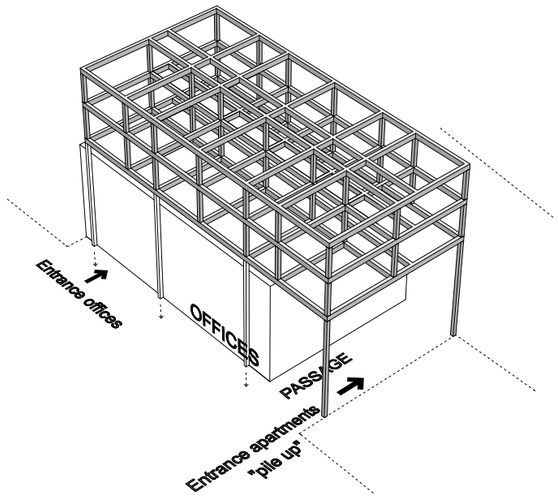
Central heating



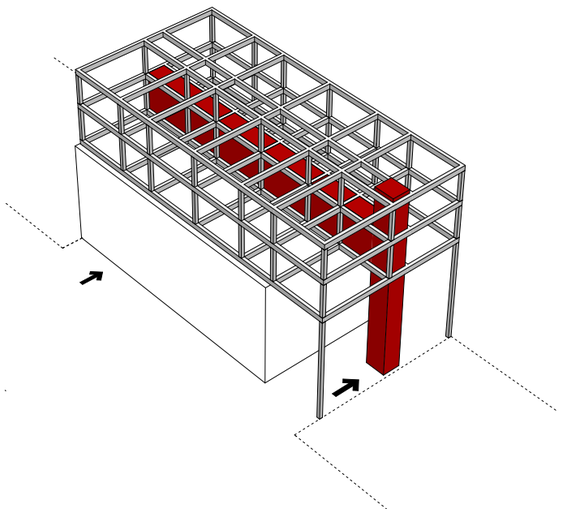
Case study for the Jagiellonska 23 building in Warsaw, Poland

Architectural Concept

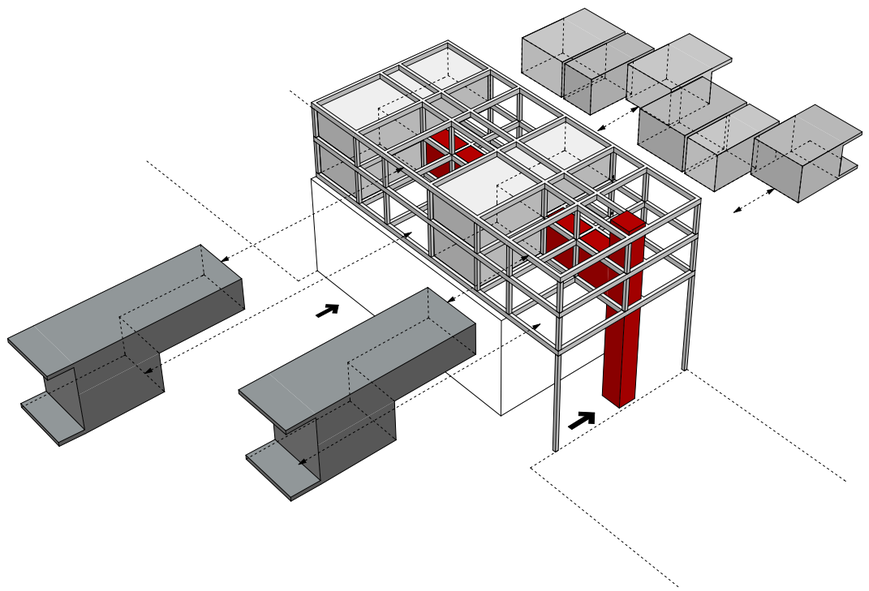
Step 1: Installation of the PTTF above the existing socle.



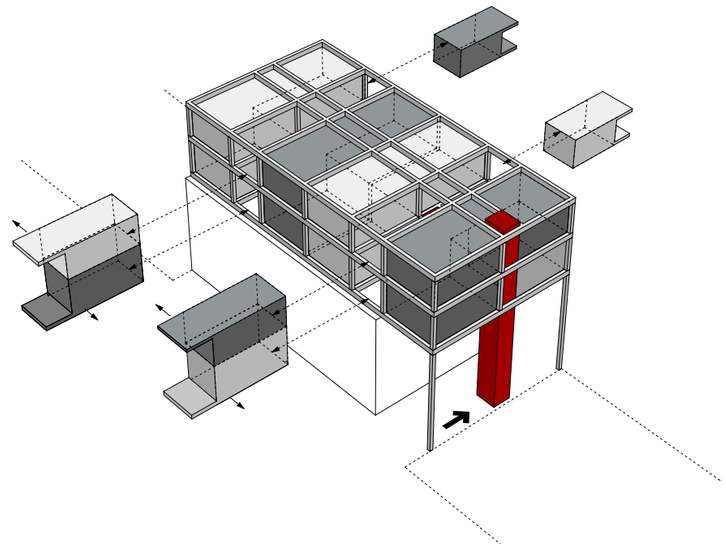
Step 2: Introduction of horizontal and vertical distribution (aisle and lift).

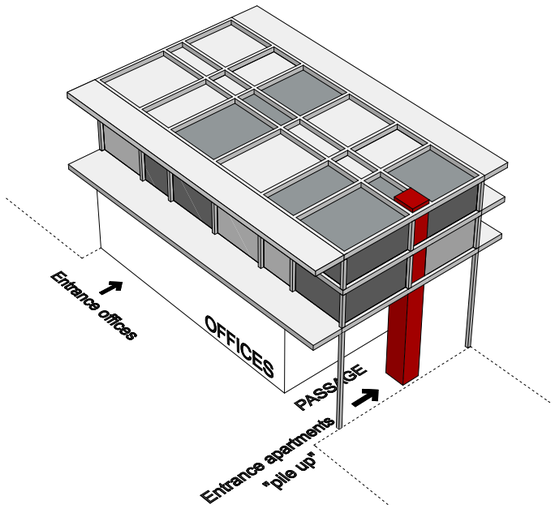


Step 3: Introduction of the housing units in the frame like ‘drawers‘. The units are build-up from sophisticated 2D elements.

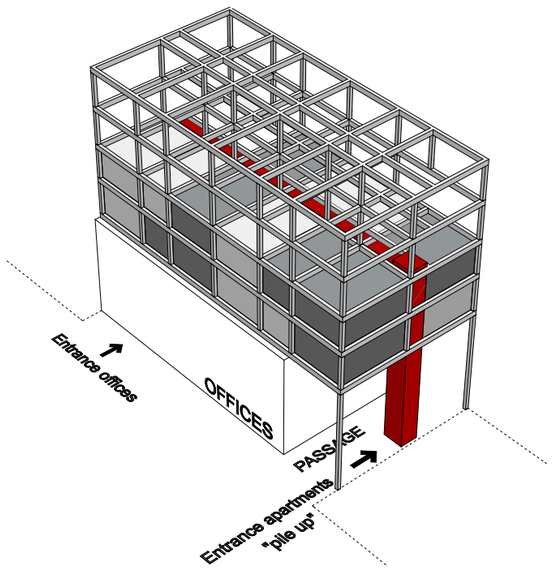


Step 4: Introduction of the housing units in the frame like ‘drawers‘. Flexible allocation of bedrooms offers organisation of diffrent size flats.

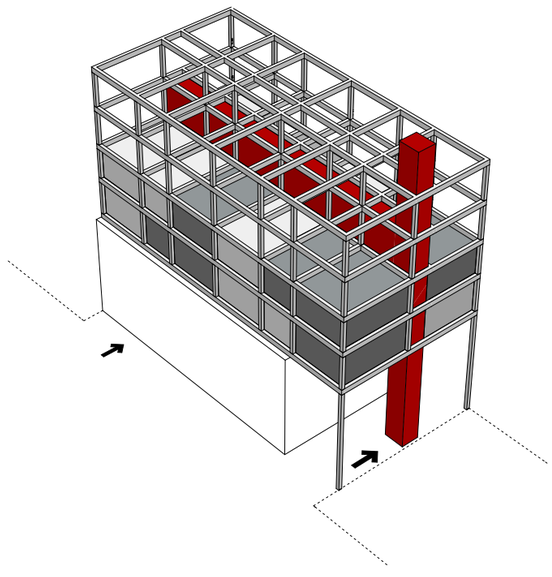




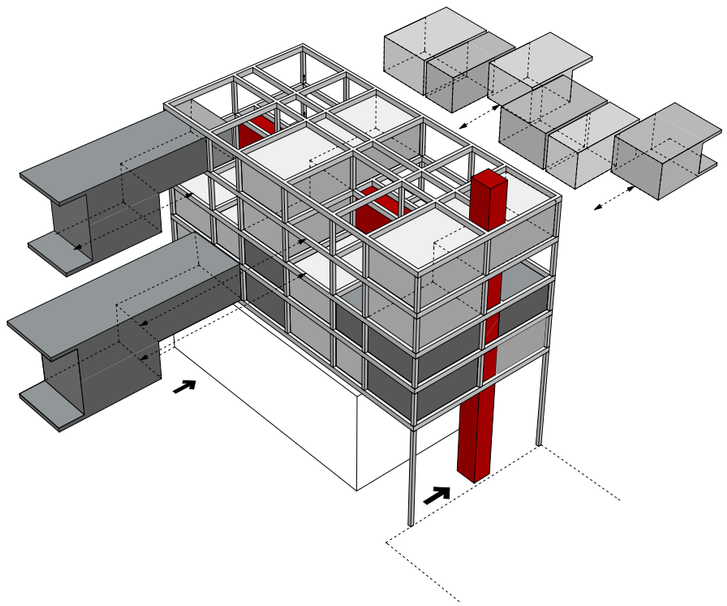
Step 5: Self supporting rigid structure (PTTF)



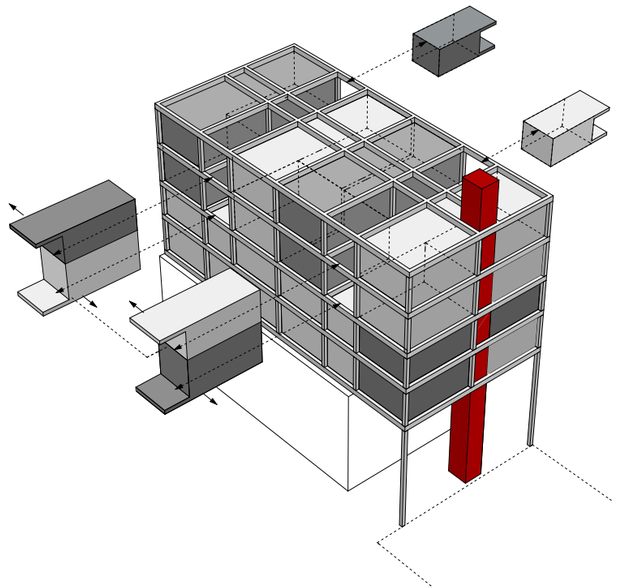
Step 6: Introduction of inner street and seperate entrance for the flats.



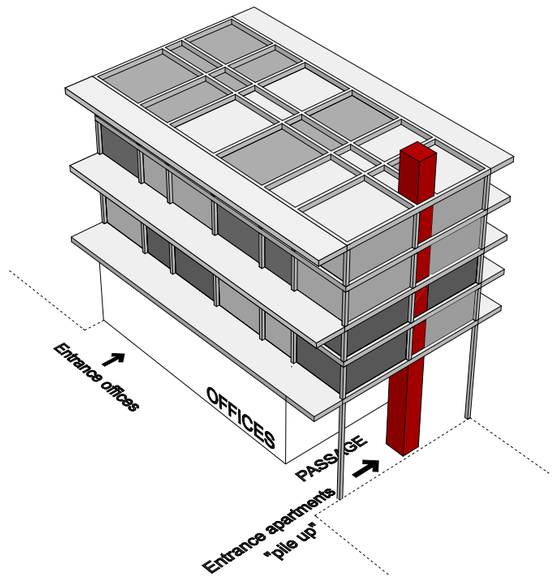
Step 7: Living units are inserted in the frame like ‘drawers‘.
The units are build-up from sophisticated 2D elements.



Step 8: Living units

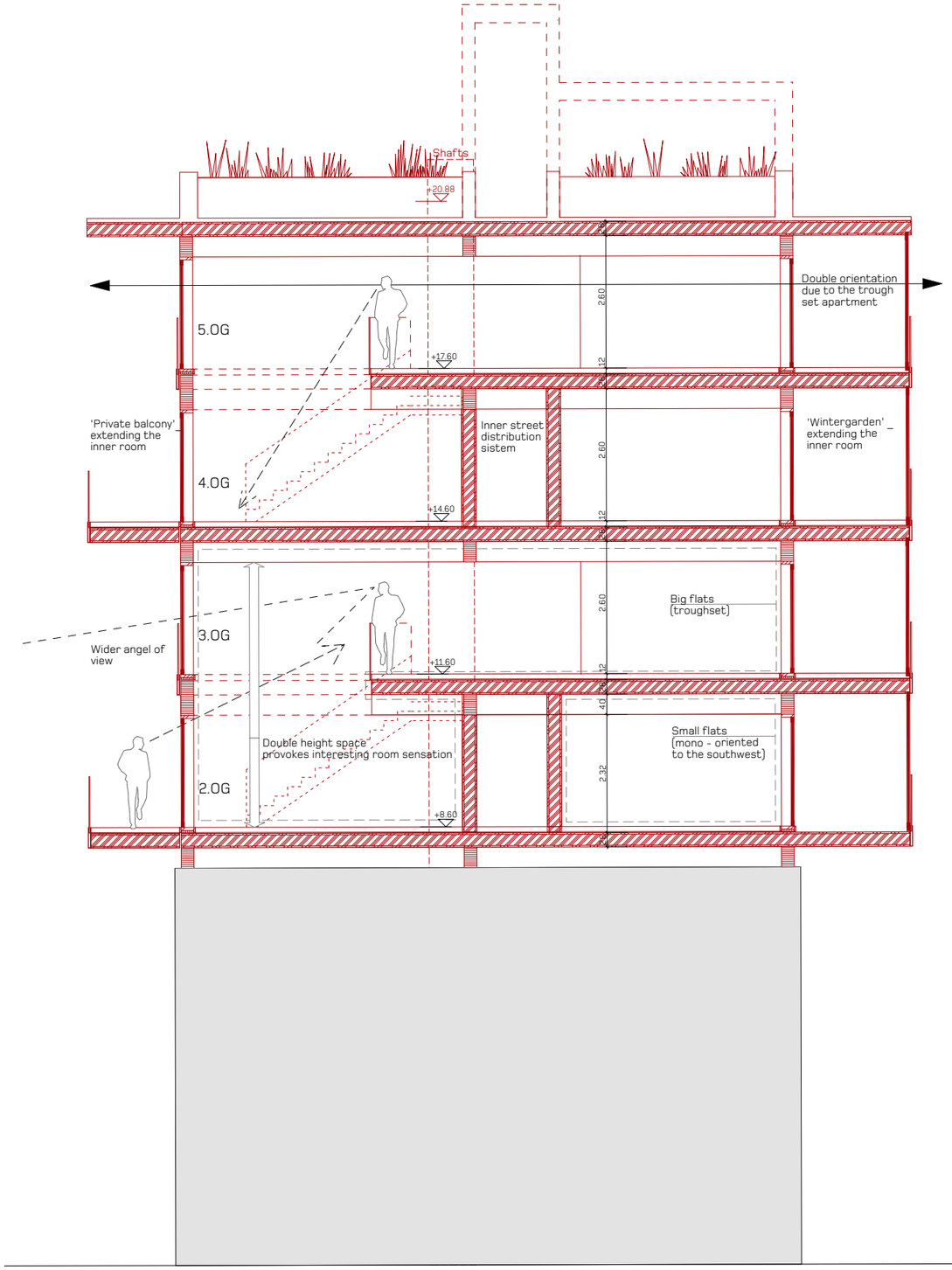


Step 9: Completed bulding



Contemporary example: Housing settlement Eulachpark, Winterthur, 2006 burkhalter sumi architekten

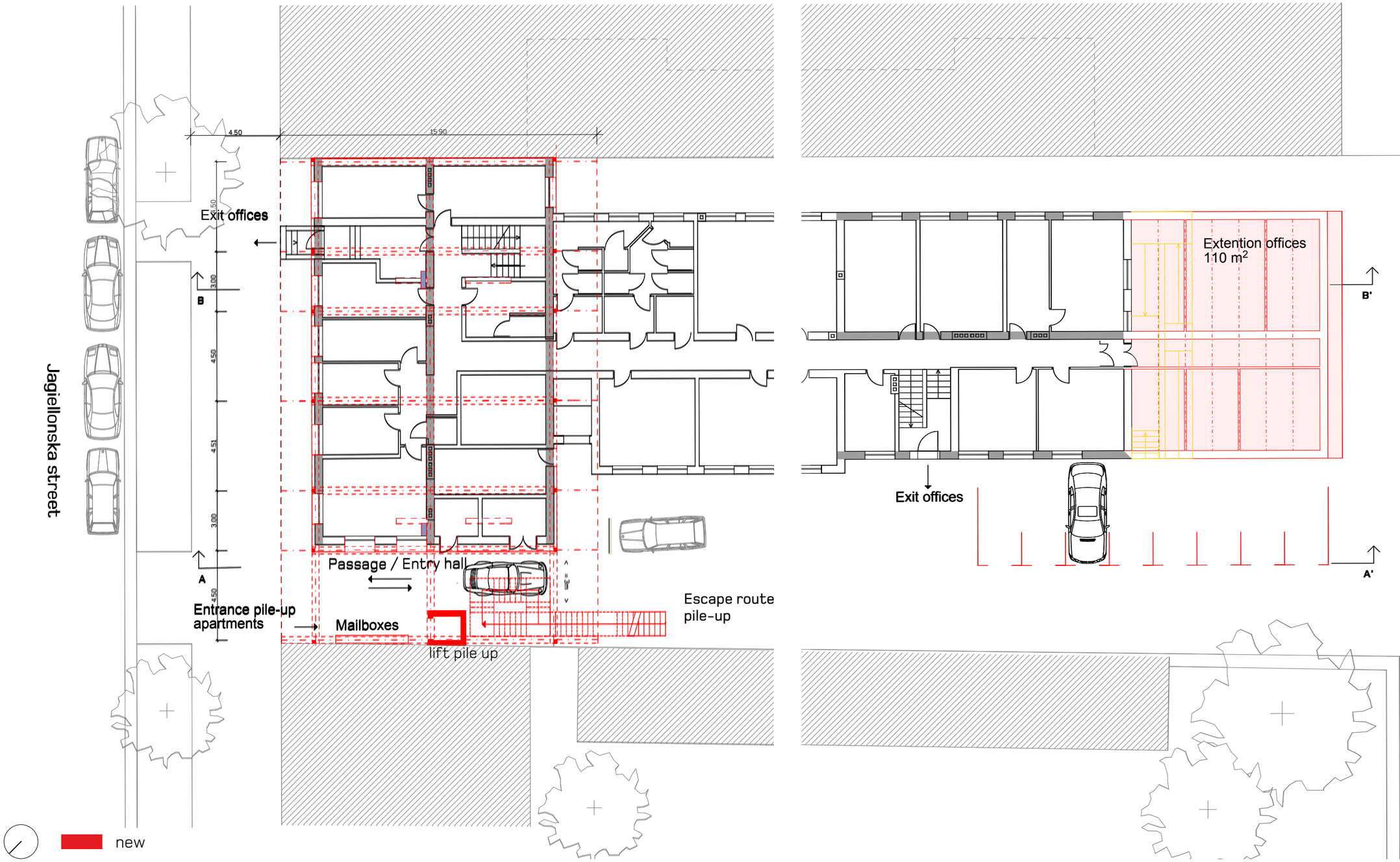
Historical example: Unité d'habitation, Marseille, 1947-1952, Le Corbusier


Shafts
+20.88
Double orientation
due to the trough
set apartment
5.0G
+17.60
'Private balcony'
extending the
inner room
Inner street
distribution
sistem
'Wintergarden'
extending the
inner room
4.0G
+14.60
Big flats
(troughset)
Wider angel of
view
3.0G
+11.60
Small flats
(mono - oriented
to the southwest)
Double height space
provokes interesting room sensation
2.0G
+8.60
2.60
12
2.60
12
2.60
12
40
2.32

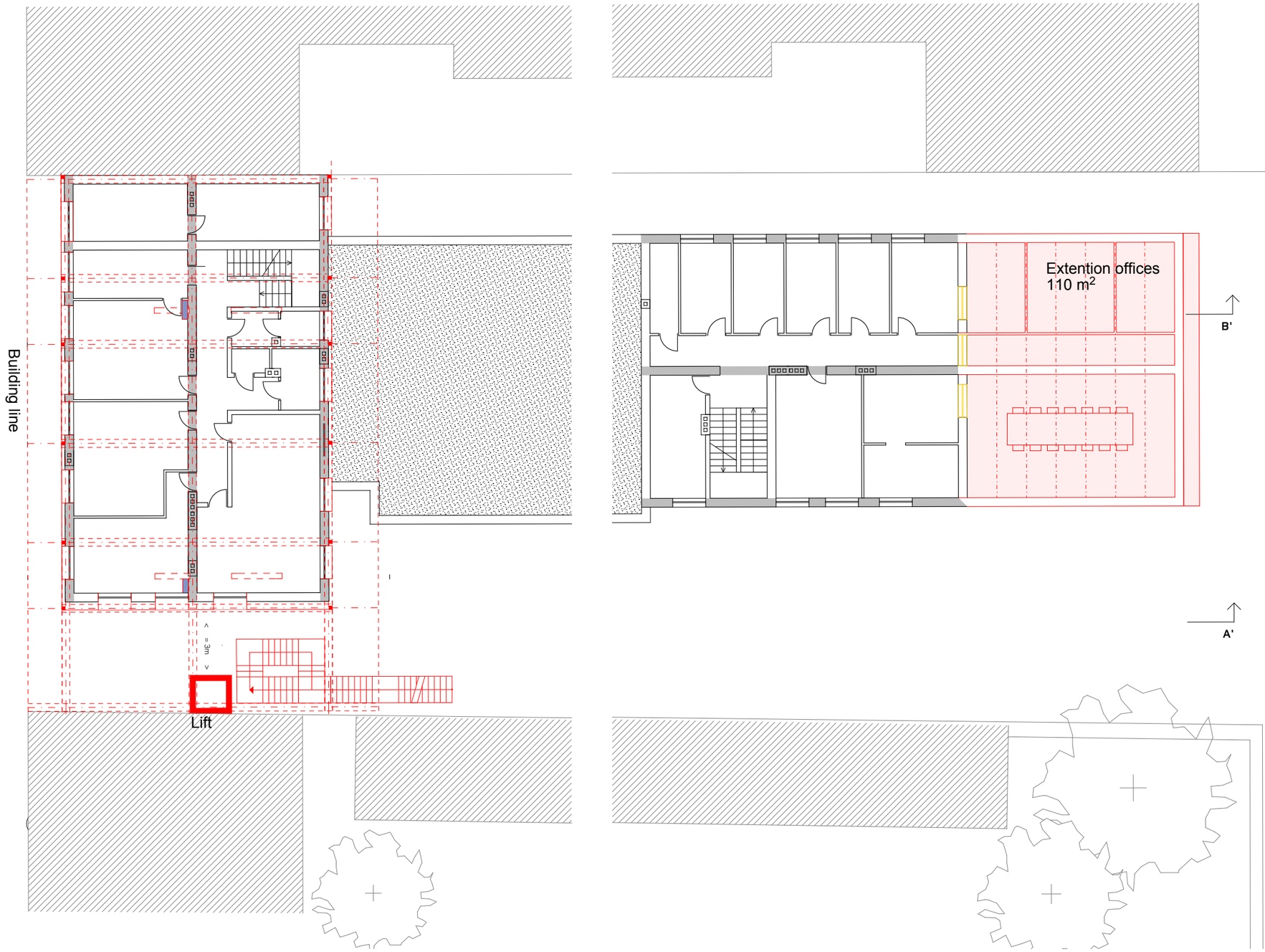
VISUALISATION: VIEW FROM THE COURT YARD

VISUALISATION: VIEW FROM JAGIELLONSKA STREET

GROUND FLOOR 1:200

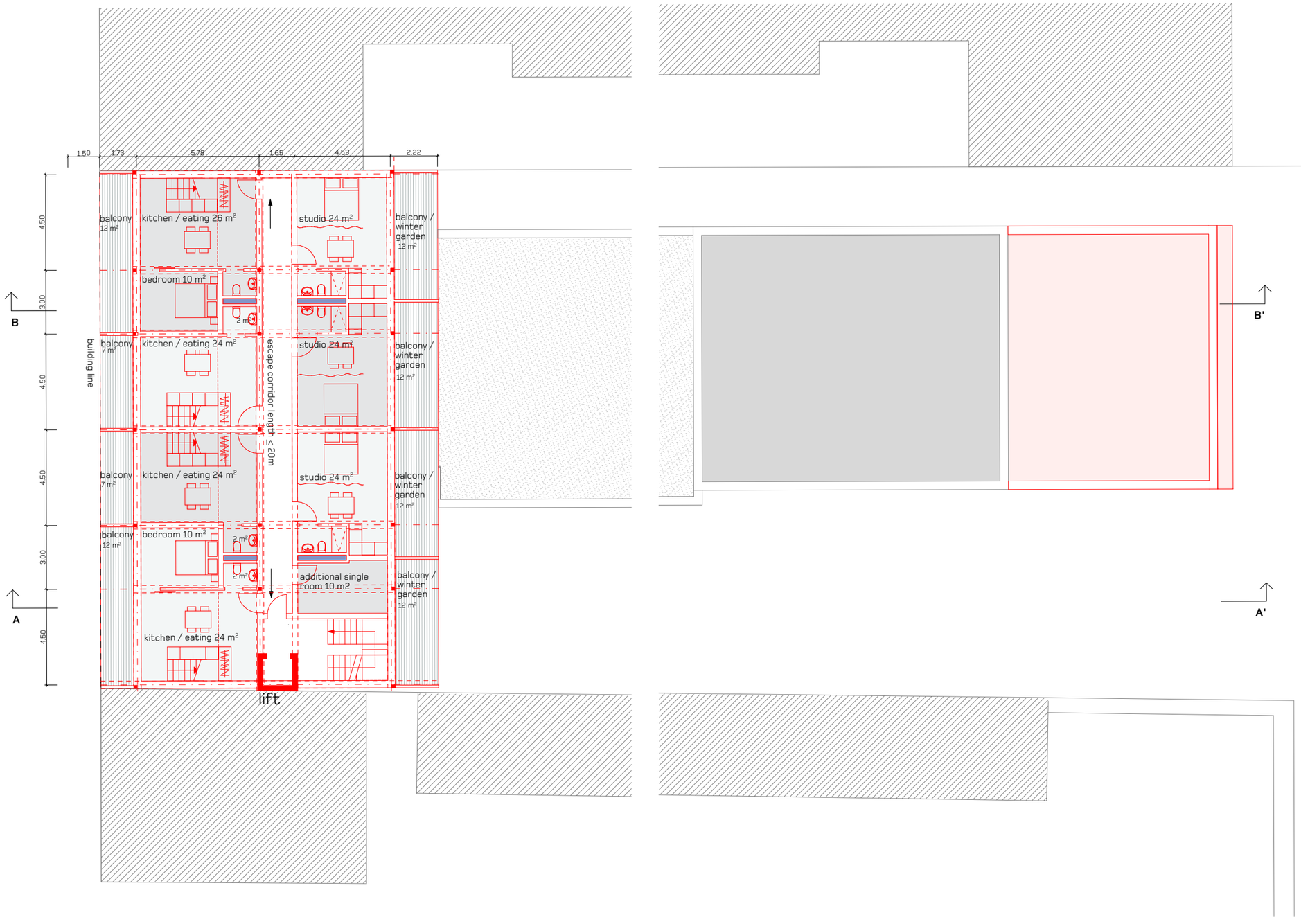


1ST FLOOR 1:200

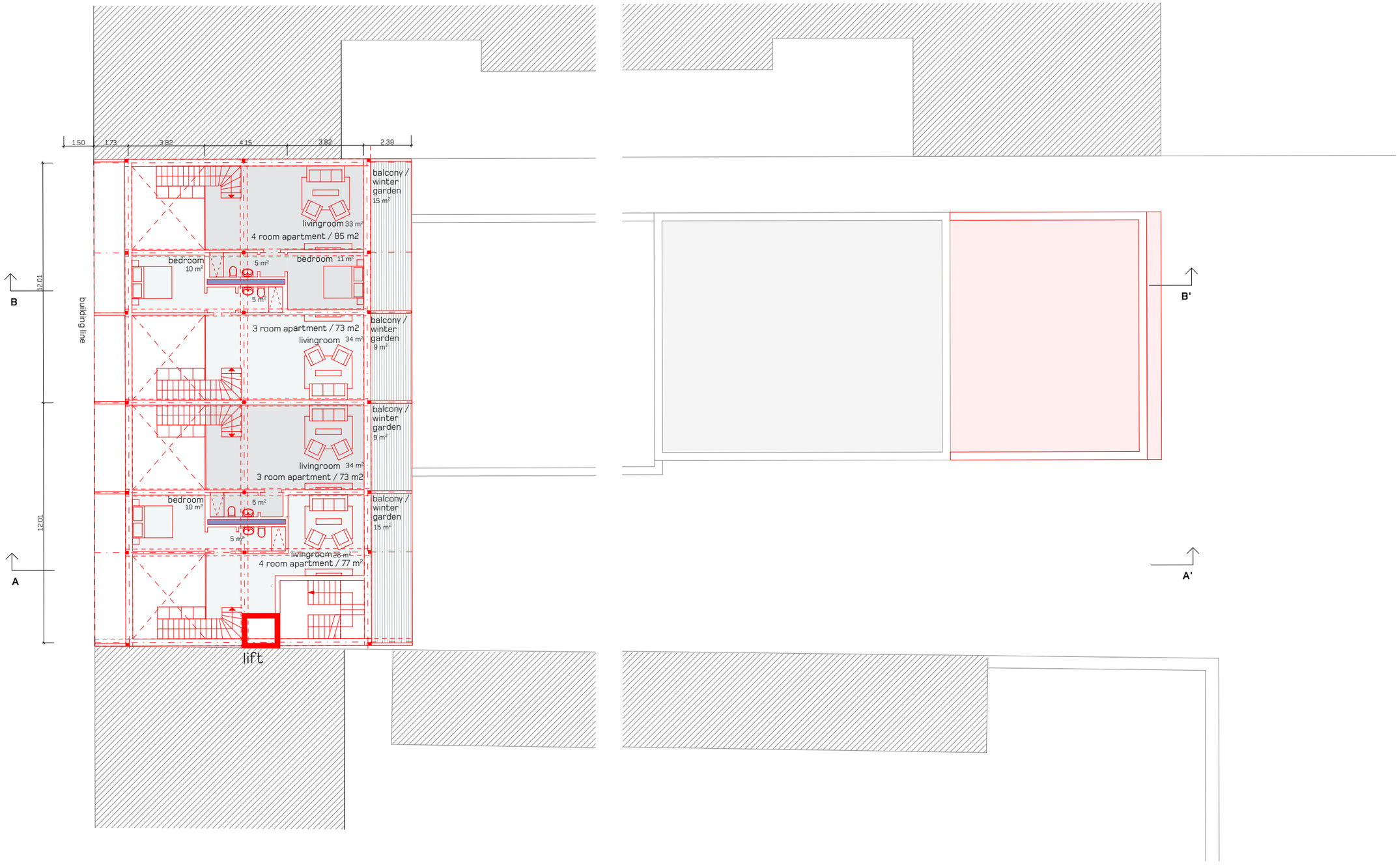


new

2ND/4TH FLOOR 1:200

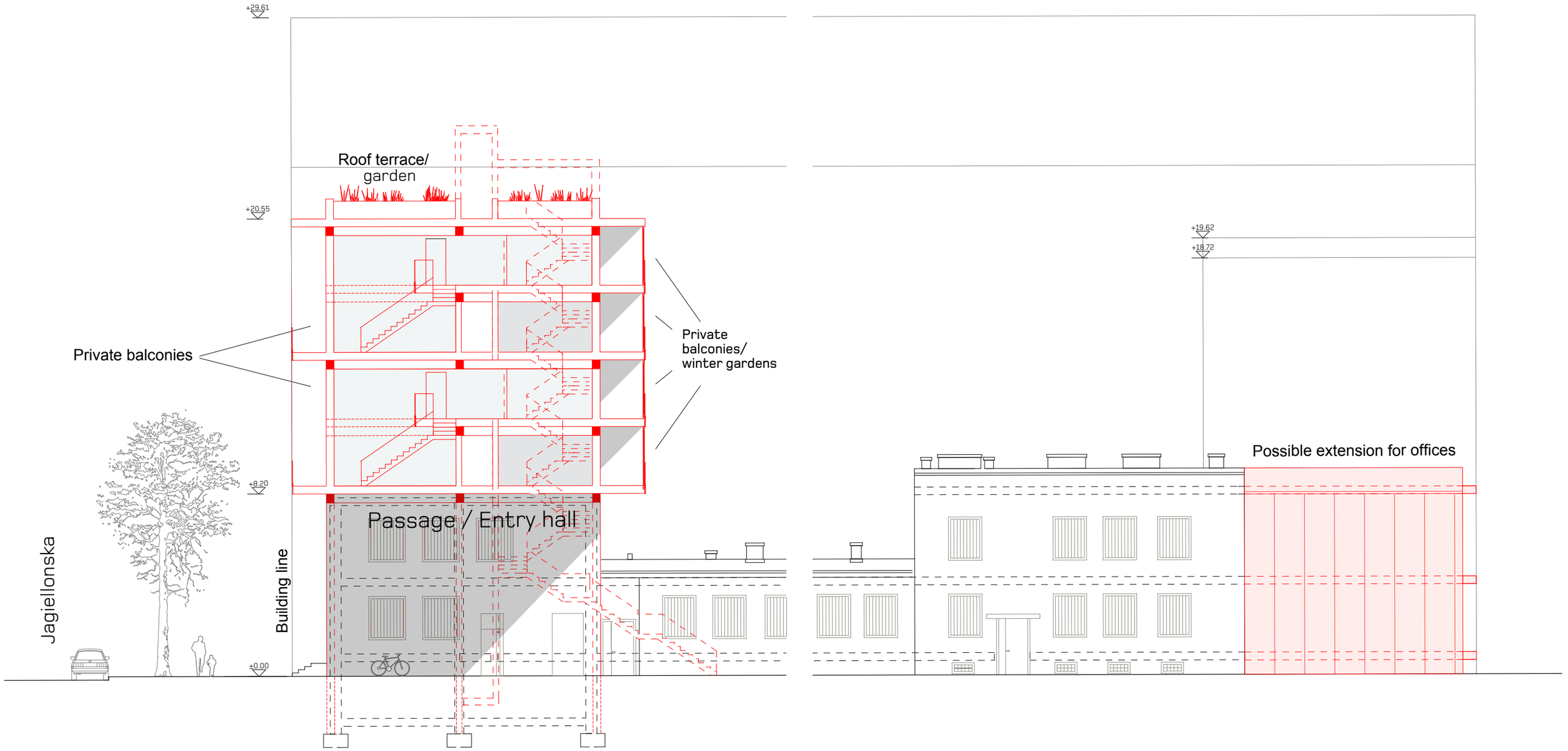


3RD/5TH FLOOR 1:200



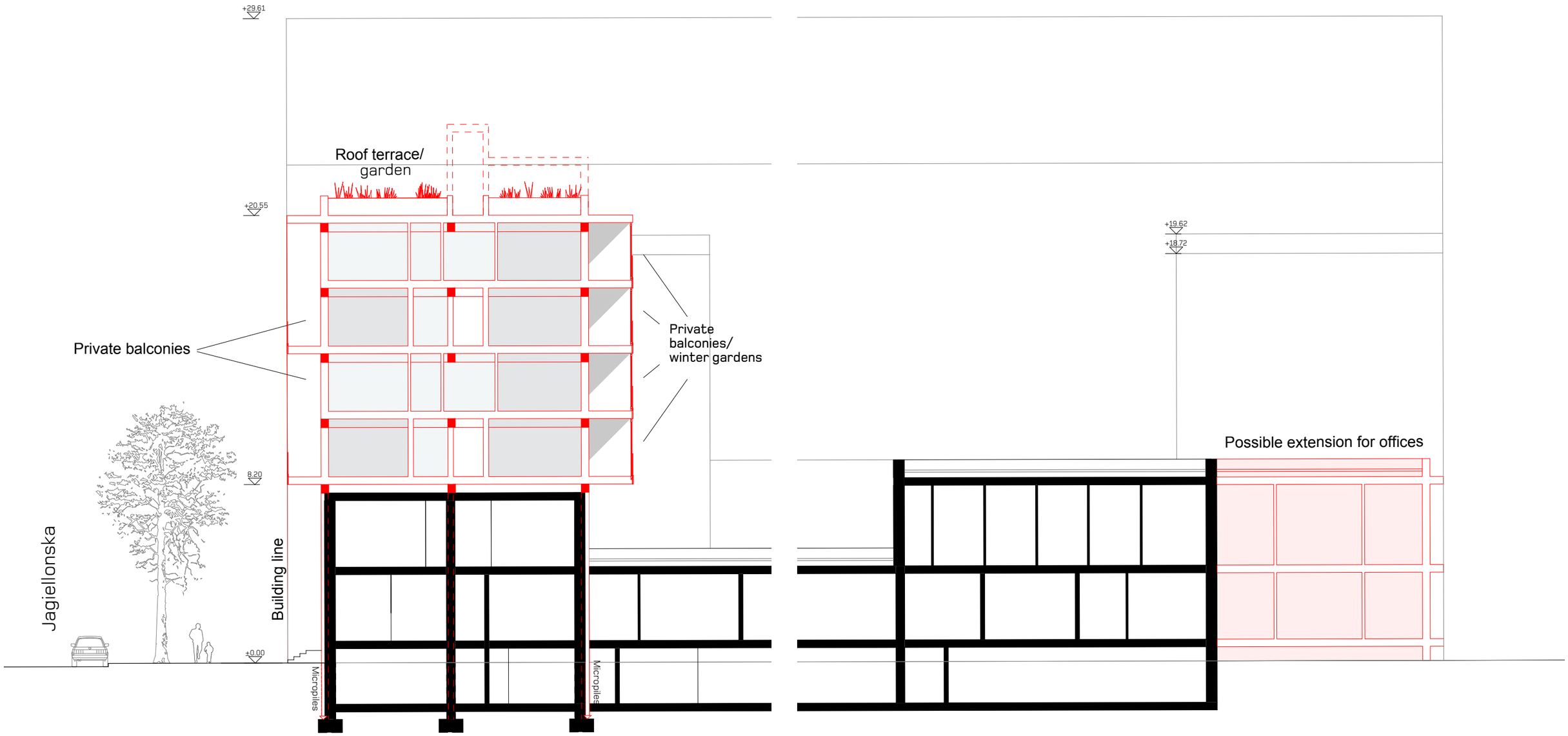
new

SECTION A-A 1:200



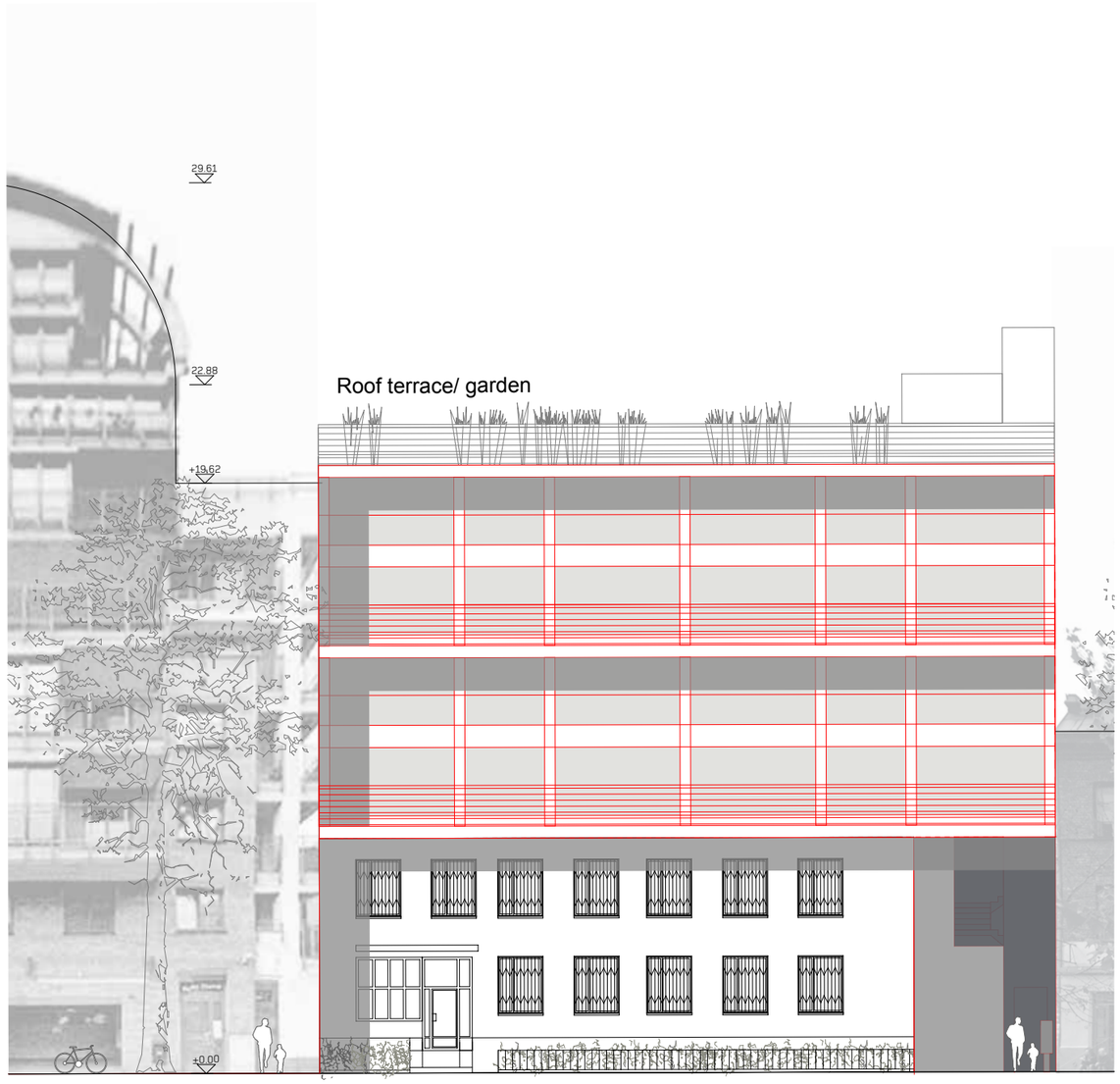
new

SECTION B-B 1:200



new

VIEW FROM JAGIELLONSKA 1:200



Distortion of the proportions: The 4 storey pile-up appears like a 2 storey and refers to the scale of the socle.

VIEW FROM THE CORTYARD 1:200

High Tech Timber

Expertise in Timber Construction

High Tech Timber is a pool of Swiss architects and engineers with unique expertise in the field of timber construction. Together, they are able to offer innovative solutions with comprehensive services to any challenge in timber construction. High Tech Timber has been formed by these Swiss professionals under the umbrella of ingenious switzerland and Lignum and with the support of ETH Swiss Federal Institute of Technology Zurich.

The aim of High Tech Timber is to collaborate and collectively provide examples of excellence in innovative timber construction to cities, where high-density housing is a key issue. Sophisticated lightweight solutions in timber used in conjunction with additional storeys to existing buildings are in High Tech Timbers expertise as well as demonstrating the future of timber construction.

Timber has many comprehensive benefits. Just a few are: A short construction time with highly prefabricated elements, the flexibility to react to changing urban challenges, the strength and lightness of the material and its solid image. These benefits make timber construction the solution for today's requirements in urban development.

Holistic planning, production and delivery
High Tech Timber's buildings are developed, planned and constructed in an interconnected planning process involving architects, engineers and timber construction specialists.

The High Tech Timber prototype
This beautiful structure — all in line with Le Corbusier's Modulor — shows the future of timber construction: no glues, no metal, just solid timber clicked together. Plug and Play.

Imprint
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Hight Tech Timber
c/o Lignum, Mühlebachstrasse 8, CH-8008 Zurich
Tel. +41 76 695 98 02
joanna.demkow@hightechtimber.ch
www.hightechtimber.ch

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Jagiellońska 23 project team

Joanna Demków	High Tech Timber
Yves Schihin	High Tech Timber
Olin Bartlome	High Tech Timber
Hermann Blumer	High Tech Timber
Beat Lauber	High Tech Timber
Markus Zimmermann	High Tech Timber
Prof. Dr. Andrea Frangi	Swiss Federal Institute of Technology Zurich, Institute of Structural Engineering
Marta Sękulska-Wrońska	WXCA
Małgorzata Dembowska	WXCA
Marcin Karczmarczyk	BuroHappold Engineering
Jarosław Kujawa	BuroHappold Engineering
Małgorzata Olszewska	BuroHappold Engineering
Dr. inz. Wojciech Terlikowski	Warsaw University of Technology, Faculty of Civil Engineering
Jacek Dąbrowski	Domy i Domki
Łukasz Brycki	LB–PROJEKT

Jagiellońska 23 supporting partners
Ingenious Switzerland powered by SIA International
Program Rewitalizacji, City of Warsaw
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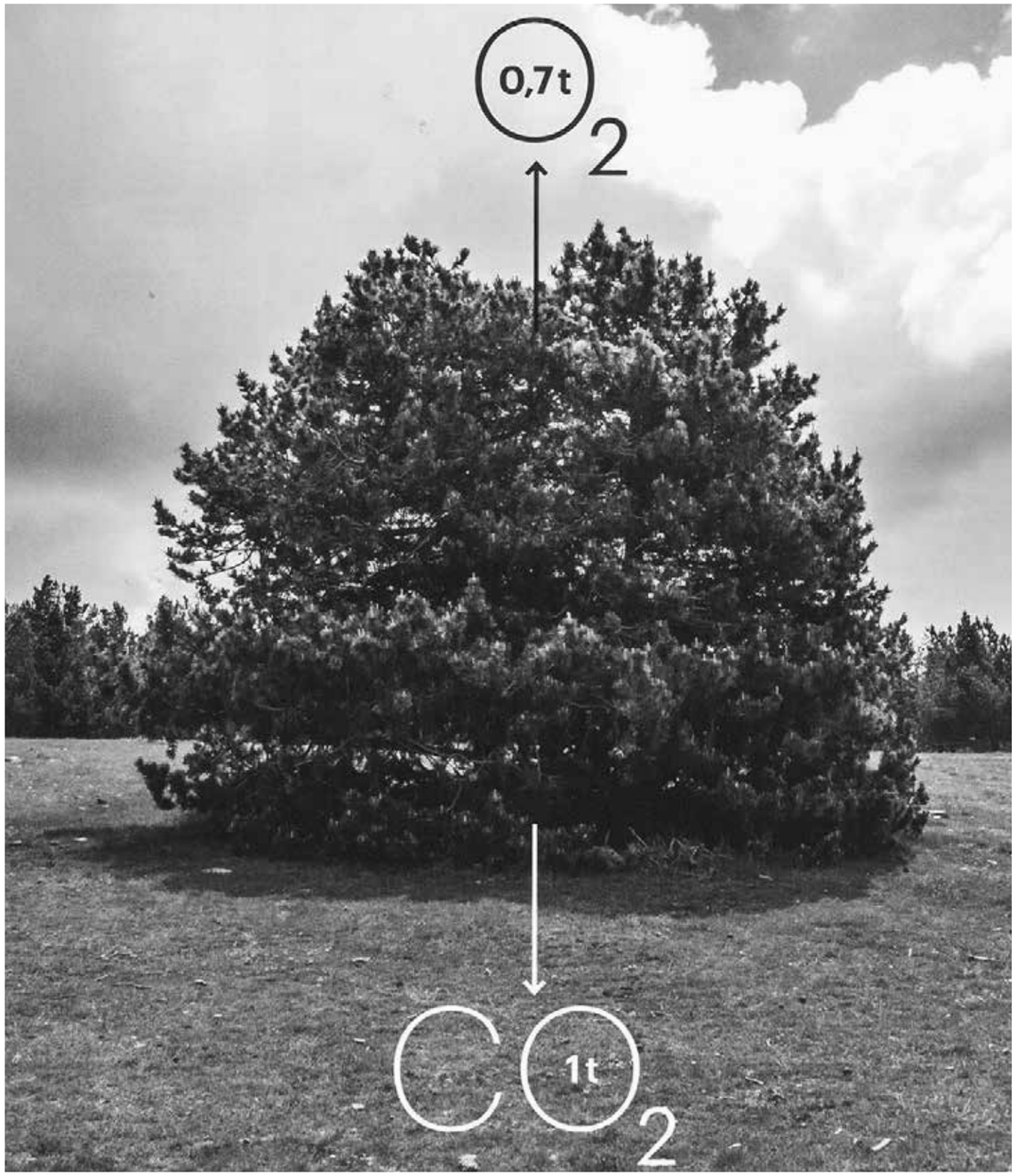
Vivid Vision



Each growing cubic meter of wood takes up one ton of carbon from the atmosphere and produces 0.7 tons of oxygen. The carbon is kept and stored in timber buildings: **To tackle global warming the earth needs timber buildings.**

High Tech Timber

is

burkhalter sumi architekten

création holz

IHT Ingenieurholzbau Holzbautechnik

Lauber Essential Timber Engineering

BUROHAPPOLD ENGINEERING

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DOMY I DOMKI

B projekt

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Program Rewitalizacji