

COOPERATIVE TRANSFORMATION FOR SUSTAINABLE DENSIFICATION

creating a catalyst for
a circular ecology in the
postwar neighborhood.

P5

MARTIN DE BEUN

6 / 7 / 2023



Structure

Part	I	A Circular Ecology	Context, research, history & theory
Part	II	The 2000-Watt Approach	Designing with cooperative rules
Part	III	The Neighborhood of the Future	Generic value and the bigger picture

PART I: A CIRCULAR ECOLOGY

Context, research, history & theory

1: Context

The built environment is facing big simultaneous challenges

- Shortage of housing
- Materials becoming scarcer
- Climate change
- Decreasing biodiversity

What to do about it?

- 1 million homes by 2030
- 1,5 degrees
- 50% less emissions

1: Context

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- Shortage of housing
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What to do about it?

- 1 million homes by 2030
- 1,5 degrees
- 50% less emissions

... But we're probably not going to realise those

'Helft van alle woningbouwplannen is onzeker'

18 november 2022, 10:08

NOS Nieuws • Maandag 22 mei, 12:47

Minister De Jonge waarschuwt voor 'forse dip' in woningbouw

De Jonge: woningbouw kan stagneren door onzekerheid op markt

30 september 2022, 9:41

NOS Nieuws • Vrijdag 2 december 2022, 19:18

Ombudsman: verduurzaming van huis voor lage inkomens vaak niet haalbaar

Corporaties: nieuwbouw in gevaar door te weinig betaalbare grond

14 september 2022, 11:09

NOS Nieuws • Woensdag 2 november 2022, 10:21 • Aangepast woensdag 2 november 2022, 10:56

Rechter haalt streep door bouwvrijstelling, grote gevolgen voor projecten

NOS Nieuws • Vrijdag 16 juni, 15:29 • Aangepast vrijdag 16 juni, 15:32

'Bouw van nieuwe woningen loopt nog sneller terug dan verwacht'

NOS Nieuws • Woensdag 23 maart 2022, 17:31

Rapport: ronduit slecht gesteld met natuur, Nederlands beleid schiet tekort

Maandag 27 juni 2022, 17:16

Het is nu zeker: onze zeespiegel stijgt steeds sneller

NOS Nieuws • Woensdag 17 mei, 20:37 • Aangepast vrijdag 19 mei, 15:27

Kans steeds groter dat grens van 1,5 graad opwarming overschreden wordt

NOS Nieuws • Dinsdag 13 september 2022, 18:14

Planbureau: klimaatdoelen 2030 nog ver weg

Woningbouwers: kabinetsdoelen nieuwe woningvoorraad niet haalbaar

19 september 2022, 9:18

NOS Nieuws • Maandag 25 oktober 2021, 12:03 • Aangepast maandag 25 oktober 2021, 12:50

1,2 of zelfs 2 meter: KNMI stelt verwachte zeespiegelstijging naar boven bij

TNO: verduurzamen van woningen moet veel sneller

21 oktober 2022, 9:59

PBL: Aanpak leefomgeving niet goed en samenhangend genoeg

9 september 2022, 9:24

ABN AMRO: bouw krijgt het zwaar door personeelsgebrek

12 juli 2022, 10:36

NOS Nieuws • Dinsdag 4 april, 12:23 • Aangepast dinsdag 4 april, 13:27

Van der Wal noemt 2030 minder relevant: het gaat om de meetmomenten

Alle bouwdata voorspellen: nieuwbouw valt terug naar 45.000 woningen

Anton van Elburg | Gepubliceerd: 31 okt. 2022 | Gewijzigd: 30 nov. 2022

An increasing imperative for a
fundamentally different
approach

To realise a circular economy by
2050

1: Context

A linear economy

Take

Make

Waste



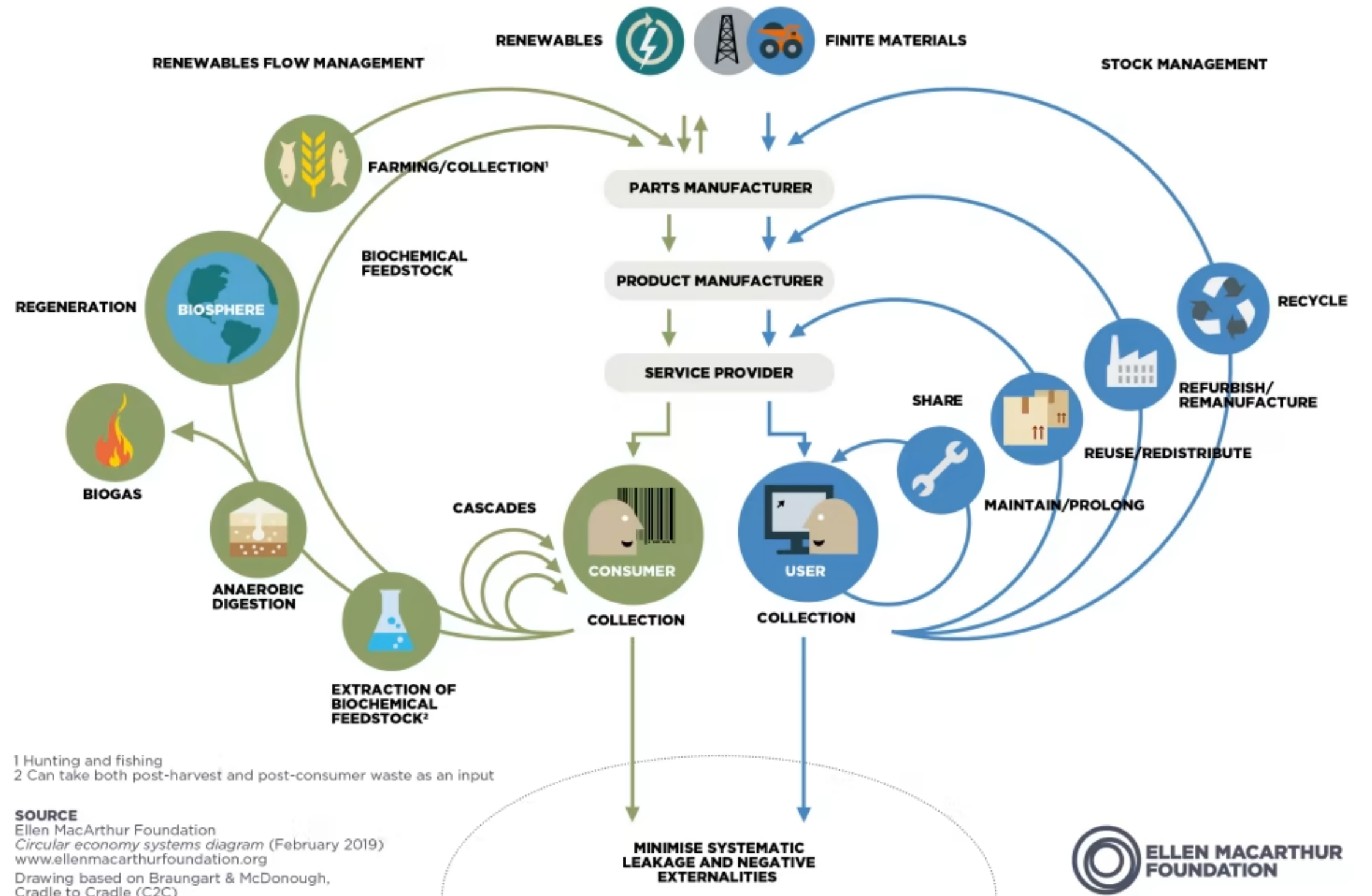
1: Context

A circular economy:

Eliminate waste and pollution

Circulate products and materials at their highest value

Regenerate nature



1: Context

Circulate products and materials at their highest value:

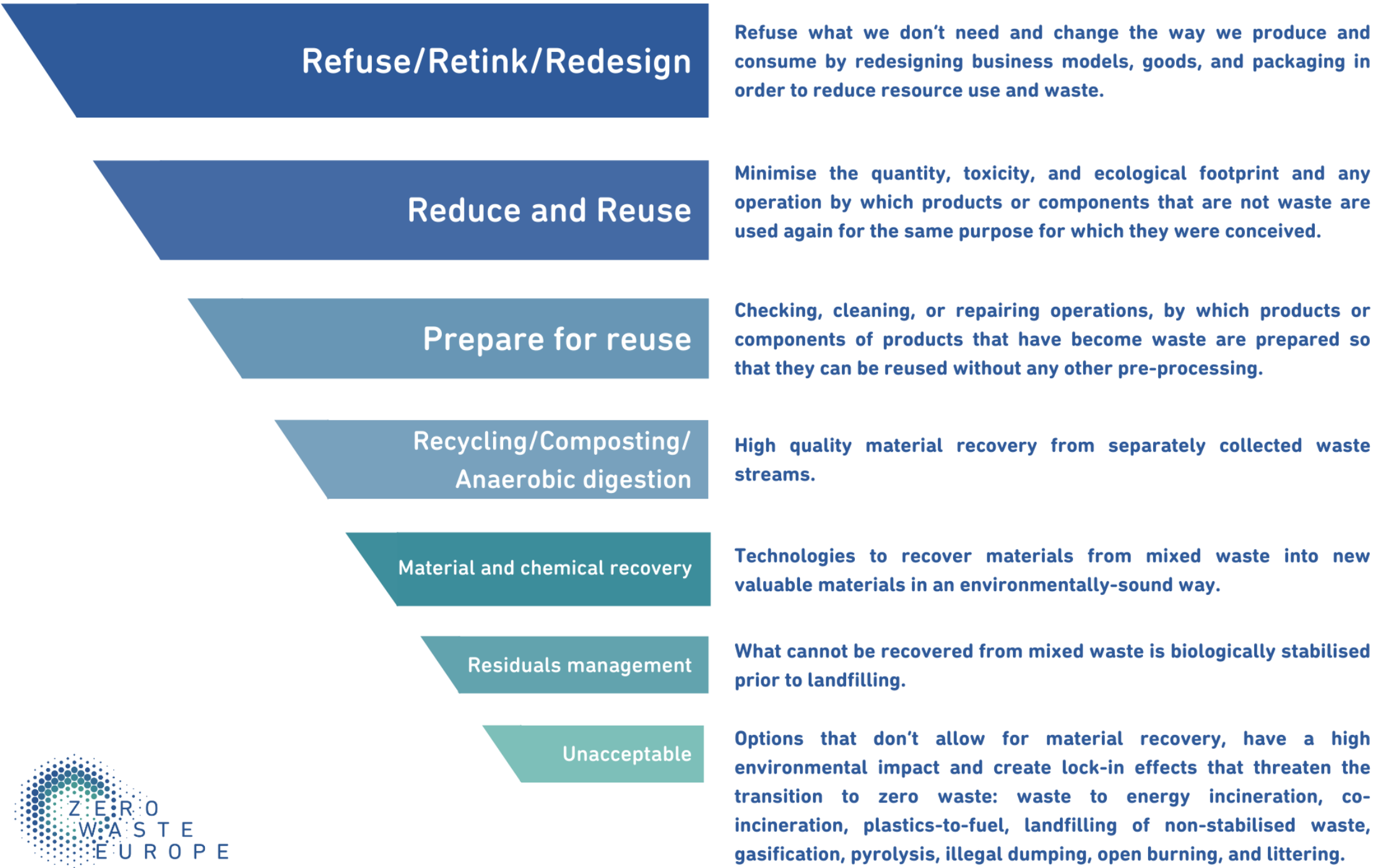
The Zero Waste Hierarchy

Aim to always be as high on the ladder as possible

It's not just about recycling

Circularity relates to lifestyle, and therefore to how we design our built environment

Zero Waste Hierarchy



A Circular Economy → A Circular Ecology

1: Context

80% of our built environment in 2050 has already been built

How to ensure those buildings are also part of that circular future?

Specifically:

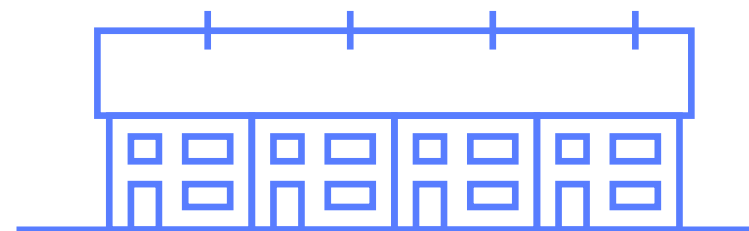
How to make the postwar neighborhood fit for a circular future?



Portiekflats



Galerijflats



Bloemkoolwijken



Vinexwijken

In a circular ecology,
what should a circular
lifestyle be like?

2: A 2000-Watt-society

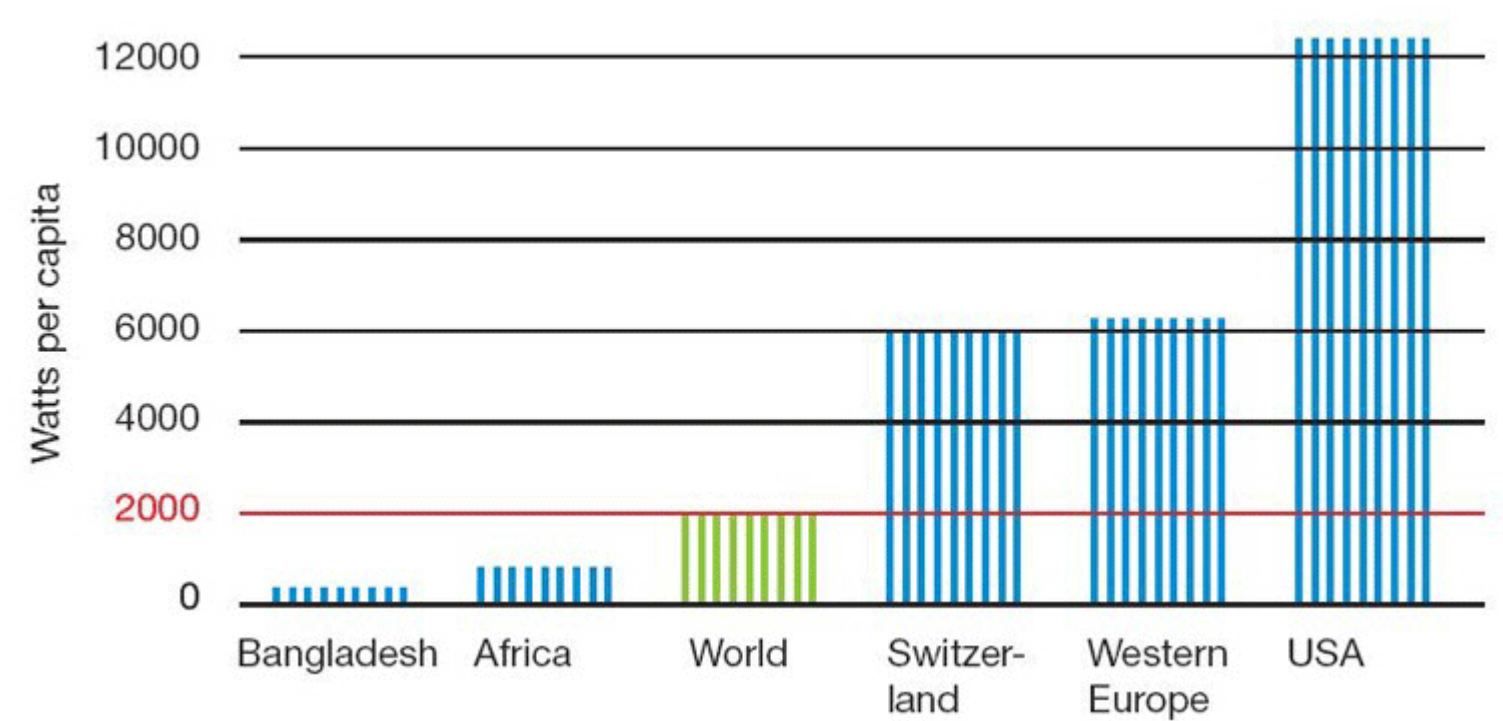
- A sustainable and equitable daily usage goal
- Includes ‘gray’ energy; production, transport, storage, etc
- A continuous stream of 2000 watts
- 48 kWh per day
- 17.500 kWh per year
- per person
- Generated with <1.000 kg CO₂ per year

Activity	Current daily energy requirement (Watt)	Envisioned daily requirement in a 2000-watt society (Watt)	Difference
Living and working environment	1500	450	-1050
Consumer goods and foodstuffs	1140	500	-640
Infrastructure	900	340	-560
Electricity consumption	570	210	-360
Mobility (automobile)	480	140	-340
Mobility (aircraft)	230	180	-50
Mobility (public transport)	140	100	-40
Total	4960	1920	-3040

Daily average total energy usage per capita for a Swiss person in 2008 (Novalantis, 2008)

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2: A 2000-Watt-society

Efficiency:
use less energy for the same
purpose

Consistency:
use renewable resources and
technologies; reuse and recycle

Sufficiency:
use less, for a better quality of
life

How can the built environment,
from city to household, contribute
to reducing energy usage to be-
come to a 2000-watt society?

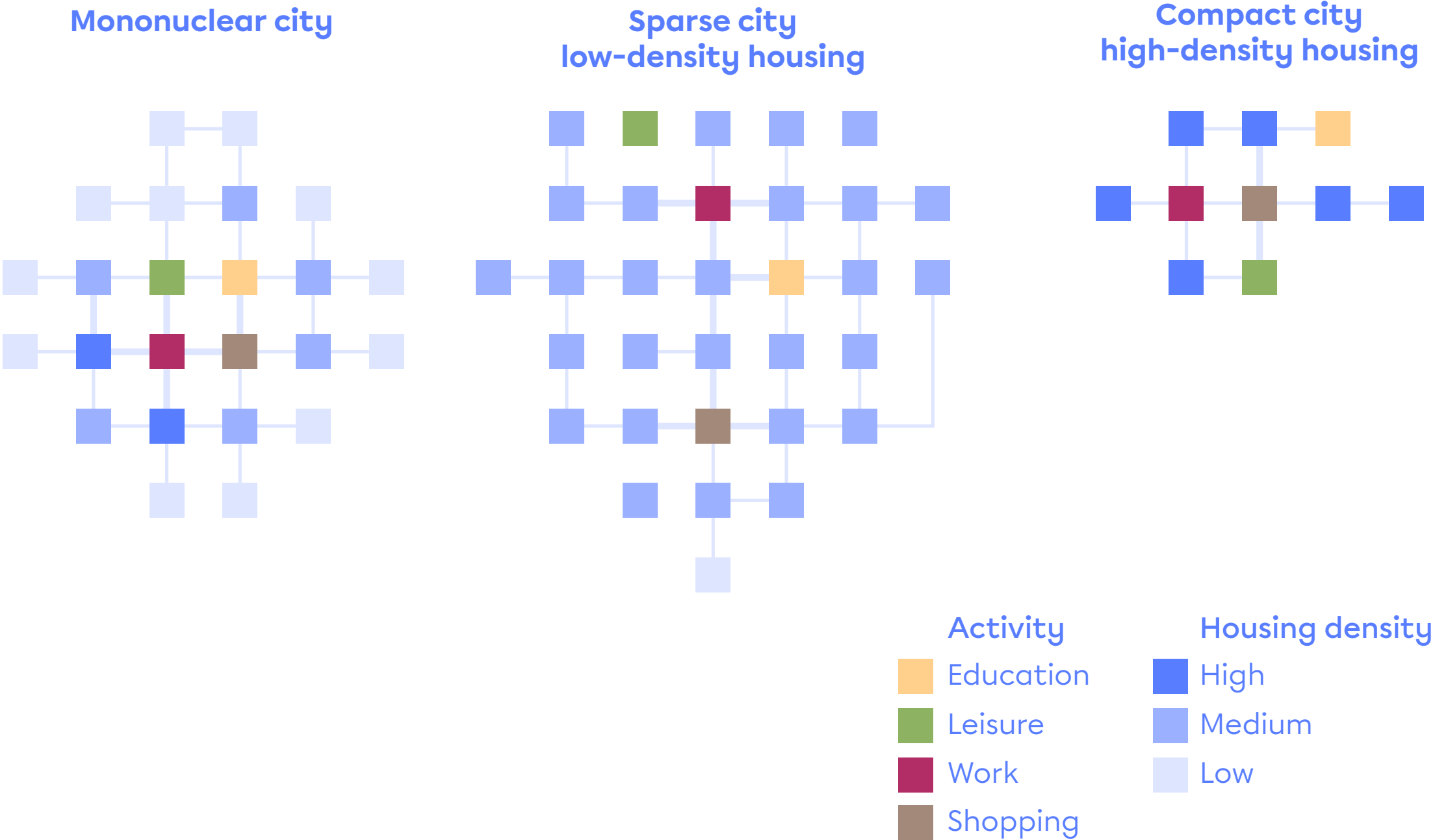
3: Urban scale, trends and space

Creating the right conditions starts with density

Mixed use-cities

Less reliance on cars, more human scale

Ideal density:
up to 15.000 people per km²



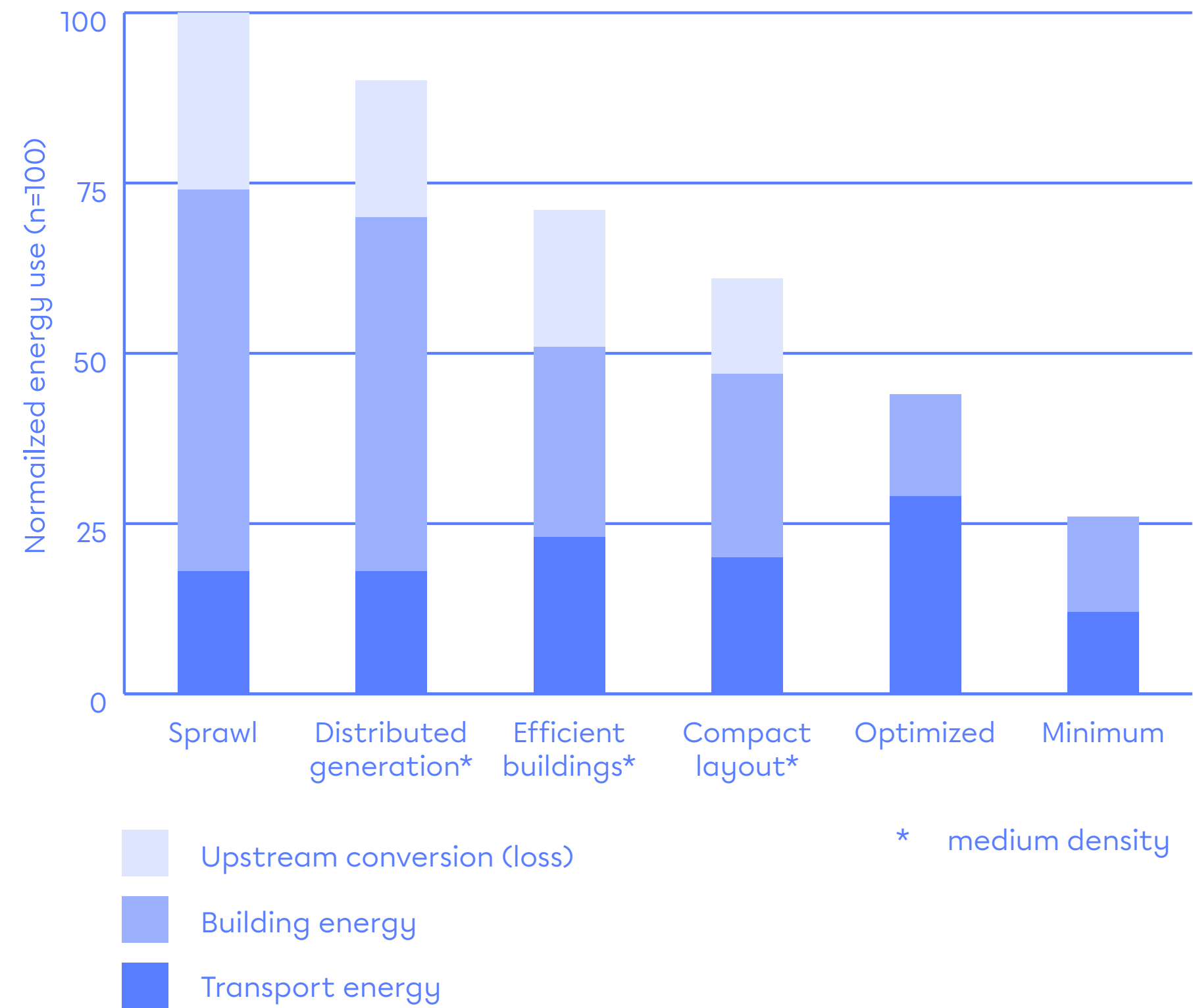
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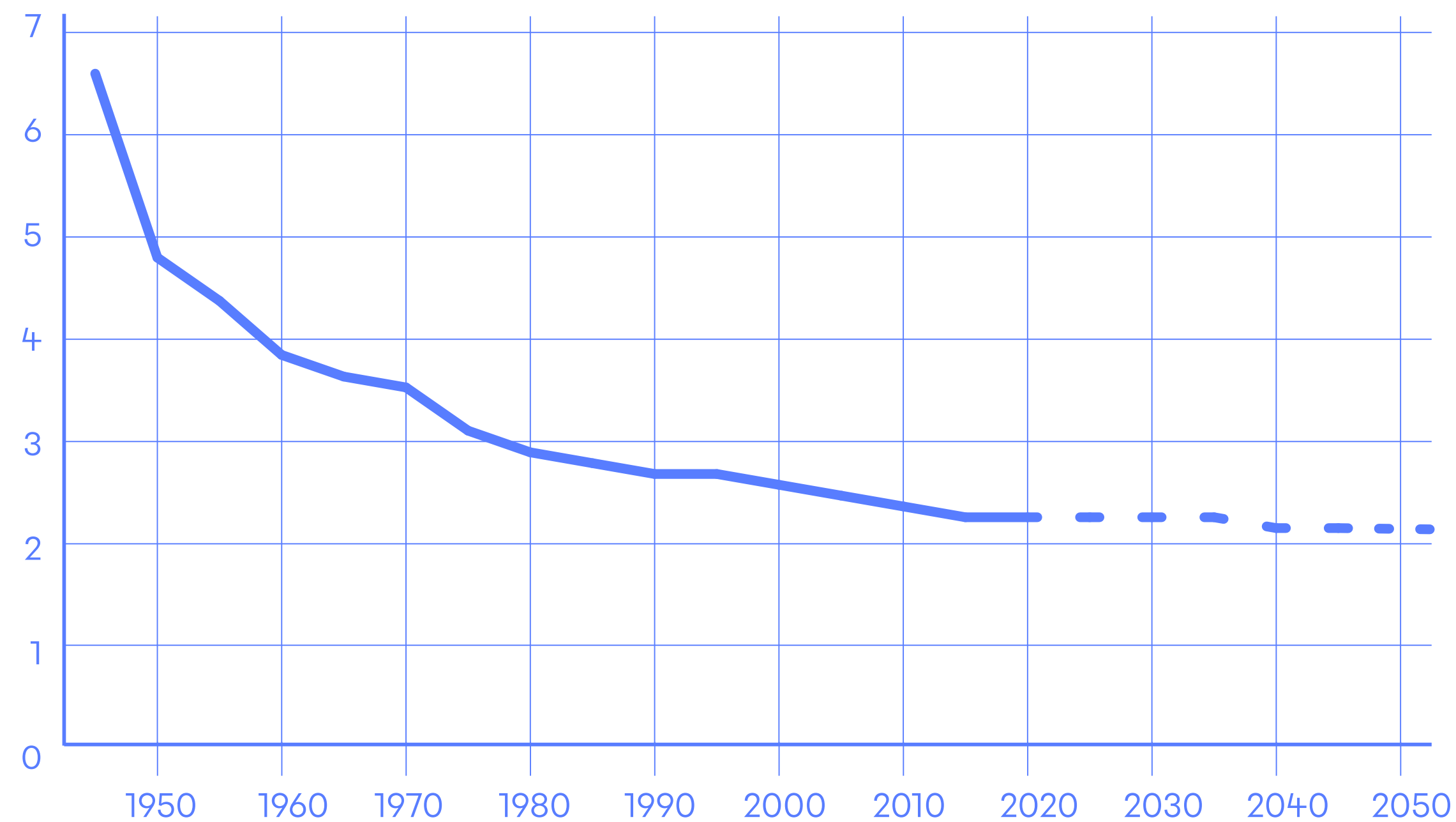
3: Urban scale, trends and space

Despite more people living in cities, density is decreasing

Less people living per household

More square metres per house

More people living alone



Average inhabitants per household in the Netherlands (CBS, 2022)

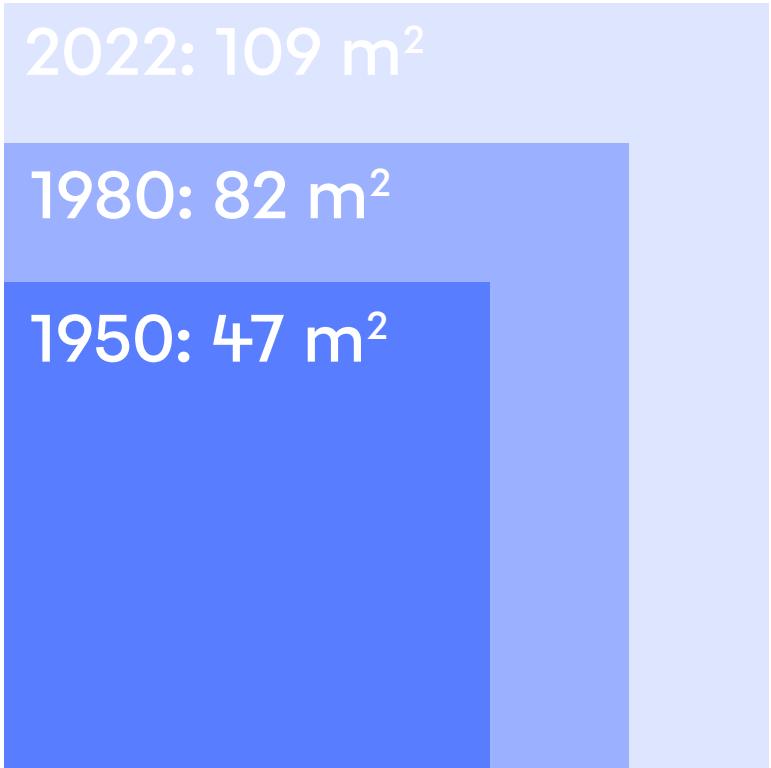
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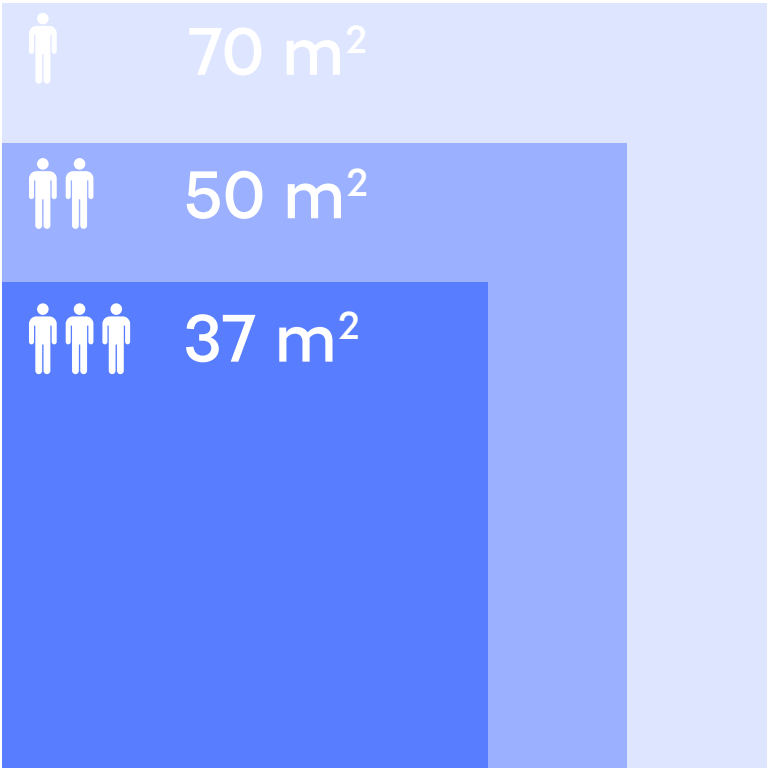
Less people living per household

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Average Dutch household floor space usage (CBS, 2022)



Average Dutch household size by composition (CBS, 2022)

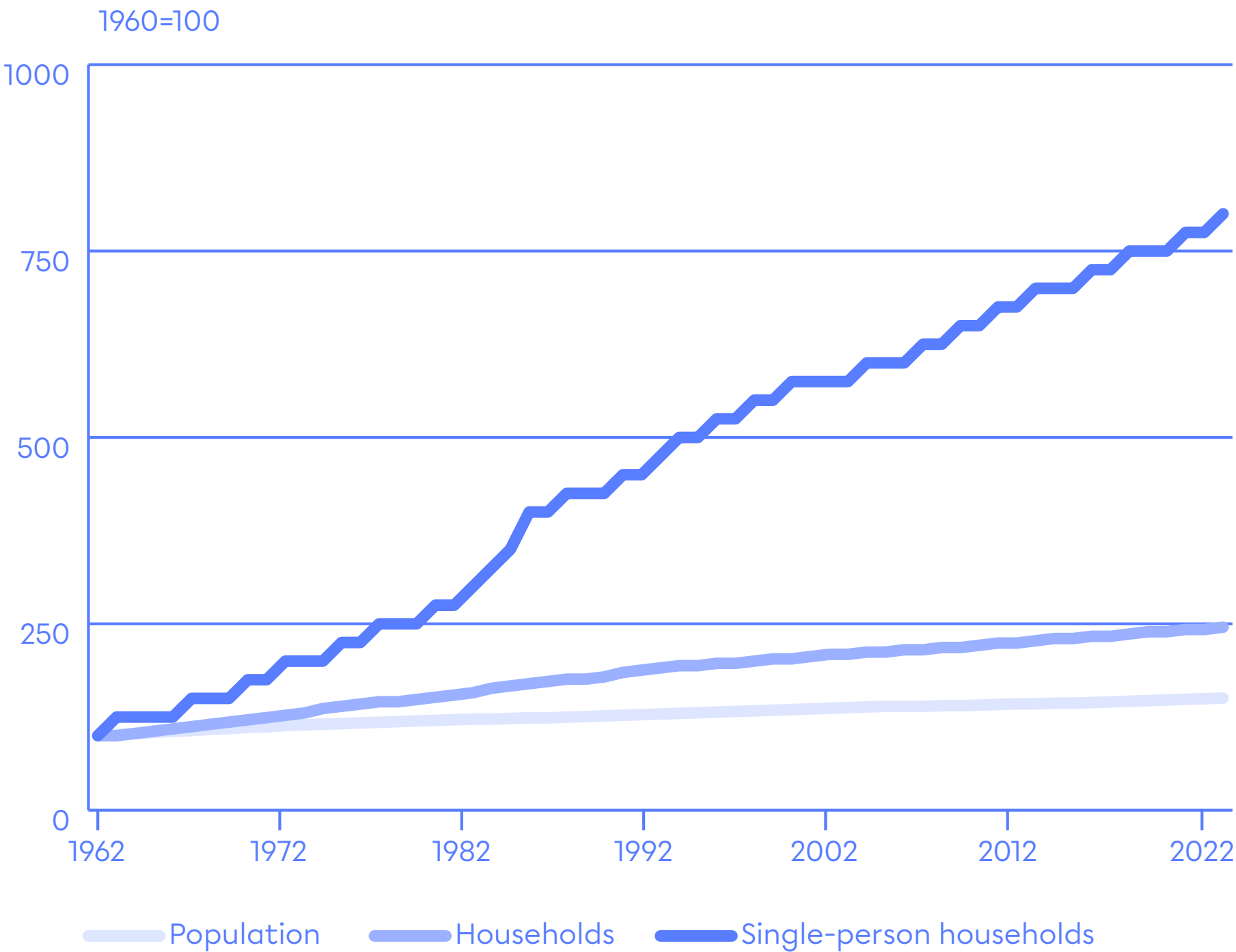
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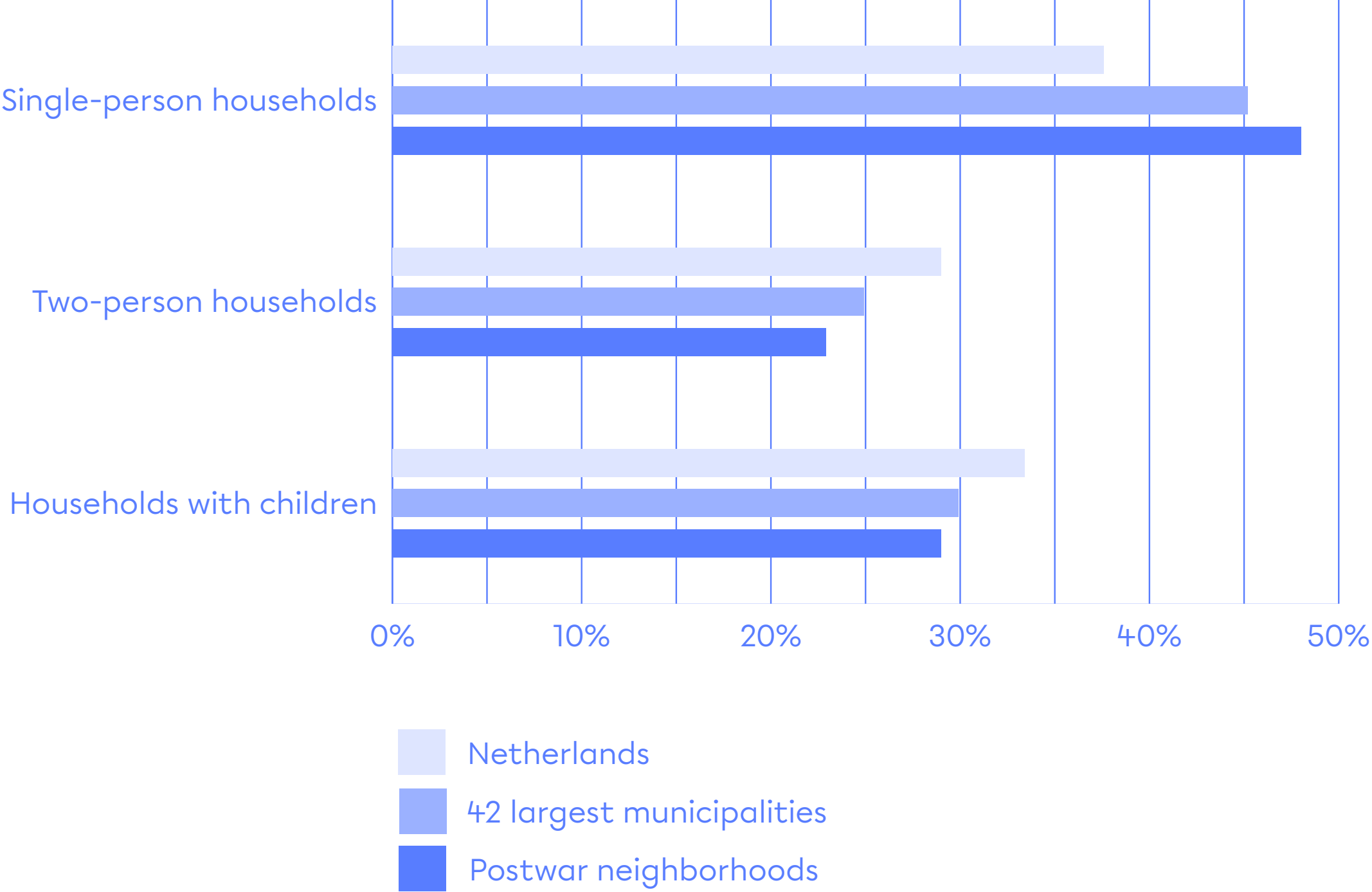


Relative growth of population and households (CBS, 2022)

4: The postwar neighborhood

Especially the postwar neighborhood suffers from this change

Almost half of households are a single person



Relative share of household types (CBS, 2022)

4: The postwar neighborhood

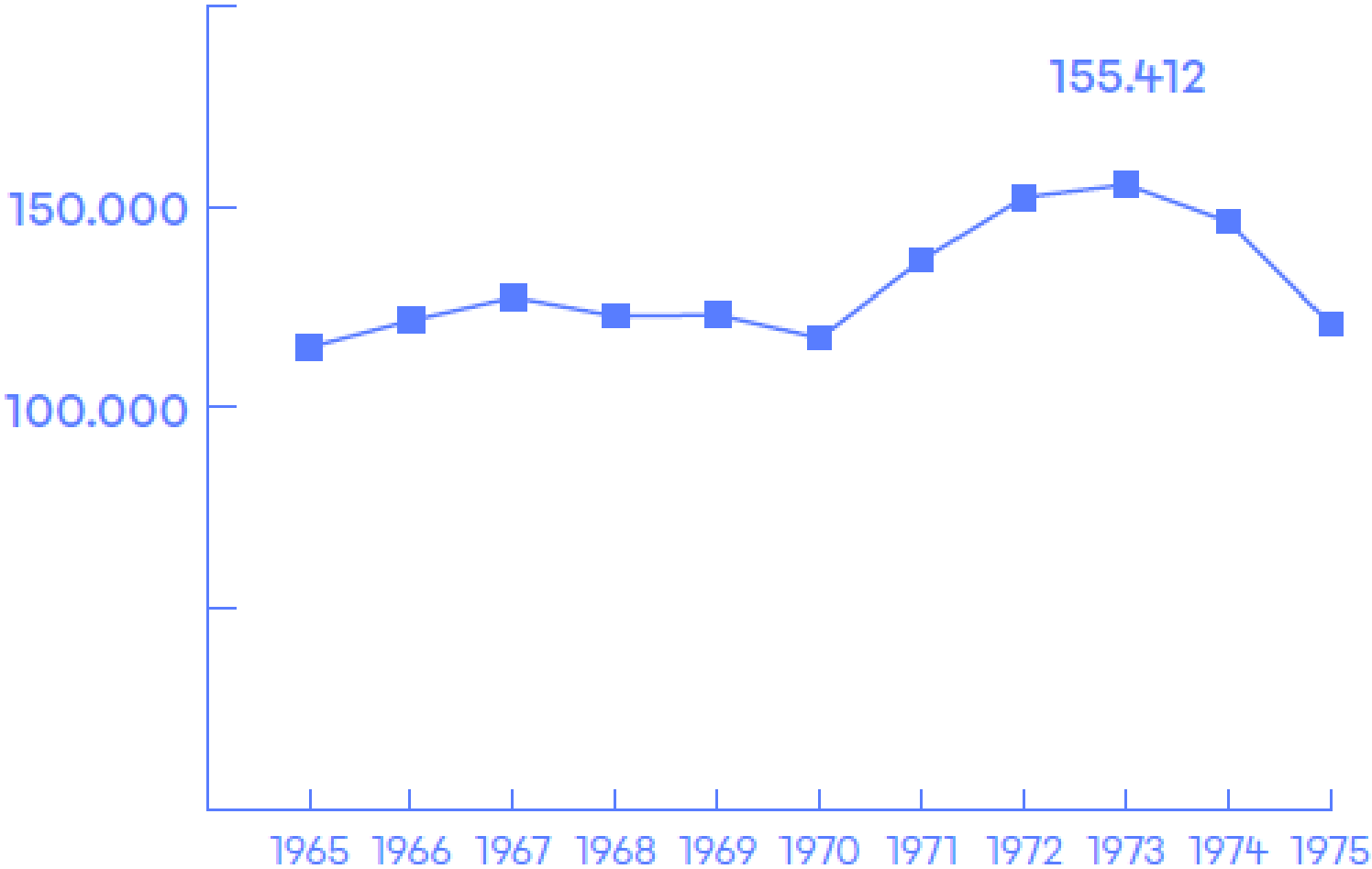
Built 1945 - 1975: more than a million homes

A departure from the past:

Low density, open spaces, ample green

Large apartments for families

Seperated by function



Newly built houses per year, 1965-1975

4: The postwar neighborhood

Built 1945 - 1975: more than a million homes

A departure from the past:

Low density, open spaces,
ample green

Large apartments for families

Separated by function



4: The postwar neighborhood

Failed idealism

Families moving out in the 80's

Decreasing density, decreasing amenities, decreasing vitality

Leaving behind the vulnerable

Our current-day image: old and ugly



Sparse, seperated, monotypical



A fundamental
mismatch?

Demolition is not an option:

Thinking from circularity

**Improving the postwar
neighborhood through
densification**

5: Cooperative ownership and the 2000-watt society

Large gains can be found in the household

Not just in active energy use, just as much lies in embodied energy

Up to 50% of lifetime energy cost is embodied energy

How can you refuse / rethink / redesign the household?

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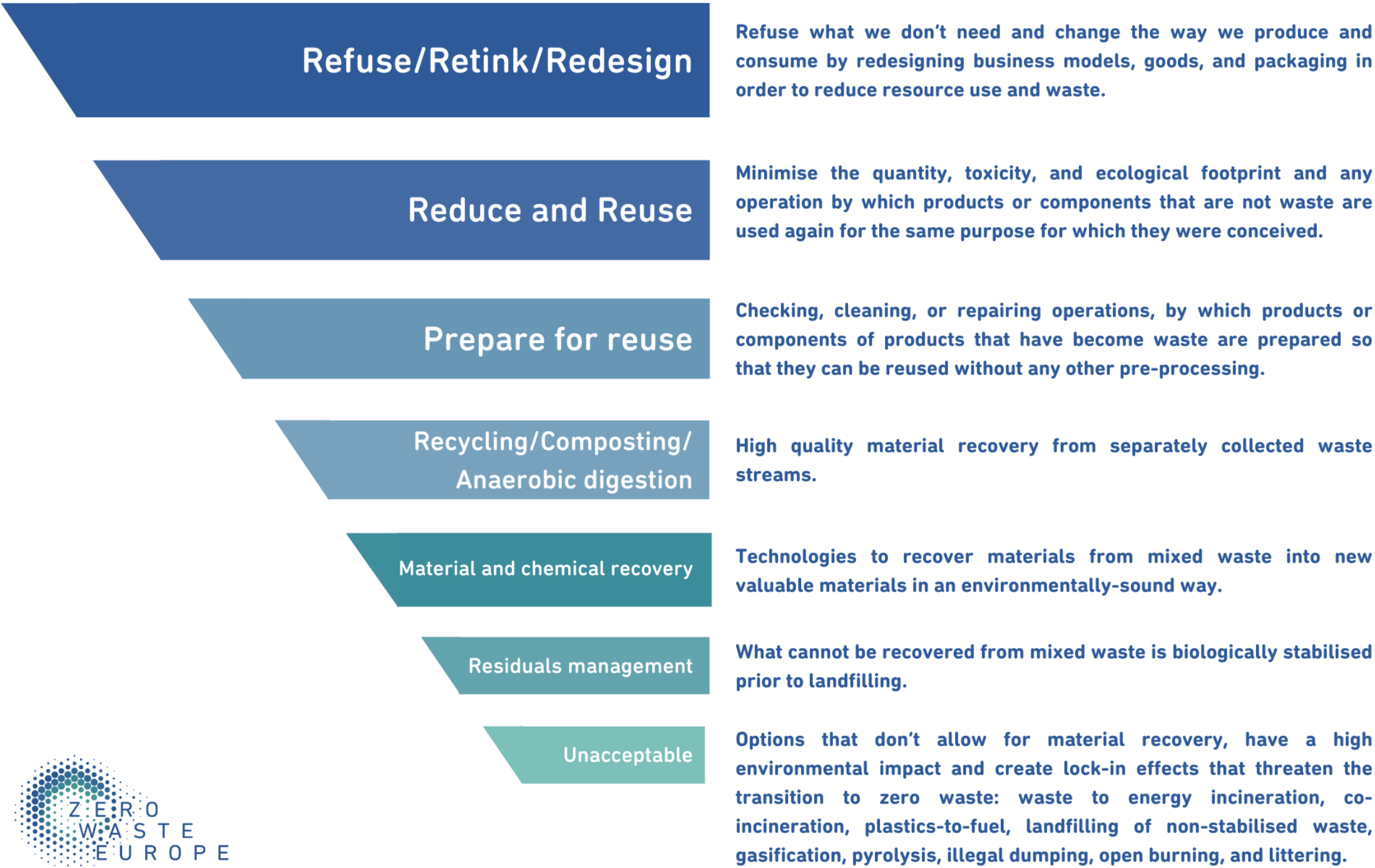
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Zero Waste Hierarchy



**WHEN IS A HOUSE
ENOUGH?**

5: Cooperative ownership and the 2000-watt society

Reversing the trend of increasing home sizes

Tiny houses? Micro apartments?



5: Cooperative ownership and the 2000-watt society

- The **cooperation** model:
 - an autonomous organisation of people:
 - that voluntarily unites to achieve their common (housing) goals and ambitions
 - in the form of a non-profit organisation
 - of which they together are equal owners and decisionmakers
 - which means that:
 - value is prioritised over profit
 - the collective is prioritized over the consumer
 - A different set of rules

5: Cooperative ownership and the 2000-watt society

A different form of ownership:
The housing cooperative

Reducing spatial needs through
sufficiency and optimisation,
without sacrificing quality of
life

In practice: sharing spaces that
you don't need are organised
collectively

Need to use is prioritised over
need to have

Impossible in traditional
market-driven housing



Cooperative housing. LRTB: Gleis 21, Zollhaus, San Riemo and Zwicky Süd

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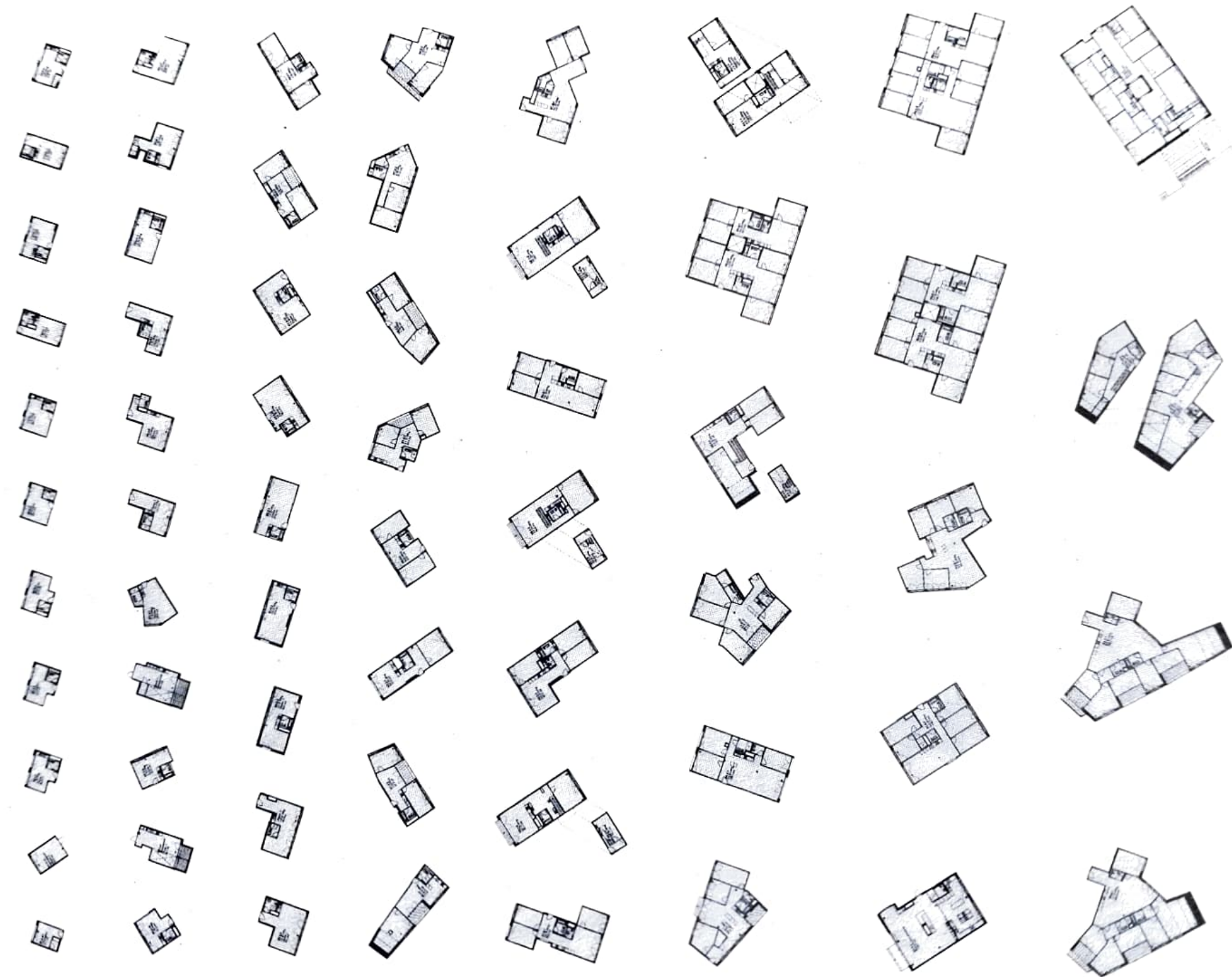
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Floor plans of all available housing in Kalkbreite cooperative (Lengkeek & Kuenzli, 2021)

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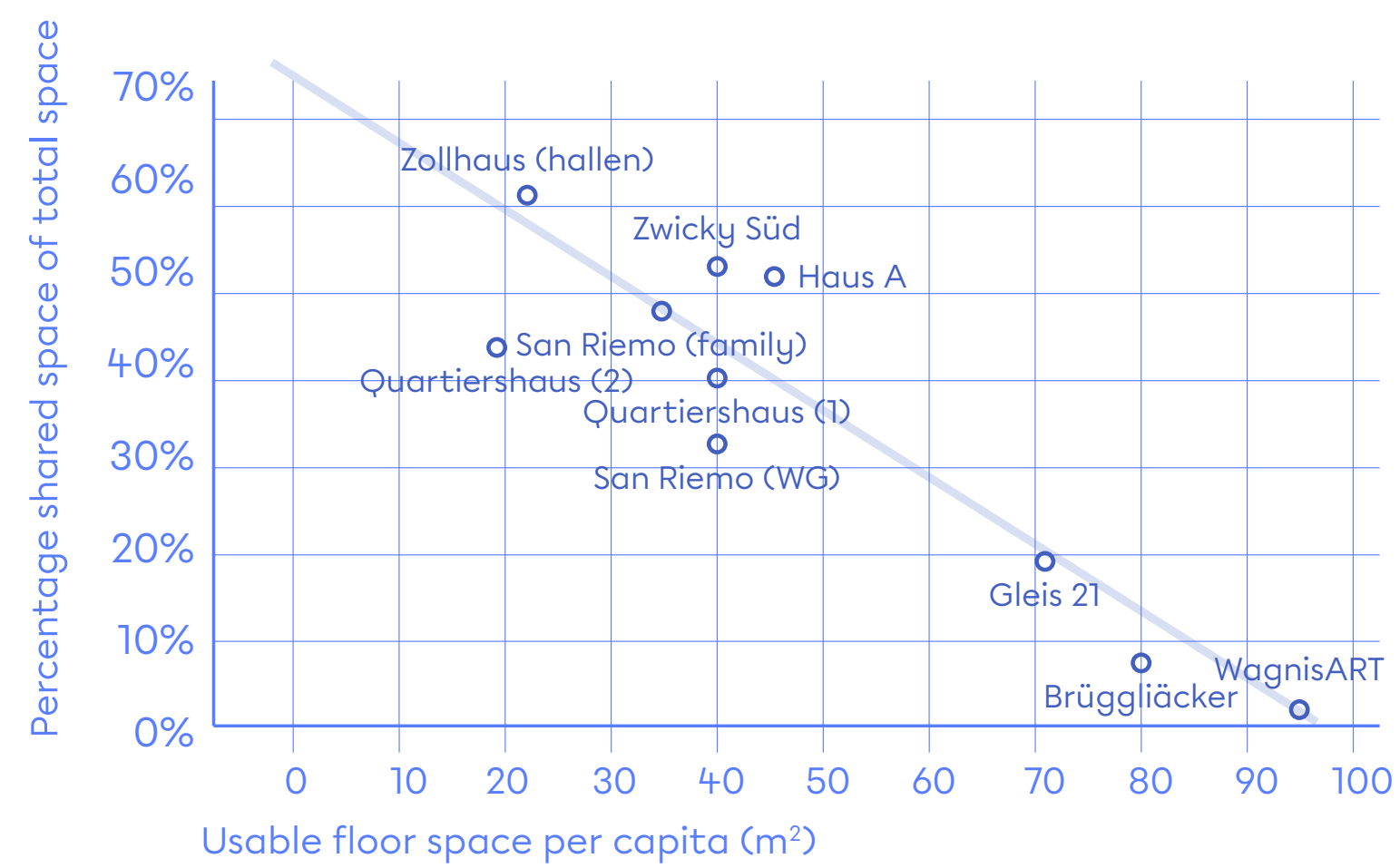
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Relation between floor space usage per capita and percentage of shared space in cooperative housing projects (own work)

PART II:

THE 2000-WATT APPROACH

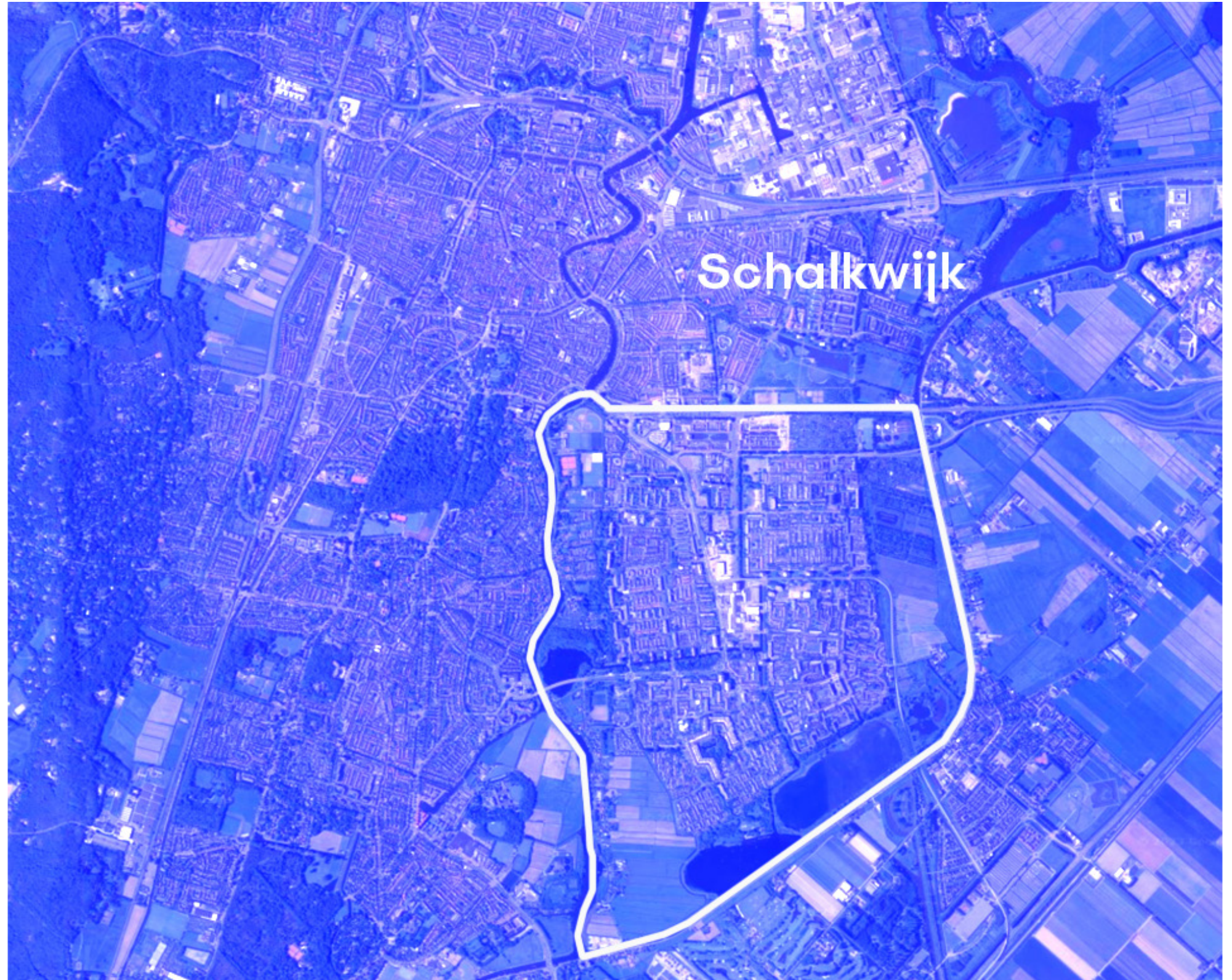
Designing with cooperative rules

6: Boerhaavewijk

Haarlem, Schalkwijk,
Boerhaavewijk

A typical 1960's postwar
neighborhood

Built for 40.000 people, now
houses 32.000



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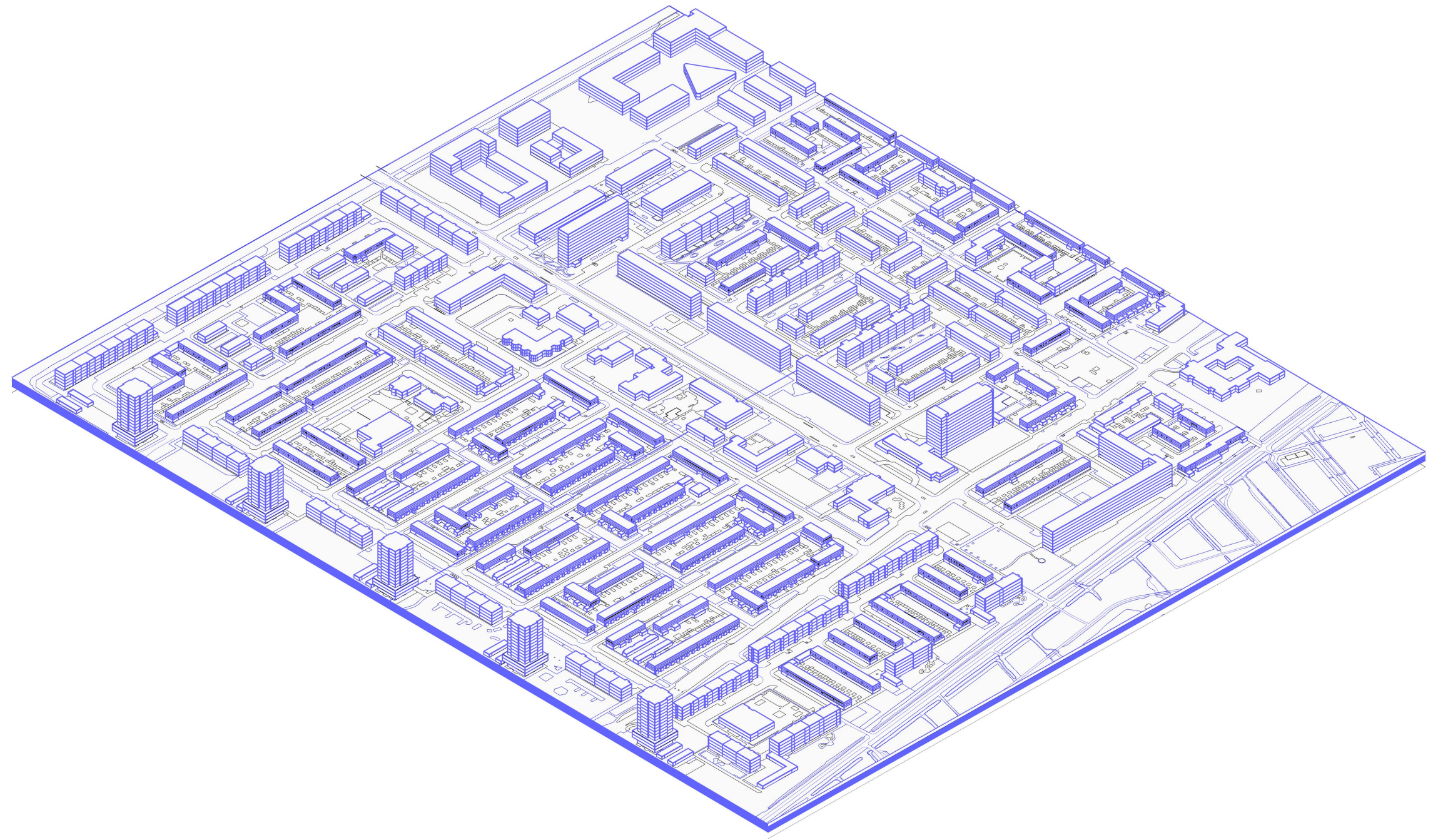
A typical 1960's postwar
neighborhood

Two residential zones divided
by a strip of schools

Currently has 6470 residents in
2735 households

9000 people / km²

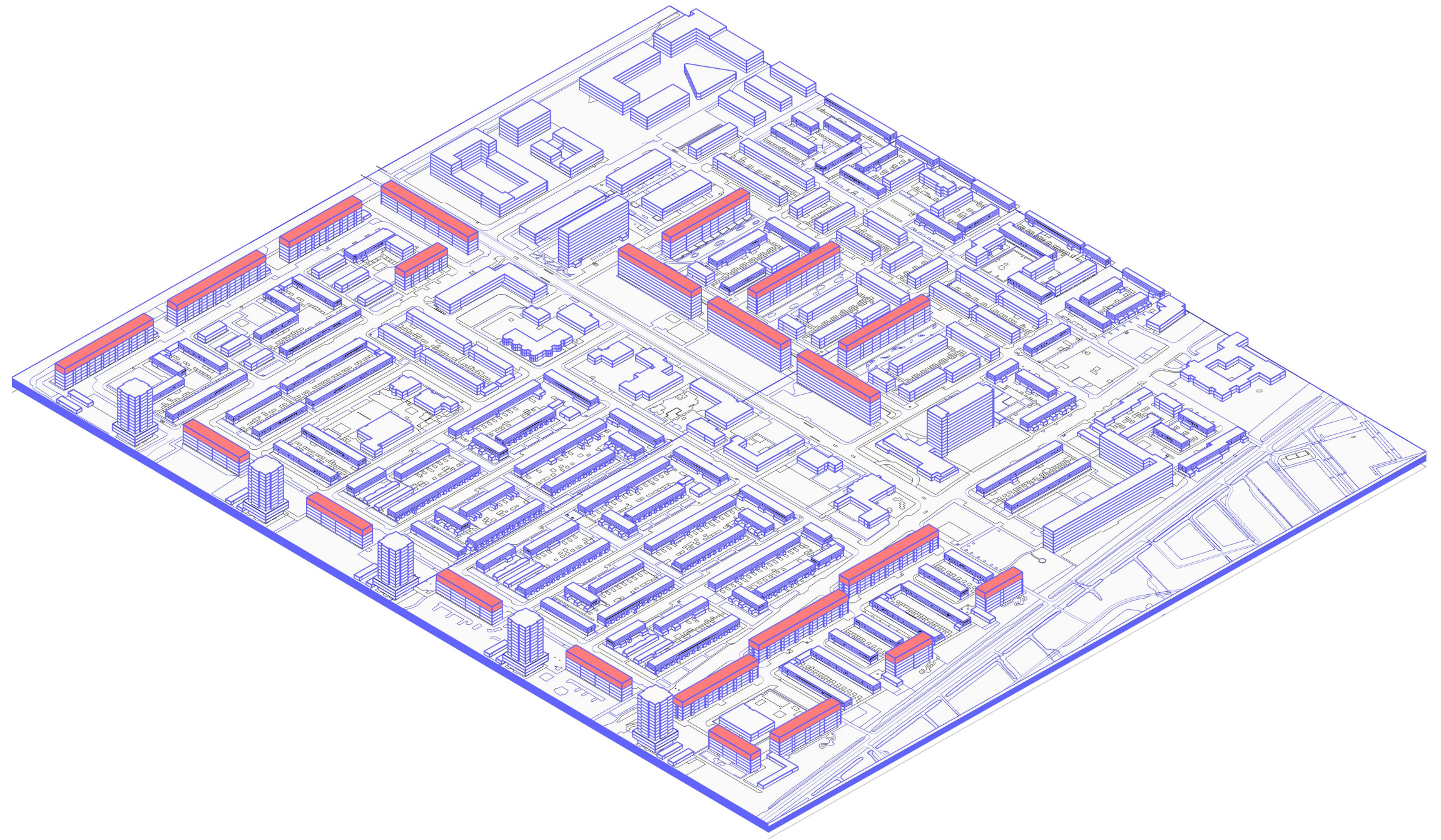
Many neighborhood initiatives
and motivated people



6: Boerhaavewijk

Urban study: densifying
Boerhaavewijk as a
precondition for a circular
neighborhood

Top-ups: integral renovation of
existing blocks

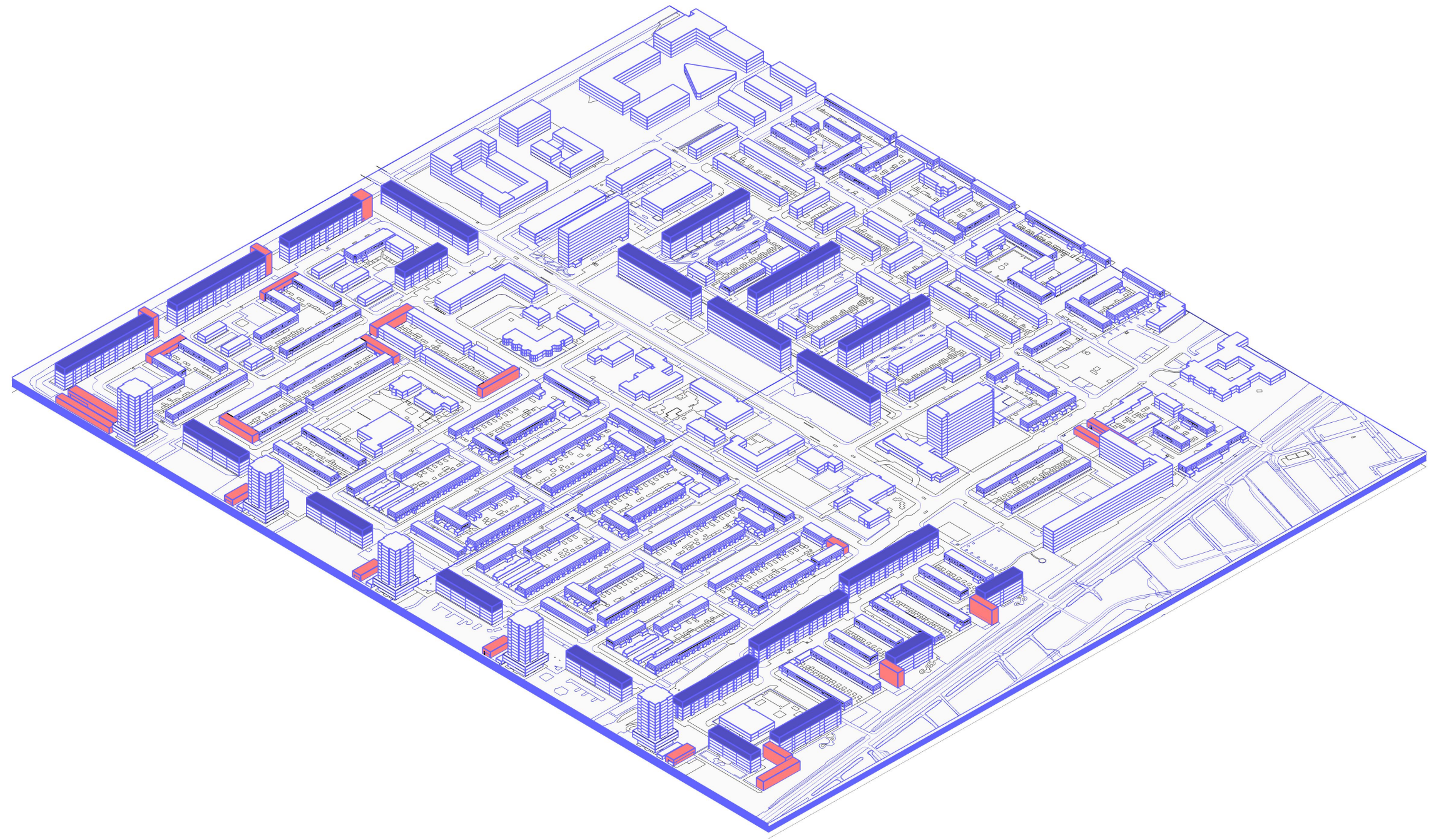


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Urban study: densifying
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Top-ups: integral renovation of
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Leftover spaces: blind facades
and garage boxes







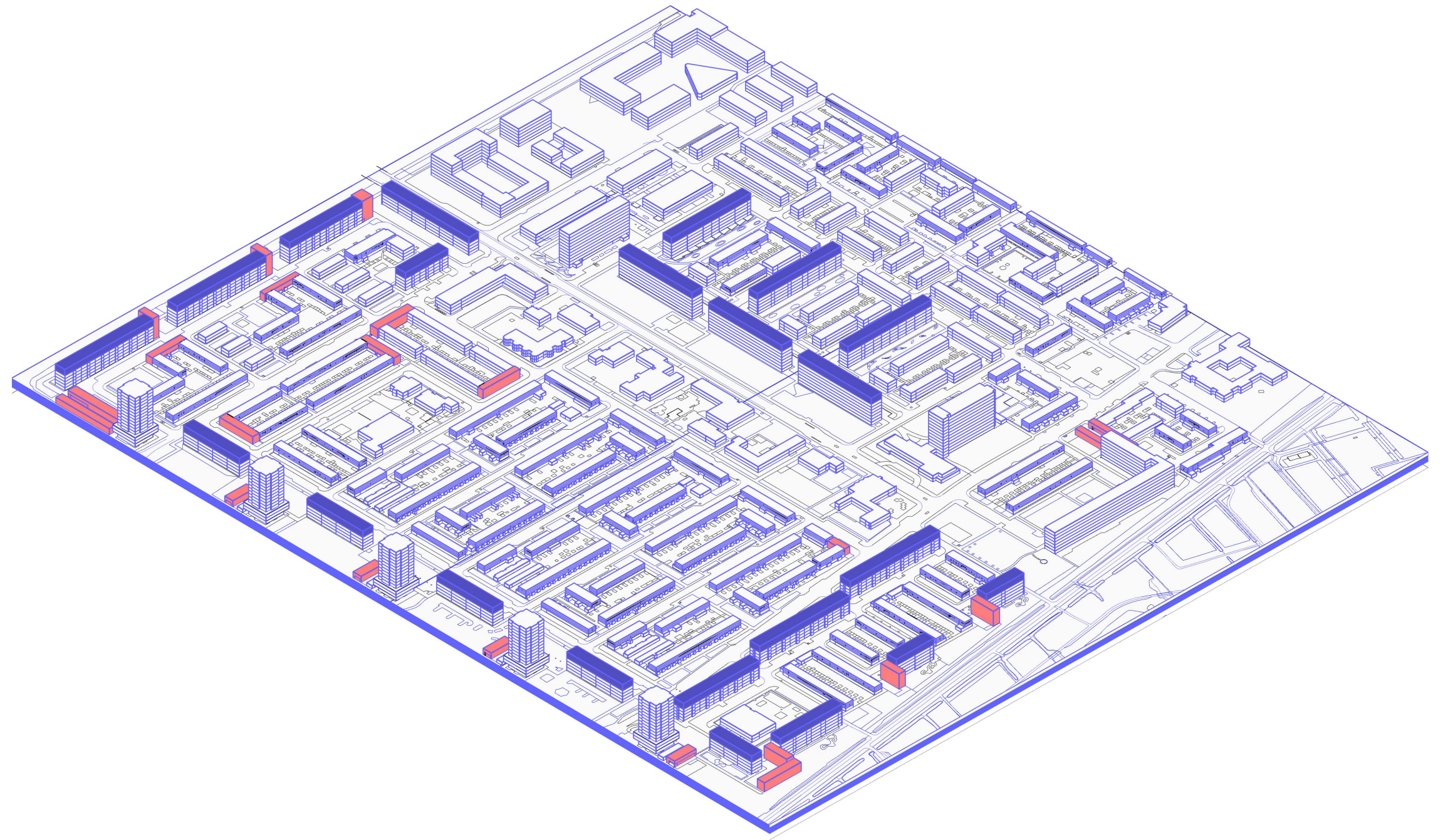
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Urban study: densifying
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Top-ups: integral renovation of
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Leftover spaces: blind facades
and garage boxes

Internal modification, splitting
of existing homes



6: Boerhaavewijk

Buurt	Inhabitants	Area	Households	Density
		km²		ppl/km²
Geleerdenbuurt	2455	0,25	990	9820
Professorenbuurt	1315	0,13	550	10115
Geneesherenbuurt	1700	0,32	1195	8437
Current total	6470	0,70	2735	9242
Phase 1 additions	+ 820	-	+ 372	- Planned new construction
Phase 2 additions	+ 1500	-	+ 670	- Top-ups, garage boxes, leftover spaces
Phase 3 additions	+ 660	-	+ 300	- Internal modification, splitting
New total	9450	-	4077	13.500
Remaining to reach sustainable target	+ 1050		+ 480	- To be realised in new construction, etc.
Total ideal target	10500	0,70	4500	15.000

6: Boerhaavewijk

90% of the required densification can come from te existing

Final bit in new construction, mixed-use development

Result: neighborhood with more incentive for stores, workspaces, less travel distance

First step towards a 2000-watt society



DESIGN OBJECTIVE:

To design a cooperative housing
in Boerhaavewijk

using the principles of a
2000-watt community

to demonstrate what a circular
lifestyle looks like

and can be the catalyst in
creating a circular ecology in
the postwar neighborhood

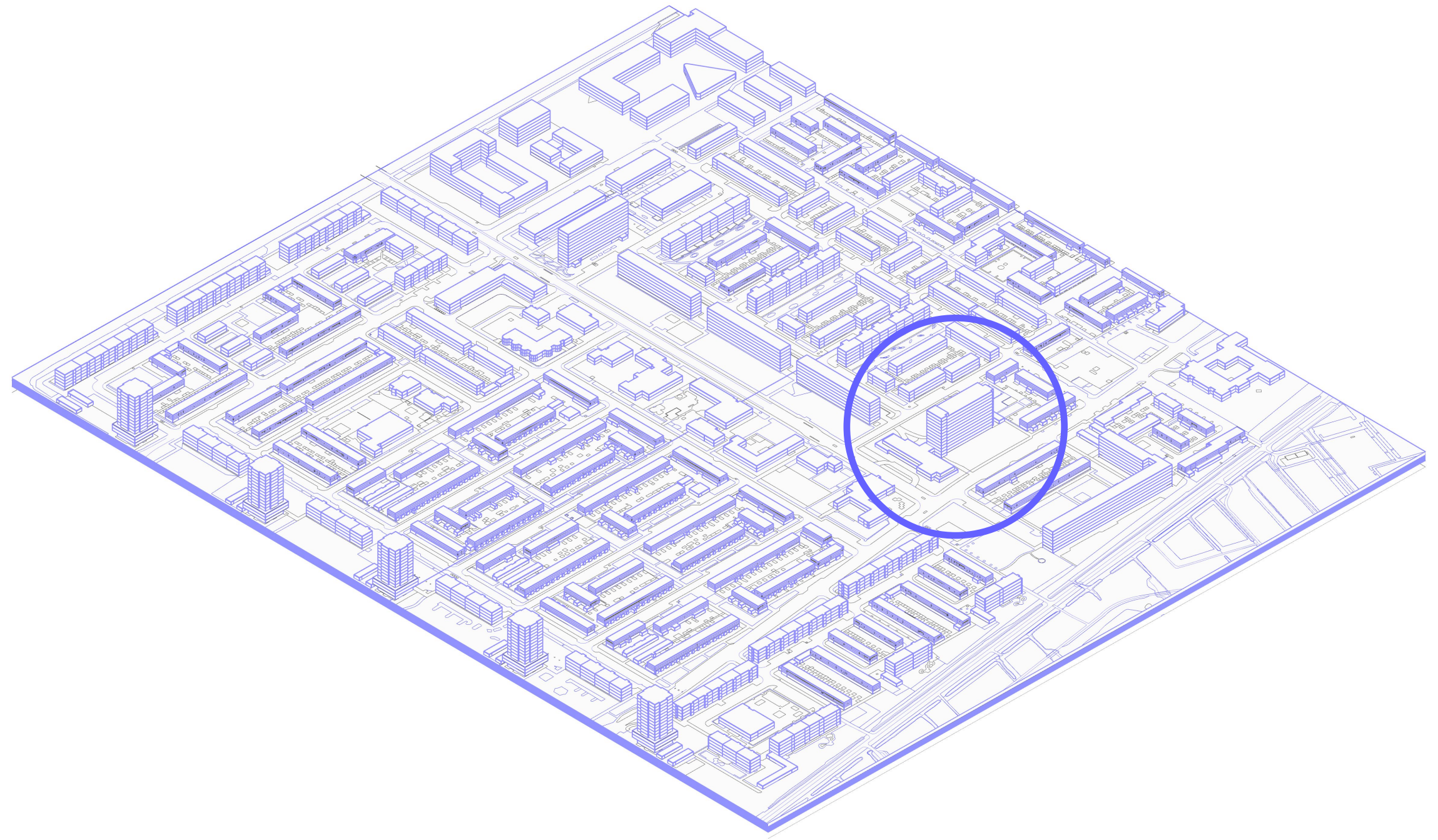
7: A 2000-watt approach to design

Transforming an old building
into cooperative housing

Hof van Jacob: elderly people's
home

Built in the 1960's

Will be vacant in 2027, with no
future plans



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7: A 2000-watt approach to design

For whom?

Target group as diverse as possible

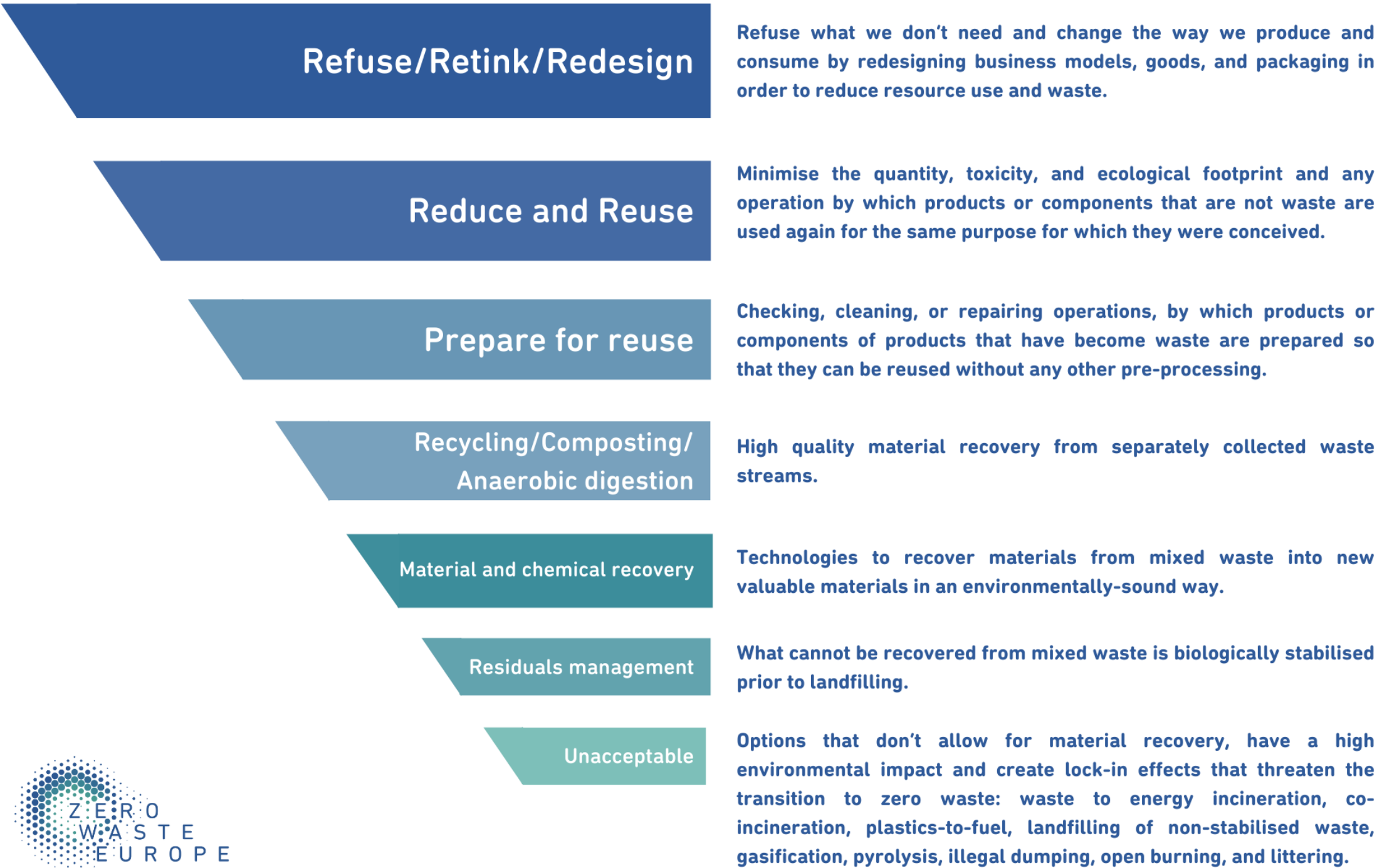
Decoupling sustainability from identity



7: A 2000-watt approach to design

How to realise that community, while staying as close as possible to the top of the hierarchy?

Zero Waste Hierarchy



7: A 2000-watt approach to design

How to realise that community, while staying as close as possible to the top of the hierarchy?

RE-THINK

Refuse
Reduce

1. designing for a 2000-watt lifestyle

USE

Reuse
Repair
Refurbish
Remanufacture

2. retaining as much of the existing as possible

END-OF-LIFE

Repurpose
Recycle

3. gathering and reusing existing local building elements

UNSUSTAINABLE

Recover

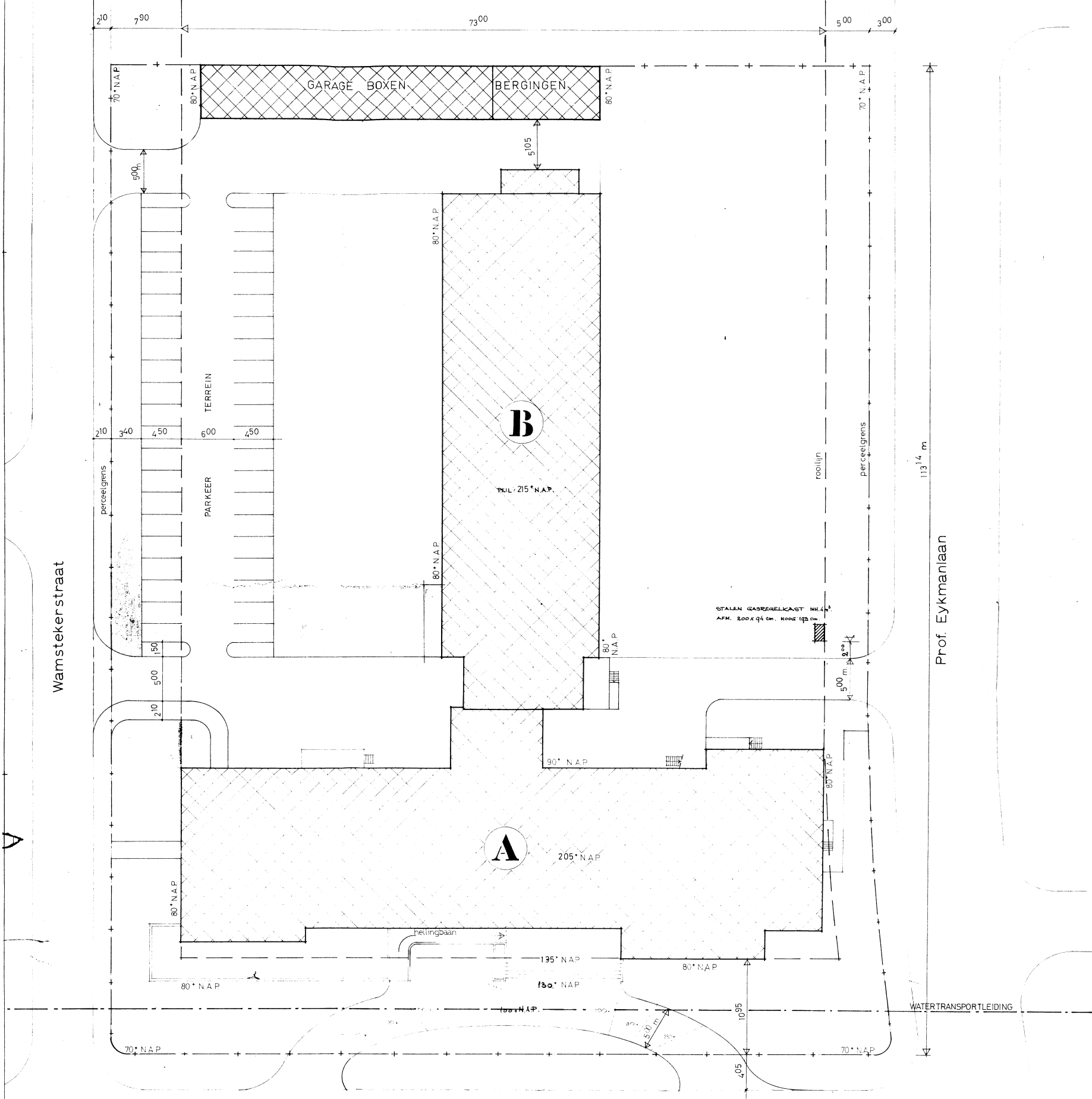
4. growing and harvesting new building elements

5. importing new materials

8: Harvesting the existing

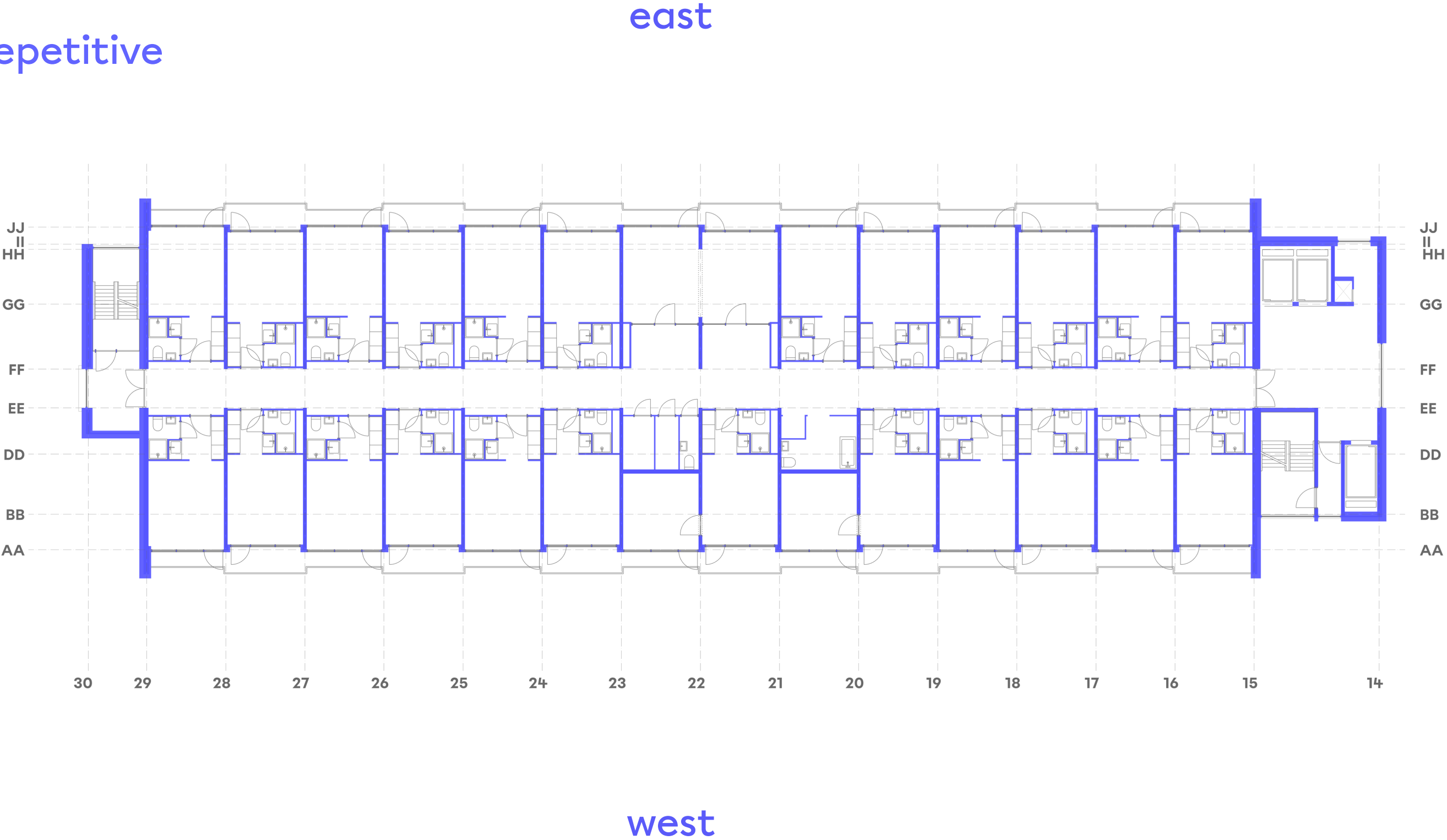
Two parts: low-rise and high-rise

Focus for the housing cooperative on the high-rise

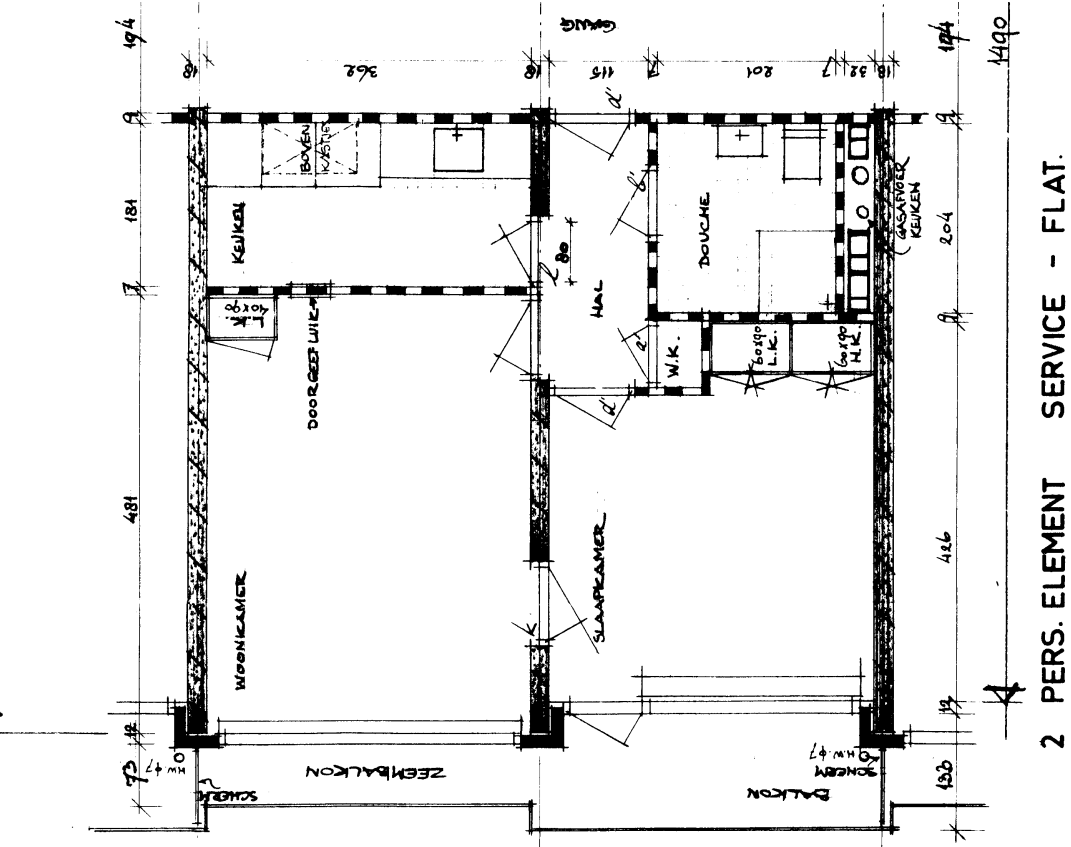


8: Harvesting the existing

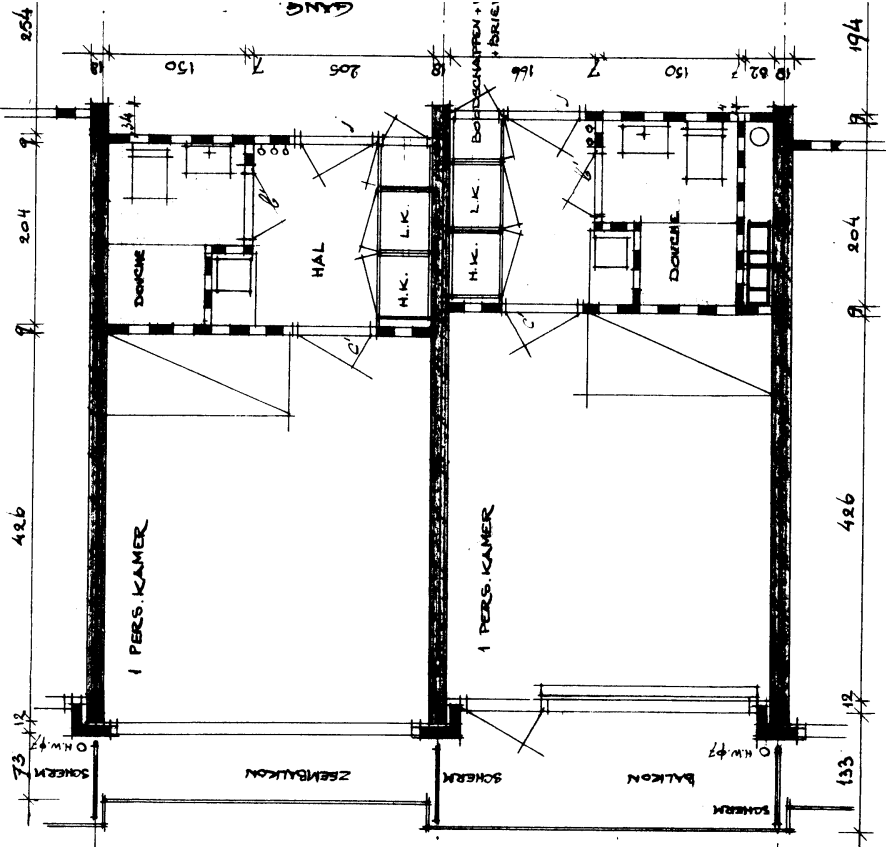
Rational and repetitive



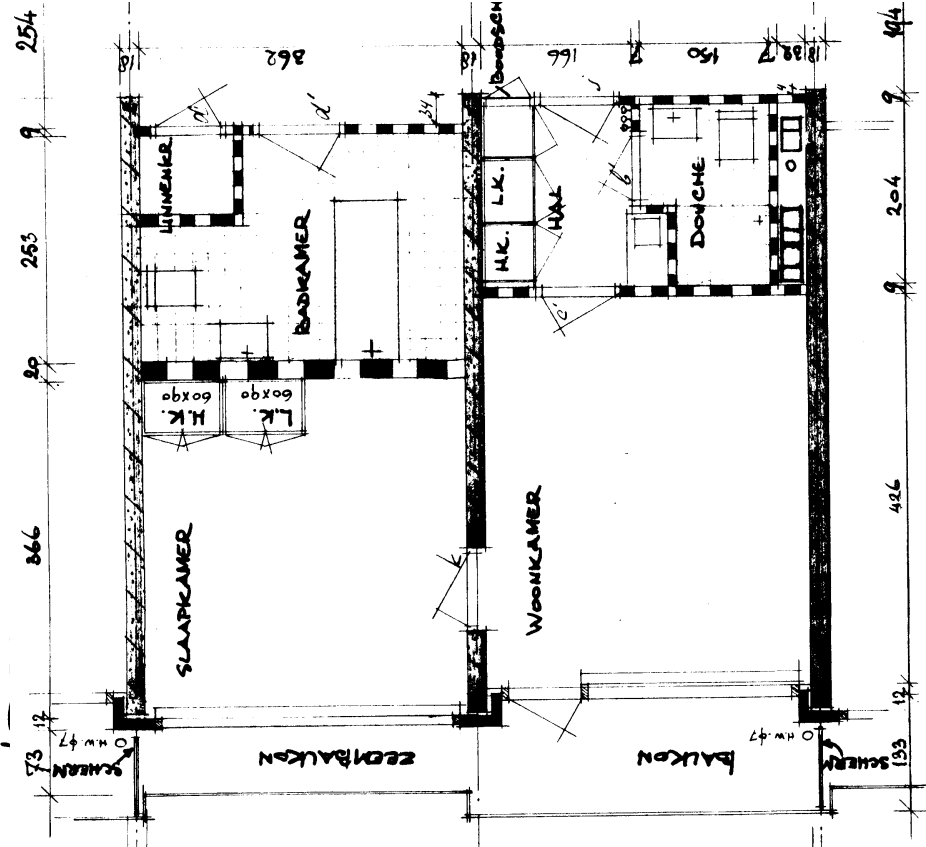
8: Harvesting the existing



Independant
2 room flat



Dependant 1
room flat

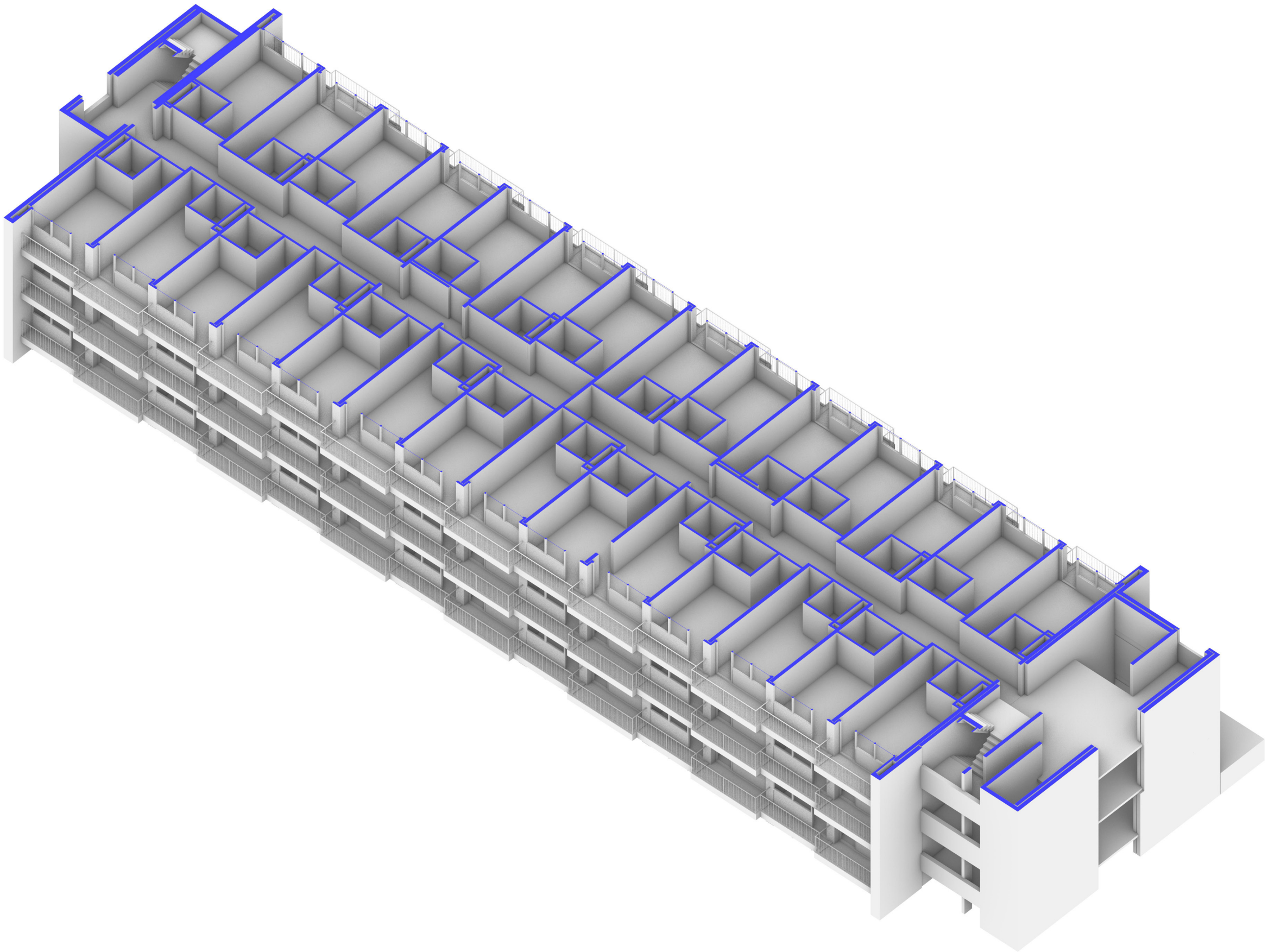


Dependant 2
room flat

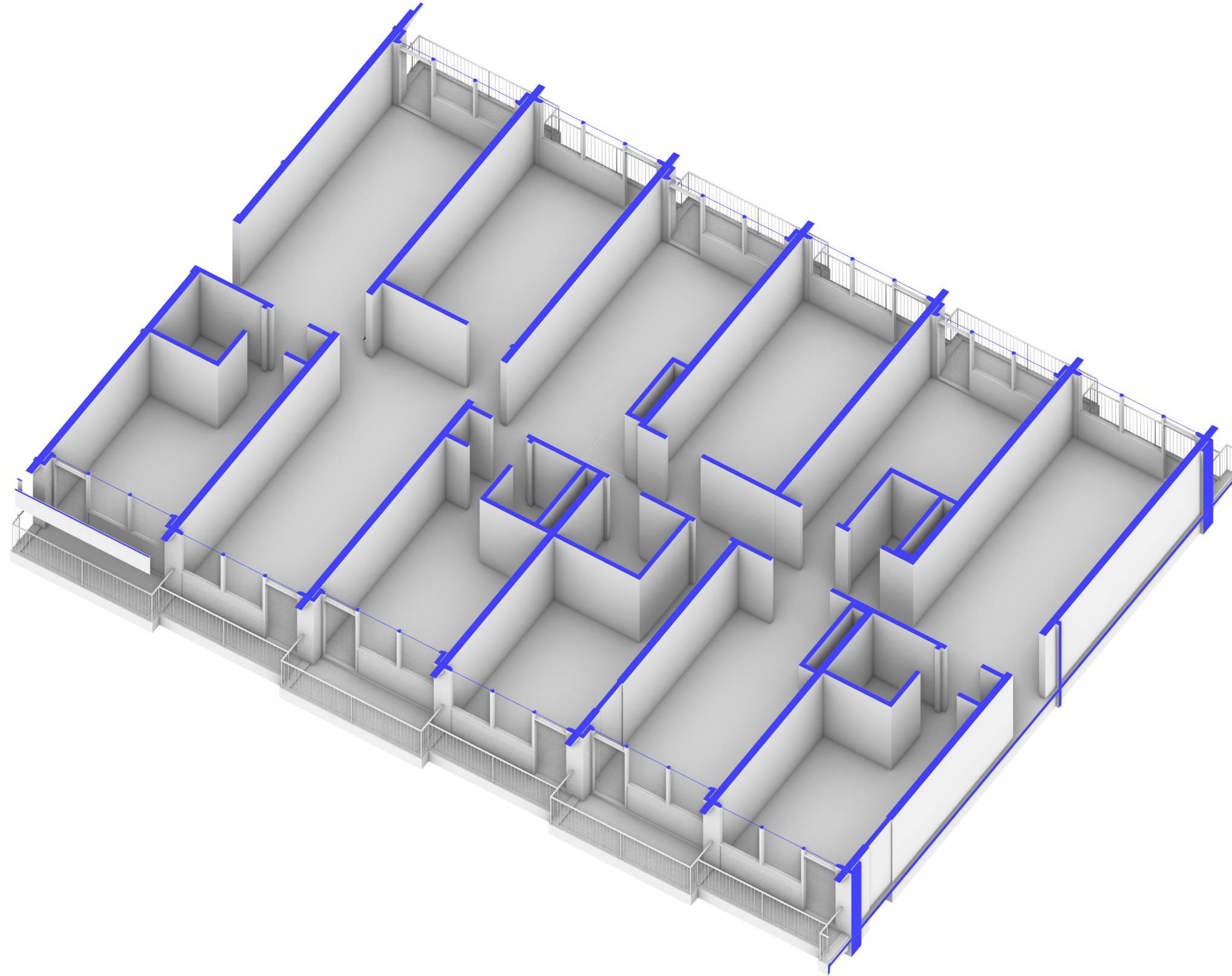
8: Harvesting the existing

12 stories

Typical floor plan



8: Harvesting the existing

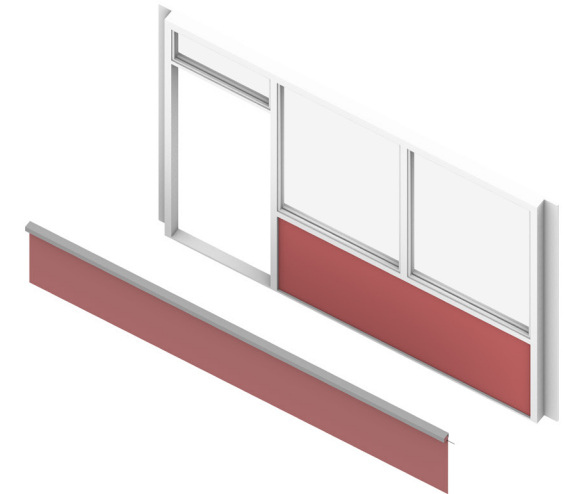


Prefab balconies
concrete
x144 (type A)
0,75 m³ concrete each
= 25 tons of CO₂ equivalent

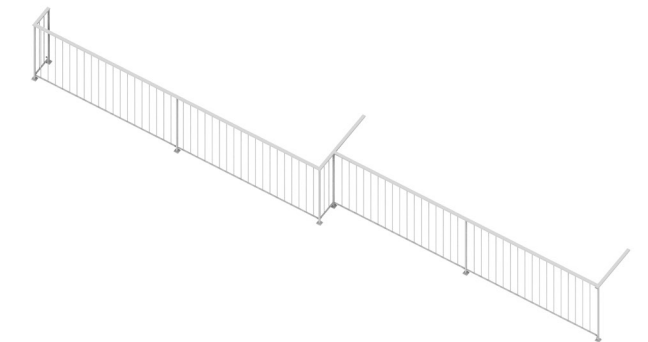


x144 (type B)
0,50 m³
= 16,5 tons of CO₂ equivalent

Facade elements
glass, timber, solar
shading
x288



Aluminum guardrails
x144 (type A)
x144 (type B)
200+ MJ embodied
energy per kg

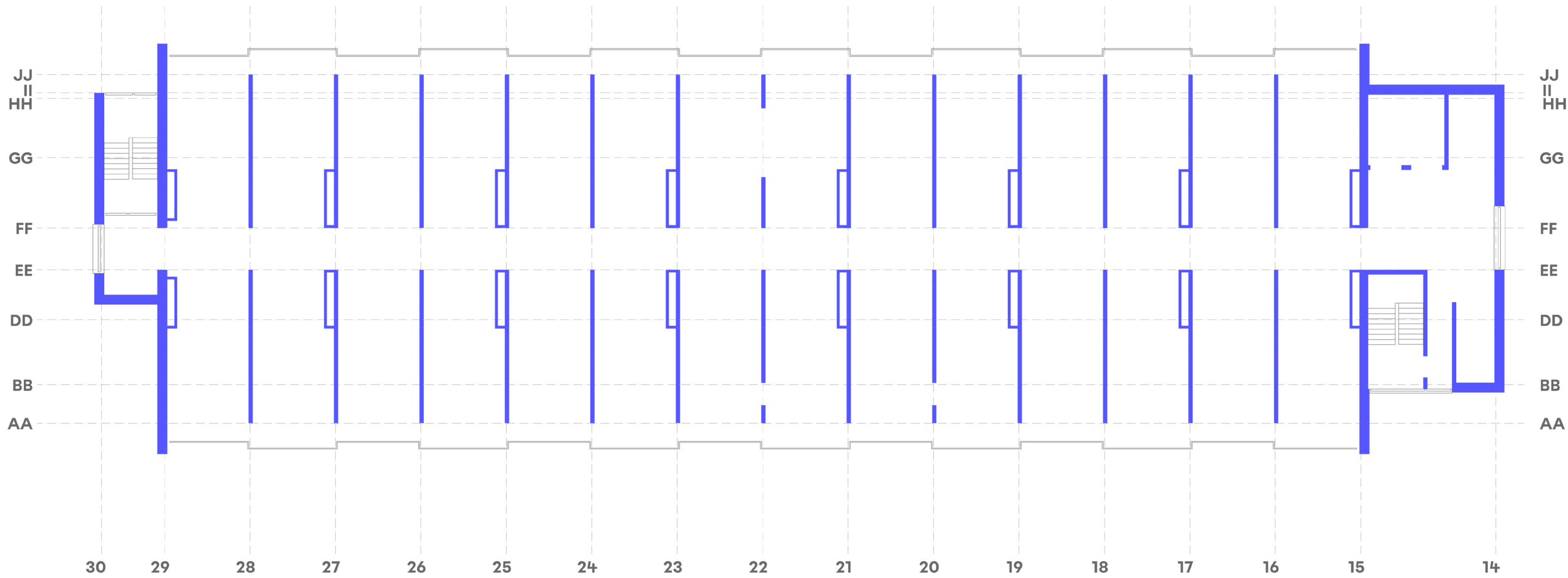


8: Harvesting the existing

18 cm
reinforced
concrete
structural walls

Vertical
ductwork
already present

Small
differences in
wall openings



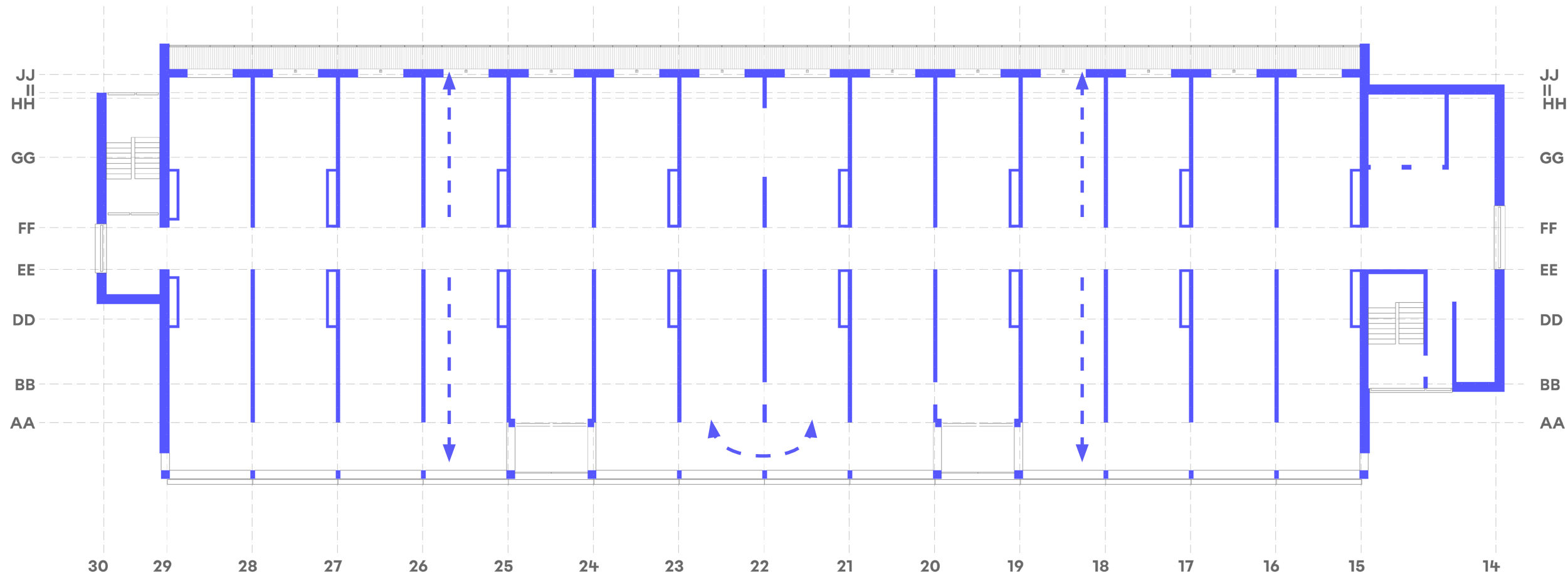
9: Designing a cooperative community

First principle:
facade
extension

More spatial
flexibility

More usable
space

Better thermal
performance



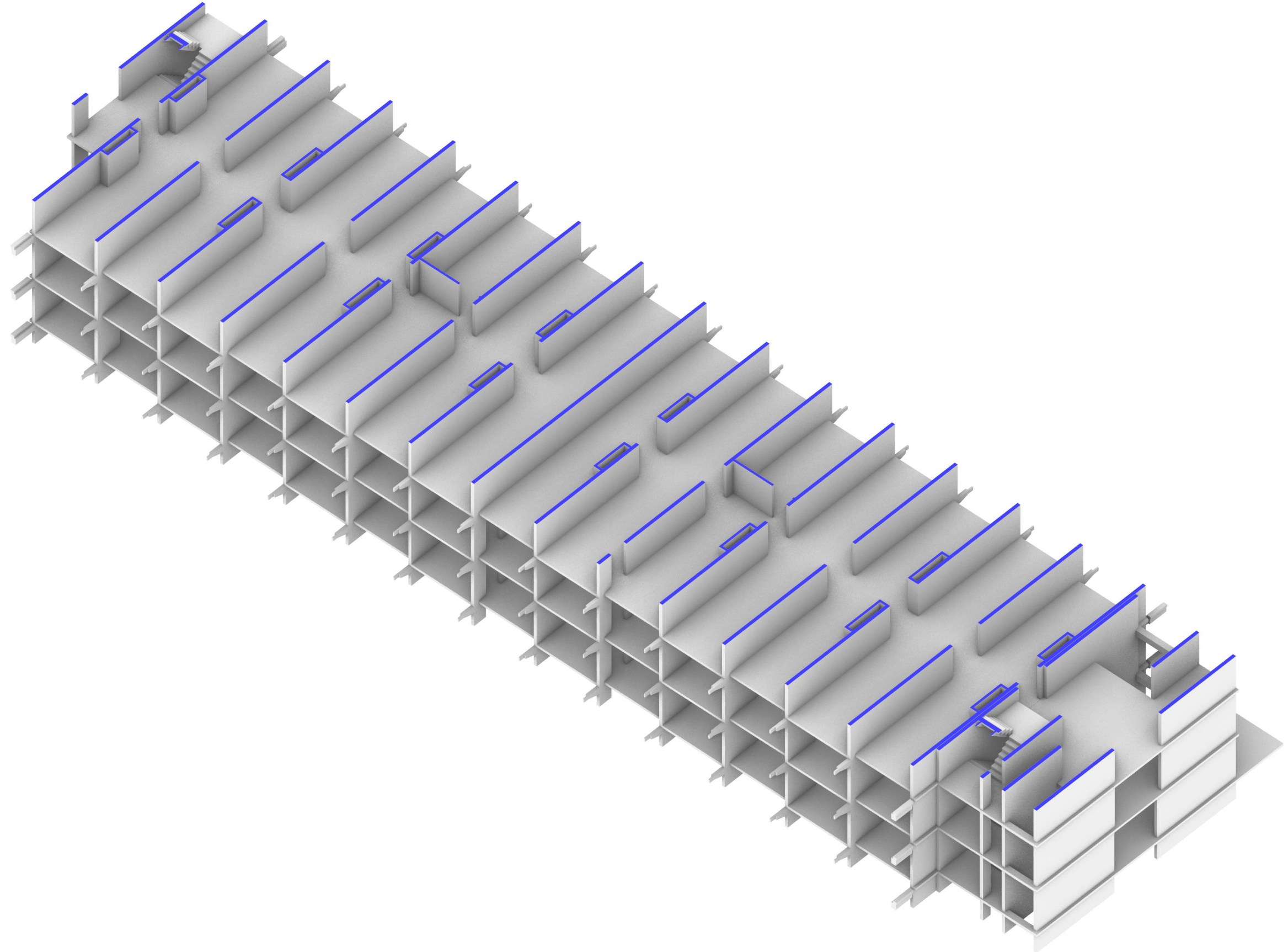
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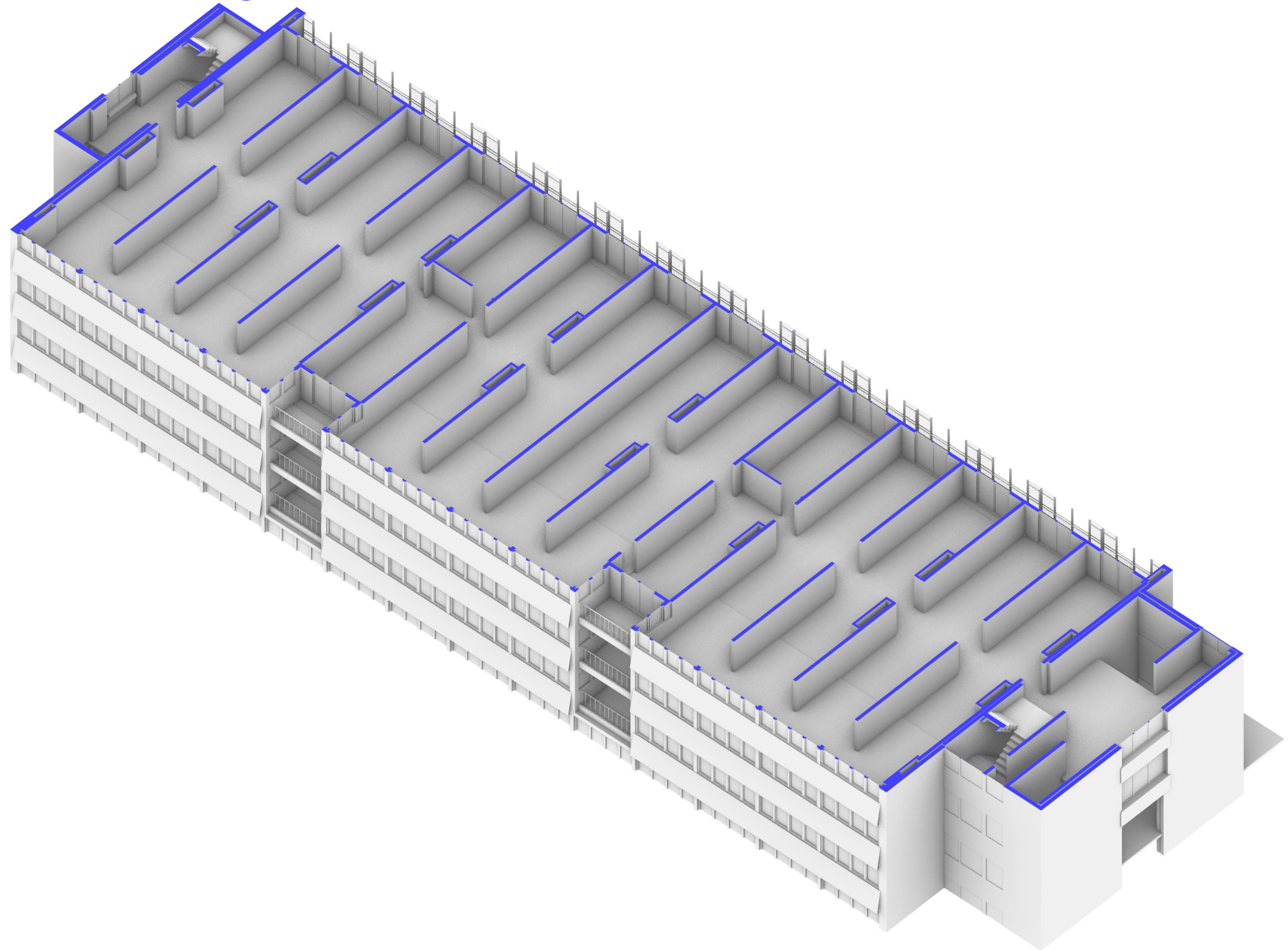
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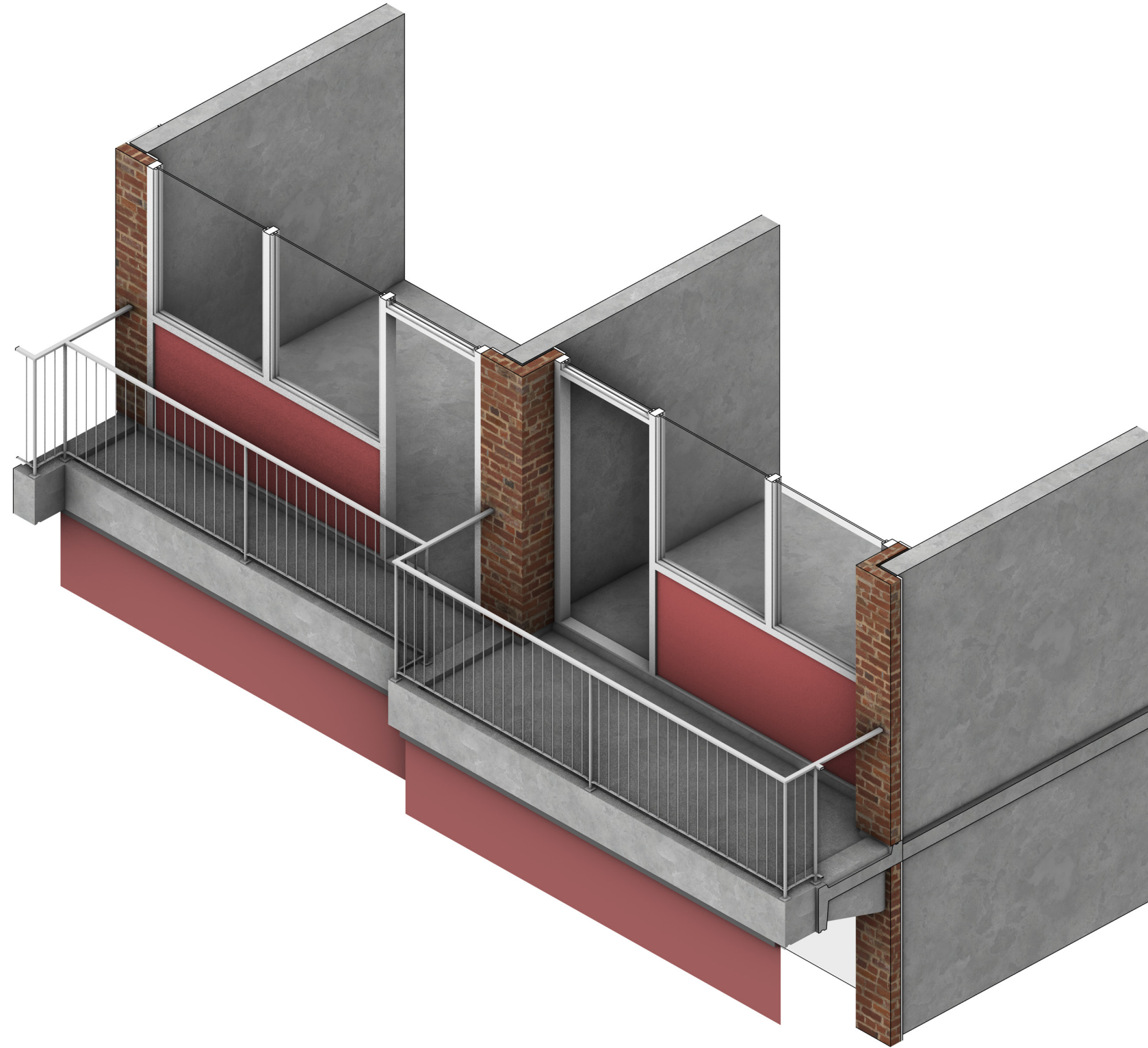
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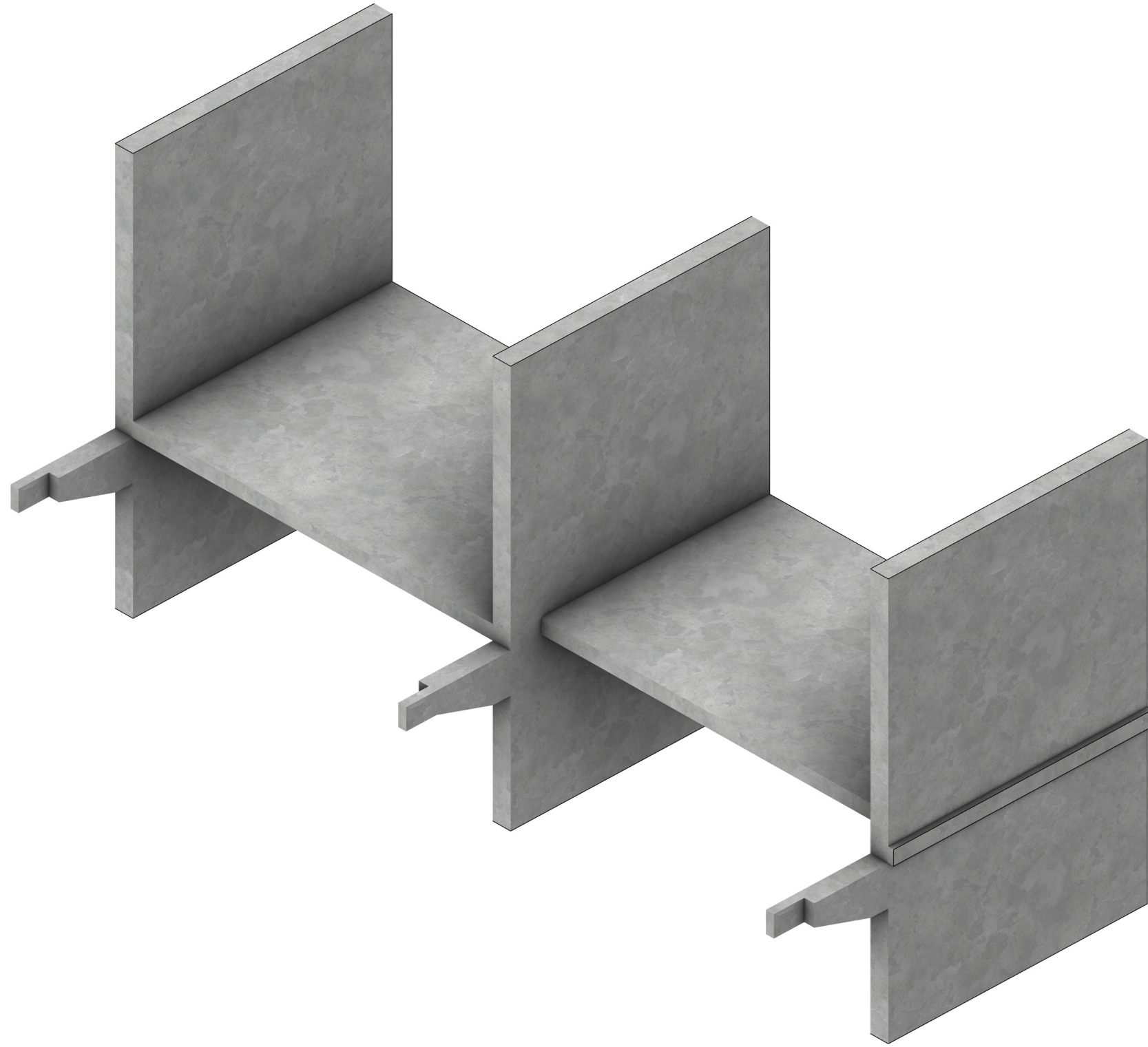
Harvest the old



9: Designing a cooperative community

Harvest the old

Retain the structure

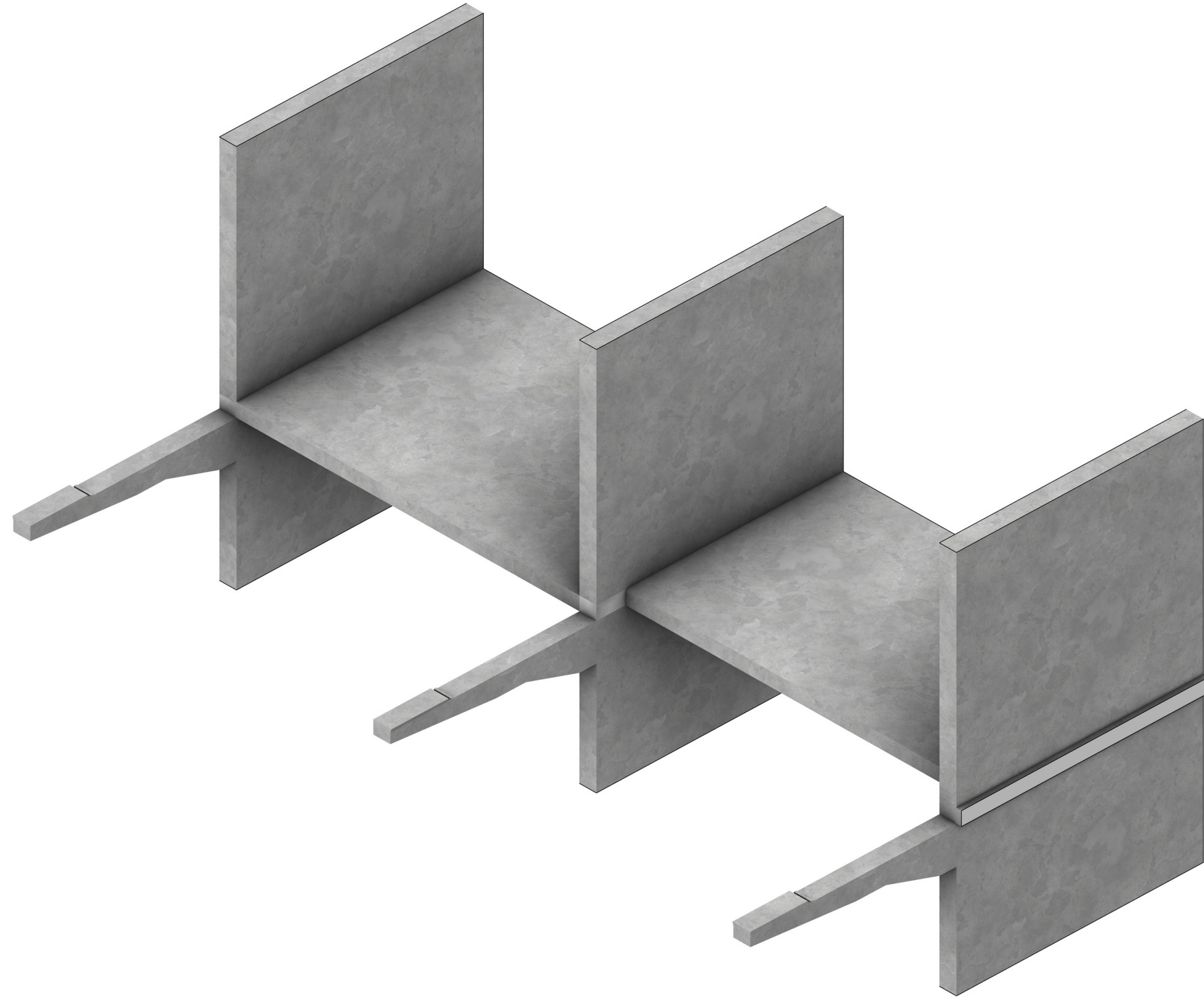


9: Designing a cooperative community

Harvest the old

Retain the structure

Add what is necessary



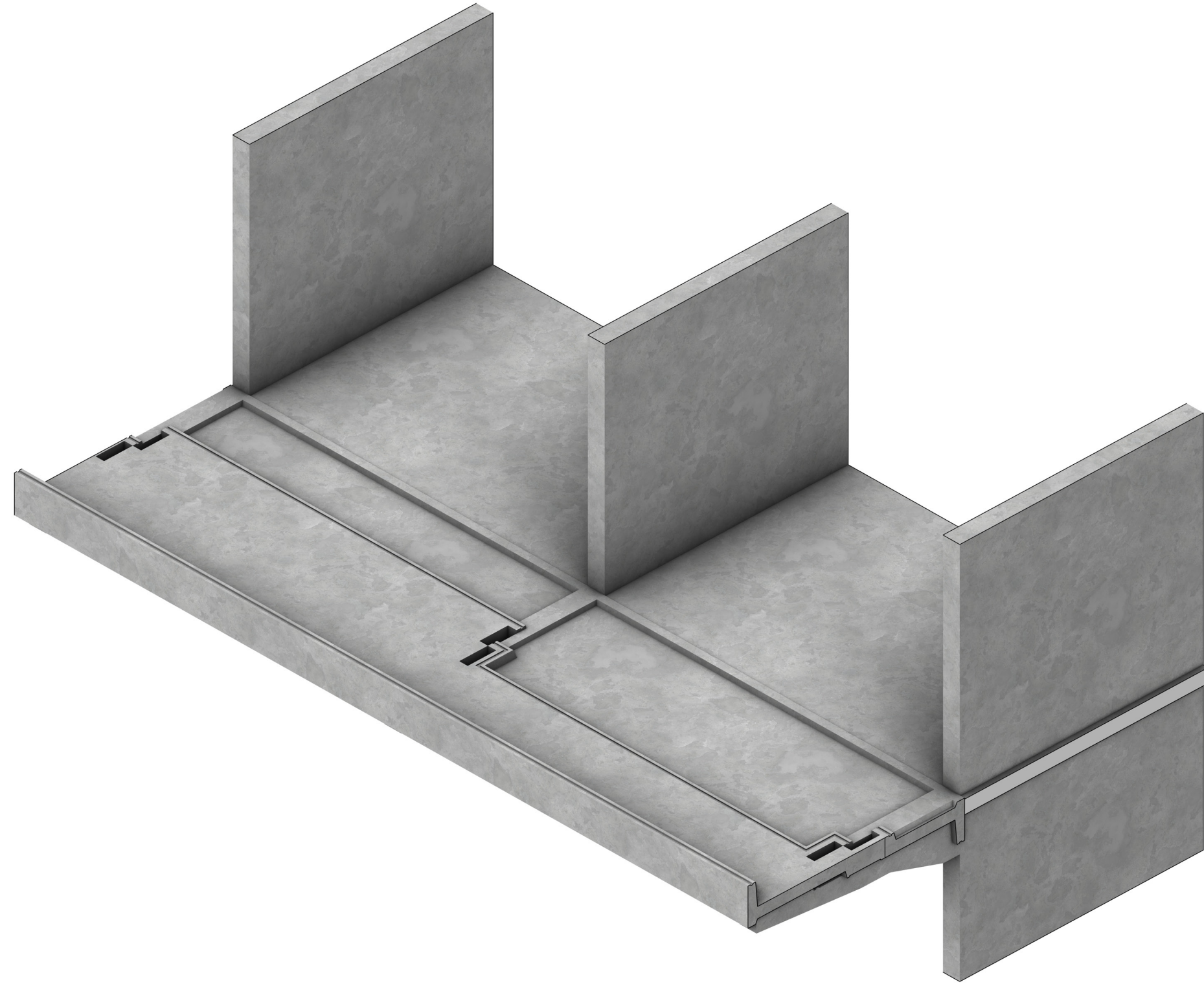
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Add what is necessary

Re-use what you can



9: Designing a cooperative community

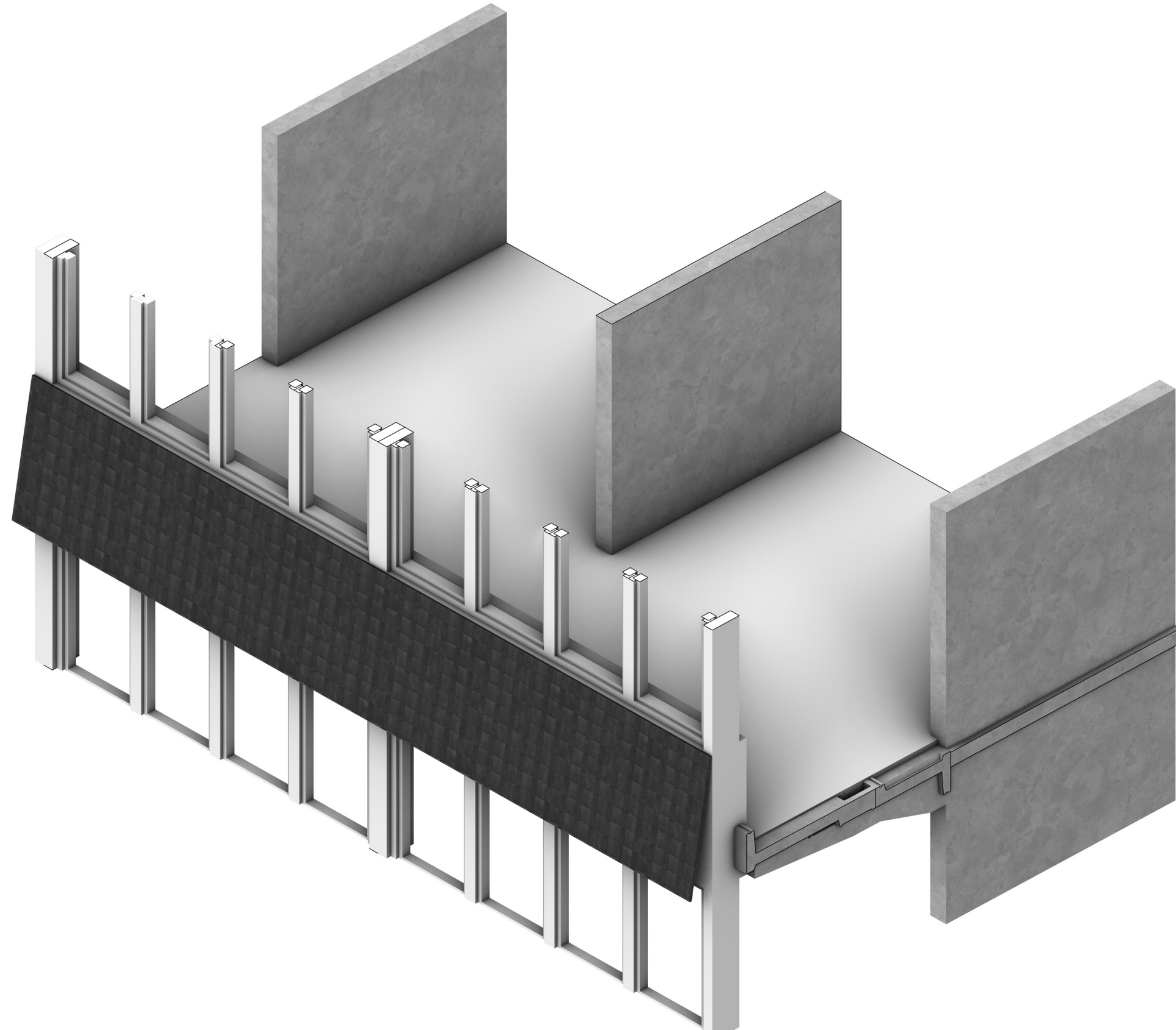
Harvest the old

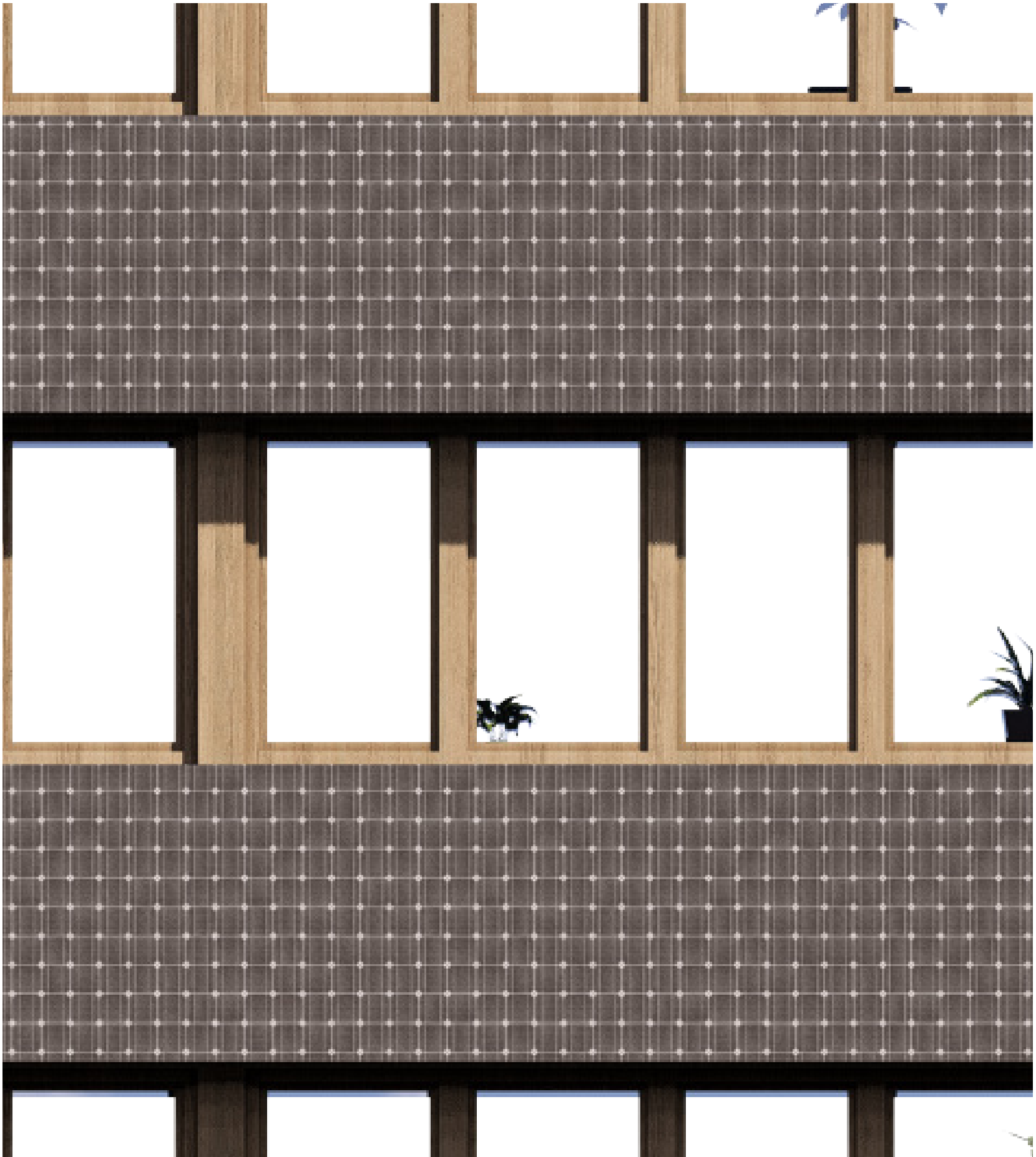
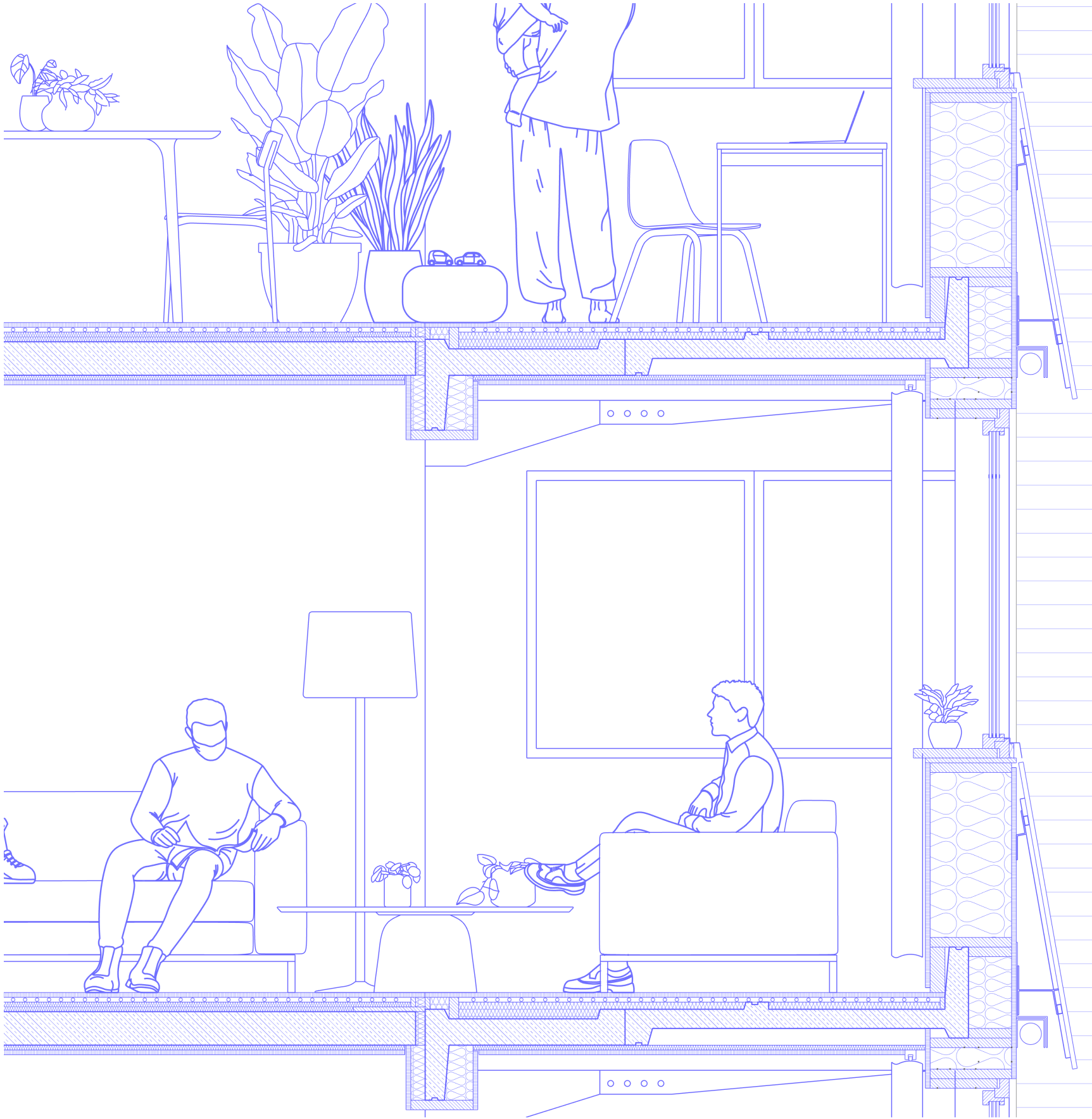
Retain the structure

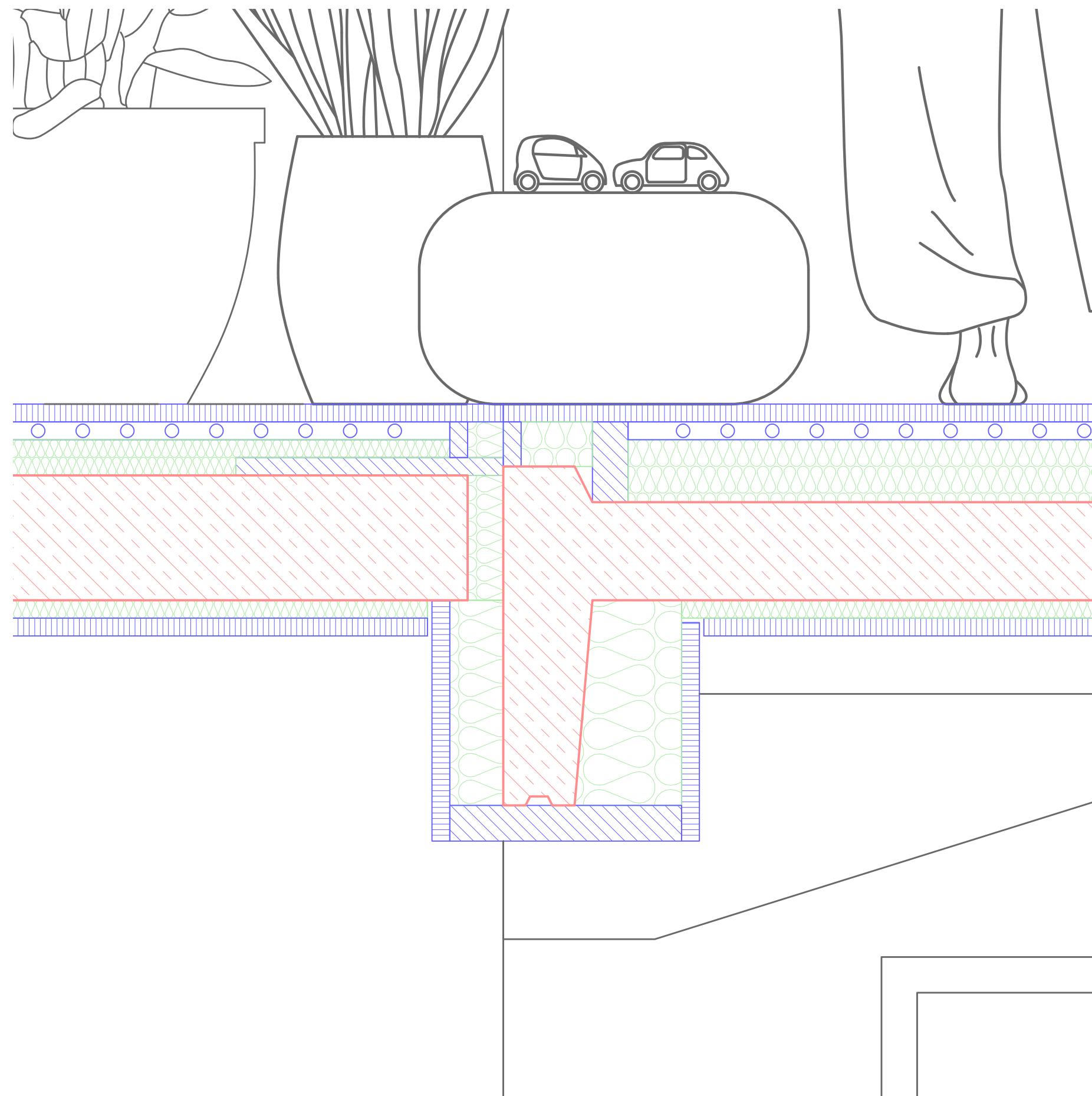
Add what is necessary

Re-use what you can

Ensure the rest is
renewable







- Re-used from building
- Locally harvested material
- New, renewable material

1:5 western facade detail



Concrete:
230kg CO₂ / m³ equivalent



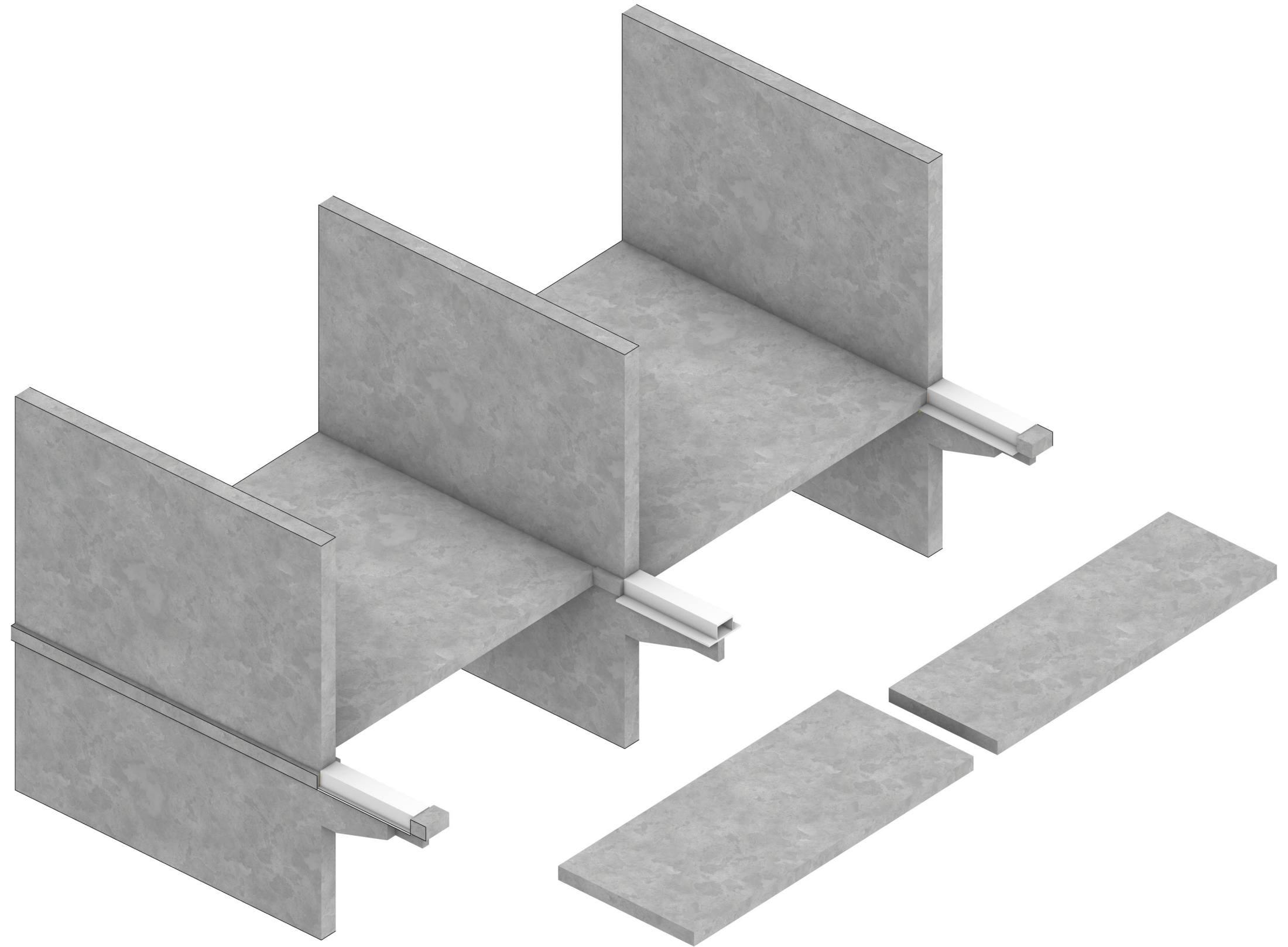
Reed/Straw insulation:
-128 kg CO₂ / m³ equivalent
Stone wool
70 CO₂ / m³ equivalent

9: Designing a cooperative community

Harvest the old

Retain the structure

Re-use old elements



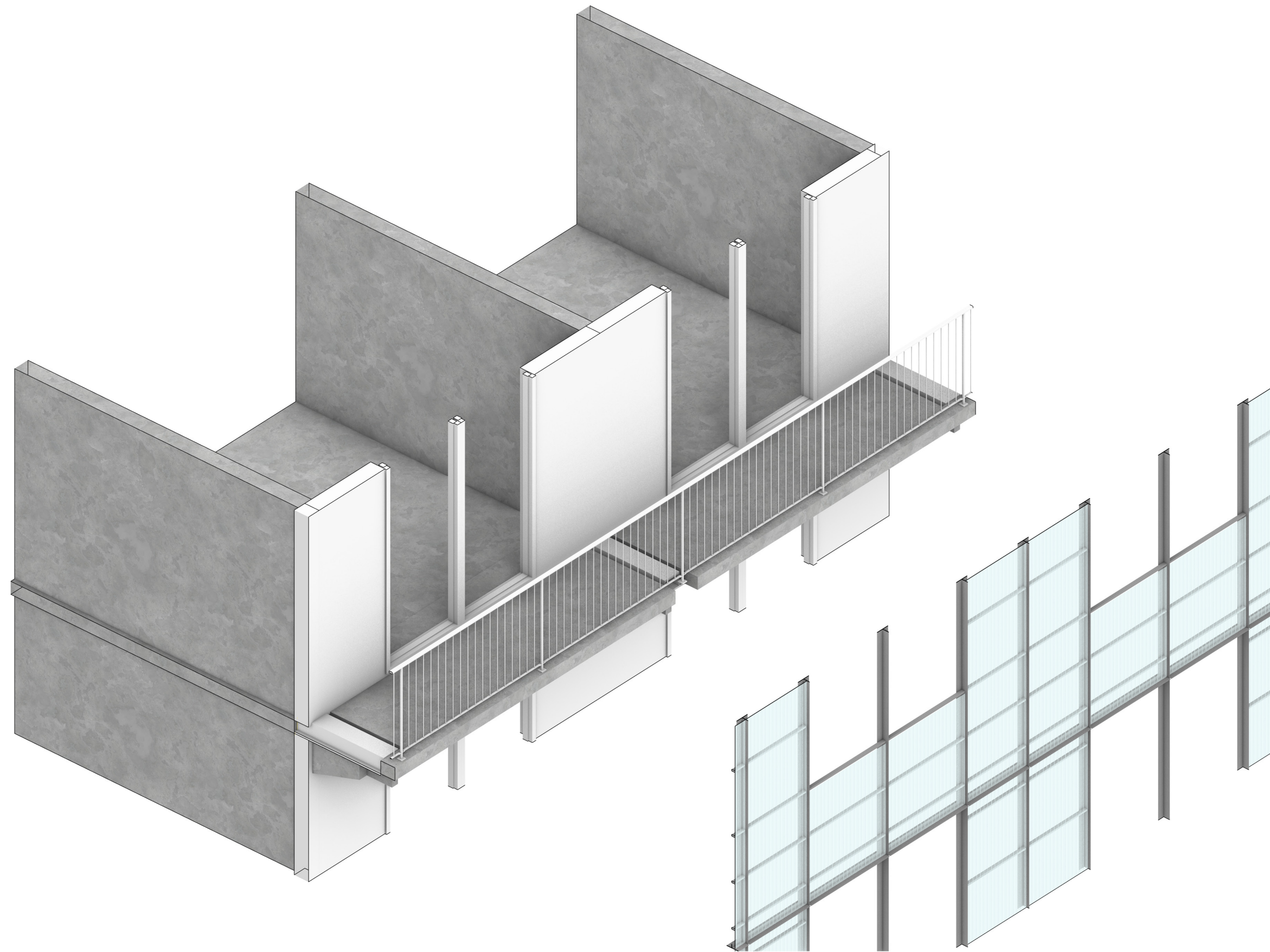
9: Designing a cooperative community

Harvest the old

Retain the structure

Re-use old elements

Add only what is necessary



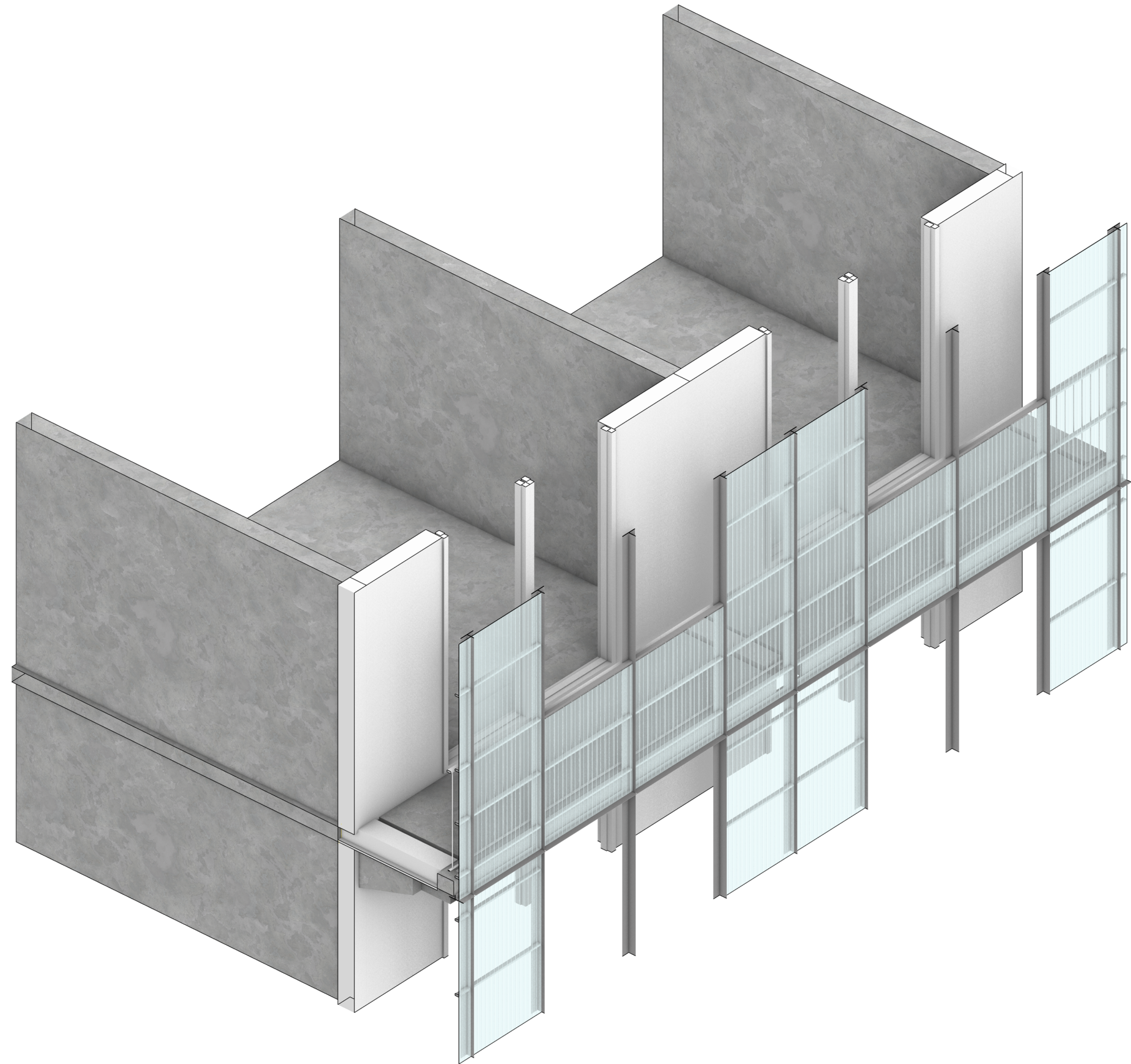
9: Designing a cooperative community

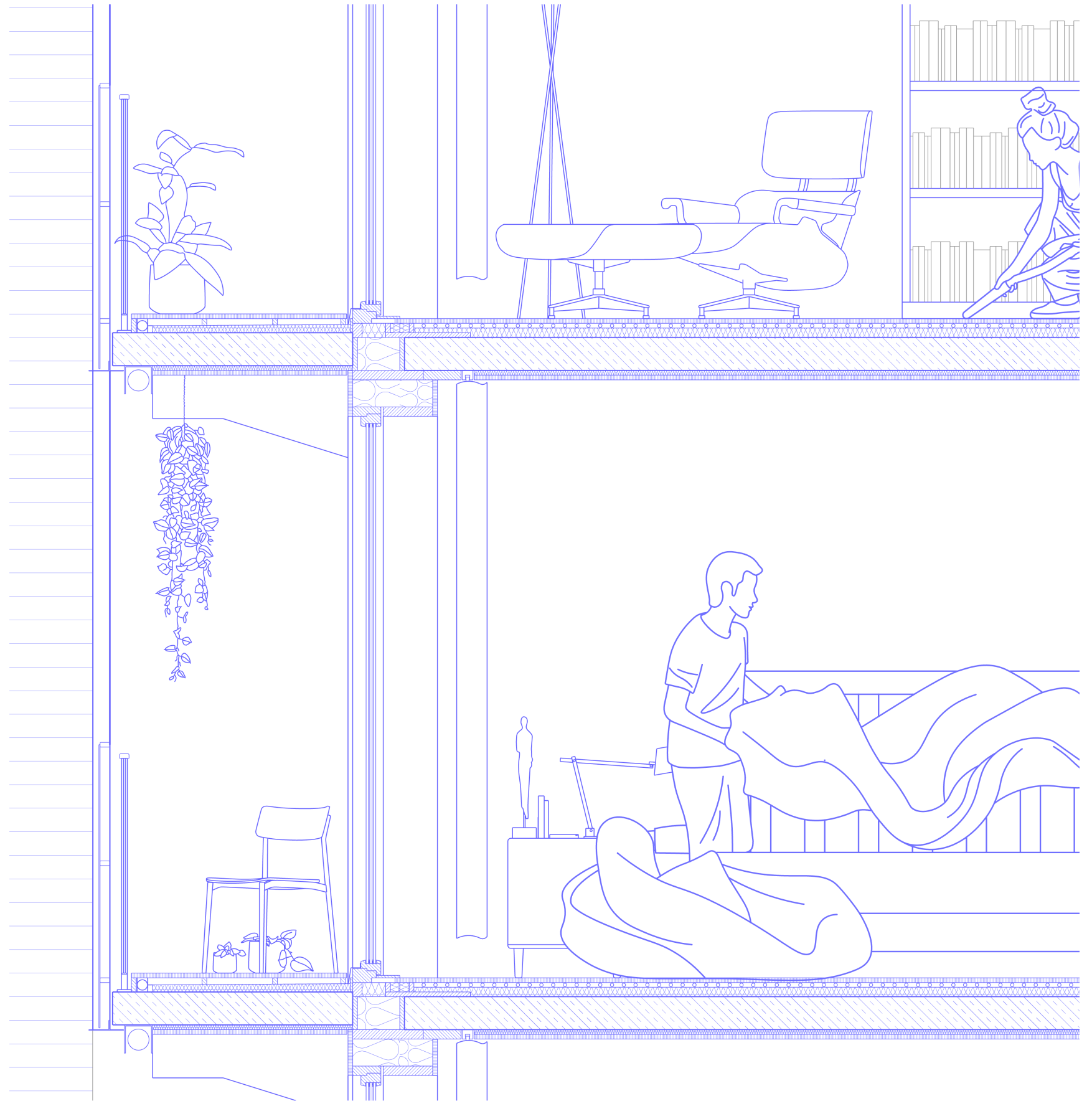
Harvest the old

Retain the structure

Re-use old elements

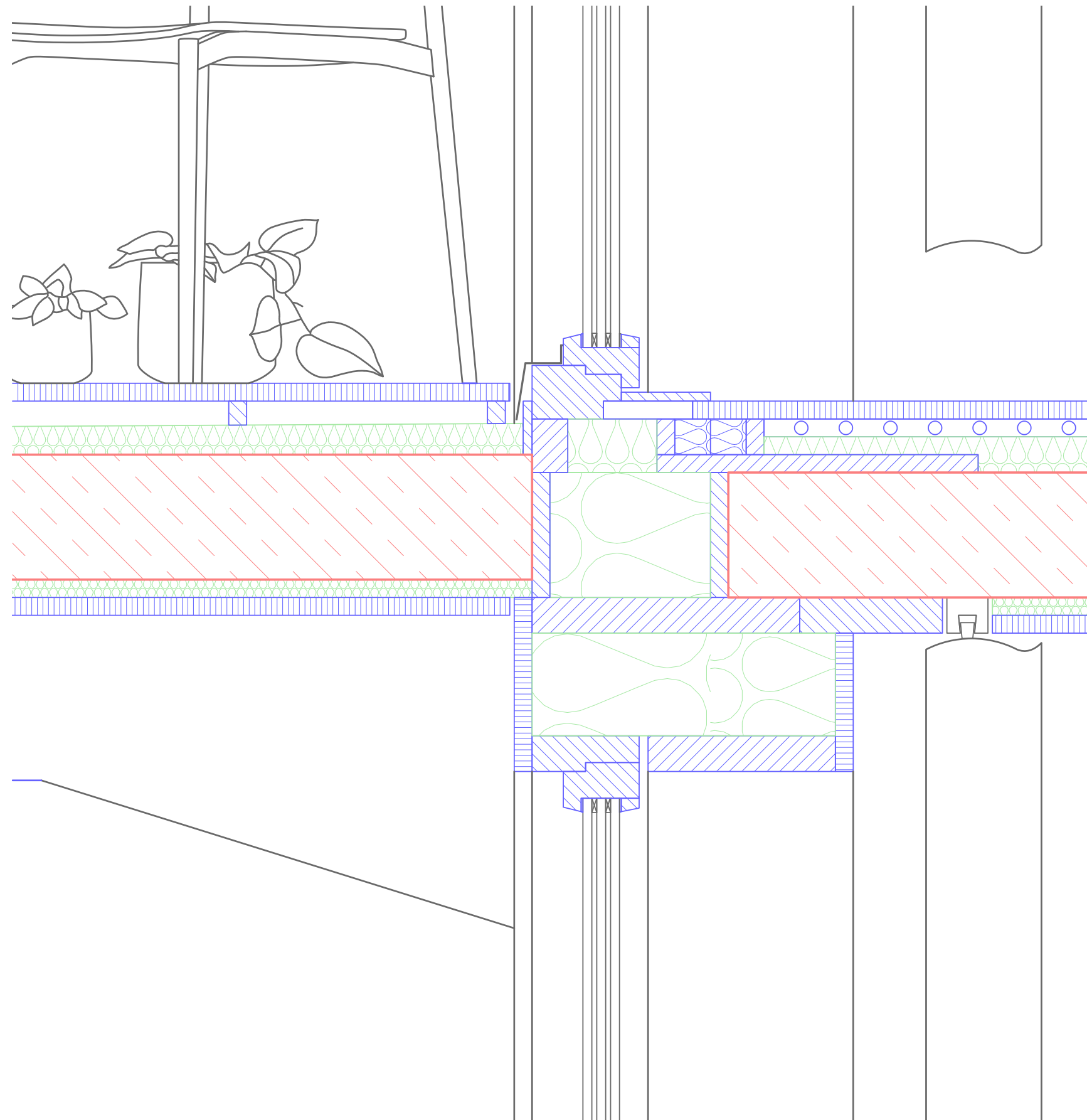
Add only what is necessary





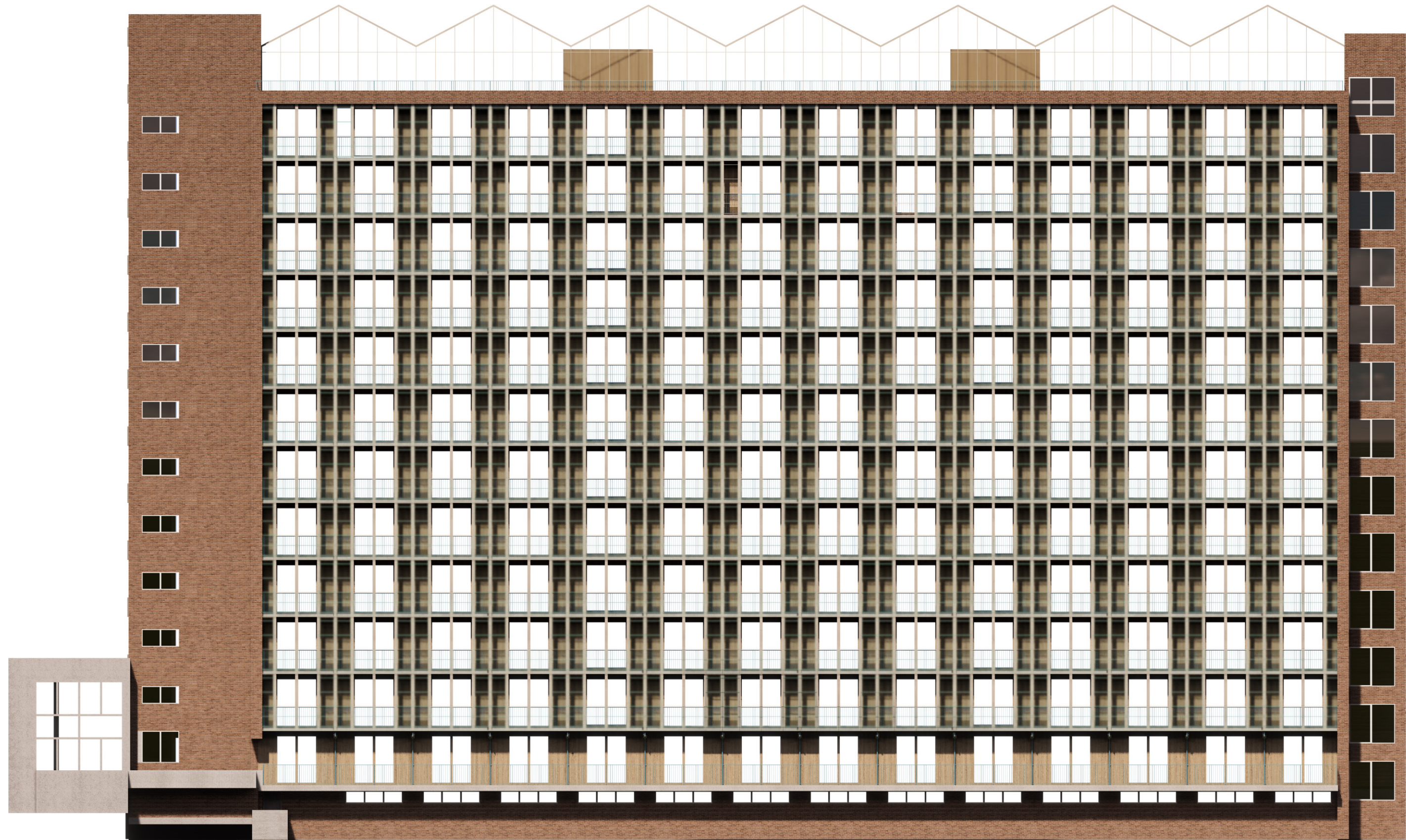
- Re-used from building
- Locally harvested material
- New, renewable material

1:5 eastern facade detail



Aluminum:
230 MJ per kg

9: Designing a cooperative community

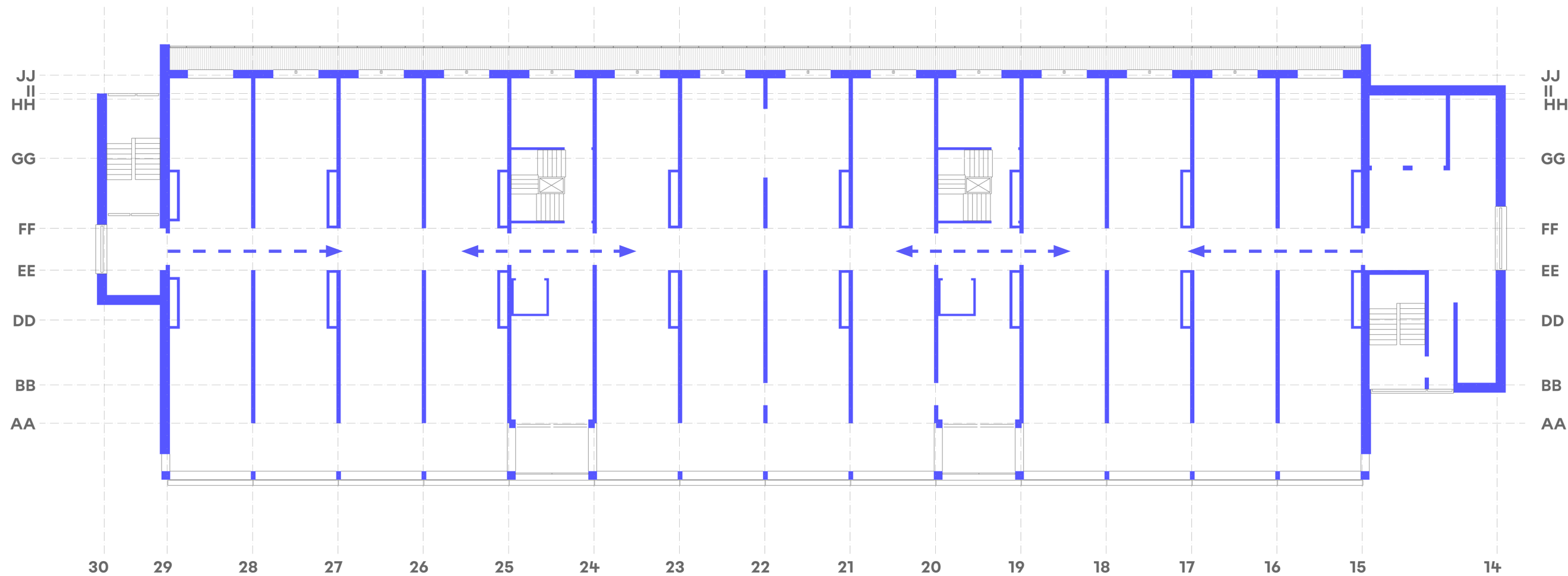


9: Designing a cooperative community



9: Designing a cooperative community

- Second principle:
new vertical cores
- Make more efficient
spatial use possible
- Two new cores for
greater flexibility in
plan
- More corridor space
can be re-used for
housing
- Better fire-safety



9: Designing a cooperative community

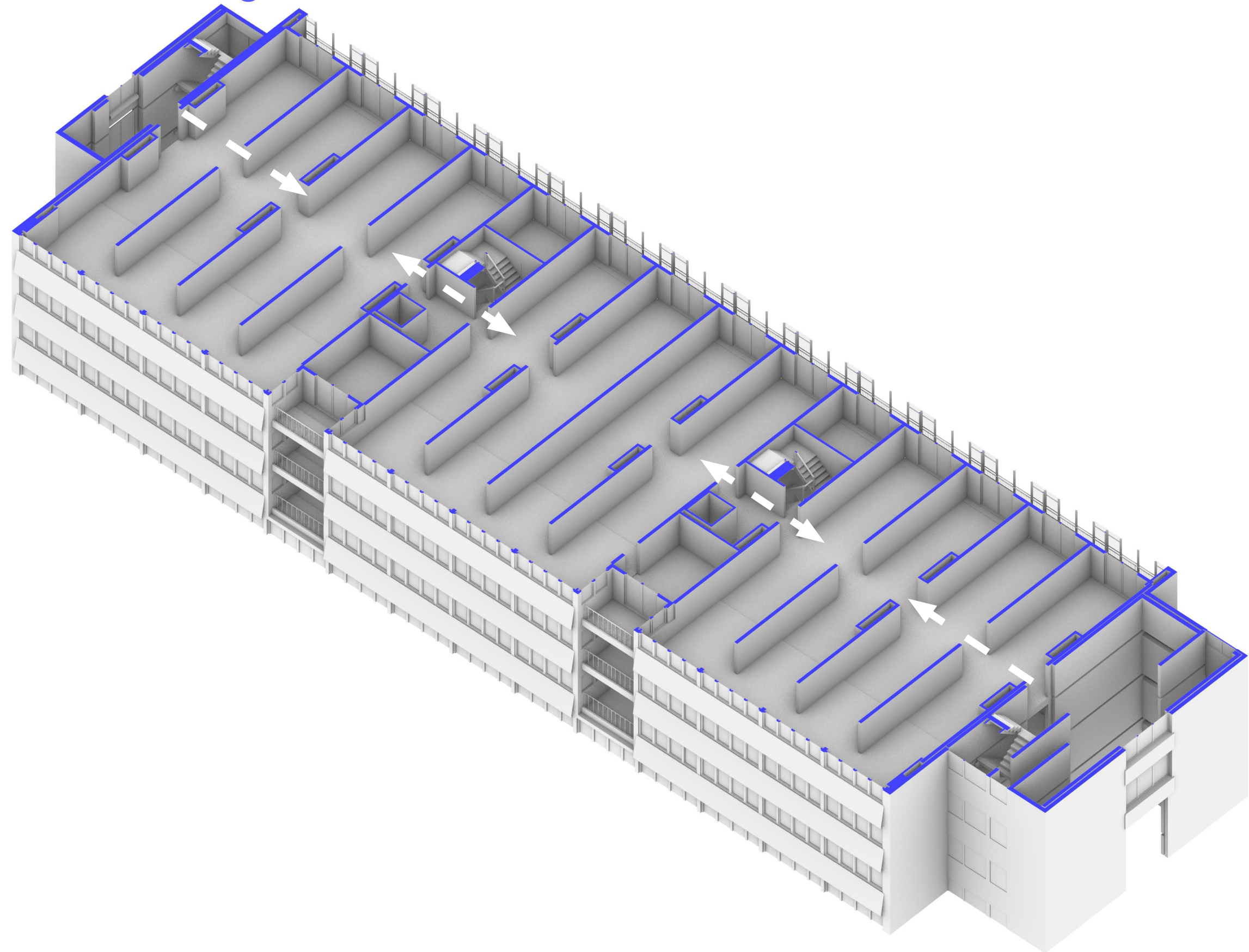
Second principle:
new vertical cores

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Two new cores for
greater flexibility in
plan

More corridor space
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9: Designing a cooperative community

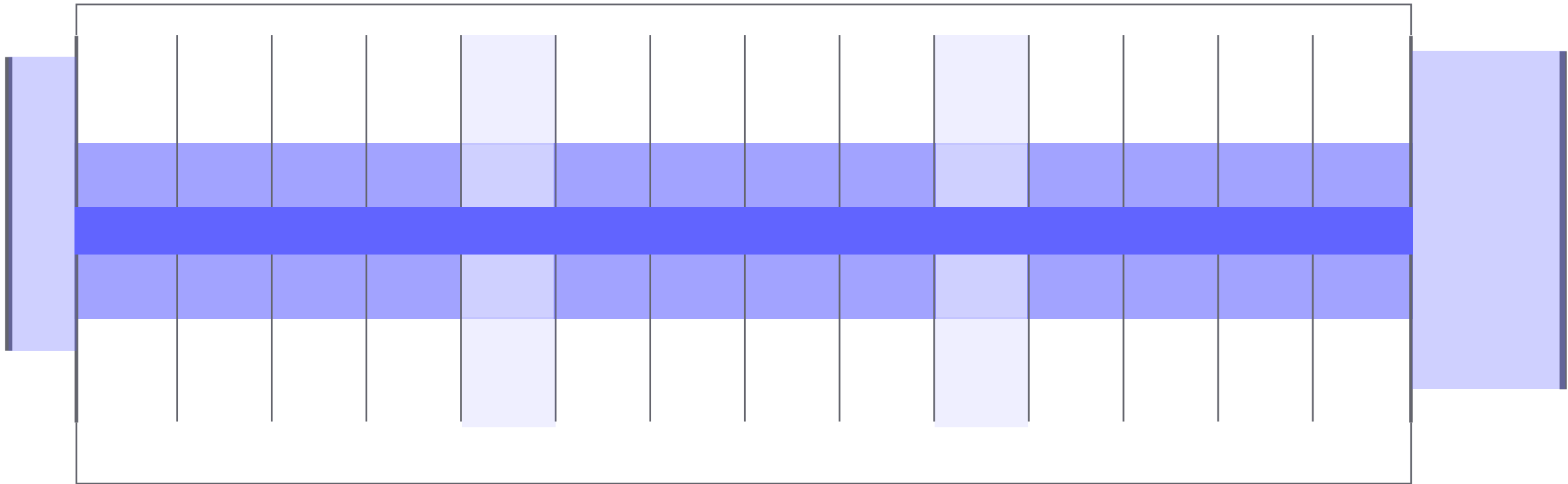
Four main access cores

Main corridor

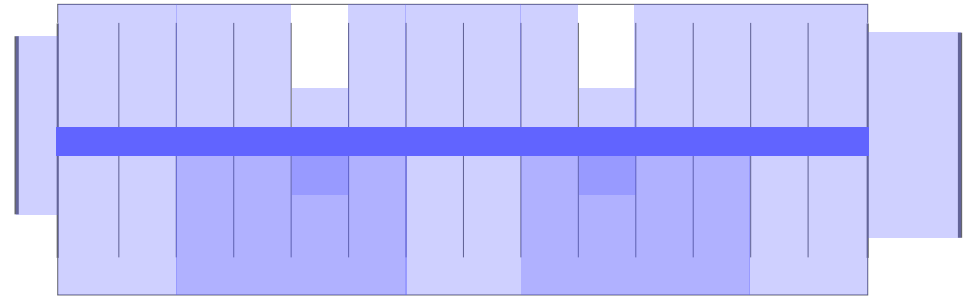
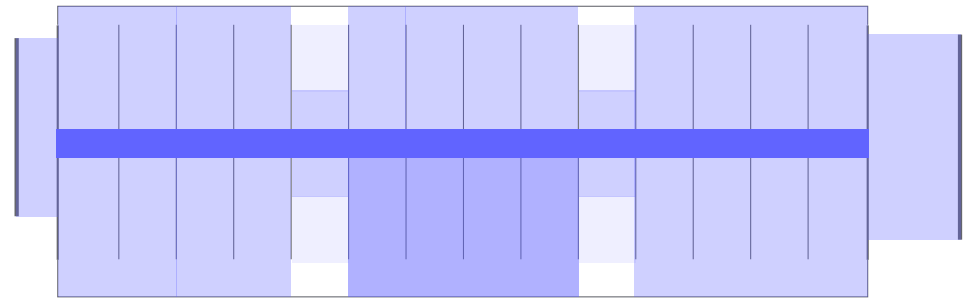
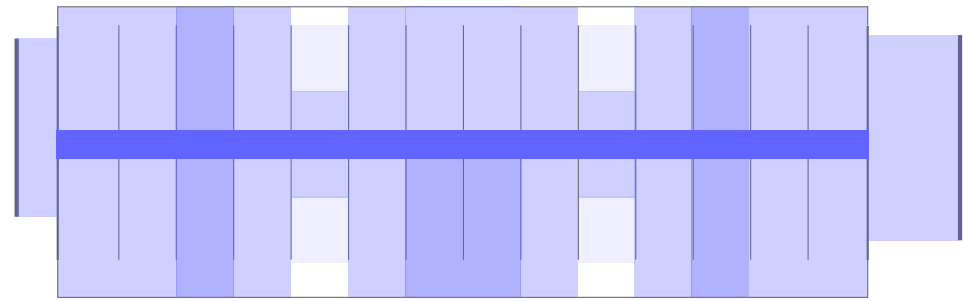
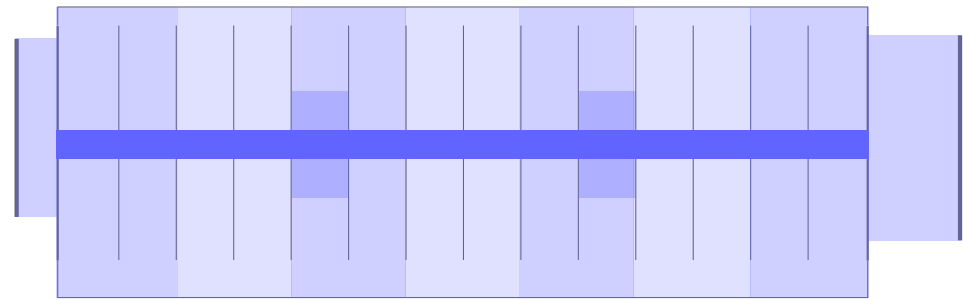
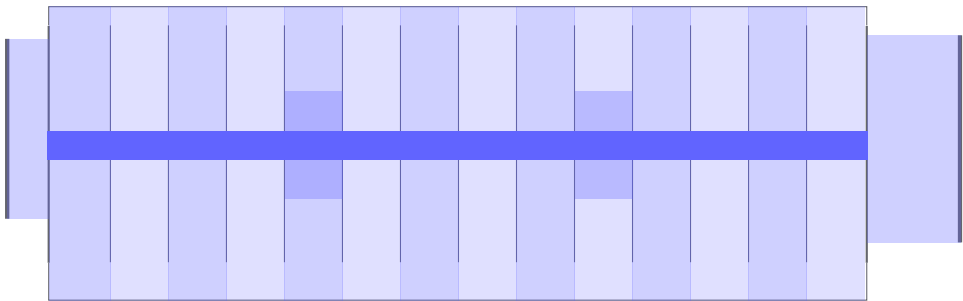
Kitchens / bathrooms
on either side

Adaptable rooms near
each middle core

Usable spaces along the
facade



9: Designing a cooperative community



Housing possibilities

Independant studio's

Shared clusters

Row-houses

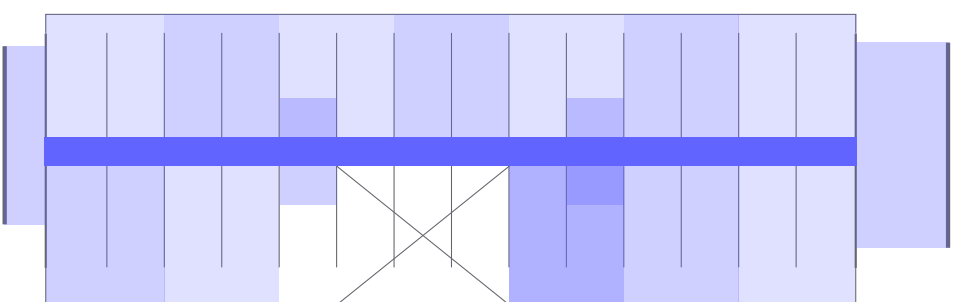
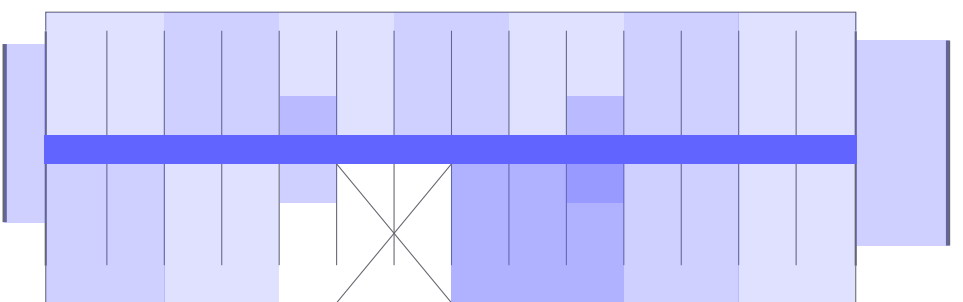
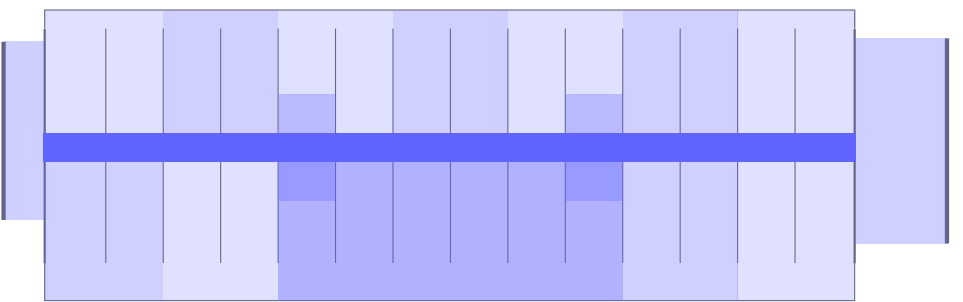
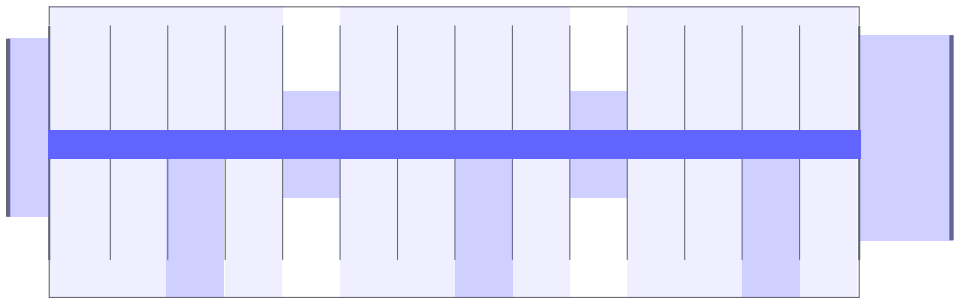
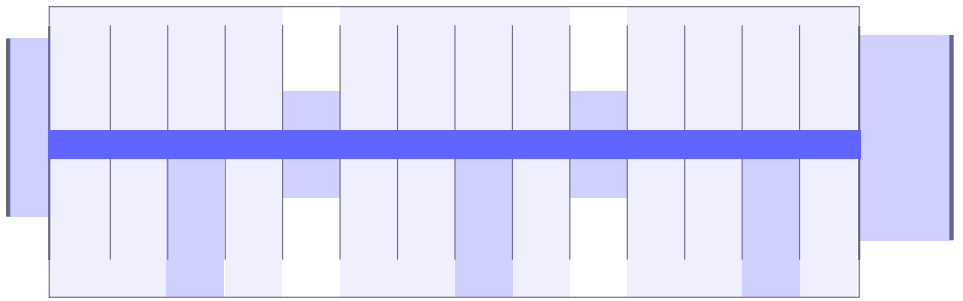
Working/living homes

Family apartments

Guest rooms

Assisted living

Ranging from
14m² to 140m²



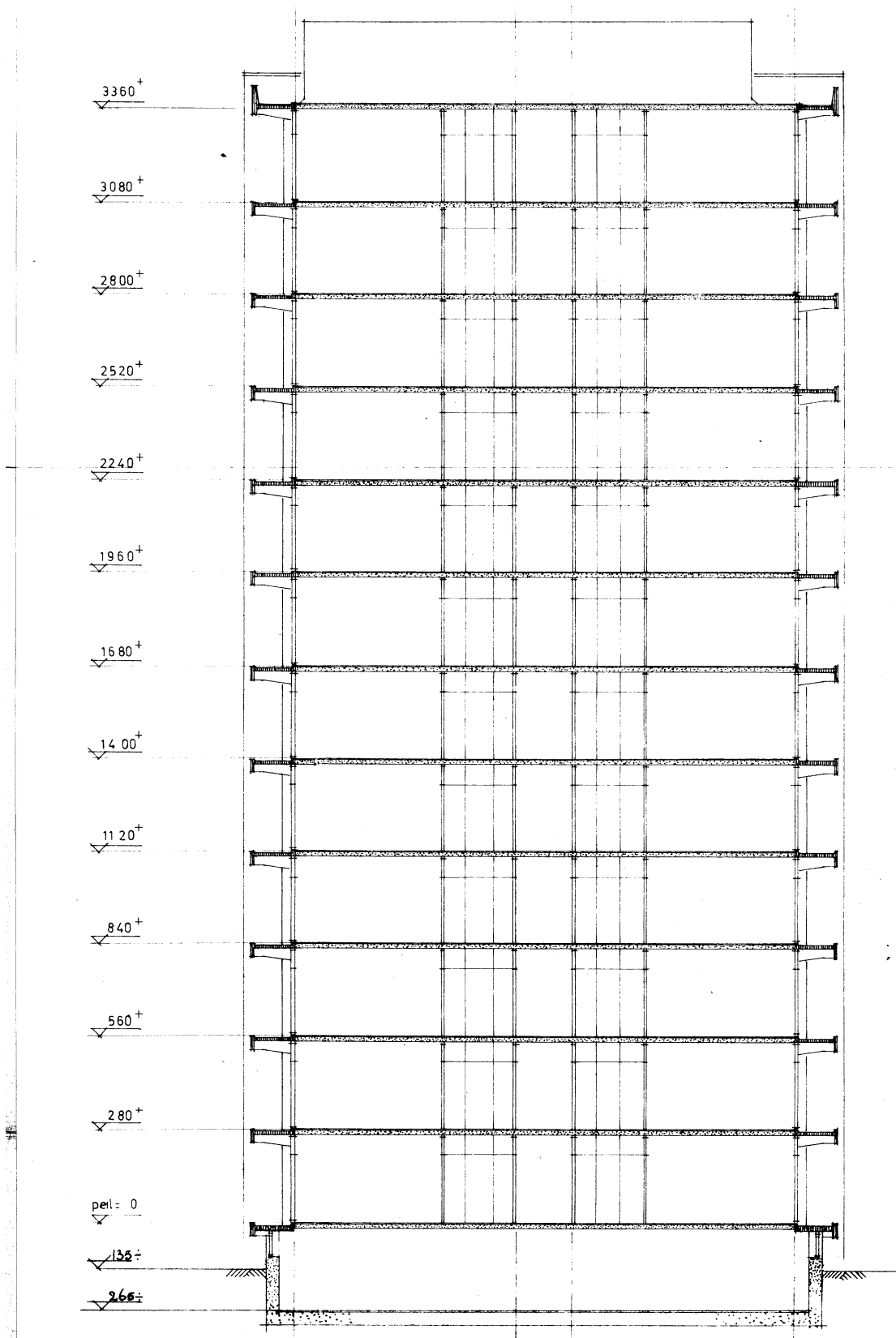
9: Designing a cooperative community



... and
many more

9: Designing a cooperative community

From the past...



9: Designing a cooperative community

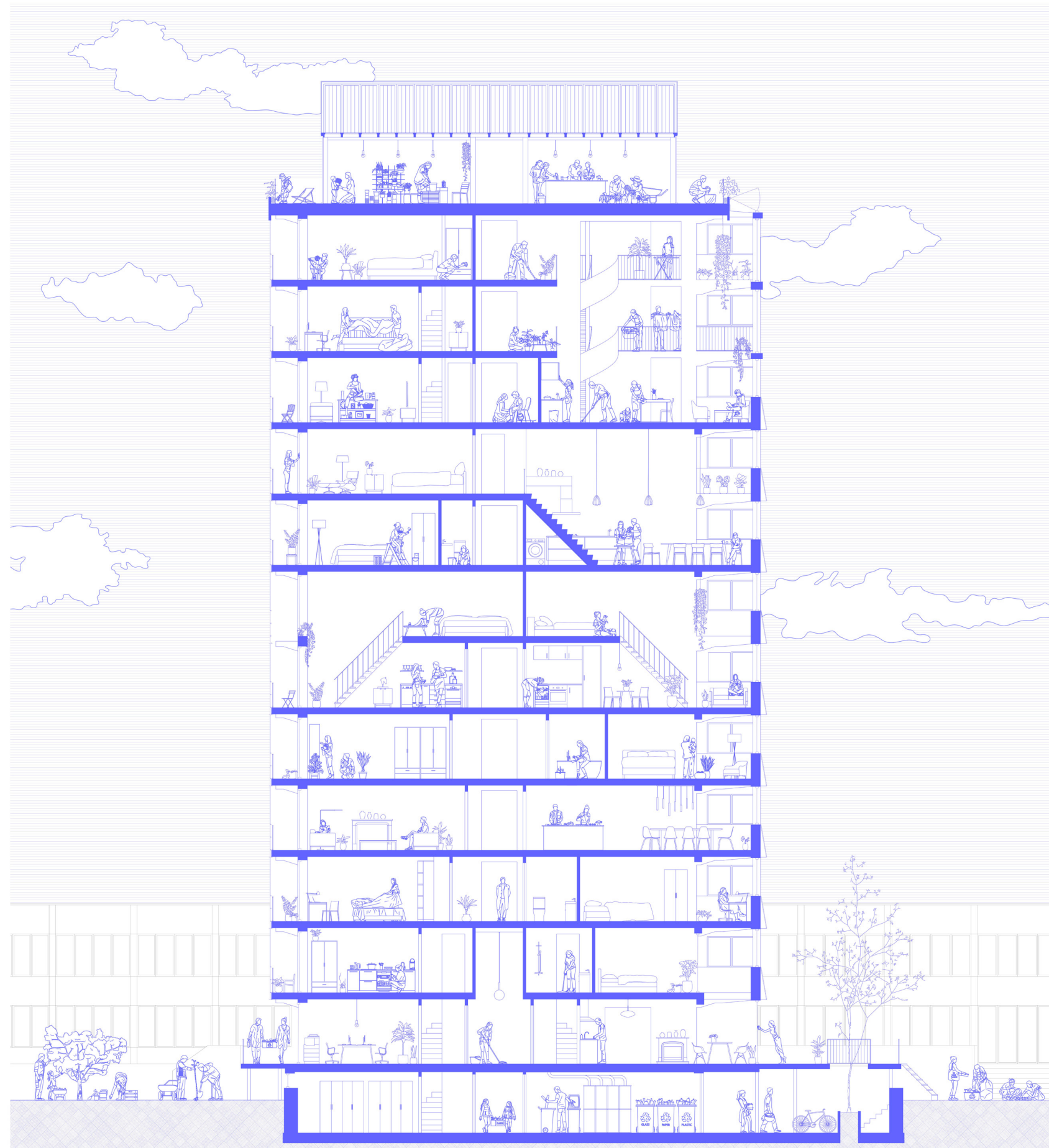
... to the future

Compact, yet qualitative
housing for 200 people

Made possible by cooperative
ownership

For a 2000-watt way of life

Realised from an old existing
structure



Electricity

Minimal 2000W threshold requirement:
ca. 35.000 kWh per year

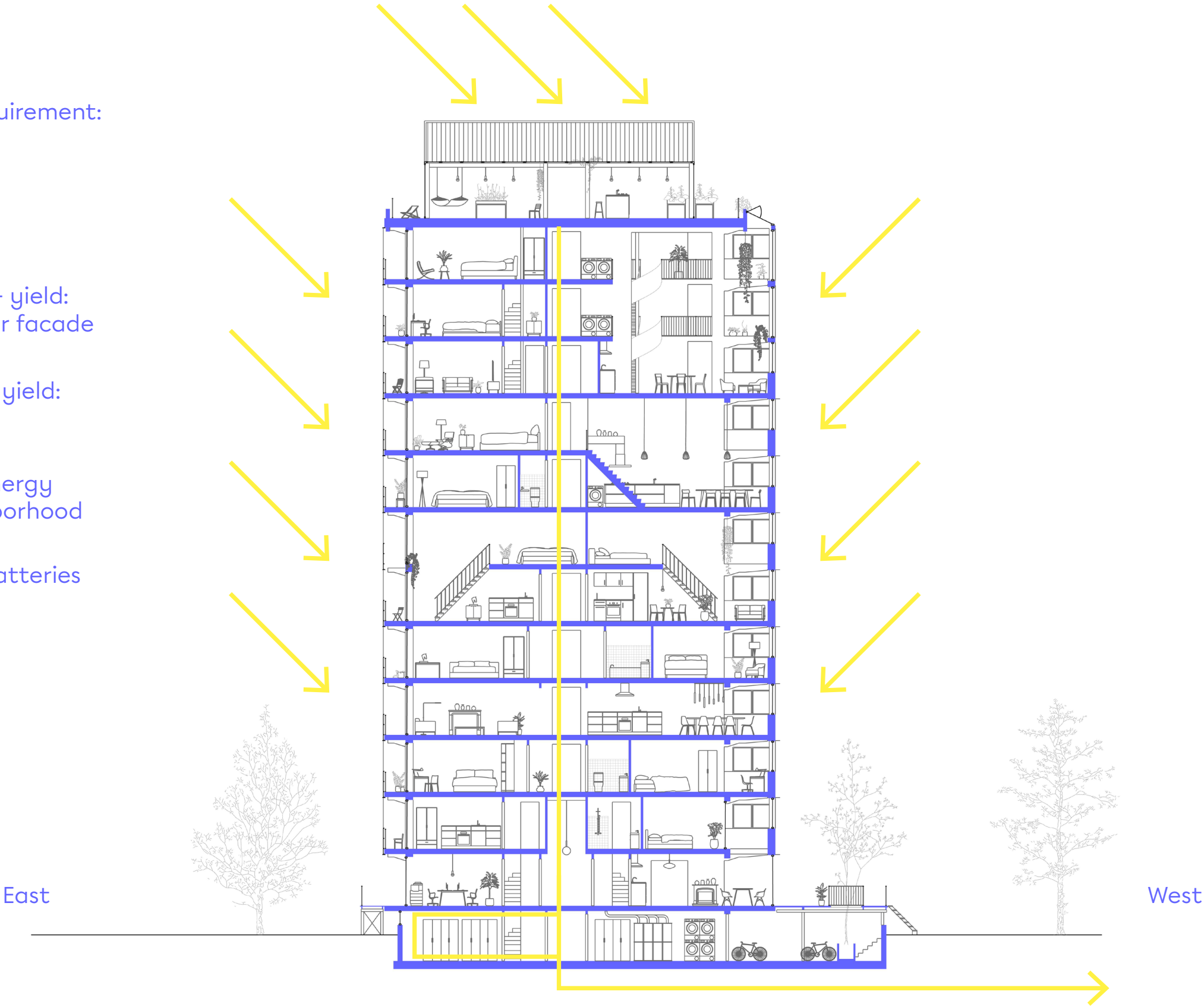
Greenhouse roof PVT- yield:
ca. 45.000 kWh per year

East/west facade possible PV- yield:
up to 35.000 kWh per year per facade

Southern facade possible PV- yield:
up to 60.000 kWh per year

Up to 140.000 kWh of solar energy
can be supplied to the neighborhood

Can be stored in basement batteries

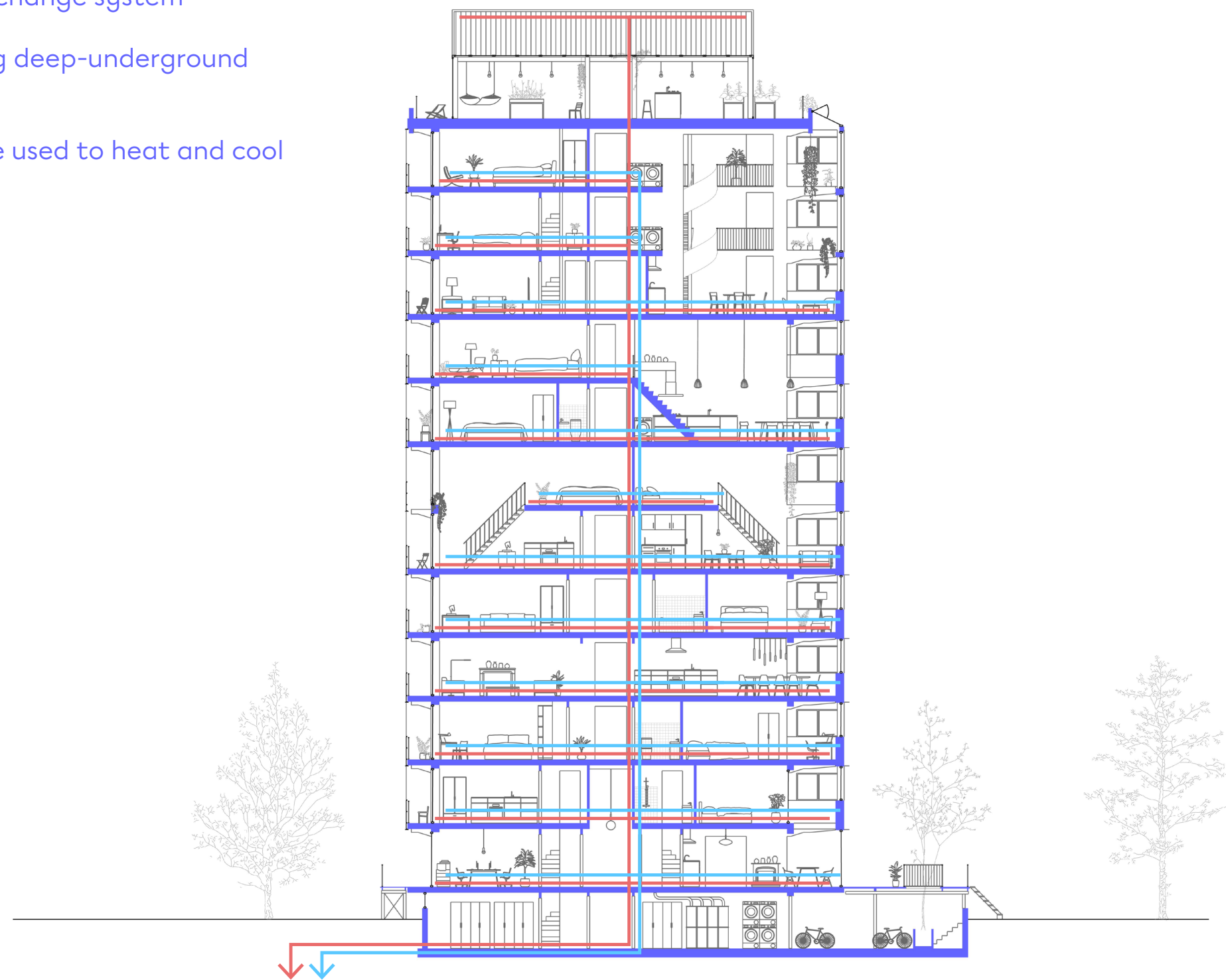


Heating / Cooling

Floor heating / cooling heat exchange system

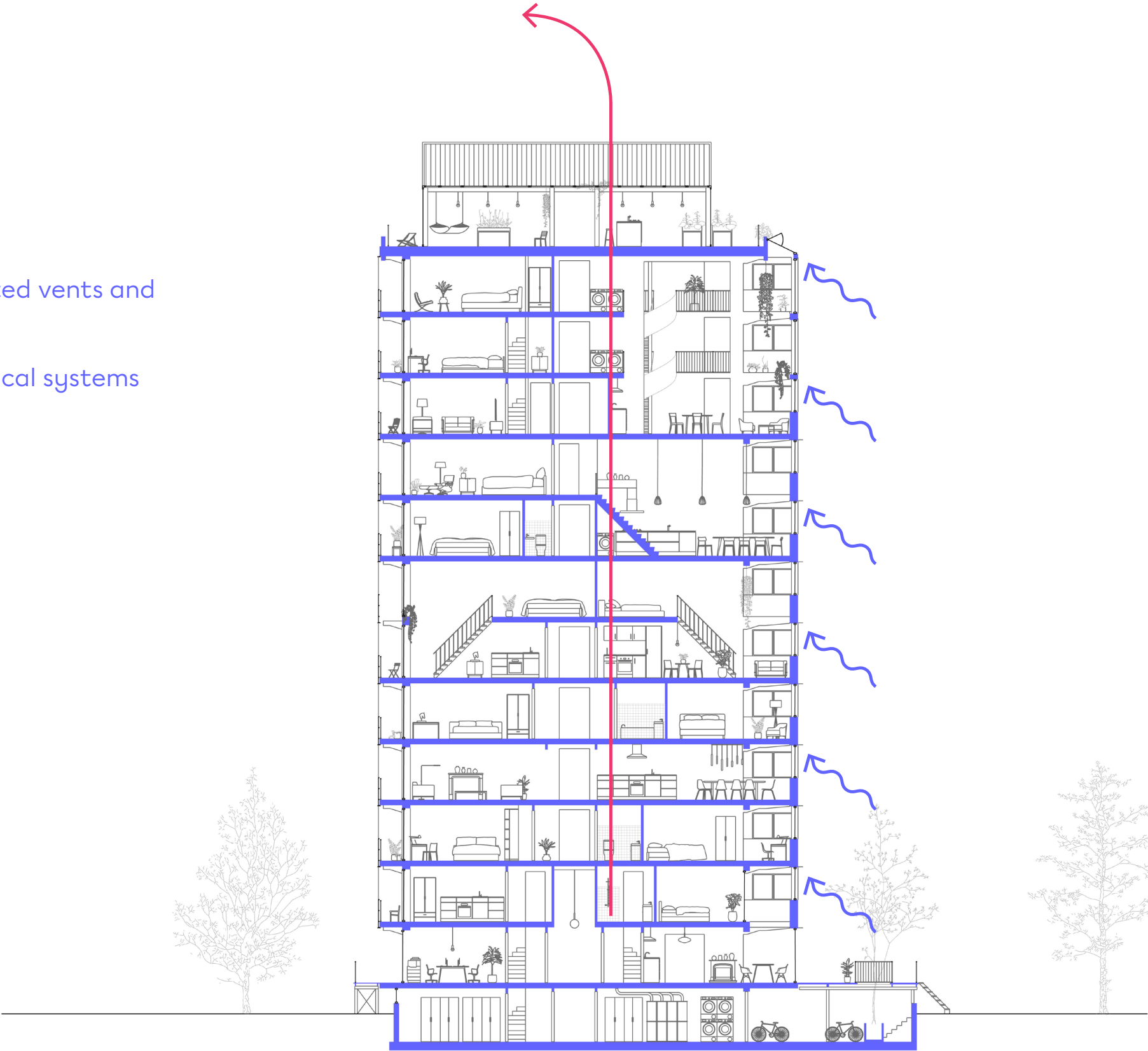
Existing garden plot used to dig deep-underground buffer

Large surplus and buffer can be used to heat and cool other nearby buildings



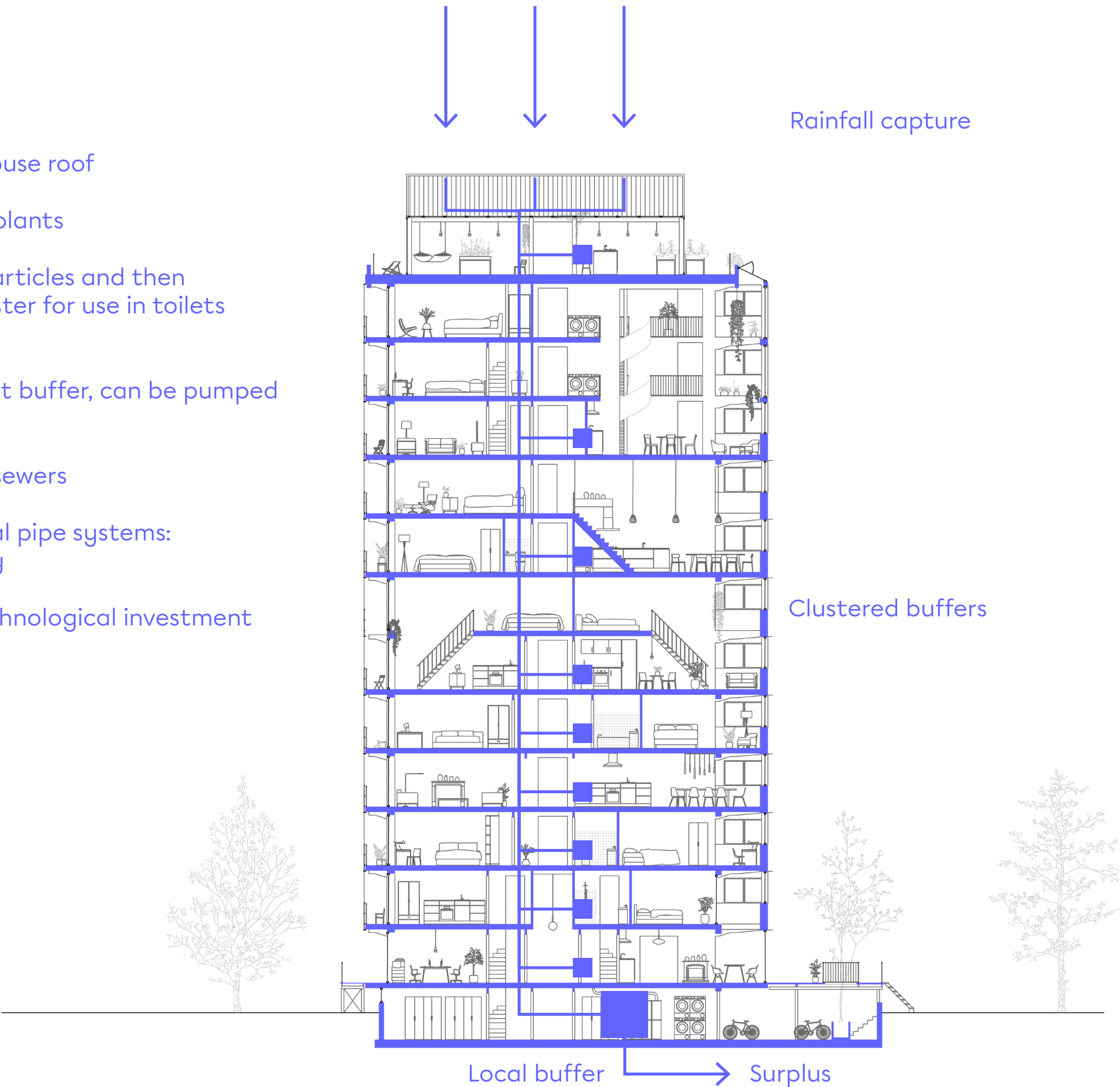
Ventilation

- Type C (as existing)
- All rooms have facade-integrated vents and openable windows
- Extraction via existing mechanical systems



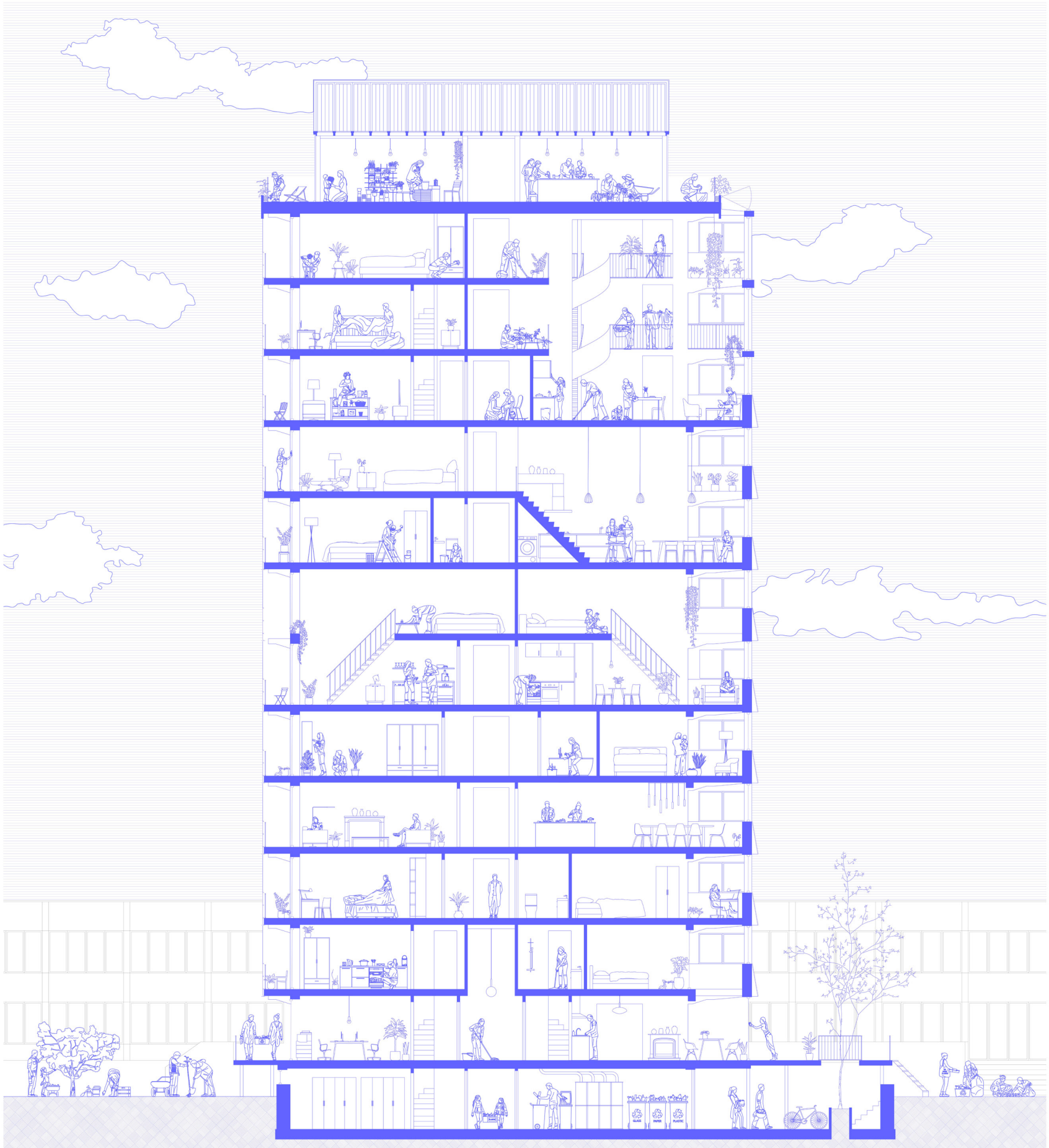
Water

- Rainwater capture via greenhouse roof
- Roof buffer used for watering plants
- Overflow is filtered for large particles and then subsequently buffered per cluster for use in toilets (non potable)
- Gravity feed to large basement buffer, can be pumped back up when reserves are dry
- Overflow surplus deposited in sewers
- All systems use existing vertical pipe systems: no new channels are necessary
- Potable filtering not worth technological investment

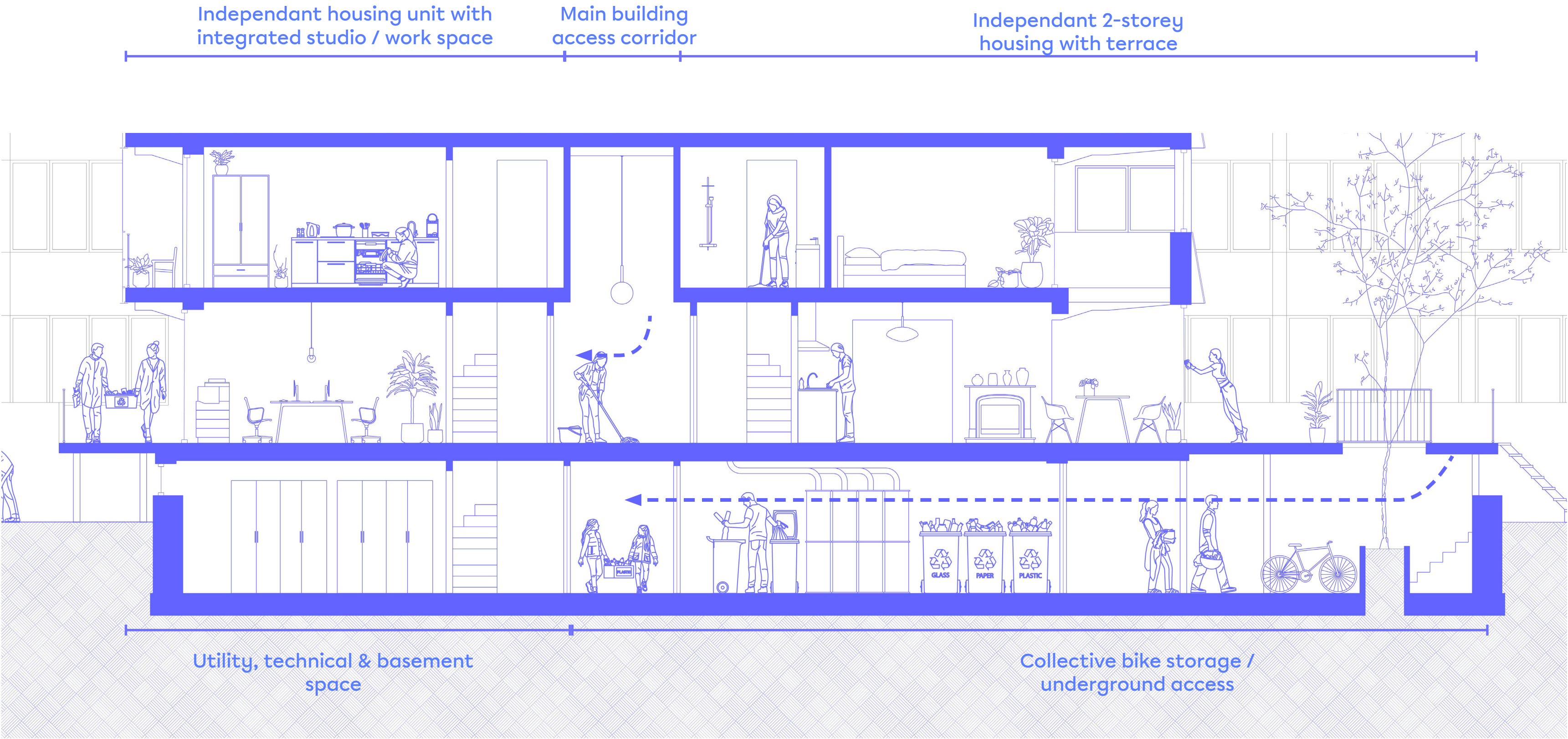


10: Housing diversity

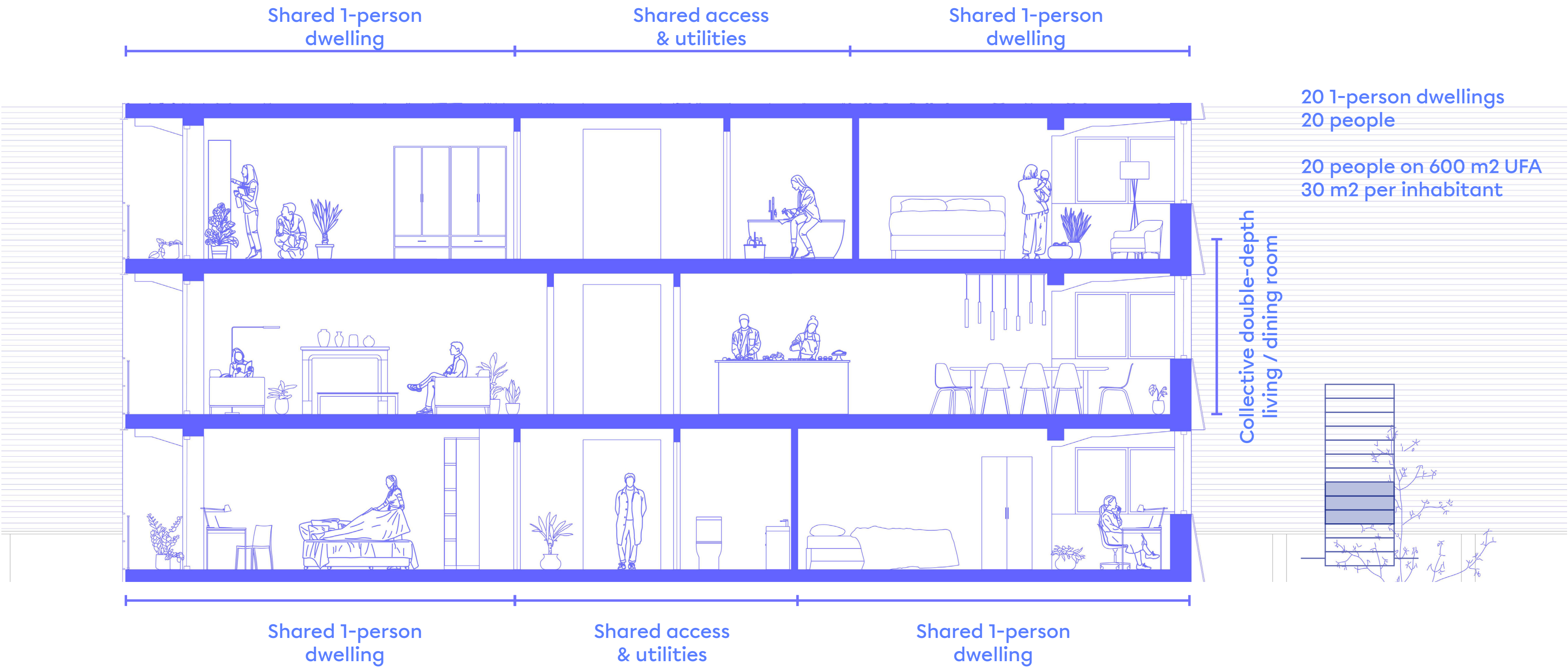
See form whom the cooperative can be



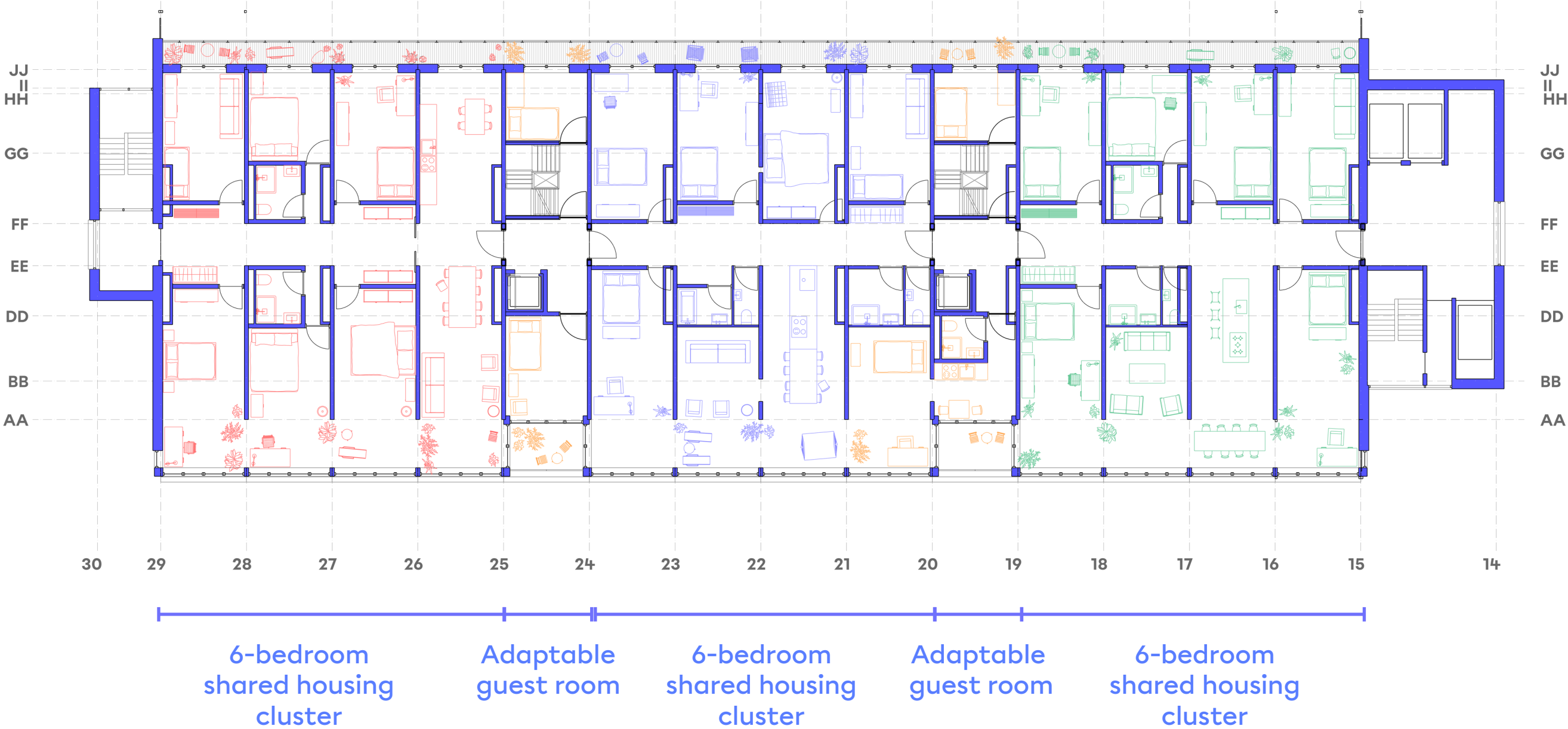
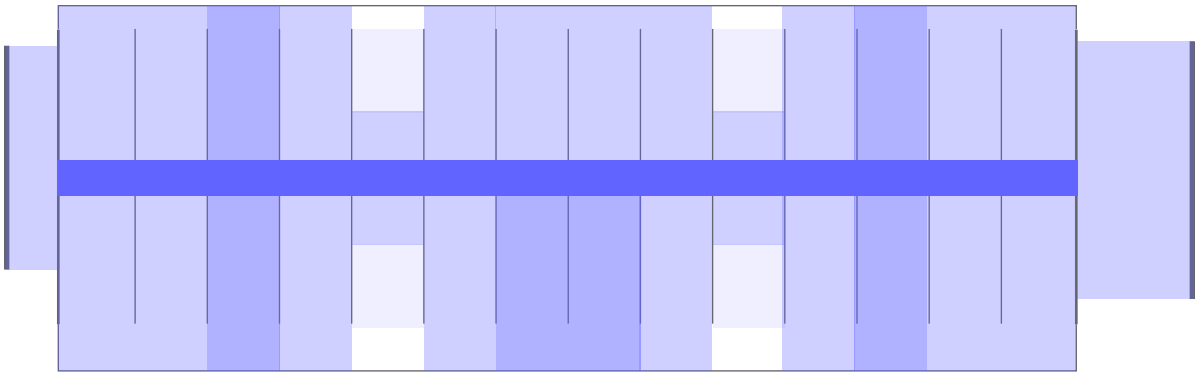
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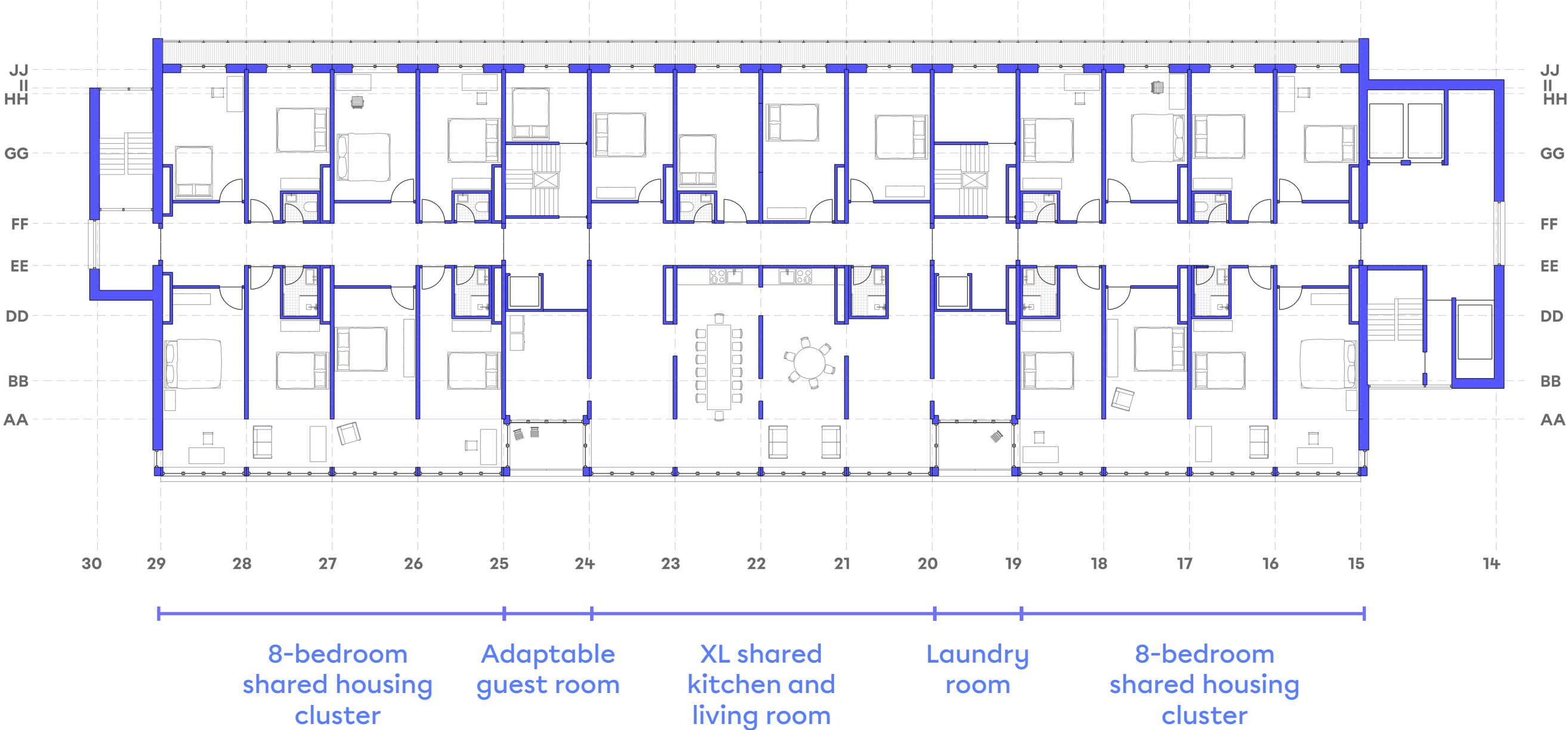
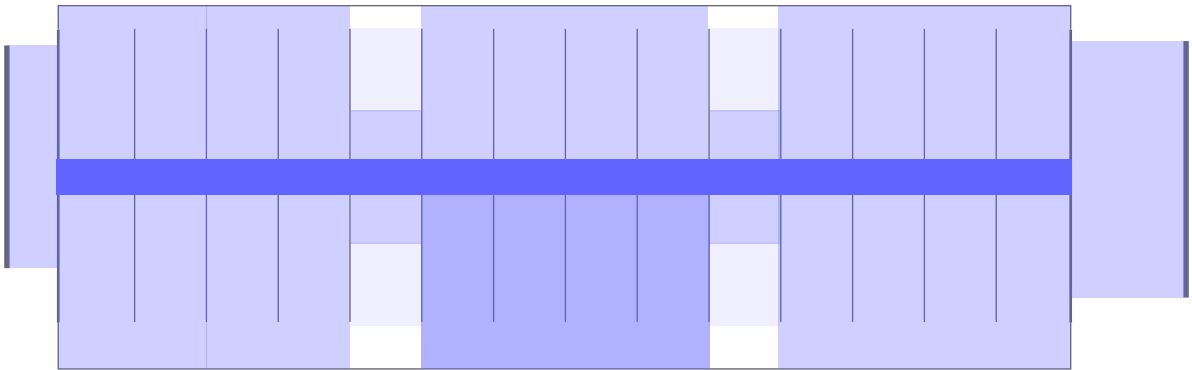
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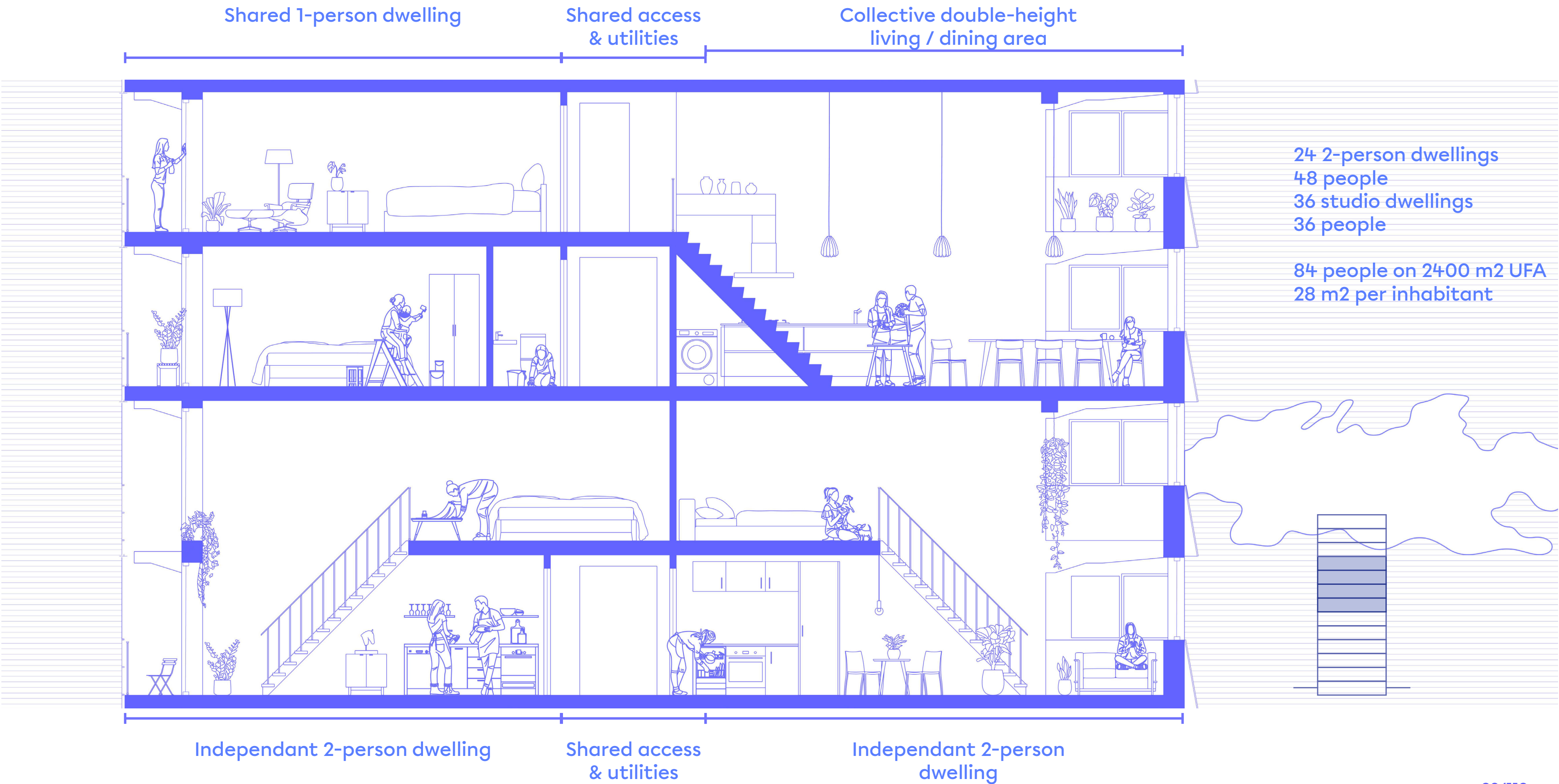
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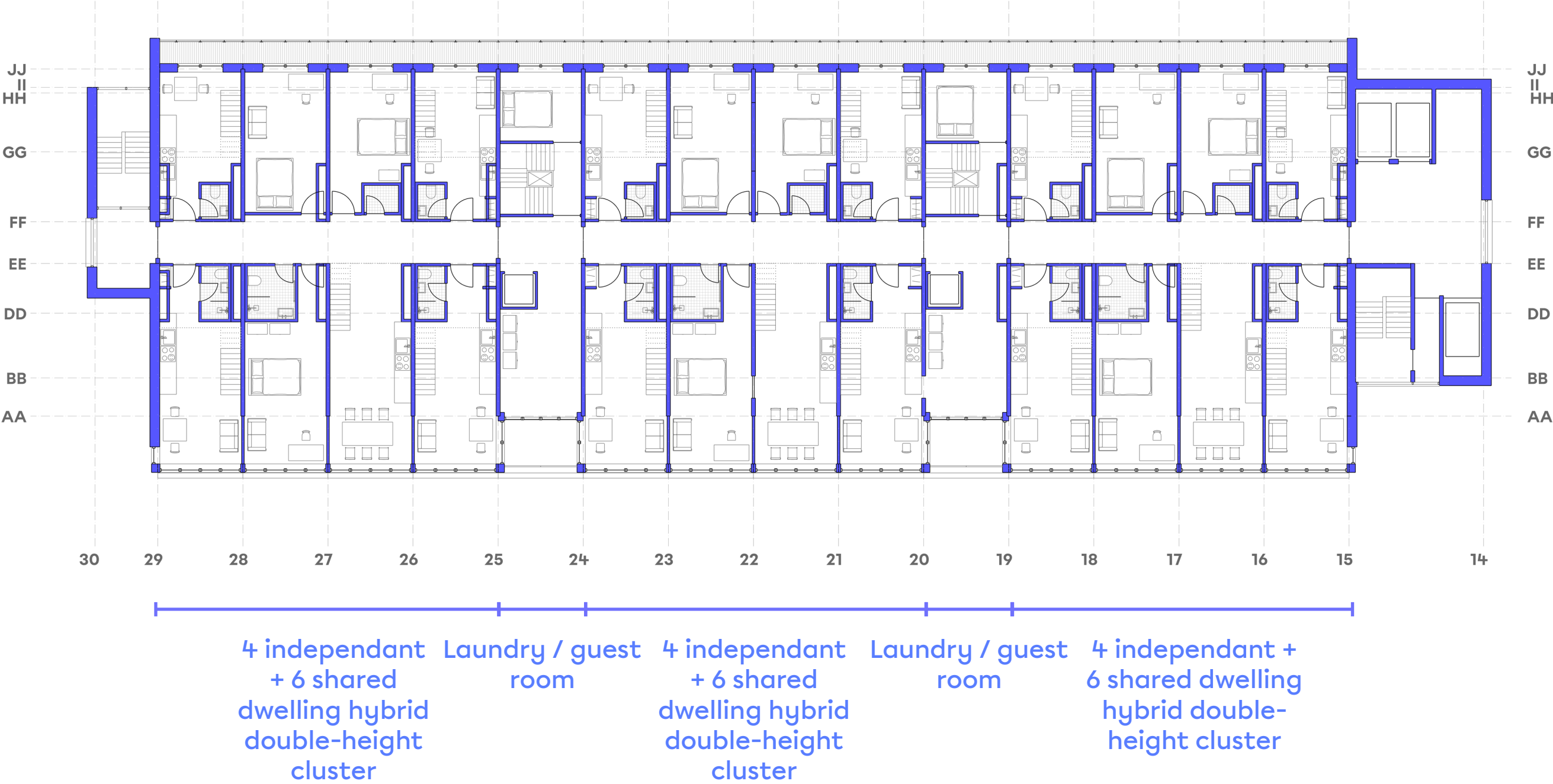
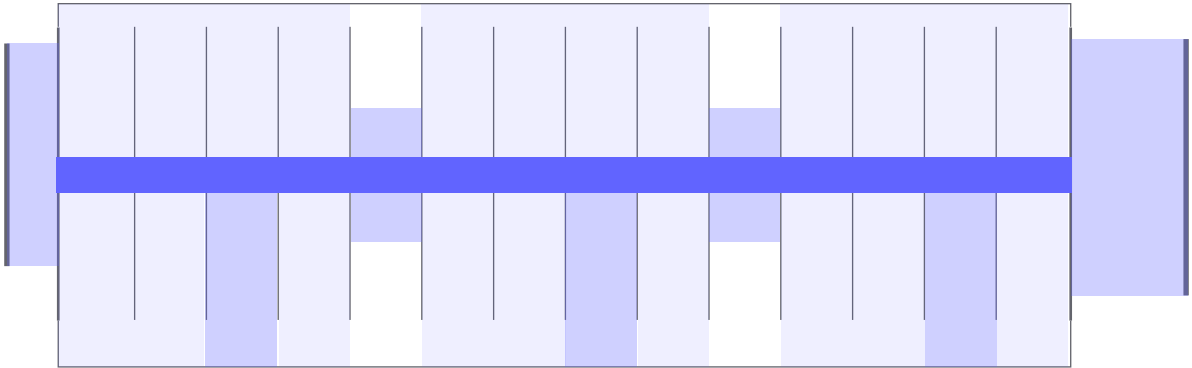
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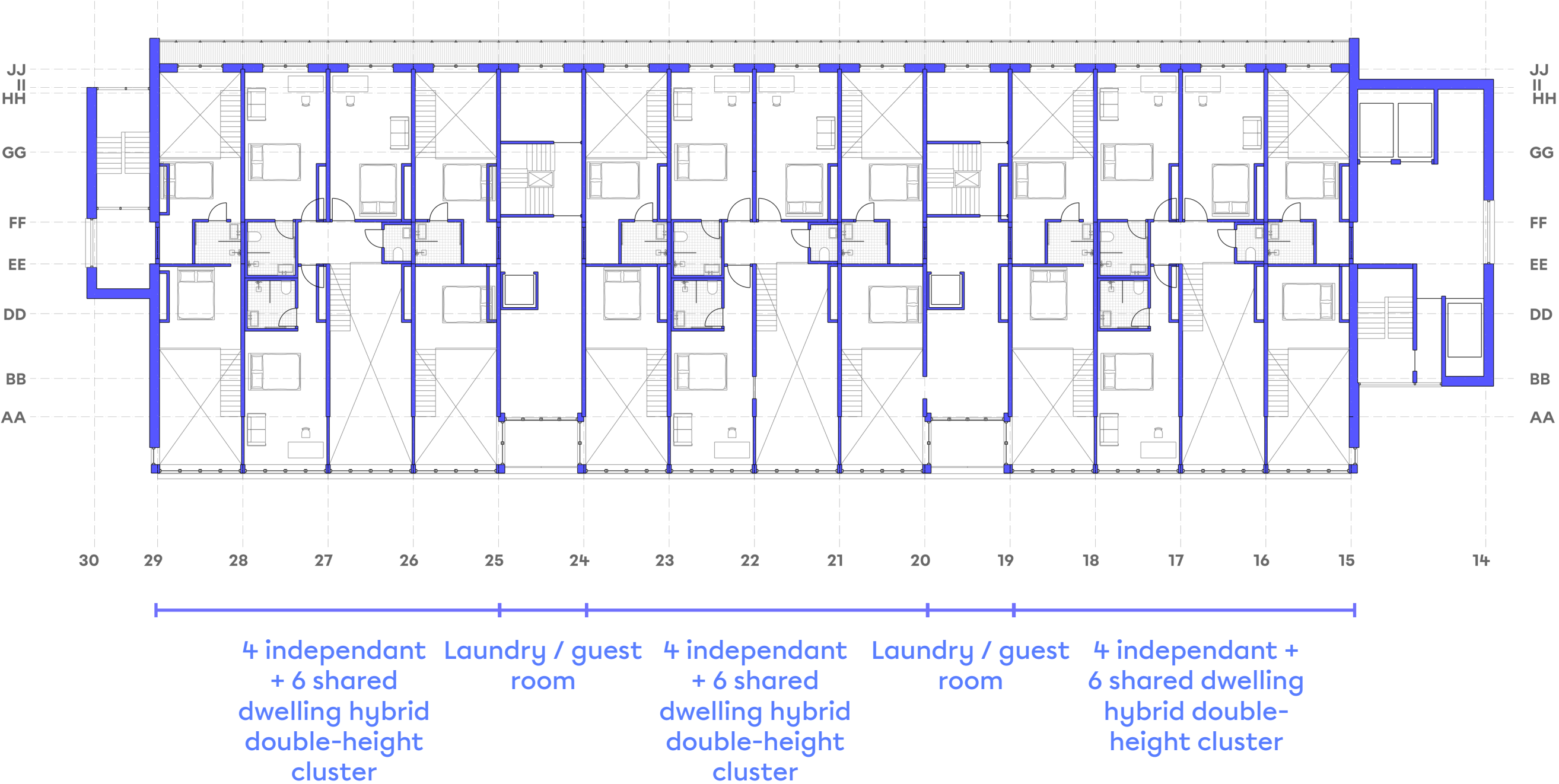
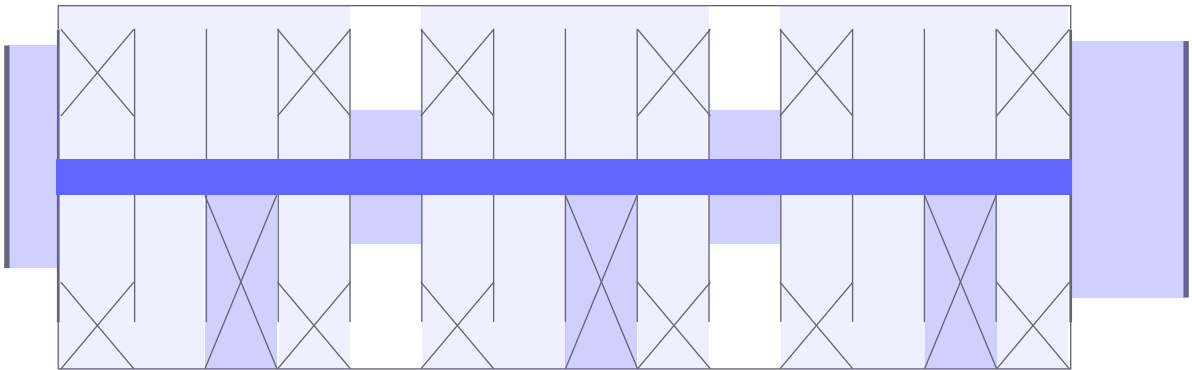
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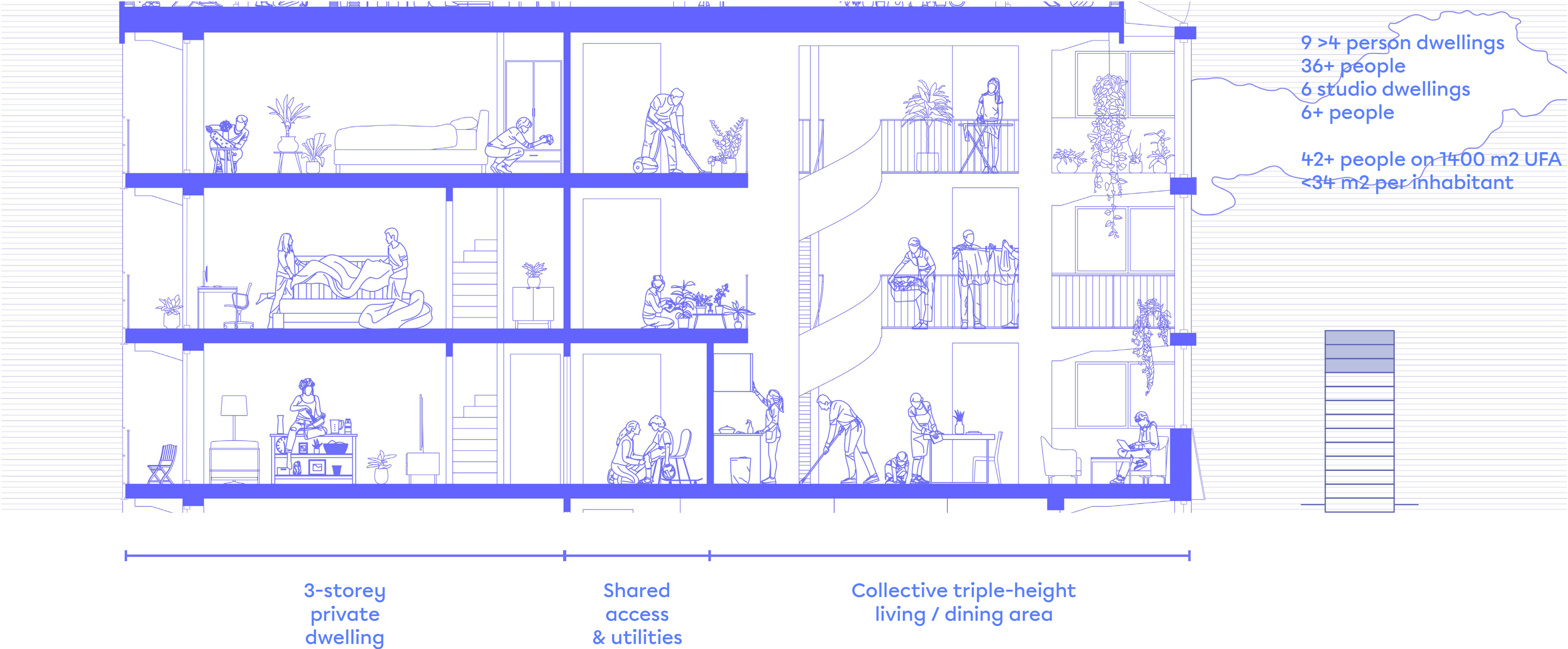
10: Housing diversity



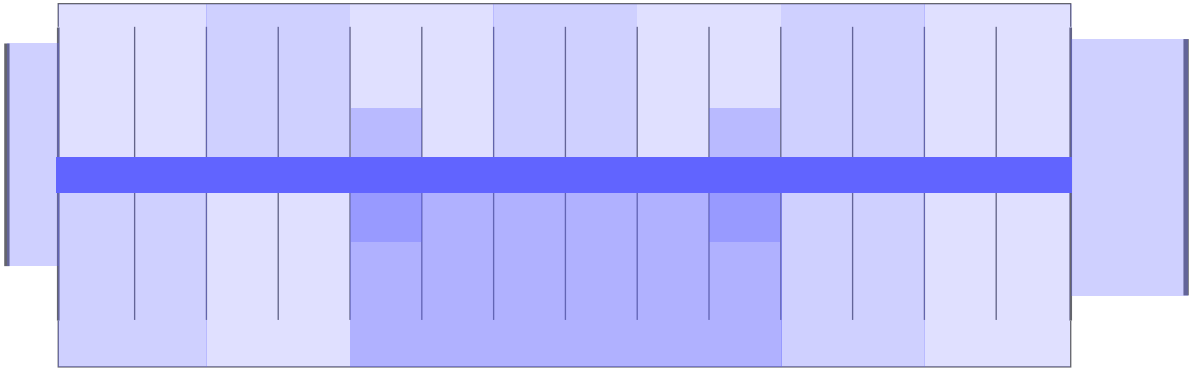
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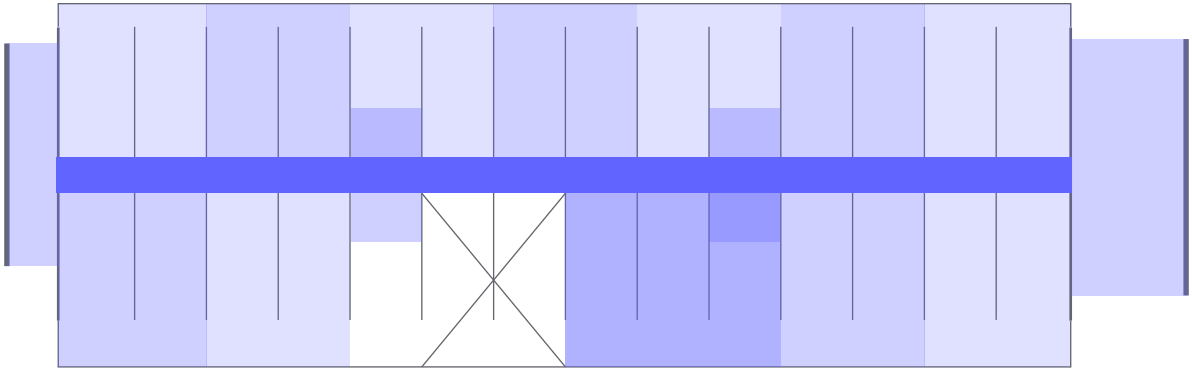
10: Housing diversity



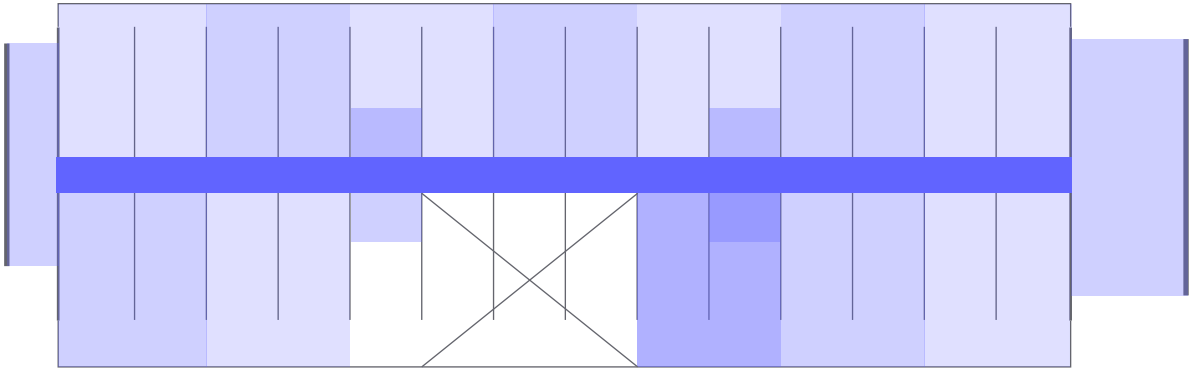
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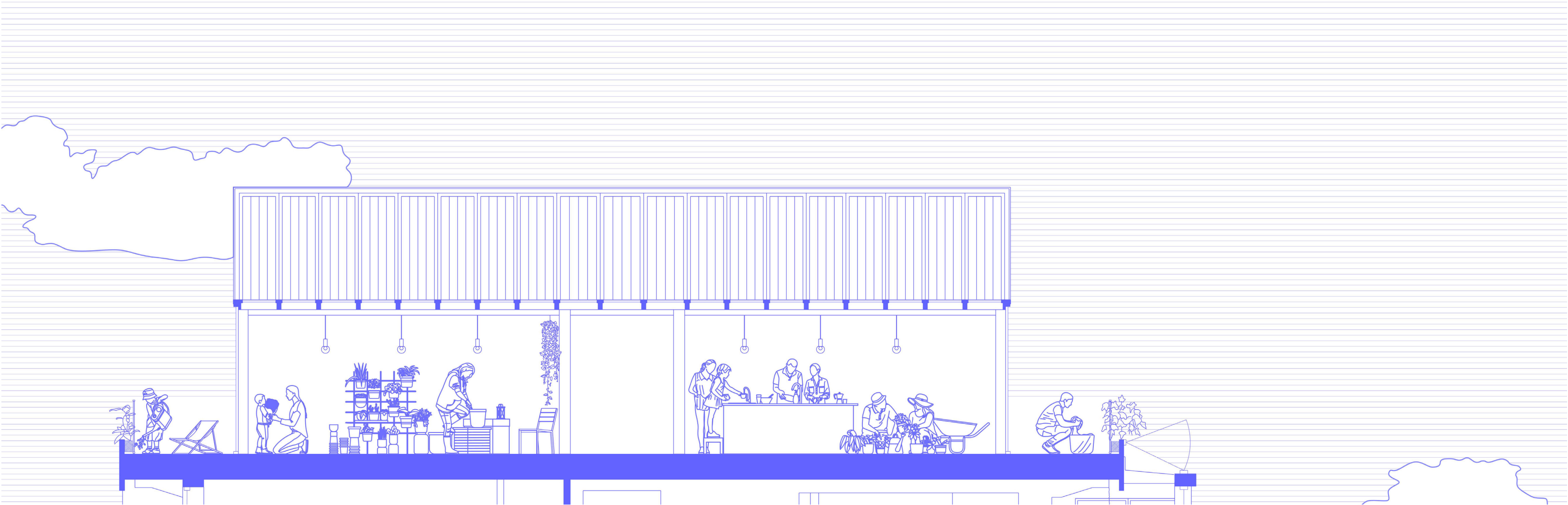


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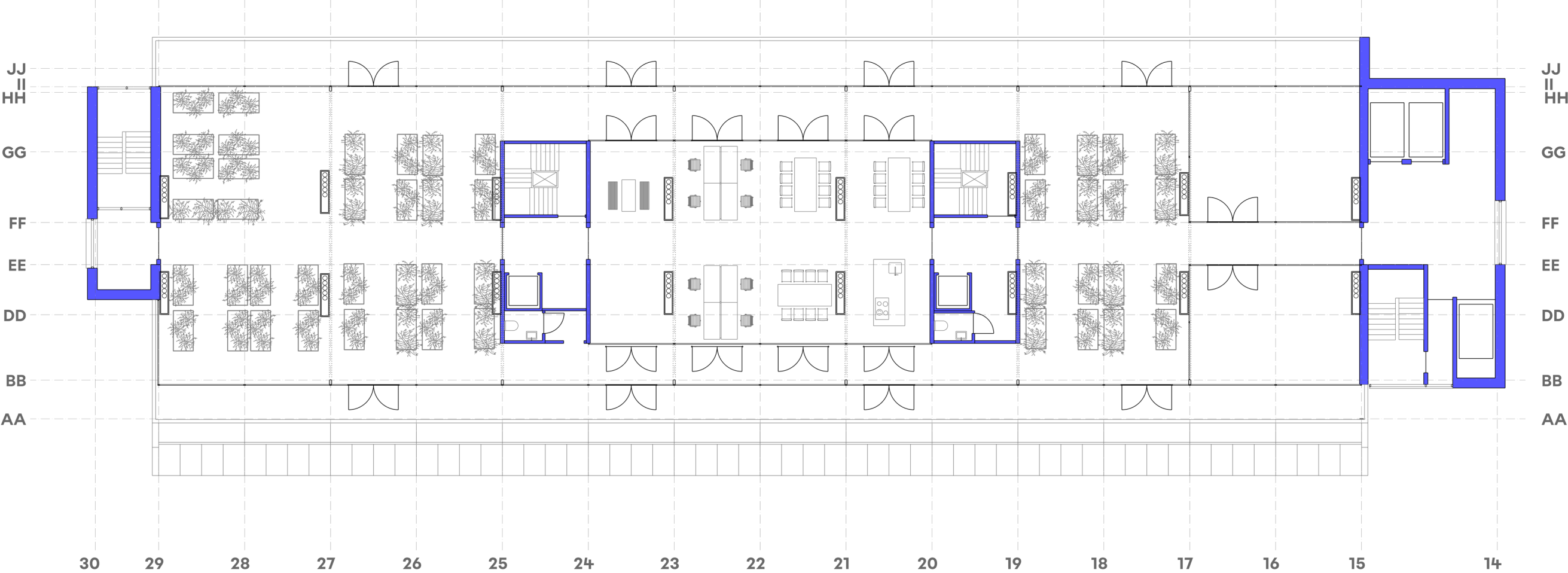


10: Housing diversity

Collective roofscape for
use by entire building



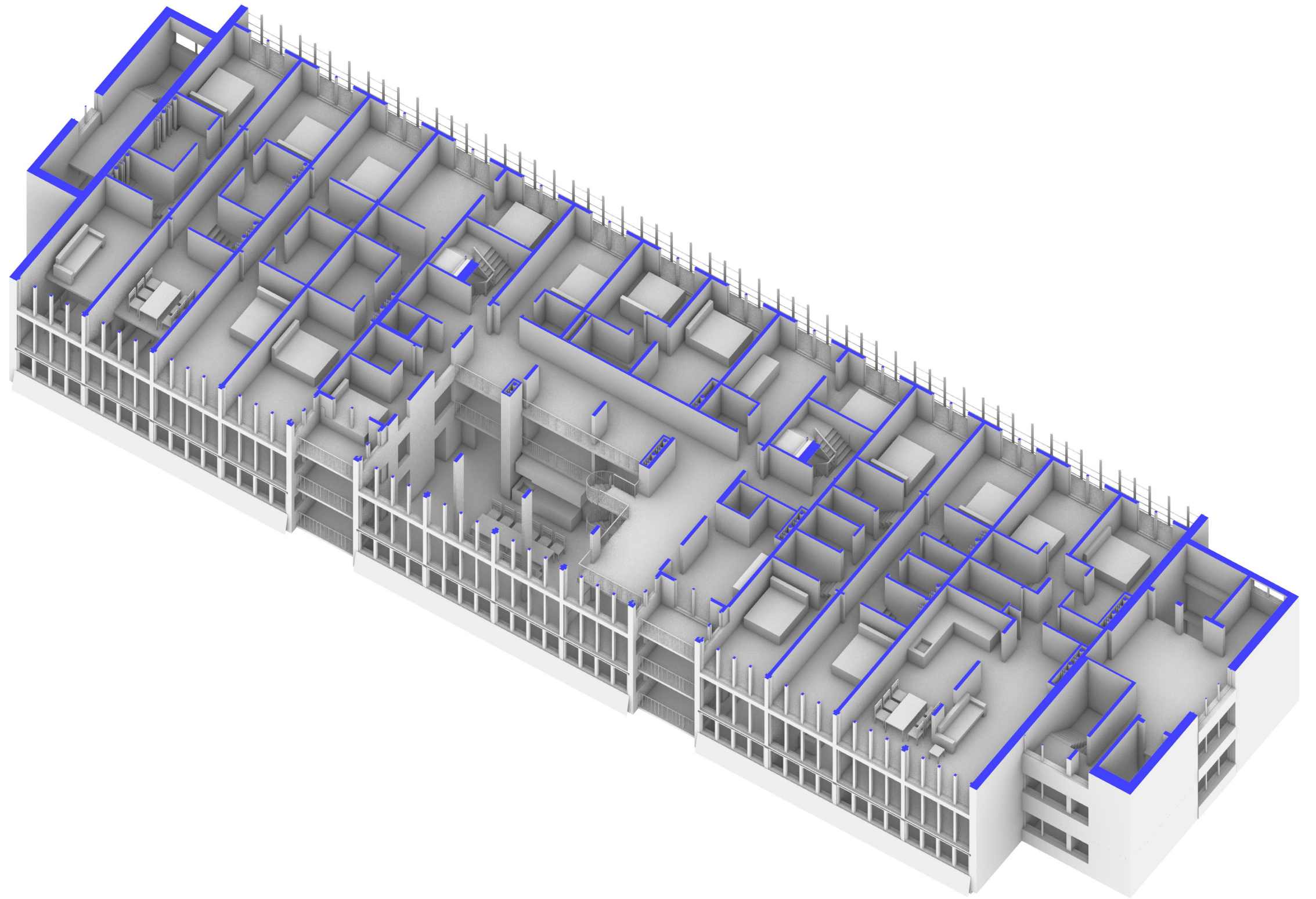
10: Housing diversity



11: A 2000-watt community

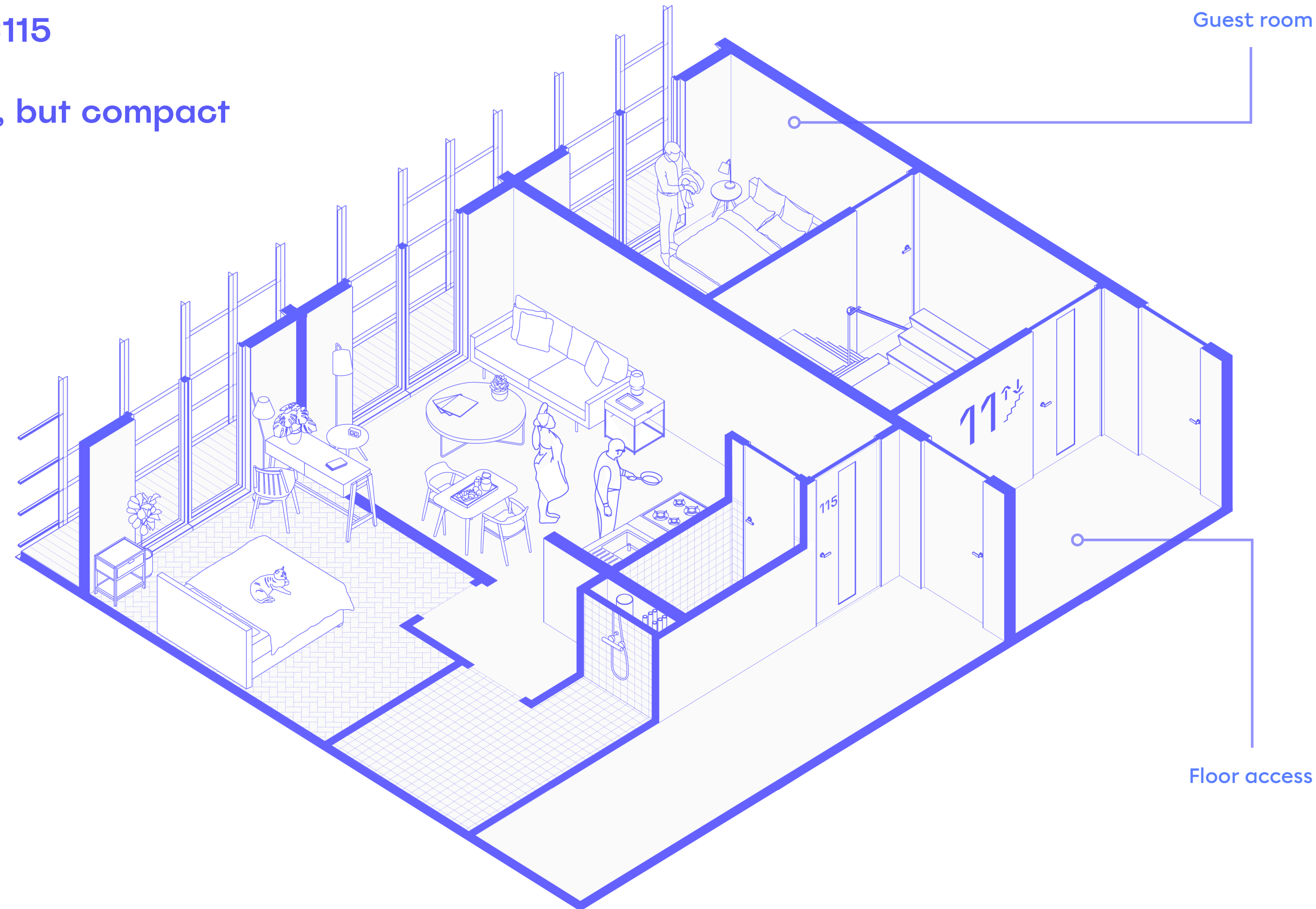
What is it like to live here?

How does the cooperative
make the difference?



Apartment #115

Independant, but compact

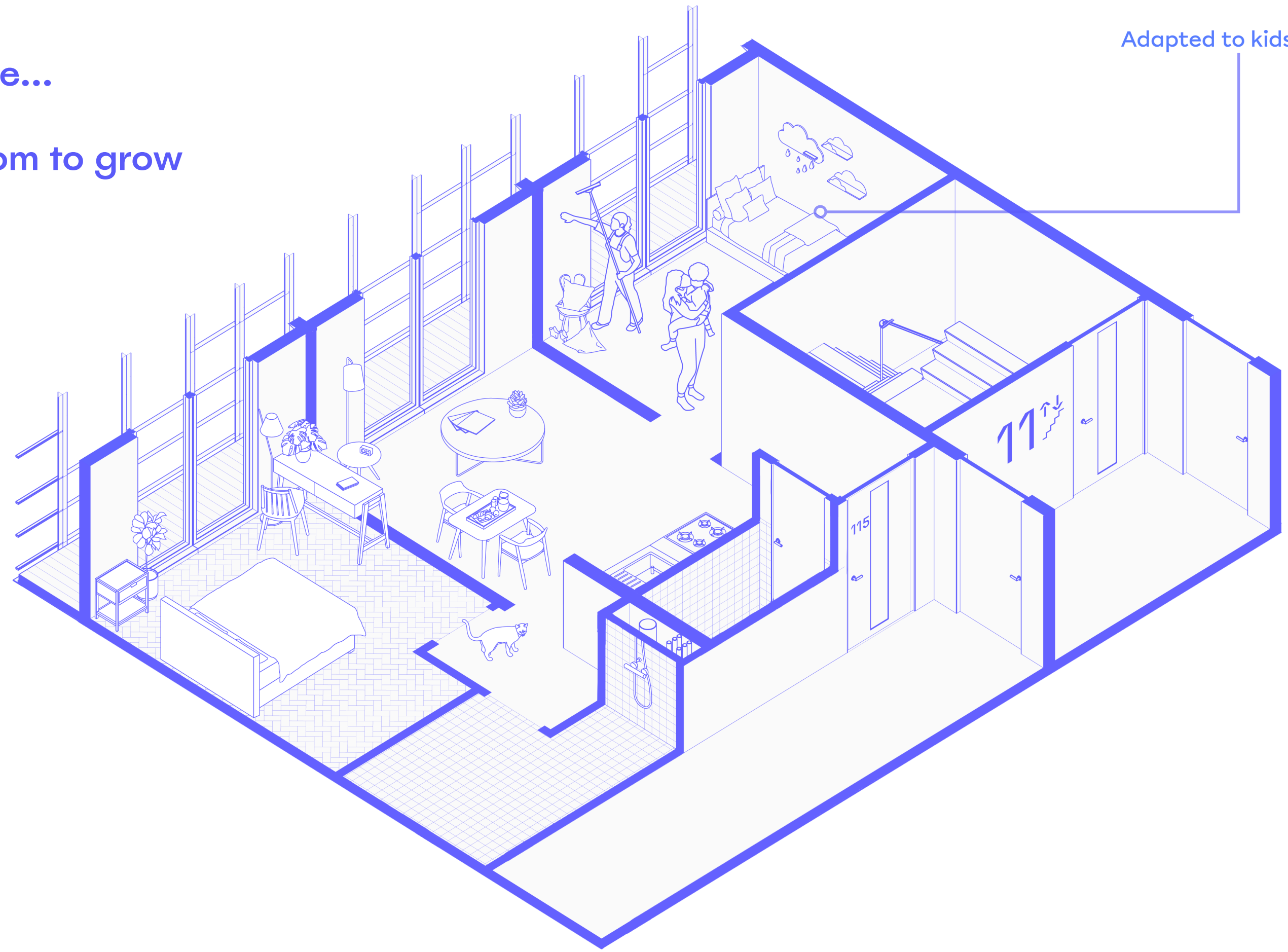


Guest room

Floor access

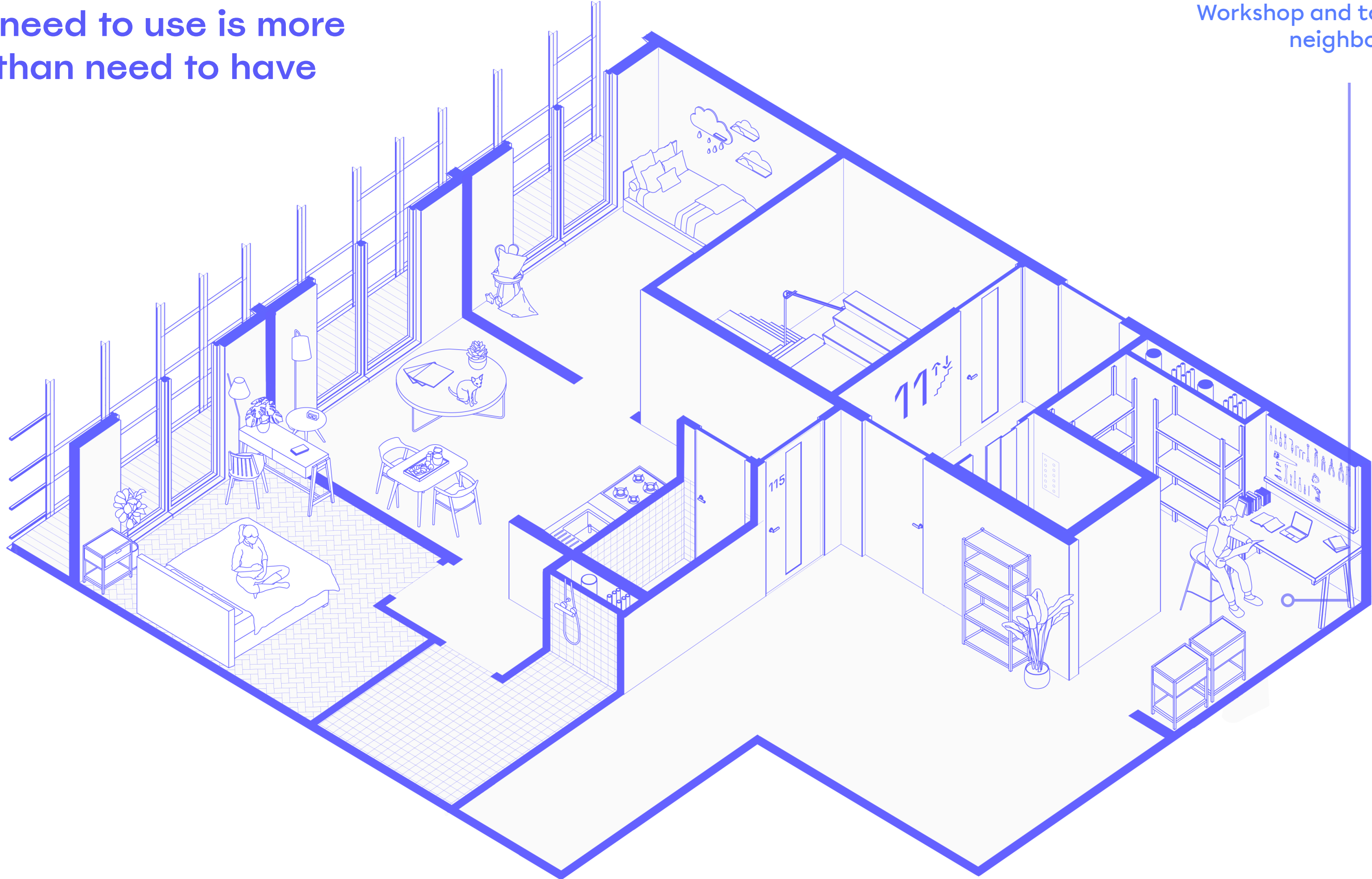
A dwelling
for two people...

...but with room to grow



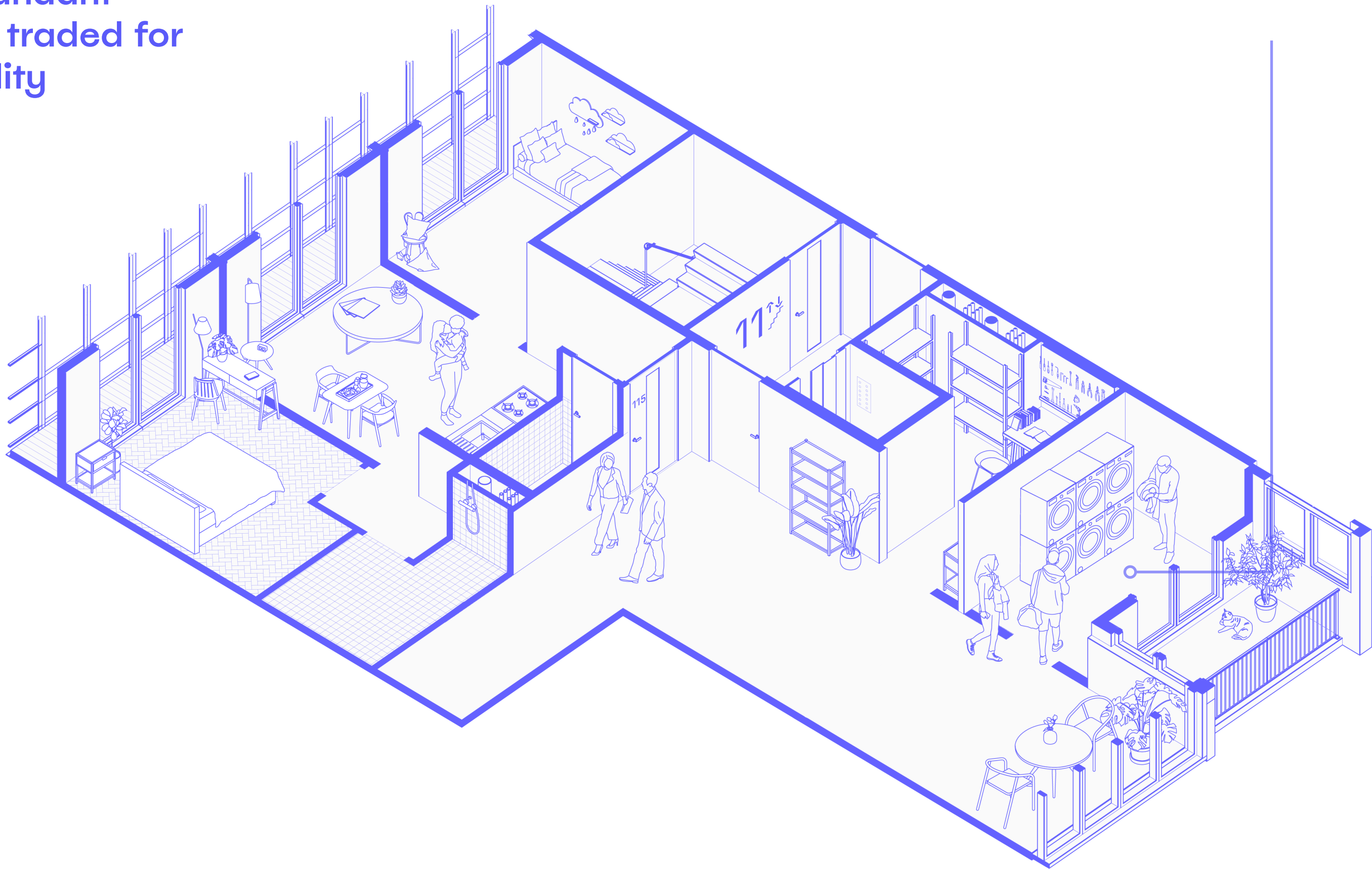
Where the need to use is more important than need to have

Workshop and tool storage per neighborhood



Where redundant
quantity is traded for
social quality

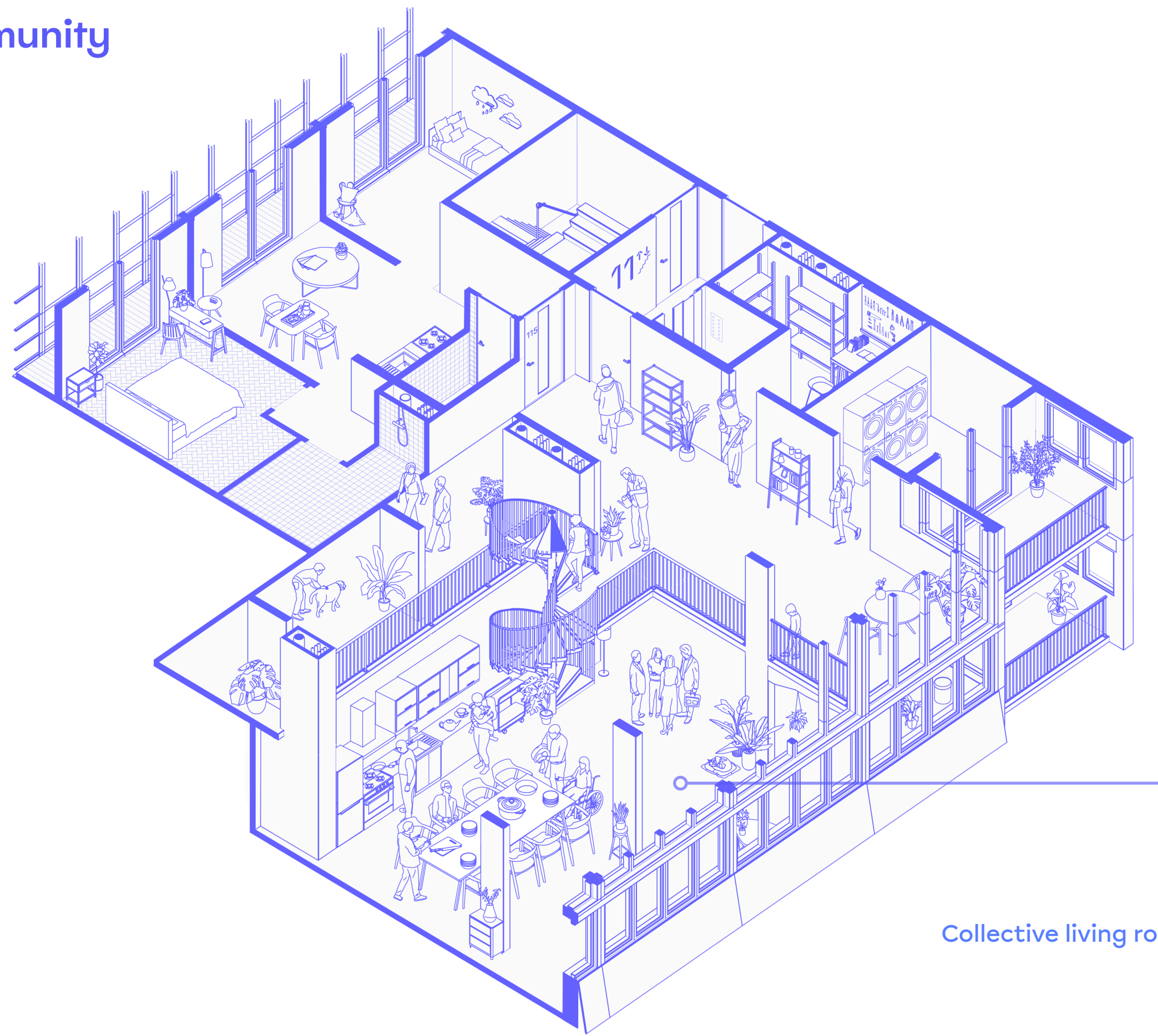
Laundry room per floor



A 2000-Watt-community

less redundancy
less waste
less energy

more versatile
more adaptable
more social



Collective living room and kitchen

11: A 2000-watt community

On the outside:

Unspectacular, as if had
always been part of the
neighborhood,

Pragmatic, low tech, built
from re-used and locally
harvested materials



11: A 2000-watt community

On the inside:

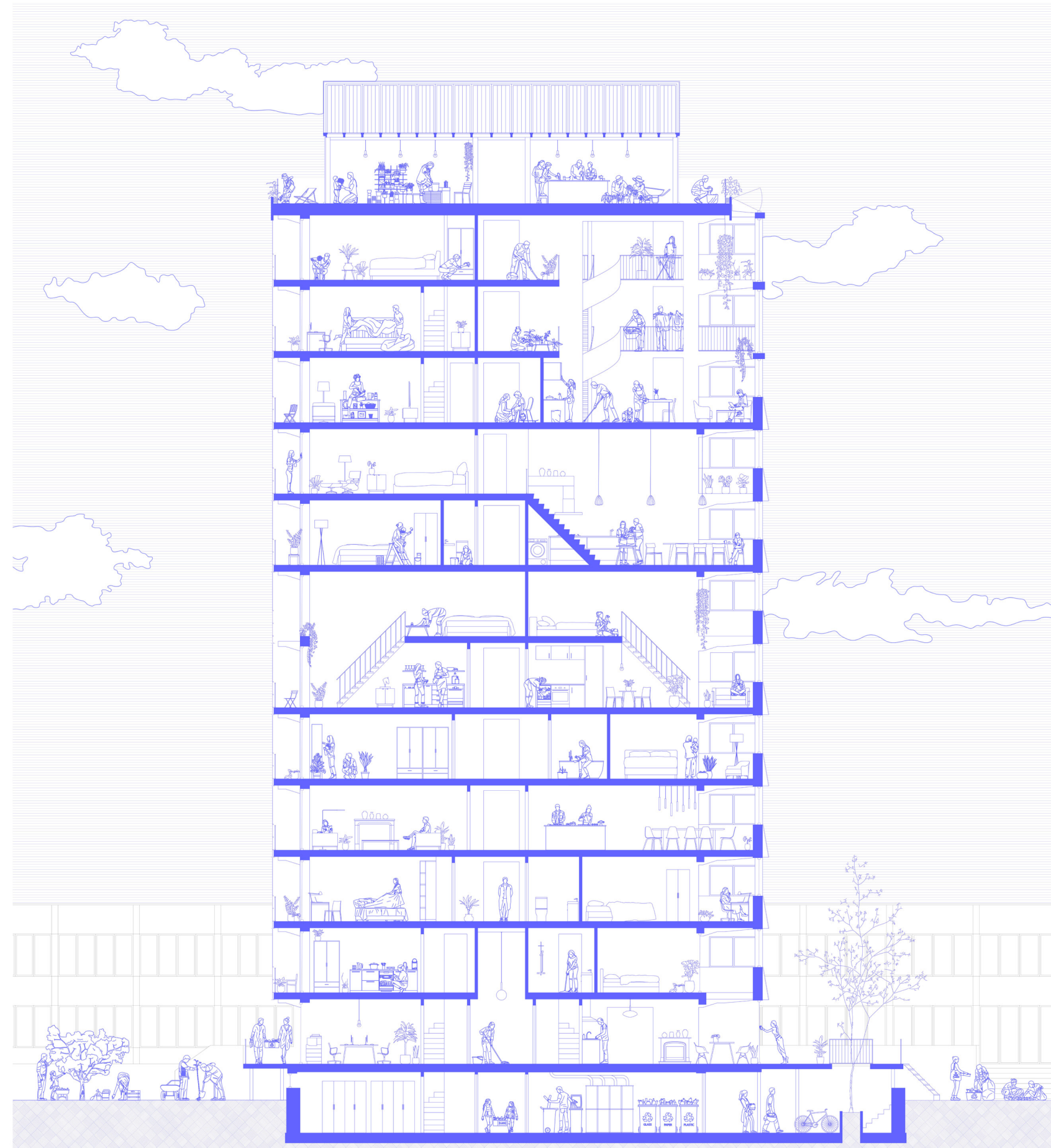
An old structure, with new life

A diverse, inclusive, sustainable and adaptable community

Empowered by cooperative ownership

A symbol and catalyst for the neighborhood

Het gaat om de mensen, niet om de dragers

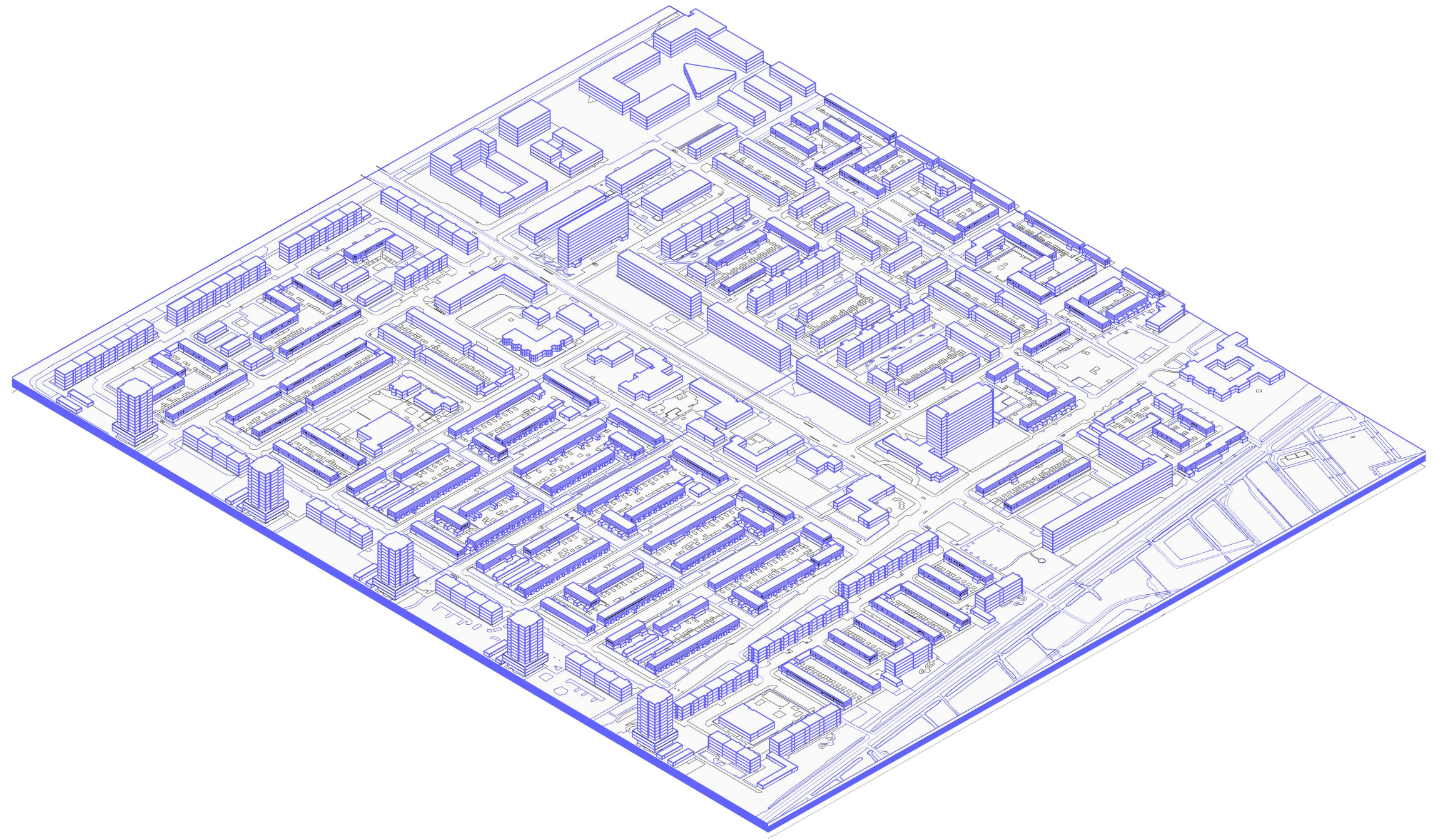


PART III: THE NEIGHBORHOOD OF THE FUTURE

Generic value and the bigger picture

12: The bigger picture

How does this community help
boerhaavewijk forward to
circularity?



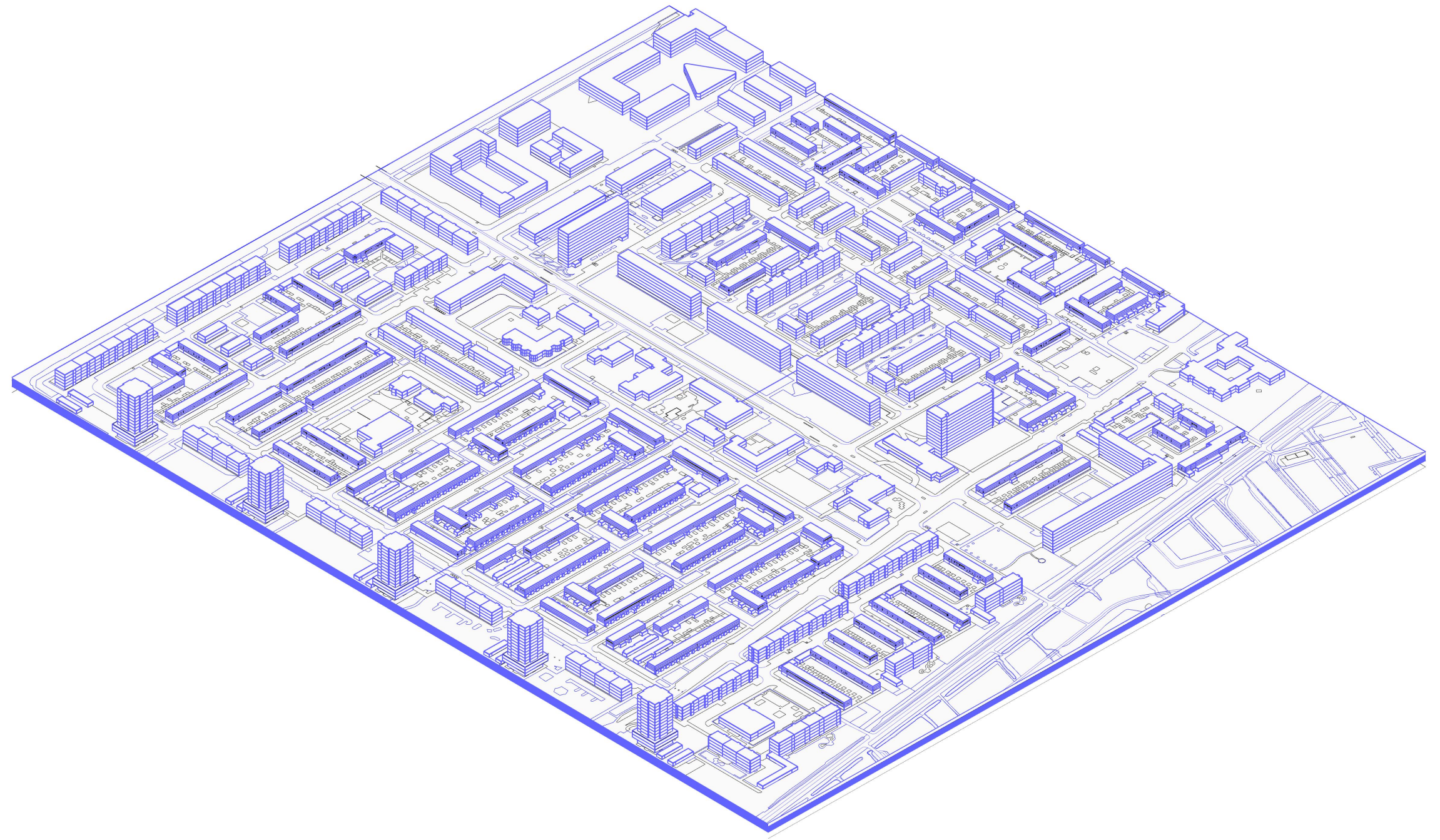
12: The bigger picture

Cooperatives can be about more than housing

Energy cooperatives

Material collection and re-use

Letting residents have their own stake in the neighborhood



12: The bigger picture

Facilitating the transition

Circular initiatives

Promote mutual trust

Stimulate a local economy

Empower inhabitants

Take the lead in re-thinking

Re-value the postwar
neighborhood

Not just energy efficient:
happier, healthier, more social



12: The bigger picture

Facilitating the transition

Circular initiatives

Promote mutual trust

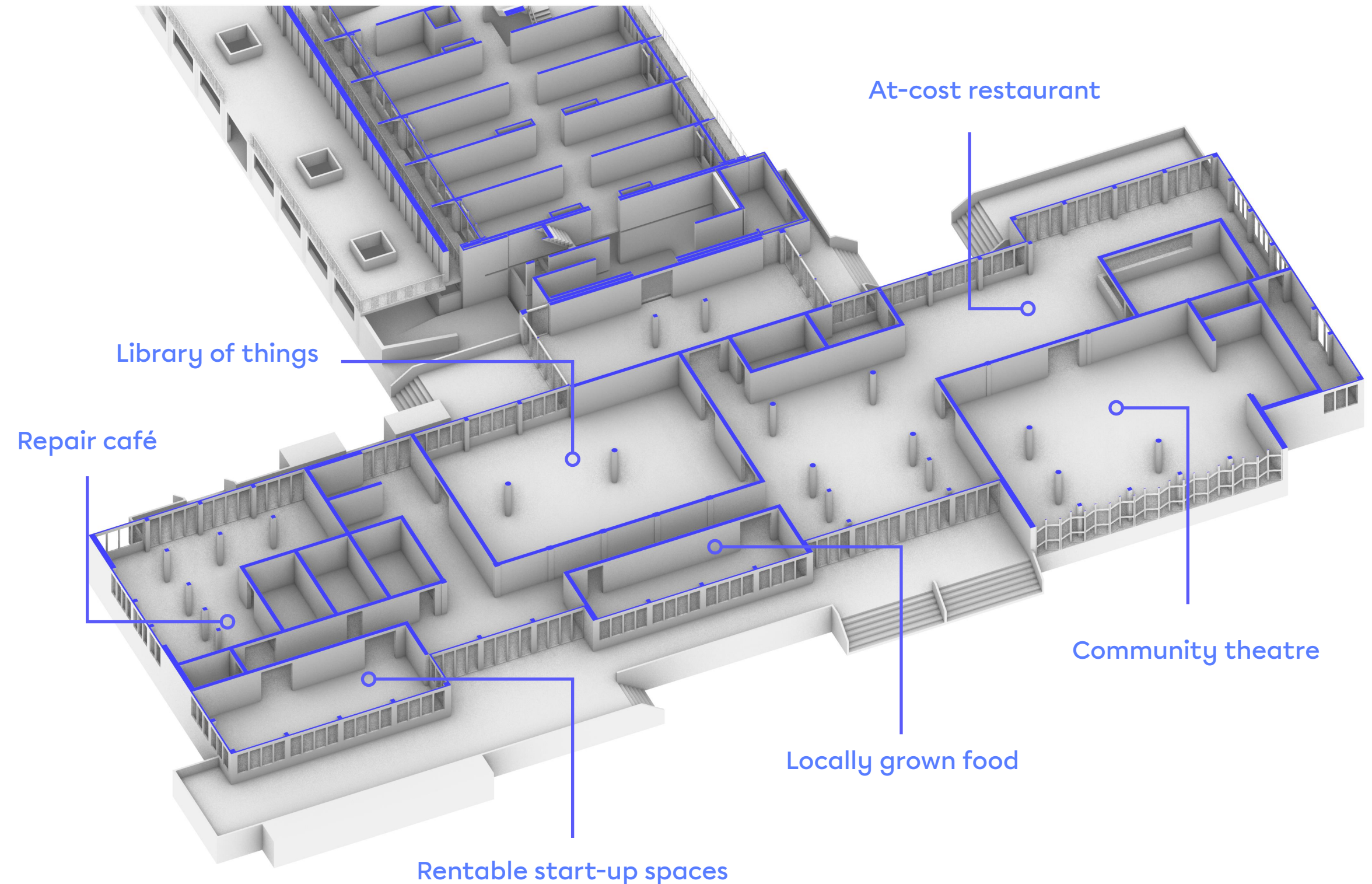
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12: The bigger picture

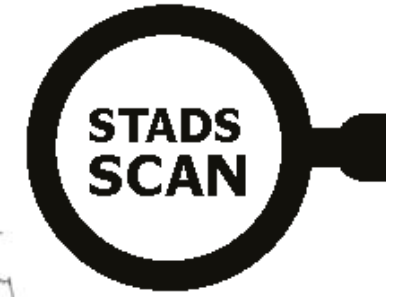


12: The bigger picture

What if you do the same for all postwar neighborhoods in the Netherlands?

1.800 neighbourhoods
1.800.000 homes

The same densification strategy can realise up to 700.000 new homes



Geografische ligging van alle buurten in Nederland met minimaal 500 huishoudens en minimaal 50% naoorlogse woningen.
Bron: Data van CBS, BAG en WOZ

12: The bigger picture

Cooperative ownership as a way to re-value disregarded post-65 heritage by removing financial incentive

For those a third option, next to buying and renting, which can better match our specific and complex specific housing needs



IN CONCLUSION,

For a sustainable, circular future,
we should fundamentally
consider how we want to live and
therefore build.

The new architect:
someone who takes a broader
approach to value, together with
users

Empowered by the cooperative to
take agency and leave no one
behind in the transition to a
common circular future

END