wonders of waste

building with recycled plastic materials designing modular student housing and exploring circular solutions

Nadine Nossbaum
4659716

dE studio p5

june 18th 2025

design mentor Dafne Swank
bt mentor Stephan Verkuijlen
research mentor Jos de Krieger

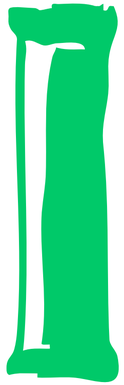
contents





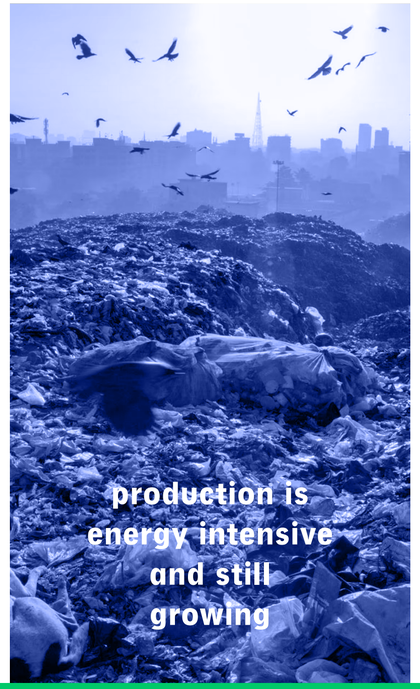
problem statement
objective
recycled plastic
modular system
kit of components
studio units
cluster
collective
circular system
conclusion





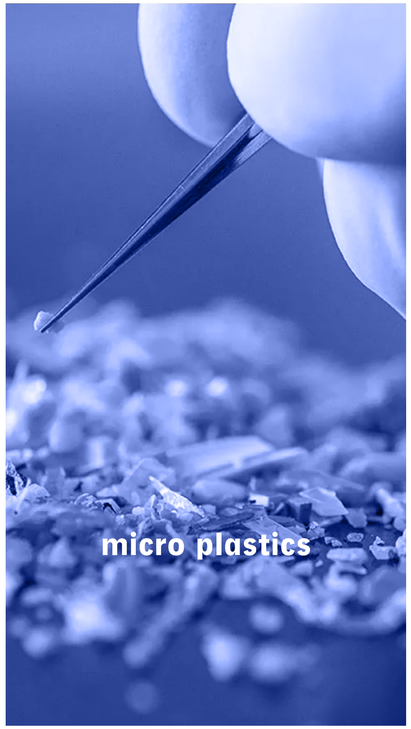
problem statement

plastic pollution









our current use of plastics harms the environment and is NOT sustainable

problems in plastic recycling industries

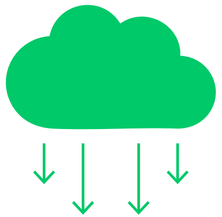
1. competing economically with virgin plastic
2. lack of specific application opportunities
3. limited (consumer) awareness and participation

"since construction uses much less plastic than concrete and bricks, we see that **plastic contributes little to the global carbon storage potential**."

de ingenieur, January 2025

source: https://deingenieur.nl/artikelen/bouwmaterialen-geschikt-voor-vastleggen-co2

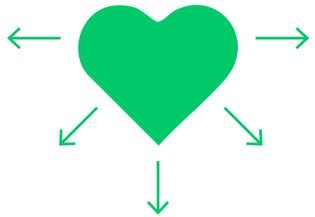
recycled plastic in building design and construction



promising resource to reduce carbon footprint



reduce waste production and better waste stream management



inspire future projects

context

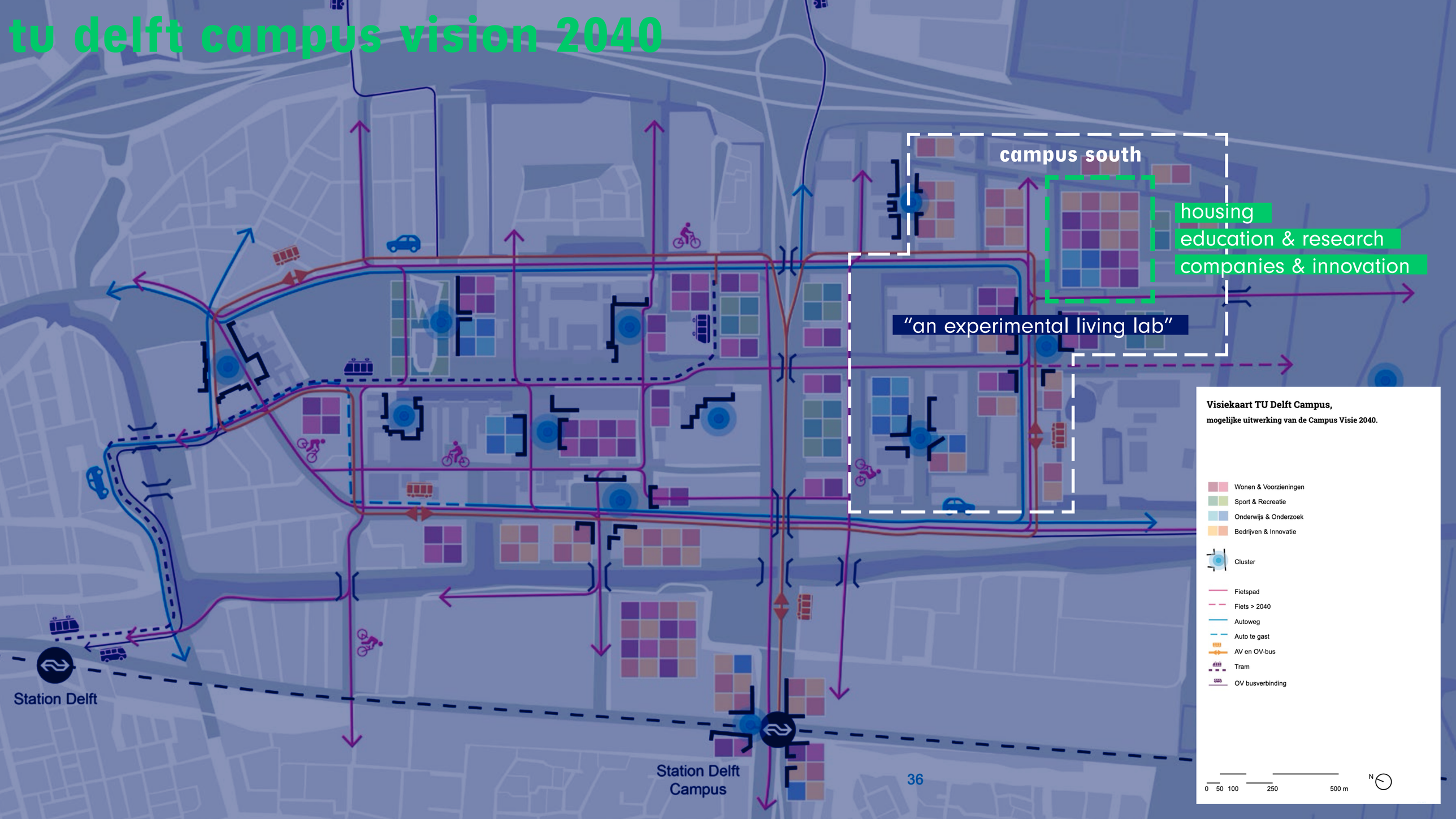
“with rising student numbers and the housing shortage in Delft, housing is a substantial part of the task for the TU Delft campus”

tu delft campus vision 2040

“the south campus as an **experimental living lab**”

tu delft campus vision 2040

tu delft campus vision 2040



objective

How can **recycled plastic materials and associated production techniques** be integrated into **modular and circular** design and construction of **small housing units** in **Delft, the Netherlands?**

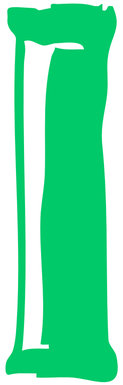
my project ambition





a shift in **waste perception**



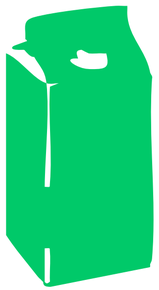


change to a sustainable approach

~~form follows **function**~~

change to a sustainable approach

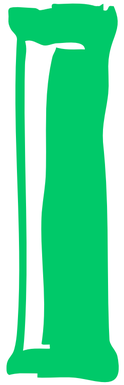
form follows **material** + **function**

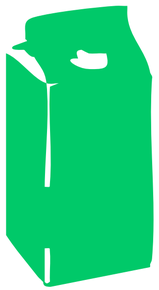




waste as a **resource**



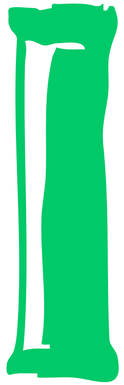


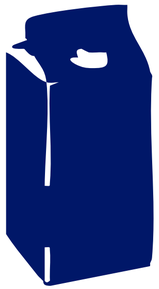


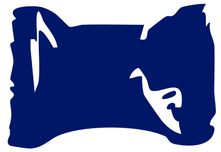


new materials new architecture



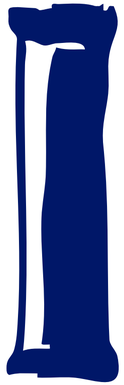






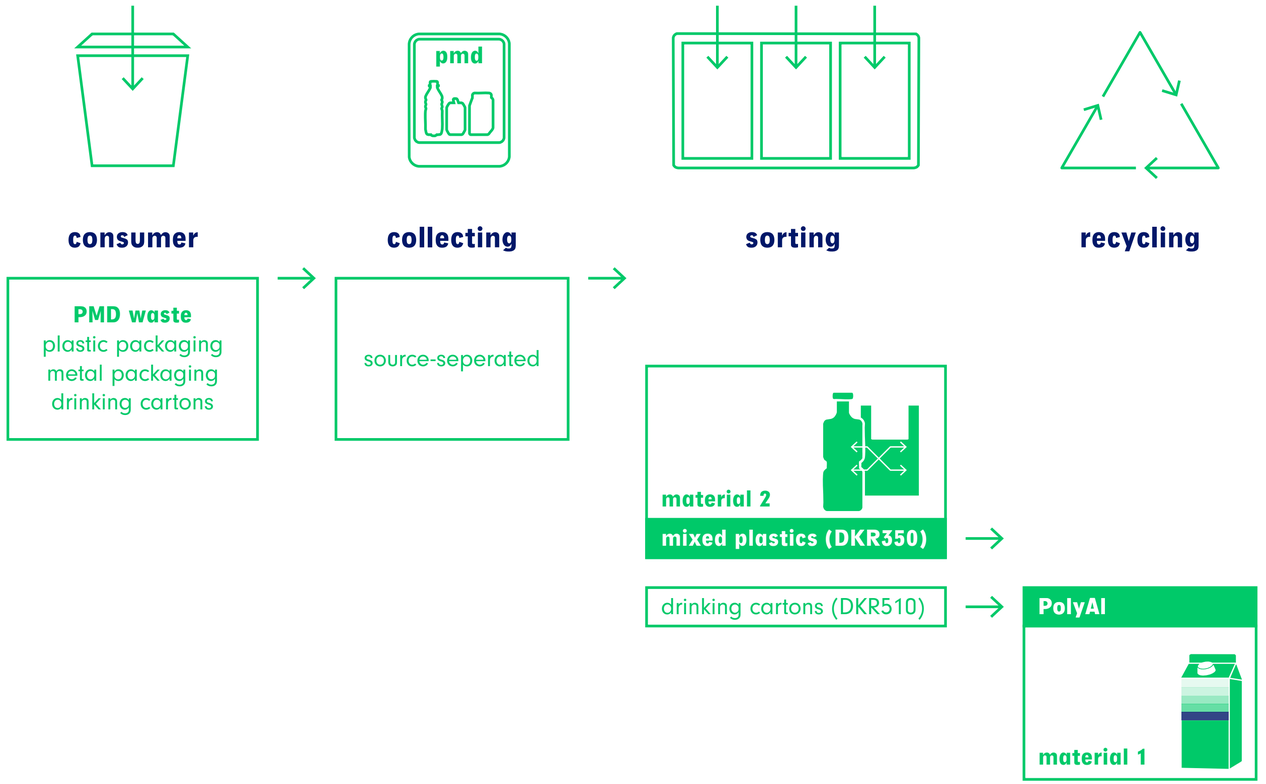
wonders of waste



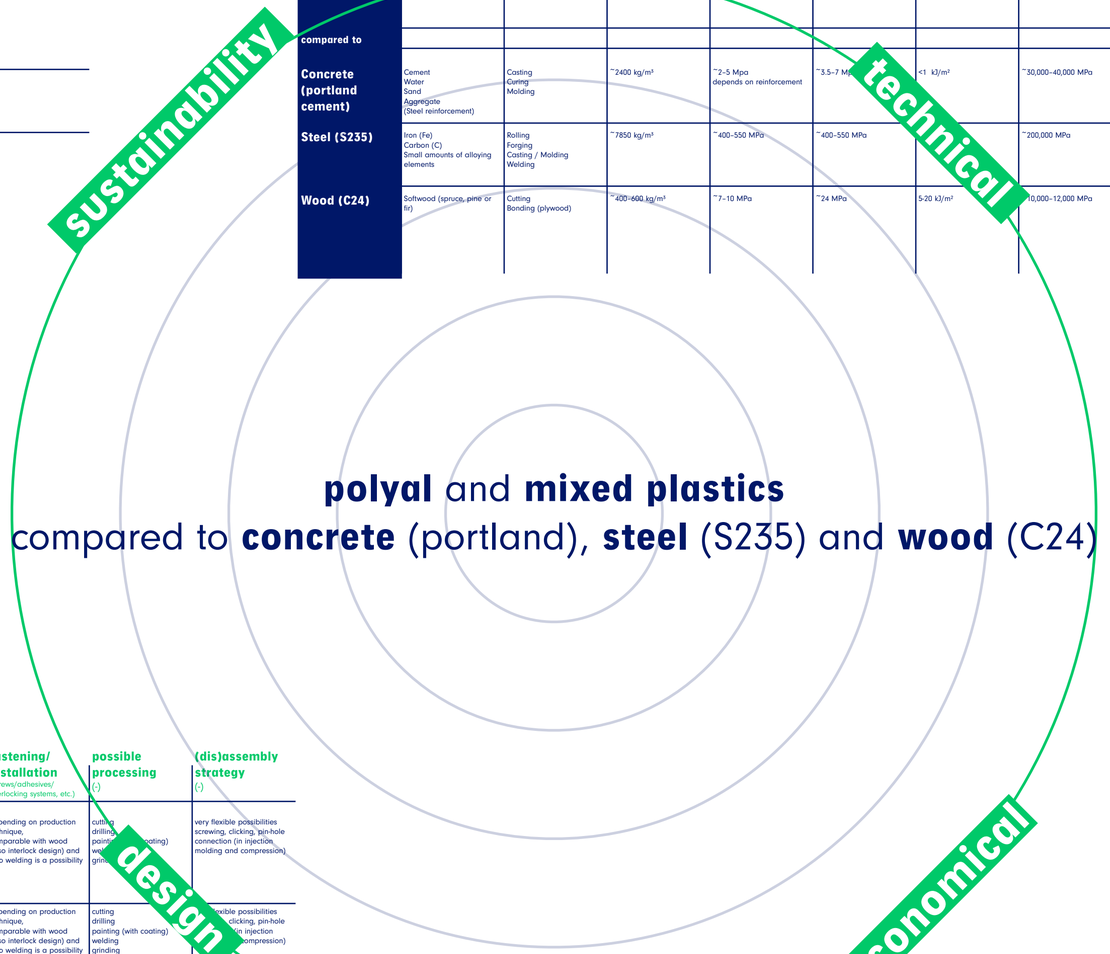


recycled plastic

research focus



polyal and mixed plastics compared to concrete (portland), steel (S235) and wood (C24)



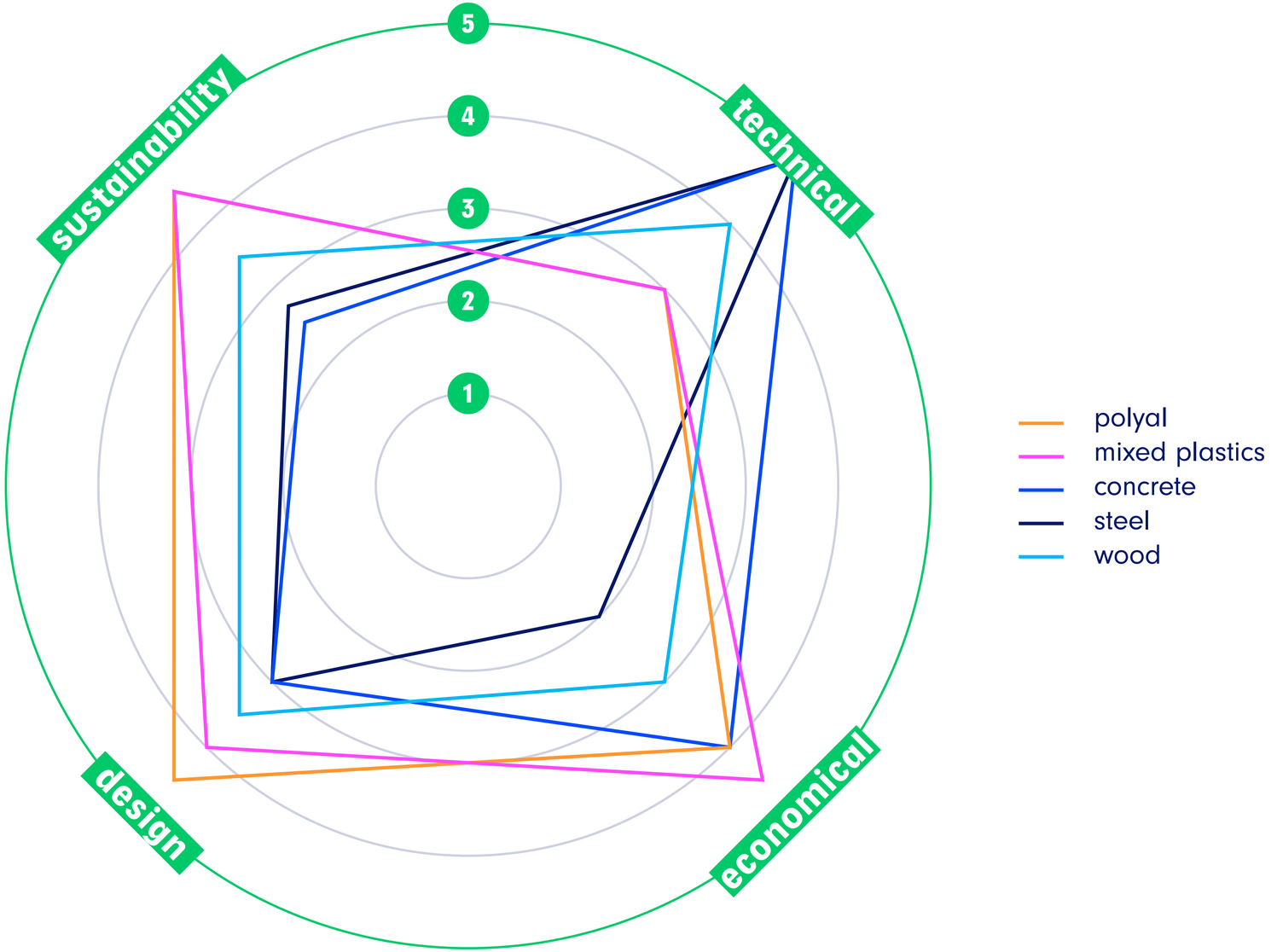
material	recyclability (%)	carbon footprint (kg CO_2e per kg)	sustainable durability (yrs)	mass balance efficiency (low - high)	location of production (onsite / offsite)	material replacement (wood / concrete / steel / etc.)
PolyAl	100%	saves about 1-1.5 kg CO_2e per kg of plastic compared to virgin production	depending on application durability ~50+ yrs	high, 100% recyclable	location of resource production off site (ReconPolymers) location of further production depends on production technique requierd	depending on production technique, biggest possibilities for wood
Mixed Plastics (DKR350)	100%	saves about 1-1.5 kg CO_2e per kg of plastic compared to virgin production	depending on application durability ~50+ yrs	high, 100% recyclable	location of resource production off site (Western Europe) location of further production depends on production technique requierd	depending on production technique, biggest possibilities for wood
compared to						
Concrete (portland cement)	low possibilities	~0.4 kg CO_2e per kg high	50+ yrs high	low	offsite, long distance to site transport needed	
Steel (S235)	100% but very energy intensive	~1.9-2.5 kg CO_2e per kg high energy usagel	50+ yrs high	medium	offsite, long distance to site transport needed	
Wood (C24)	possible not always in same form	~0.8 kg CO_2e per kg	50+ yrs high	low	onsite production possible still regular offsite, long distance and transport needed	

material	composition (-)	production technique (-)	density (kg/m³)	tensile strength (N/mm²) or (MPa)	flexural strength (N/mm²) or (MPa)	impact strength (J) or (kJ/m²)	elastic modulus (N/mm²) or (MPa)	technical durability (yrs)	thermal conductivity (W/m·K)	fire resistance A1-E, s, d	moisture resistance (low - high)	expansion coefficient (mm/m/°C)	key considerations (-)	safety (yes/no)
PolyAl	Polyethylene (PE): 82% Polypropylene (PP): 7% Aluminium (Al): 11%	3D-Printing Compression Molding Injection Molding Injection Molding (small/medium/ large objects) Extrusion Molding Intrusion Molding	1083 kg/m³	13.3 Mpa	~19 Mpa	6.7 kJ/m²	8380 Mpa	50+ yrs	0.22 (W/m·K)	unknown depends on application additives possible	high non absorbing water proof	0.05 mm/m/°C (estimated)	> Odur at higher production temperatures (>200°C) > Molecule direction	yes, coming from food contacted sources and heavily washed, basic input material originating from mainly food contacted packaging, proof that it has already been used in building and construction
Mixed Plastics (DKR350)	Typical packaging (PE / PP / PS / PET): 90% Impurities: 10%	Compression Molding Injection Molding (large objects) Extrusion Molding Intrusion Molding	960 kg/m³	17.2 Mpa	15.7 Mpa	65.6 kJ/m²	572 Mpa	50+ yrs	0.34 (W/m·K)	B2	high non absorbing water proof	0.109 mm/m/°C	> Molecule direction > Difference and percentage in contamination > Color is limited	yes, coming from food contacted sources and heavily washed, basic input material originating from mainly food contacted packaging, proof that it has already been used in building and construction
compared to														
Concrete (portland cement)	Cement Water Sand Aggregate (Steel reinforcement)	Casting Curing Molding	~2400 kg/m³	~2-5 Mpa depends on reinforcement	~3.5-7 MPa	<1 kJ/m²	~30,000-40,000 MPa	50+ yrs with proper maintenance	~1.4 W/m·K	high	high	low cracking due to temperature fluctuations	> Heavy > Labor-intensive installation > Limited flexibility > Requires curing time	yes
Steel (S235)	Iron (Fe) Carbon (C) Small amounts of alloying elements	Rolling Forging Casting / Molding Welding	~7850 kg/m³	~400-550 MPa	~400-550 MPa		~200,000 MPa	50+ yrs depends on environmental exposure and treatment	~50 W/m·K	low requires fireproof coating to keep integrity	high rusts without coating in wet environments	moderate experiences significant expansion under heat, requires allowance in design	> Requires corrosion protection > Heavy > High precision in fabrication	yes
Wood (C24)	Softwood (spruce, pine or fir)	Cutting Bonding (plywood)	~400-600 kg/m³	~7-10 MPa	~24 MPa	5-20 kJ/m²	~10,000-12,000 MPa	20-50 yrs depends on wood treatment and maintenance	~0.13 W/m·K	low requires fire-retardant chemicals	low / moderate if not treated	moderate	> Susceptible to rot > Pests, treated wood is more durable but costly	yes

material	production size (min.) WxLxH (mm)	production size (max.) WxLxH (mm)	versatility/application potential (-)	formability (-)	aesthetic flexibility (-)	fastening/ installation (screws/adhesives/ interlocking systems, etc.)	possible processing (-)	(dis)assembly strategy (-)
PolyAl	flexible depending on production technique	flexible depending on production technique	high	molded in any producable shape 3d print makes complex possible	texture: smooth - rough (matt) depending on production technology (3d printing, compression and injection molding make this possible) color: flexible in color finishing: in mold labeling possible, very flexible in aesthetic, finishing like painting possible with coating much possibilities to influence aesthetic (verchromen) chrome plating	depending on production technique, comparable with wood (also interlock design) and also welding is a possibility	cutting drilling painting (with coating) welding grinding	very flexible possibilities screwing, clicking, pin-hole connection (in injection, molding and compression)
Mixed Plastics (DKR350)	flexible depending on production technique	flexible depending on production technique	high	molded in many producable shape less complex possible, more focus on large object	texture: smooth - rough finishing: texture is possible in compression molding and injection molding (less detailed)) color: less flexible in colour (dark colours)	depending on production technique, comparable with wood (also interlock design) and also welding is a possibility	cutting drilling painting (with coating) welding grinding	flexible possibilities screwing, clicking, pin-hole connection (in injection, molding and compression)
compared to								
Concrete (portland cement)	cast in any size	cast in any size	foundations structural beam slabs columns floors walls	molded in any shape	limited finishing possible	bolted welded cast-in-place	cutting drilling grinding polishing	
Steel (S235)	standard profiles	standard profiles	beams columns trusses framing	flexible in forming techniques	limited in raw state finishing possible	bolted welded riveted connections	cutting welding painting other surface treaments	
Wood (C24)	depending sheet / planks	depending sheet / planks	walls floors roofs framing furniture cabinetry	flexible in forming techniques	limited in raw state finishing wide range possibilities	nails screws adhesives interlocking systems	cutting drilling painting	

material	material costs (low/medium/high)	production costs (low/medium/high)	gate fee* (yes/no) * Gate Fee = charged levied	overall costs (low/medium/high)	CO_2-emission (low/medium/high)
PolyAl	low	medium	no	low / medium	low
Mixed Plastics (DKR350)	low	medium	yes	low	low
compared to					
Concrete (portland cement)	medium / high	low	no	low	medium
Steel (S235)	medium / high	high	no	high	high
Wood (C24)	high	low / medium	no	low / medium	low

performance compared to traditional building materials



recycled plastic materials application potential



1

plastics design flexibility

2

high recyclability, circular & low environmental impact

3

customizable properties (additives)

4

comparability with wood

5

cost efficient

recycled plastic materials application limitations

1

structural performance

2

social acceptance in application



polyal for constructive use has potential

elastic modulus polyal
8380 Mpa

>

elastic modulus mixed
572 Mpa



elastic modulus cracked concrete
7500 - 10 000 Mpa



pressed
pellets

structural limitations to address

1. flexural strength + creep
2. lightweight properties for load-bearing design
3. tensile strength + force transfer
4. stiffness
5. buckling

solutions for structural limitations - “rules of thumb”

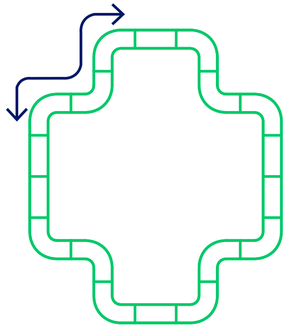
1	**flexural strength + creep**	• multi-layered structure to enhance stiffness • glass fiber reinforcement is strategically integrated • optimal load distribution from floor and roof components to walls • honeycomb cores and ribs or stiffening beams
2	**lightweight properties for load-bearing design**	• double bent walls for expanding wall footprint • vertical reinforcements to connect with foundation • honeycomb increases load-carrying capacity without adding weight • max. 5 levels: greater heights, wind forces increase exponentially, lightweight structures need to be reinforced heavily
3	**tensile strength + force transfer**	• create stiffness in wall / floor system • small openings with rounded edges to optimize force transfer • glass fibre reinforcements in tensile zones • mechanical connections • overdimensioning
4	**stiffness**	• double-bent wall system • honeycomb cores and ribs • glass fiber reinforcement is strategically integrated • bended and curved shapes
5	**buckling**	• honeycomb cores • short spans

modular system

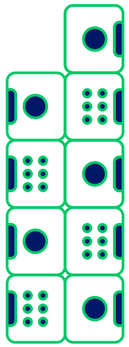
form follows material + function

plastics unique flexibility

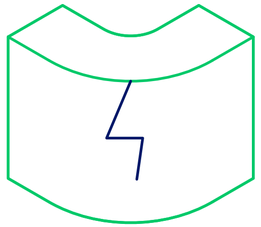
form follows material - structural strength and load



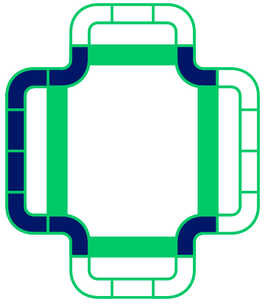
double-bent walls



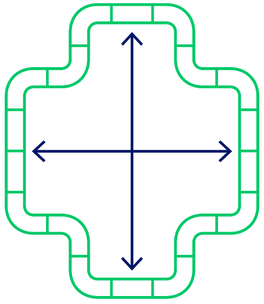
max. 5 levels



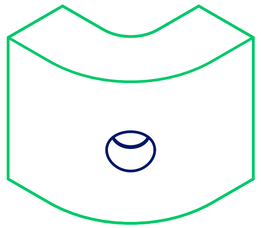
round avoids cracking



constructively
continuously closed
inner bent +
one side wall

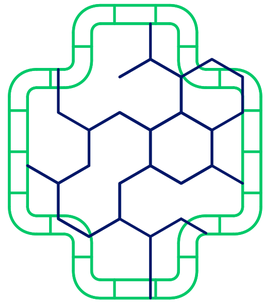


optimal load
distribution floor +
roof to walls

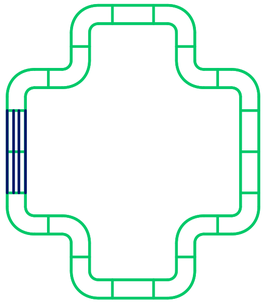


small round window
openings in bent walls to
take compressive loads

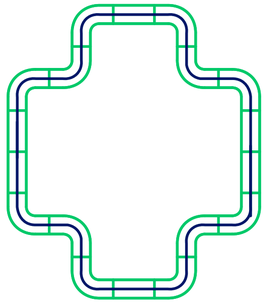
form follows material - efficiency and reinforcement



honeycomb cores and ribs

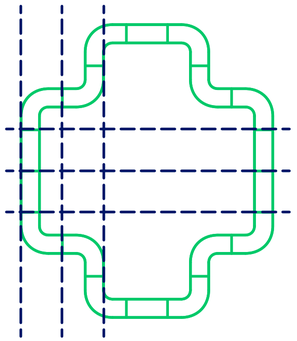


multi-layered structures

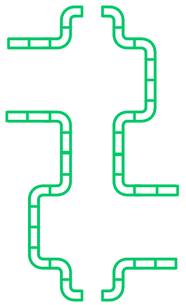


strategic glass fibre reinforcement

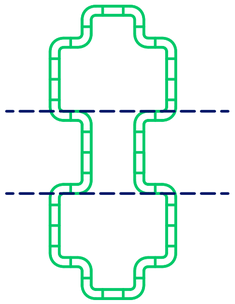
form follows function - space



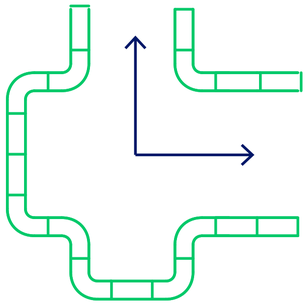
grid 900mm



scalable modular system

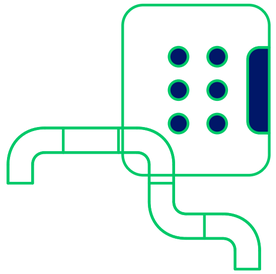


natural spatial division

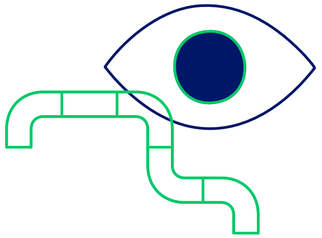


flexibility in expansion size

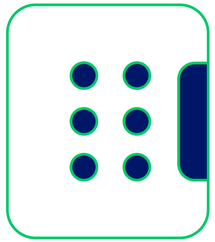
form follows function - shape



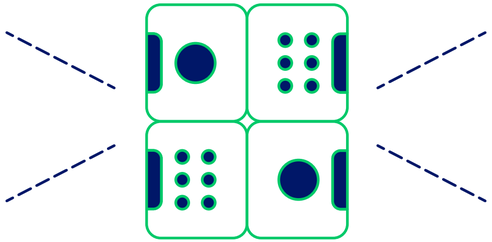
round shape
friendly and
familiar



round shape
visual comforting



futuristic and
innovative aesthetic



expressive to engage
perception shift

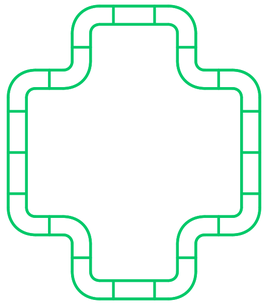
+ shape

double
double-bent walls

round shape
inside and outside
corners

constructively
continuously closed
inner bent
+ one side wall

natural spatial
division

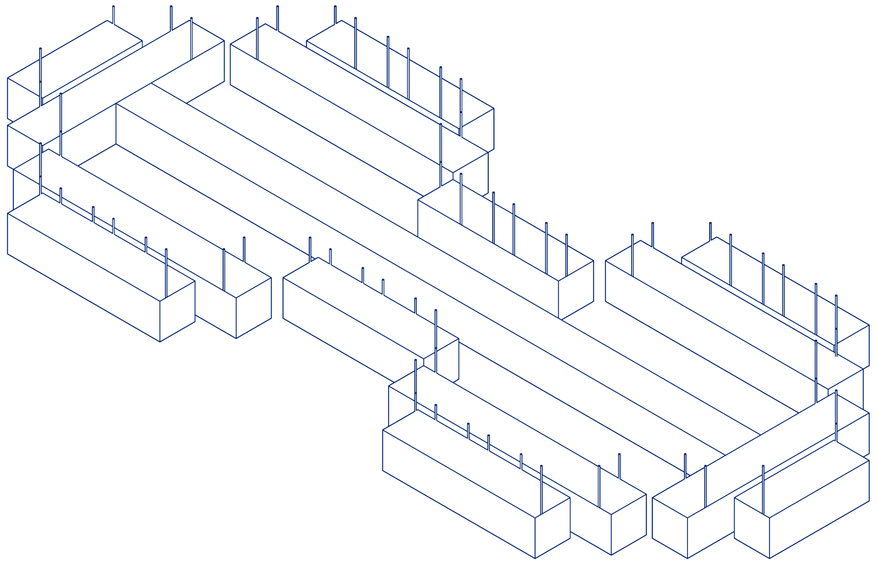


expressive shape

scalable and expandable
in multiple directions

construction sequence

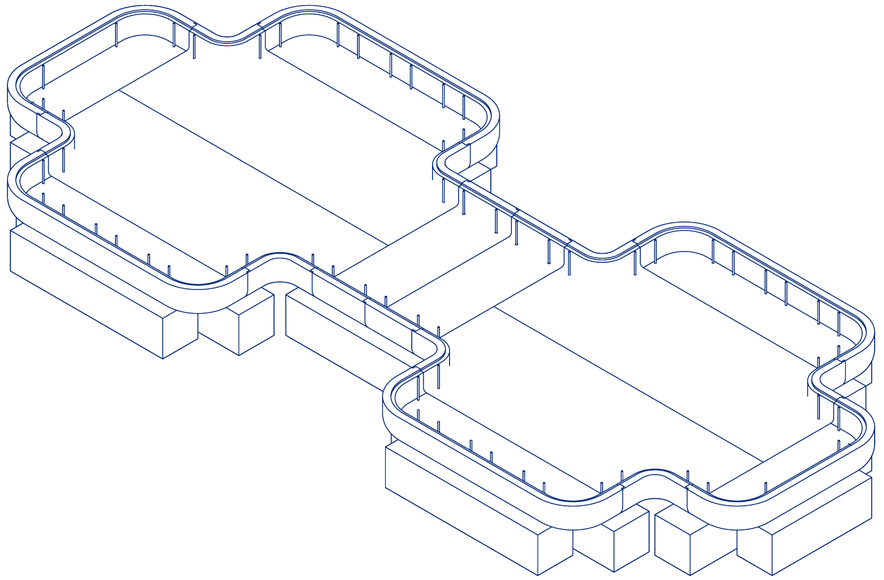
1 concrete foundation + steel tie rods



construction sequence

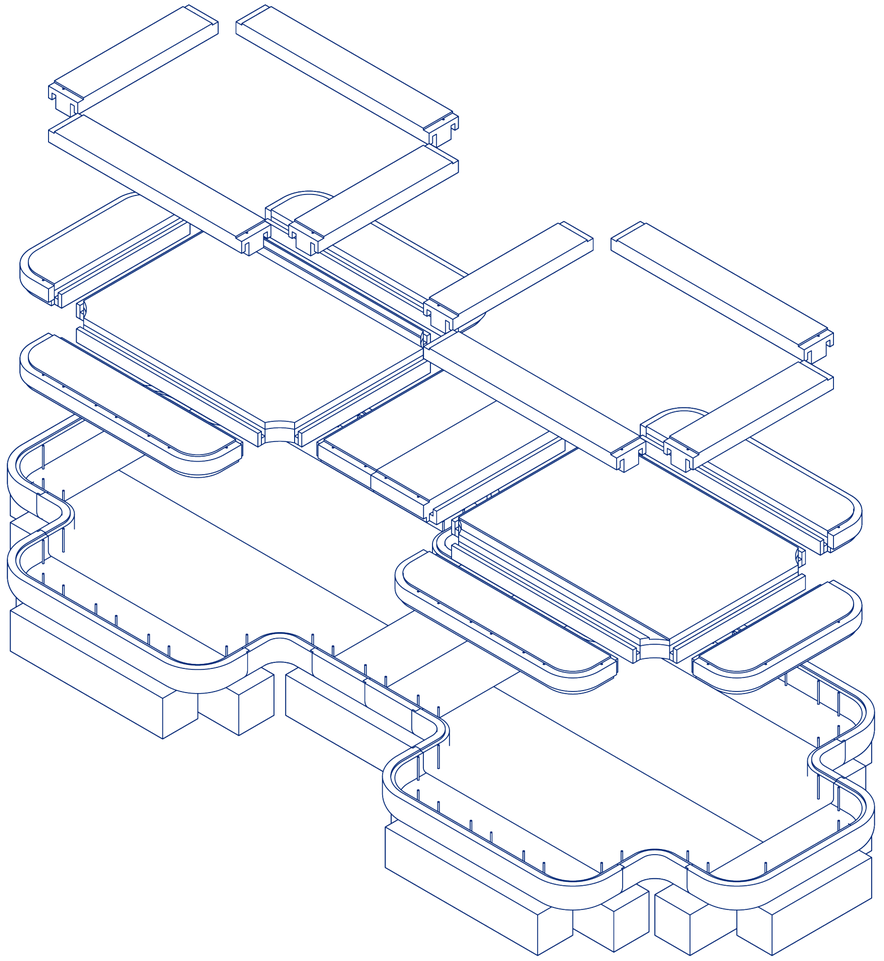
1 concrete foundation + steel tie rods

2 shell base



construction sequence

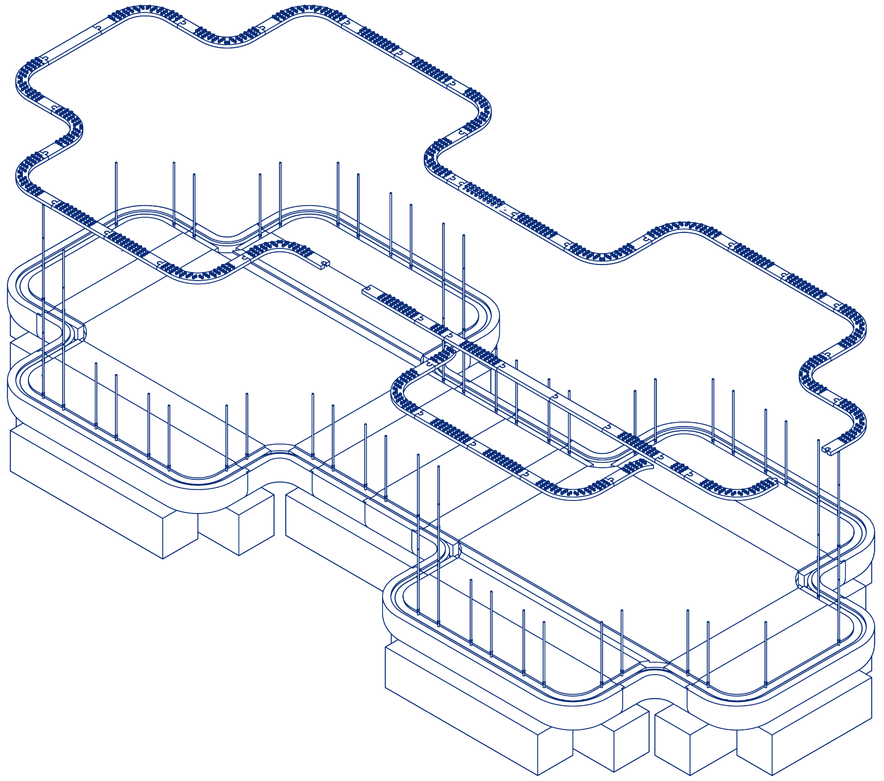
1 concrete foundation + steel tie rods
2 shell base
3 dual plate floor
4 connecting beams



glass fibre reinforced

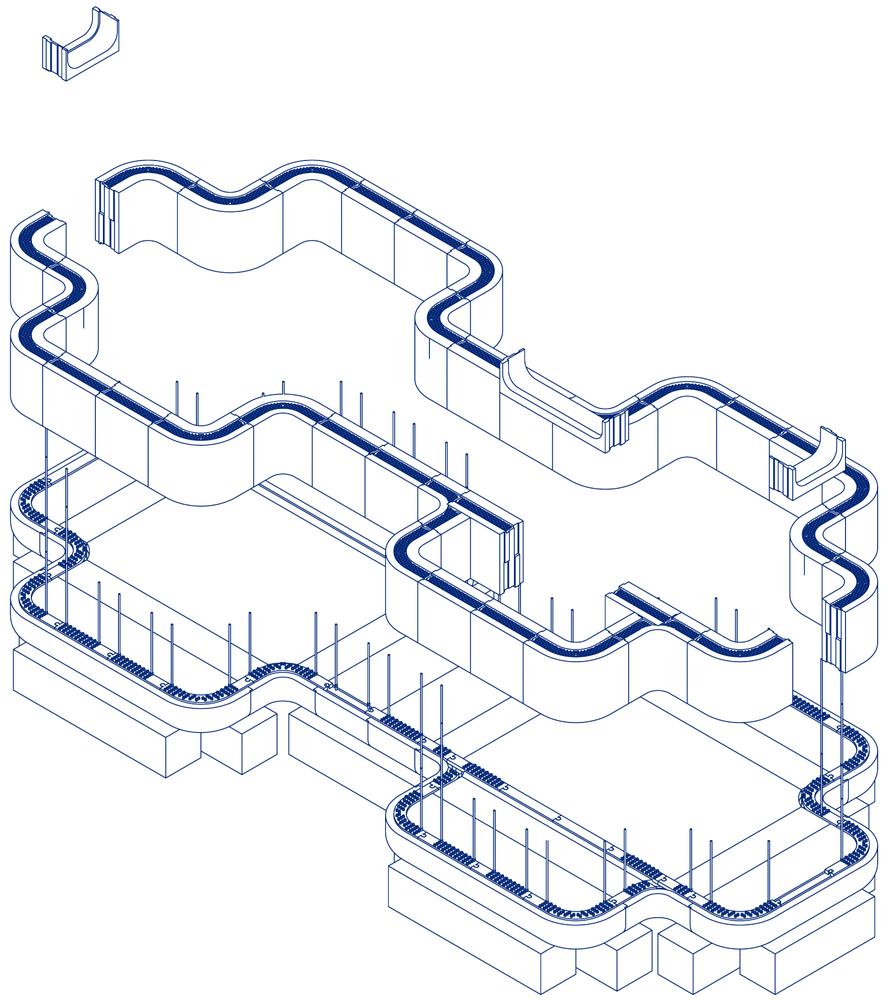
construction sequence

1 concrete foundation + steel tie rods
2 shell base
3 dual plate floor
4 connecting beams
5 steel tie rods (per wall component layer)
6 interlocking ring



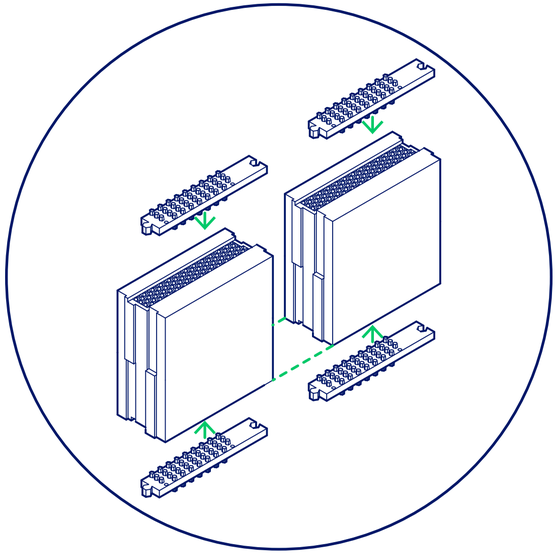
glass fibre reinforced

construction sequence



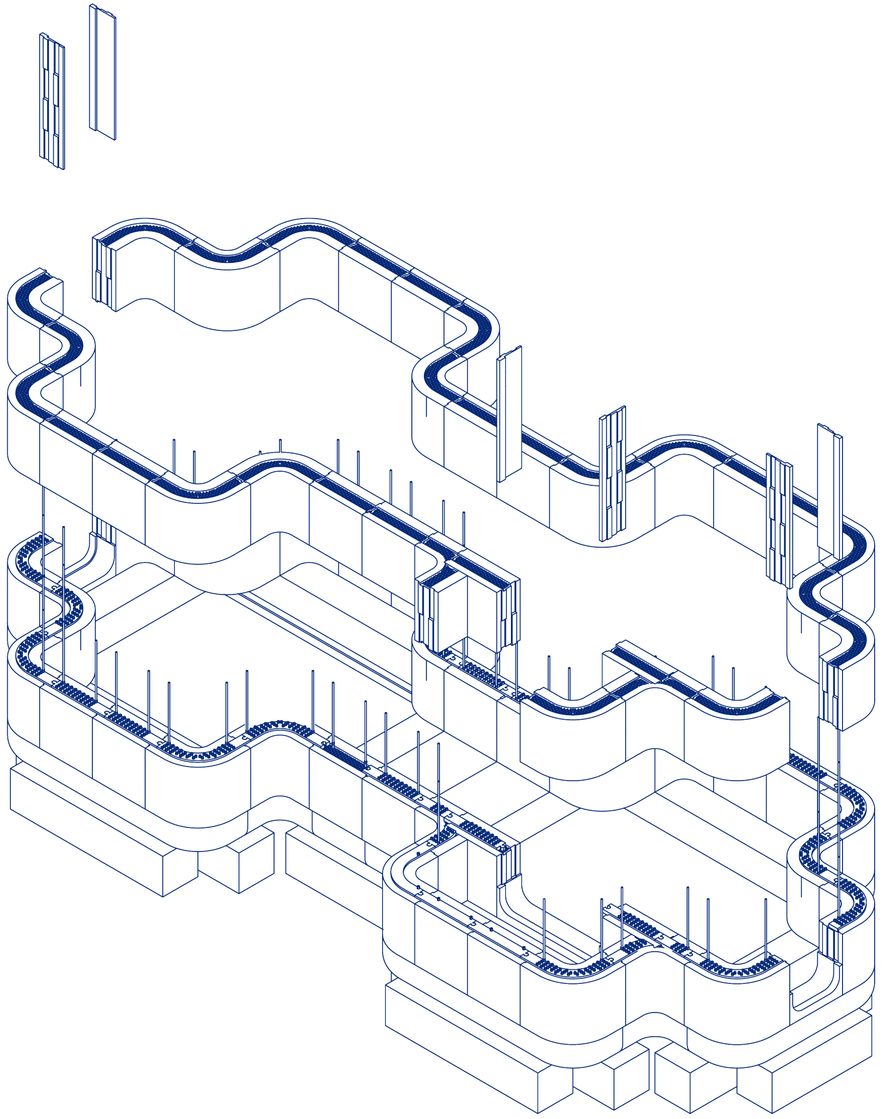
1 concrete foundation + steel tie rods
2 shell base
3 dual plate floor
4 connecting beams
5 steel tie rods (per wall component layer)
6 interlocking ring
7 wall components (900mm)
8 frames base

construction sequence



double tongue-and-groove joint system
the blocks resist both horizontal and vertical movement

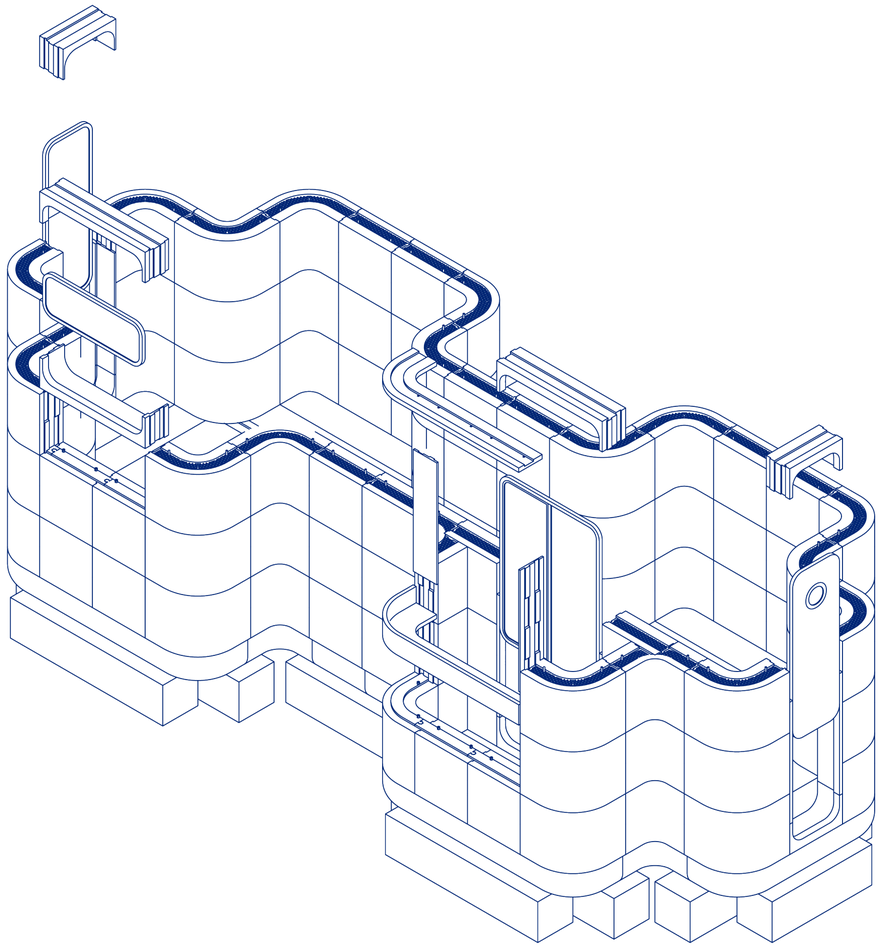
interlocking ring ensures
> airtightness
> fire resistance
> prevents structural buckling



1 concrete foundation + steel tie rods
2 shell base
3 dual plate floor
4 connecting beams
5 steel tie rods (per wall component layer)
6 interlocking ring
7 wall components (900mm)
8 frames base
9 steel tie rods
10 interlocking ring
11 wall components (1800mm)
12 frames side

glass fibre reinforced

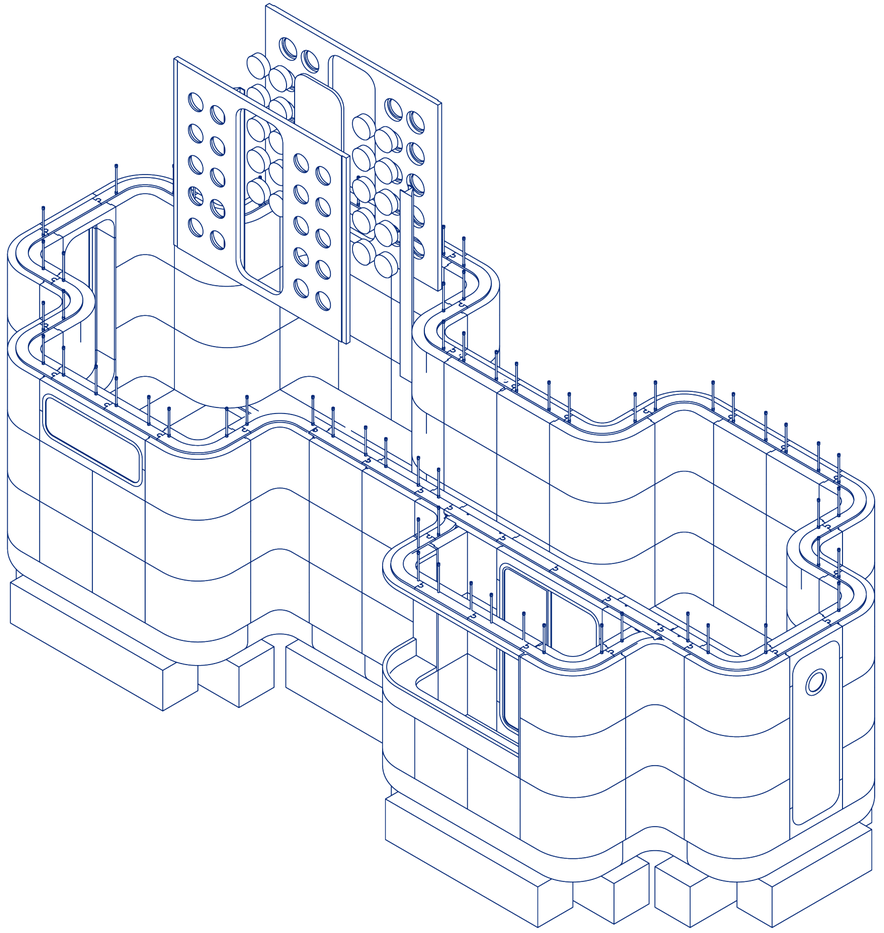
construction sequence



1 concrete foundation + steel tie rods
2 shell base
3 dual plate floor
4 connecting beams
5 steel tie rods (per wall component layer)
6 interlocking ring
7 wall components (900mm)
8 frames base
9 steel tie rods
10 interlocking ring
11 wall components (1800mm)
12 frames side
13 steel tie rods
14 interlocking ring
15 wall components (2700mm)
16 frames top + windows + door
17 balcony finish

glass fibre reinforced

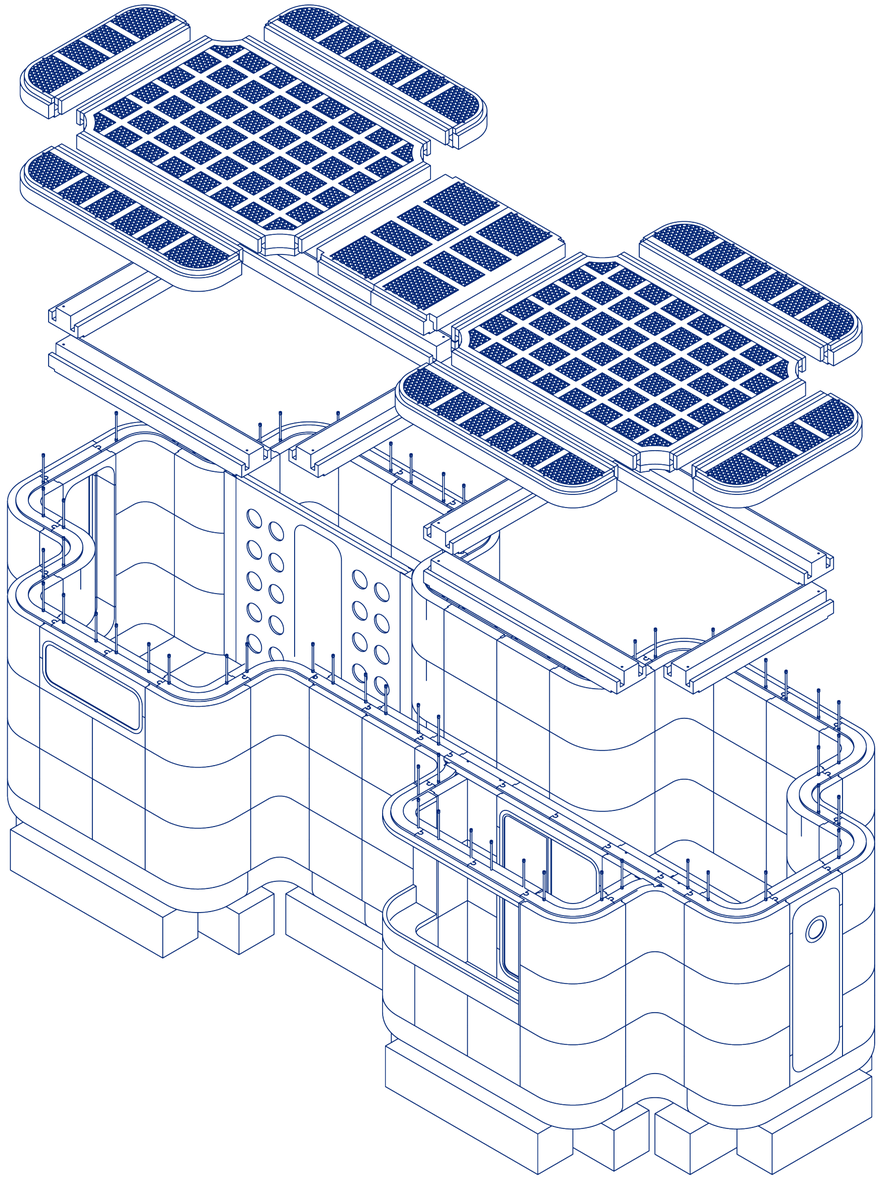
construction sequence



1 concrete foundation + steel tie rods
2 shell base
3 dual plate floor
4 connecting beams
5 steel tie rods (per wall component layer)
6 interlocking ring
7 wall components (900mm)
8 frames base
9 steel tie rods
10 interlocking ring
11 wall components (1800mm)
12 frames side
13 steel tie rods
14 interlocking ring
15 wall components (2700mm)
16 frames top + windows + door
17 balcony finish
18 steel tie rods
19 interlocking ring
20 inside wall framing
21 inside wall

glass fibre reinforced

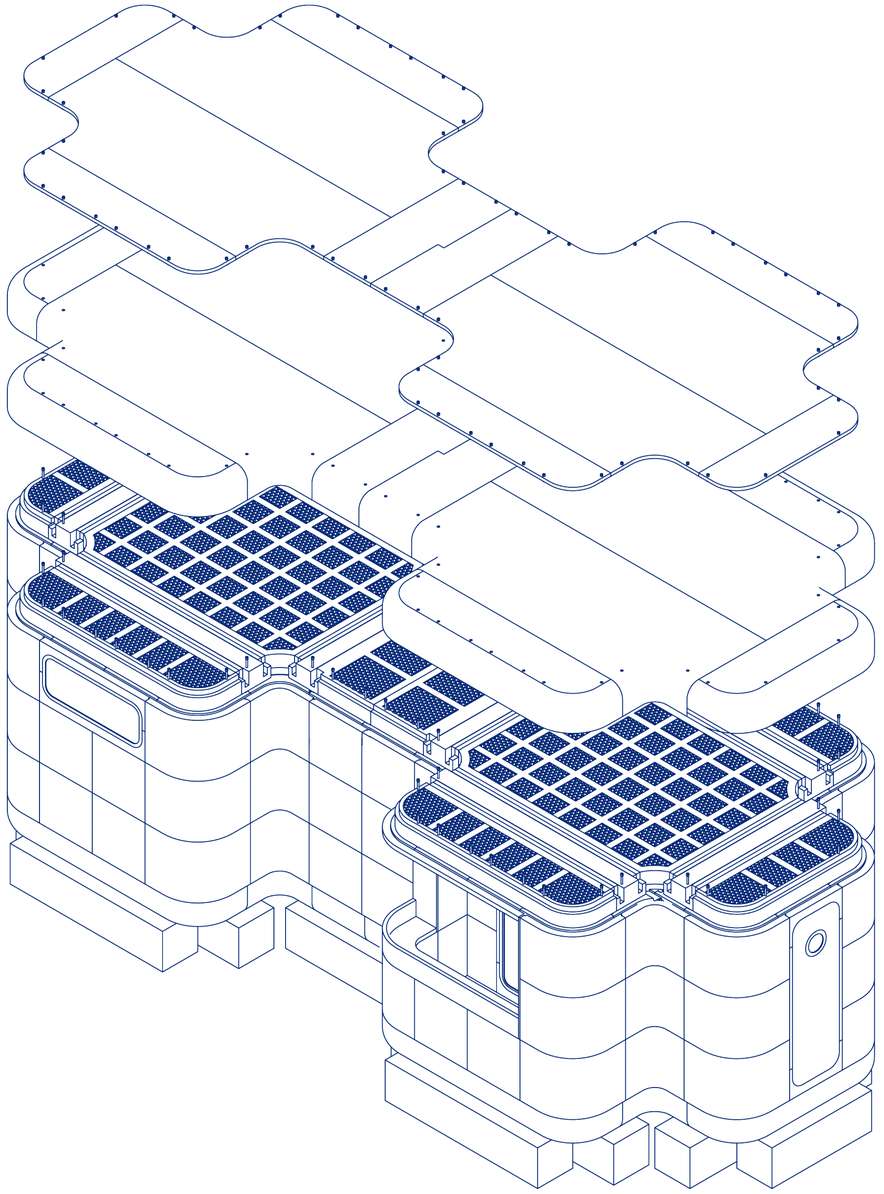
construction sequence



1 concrete foundation + steel tie rods
2 shell base
3 dual plate floor
4 connecting beams
5 steel tie rods (per wall component layer)
6 interlocking ring
7 wall components (900mm)
8 frames base
9 steel tie rods
10 interlocking ring
11 wall components (1800mm)
12 frames side
13 steel tie rods
14 interlocking ring
15 wall components (2700mm)
16 frames top + windows + door
17 balcony finish
18 steel tie rods
19 interlocking ring
20 inside wall framing
21 inside wall
22 connecting beams
23 dual plate ceiling

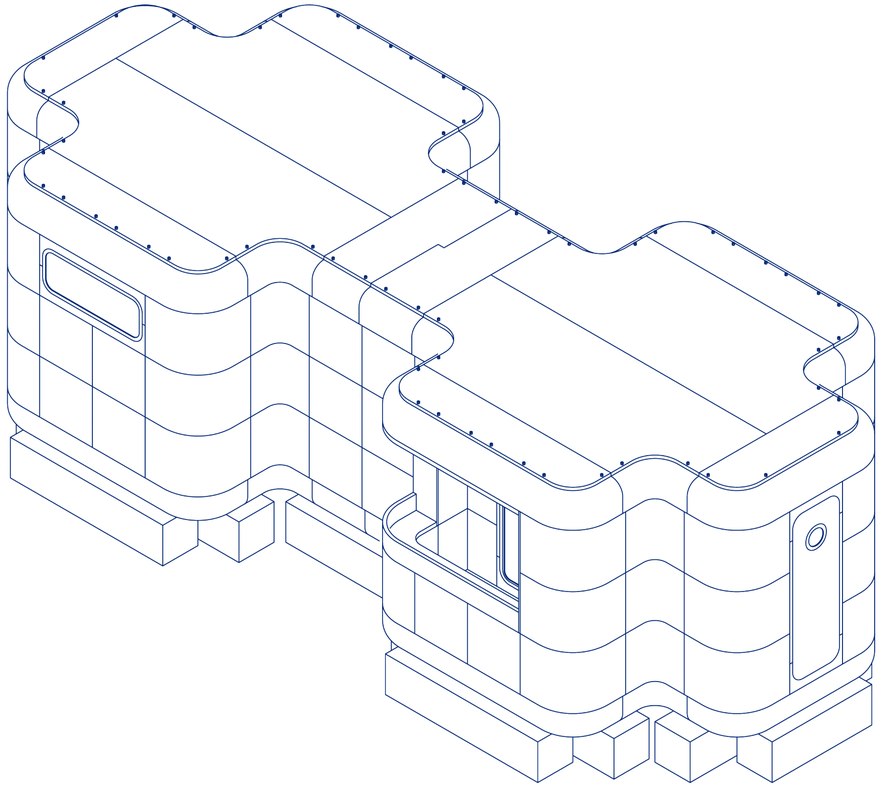
glass fibre reinforced

construction sequence



1 concrete foundation + steel tie rods
2 shell base
3 dual plate floor
4 connecting beams
5 steel tie rods (per wall component layer)
6 interlocking ring
7 wall components (900mm)
8 frames base
9 steel tie rods
10 interlocking ring
11 wall components (1800mm)
12 frames side
13 steel tie rods
14 interlocking ring
15 wall components (2700mm)
16 frames top + windows + door
17 balcony finish
18 steel tie rods
19 interlocking ring
20 inside wall framing
21 inside wall
22 connecting beams
23 dual plate ceiling
24 shell roof
25 connecting plate next module

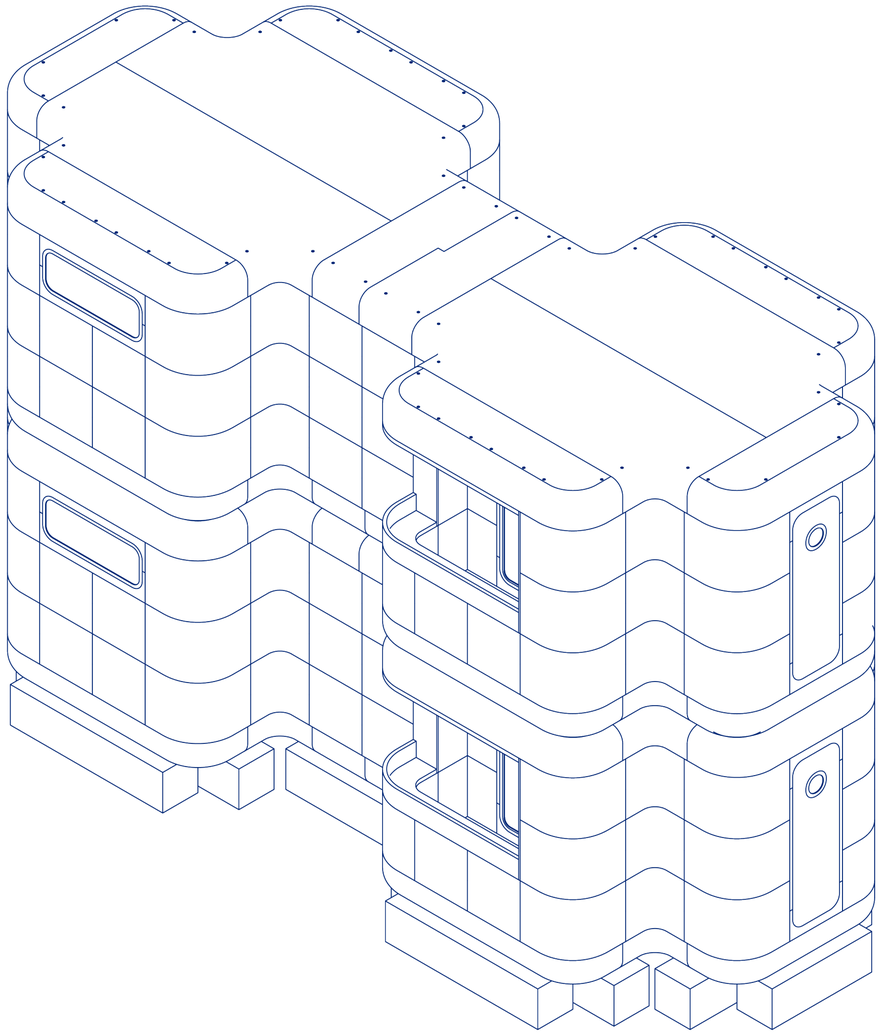
construction sequence



glass fibre reinforced

1 concrete foundation + steel tie rods
2 shell base
3 dual plate floor
4 connecting beams
5 steel tie rods (per wall component layer)
6 interlocking ring
7 wall components (900mm)
8 frames base
9 steel tie rods
10 interlocking ring
11 wall components (1800mm)
12 frames side
13 steel tie rods
14 interlocking ring
15 wall components (2700mm)
16 frames top + windows + door
17 balcony finish
18 steel tie rods
19 interlocking ring
20 inside wall framing
21 inside wall
22 connecting beams
23 dual plate ceiling
24 shell roof
25 connecting plate next module

construction sequence



1 concrete foundation + steel tie rods
2 shell base
3 dual plate floor
4 connecting beams
5 steel tie rods (per wall component layer)
6 interlocking ring
7 wall components (900mm)
8 frames base
9 steel tie rods
10 interlocking ring
11 wall components (1800mm)
12 frames side
13 steel tie rods
14 interlocking ring
15 wall components (2700mm)
16 frames top + windows + door
17 balcony finish
18 steel tie rods
19 interlocking ring
20 inside wall framing
21 inside wall
22 connecting beams
23 dual plate ceiling
24 shell roof
25 connecting plate next module

kit of components

kit of components design approach

1

production techniques possibilities

2

demountable / remountable

3

grid size
- structural
- human centered
- dutch norms

4

truck transport proof

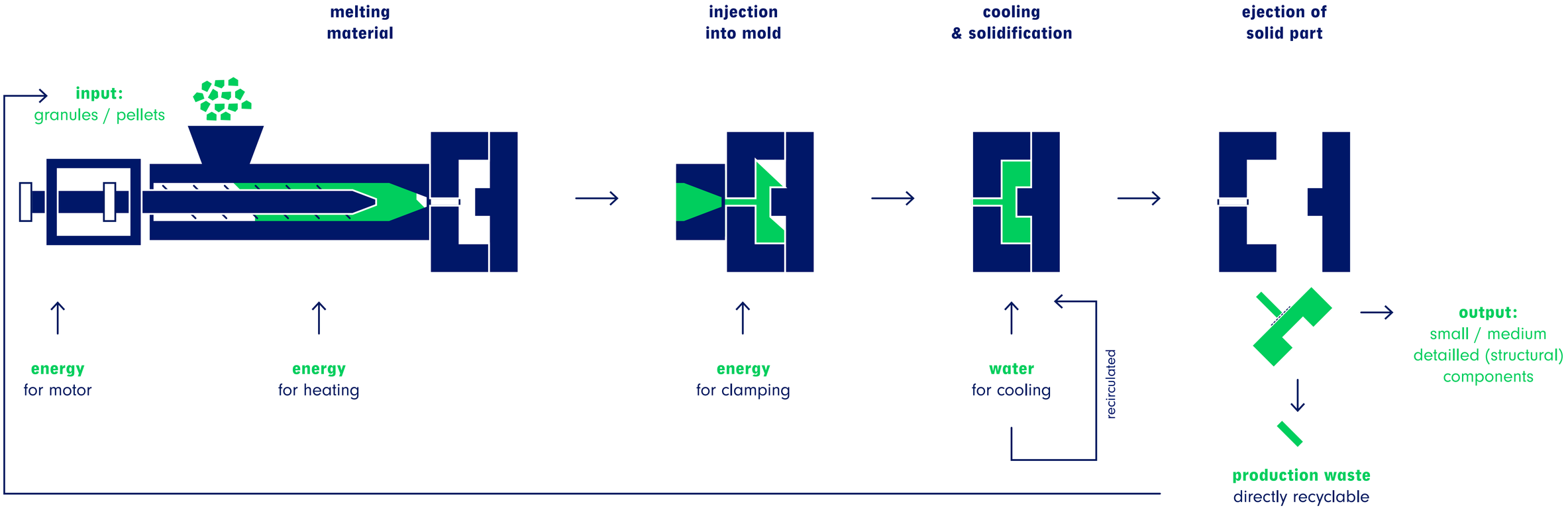
kit of components



production technique

- injection molding
- compression molding
- extrusion molding

production technique 1:
injection molding

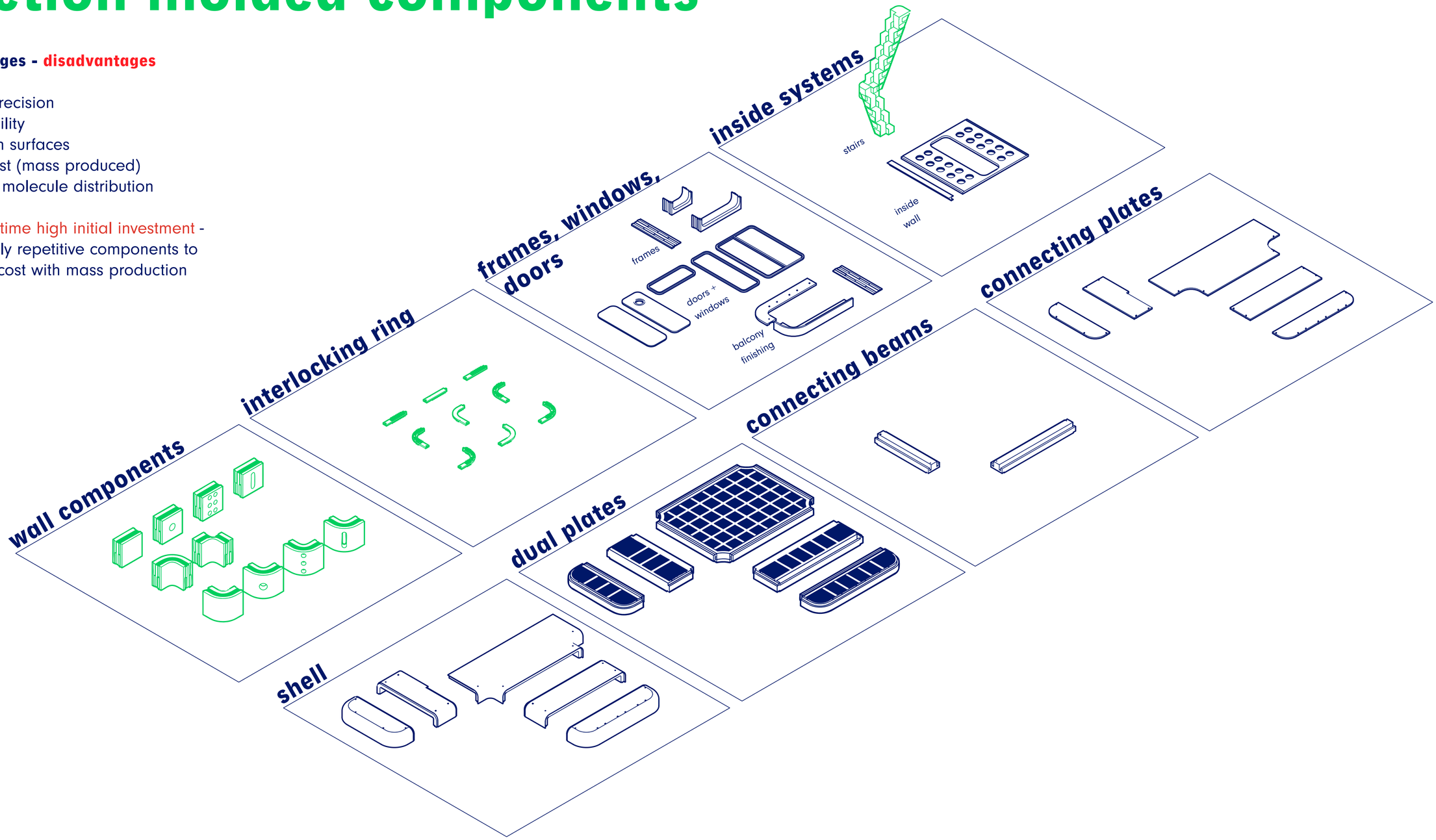


injection molded components

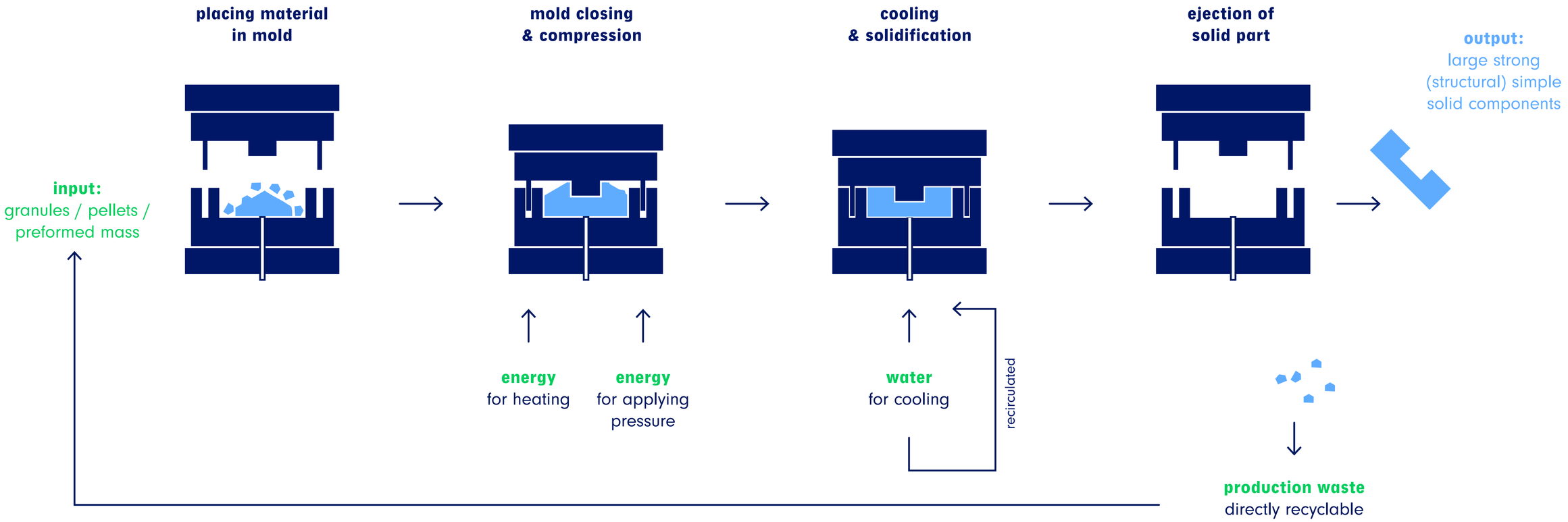
advantages - disadvantages

- high precision
- scalability
- smooth surfaces
- low cost (mass produced)
- strong molecule distribution

- a one time high initial investment - use only repetitive components to lower cost with mass production



production technique 2:
compression molding

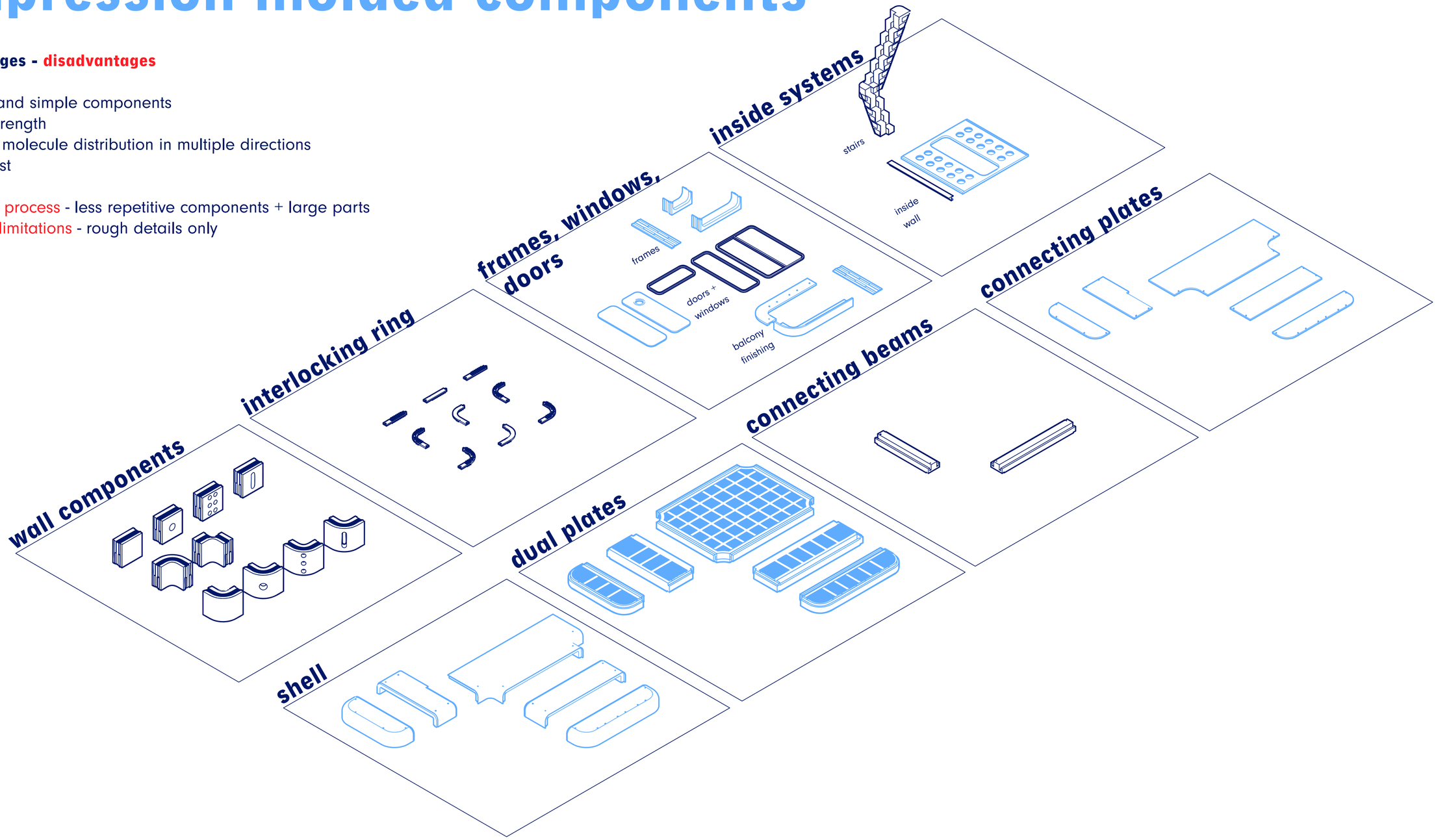


compression molded components

advantages - disadvantages

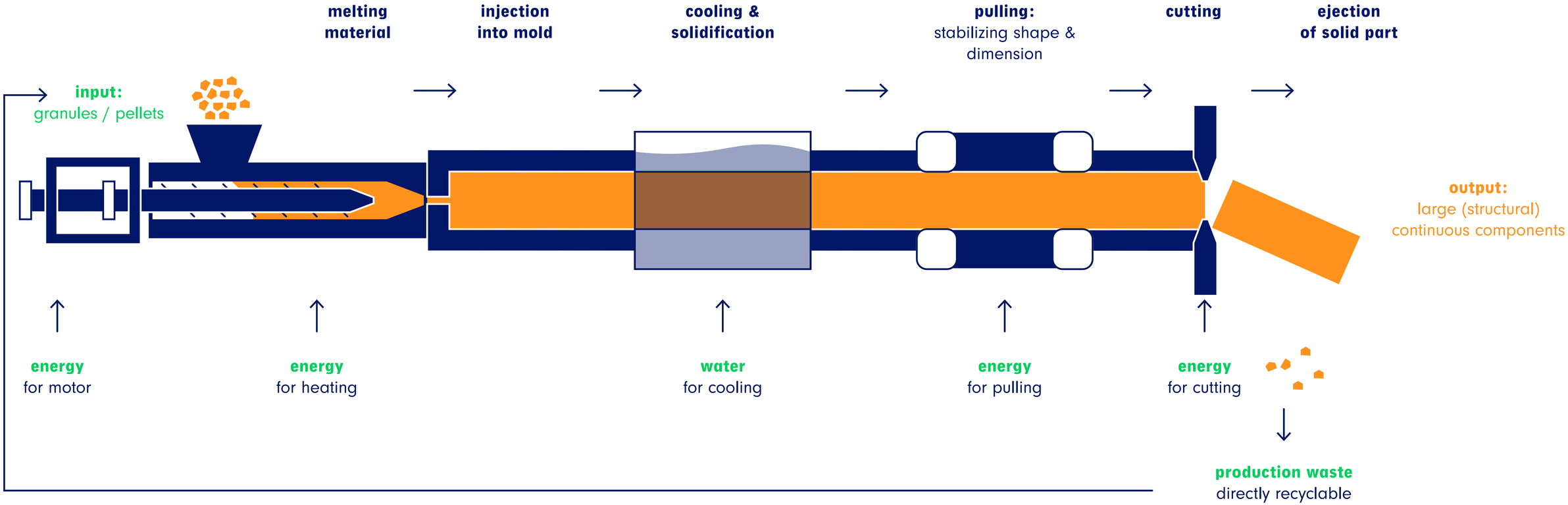
- large and simple components
- high strength
- strong molecule distribution in multiple directions
- low cost

- slower process - less repetitive components + large parts
- detail limitations - rough details only



production technique 3

extrusion molding

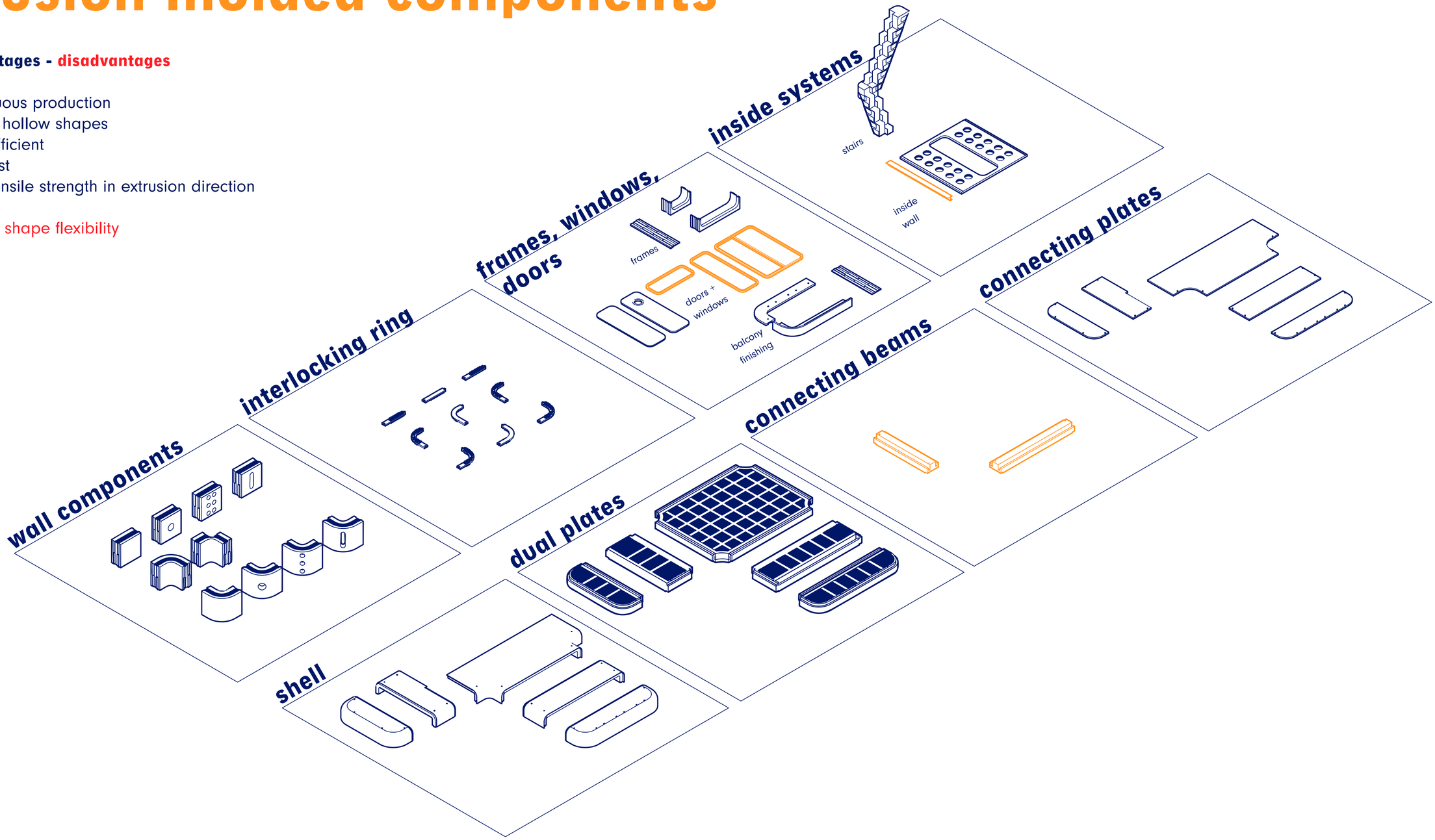


extrusion molded components

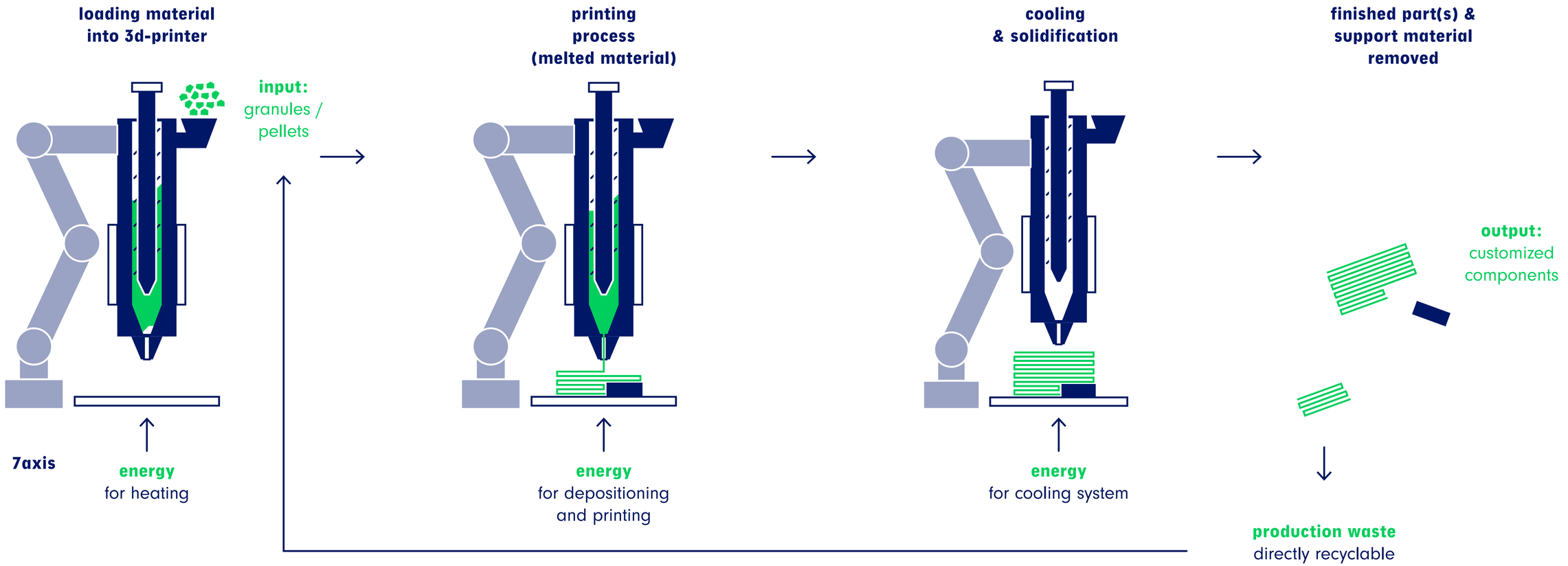
- **advantages - disadvantages**

- continuous production
- solid / hollow shapes
- high efficient
- low cost
- high tensile strength in extrusion direction

- limited shape flexibility



production technique 4:
3d-printing - fused granular fabrication (FGF)



- **advantages - disadvantages**

- design freedom
- small scale possible
- lightweight

- slow speed

- high cost
- weak, only decorative structures









3d-printing
poly al

sources: Aectual and Recon Polymers

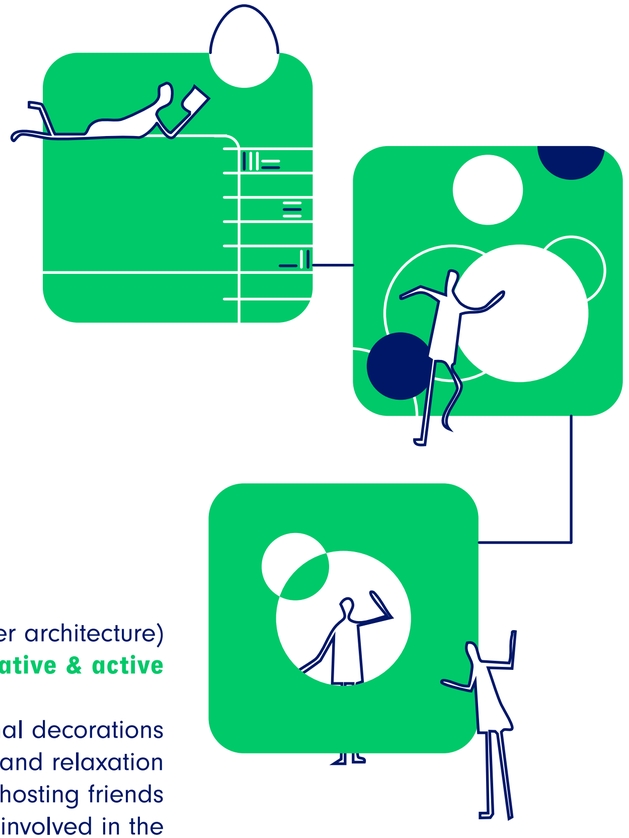
minimal parts flexible system

studio units

student users

coco (24, master SET)
calm, resourceful & interested in sustainability

- serene and imaginative space for studying
- surrounded by personal touches
- storage solutions books, hobbies and plants
- collaboration space when friends come over
- access to shared green spaces & workshops



frits (19, bachelor industrial design)
international, high-level sports & very social

- small shared spaces for socializing
- adjustable space for studying and home workouts
- functional kitchen for preparing fresh meals
- space for hosting friends

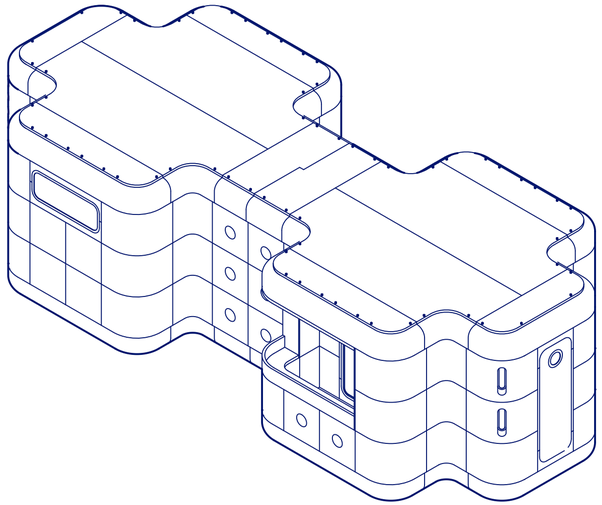
nadine (26, master architecture)
graduating student, creative & active

- storage for architecture supplies and all personal decorations
- space adapts for focused work, creativity and relaxation
- space for hosting friends
- shared spaces to be involved in the recycled plastic housing project (:

studio flexibility

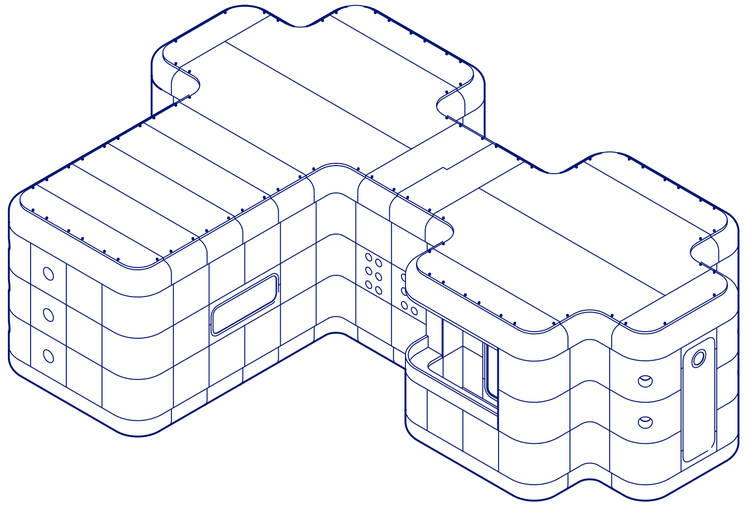
kitchen
bathroom
balcony
single-floor
€

regular
32 m²



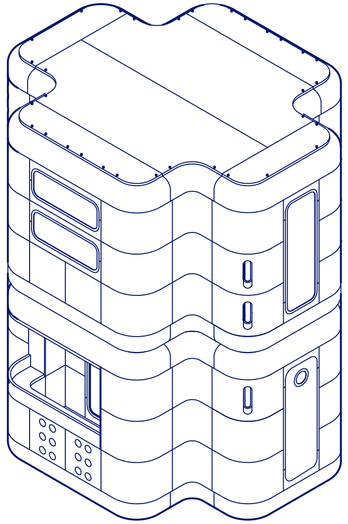
kitchen
bathroom
balcony
single-floor
€€

regular +
42 m²



kitchen
bathroom
balcony
double-floor
€

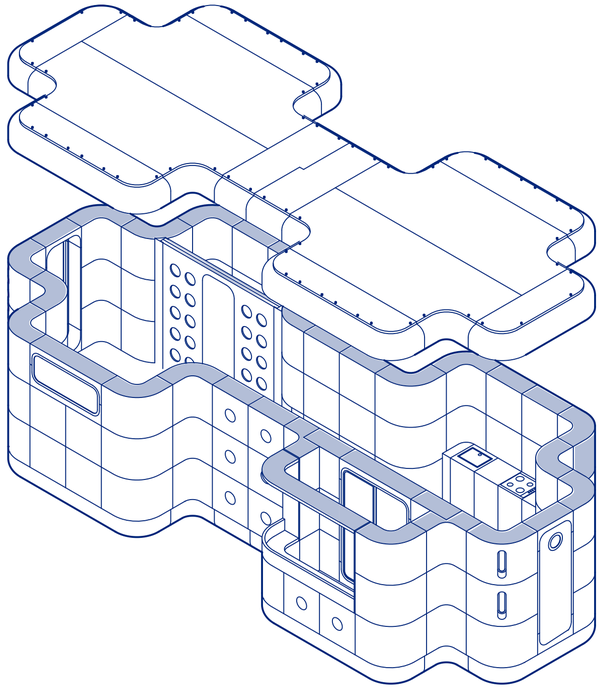
loft
30 m²

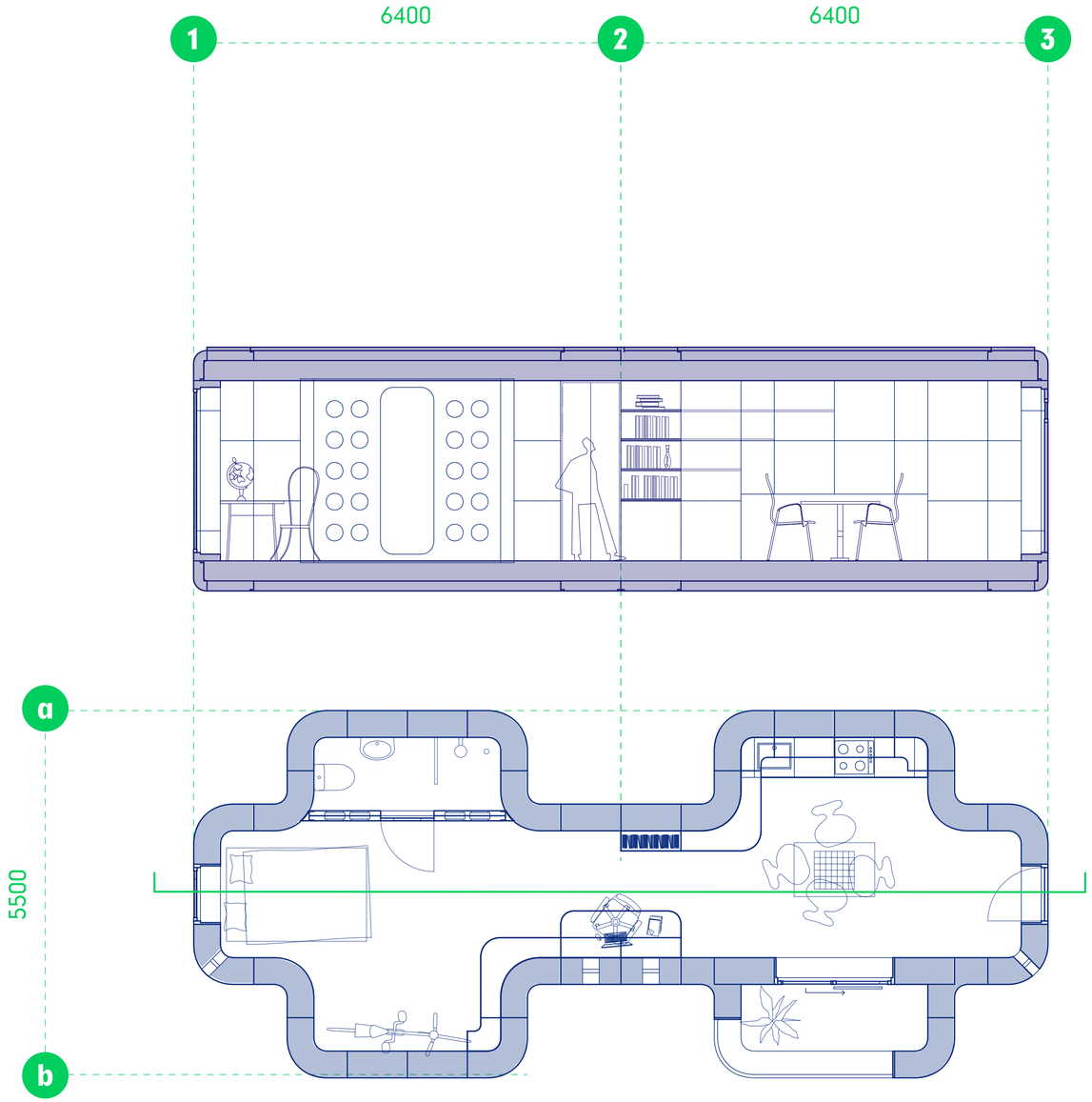


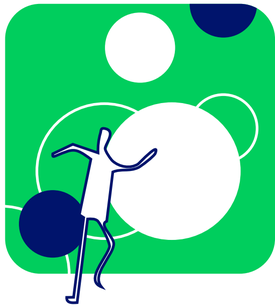


studio regular

32 m²



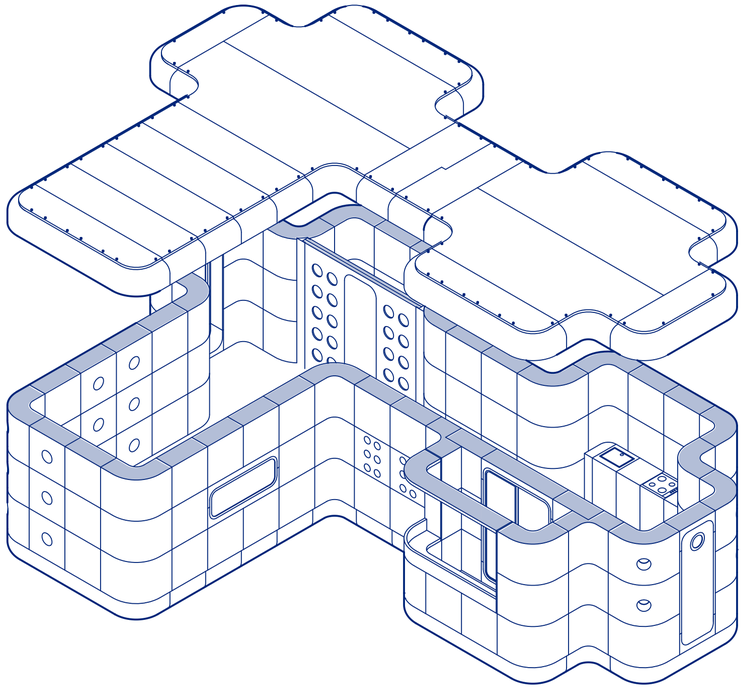


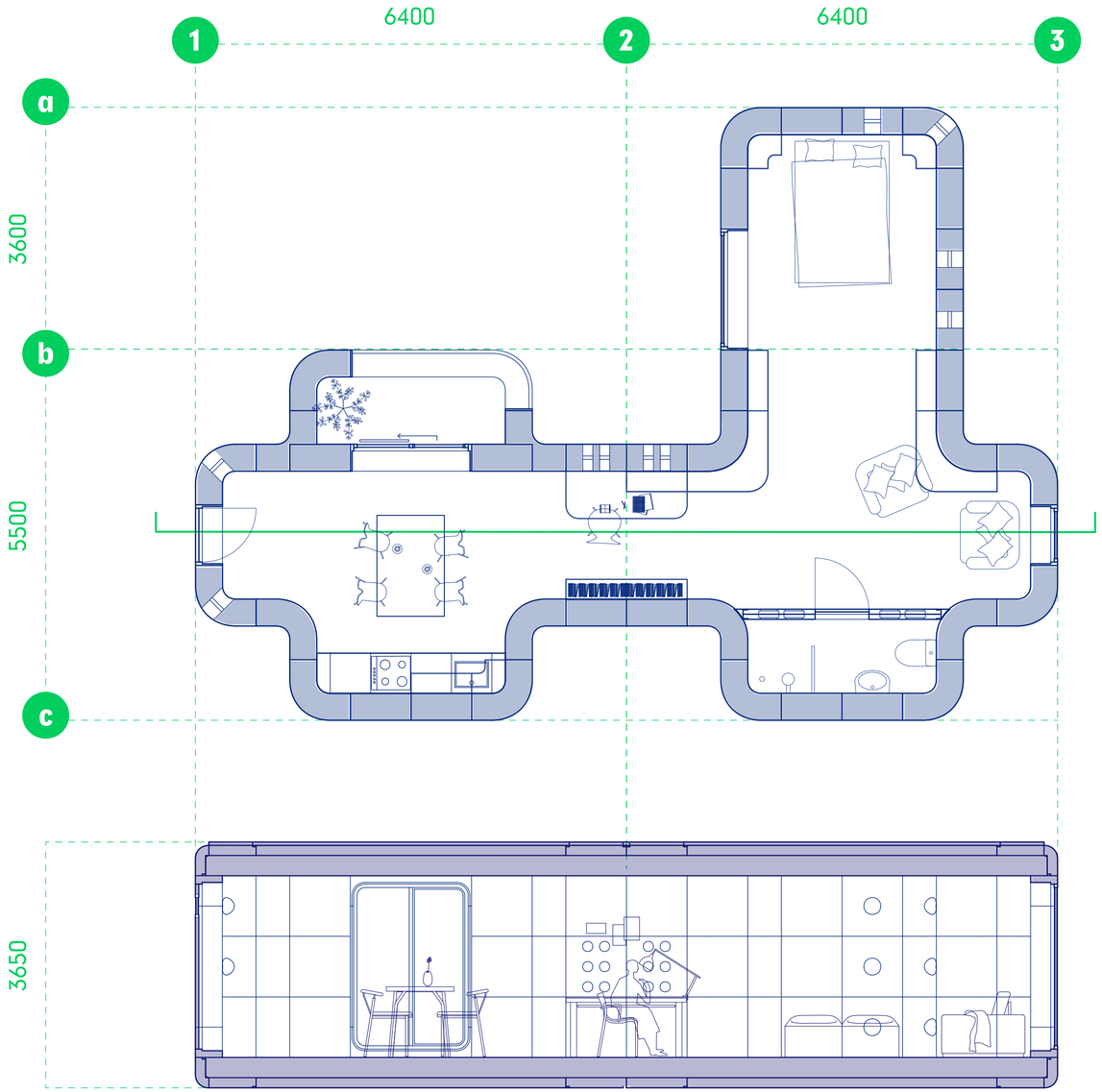




studio regular +

42 m²



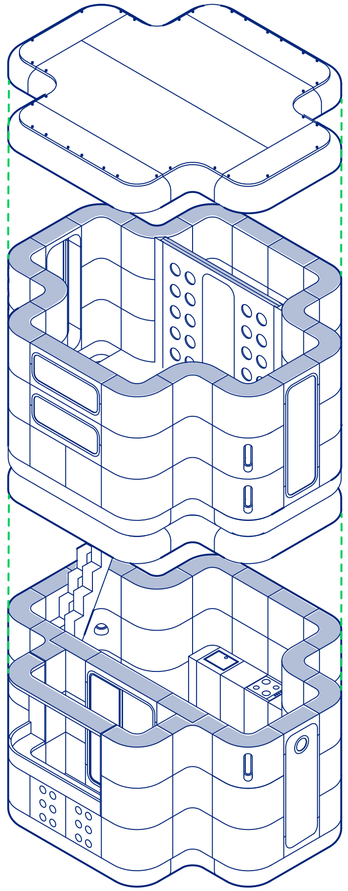


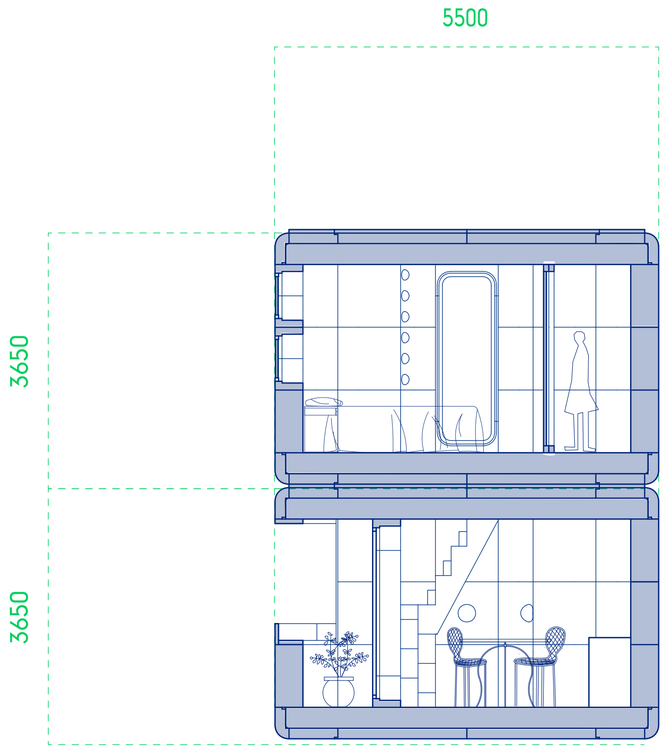


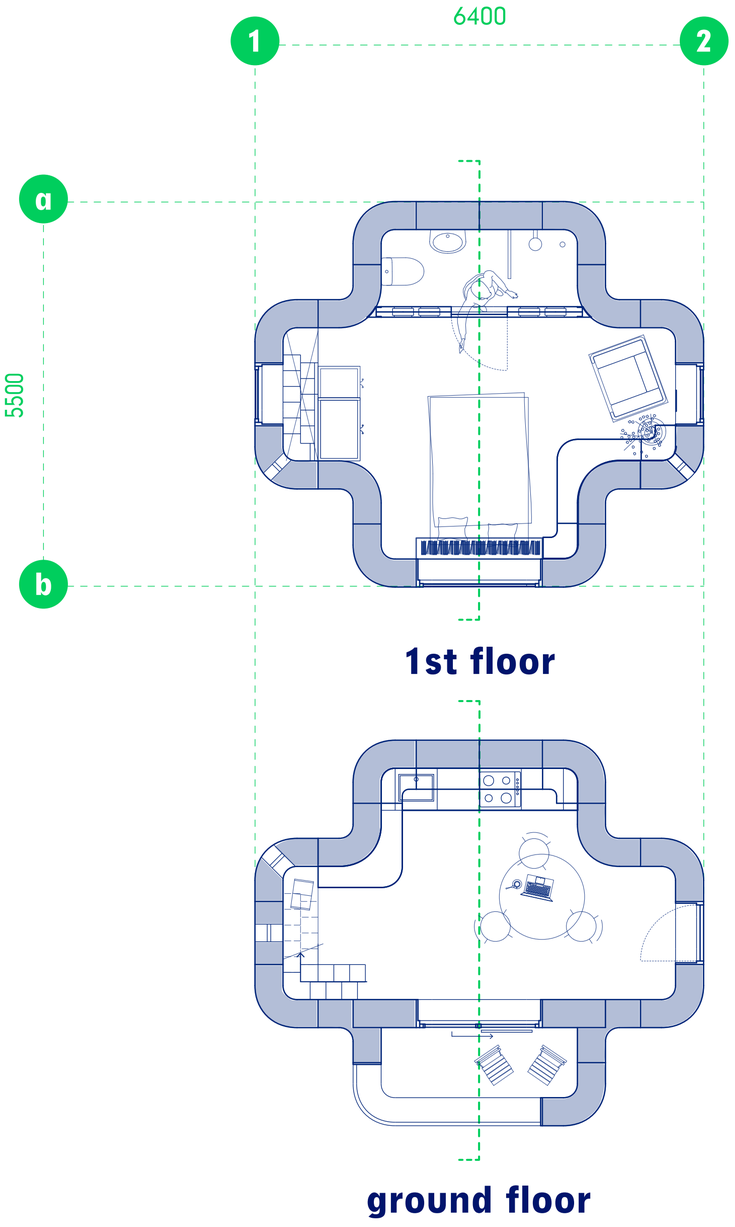


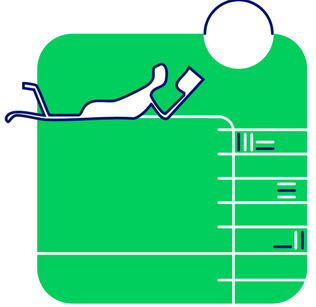
studio loft

30 m²



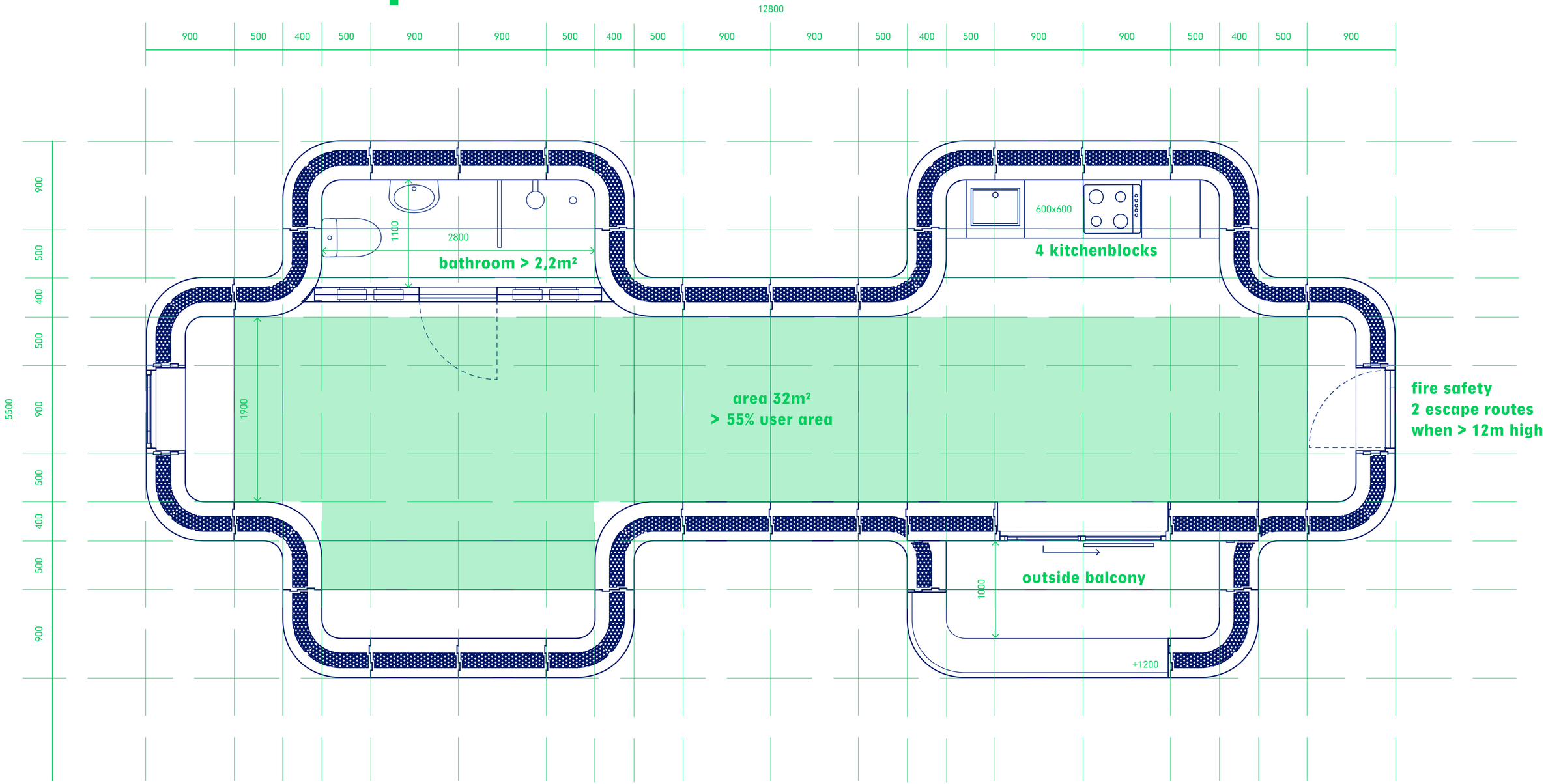




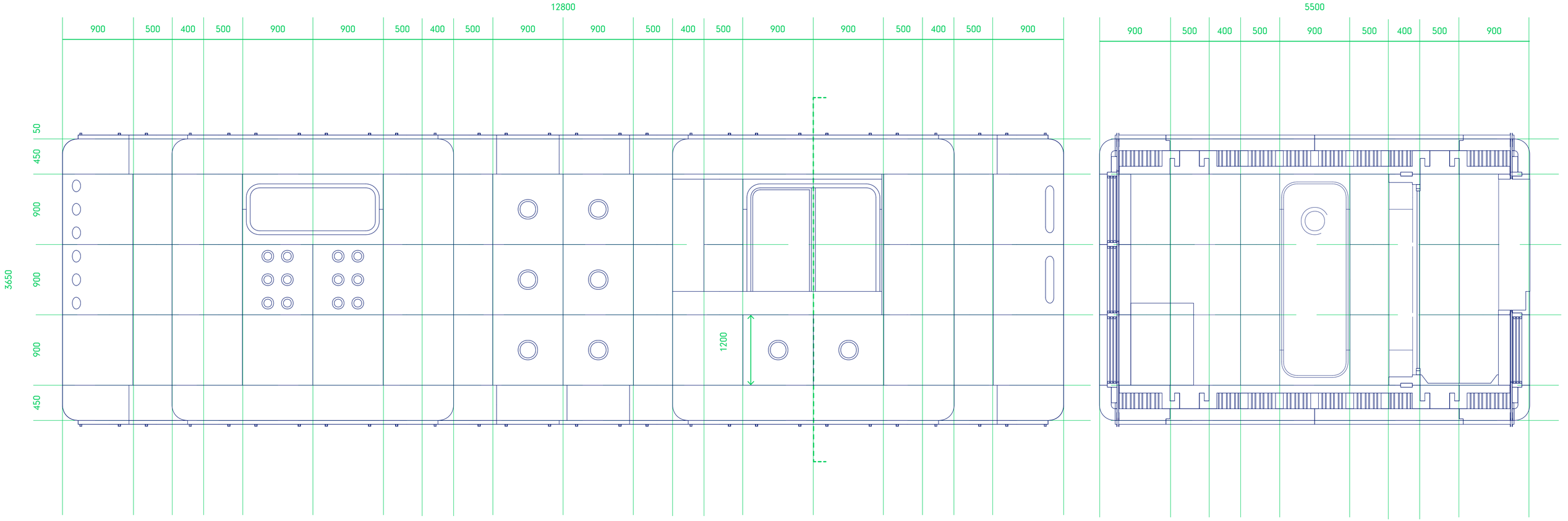




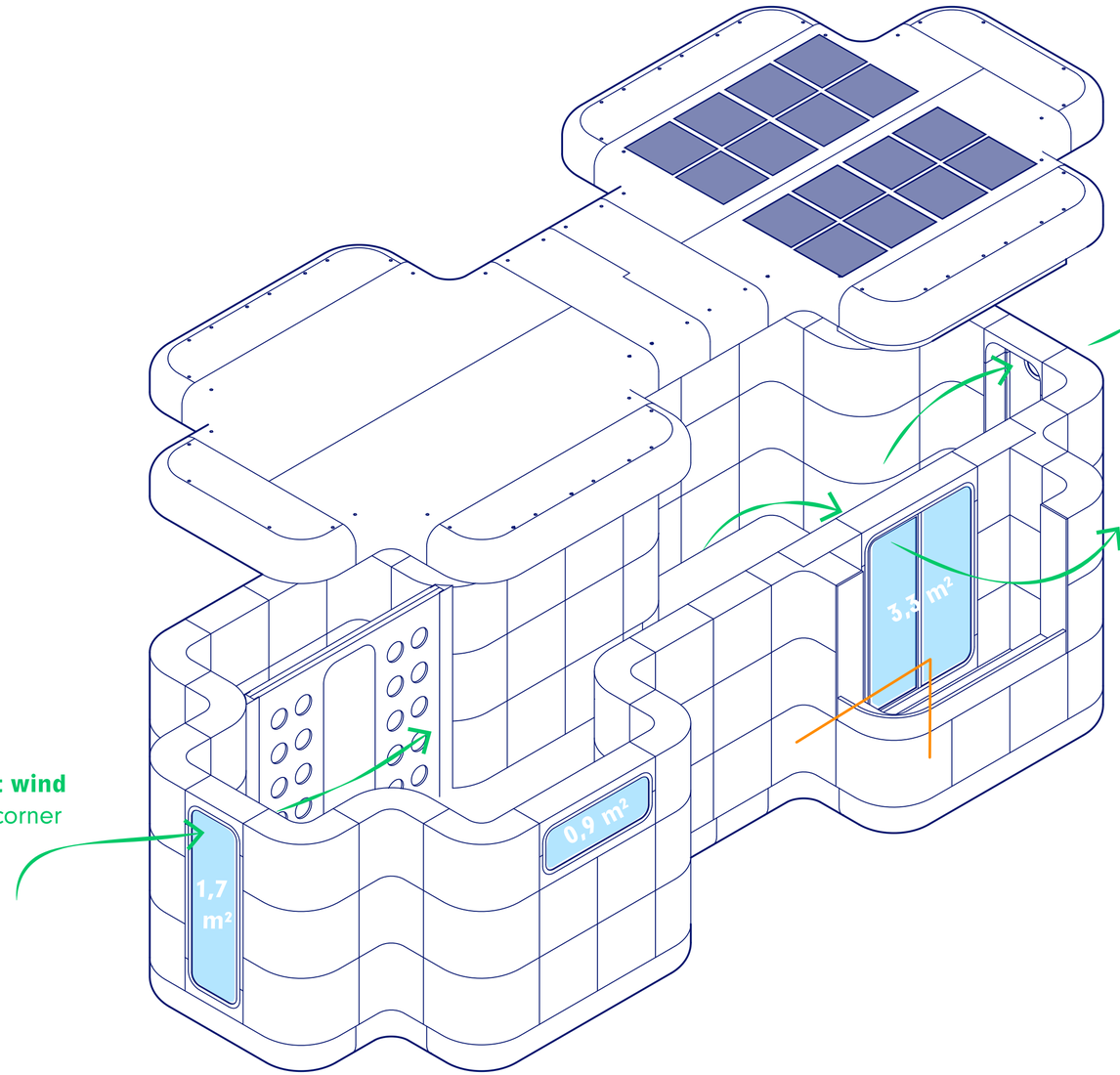
studio meets requirements



studio meets requirements



integration of building services



natural ventilation
> opening windows
> integrated systems

PV systems on free roof surfaces
> including storage and exhibition buildings

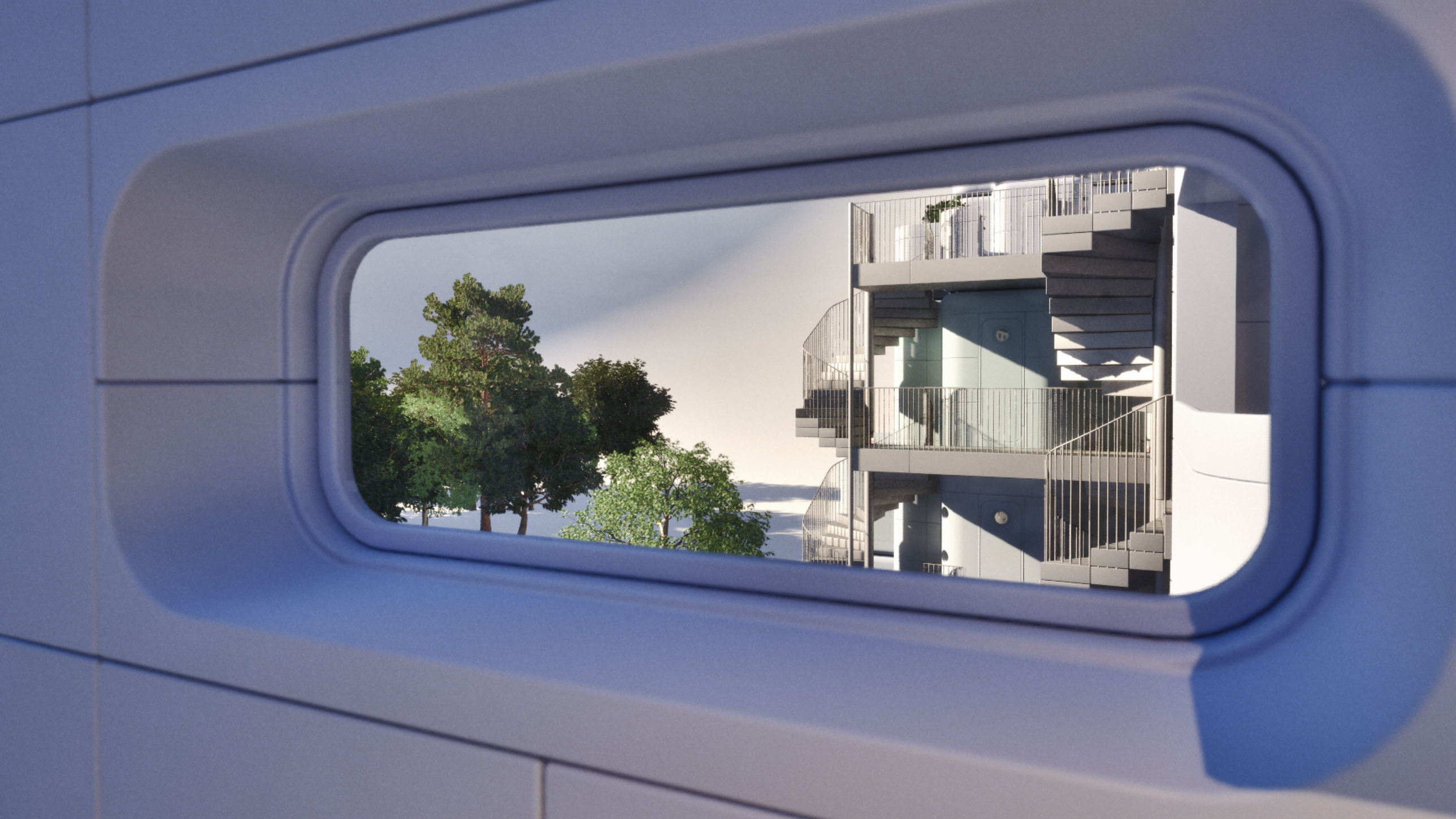
3,3 m² x 0,8 = 2,6 m²
> effective daylight correction factor

open sightline
> daylight access
> prevent sense of enclosure

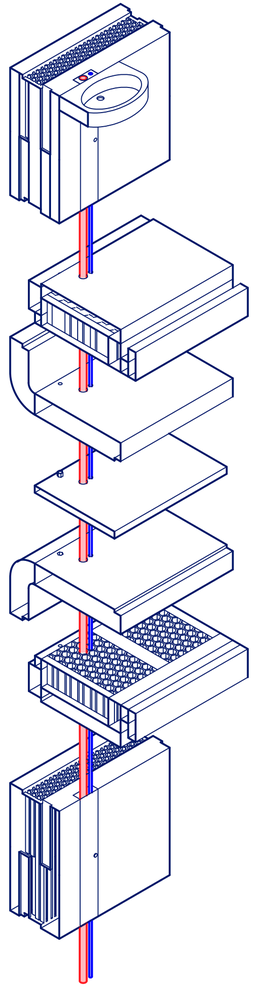
southwest wind
> angled corner

1,7 m² + 0,9 m² + 3,3 m² x 0,8 = 5,2 m²

daylight 5,2 m² > 3,2 m²



integration of building services



water supply

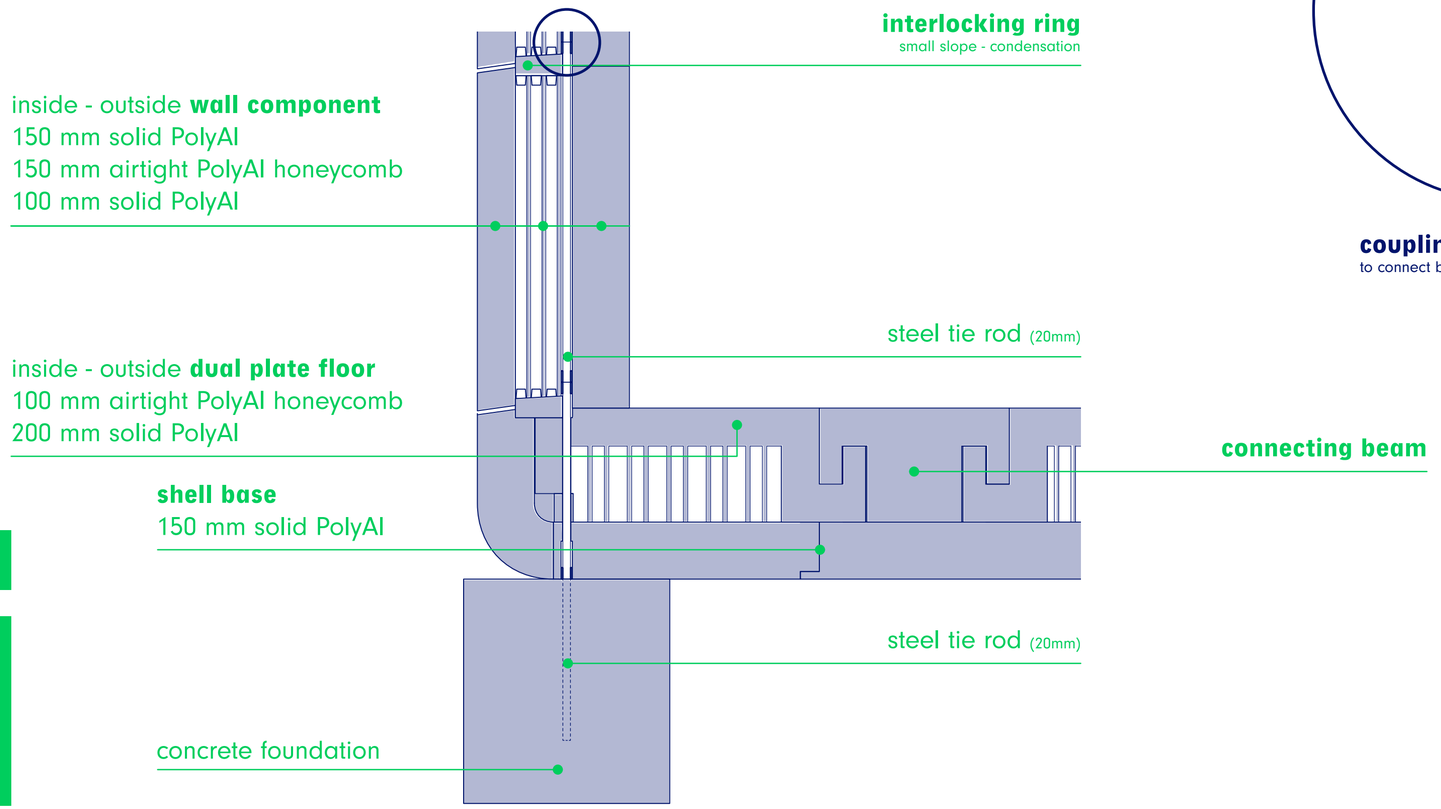
(grey)water drainage

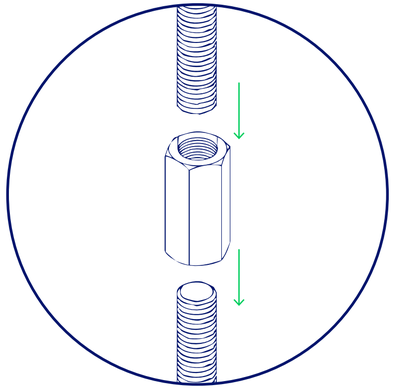
> integrated within building blocks
positioned along inner surface enclosed in fire-resistant casing

> through honeycomb floor system
> service openings created in other components

> greywater is collected for low-grade water applications

facade - floor





coupling nut connection
to connect building components modularly

sound insulation 34 dB > 20 dB

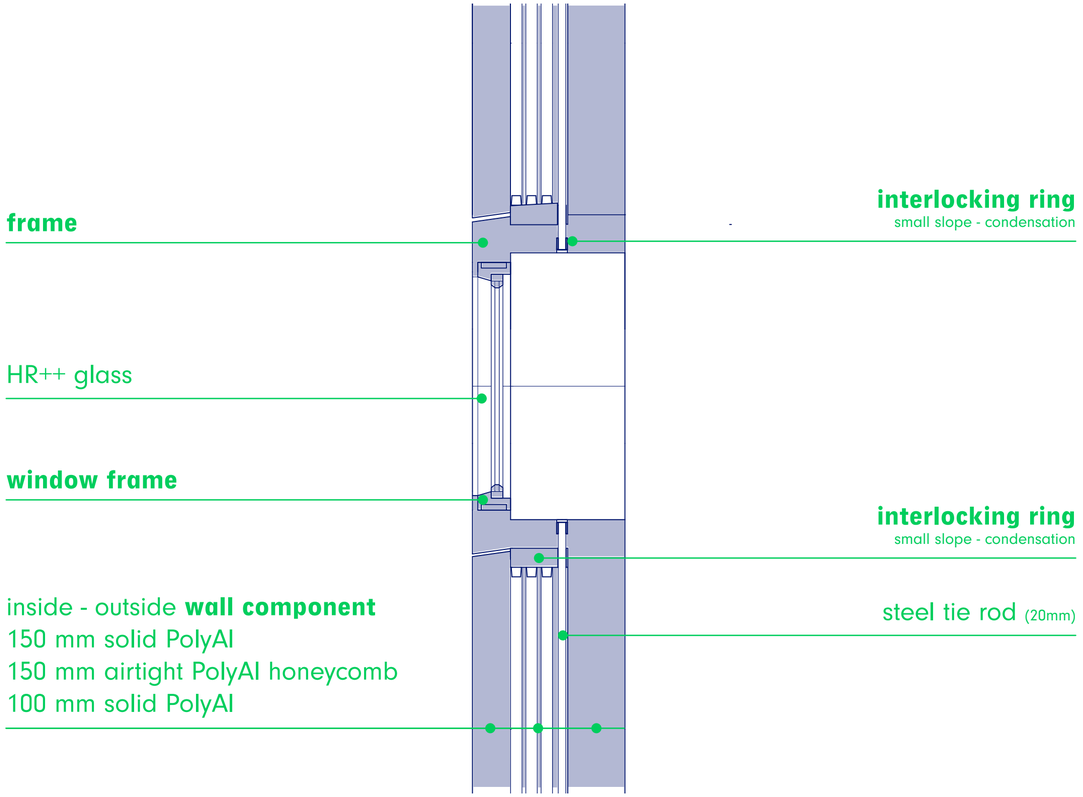
inside - outside
150 mm solid PolyAl (λ = 0,22 W/m-K) = 0,68
150 mm airtight honeycomb (λ = 0,035 W/m-K) = 4,29
100 mm solid PolyAl (λ = 0,22 W/m-K) = 0,45
Rc tot. = 0,68 + 4,29 + 0,45 = 5,42 m²·K/W

facade Rc 5,4 > 4,7 m²·K/W

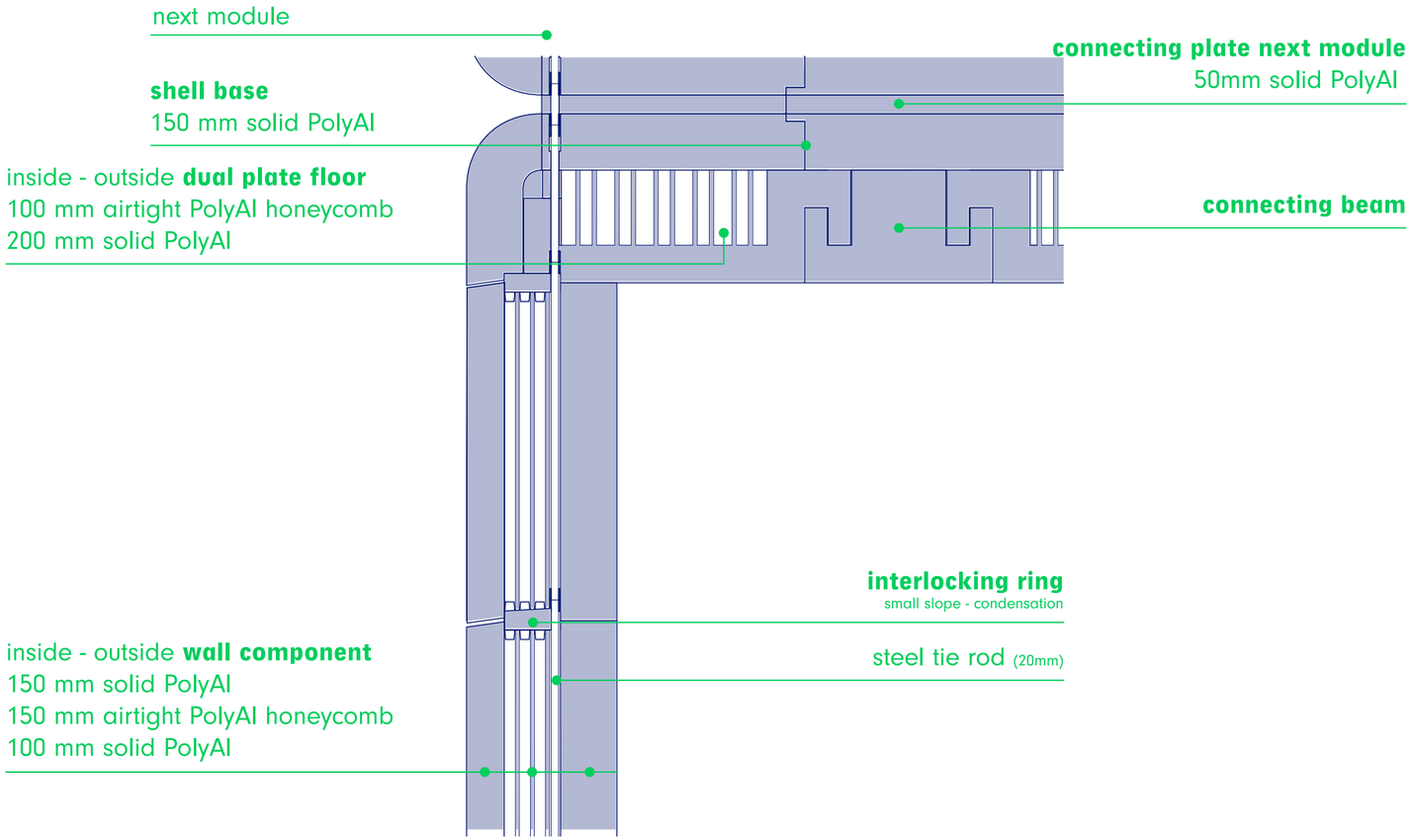
inside - outside
100 mm solid PolyAl (λ = 0,22 W/m-K) = 0,45
200 mm airtight honeycomb (λ = 0,035 W/m-K) = 5,71
150 mm solid PolyAl (λ = 0,22 W/m-K) = 0,68
Rc tot. = 0,45 + 5,71 + 0,68 = 6,84 m²·K/W

roof Rc 6,8 > 6,3 m²·K/W
floor Rc 6,8 > 3,7 m²·K/W

window frame



facade - roof


next module
connecting plate next module
50mm solid PolyAl
shell base
150 mm solid PolyAl
inside - outside **dual plate floor**
100 mm airtight PolyAl honeycomb
200 mm solid PolyAl
connecting beam
interlocking ring
small slope - condensation
steel tie rod (20mm)
inside - outside **wall component**
150 mm solid PolyAl
150 mm airtight PolyAl honeycomb
100 mm solid PolyAl

fire safety

1

connecting ring for
airtight wall components

2

flame retardant
additives

3

outdoor gallery
2 escape routes height > 12m

4

2 escape routes
height > 12m



interior system

universal student

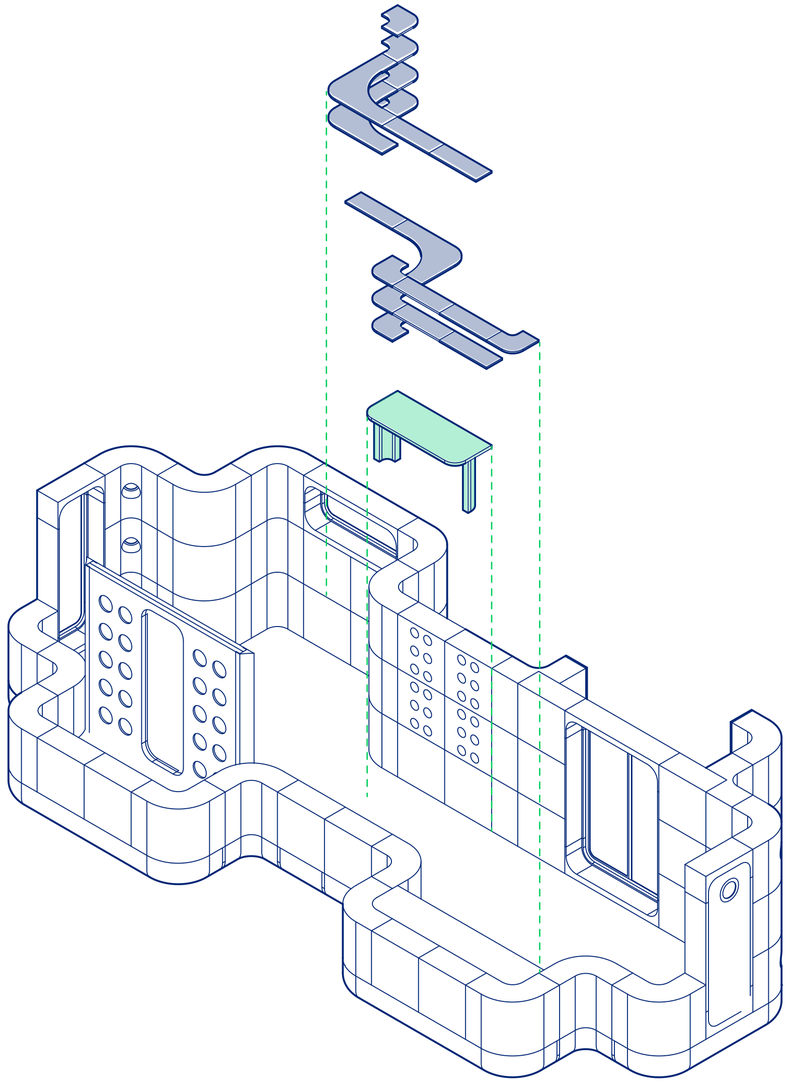
modular furniture
part of the
architecture



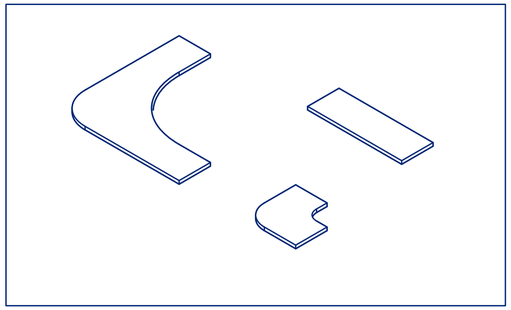
individual student

own identity and
expression

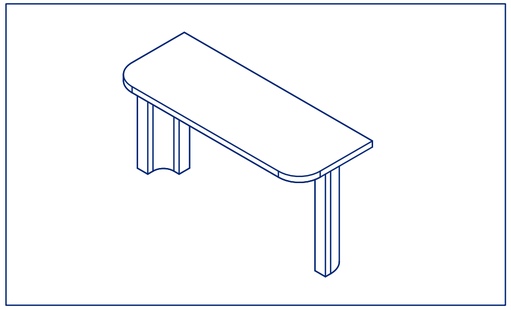
interior system



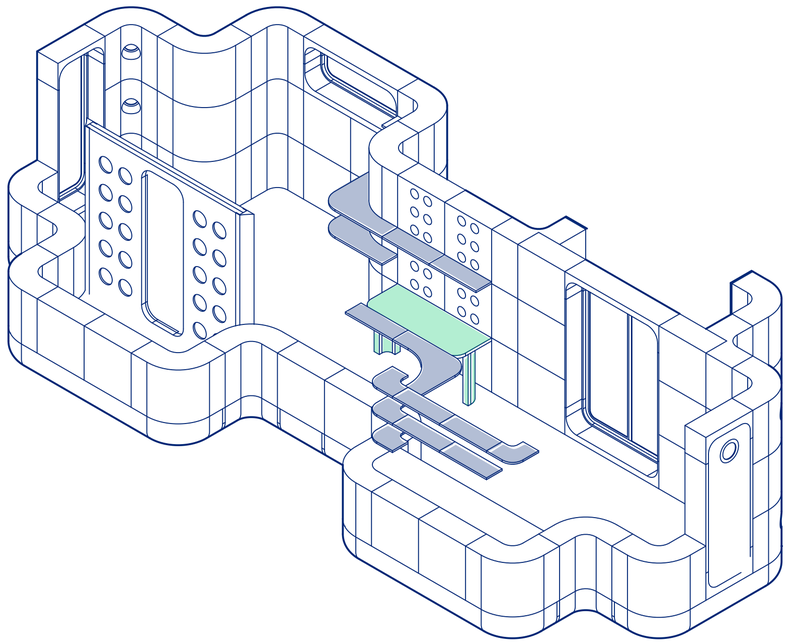
shelves



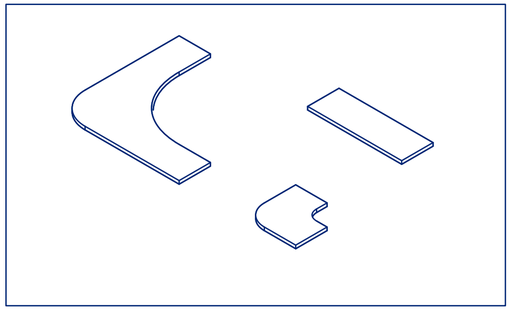
desk



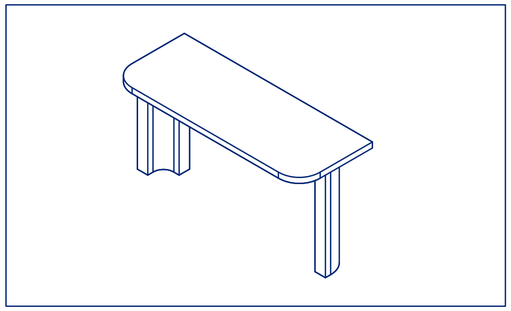
interior system



shelves



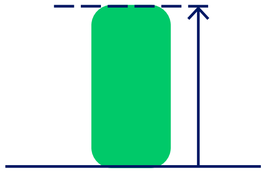
desk





cluster

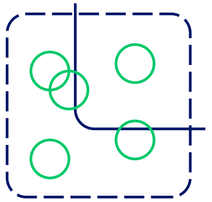
tu delft campus vision 2040
building guidelines



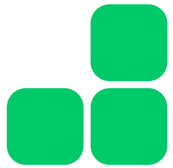
height restriction maximum 20m



building at / close to plot boundary



green character and water space plot



simple orthogonally oriented volumes



nature inclusive, energy generation, greenery and water buffering

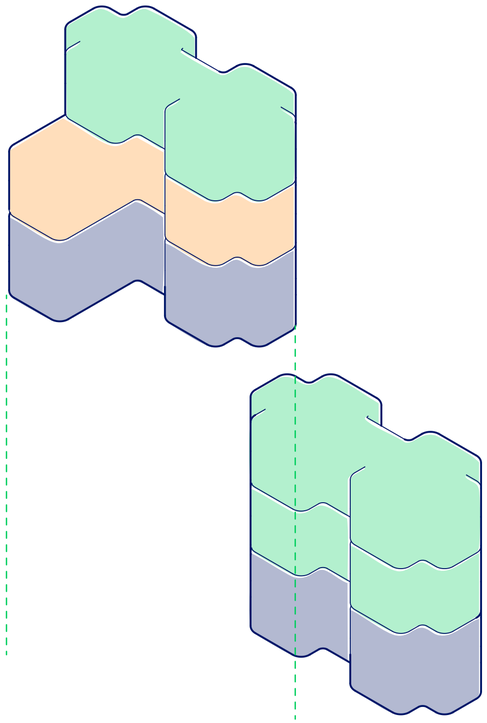


biking route & storage on plot and parkinghubs

“the south campus as an **experimental living lab**”

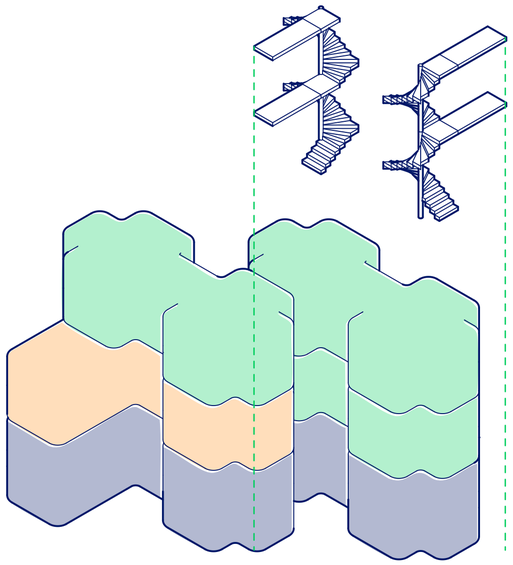
cluster configuration

a recycled plastic-based modular and expandable building system



studio regular
studio regular +
studio loft
communal space

cluster configuration

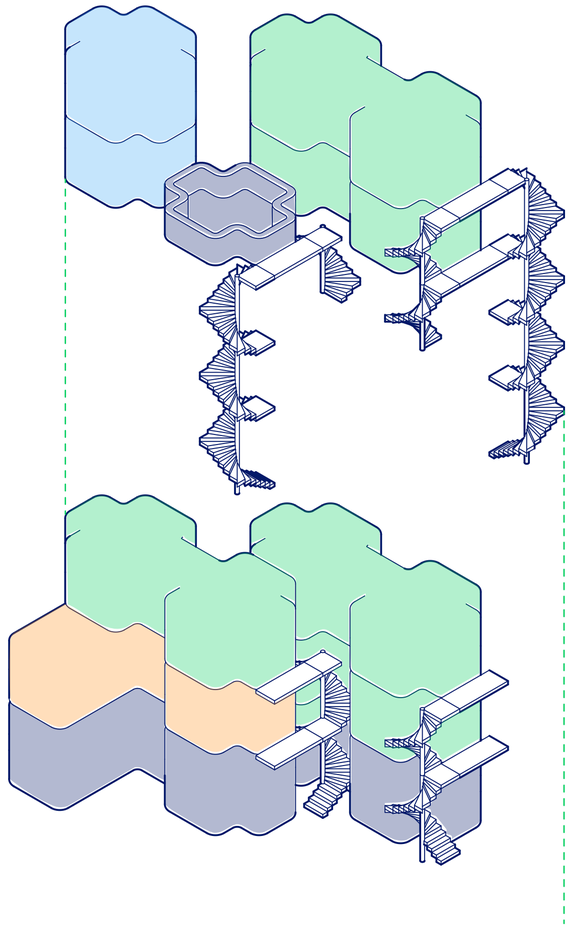


a modular steel stairs + gallery system

students 4
building height < 12m
1 fire escape needed
communal space
washing + mail room
open cafe

studio regular
studio regular +
studio loft
communal space

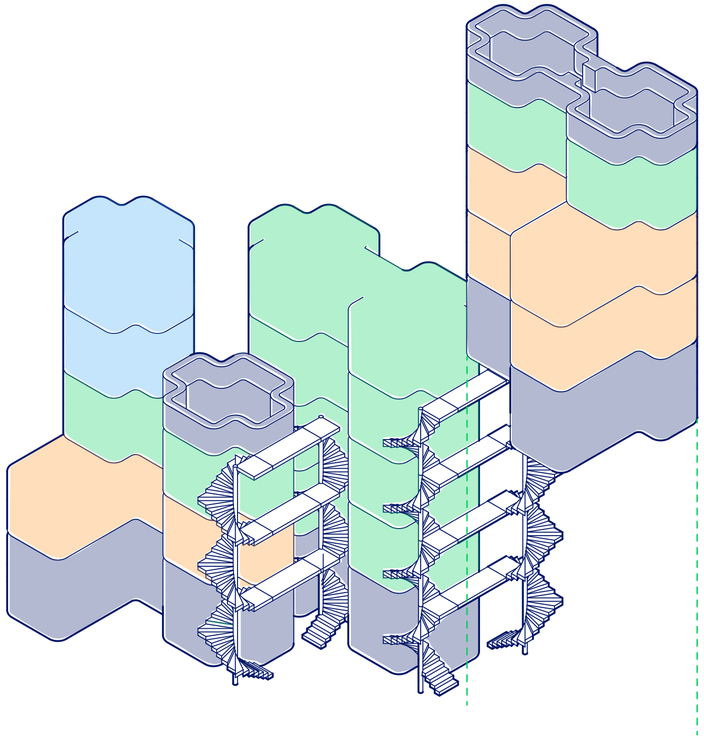
cluster configuration



students 7
building height > 12m
2 fire escapes needed
communal space
washing + mail room
open cafe
roof terrace

studio regular
studio regular +
studio loft
communal space

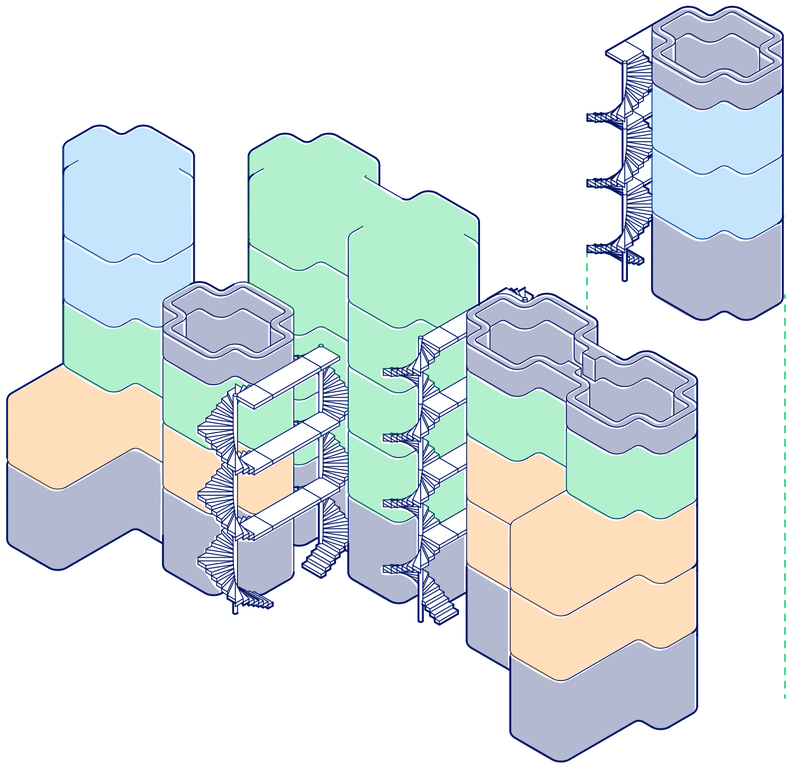
cluster configuration



students 10
building height > 12m
2 fire escapes needed
communal space
washing + mail room
open cafe
2 roof terraces
communal kitchen + dining

studio regular
studio regular +
studio loft
communal space

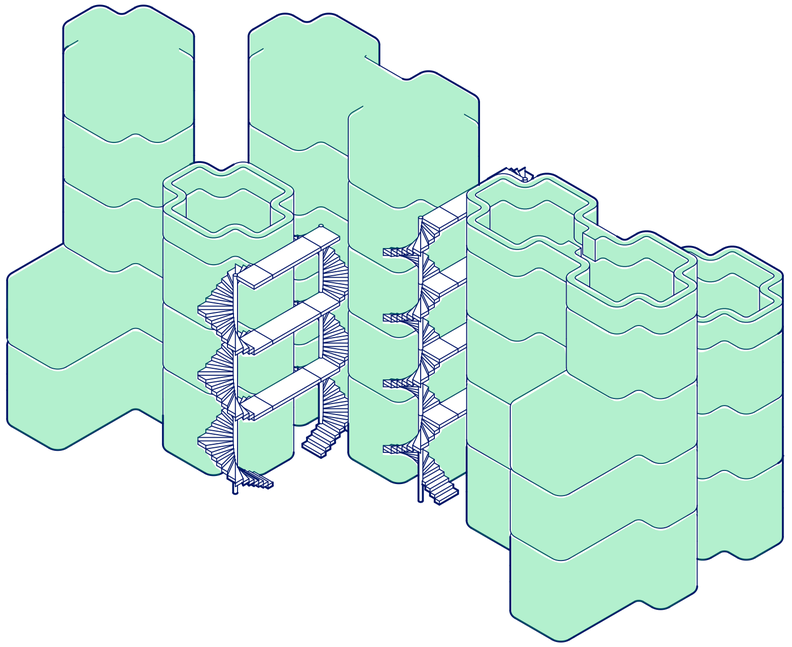
cluster configuration



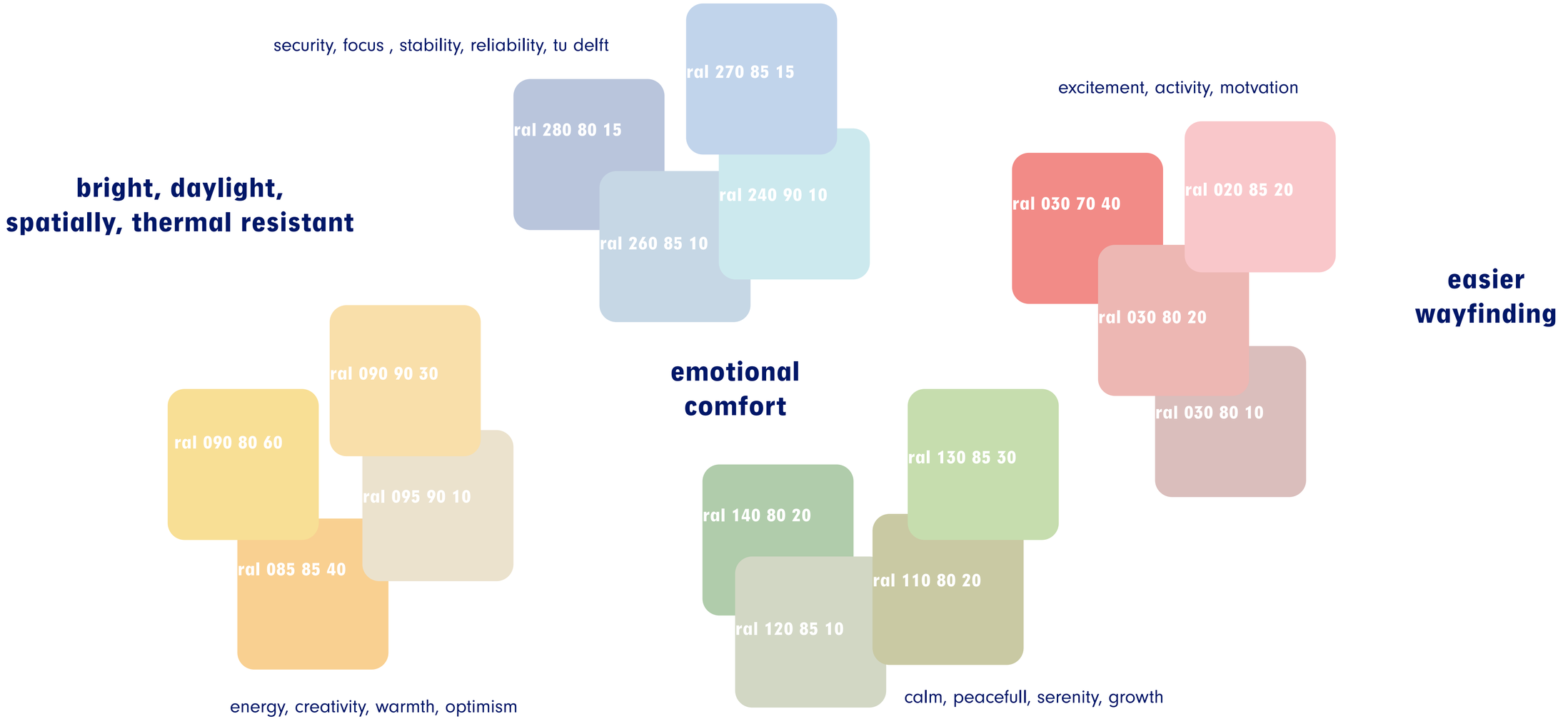
students 11
building height > 12m
2 fire escapes needed
communal space
washing + mail room
open cafe
3 roof terraces
communal kitchen + dining
maintenance room for multiple clusters

studio regular
studio regular +
studio loft
communal space

cluster configuration



cluster colors



material and texture



cluster facade

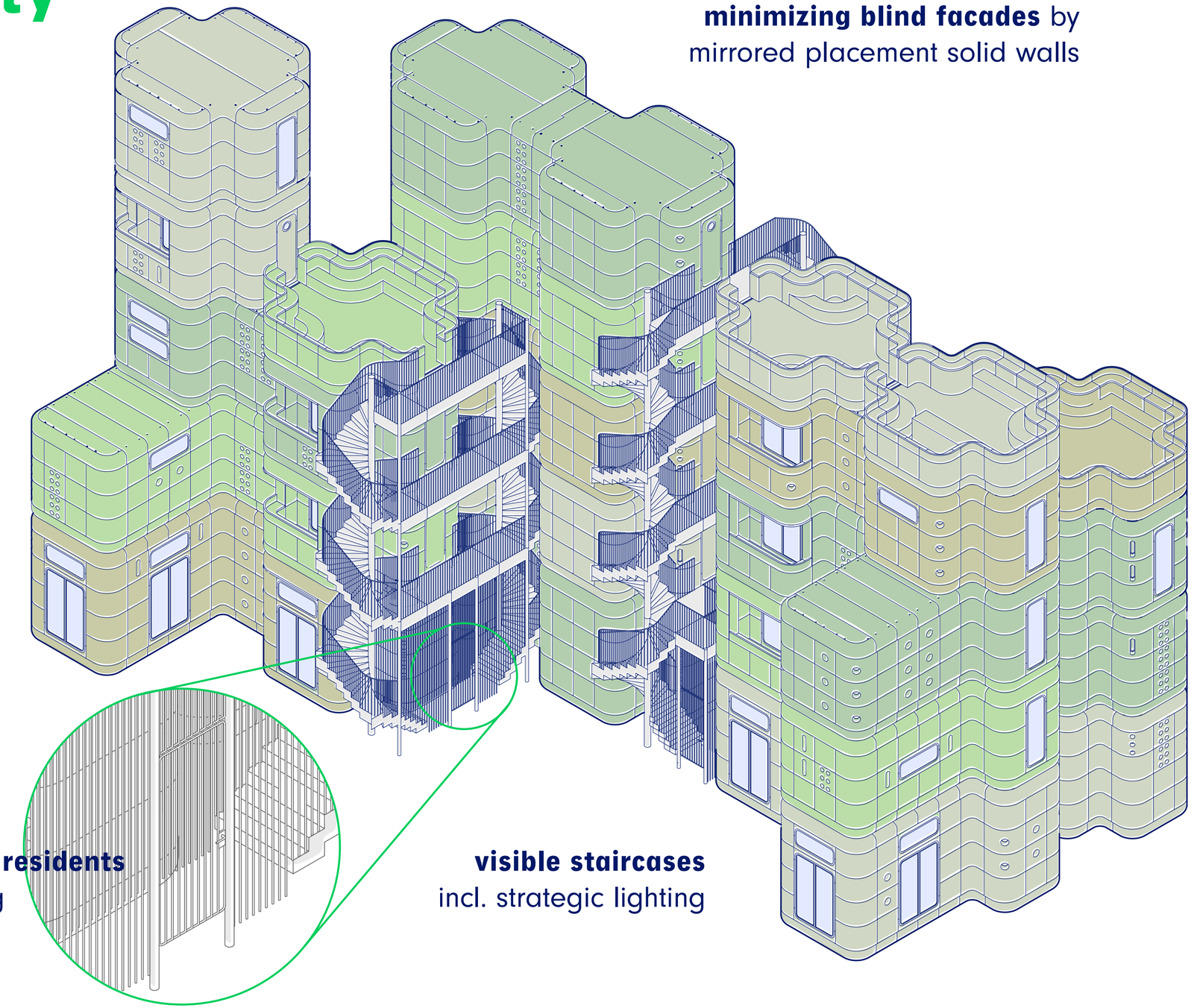
section



cluster section a-a'

social safety

minimizing blind facades by
mirrored placement solid walls

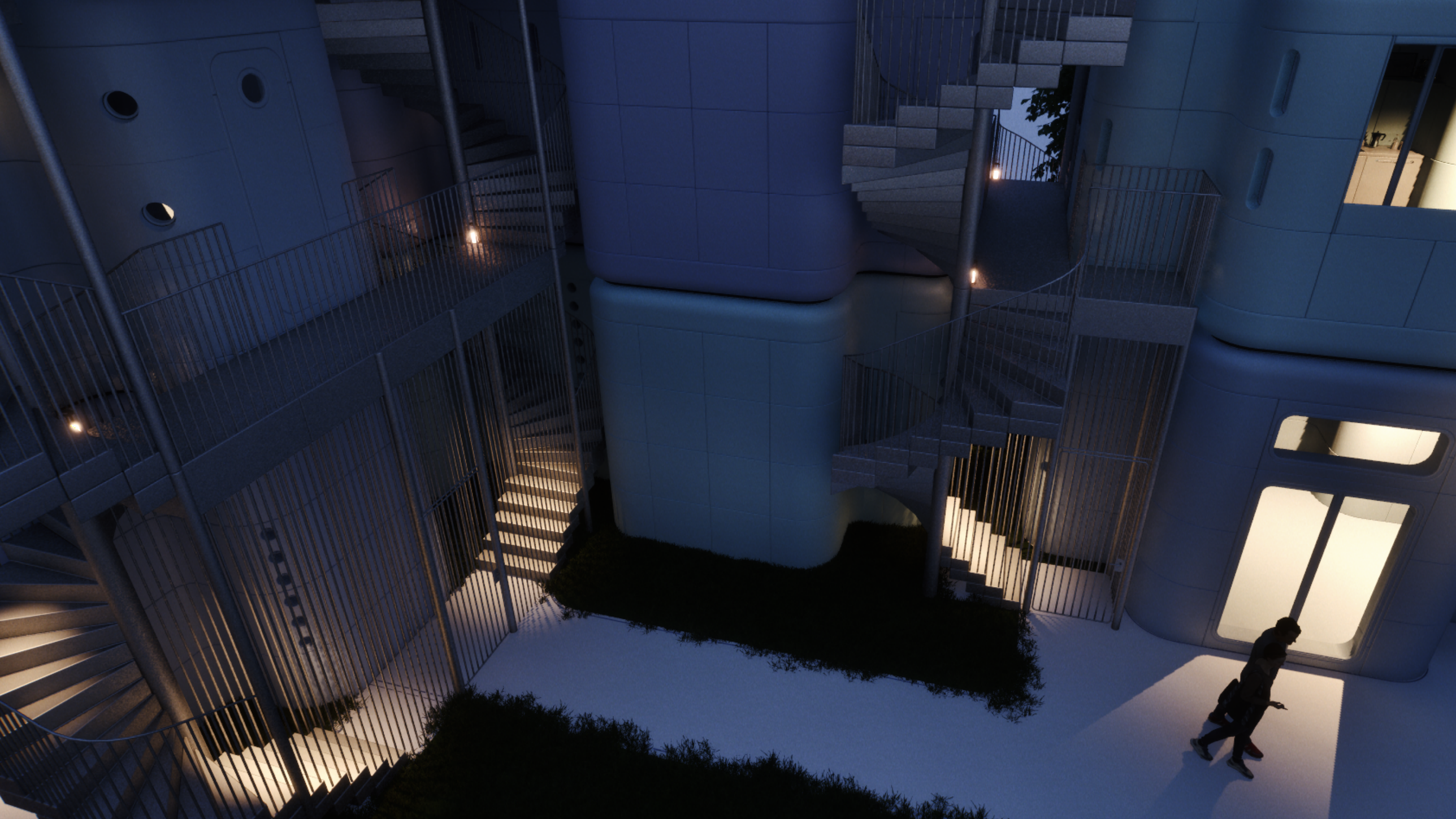


restricted access residents
secured by fencing

visible staircases
incl. strategic lighting

communal spaces
ground floor

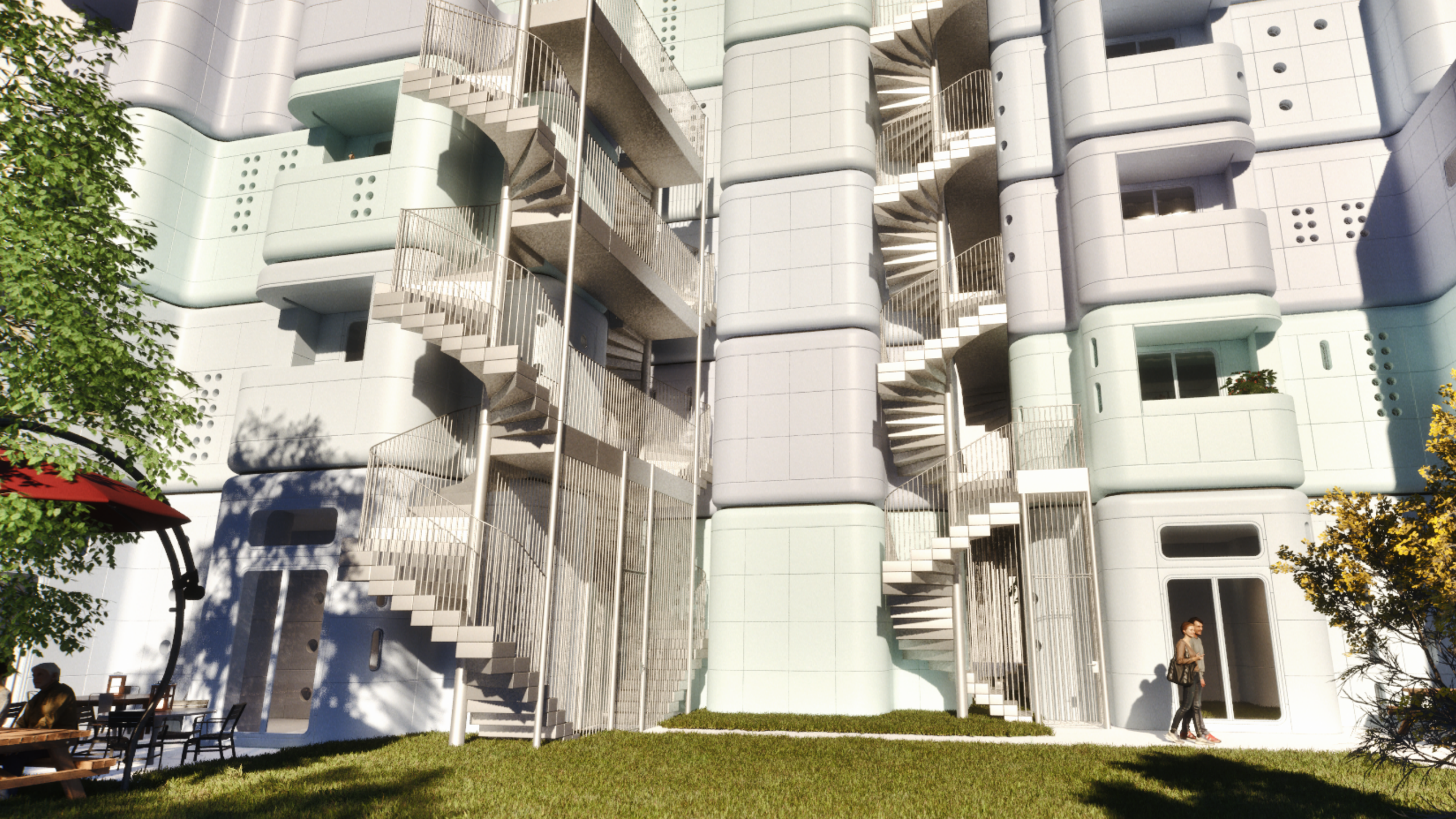




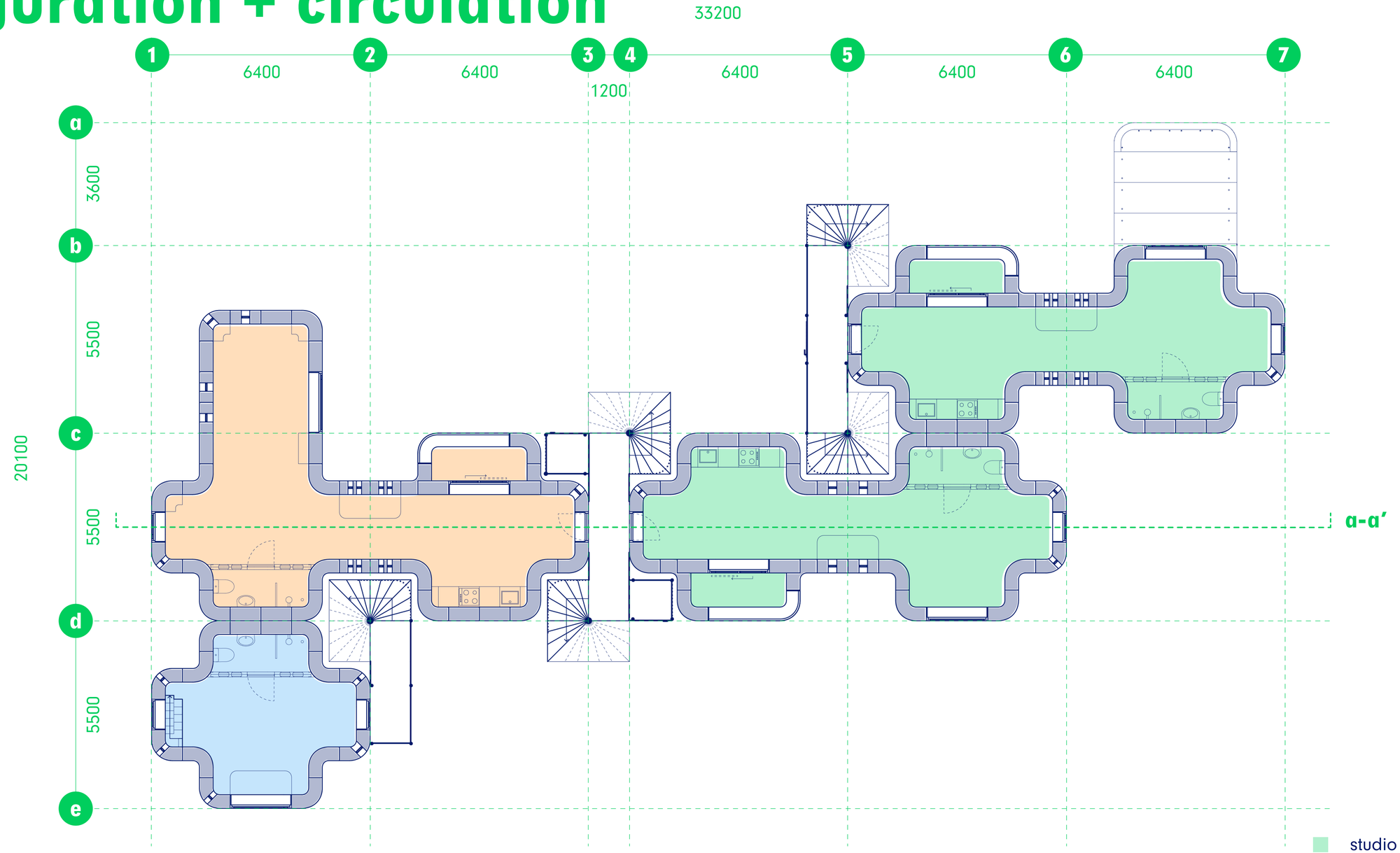


material dialogue of contrasts

diverse in expression, yet unified within the architecture through their own material and functional logic



configuration + circulation

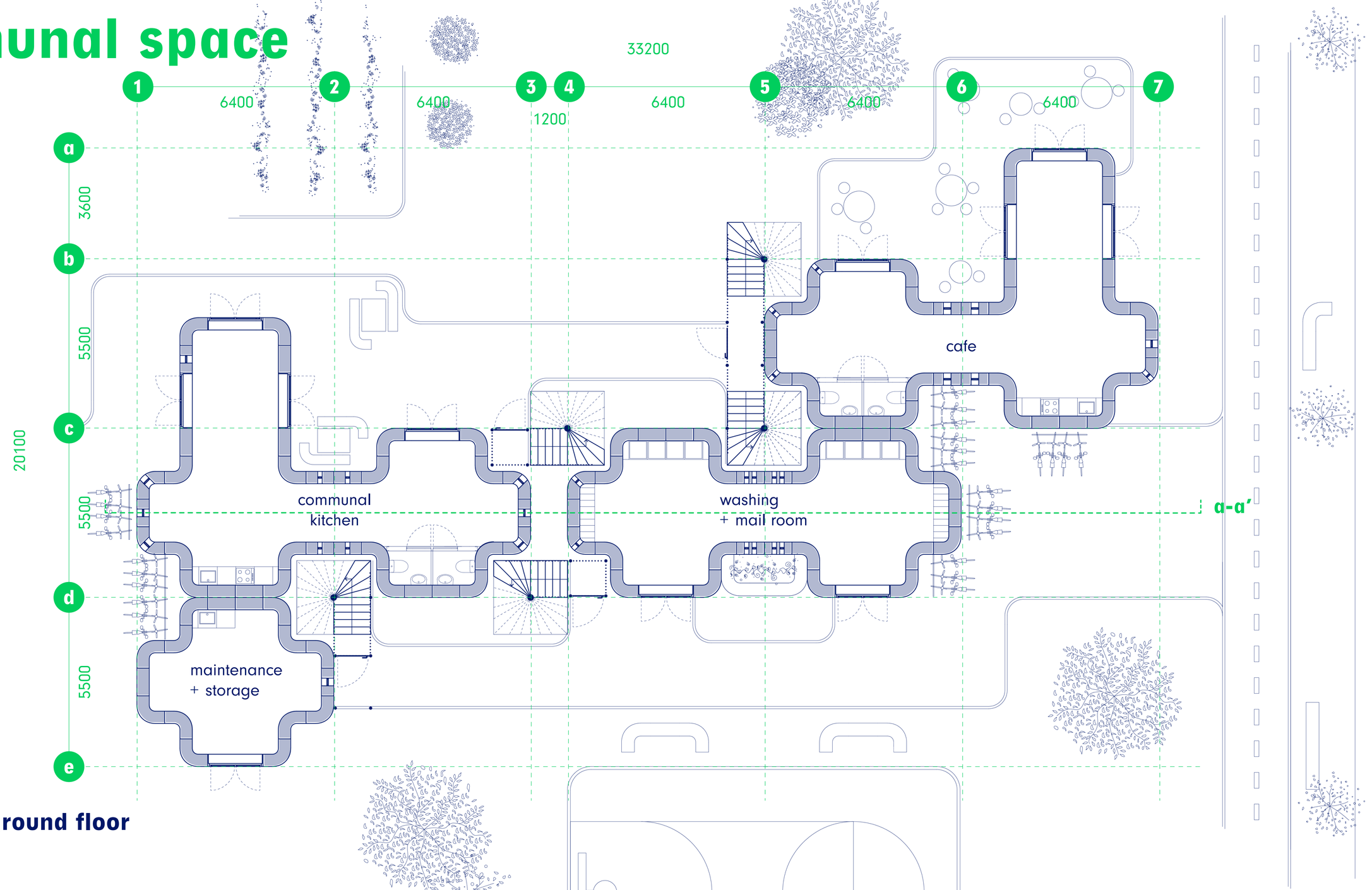


studio regular
studio regular +
studio loft

cluster 2nd floor

N

communal space



cluster ground floor

N↘





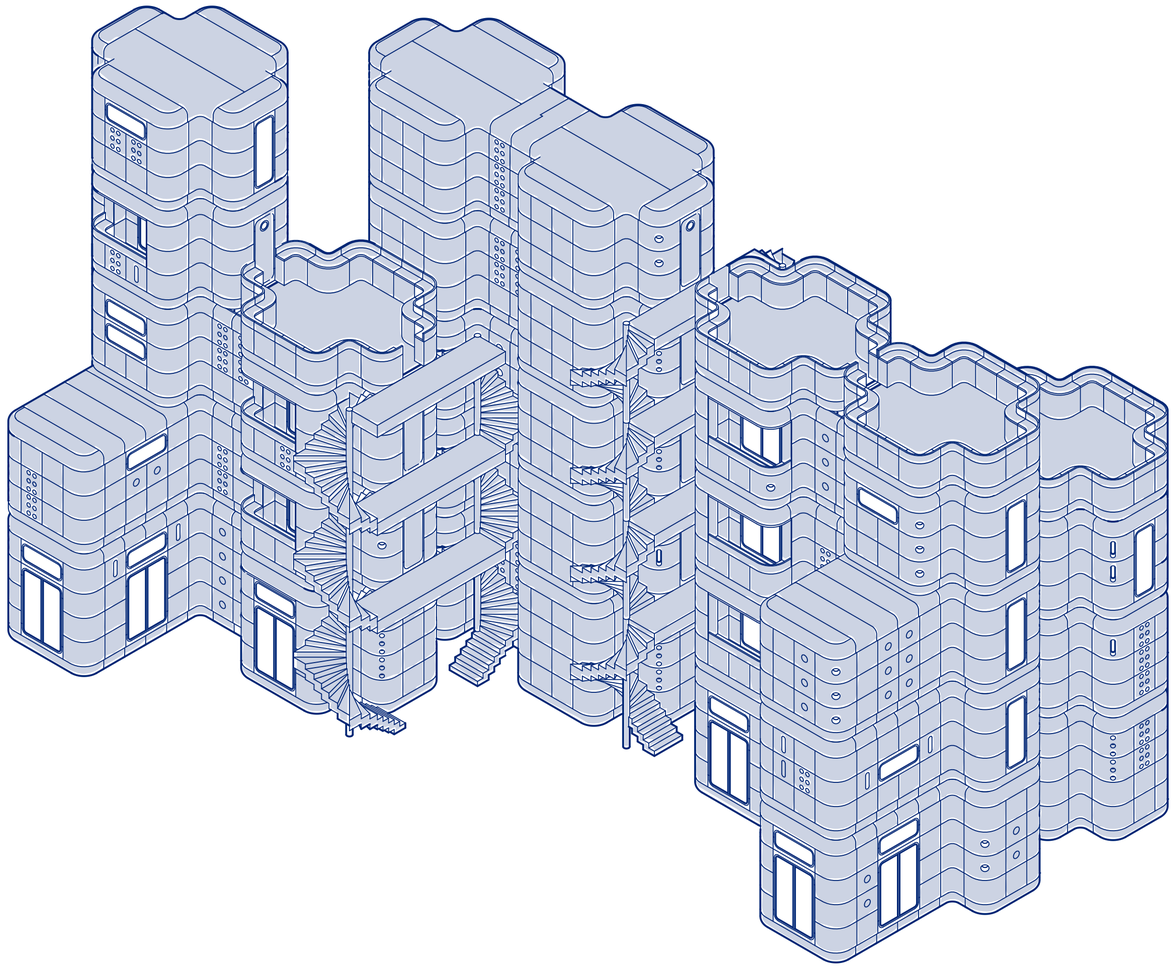


collective

an adaptive open-ended modular flexibility

modular flexibility enables functional versatility

1 **collective living**



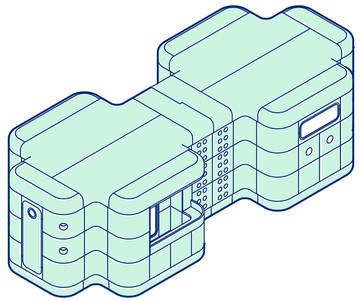
multiple student housing



modular flexibility enables functional versatility

1 **collective living**

2 **compact living**



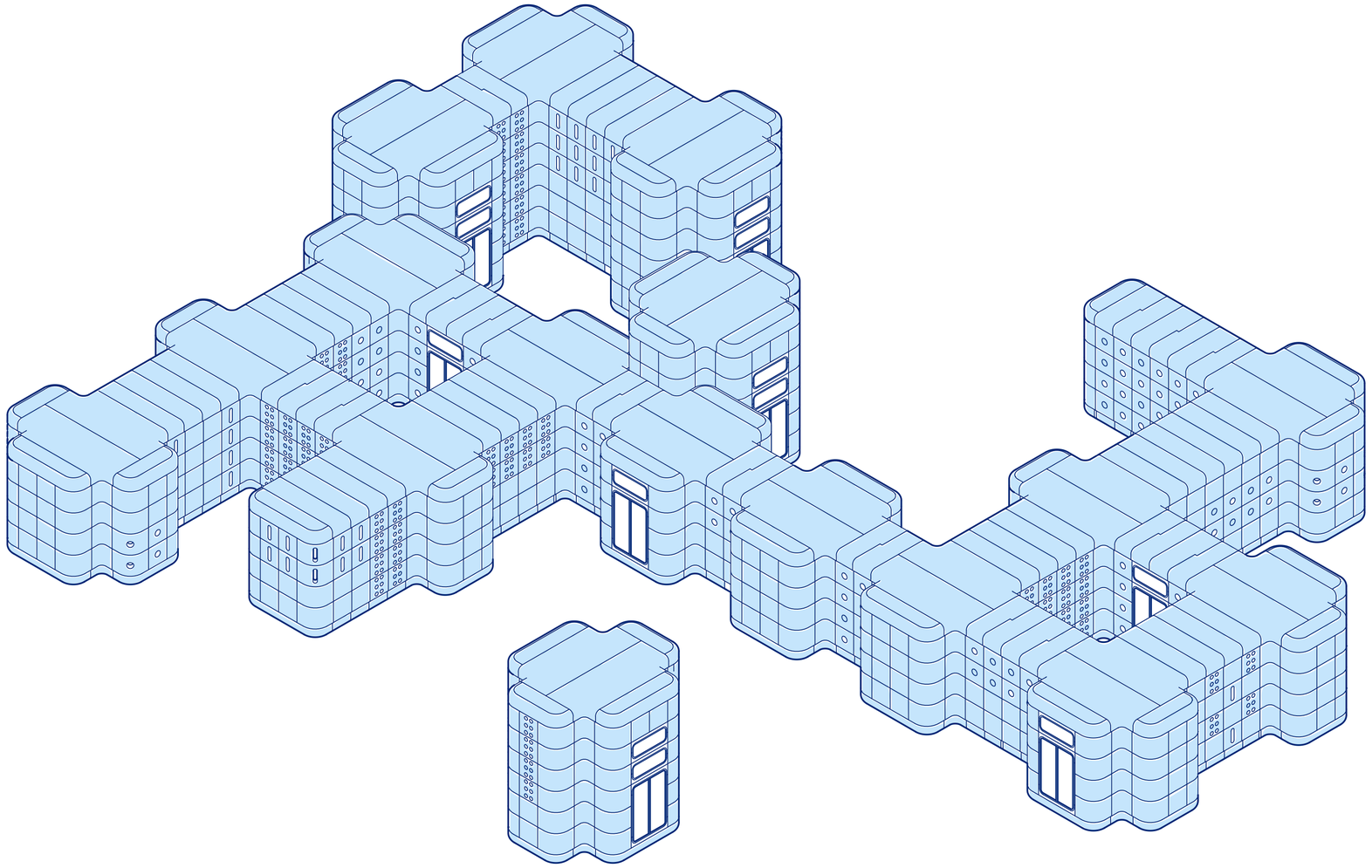
tiny house

modular flexibility enables functional versatility

1 collective living

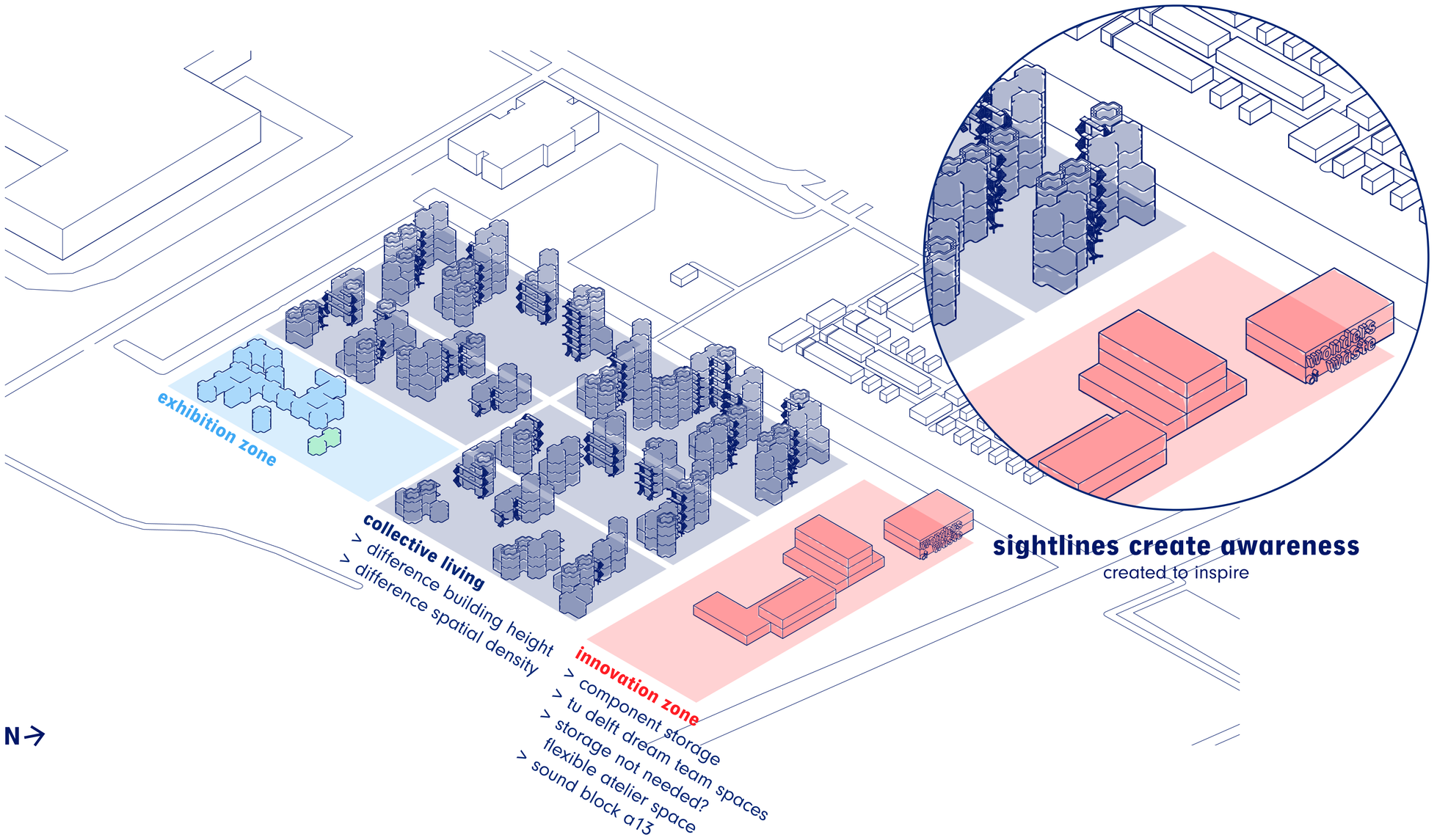
2 compact living

2 public building

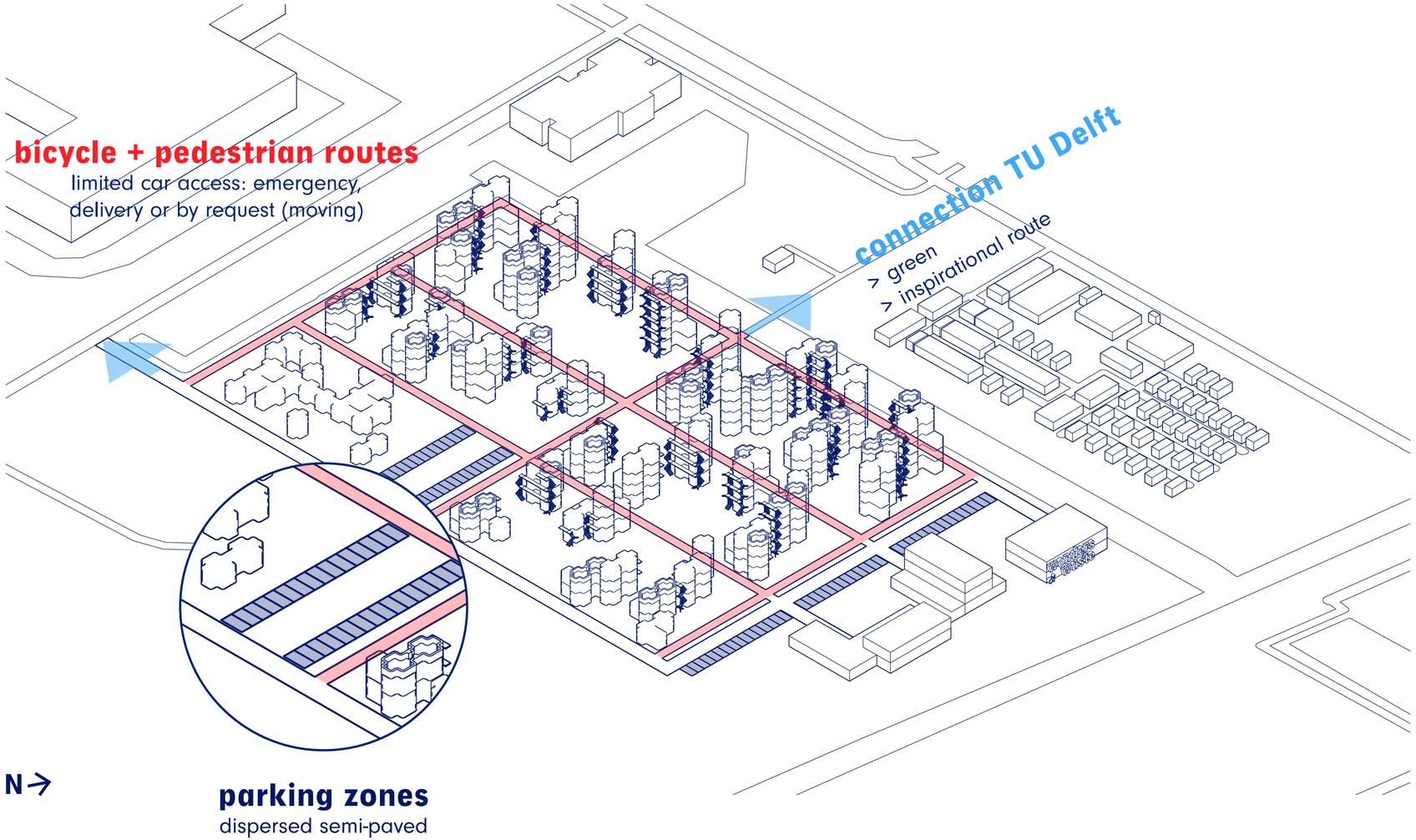


exhibition hall

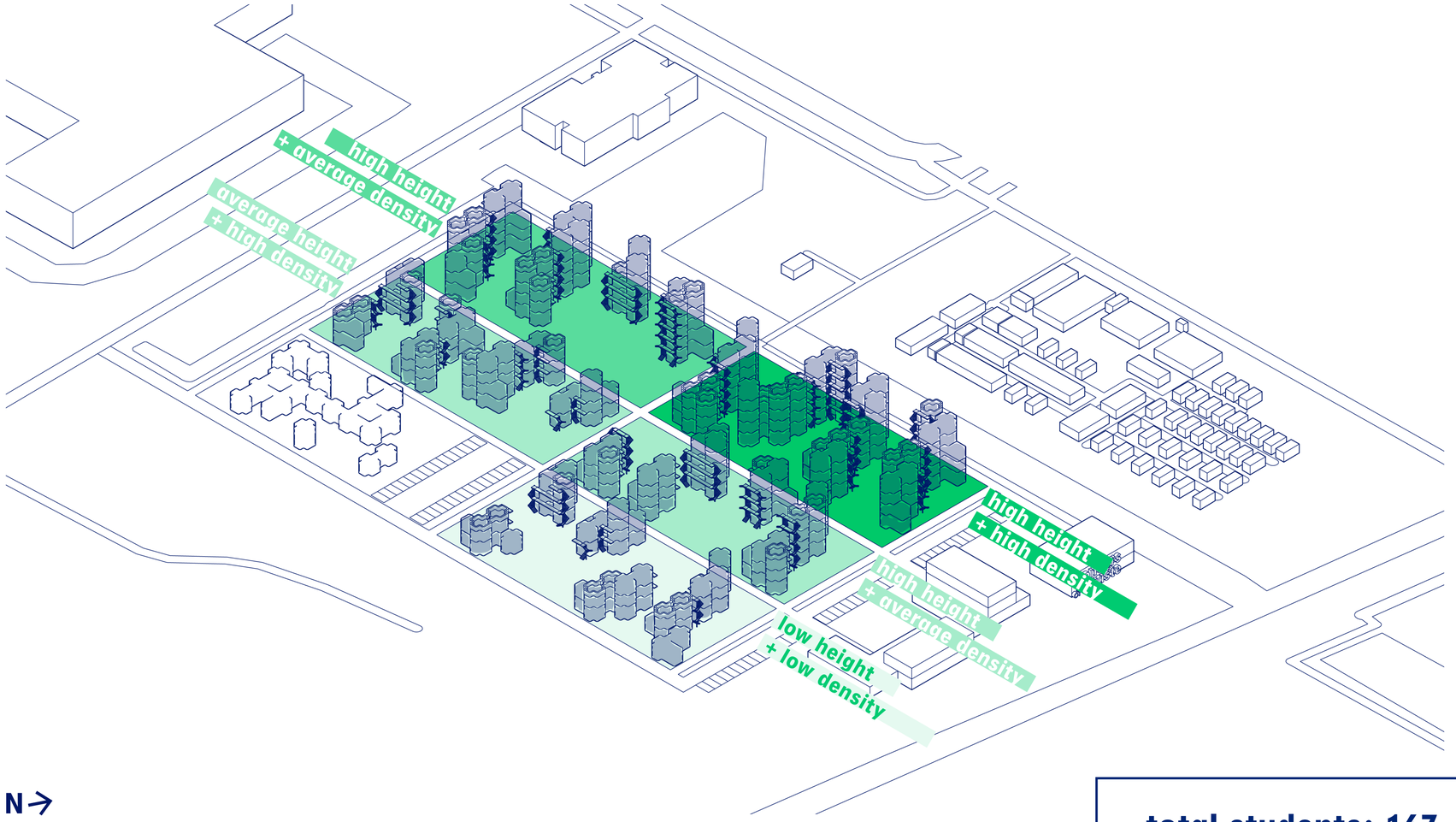
collective program



collective circulation



different building height + density



N→

total students: 167

ultimate max. students: 304

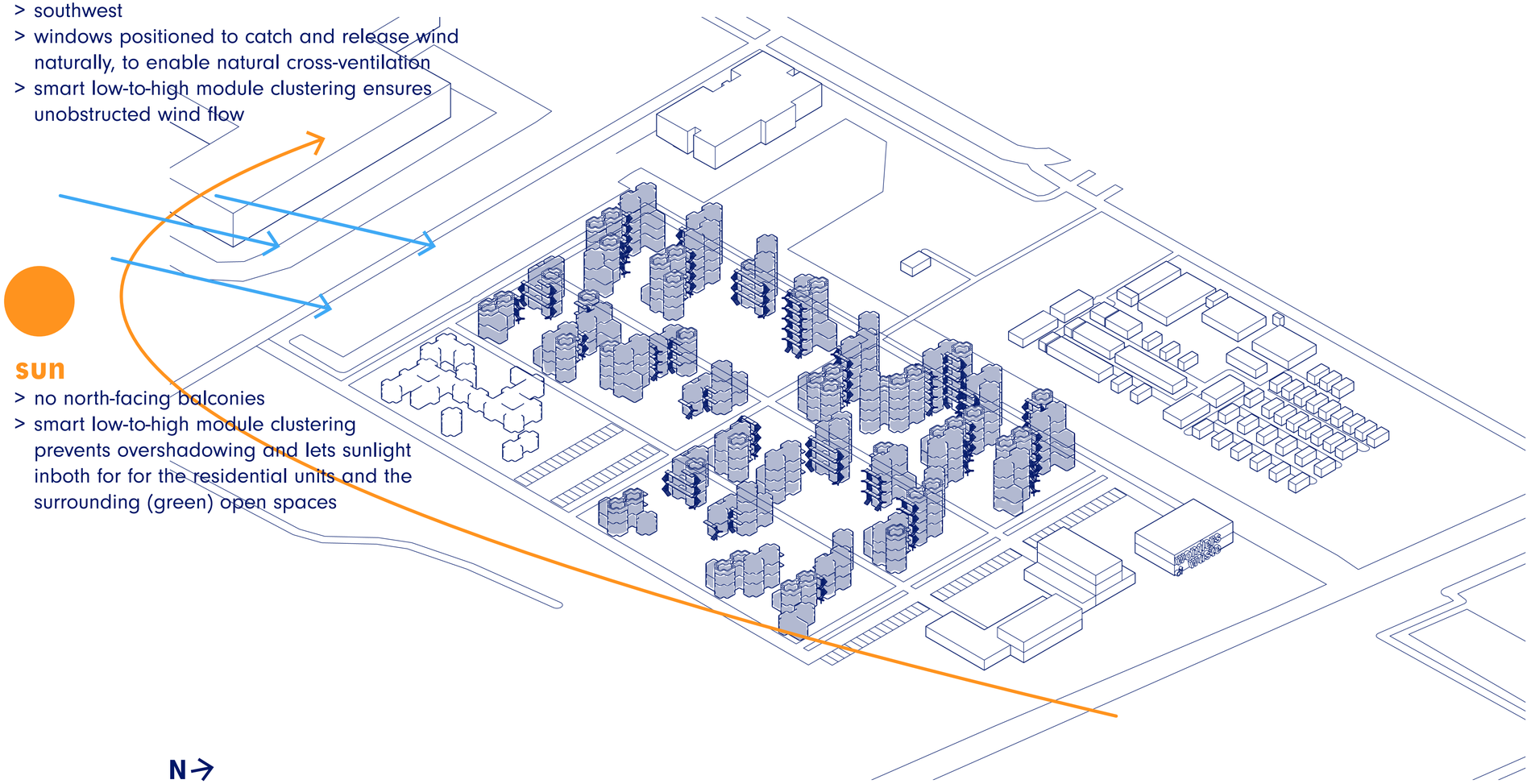
collective sun + wind

wind

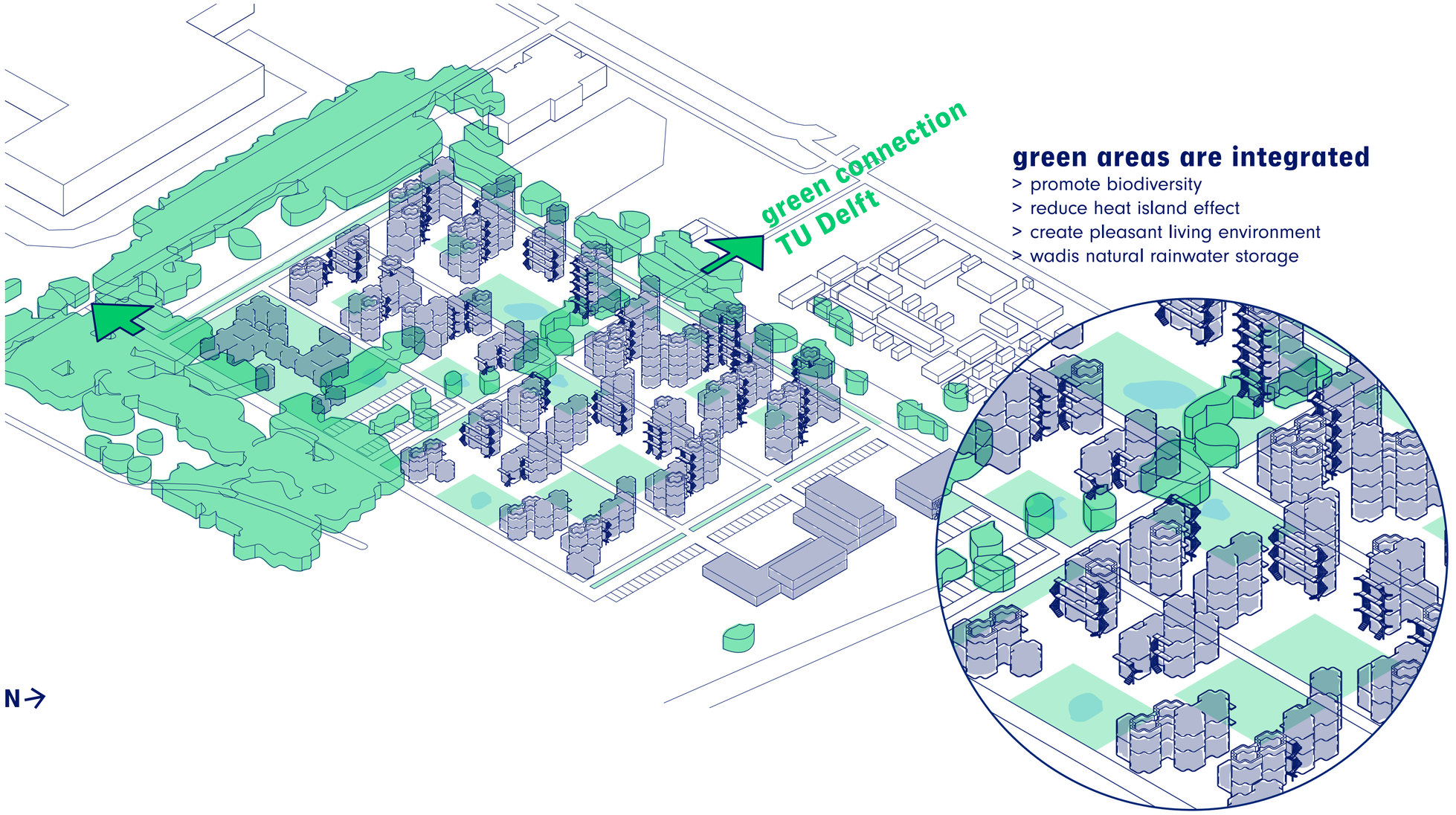
> southwest
> windows positioned to catch and release wind naturally, to enable natural cross-ventilation
> smart low-to-high module clustering ensures unobstructed wind flow

sun

> no north-facing balconies
> smart low-to-high module clustering prevents overshadowing and lets sunlight inboth for for the residential units and the surrounding (green) open spaces



collective green + water



green areas are integrated

> promote biodiversity
> reduce heat island effect
> create pleasant living environment
> wadis natural rainwater storage

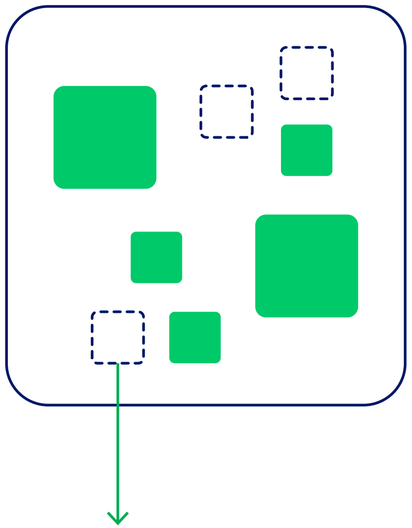
system is scalable, form-flexible and not site-bound due to demountable nature

circular system

partner universities system

scenario 1

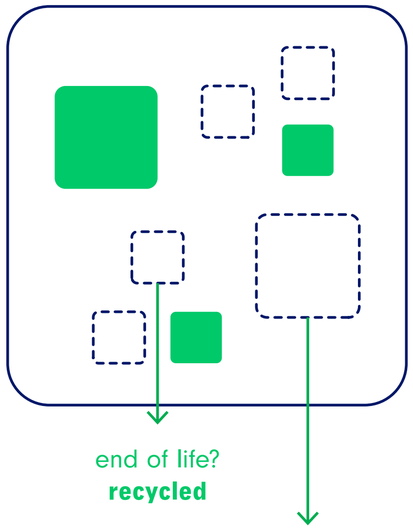
average need



stored in on-site
component storage

scenario 2

low need

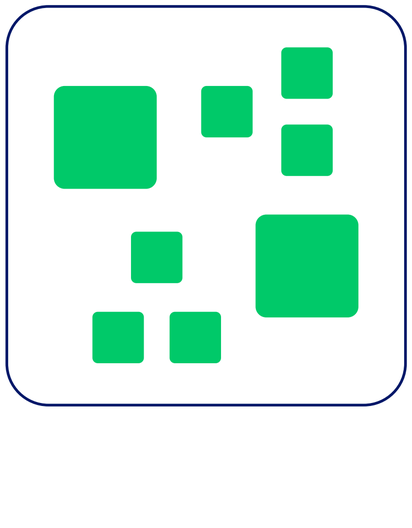


end of life?
recycled

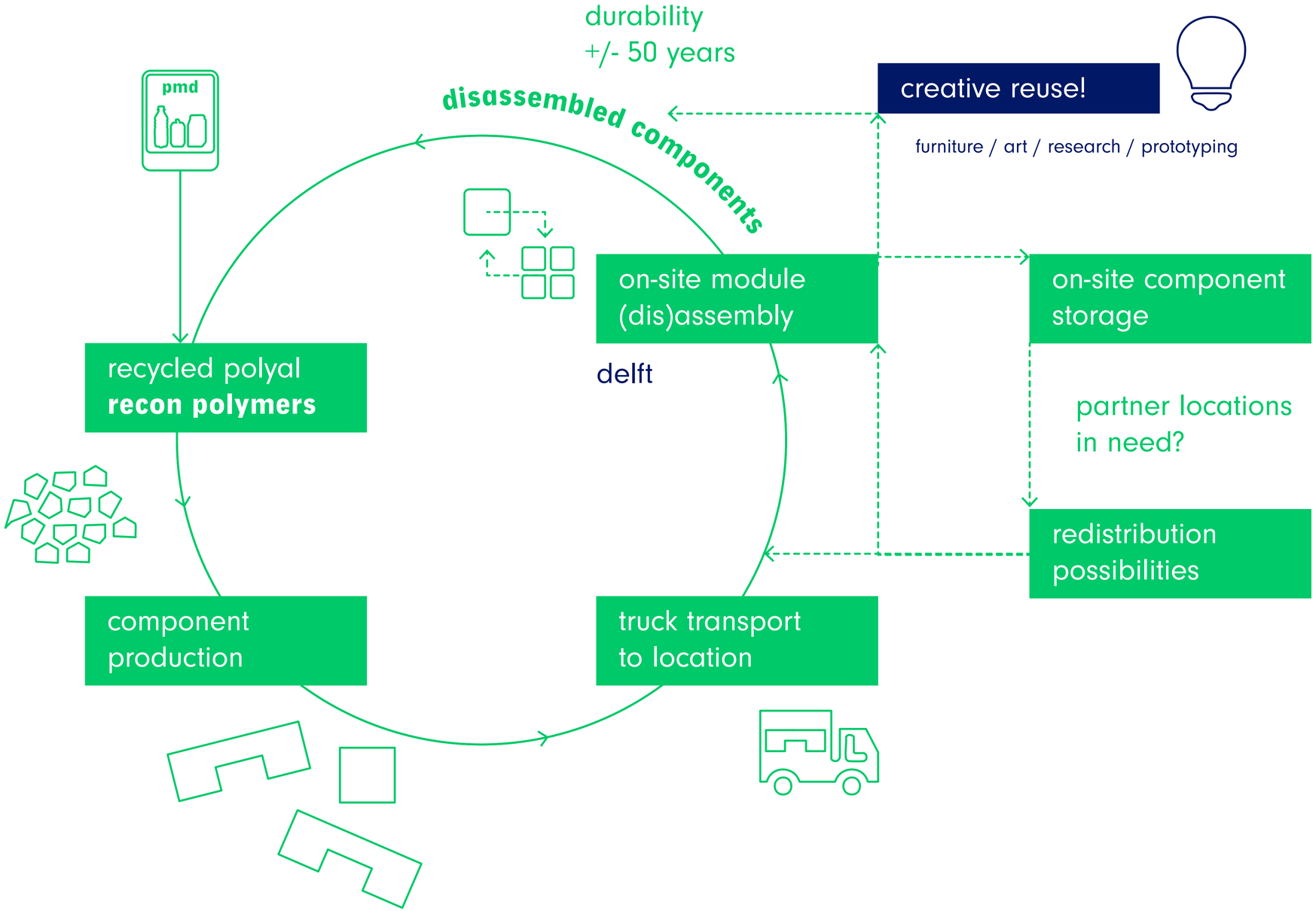
transported to the sites
at partner universities in need

scenario 3

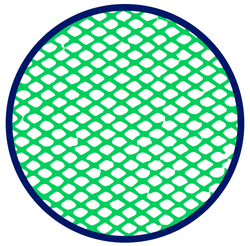
high need

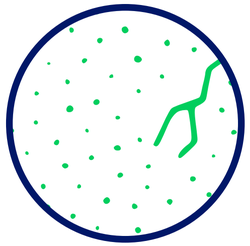


waste (resource) to wonder to ...



impact per material









	steel	concrete	wood	recycled polyal
density (kg/m³)	7850	2400	550	1083
energy production (kWh/kg)	5,6	0,25	2,4	2,5
impact production (kg CO_2/kg)*	1,68	0,075	0,72	0,75
impact reduction (kg CO_2/kg)**	0,9	0	0	-3,1
total impact (kg CO_2/kg)	**0,78**	**0,075**	**0,72**	**-2,35**
circularity	**circular**	**not circular**	**not circular**	**circular**

*CO_2/kg (production) = kWh/kg × 0.3
(1 kWh = 0,3 kgCO_2)

**based on circular use (avoiding incineration)

recycled plastic reduces footprint through circularity

impact calculation studio regular



weight	277
impact per unit	**652**
# units	36



weight	381
impact per unit	**896**
# units	24



weight	374
impact per unit	**878**
# units	34



weight	9
impact per unit	**20**
# units	62



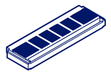
weight	10
impact per unit	**25**
# units	40



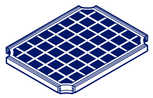
weight	10
impact per unit	**25**
# units	46



weight	596
impact per unit	**1400**
# units	4



weight	726
impact per unit	**1705**
# units	0



weight	2491
impact per unit	**5854**
# units	4



weight	531
impact per unit	**1247**
# units	4



weight	422
impact per unit	**993**
# units	4



weight	102
impact per unit	**239**
# units	1



weight	84
impact per unit	**199**
# units	1



weight	12
impact per unit	**28**
# units	1



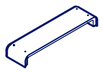
weight	16
impact per unit	**38**
# units	1



weight	36
impact per unit	**84**
# units	1



weight	675
impact per unit	**1586**
# units	4



weight	596
impact per unit	**1400**
# units	0



weight	1392
impact per unit	**3270**
# units	8



weight	460
impact per unit	**1082**
# units	4



weight	510
impact per unit	**1199**
# units	4



weight	92
impact per unit	**216**
# units	4



weight	54
impact per unit	**127**
# units	4



weight	24
impact per unit	**56**
# units	6



weight	288
impact per unit	**677**
# units	8



weight	396
impact per unit	**931**
# units	8



weight	109
impact per unit	**257**
# units	2



weight	156
impact per unit	**366**
# units	0



weight	427
impact per unit	**1003**
# units	4



weight	106
impact per unit	**249**
# units	2



weight	77
impact per unit	**181**
# units	2



weight	71
impact per unit	**168**
# units	1



weight	107
impact per unit	**252**
# units	1



weight	19
impact per unit	**46**
# units	2



weight	32
impact per unit	**76**
# units	2



weight	390
impact per unit	**916**
# units	2



weight	639
impact per unit	**1502**
# units	0

studio regular



total impact =
-193569 kg CO_2

This represents the carbon savings from avoiding virgin plastic production and incineration, assuming good recycling and circularity.

impact calculation

studio regular +



total impact =
-223743 kg CO_2

studio regular



total impact =
-193569 kg CO_2

studio loft

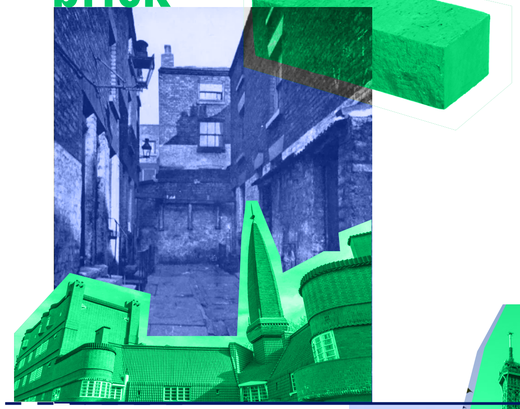


total impact =
-201965 kg CO_2

conclusion

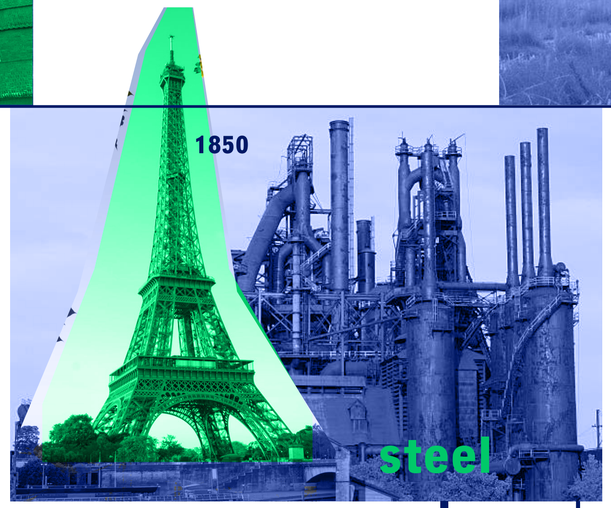
timeline of material perception in architecture

poor man's stone
brick



1800

1850



steel
ugly and
shamefully structural

1900

old, **fragile** and **rural**
not for the cities
wood





1950



concrete
only for **infrastructure**
brutal and **ugly**



2025

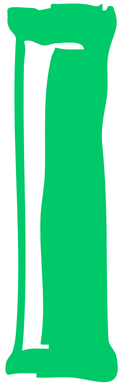

recycled plastic
the **next** chapter
2025
a circular future

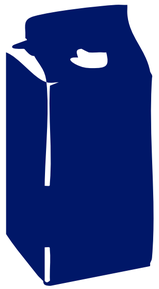


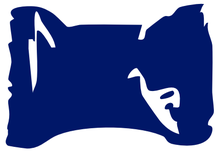


shift in **waste perception**



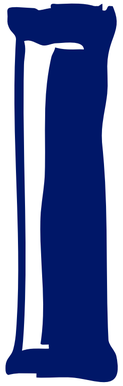






wonders of waste





Nadine Nossbaum
4659716

dE studio p5

june 18th 2025

design mentor Dafne Swank
bt mentor Stephan Verkuijlen
research mentor Jos de Krieger

thank you! questions?

Nadine Nossbaum
4659716

dE studio p5

june 18th 2025

design mentor Dafne Swank
bt mentor Stephan Verkuijlen
research mentor Jos de Krieger