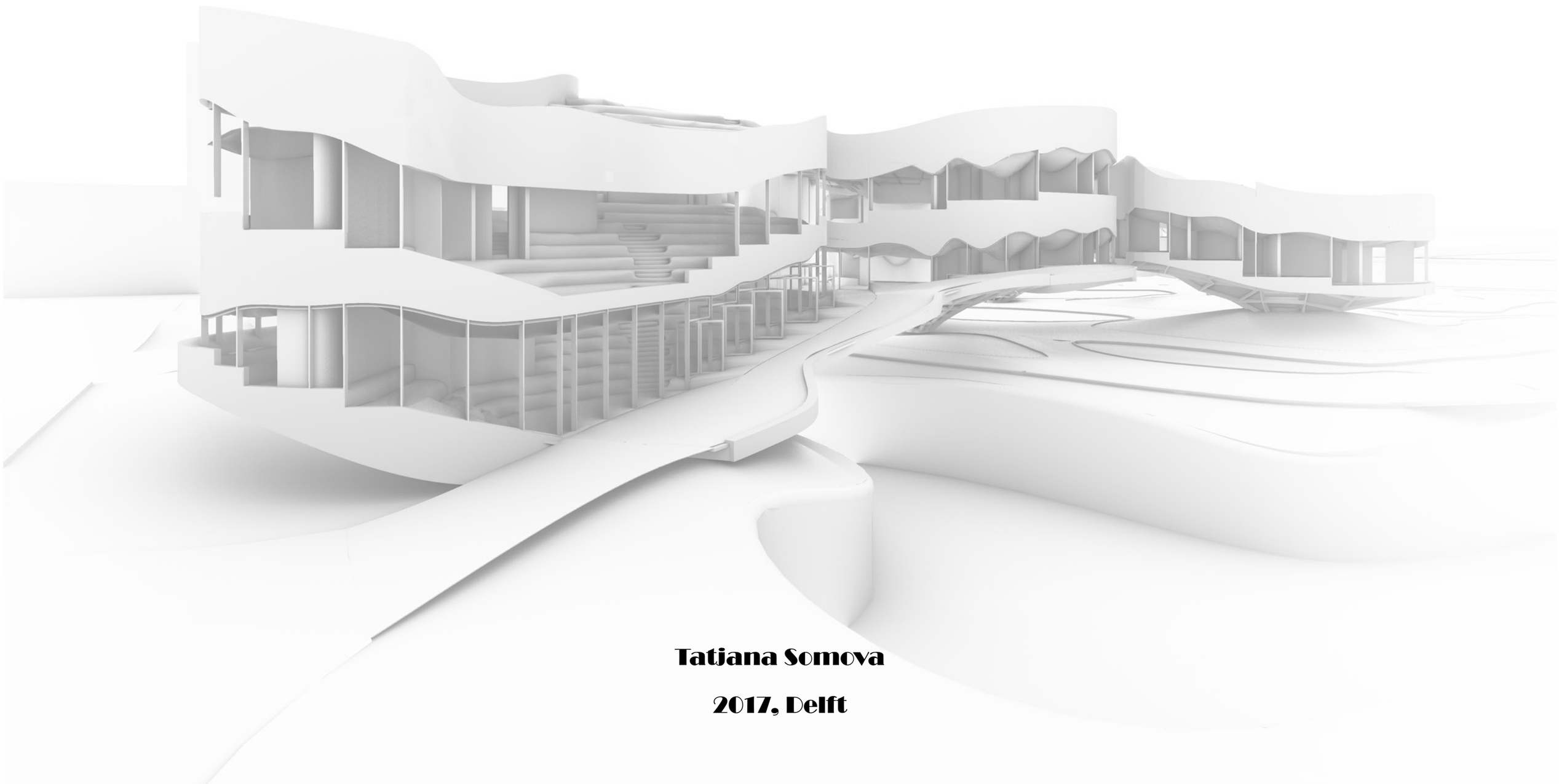
Maximized space usage

Studio: Hyperbody



Tatjana Somova

2017, Delft


2.5km
Delft
centre
Rotterdam
14.5km

Site analysis

Delft
Area: 24 km²
Population: 101,033

Students: 20,980

Central Station

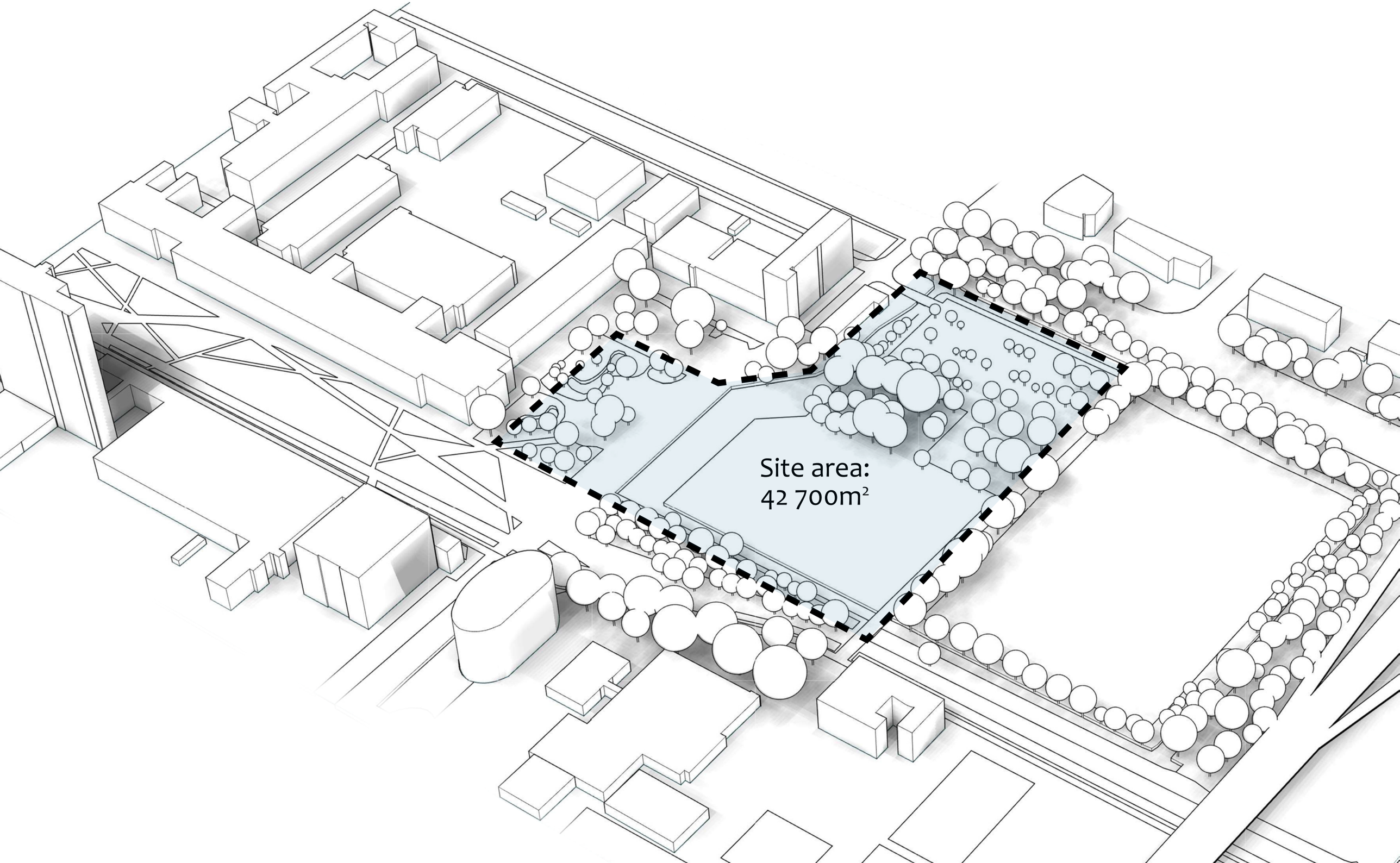
South Station

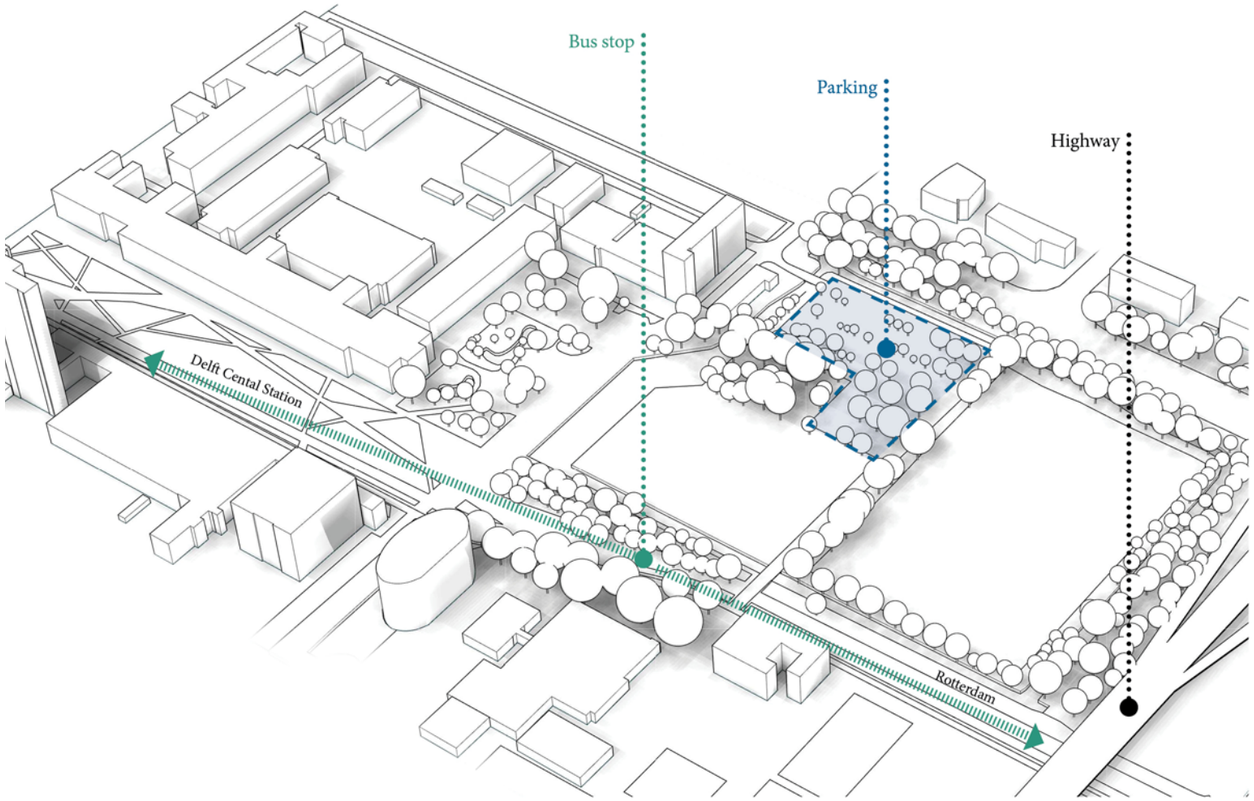
Building Site

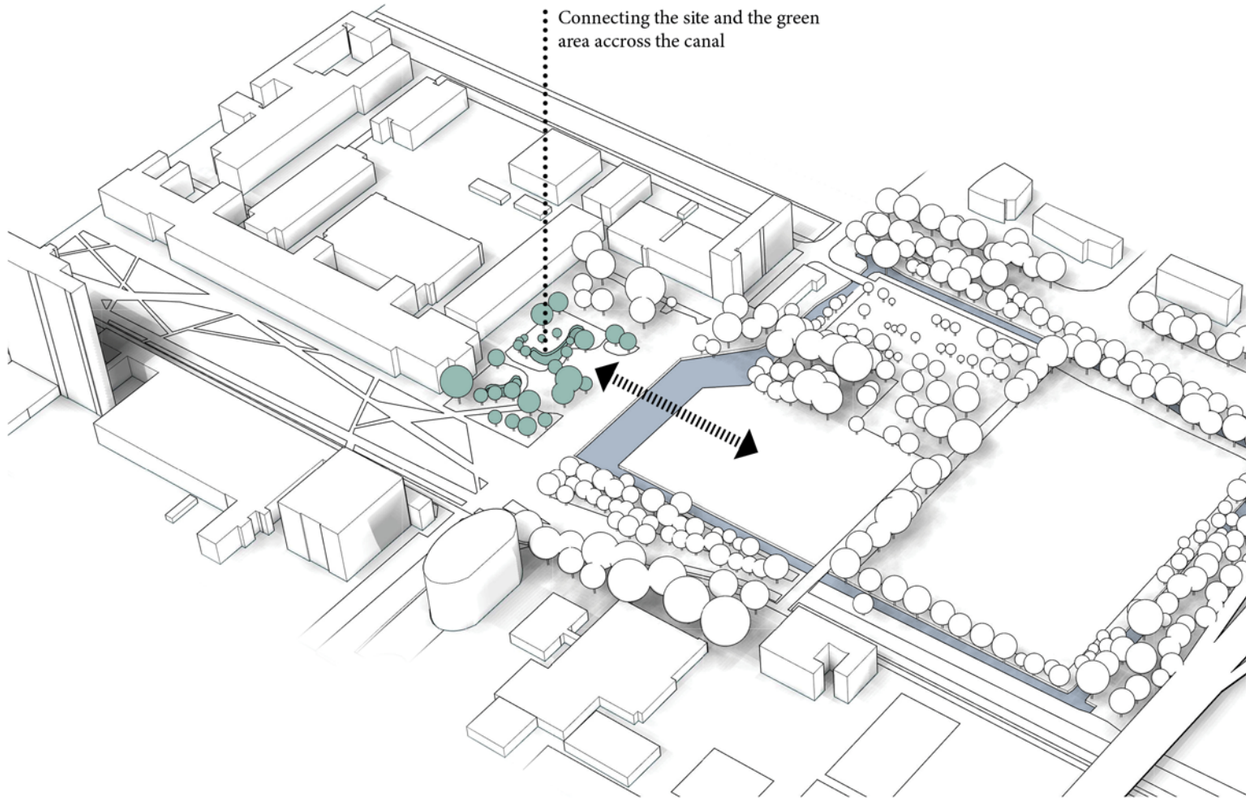
To The Hague:
by car: 15 km, 20 min
by train: 10 services per hour, 15 min

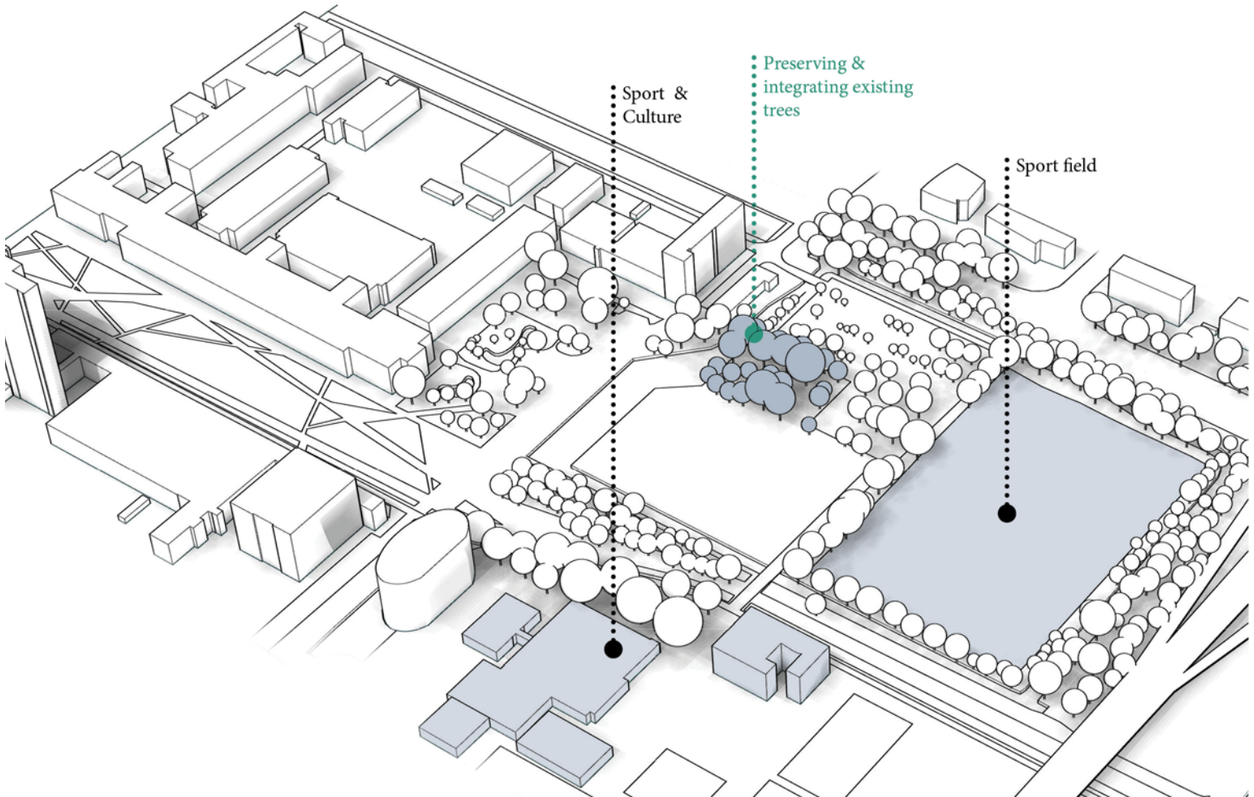
To Amsterdam:
by car: 66 km, 44 min
by train: 4 services per hour, 58 min

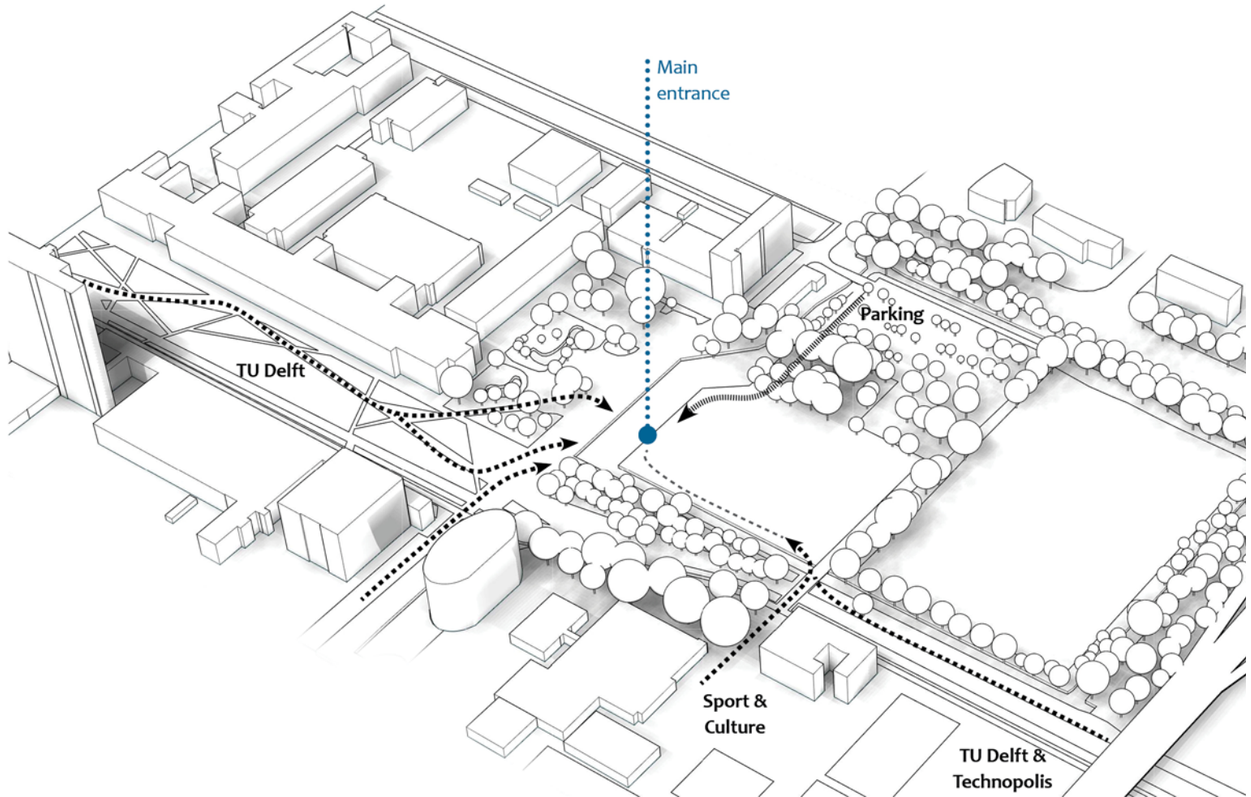
To Rotterdam
by car: 14.5 km, 20 min
by train: 4 services per hour, 15 min


Site area:
42 700m²

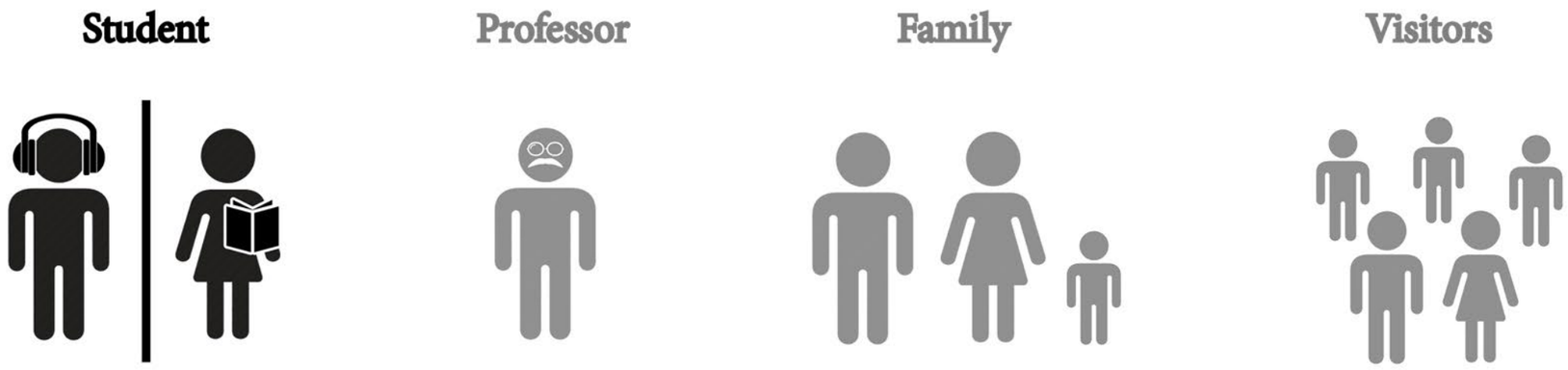

Bus stop
Parking
Highway
Delft Cental Station
Rotterdam


Connecting the site and the green
area accross the canal


Sport &
Culture
Preserving &
integrating existing
trees
Sport field


Main
entrance
TU Delft
Parking
Sport &
Culture
TU Delft &
Technopolis

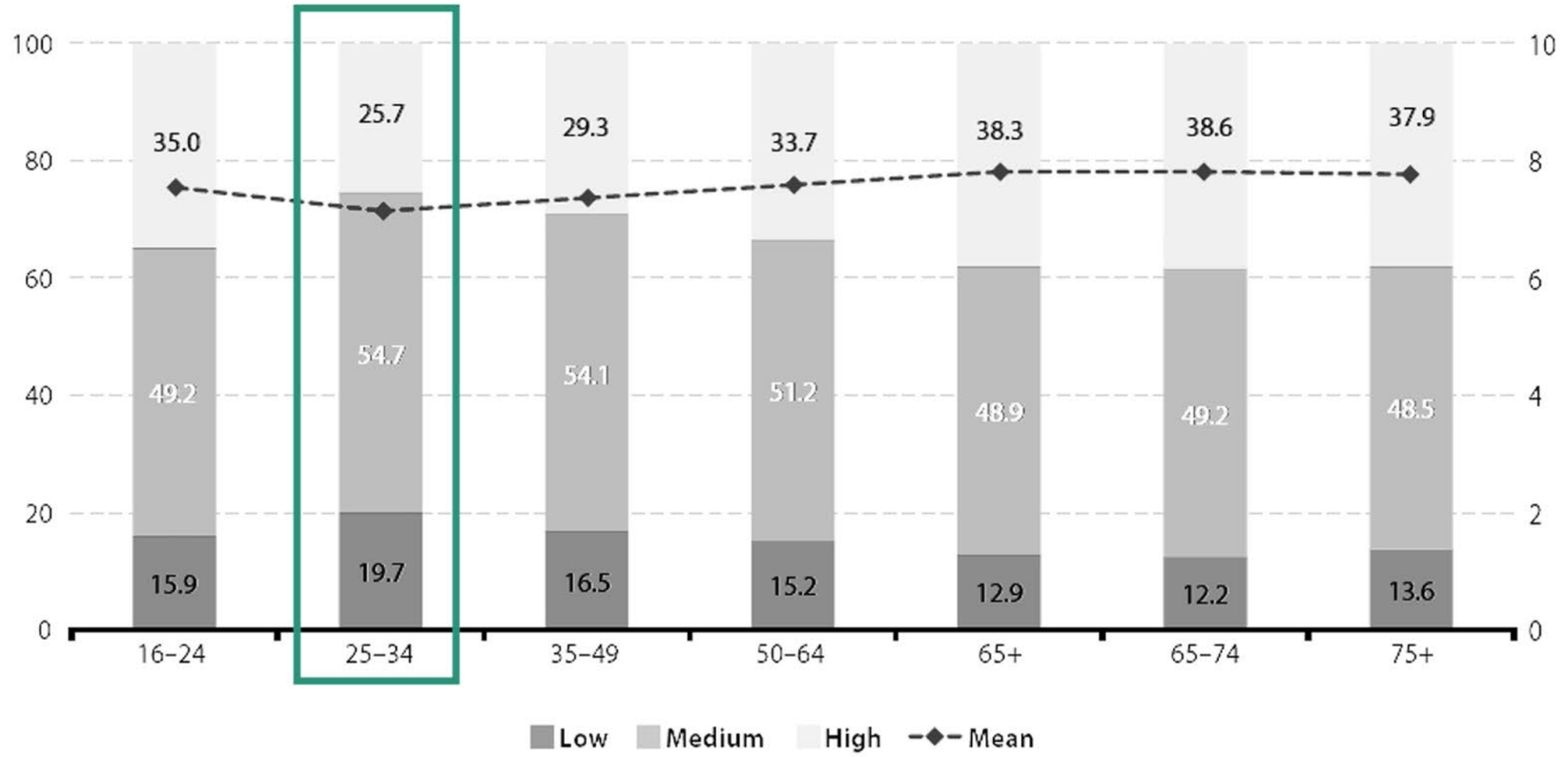
Main Users: Students
- The most unsatisfied age group with the present housing situation.
- 20% of the population in Delft.

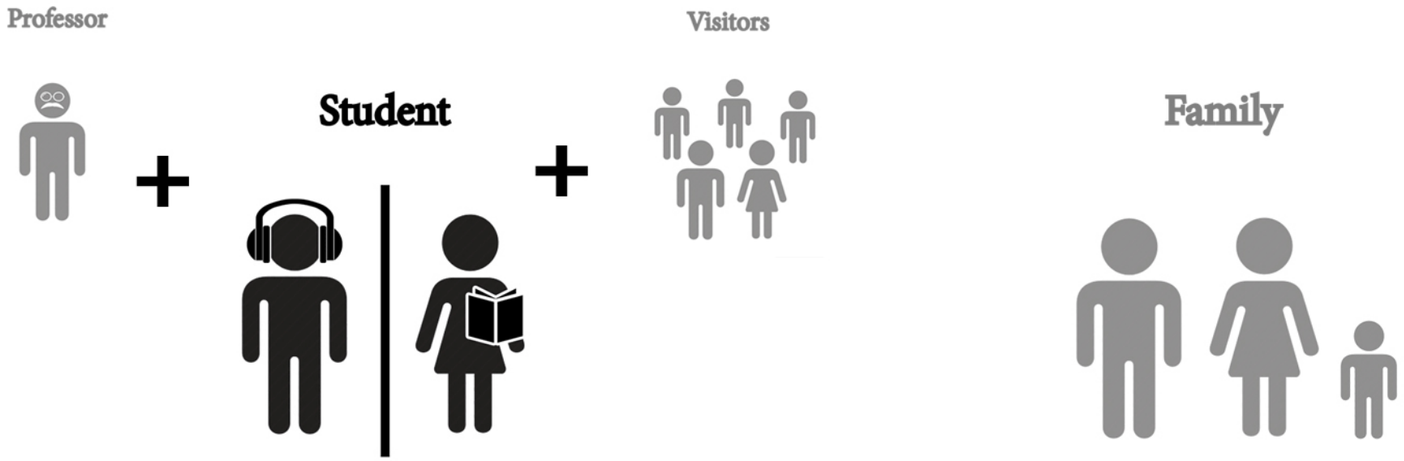


15.7 %

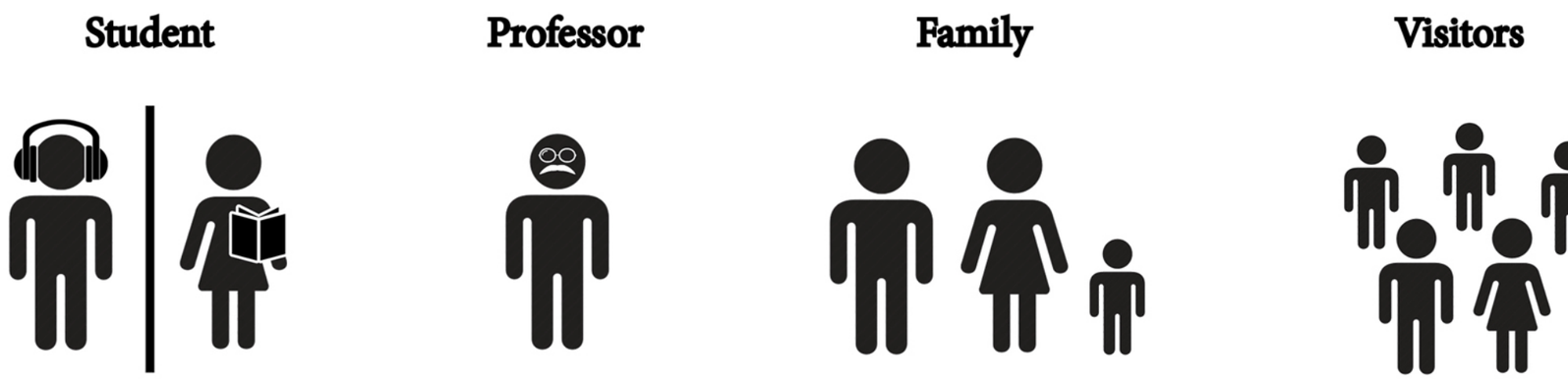
51.8 %

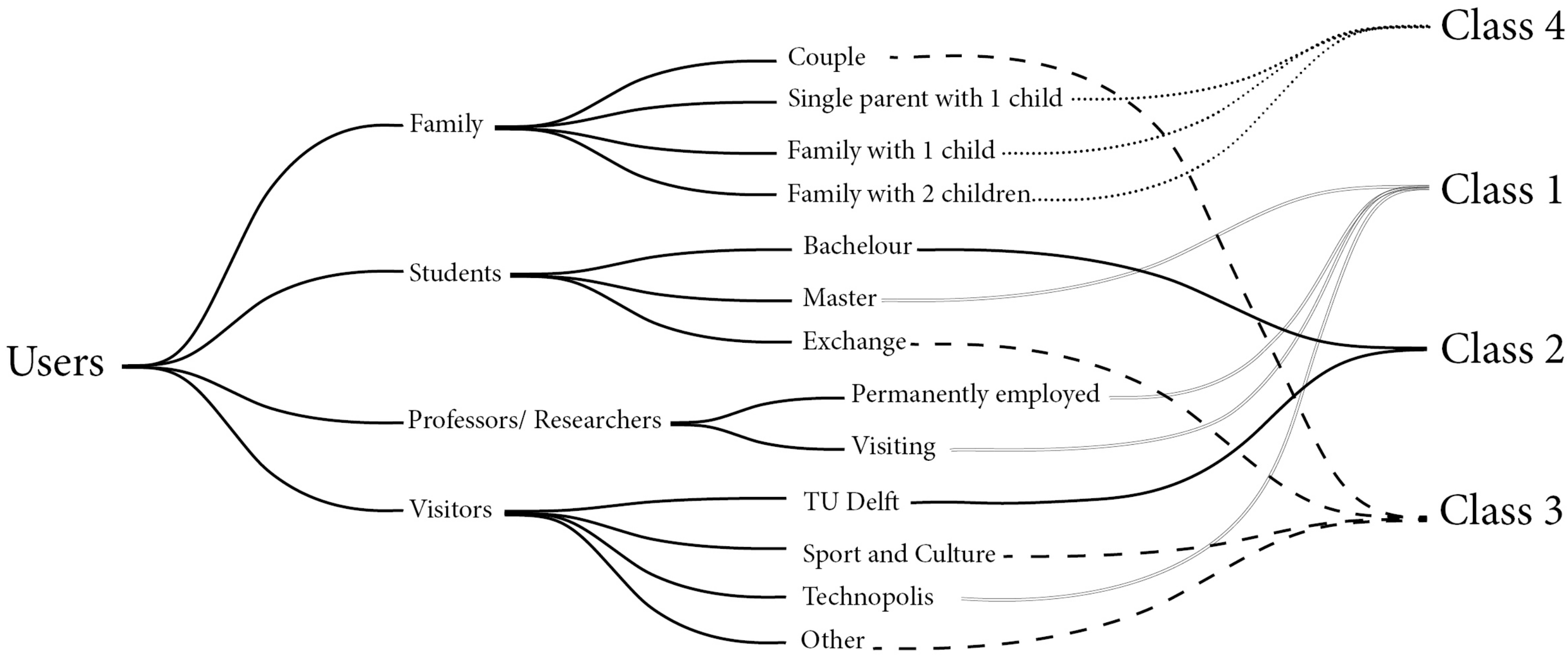
32.5 %



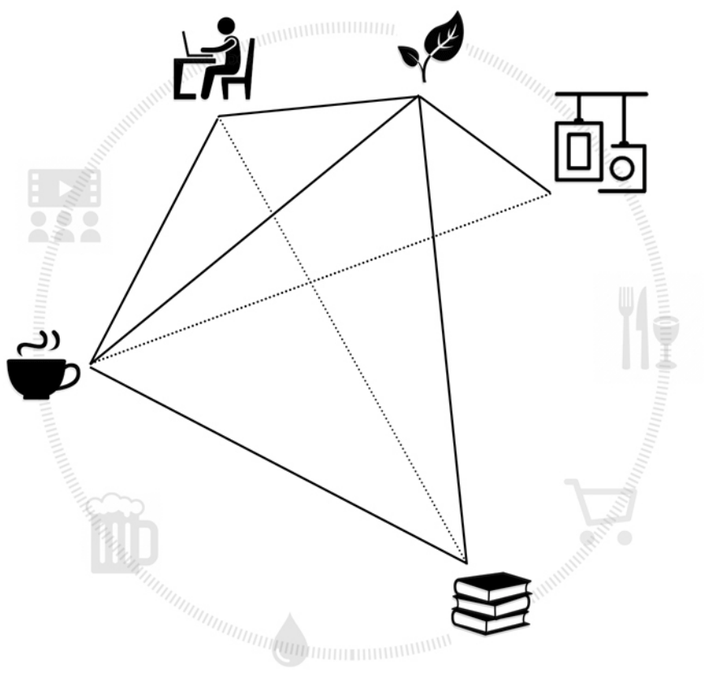


Class 1	Class 2	Class 3	Class 4
Bachelour	Exchange	Master	
Duration: 3-4 year	Duration: 0.5-1 year	Duration: 2-3 year	Duration:
Flexibility: Low	Flexibility: High	Flexibility: Medium	Flexibility: Low
Privacy: Medium	Privacy: Low	Privacy: High	Privacy: High
Age: 18-22	Age: 18-25	Age: 22-30	Age:

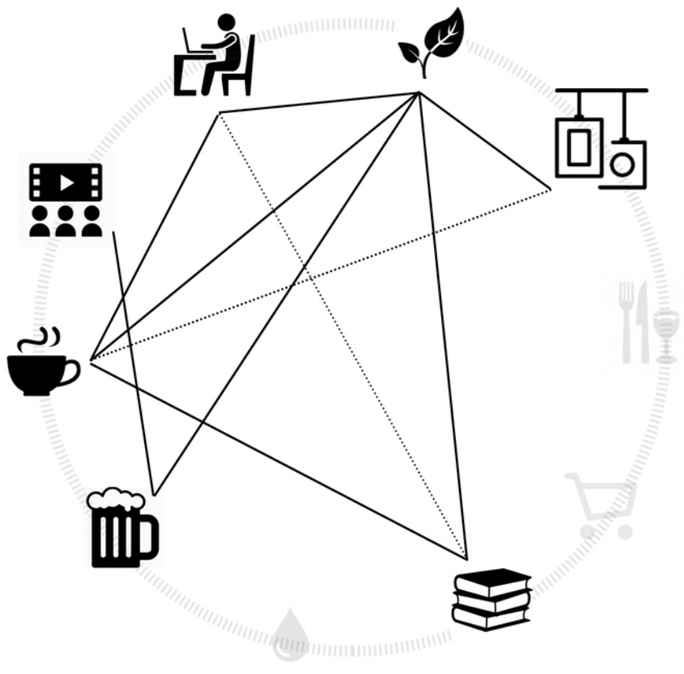

Student
Professor
Family
Visitors


Users
Family
Couple
Single parent with 1 child
Family with 1 child
Family with 2 children
Students
Bachelour
Master
Exchange
Professors/ Researchers
Permanently employed
Visiting
Visitors
TU Delft
Sport and Culture
Technopolis
Other
Class 4
Class 1
Class 2
Class 3

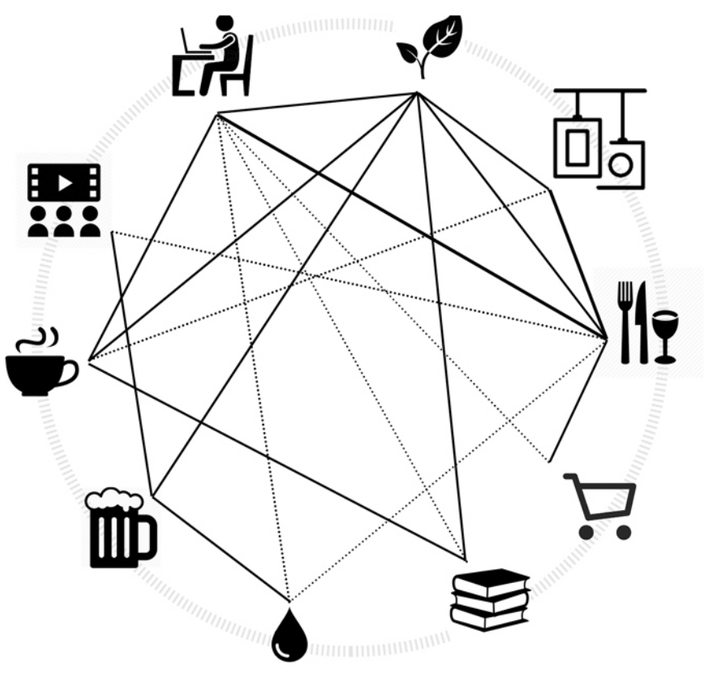
Class 1

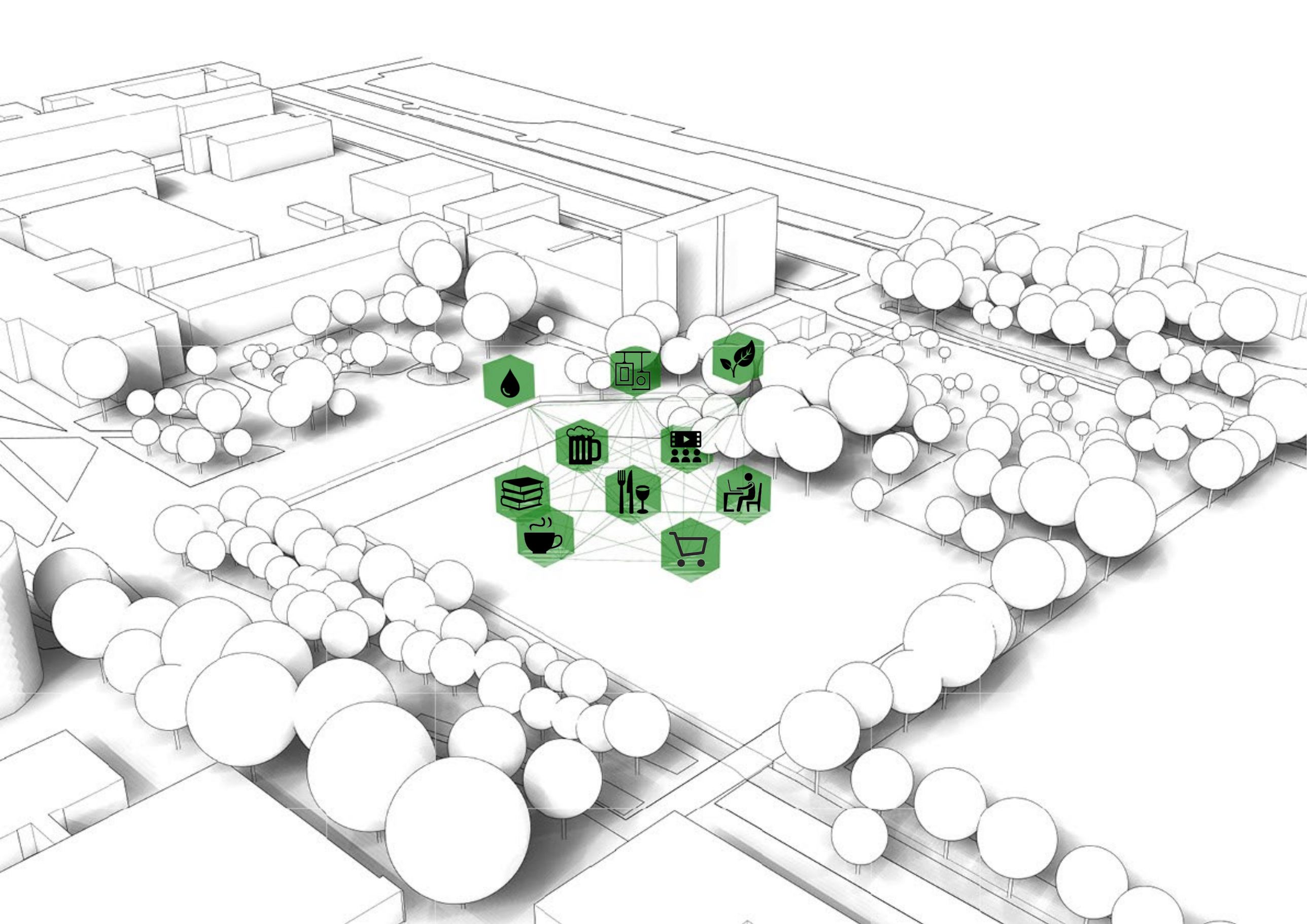


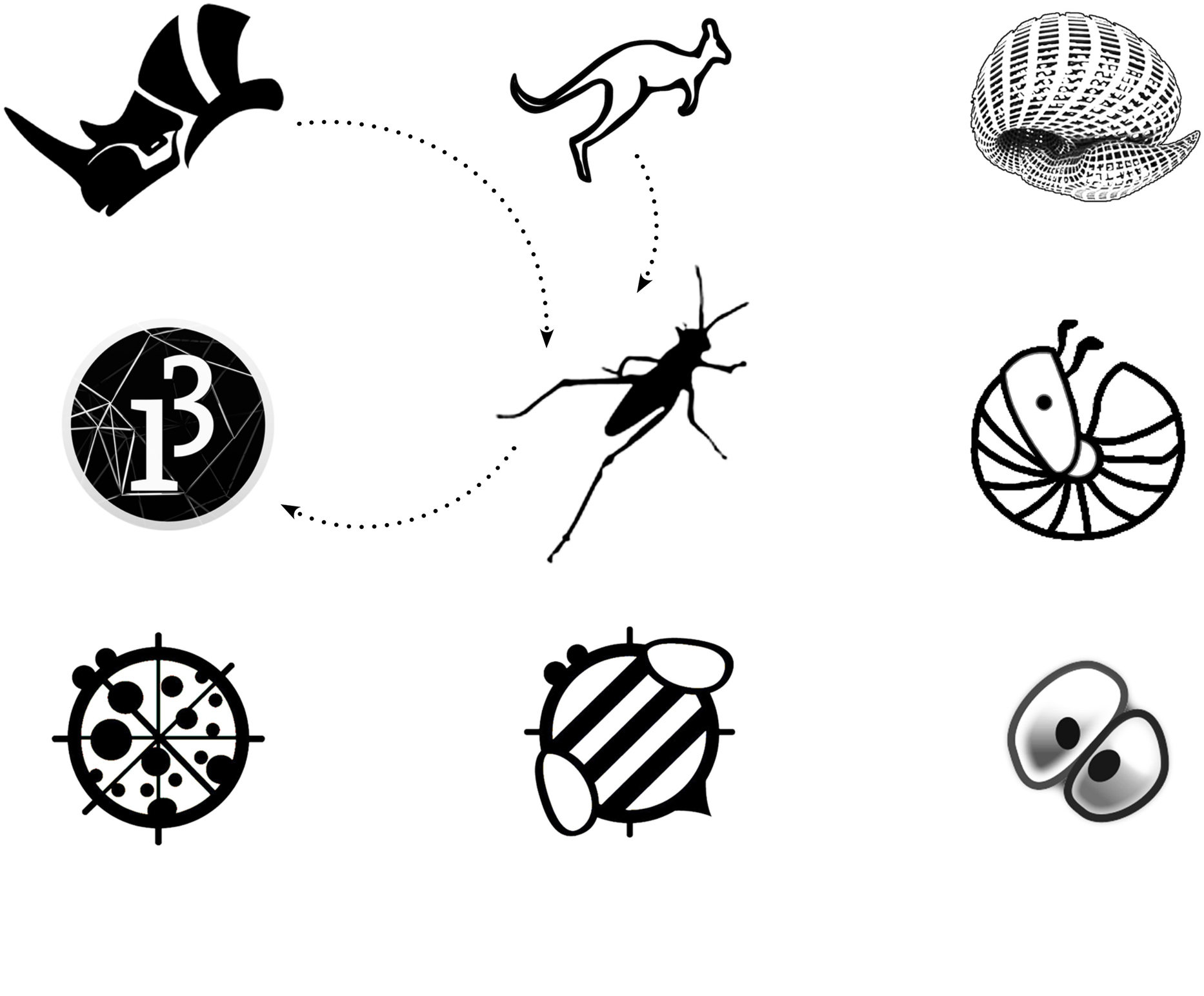
Class 2



Class 3 + Class 4



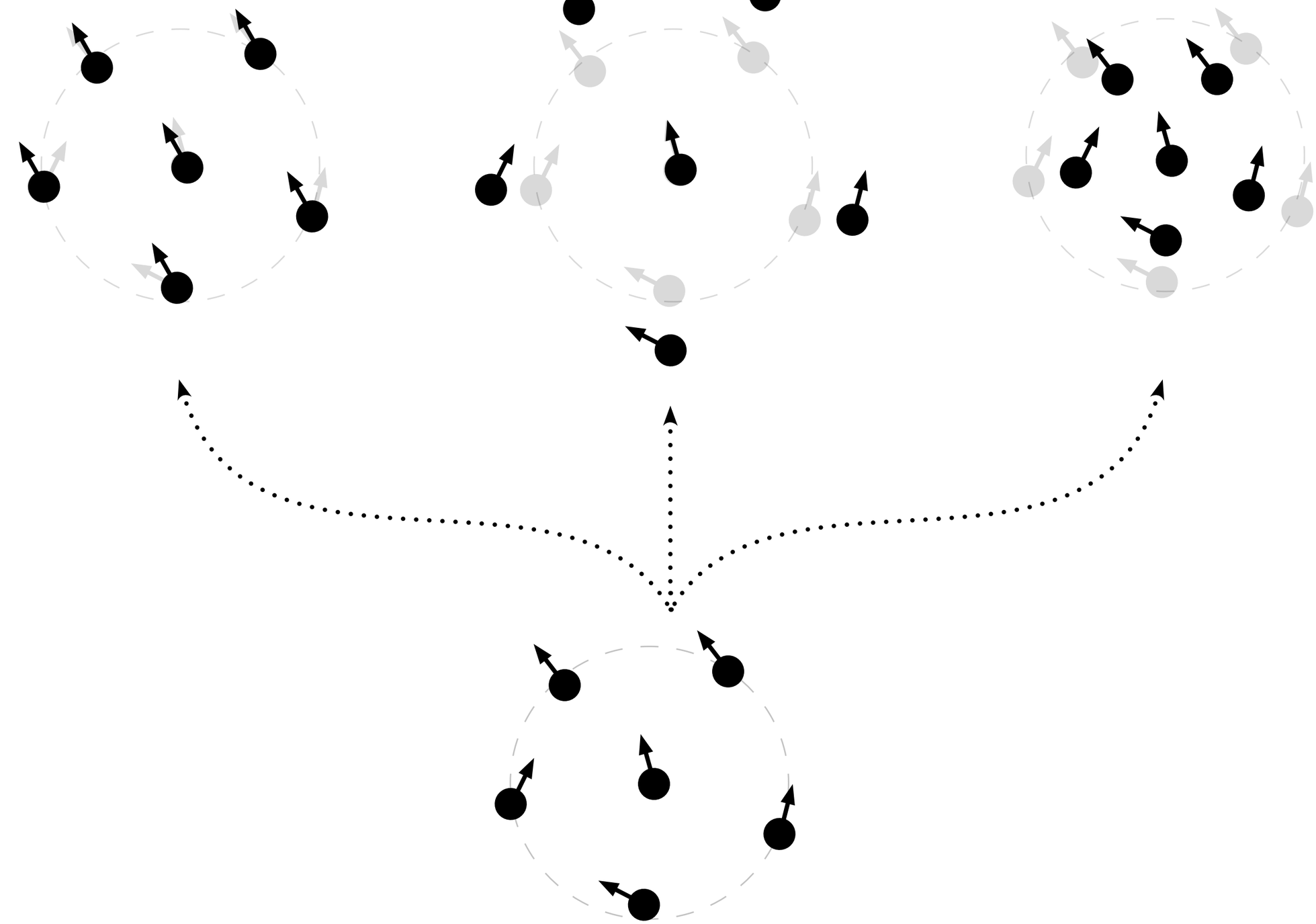




Alignment

Separation

Cohesion



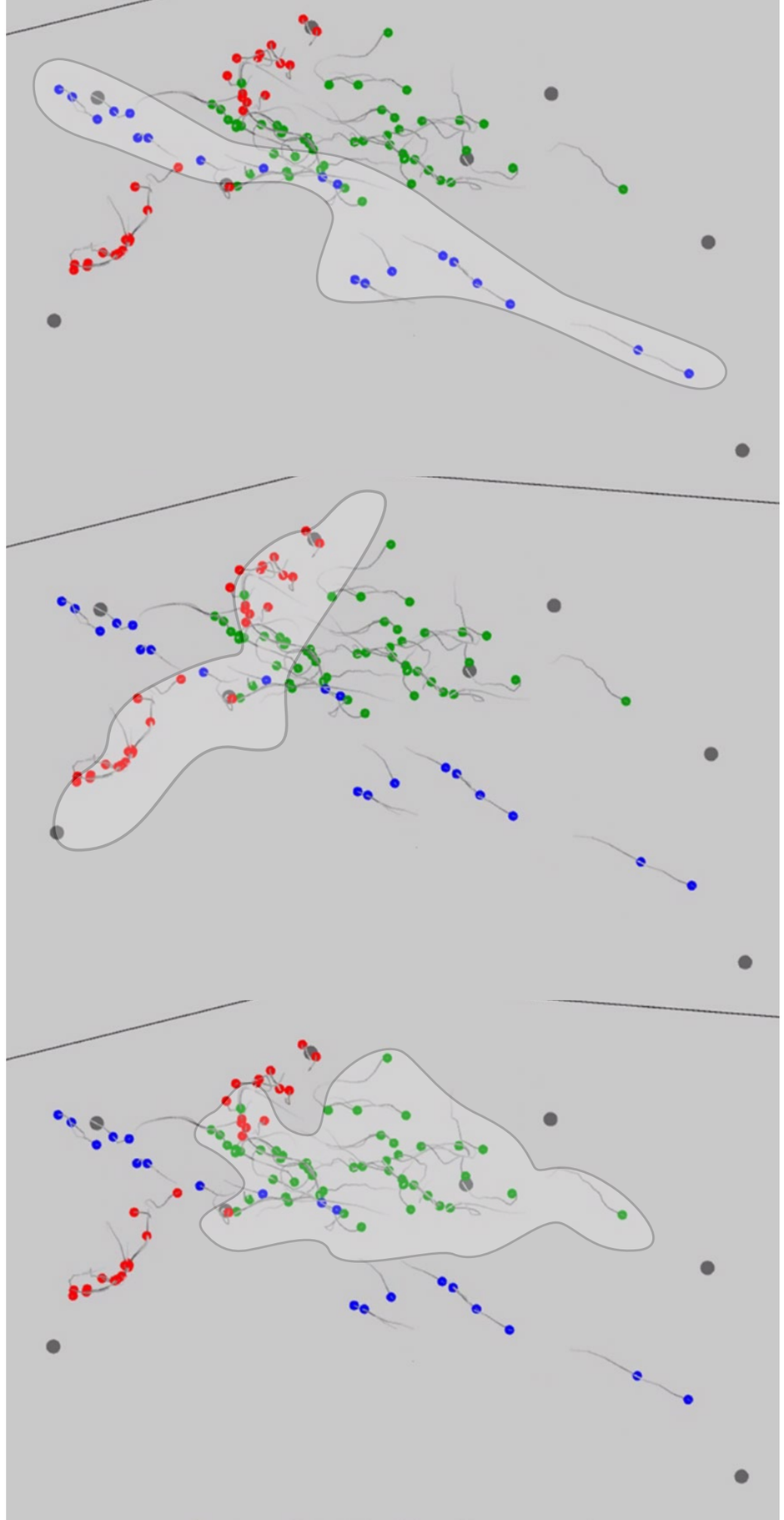
sketch_27_01_3classes | Processing 3.2.3

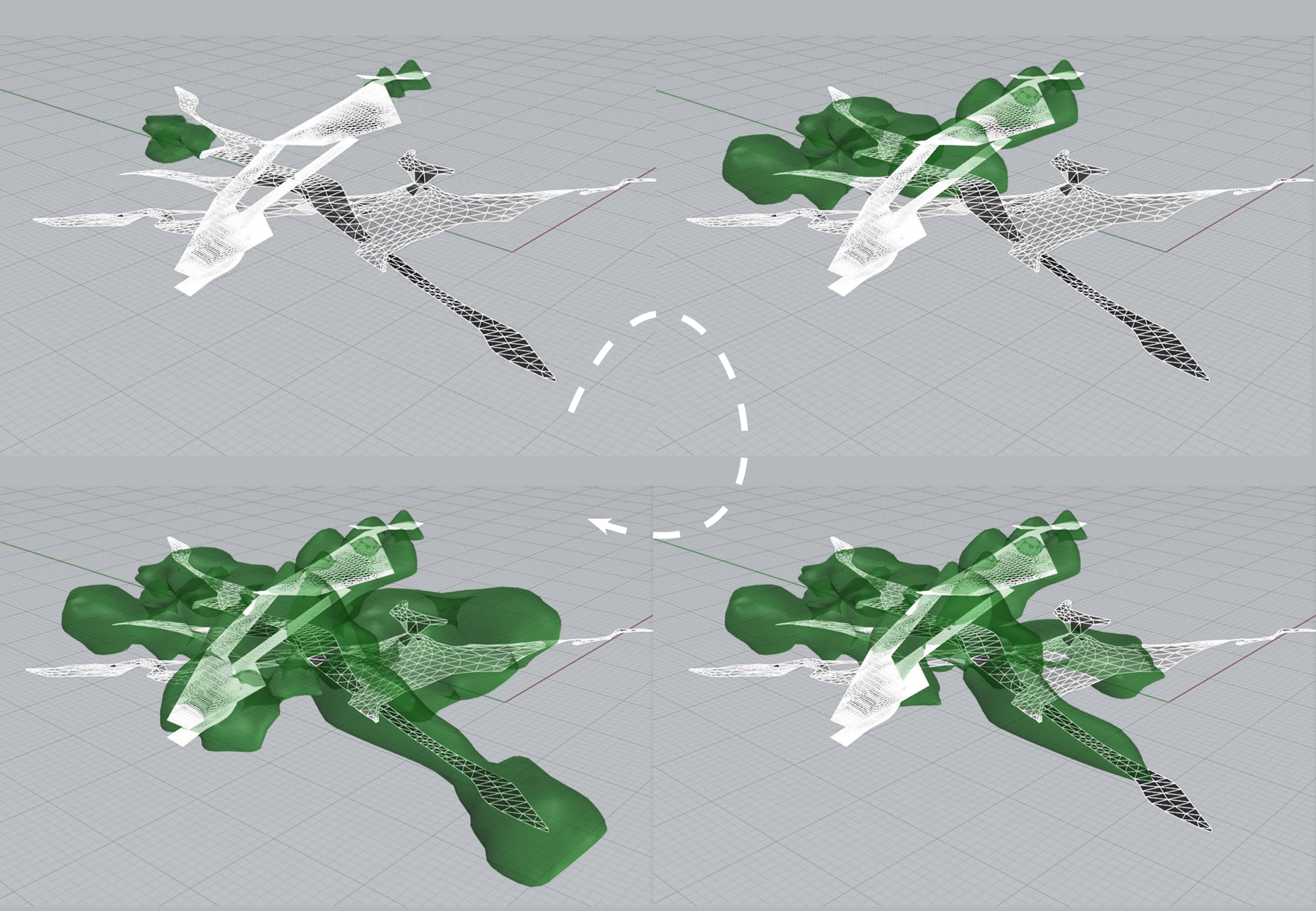
File Edit Sketch Debug Tools Help

sketch_27_01_3classes | A_Draw | A_Void

```
169 int population = 30;
170 int population2 = 20;
171 int population3 = 50;
172
173 float maxVel = 3;
174 float maxVel2 = 1.5;
175 float maxVel3 = 2;
176
177 float wandertheta = 40;
178
179 float futLocMag = 3;
180
181 float tailViewAngle = 30;
182
183 float tailCohMag = 30;
184 float tailCohViewRange = 23;
185 float tailSepMag = 40;
186 float tailSepViewRange = 20;
187
188 float att = 5;
189 float att2 = 4;
190 float att3 = 2;
191
192 float maxAttract = 0.15;
193 float maxAttract2 = 0.07;
194 float maxAttract3 = 0.05;
195
196 int DIMX = 2500;
197 int DIMY = 2400;
198 int DIMZ = 300;
```

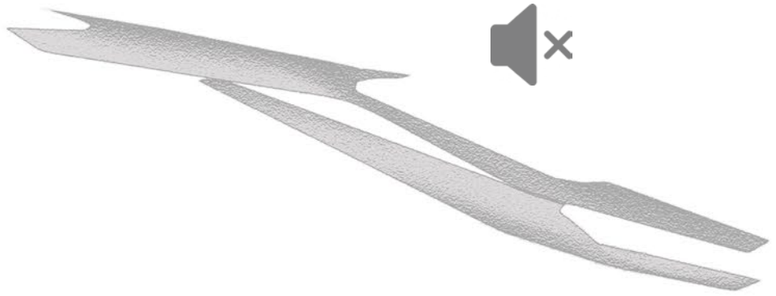
You are running Processing revision 0255, the





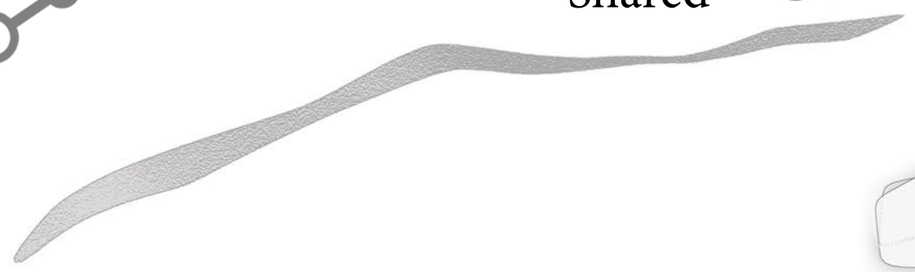
Silent route/
Working

1



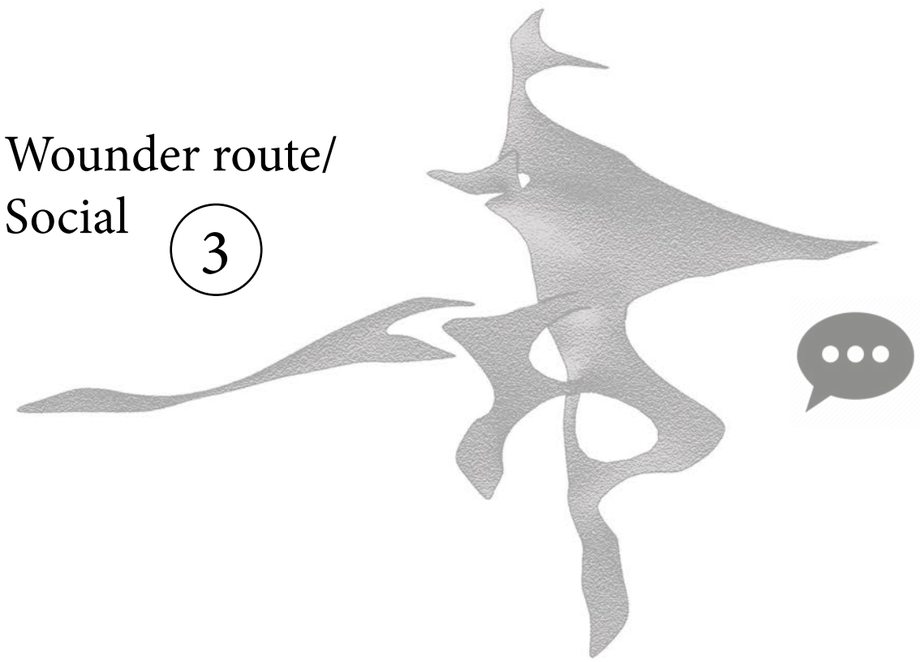
Speed route/
Shared

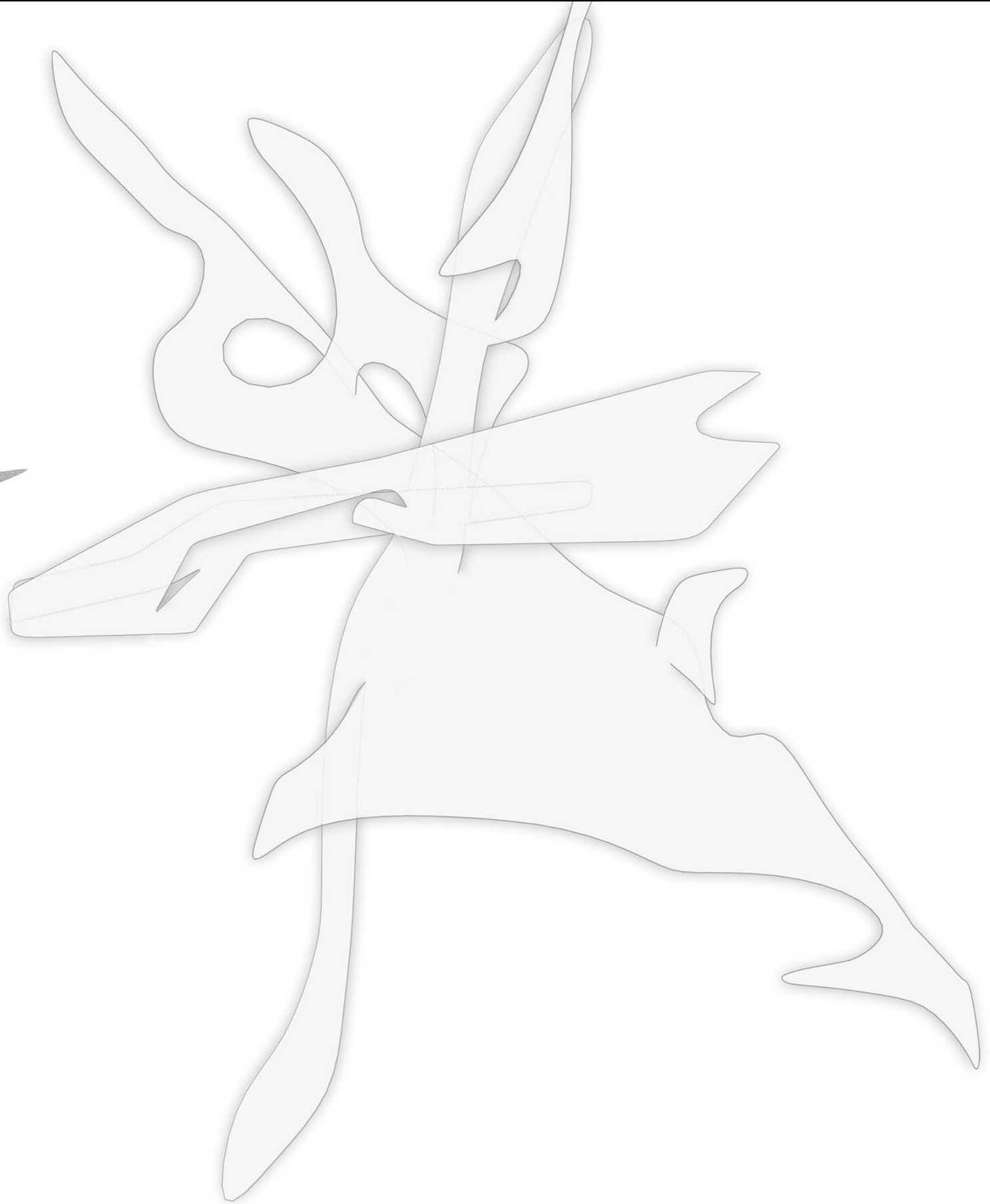
2



Wounder route/
Social

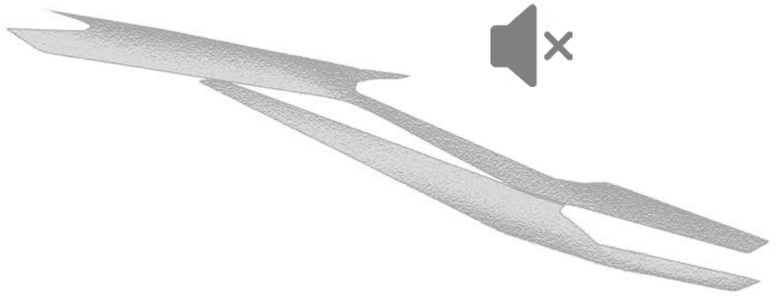
3





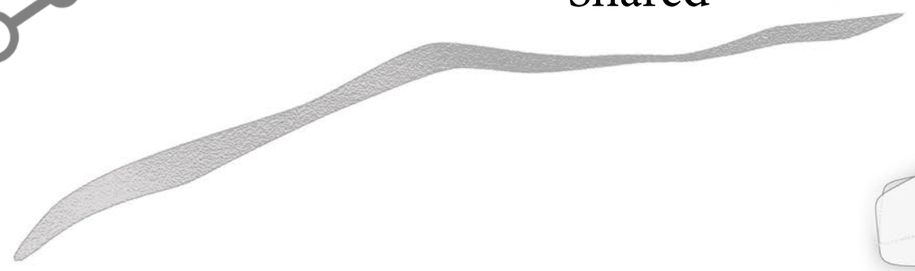
Silent route/
Working

1



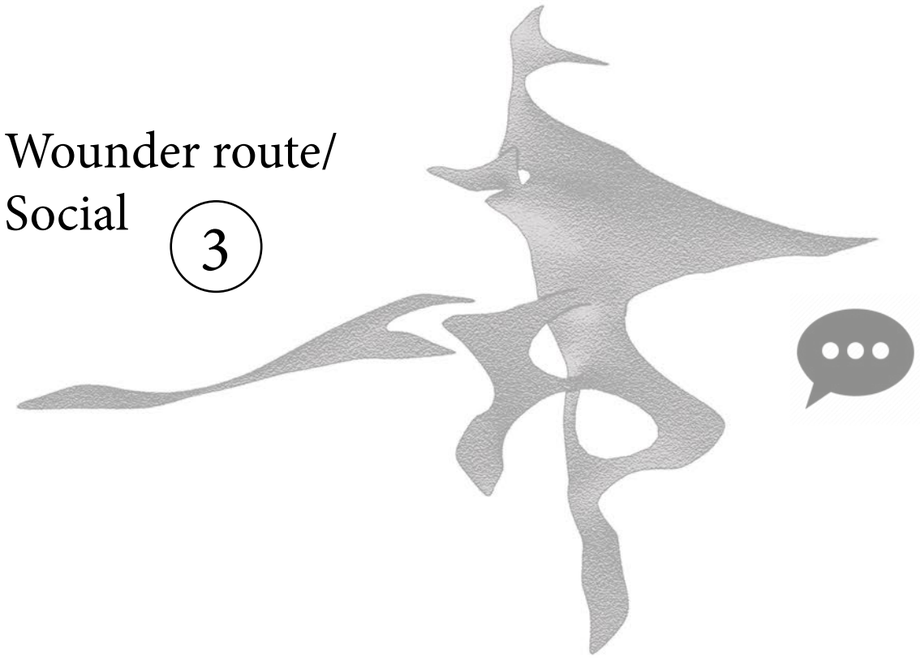
Speed route/
Shared

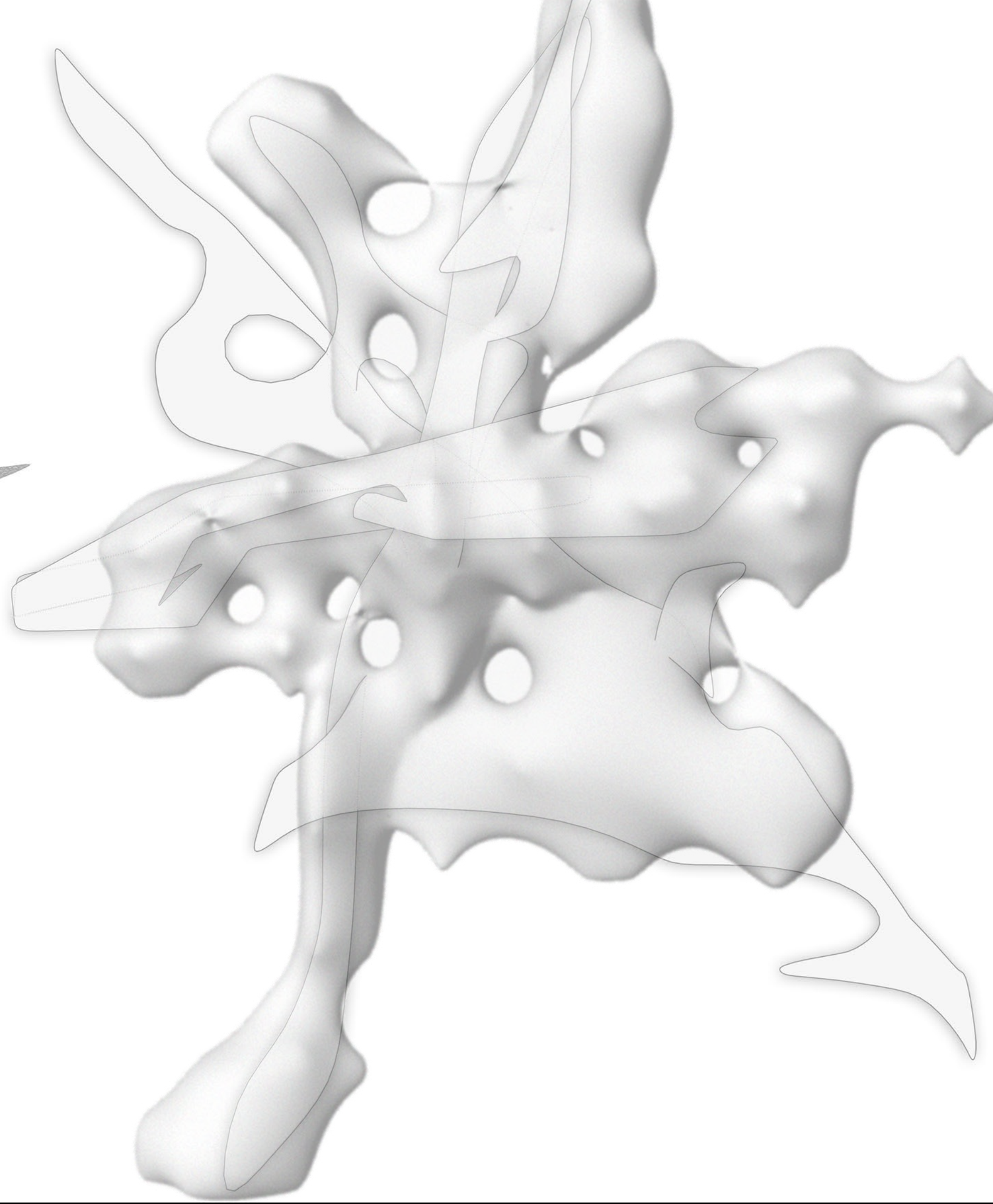
2



Wounder route/
Social

3

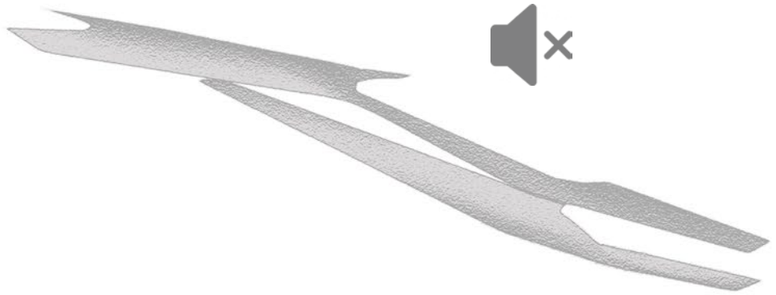




Concept design

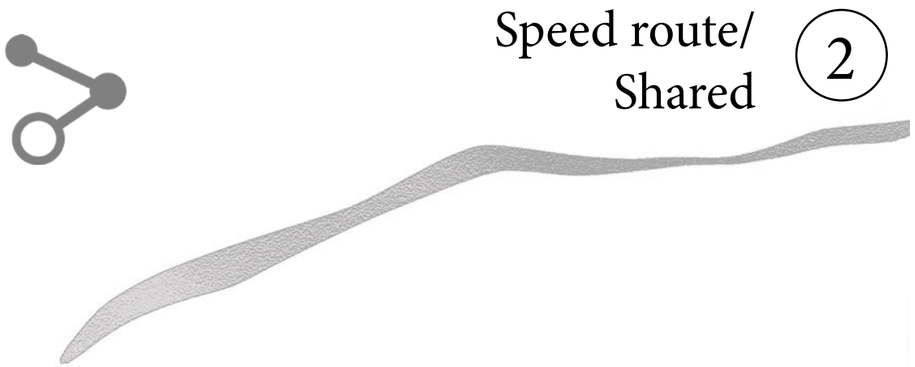
Silent route/
Working

1



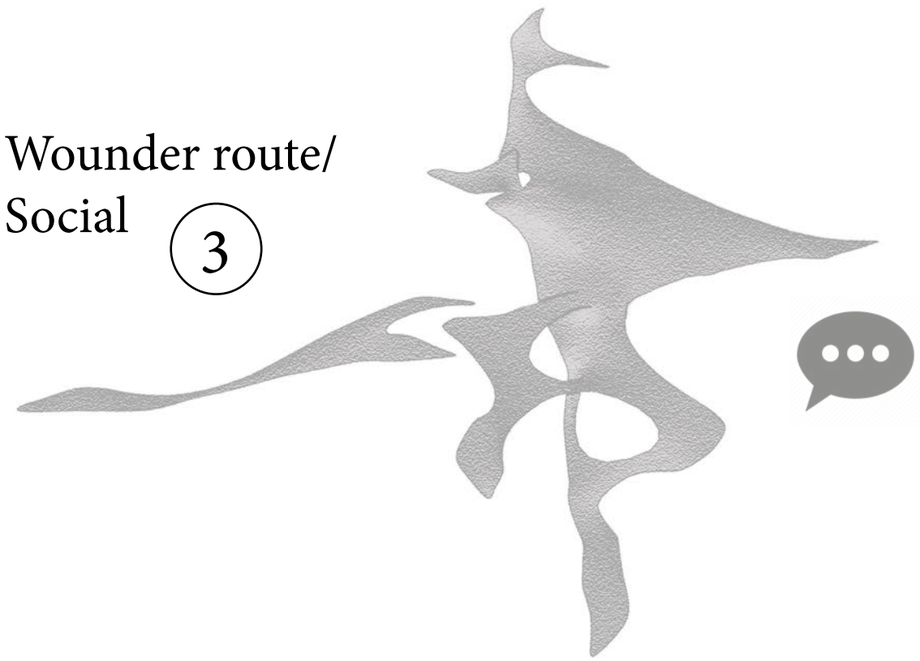
Speed route/
Shared

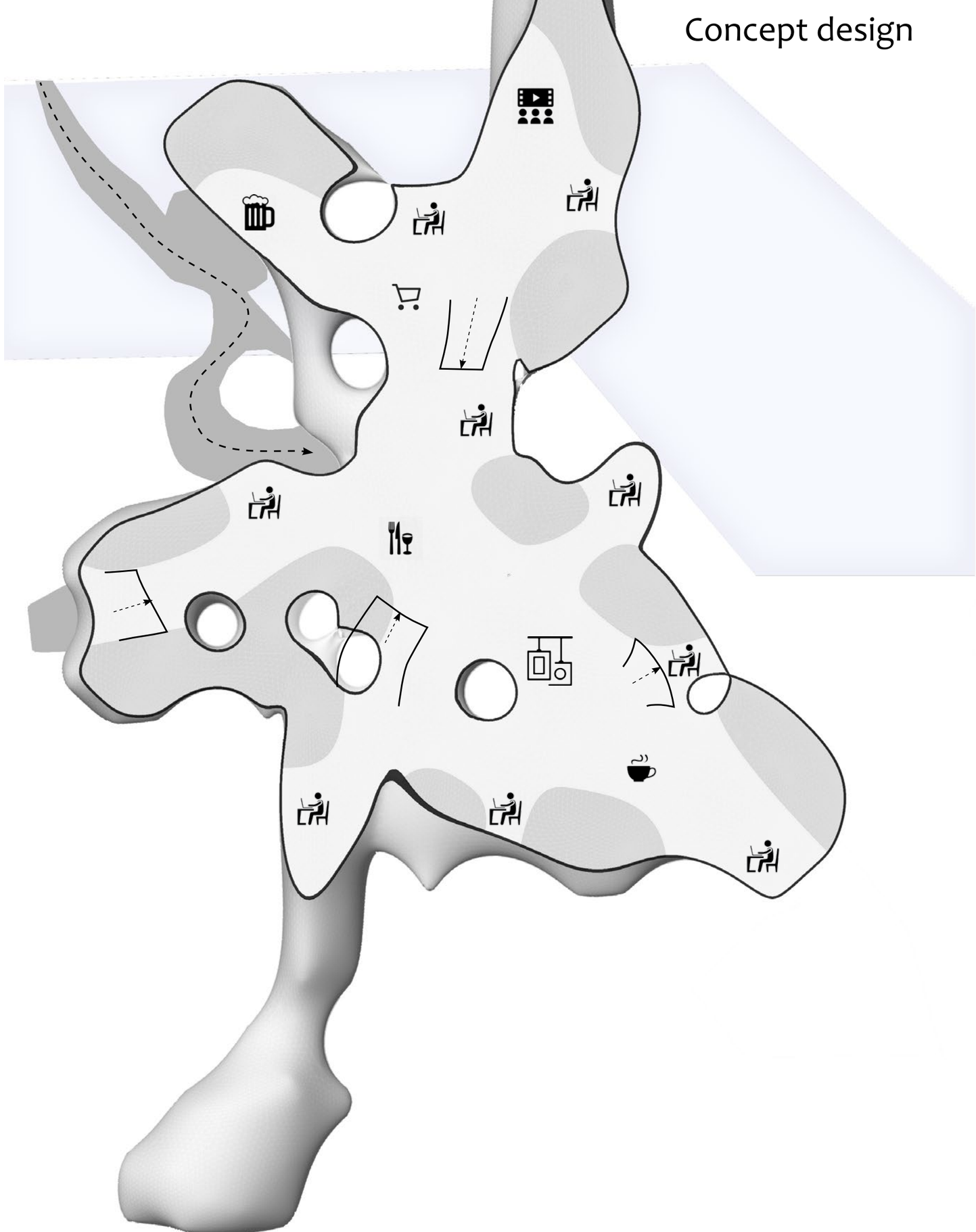
2



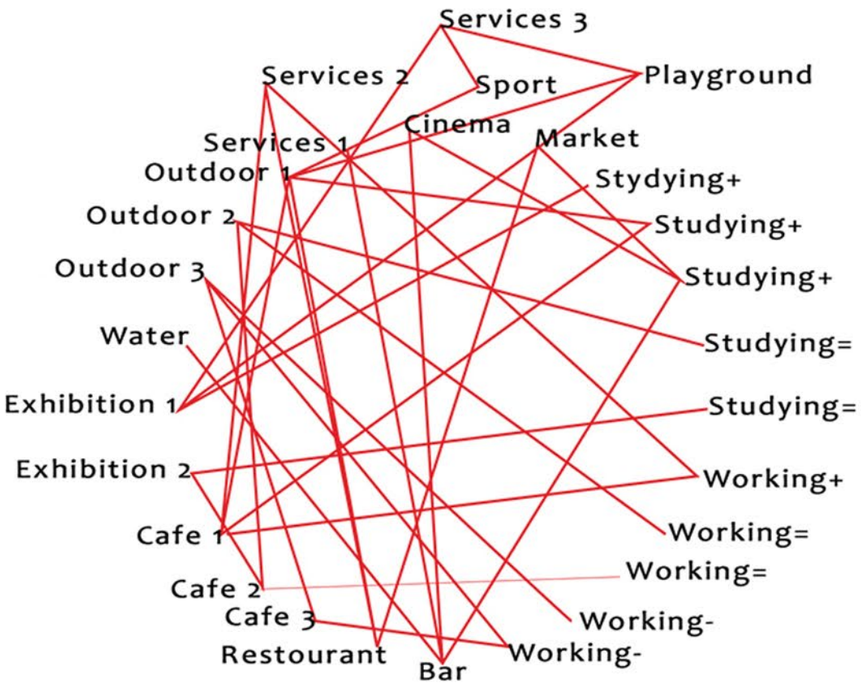
Wounder route/
Social

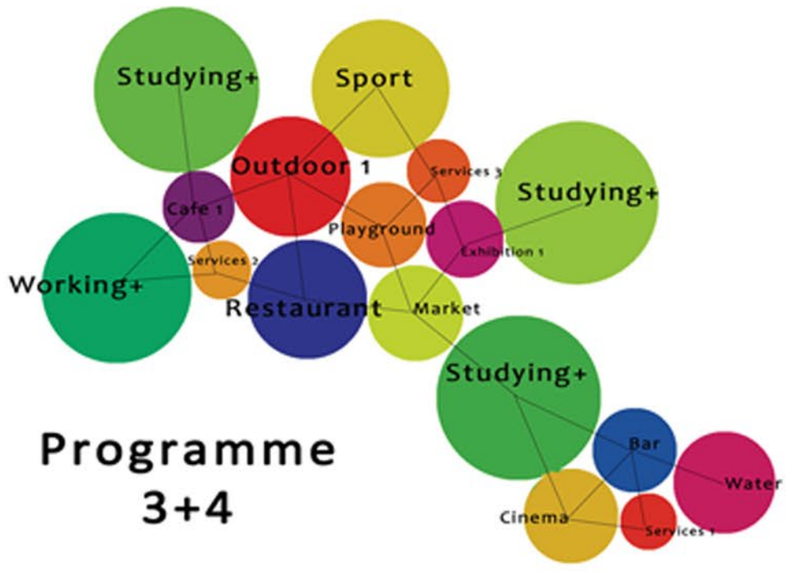
3





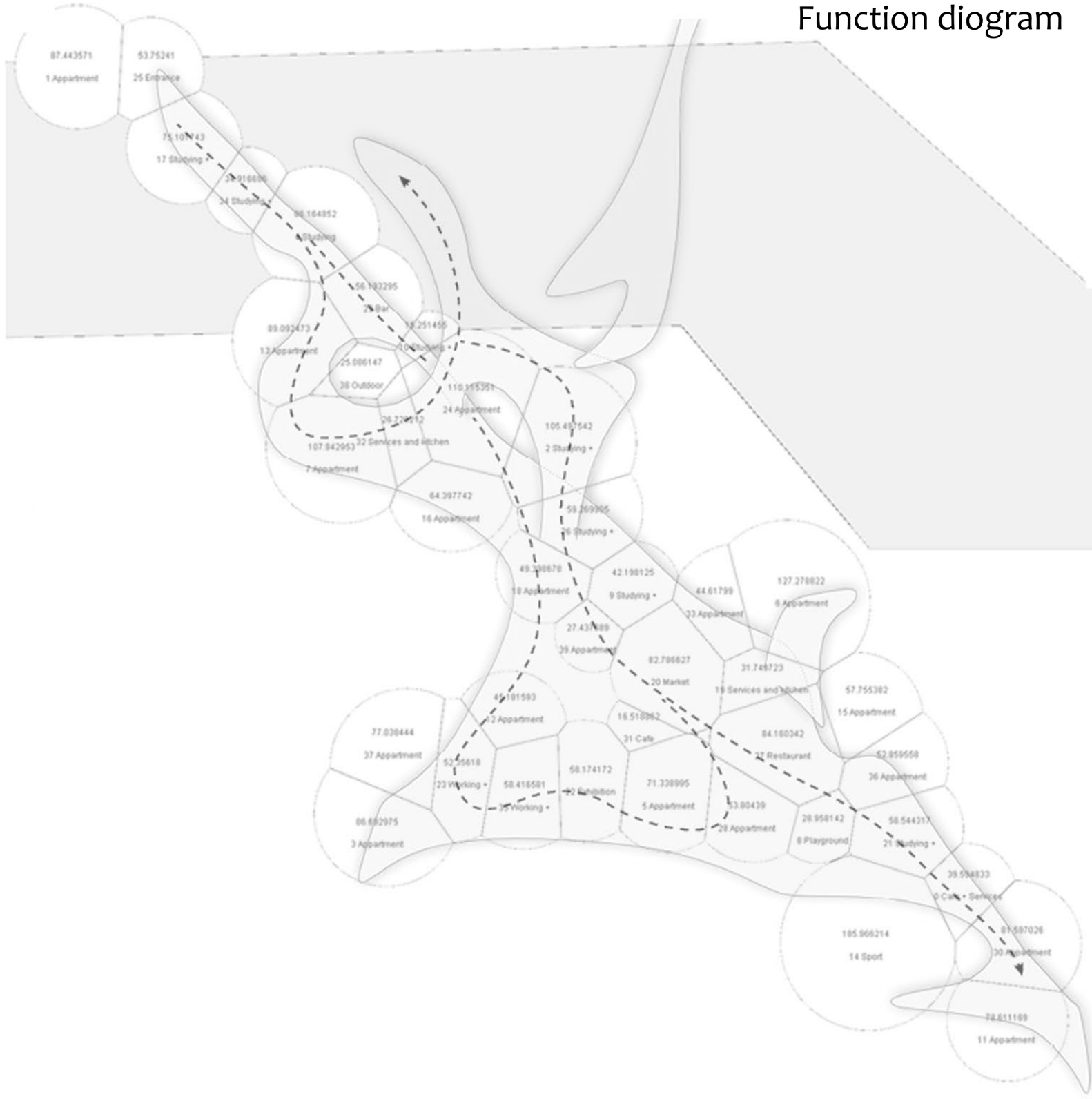
Connections between spaces

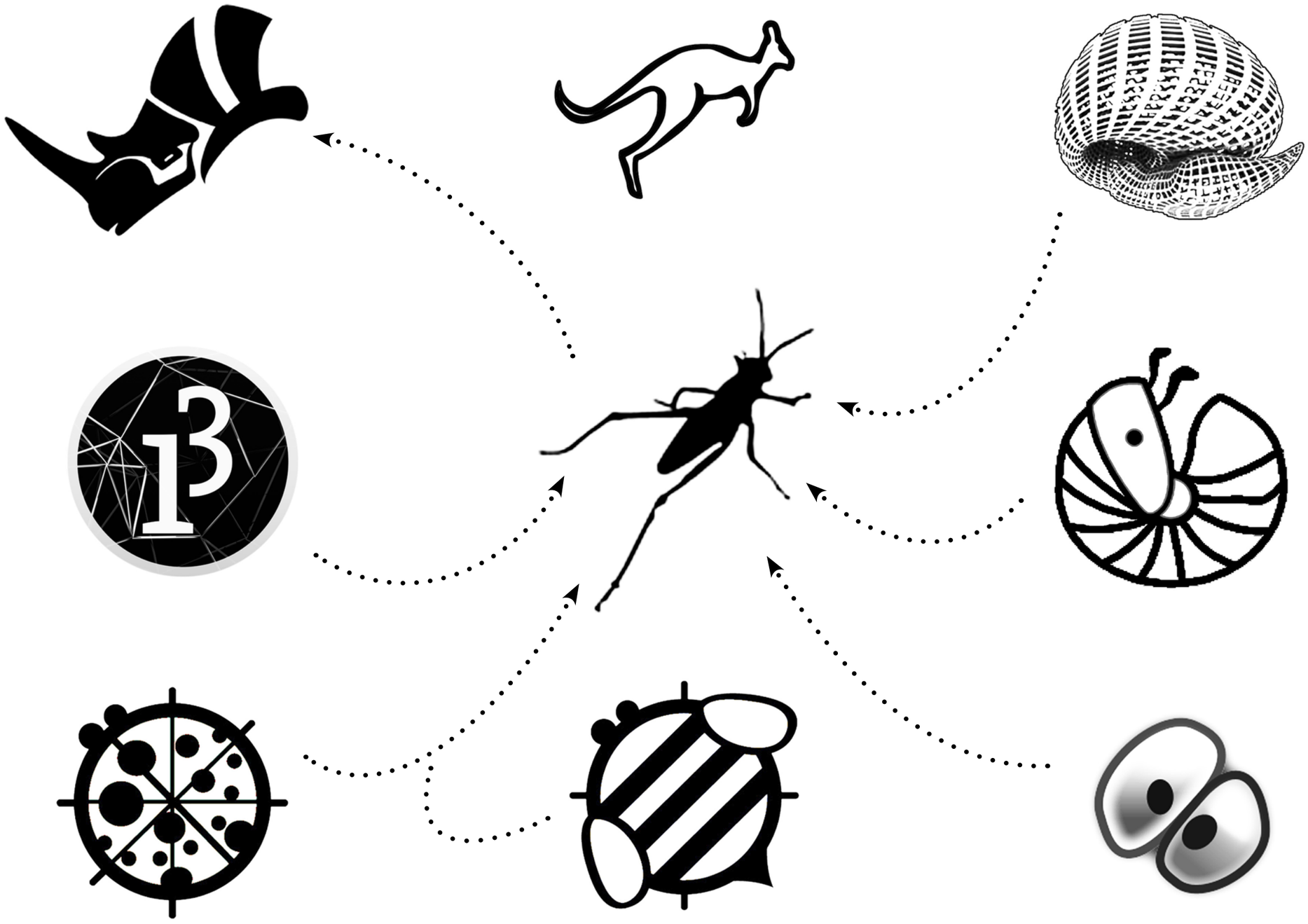




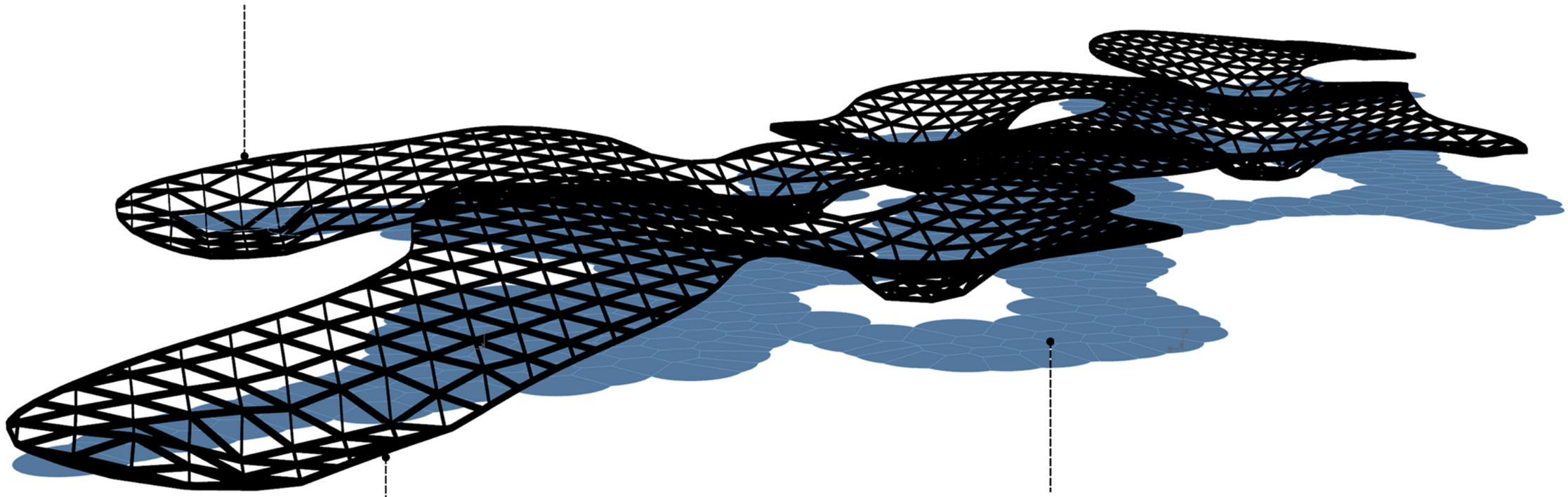
Programme
3+4

Function diogram



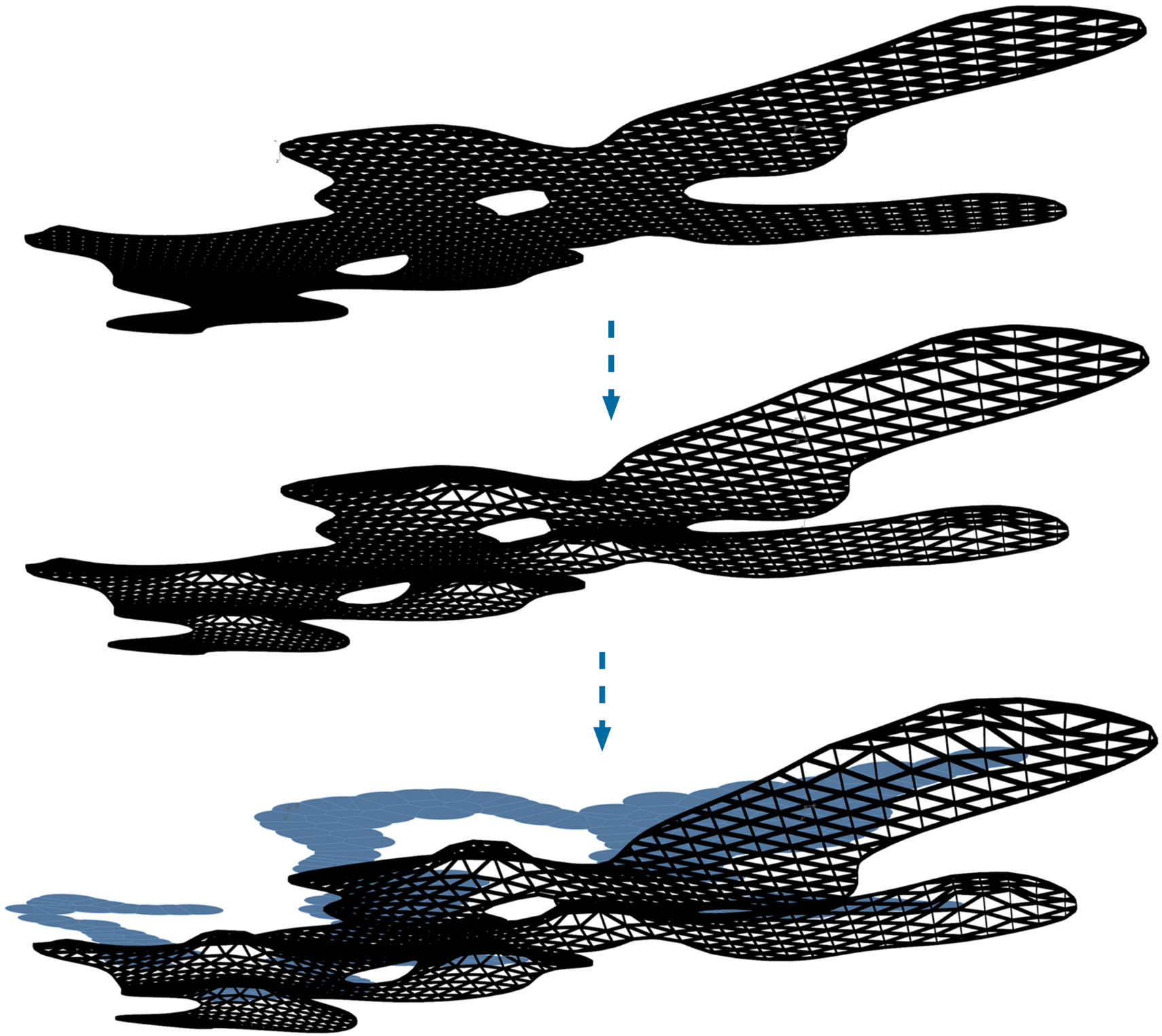


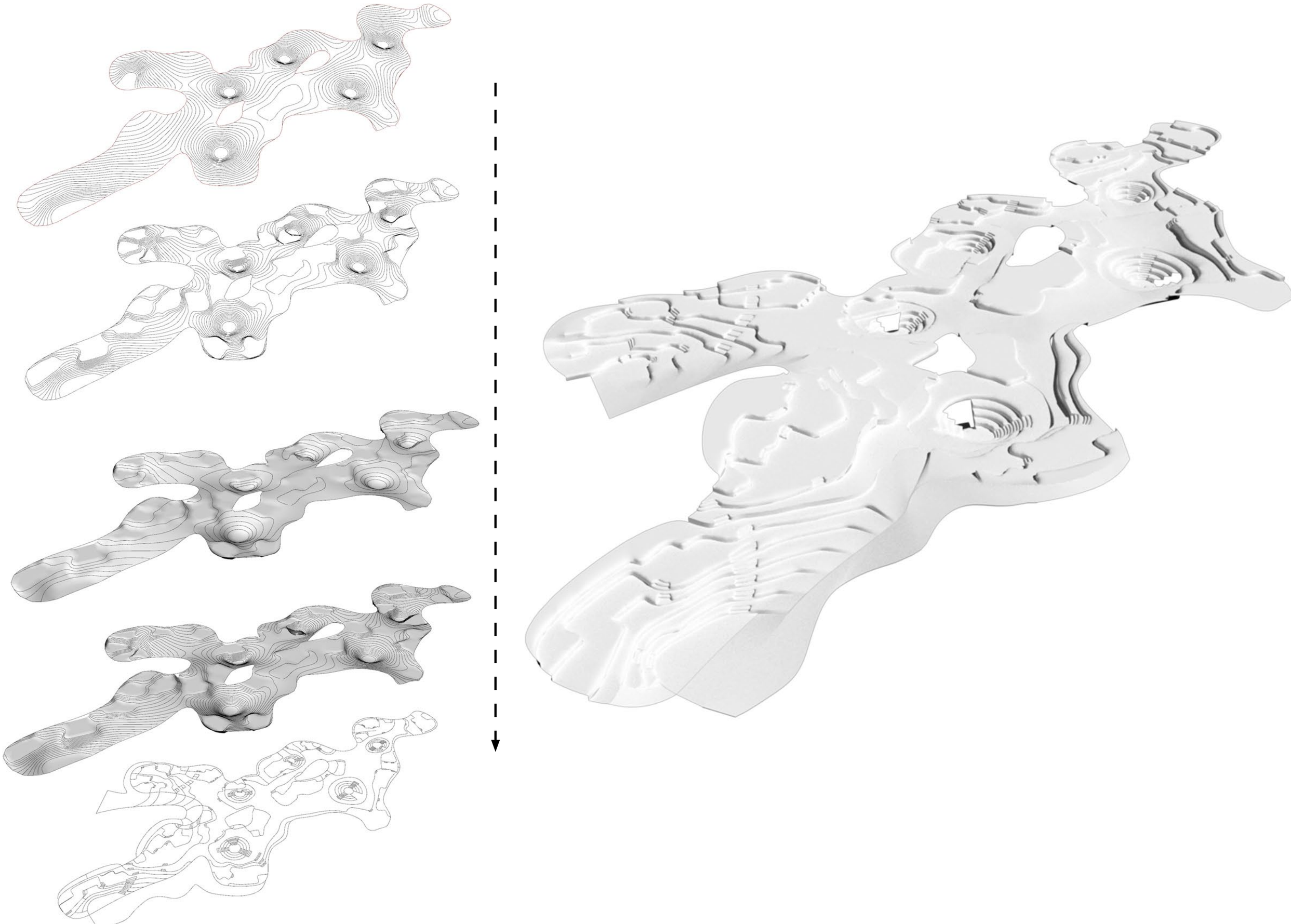
Structural grid is elevated under
the gravity force applyed in
opposite direction
(MAX displacement = 5.5m)



At the supports structure
is fixed to the ground.
Desired shape is achieved

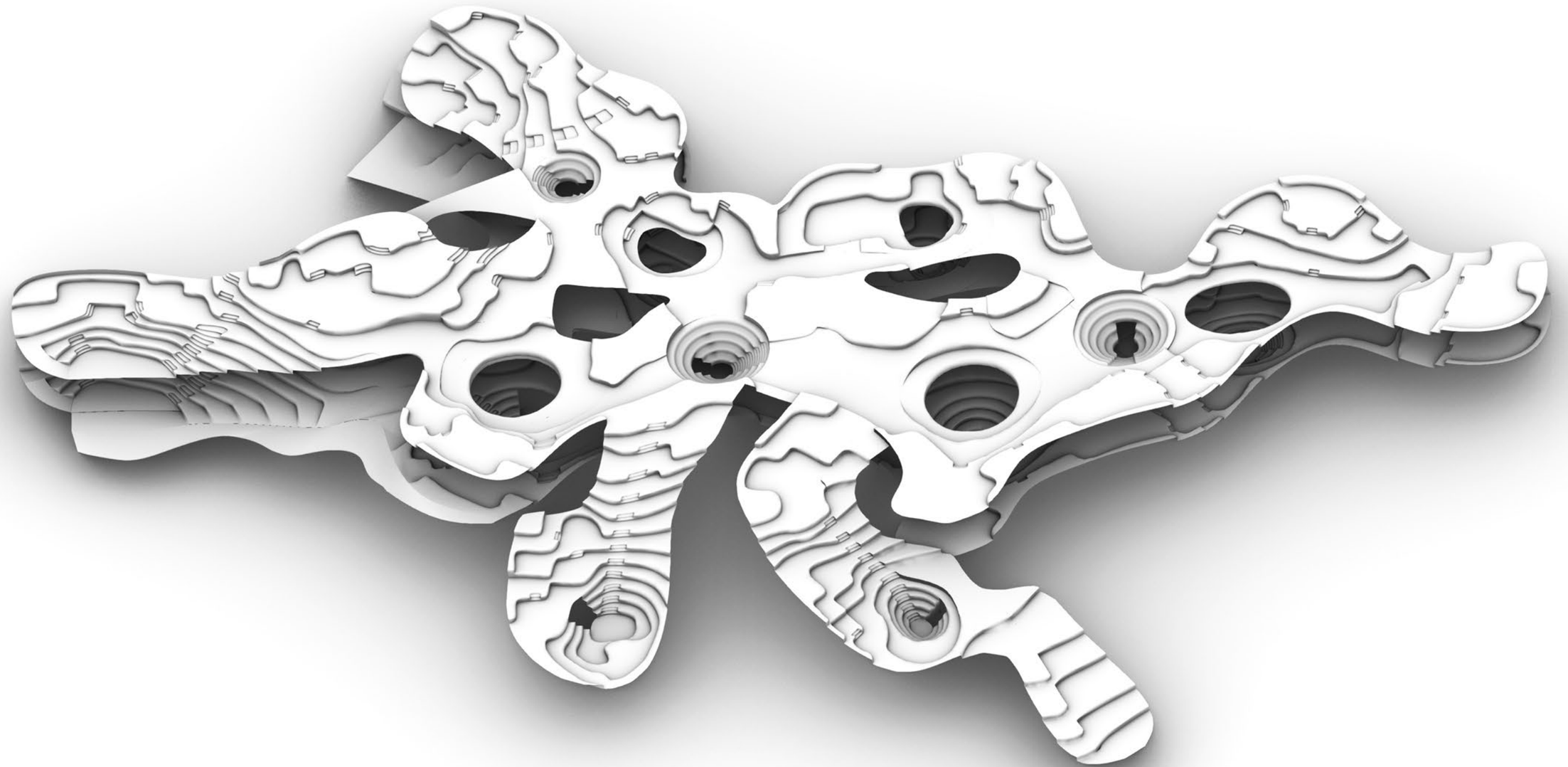
Distance from structure
to the ground over 3m



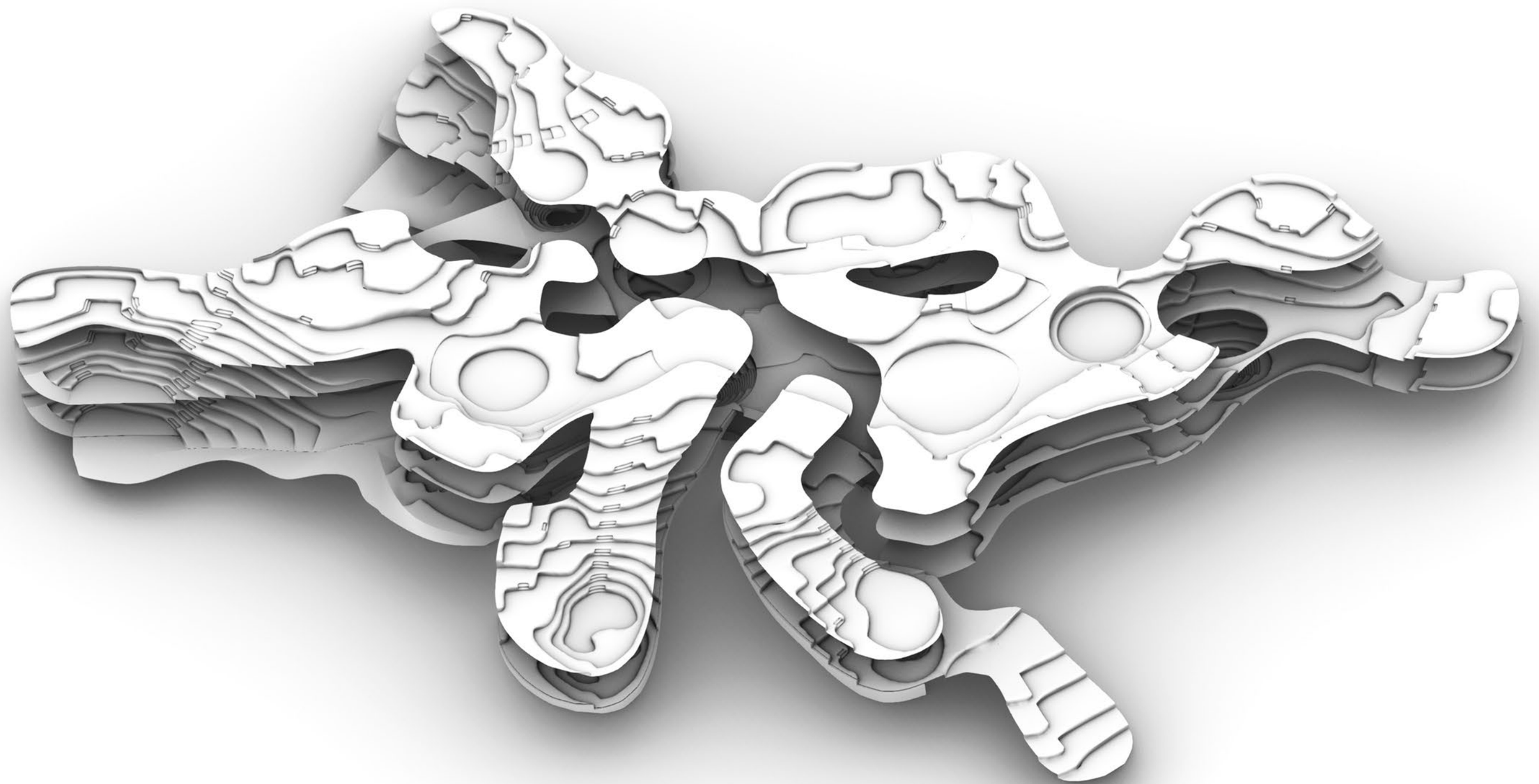


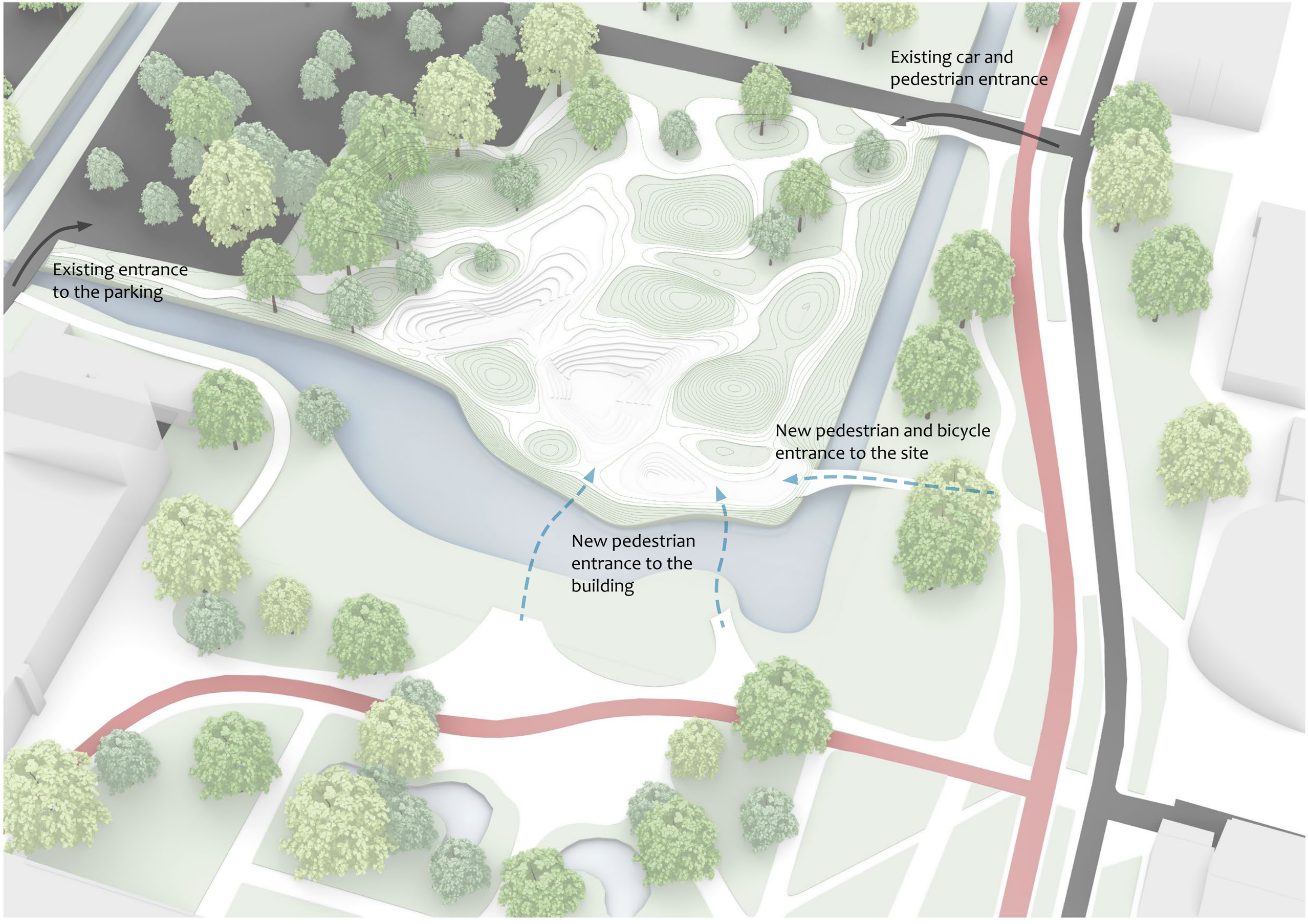
Ground floor

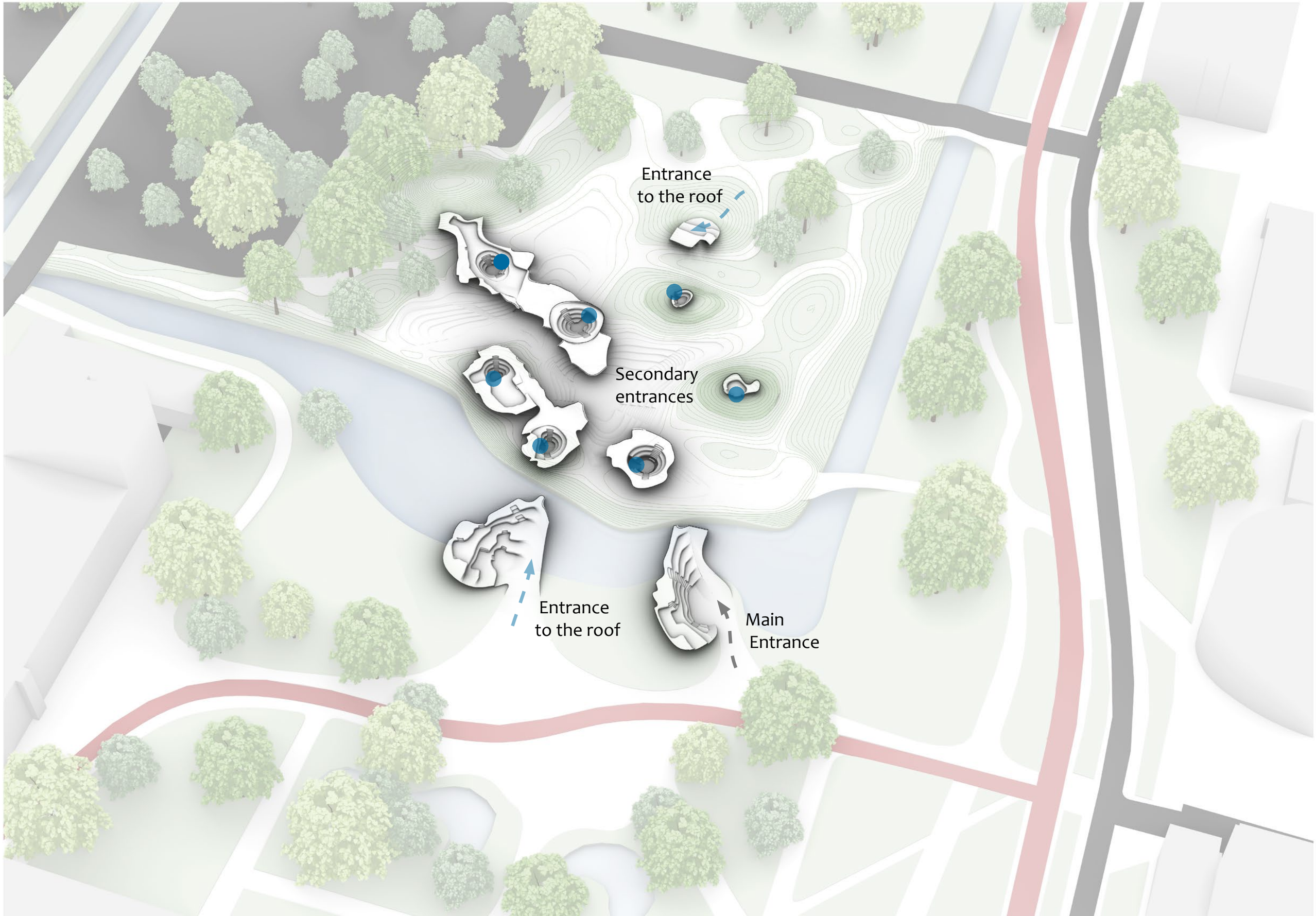
First floor



Roof




Existing car and
pedestrian entrance
Existing entrance
to the parking
New pedestrian and bicycle
entrance to the site
New pedestrian
entrance to the
building


Entrance
to the roof
Secondary
entrances
Entrance
to the roof
Main
Entrance

Sun-Path Diagram - Latitude: 52.3
Hourly Data: Dry Bulb Temperature (C)
AMSTERDAM

C
20.20<=
18.47
16.74
15.01
13.28
11.55
9.82
8.09
6.36
4.63
<=2.90

Directing sunlight
undernith the building

120
150
210
240
W
300
330
N
30
60

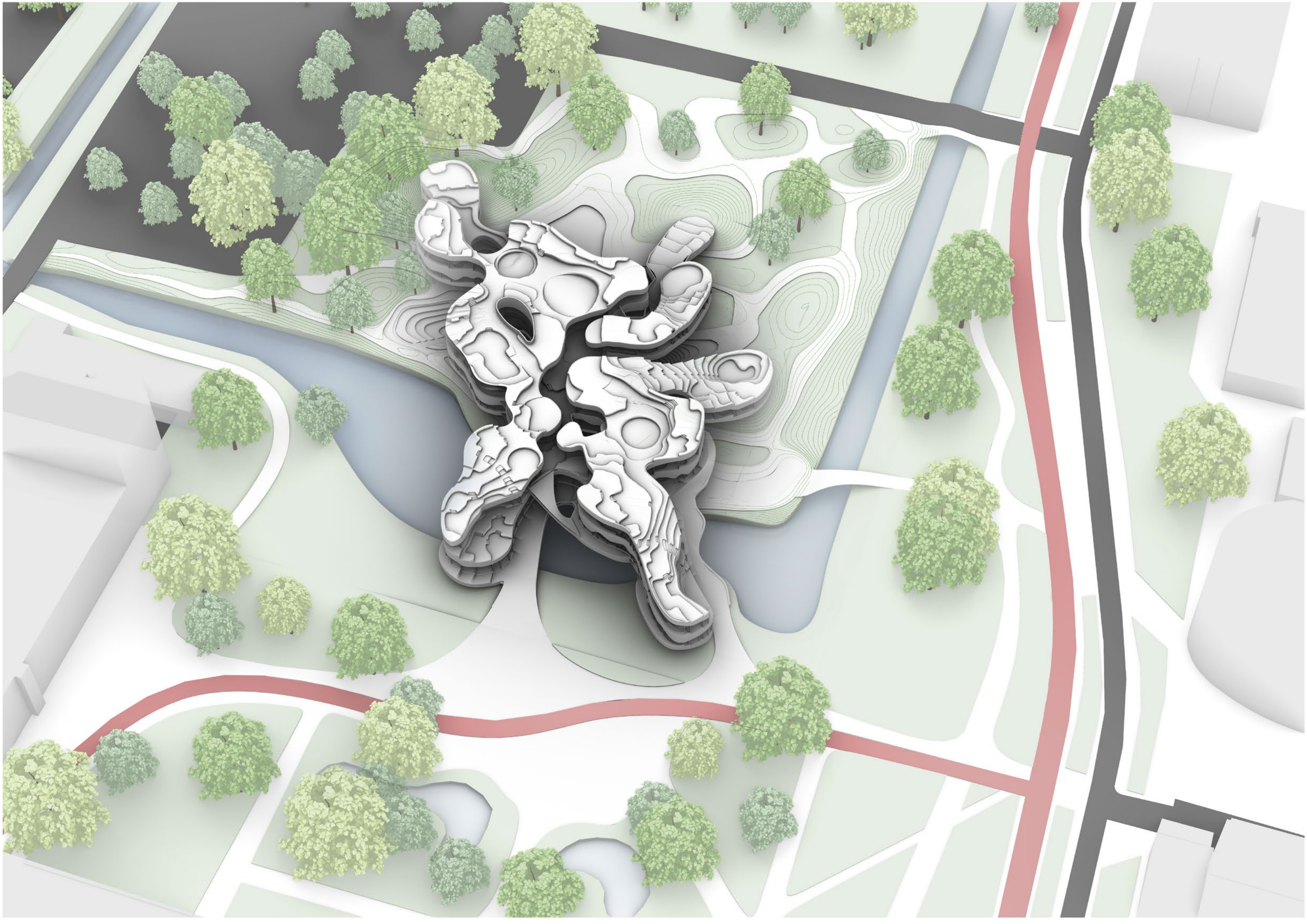
Sun-Path Diagram - Latitude: 52.3
Hourly Data: Dry Bulb Temperature (C)
AMSTERDAM

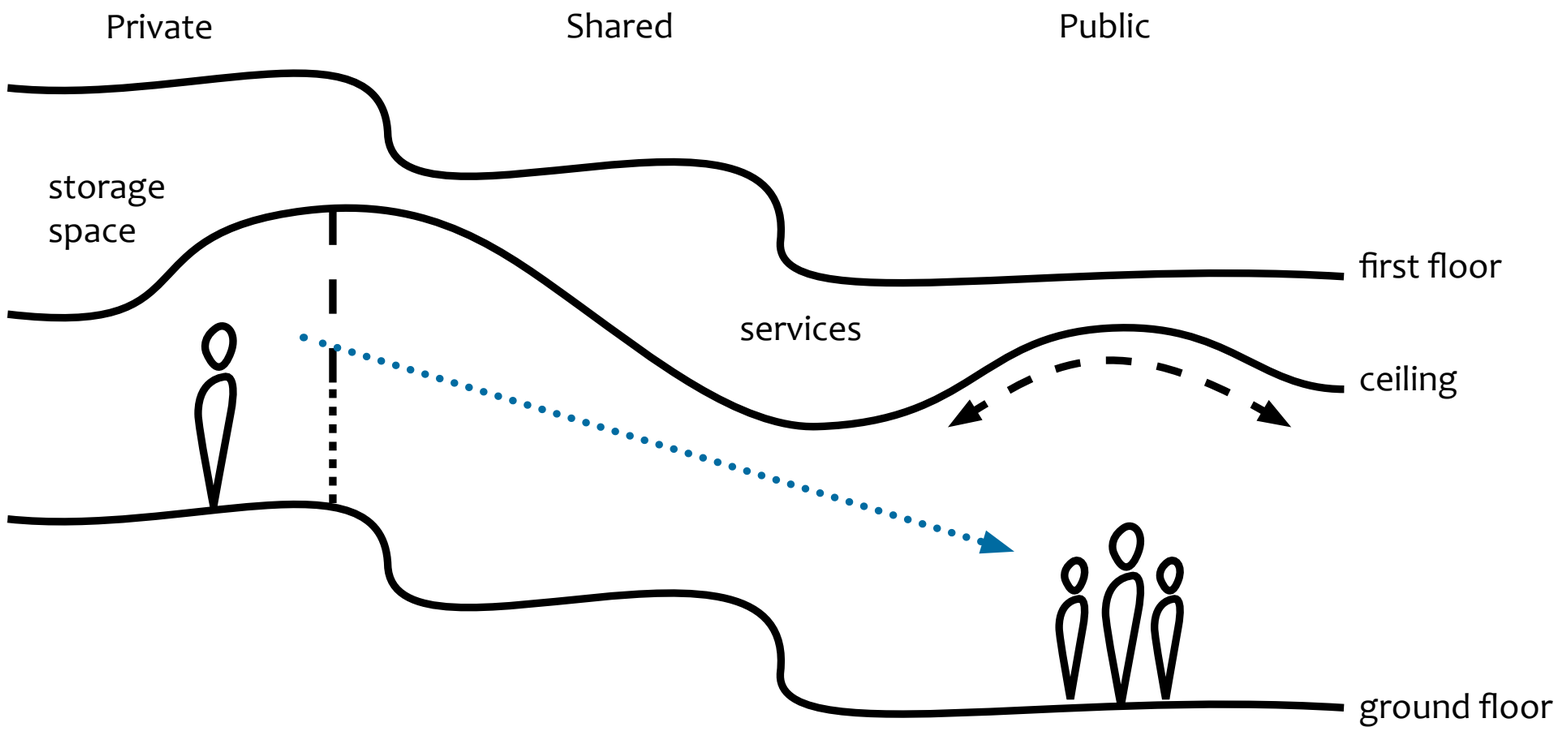
C
20.20<=
18.47
16.74
15.01
13.28
11.55
9.82
8.09
6.36
4.63
<=2.90

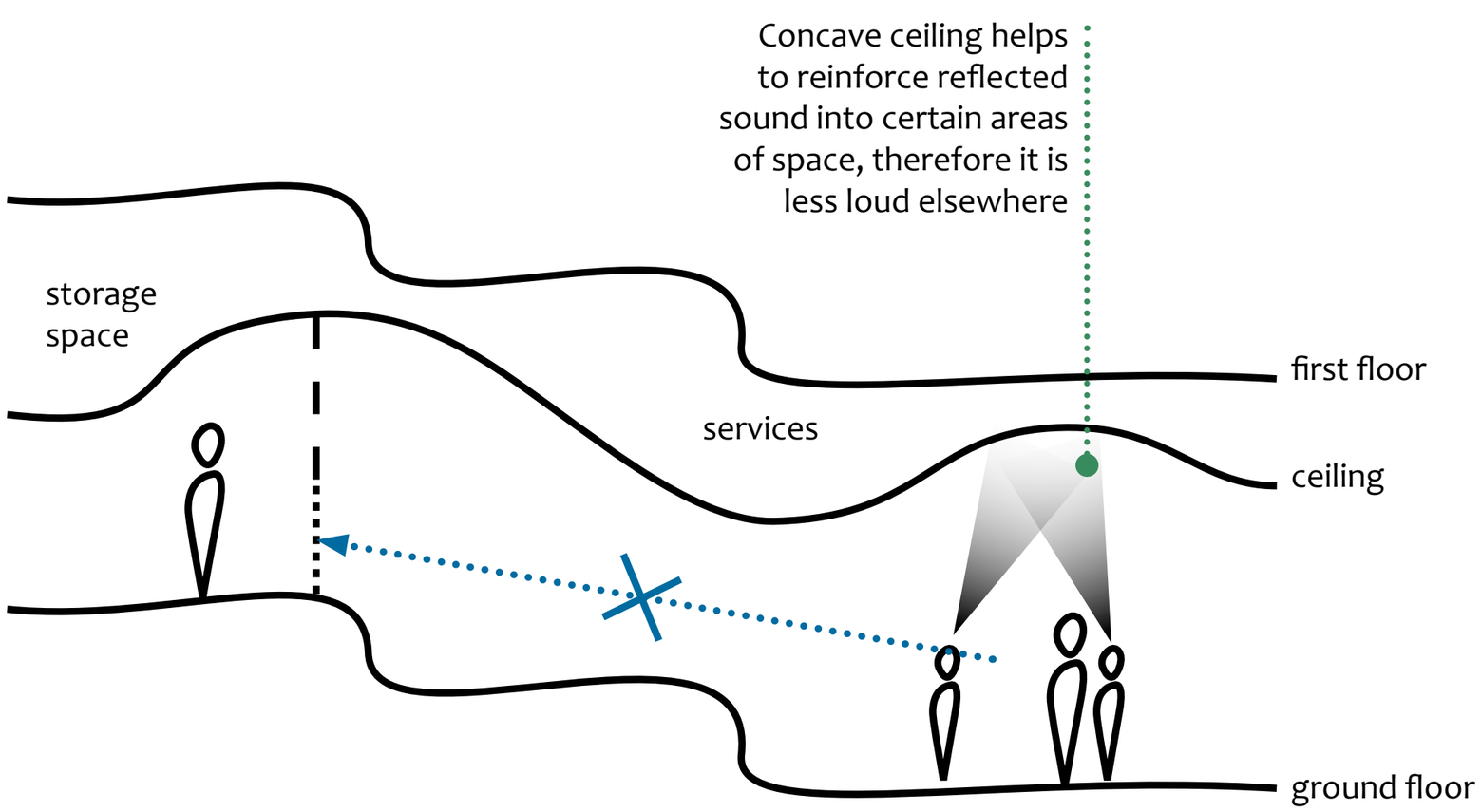
3. Second Optimization

2. First Optimization

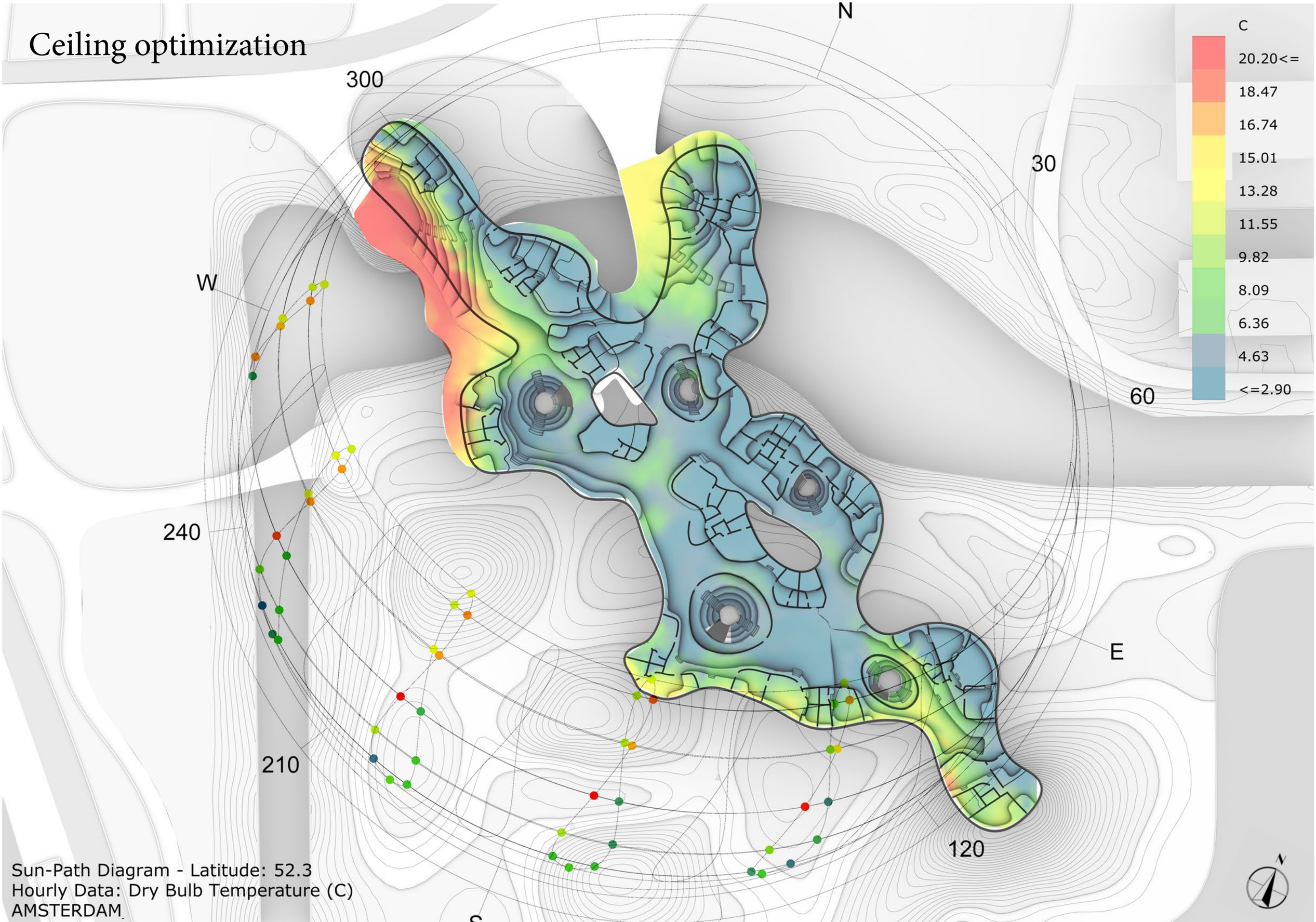
1. Flat ground



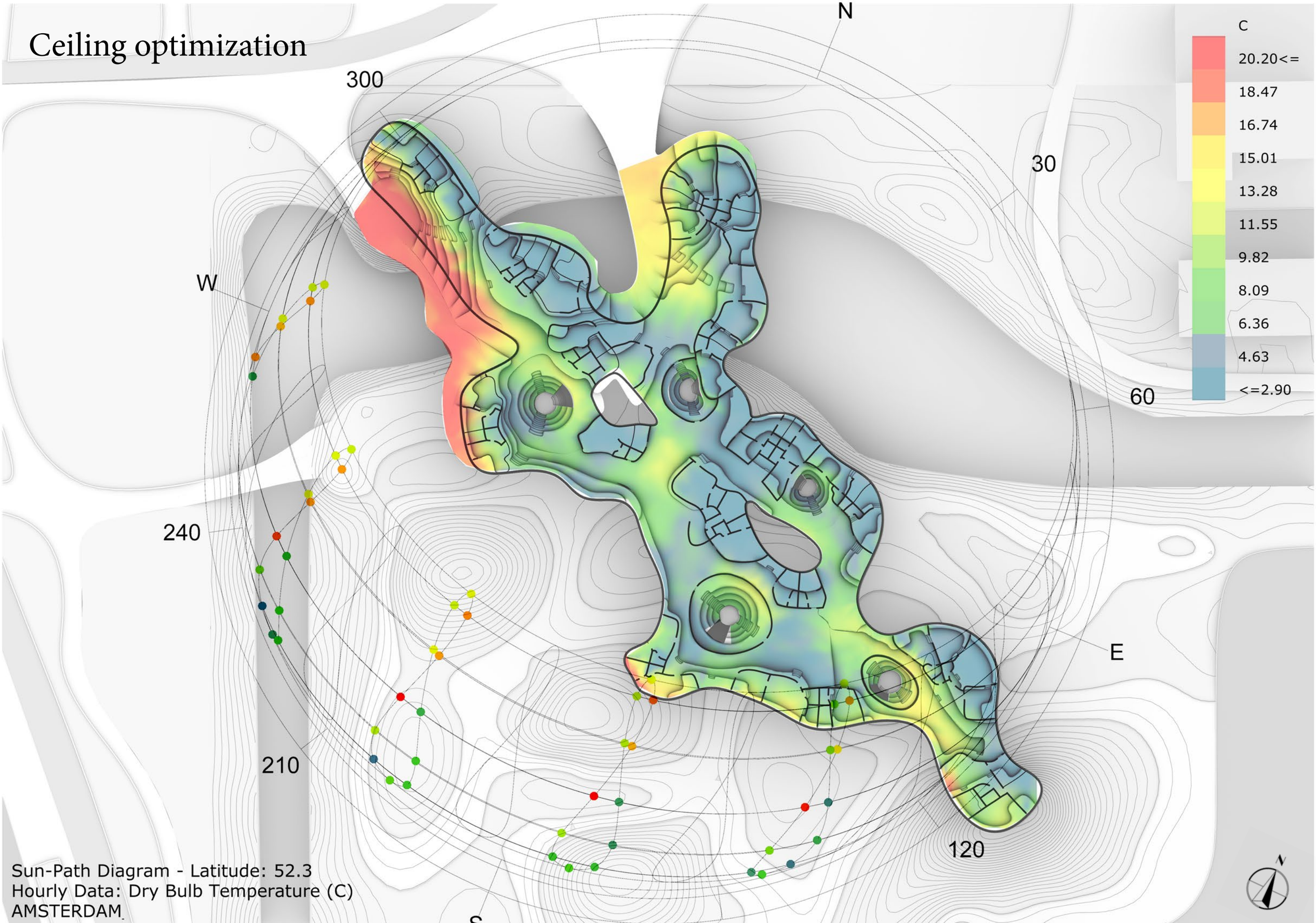

Private
Shared
Public
storage space
services
first floor
ceiling
ground floor


Concave ceiling helps to reinforce reflected sound into certain areas of space, therefore it is less loud elsewhere
storage space
services
first floor
ceiling
ground floor

Ceiling optimization

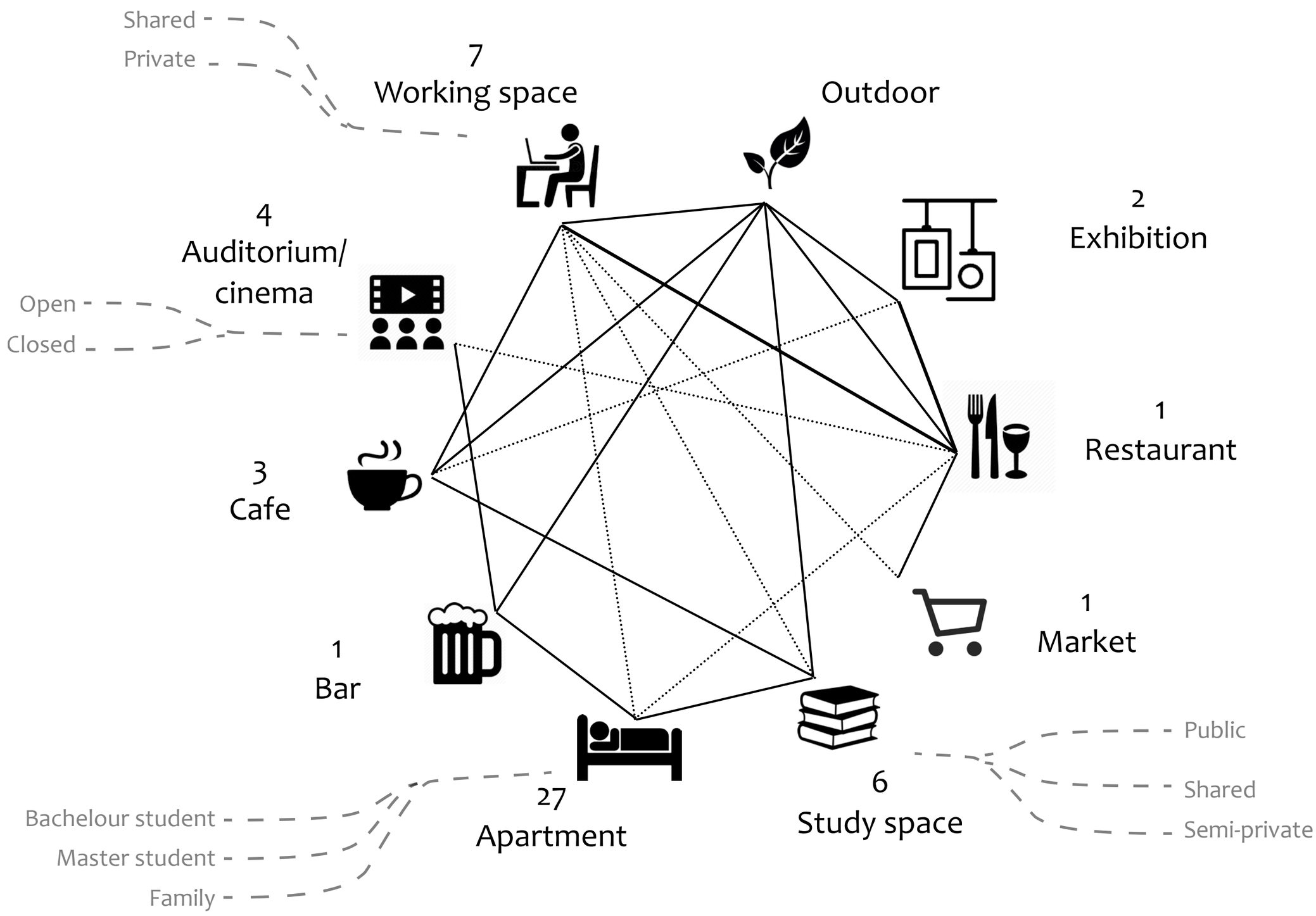


Ceiling optimization



Ground floor

Area - 3 534 m2



1 5 10 20 50

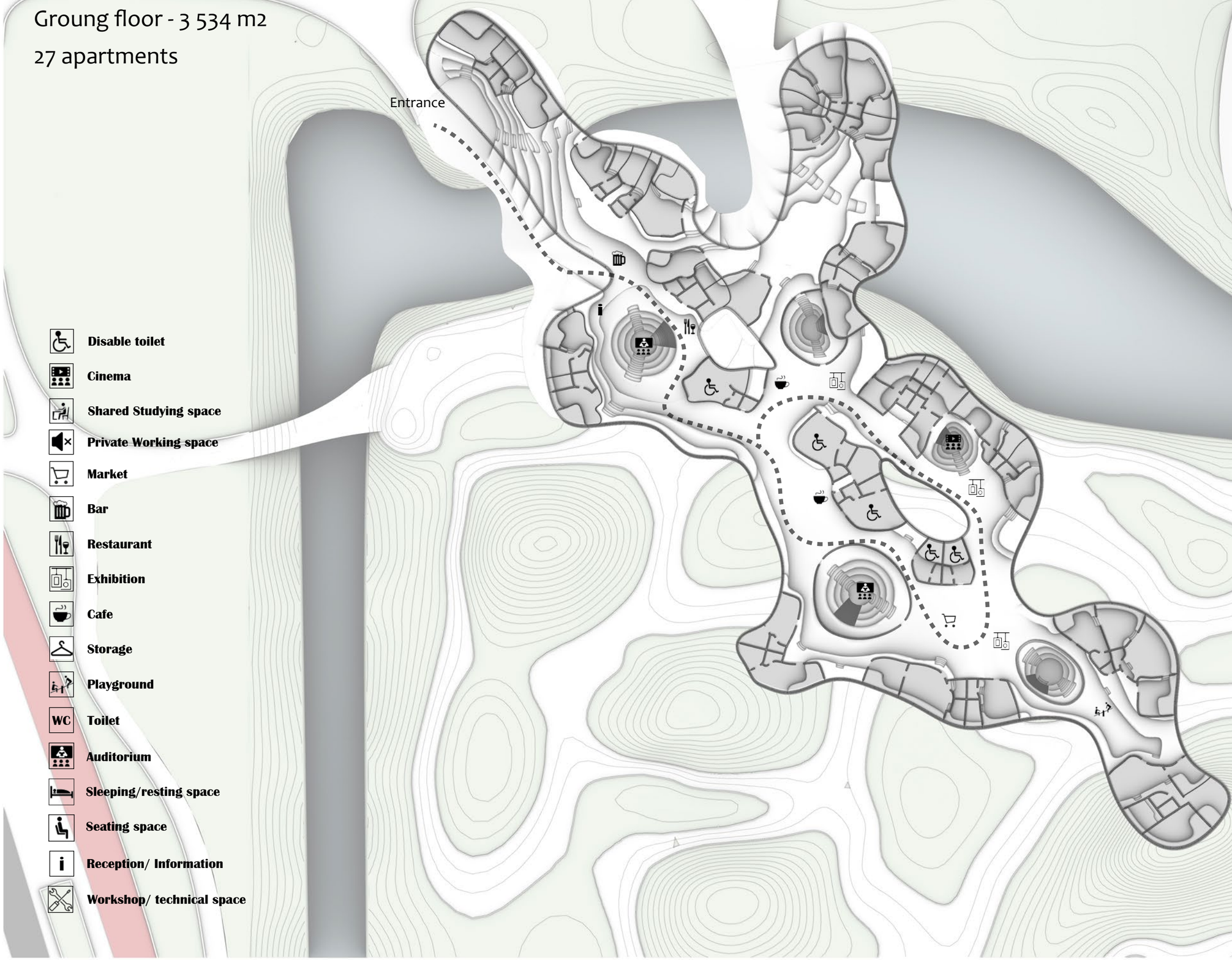
Ground Floor Plan 1:500

Gross area:

Groung floor - 3 534 m2

27 apartments

Entrance



- Disable toilet
- Cinema
- Shared Studying space
- Private Working space
- Market
- Bar
- Restaurant
- Exhibition
- Cafe
- Storage
- Playground
- WC Toilet
- Auditorium
- Sleeping/resting space
- Seating space
- Reception/ Information
- Workshop/ technical space

Name	No	Area/ m²
A Bedroom	30	216.9
B Flexible space	38	816.5
C Kitchen	30	305.5
F Storage	1	7.9
D Toilet	40	153.5
E Terrace	4	64.6
1 Cafe	1	115.7
2 Restaurant	1	70.1
3 Bar	1	21.0
4 Market	1	214.3
5 Exhibition	2	123.7
6 Playground	1	117.7
7 Technical room	1	9.7
8 Studying	3	872.5
9 Outdoor		
10 Working	7	167.0
11 Workshop	1	33.5
12 Auditorium	5	321.1
13 Entrance	5	21.6
14 Main Entrance	1	39.5
Total	170	3 533.5

N

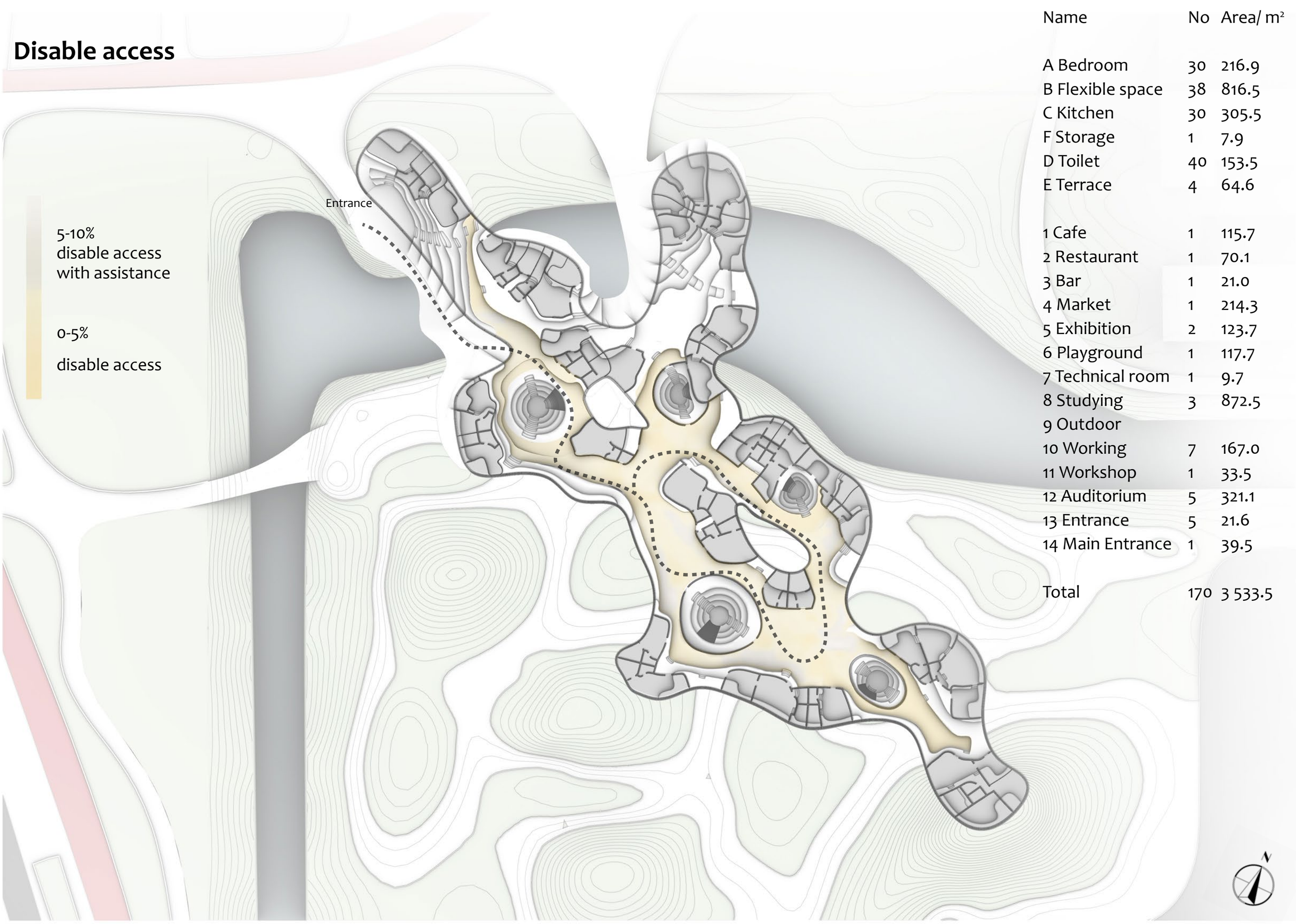
Disable access

5-10%
disable access
with assistance

0-5%

disable access

Entrance

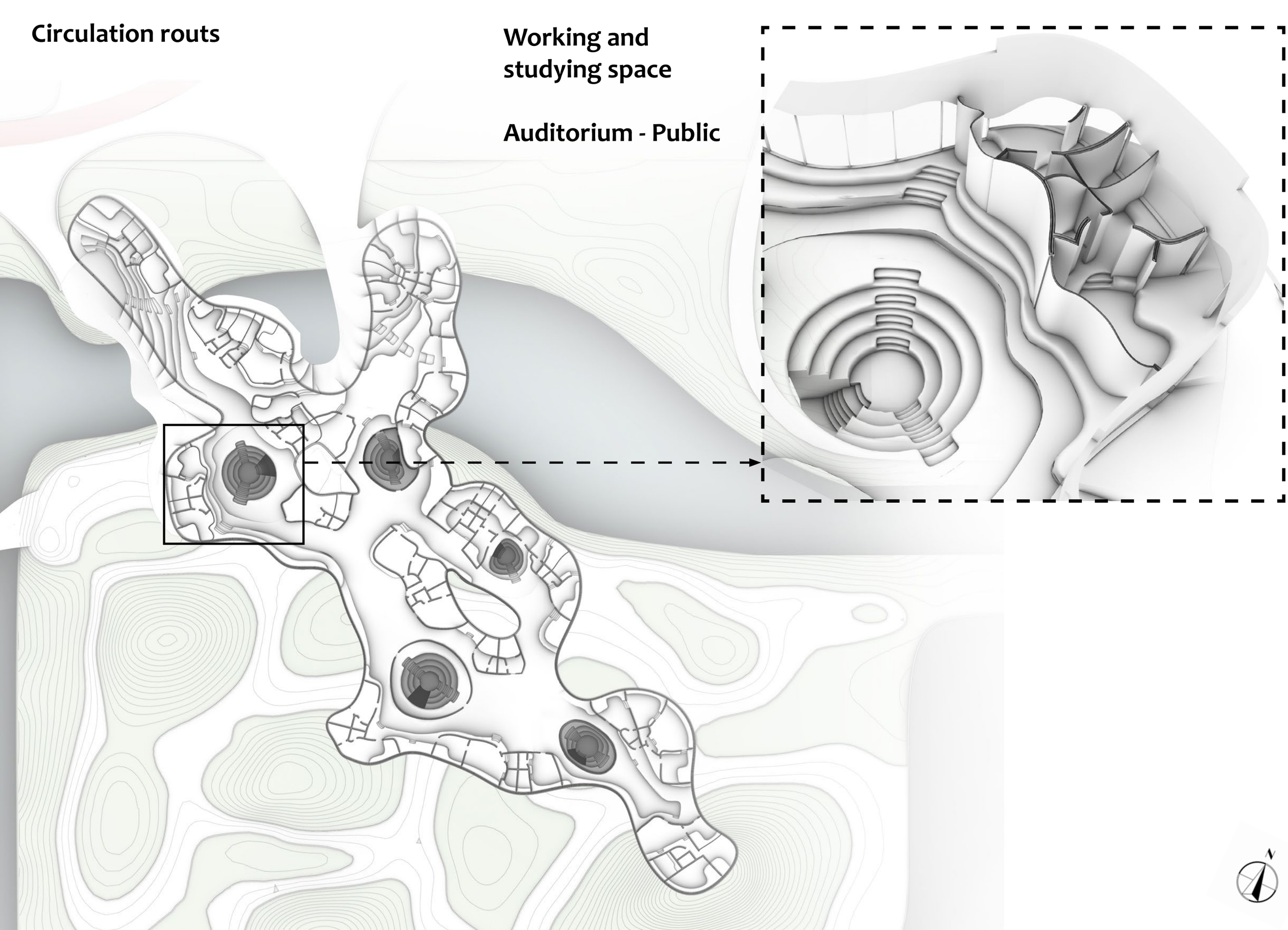


Name	No	Area/ m²
A Bedroom	30	216.9
B Flexible space	38	816.5
C Kitchen	30	305.5
F Storage	1	7.9
D Toilet	40	153.5
E Terrace	4	64.6
1 Cafe	1	115.7
2 Restaurant	1	70.1
3 Bar	1	21.0
4 Market	1	214.3
5 Exhibition	2	123.7
6 Playground	1	117.7
7 Technical room	1	9.7
8 Studying	3	872.5
9 Outdoor		
10 Working	7	167.0
11 Workshop	1	33.5
12 Auditorium	5	321.1
13 Entrance	5	21.6
14 Main Entrance	1	39.5
Total	170	3 533.5

Circulation routs

Working and studying space

Auditorium - Public



Circulation routs

Entrance

Working and studying space

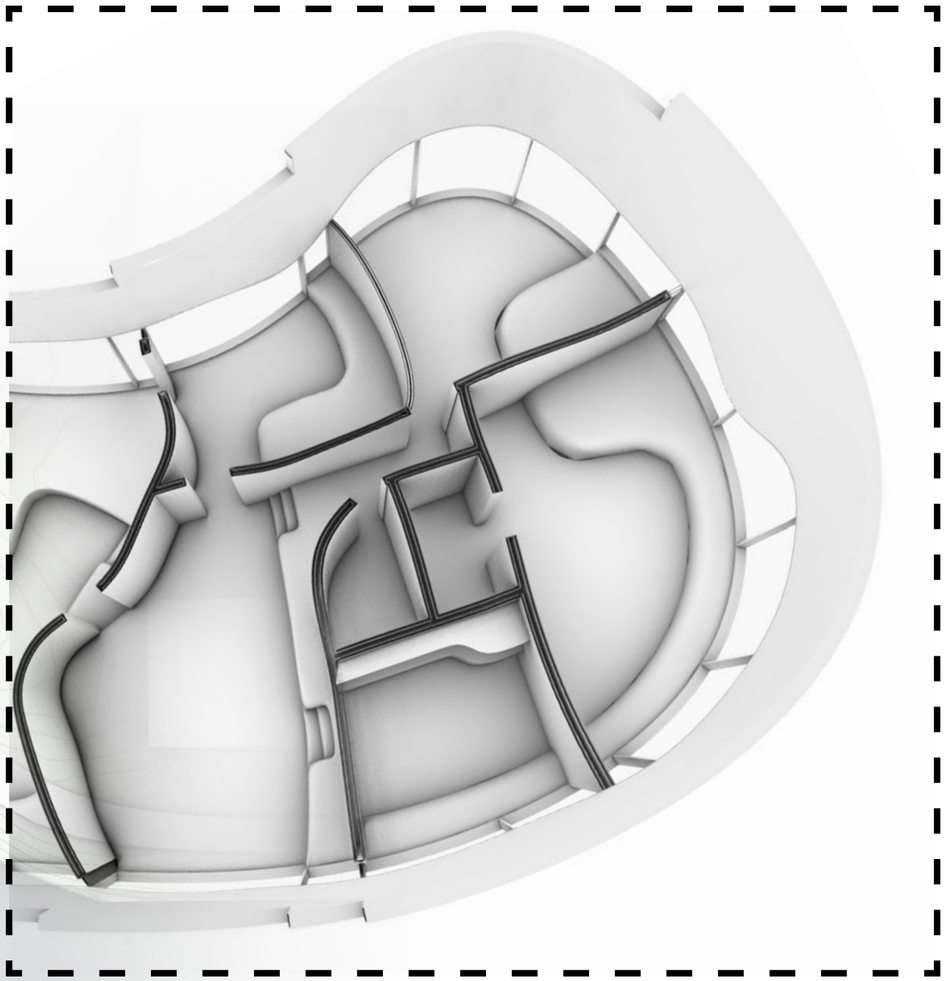
Shared

Public

Shared

Semi-Private

Apartment type 1



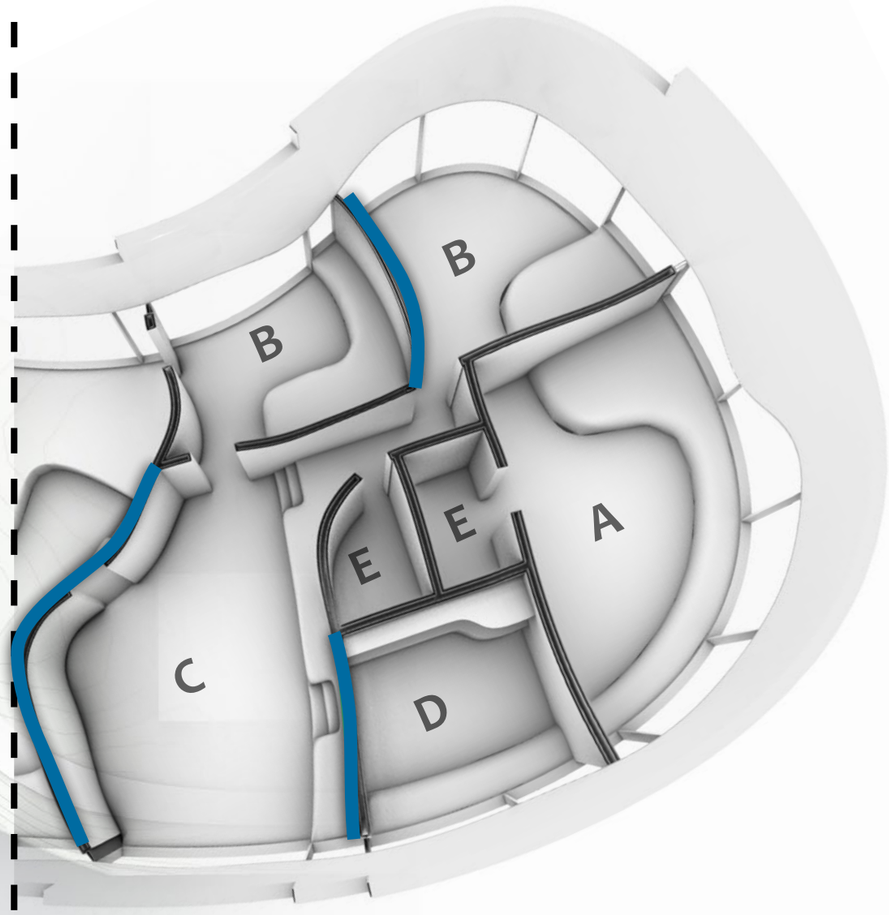
Apartment type 1

A Master Bedroom
B Bedroom
C Kitchen
F Storage
D Toilet

Public

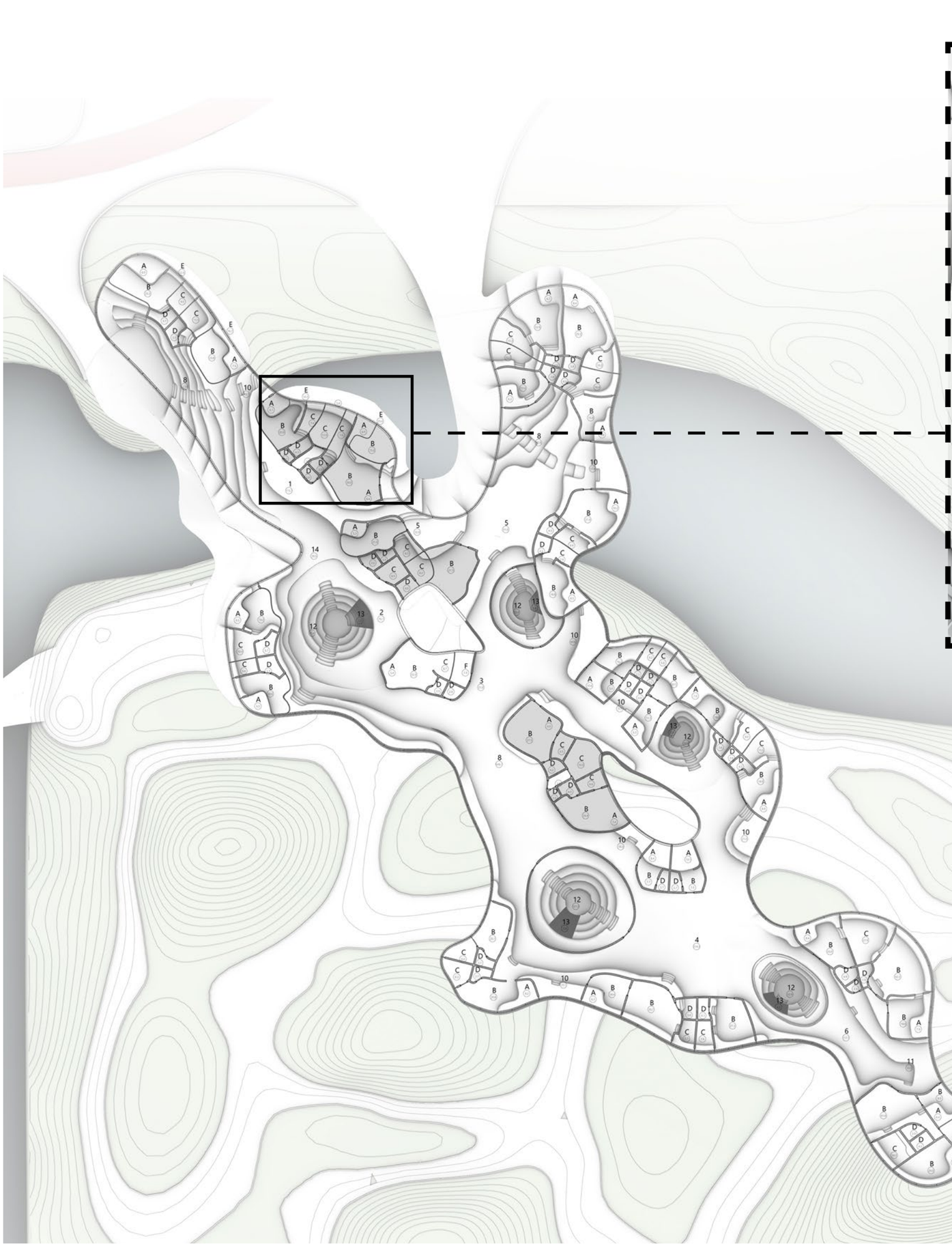
4 Market
5 Exhibition
6 Playground
8 Studying
9 Outdoor
10 Working
11 Workshop
12 Auditorium
13 Entrance

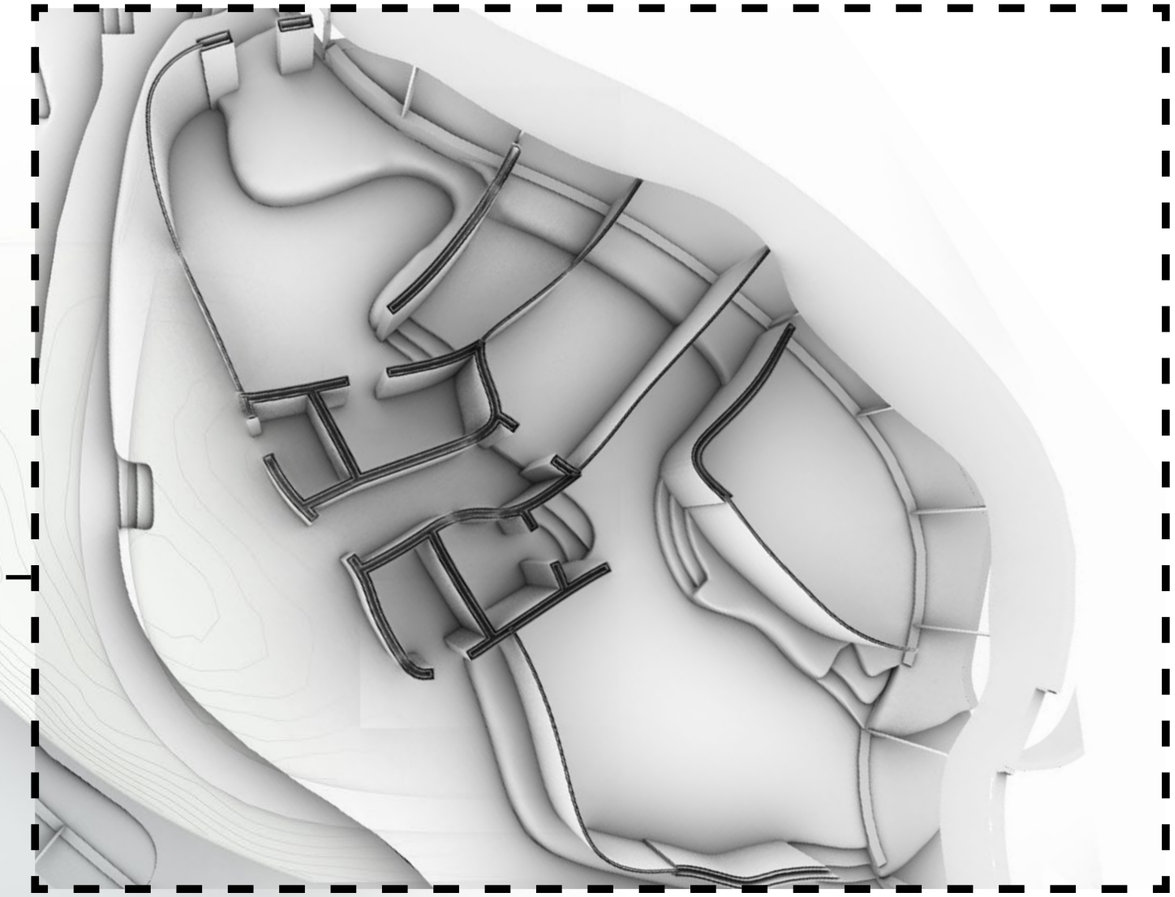
Apartment type 1 - 132m²



Apartment type 1

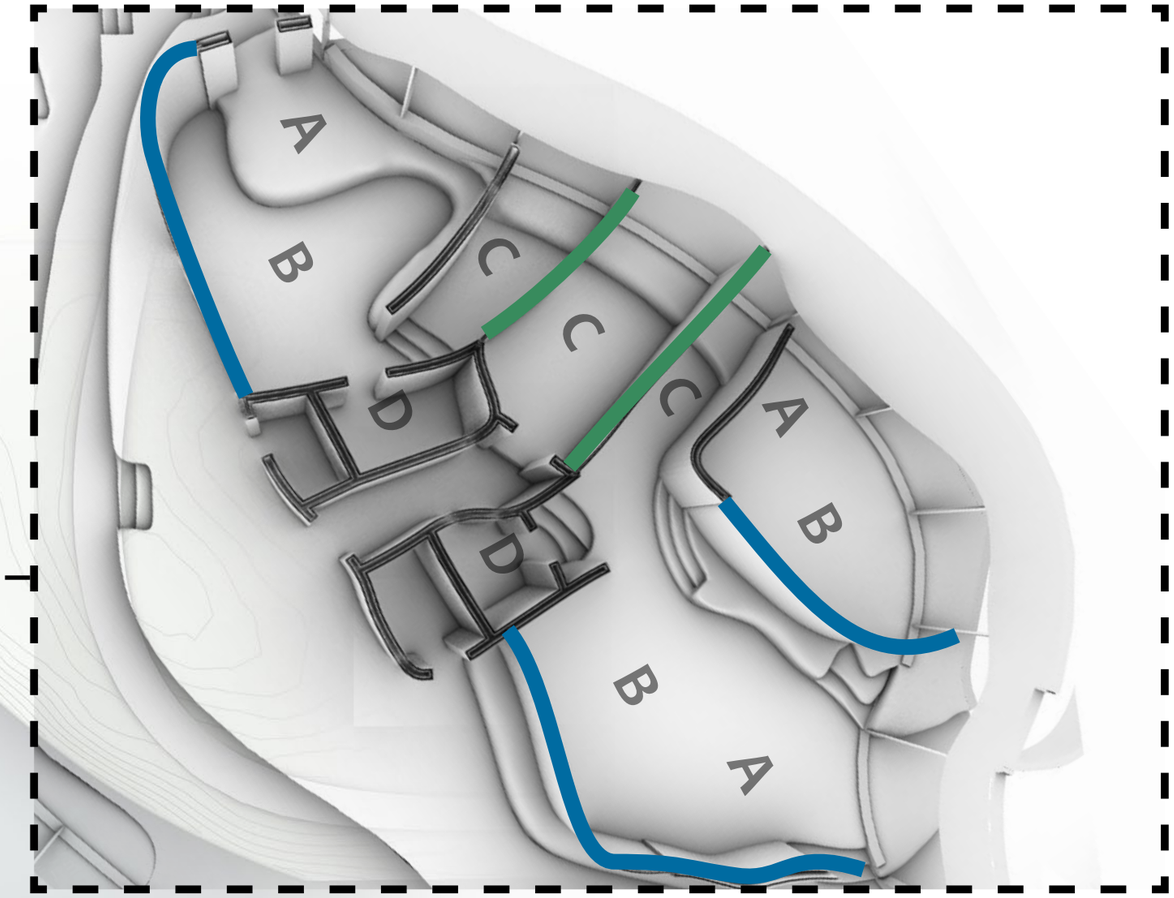
A Master bedroom	30 m²
B Bedroom	16,3 m²
	22,4 m²
C Flexible space	41 m²
D Kitchen	14 m²
E Toilet	8,2 m²





Apartment type 2

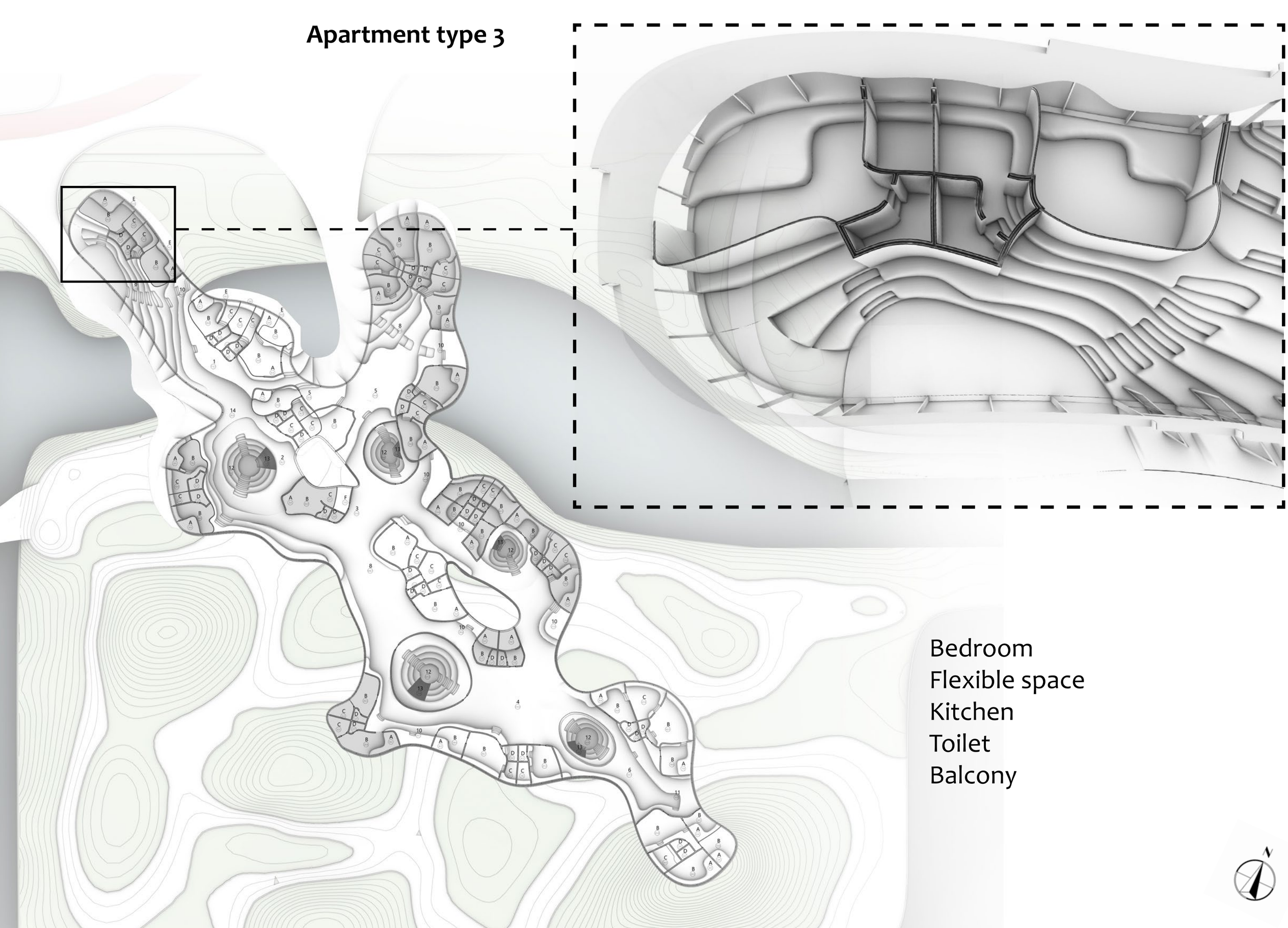
Bedroom
Flexible space
Kitchen +
shared kitchen
Toilet
Balcony



Apartment type 2.2 - 71m²

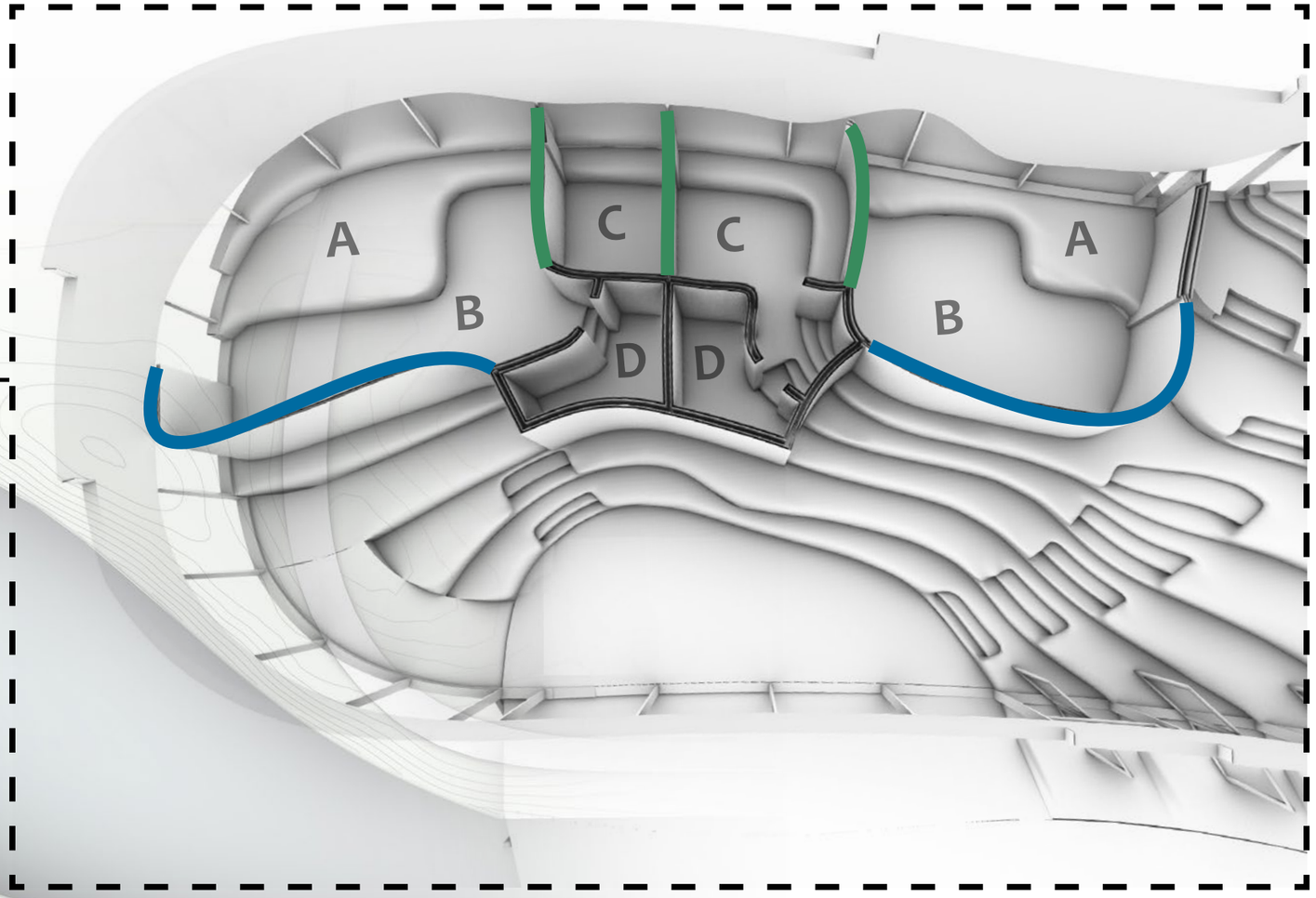
A Bedroom	6 m²
	6,4 m²
B Flexible space	30 m²
	15 m²
C Kitchen	7,5 m²
D Toilet	3,2 m²

Apartment type 3



Bedroom
Flexible space
Kitchen
Toilet
Balcony

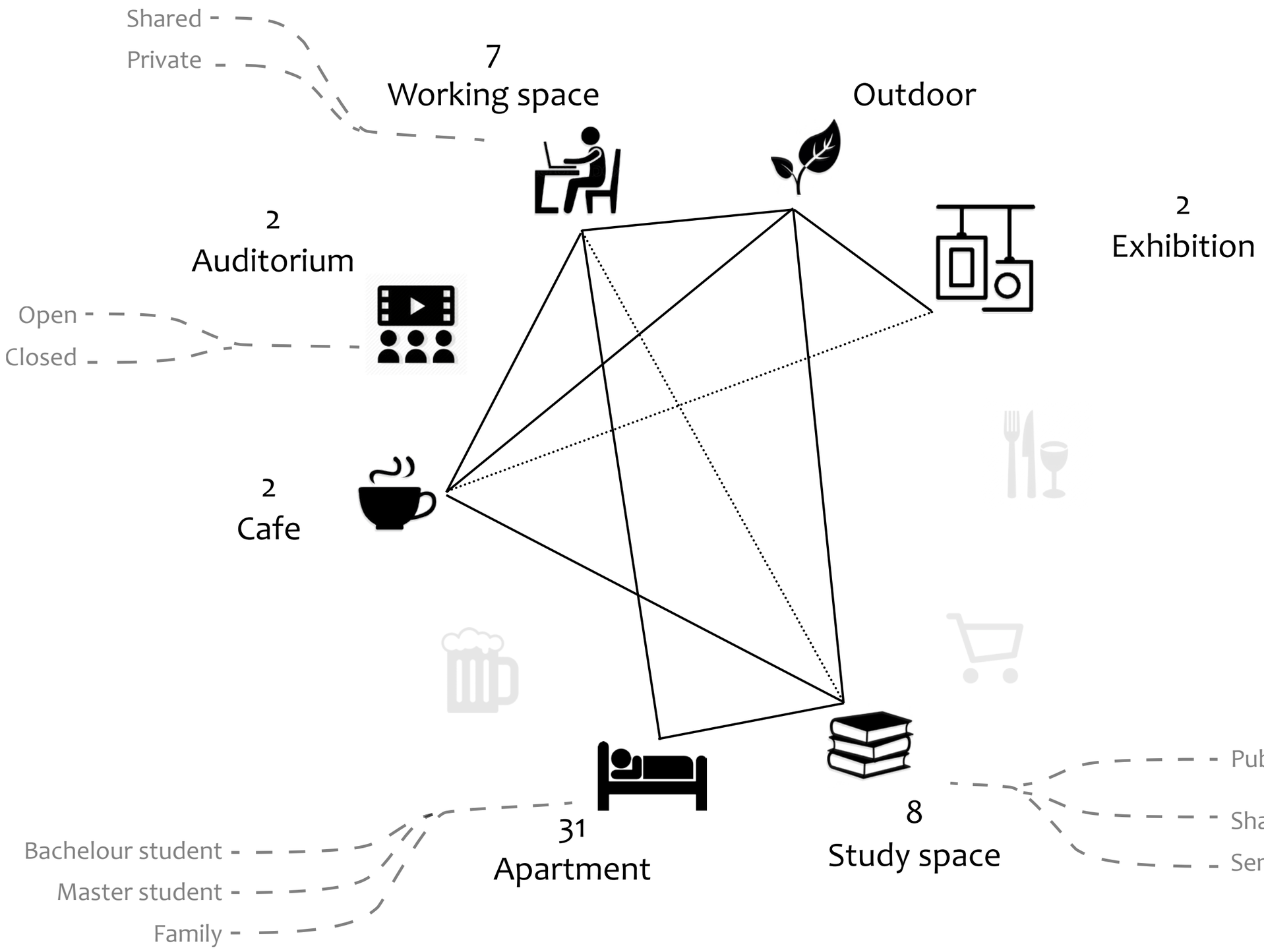
Apartment type 3



Bedroom
Flexible space
Kitchen
Toilet
Balcony

First floor

Area - 3486 m2



1 5 10 20 50

First Floor Plan 1:500

First floor - 3486 m2

31 apartment

Total area - 6912 m2

Entrance

Entrance

- **Shared Studying space**
- **Private Working space**
- **Exhibition**
- **Cafe**
- **Storage**
- **Playground**
- **WC** **Toilet**
- **Auditorium**
- **Sleeping/resting space**
- **Seating space**
- **Reception/ Information**

N

1 5 10 20 50

First Floor Plan 1:500

First floor - 3486 m2

31 apartment

Total area - 6912 m2

Name

A Bedroom
B Flexible space
C Kitchen
F Storage
D Toilet
E Terrace

1 Cafe
5 Exhibition
6 Playground
8 Studying
9 Outdoor
10 Working
12 Auditorium
13 Entrance
14 Main Entrance

1 5 10 20 50

Roof Plan 1:500

A

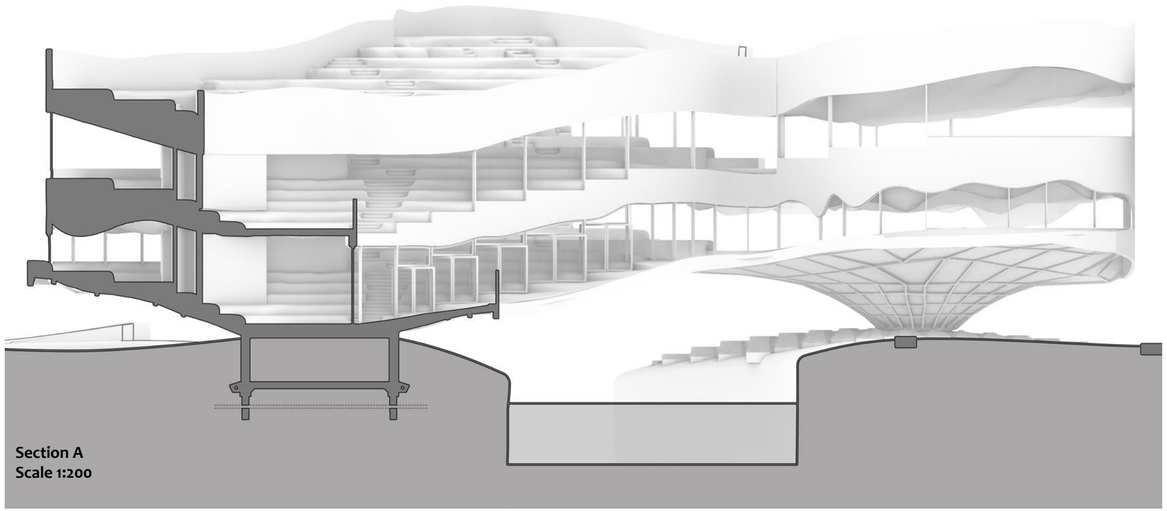
B

C

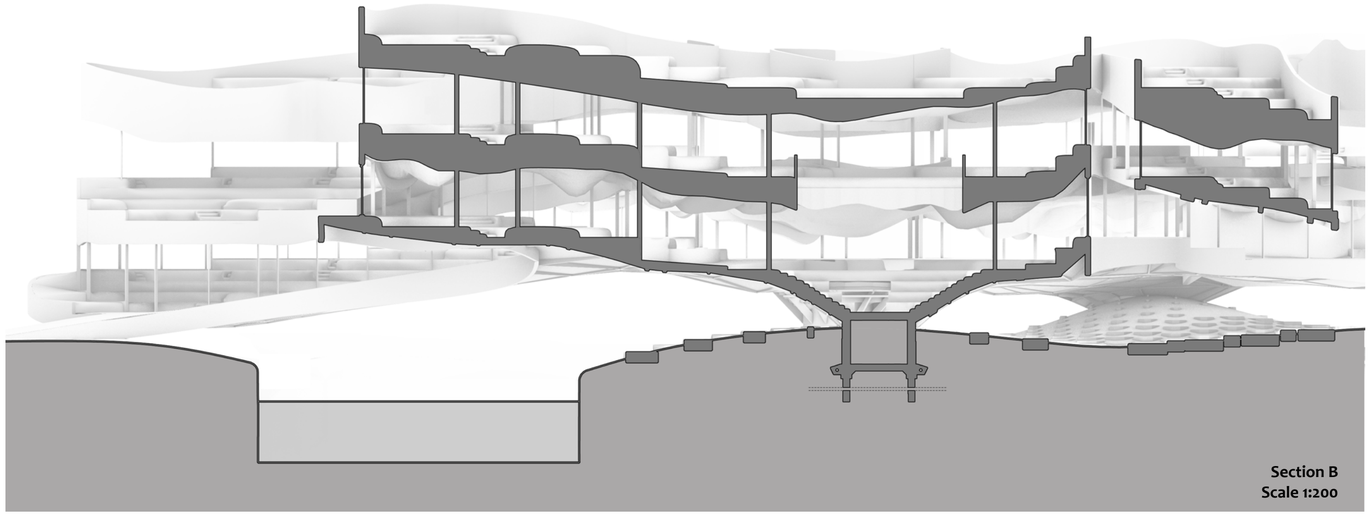
1

2

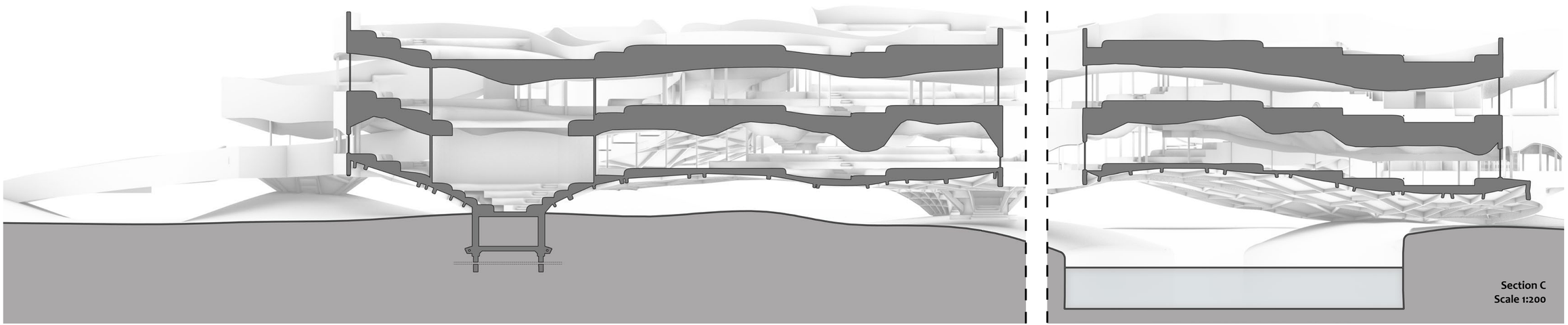
N



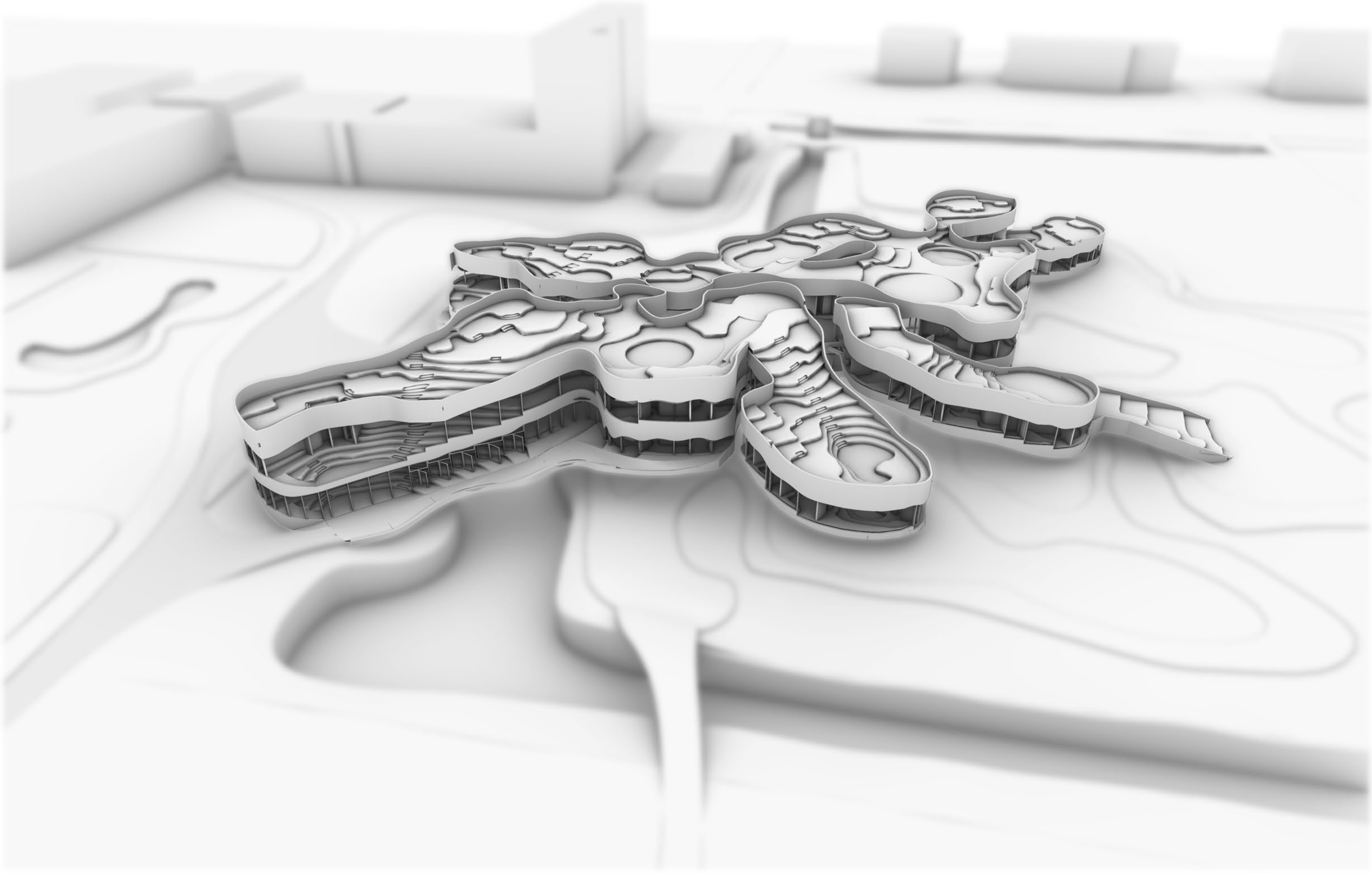
Section A
Scale 1:200

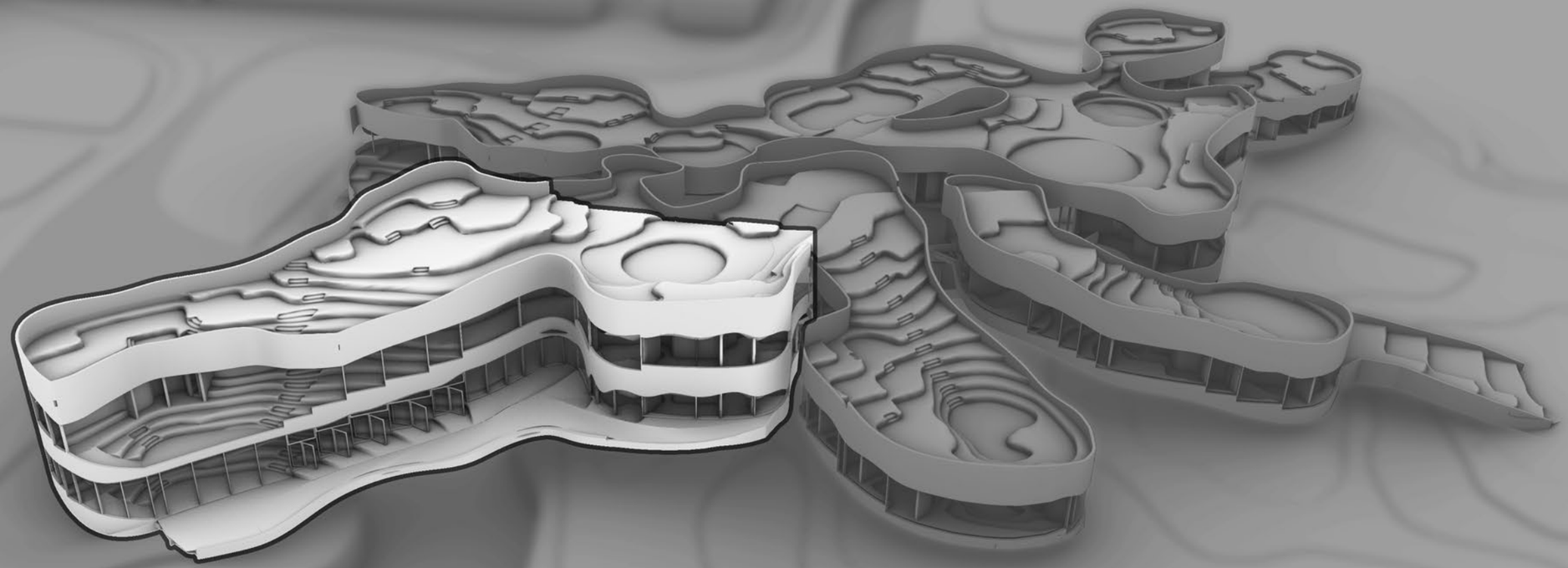


Section B
Scale 1:200

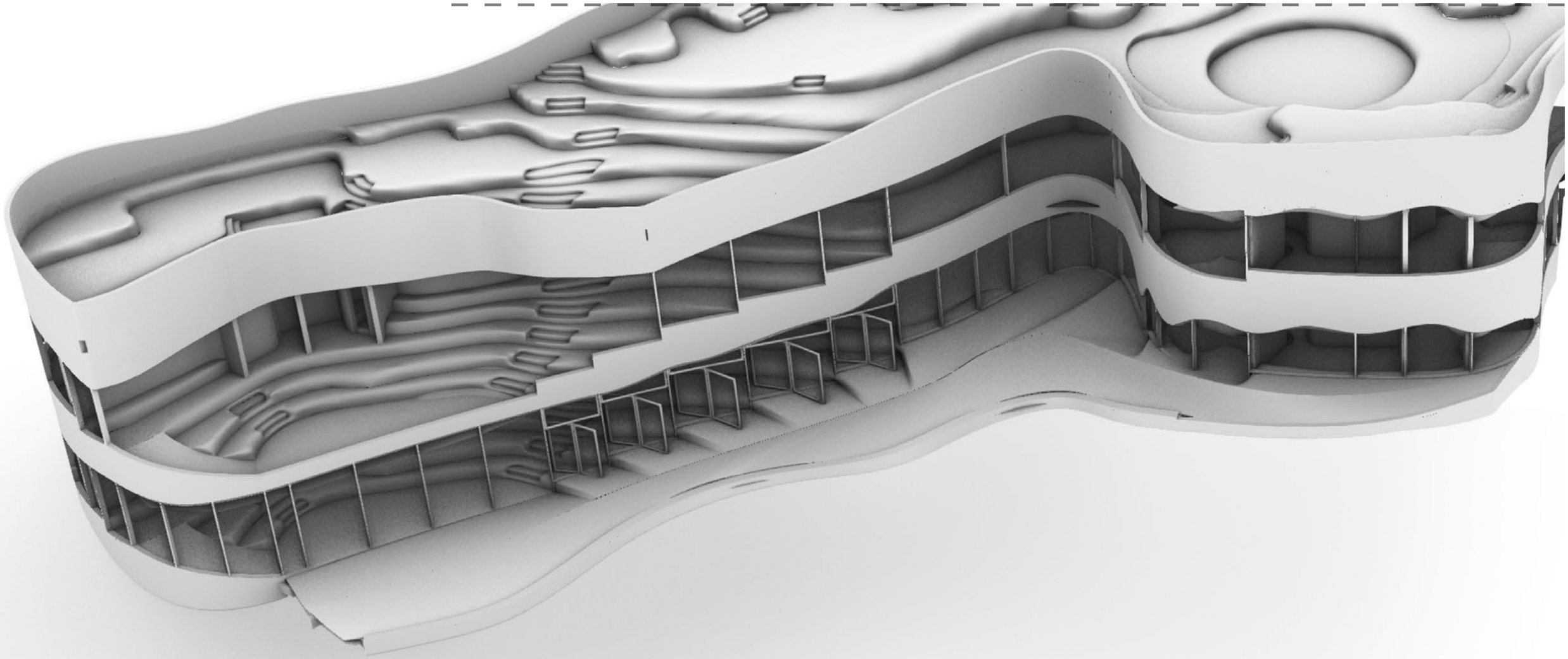


Section C
Scale 1:200

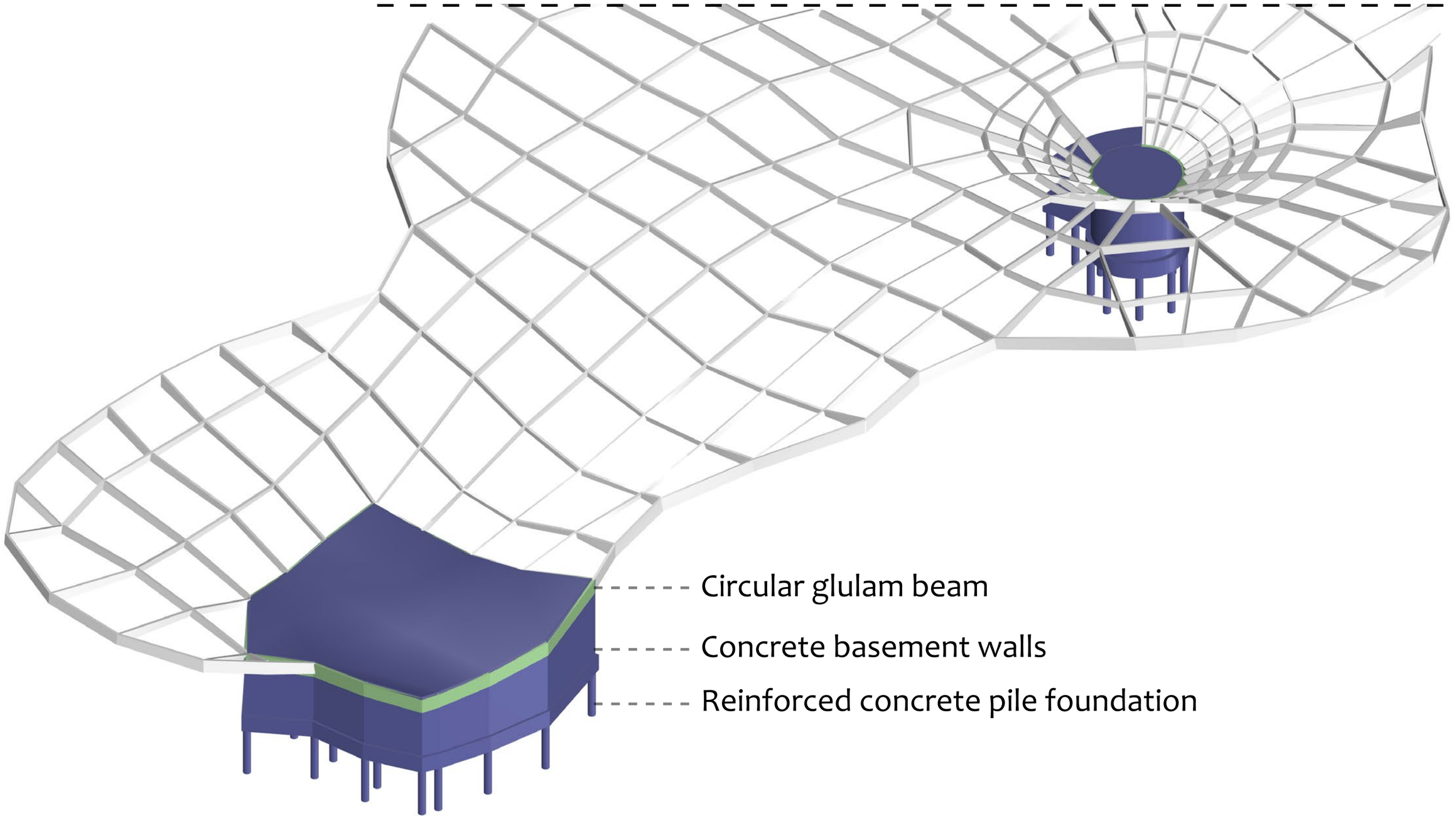




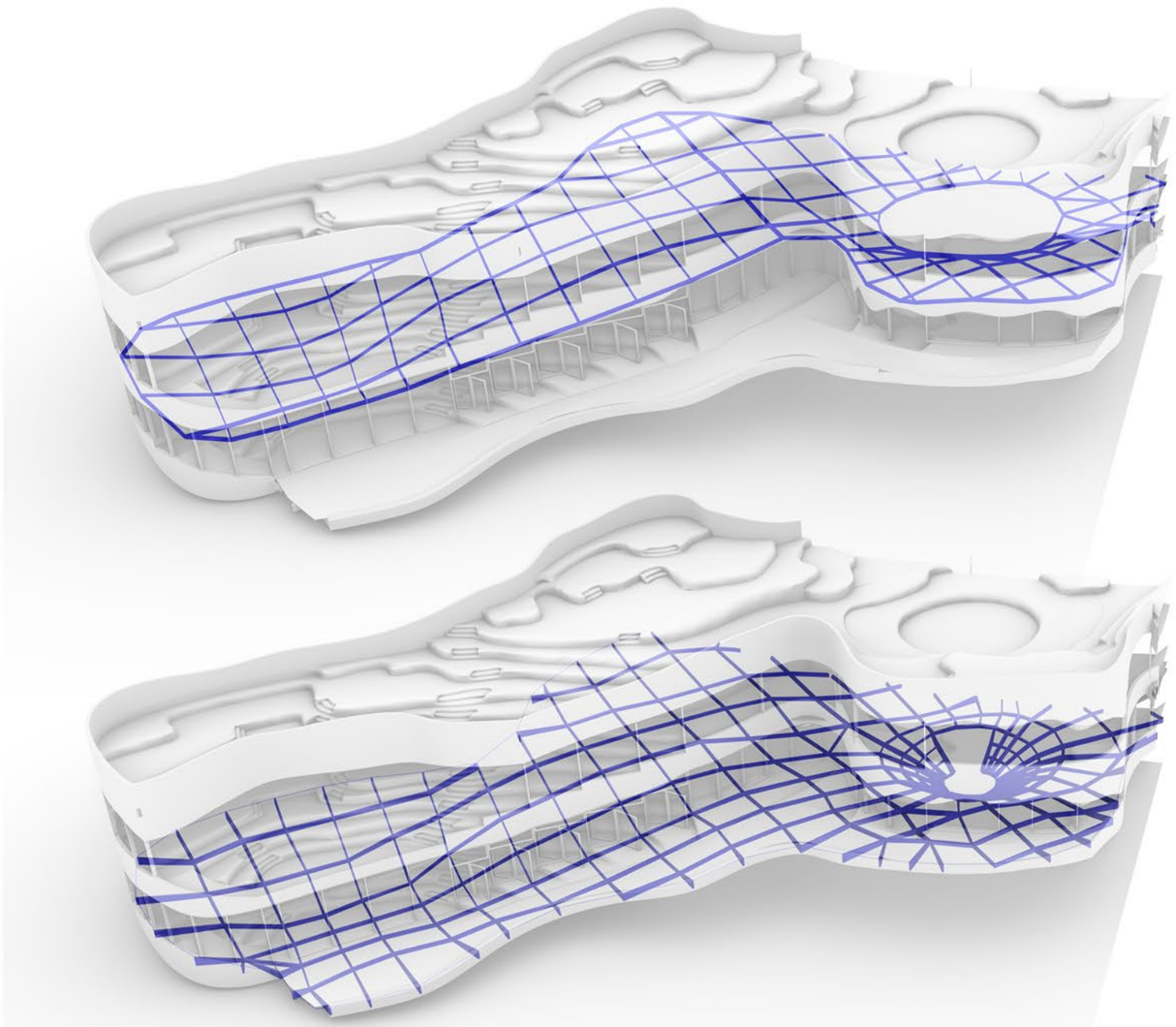
Fragment 1

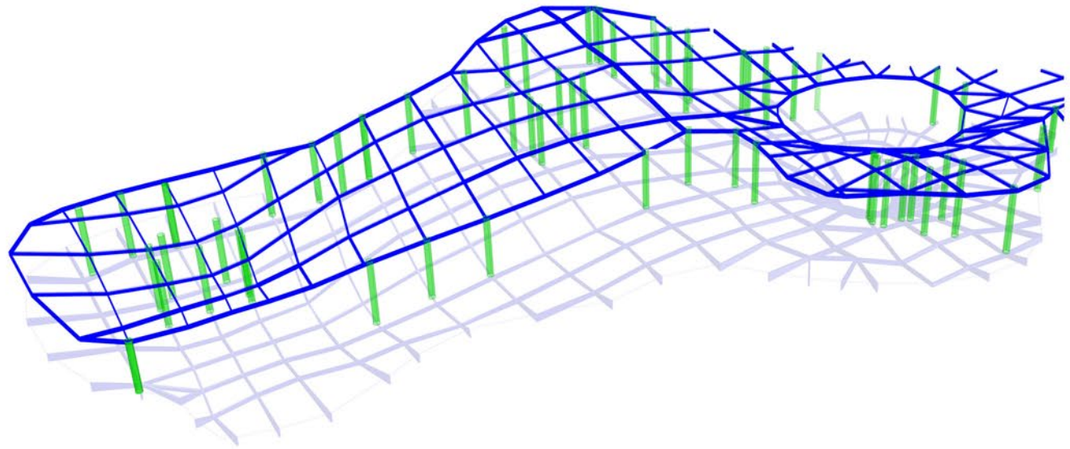


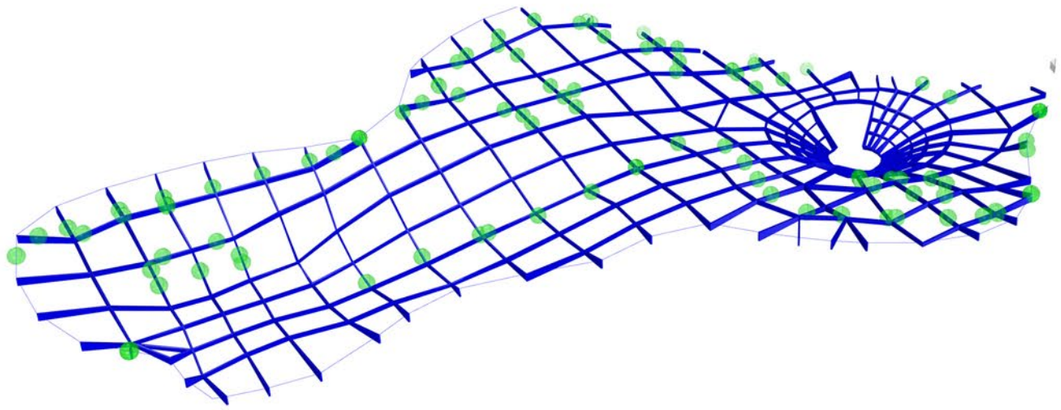
Structure diagram

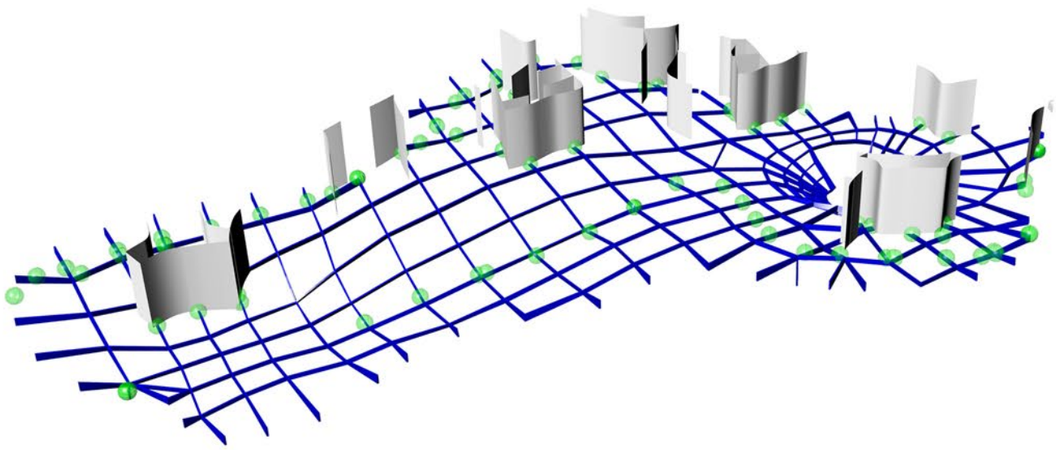


Structure diagram

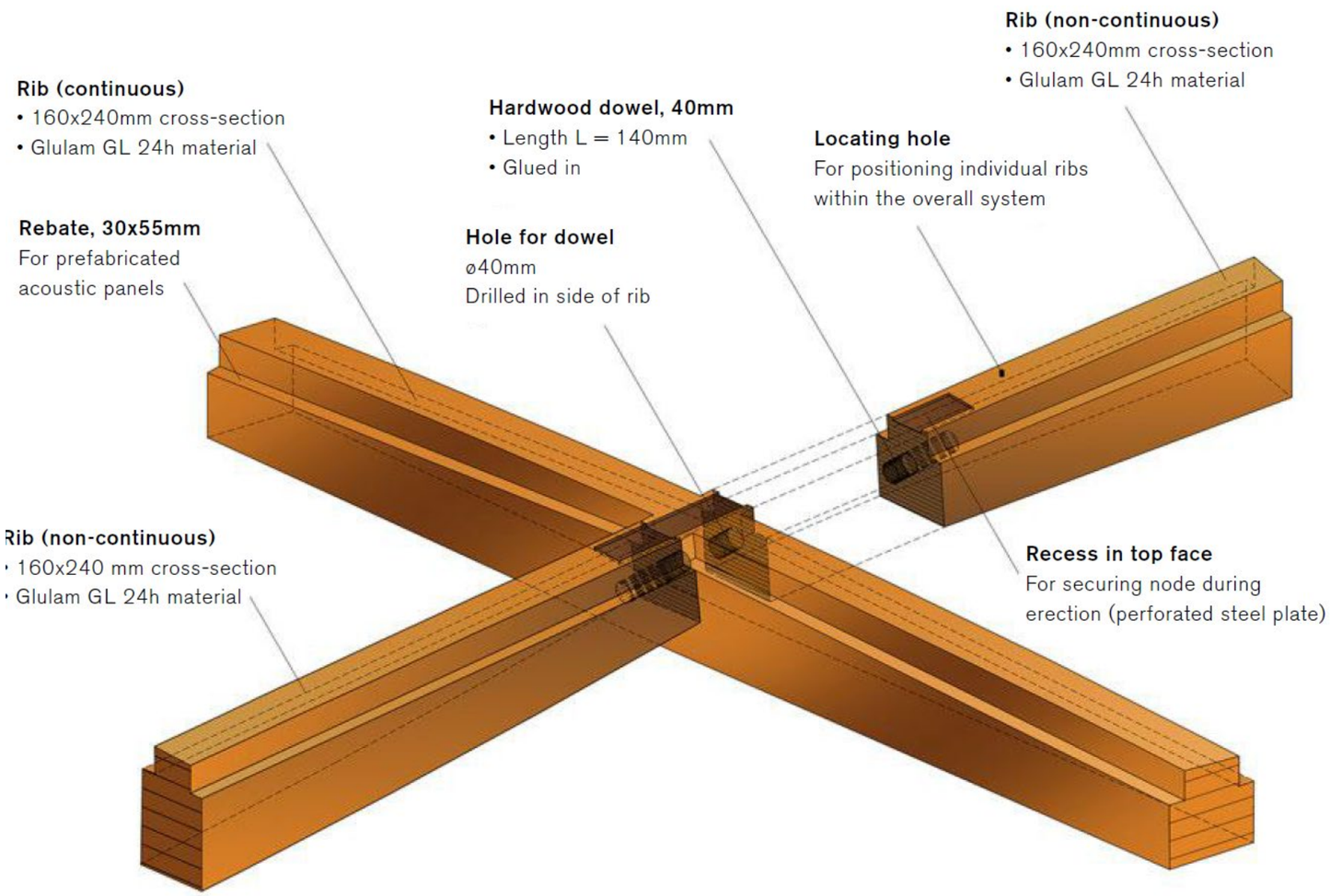








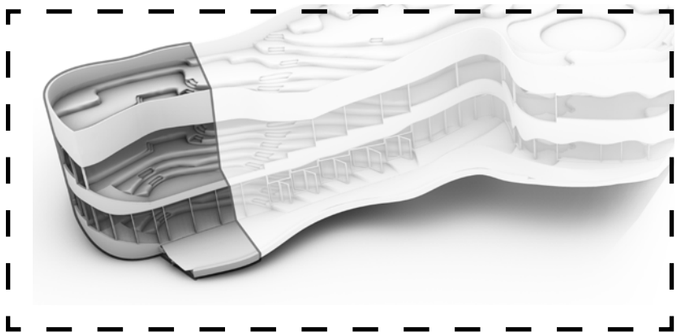
Reference structure example



The clamping bed was specially developed with the help of digital techniques and produced with CNC routers in order to fabricate the double-curvature edge beam workpieces.

Toskana thermal baths, Bad Orb, Germany; architects: Ollertz Architekten; structural engineers: Trabert + Partner, 2010.

Exploded structure



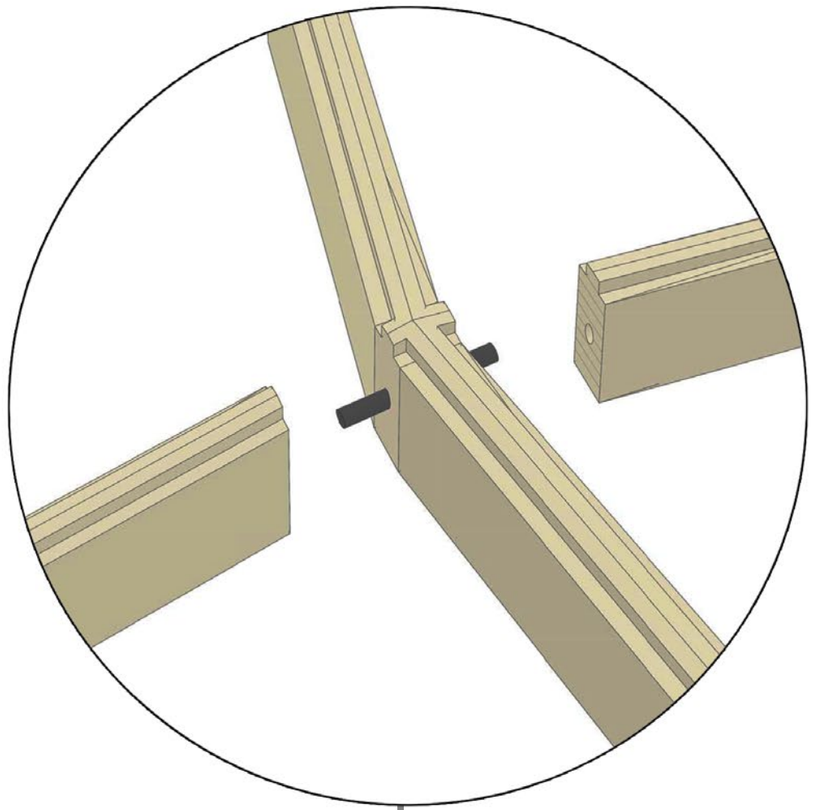
Main structure:

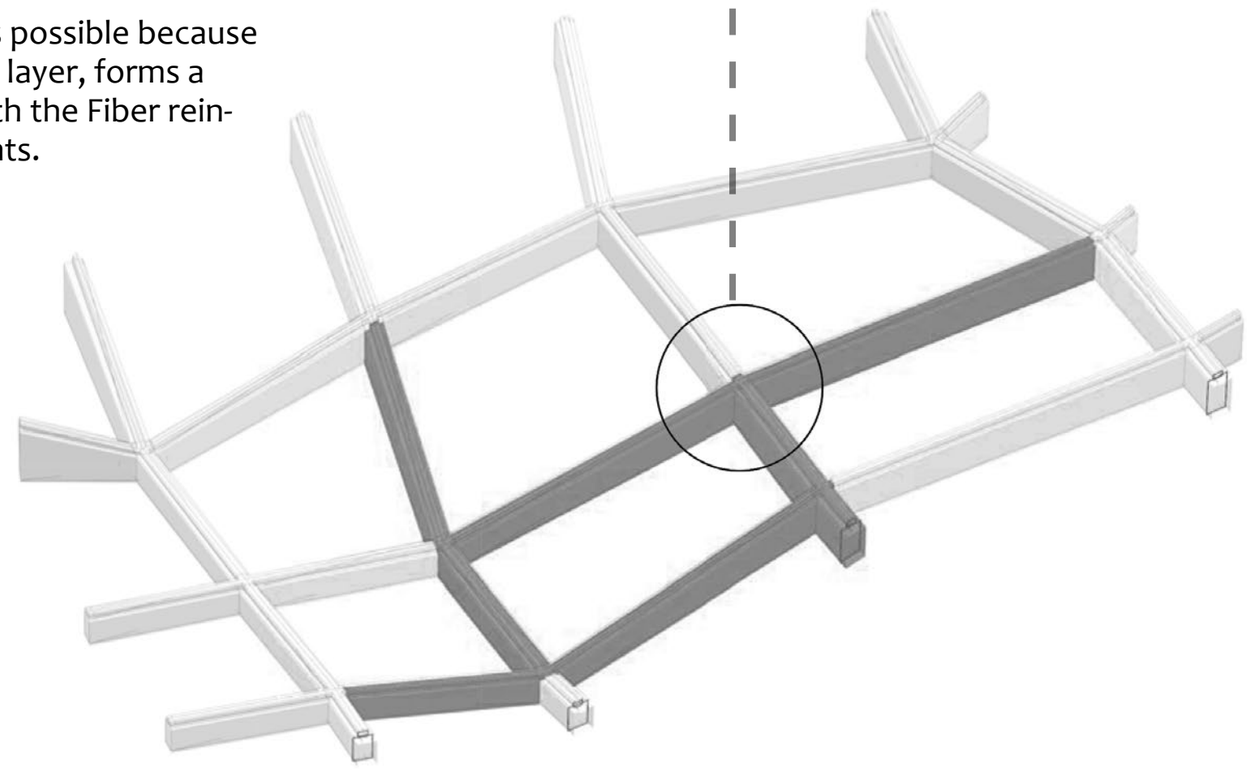
Irregular square grid of glued laminated timber members.

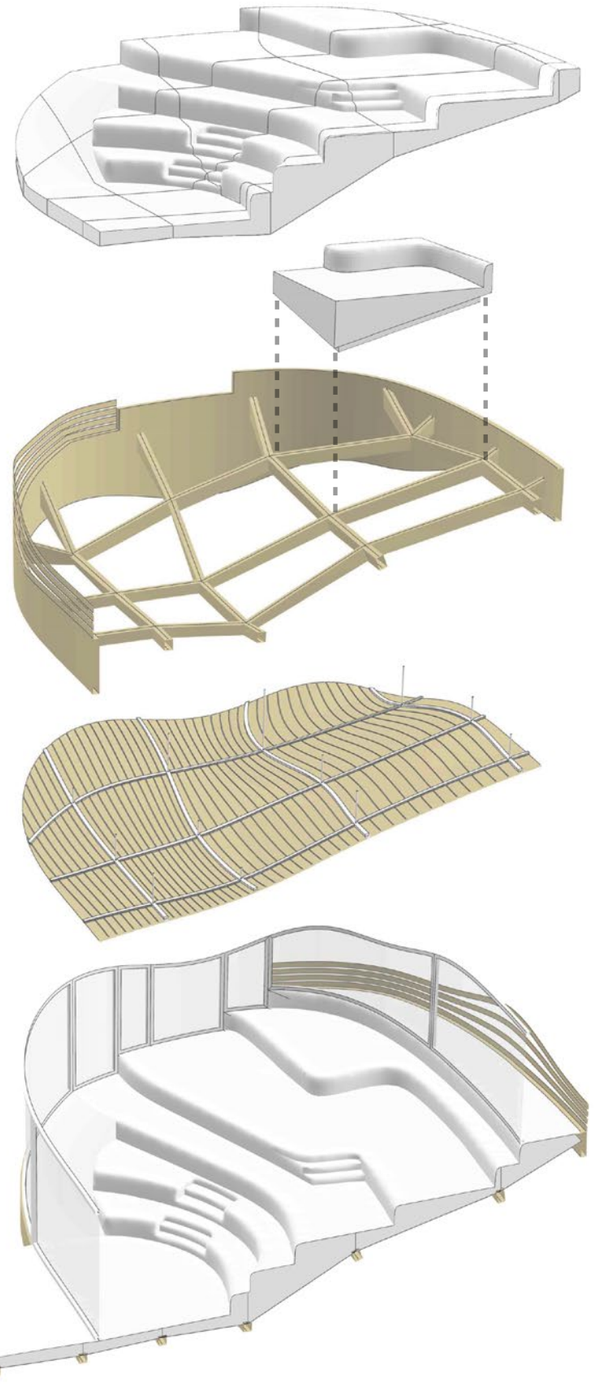
Transferring shear forces at the nodes between the curved timber members is achieved by beech dowels (30mm diameter, about 14cm long) glued in on one side.

A small steel plate nailed in place secures the node during erection.

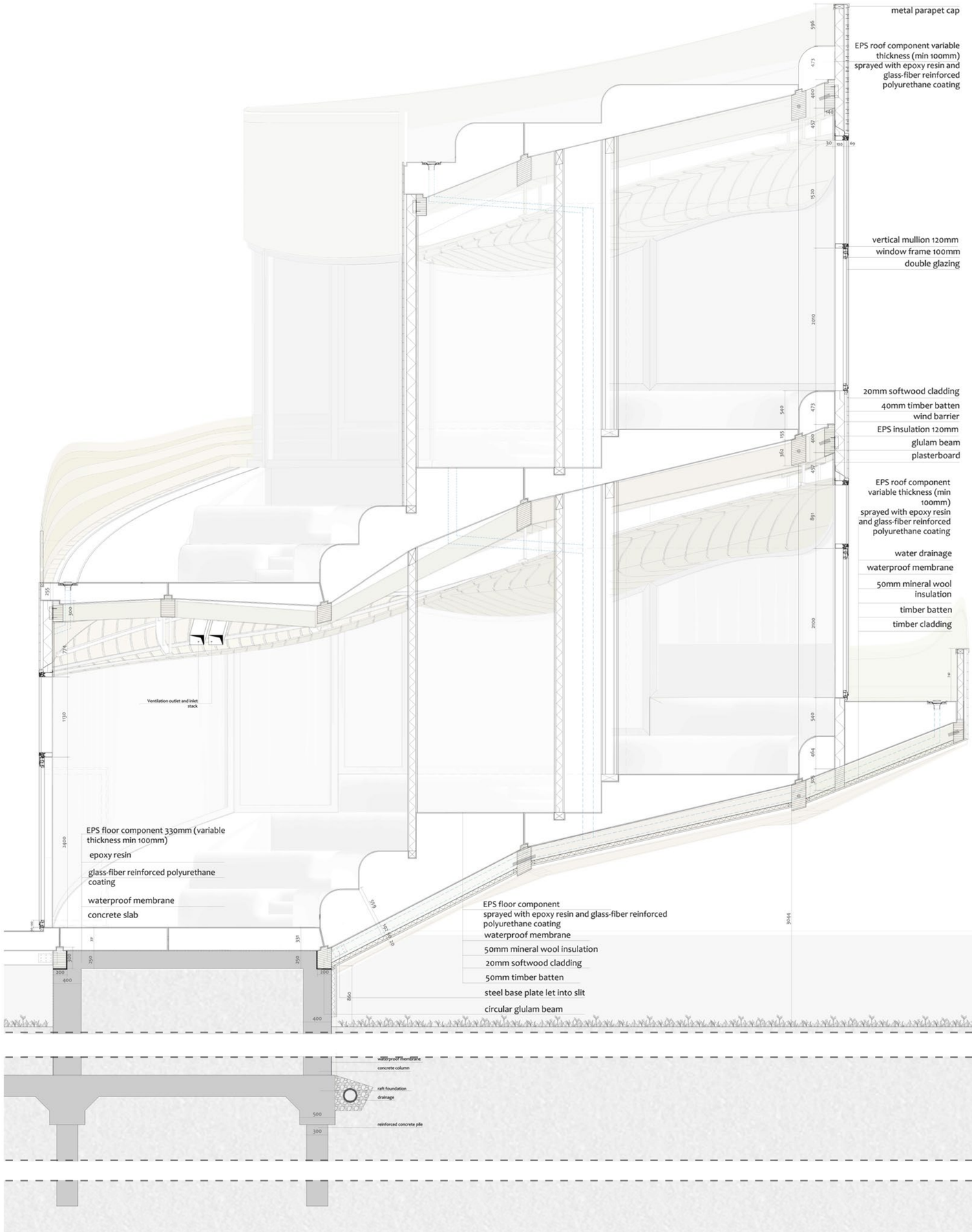
This simple connection was possible because the grid of ribs, as the third layer, forms a shell structure together with the Fiber reinforced EPS floor components.

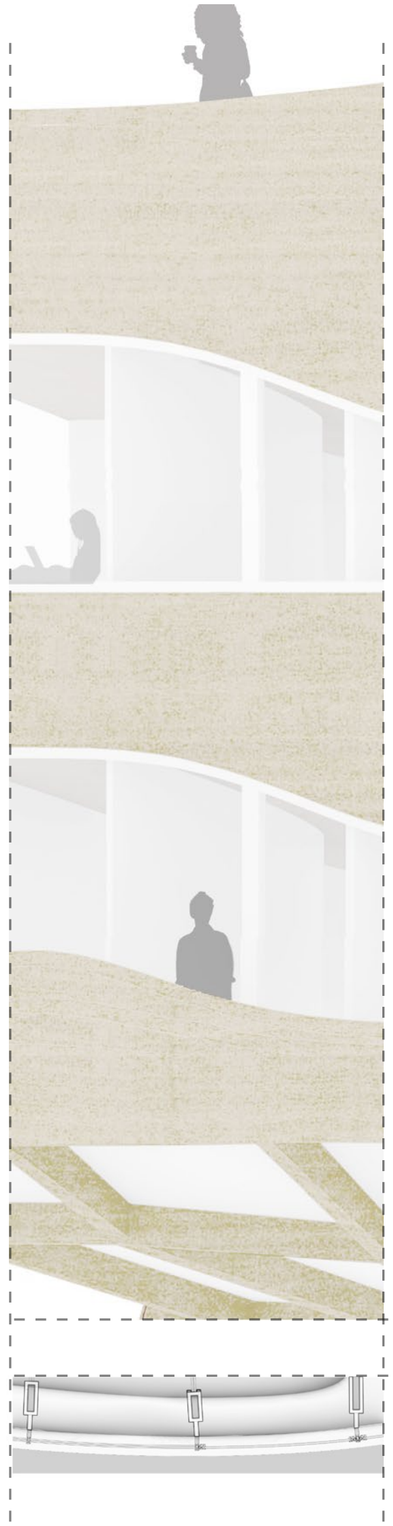






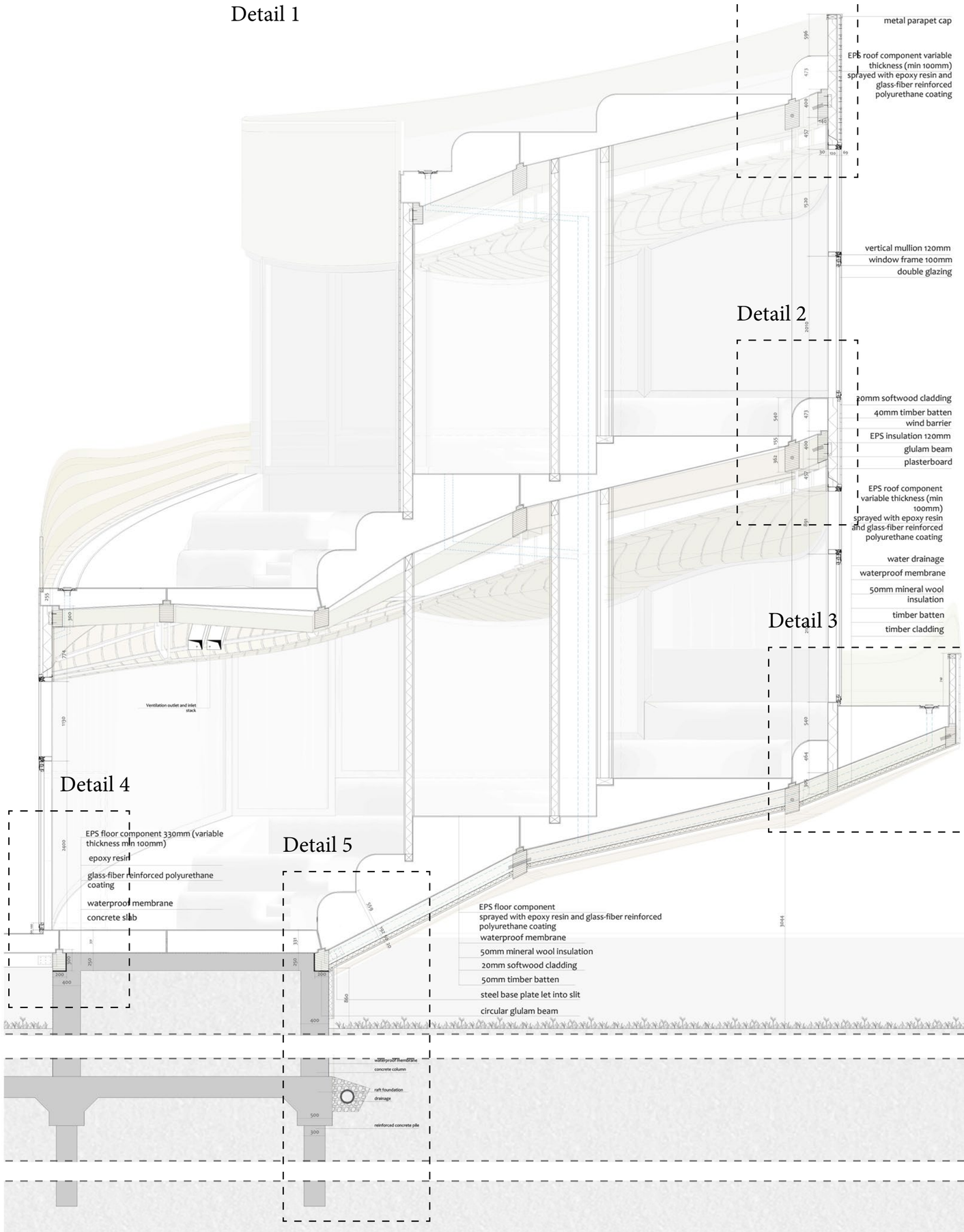
Fragment 2


metal parapet cap
EPS roof component variable thickness (min 100mm) sprayed with epoxy resin and glass-fiber reinforced polyurethane coating
vertical mullion 120mm
window frame 100mm
double glazing
20mm softwood cladding
40mm timber batten
wind barrier
EPS insulation 120mm
glulam beam
plasterboard
EPS roof component variable thickness (min 100mm) sprayed with epoxy resin and glass-fiber reinforced polyurethane coating
water drainage
waterproof membrane
50mm mineral wool insulation
timber batten
timber cladding
Ventilation outlet and inlet stack
EPS floor component 330mm (variable thickness min 100mm)
epoxy resin
glass-fiber reinforced polyurethane coating
waterproof membrane
concrete slab
EPS floor component
sprayed with epoxy resin and glass-fiber reinforced polyurethane coating
waterproof membrane
50mm mineral wool insulation
20mm softwood cladding
50mm timber batten
steel base plate let into slit
circular glulam beam
waterproof membrane
concrete column
raft foundation
drainage
reinforced concrete pile



Fragment 2

Detail 1



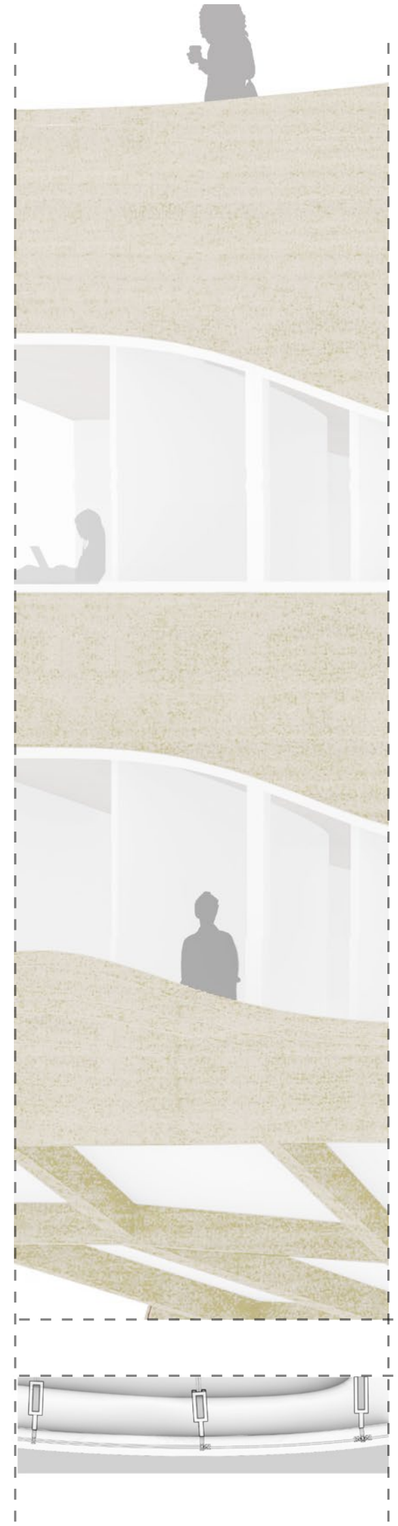
Detail 1

Detail 2

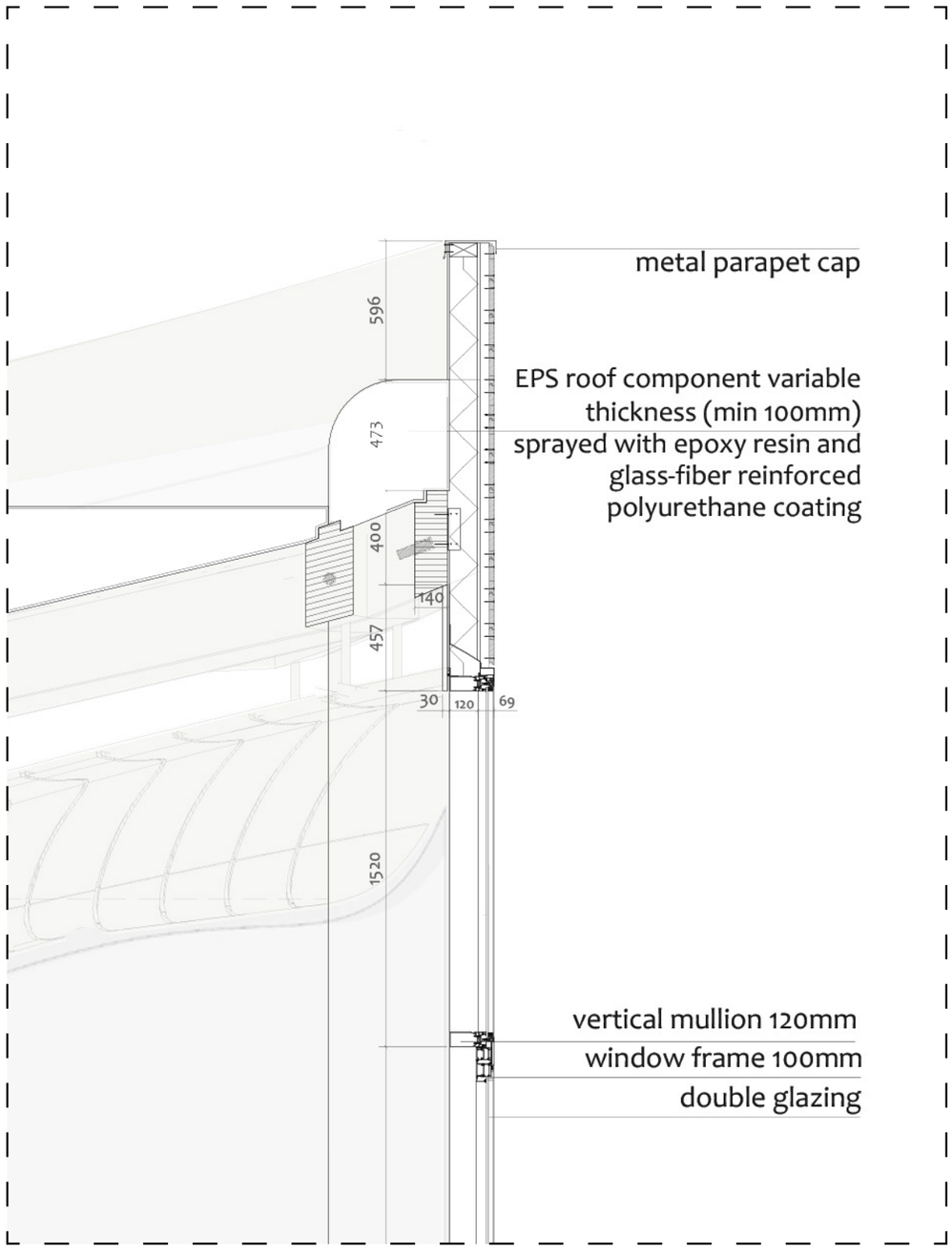
Detail 3

Detail 4

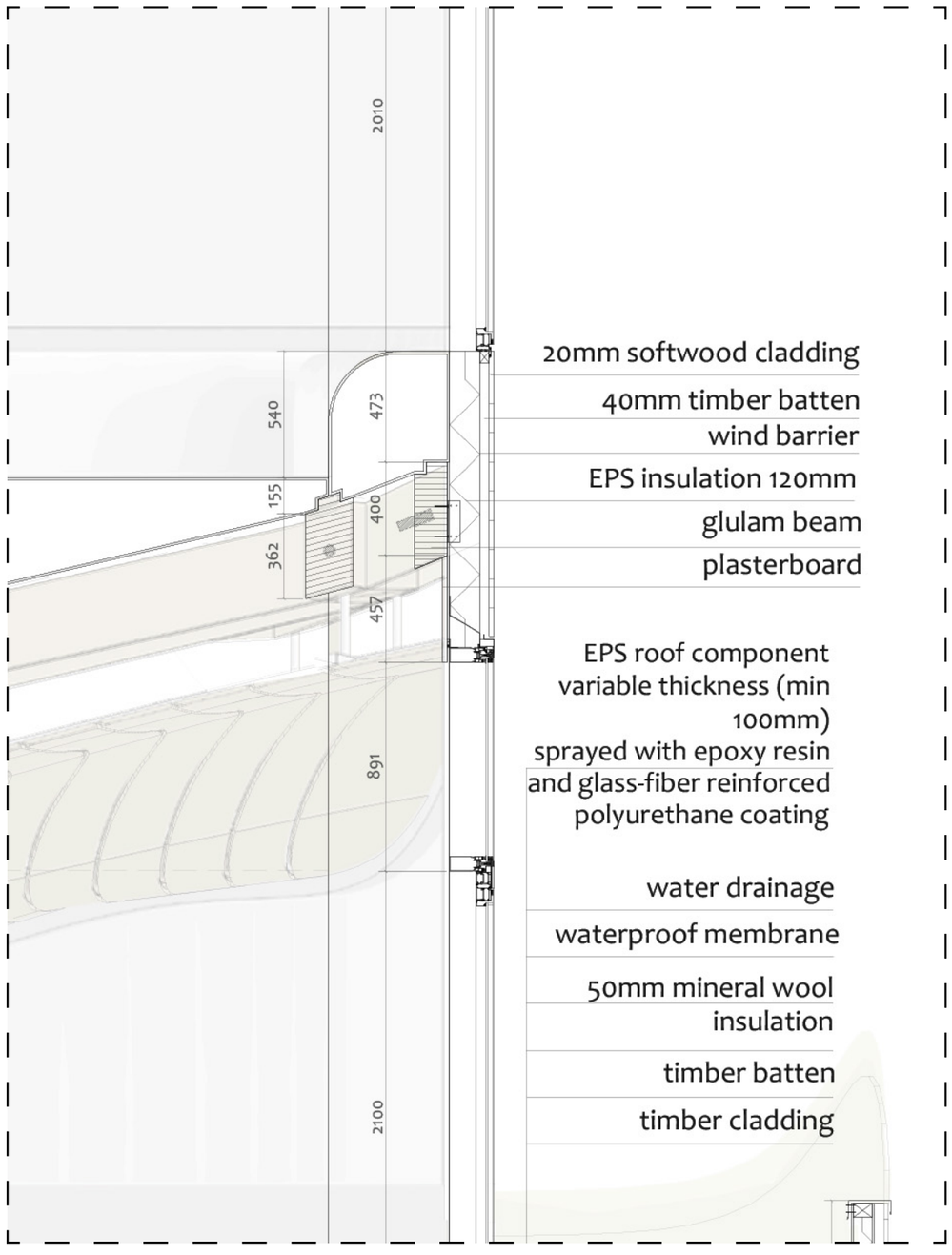
Detail 5



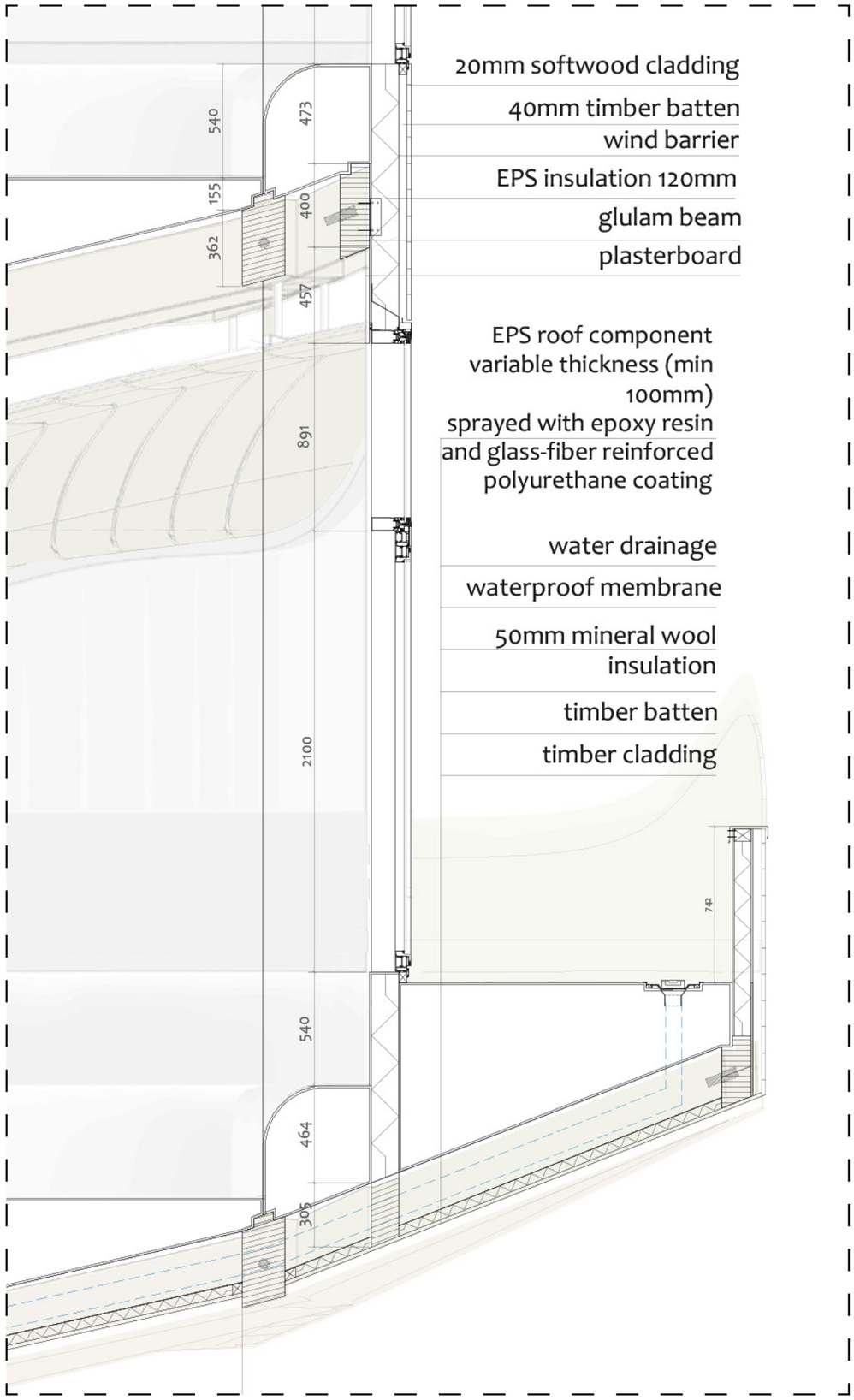
Detail 1



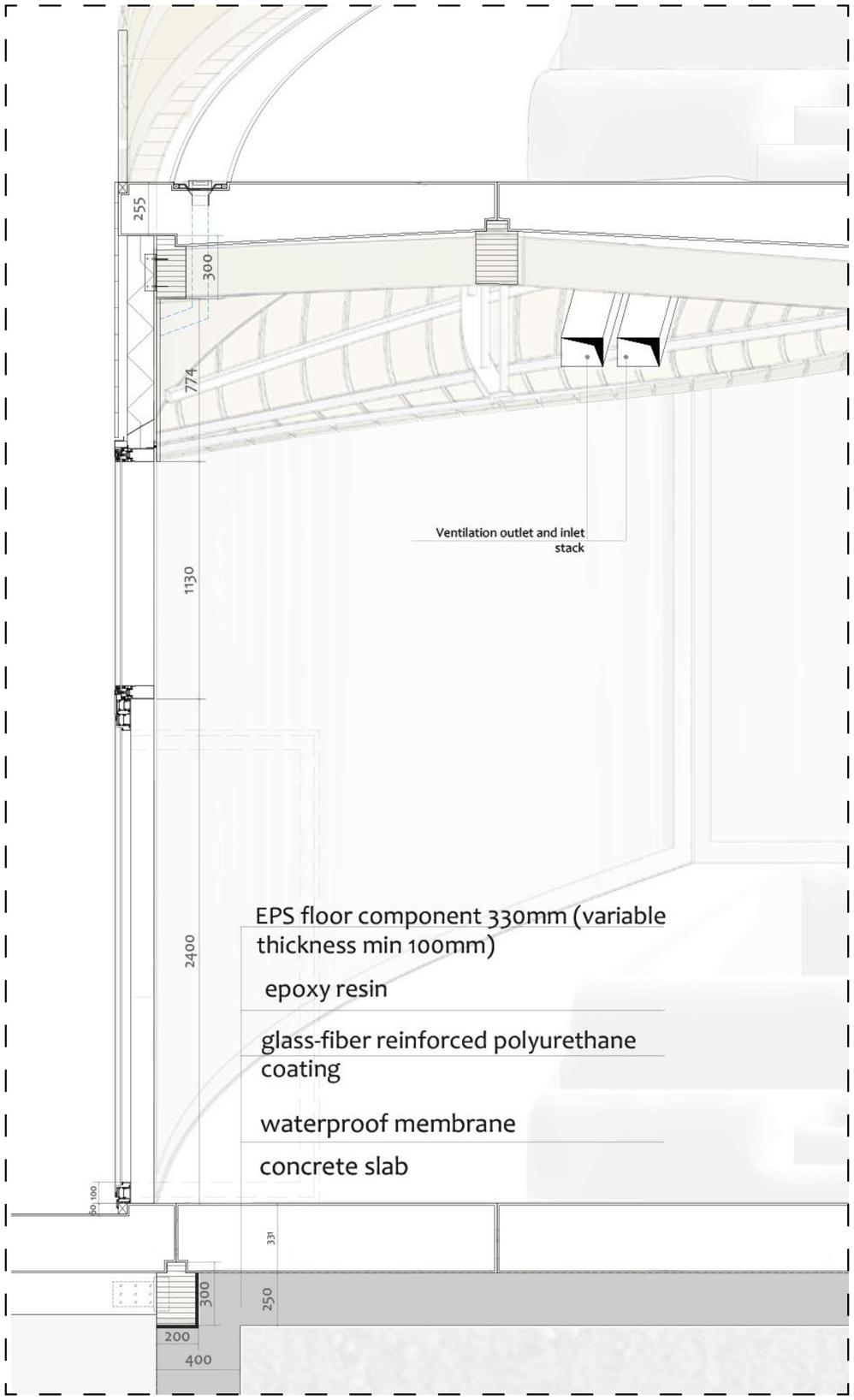
Detail 2



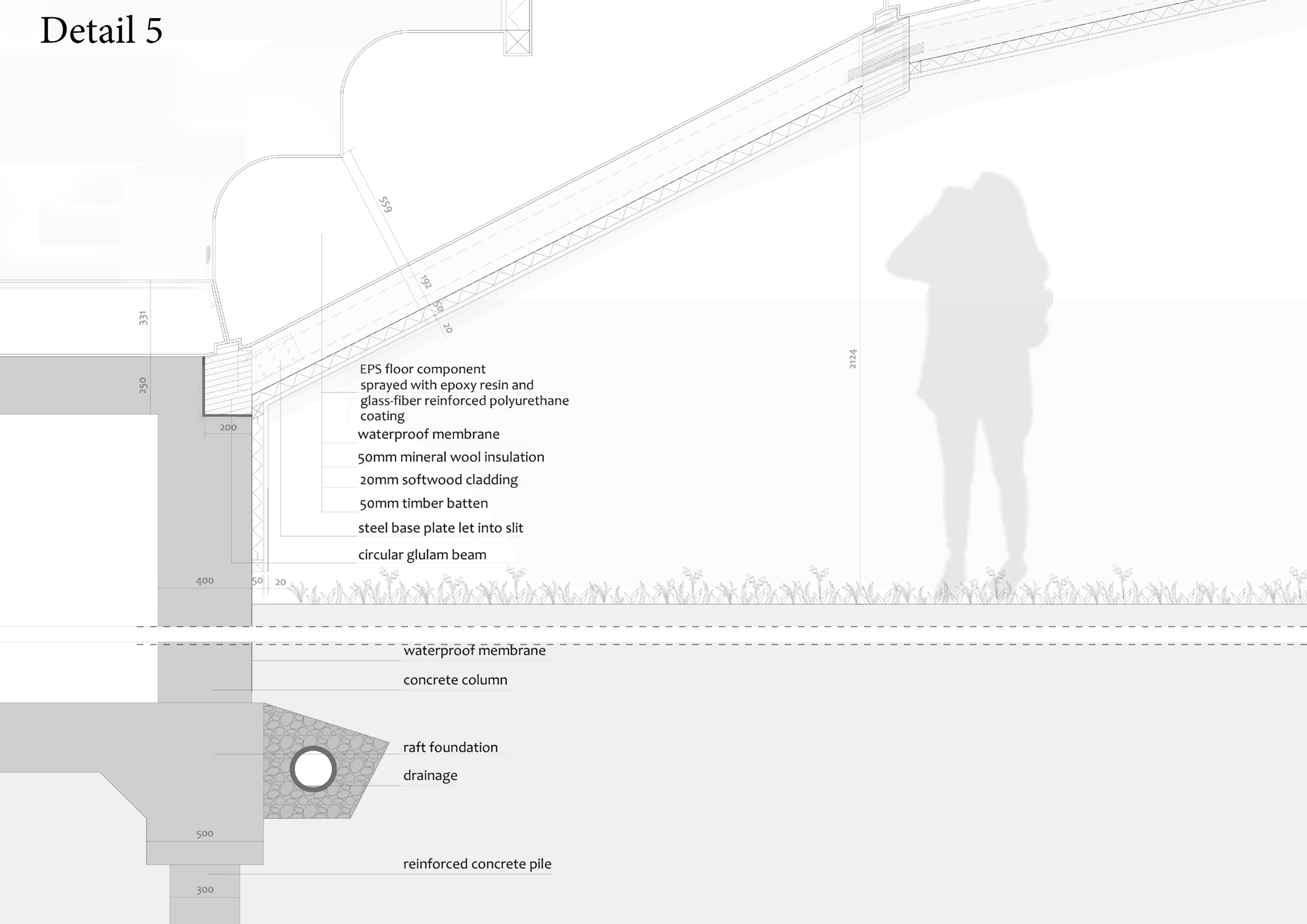
Detail 3



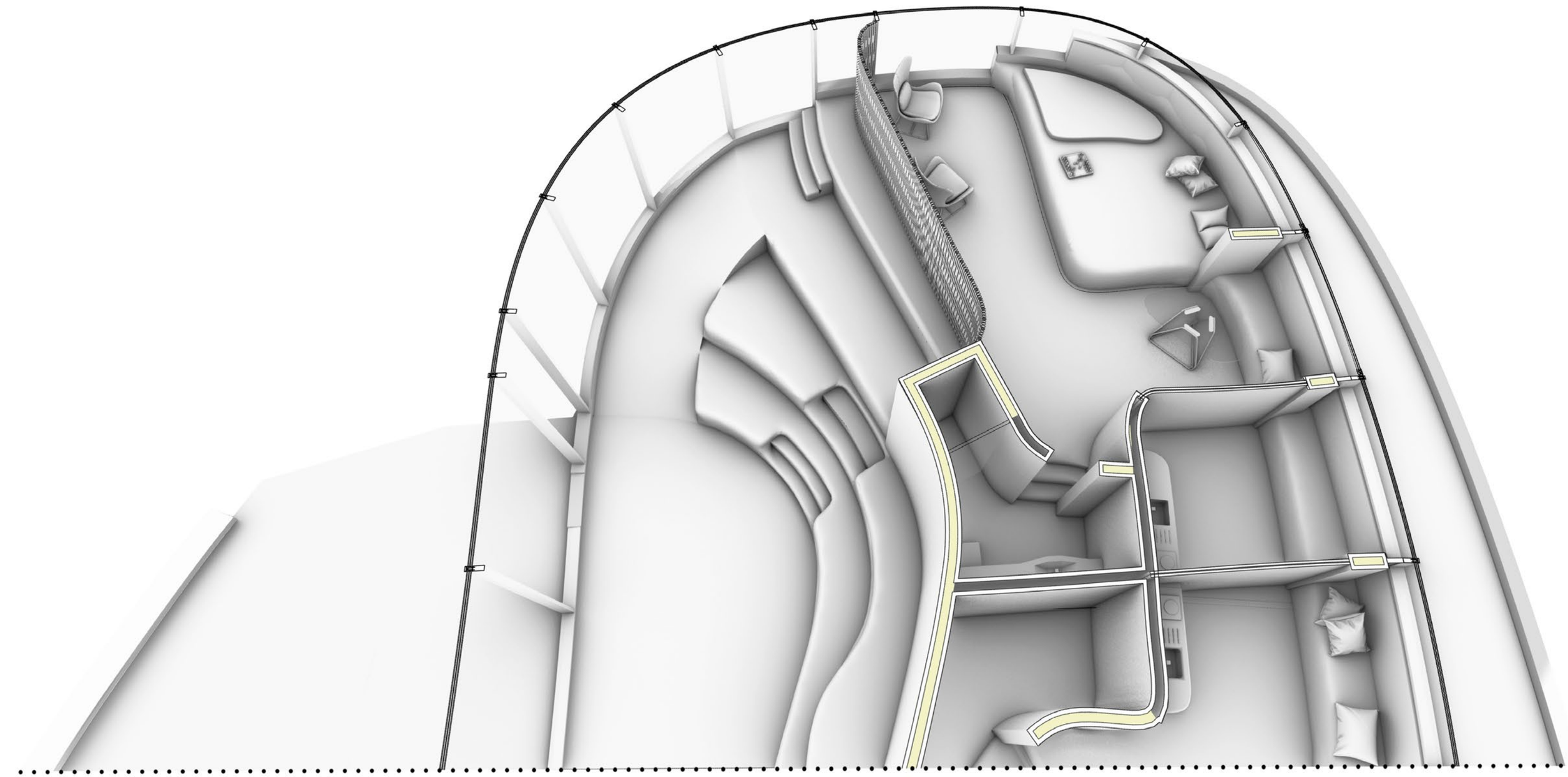
Detail 4

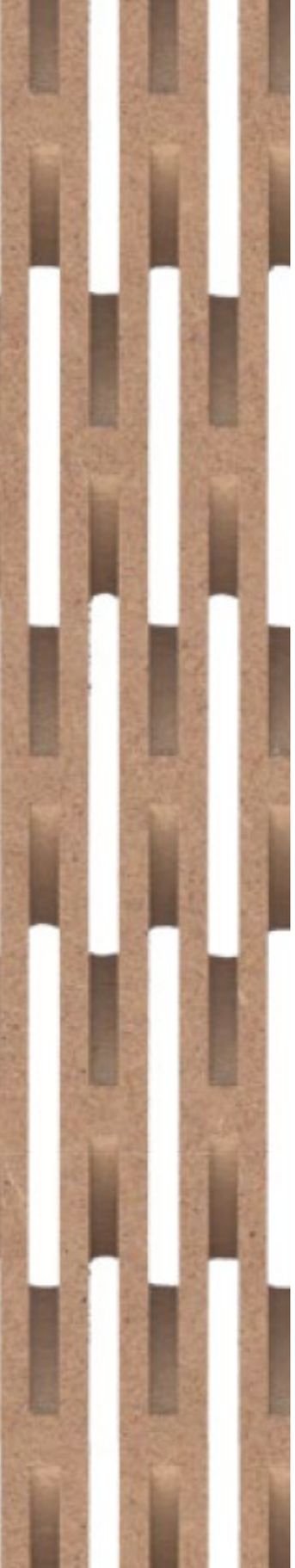


Detail 5


559
192
59
20
331
250
200
400
50
20
2124
EPS floor component
sprayed with epoxy resin and
glass-fiber reinforced polyurethane
coating
waterproof membrane
50mm mineral wool insulation
20mm softwood cladding
50mm timber batten
steel base plate let into slit
circular glulam beam
waterproof membrane
concrete column
raft foundation
drainage
500
reinforced concrete pile
300

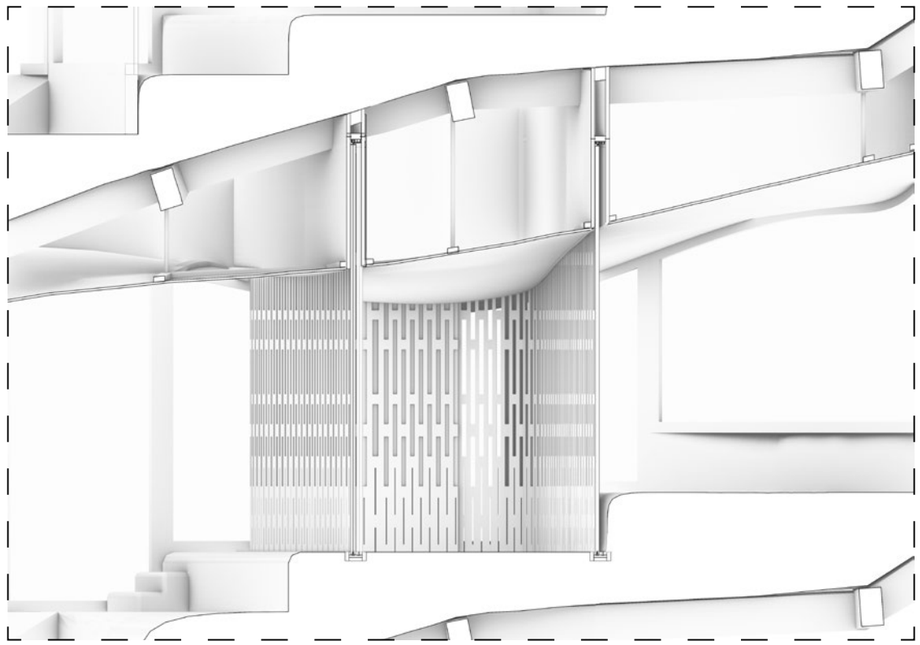
Apartment design



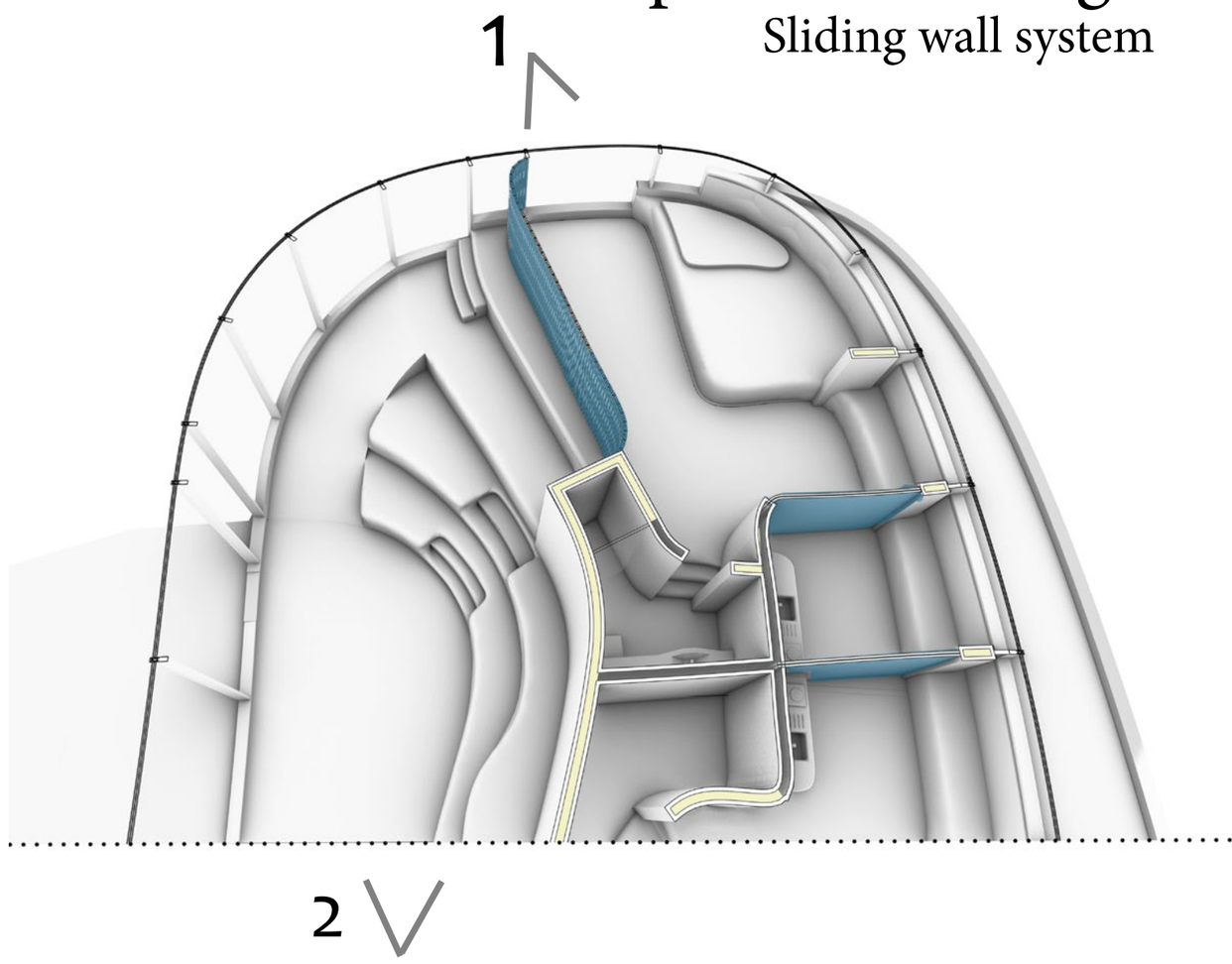


Wall type 1 - pattern by Dukta Sonar

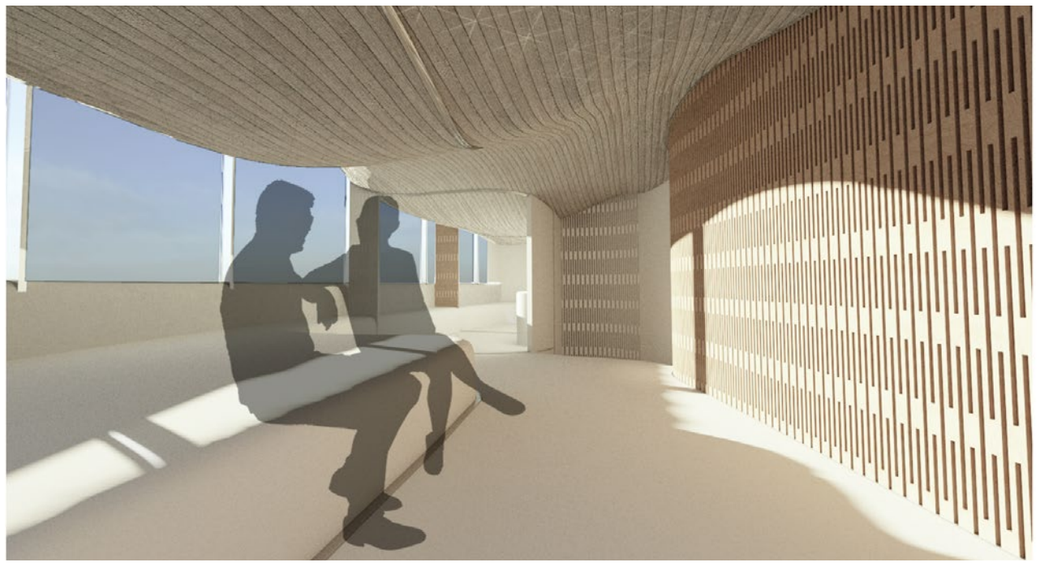
Properties:
Material: Plywood, fabric
Min. Bending Radius: 80mm
Open Area: 20% – 40%
Surface: Spray paint



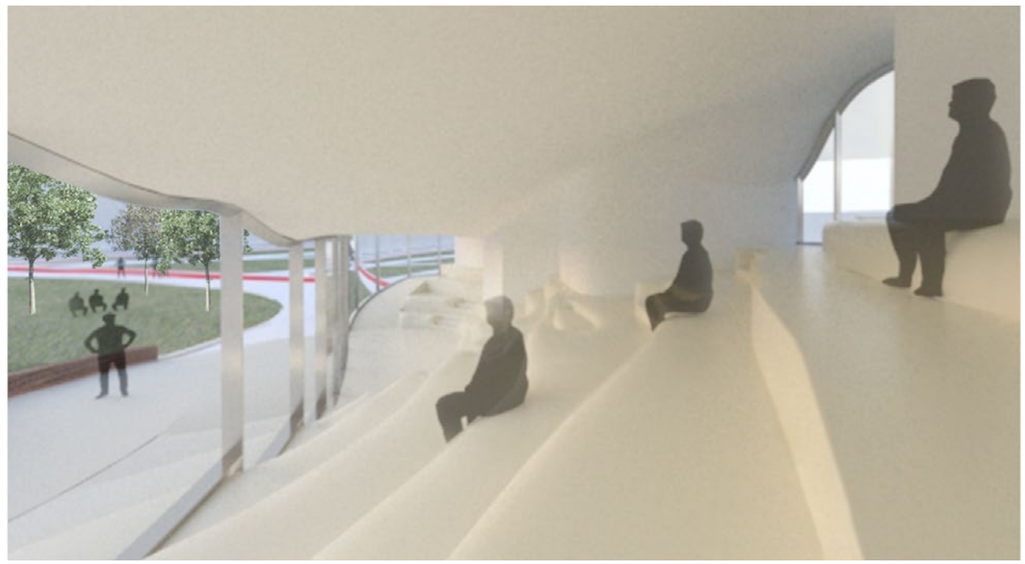
Apartment design
Sliding wall system



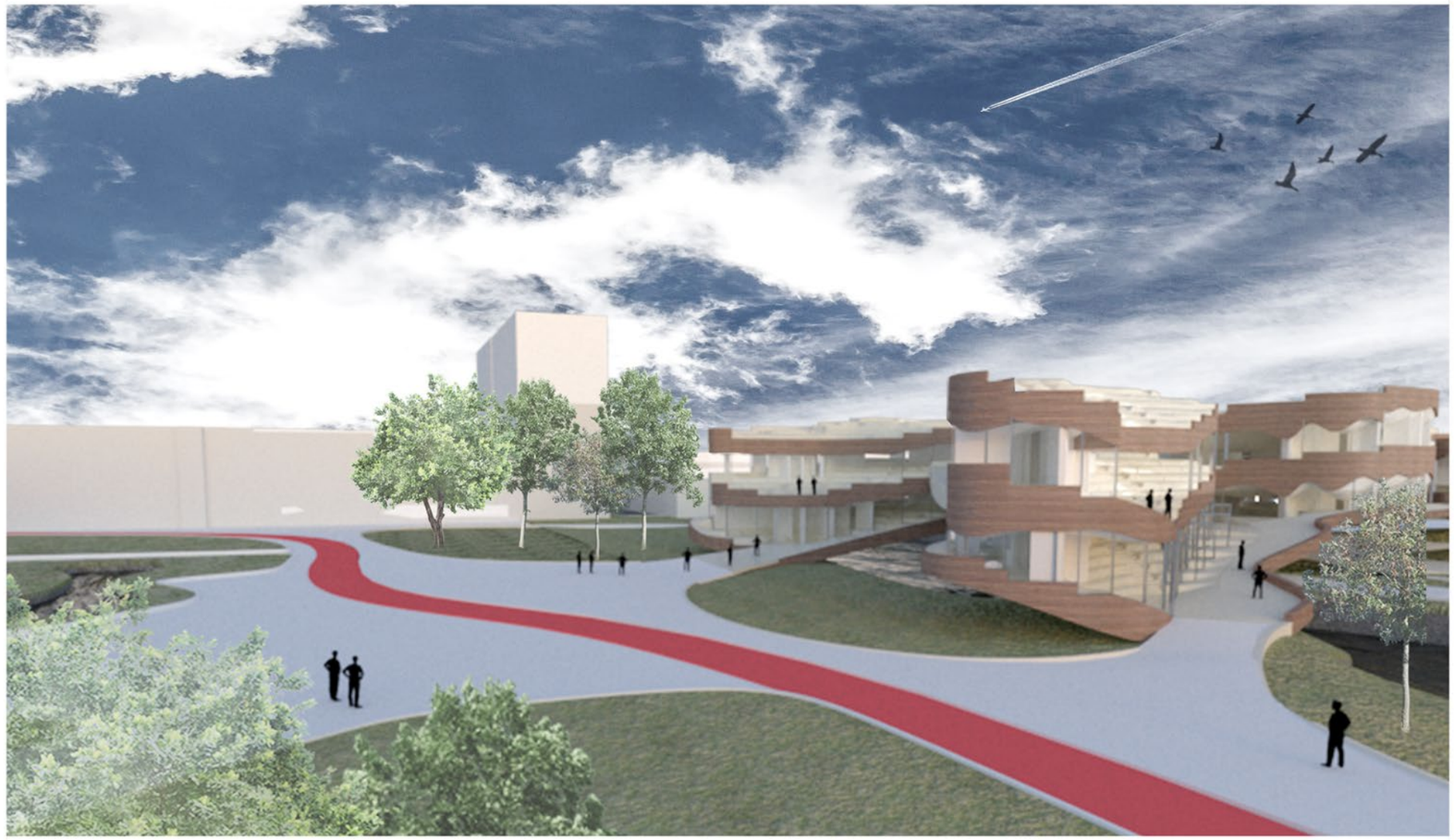
1 - Private



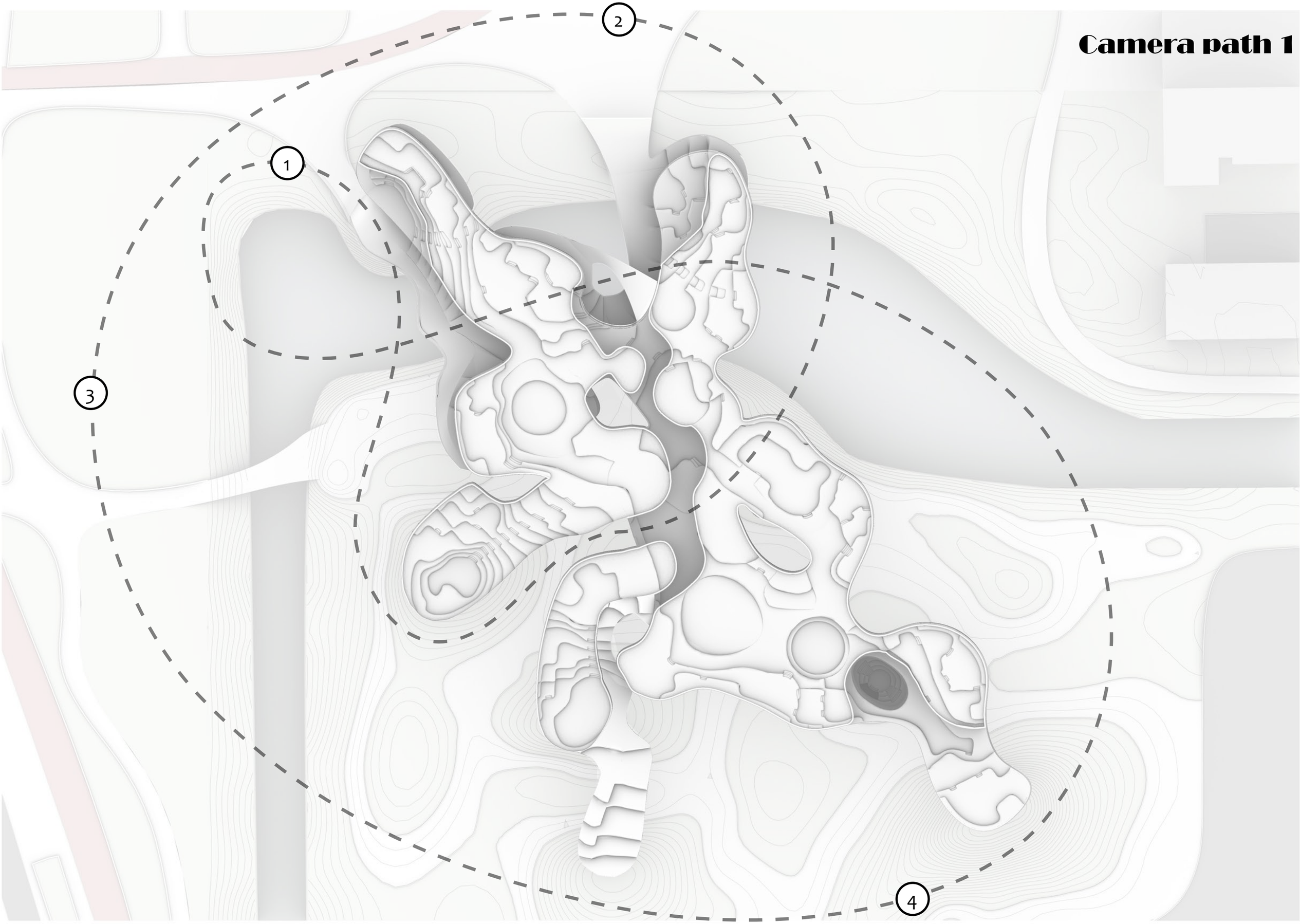
2 - Shared



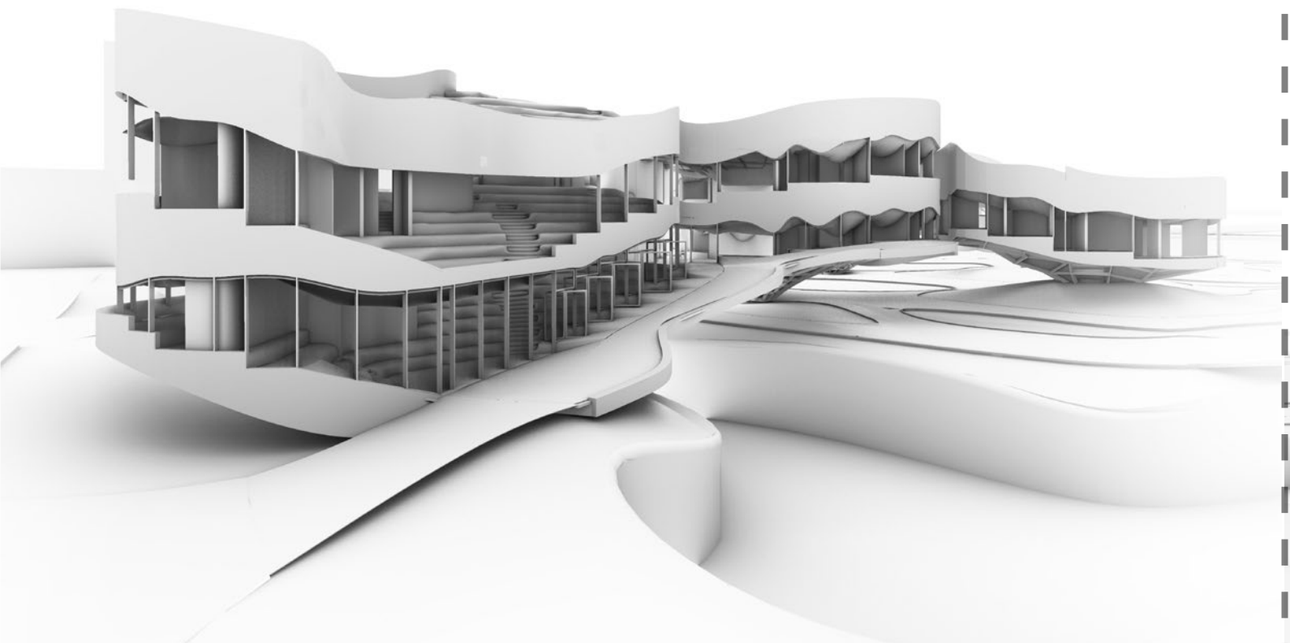
Main Entrance



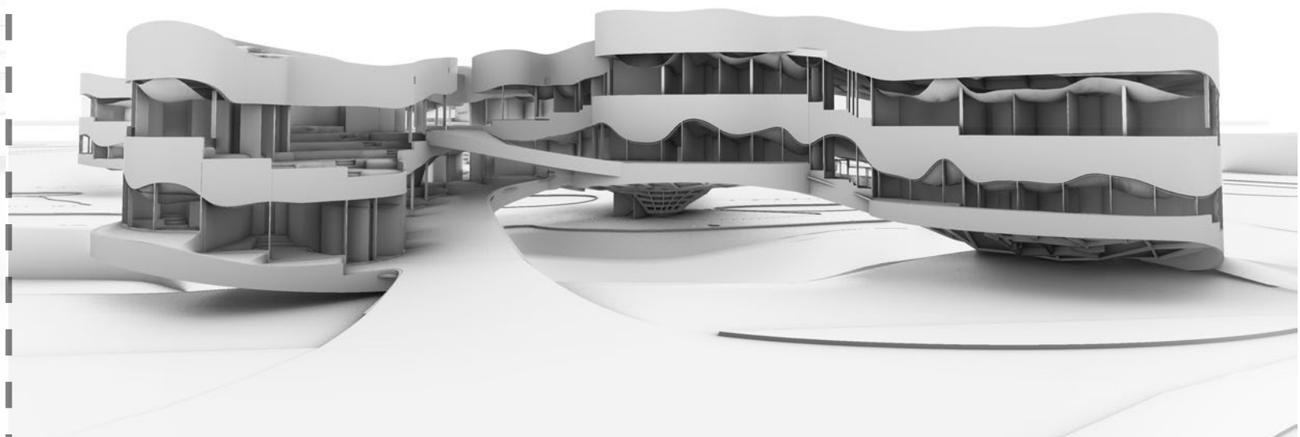
Camera path 1



1



2



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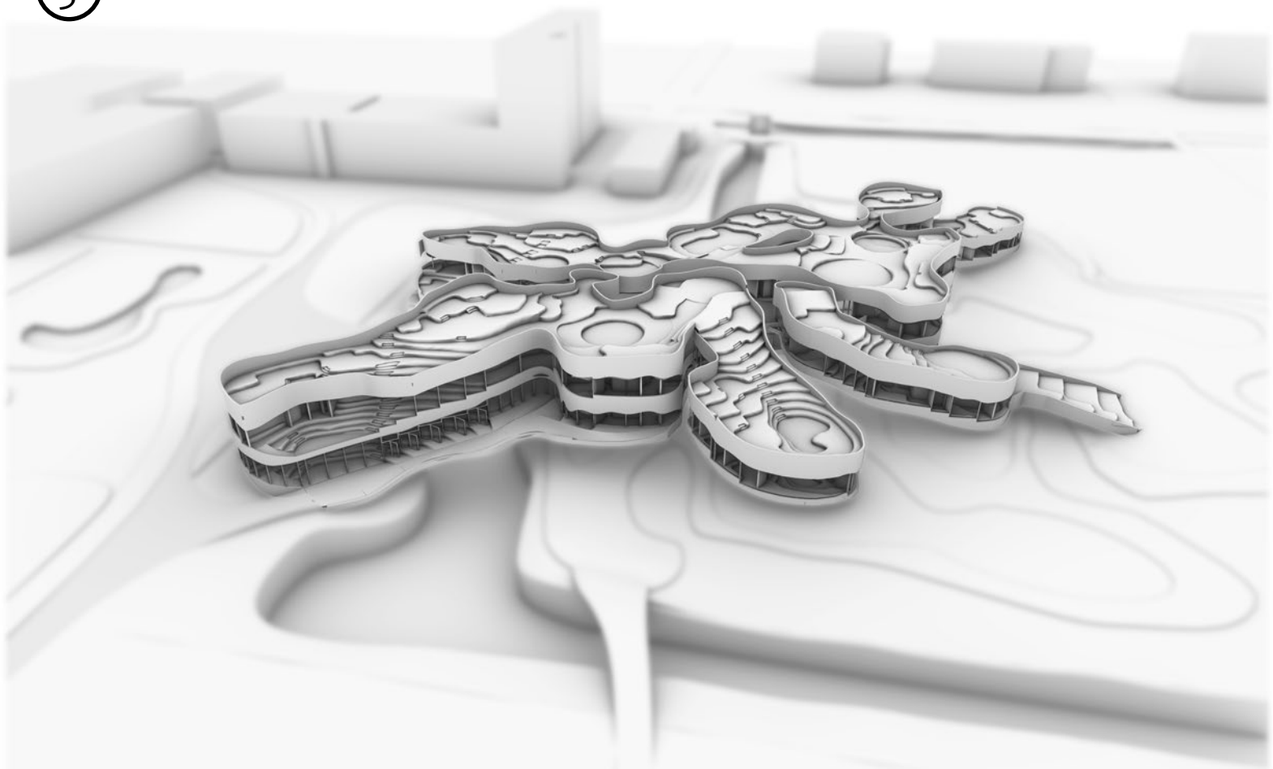

4