

MERGING OF **BUILDING** AND
LANDSCAPE IN A **HIGHWAY**
ENVIRONMENT

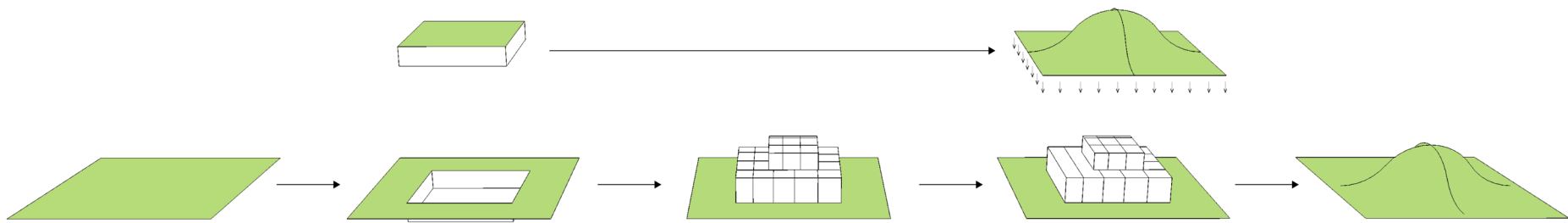







Worth 1000.com

MERGE



SUSTAIN ABILITY



A person wearing a bright blue rain poncho and glasses is pushing a bicycle on a paved sidewalk. The bicycle has a white mesh basket on the front and a black bag on the back. The person is wearing red pants and black shoes. The background shows a city street with a railing on the left and a utility pole on the right. The overall atmosphere is overcast and rainy.

65%
HEATING
0%
COOLING



W

S

A

C



< 1800

1800-1850

1850-1900

1900-1930

1930-1945

1945-1960

1960-1975

1975-1985

1985-1995

1995-2005

> 2005



< 1800

1800-1850

1850-1900

1900-1930

1930-1945

1945-1960

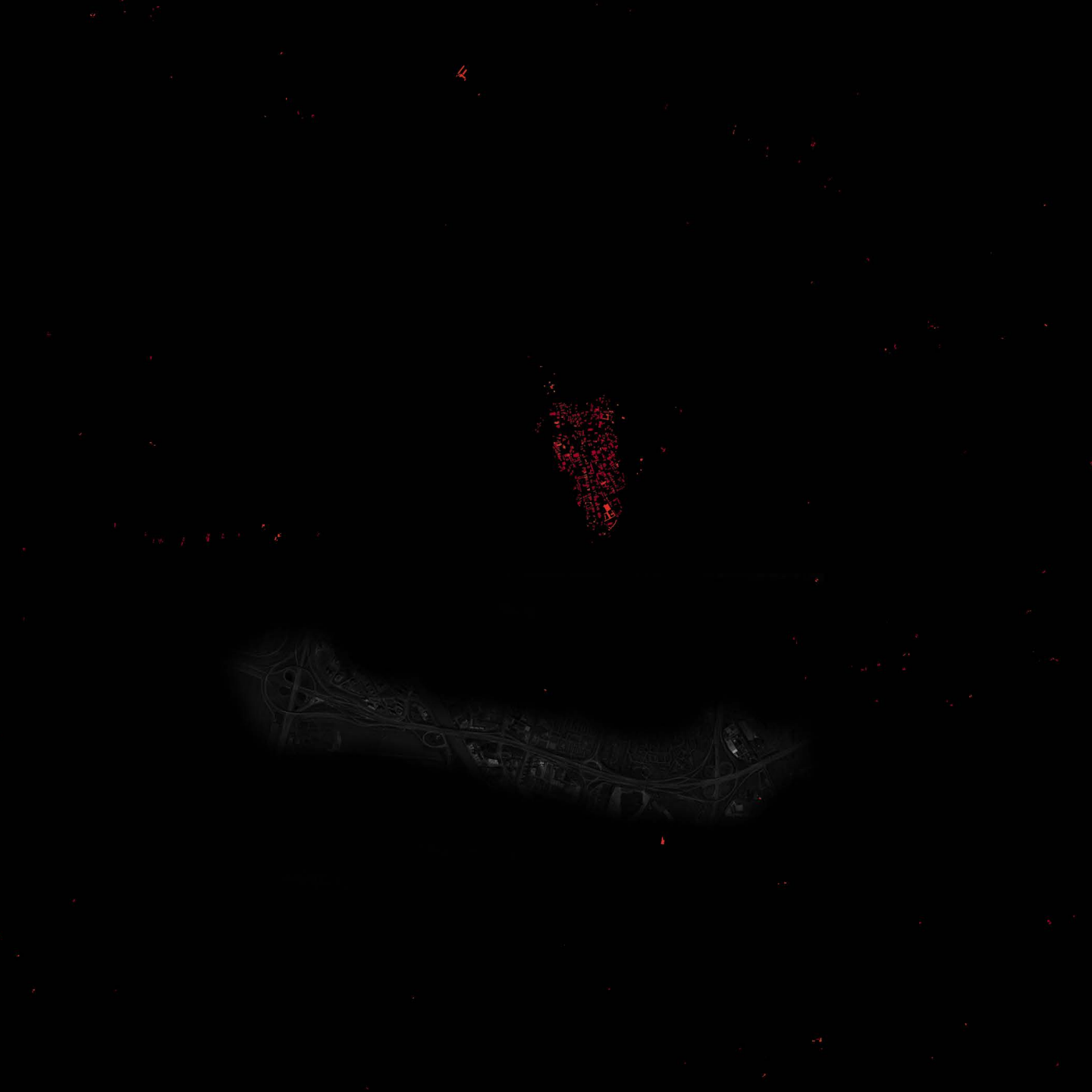
1960-1975

1975-1985

1985-1995

1995-2005

> 2005



< 1800

1800-1850

1850-1900

1900-1930

1930-1945

1945-1960

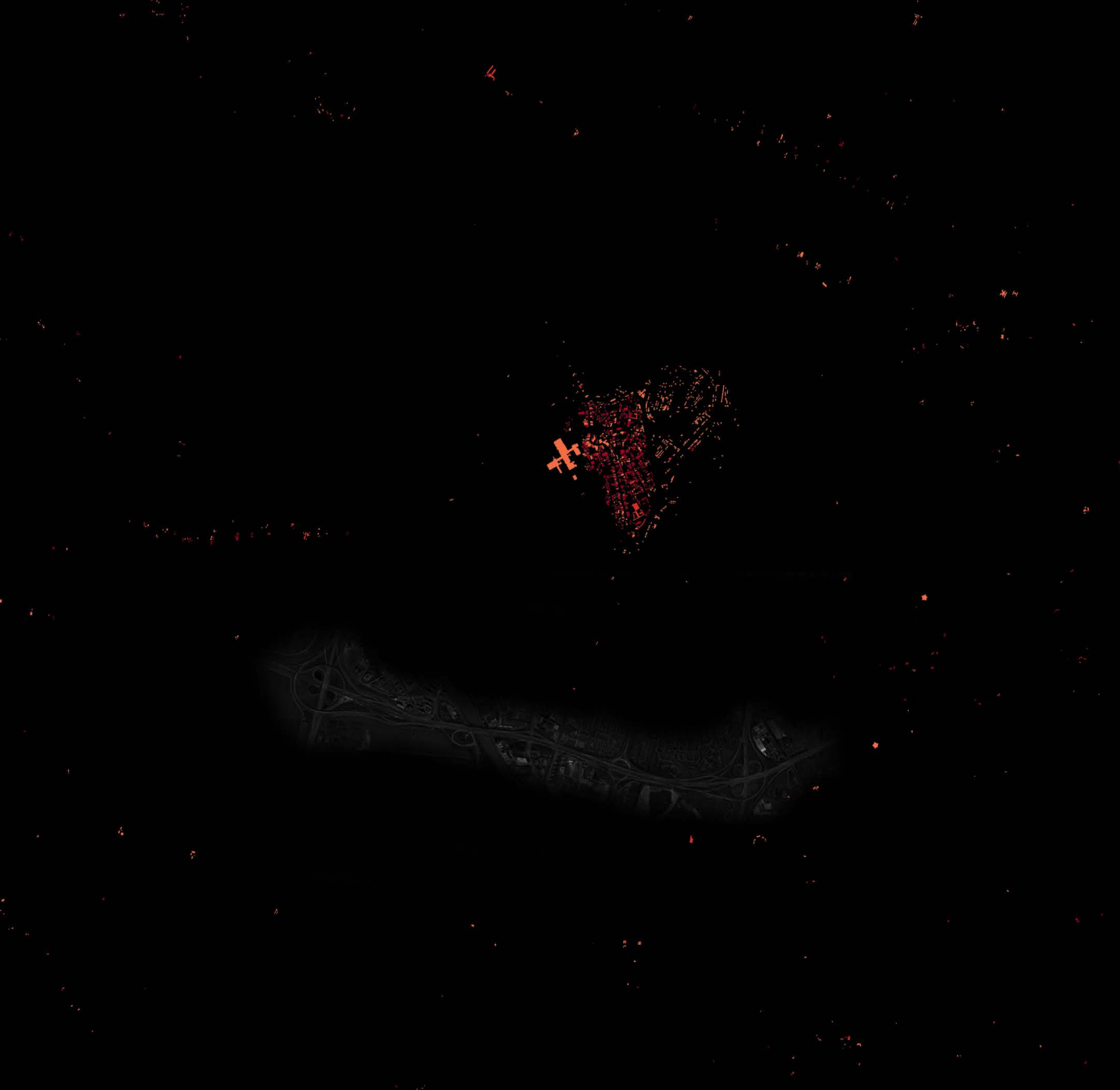
1960-1975

1975-1985

1985-1995

1995-2005

> 2005



< 1800

1800-1850

1850-1900

1900-1930

1930-1945

1945-1960

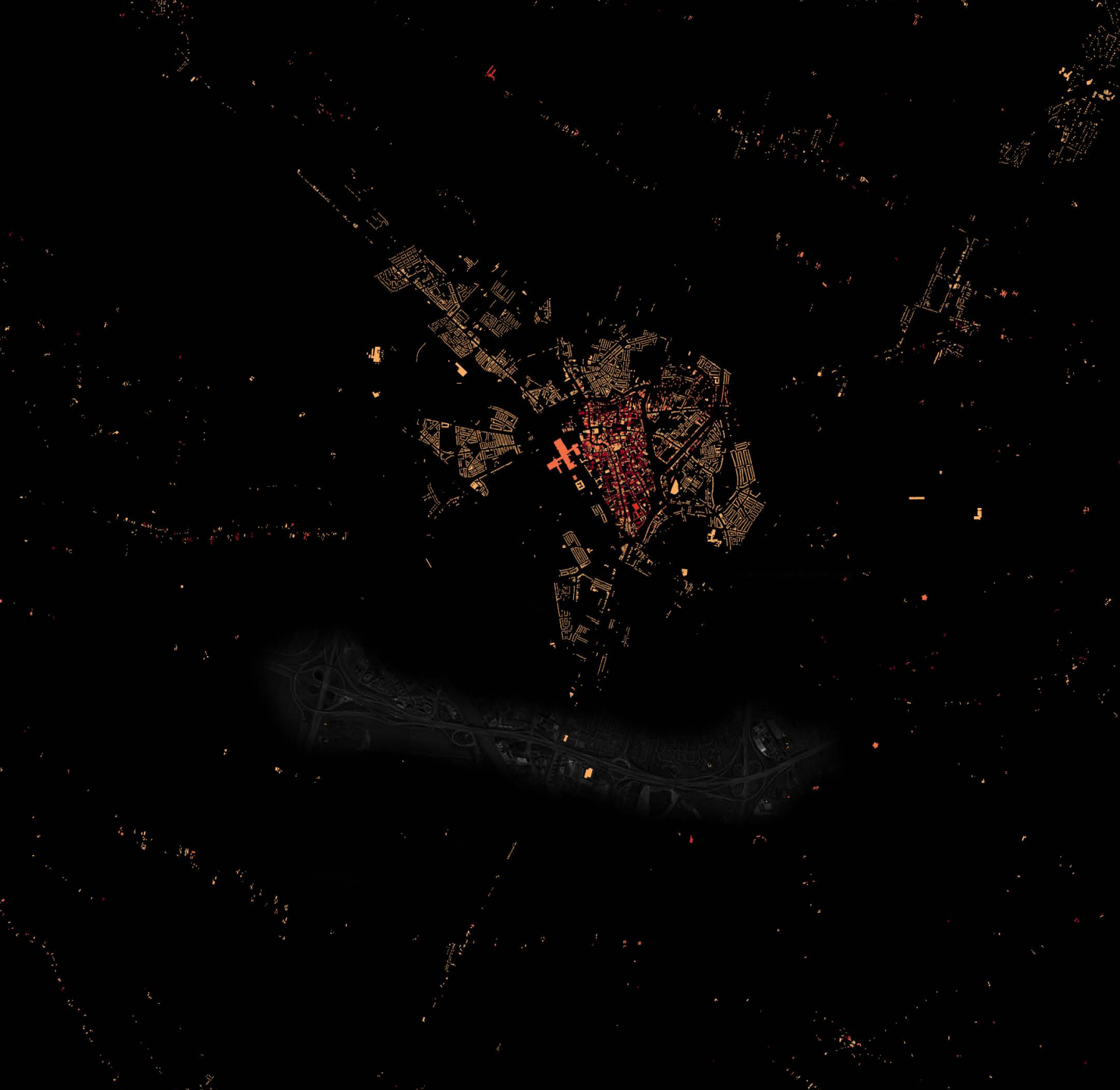
1960-1975

1975-1985

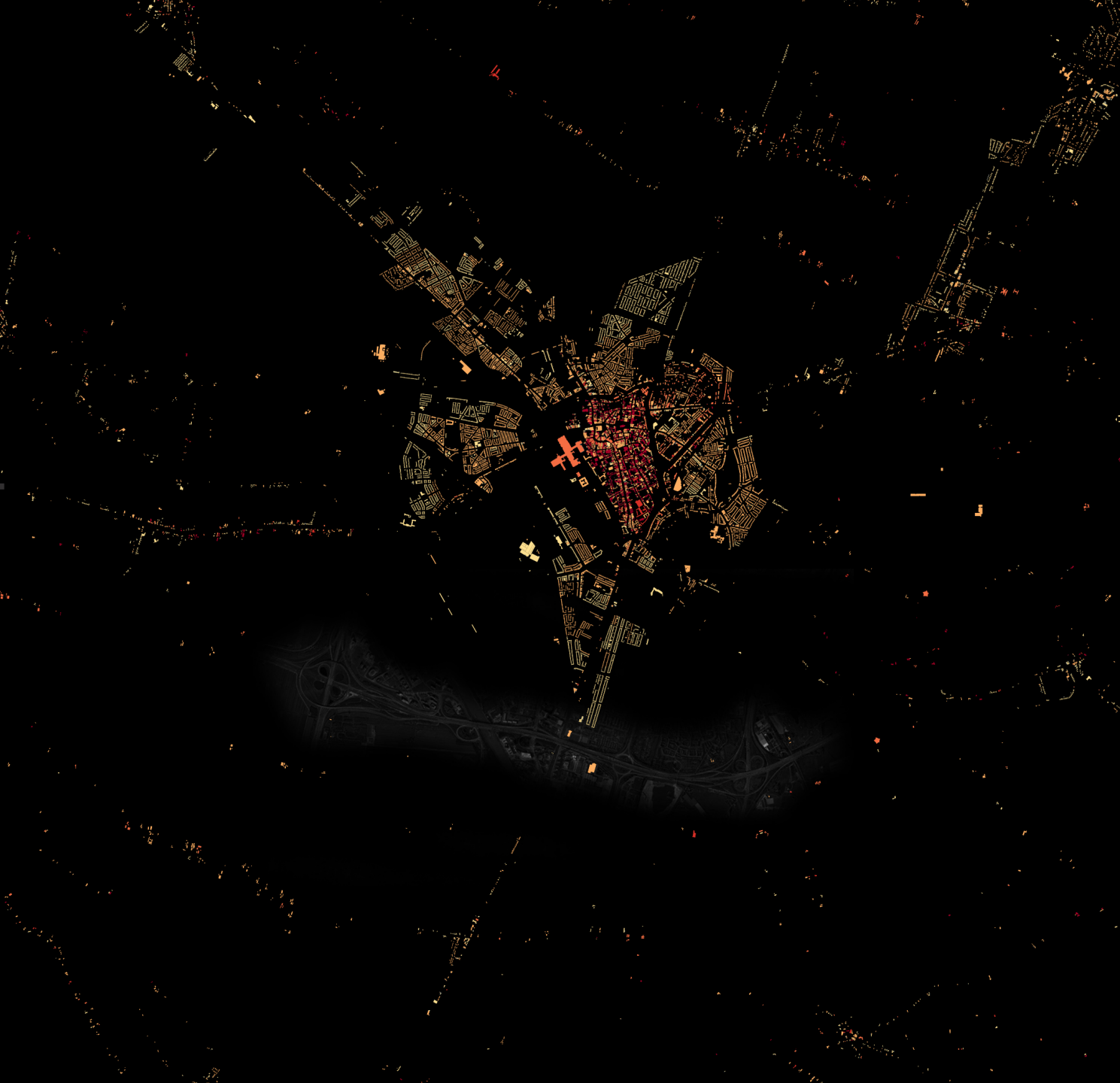
1985-1995

1995-2005

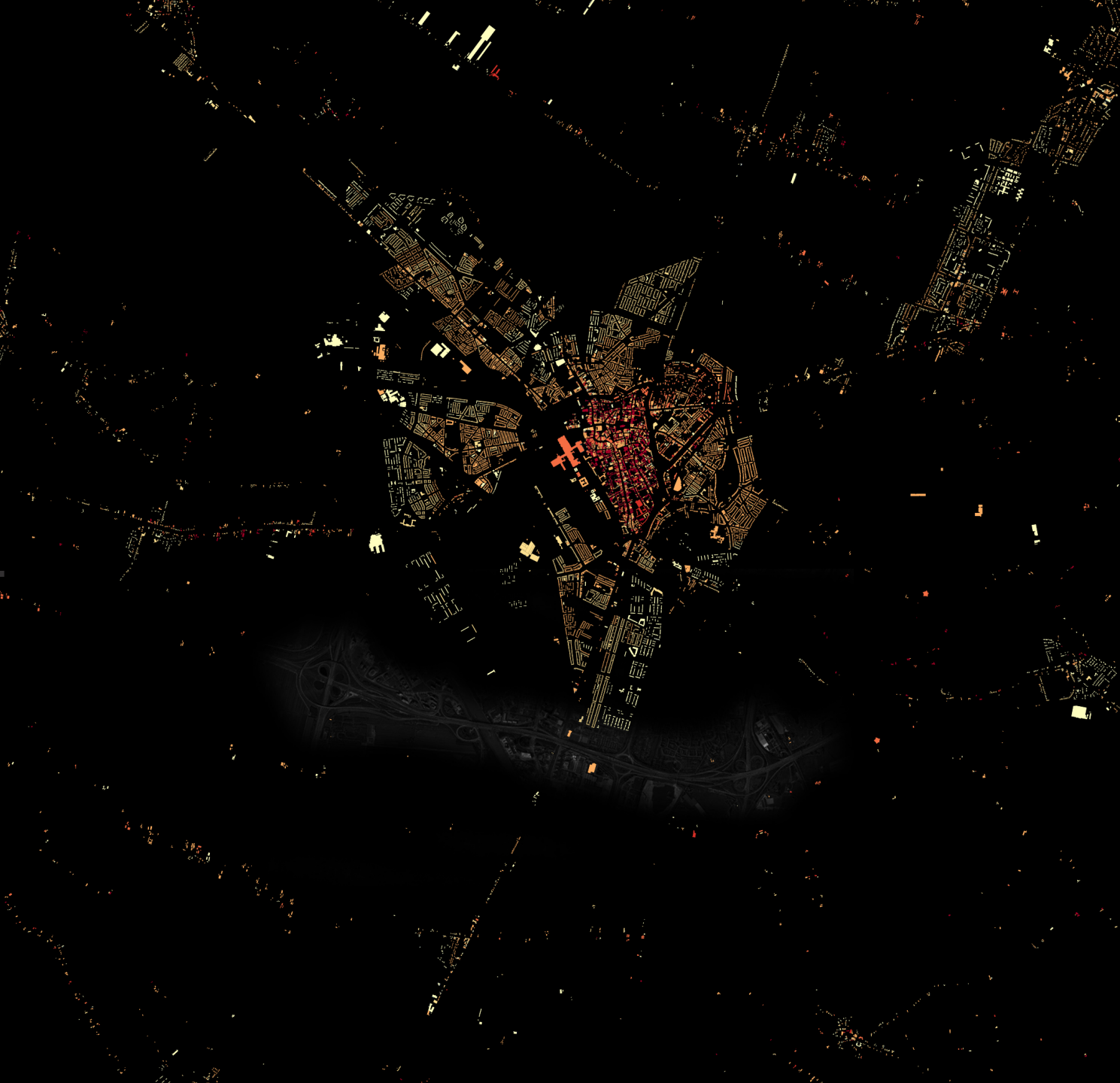
> 2005

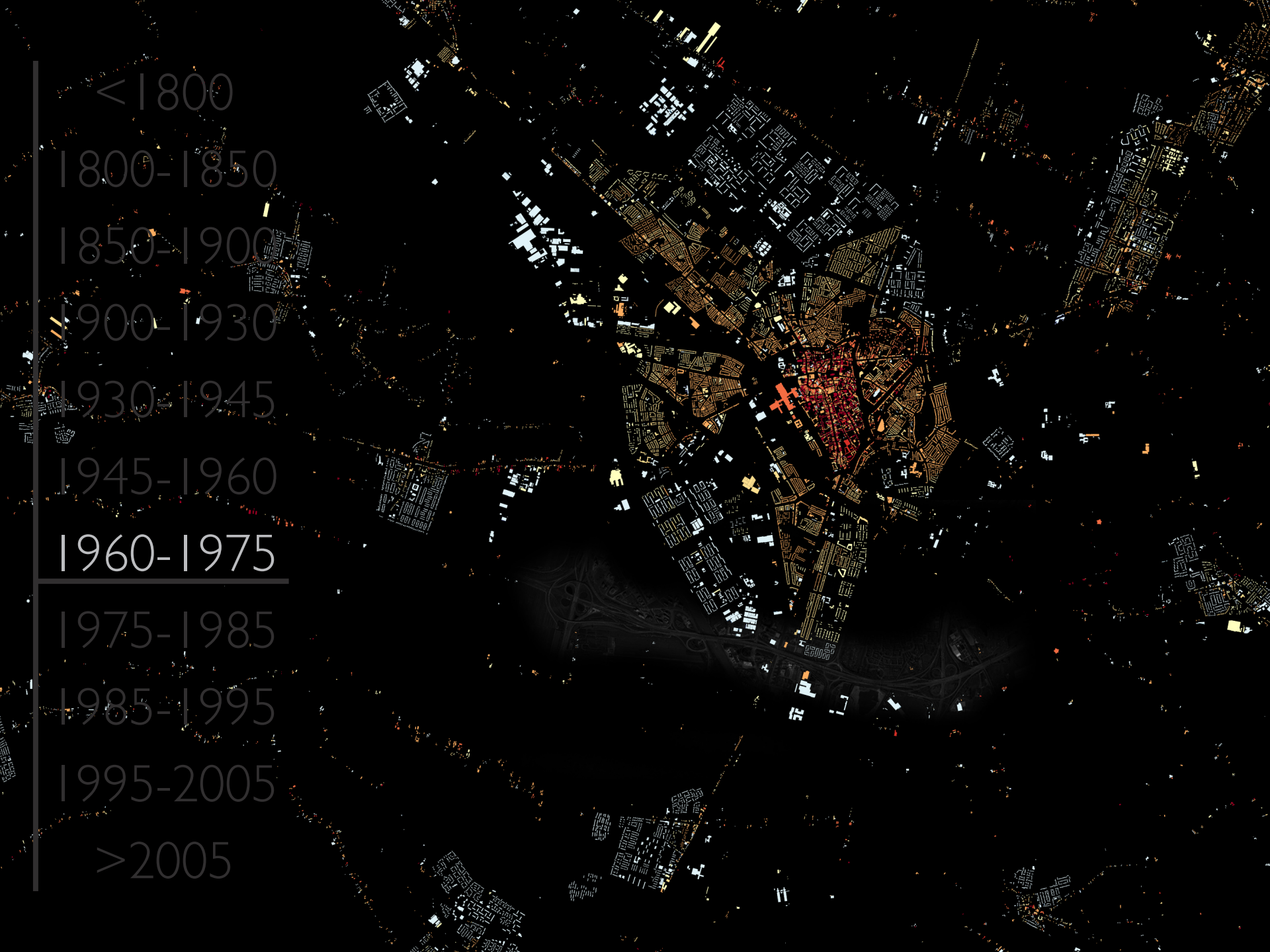


- < 1800
- 1800-1850
- 1850-1900
- 1900-1930
- 1930-1945
- 1945-1960
- 1960-1975
- 1975-1985
- 1985-1995
- 1995-2005
- > 2005



- < 1800
- 1800-1850
- 1850-1900
- 1900-1930
- 1930-1945
- 1945-1960**
- 1960-1975
- 1975-1985
- 1985-1995
- 1995-2005
- > 2005





<1800

1800-1850

1850-1900

1900-1930

1930-1945

1945-1960

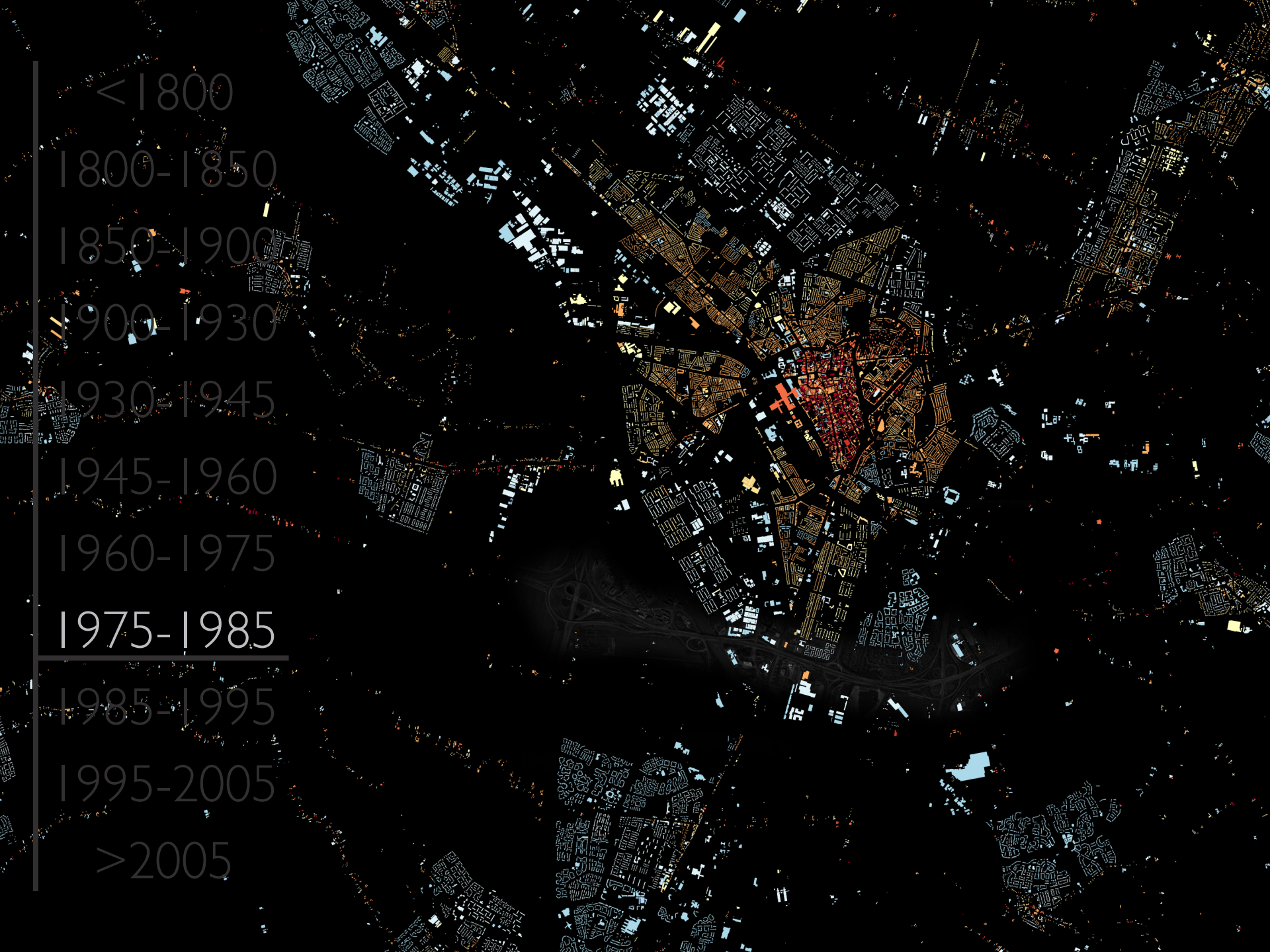
1960-1975

1975-1985

1985-1995

1995-2005

>2005



< 1800

1800-1850

1850-1900

1900-1930

1930-1945

1945-1960

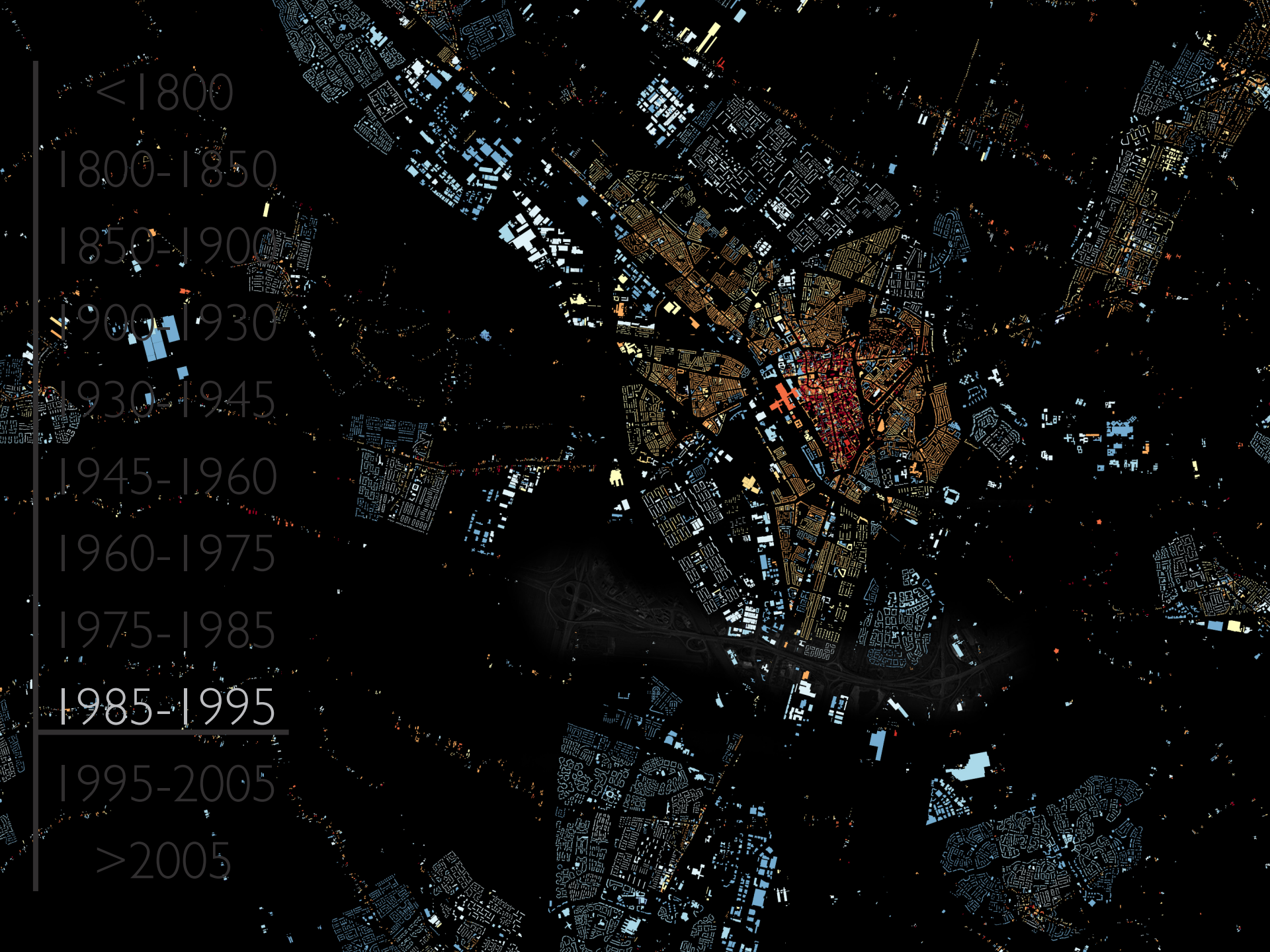
1960-1975

1975-1985

1985-1995

1995-2005

> 2005



<1800

1800-1850

1850-1900

1900-1930

1930-1945

1945-1960

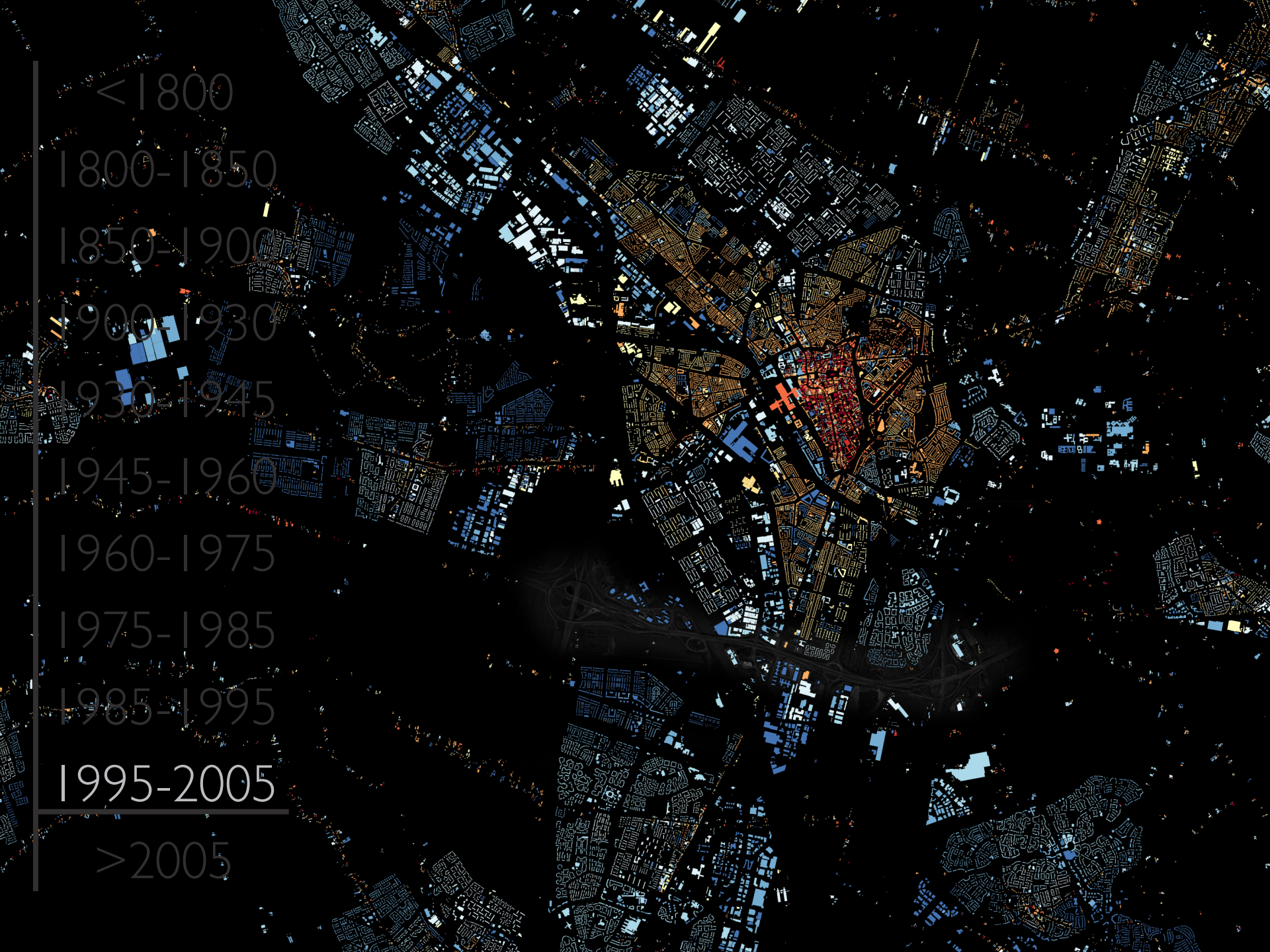
1960-1975

1975-1985

1985-1995

1995-2005

>2005



<1800

1800-1850

1850-1900

1900-1930

1930-1945

1945-1960

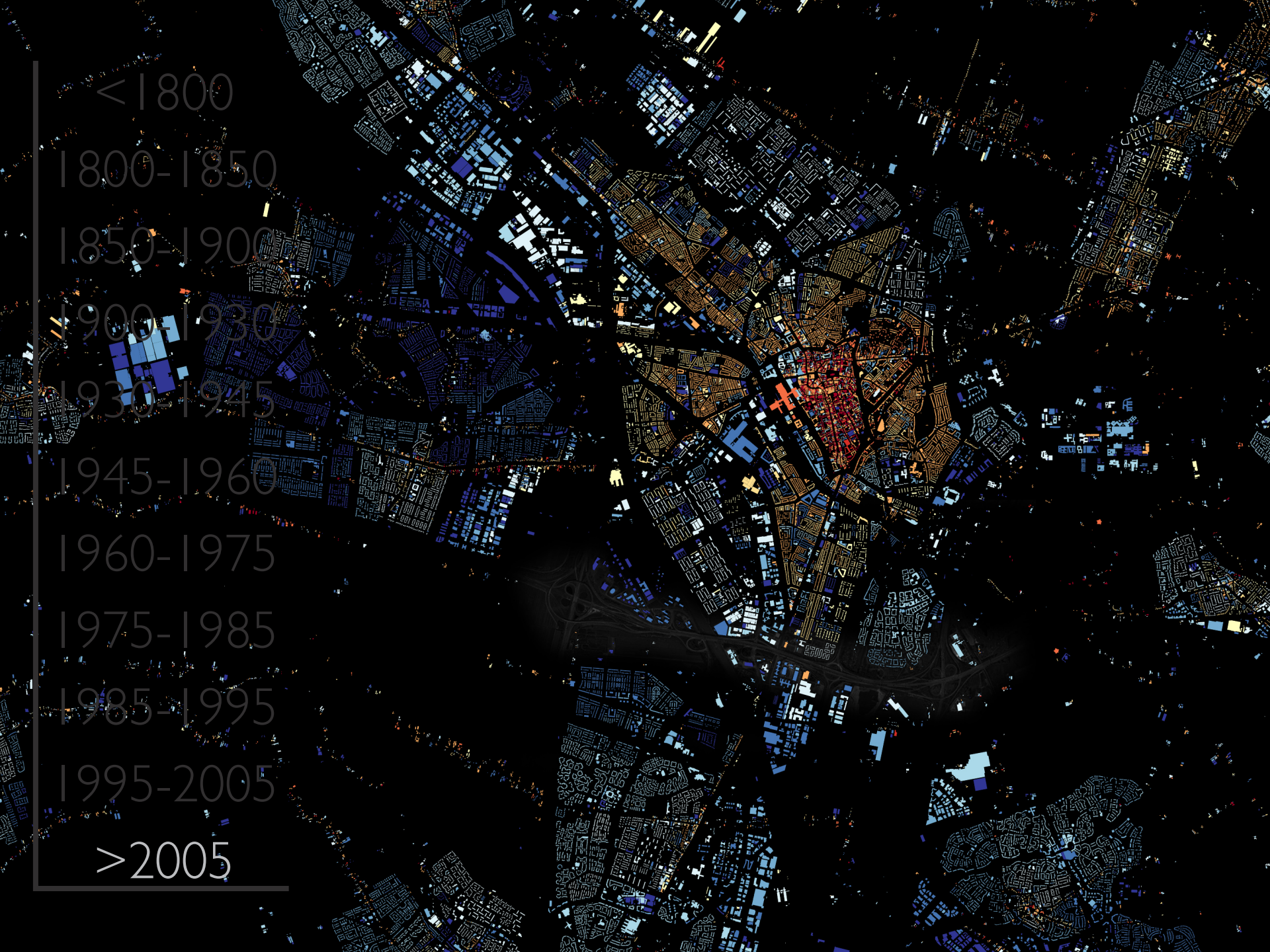
1960-1975

1975-1985

1985-1995

1995-2005

>2005



< 1800

1800-1850

1850-1900

1900-1930

1930-1945

1945-1960

1960-1975

1975-1985

1985-1995

1995-2005

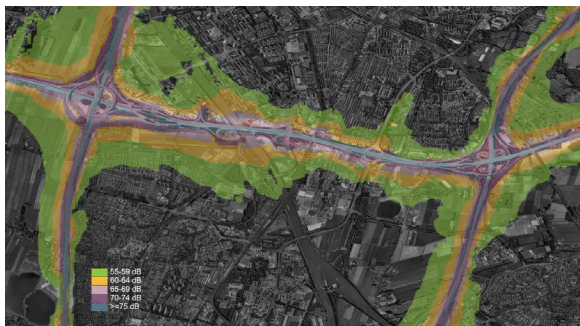
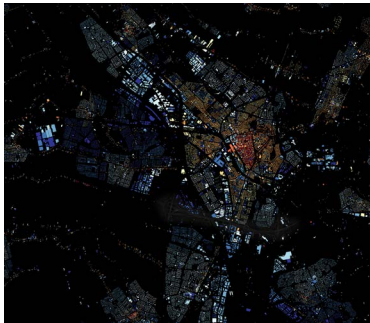
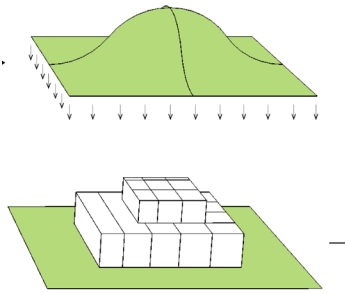
> 2005





- 55-59 dB
- 60-64 dB
- 65-69 dB
- 70-74 dB
- ≥75 dB





FASCINATION

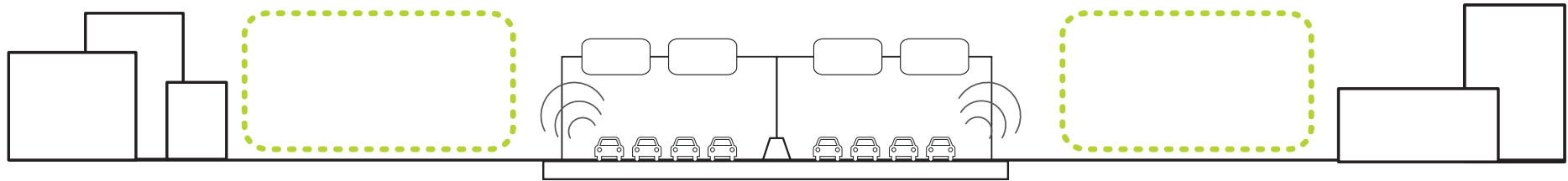
+

POPULATION

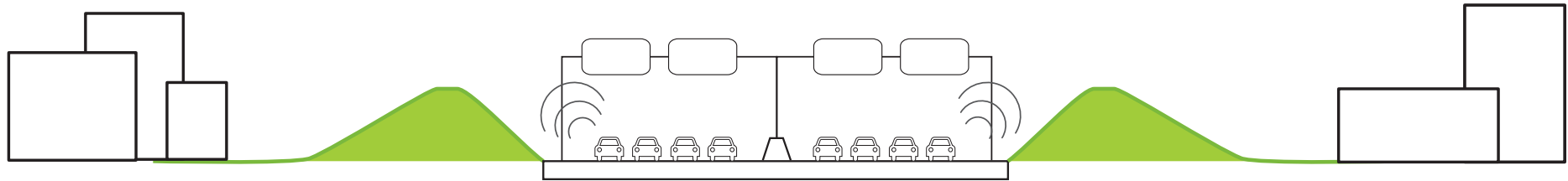
+

POLLUTION

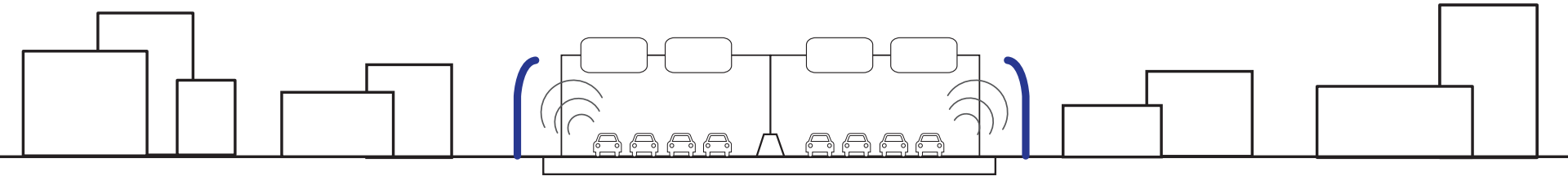
MAKE THE AREA LIVABLE: NOISE REDUCTION

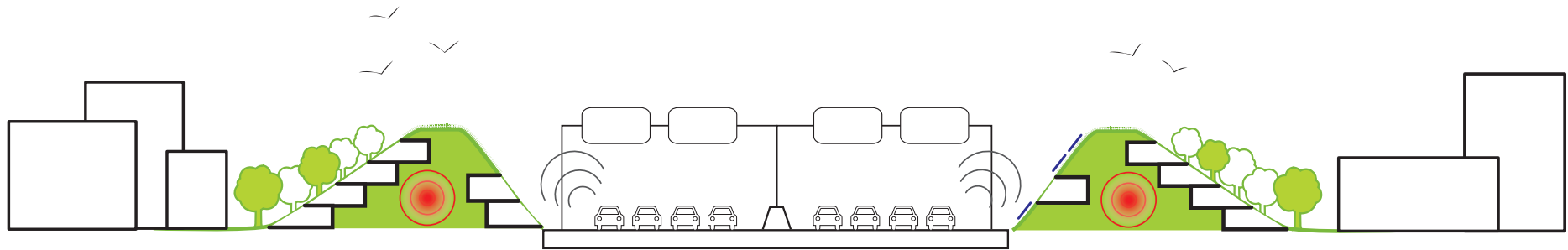


TYPICAL EARTH BERMS

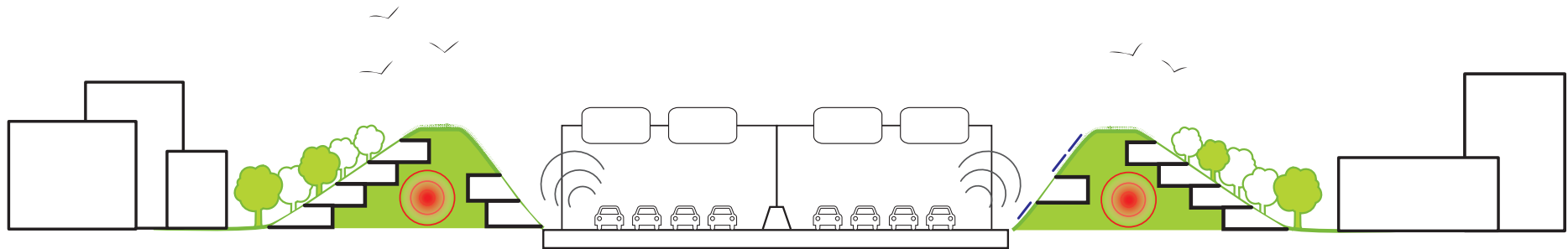


SOUND WALL





SMART!



INTEGRATED FUNCTIONS LANDSCAPE ENERGY & SUSTAINABILITY

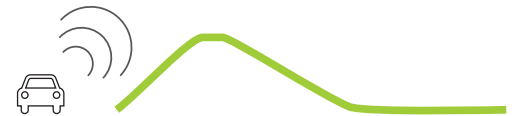
DESIGN QUESTION

How can building and landscape be merged and made to respond to the problems present in a highway environment, by turning the earth berm sound barriers into a smart solution and exploiting their potentials?

CONSTRUCTING AN EARTH SHELTER



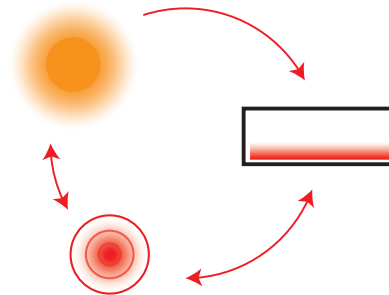
EARTH BERMS AS SOUND BARRIERS



GREEN OVER BUILDINGS



THERMAL ENERGY CYCLE



LIGHT CONDITIONS

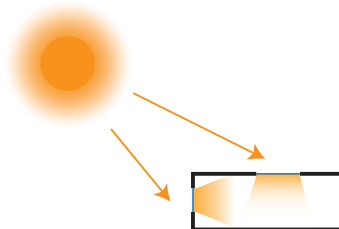




Fig. 3.3.1 Sound is reduced with distance.

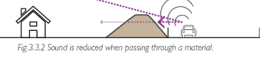


Fig. 3.3.2 Sound is reduced when passing through a material.



Fig. 3.3.3 Buildings can act as sound barriers.

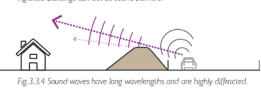


Fig. 3.3.4 Sound waves have long wavelengths and are highly diffract.

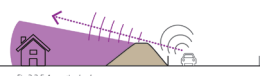


Fig. 3.3.5 Acoustic shadow zone.

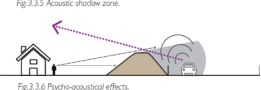


Fig. 3.3.6 Psycho-acoustic effects.

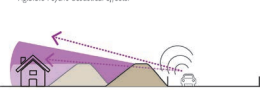


Fig. 3.3.7 The closer the barrier to the source the better.

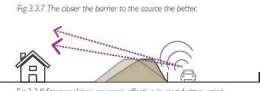


Fig. 3.3.8 Steeper slopes are more effective in sound attenuation.

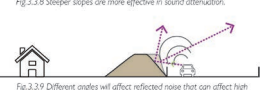


Fig. 3.3.9 Different angles will affect reflected noise that can affect high angles.



Fig. 3.3.10 A soft edge will encourage greater diffraction.

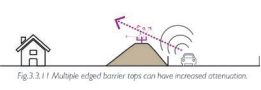


Fig. 3.3.11 Multiple edged barrier tops can have increased attenuation.

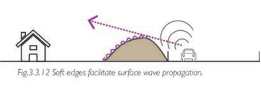


Fig. 3.3.12 Soft edges facilitate sound wave propagation.

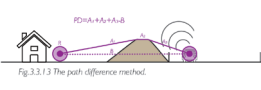


Fig. 3.3.13 The path difference method.

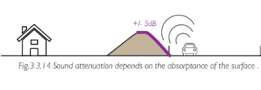


Fig. 3.3.14 Sound attenuation depends on the absorbance of the surface.

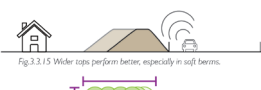


Fig. 3.3.15 Wider tops perform better, especially in soft berms.

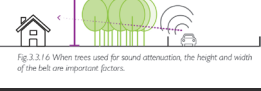


Fig. 3.3.16 When trees used for sound attenuation, the height and width of the belt are important factors.



Fig. 3.1.2 Pressure and loads exerted by surrounding soil.



Fig. 3.1.3 Lateral thrusts exerted by creep of the hill.



Fig. 3.1.4 Snow will exert extra load.

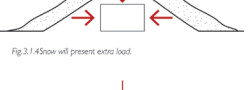


Fig. 3.1.5 Lighter substrates can be used instead of soil.

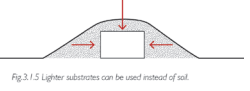


Fig. 3.1.6 Foam below the soil can reduce pressure and loads.

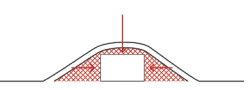


Fig. 3.1.7 Amount of thermal insulation needed in vertical surfaces varies.

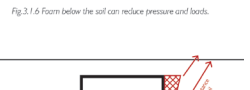


Fig. 3.1.8 Pressure and loads exerted by surrounding soil.

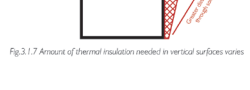


Fig. 3.1.9 The amount of thermal mass is proportional to the time of heat storage.

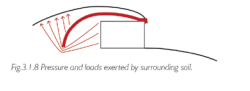


Fig. 3.1.9 Good ventilation to avoid summer humid air to condensate in rooms and against cold walls.



Fig. 3.1.10 A soft edge will encourage greater diffraction.

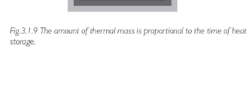


Fig. 3.1.11 Multiple edged barrier tops can have increased attenuation.

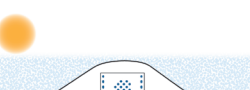


Fig. 3.1.12 Soft edges facilitate sound wave propagation.



Fig. 3.1.13 The path difference method.



Fig. 3.1.14 Sound attenuation depends on the absorbance of the surface.



Fig. 3.1.15 Wider tops perform better, especially in soft berms.



Fig. 3.1.16 When trees used for sound attenuation, the height and width of the belt are important factors.

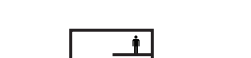


Fig. 3.2.1 Multi-level spaces as much as possible.



Fig. 3.2.2 Warm and bright colours.



Fig. 3.2.3 Natural light in entrance area.



Fig. 3.2.4 Ventilation in a manner perceptible to the users.

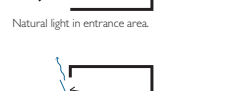


Fig. 3.2.5 Easily recognisable entrance.



Fig. 3.2.6 High ceilings. (low ceilings bring negative associations with the underground).



Fig. 3.2.7 Spacious rooms to avoid claustrophobic feeling.

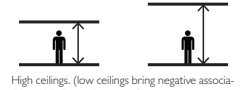


Fig. 3.2.8 Domed ceilings will circulate air up to 3 times faster than flat ceilings.

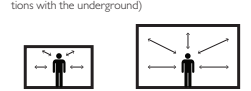


Fig. 3.2.9 Limiting Depth = (h-2H) x tanA



Fig. 3.2.10 For daylight uniformity: Limiting Depth = 2[(1-Rg)] / [(1+Rg) + (1-Rg)]

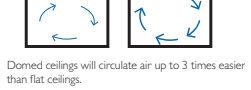


Fig. 3.2.11 As a rule of thumb the limiting depth in terms of light is 2.5 times the floor-to-window height.



Fig. 3.2.1 Light is the most important physiological criterion in designing underground structures.



Fig. 3.2.2 More than one light sources for each space. Skylights.



Fig. 3.2.3 Glass partitions where possible.

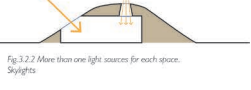


Fig. 3.2.4 Large atrium spaces.

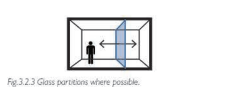


Fig. 3.2.5 Beamed daylight systems.

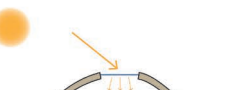


Fig. 3.2.6 Replicate spectral composition of daylight.

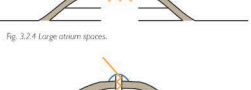


Fig. 3.2.7 Avoid narrow dark stairways.



Fig. 3.2.8 Bright outside surfaces for maximum light reflections.



Fig. 3.2.9 Use of water for light reflections.



Fig. 3.2.10 Domed ceilings can magnify light reflection up to 3 times that of a flat ceiling.



Fig. 3.2.11 Interior courtyards as a substitute for outside view.



Fig. 3.4.1 More efficient land use.



Fig. 3.4.2 Different depths required for kind of vegetation.

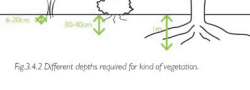


Fig. 3.4.3 Root protection layer.



Fig. 3.4.4 Drainage around the berms is required to avoid puddling.

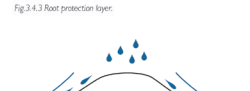


Fig. 3.4.5 For slopes steeper than 1:3 water may not be absorbed sufficiently for plant growth.



Fig. 3.4.6 Maximum slopes for planting.



Fig. 3.4.7 For steeper slopes a stepped solution is possible.



Fig. 3.4.8 Retention techniques for steeper slopes than 20a.



Fig. 3.2.12 Need for connection with the outside world.



Fig. 3.2.15 People in work environments are more likely to favour view over direct sunlight if no sunlight is available.



Fig. 3.2.16 Interior courtyards as a substitute for outside view.



Fig. 3.5.1.1 Of the 100% solar radiation, part is absorbed by the atmosphere, part reflected back to space, and part absorbed at the earth's surface.

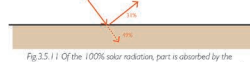


Fig. 3.5.1.2 Grass shading. Grass and low vegetation will shade the surface of the soil.



Fig. 3.5.1.3 A thin insulating layer of air is entrapped in the vegetation.



Fig. 3.5.1.4 Moisture in grass. The release of moisture from grass eliminates solar gains.



Fig. 3.5.1.5 More greenery will increase evaporation rates of the soil.



Fig. 3.5.1.6 Snow will form an insulating layer in winter time.



Fig. 3.5.1.7 An earth layer reduces thermal energy exchange between building and surroundings.

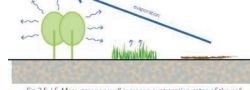


Fig. 3.5.1.8 The soil can provide passive radiative cooling or heating in the seasons.

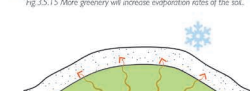


Fig. 3.5.1.9 The yearly temperature fluctuation of the interior is lower than that of outside air.



Fig. 3.5.1.10 Earthship principles.



Fig. 3.5.1.7 Soil can gain / lose heat when it comes in contact with water of different temperature.



Fig. 3.5.1.8 Moisture in the soil will absorb / release heat during phase changes (mainly evaporating).

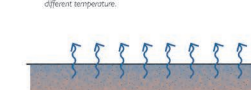


Fig. 3.5.1.9 Programmed irrigation can be used to influence the heat flux in the soil.



Fig. 3.5.2.0 Higher water content increases the thermal conductivity of soil but also its heat capacity.



Fig. 3.5.8 Interseasonal heat storage can be achieved in the ground.



Fig. 3.5.9 Aquifers are good heat storage mediums.

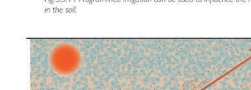


Fig. 3.5.10 Interseasonal heat storage in the soil is done in 100-500m depths.



Fig. 3.5.5 Rebalancing of interior temperature.

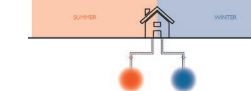
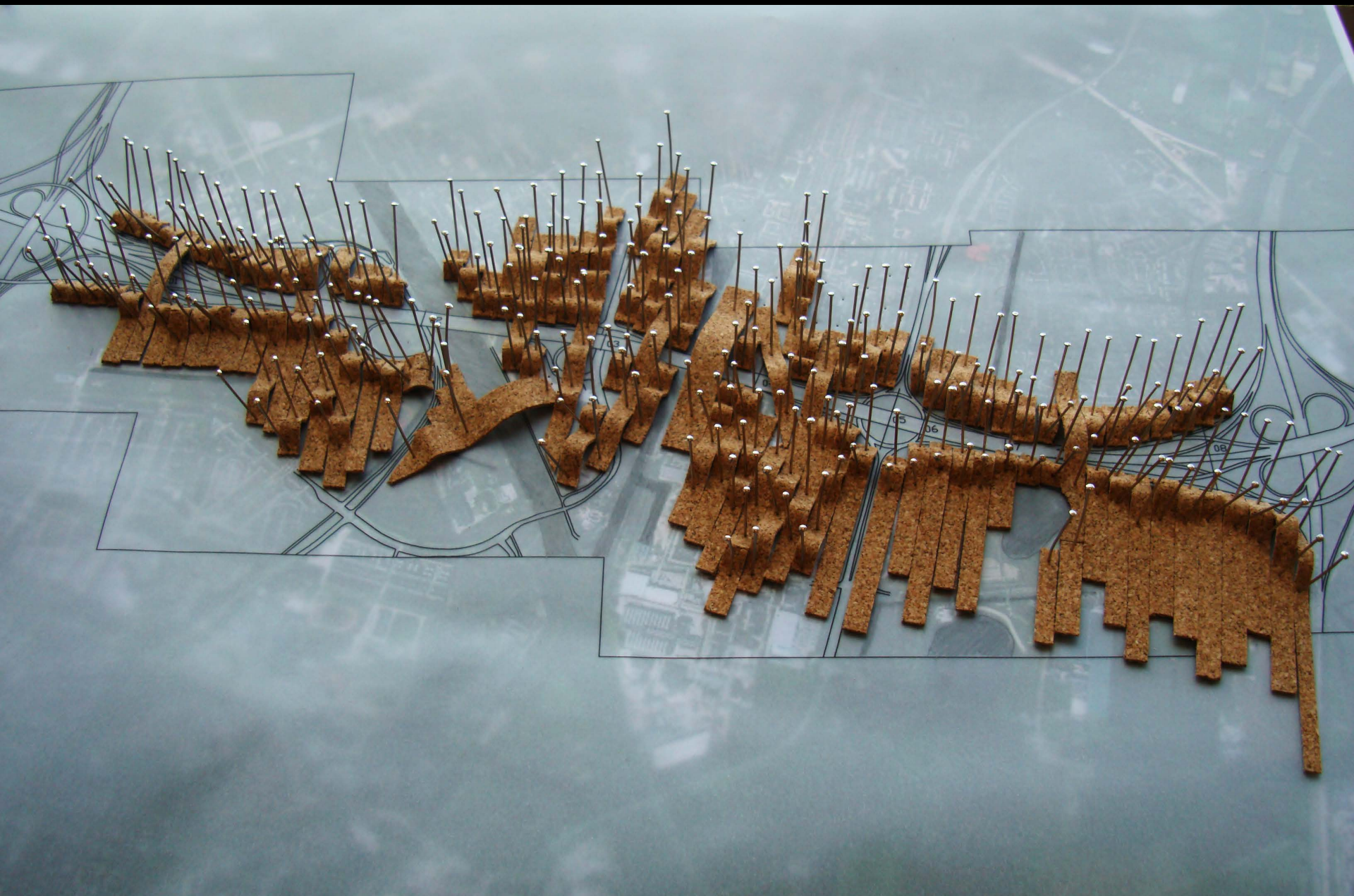


Fig. 3.5.6 Optimize thermal mass/space volume/gazing ratio.



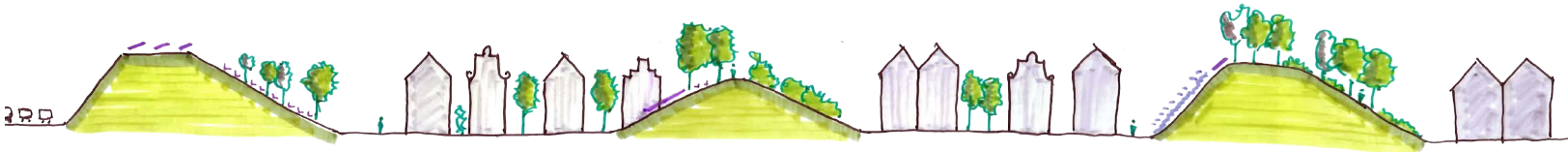




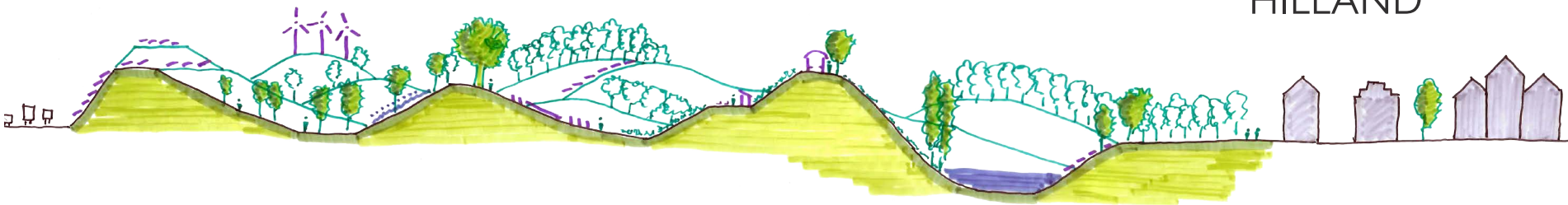
ACOUSTI-HILL (A)



ACOUSTI-HILL (B)



INTER-HILL



HILLAND



LINK





ACOUSTI-HILLS (A)

ACOUSTI-HILLS (B)

LINK

INTER-HILLS

02

HILLAND LINK HILLAND

LINK

03

LINK

HILLAND

LINK

INTER-HILLS

05

06

ACOUSTI-HILLS (A)

07

ACOUSTI-HILLS (B)

LINK





NEIGHBOURHOOD

HOUSING

RETAIL

ENTERTAINMENT

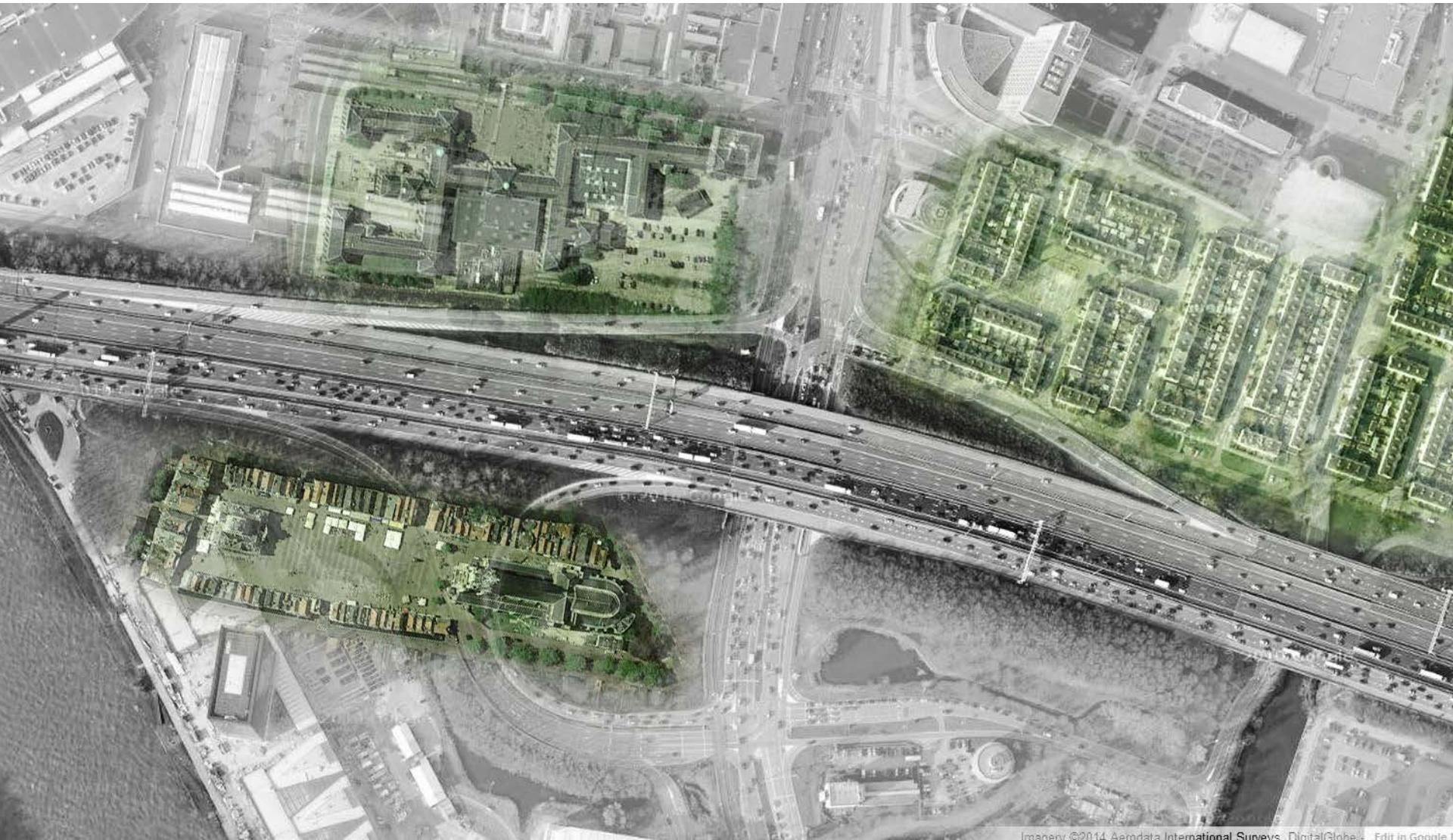
PUBLIC SPACE



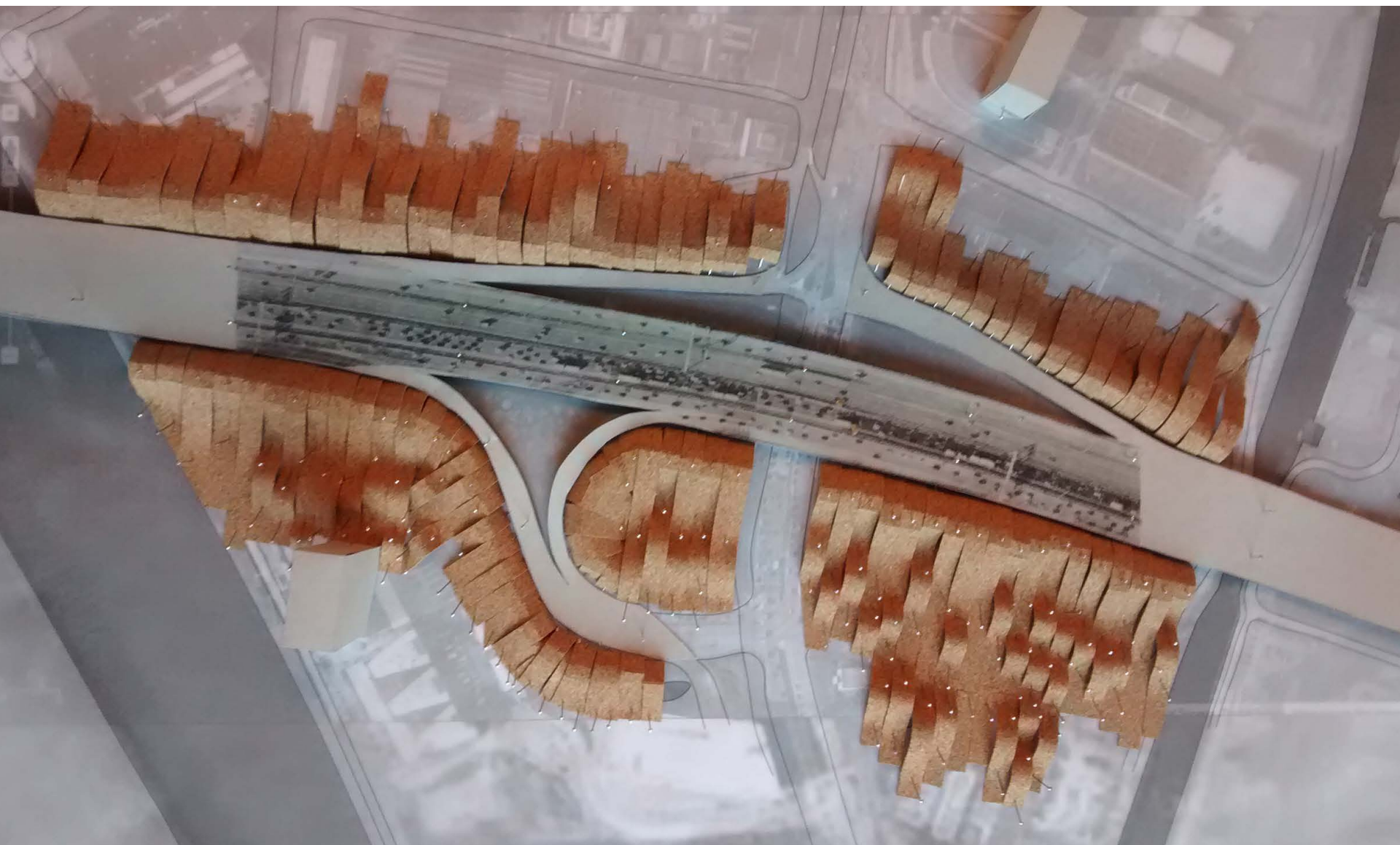
Imagery ©2014 Aerodata International Surveys, DigitalGlobe - Edit in Google M



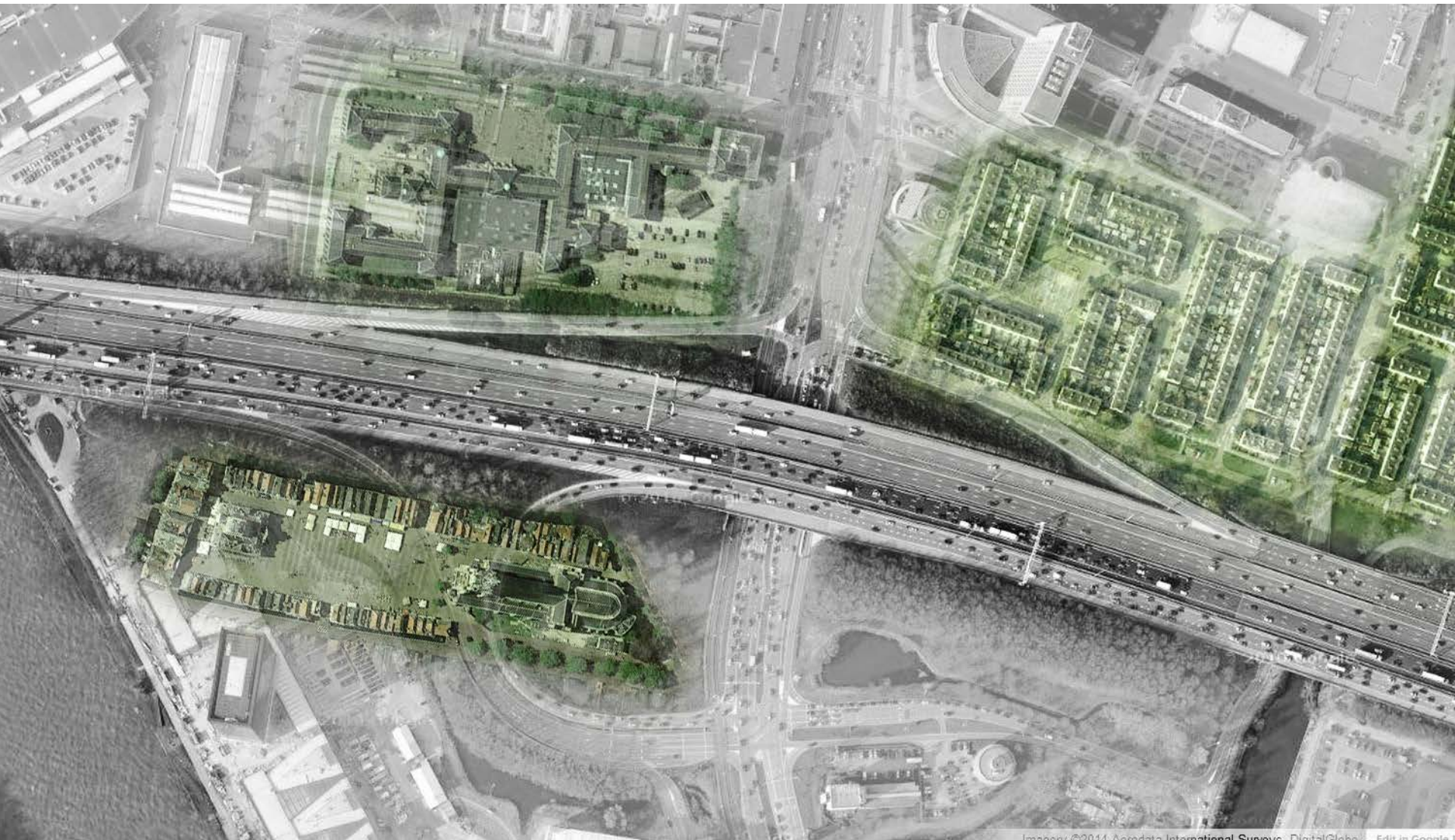
Imagery ©2014 Aerodata International Surveys, DigitalGlobe, Edit in Google



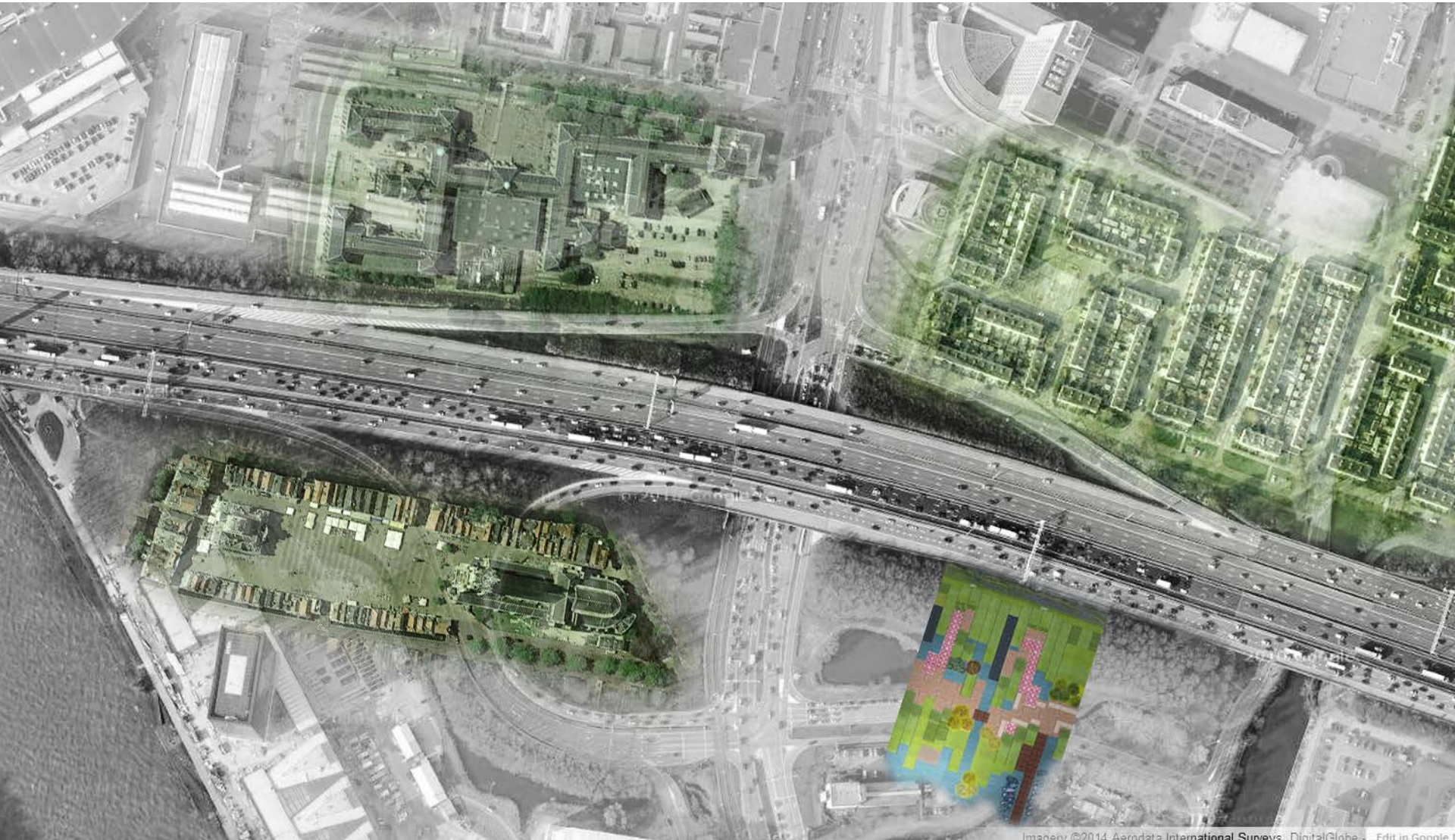
Imagery ©2014 Aerodata International Surveys, DigitalGlobe. Edit in Google Earth







Imagery ©2014 Aerodata International Surveys, DigitalGlobe, Edit in Google



INTEGRATED
DESIGN:

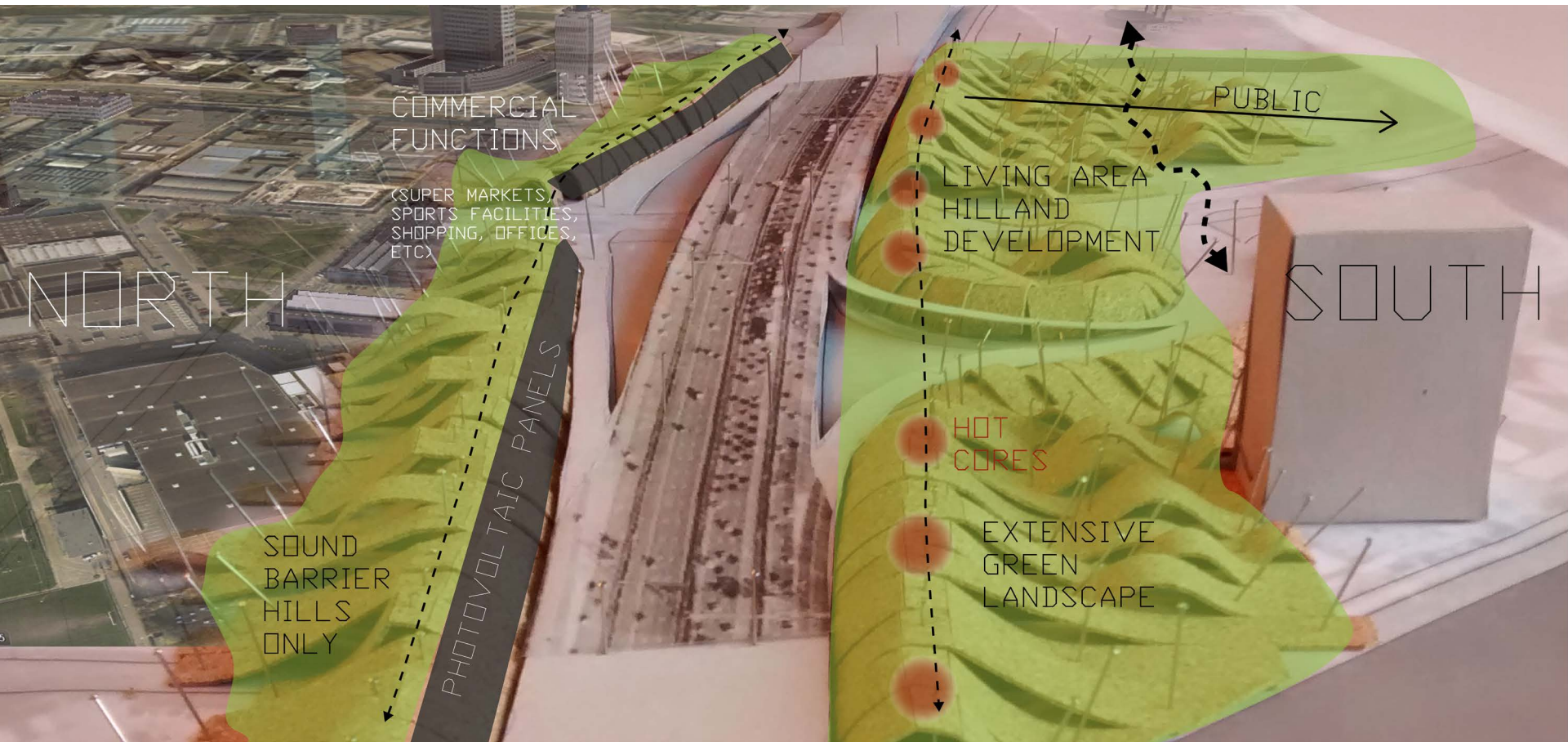
ARCHITECTURE
BUILDING TECHNOLOGY
CLIMATE DESIGN

ARCHITECTURE

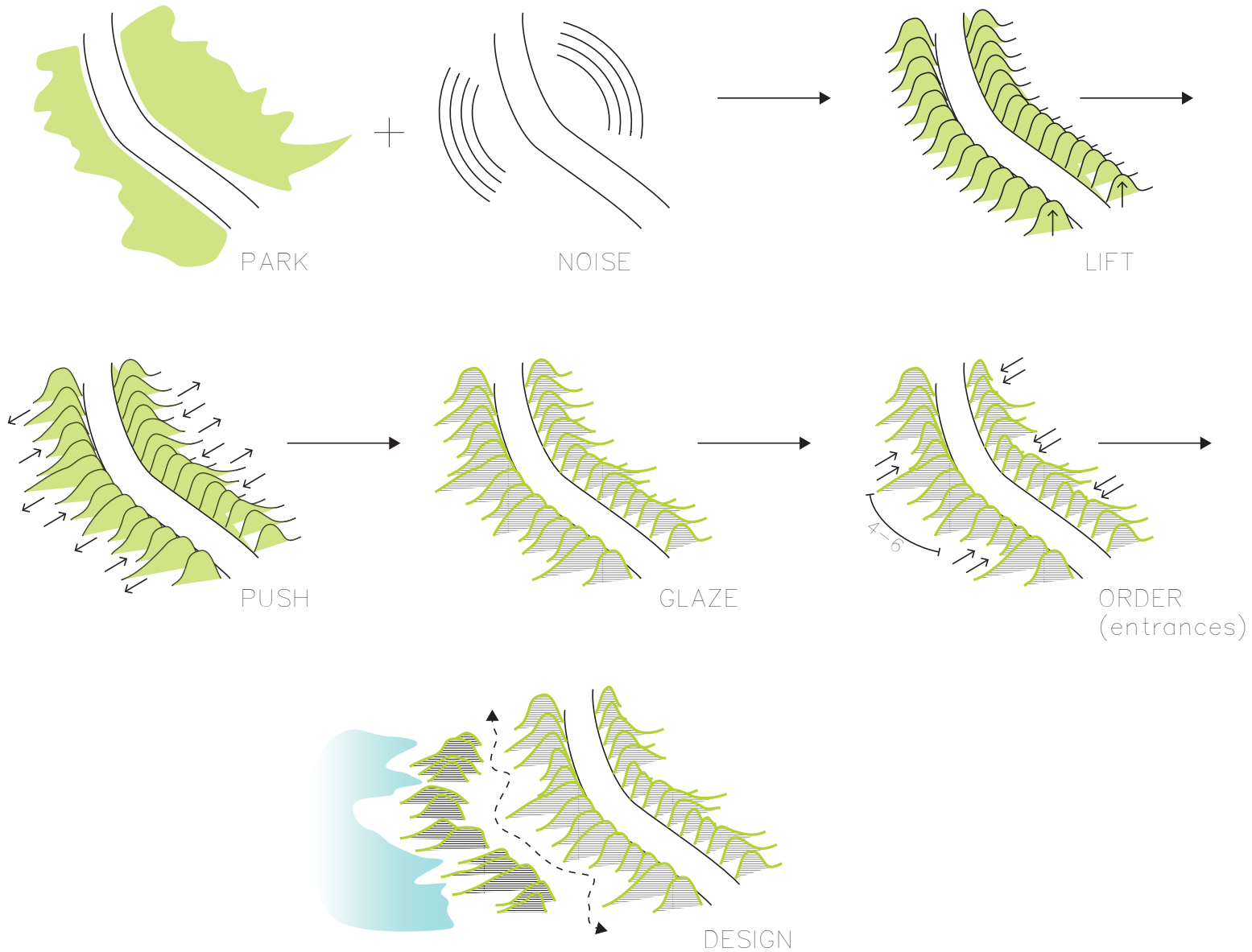


TECTURE

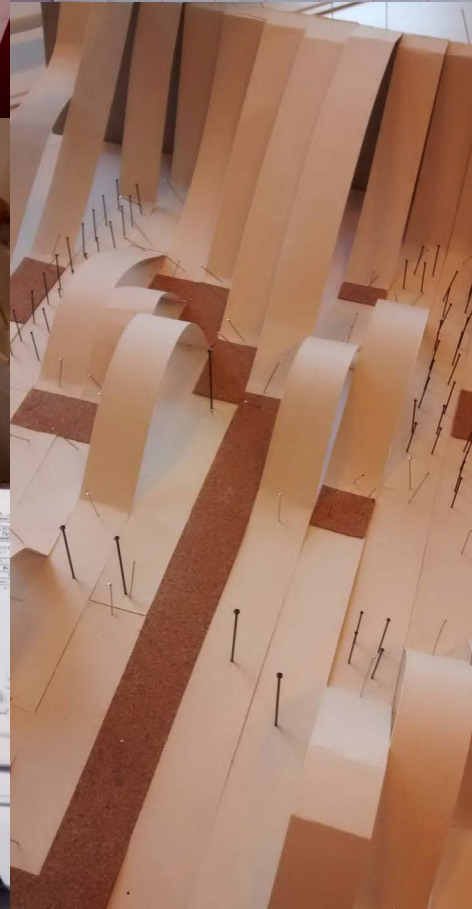
CONTEXT

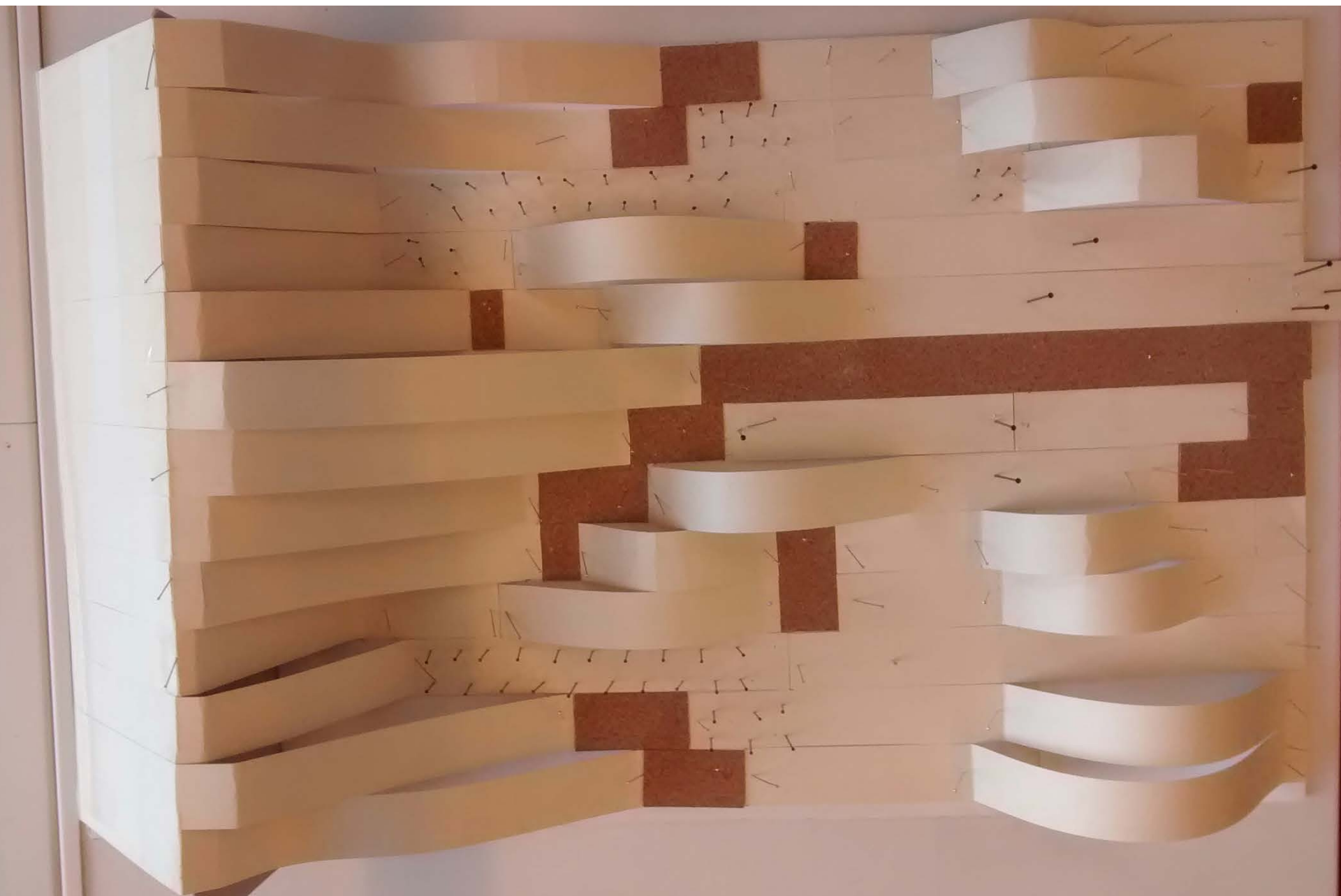


DEVELOPMENT

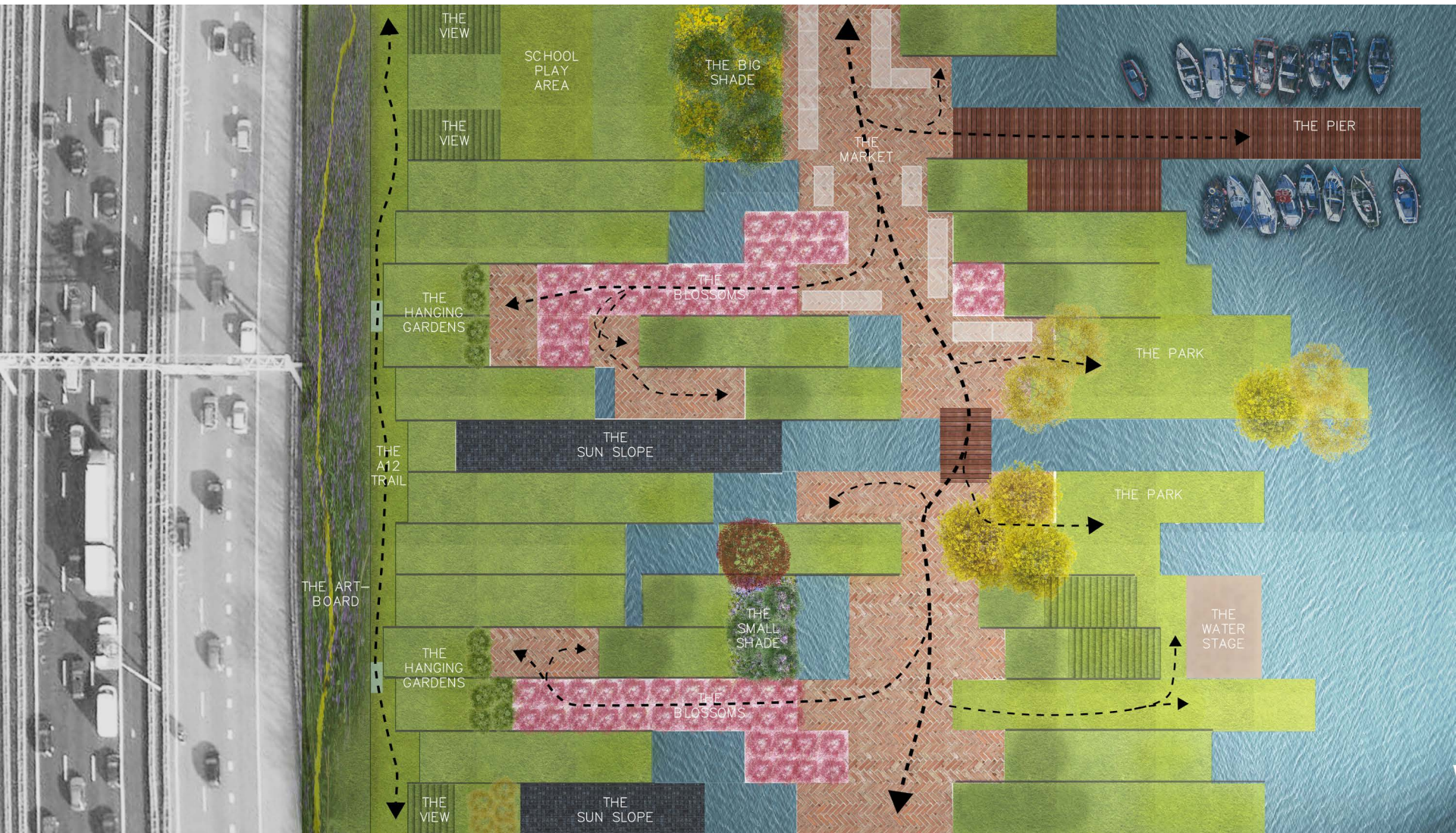


DEVELOPMENT

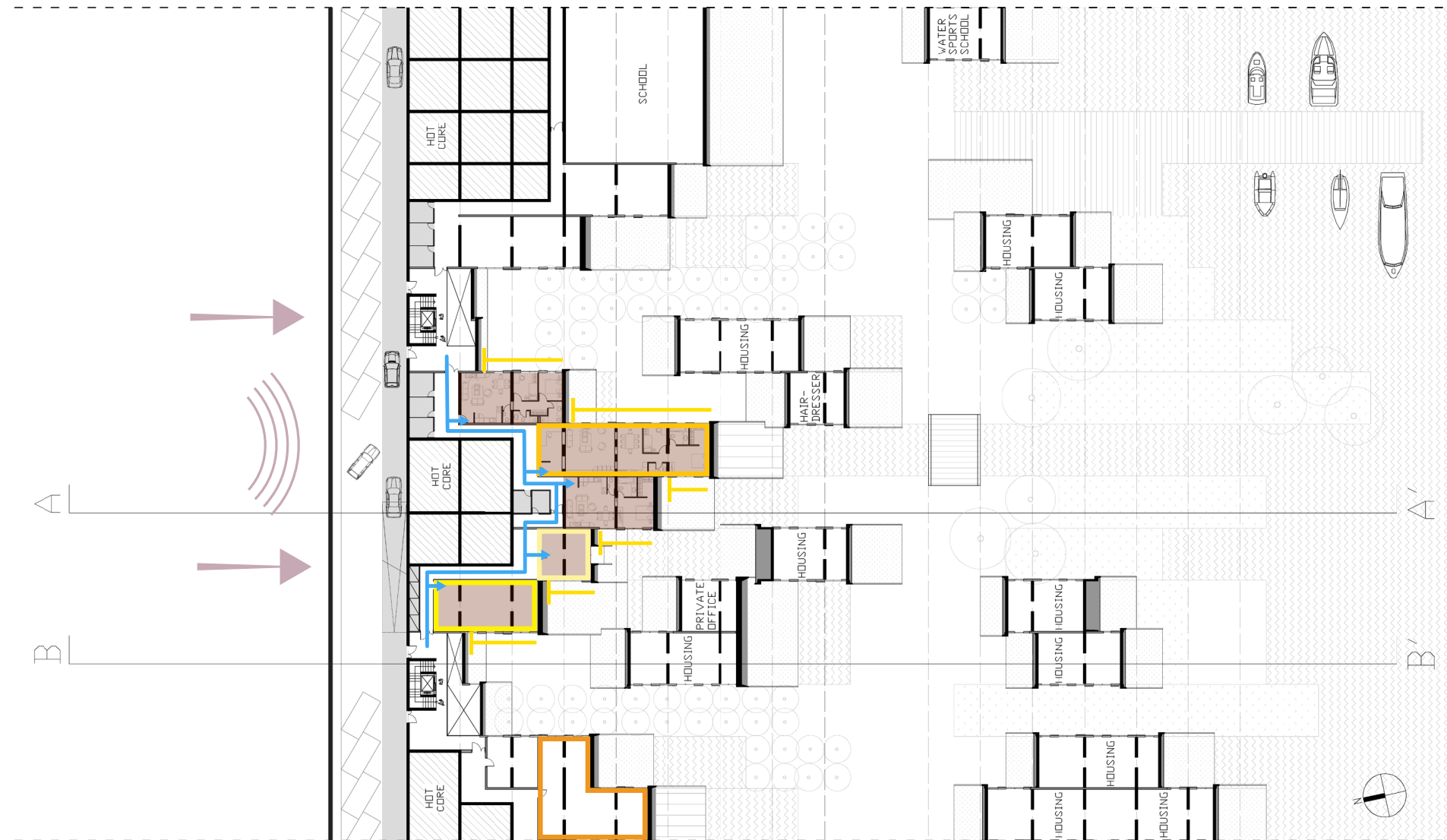


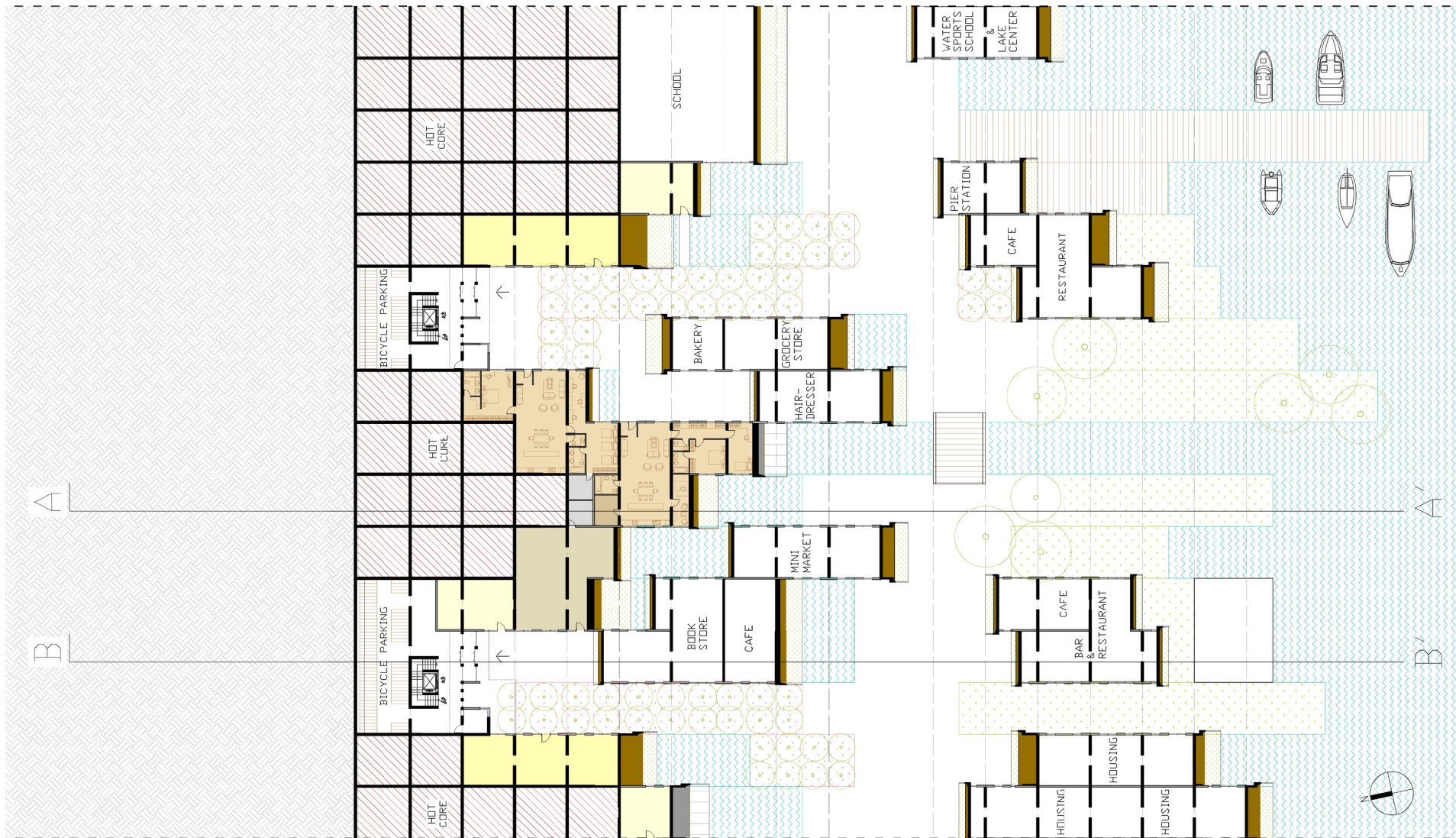


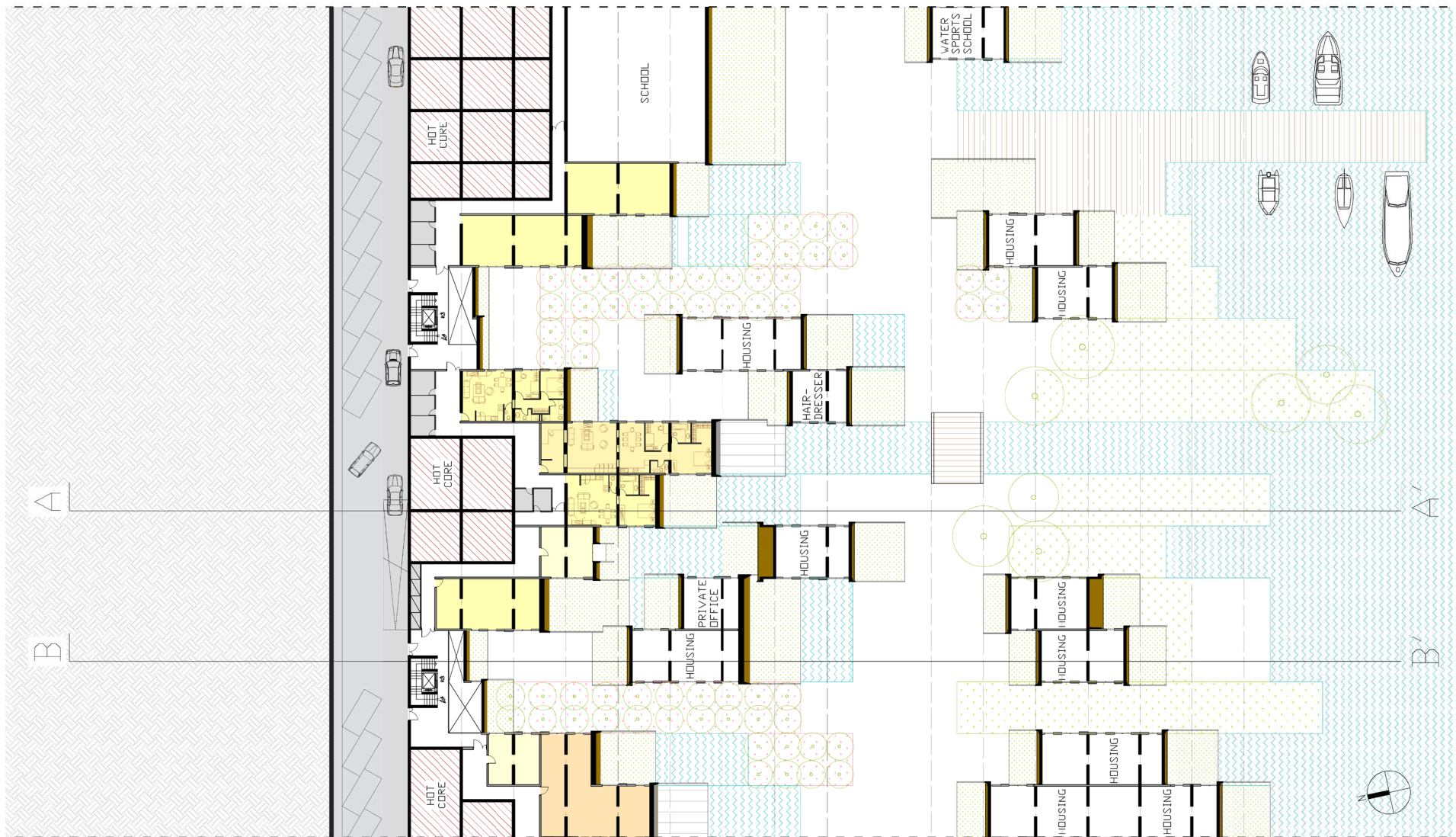
LANDSCAPE PLAN



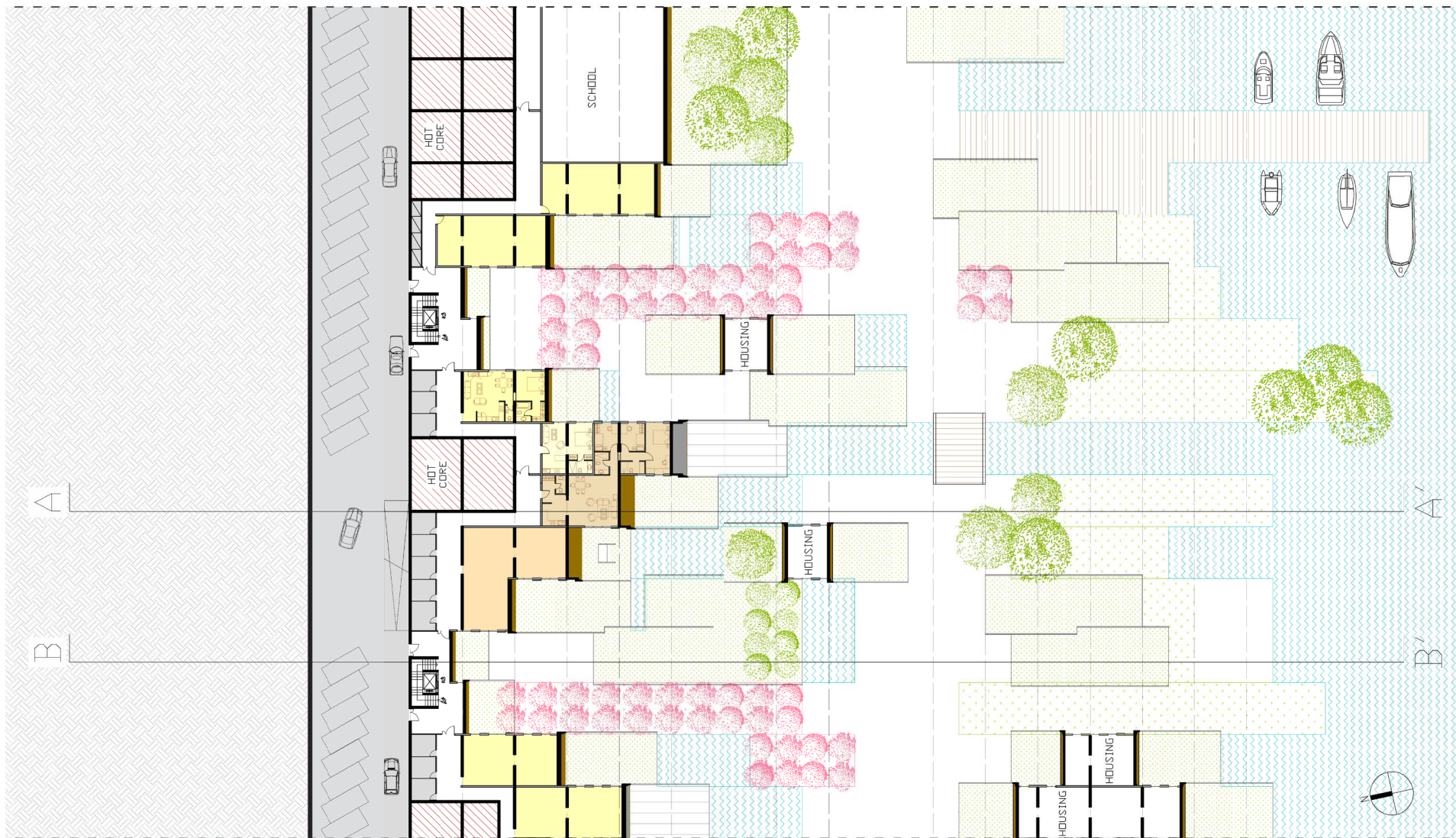
RULES OF PLANNING

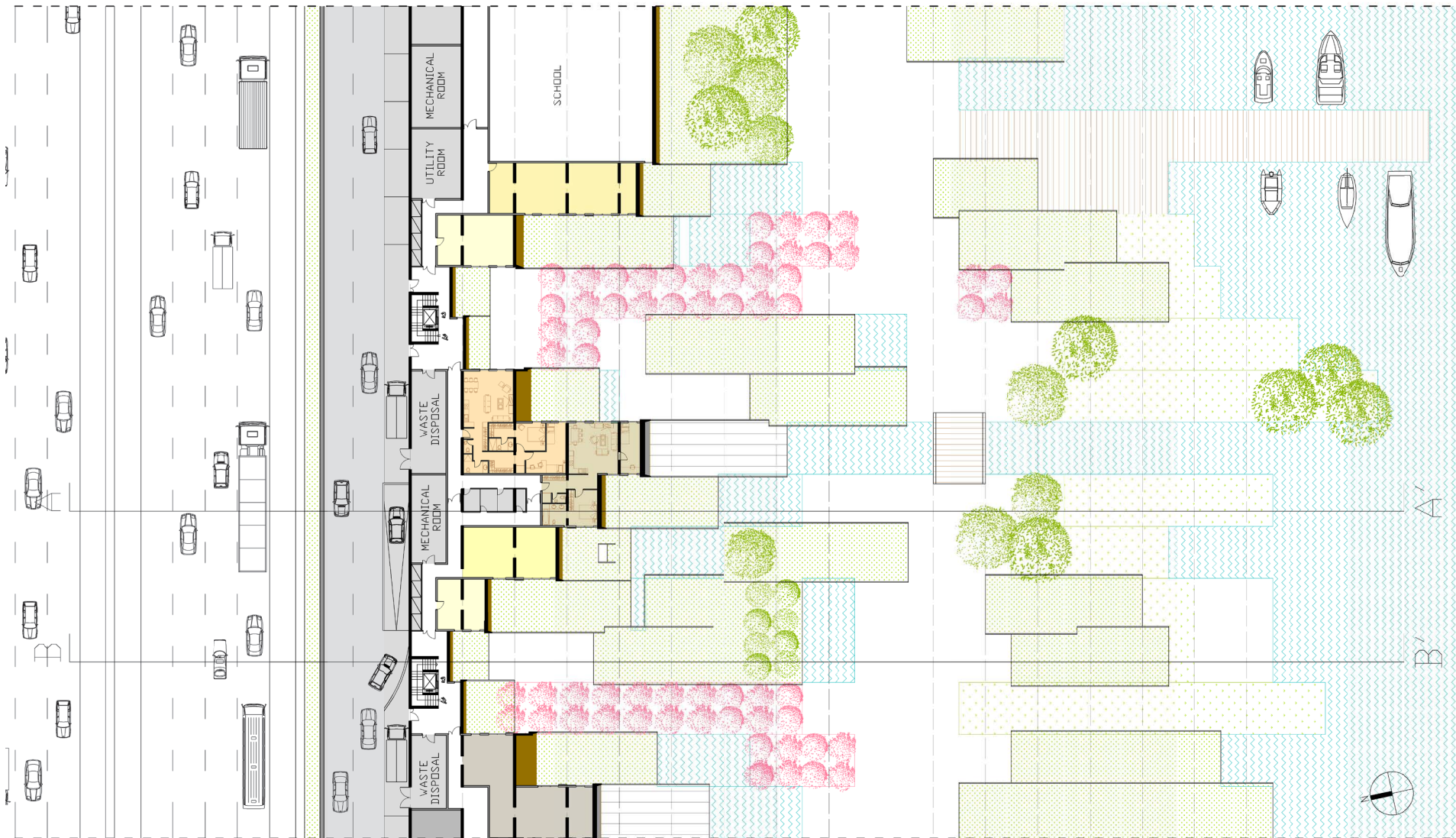


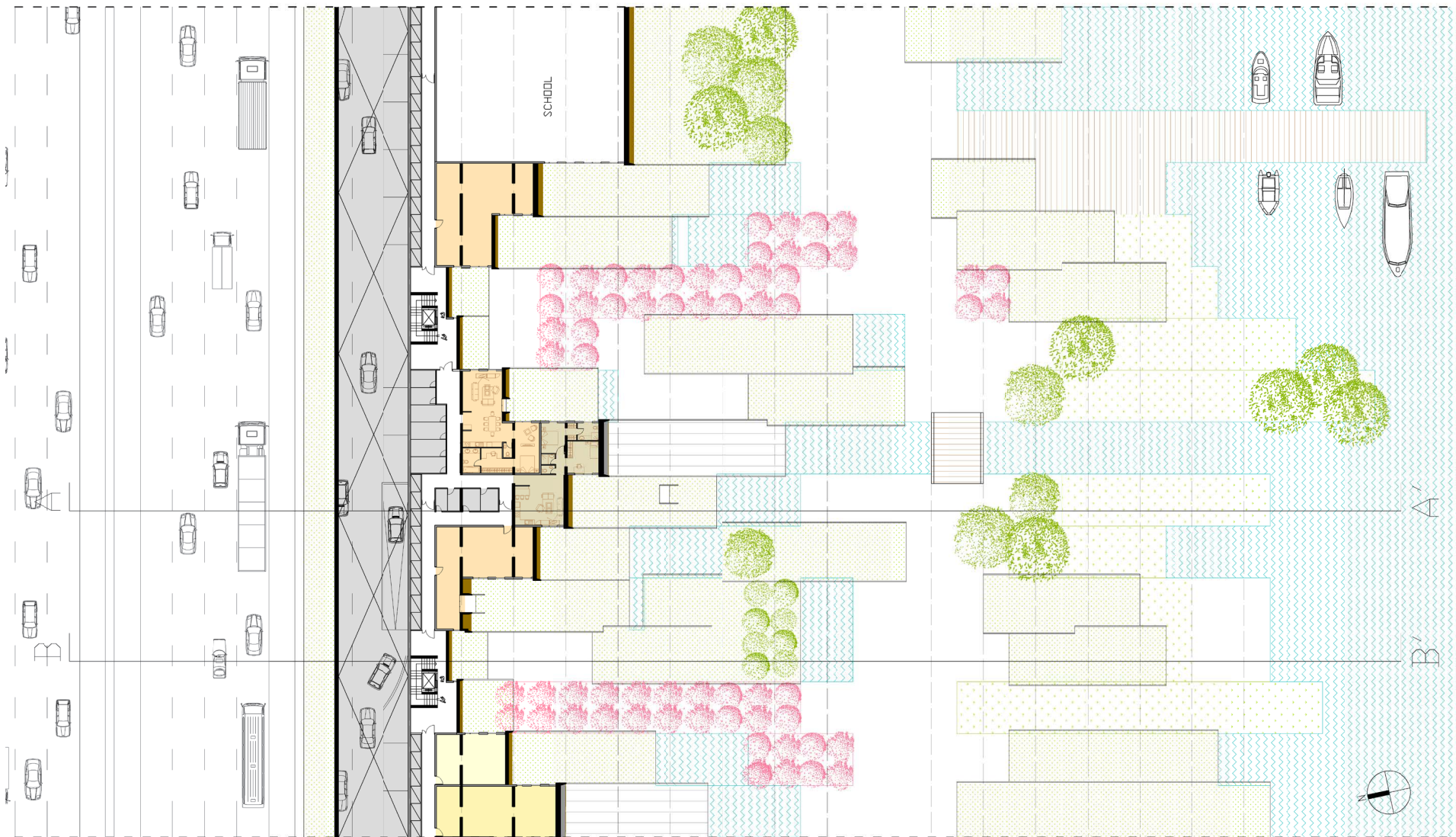


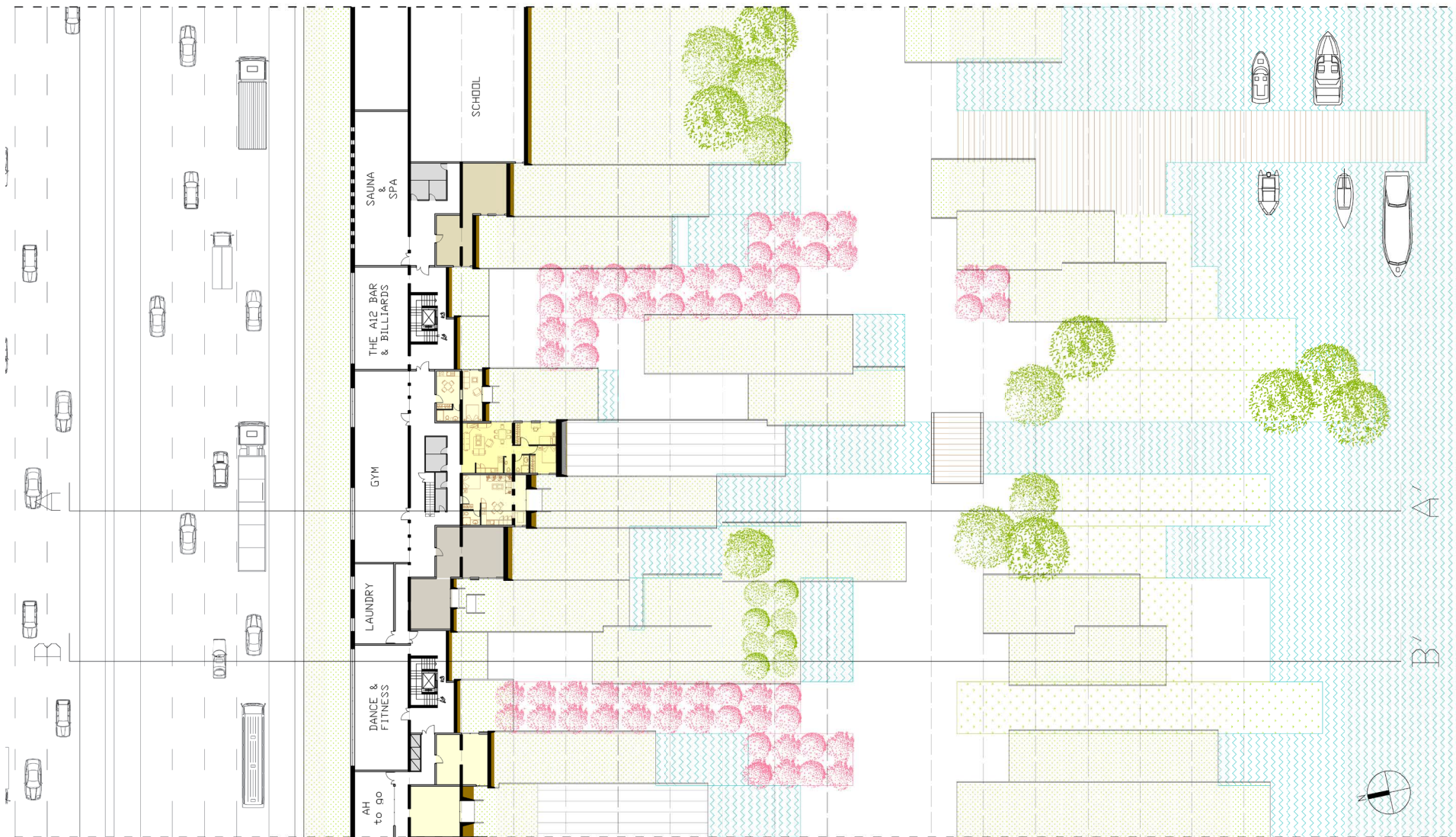


1:200







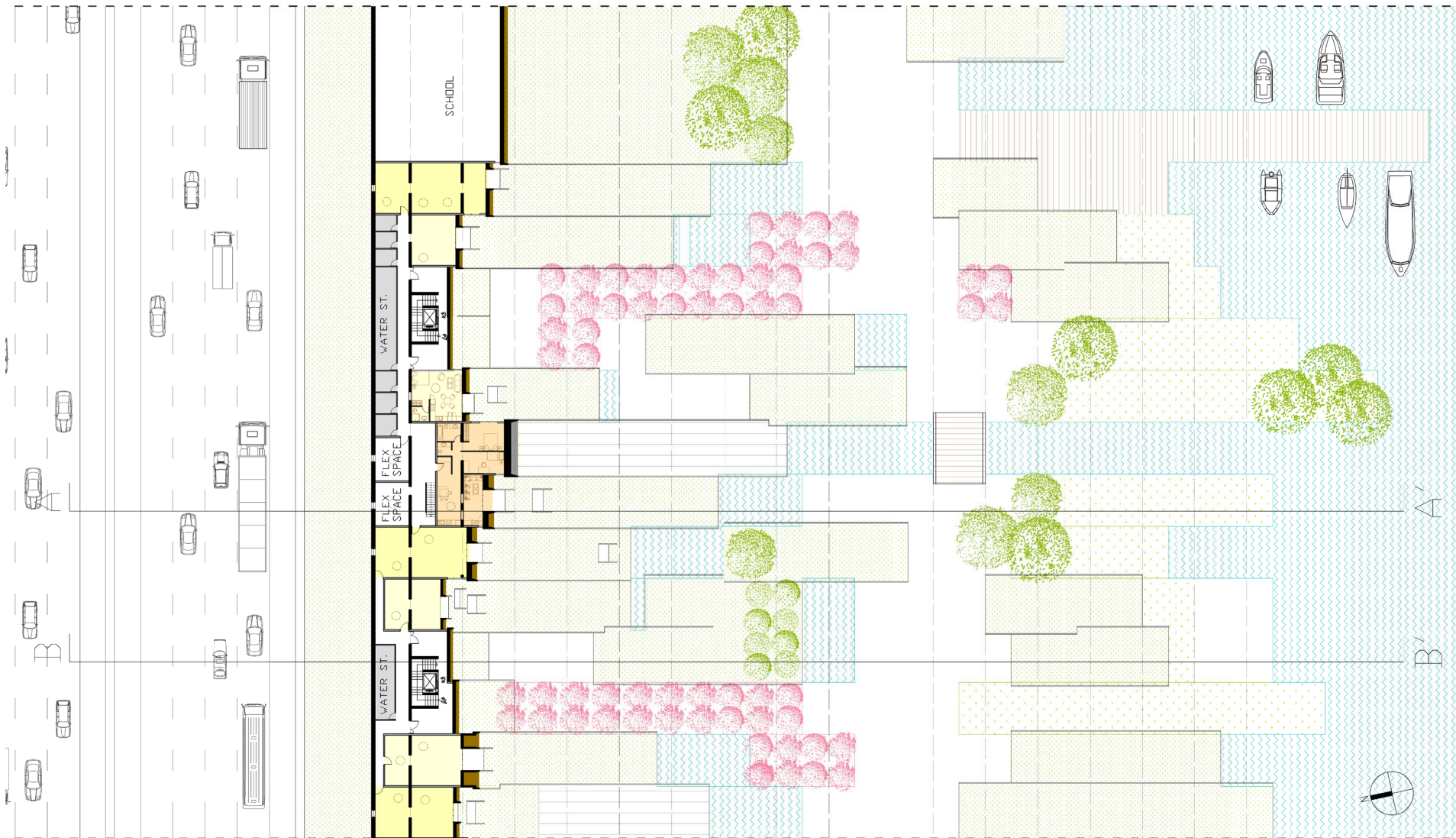


PLAN +06

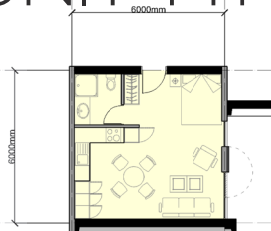
DWELLINGS: 7 DWELLERS: 16 STORAGE ROOMS: 6

1:200

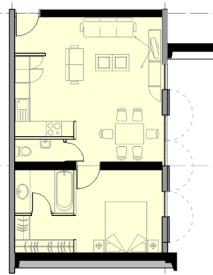
TOTAL: DWELLINGS: 52 DWELLERS: 147 STORAGE ROOMS: 49



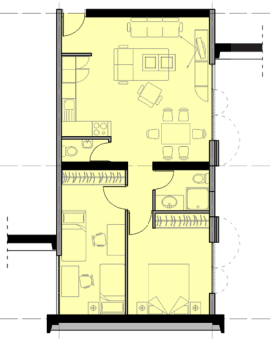
UNIT TYPOLOGIES 1:100



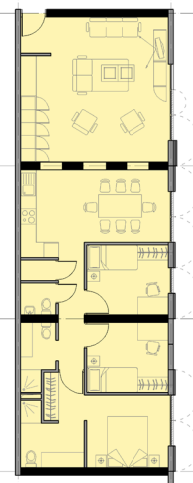
STUDIO
(1-2)
33m²



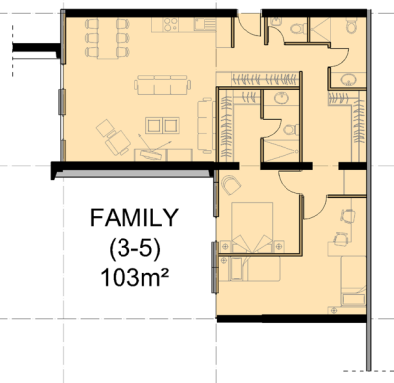
SINGLE/
COUPLE
(1-2)
54m²



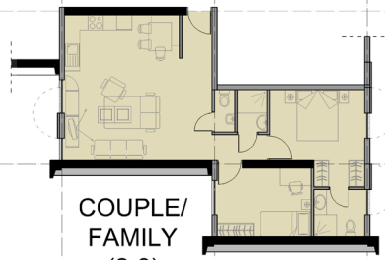
COUPLE/
FAMILY
(2-4)
68m²



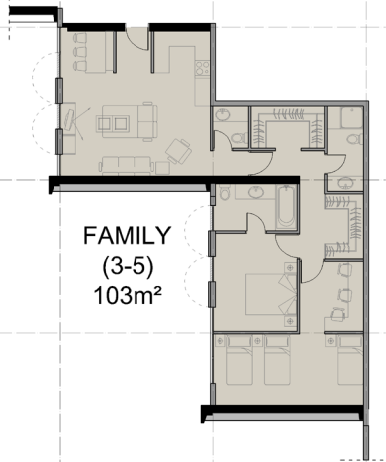
FAMILY
(3-5)
103m²



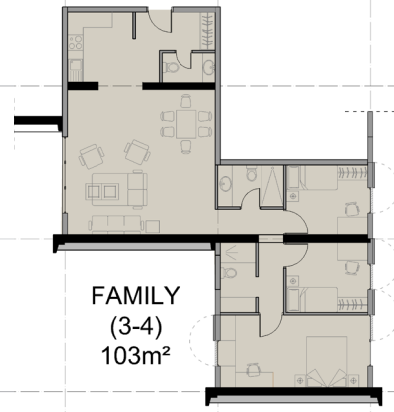
FAMILY
(3-5)
103m²



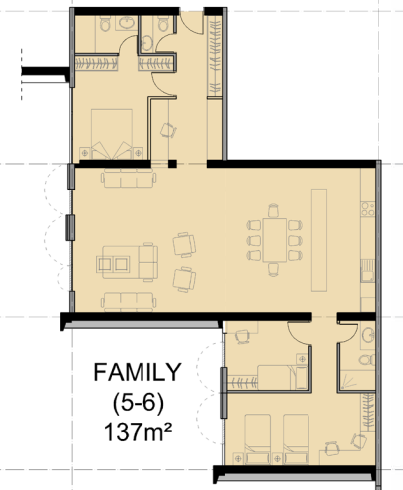
COUPLE/
FAMILY
(2-3)
68m²



FAMILY
(3-5)
103m²



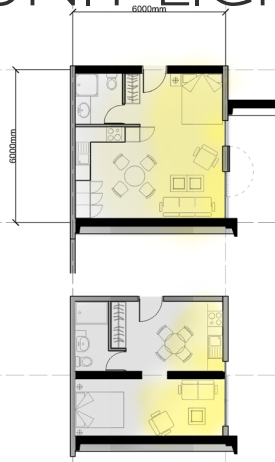
FAMILY
(3-4)
103m²



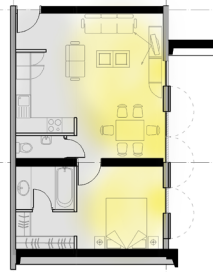
FAMILY
(5-6)
137m²

Typical Unit Internal Arrangement
Floor Plans
1:100

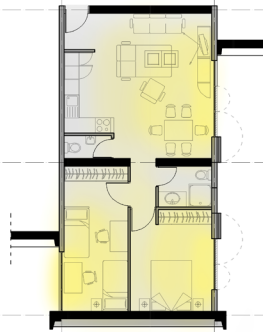
UNIT LIGHT DIAGRAMS



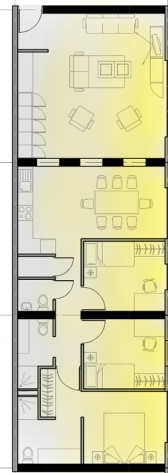
STUDIO
(1-2)
33m²



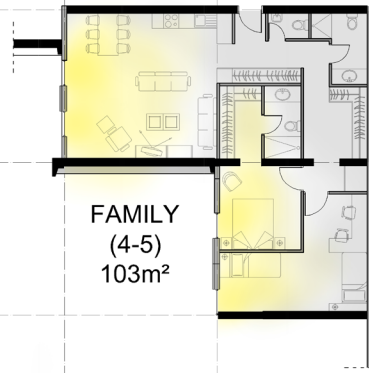
SINGLE/
COUPLE
(1-2)
54m²



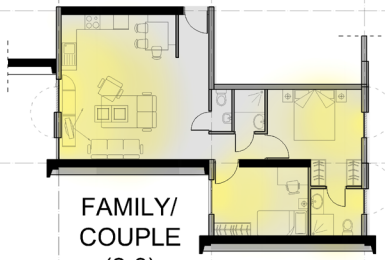
FAMILY/
COUPLE
(2-4)
68m²



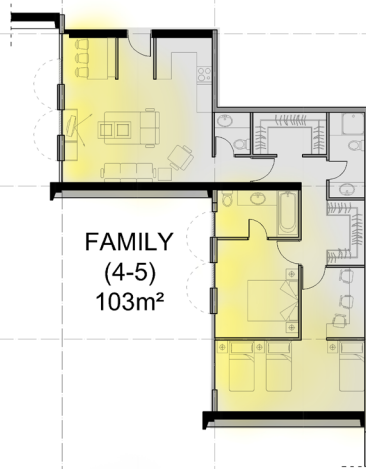
FAMILY
(4-5)
103m²



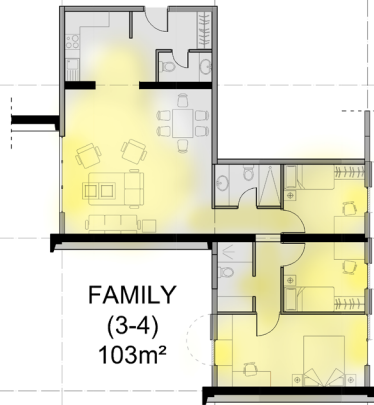
FAMILY
(4-5)
103m²



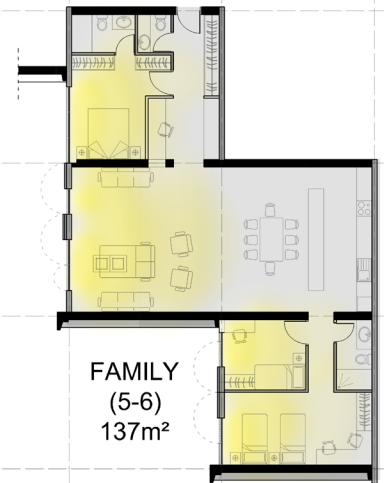
FAMILY/
COUPLE
(2-3)
68m²



FAMILY
(4-5)
103m²



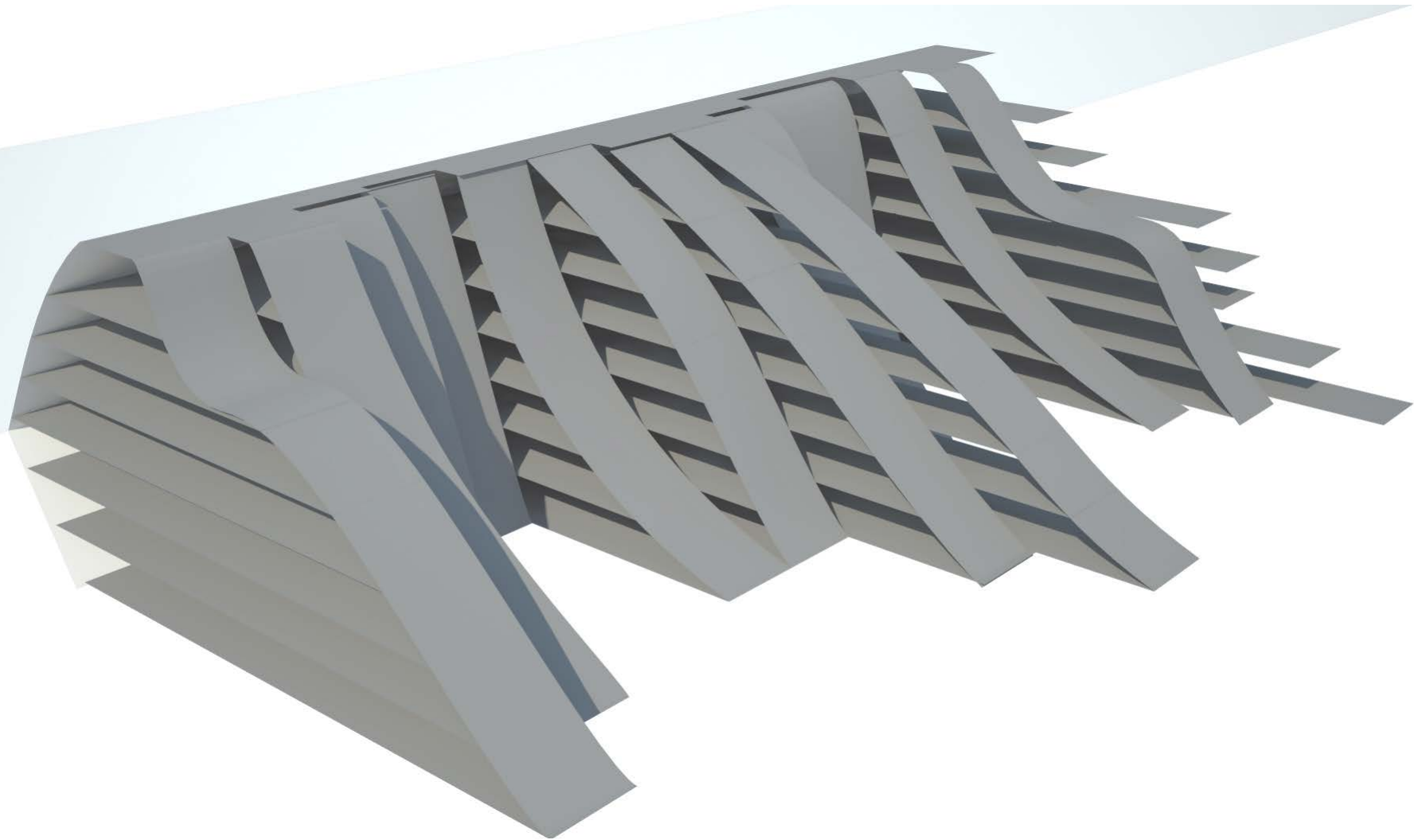
FAMILY
(3-4)
103m²



FAMILY
(5-6)
137m²

Typical Unit Internal Arrangement
Floor Plans
1:100

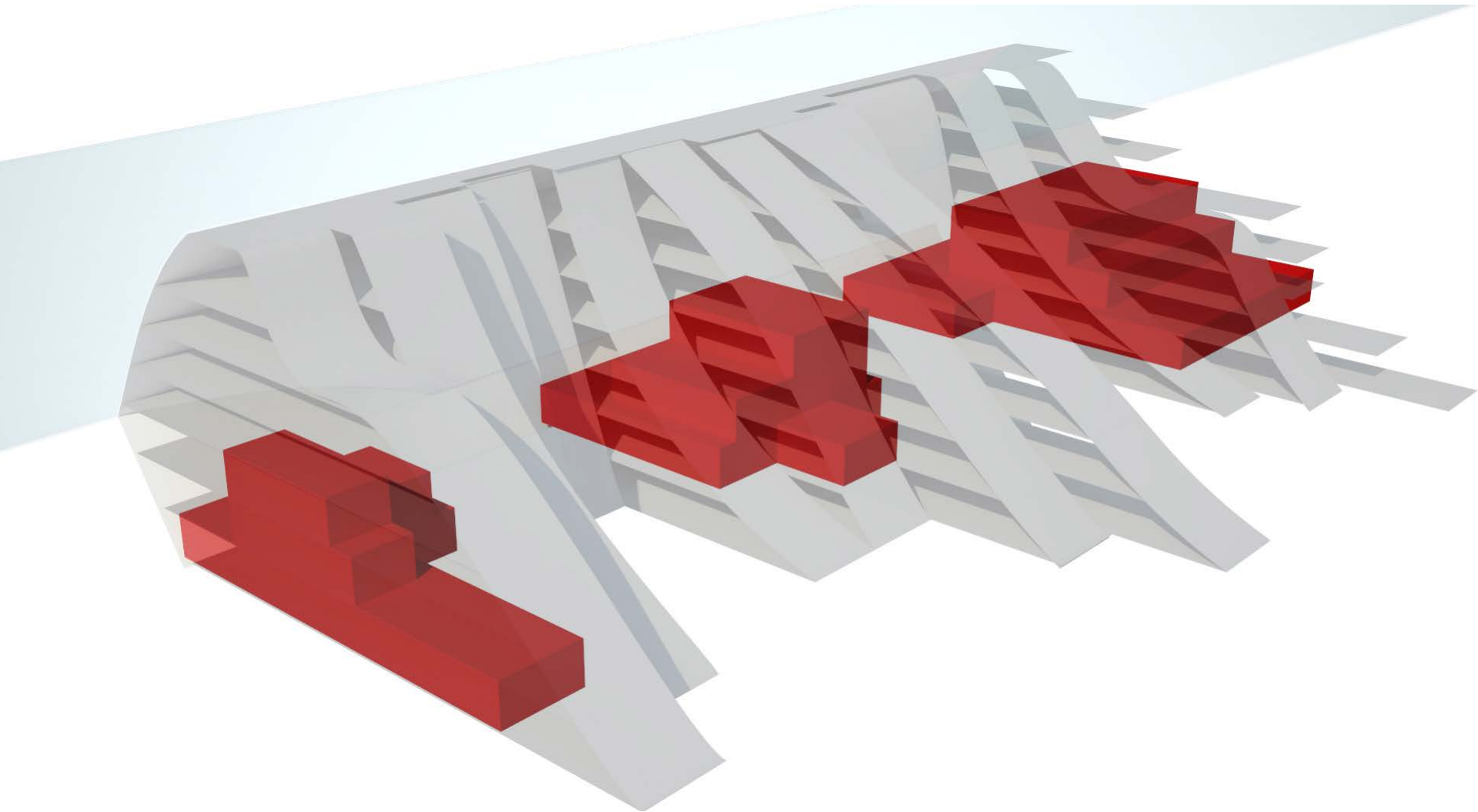
BUILD UP DIAGRAM



HOT CORES

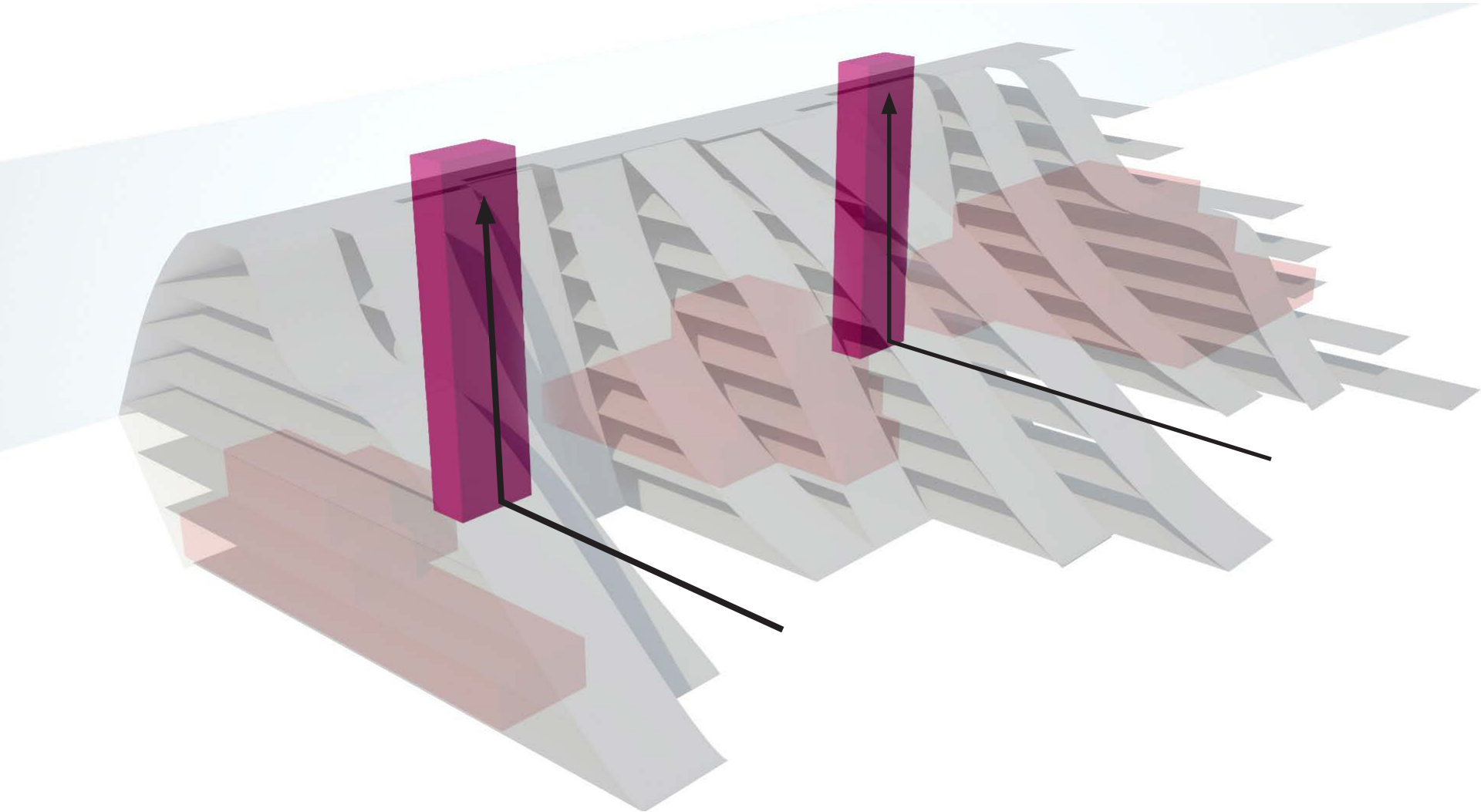
DARK AREAS

SOUND INSULATION



VERTICAL CIRCULATION

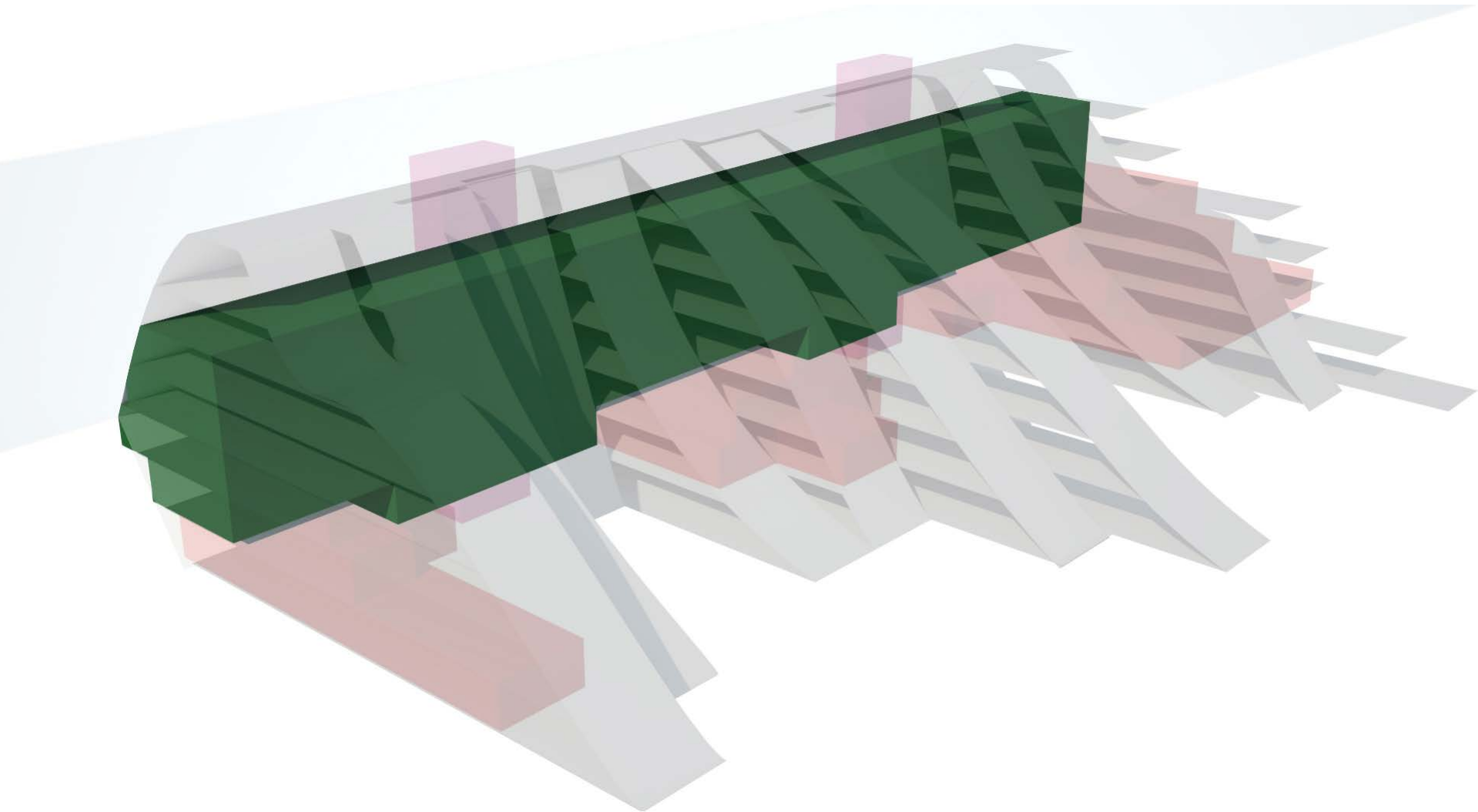
REGULAR PLACING



VEHICLE AREAS

DARK AREAS

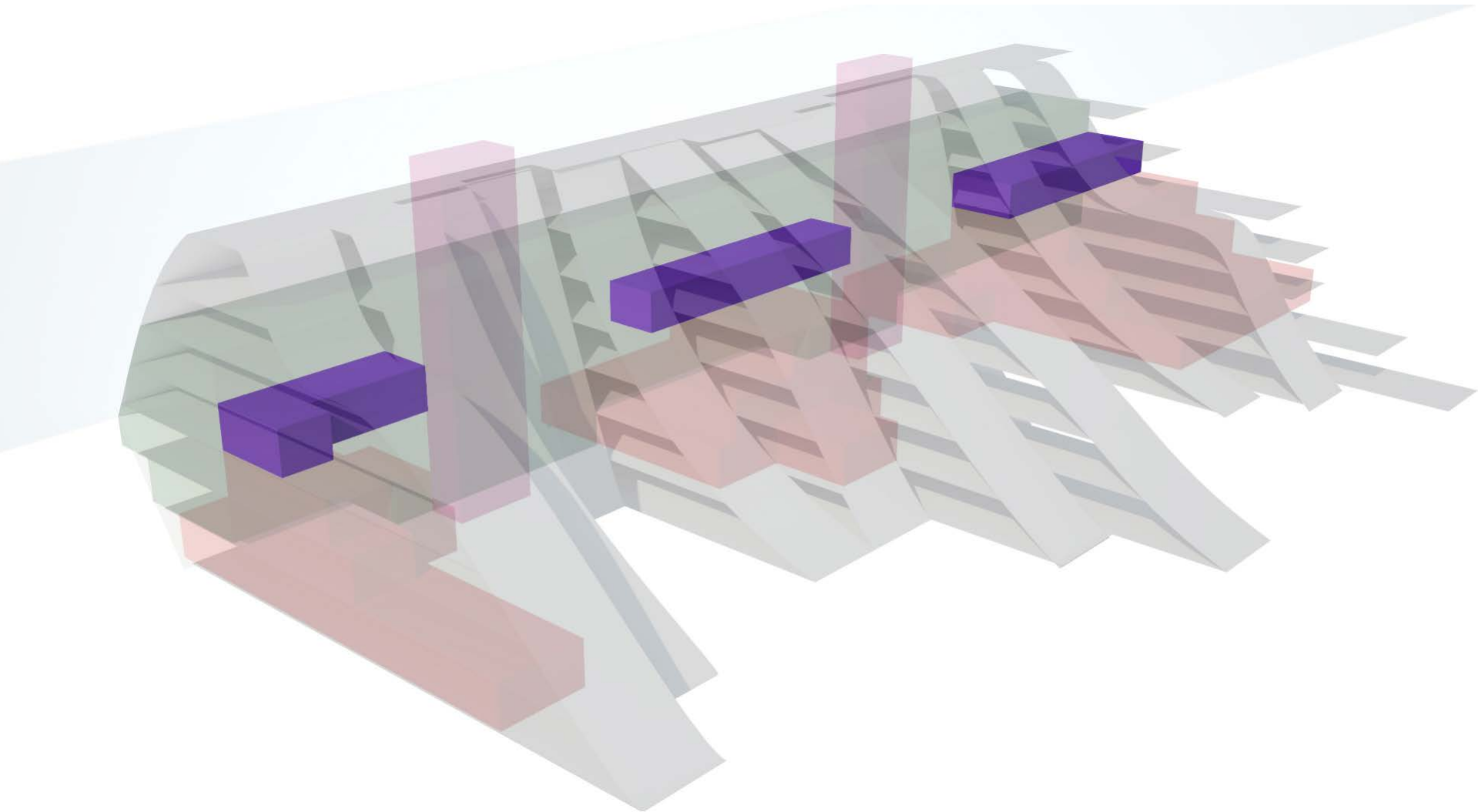
HIGH SOUND LEVELS



SERVICE AREAS

ROAD ACCESS

NO NEED FOR LIGHT

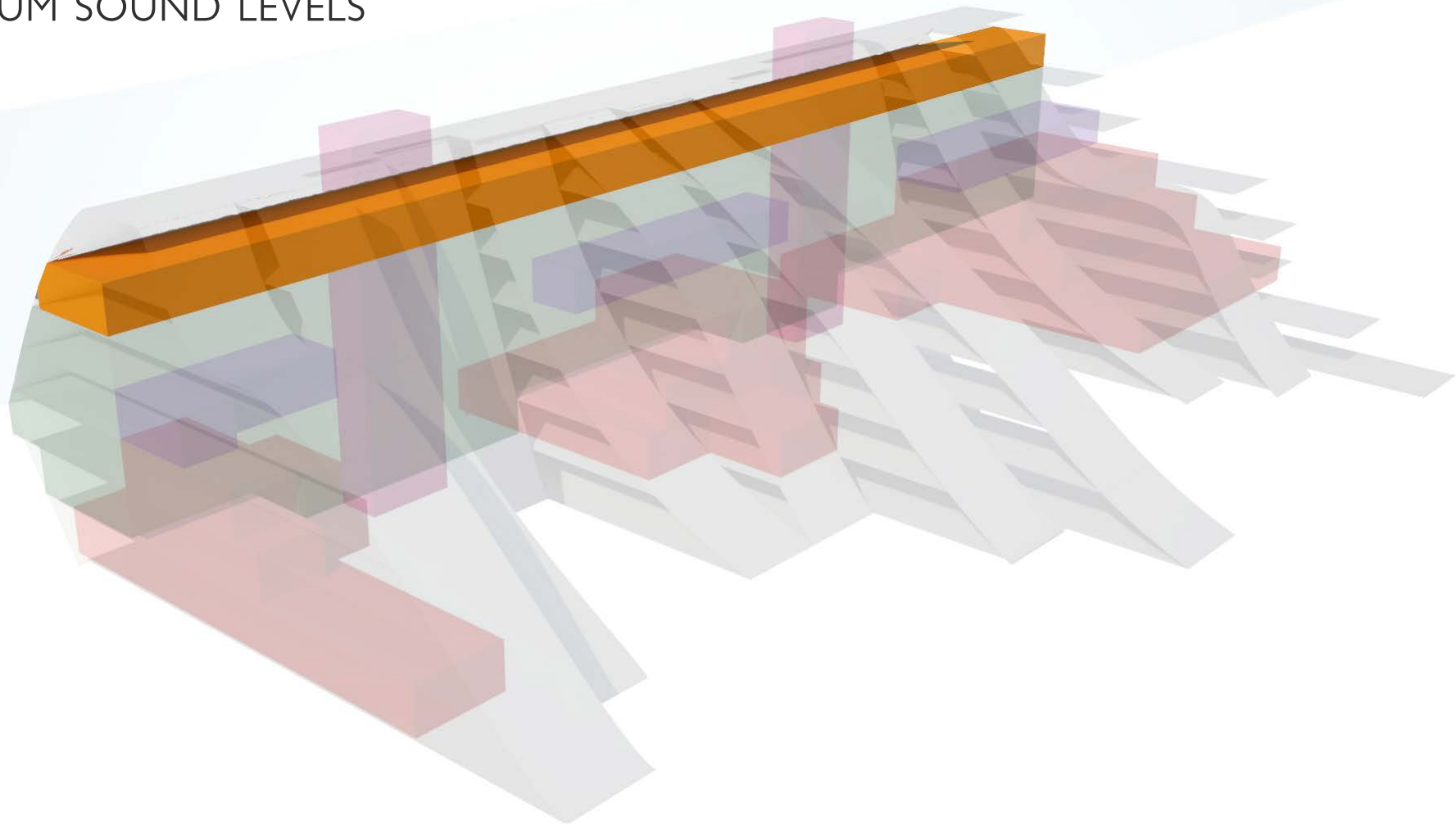


SHARED FACILITIES

GOOD LIGHT ACCESS

PUBLIC VIEW

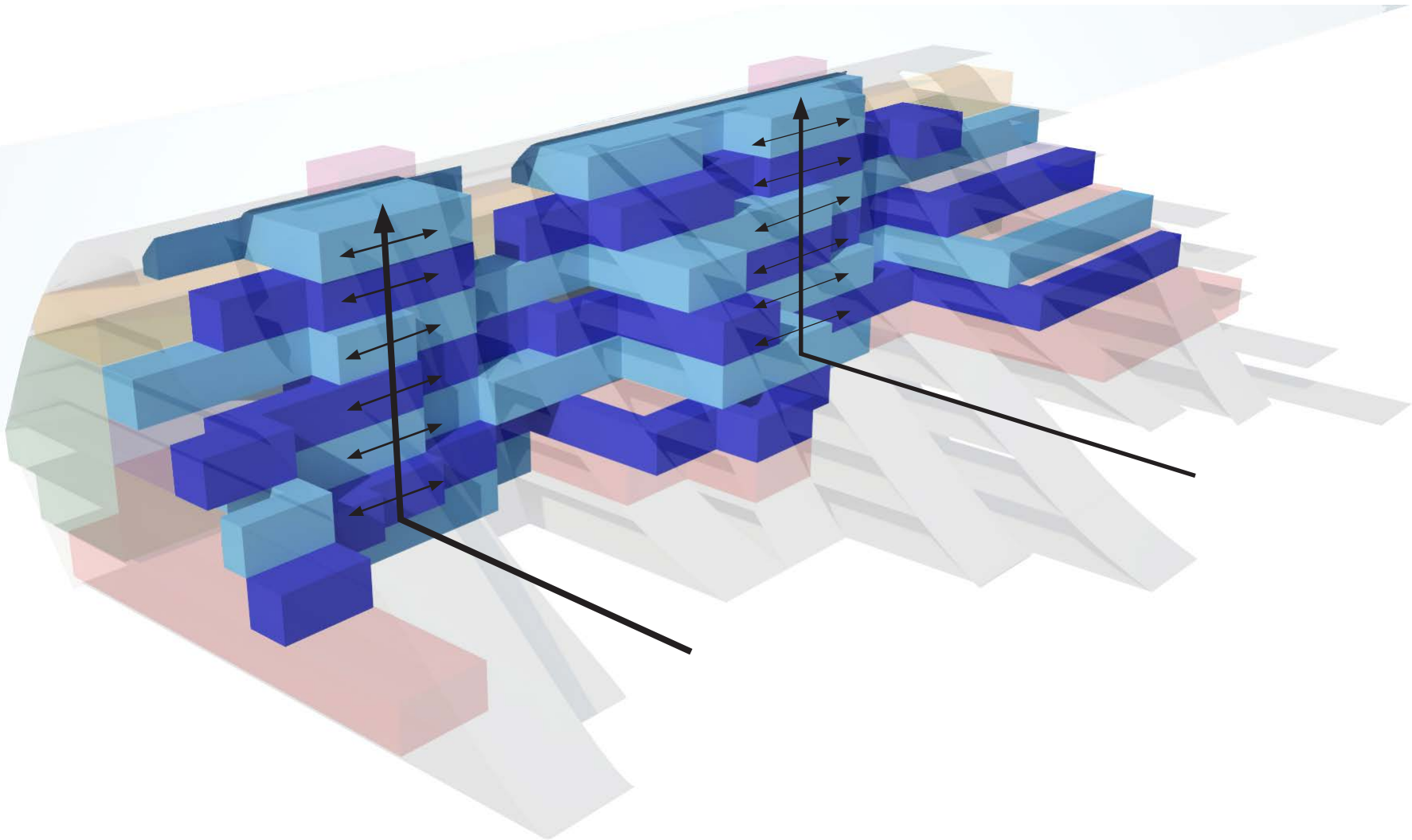
MEDIUM SOUND LEVELS



HORIZONTAL CIRCULATION

ACCESS TO UNITS FROM INSIDE HILL

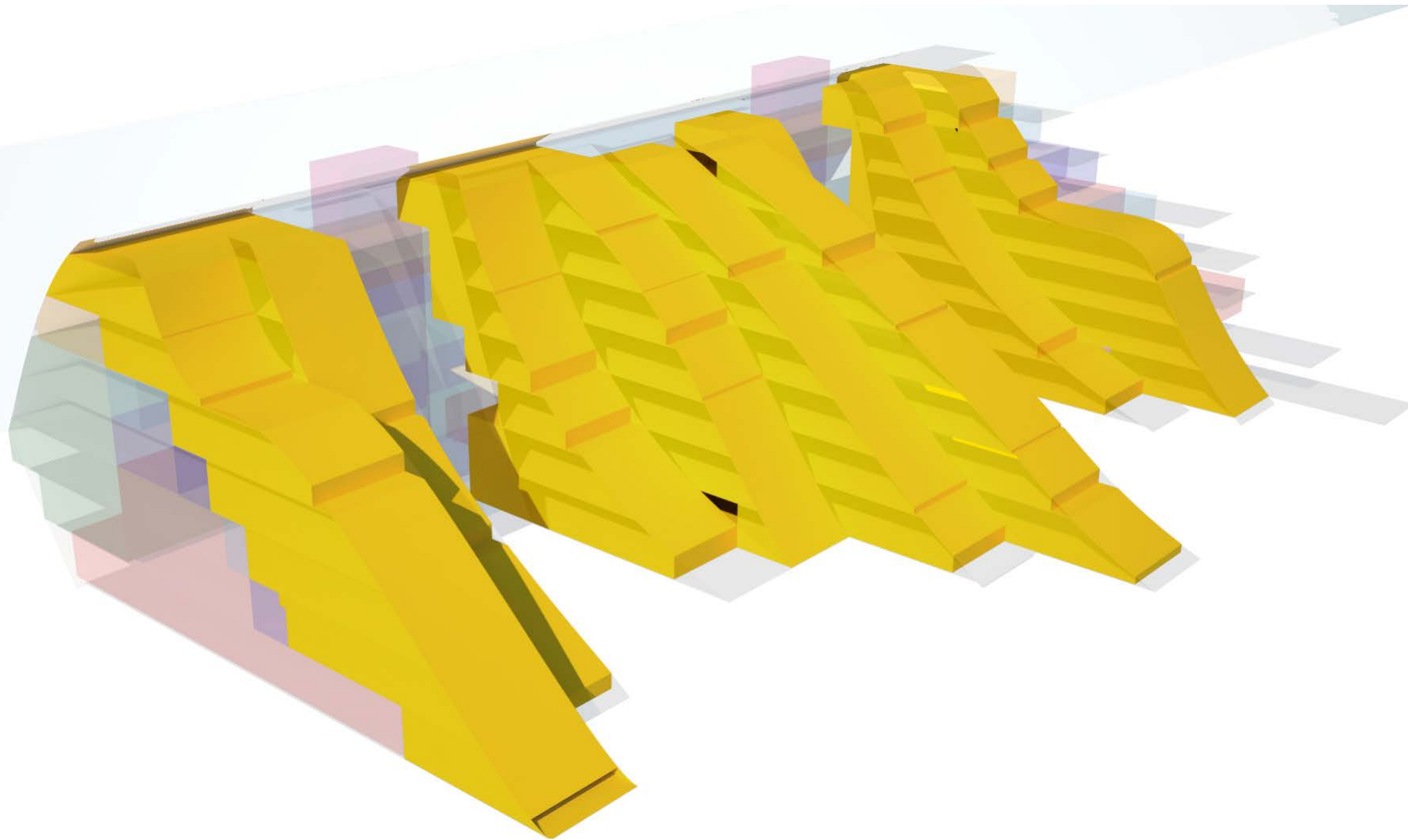
CONTINUITY



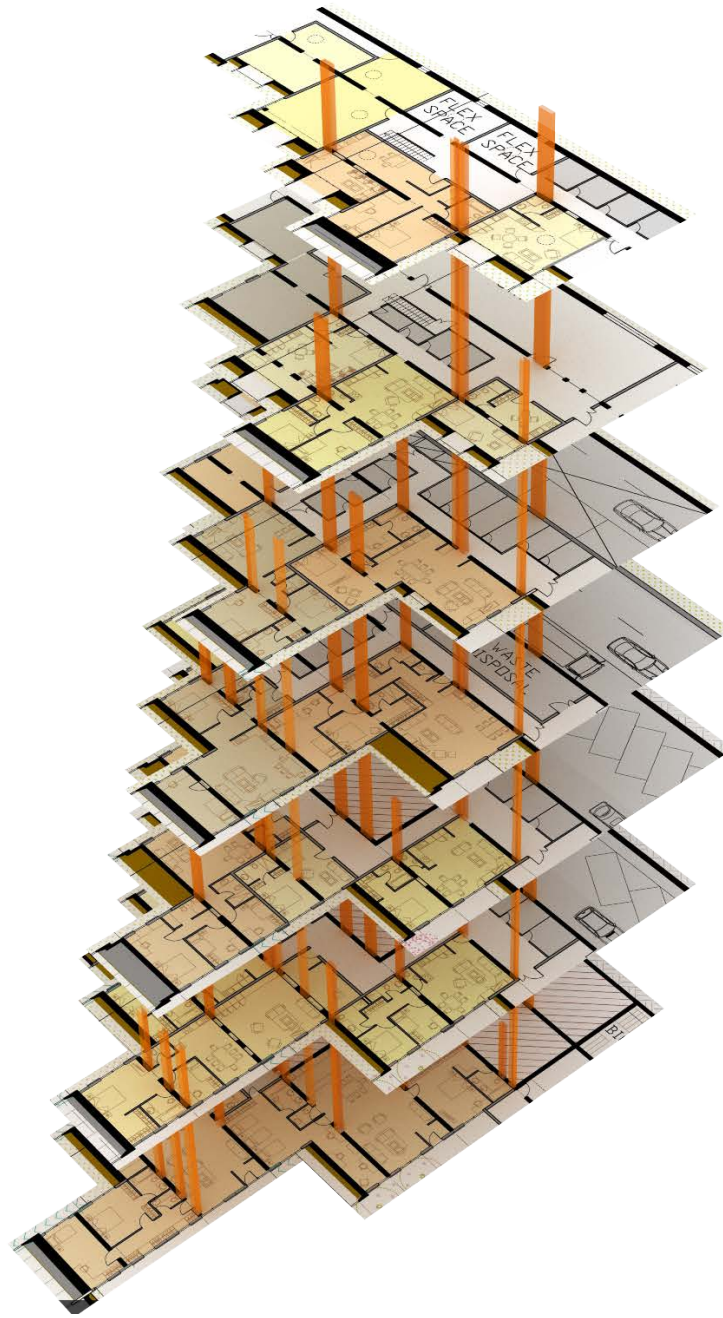
UNITS

MAXIMUM LIGHT ACCESS

MINIMUM SOUND LEVELS

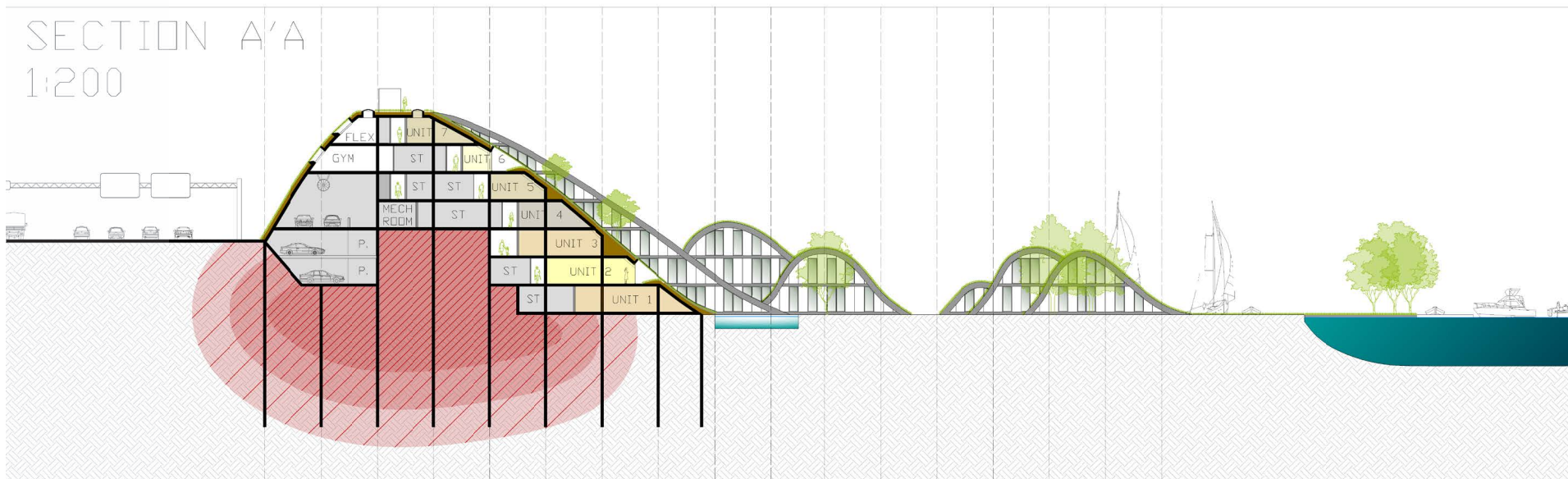
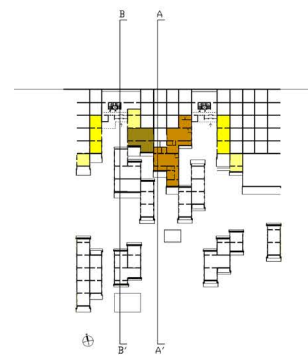


STACKING VERTICAL PIPING



TYPICAL SECTION A'A

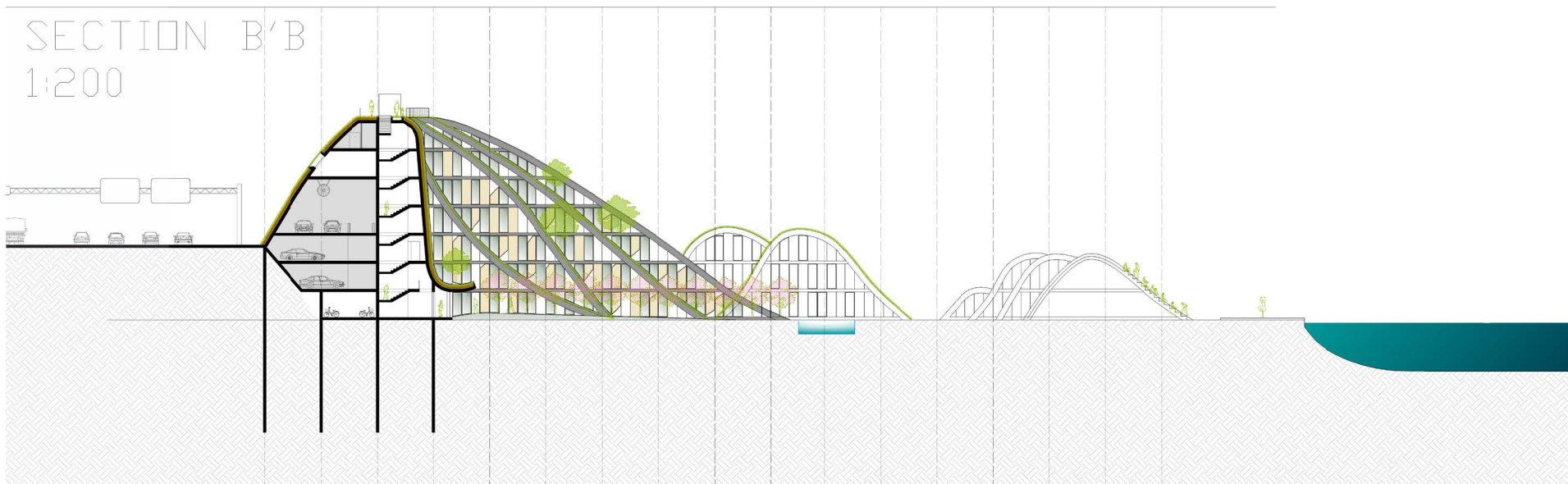
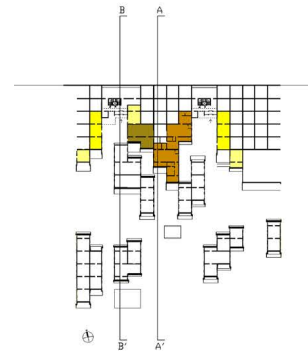
1:200



ENTRANCE SECTION B'B

OPEN MODE

1:200



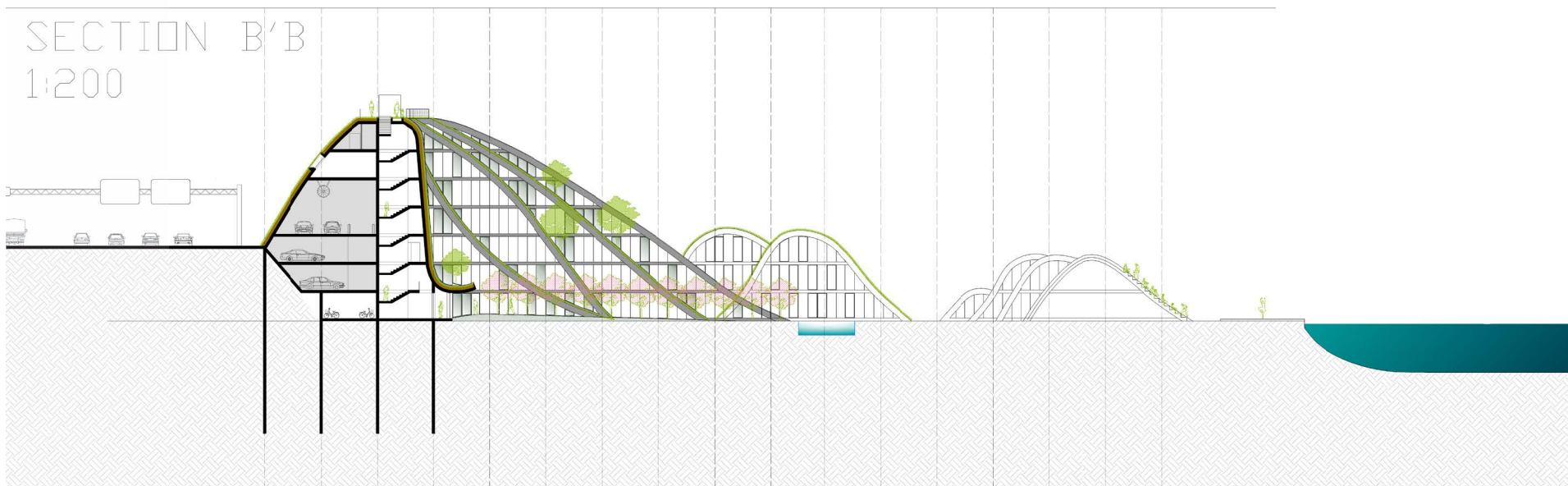
ENTRANCE SECTION B'B

CLOSED MODE

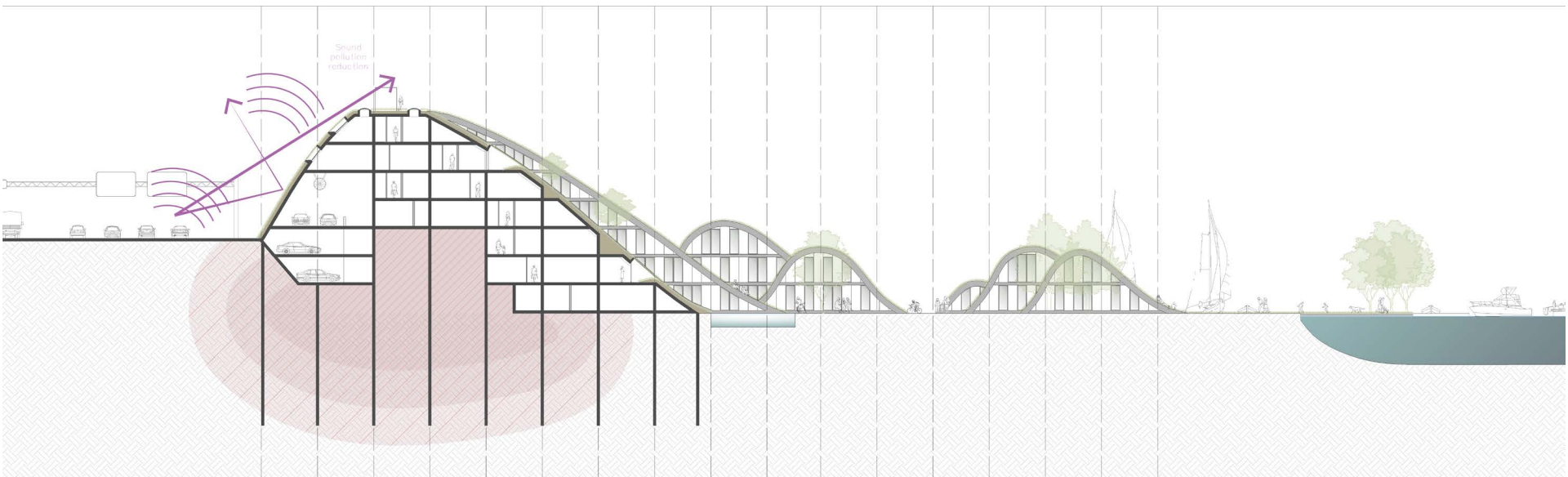
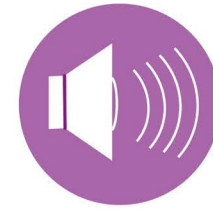
1:200

TOTAL FACADE AREA:	349m ²	100%	
TOTAL GLAZED AREA:	140m ²	40%	100%
MINIMUM GLAZED AREA:	75m ²	20%	50%

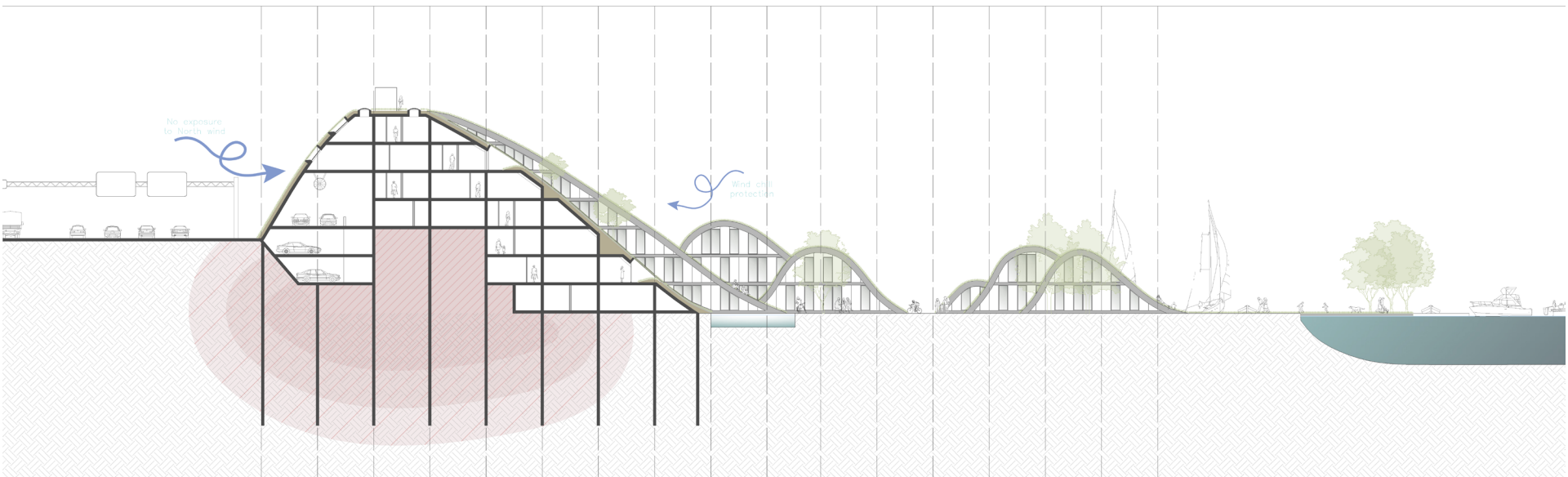
TEXT TEXT TEXT



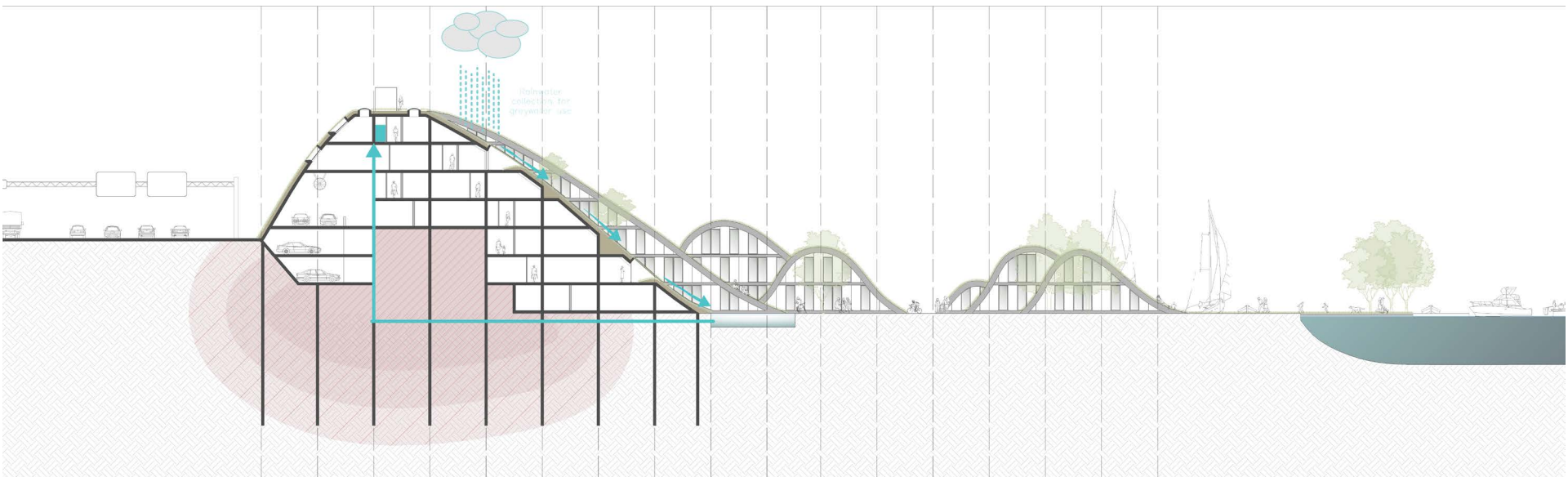
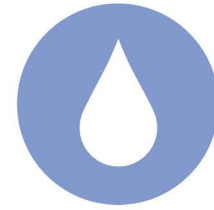
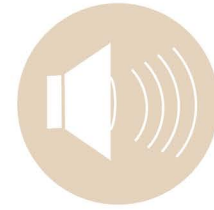
OVERALL CLIMATE STRATEGY



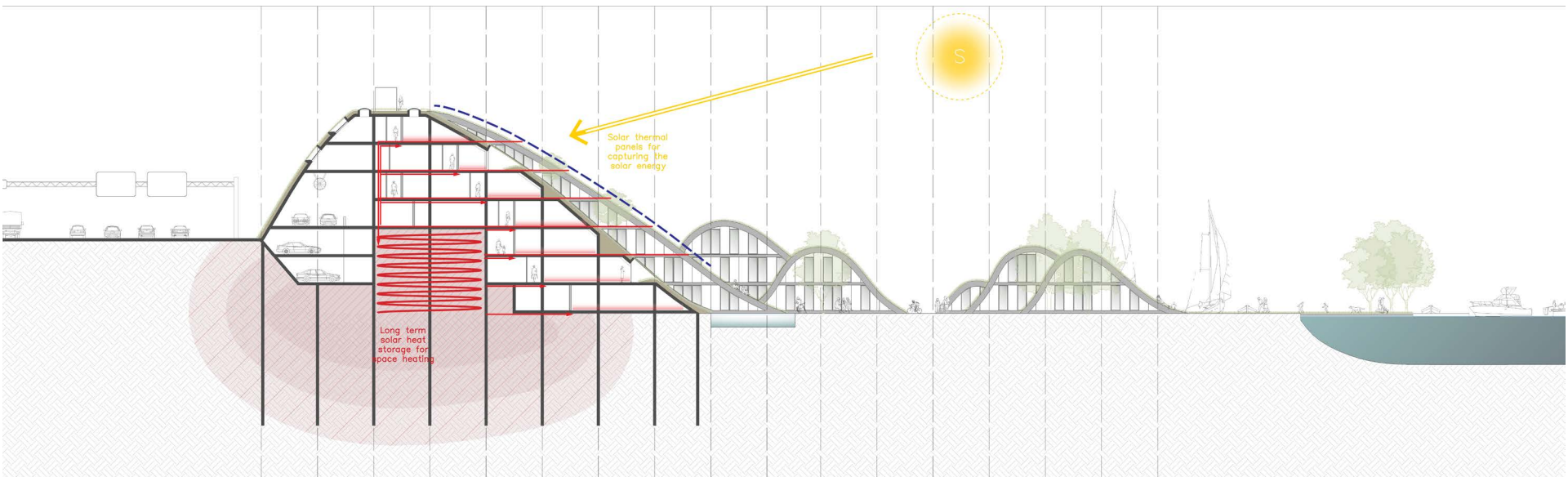
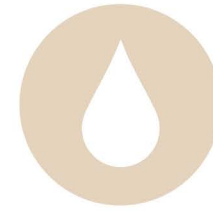
OVERALL CLIMATE STRATEGY



OVERALL CLIMATE STRATEGY

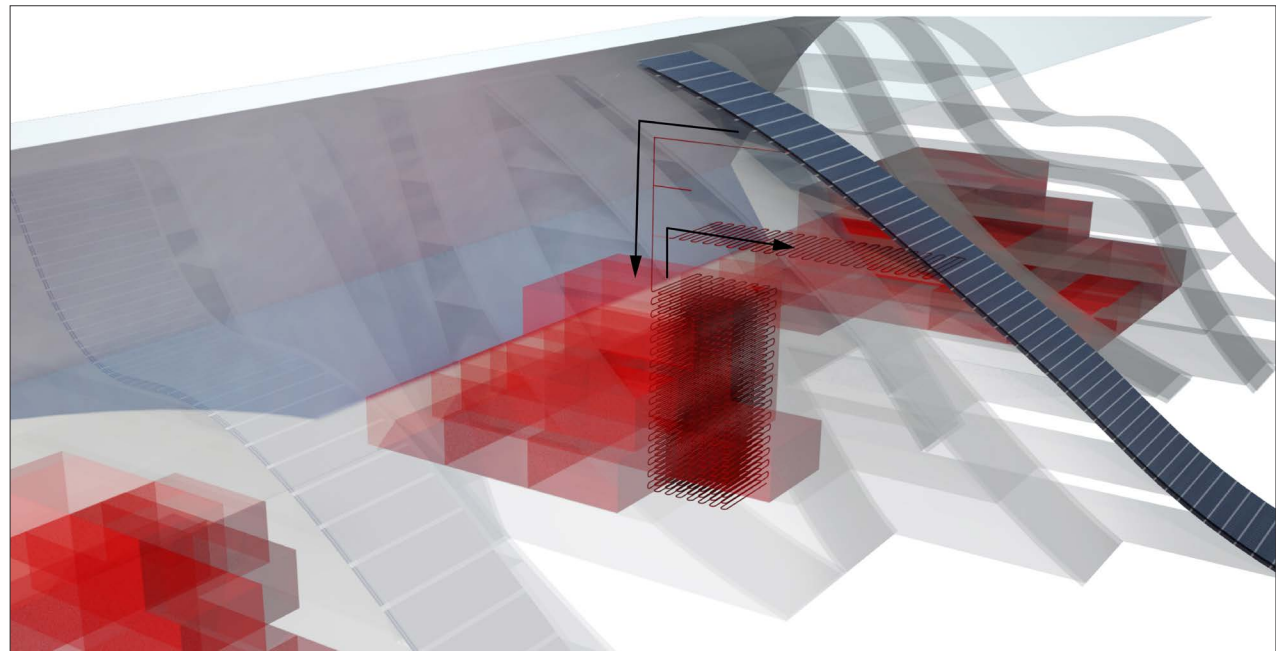
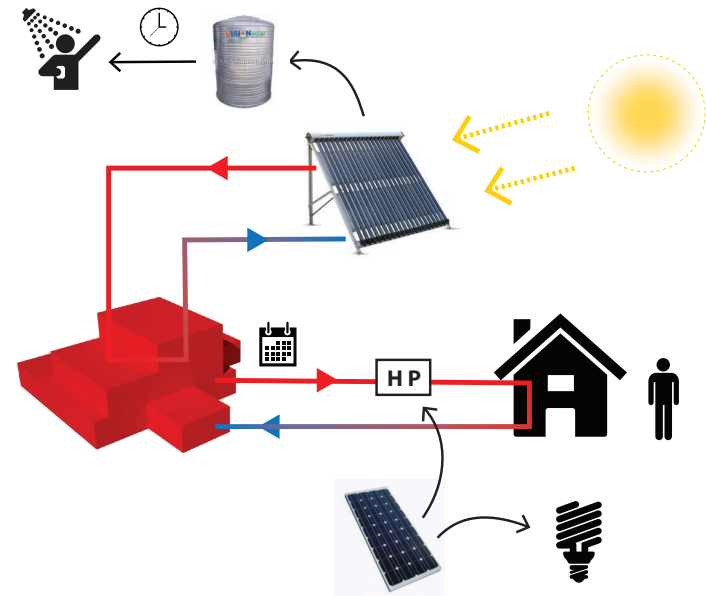


OVERALL CLIMATE STRATEGY



HOT CORE SYSTEM

VOLUMENIS QUE EA ATET, EX
ET ESCIAND IPSANDU STORRO
EVERAE. EHENDIGNIS UNT
MAXIMUSAM
DELIAM LIQUATIS NIS VITEMQU
IDUCIET PLAM SUNT ET AM
DOLUPIS EA DOLUPTAT EA NIHIC
TEST OMNIS SIMPOR AUTATIURIAM
NEM FUGA. ANDI RERCIMP
ORRUMENDAM RES CUPTAE
VOLORUPID ES RESTIS REHENT QUI
AUT LABORRO ILLACEPUDA QUO
VENI QUUNT AS ANIM FUGITIA
QUIA QUIATUR? IS RE SOLORERIA
SOLUT MOS MIN PA QUI IN REPED
QUATUSCIIS MIL ET AD MAXIMUSAE



BUILDING



TECHNOLOGY

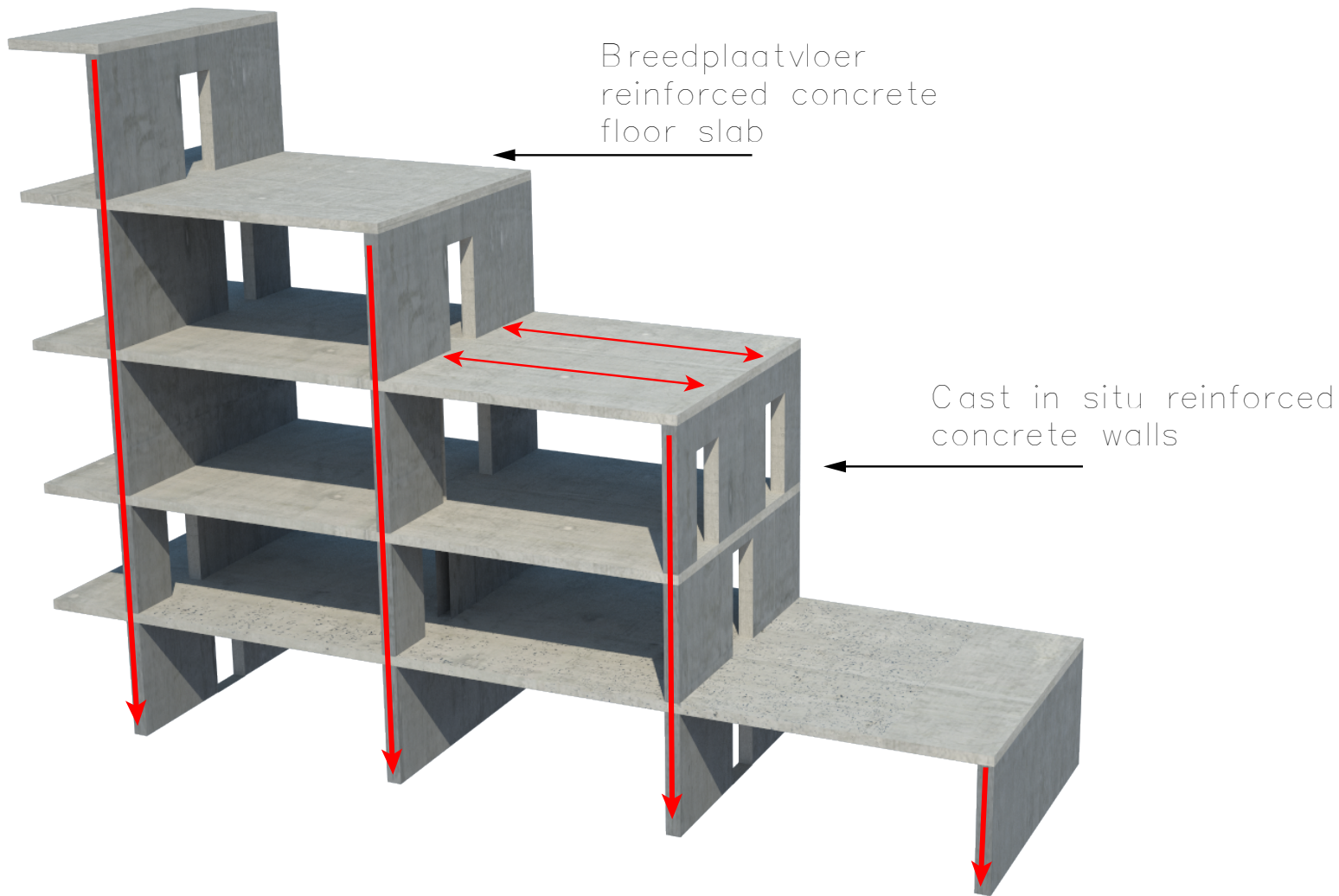
STRUCTURAL SYSTEM

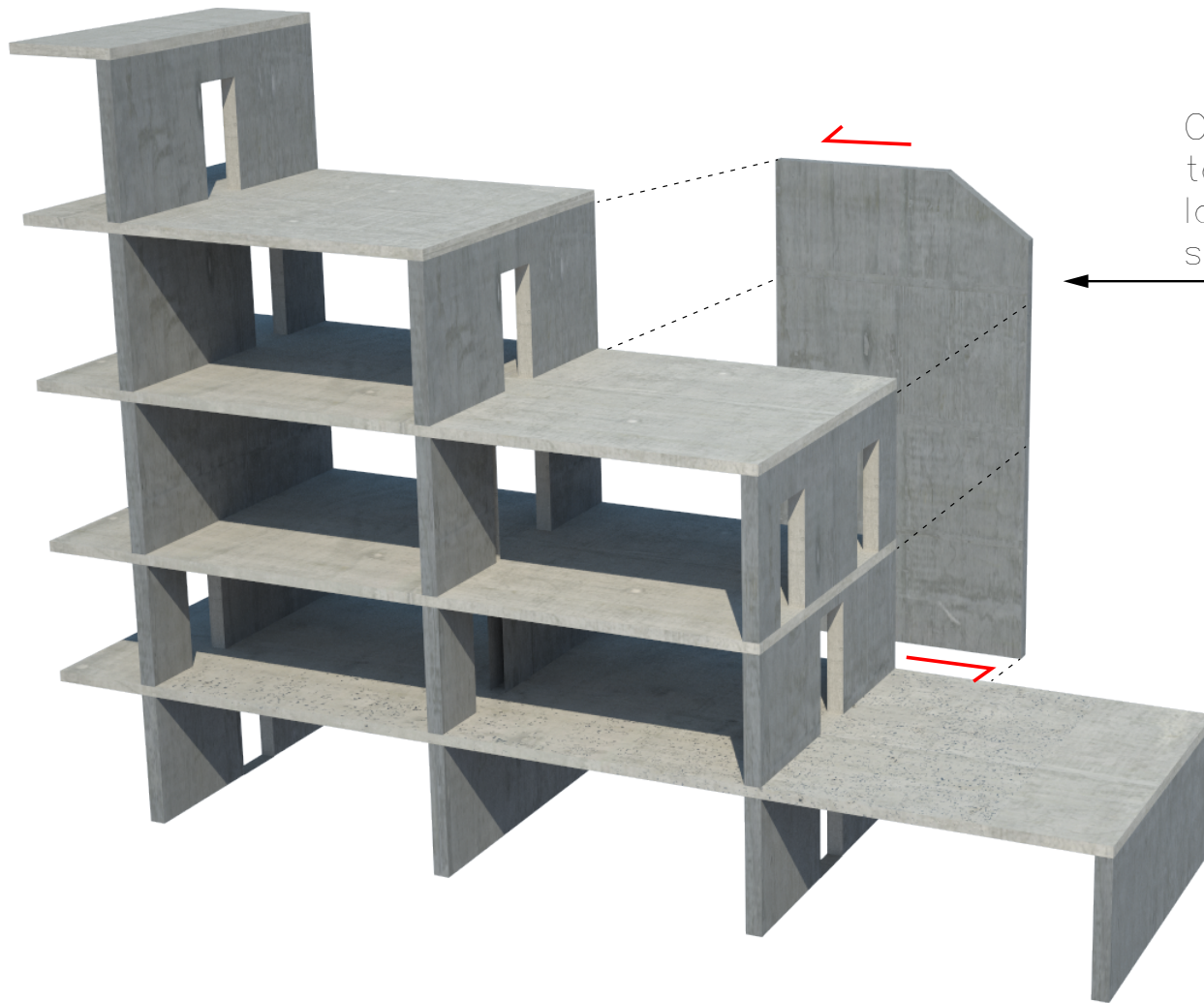




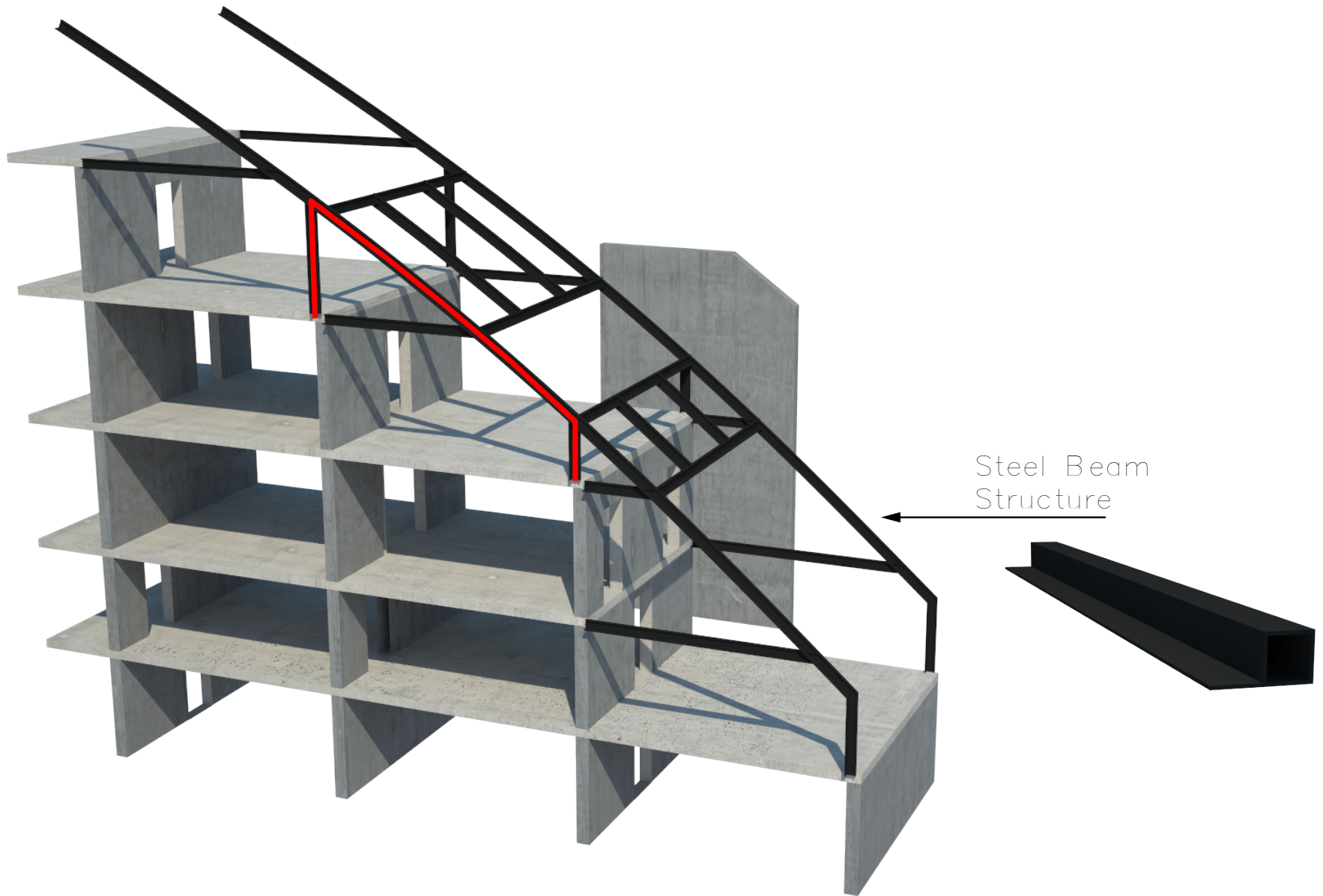


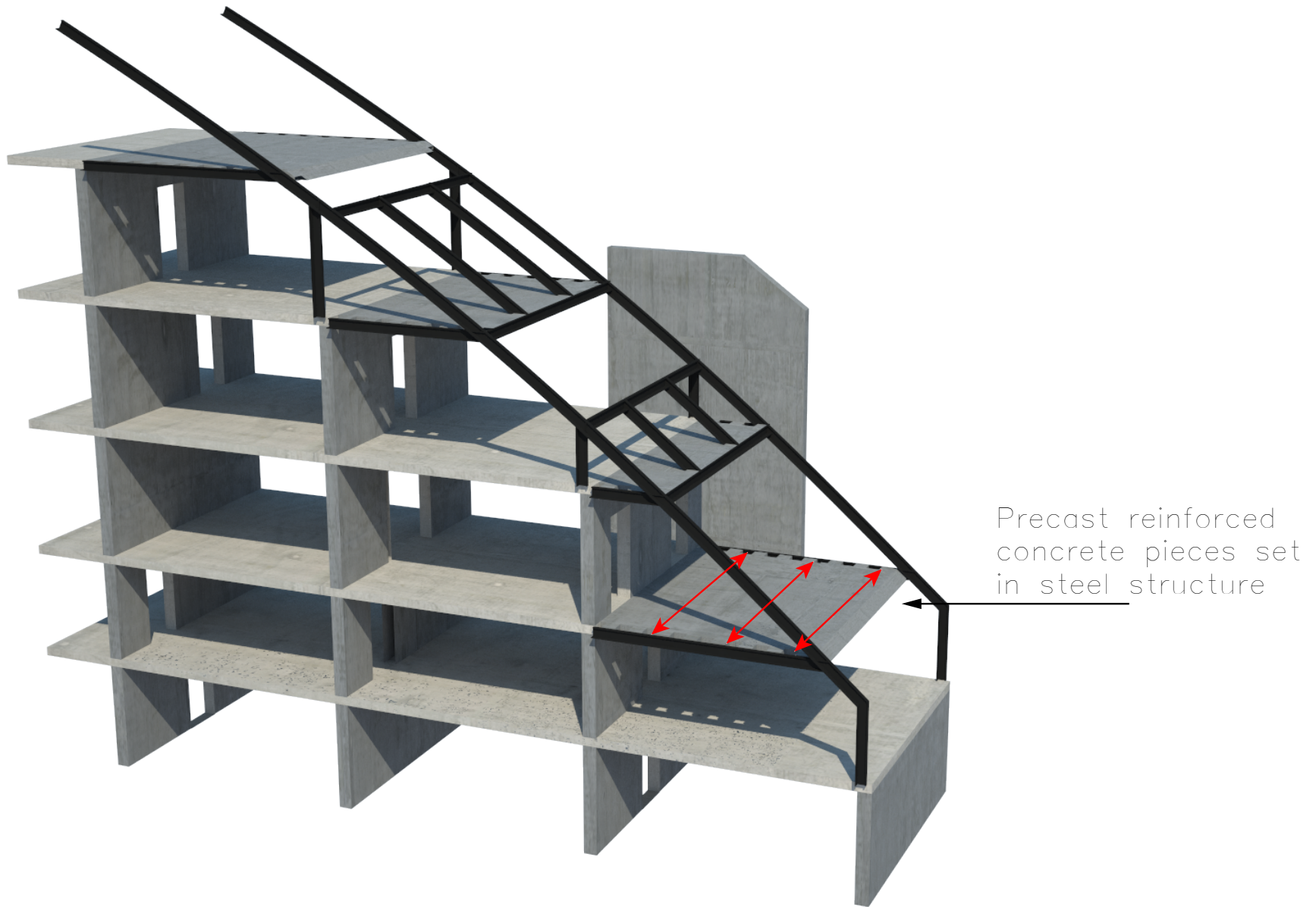




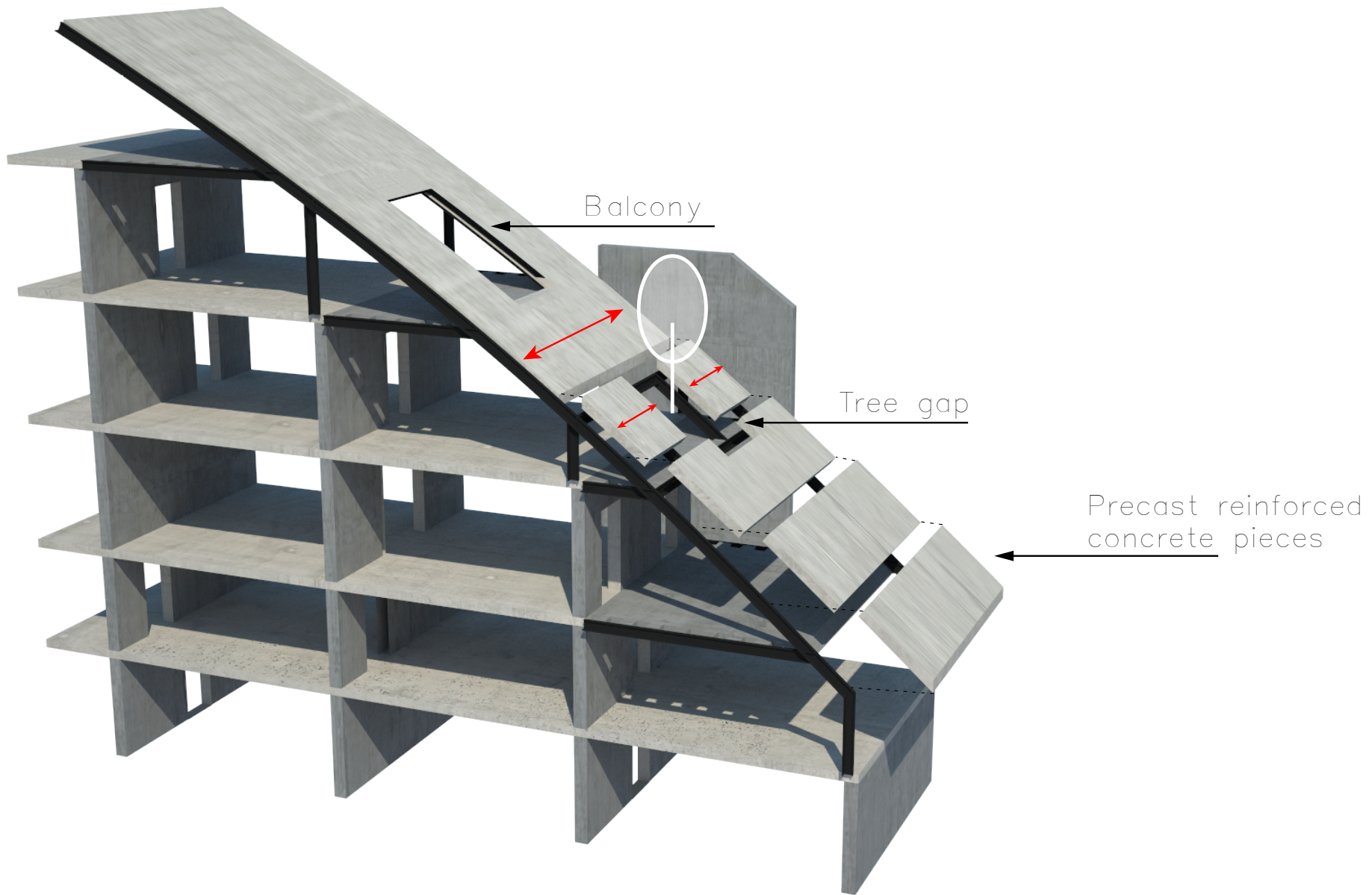


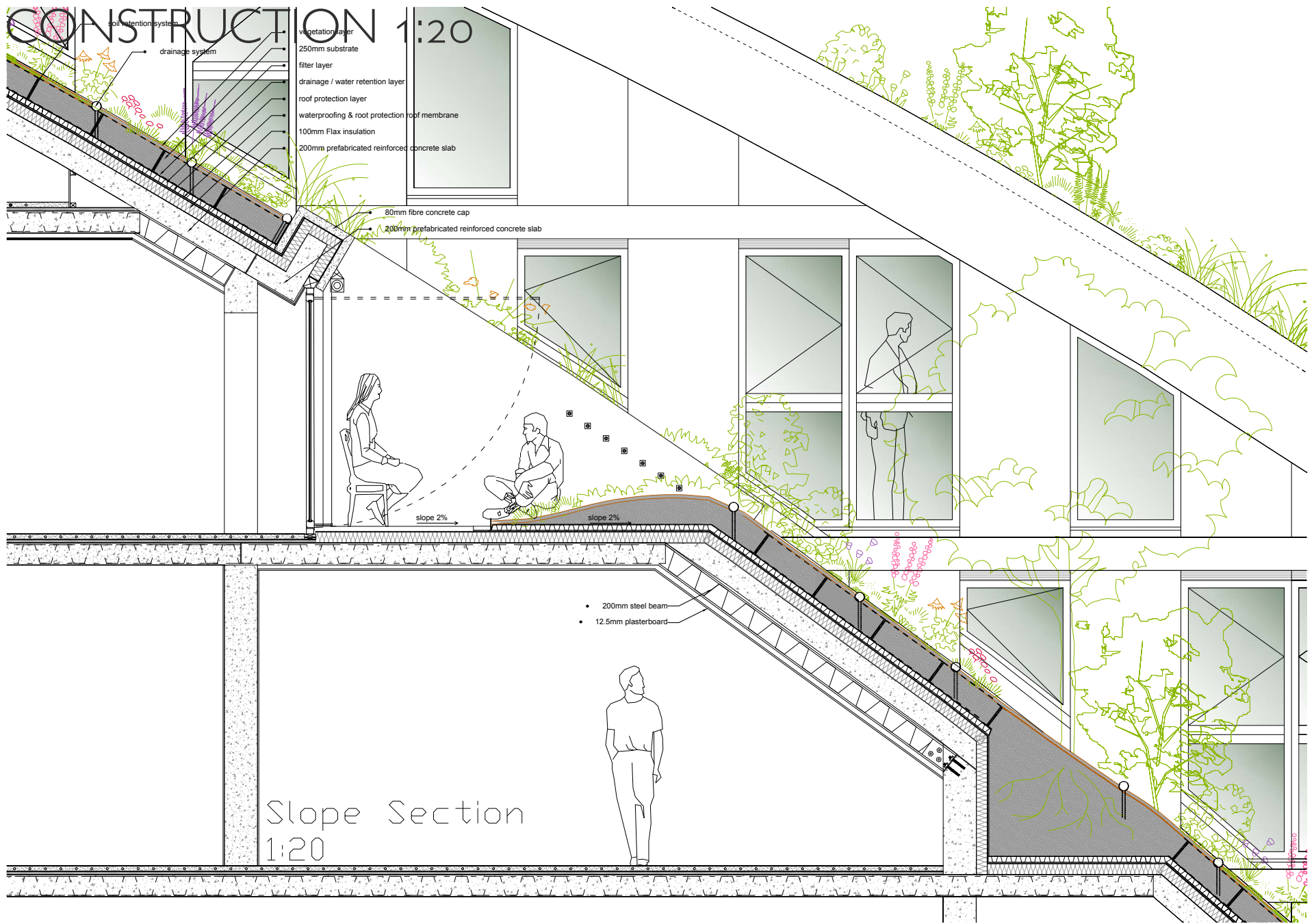
Concrete Shear Wall
to counteract
lateral shear wind
stresses



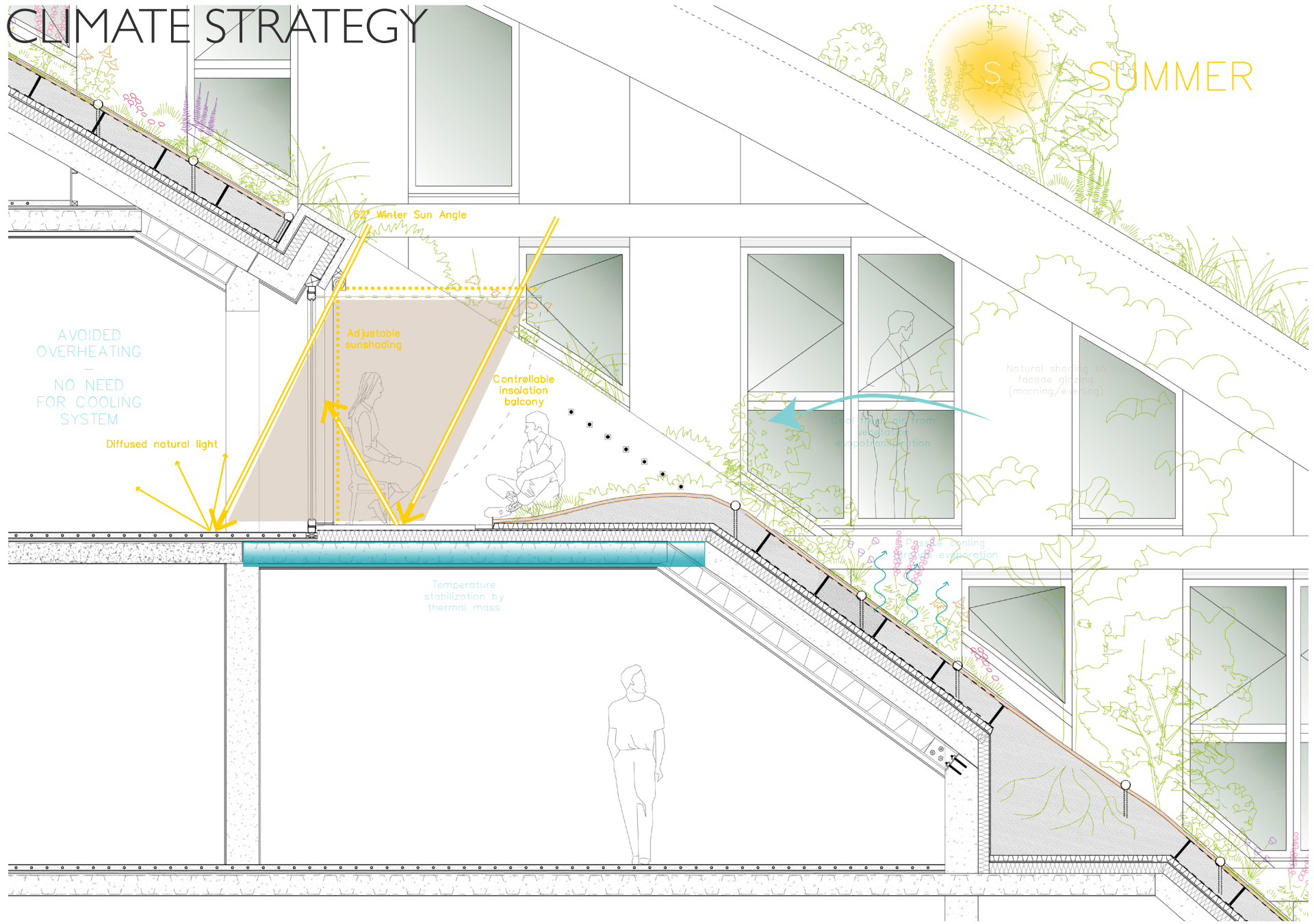


Precast reinforced
concrete pieces set
in steel structure



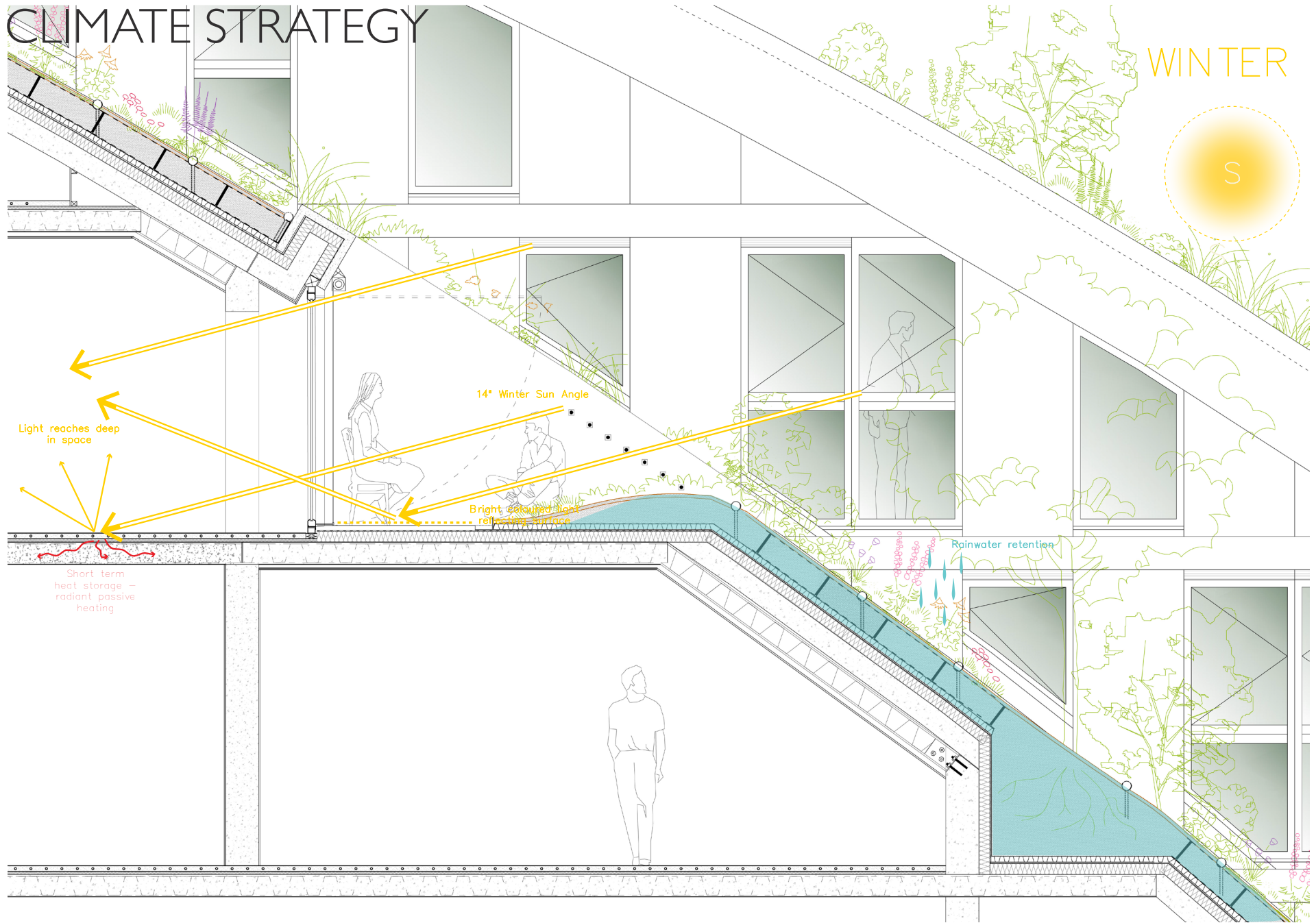
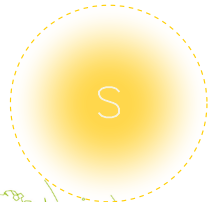


CLIMATE STRATEGY

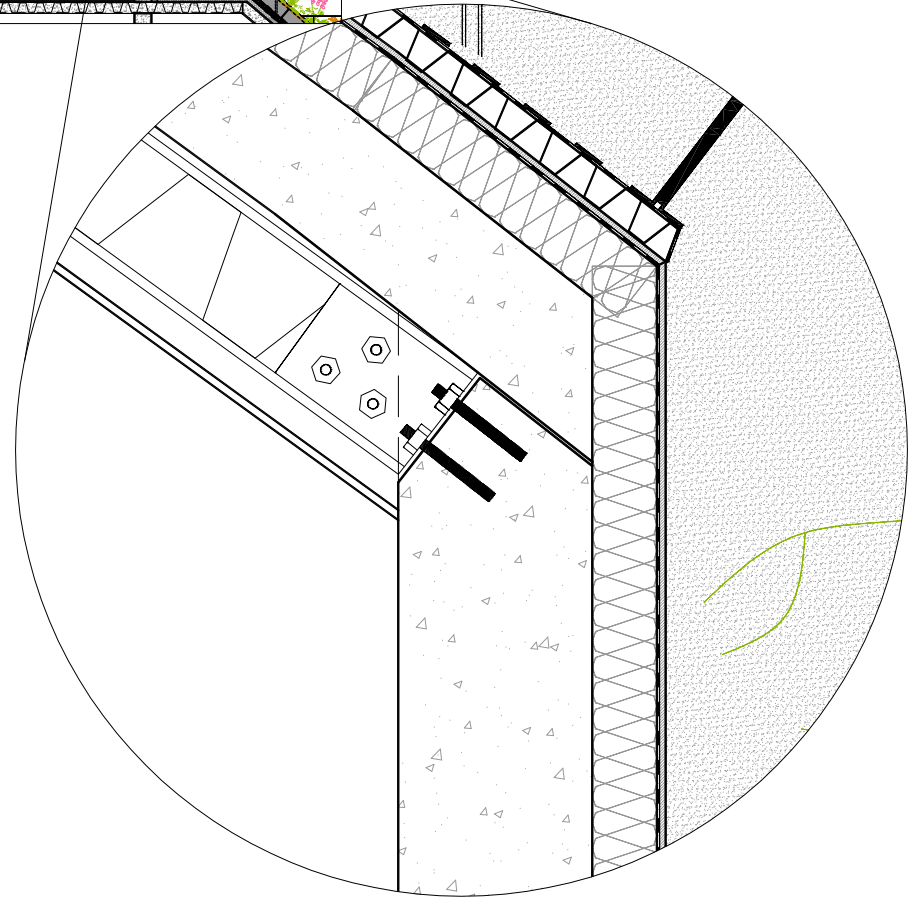
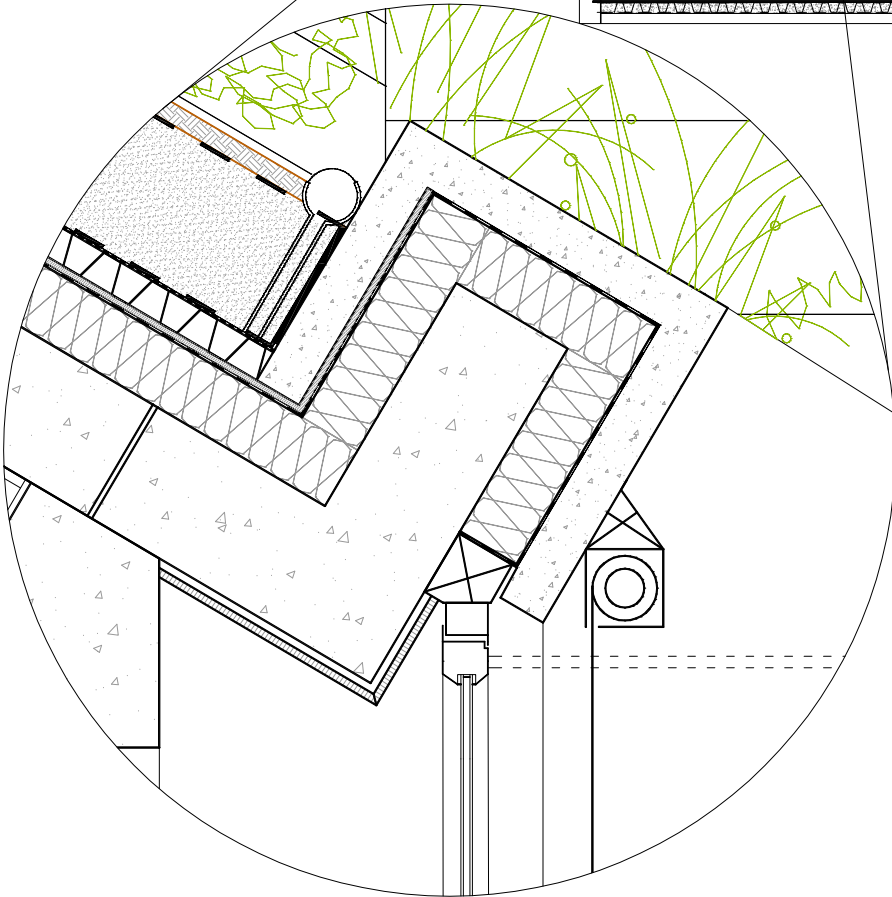
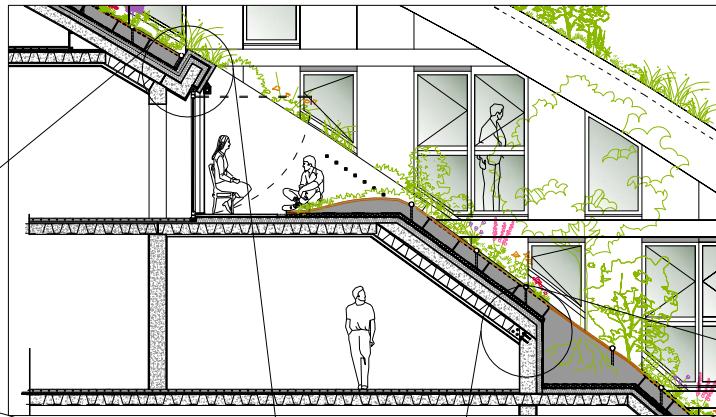


CLIMATE STRATEGY

WINTER

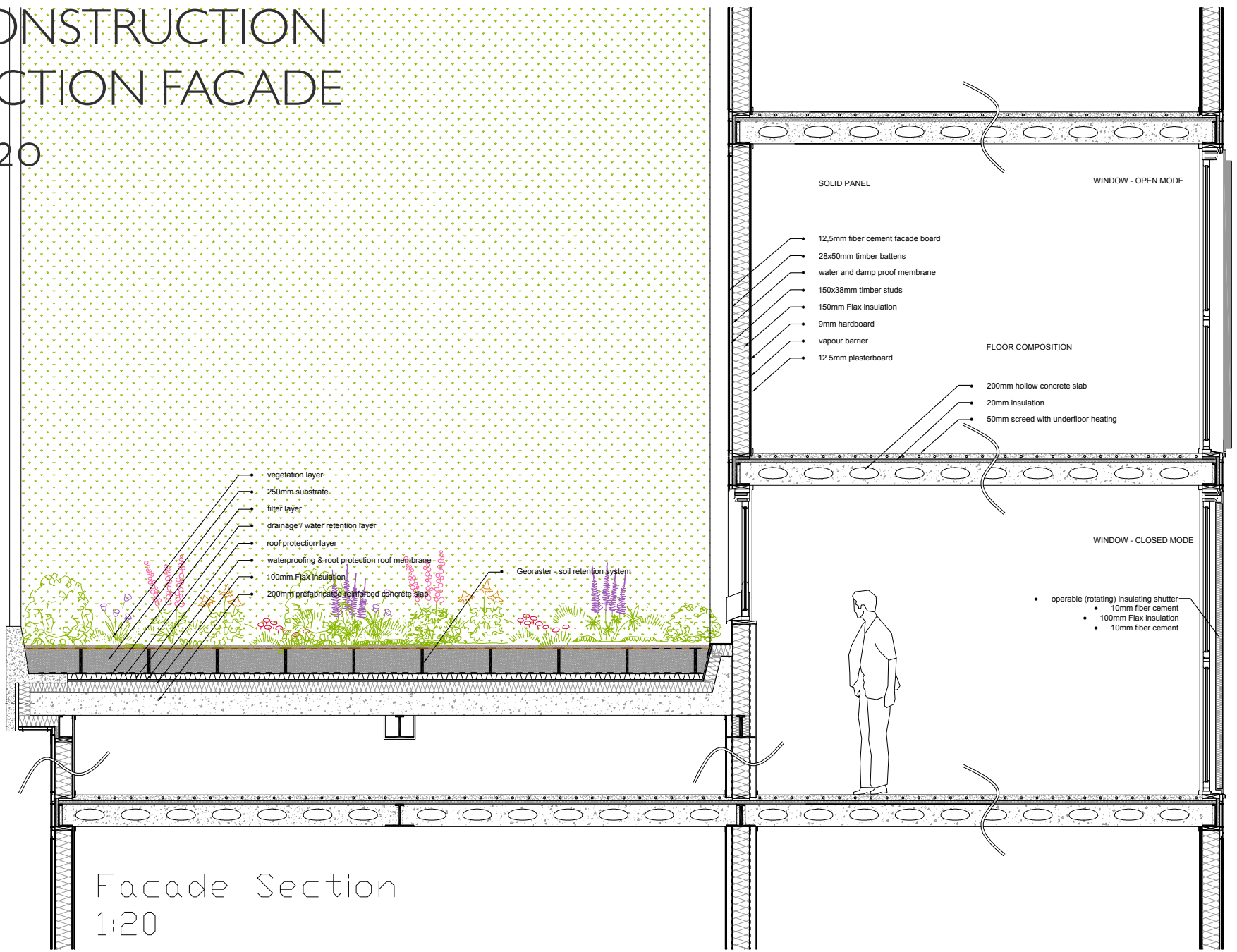


Slope Section
Details
1:5



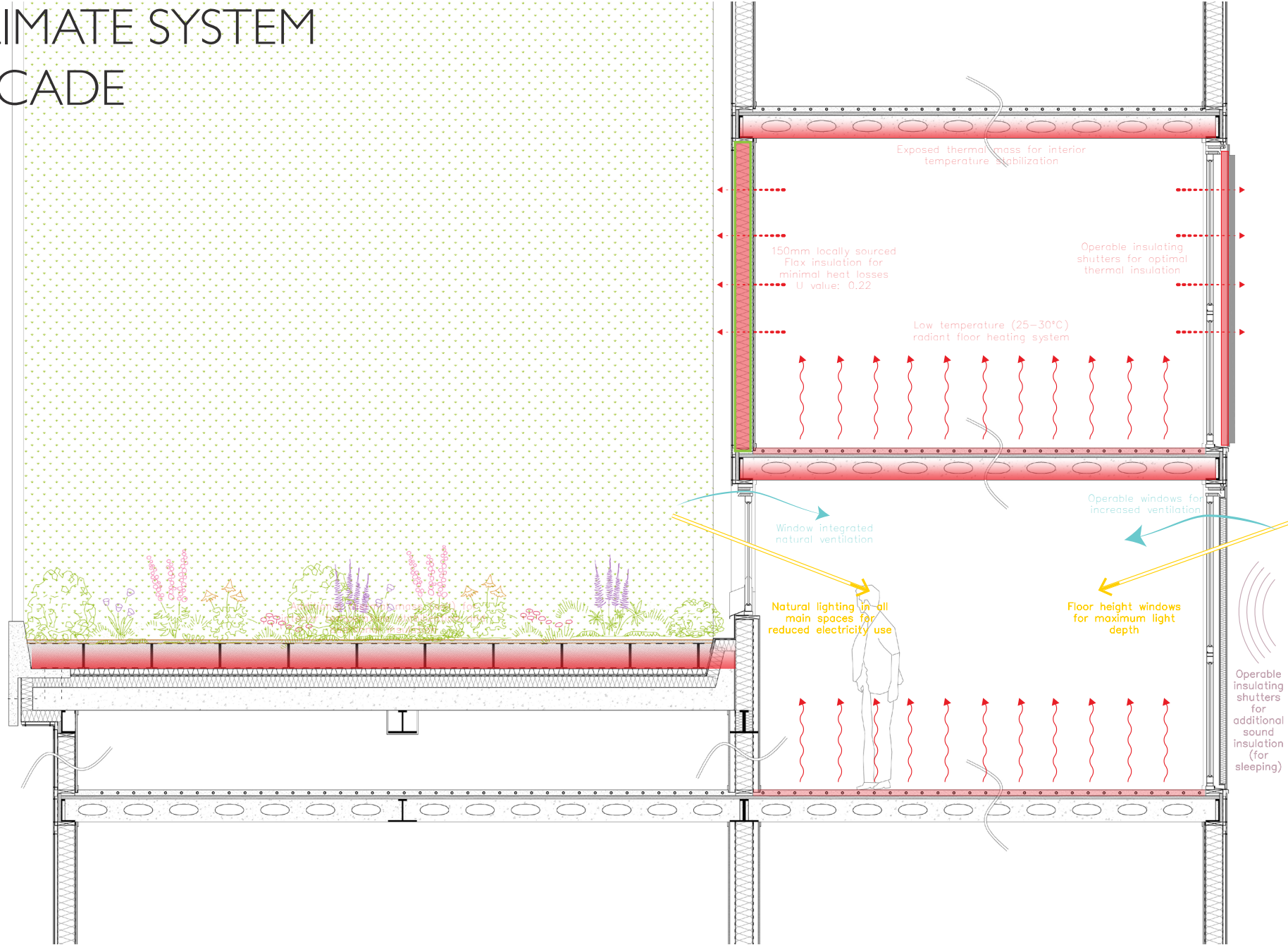
CONSTRUCTION SECTION FACADE

1:20

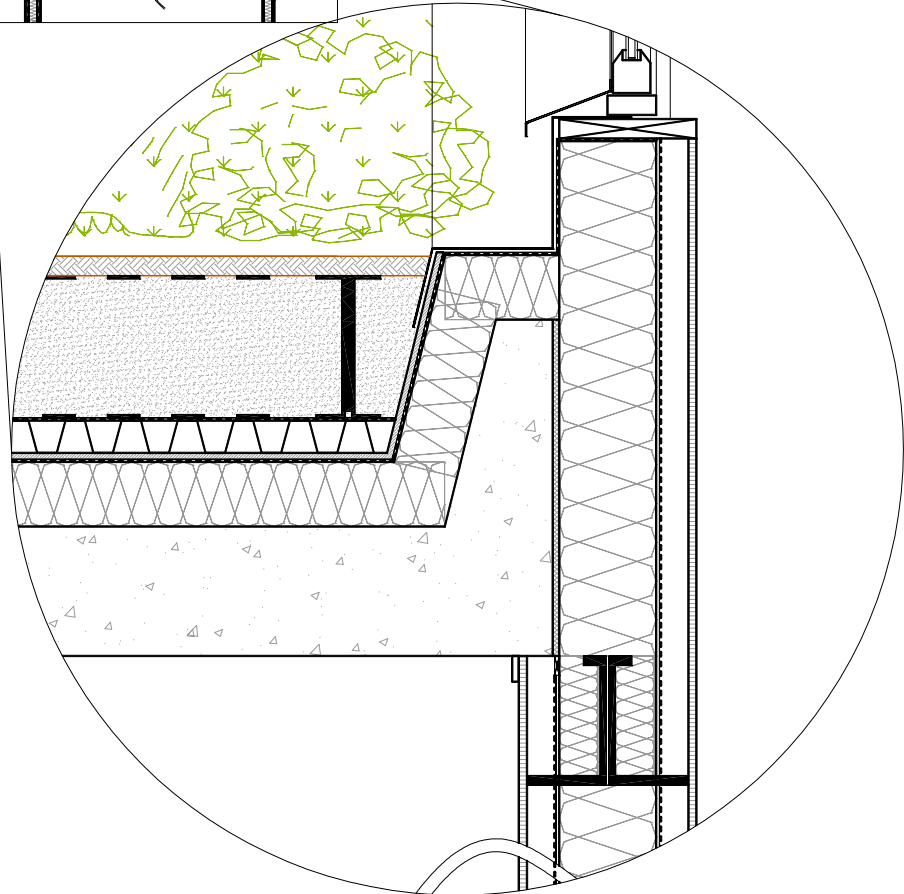
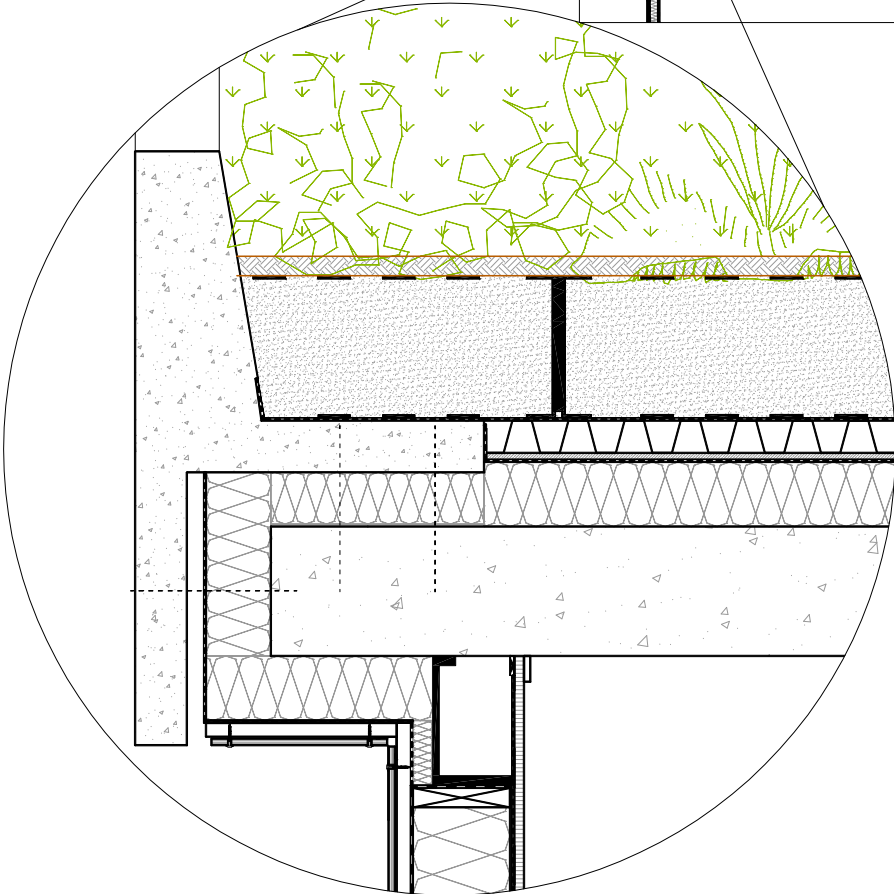
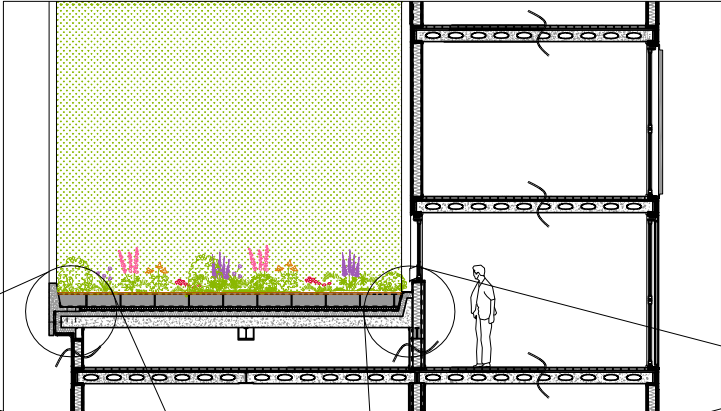


Facade Section
1:20

CLIMATE SYSTEM FACADE



Facade Section
Details
1:5





IMPRESSIONS

HIGHWAY VIEW



PUBLIC SPACE



PUBLIC SPACE



THANK YOU FOR YOUR ATTENTION!

QUESTIONS

