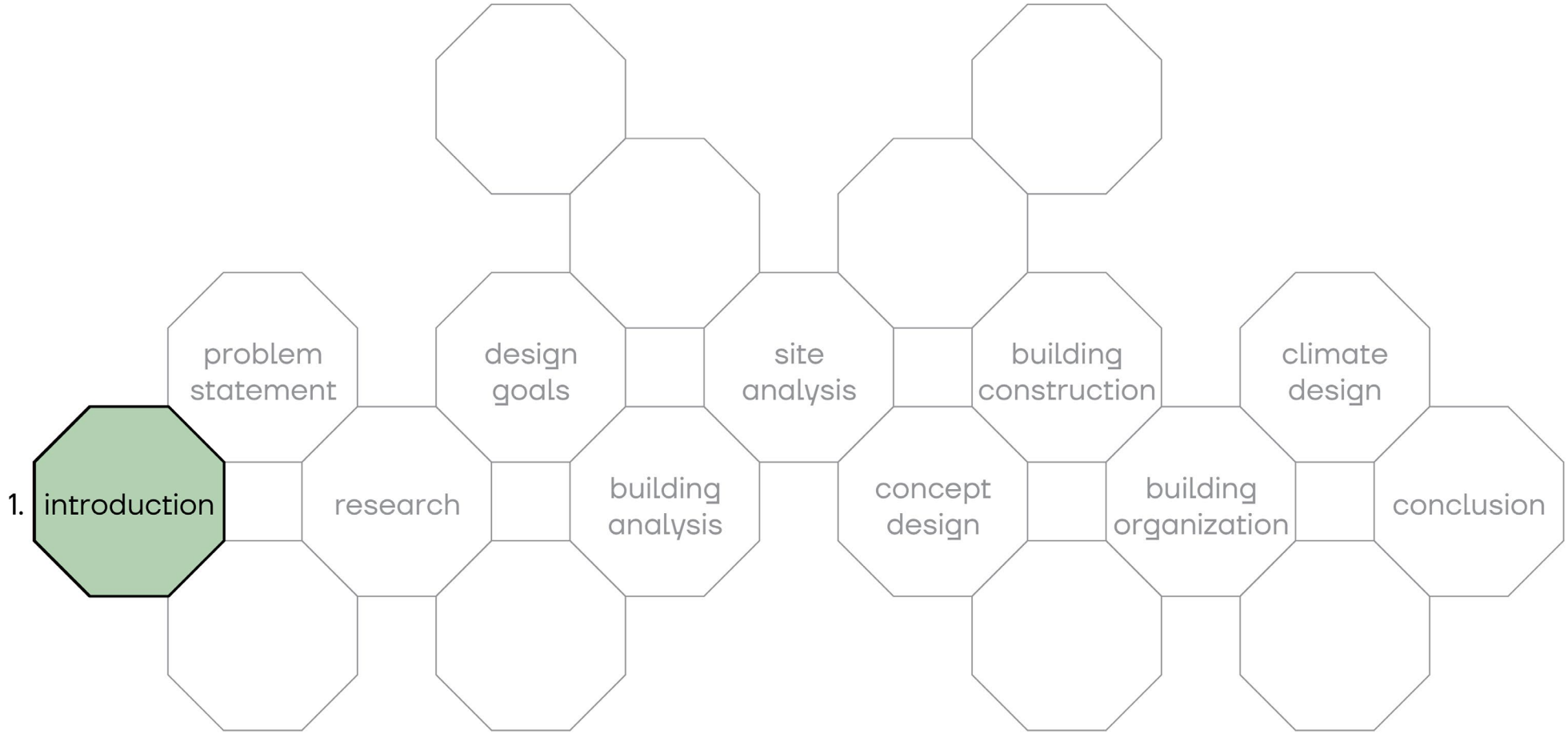
SoZaWe and its future...



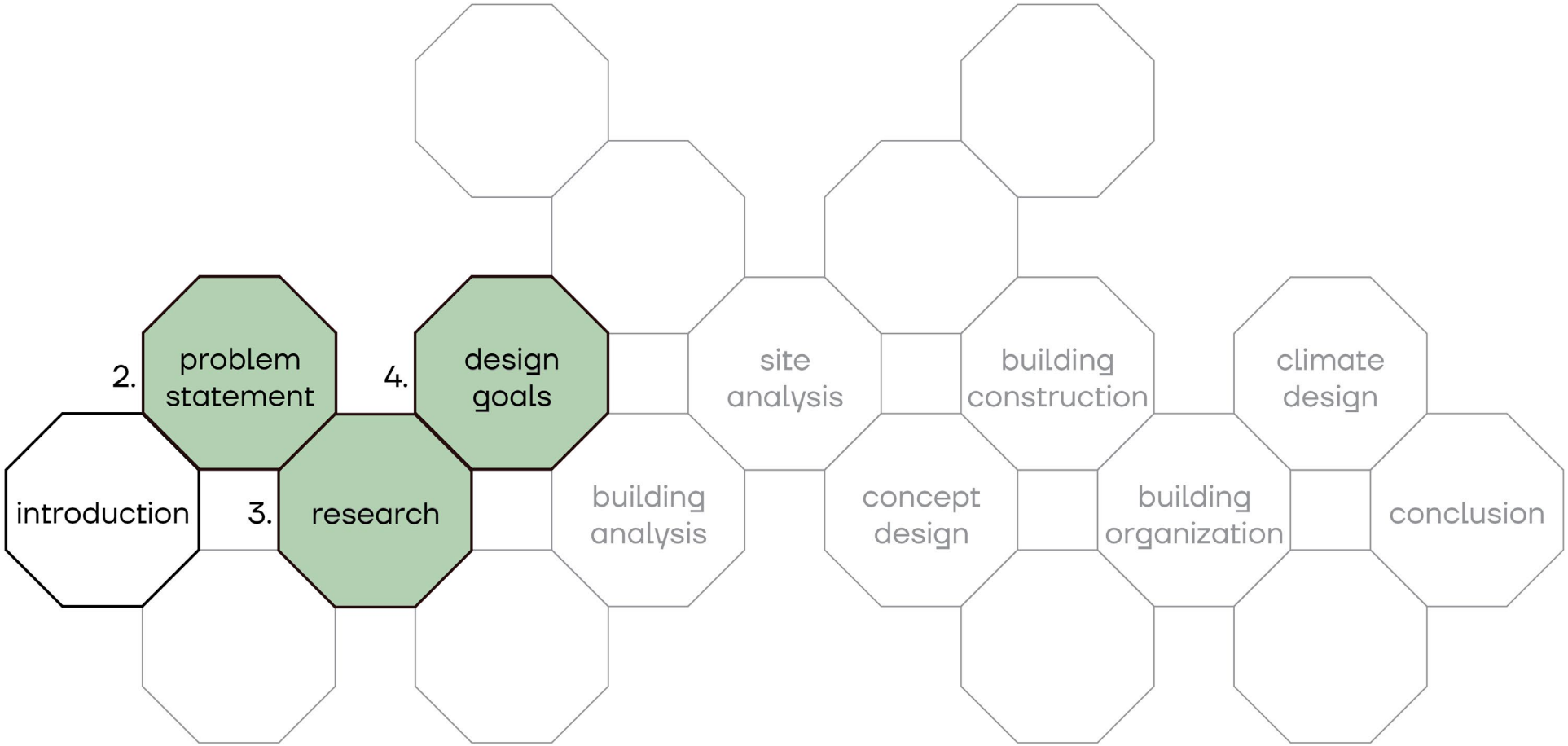
towards a circular construction industry

P5 presentation
architectural engineering
wouter van oekel

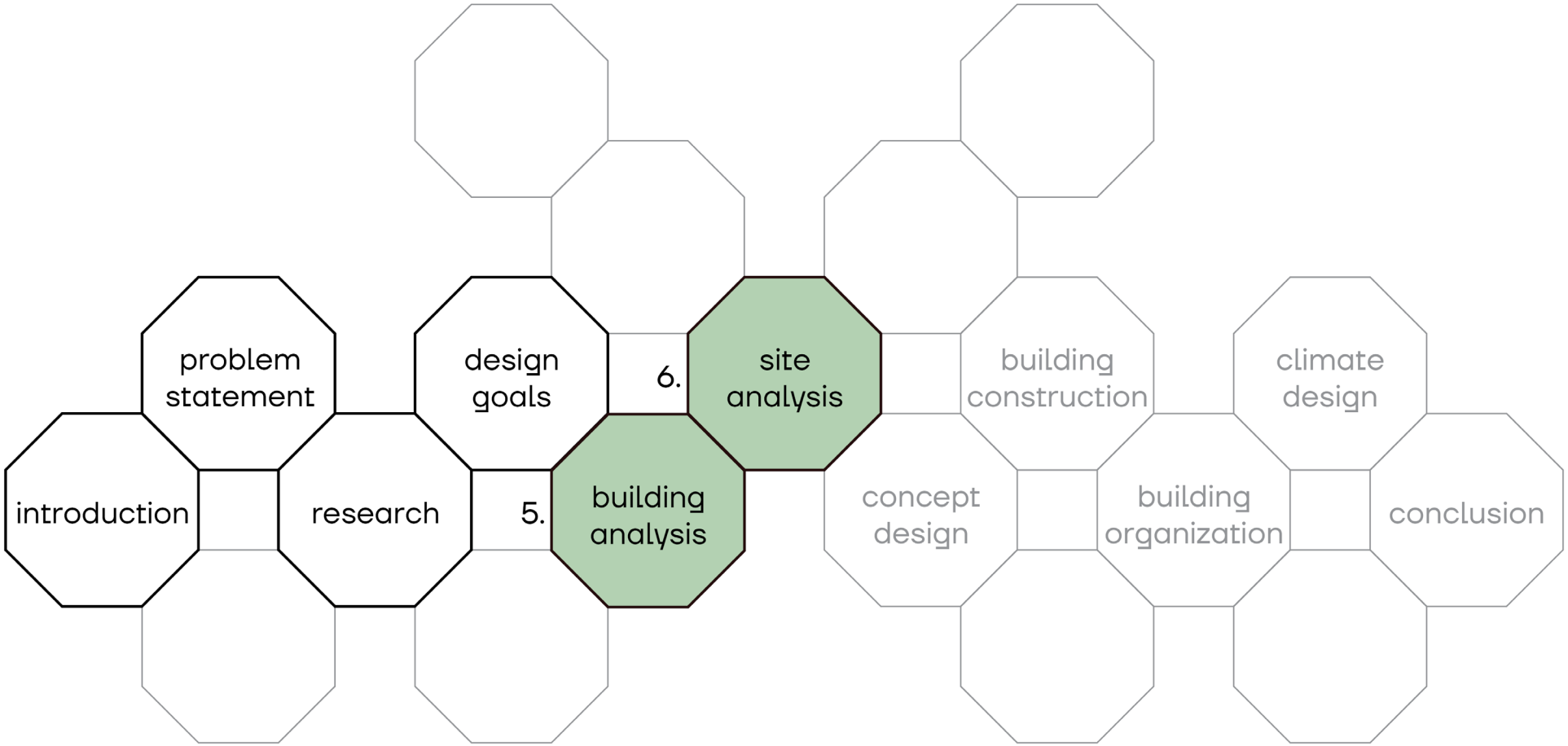
INTRODUCTION



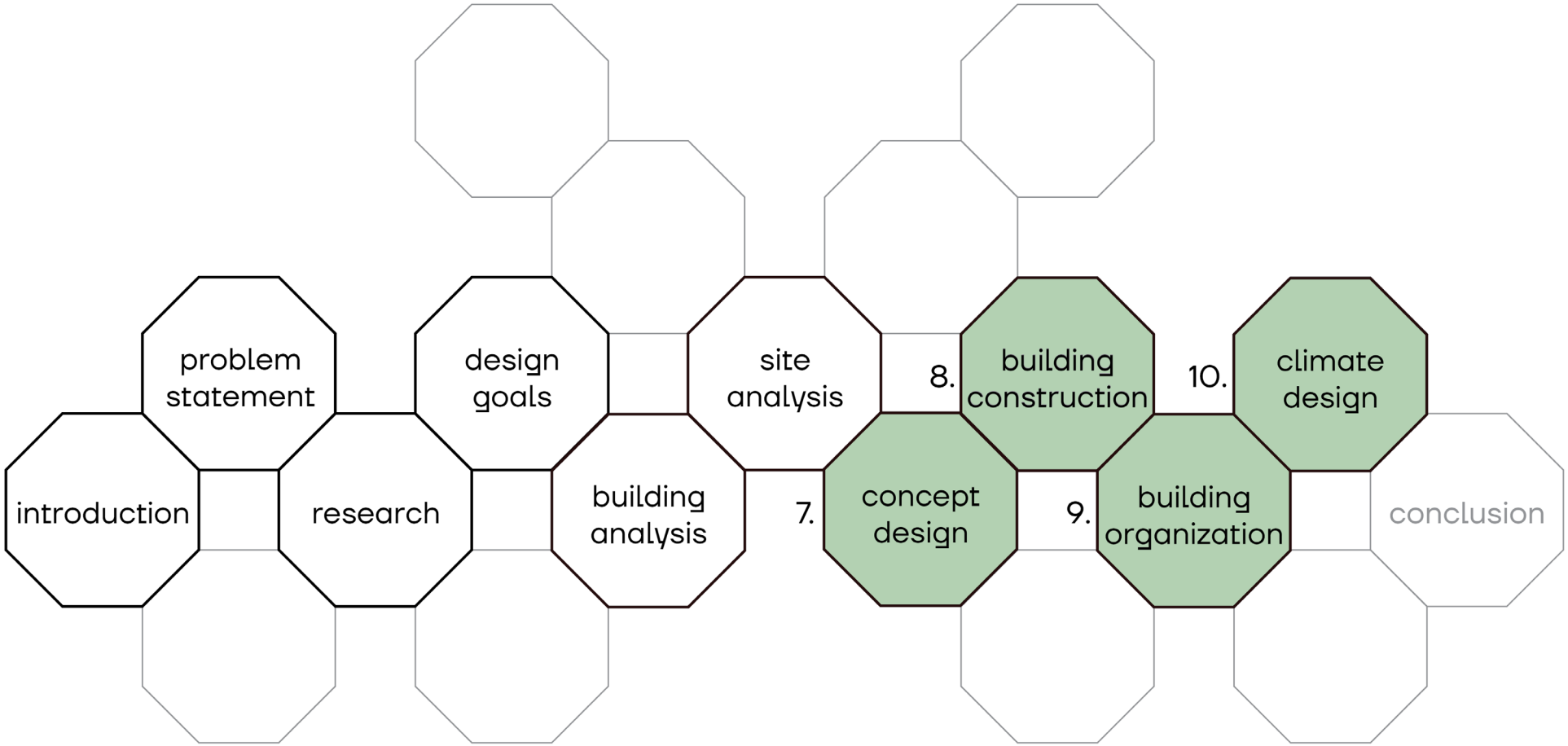
INTRODUCTION



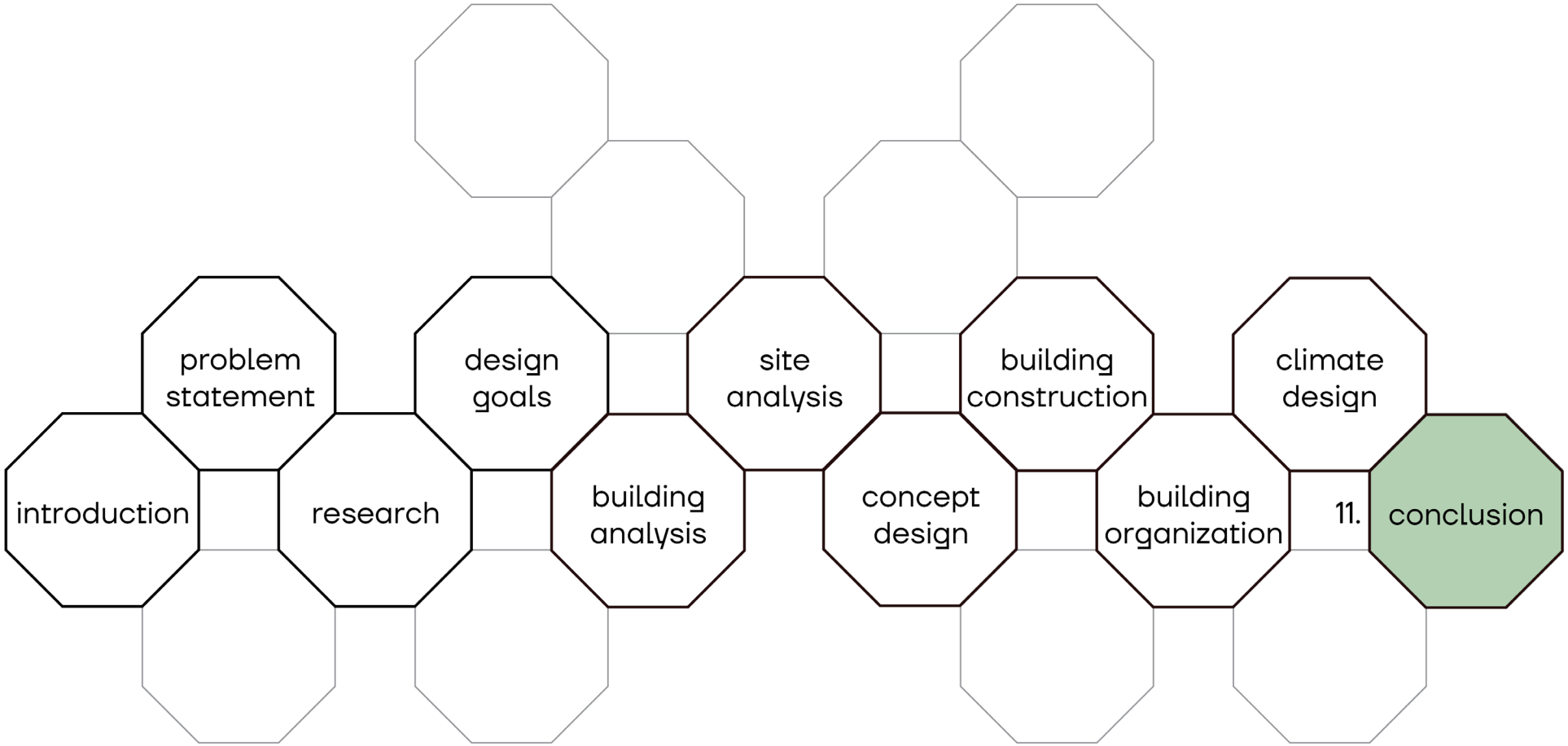
INTRODUCTION



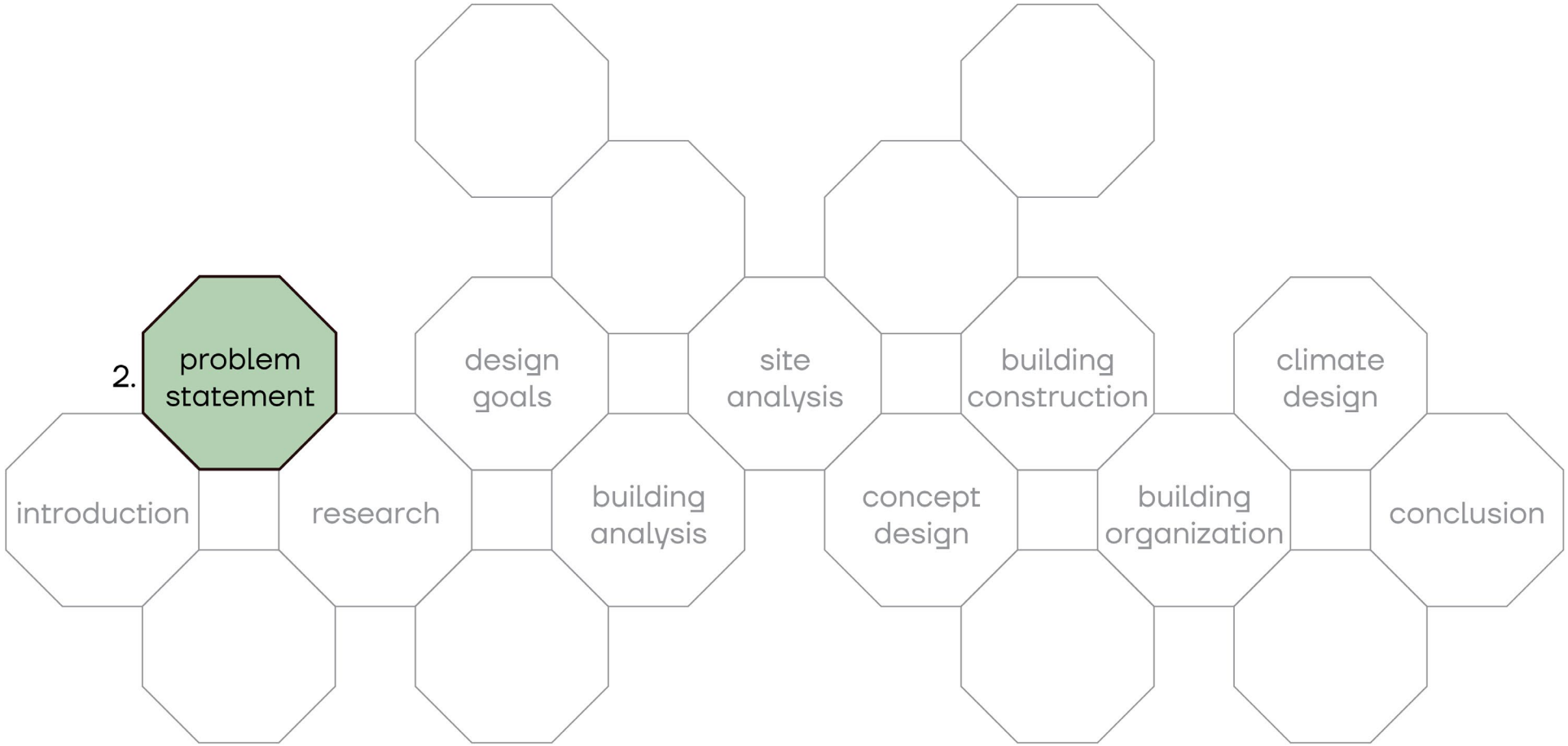
INTRODUCTION



INTRODUCTION



PROBLEM STATEMENT



PROBLEM STATEMENT

construction industry

The construction industry accounts for up to 12% of the total global CO_2 emissions [1]



sources: *https://single-market-economy.ec.europa.eu/industry/sustainability/buildings-and-construction_en [1]*

source: *https://www.thermofisher.com/blog/mining/the-cement-manufacturing-process/*

PROBLEM STATEMENT

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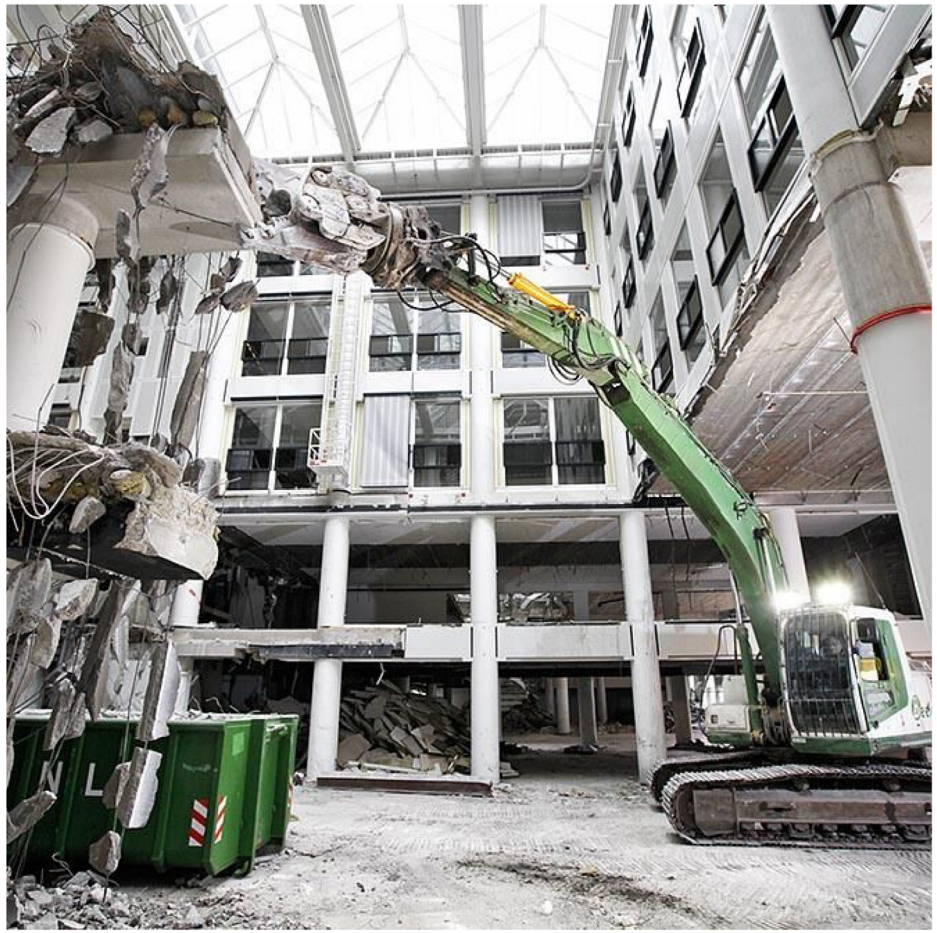
The production process of concrete produces significant amounts of CO_2



source: *https://www.thermofisher.com/blog/mining/the-cement-manufacturing-process/*

sources: *https://single-market-economy.ec.europa.eu/industry/sustainability/buildings-and-construction_en [1]*
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PROBLEM STATEMENT



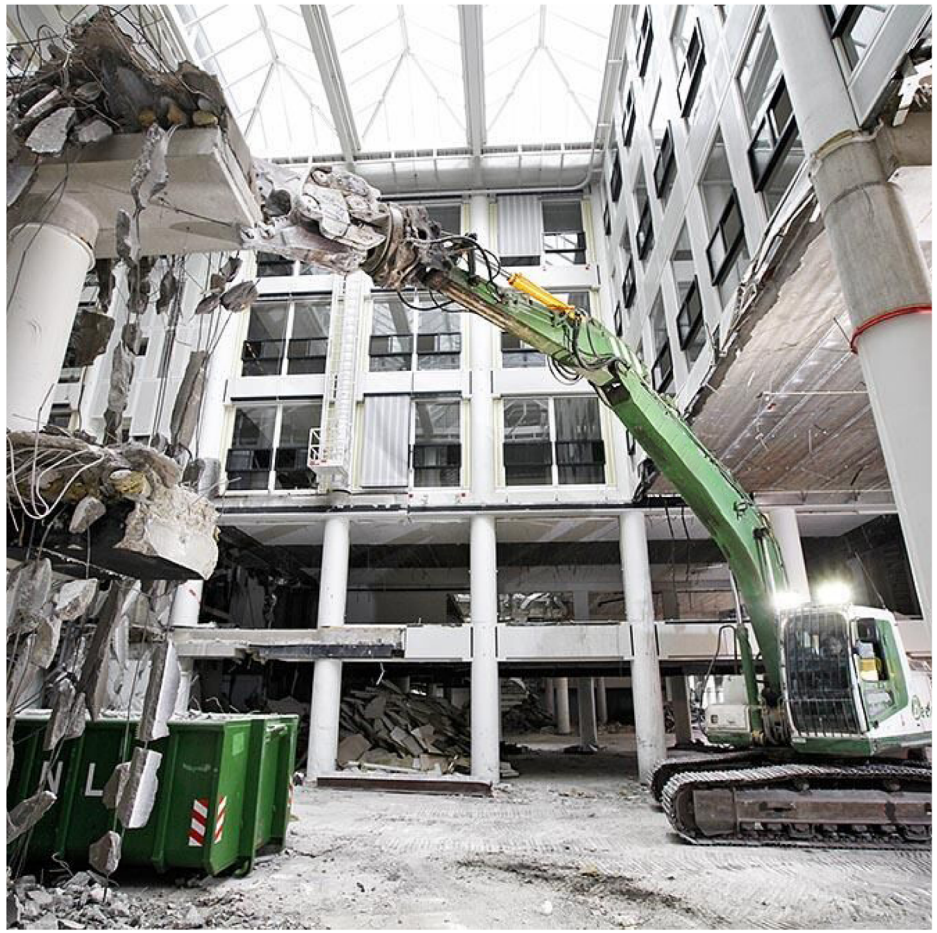
source: *https://bbcifrijwijk.nl/blog/omgevingsbeinvloeding-sloop/*

demolition trend

The Netherlands aims for 100% circularity in the construction industry by 2050 [3]

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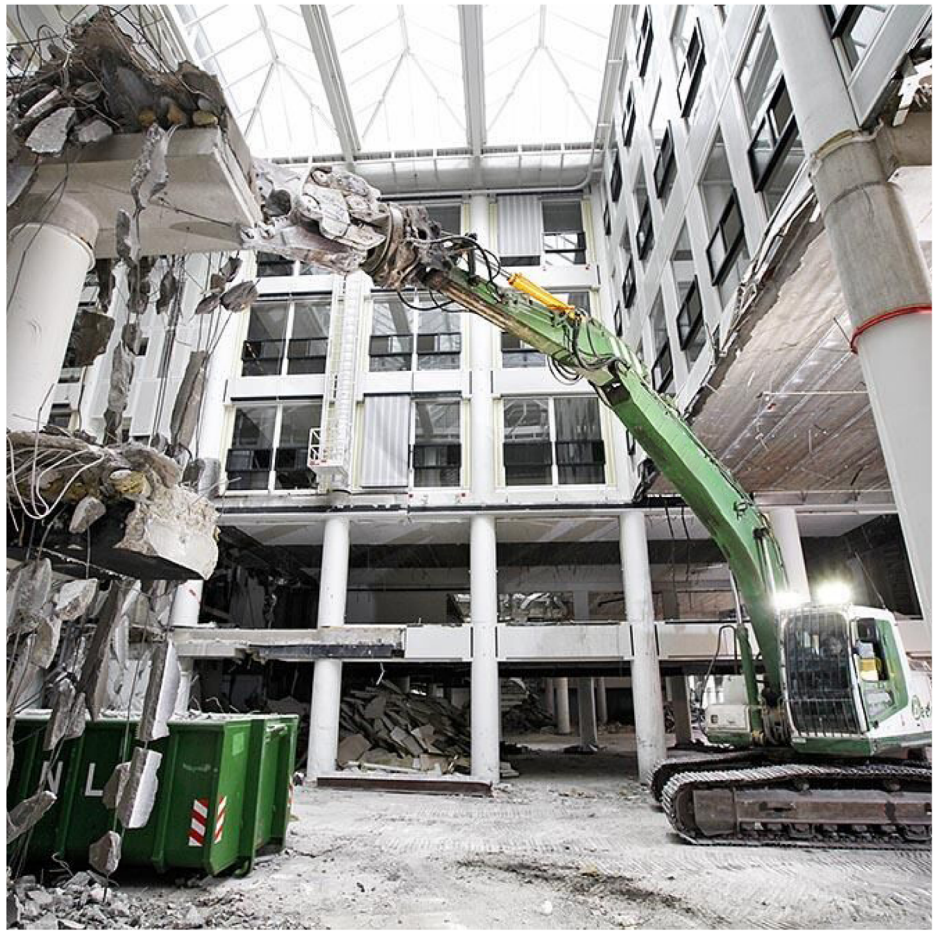
demolition trend

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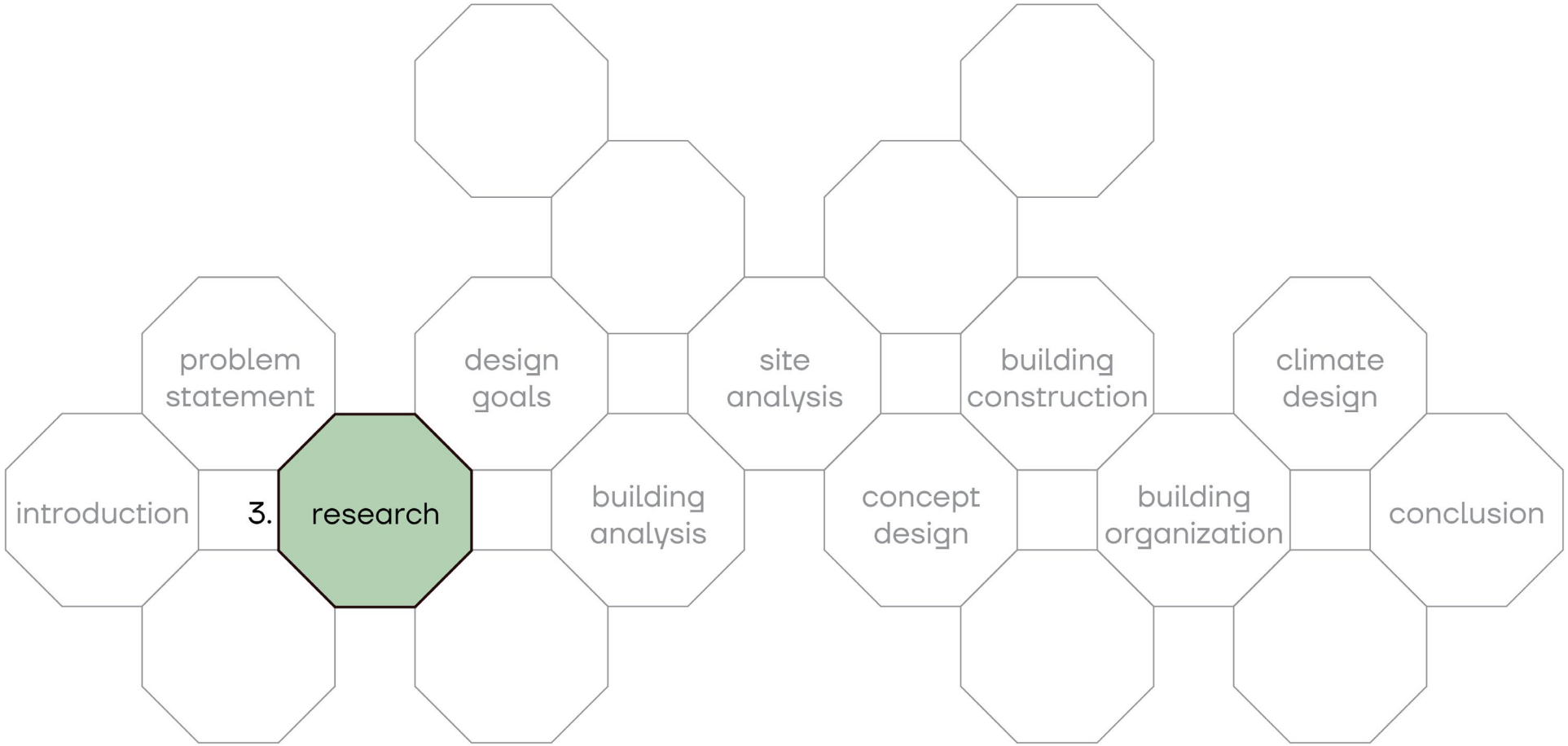
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Many post ‘65 buildings in the Netherlands are facing demolition [4]

Much of the waste, often concrete, is not being reused and ends op on landfills

sources: *https://www.metabolic.nl/publication/materiaalstromen-milieu-impact-en-energieverbruik-in-de-woningbouw/ [3]*
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RESEARCH


problem statement
design goals
site analysis
building construction
climate design
introduction
3. research
building analysis
concept design
building organization
conclusion



overarching reasearch question:

“How can reclaimed concrete from end-of-life buildings be effectively integrated into new building projects and create future ease of disassembly and reassembly?"

deconstruction methods

Diamond circular saw blade

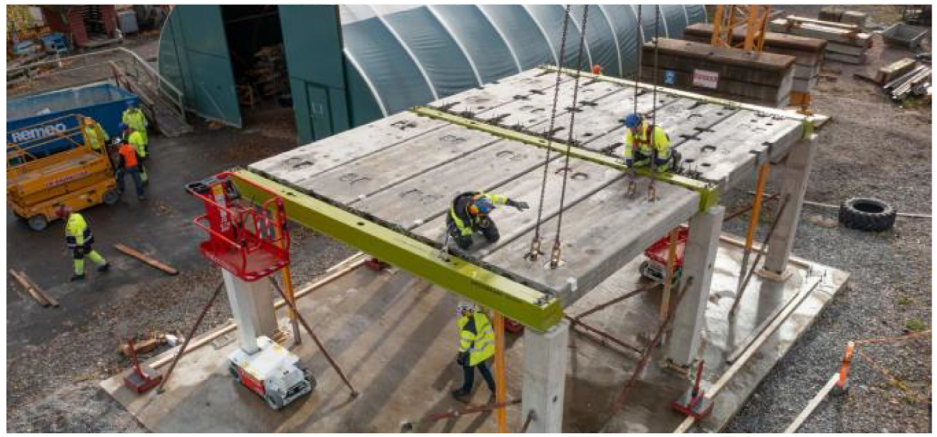


source: *https://www.pontiacconcrete.com/concrete-cutting.html*

Abrasive Water Jet (AWJ)



source: *https://www.aquaforceconcreteservices.co.uk/hydro-demolition/*



source: *https://www.bft-international.com/en/artikel/towards-sustainable-and-green-building-industry-dismount-and-reuse-of-precast-structures-3888462.html*



source: *https://www.peikko.co.uk/products/product/hpkm-column-shoe/*

reconstruction methods

concrete floor slabs

concrete column

RESEARCH



case study

The former Ministry of Social Affairs and Employment is designed by Herman Hertzberger and was completed in 1990



source: *https://www.ahh.nl/index.php/nl/projecten2/12-utiliteitsbouw/120-ministerie-van-sociale-zaken-en-werkgelegenheid-den-haag*

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Its construction consists of interconnected octagonal units built from prefabricated concrete elements



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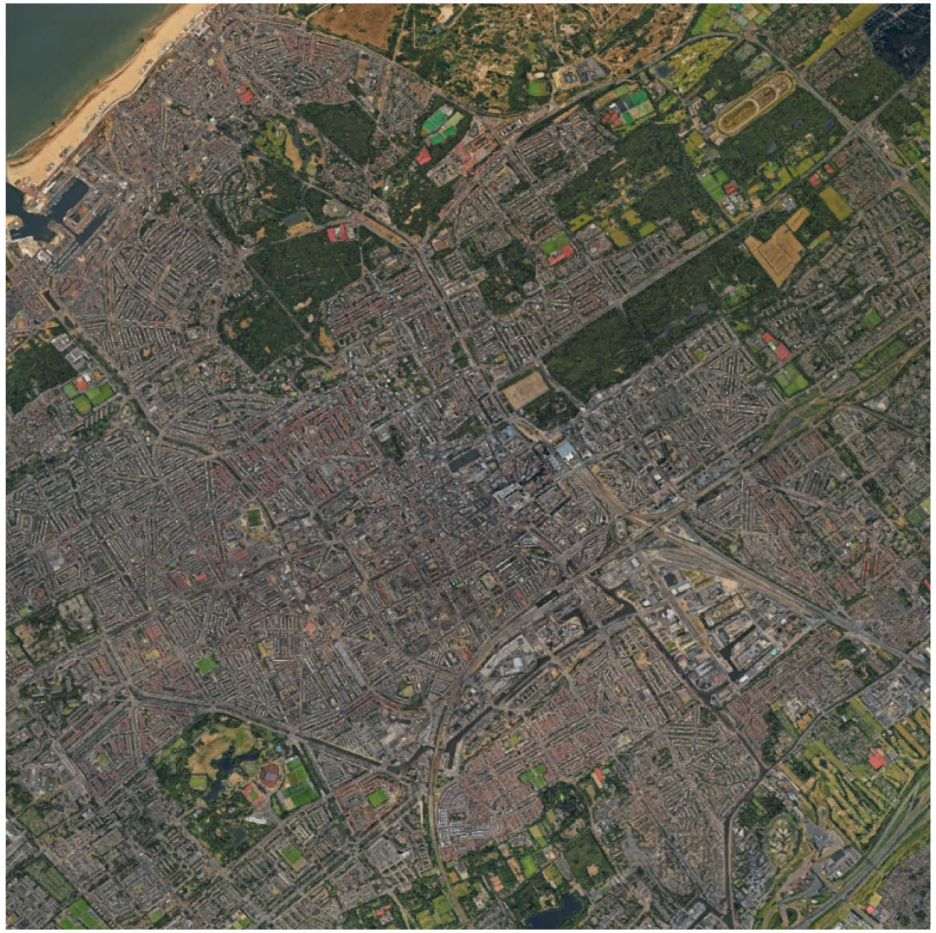
Its construction consists of interconnected octagonal units built from prefabricated concrete elements

Despite several researches for transformation, the building is facing demolition to make place for a new building project



source: *https://www.ahh.nl/index.php/nl/projecten2/12-utiliteitsbouw/120-ministerie-van-sociale-zaken-en-werkgelegenheid-den-haag*

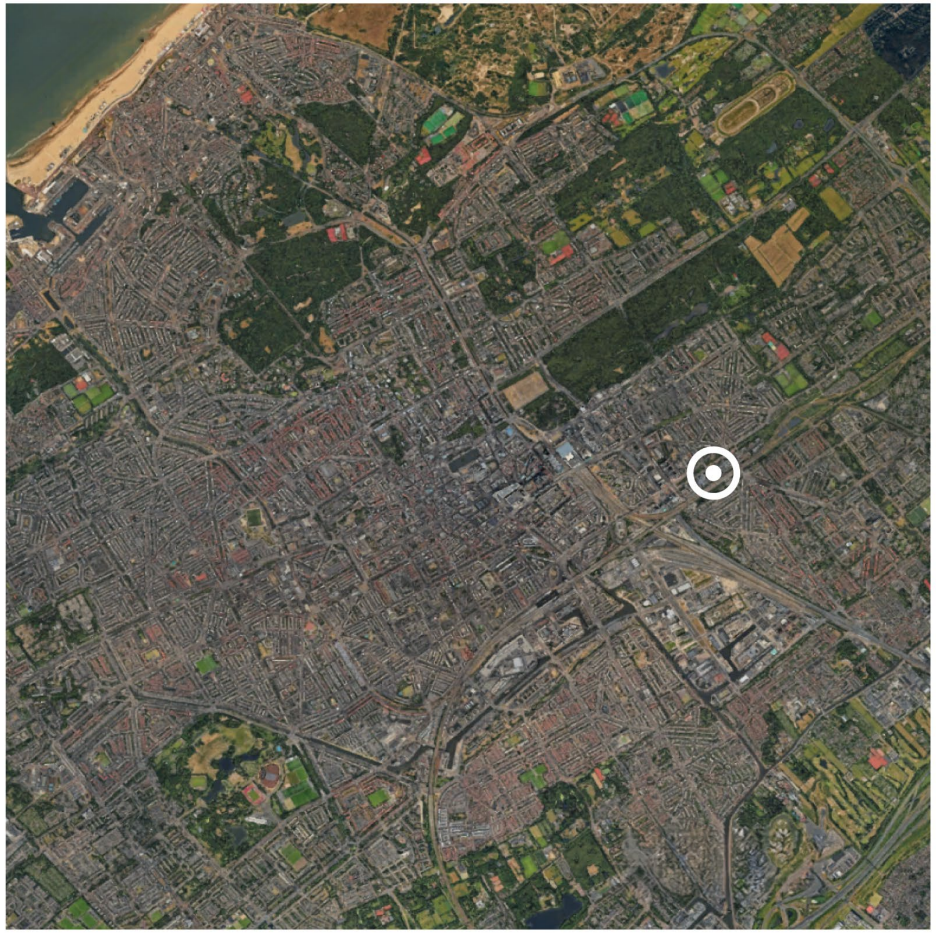
RESEARCH



source: *https://www.google.com/maps*

scale 1:50000

RESEARCH



source: *https://www.google.com/maps*

scale 1:50000

RESEARCH



source: *https://www.google.com/maps*

scale 1:5000

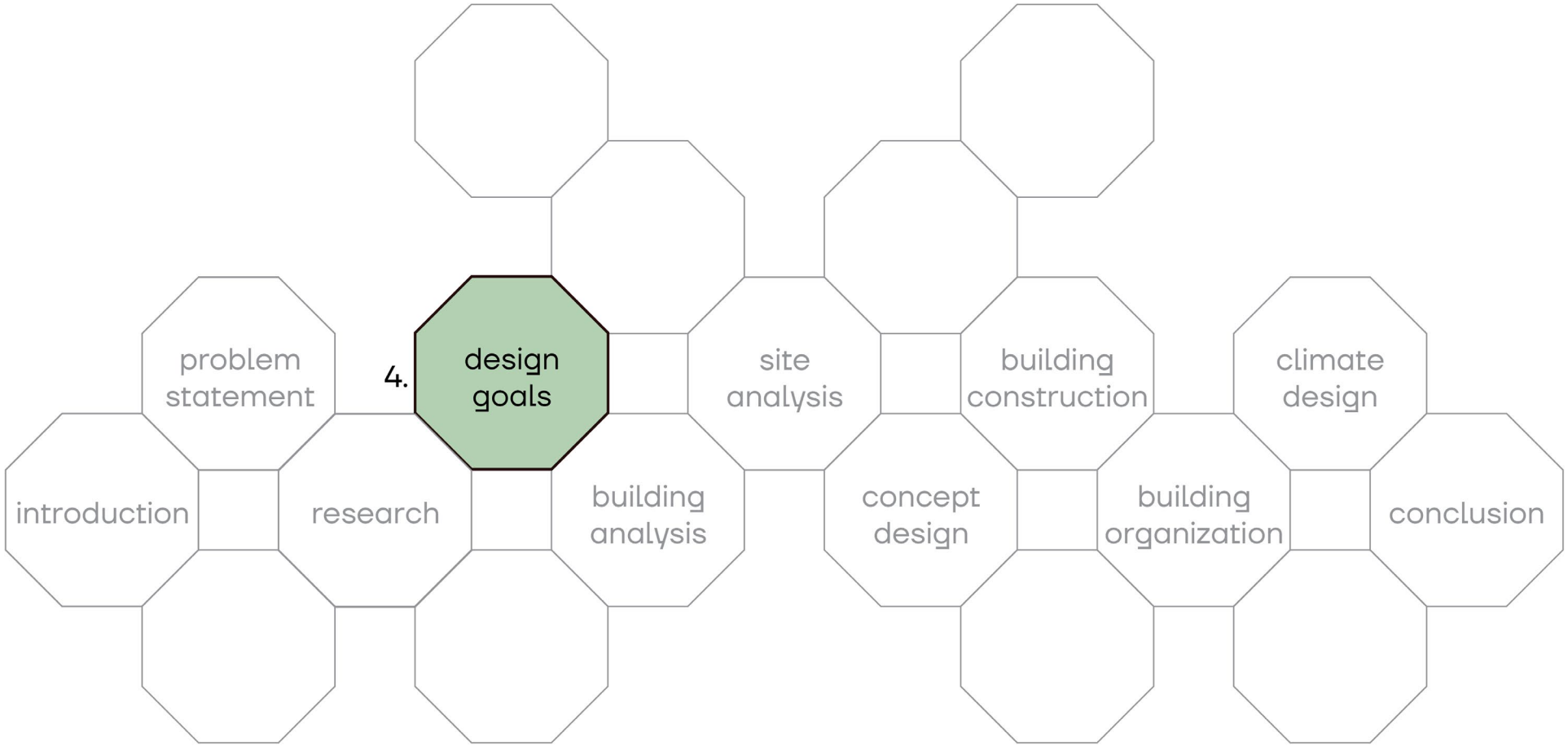
RESEARCH



source: *https://www.google.com/maps*

scale 1:5000

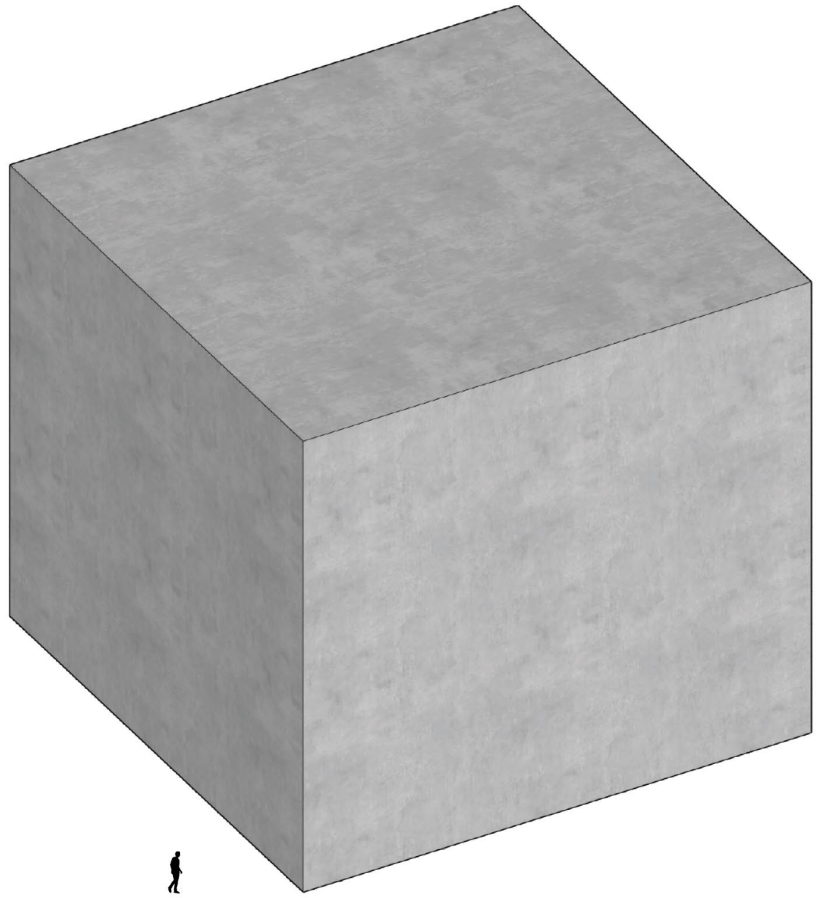
DESIGN GOALS



DESIGN GOALS

CO_2 footprint

The building contains a total of 20.293 m^3 of prefab concrete elements



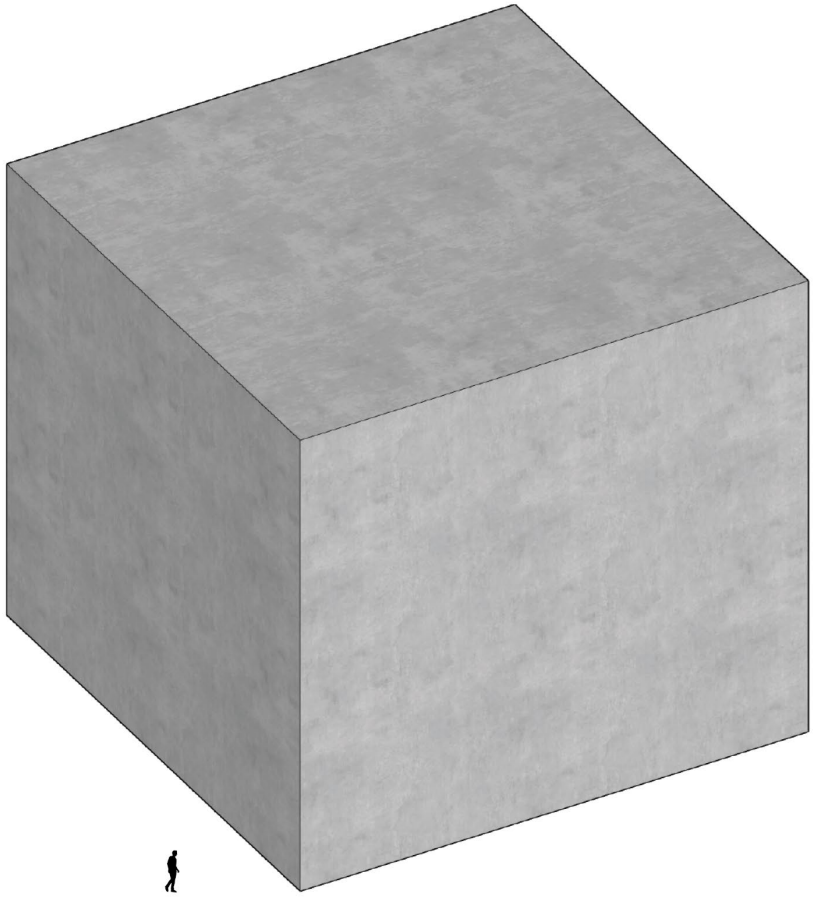
DESIGN GOALS



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The building contains a total of 20.293 m^3 of prefab concrete elements

These elements embody all together 9.277 tonnes of CO_2, which can be considered as "lost" when demolishing the building



DESIGN GOALS

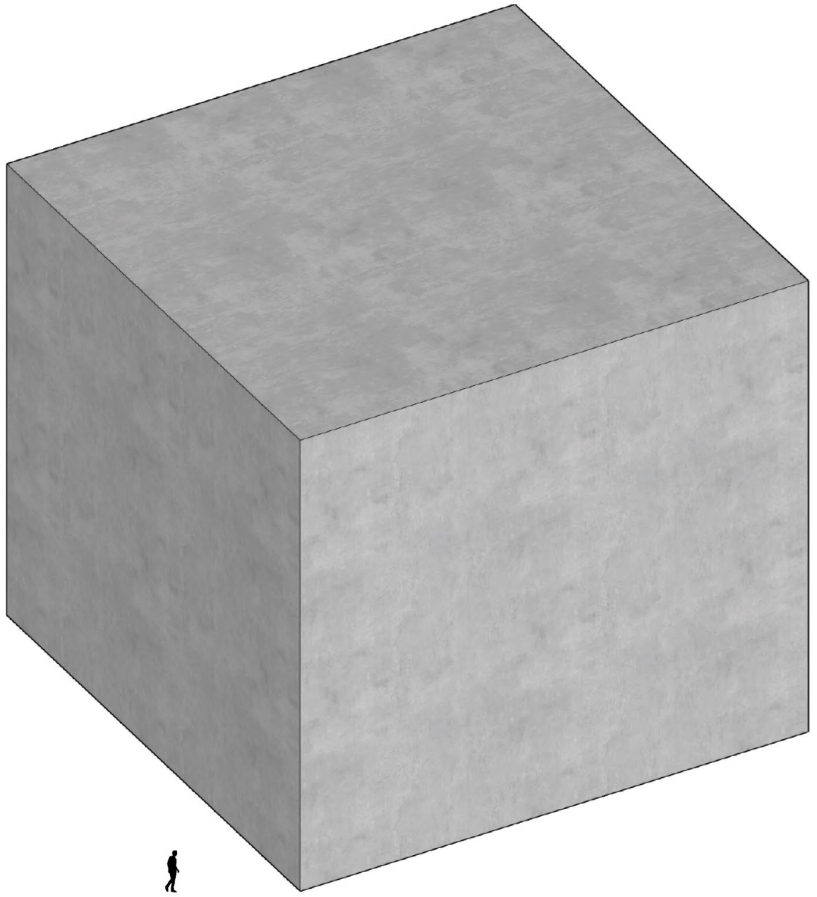


CO_2 footprint

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This is equivalent to the emissions from approximately 9.000 flights from Amsterdam to New York



DESIGN GOALS



deconstruct and reuse

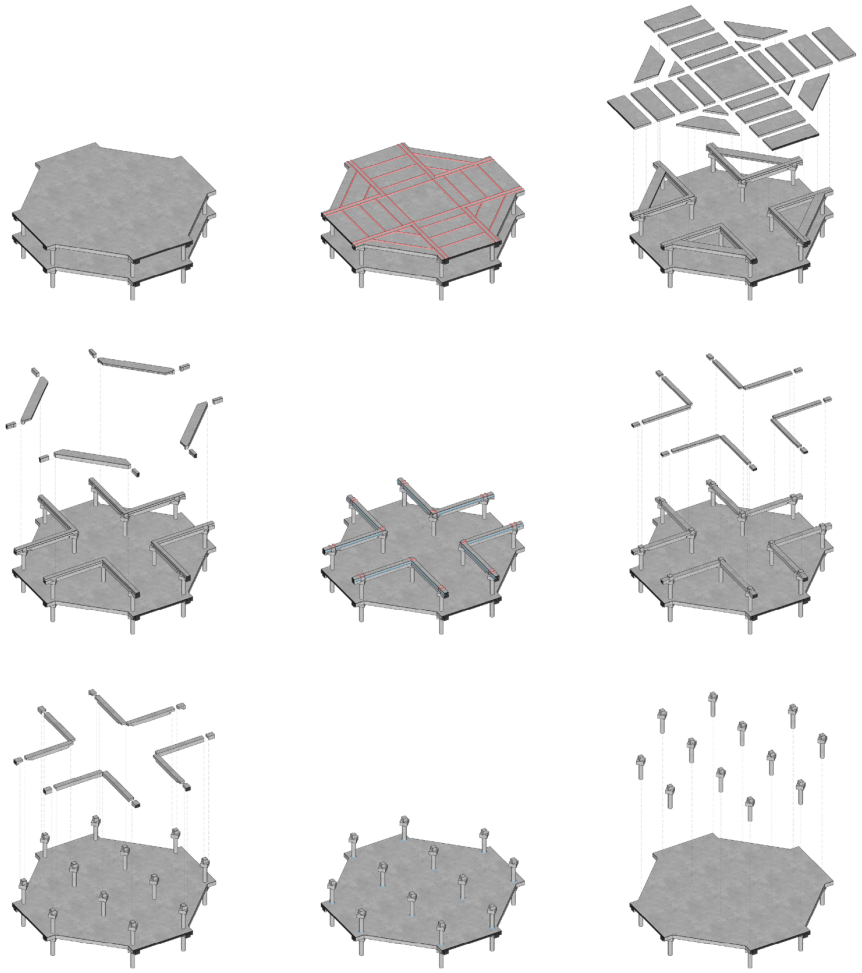
In a draft of the zoning plan proposal dated November 7, 2023, it states:

…“*The developer aims to salvage materials and components during the demolition process, including exploring the possibility of repurposing elements like the prefab columns*”… [5]

source: *https://projecten.denhaag.nl/project/herontwikkeling-voormalig-ministerie-sociale-zaken-soza/ [5]*

DESIGN GOALS





deconstruct and reuse

In a draft of the zoning plan proposal dated November 7, 2023, it states:

..."*The developer aims to salvage materials and components during the demolition process, including exploring the possibility of repurposing elements like the prefab columns*"... [5]

The goal is to deconstruct the prefabricated concrete elements and reuse them for the new construction project

source: *https://projecten.denhaag.nl/project/herontwikkeling-voormalig-ministerie-sociale-zaken-soza/ [5]*

DESIGN GOALS



program of requirements

The municipality and developers have presented a new plan to establish a mixed-use project at this location with 1.200 apartments [6]

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DESIGN GOALS



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The total GFA will need to be doubled from 60.000 m² to 120.000 m² to accommodate this plan

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DESIGN GOALS

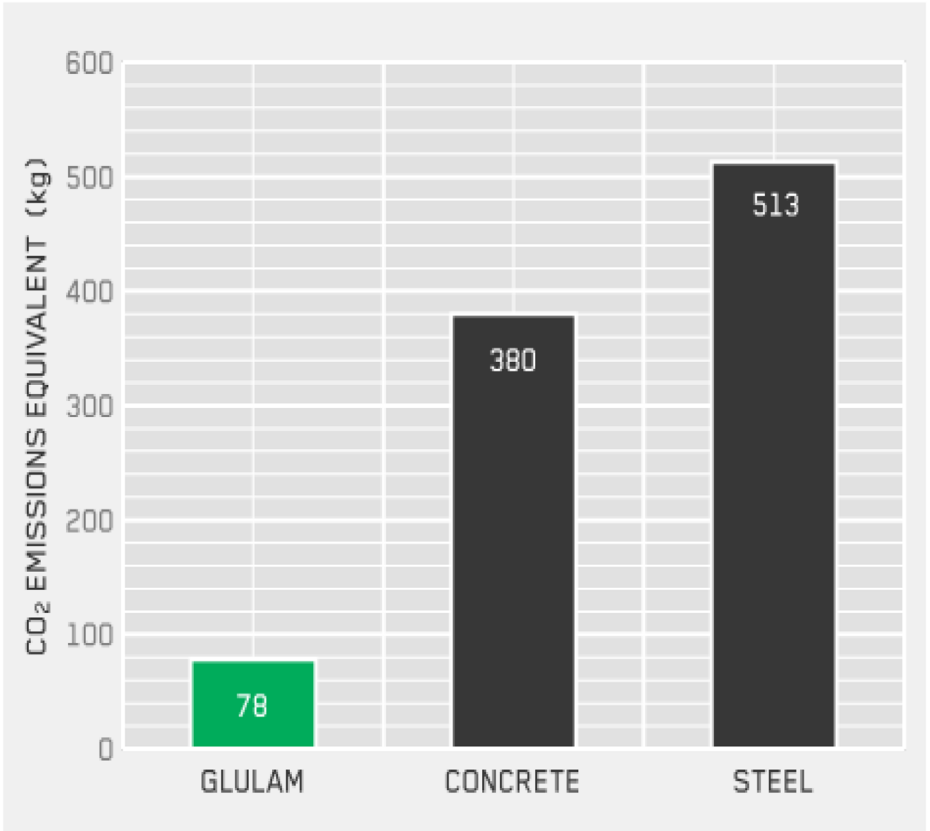


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New construction materials will be needed to meet the demand, and to keep the CO_2 footprint as low as possible, the new section will be built using wood



CO_2 emissions for a 7.3 meter beam

source: *https://projecten.denhaag.nl/project/herontwikkeling-voormalig-ministerie-sociale-zaken-soza/* [6]

source: *https://www.nordic.ca/en/sustainable-construction/sustainable-development*

DESIGN GOALS



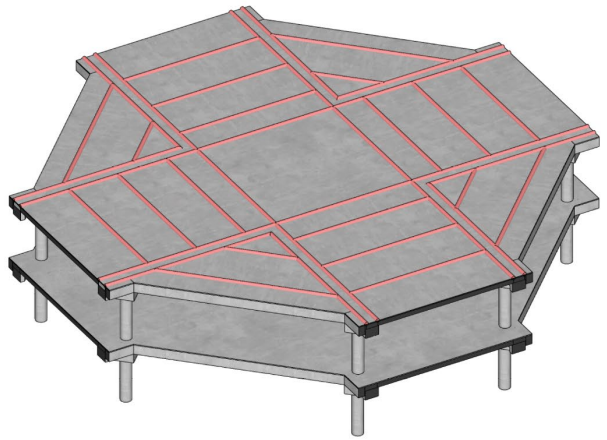
deconstruction method

standard octaganol island as starting point



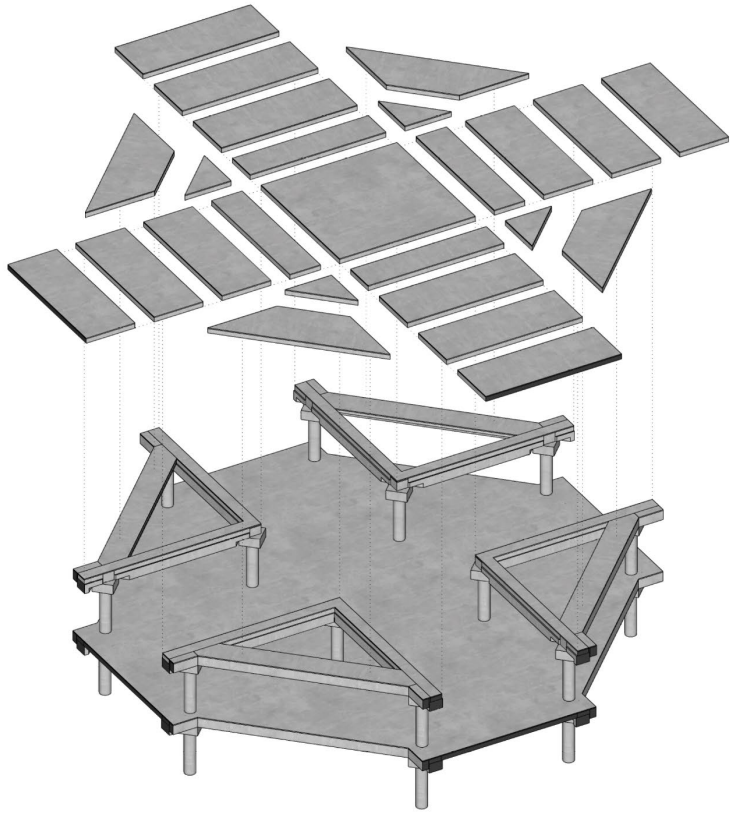
deconstruction method

cutting with the diamond saw through the topped-up cast-in-place concrete floor



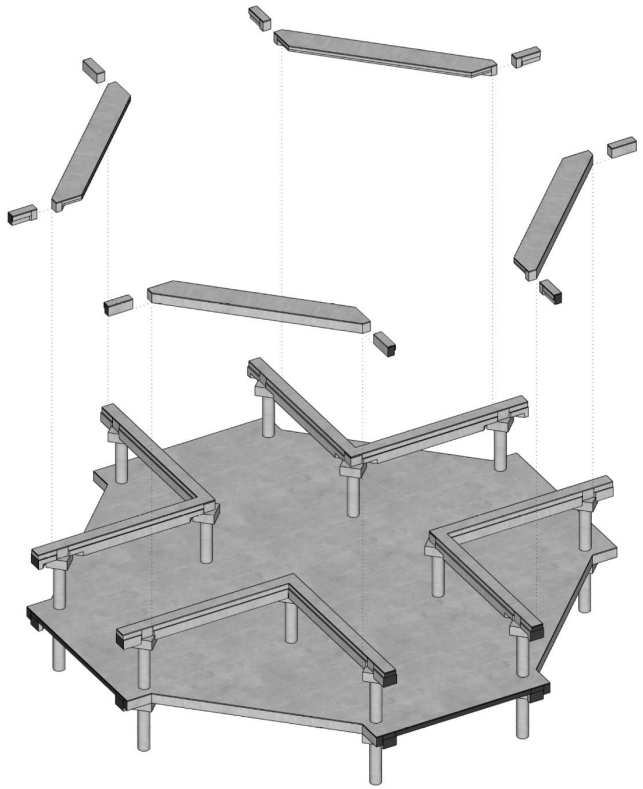
deconstruction method

removing the pre-tensioned floor slabs with the topped-up concrete



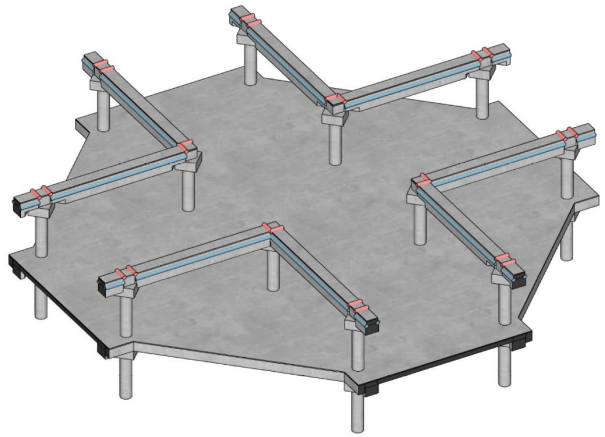
deconstruction method

dismantling the dowel connected
side beams from the capitals by chiseling



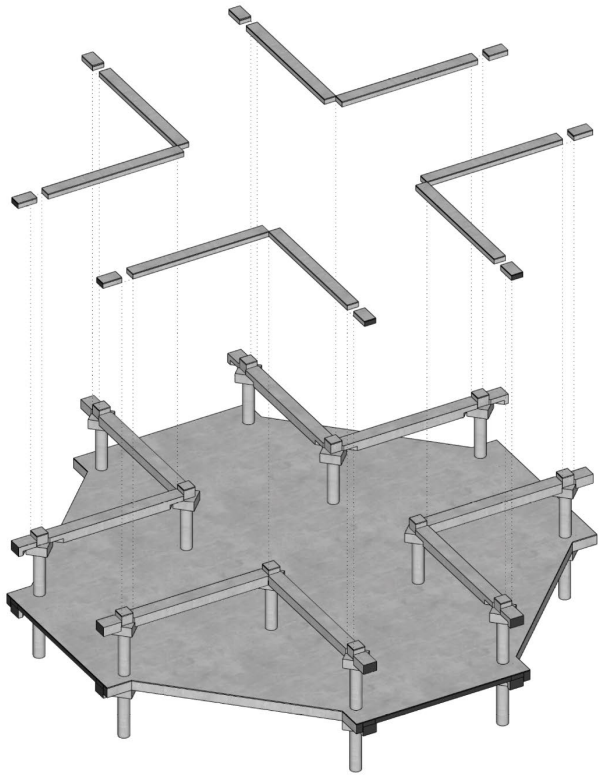
deconstruction method

cutting with the diamond saw and the AWJ
through the topped-up concrete remainings



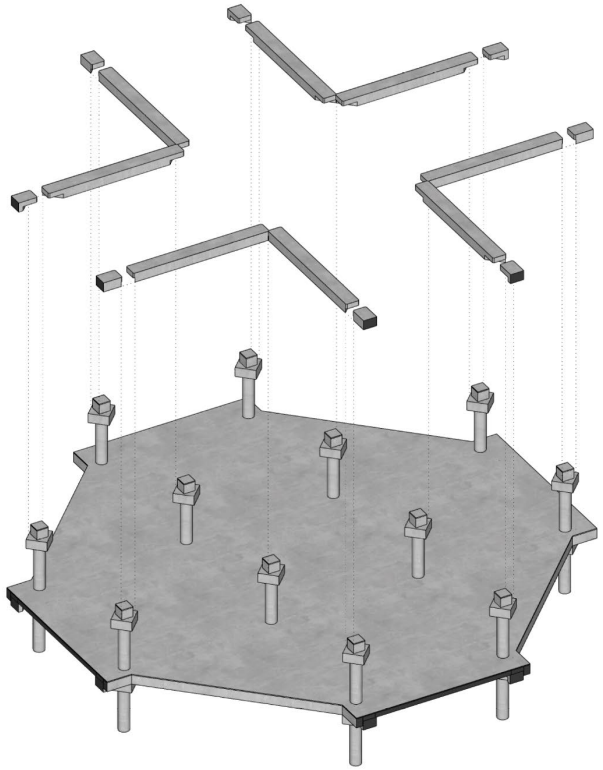
deconstruction method

removing the topped-up concrete
remainings from the main beams



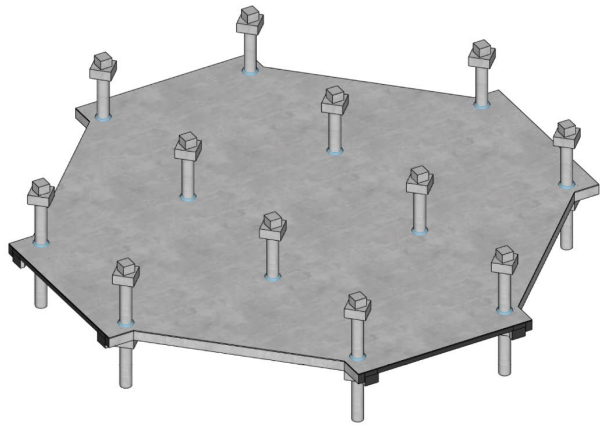
deconstruction method

dismantling the dowel connected main beams from the capitals by chiseling



deconstruction method

removing a small layer of concrete
from the colums with the A WJ so that
the rebars can be sawn apart

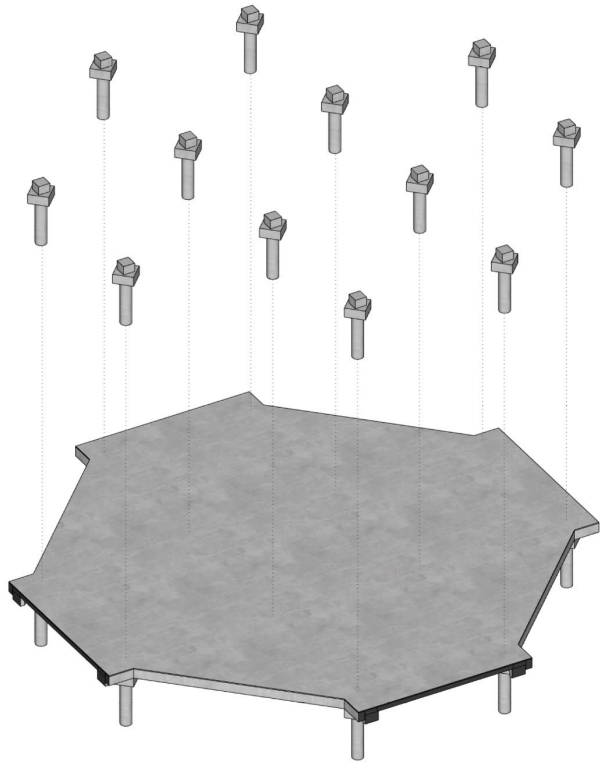


DESIGN GOALS

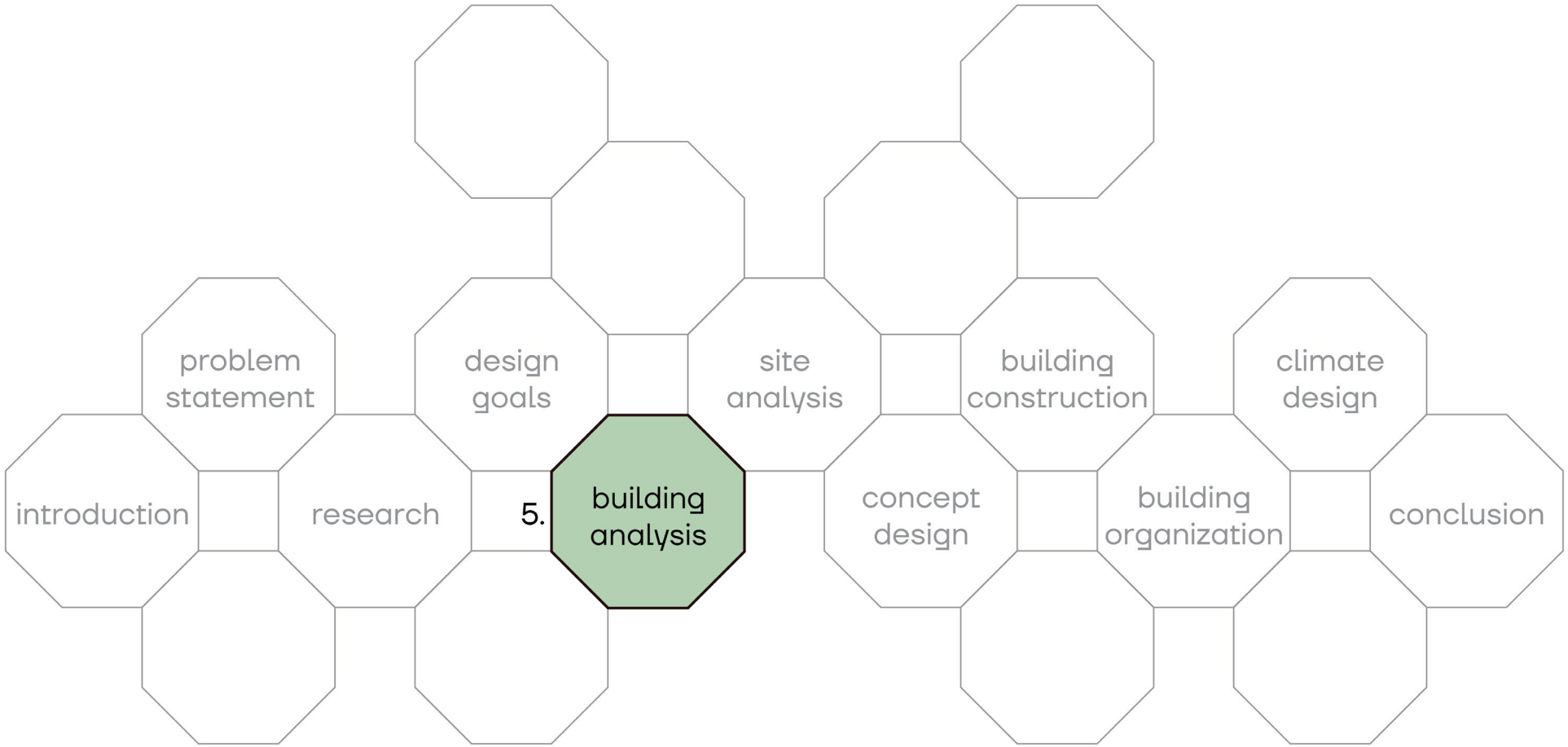


deconstruction method

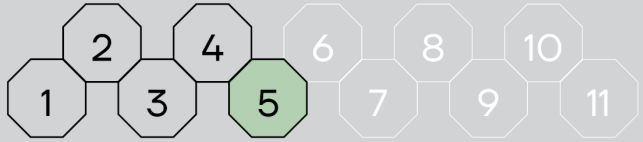
removing the columns from the standard island so that the process can be repeated



BUILDING ANALYSIS



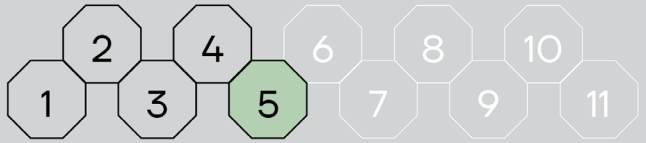
BUILDING ANALYSIS



so,

why ***deconstruct*** the building, and not ~~transform~~?

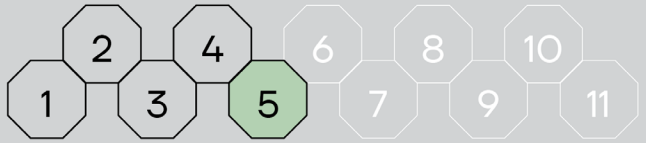
BUILDING ANALYSIS



transformation impossibilities

Several research studies have already been done by architectural firms aiming to transform the building from offices to residential units, but each time it proved to be unfeasible

BUILDING ANALYSIS

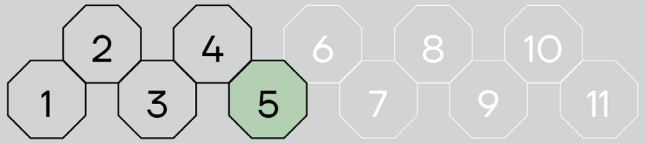


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Several research studies have already been done by architectural firms aiming to transform the building from offices to residential units, but each time it proved to be unfeasible

The program of requirements couldn't fit within the building, resulting in a shortage of residential units to sale, making it financially not possible

BUILDING ANALYSIS



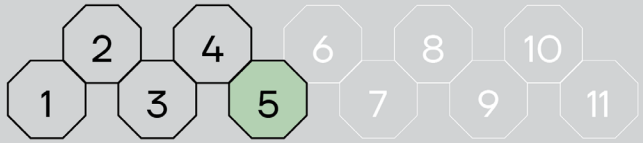
transformation impossibilities

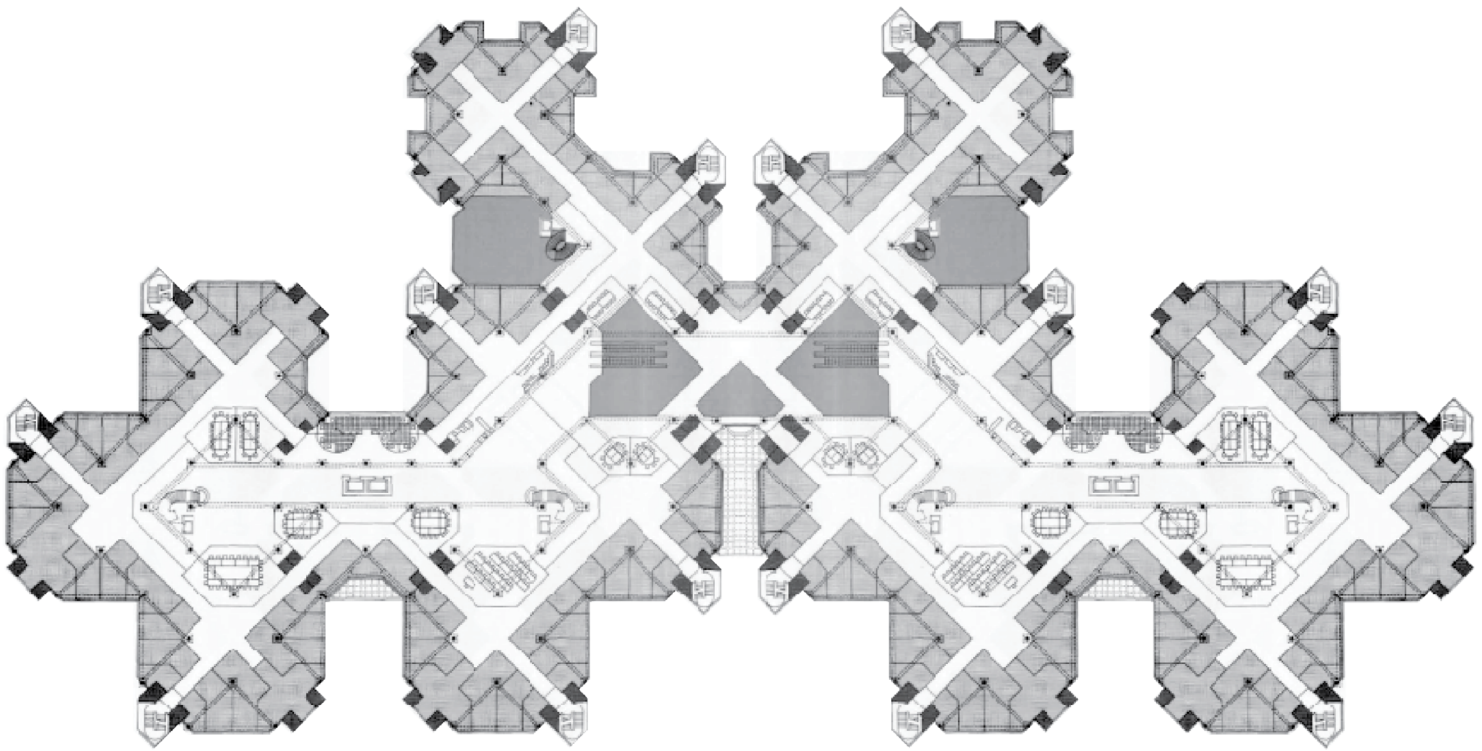
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The program of requirements couldn't fit within the building, resulting in a shortage of residential units to sale, making it financially not possible

The structural layout of the existing building is not ideal to accommodate housing units

BUILDING ANALYSIS

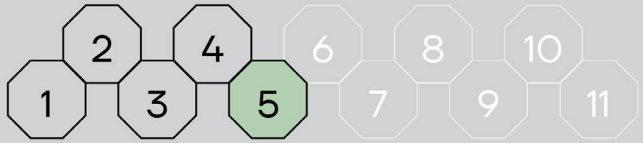


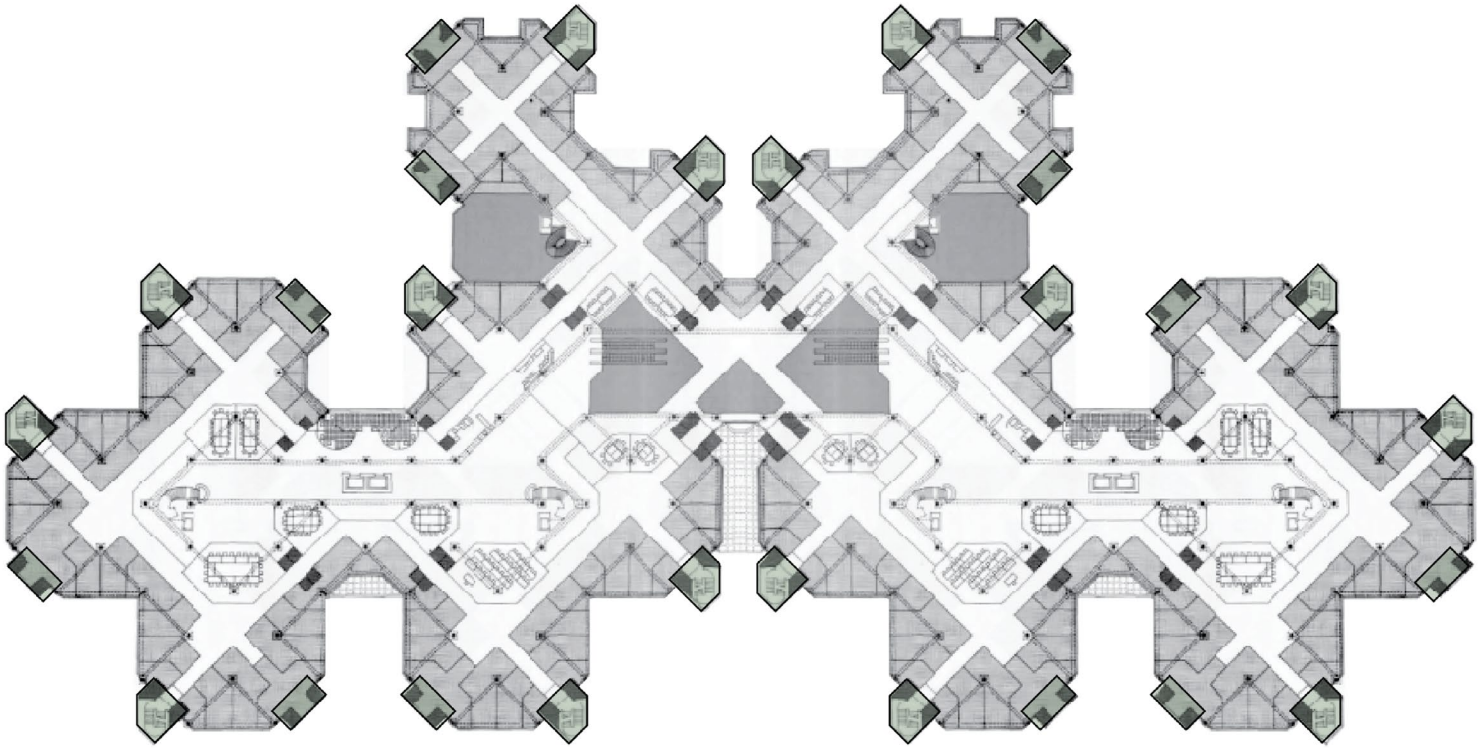


source: *Ministerie van Sociale Zaken en Werkgelegenheid. (n.d.). Een nieuw gebouw voor Sociale Zaken en Werkgelegenheid : van plan tot werkelijkheid*

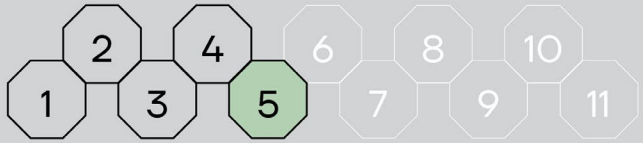
floorplan level 2
scale 1:500

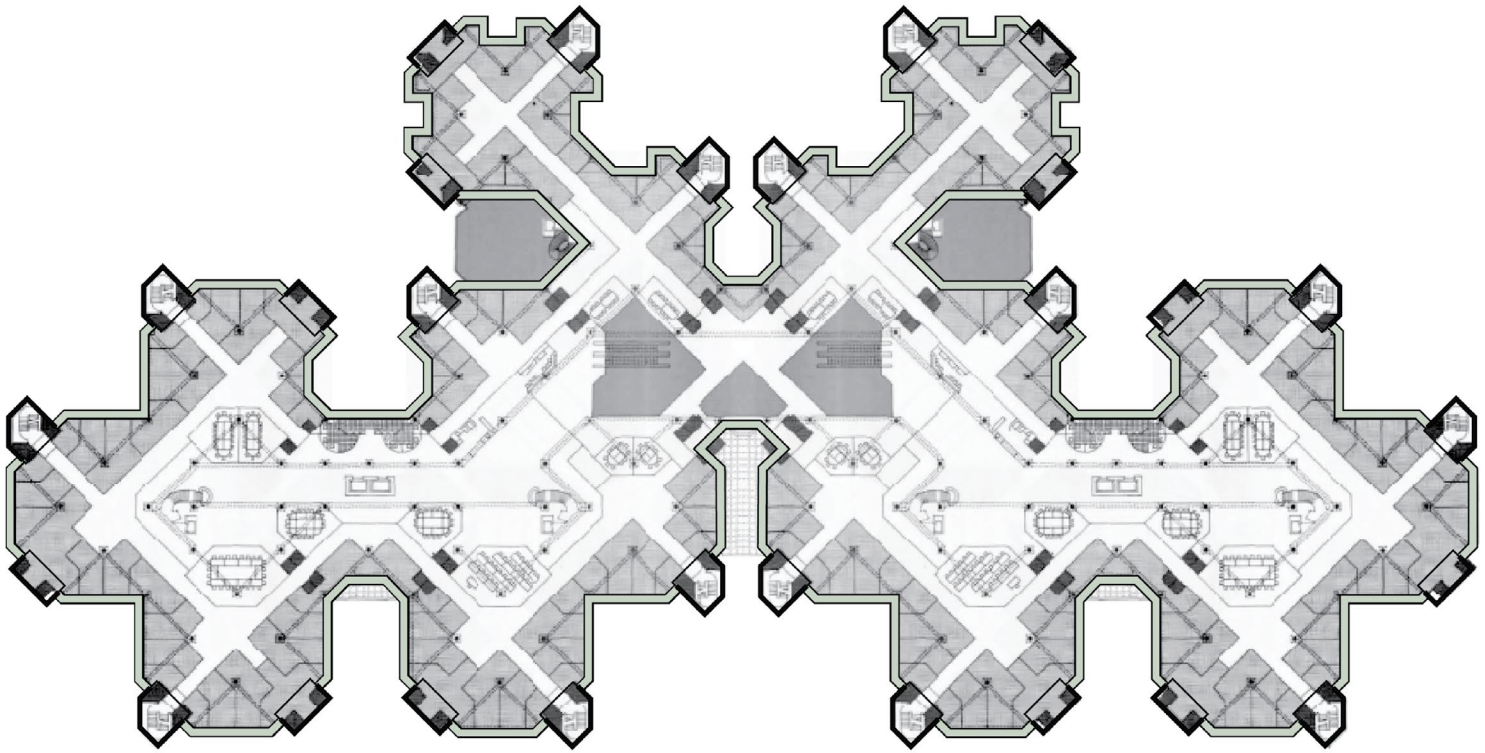
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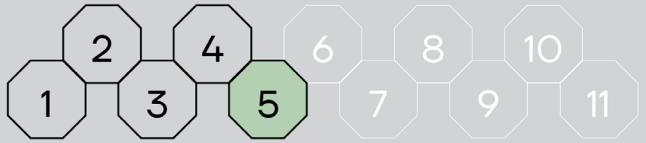


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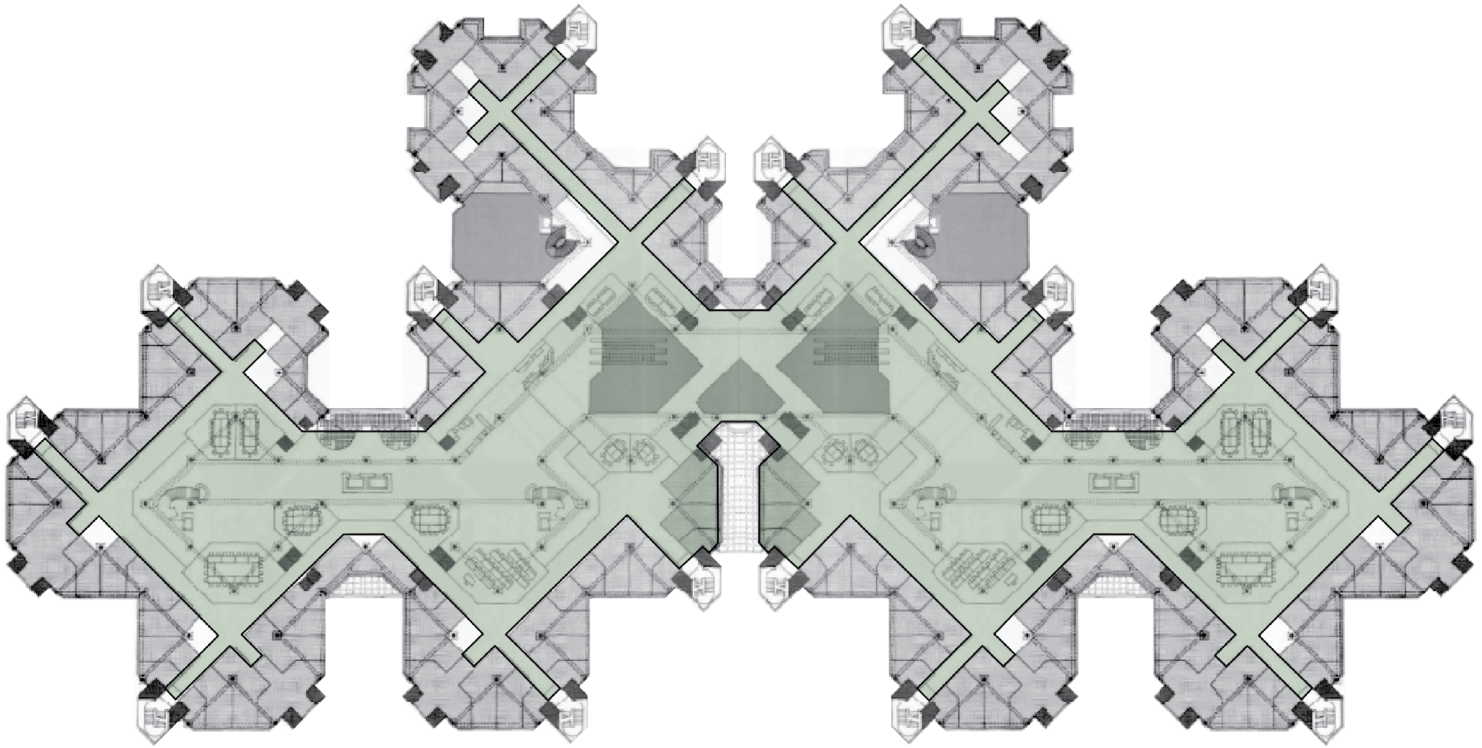




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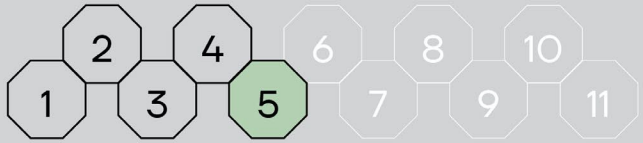


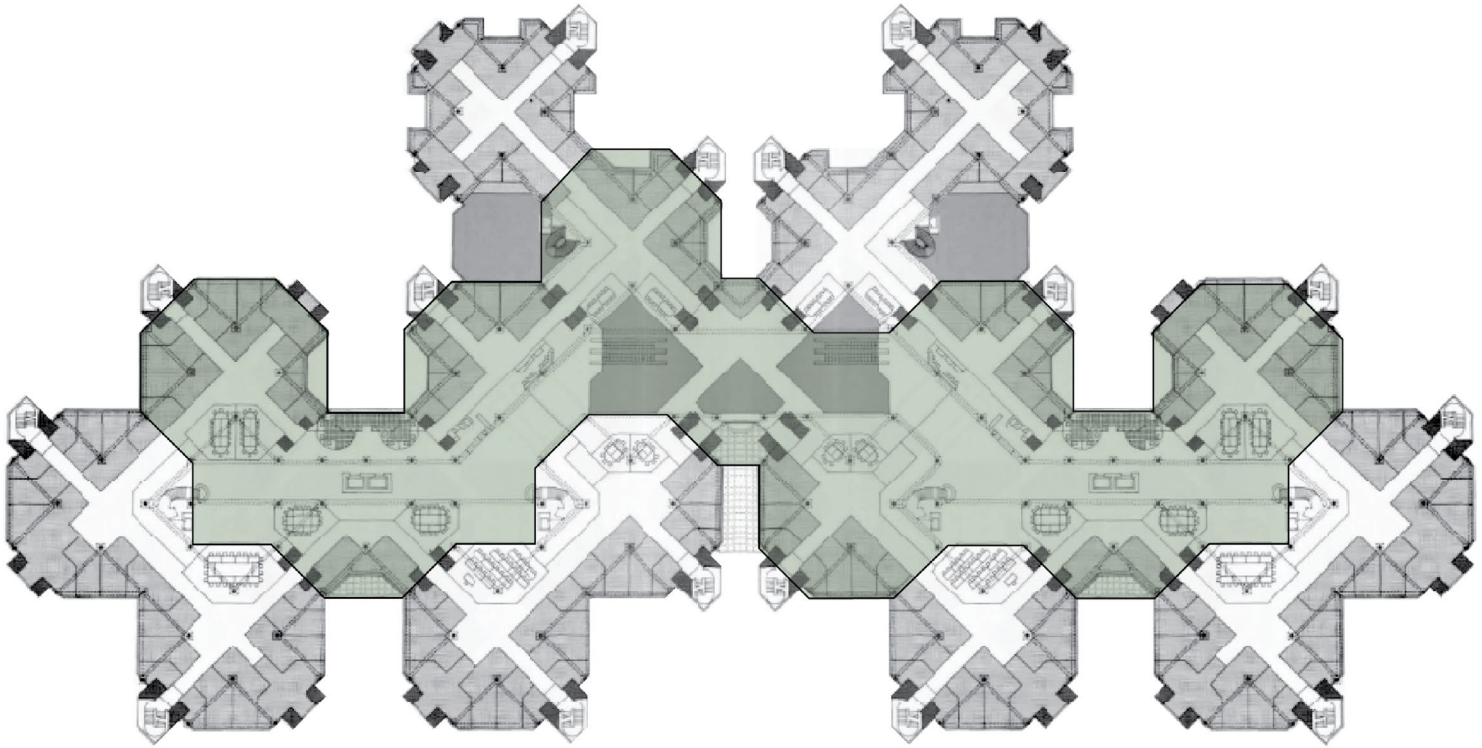
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70% insufficient daylight penetration [7]



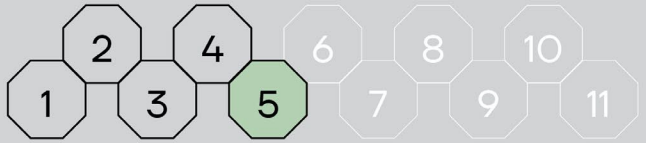
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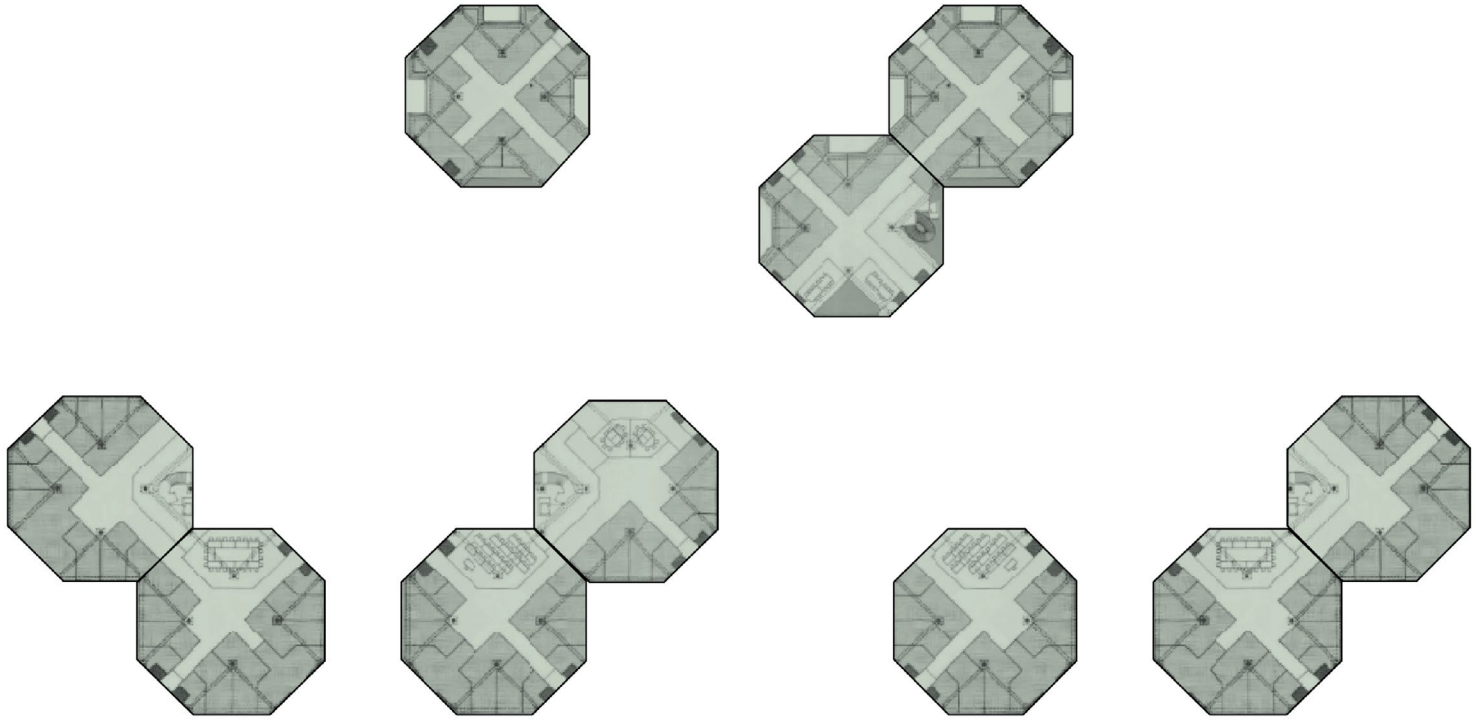
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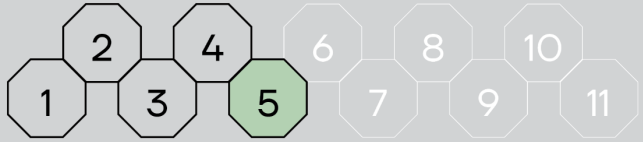


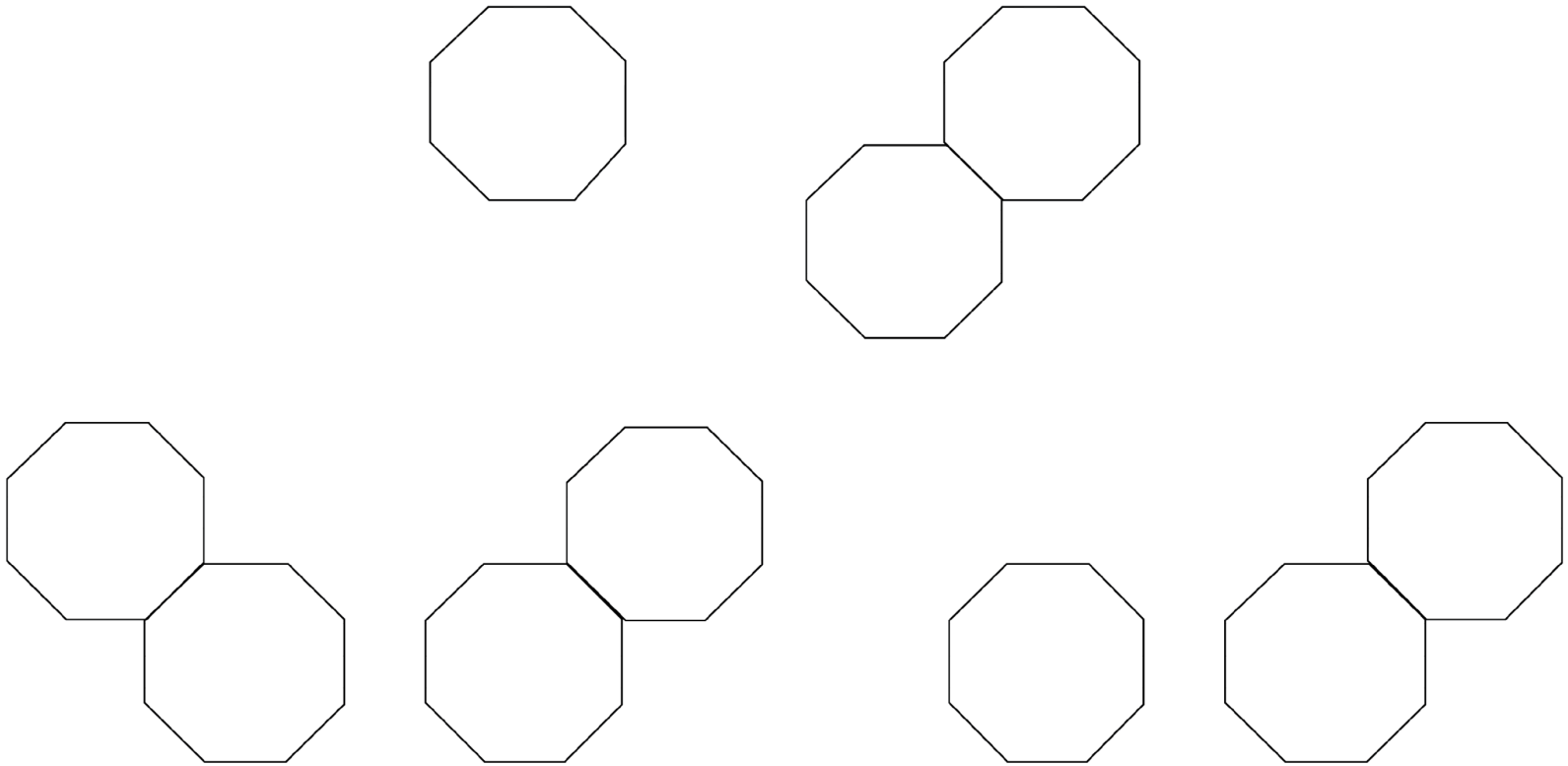
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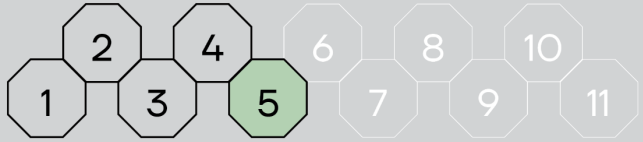


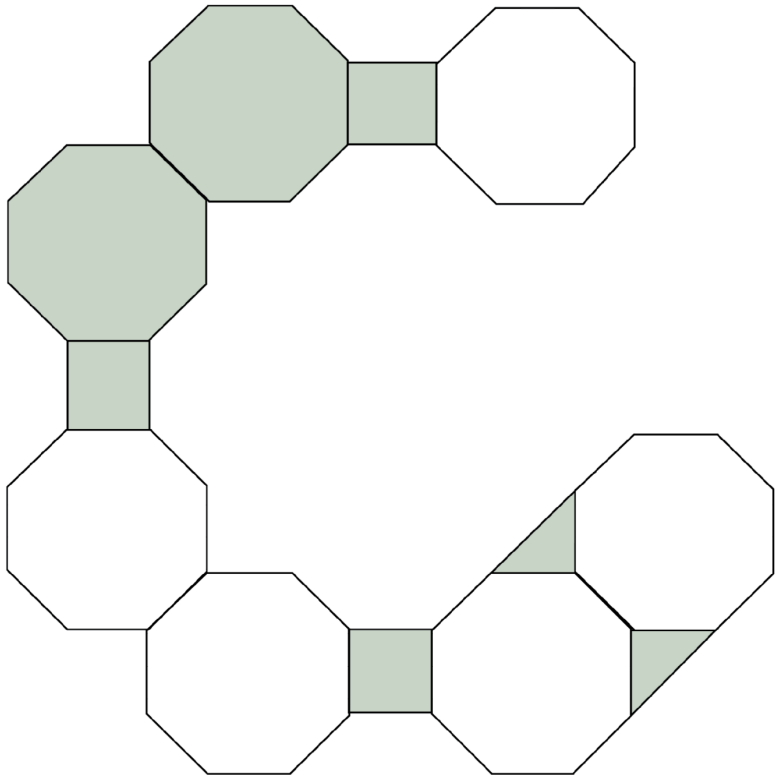
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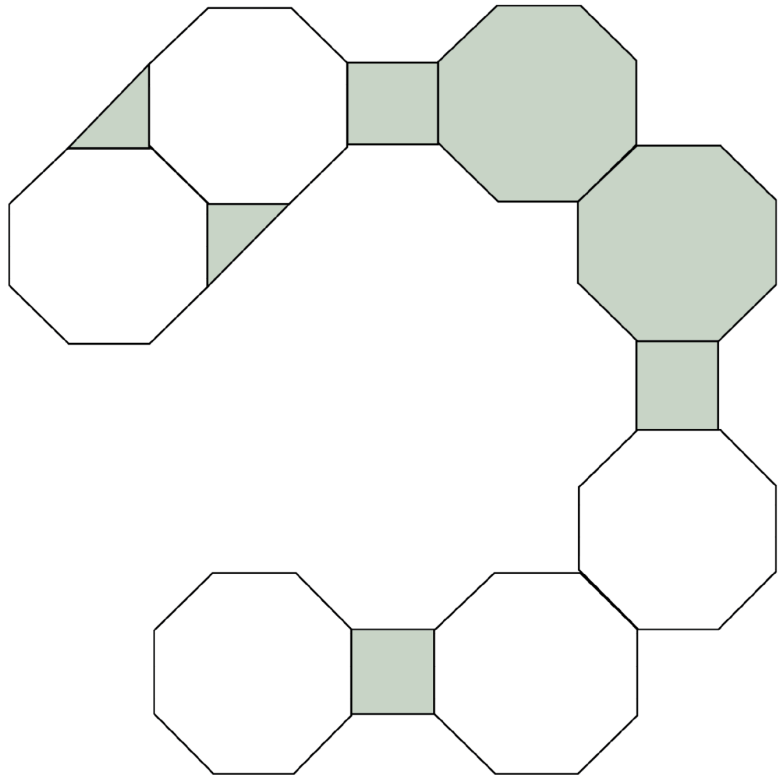




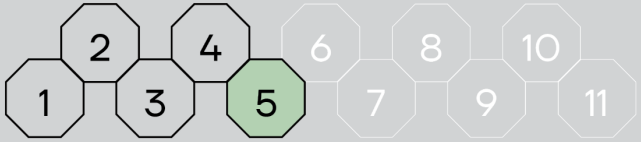
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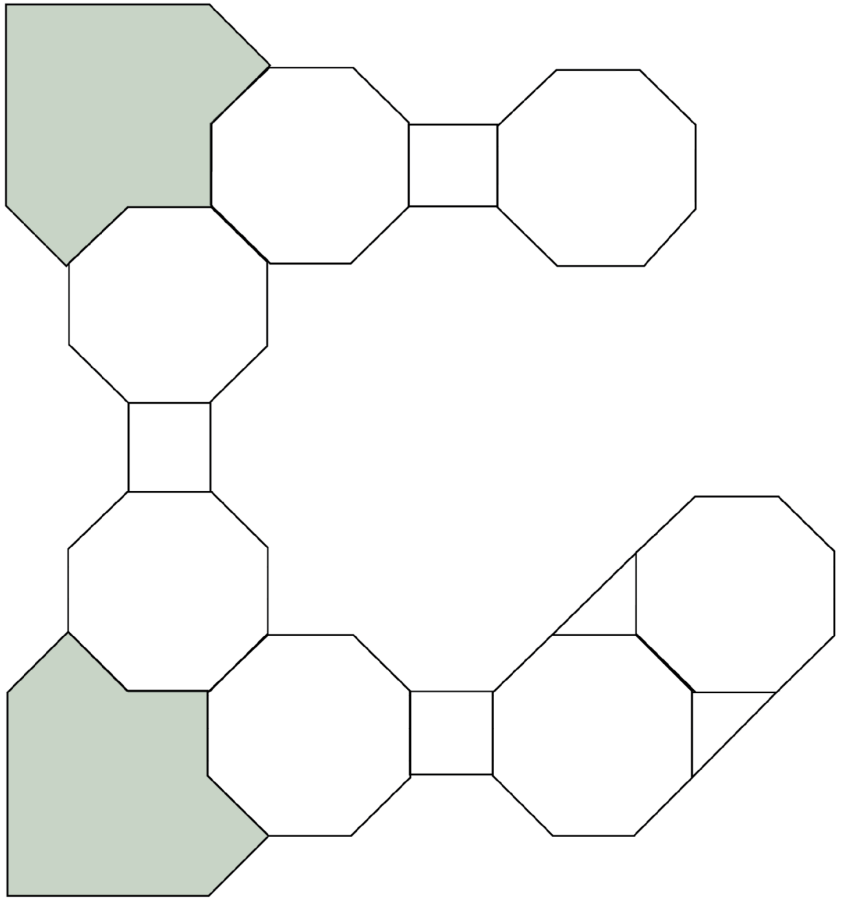


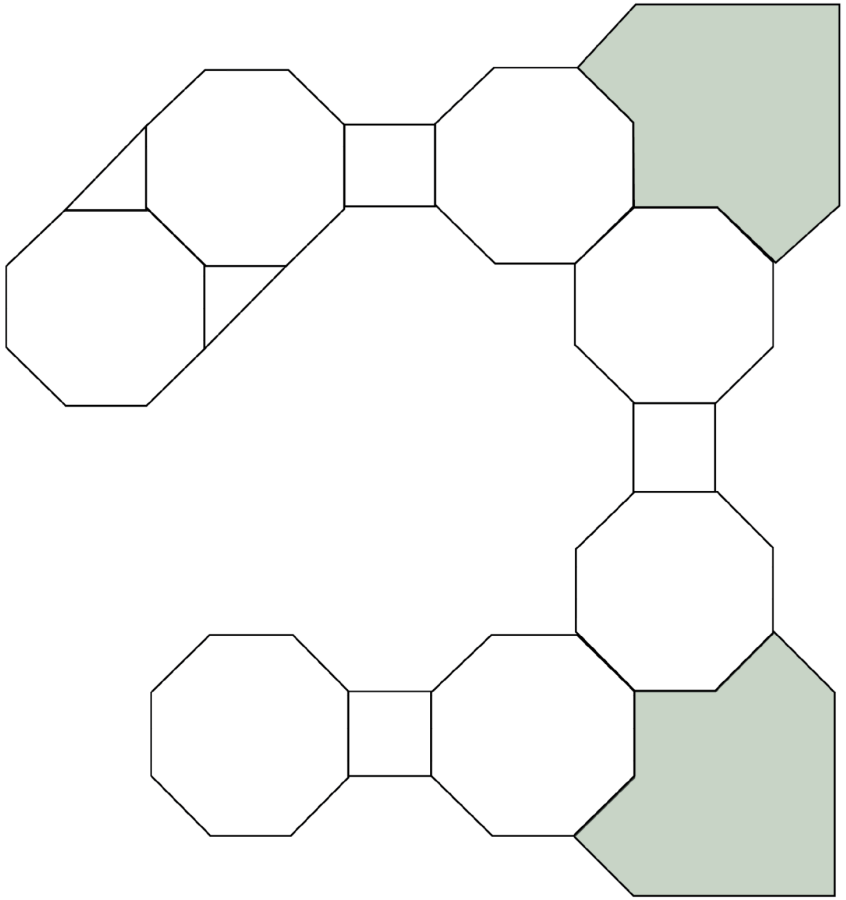




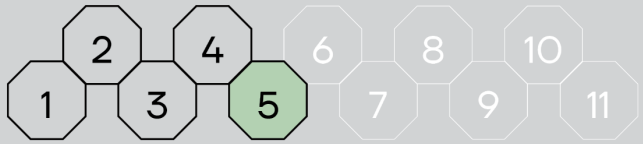
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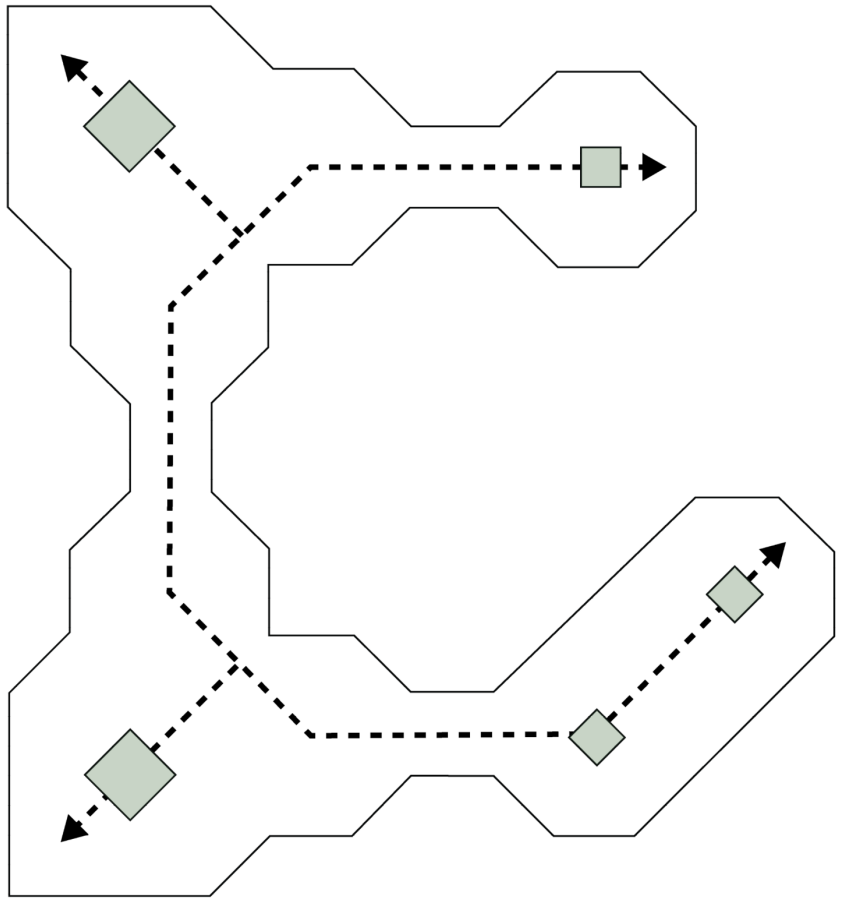


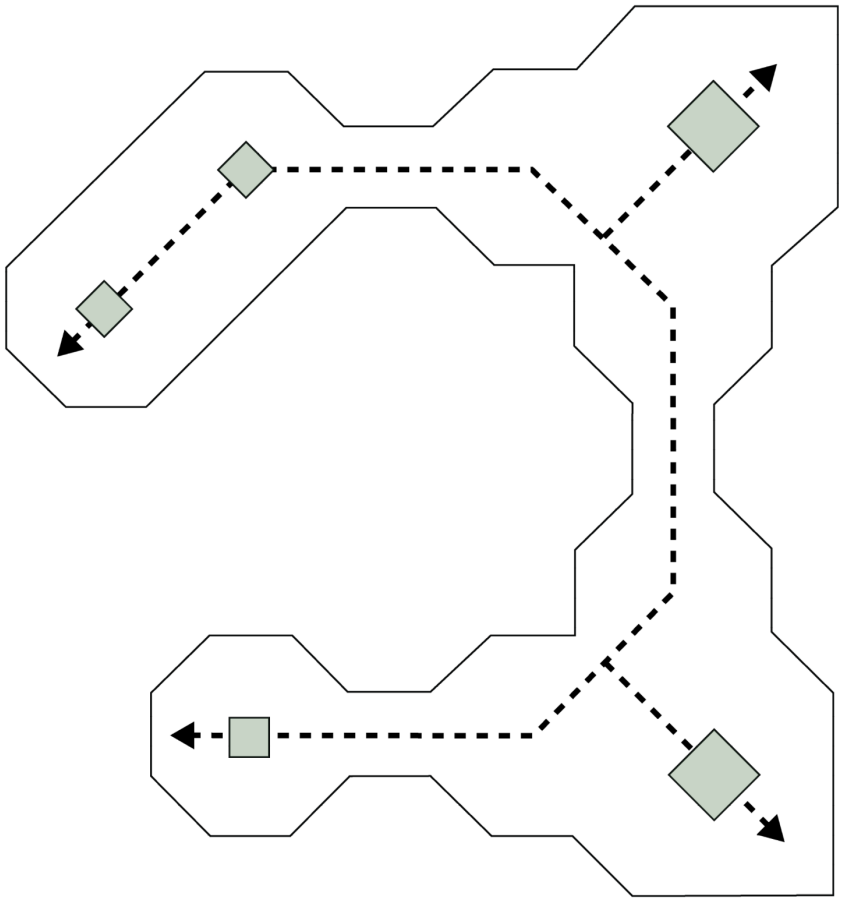




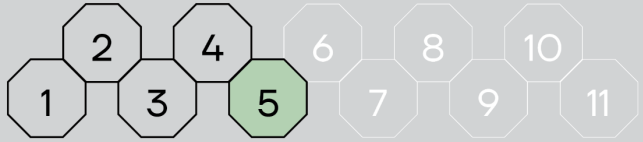
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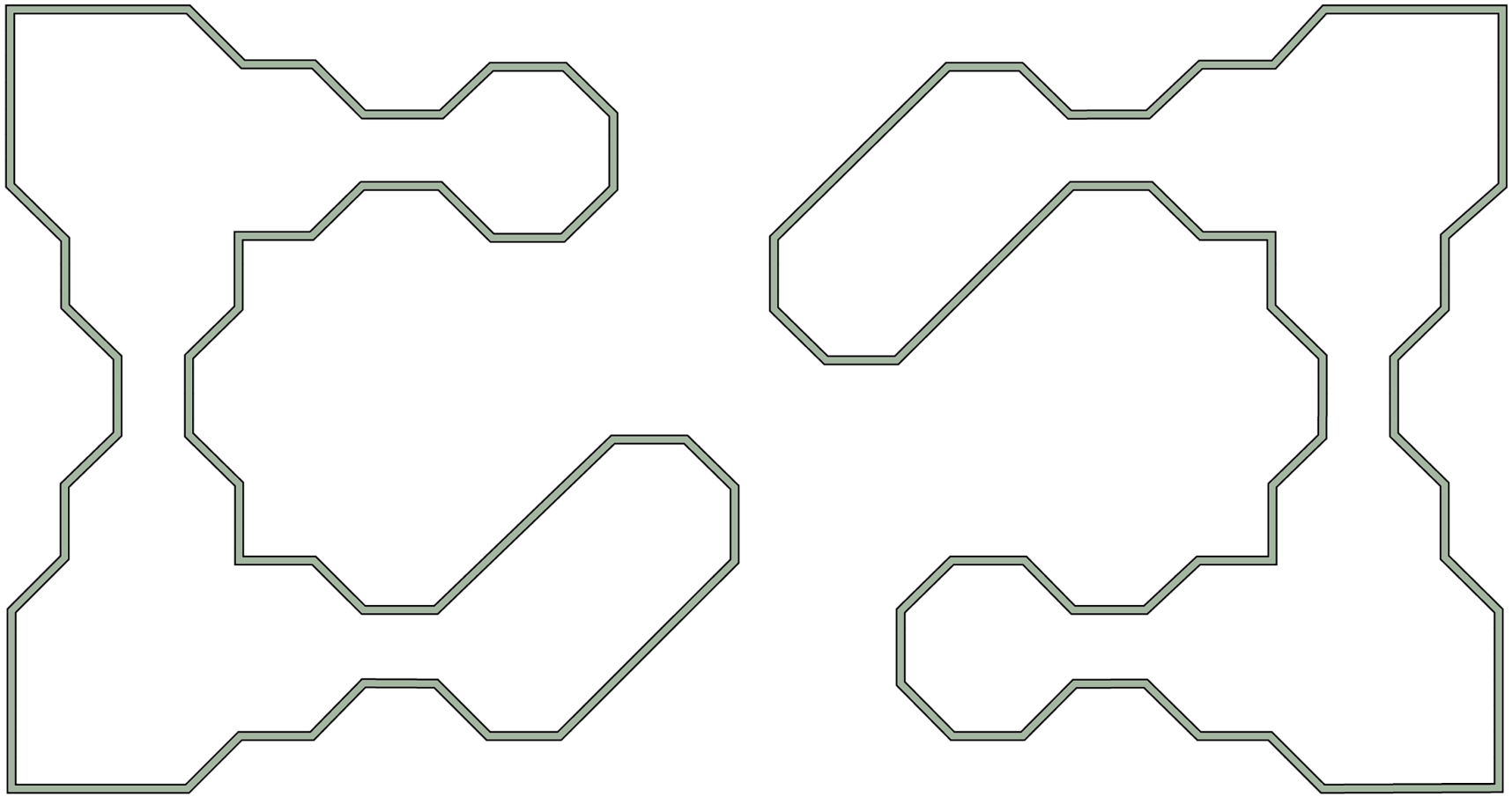




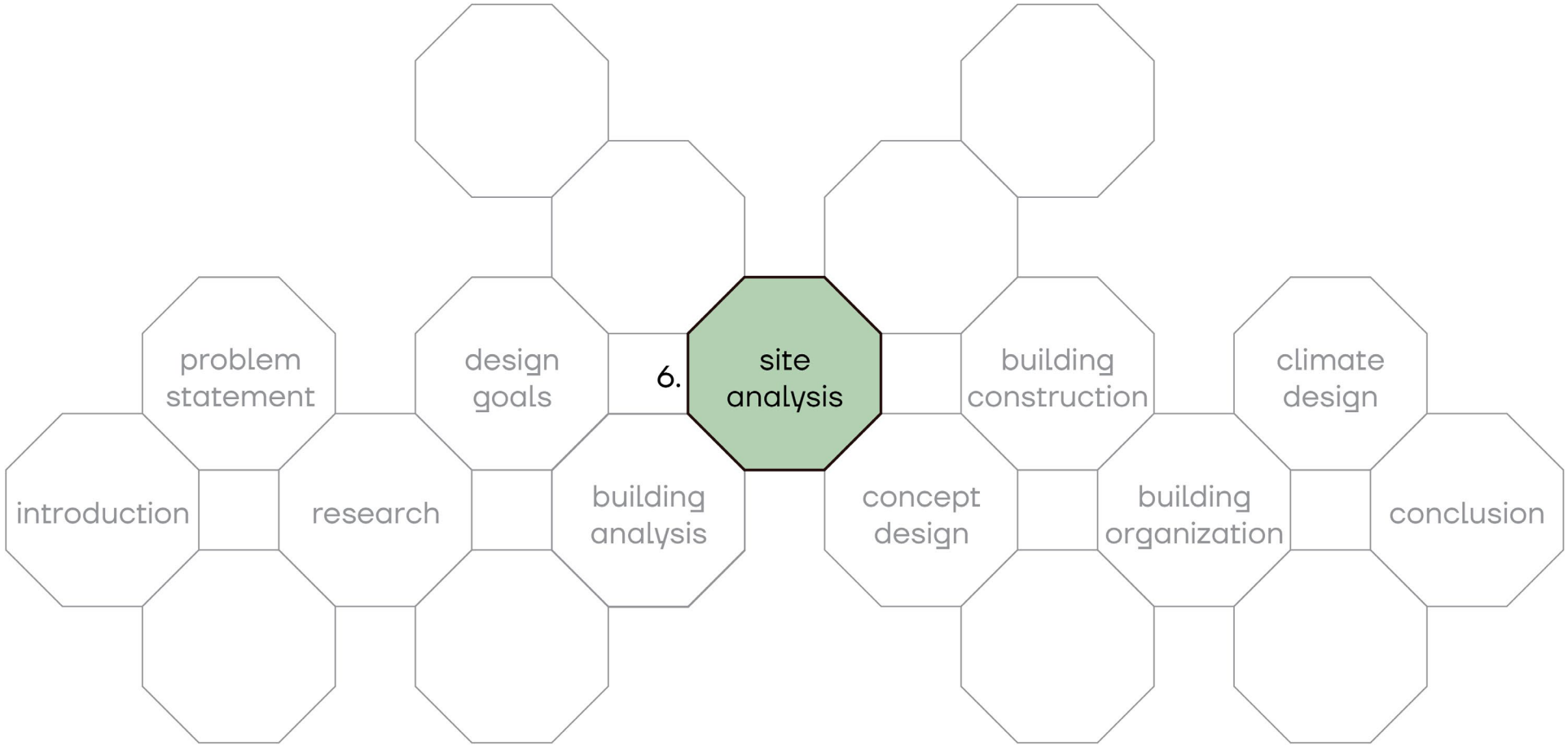


BUILDING ANALYSIS

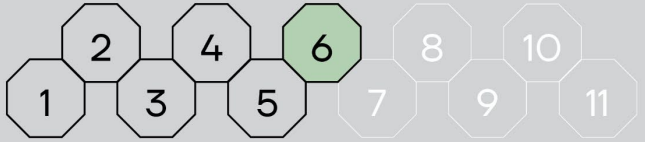




SITE ANALYSIS



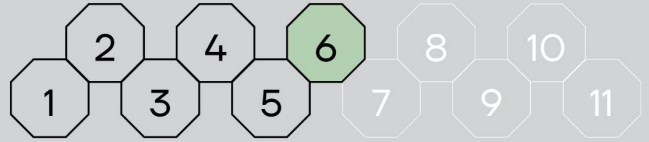
SITE ANALYSIS





scale 1:2500

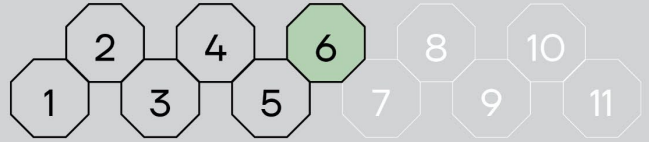
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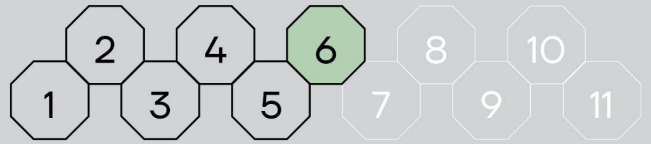
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SITE ANALYSIS





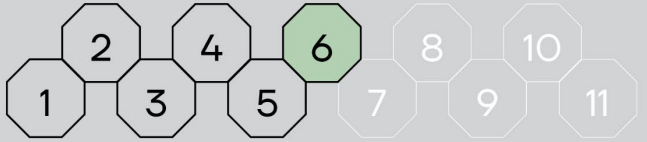
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SITE ANALYSIS



scale 1:2500

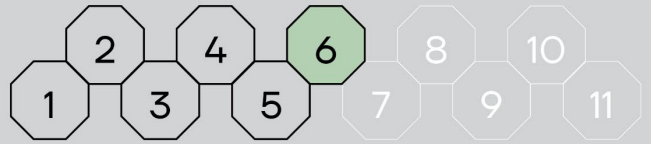
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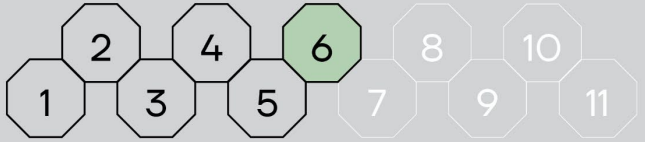
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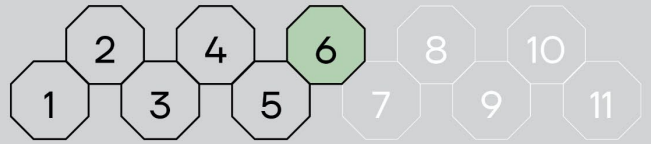
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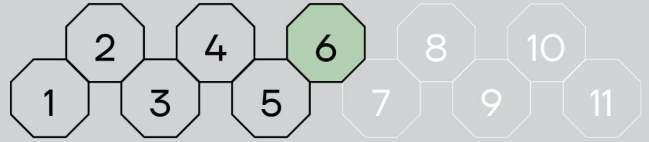
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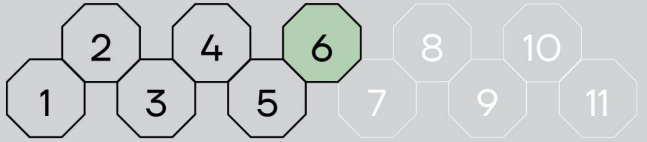
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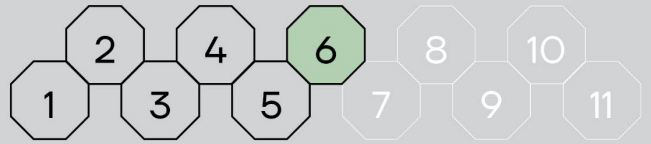
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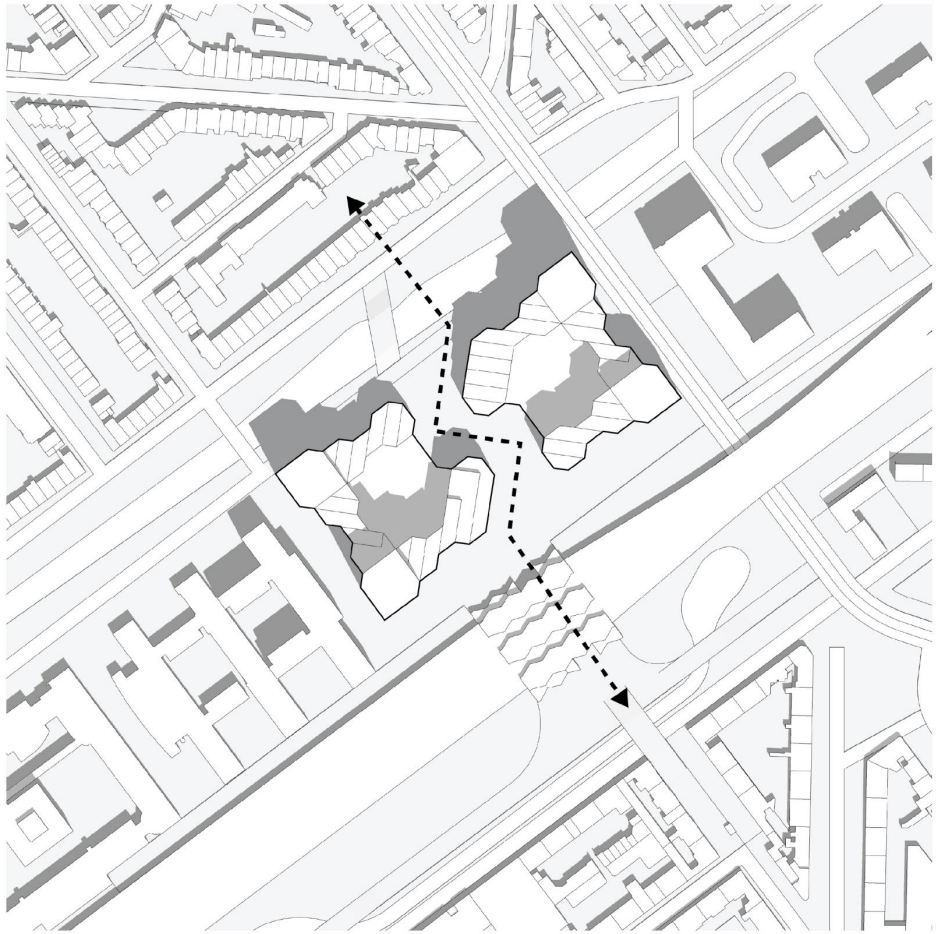




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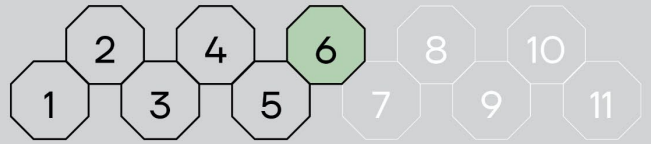
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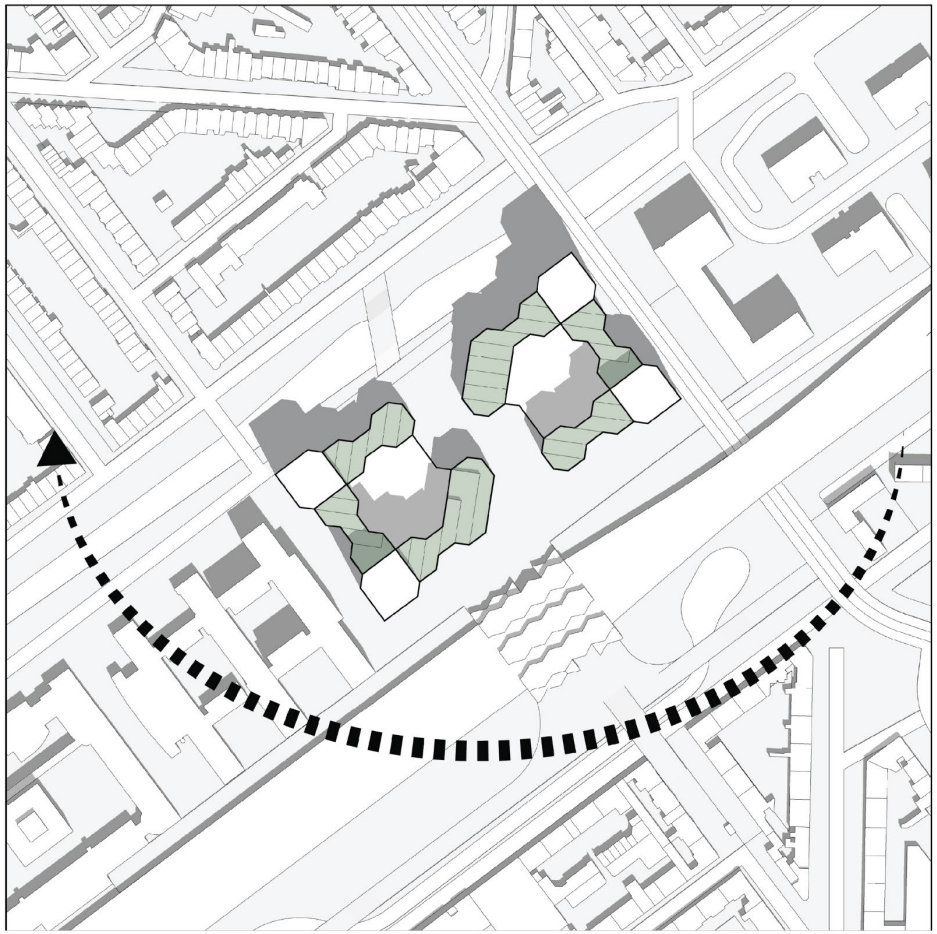
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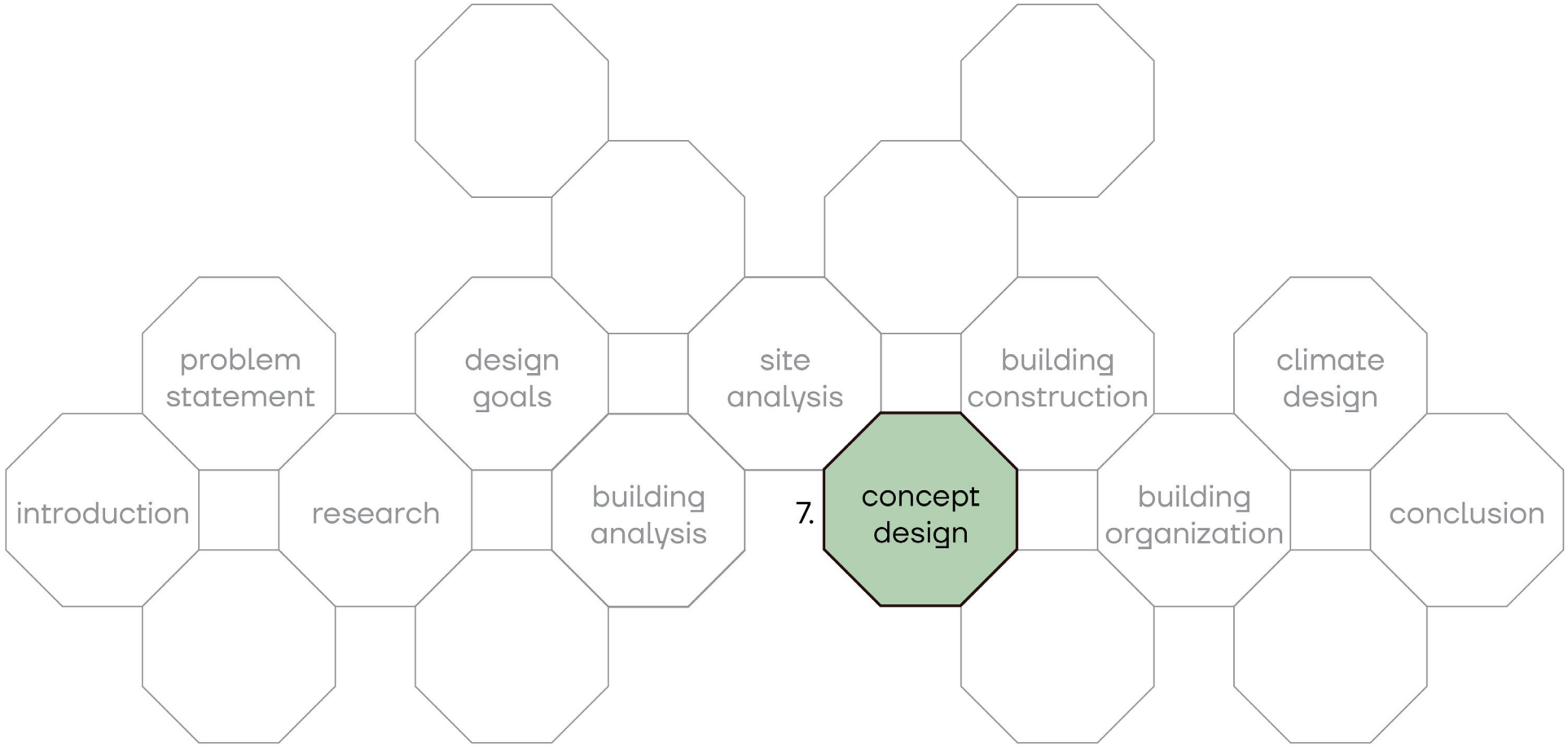
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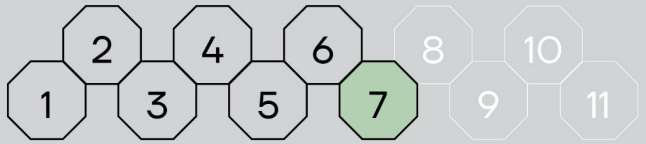
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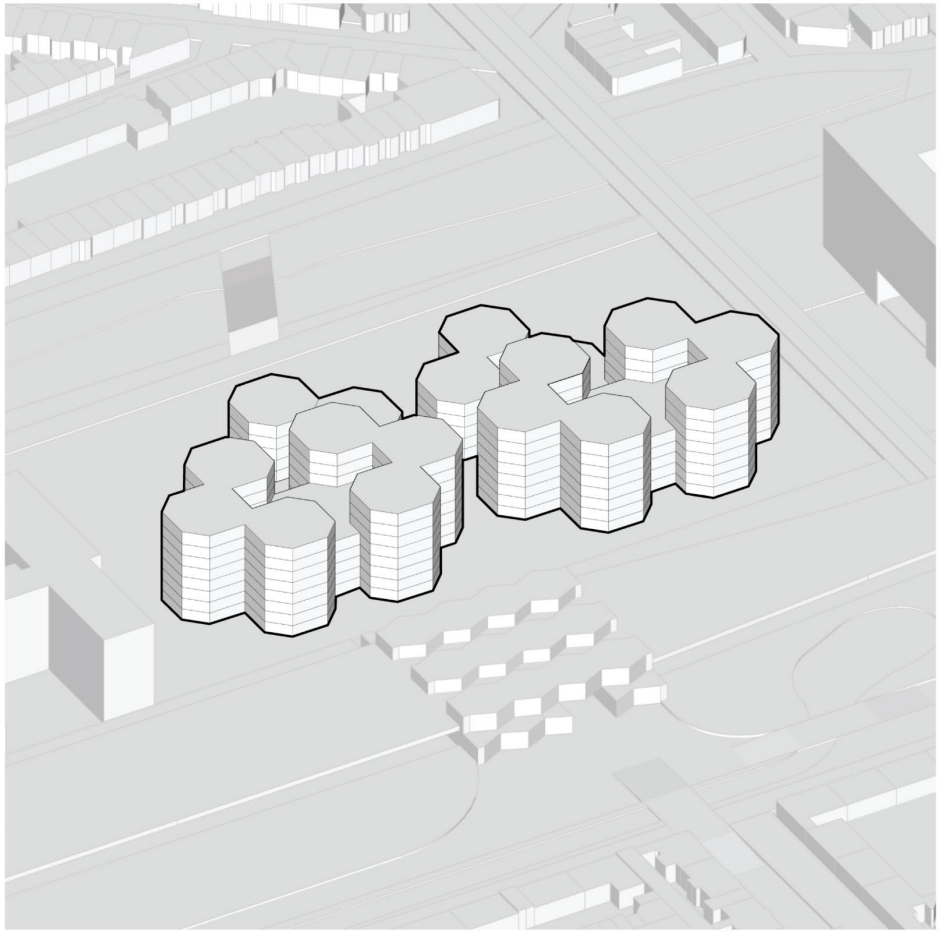
CONCEPT DESIGN

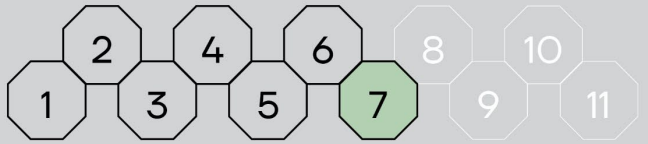




form development

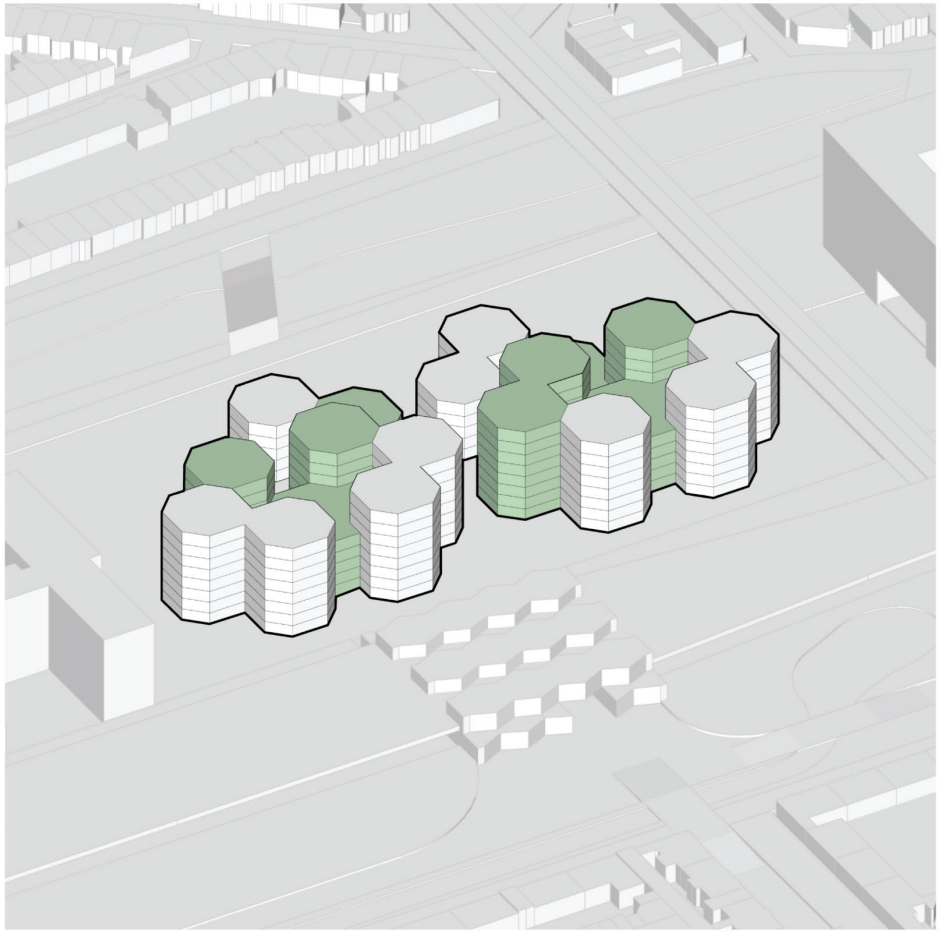
current situation

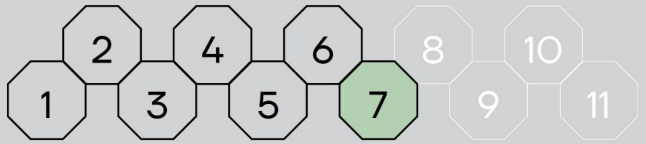




form development

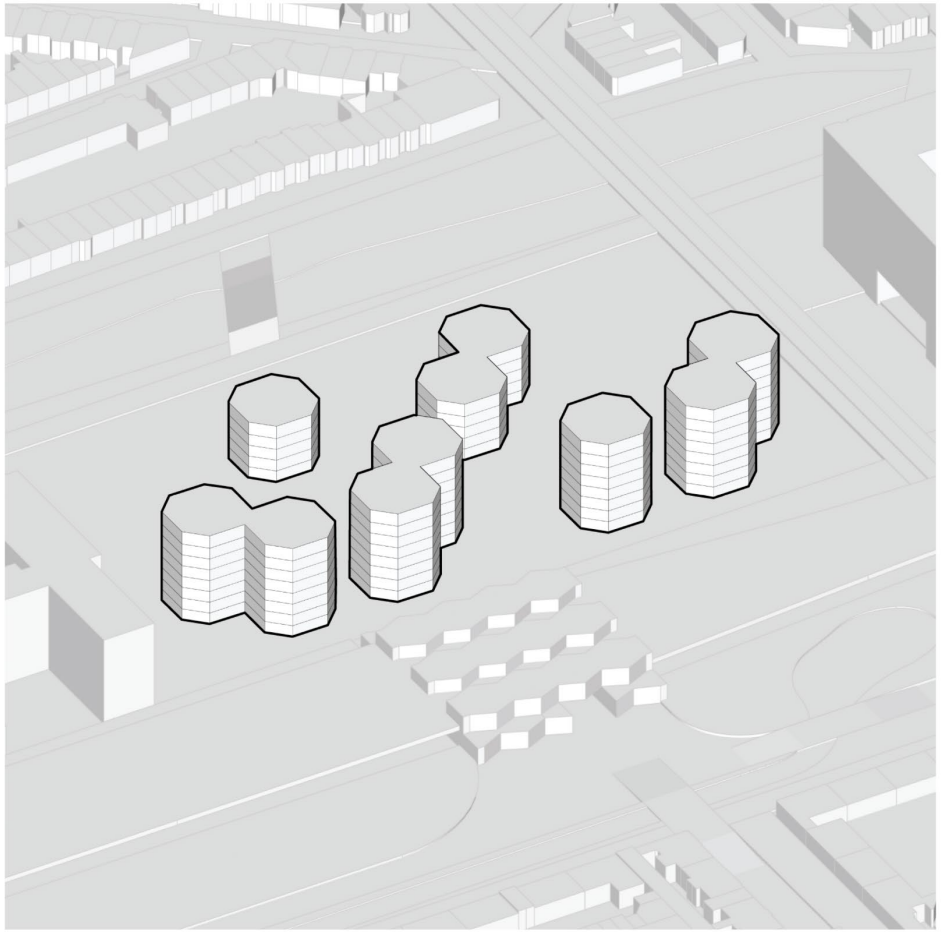
removing inner part

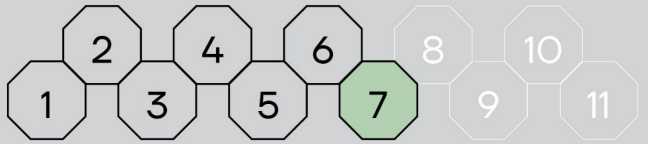




form development

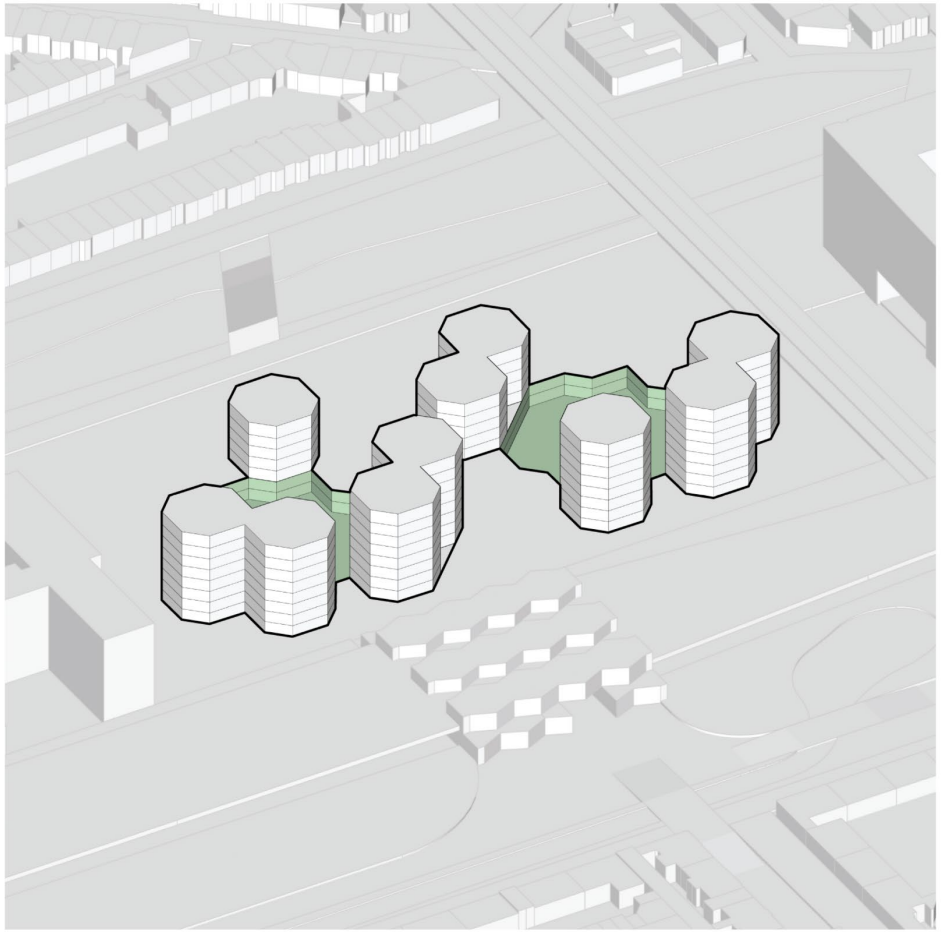
preserving outer part

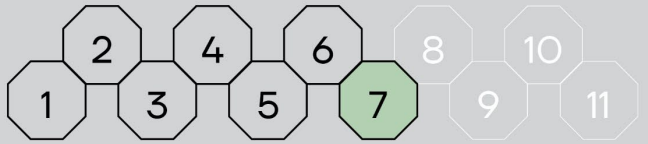




form development

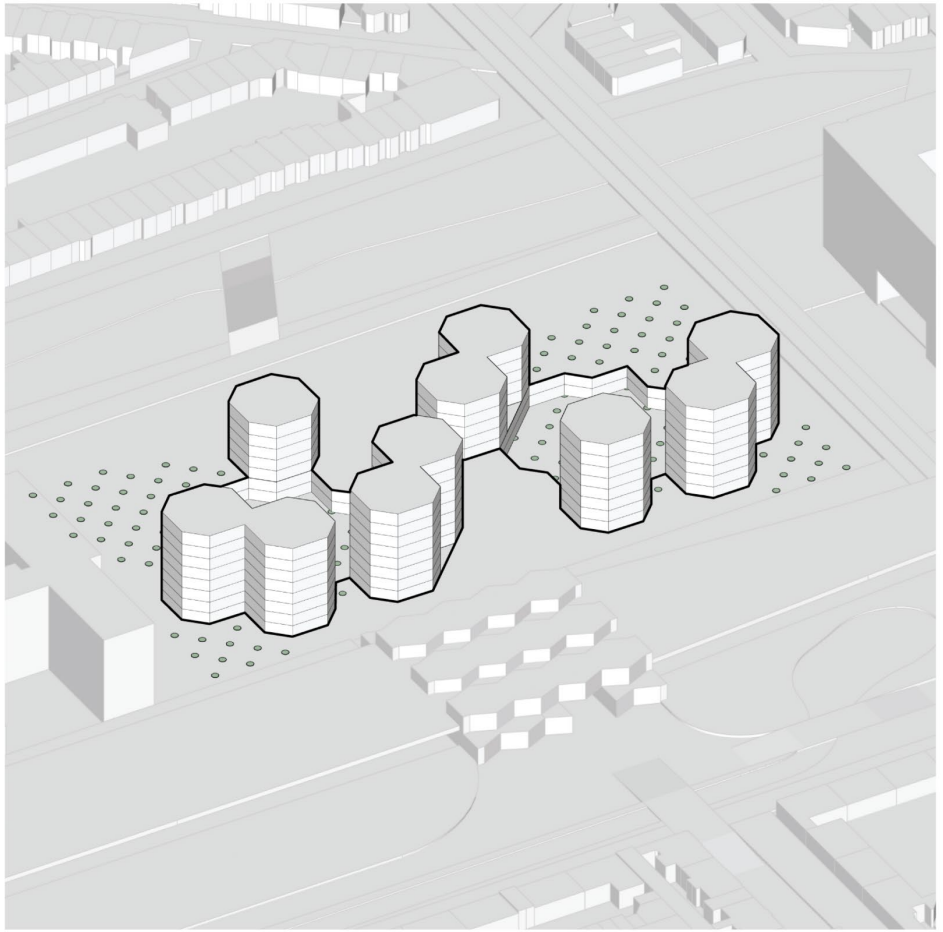
excavation for
parking garage

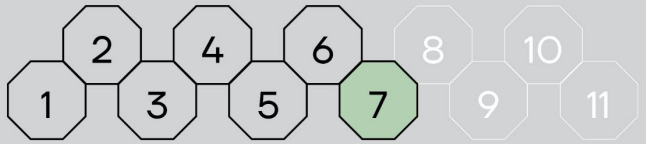




form development

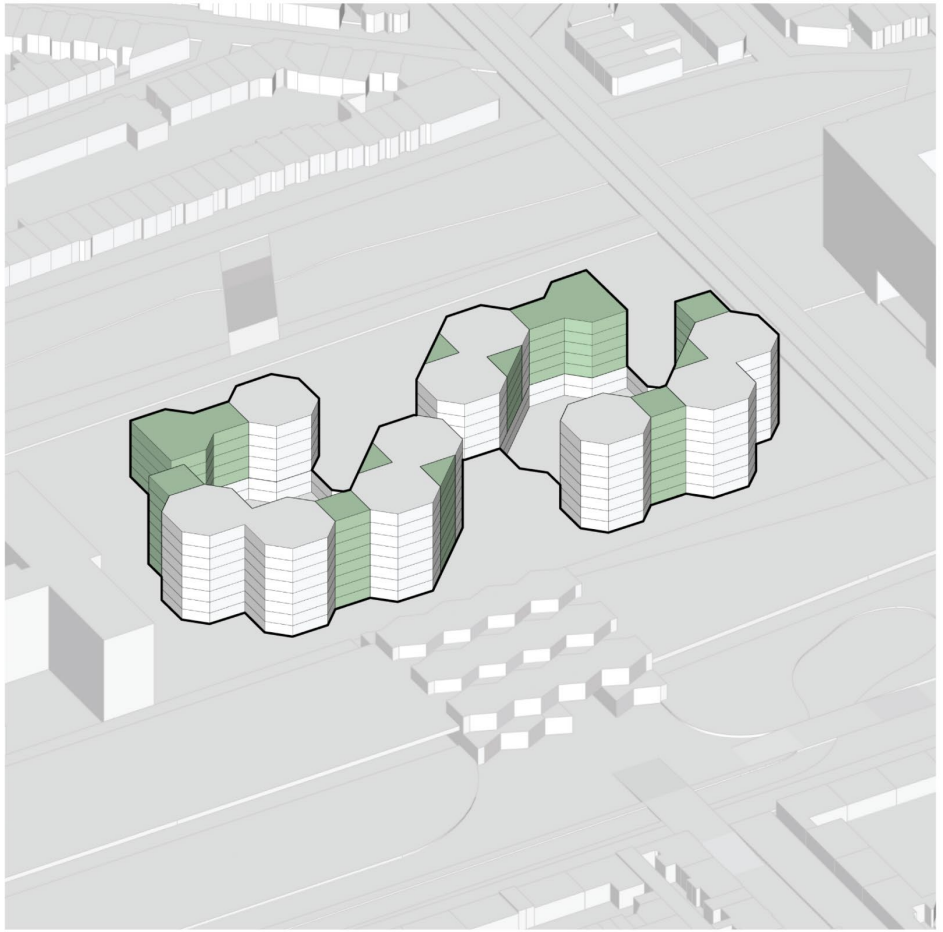
drilling new
foundation piles





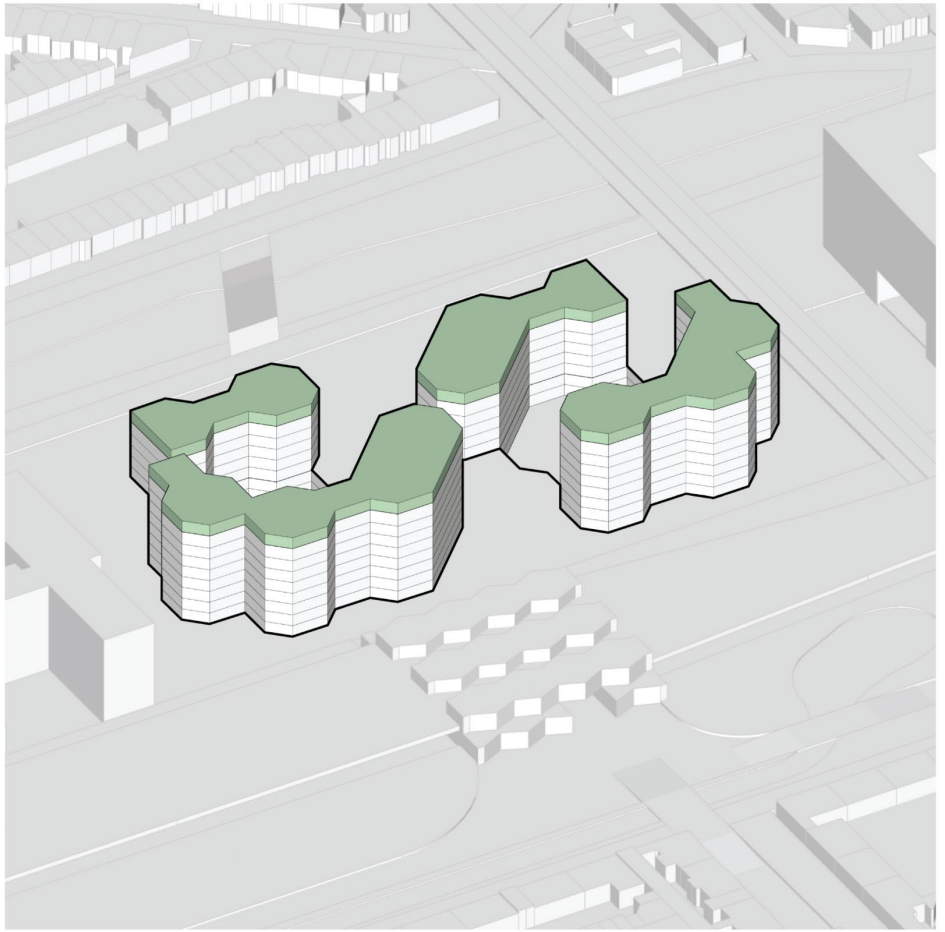
form development

expanding and reconnecting the octagonal units with prefab concrete elements

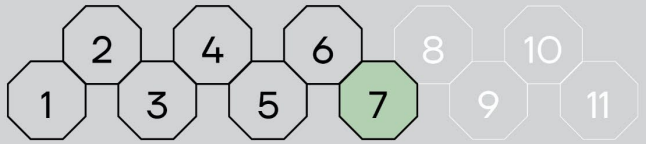


form development

topping up with prefab
concrete elements

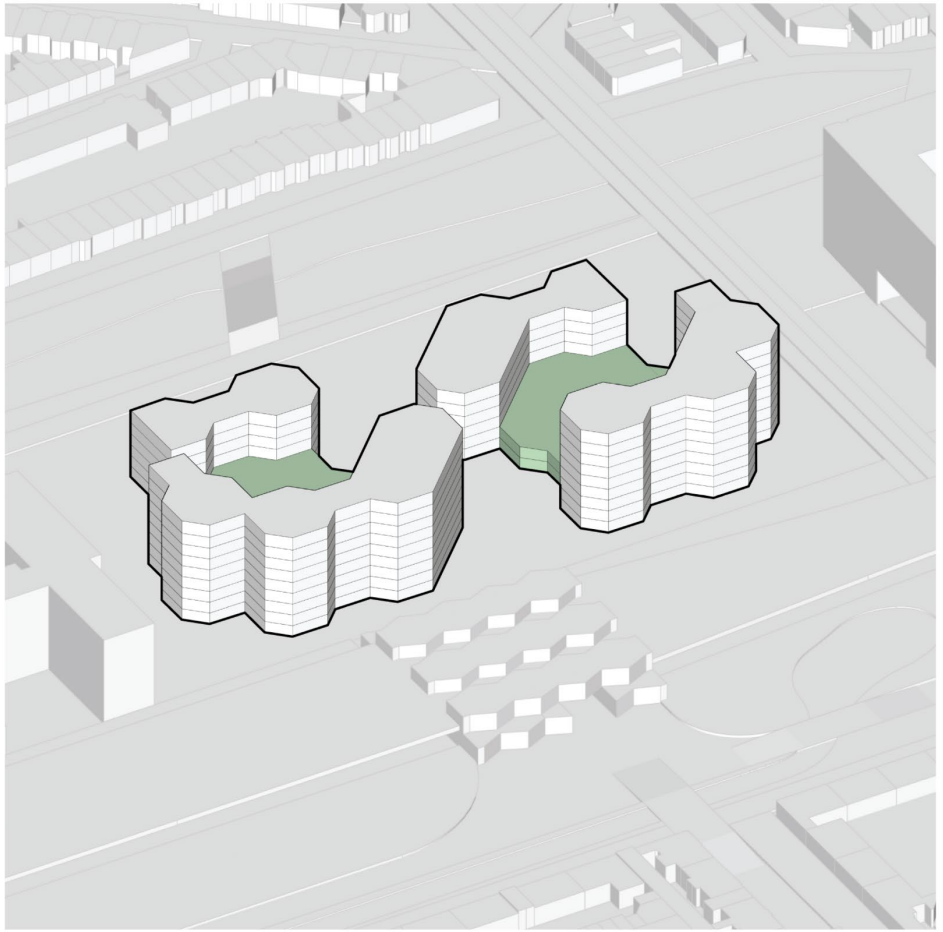


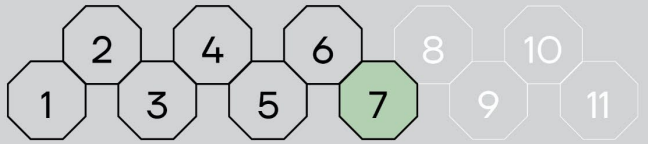
CONCEPT DESIGN



form development

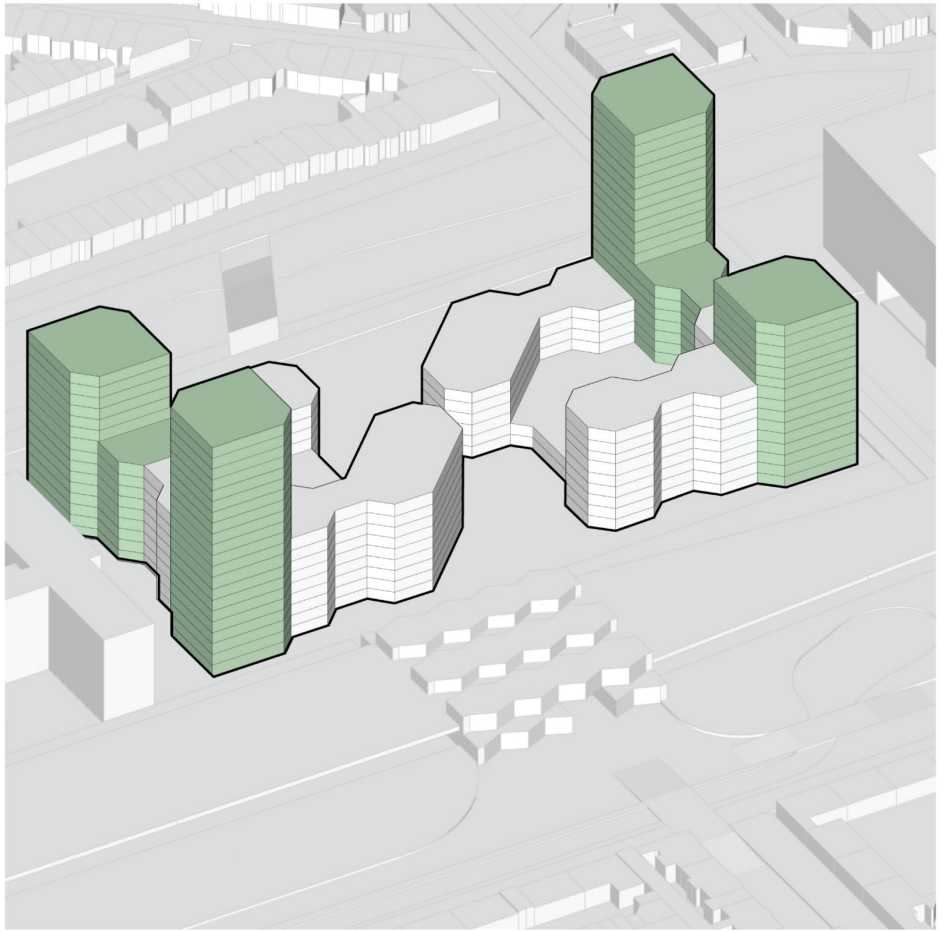
adding parking garage with
new wood construction material

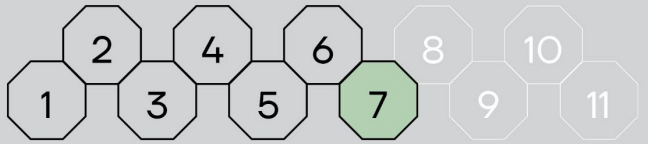




form development

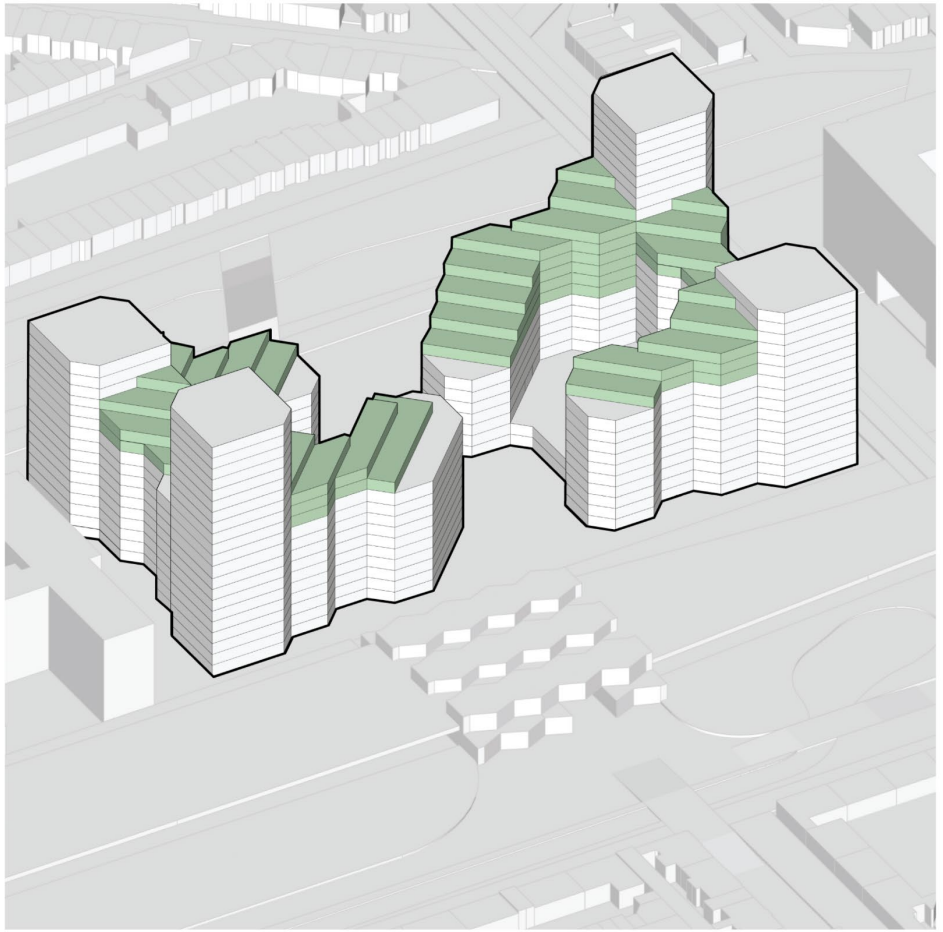
constructing towers with
new wood construction

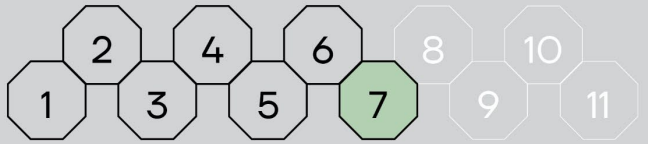




form development

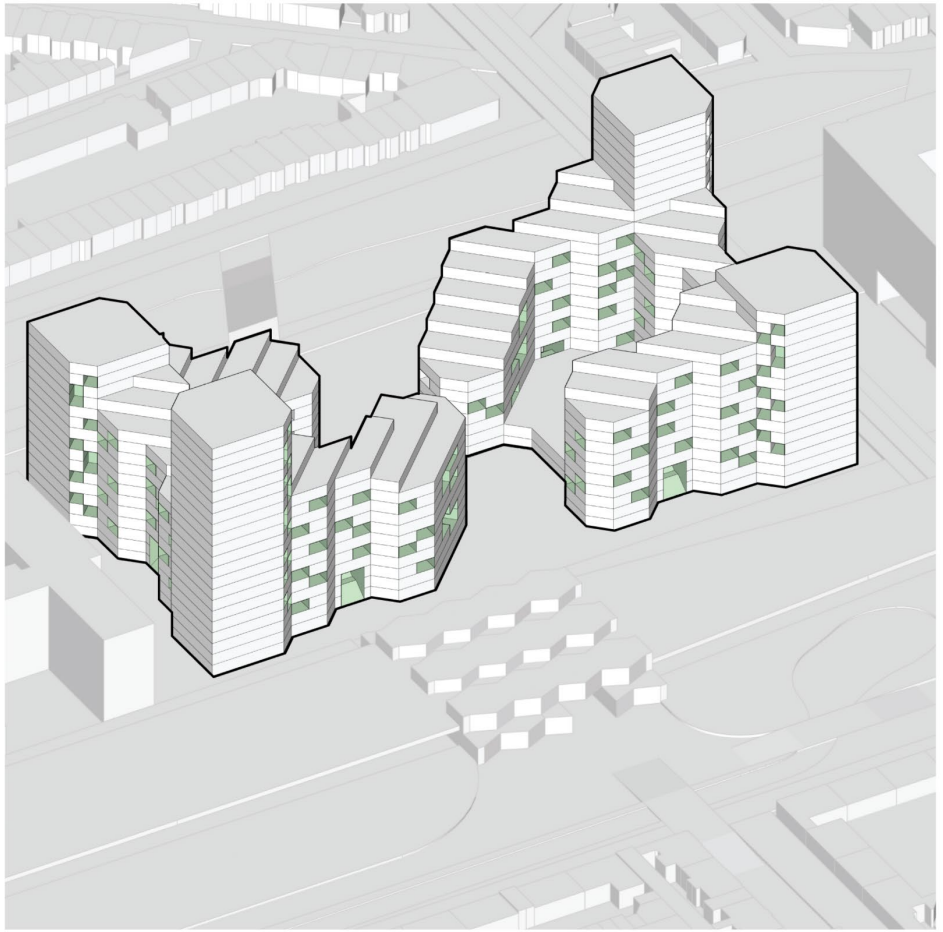
adding sun oriented
roofing terraces

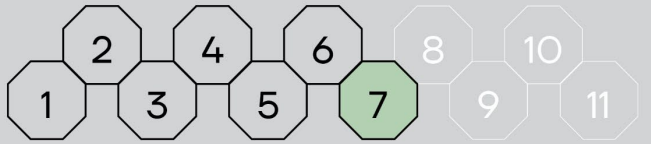




form development

creating daylight & ventilation coves

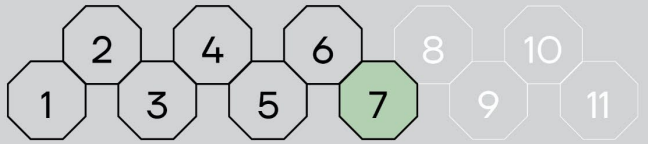




form development

adding green roofs &
solar panels



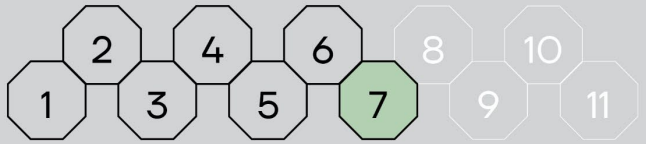


form development

tower roofs serving as installation areas

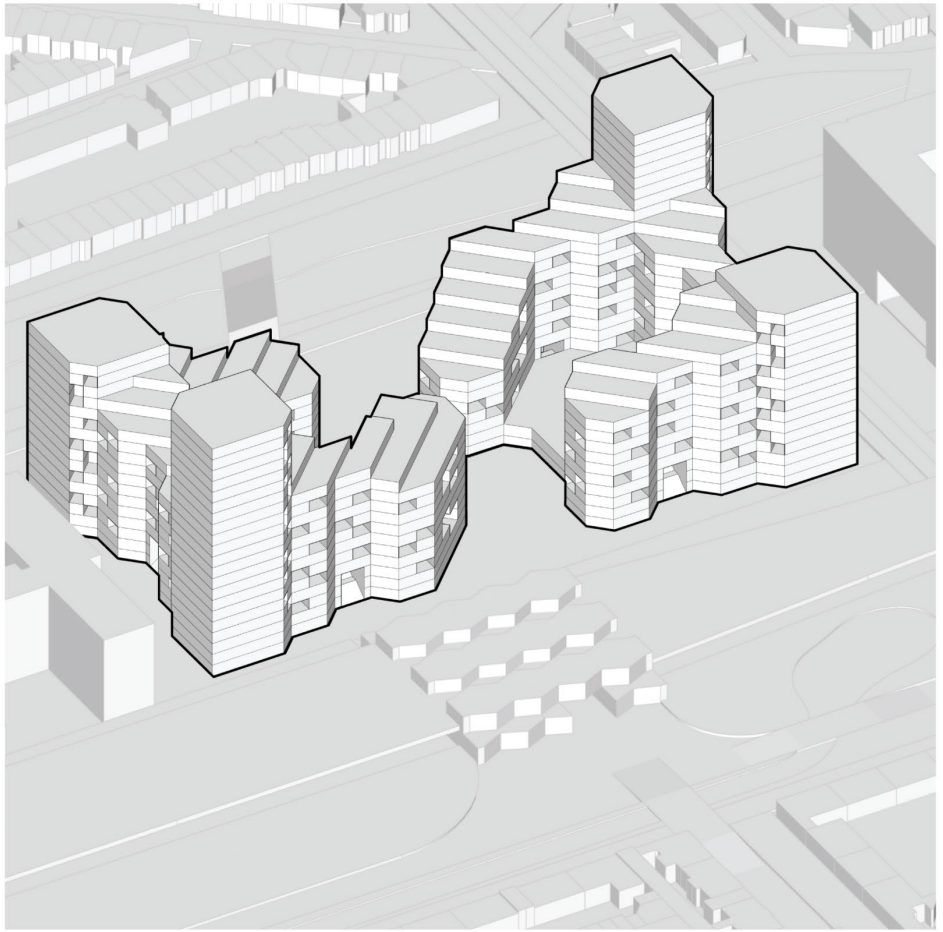


CONCEPT DESIGN

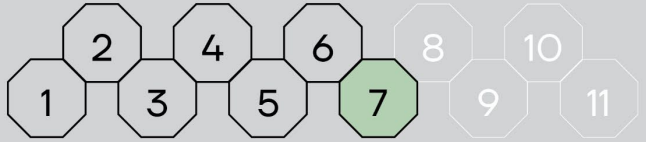


form development

conceptual end result



CONCEPT DESIGN

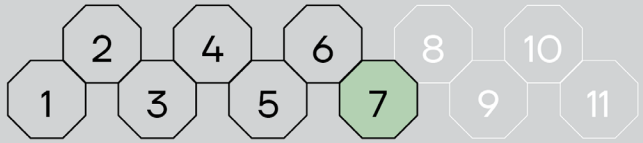


form development

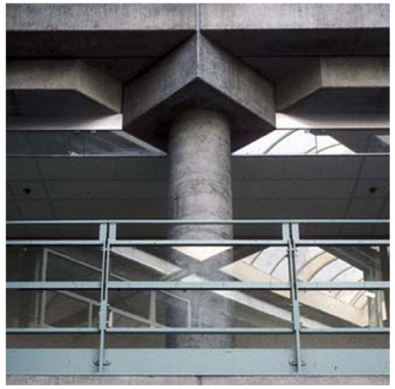
part of the building that
is worked out in detail



CONCEPT DESIGN



materials & reuse









CONCEPT DESIGN

materials & reuse

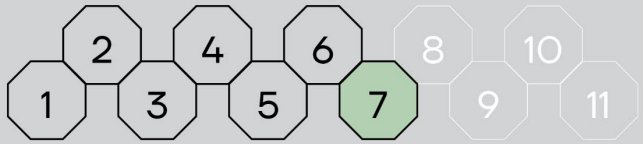


steel construction
beams & columns



infrastructure projects

CONCEPT DESIGN



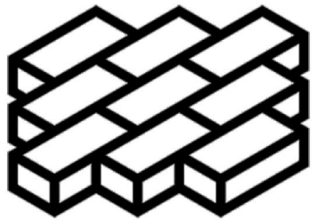
materials & reuse





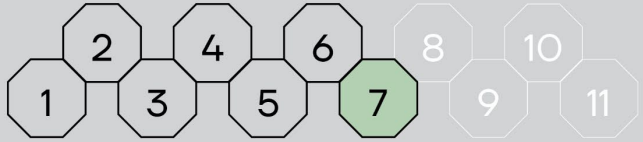
concrete stone masonry





roads & pavement

CONCEPT DESIGN



materials & reuse

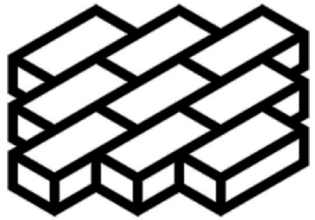


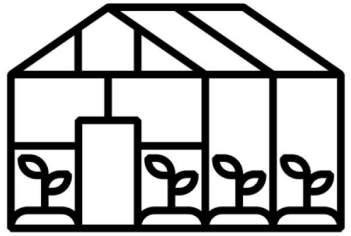




aluminium
window frames

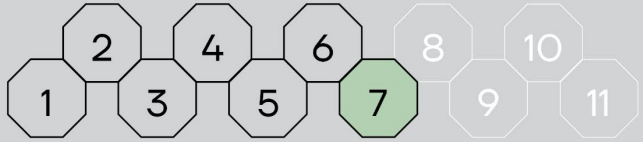






greenhouse gardens

CONCEPT DESIGN

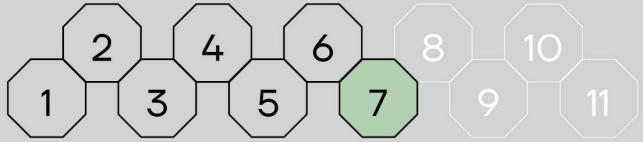


materials & reuse



materials & reuse

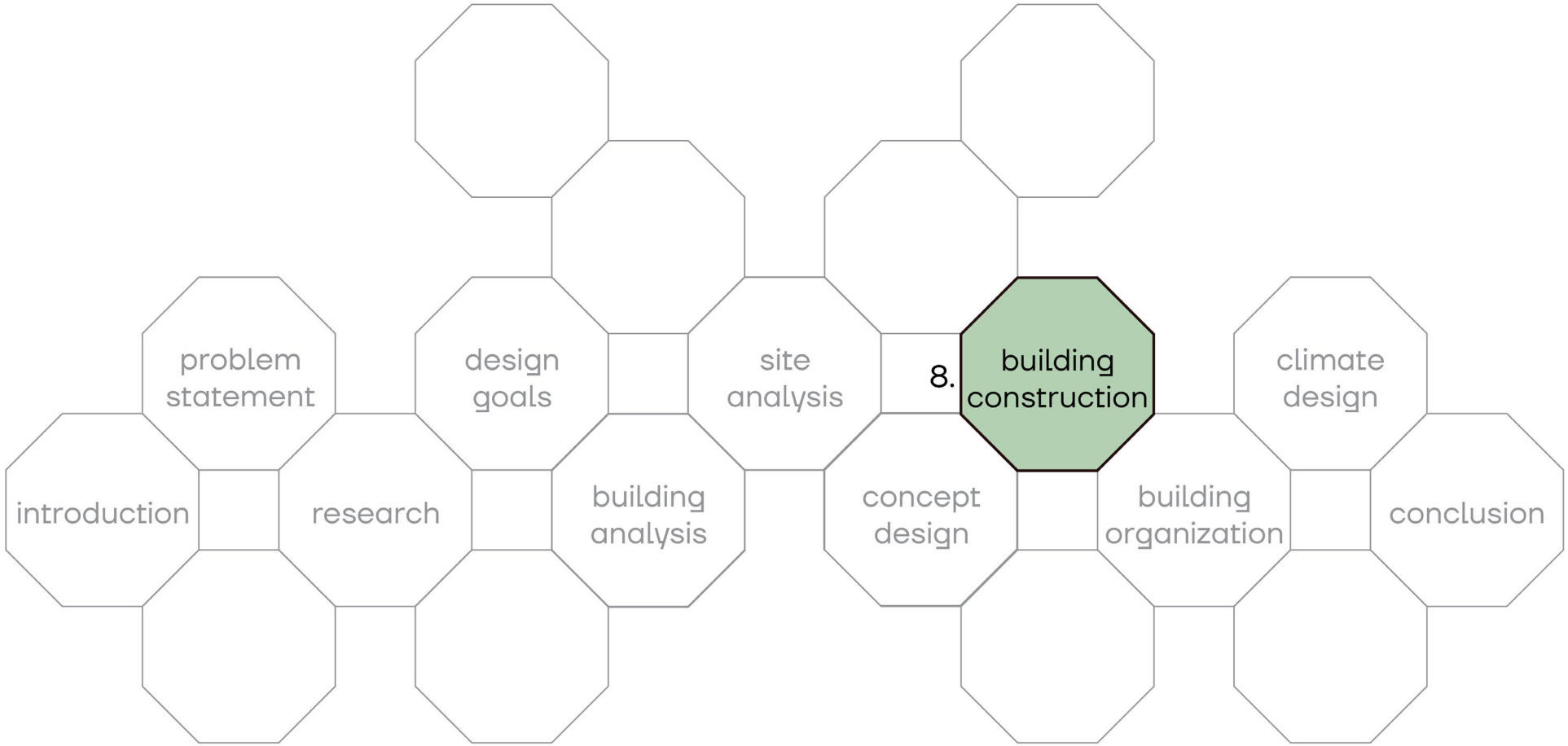




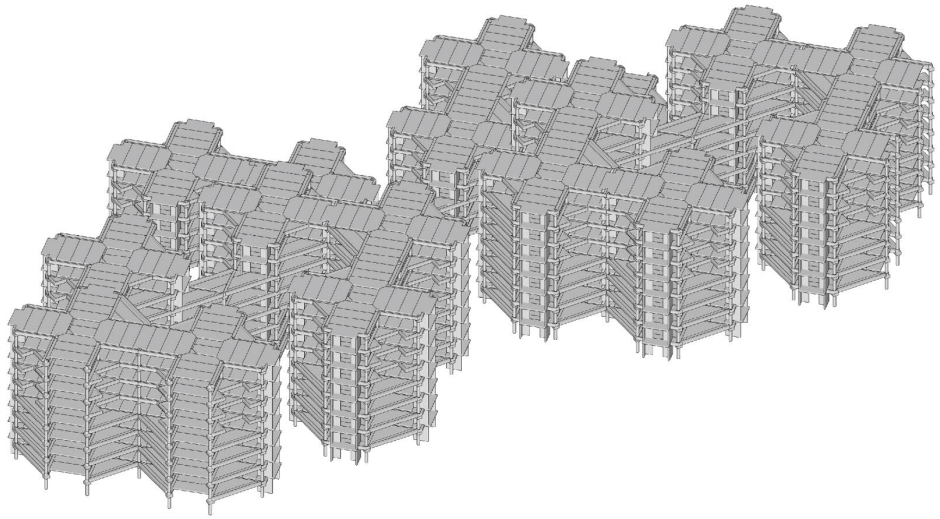
materials & reuse

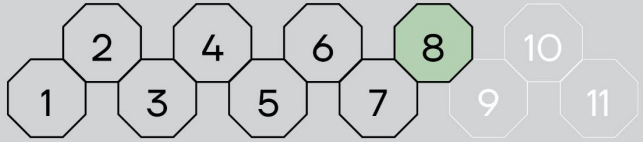


BUILDING CONSTRUCTION

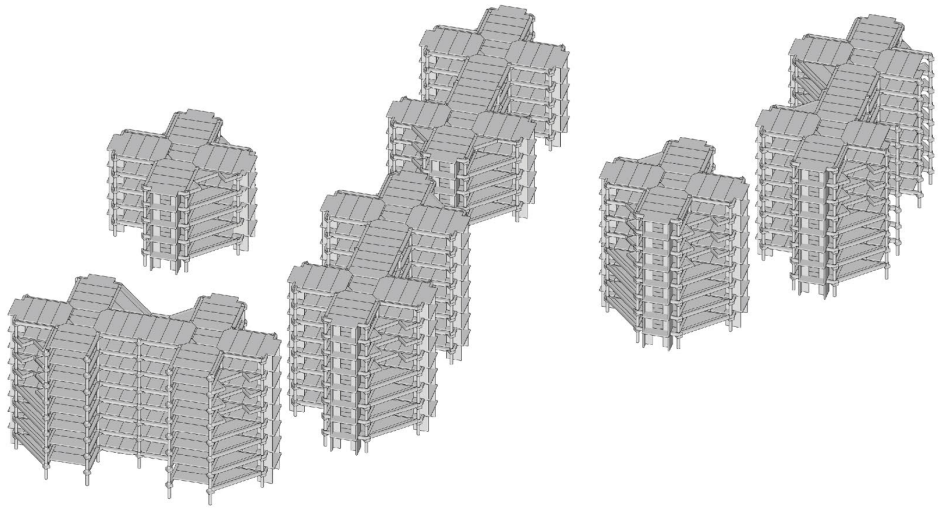


existing construction



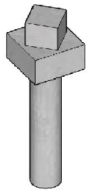


remaining construction

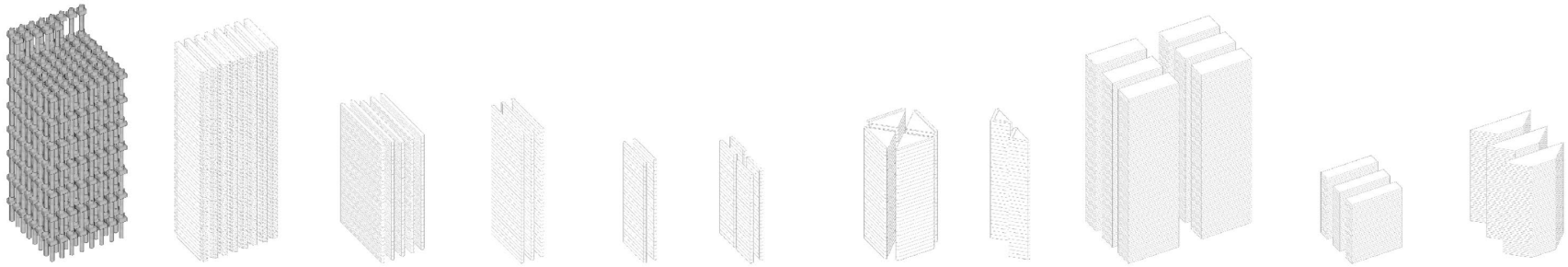


inventory of deconstructed prefab elements

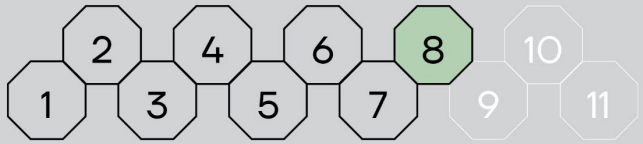
columns



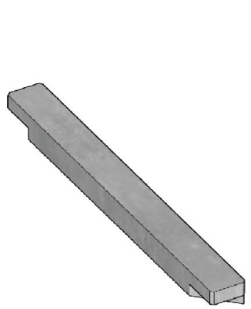
461 x



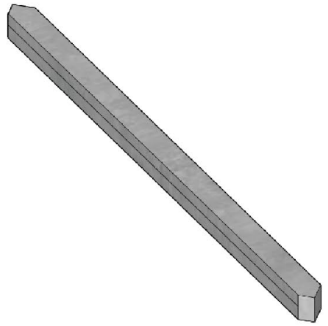
BUILDING CONSTRUCTION



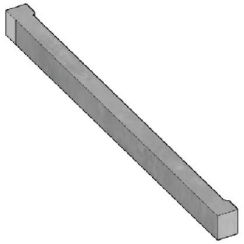
beams



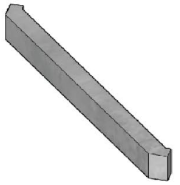
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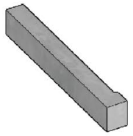
162 x



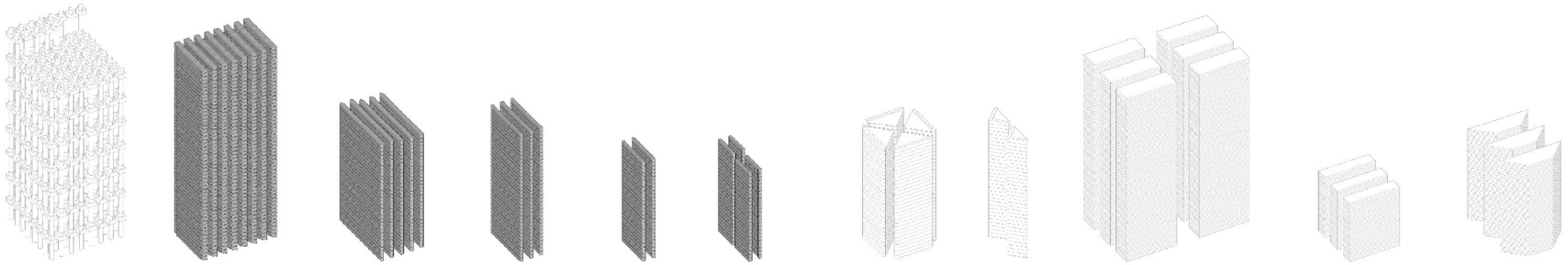
108 x



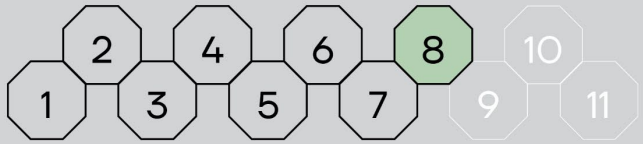
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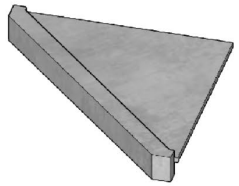
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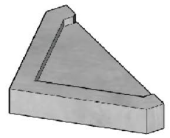
BUILDING CONSTRUCTION



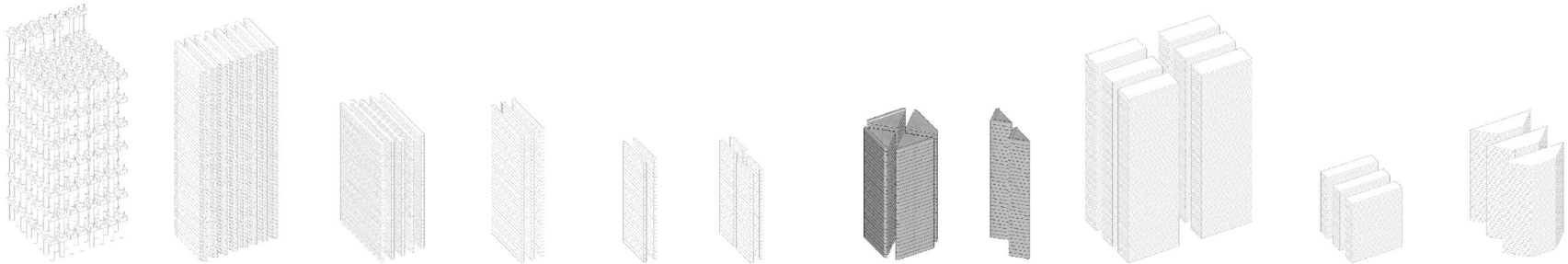
floor/beams



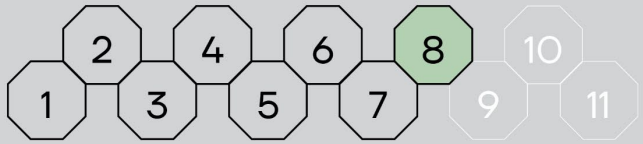
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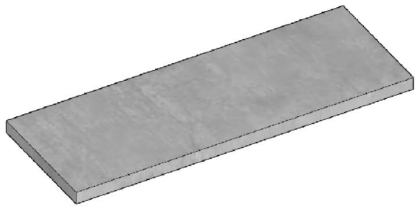
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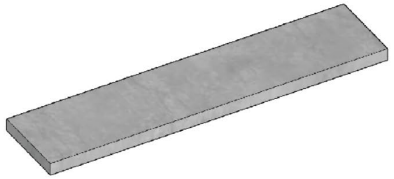
BUILDING CONSTRUCTION



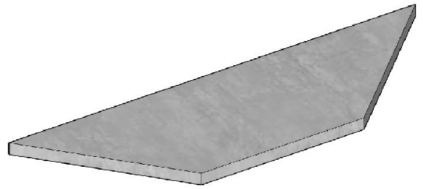
floors



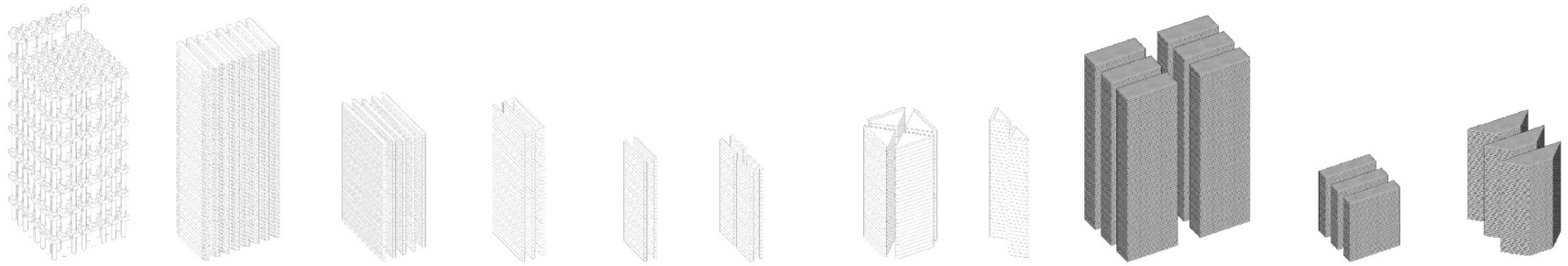
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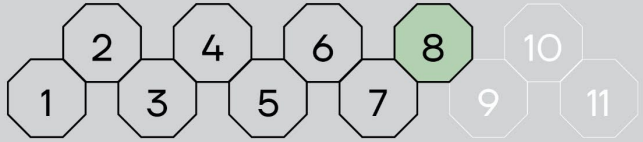


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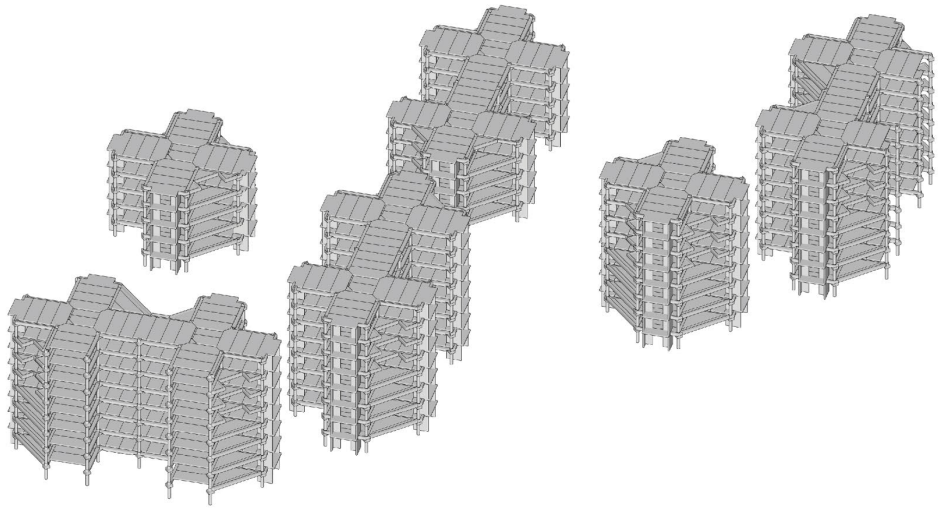


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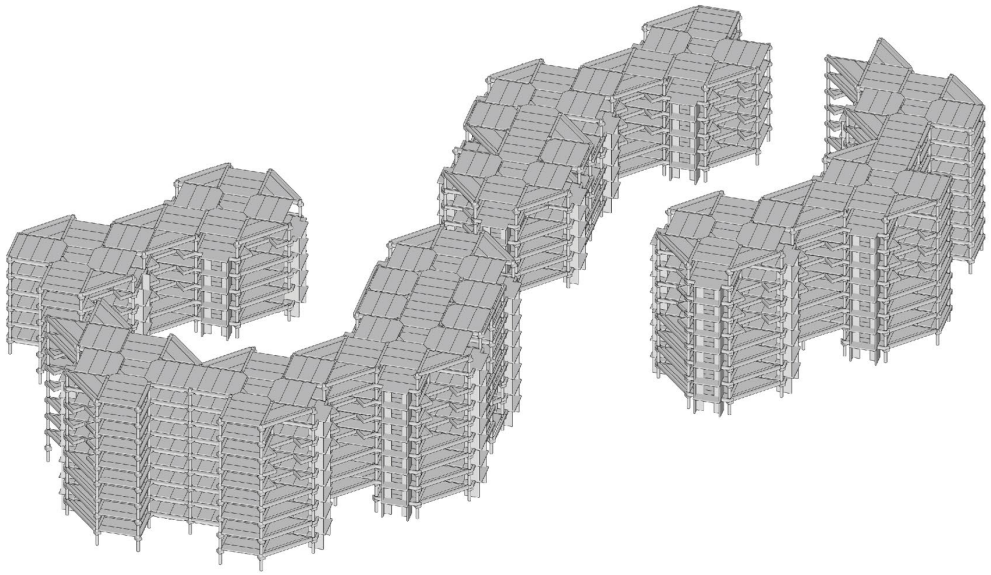




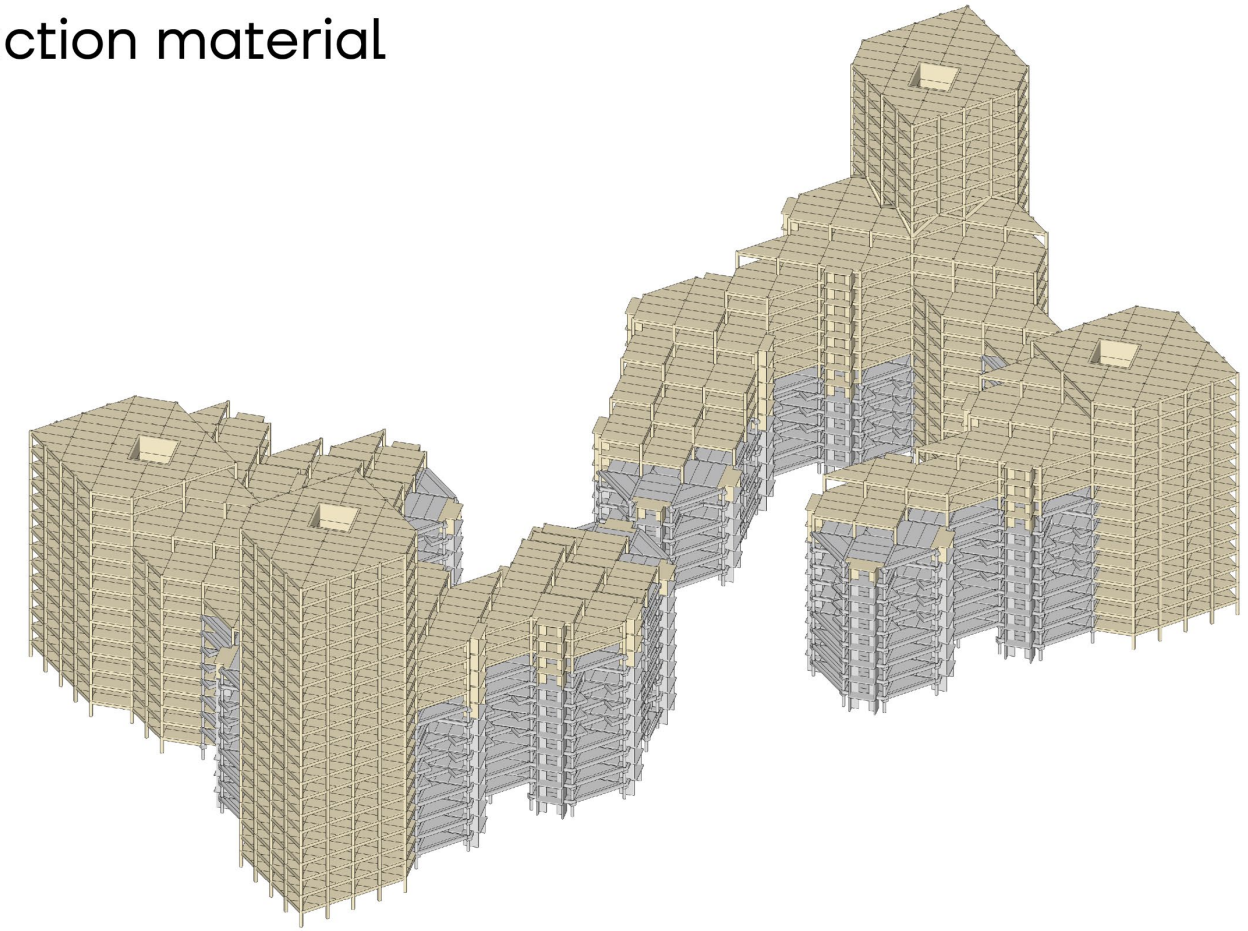
remaining construction



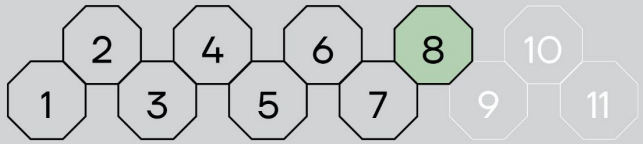
replacement of elements



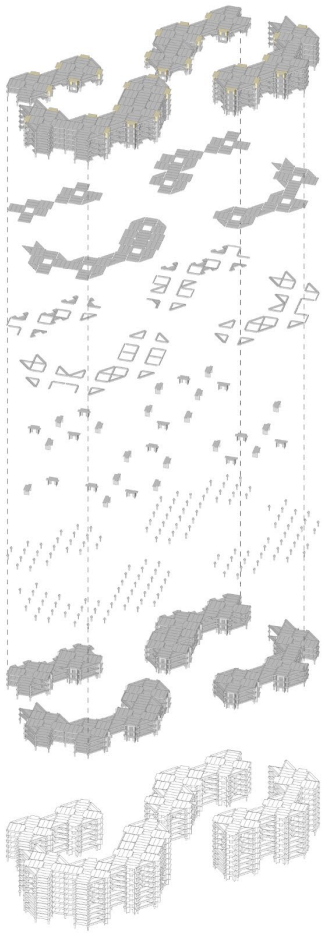
new construction material



BUILDING CONSTRUCTION



concrete (re)construction



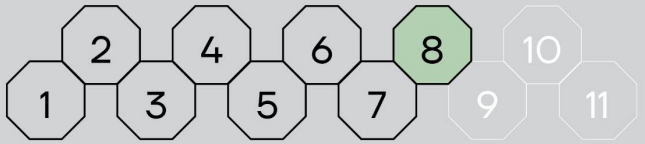
floors

beams

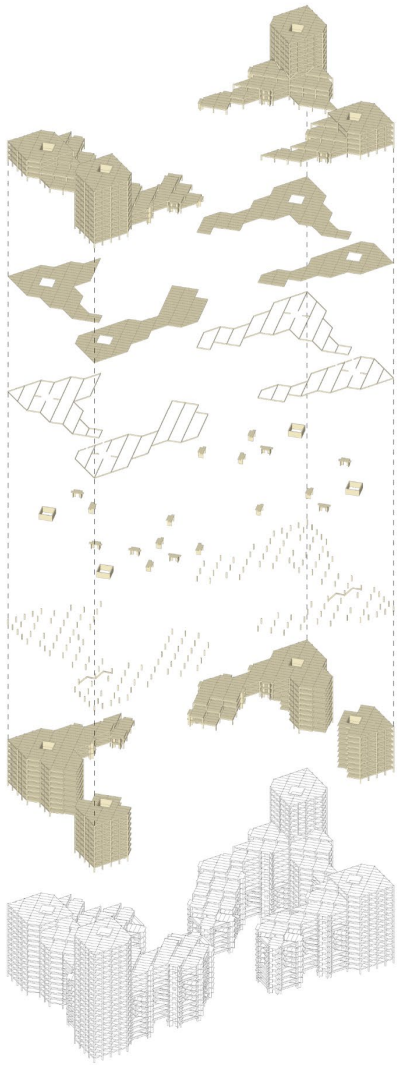
cores

columns

BUILDING CONSTRUCTION



wood construction



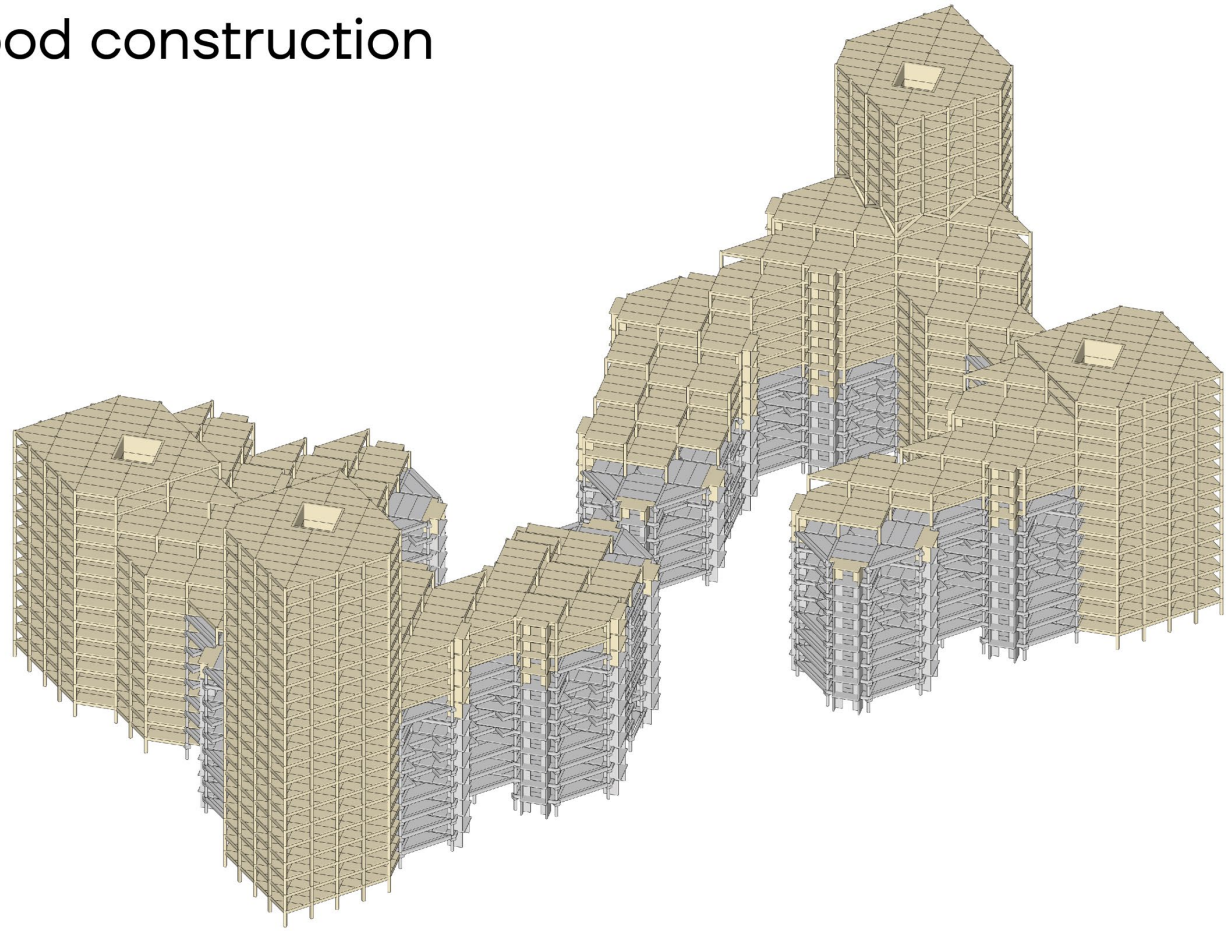
floors

beams

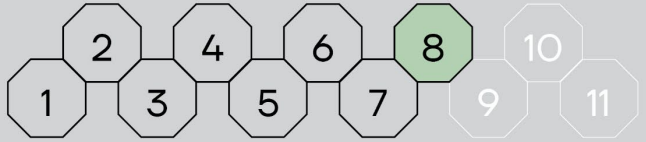
cores

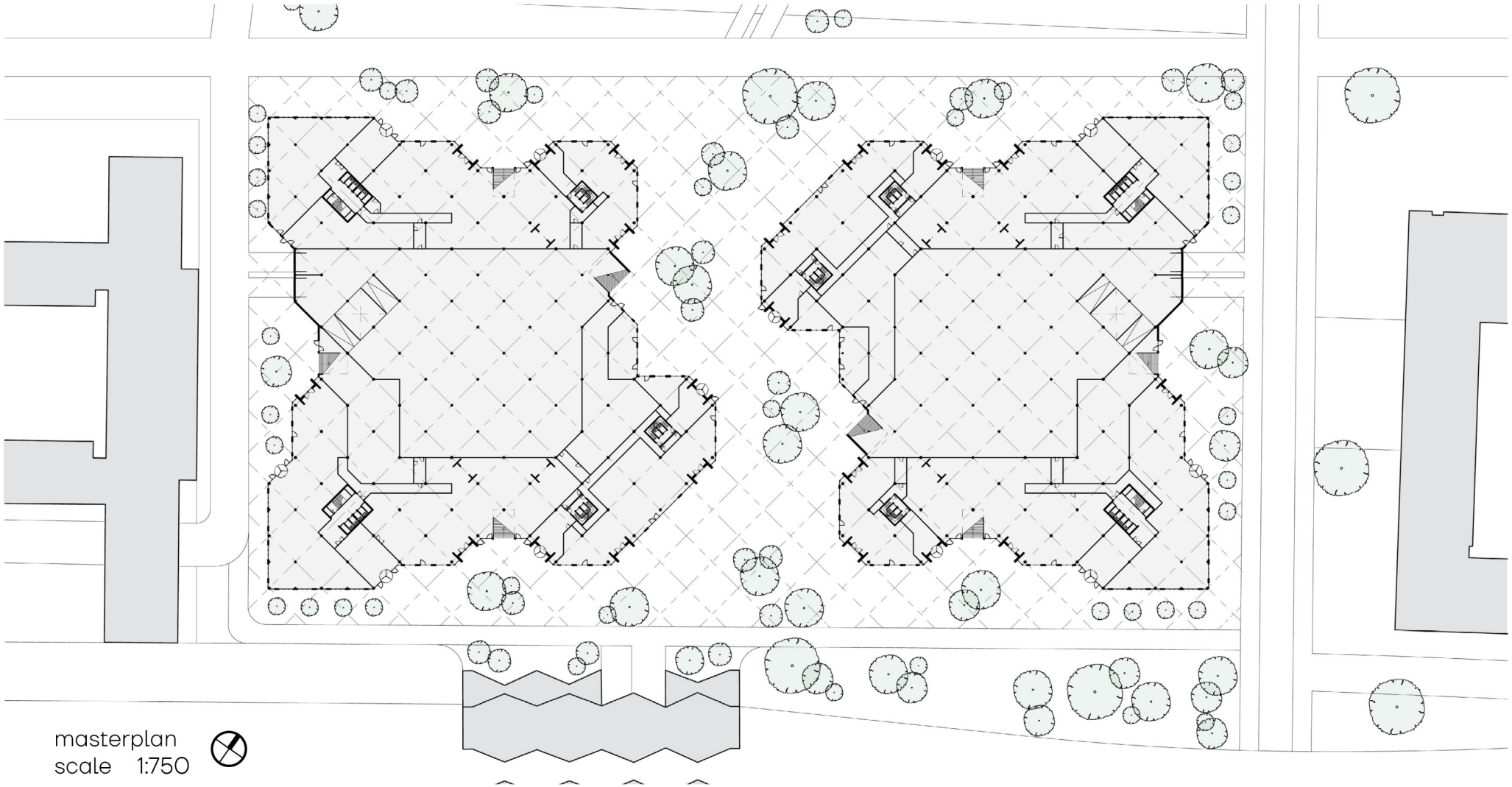
columns

concrete-wood construction



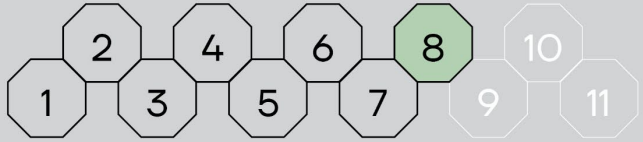
BUILDING CONSTRUCTION

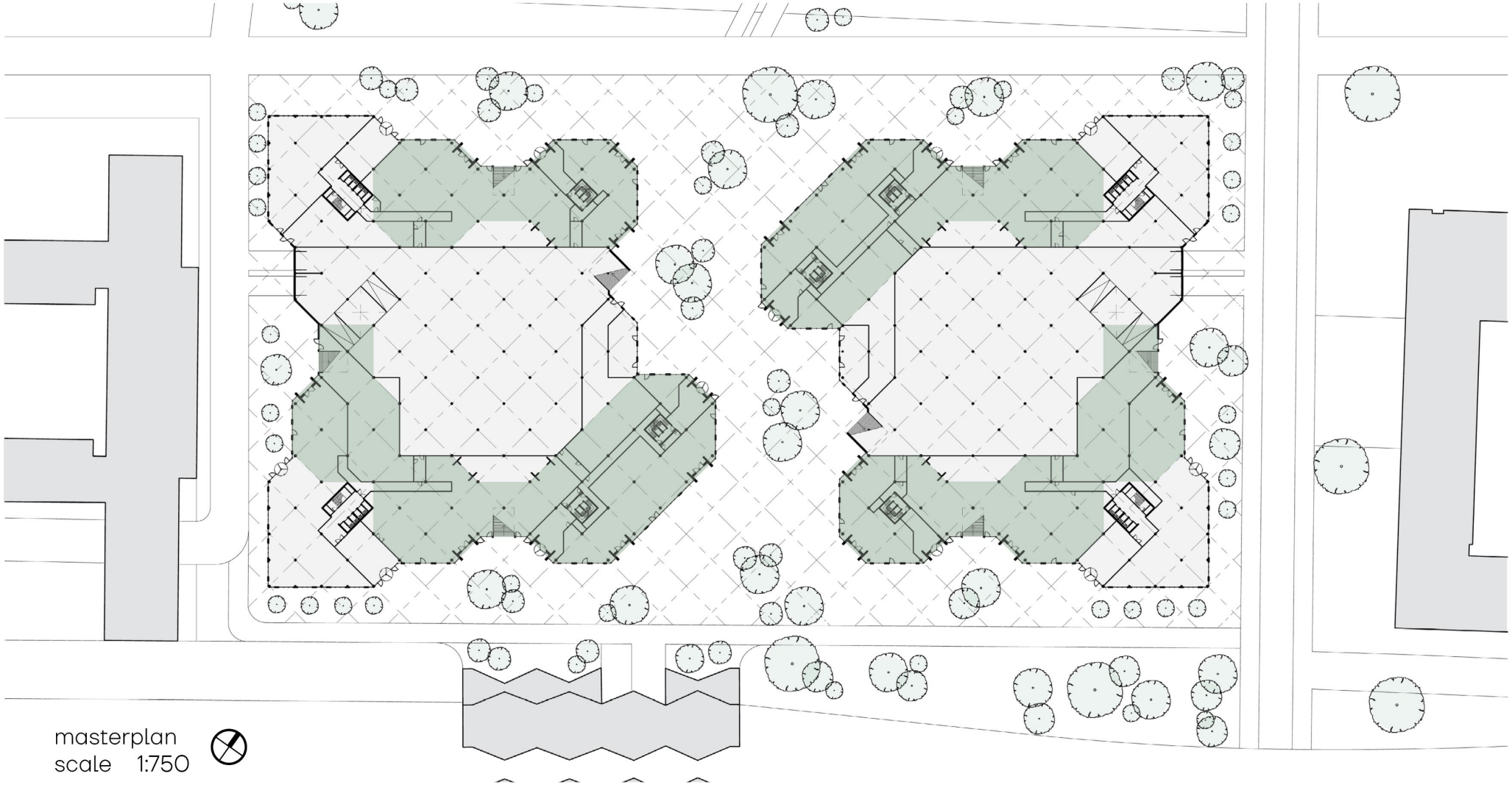




masterplan
scale 1:750

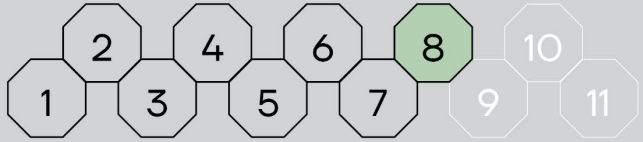
BUILDING CONSTRUCTION

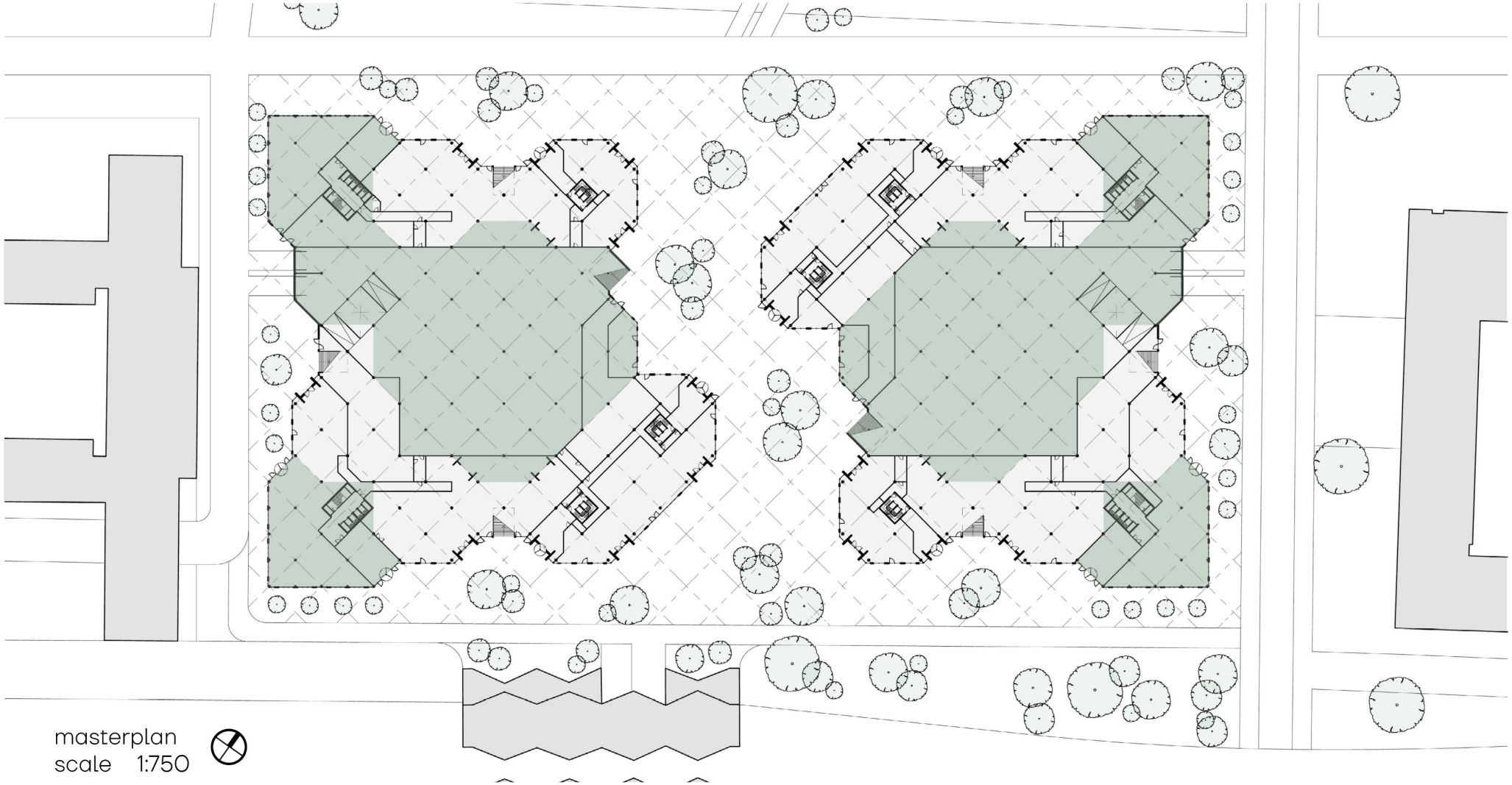




masterplan
scale 1:750

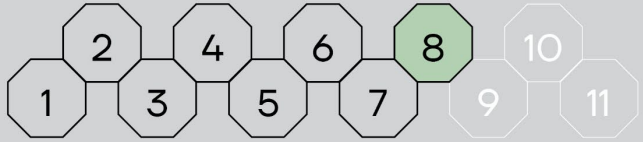
BUILDING CONSTRUCTION

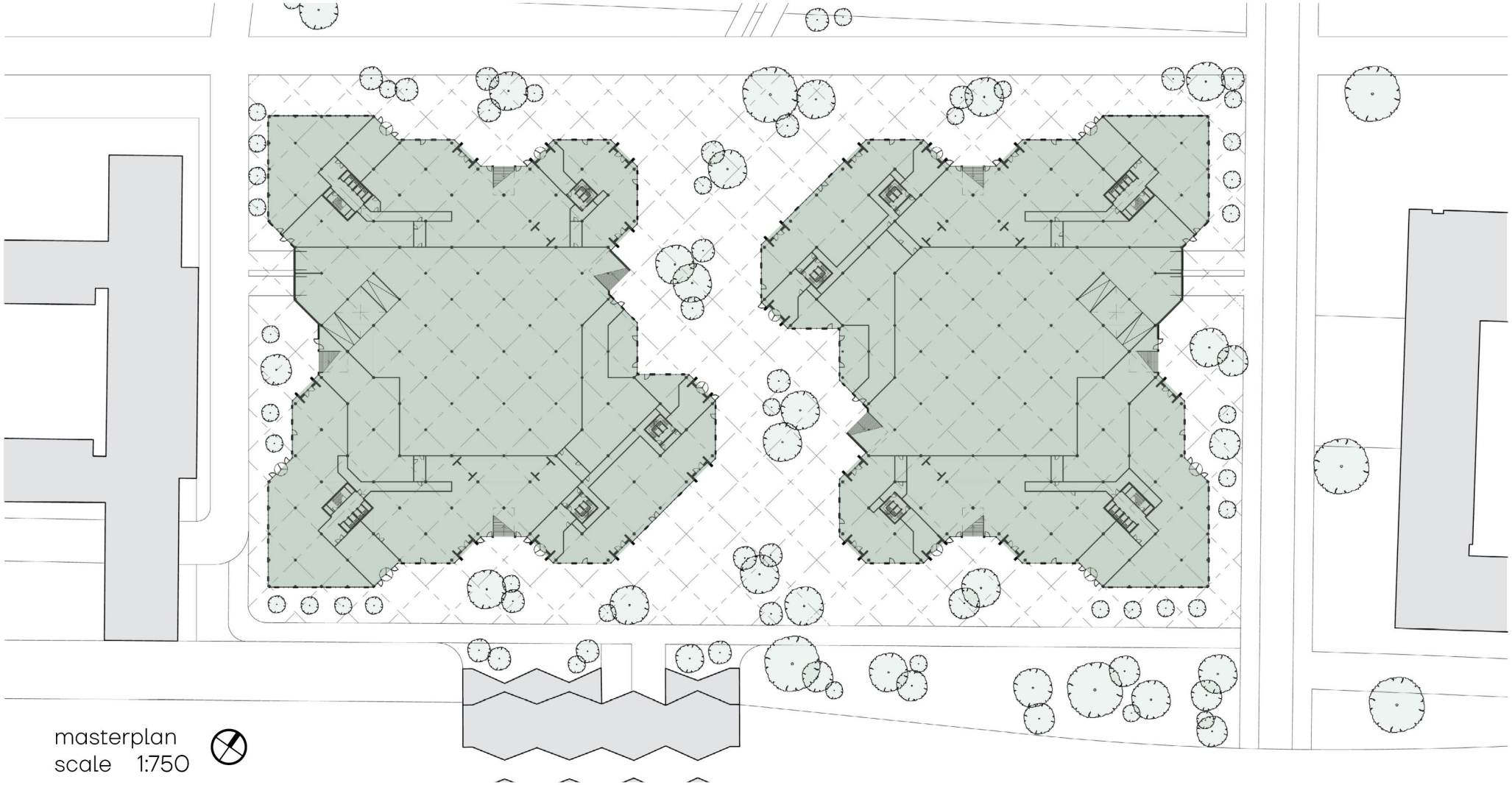




masterplan
scale 1:750

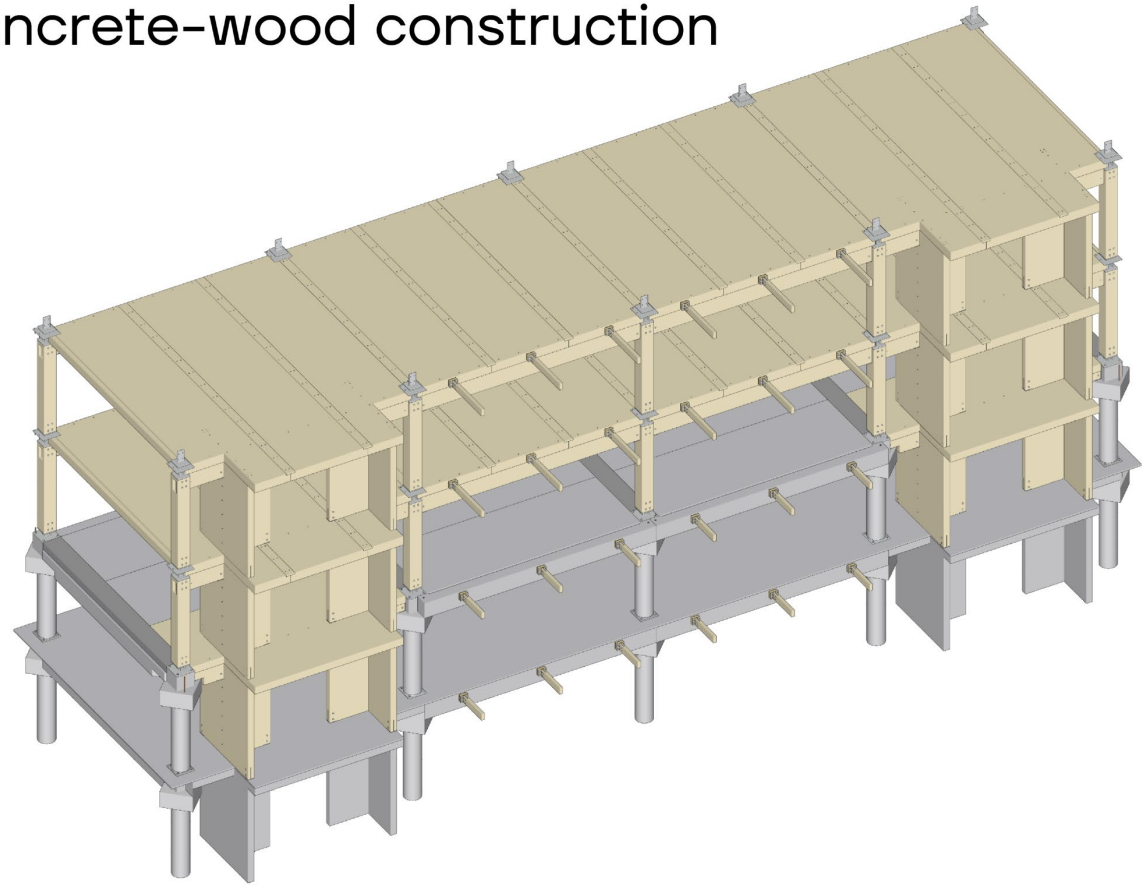
BUILDING CONSTRUCTION



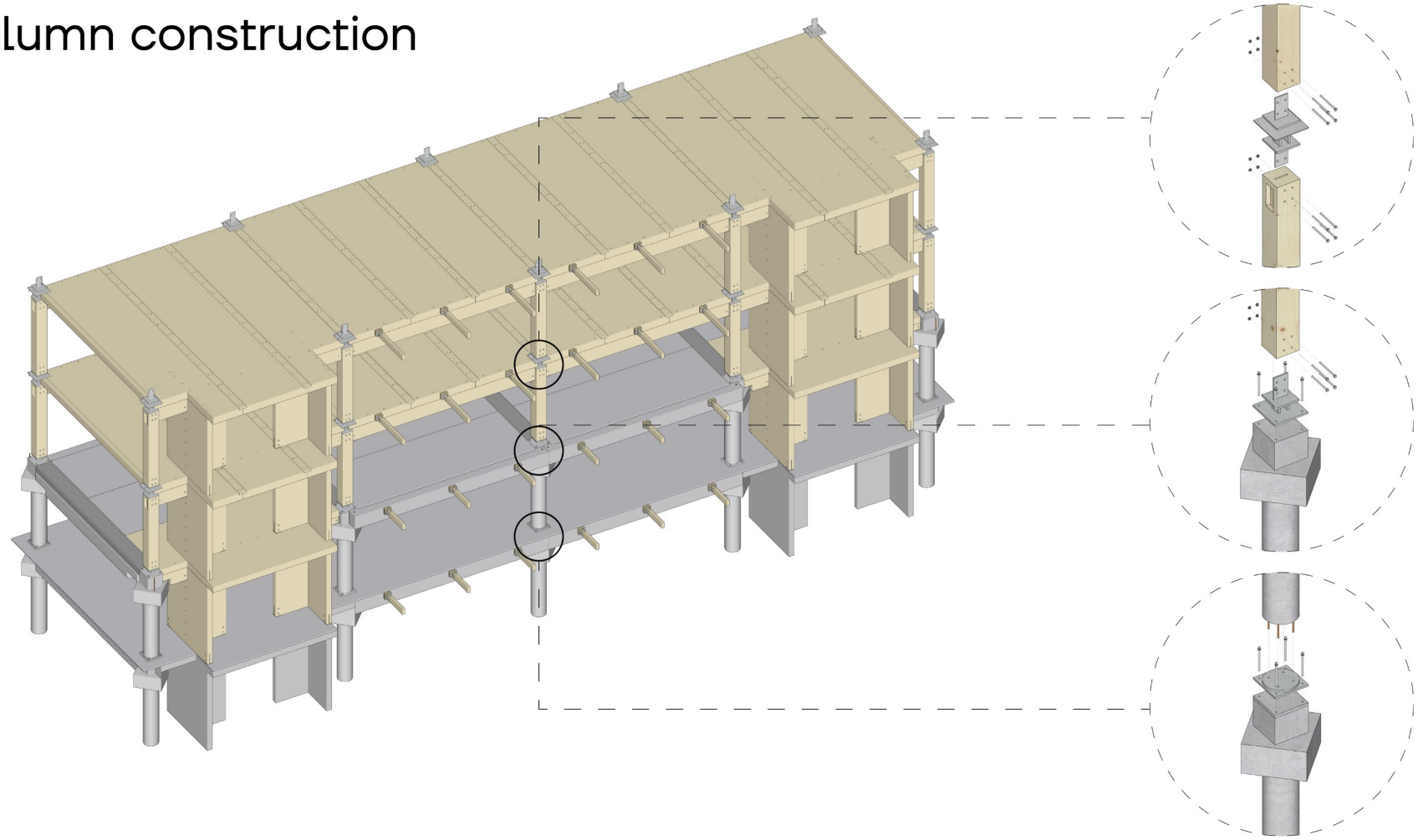


masterplan
scale 1:750

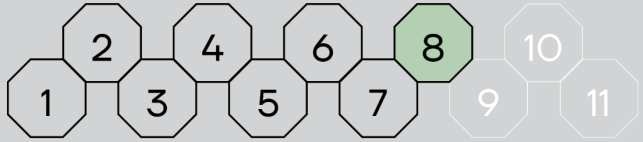
concrete-wood construction

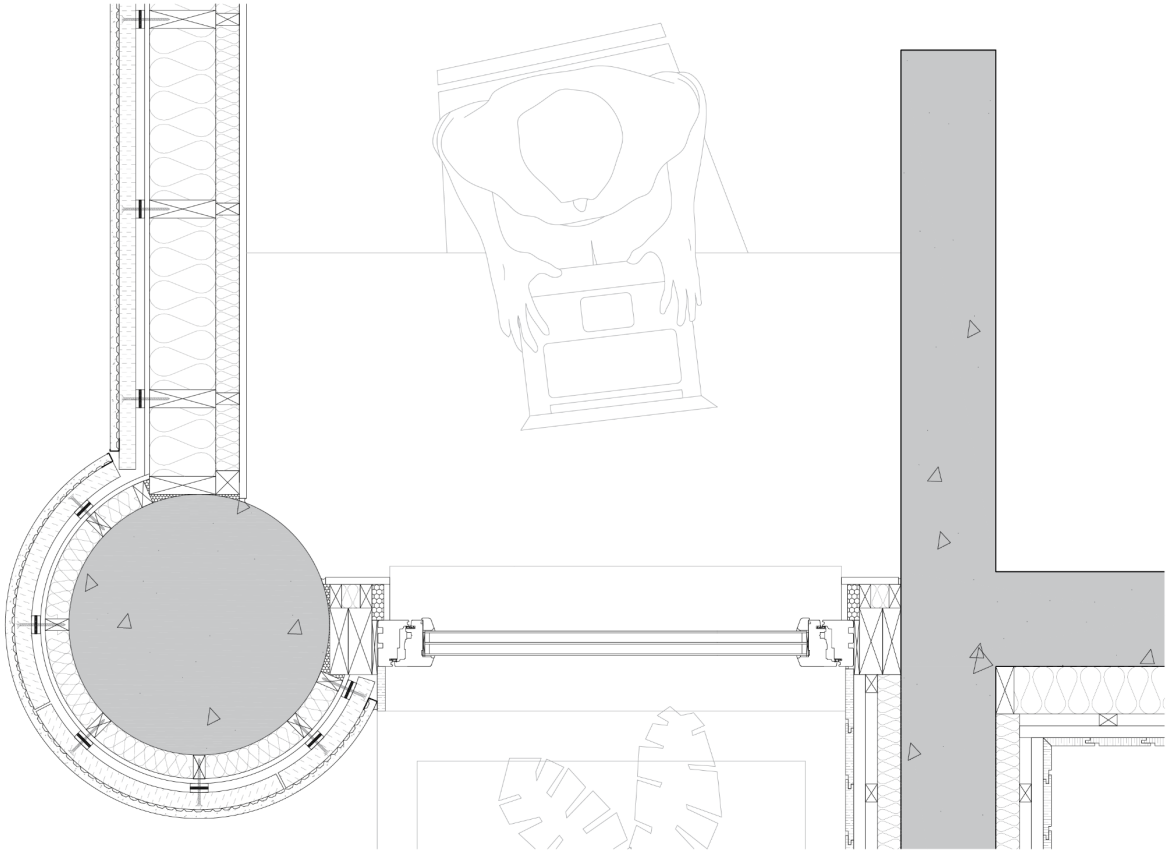


column construction

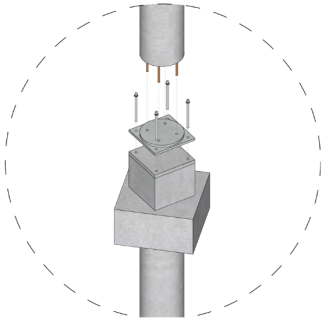


BUILDING CONSTRUCTION

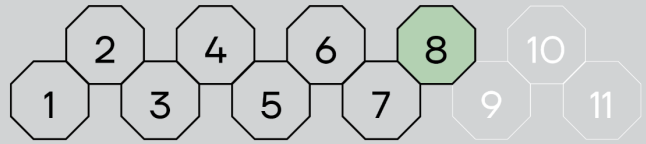


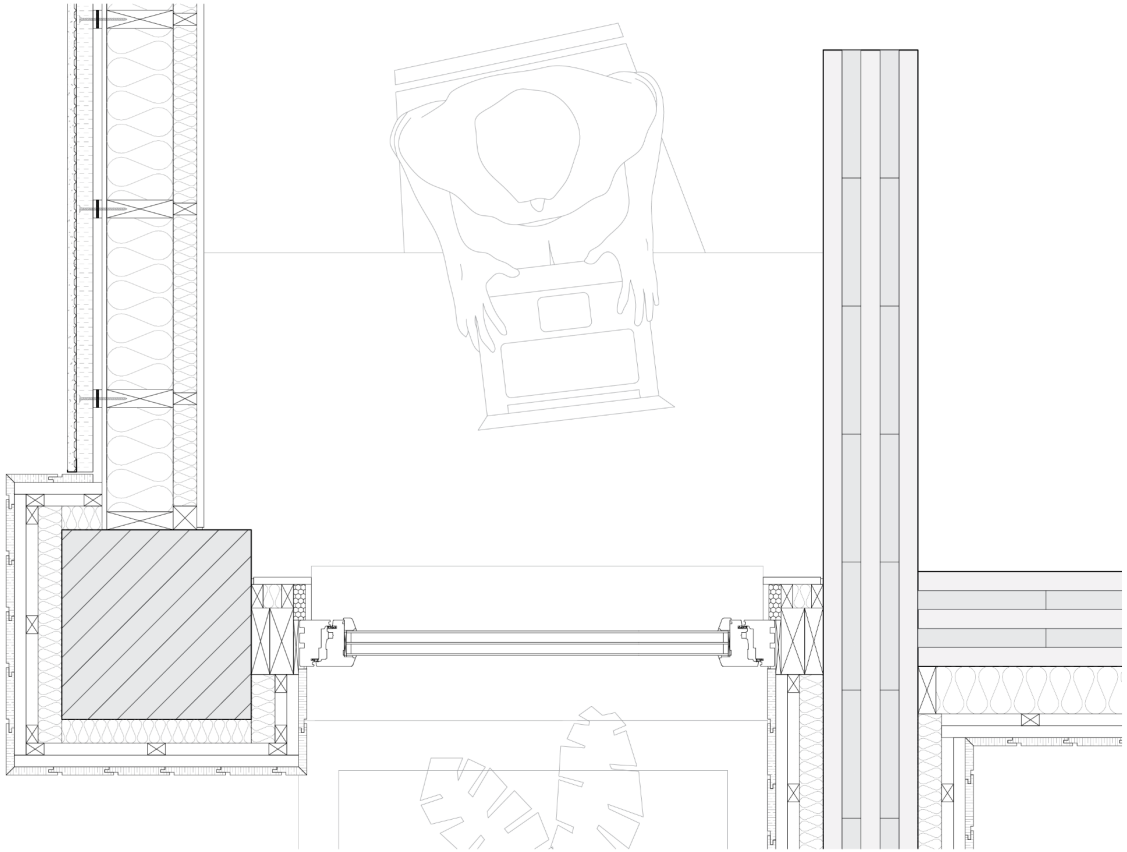


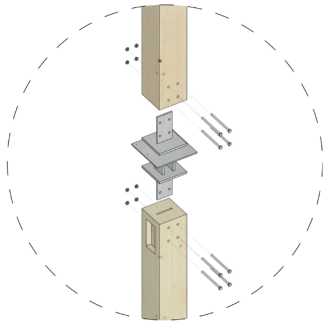
scale 1:10



BUILDING CONSTRUCTION

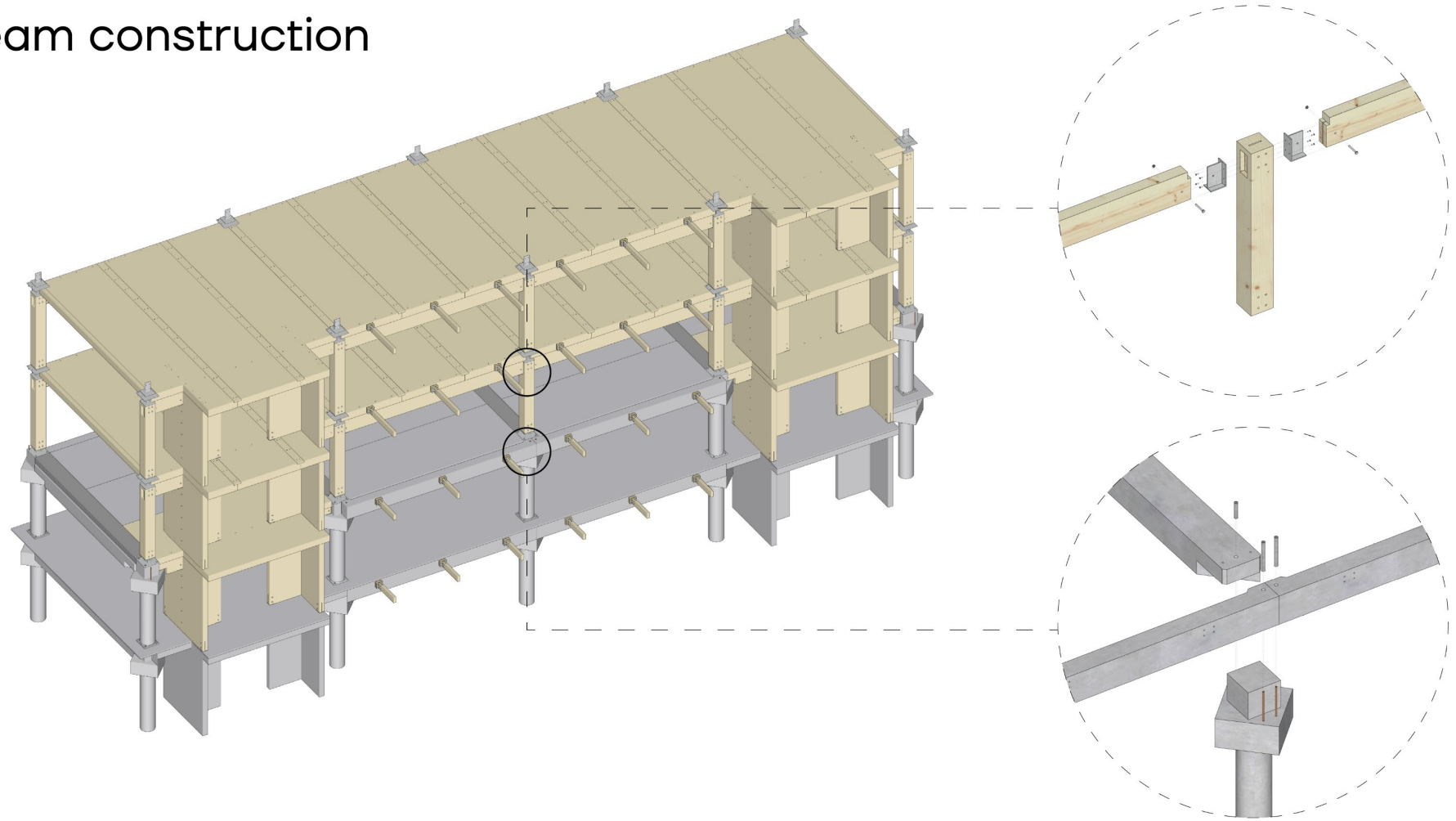




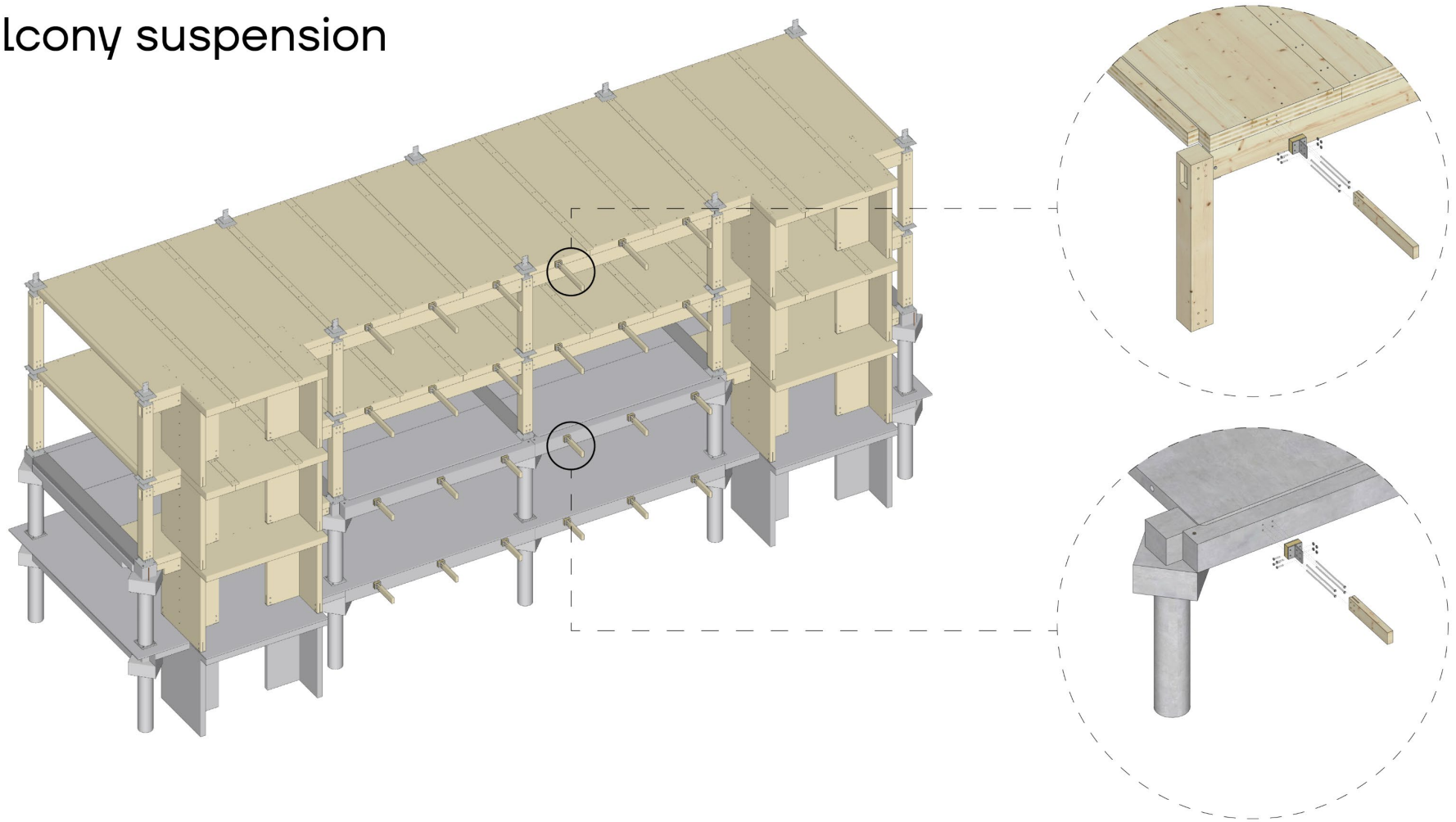


scale 1:10

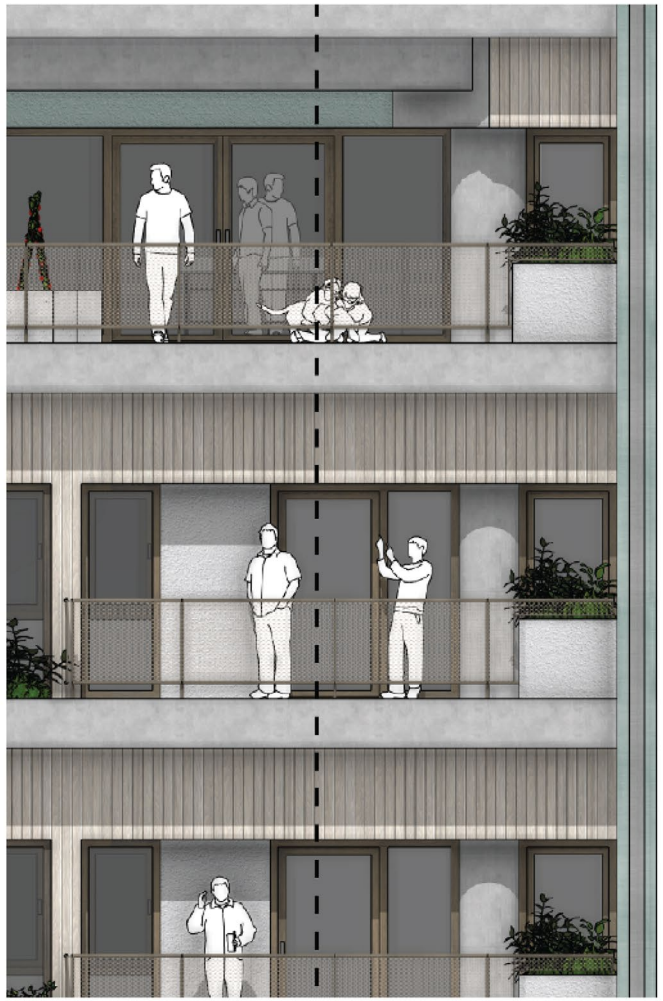
beam construction

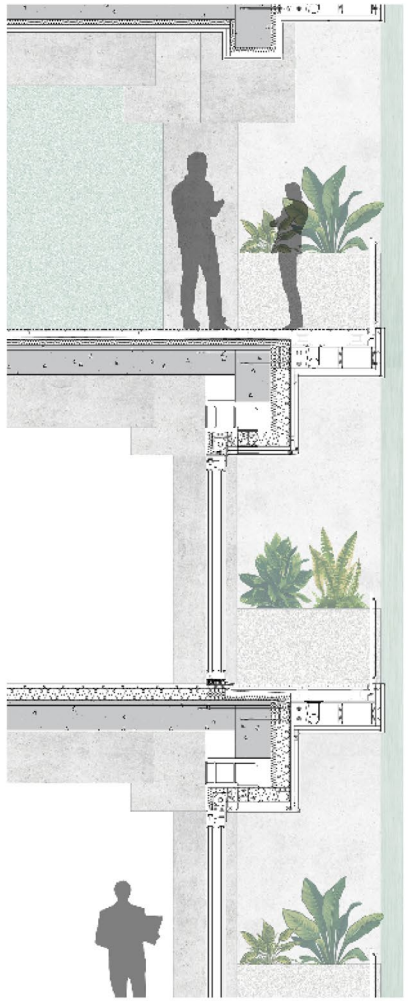


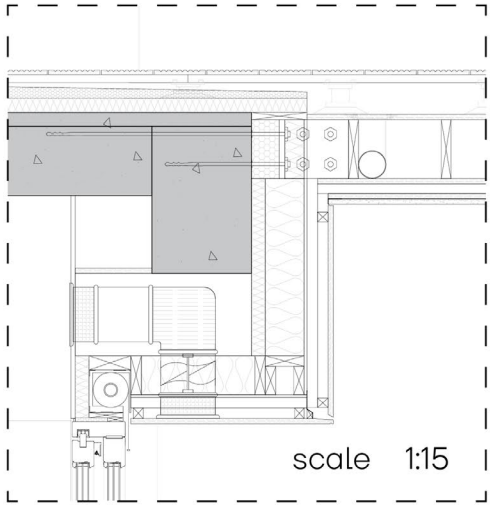
balcony suspension



BUILDING CONSTRUCTION



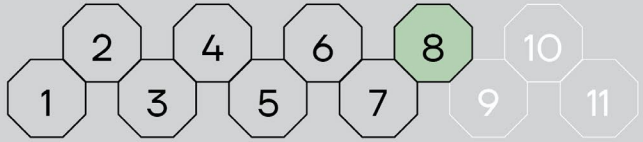






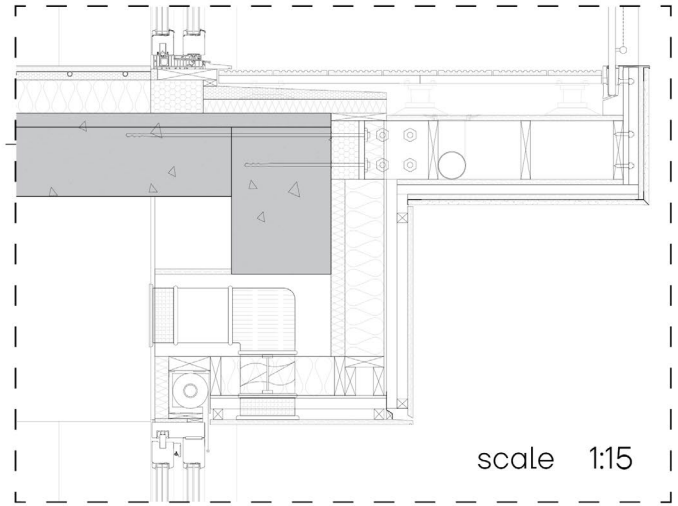


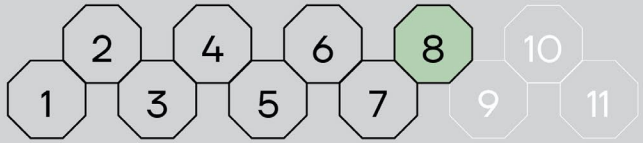
BUILDING CONSTRUCTION



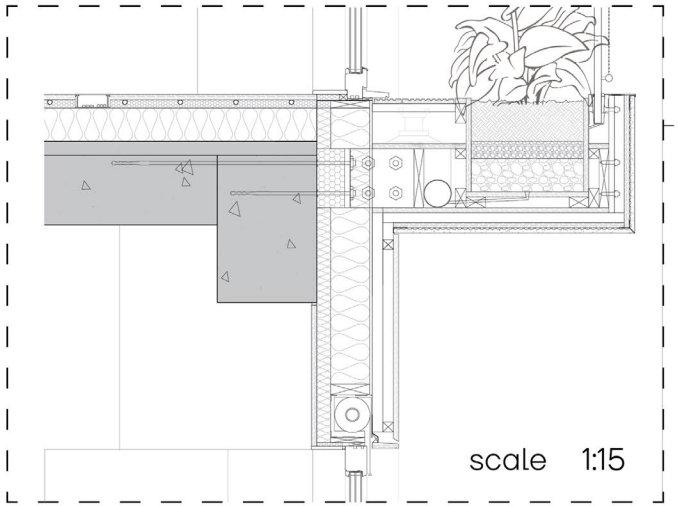


balcony detail





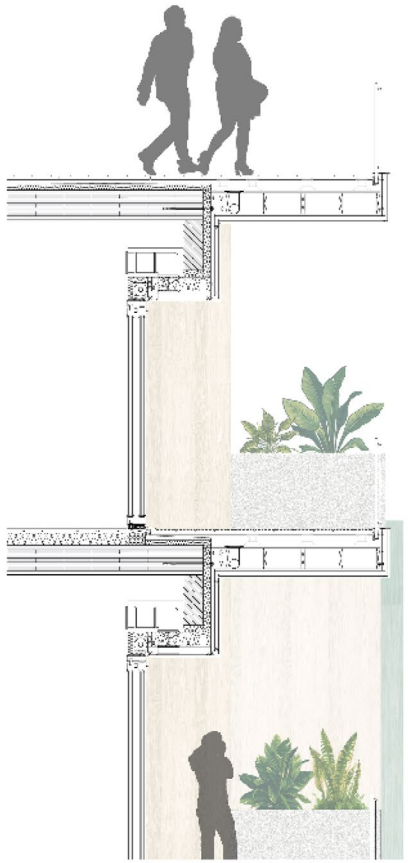
planter detail



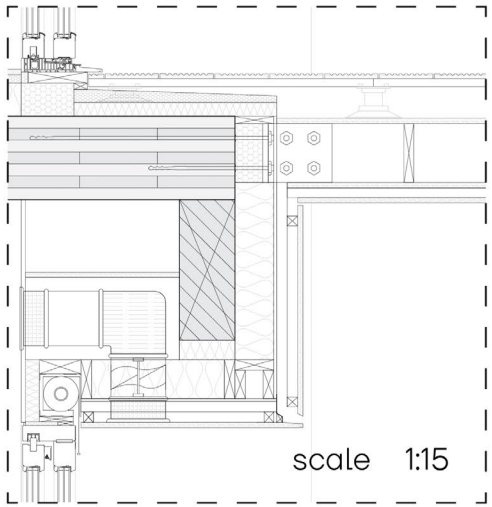


BUILDING CONSTRUCTION



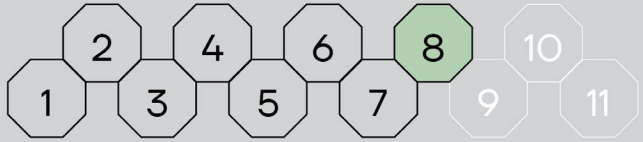






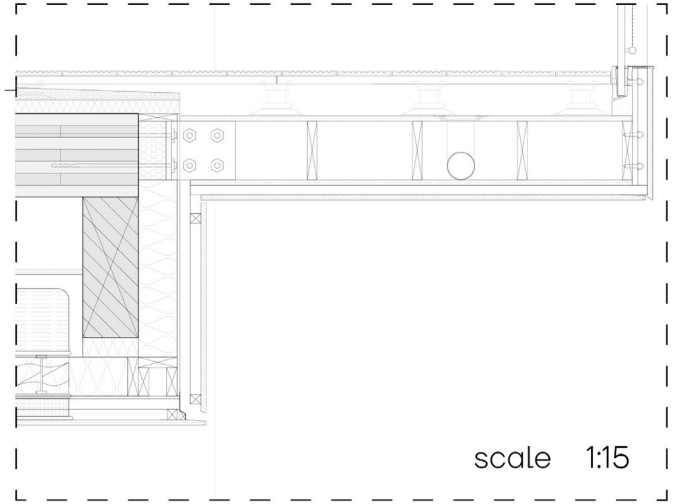


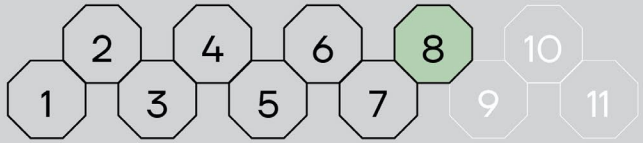
BUILDING CONSTRUCTION



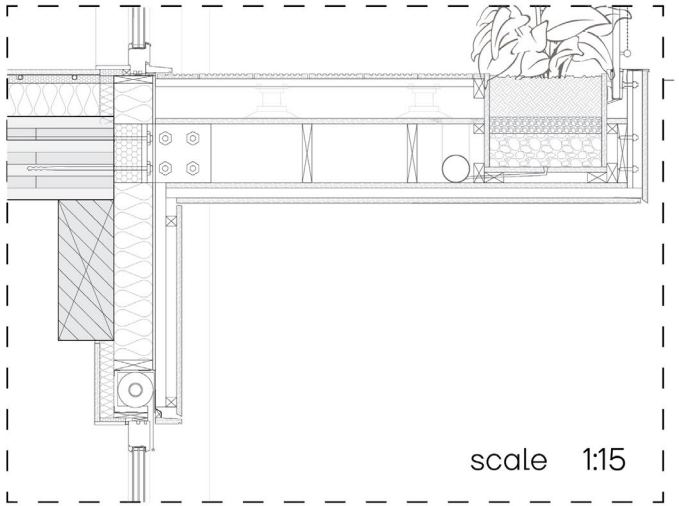


balcony detail



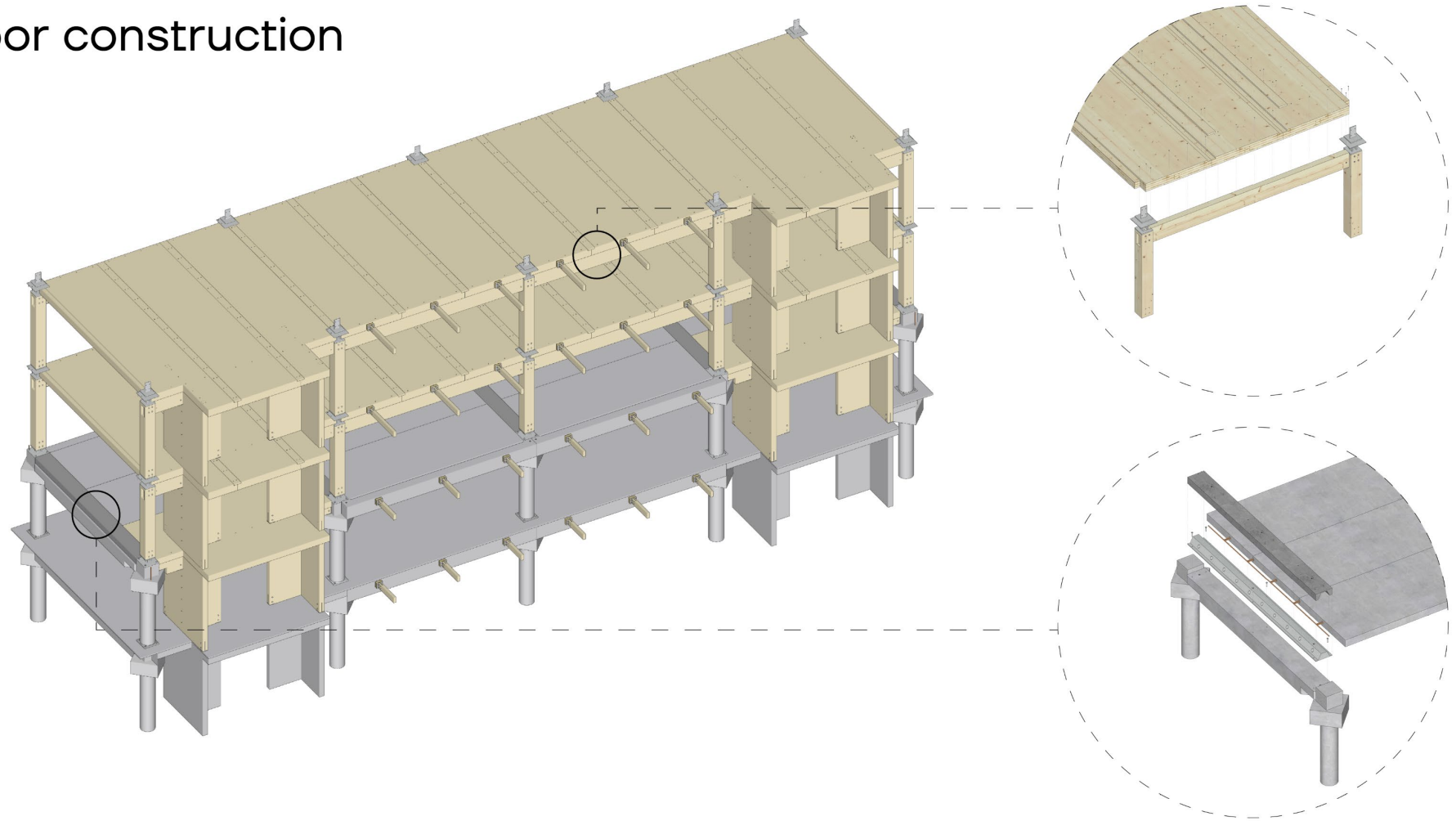


planter detail

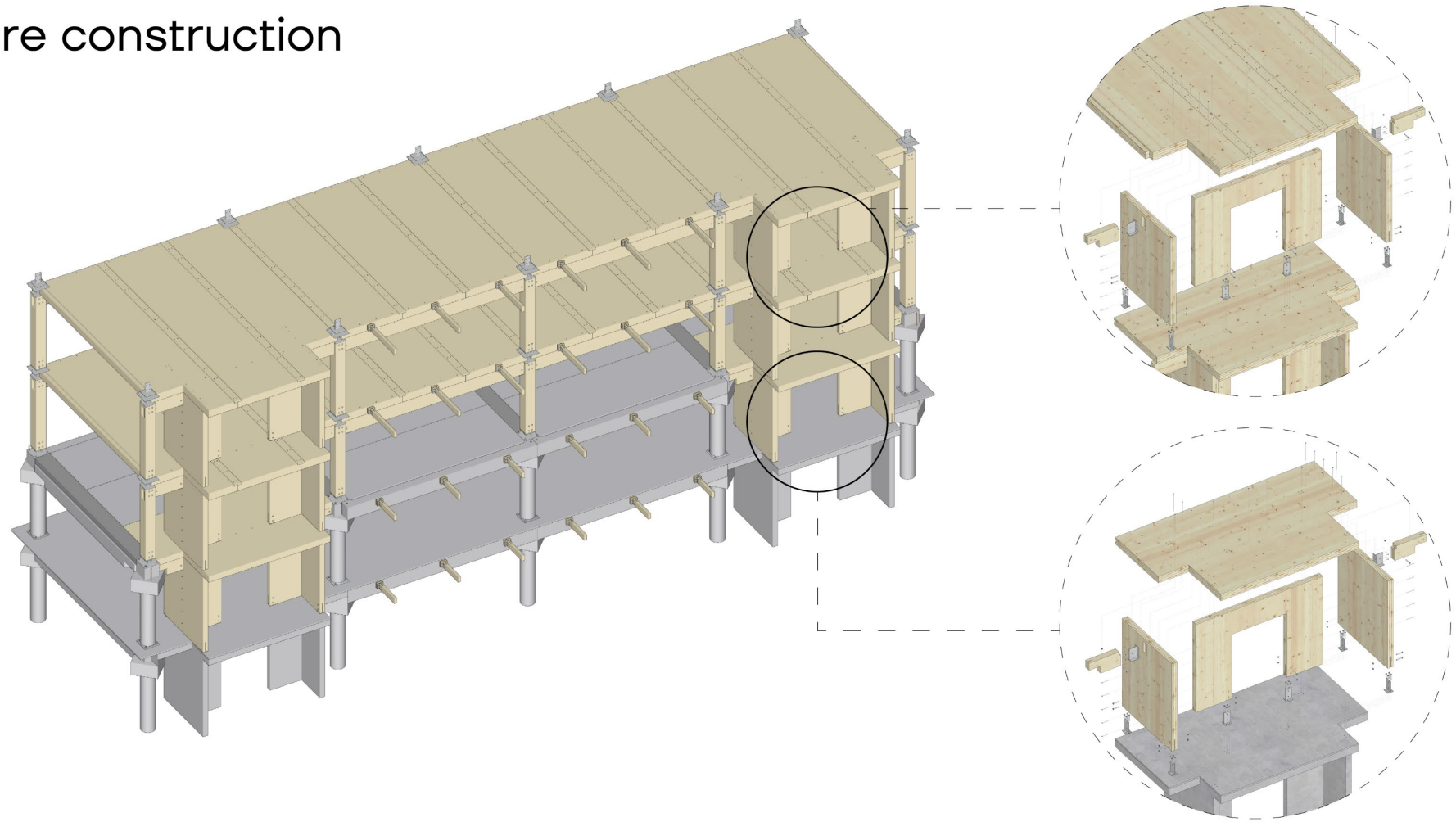




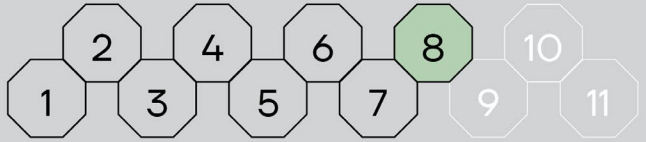
floor construction



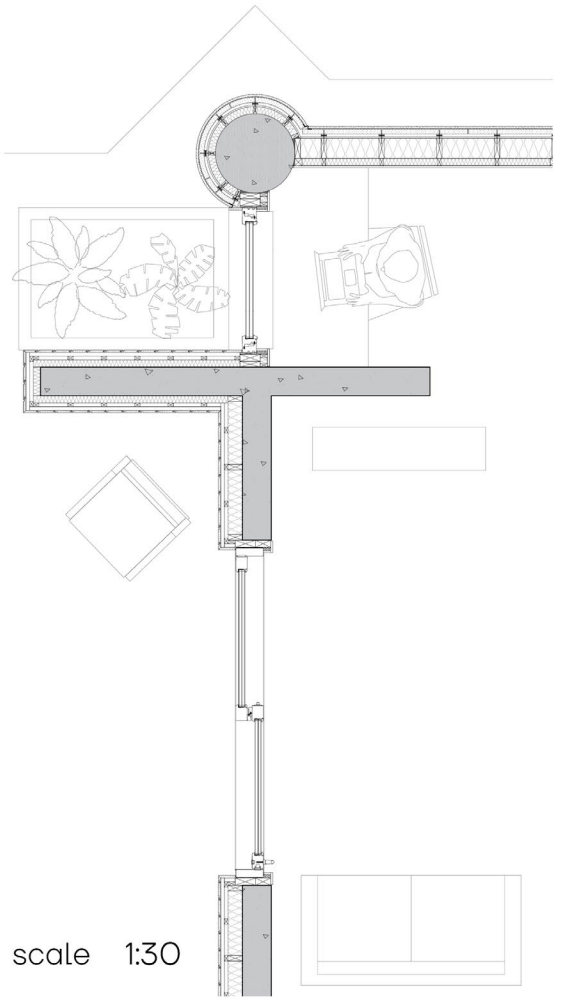
core construction



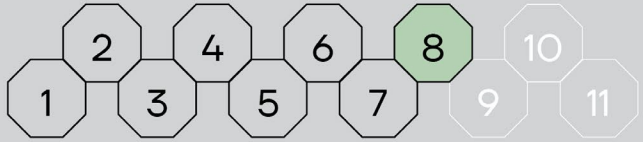
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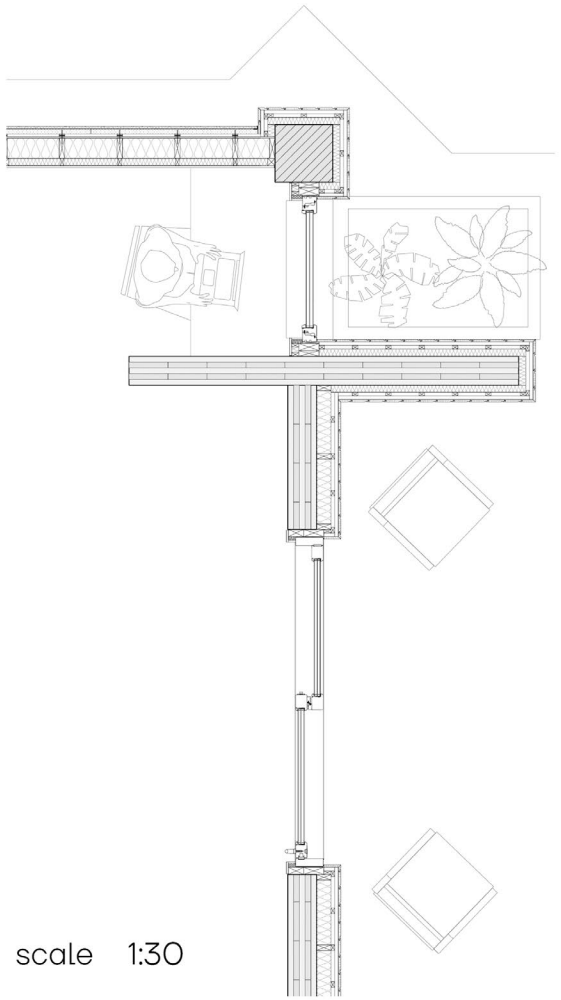






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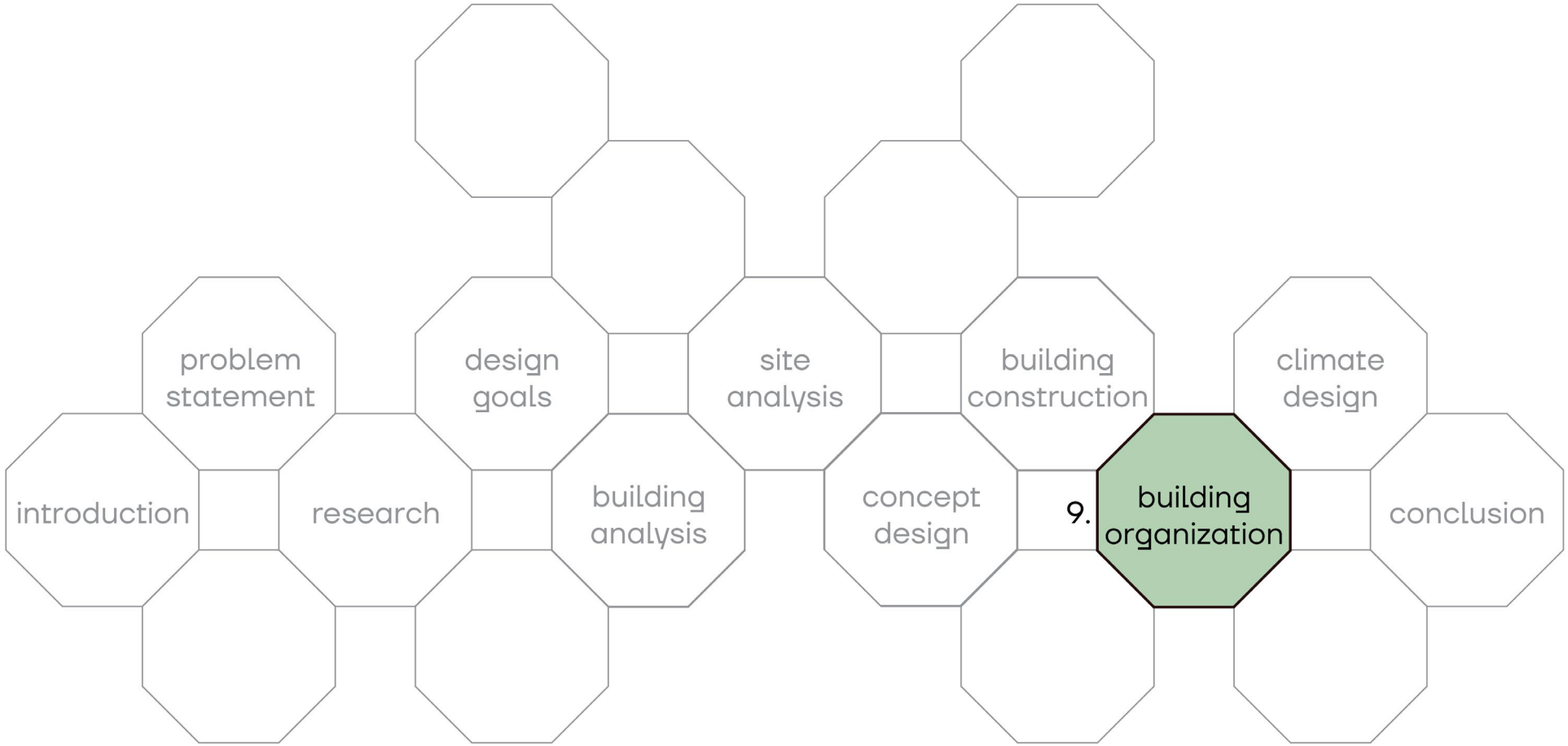




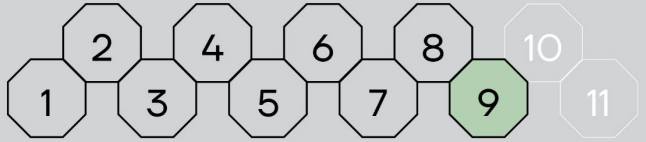
scale 1:30



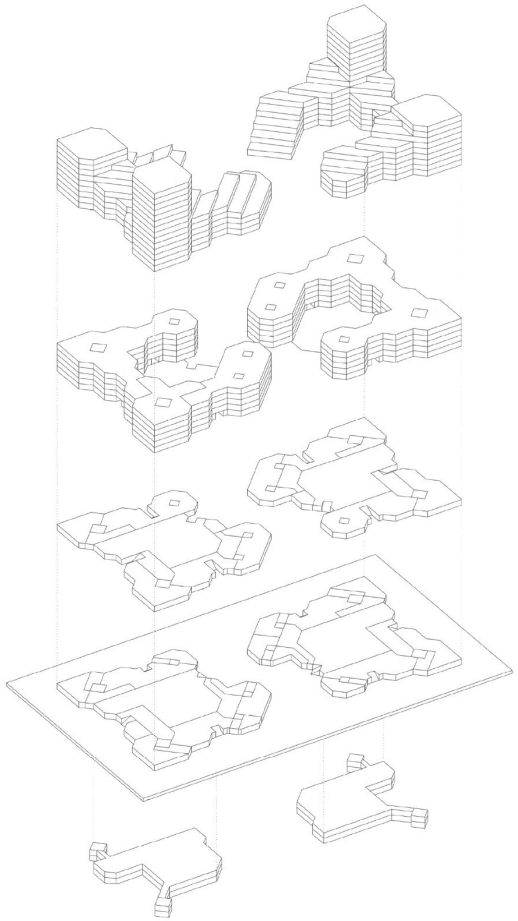
BUILDING ORGANIZATION



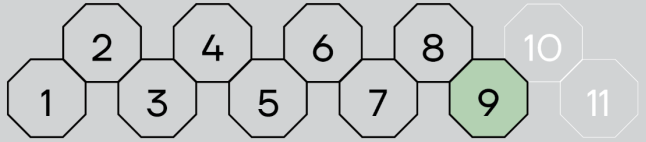
BUILDING ORGANIZATION



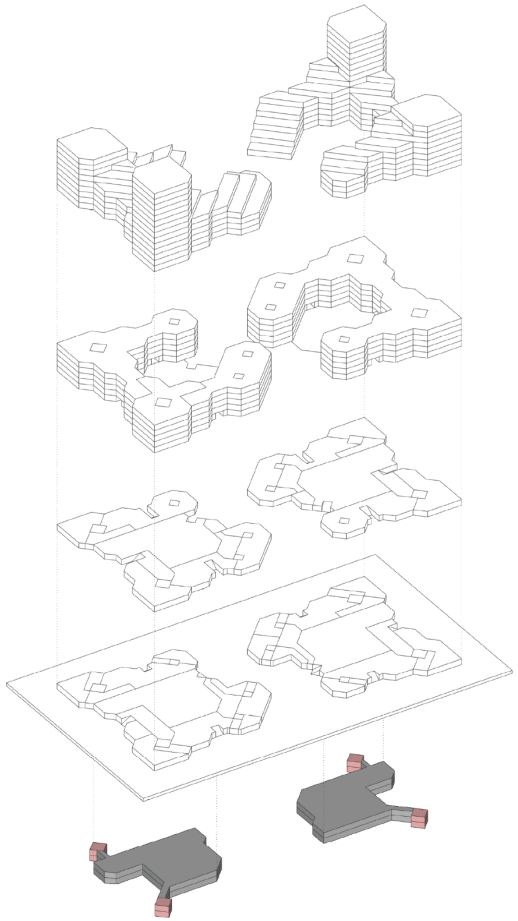
program layout



BUILDING ORGANIZATION



program layout

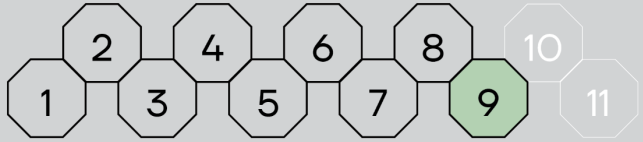


level -1
level -2

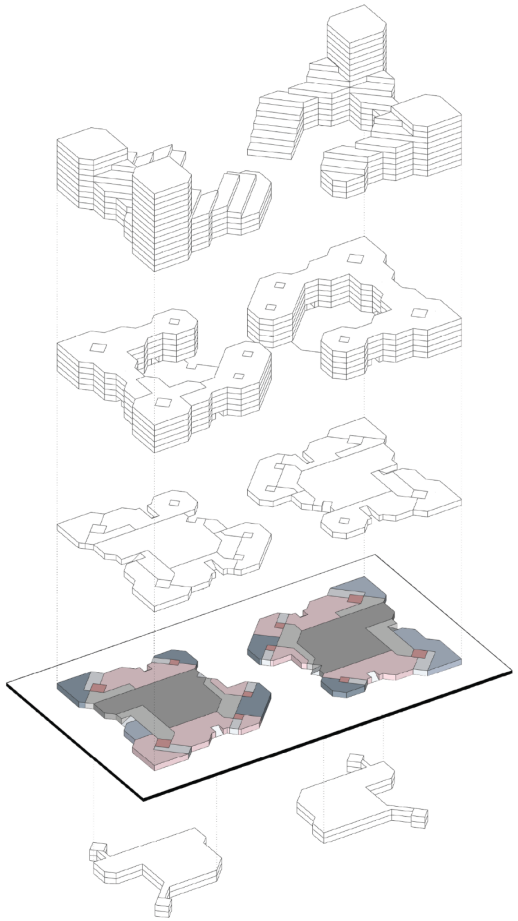
vertical transport

parking garage

BUILDING ORGANIZATION



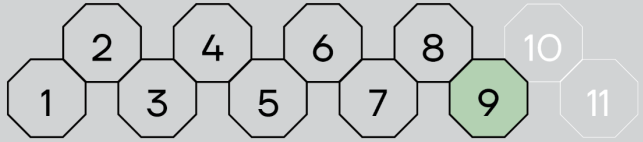
program layout



groundfloor

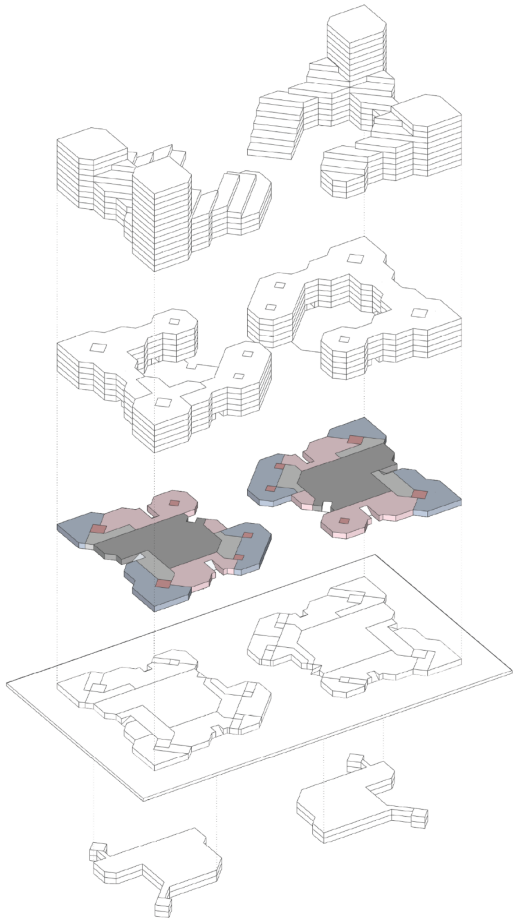
- vertical transport
- cycle parking
- parking garage
- restaurants, cafes etc.
- commercial
- offices

BUILDING ORGANIZATION



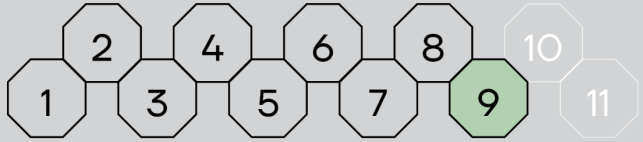
program layout

level 1



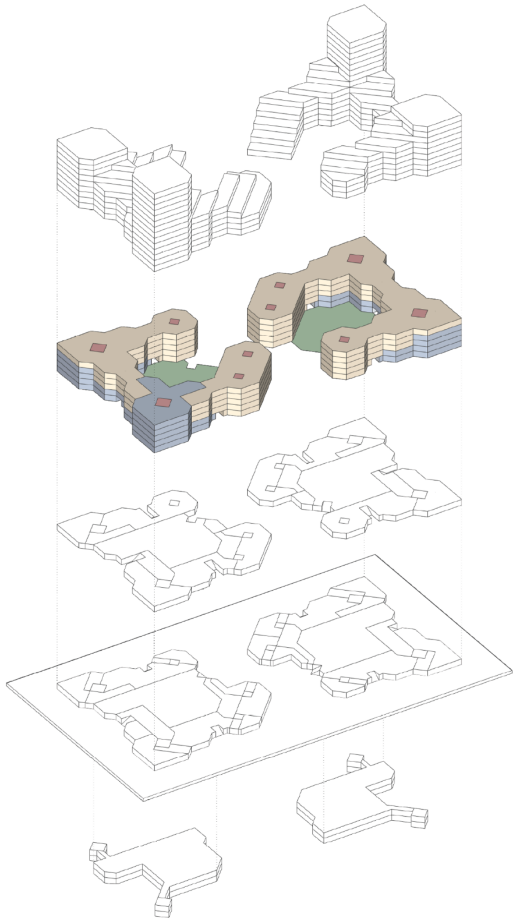
- vertical transport
- cycle parking
- parking garage
- restaurants, cafes etc.
- commercial
- offices

BUILDING ORGANIZATION



program layout

level 6
-
level 2



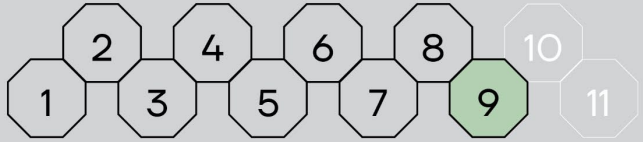
vertical transport

offices

dwellings

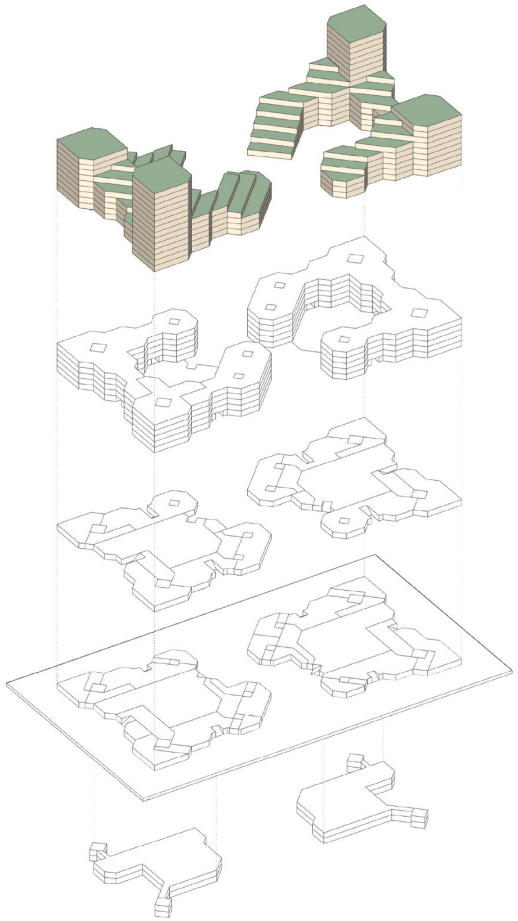
courtyard

BUILDING ORGANIZATION



program layout

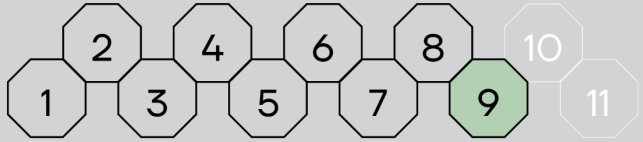
level 20
-
level 7



dwellings

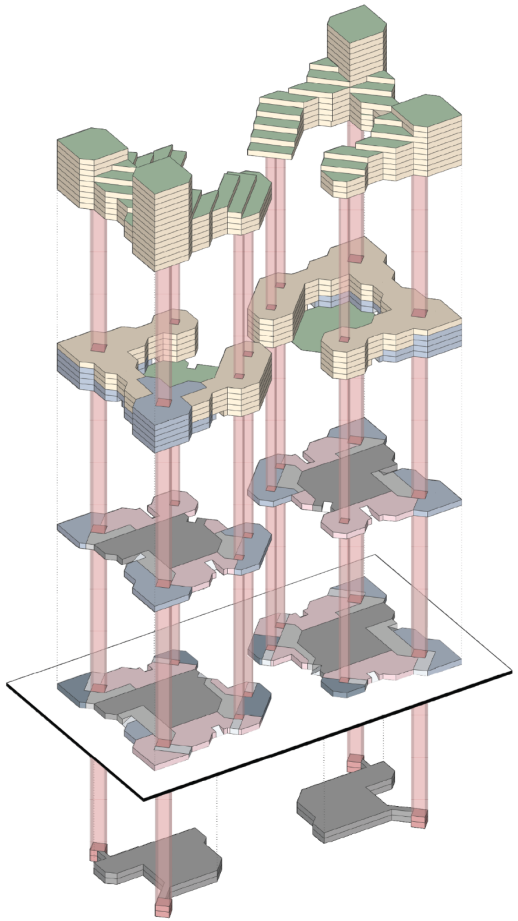
roofterraces

BUILDING ORGANIZATION



program layout

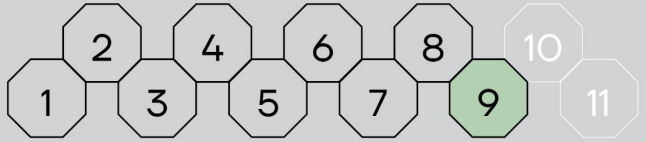
total GFA 148.300 m²

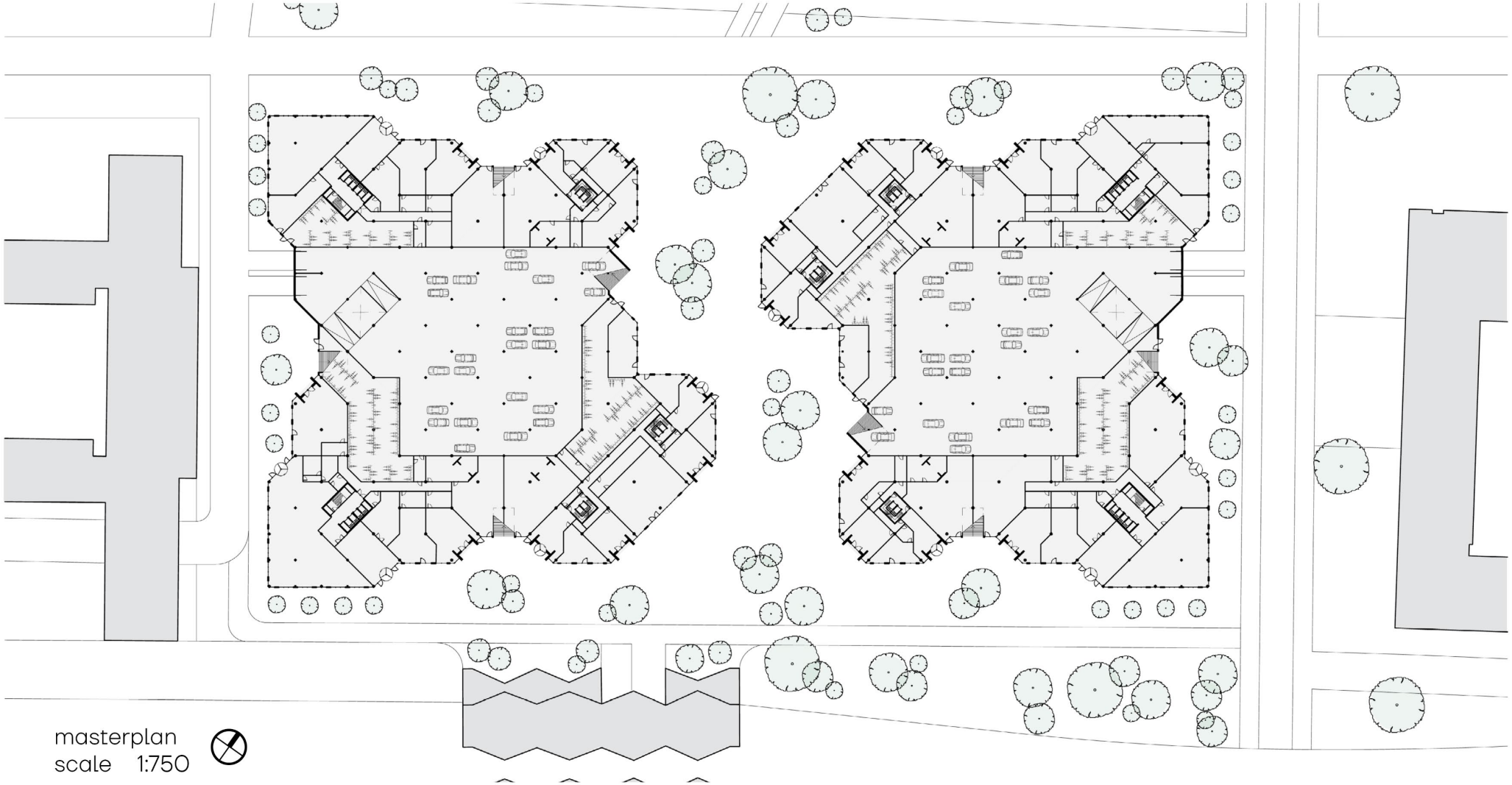


vertical transport	5.600 m²
cycle parking	3.500 m²
parking garage	17.000 m²
restaurants, cafes etc.	1.300 m²
commercial	6.300 m²
offices	19.400 m²
dwellings	78.400 m²
roofterraces	10.200 m²



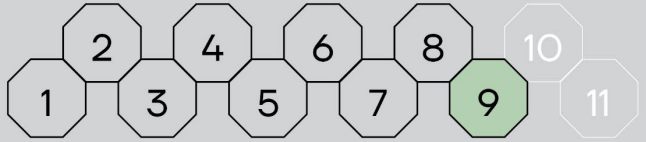
BUILDING ORGANIZATION

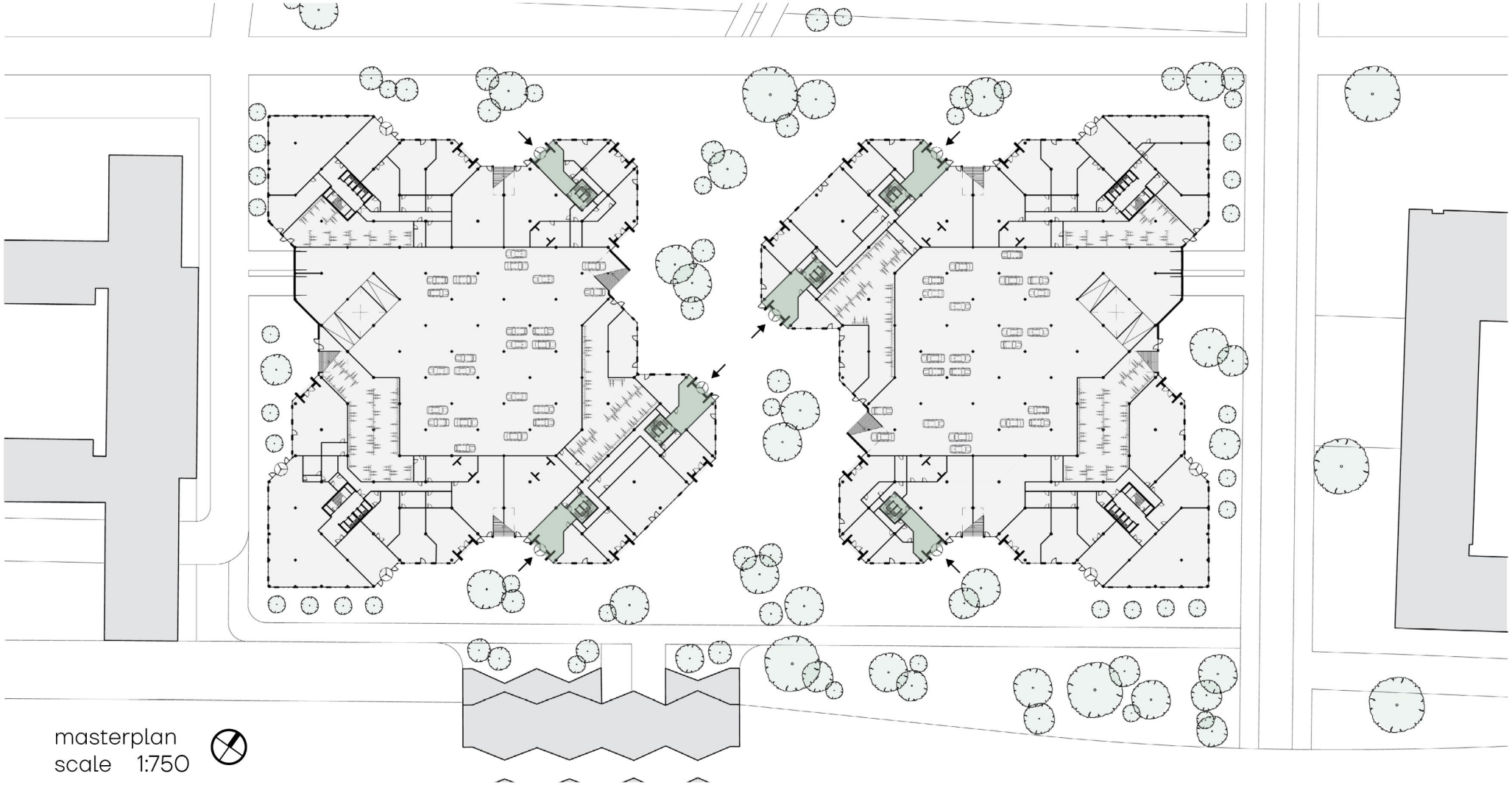




masterplan
scale 1:750

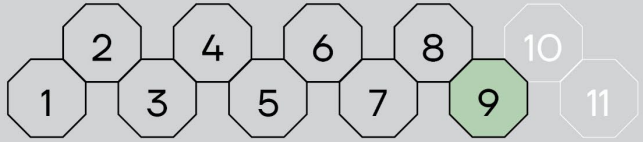
BUILDING ORGANIZATION

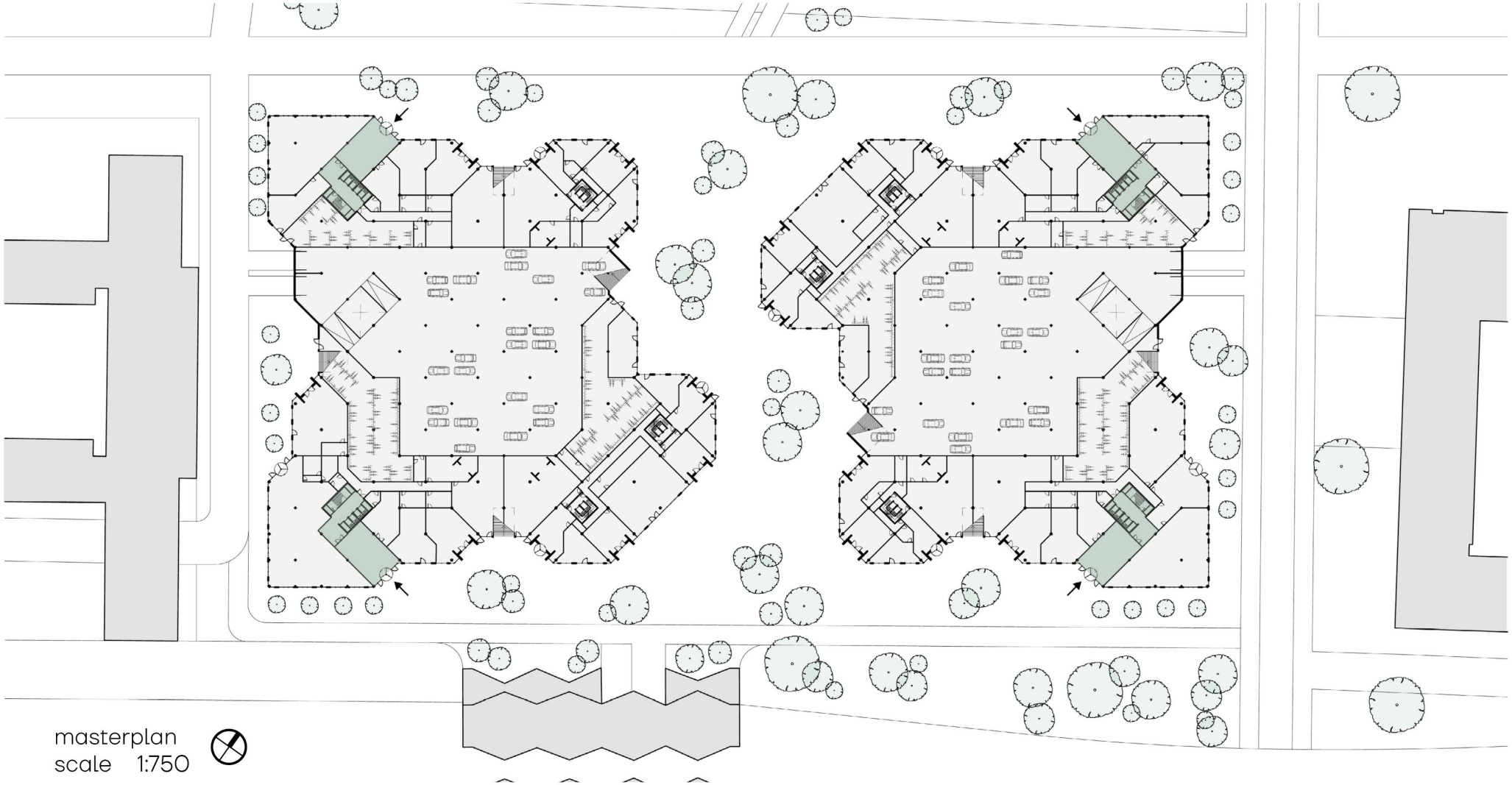




masterplan
scale 1:750

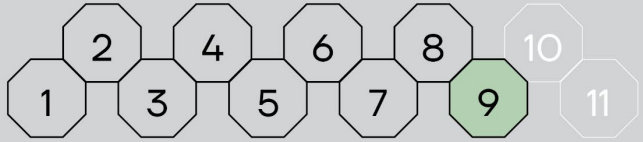
BUILDING ORGANIZATION

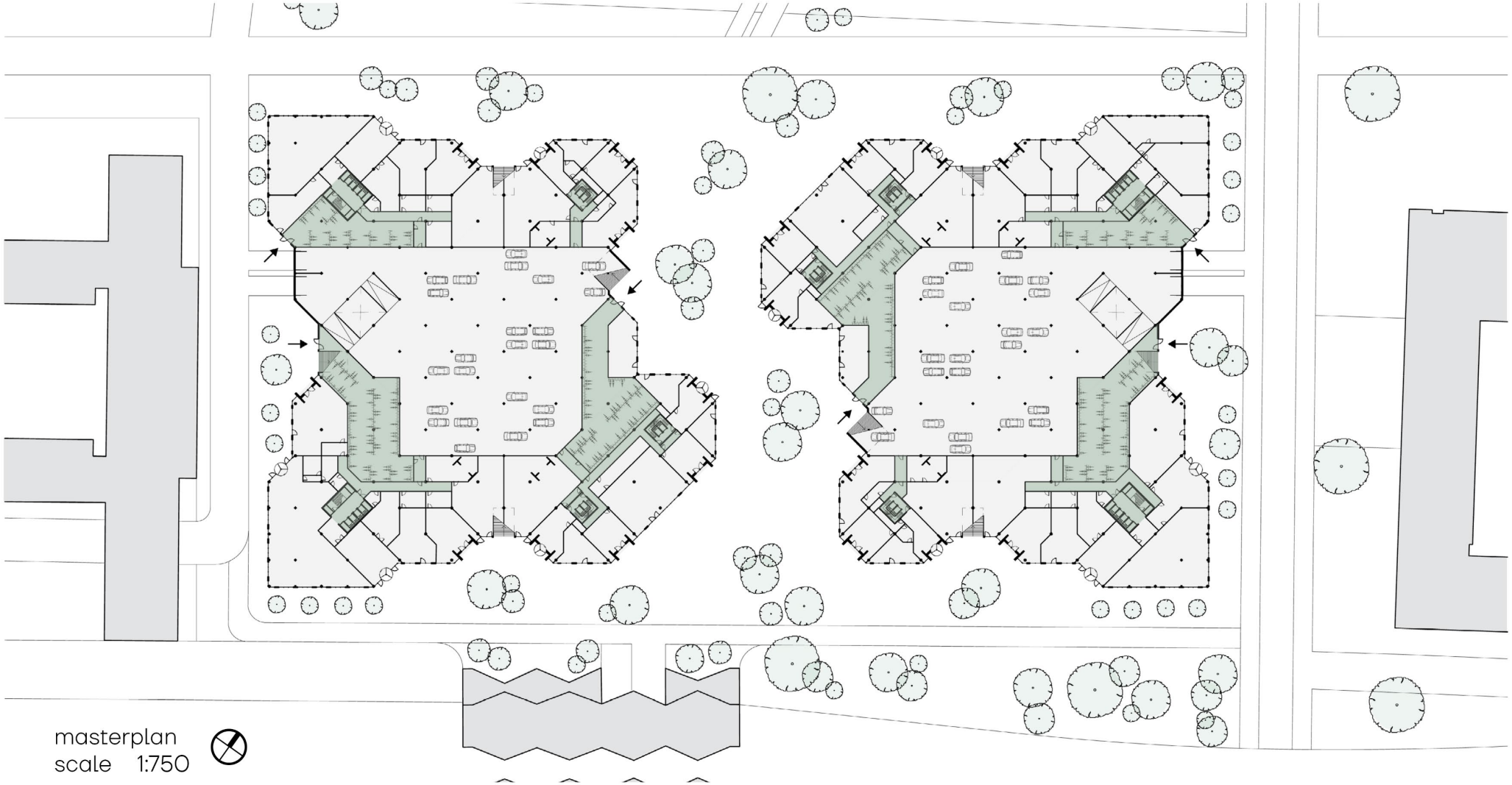




masterplan
scale 1:750

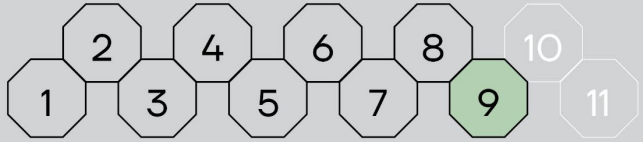
BUILDING ORGANIZATION

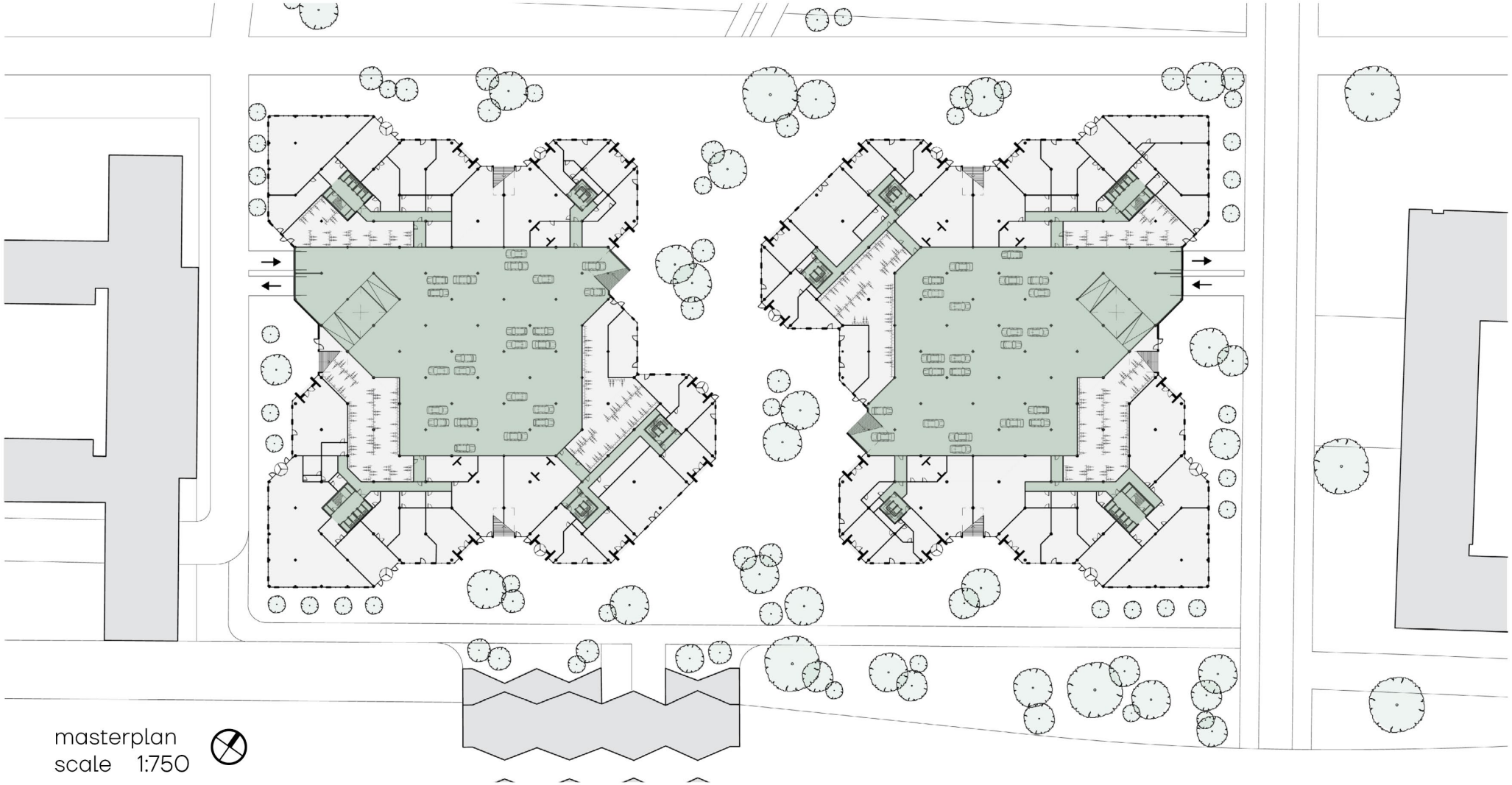




masterplan
scale 1:750

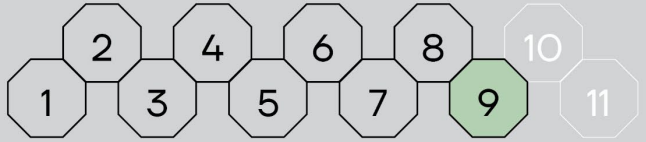
BUILDING ORGANIZATION

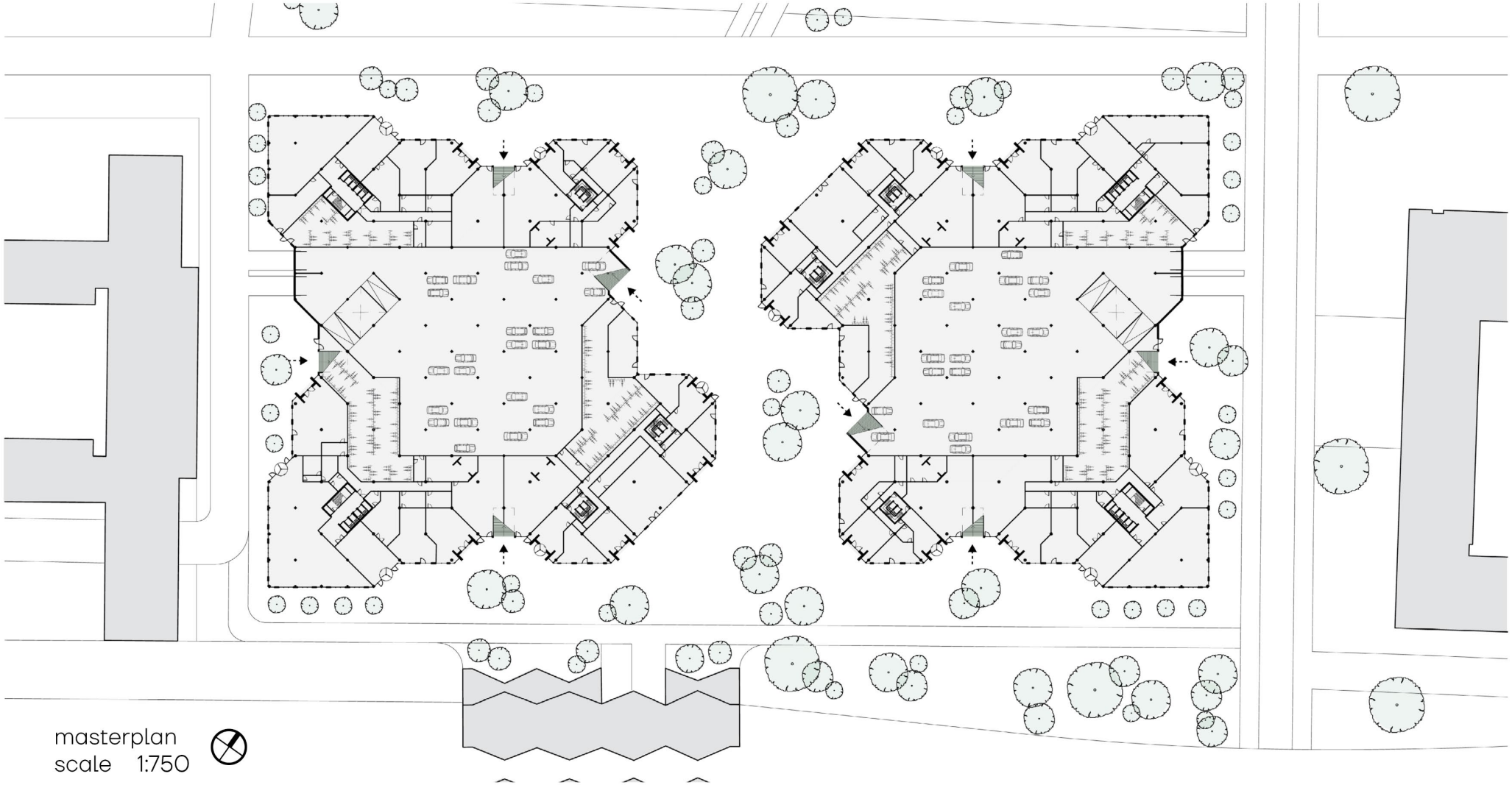




masterplan
scale 1:750

BUILDING ORGANIZATION

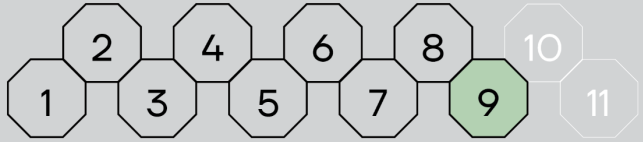


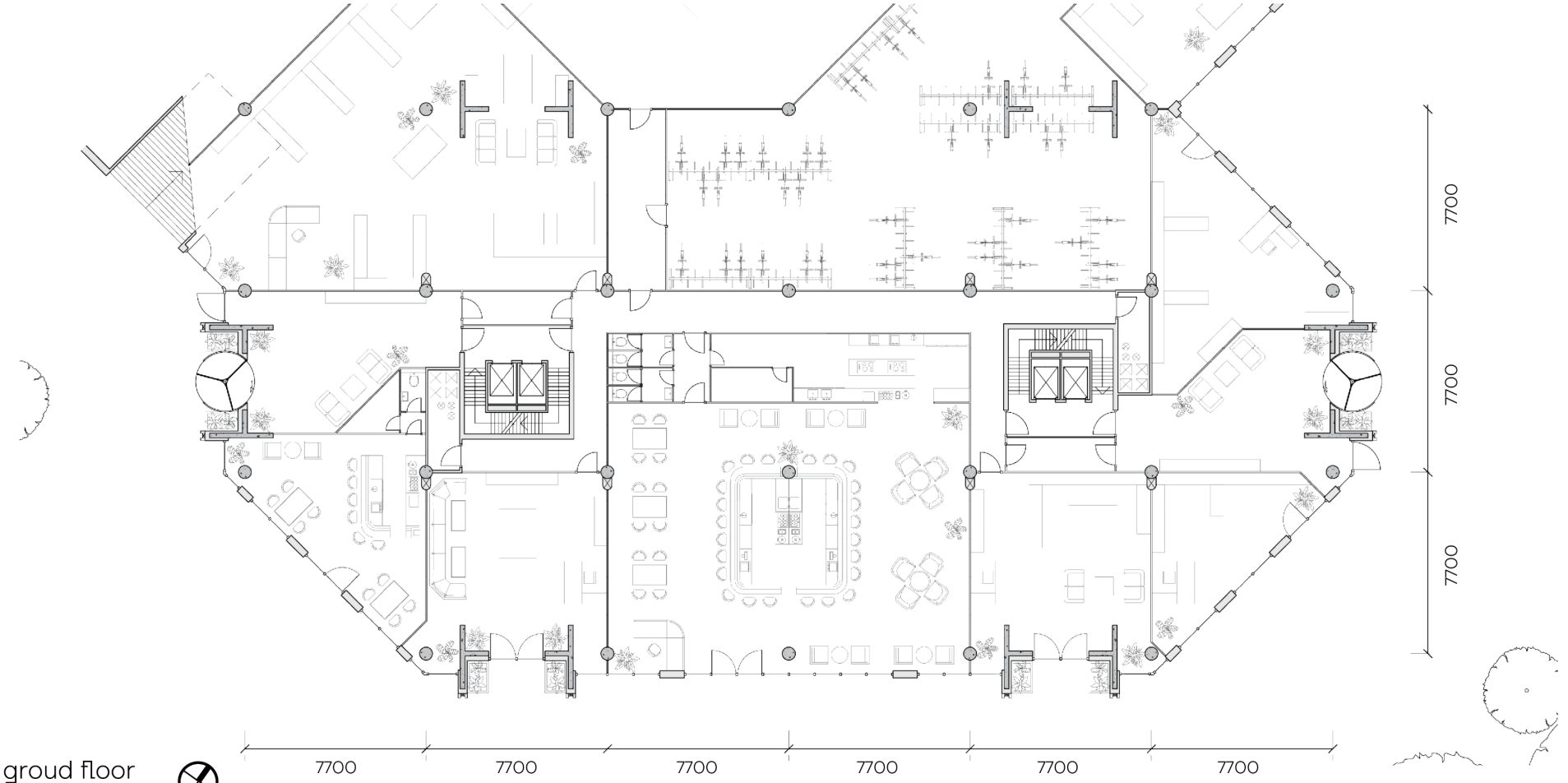


masterplan
scale 1:750



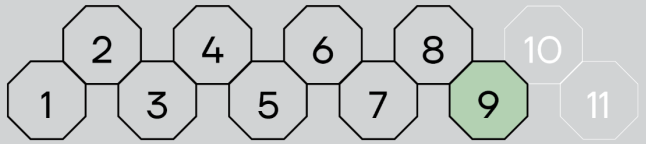
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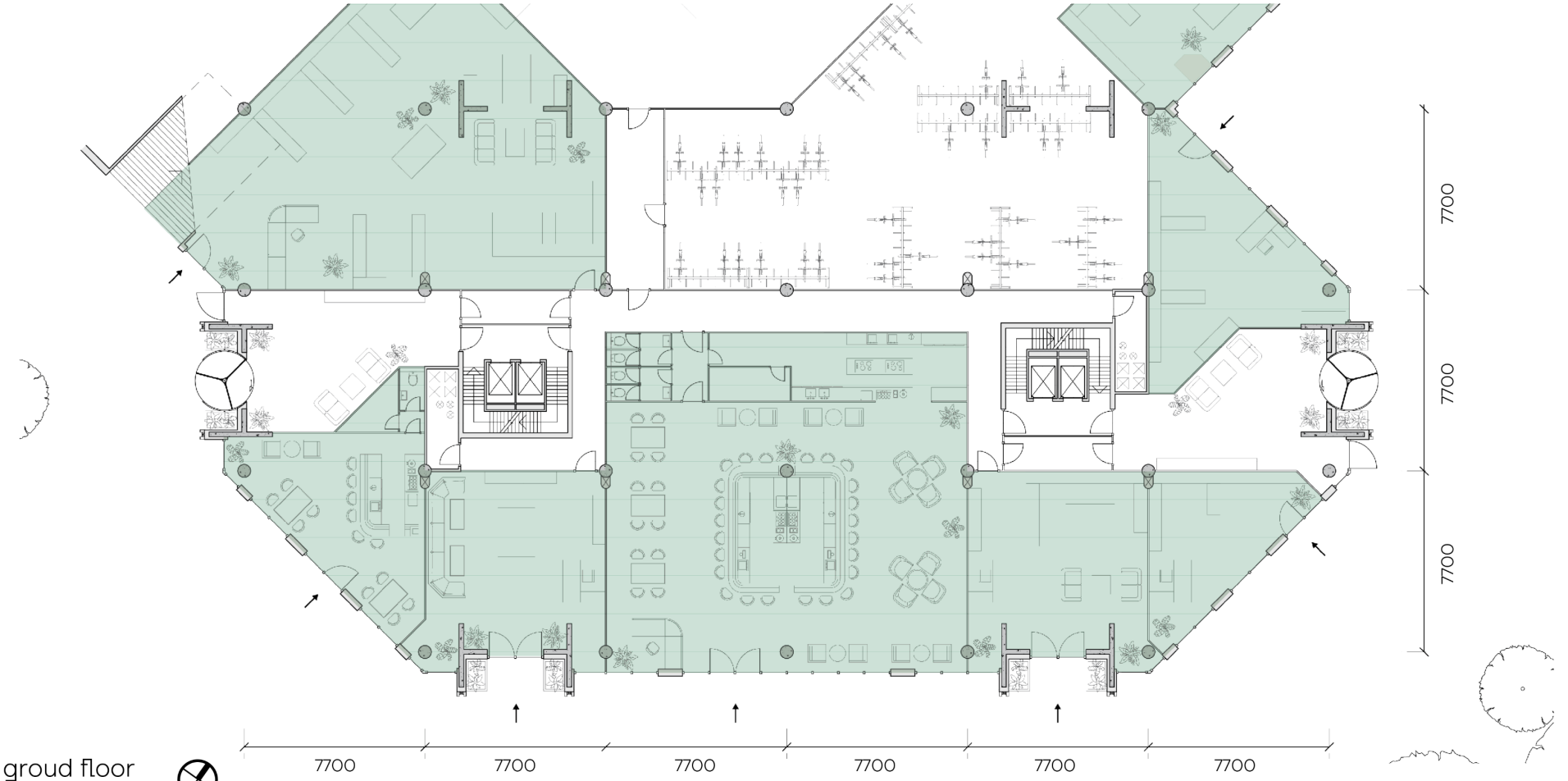




groud floor
scale 1:200

BUILDING ORGANIZATION

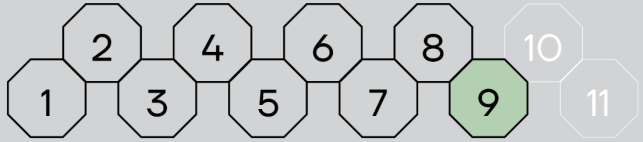


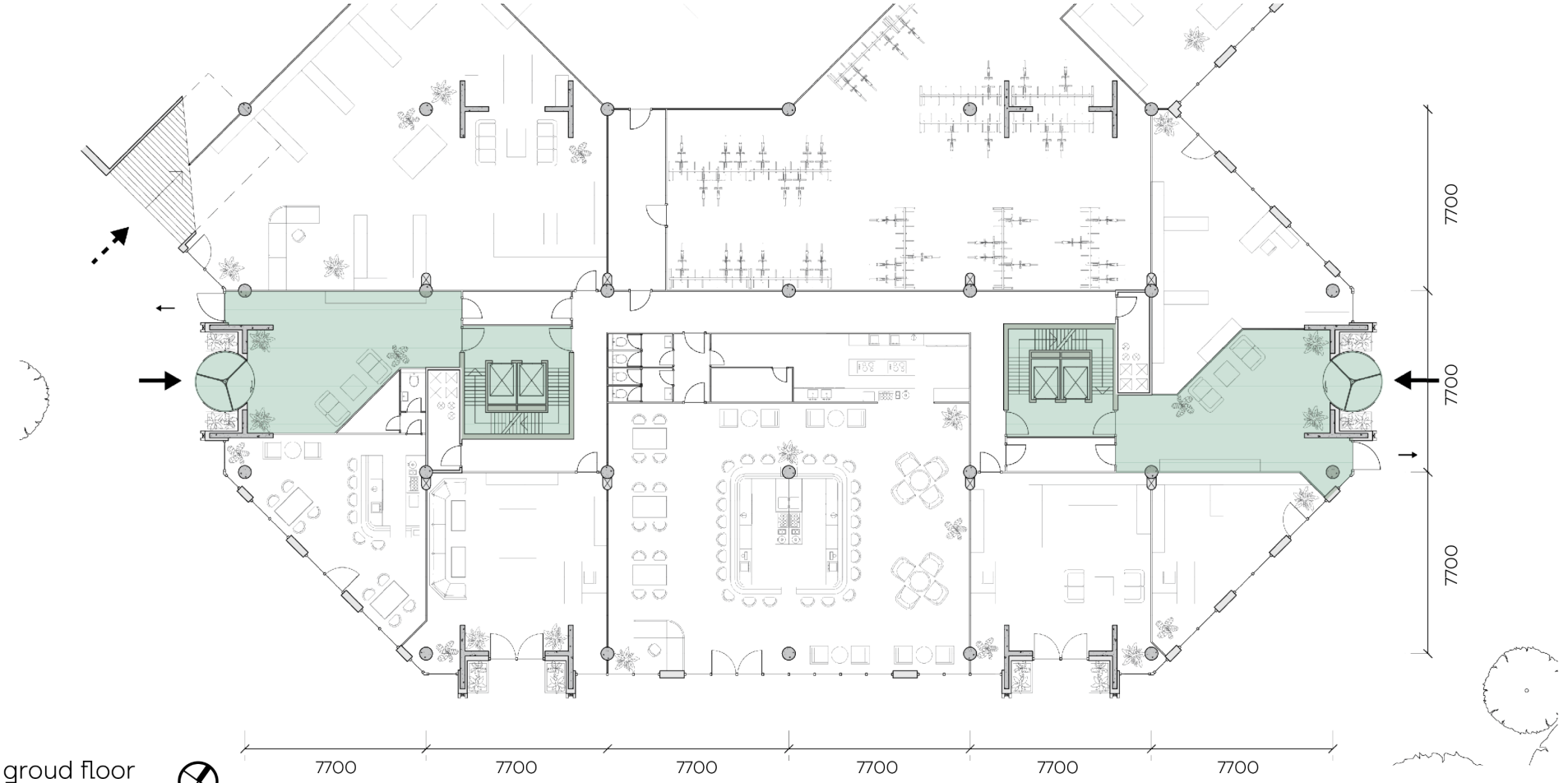


groud floor
scale 1:200


RESTAURANT

BUILDING ORGANIZATION

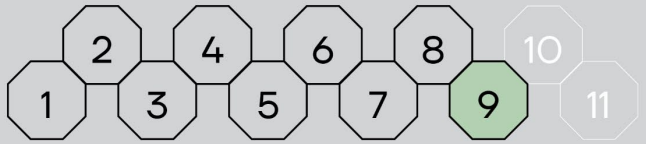


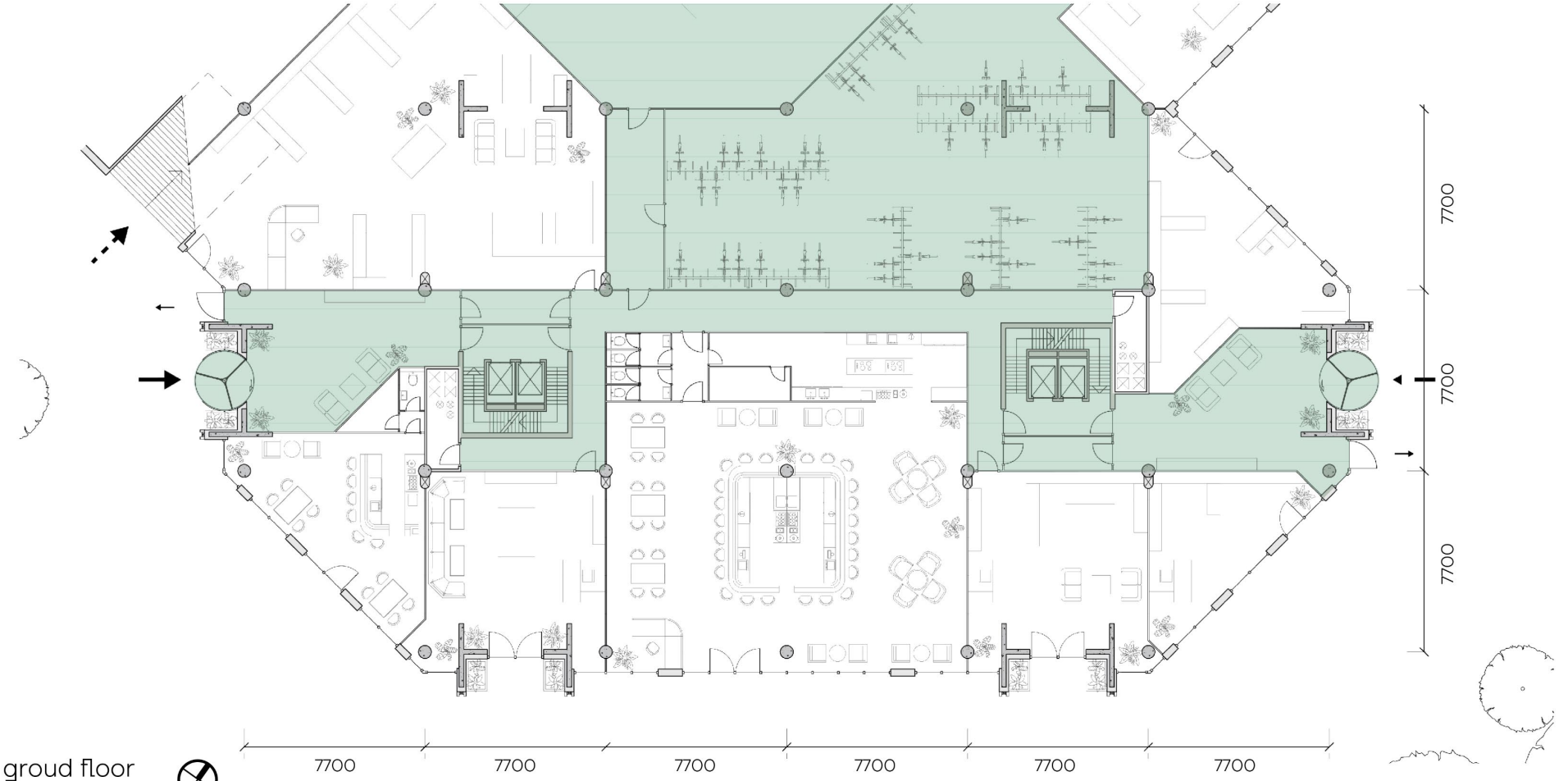


groud floor
scale 1:200



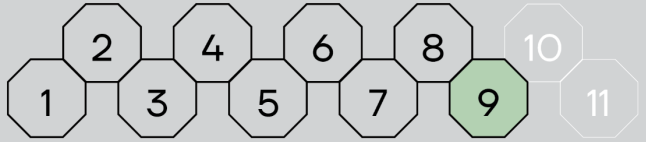
BUILDING ORGANIZATION

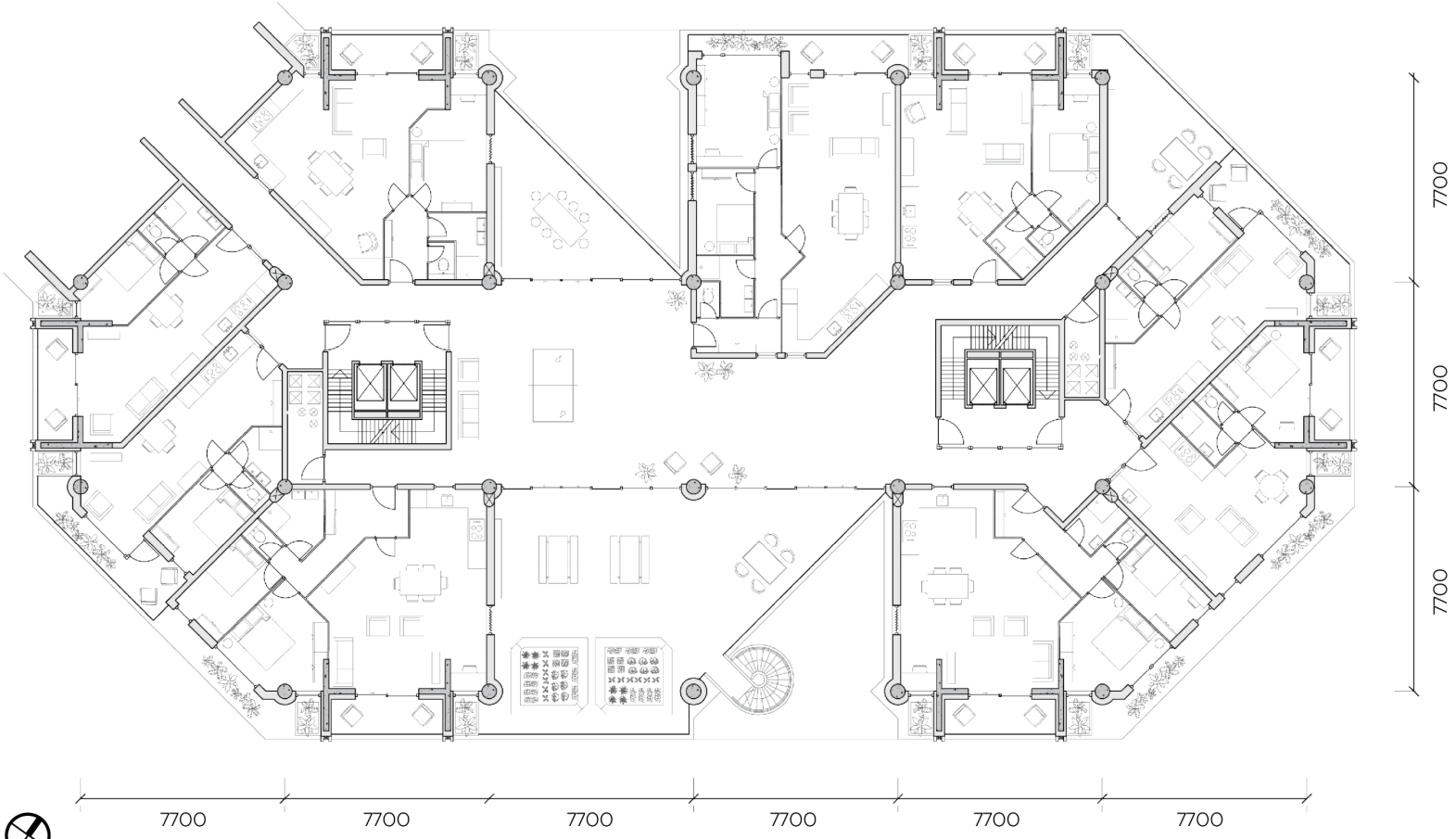




groud floor
scale 1:200

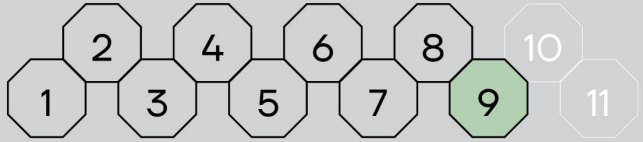
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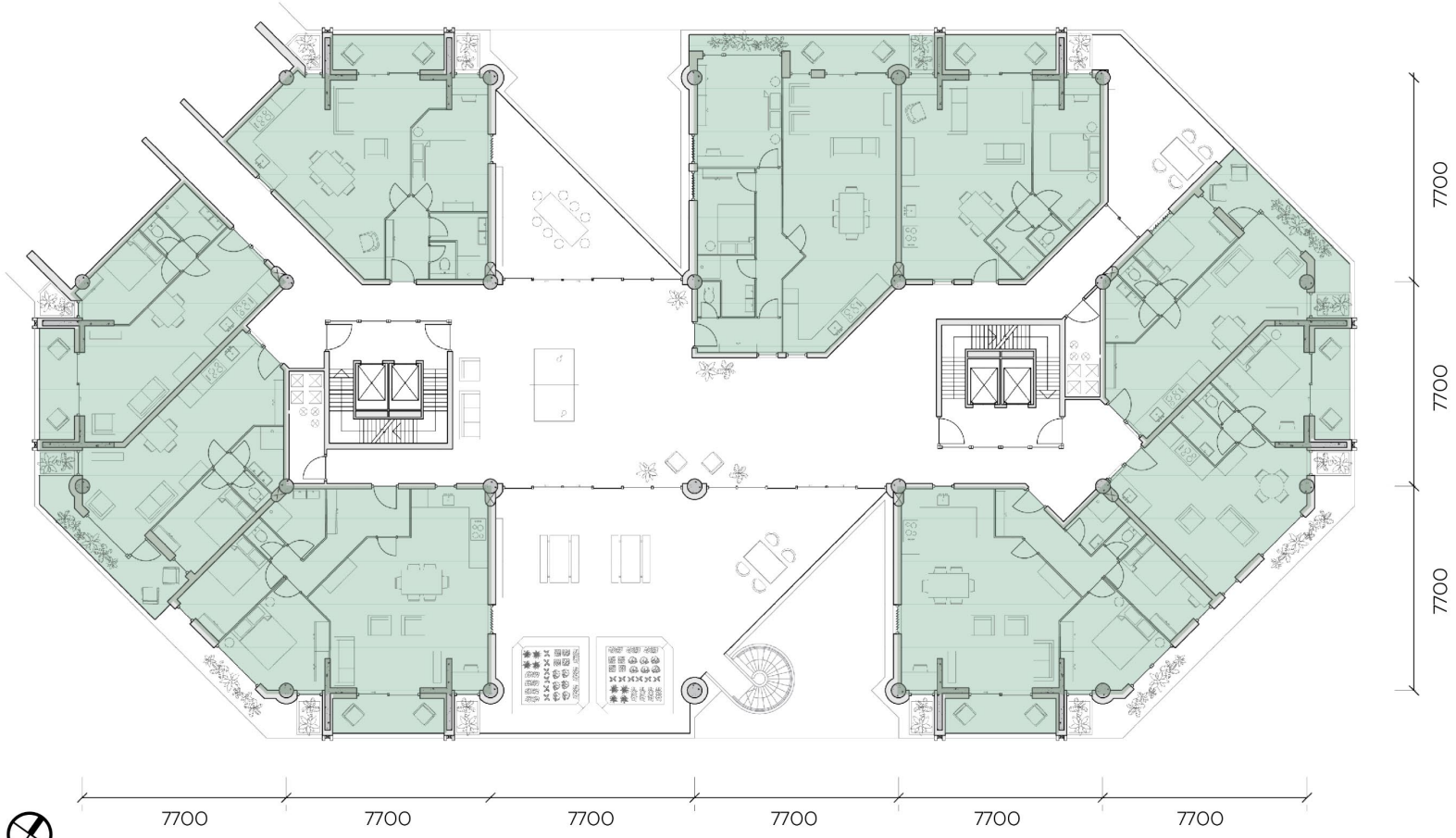




level 3
scale 1:200

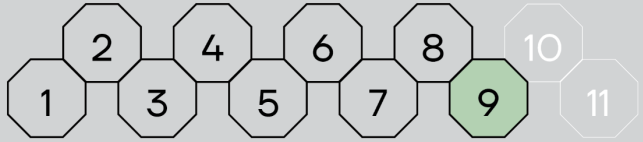
BUILDING ORGANIZATION

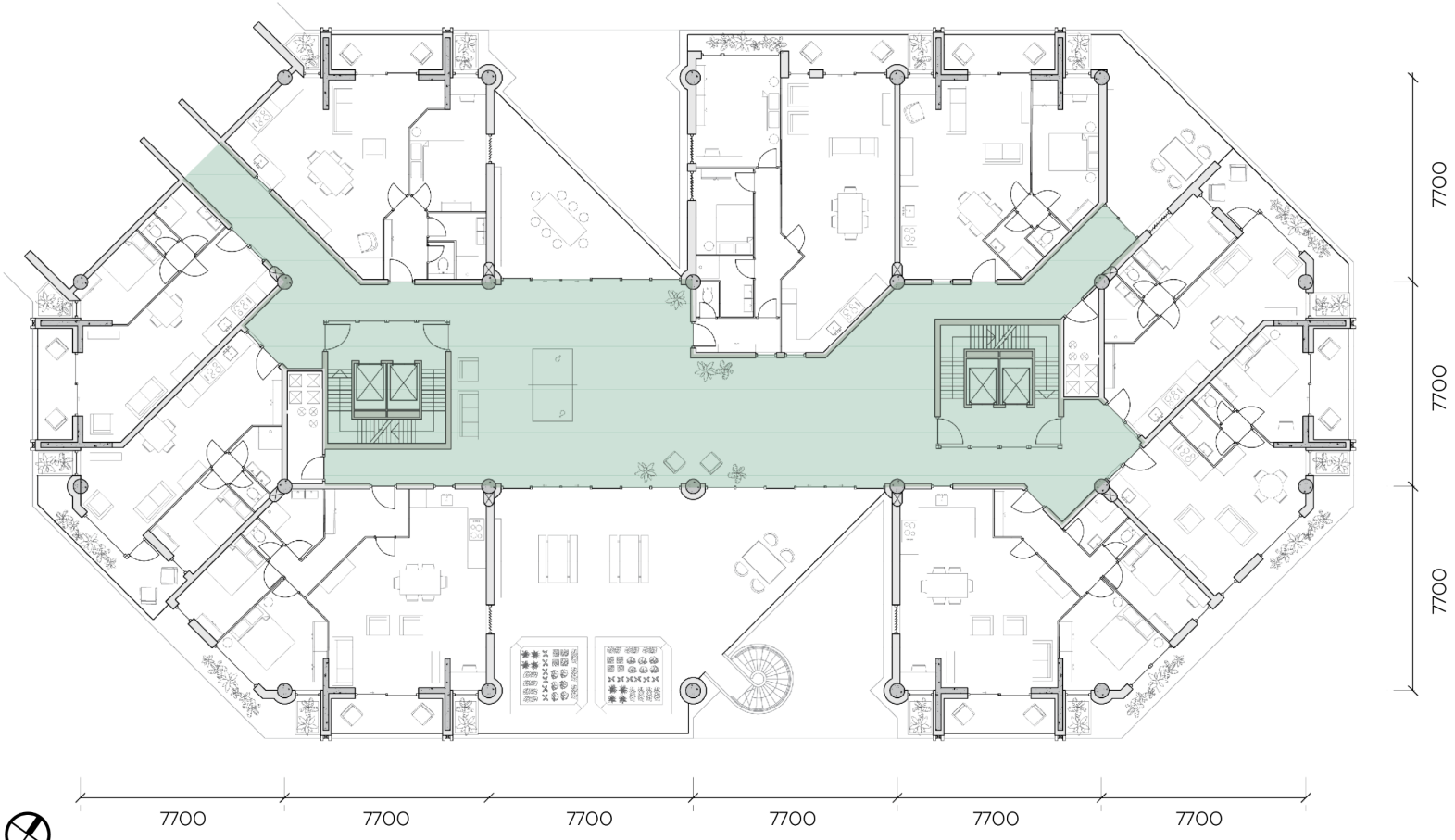




level 3
scale 1:200

BUILDING ORGANIZATION

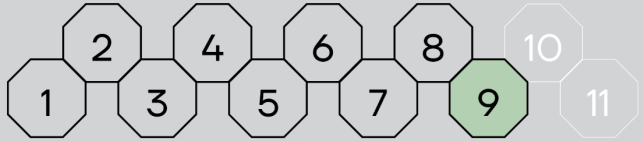




level 3
scale 1:200



BUILDING ORGANIZATION

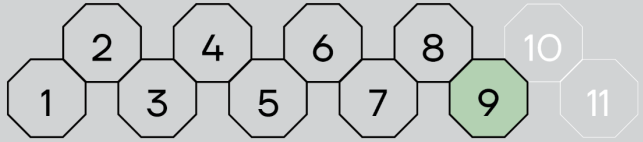


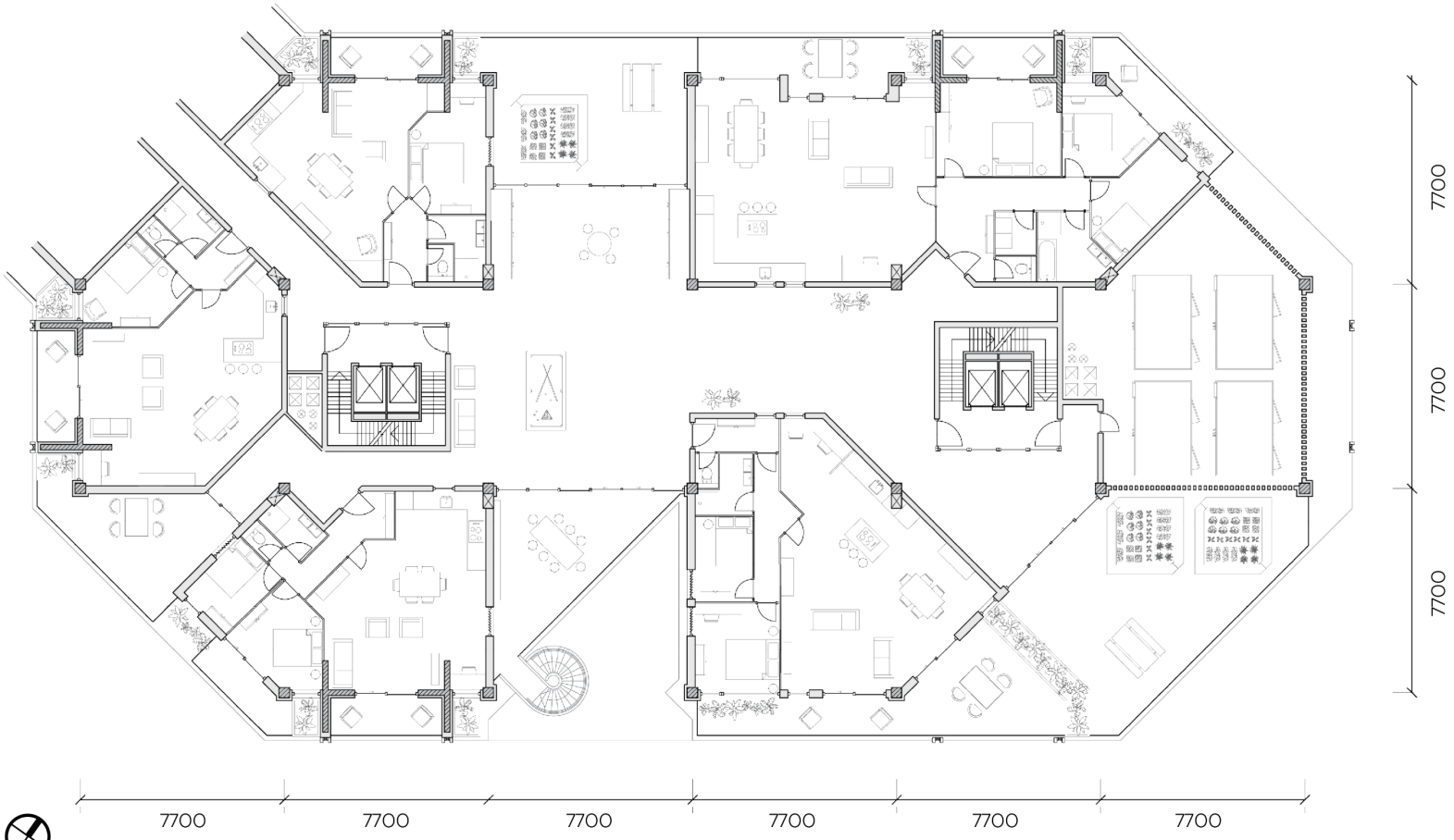


level 3
scale 1:200



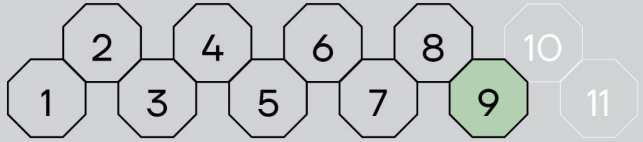
BUILDING ORGANIZATION

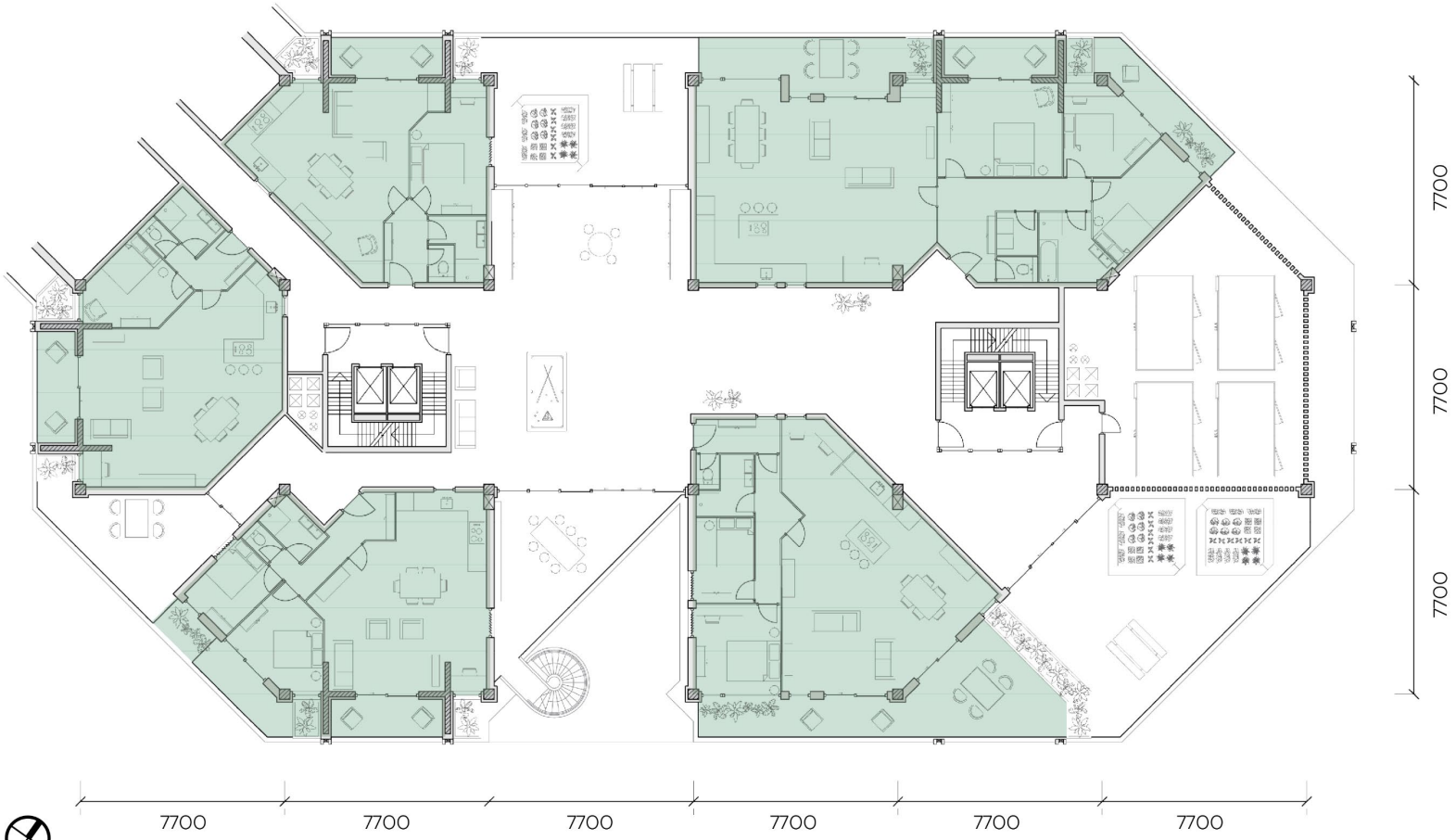




level 10
scale 1:200

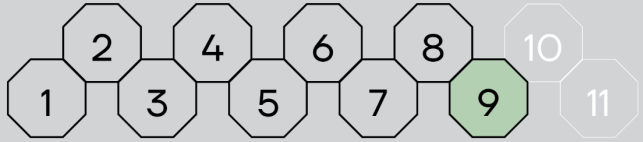
BUILDING ORGANIZATION

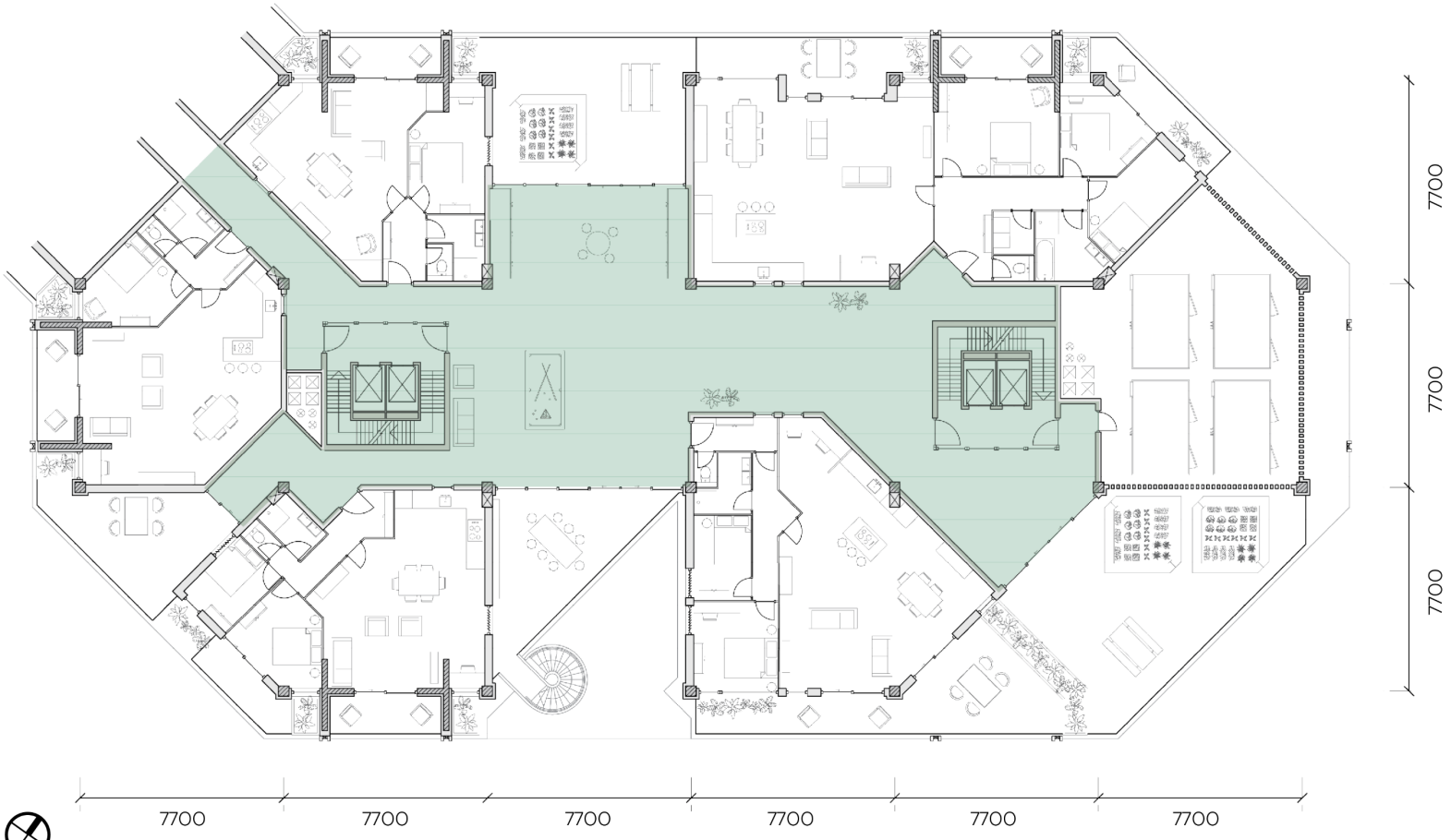




level 10
scale 1:200

BUILDING ORGANIZATION

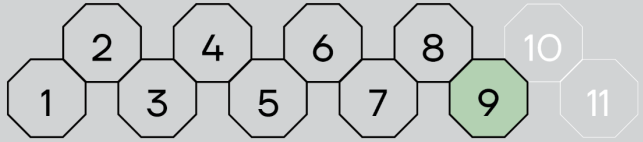


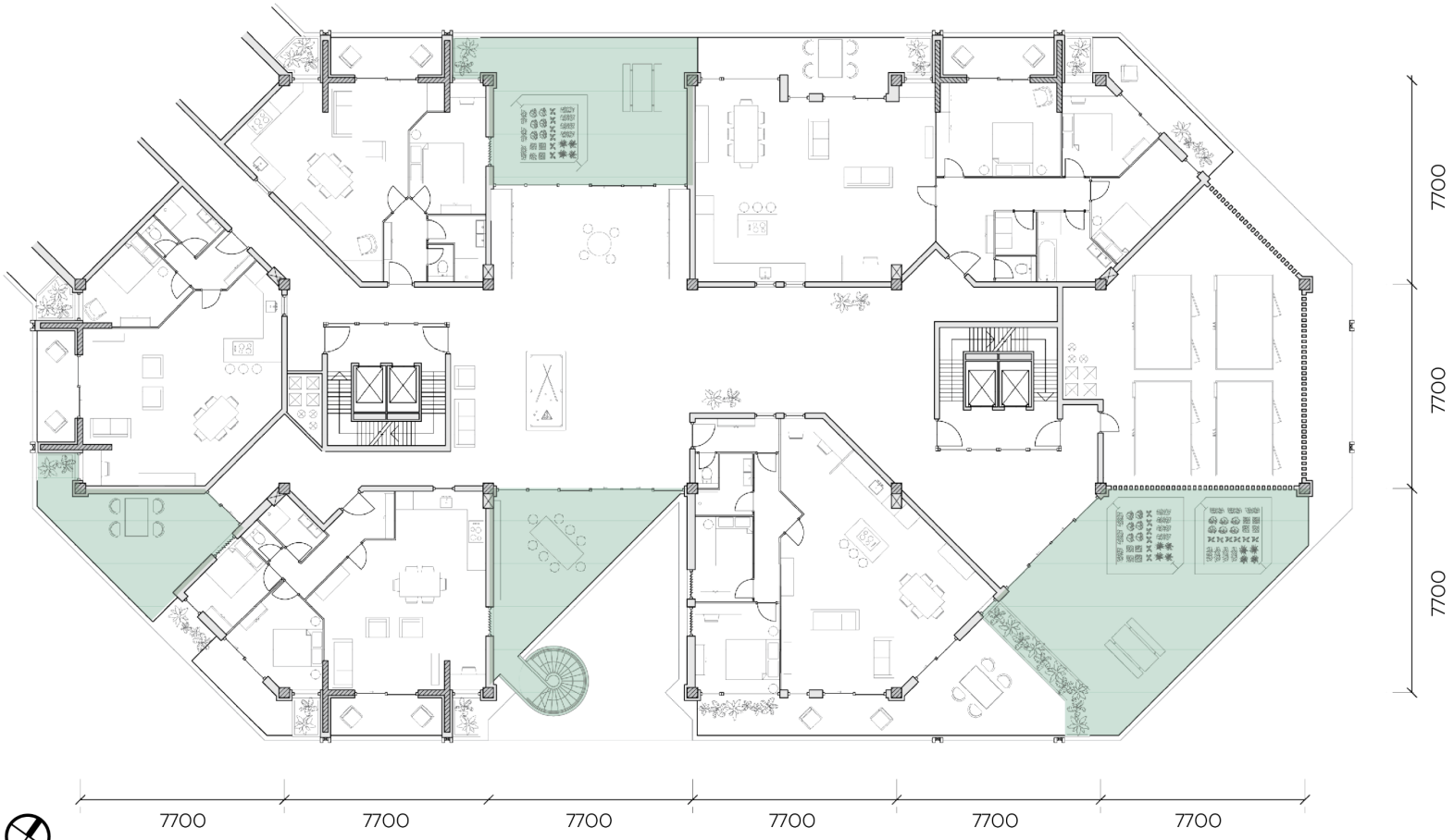


level 10
scale 1:200



BUILDING ORGANIZATION

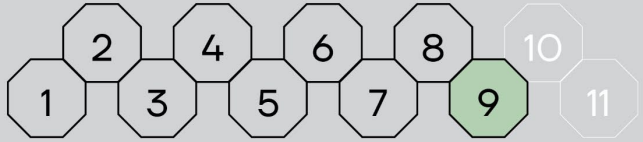




level 10
scale 1:200



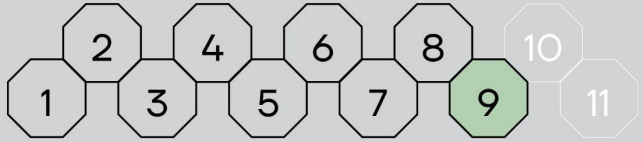
BUILDING ORGANIZATION





south elevation
scale 1:350

BUILDING ORGANIZATION

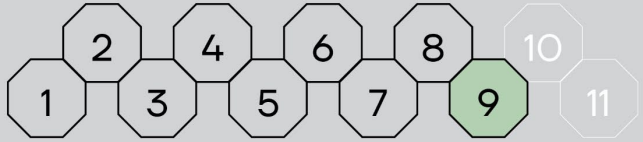




south elevation
scale 1:350



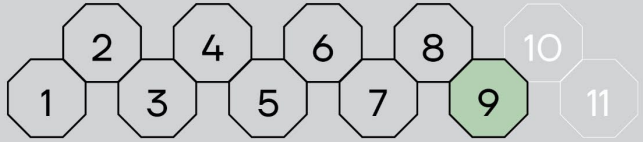
BUILDING ORGANIZATION



axonometric
sections



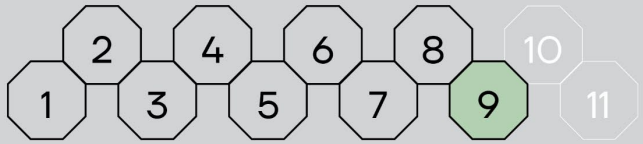
BUILDING ORGANIZATION



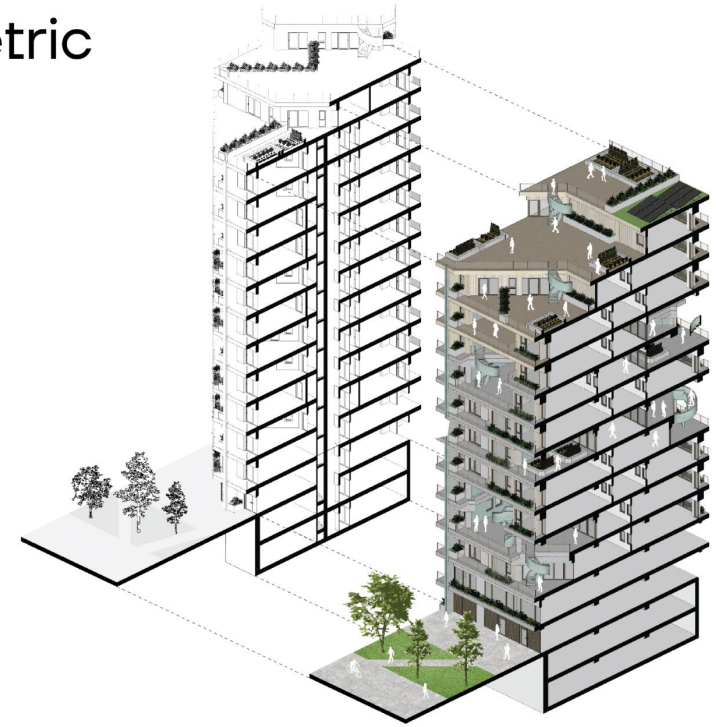
axonometric
sections



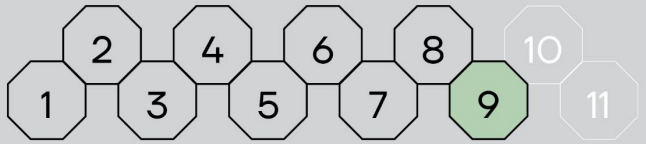
BUILDING ORGANIZATION



axonometric
sections

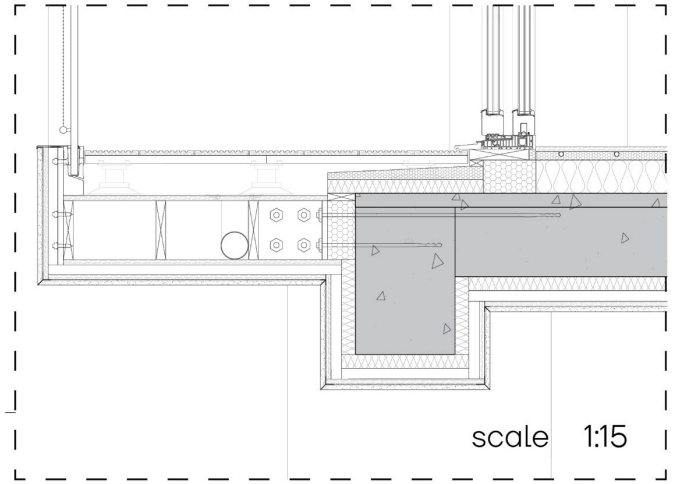


BUILDING ORGANIZATION

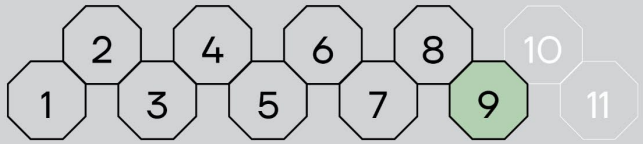


insulation
line detail



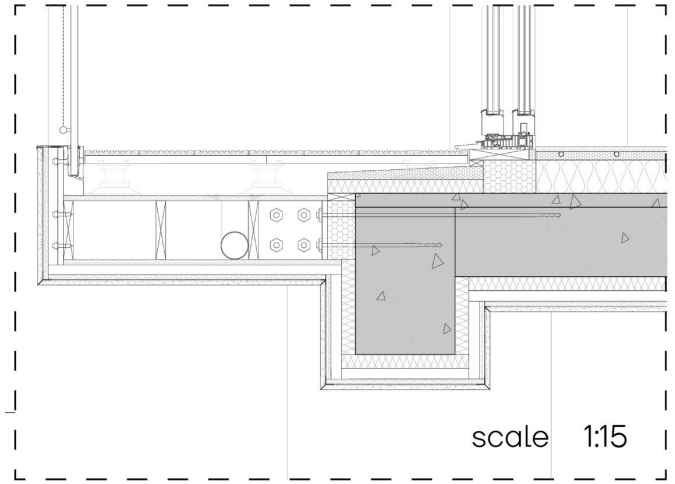


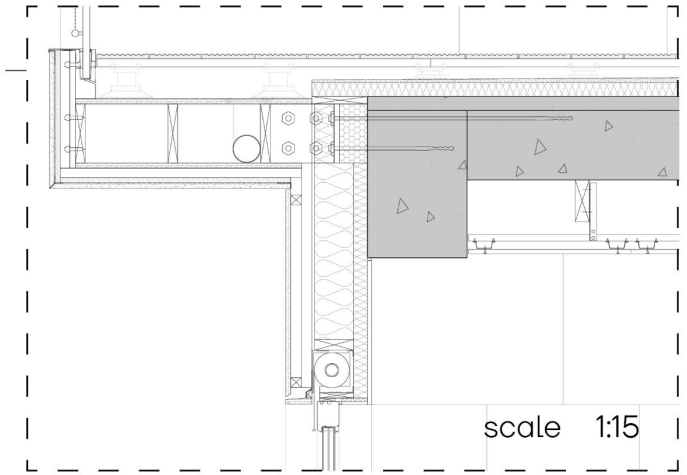
BUILDING ORGANIZATION



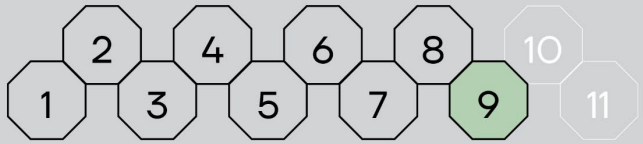
insulation
line detail



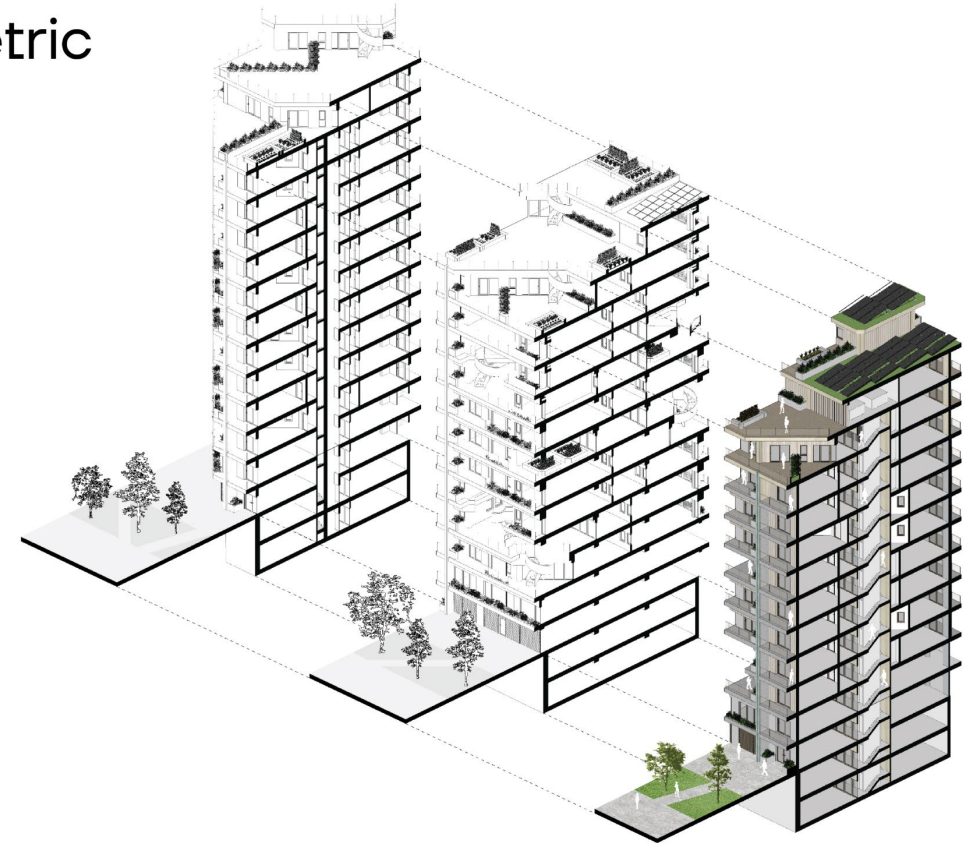




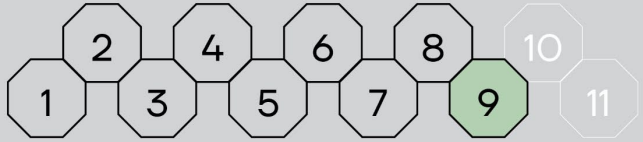
BUILDING ORGANIZATION



axonometric sections



BUILDING ORGANIZATION



axonometric
sections



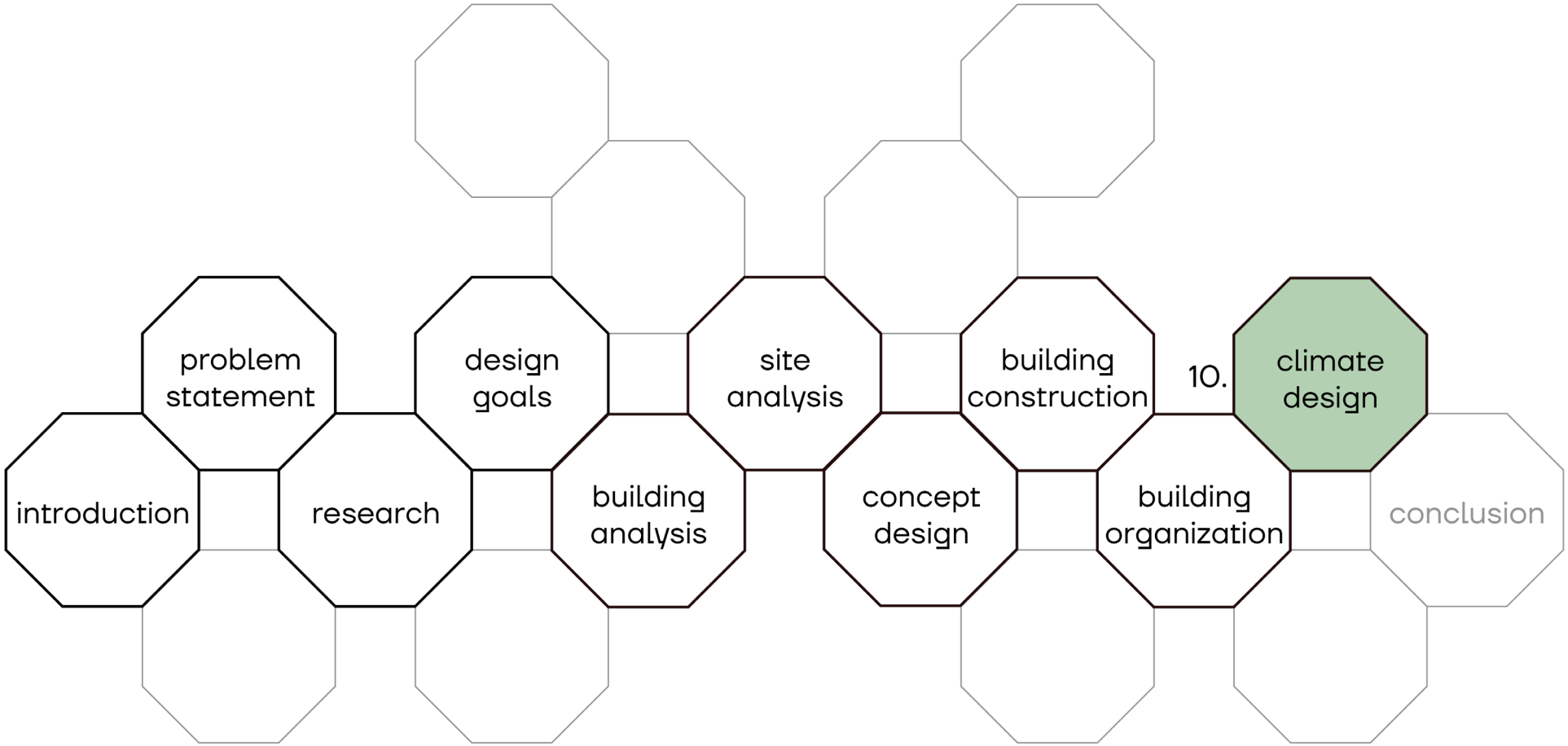
BUILDING ORGANIZATION

axonometric
sections

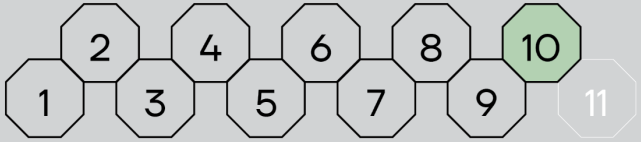


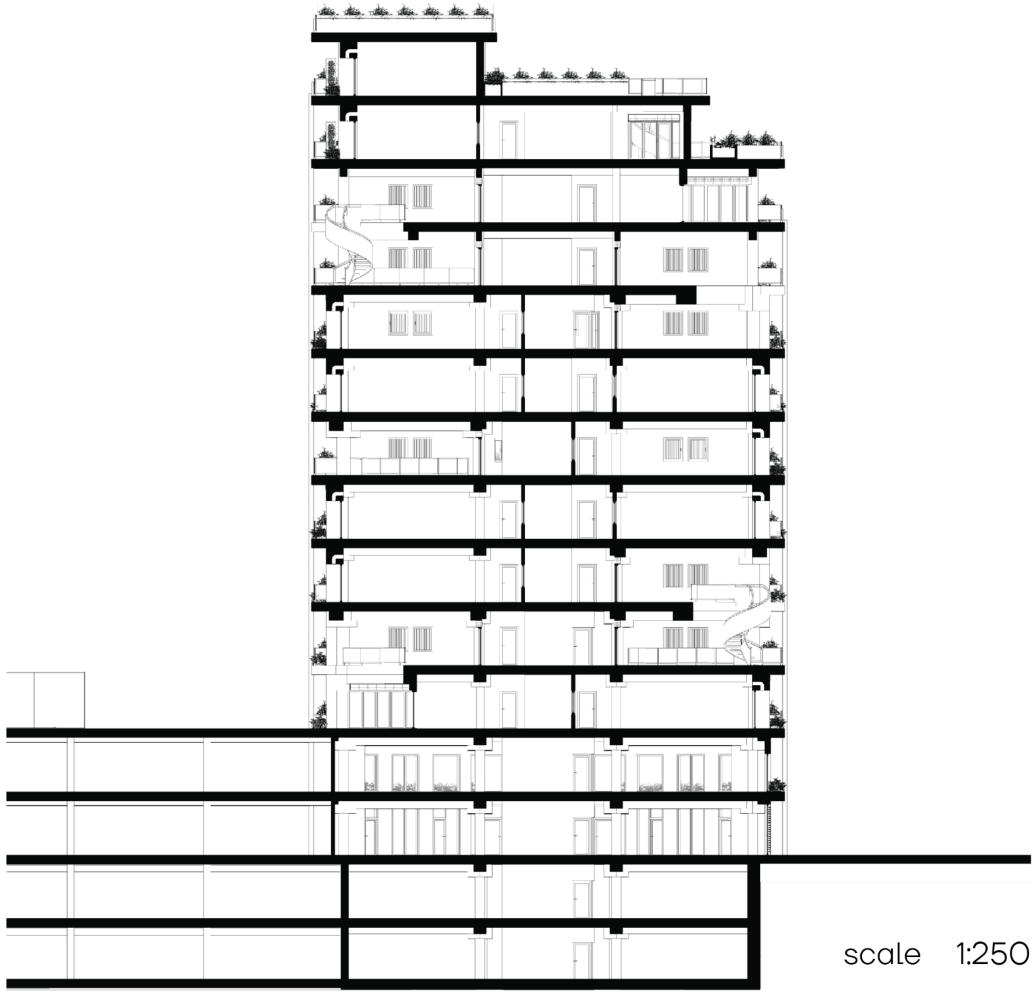


CLIMATE DESIGN



CLIMATE DESIGN

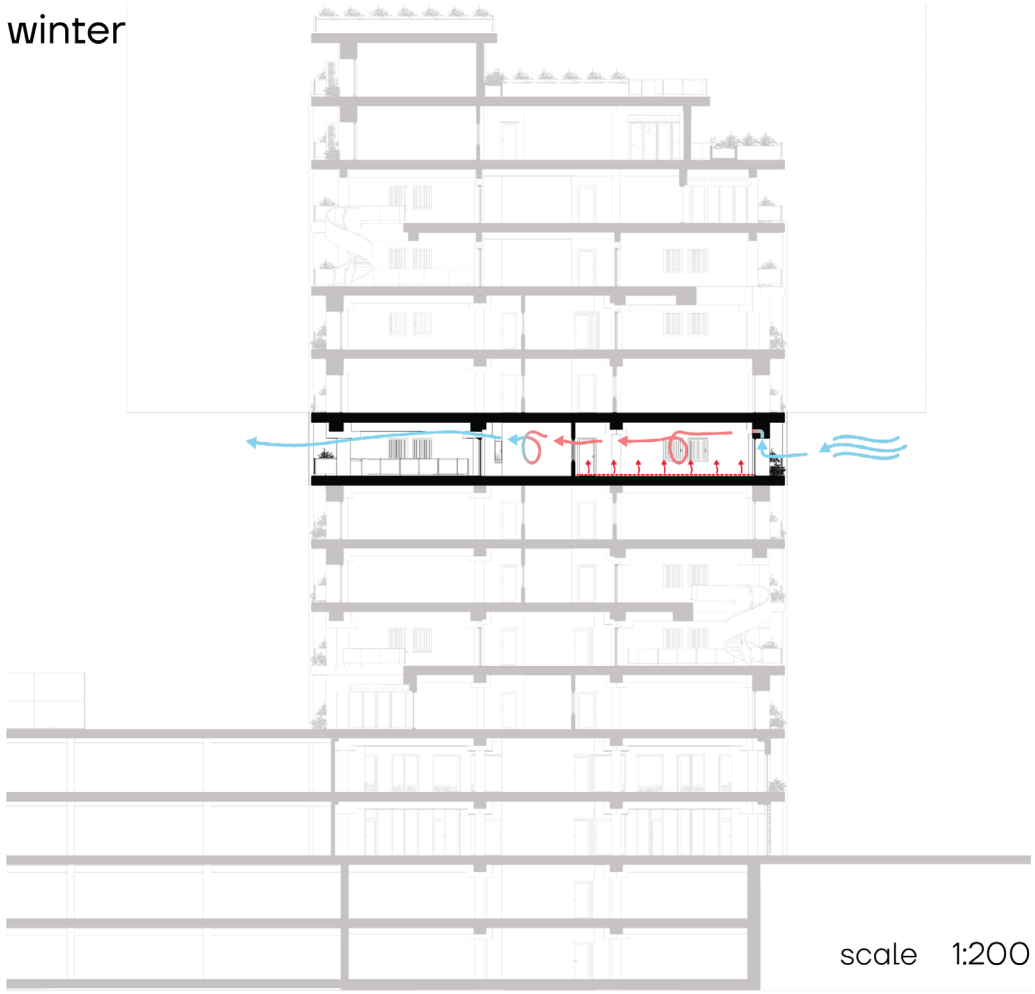




scale 1:250

ventilation

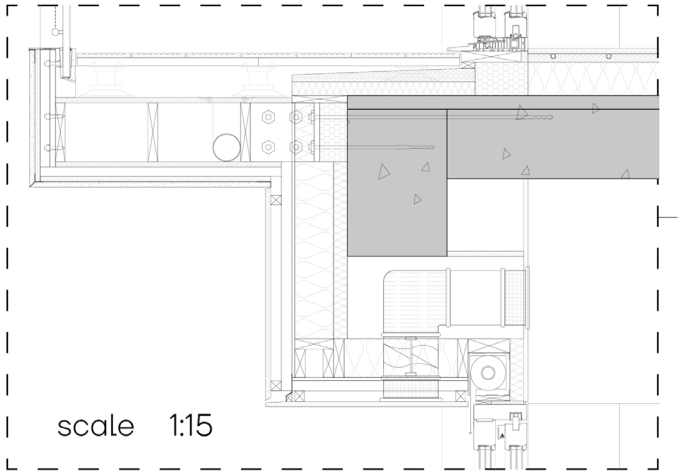
winter



scale 1:200

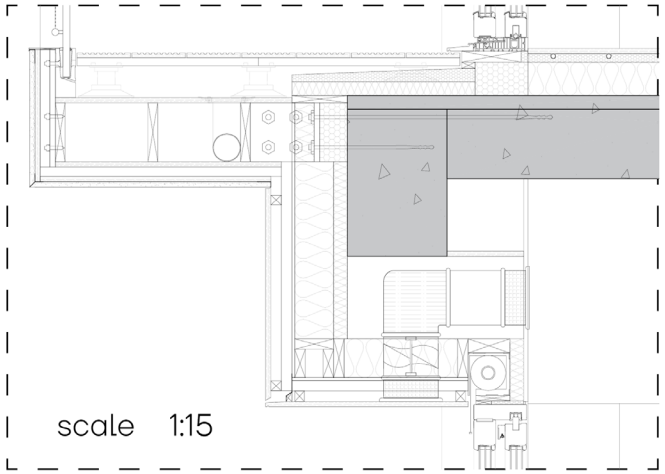


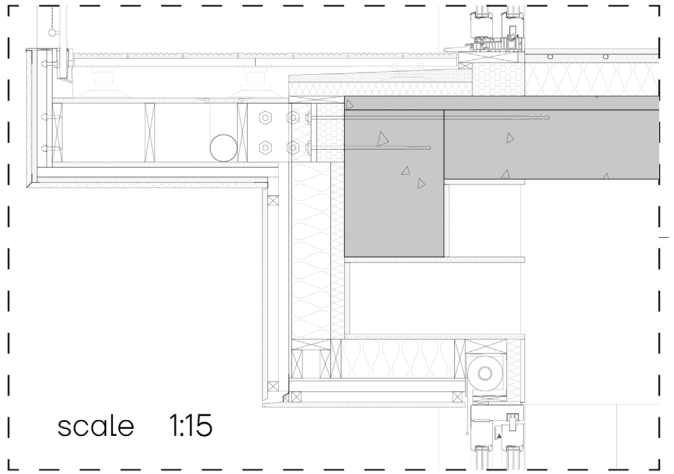
ventilation system



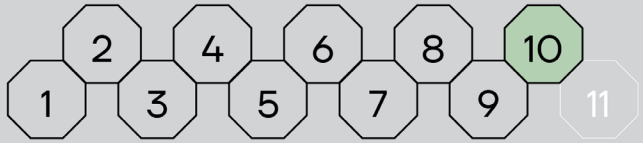


storage space



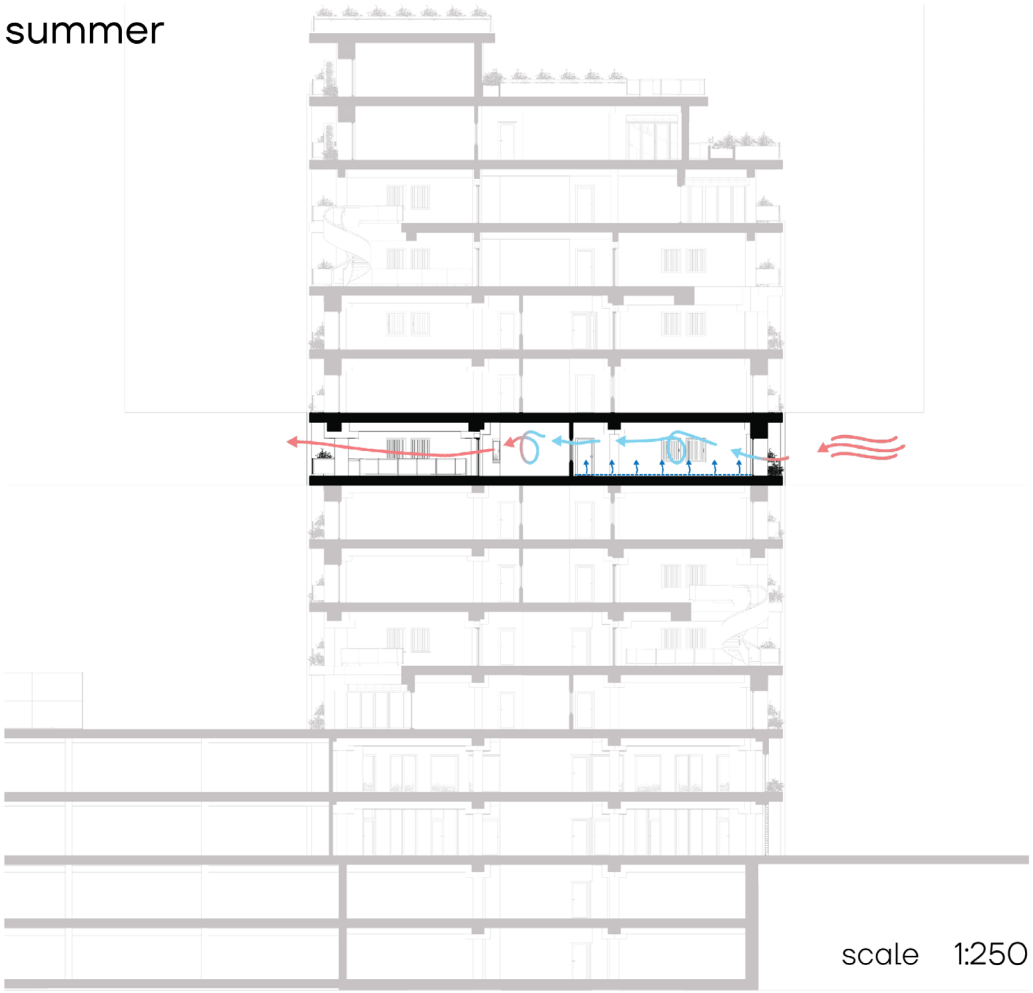






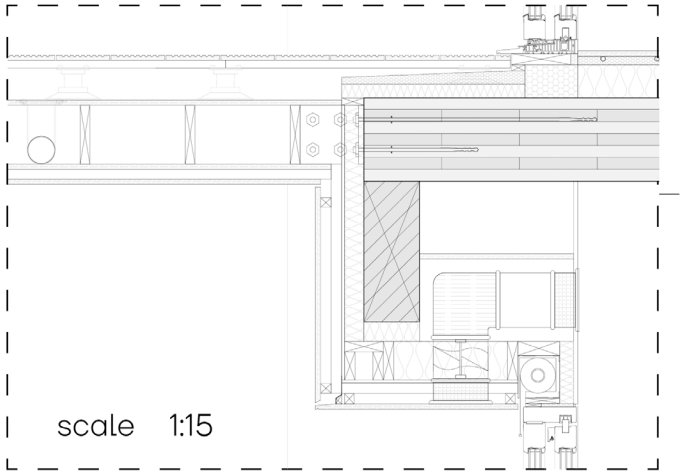
ventilation

summer



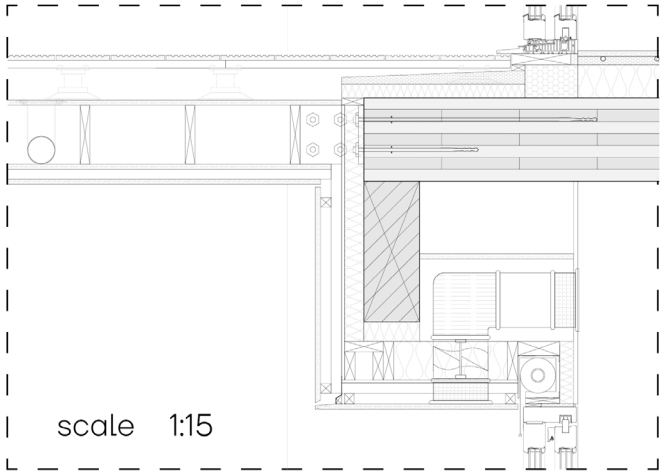


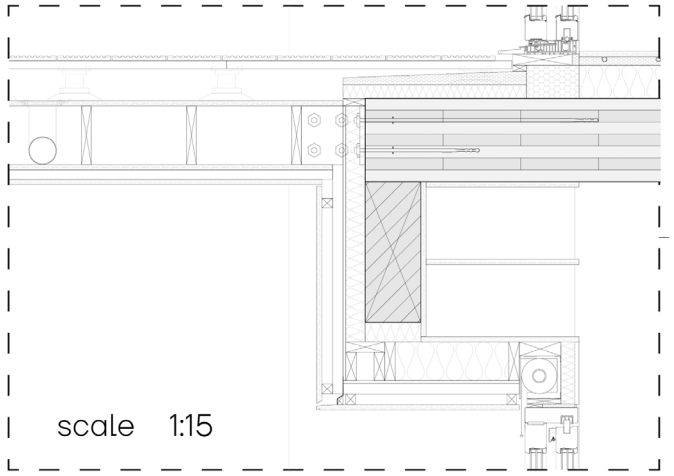
ventilation system





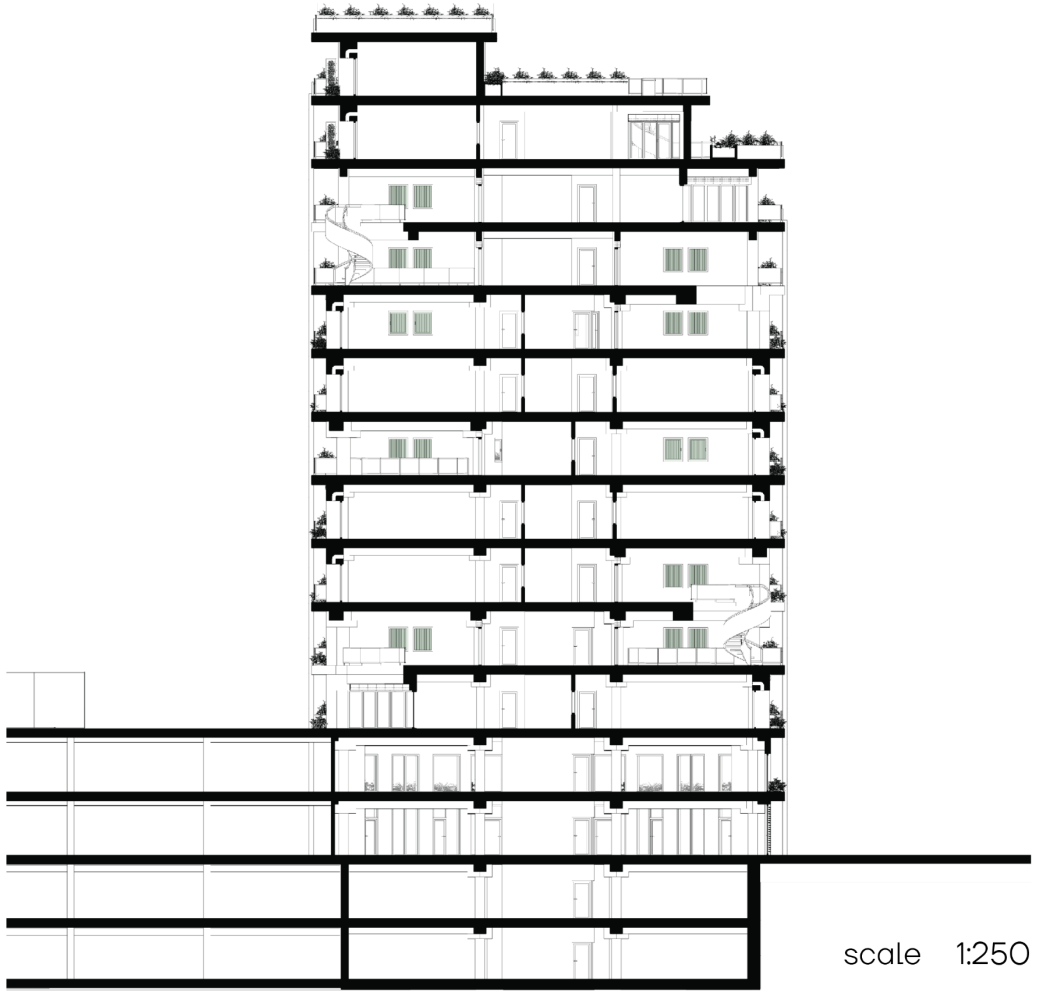
storage space



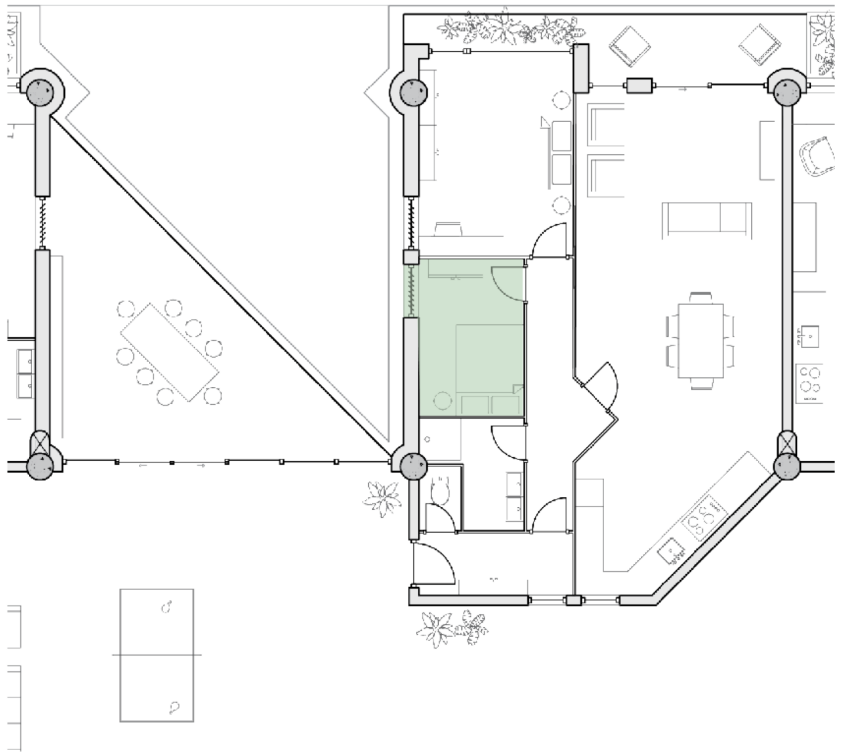




daylight



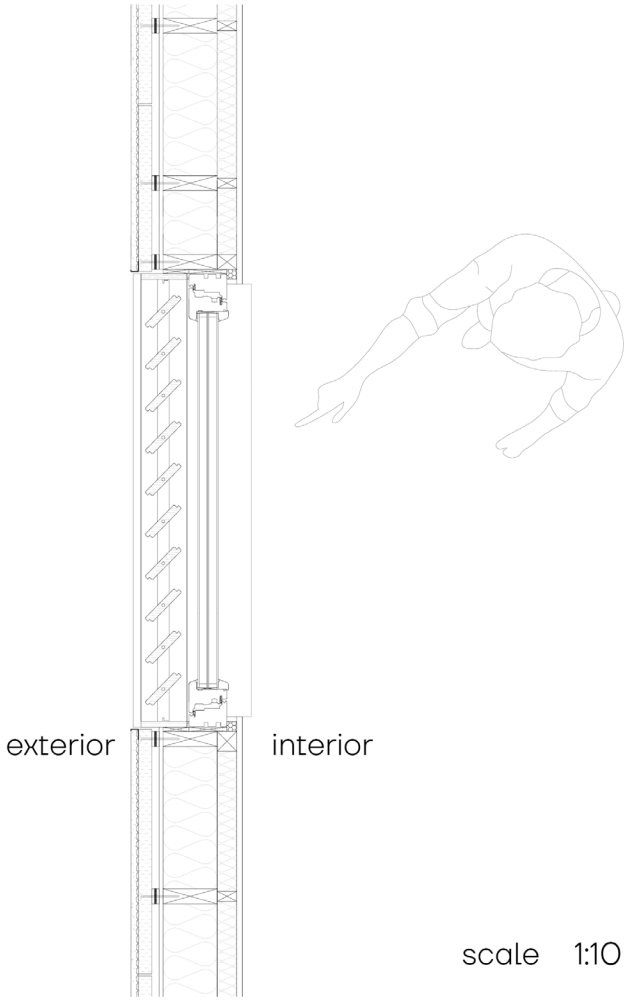
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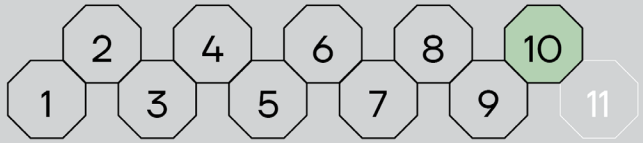
dwelling floor plan
scale 1:100

vertical shutters



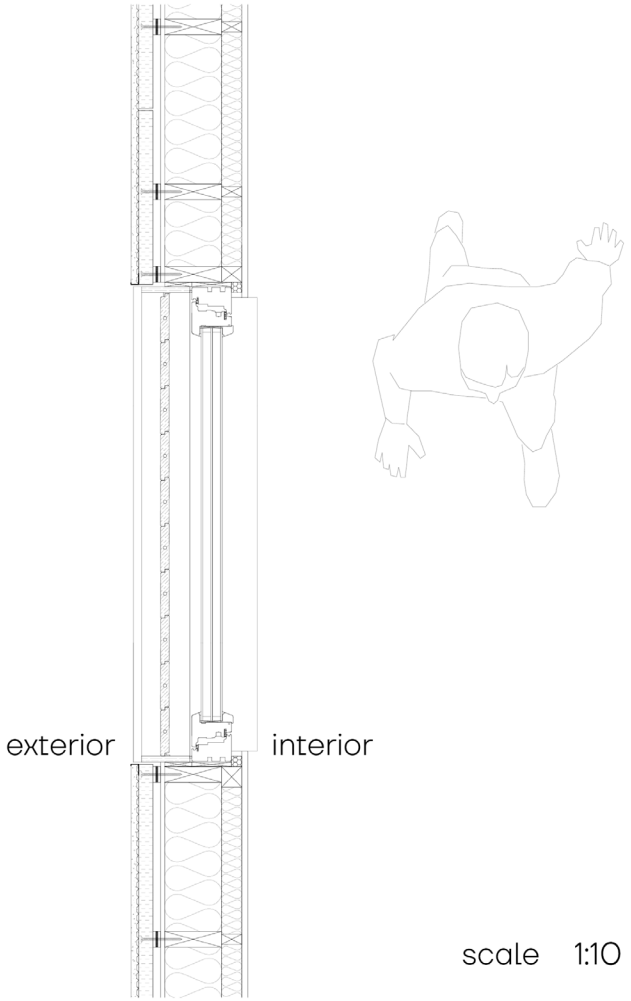


scale 1:10



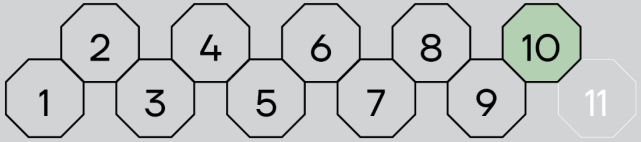
vertical shutters





scale 1:10

CLIMATE DESIGN





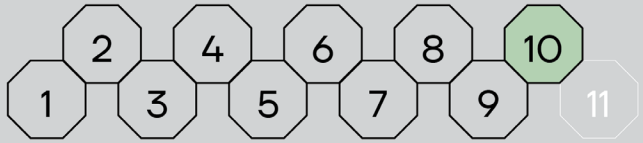
scale 1:250

solar panels & green roofs

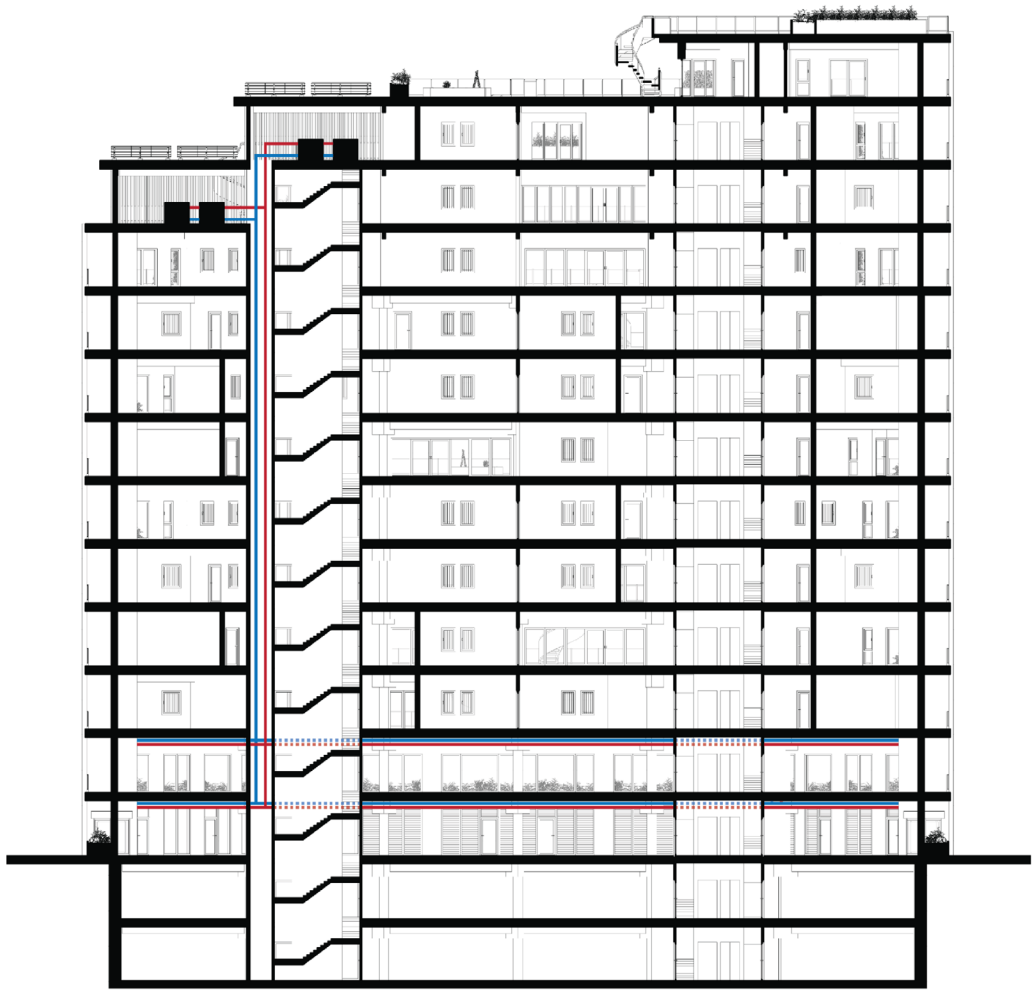




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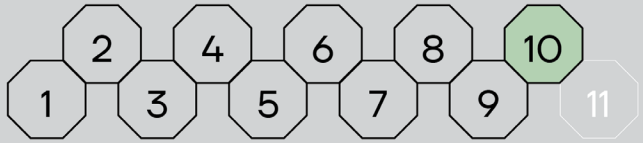


mechanical ventilation





CLIMATE DESIGN



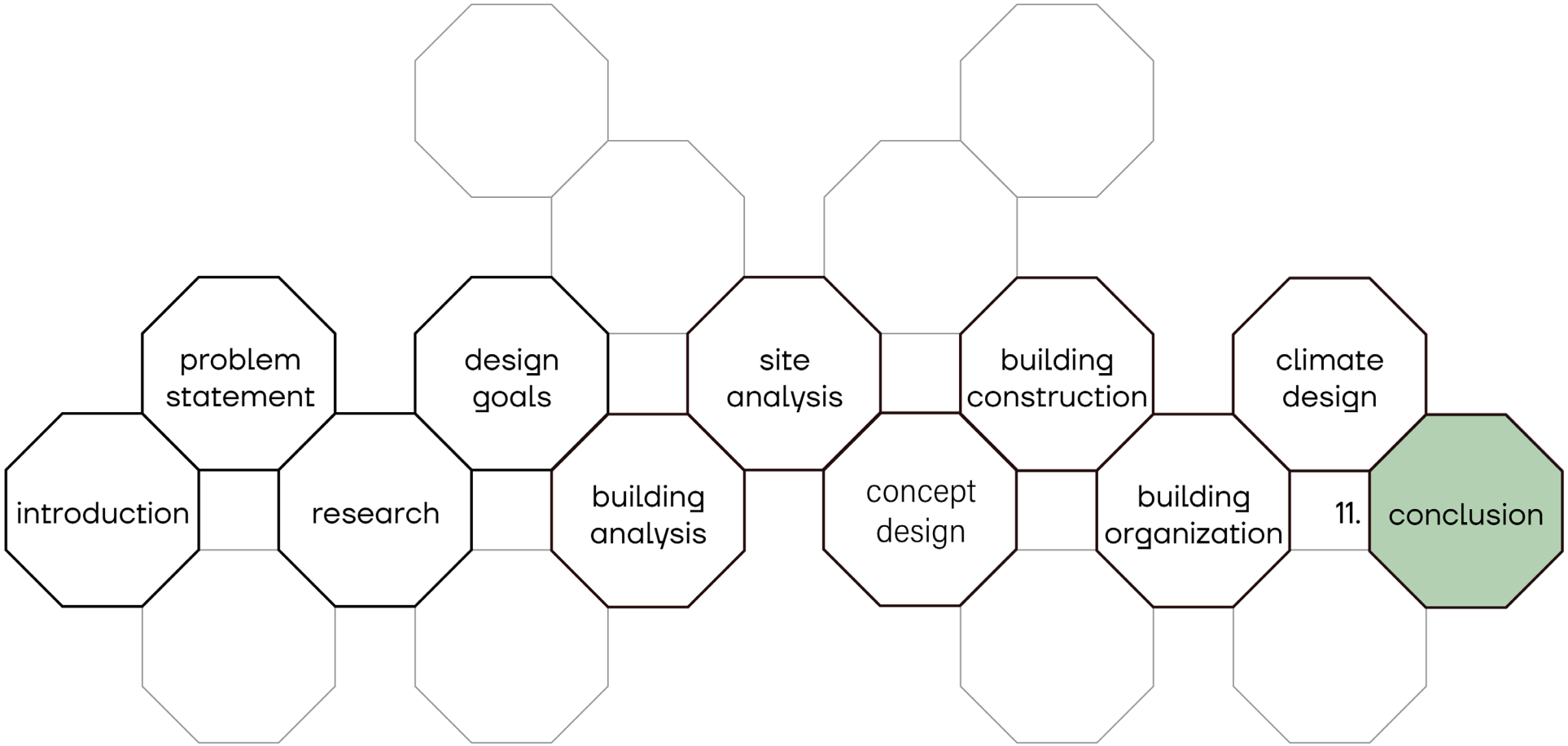
rainwater



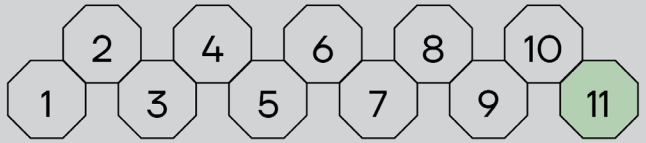



RESTAURANT

CONCLUSION

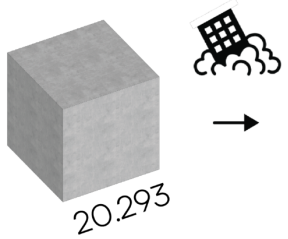
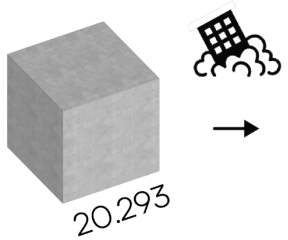
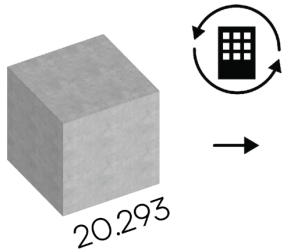

introduction
problem statement
research
design goals
building analysis
site analysis
concept design
building construction
building organization
climate design
11.
conclusion

CONCLUSION

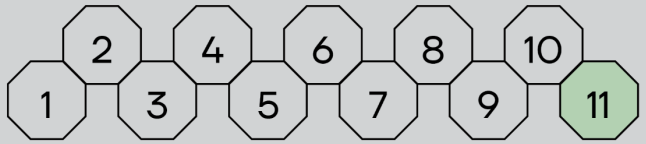


	building material	existing building material (m^3)	lost embodied CO_2 (x1000 kg)	total new material needed (m^3)	CO_2 released in production process (x1000 kg)
1.	total new with concrete				
2.	total new with wood				
3.	reused concrete & new wood				

CONCLUSION

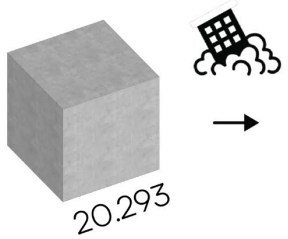
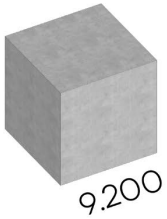
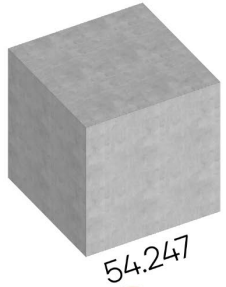
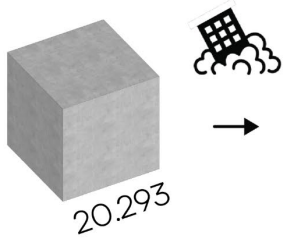
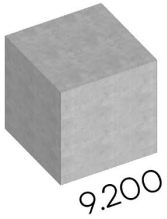
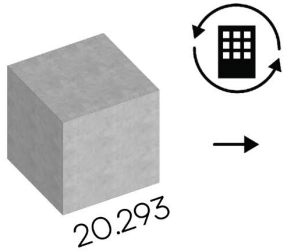
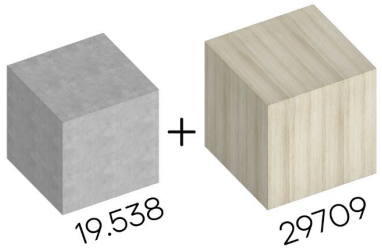
	building material	existing building material (m^3)	lost embodied CO_2 (x1000 kg)	total new material needed (m^3)	CO_2 released in production process (x1000 kg)
1.	total new with concrete				
2.	total new with wood				
3.	reused concrete & new wood				

CONCLUSION

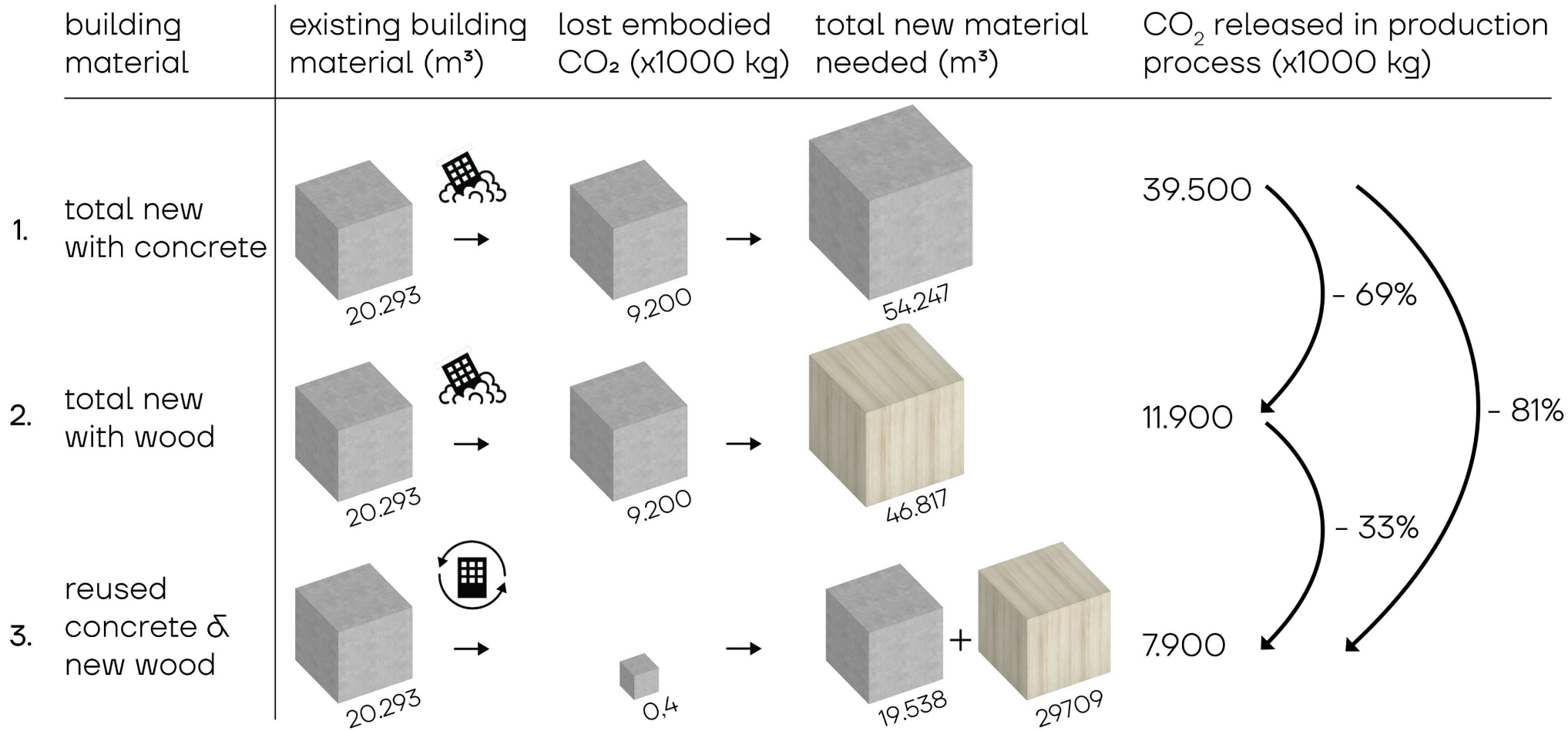


	building material	existing building material (m^3)	lost embodied CO_2 (x1000 kg)	total new material needed (m^3)	CO_2 released in production process (x1000 kg)
1.	total new with concrete	20.293	9.200		
2.	total new with wood	20.293	9.200	- 0%	
3.	reused concrete & new wood	20.293	0,4	- 96%	

CONCLUSION

	building material	existing building material (m^3)	lost embodied CO_2 (x1000 kg)	total new material needed (m^3)	CO_2 released in production process (x1000 kg)
1.	total new with concrete				39.500
2.	total new with wood				11.900
3.	reused concrete & new wood				7.900

CONCLUSION


building material
existing building material (m³)
lost embodied CO_2 (x1000 kg)
total new material needed (m³)
CO_2 released in production process (x1000 kg)
1. total new with concrete
20.293
9.200
54.247
2. total new with wood
20.293
9.200
46.817
3. reused concrete & new wood
20.293
0,4
19.538
29709
39.500
- 69%
11.900
- 81%
- 33%
7.900

