P5

Continuous Workscapes
Hyperbody Studio
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Tutors: H.H. Bier, F. Adema & S. Mostafavi

INTRODUCTION

COMPUTATIONAL STRATEGY

THE DESIGN

MATERIALS & FABRICATION


INTRODUCTION

URBAN SCALE
M4H REDEVELOPMENT

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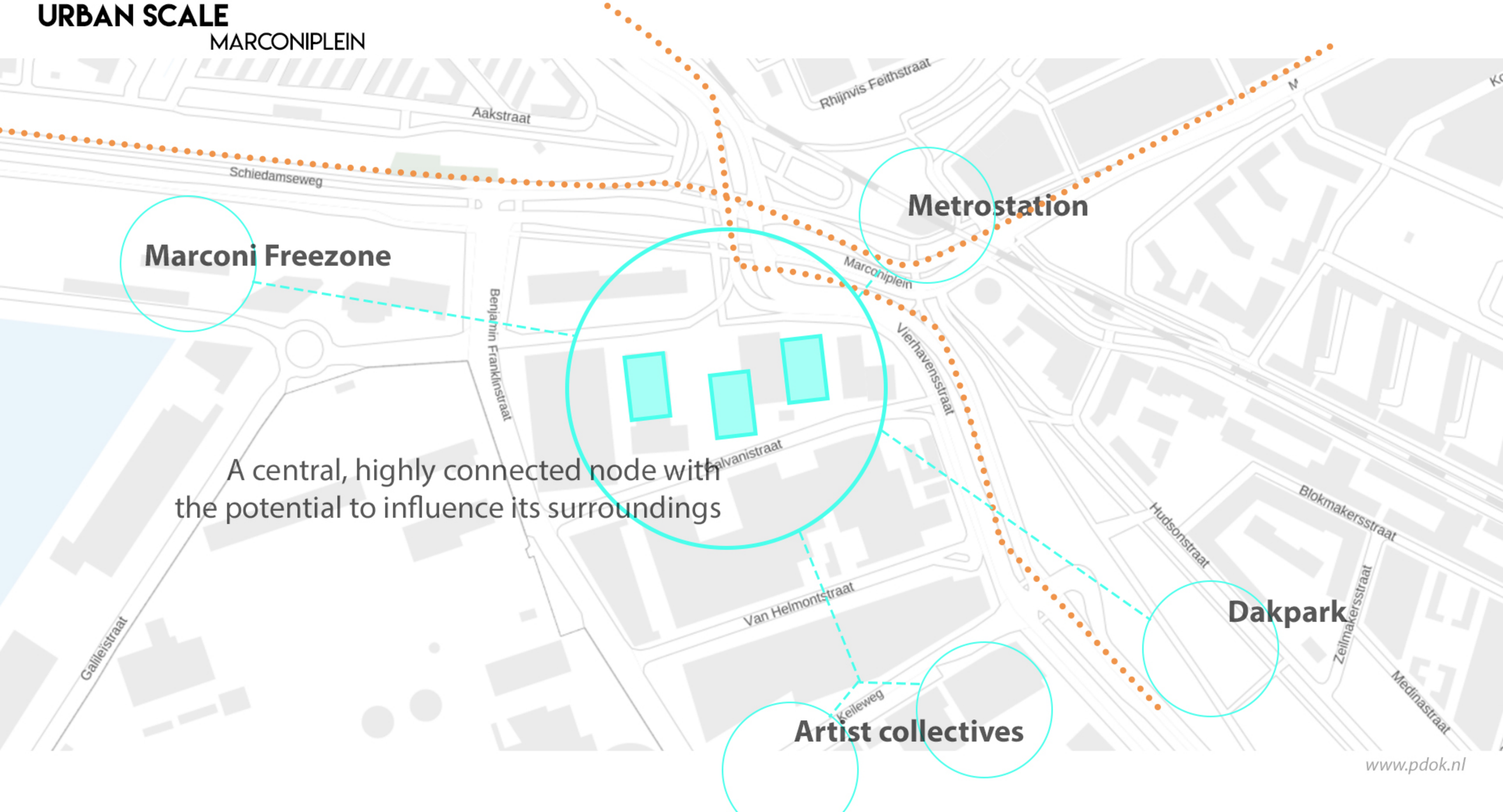
URBAN SCALE

MARCONIPLEIN

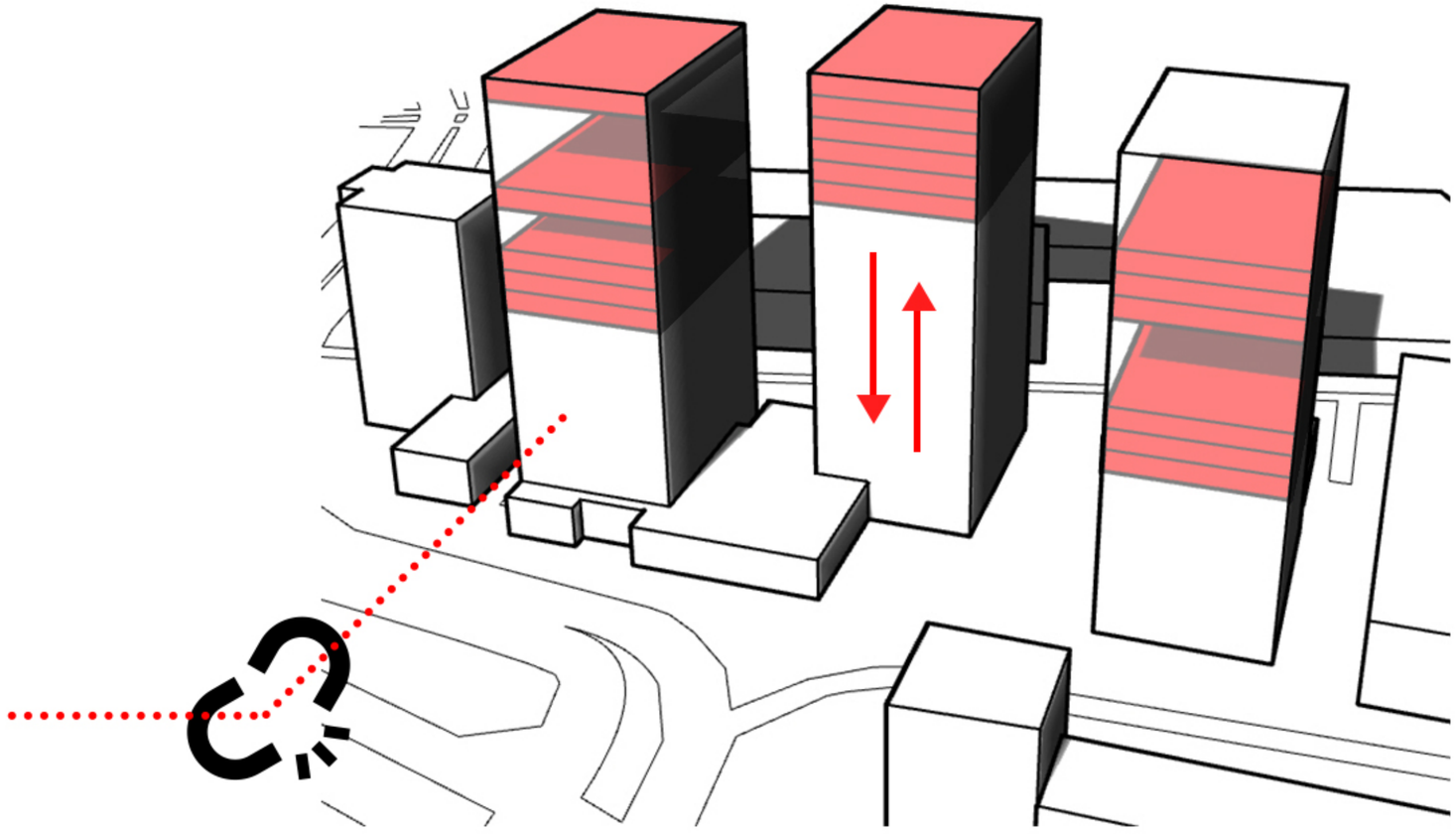


PROBLEM STATEMENT
MARCONI TOWERS

Vacancy breeds vacancy.
30% of all offices in the netherlands are vacant

There is a **disconnect** between their monofunctional use and the changing needs of its surroundings

The spaces within the towers are only vertically connected



FUNCTIONAL INTENT

START-UPS

Attract startups to stimulate innovation

Proximity breeds collaboration

50% of the startups fail during the first 4 years

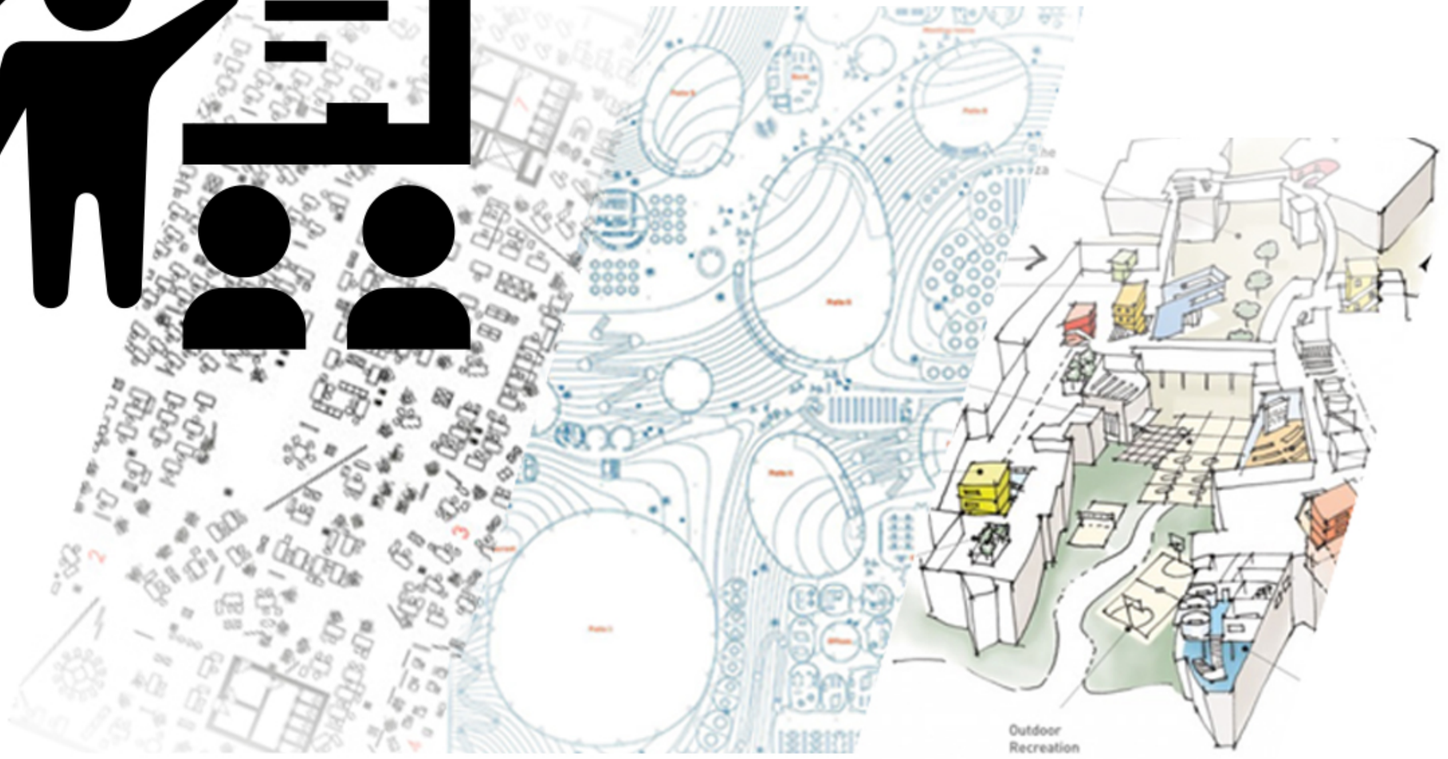
Clustered facilities are more efficient and cost effective

KNOWLEDGE ECONOMY
THEORETICAL FRAMEWORK

Today's work is not just work
the boundaries between working, living and playing are to be blurred

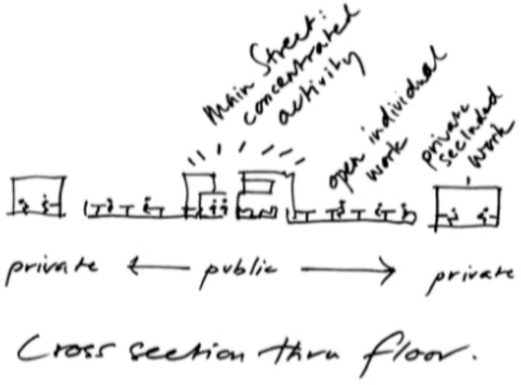
Spaces in between serve as a facilitator of collaboration

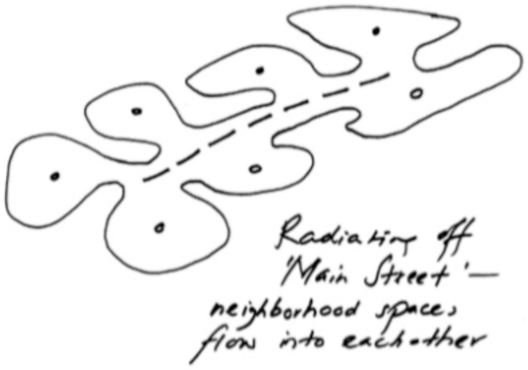
Transparancy and permeability are important



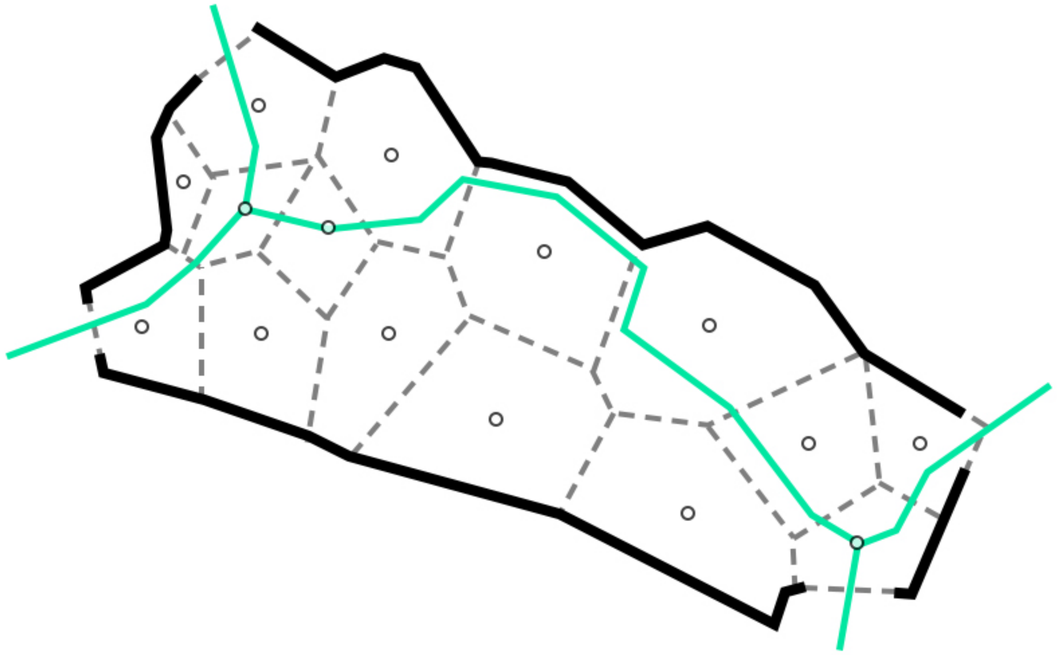
Buch and Ton *Rolex Learning Centre* *Googleplex*

SPATIAL INTERACTION
CONNECTED ' NEIGHBOURHOODS



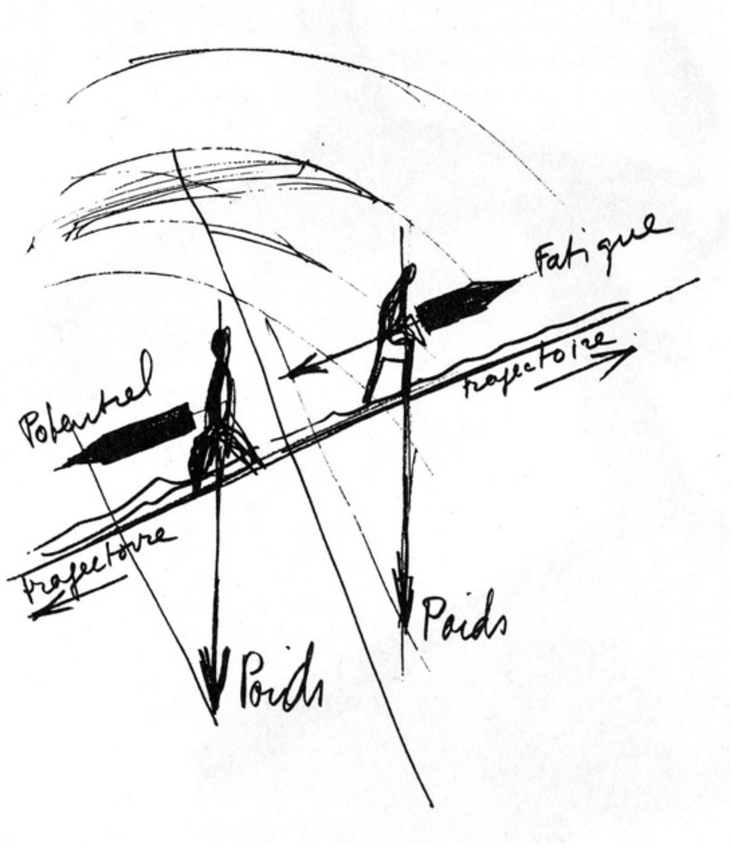


Googleplex - Clive Wilkerson Architects



Connected spaces flow into eachother
concentrating activity around circulation
with varying degrees of activity and privacy

SPATIAL INTERACTION
THE FUNCTION OBLIQUE



Claude Parent & Paul Virilio The Function of the Oblique

PROPOSED INTERVENTION
DESIGN OBJECTIVE

Adaptable

The intervention should serve the changing needs in the innovative technological sector.

Effective workspace

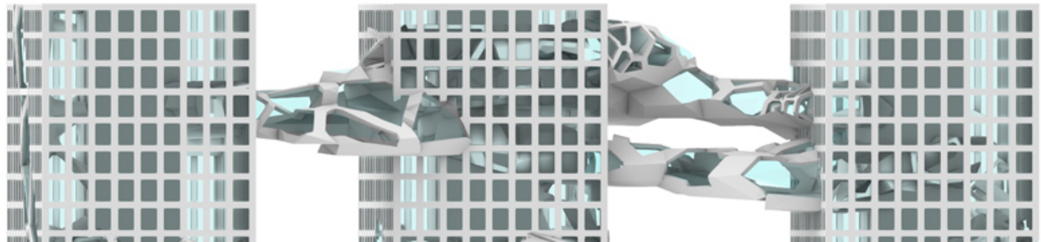
The spatial qualities should promote collaboration, productivity and innovation.

Upgrade the old

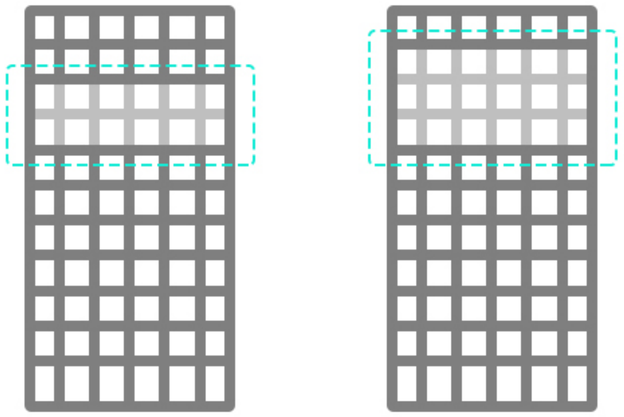
The intervention should use, retool and add on to the existing fabric of the Marconi towers and upgrade its monofunctional character.

PROPOSAL

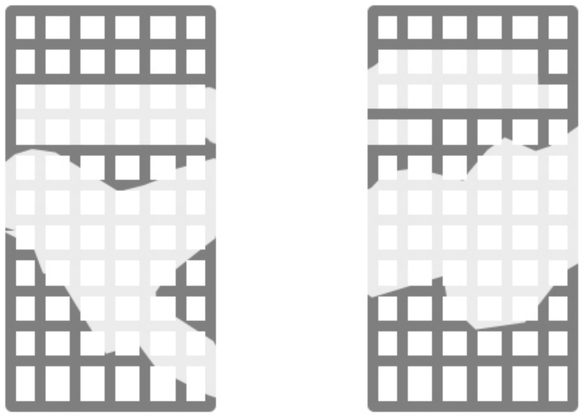
A multifunctional workscape that bridges and interconnects the towers.



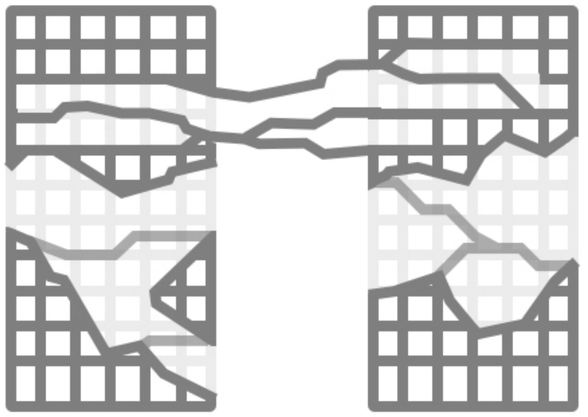
BUILDING ALTERATION



1. Vacant floors
are the starting point for the intervention

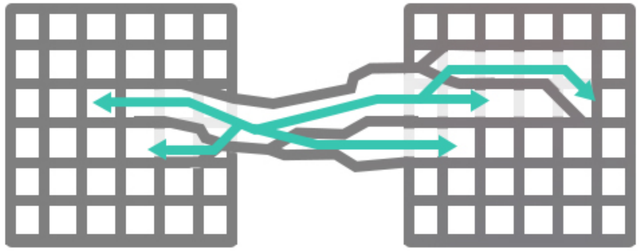


2. Removing old structure
and floors to make room for the new

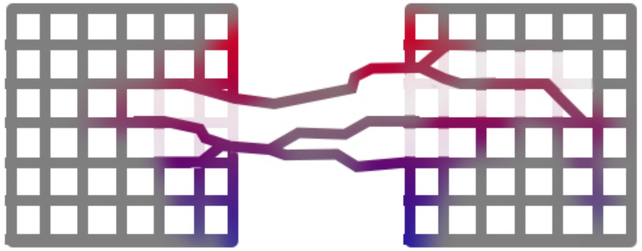


3. Interjecting new structure
to interconnect the towers and form the basis for future interventions

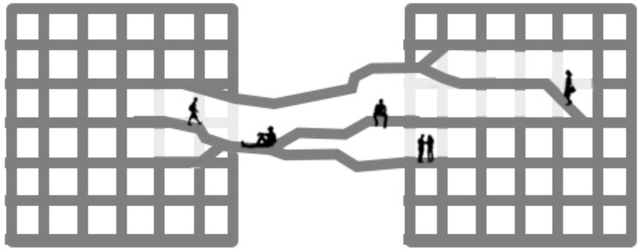
SPACE PLANNING CONCEPT



Bridges as circulation.
The geometry serves as a permeable connection & circulation between the towers.



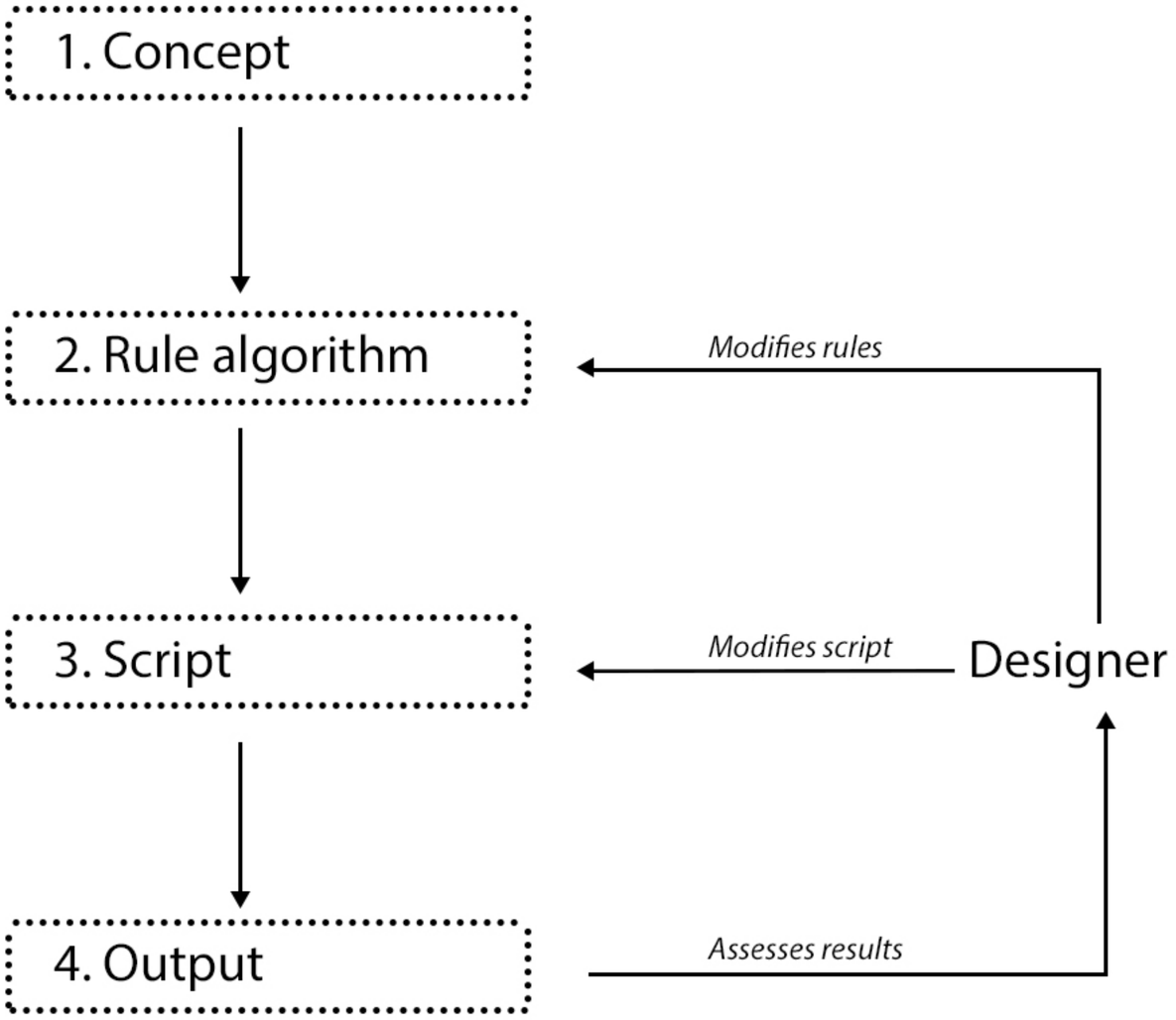
Bridges as structure.
Substitutes & strengthens the existing structure of the towers.



Bridges facilication.
The oblique geometry allows different, varied use of space, enabling interesting interactions.

COMPUTATIONAL STRATEGY

PARAMETRIC DESIGN PROCESS



tools used throughout

FUNCTIONAL SCENARIO

VARIOUS START-UPS

IT

	people		factor	m²		factor	m²		factor	m²		factor	m²		m²
Start-Up	62	Office Space	12	744	Production Space	2	124	Assembly Space	2	124	Auxiliary Space	12	744	Total	1736
		Open plan	0,7	520,8	Machinery	0	0	Retail	0,2	24,8	Restaurant	0,2	148,8		
		Private space	0,2	148,8	Technical workspace	0,8	99,2	Meeting space	0,4	49,6	Hotel	0,4	297,6		
		Conference space	0	0	Clean lab	0	0	Lecture room	0,4	49,6	Public space	0,2	148,8		
		Subsidiary space	0,1	74,4	Fab-lab	0,2	24,8	Exposition hall	0	0					
					Testing Space	0	0								

Innovative/Emergent Technology

	people		factor	m²		factor	m²		factor	m²		fa
Start-Up	38	Office Space	10	380	Production Space	9,5	361	Assembly Space	3	114	Auxiliary Space	
		Open plan	0,2	76	Machinery	0,2	72,2	Retail	0	0	Restaurant	
		Private space	0,4	152	Technical workspace	0,3	108,3	Meeting space	0,2	22,8	Hotel	
		Conference space	0,2	76	Clean lab	0	0	Lecture room	0,2	22,8	Public space	
		Subsidiary space	0,2	76	Fab-lab	0,2	72,2	Exposition hall	0,6	68,4		
					Testing Space	0,3	108,3					

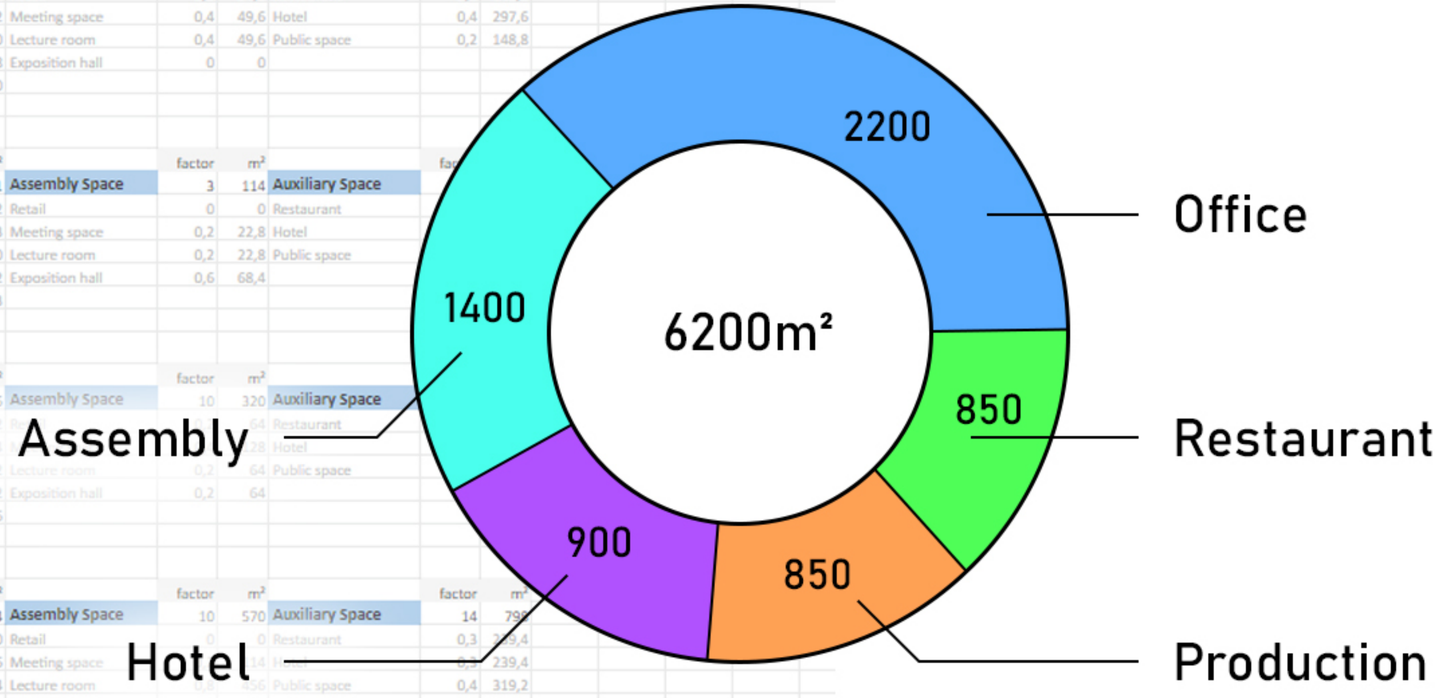
Sust. Product development

	people		factor	m²		factor	m²		factor	m²	
Start-Up	32	Office Space	8	256	Production Space	8	256	Assembly Space	10	320	Auxiliary Space
		Open plan	0,2	51,2	Machinery	0,2	51,2	Retail	0,2	64	Restaurant
		Private space	0,4	102,4	Technical workspace	0,4	102,4	Meeting space	0,4	128	Hotel
		Conference space	0,2	51,2	Clean lab	0,2	51,2	Lecture room	0,2	64	Public space
		Subsidiary space	0,2	51,2	Fab-lab	0,2	51,2	Exposition hall	0,2	64	
					Testing Space	0,1	25,6				

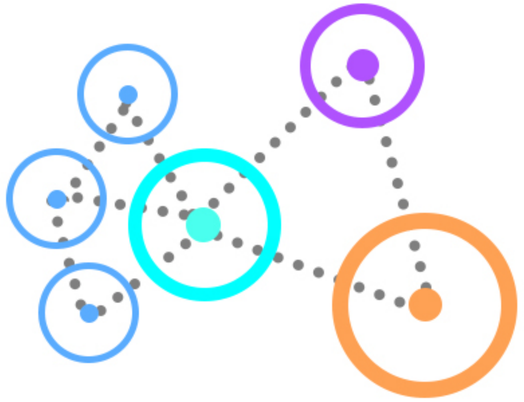
Educational

	people		factor	m²		factor	m²		factor	m²		factor	m²
Start-Up	57	Office Space	10	570	Production Space	2	114	Assembly Space	10	570	Auxiliary Space	14	798
		Open plan	0,4	228	Machinery	0	0	Retail	0	0	Restaurant	0,3	239,4
		Private space	0	0	Technical workspace	0,4	45,6	Meeting space	0,3	114	Hotel	0,3	239,4
		Conference space	0,5	285	Clean lab	0,6	68,4	Lecture room	0,5	256	Public space	0,4	319,2
		Subsidiary space	0,1	57	Fab-lab	0	0	Exposition hall	0	0			
					Testing Space	0	0						

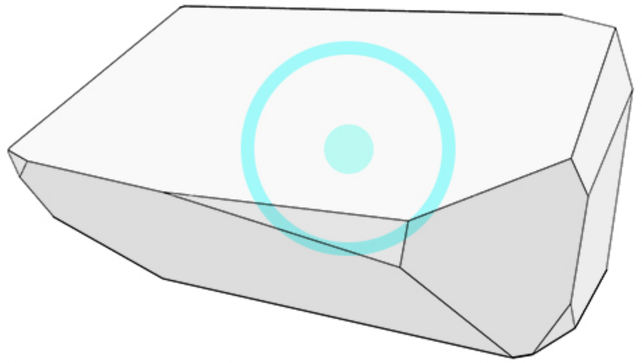
	people		m²		m²		m²		m²		m²
Functions	189	Office	1950	Production	855	Assembly	1128	Auxiliary	2446	Total	6379
		Open plan	876	Machinery	123,4	Retail	88,8	Restaurant	705		
		Private space	403,2	Technical workspace	355,5	Meeting space	314,4	Hotel	898,6		
		Conference space	412,2	Clean lab	119,6	Lecture room	592,4	Public space	693,6		
		Subsidiary space	258,6	Fab-lab	148,2	Exposition hall	132,4				
				Testing Space	133,9						



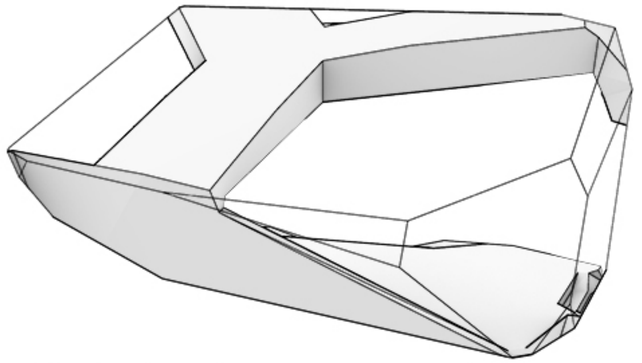
COMPUTATIONAL STRATEGY



1. Spatial Planning
Organising the new program in 3D space with and iterative agent-based modelling process



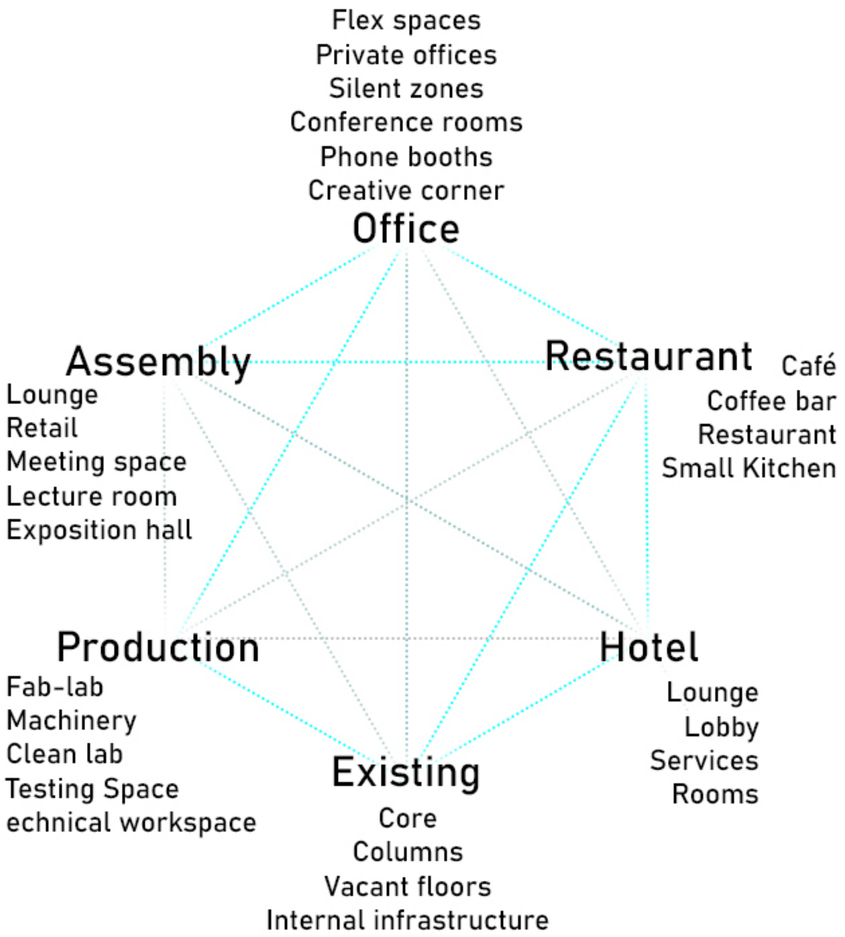
2. Geometry generation
Geometry is formed by allocating volumes to the agent-based pointcloud

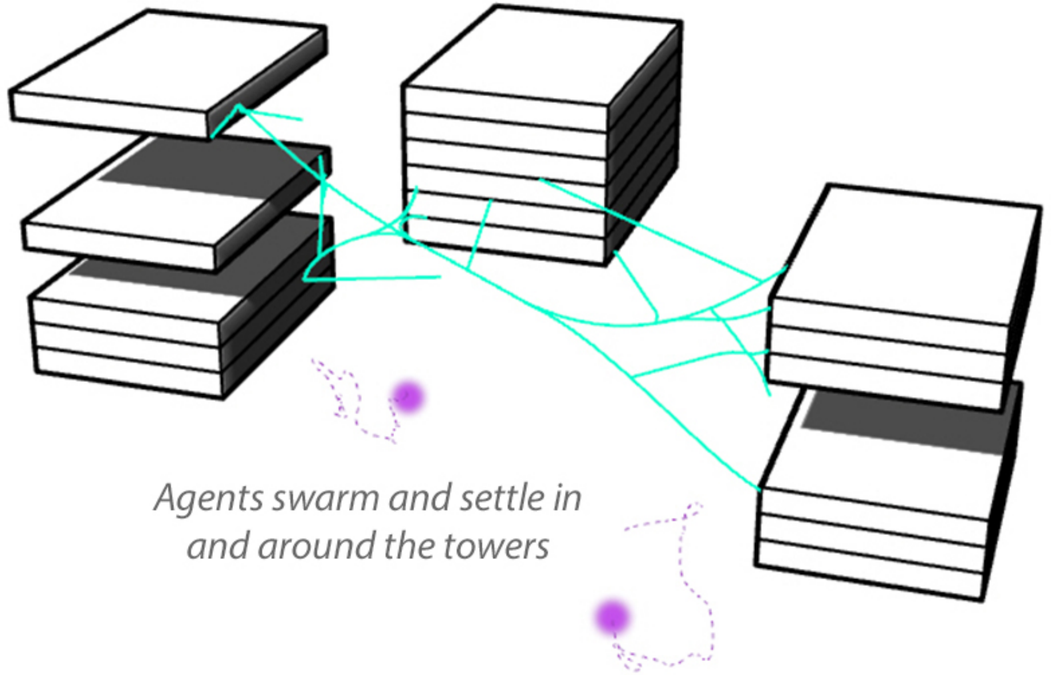


3. Altering geometry
exterior & interior porosities, steps & stairs are informed by use of 3D-mapping

AGENT BASED MODELLING

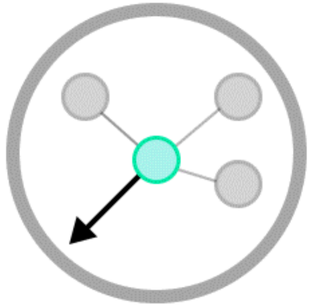
FUNCTIONAL RELATIONS





AGENT-BASED MODELLING

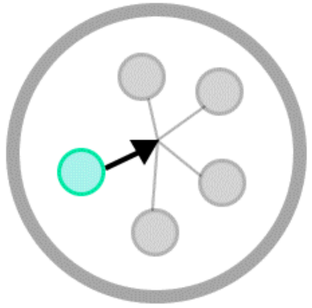
FORM FINDING



SEPARATION

DISTRIBUTION

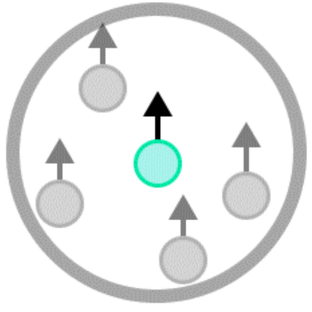
PRIVACY



COHESION

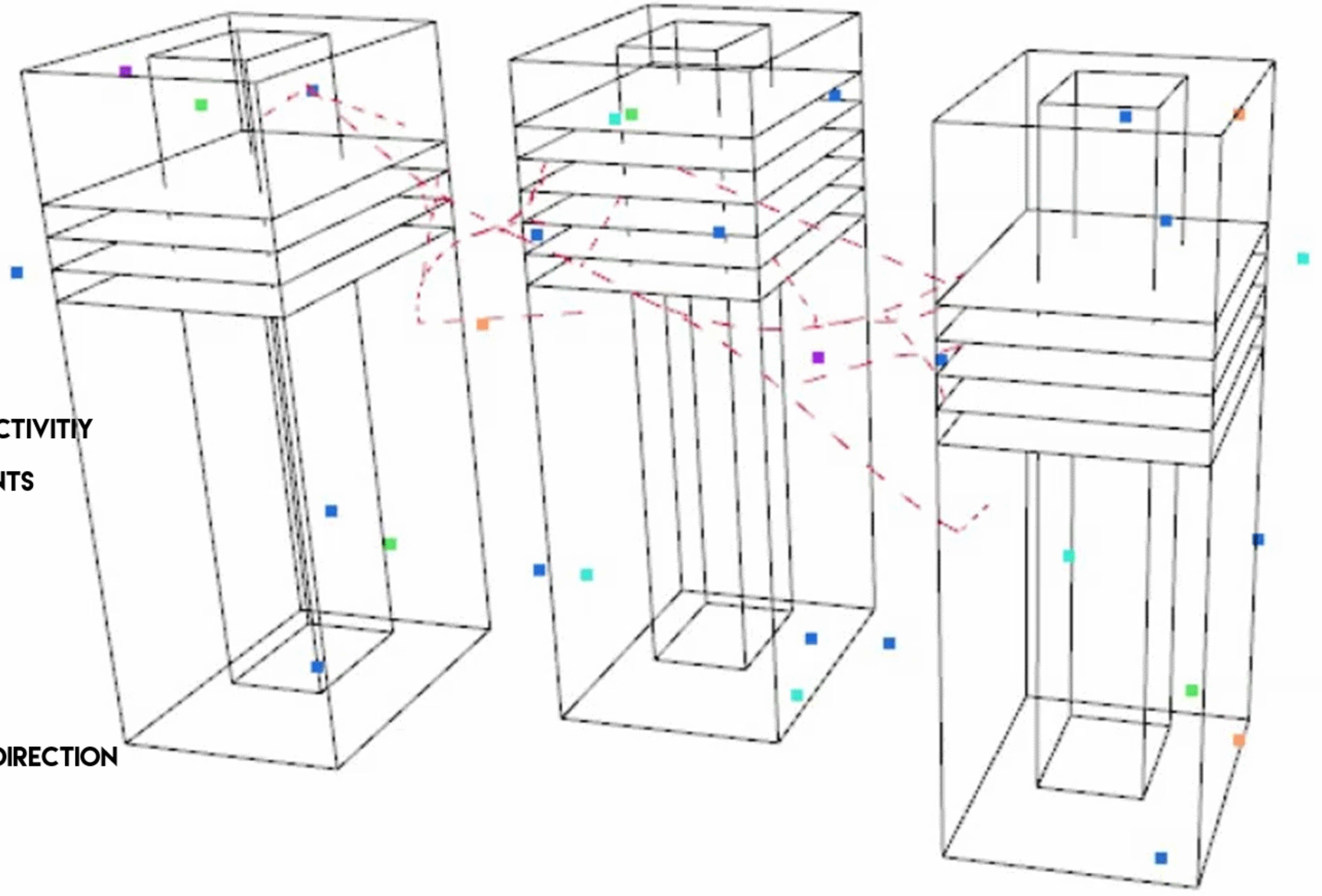
FUNCTIONAL CONNECTIVITIY

SPECIFIC REQUIREMENTS



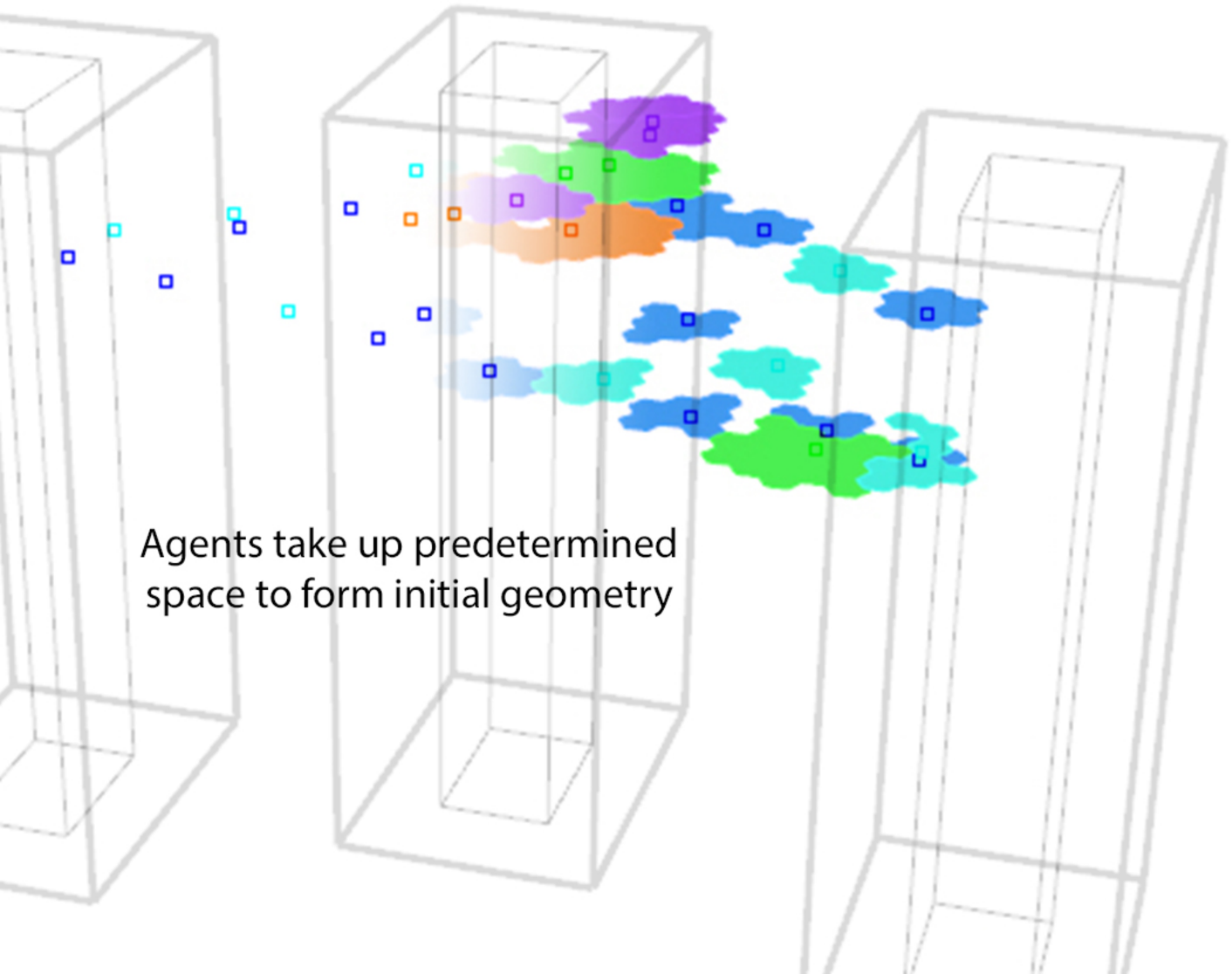
ALIGNMENT

COLLECTIVE ORDER/DIRECTION



SPACE ALLOCATION

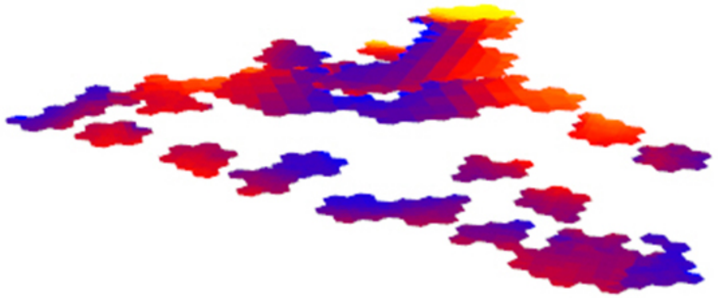
MACRO



Agents take up predetermined space to form initial geometry

Flow & circulation

Sunlight hours

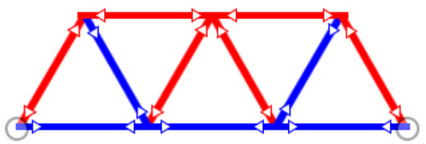


Structural potential

Configurations assesed on flow, sunlight hours & structural potential

INITIAL STRUCTURAL OPTIMIZATION

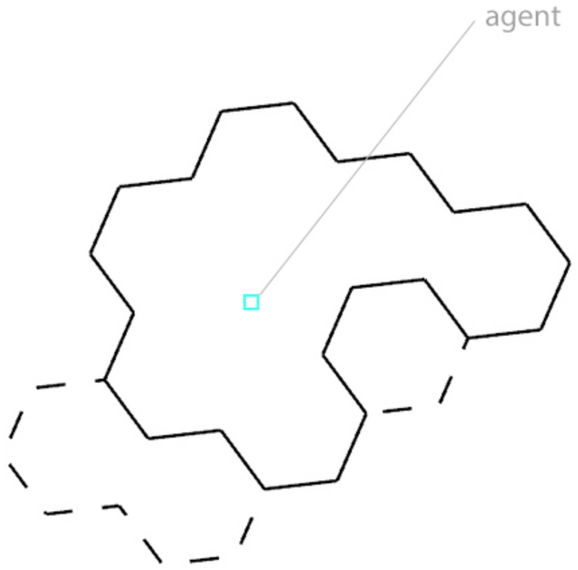
MACRO



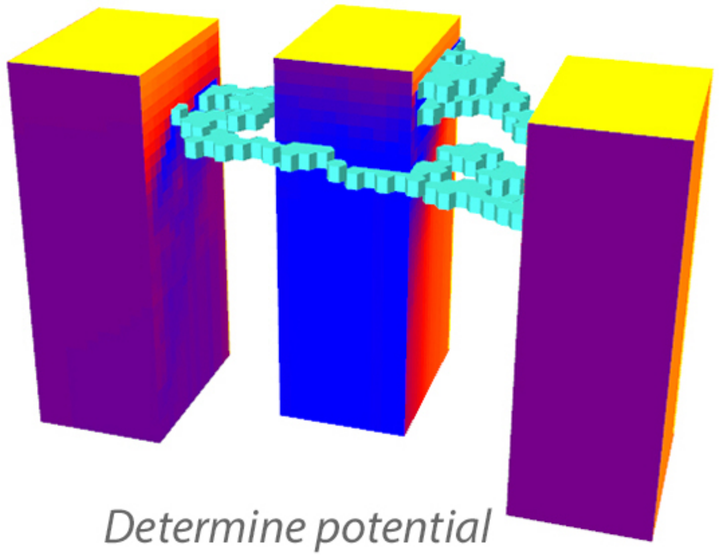
Structure simplified to truss between the cores in order to optimize initial structural viability

ENVIRONMENTAL OPTIMIZATION

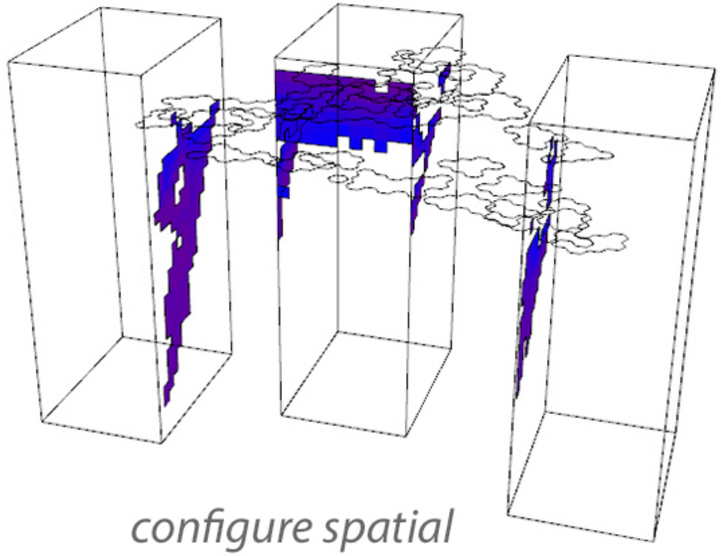
MAXIMIZE SUNLIGHTHRS



Parametrized buffer in allocated space to allow porosities for optimization



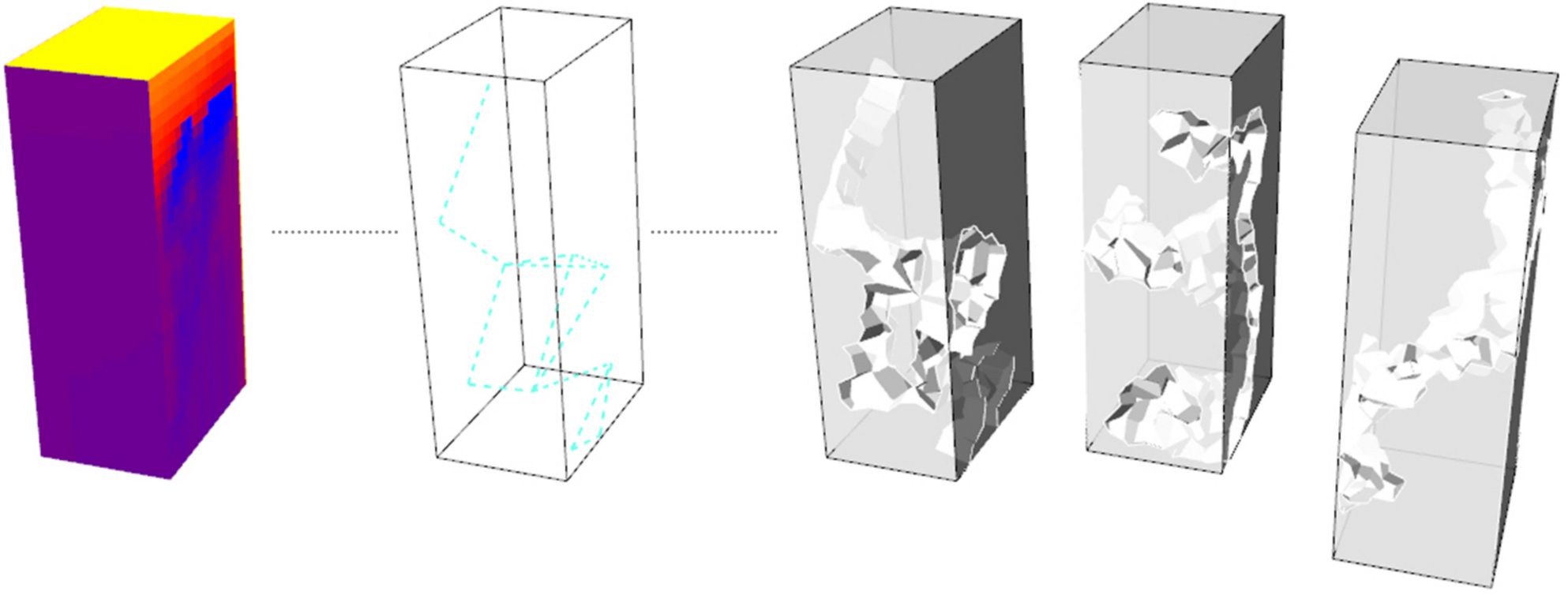
Determine potential risk zones for sunlight hours



configure spatial organisation to optimize sunlight hours on risk zones

VOID GENERATION

MACRO

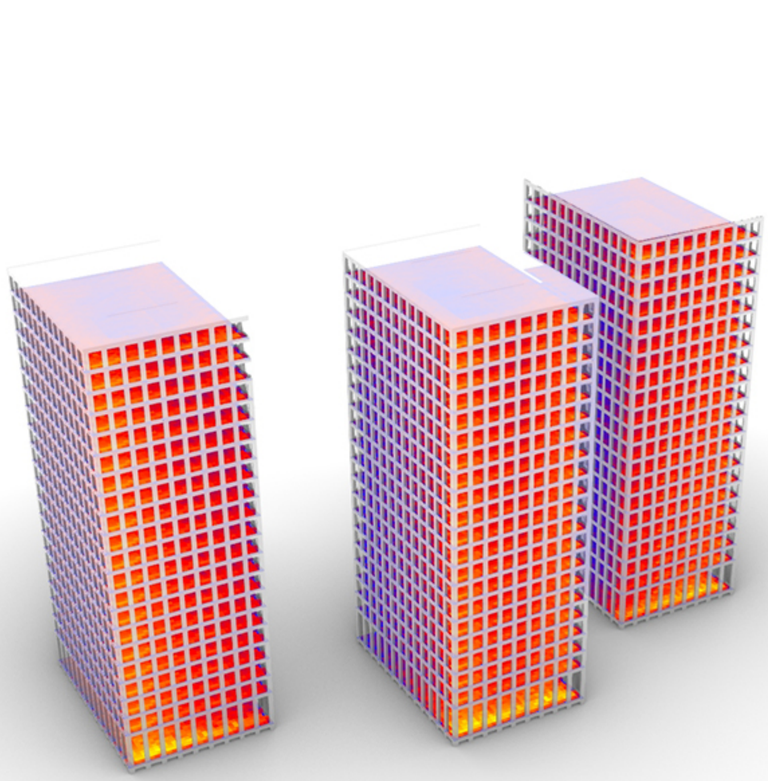


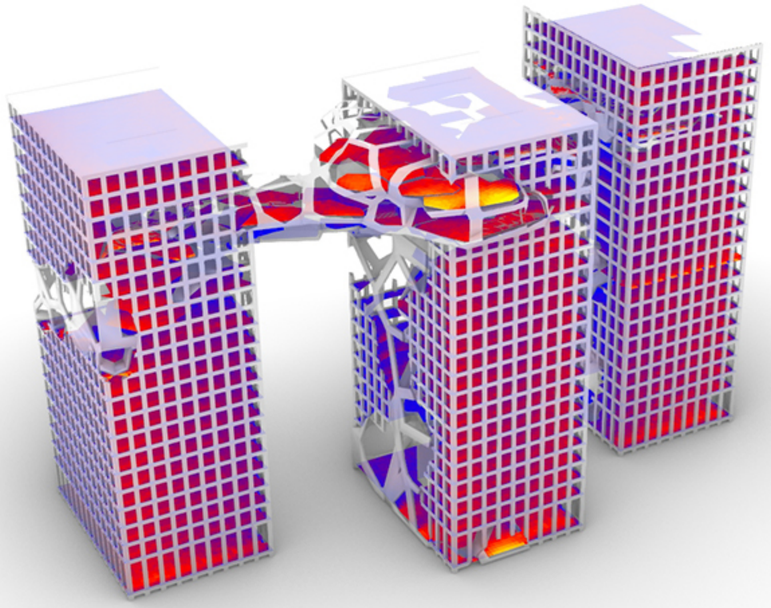
Sunlight hours analysis as map for agent based modelling to generate void structure

The voids improve sunlight hours throughout existing building and provide infrastructure for future interventions

SOLAR EVALUATION - FINAL DESIGN

SUNLIGHT HOURS

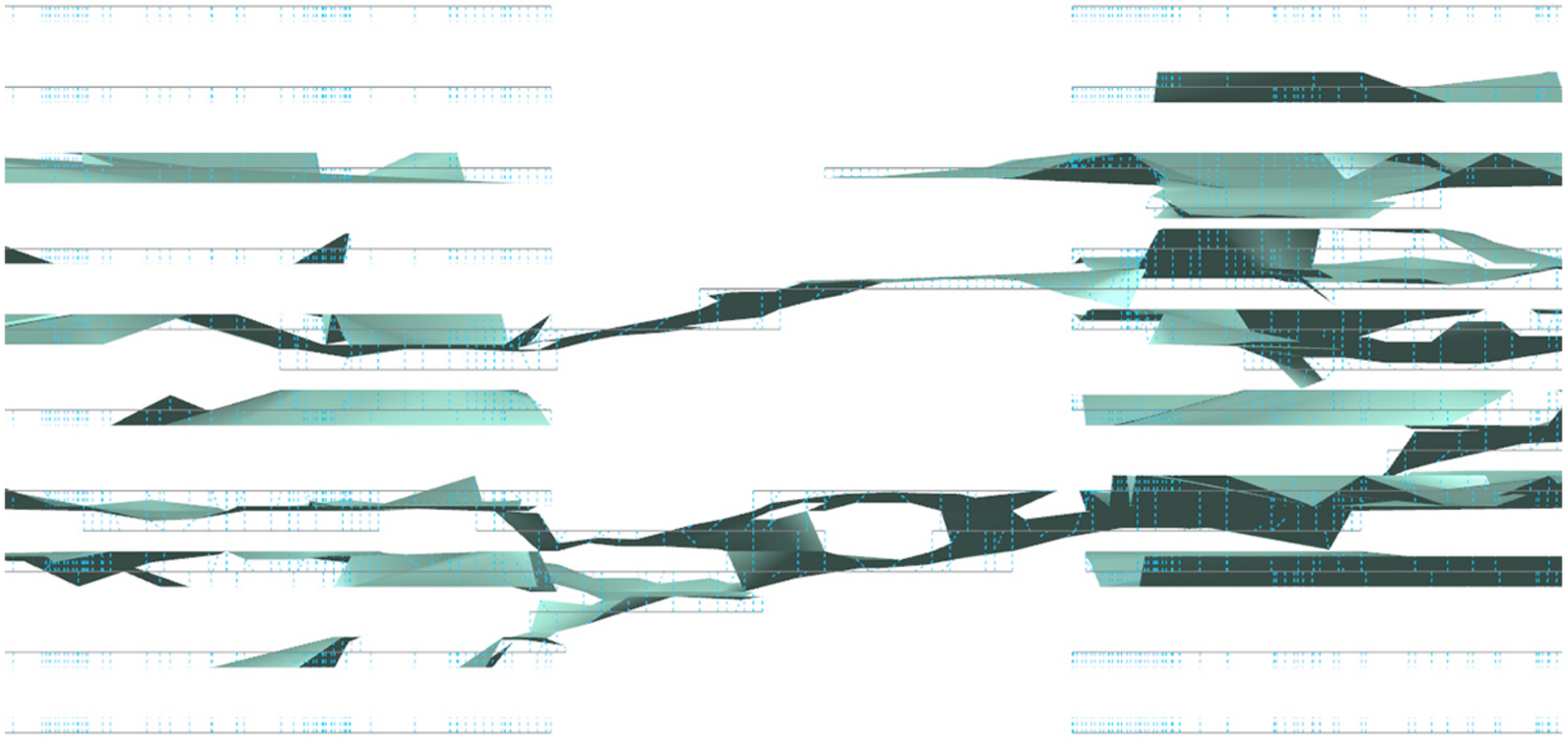




13% increase in average sunlight hours

SPACE WEAVING

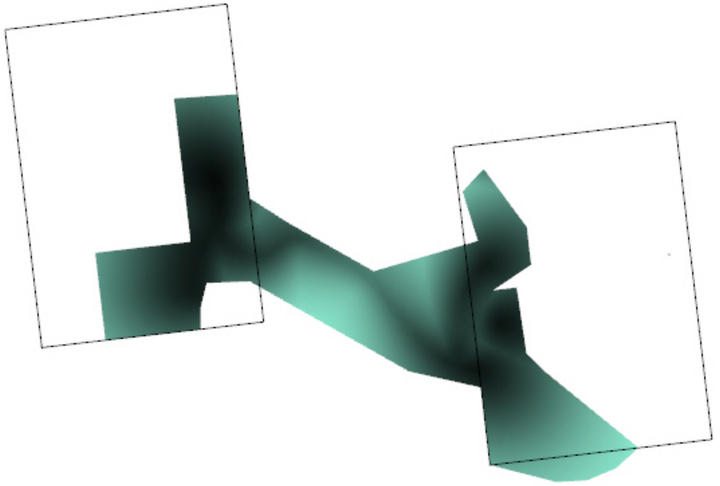
OBLIQUE SURFACES



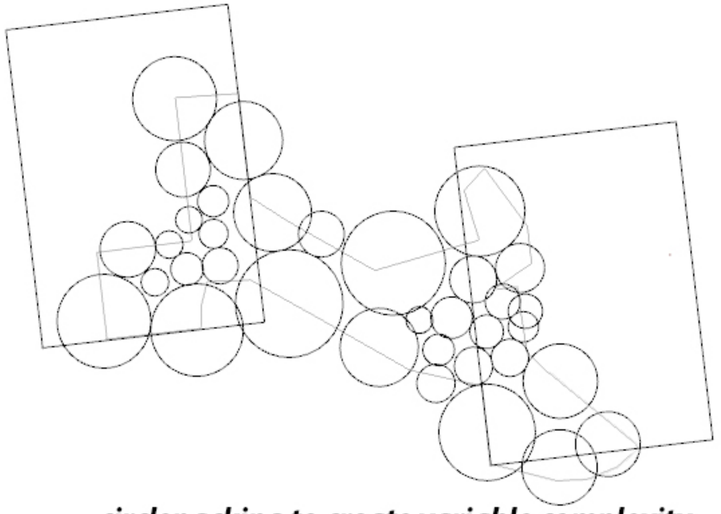
Weave from planar connections
to oblique circulation

GEOMETRY GENERATION

COMPLEXITY CIRCLE PACKING



mapping oblique surfaces
[walking angle, circulation,
proximity cores & points of interest]

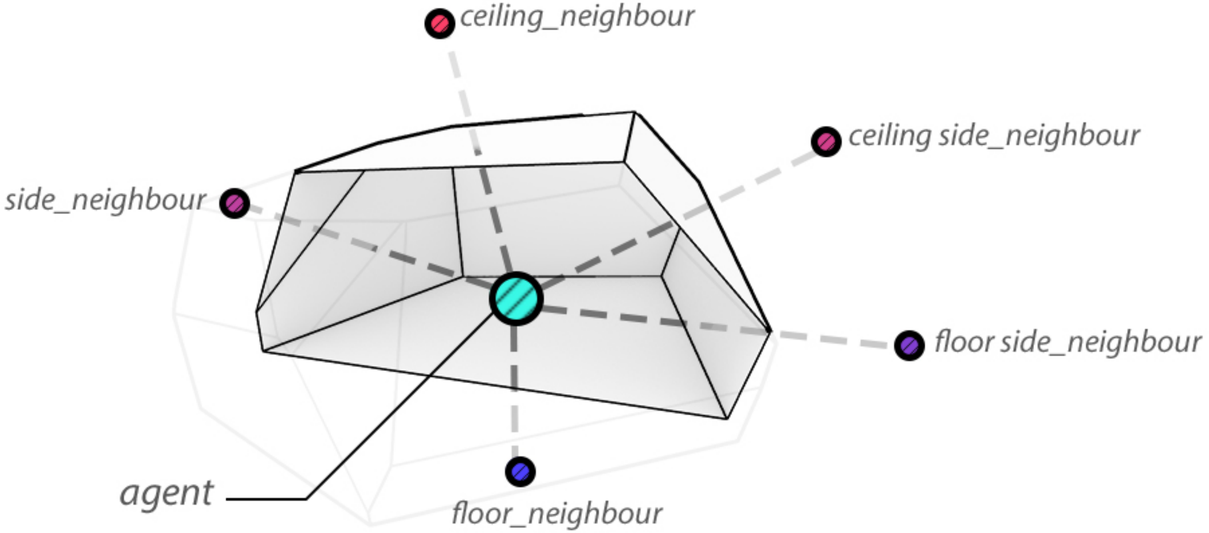


circlepacking to create variable complexity

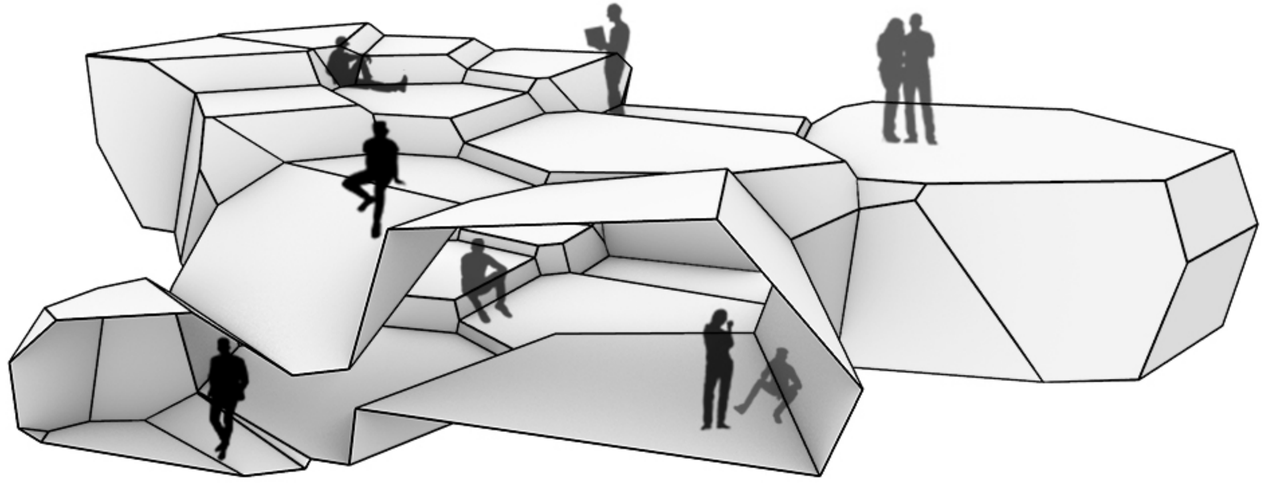
varying cellsizes inform the geometry

GEOMETRY GENERATION

2D CLUSTERS TO 3D



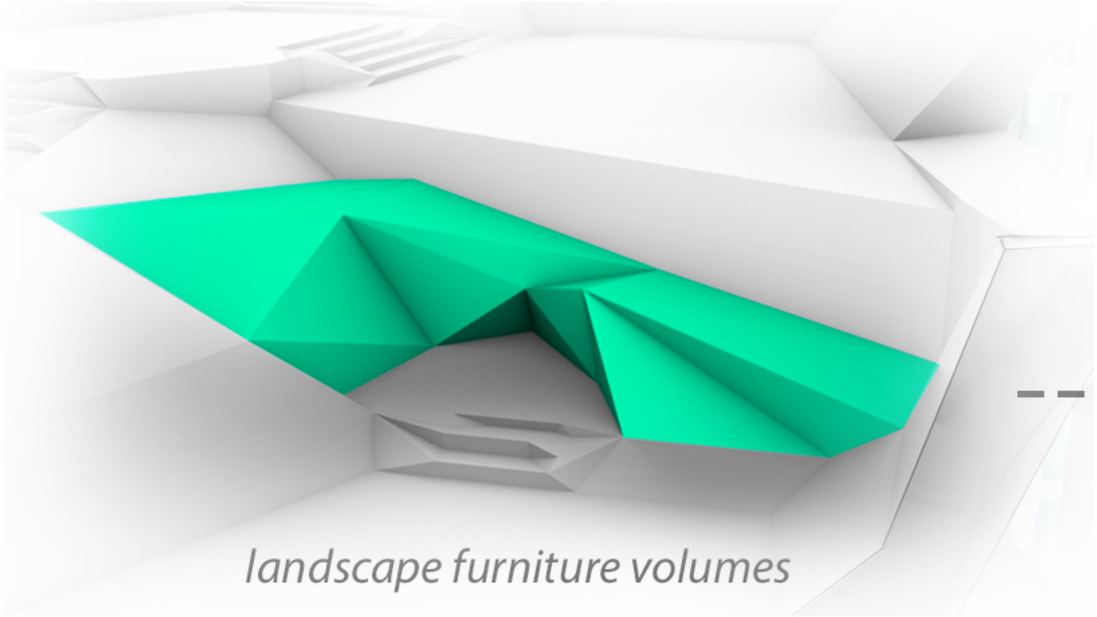
Cell centre points offset to create a set of enveloping surfaces



Inherent oblique quality to the generated geometry

LANDSCAPE FURNITURE

FACILITIATING NEW WAYS OF WORKING

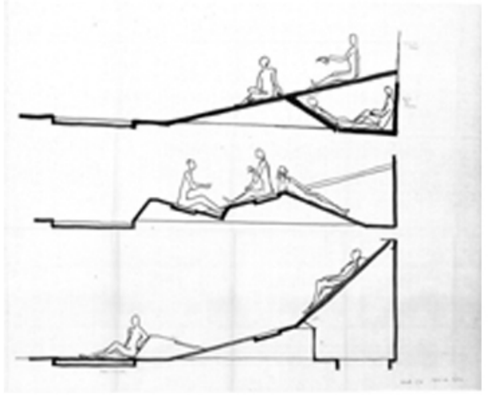


landscape furniture volumes

ergonomicly refined

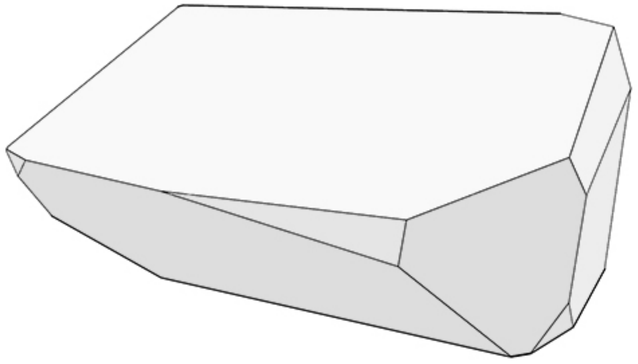
foam seating

The end of sitting - Studio RAAF

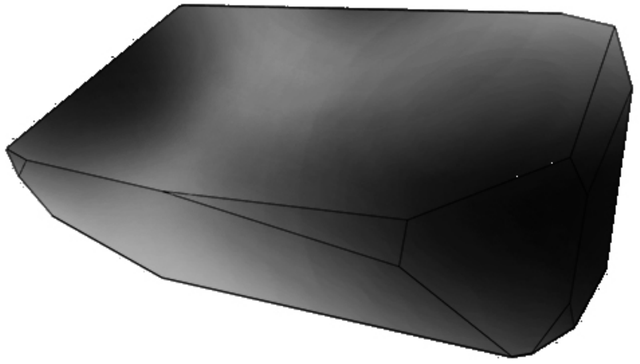


Claude Parent

ADDING POROSITY
3D MAPPING ANALYSIS

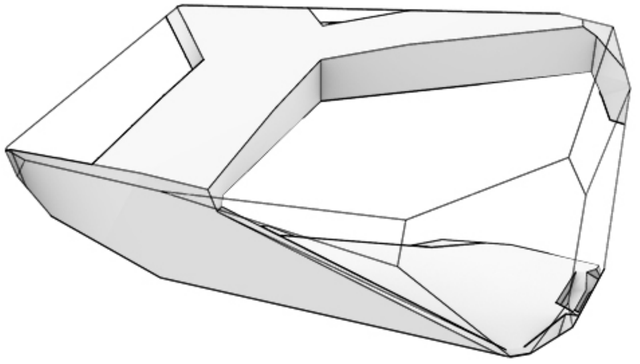


Initial geometry



3D mapped geometry

-Structural
-Sights & Views
-Sunlight hours

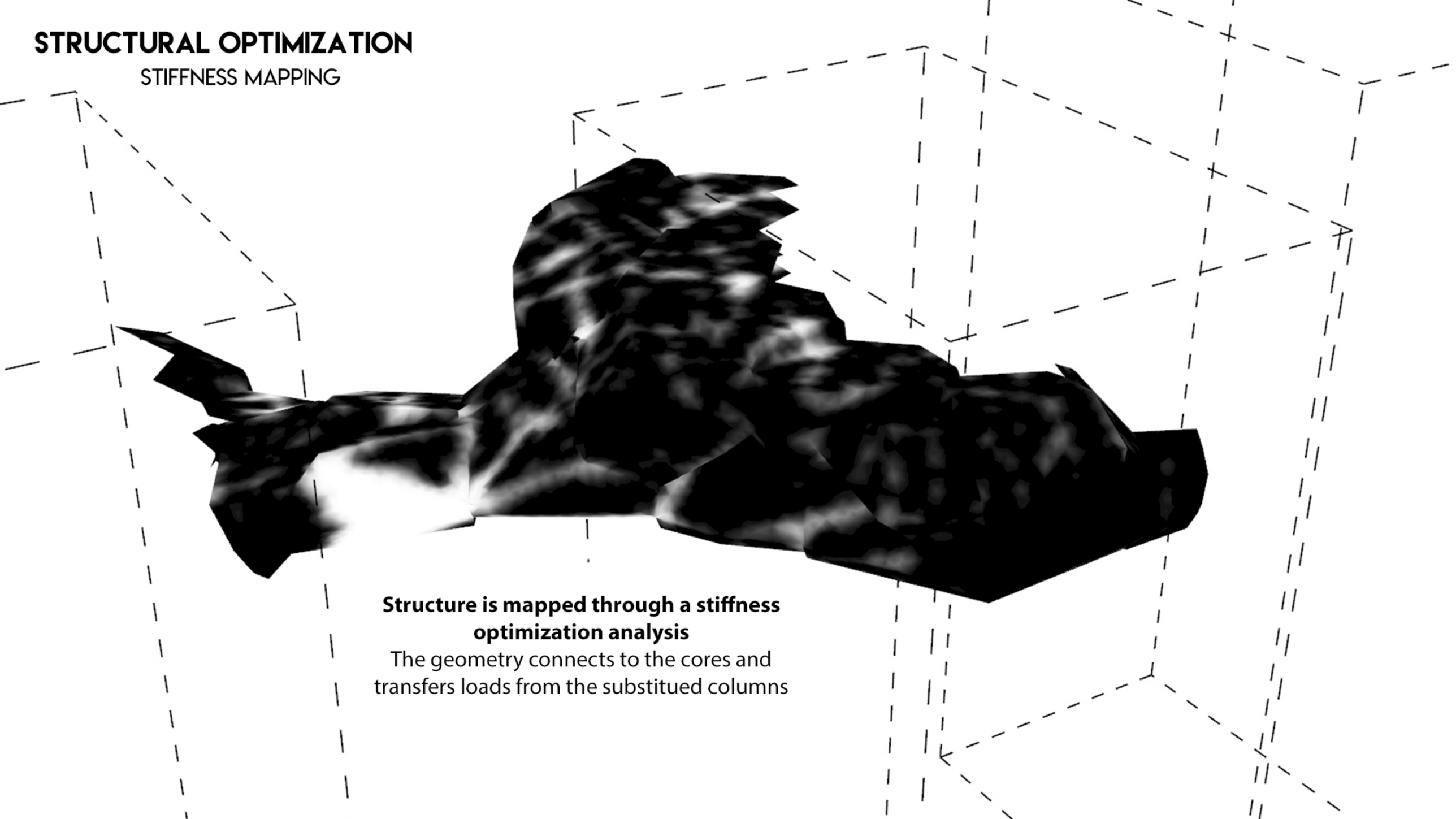


Informed porosities

-facade openings

STRUCTURAL OPTIMIZATION

STIFFNESS MAPPING

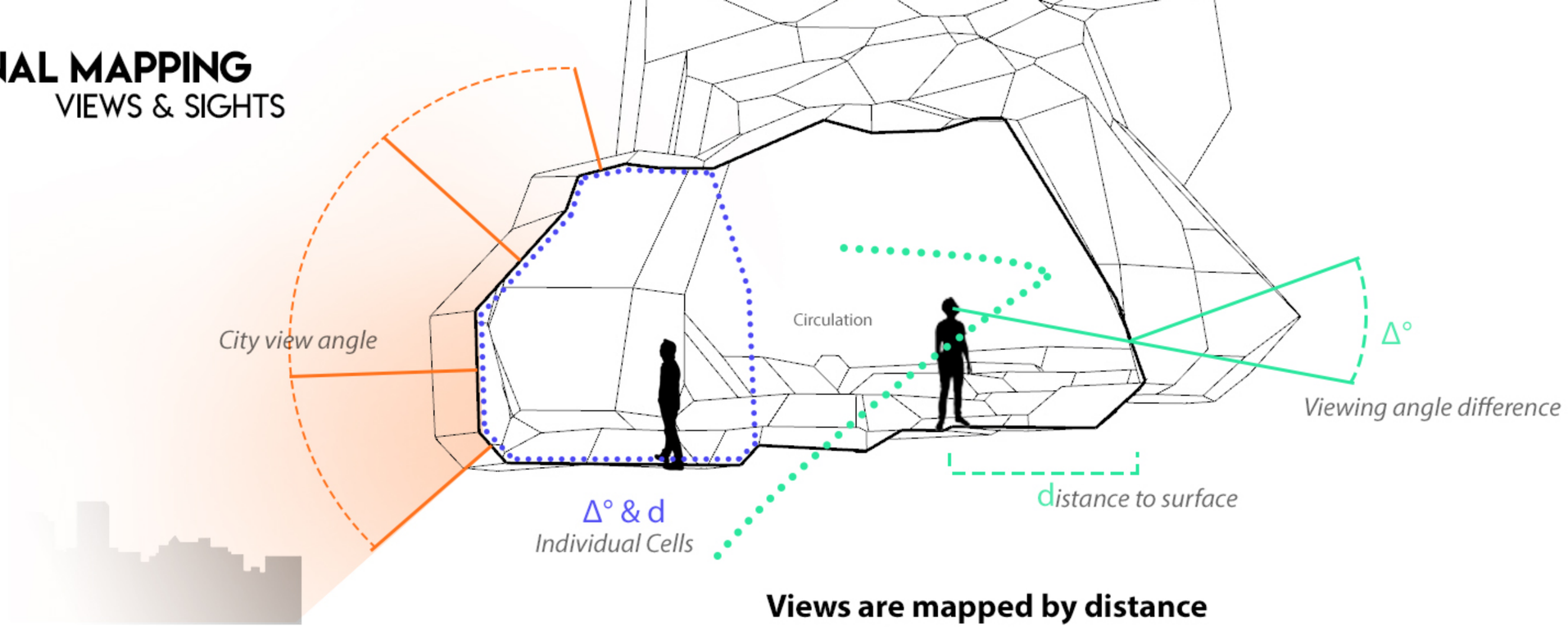


Structure is mapped through a stiffness optimization analysis

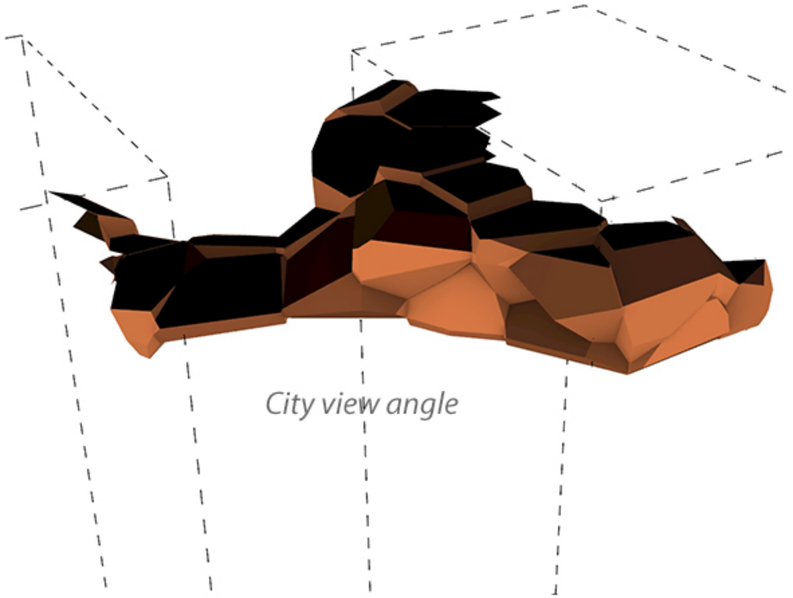
The geometry connects to the cores and transfers loads from the substitued columns

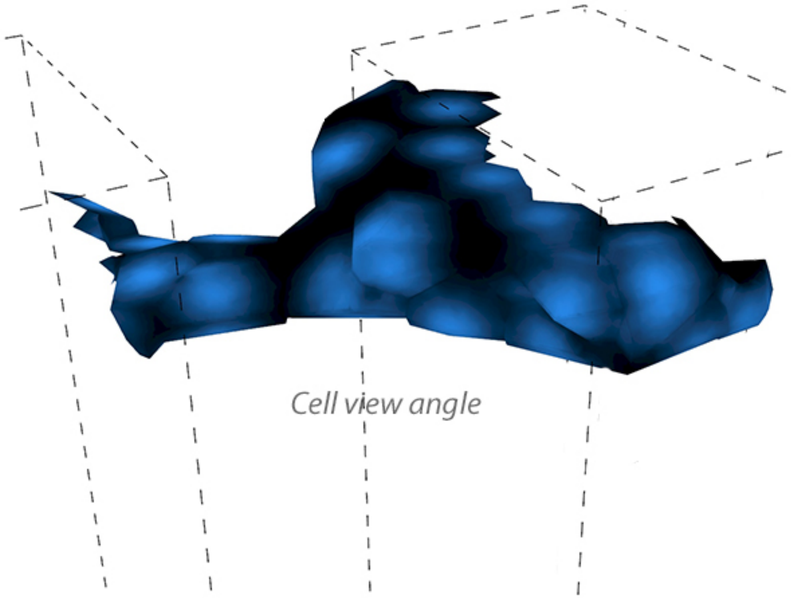
FUNCTIONAL MAPPING

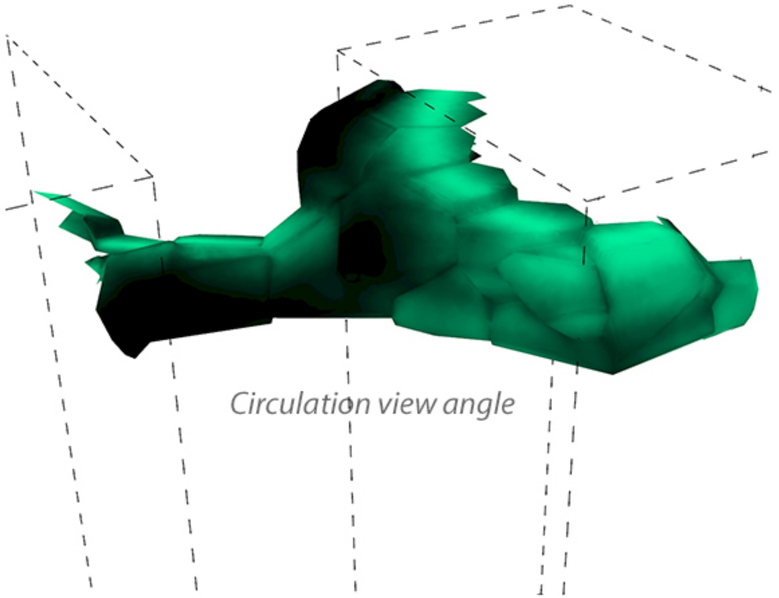
VIEWS & SIGHTS



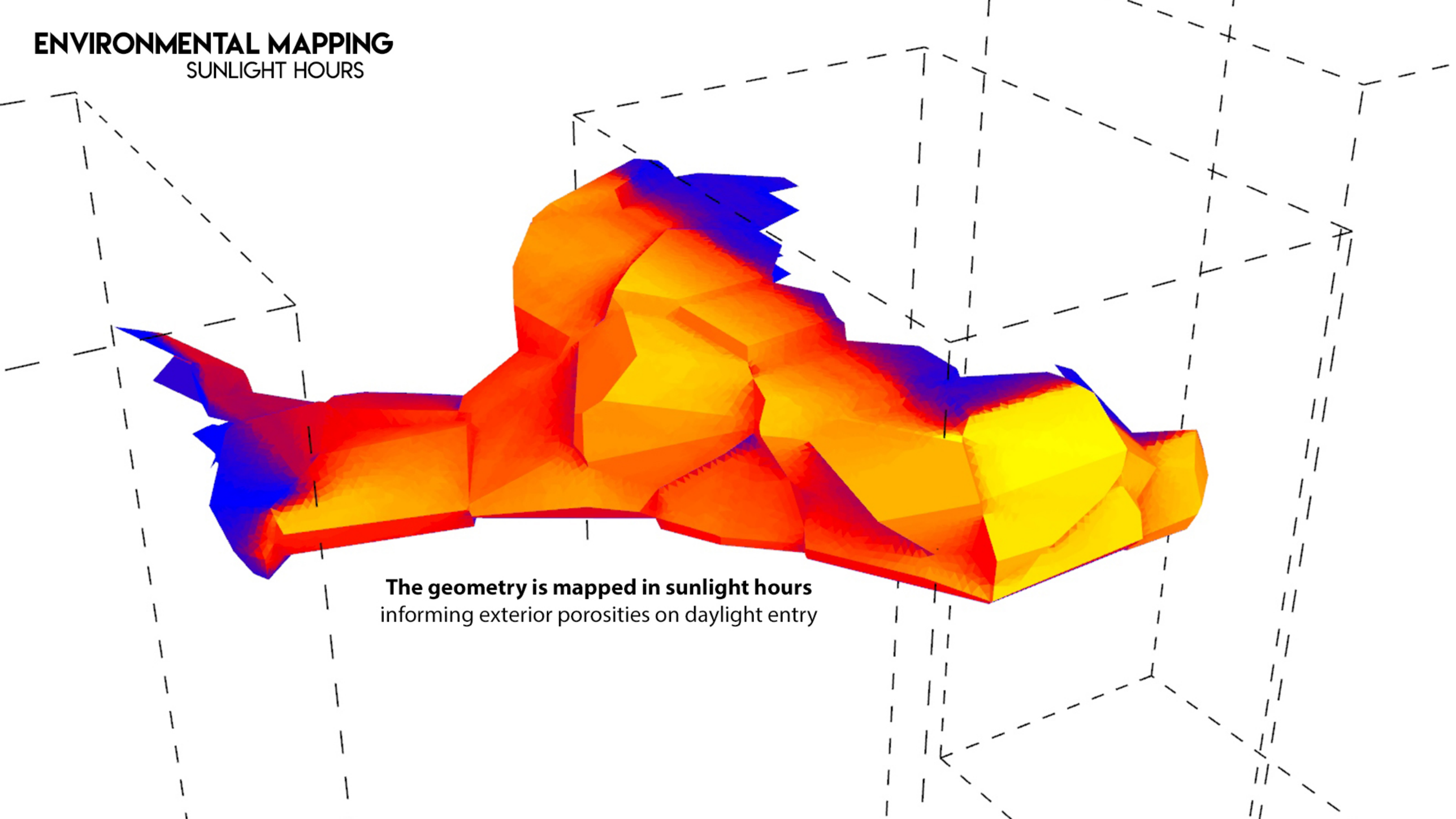
Views are mapped by distance and angle alignment







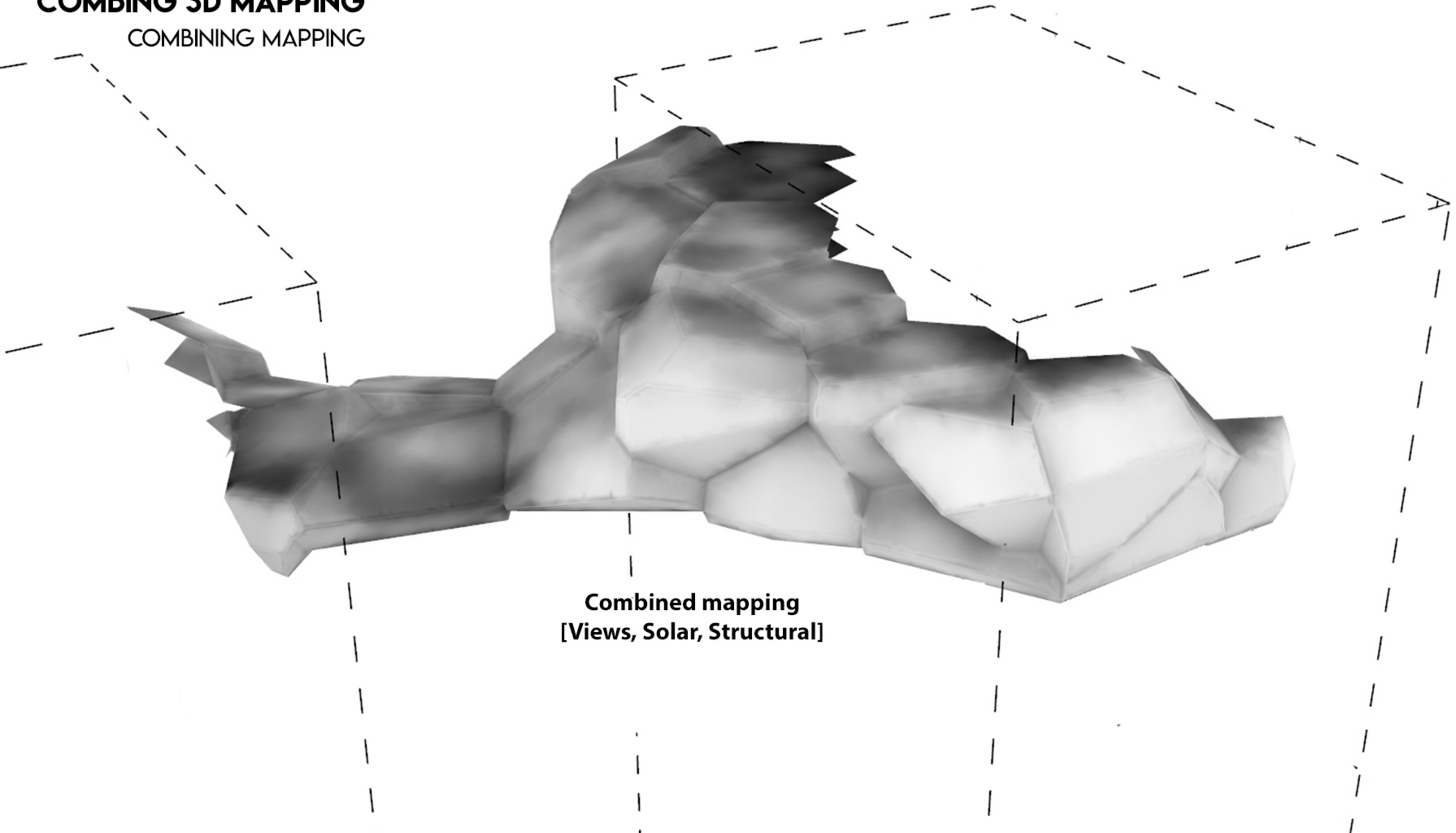
ENVIRONMENTAL MAPPING
SUNLIGHT HOURS



The geometry is mapped in sunlight hours
informing exterior porosities on daylight entry

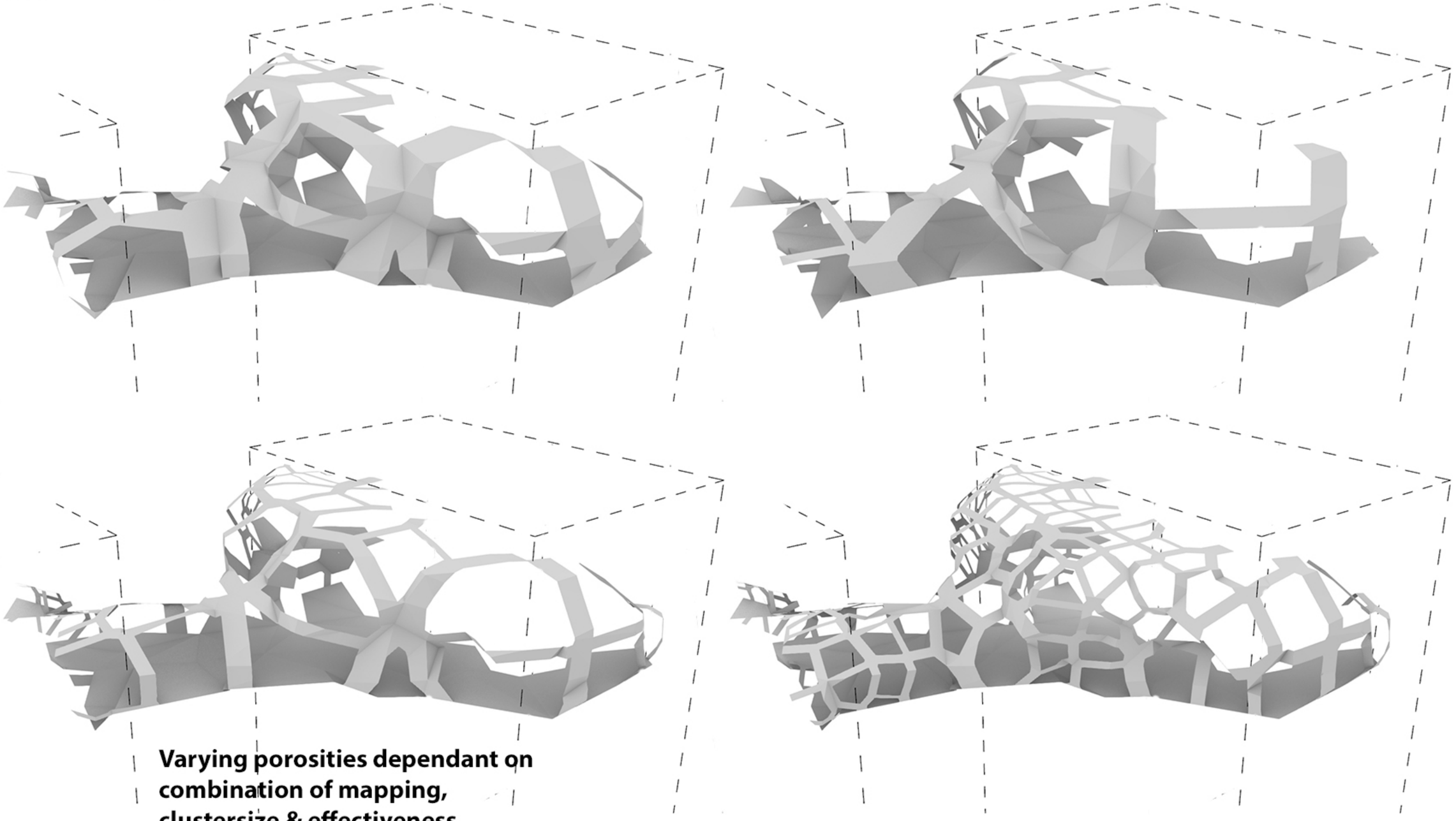
COMBING 3D MAPPING

COMBINING MAPPING



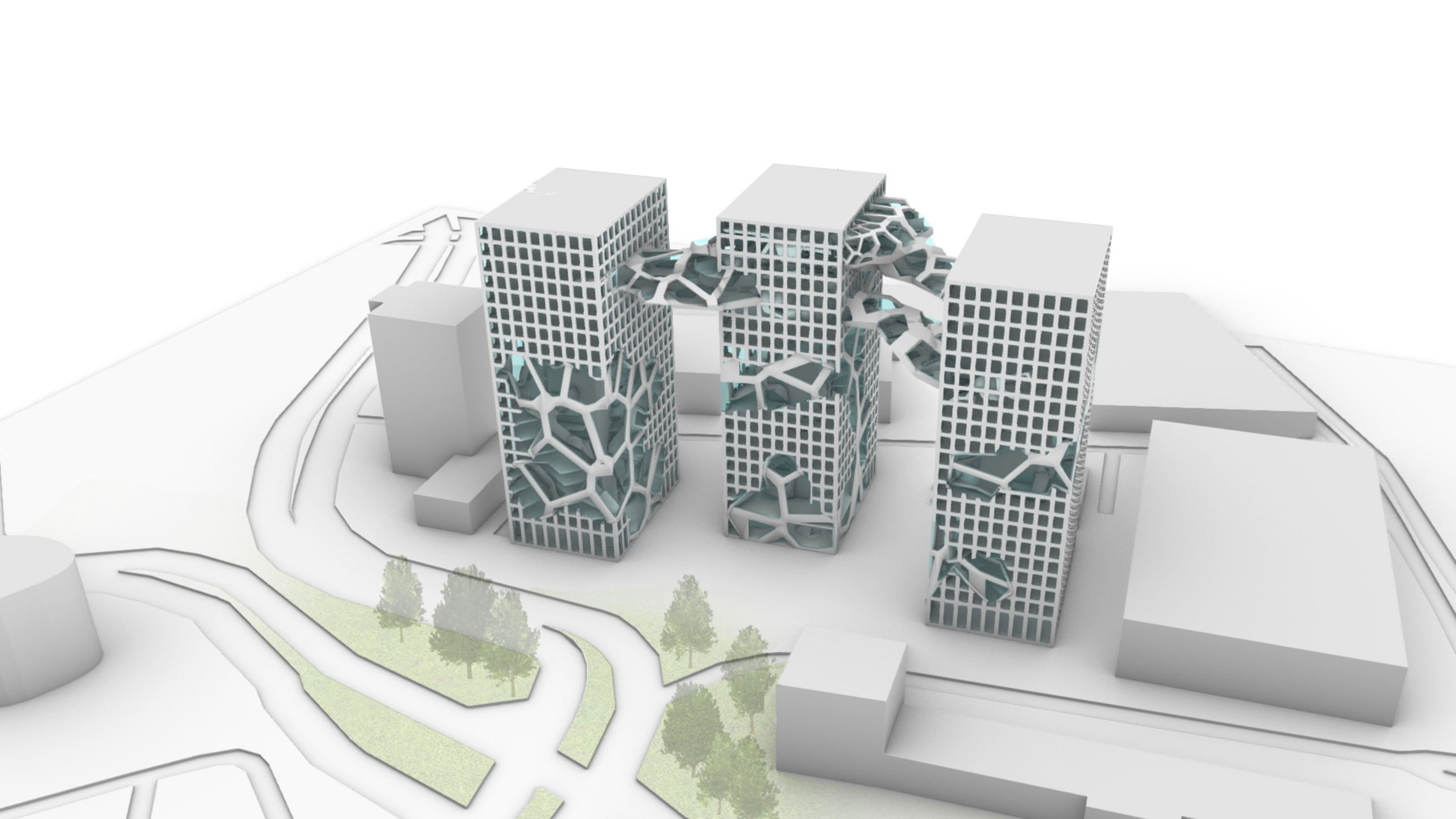
Combined mapping
[Views, Solar, Structural]

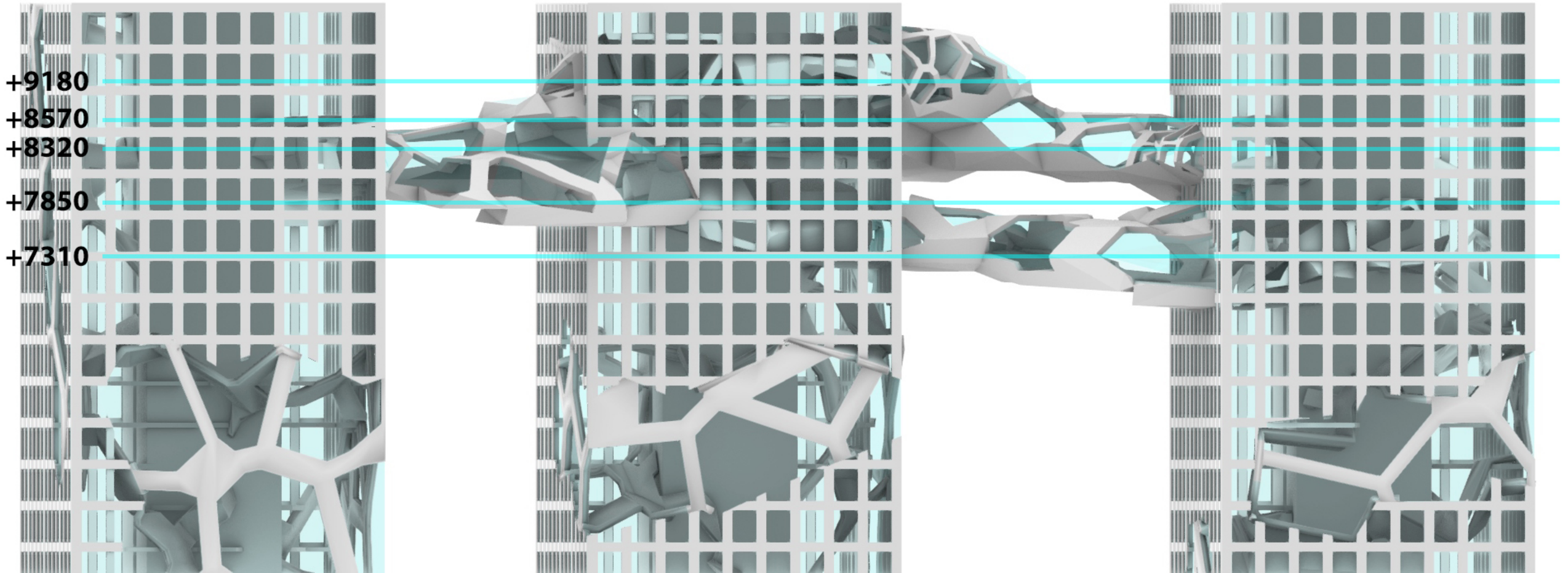
VARYING POROSITIES

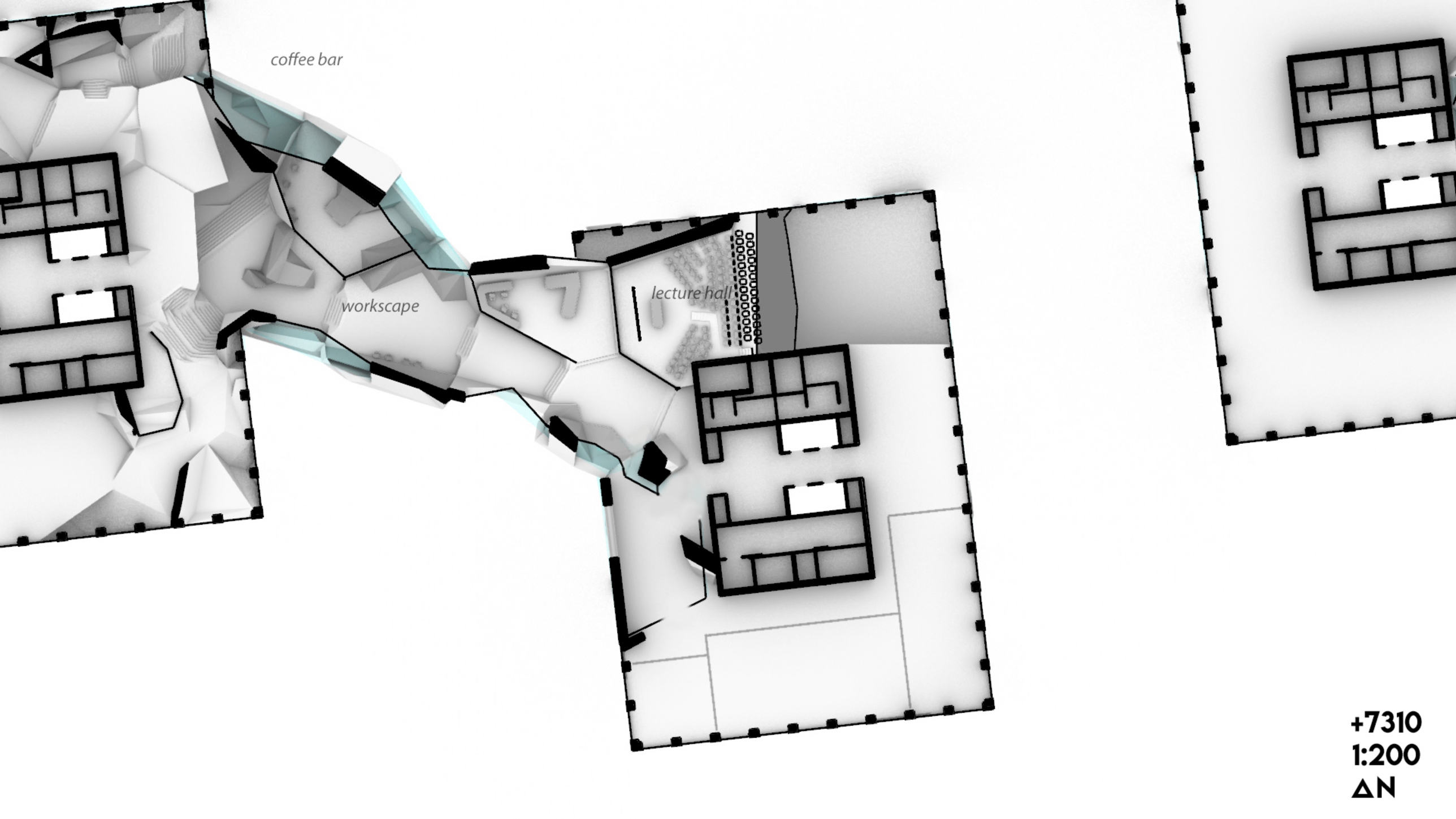


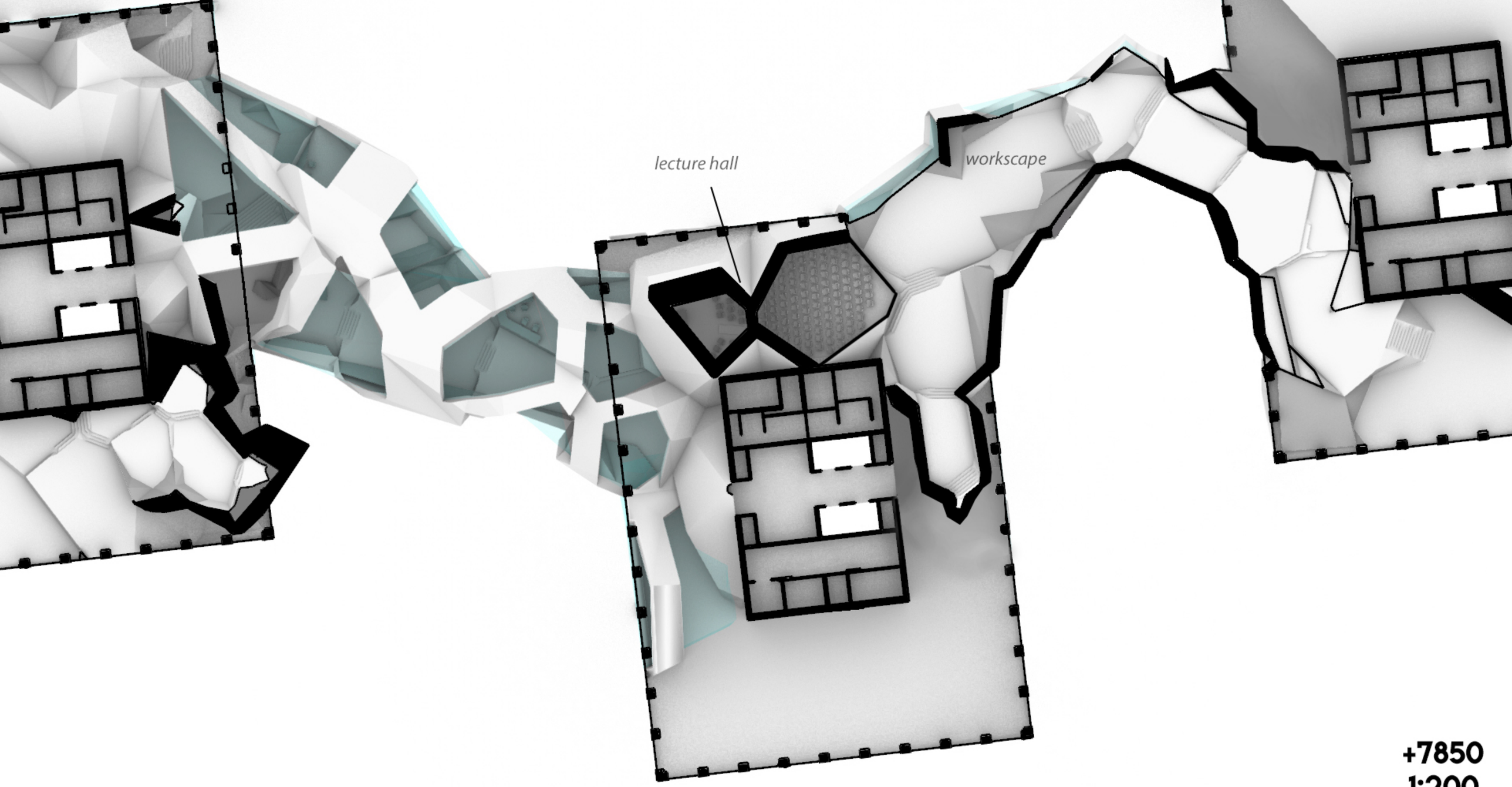
Varying porosities dependant on combination of mapping, clustersize & effectiveness

THE DESIGN



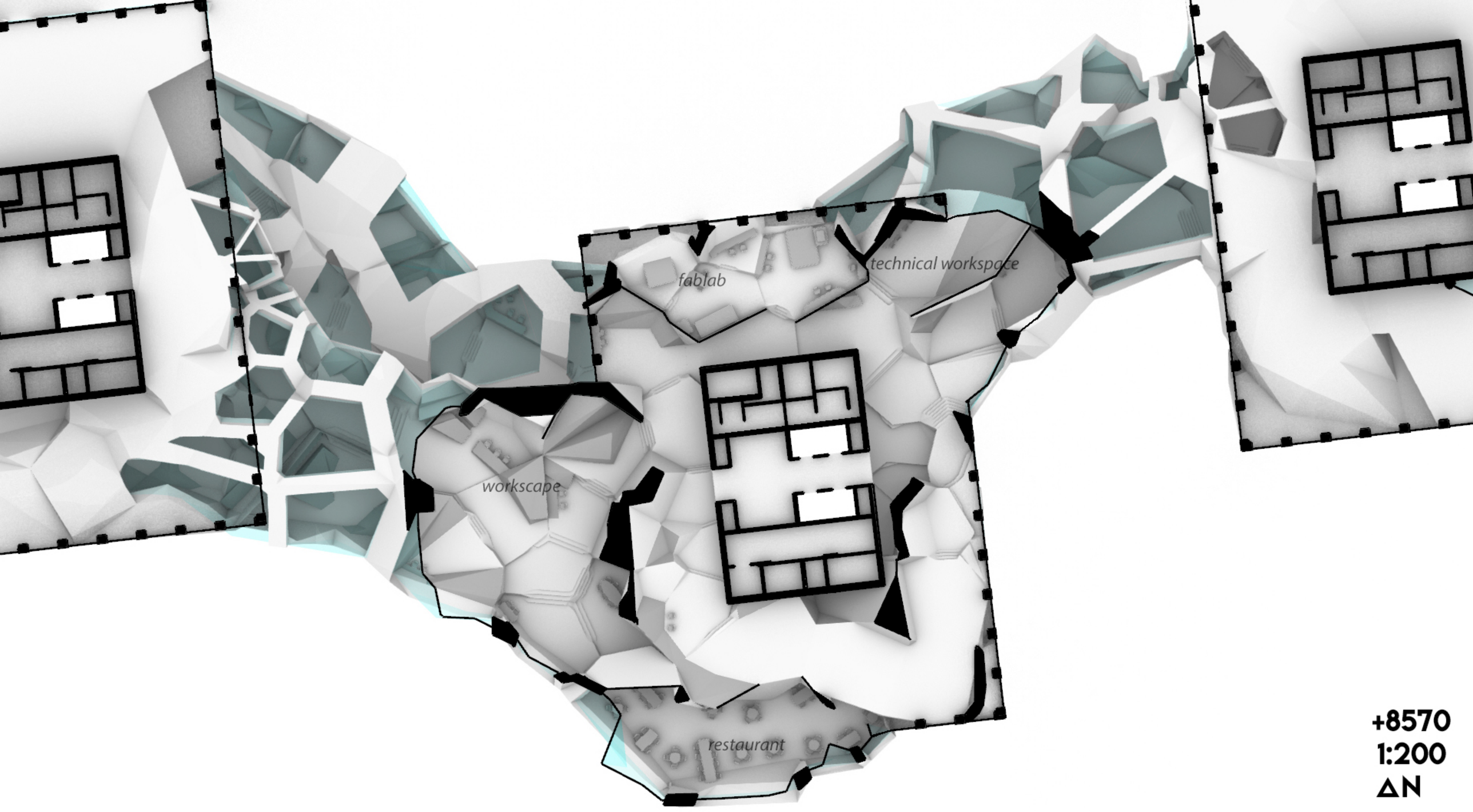

+9180
+8570
+8320
+7850
+7310


coffee bar
workscape
lecture hall
+7310
1:200
N

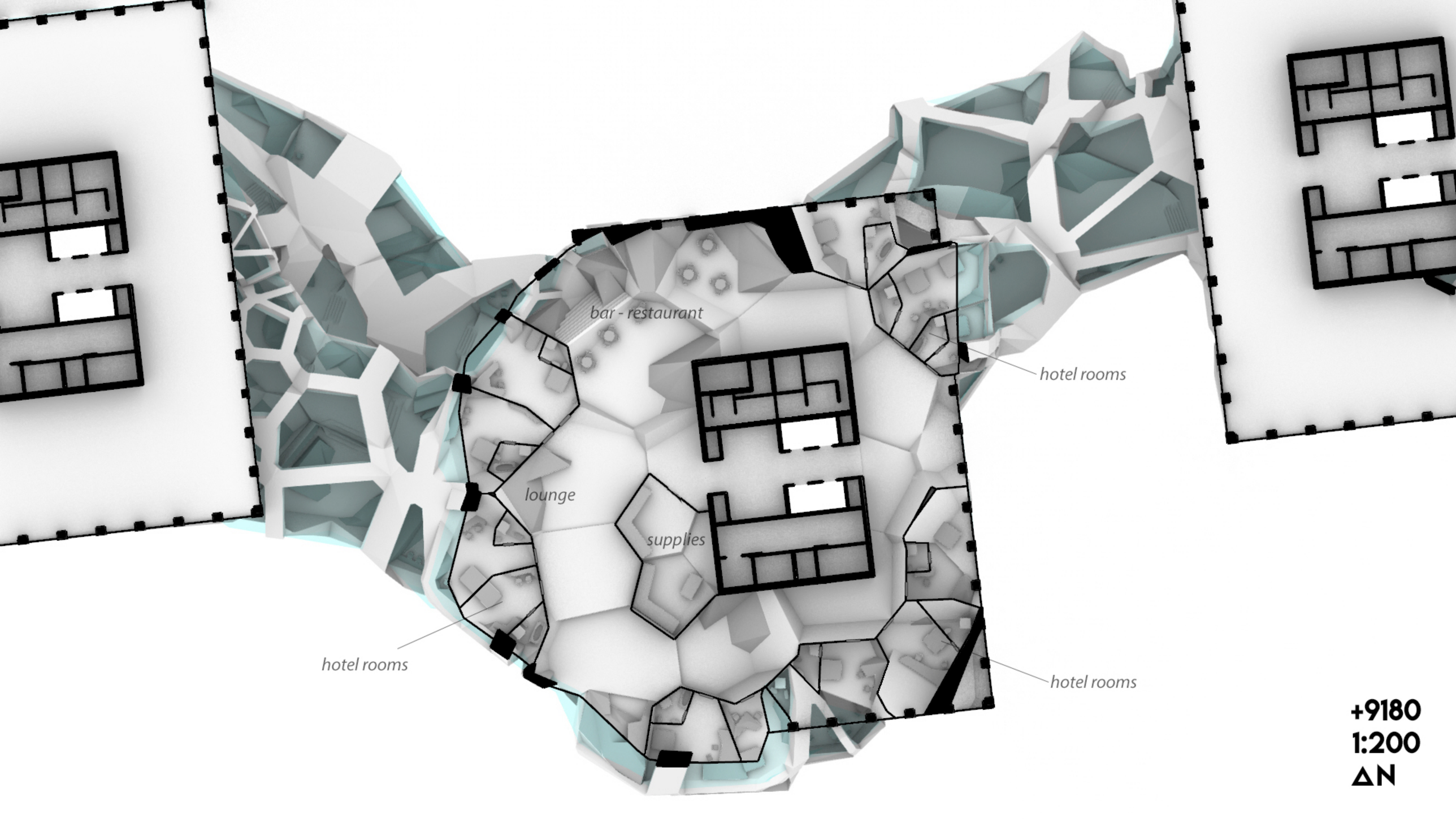


+7850
1:200
AN

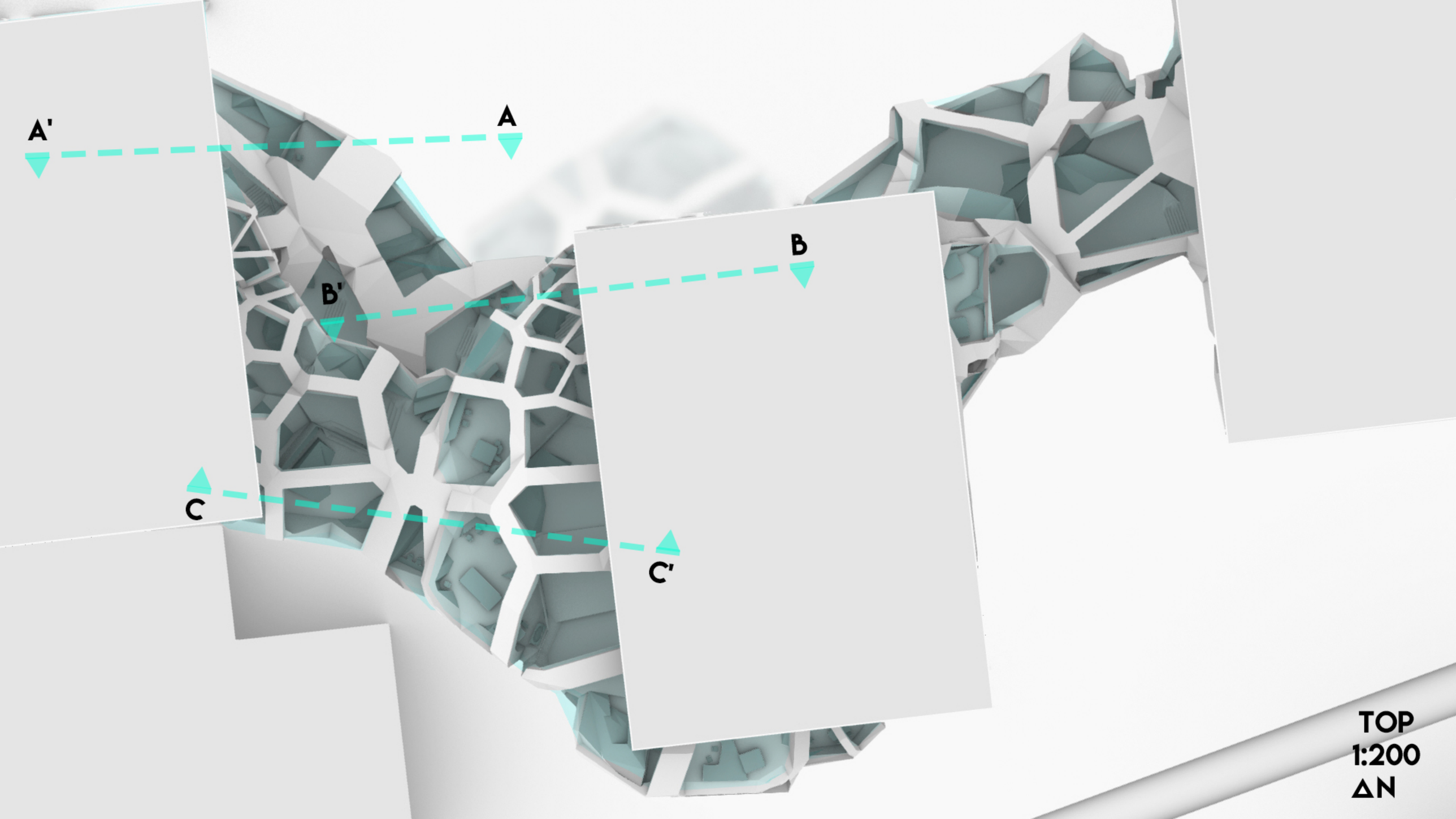

workscape
workscape
kitchen
storage
restaurant
+8320
1:200
N



+8570
1:200
AN

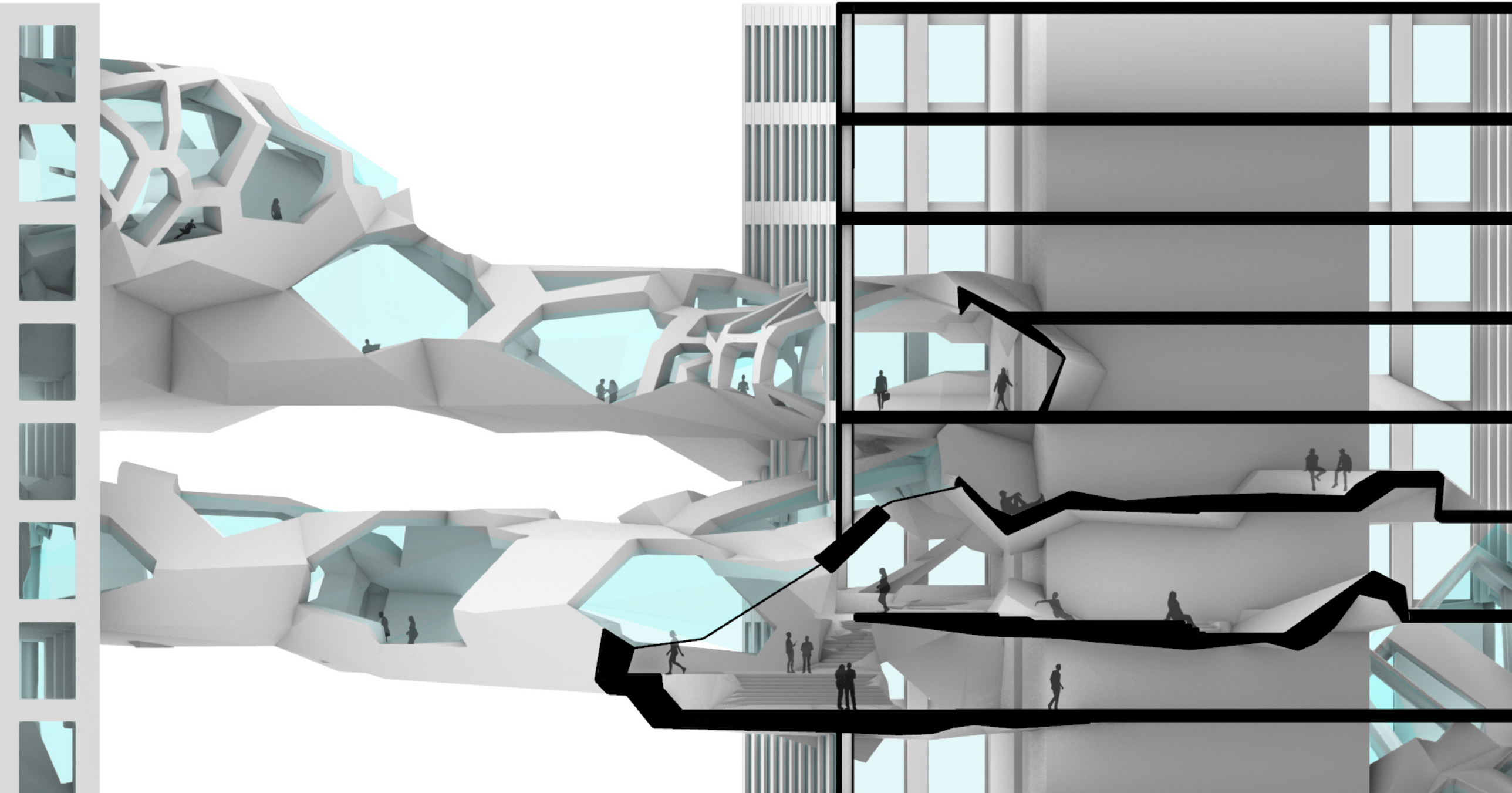

bar - restaurant
hotel rooms
lounge
supplies
hotel rooms
hotel rooms

+9180
1:200
△N


A'
A
B'
B
C
C'
TOP
1:200
N

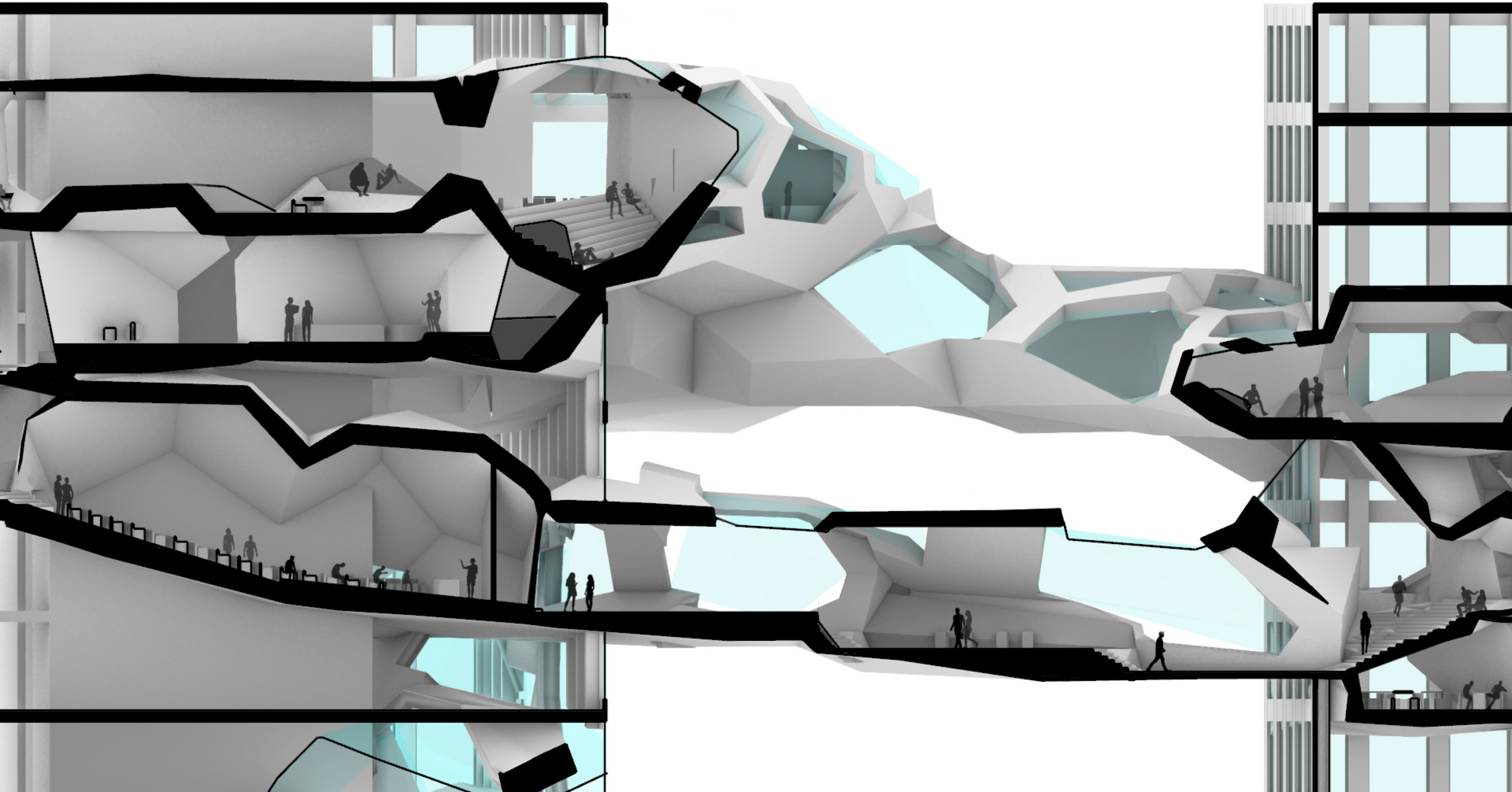
A-A'

1:100



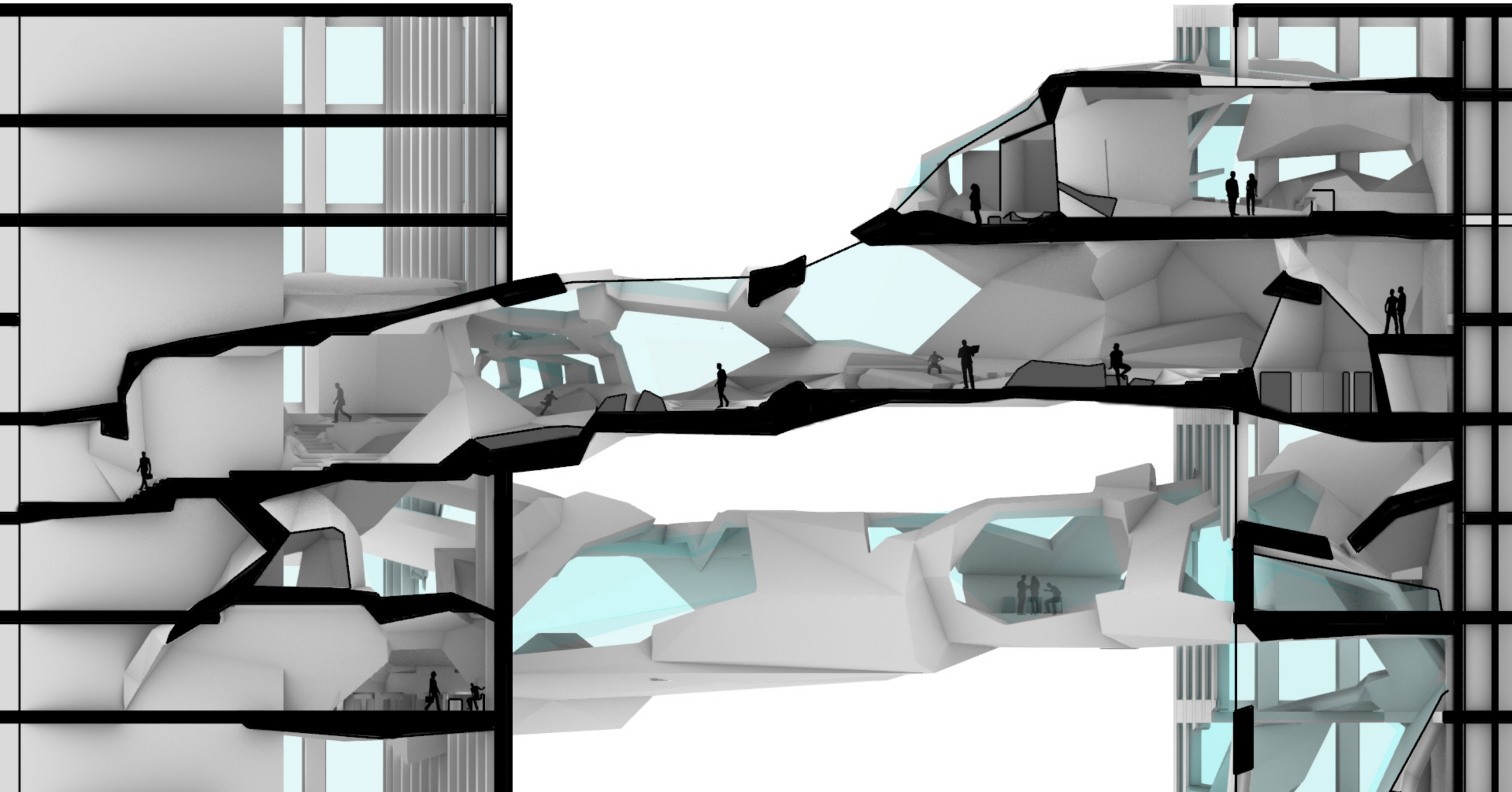
B-B'

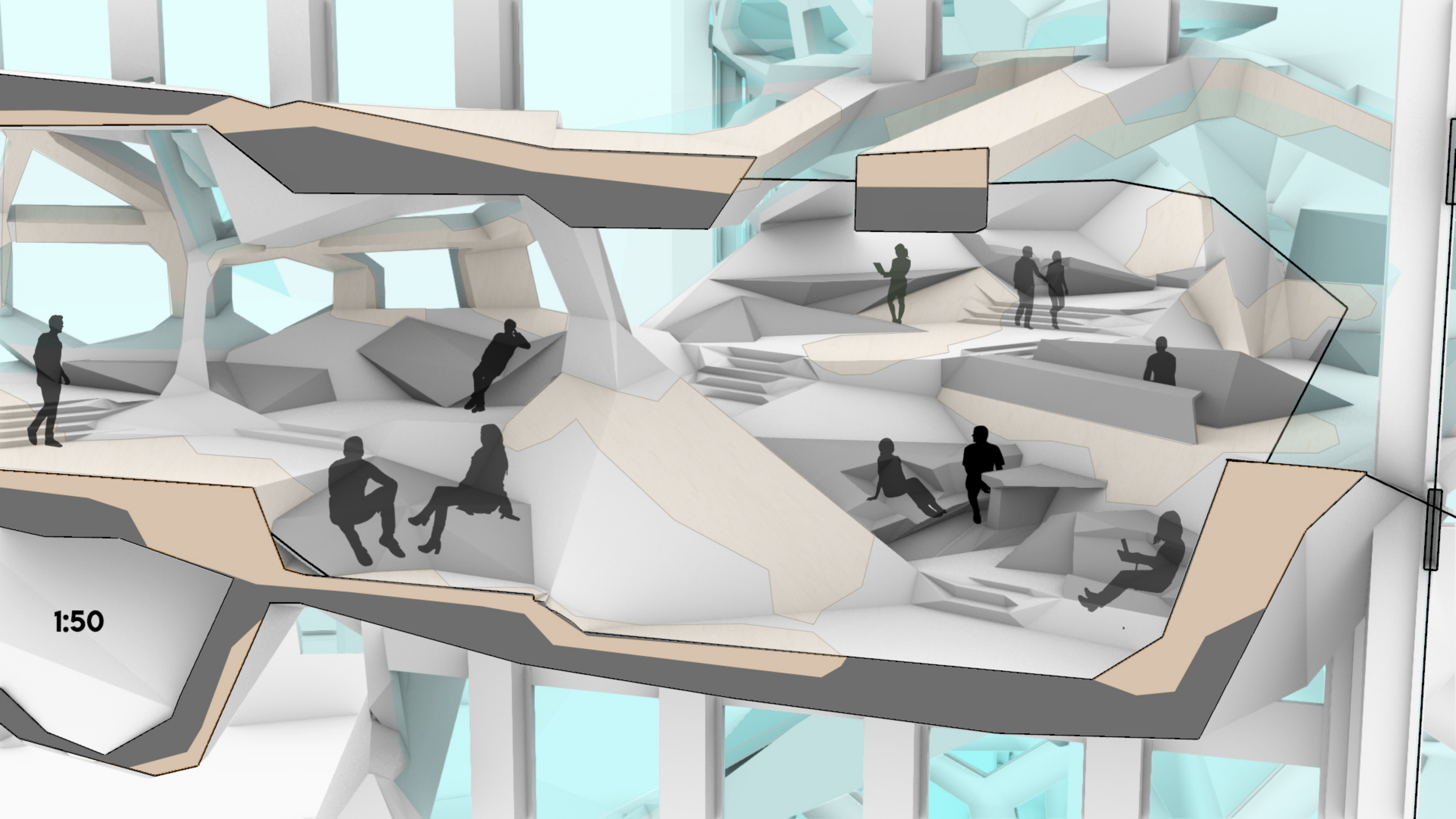
1:100



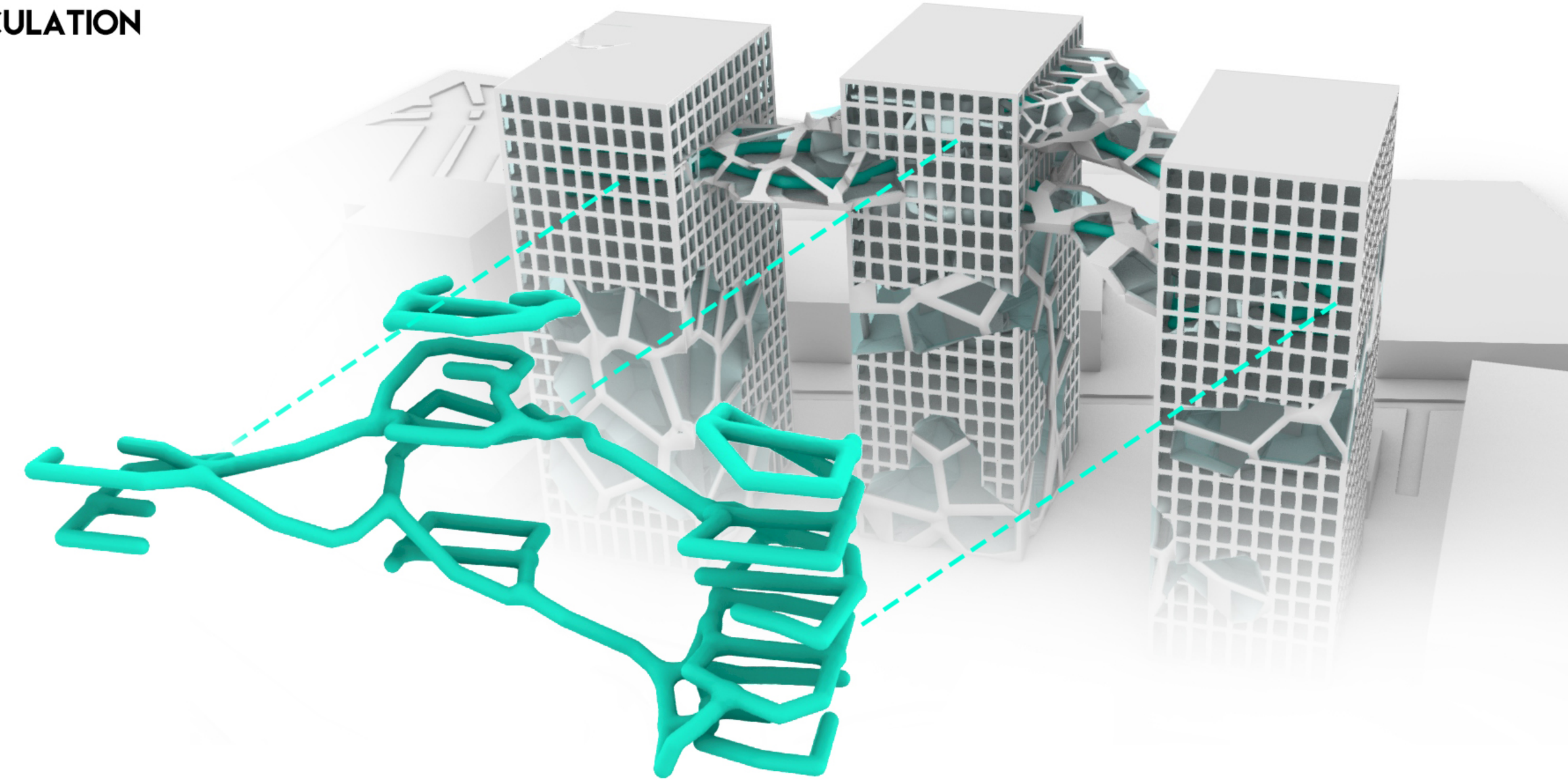
C-C'

1:100



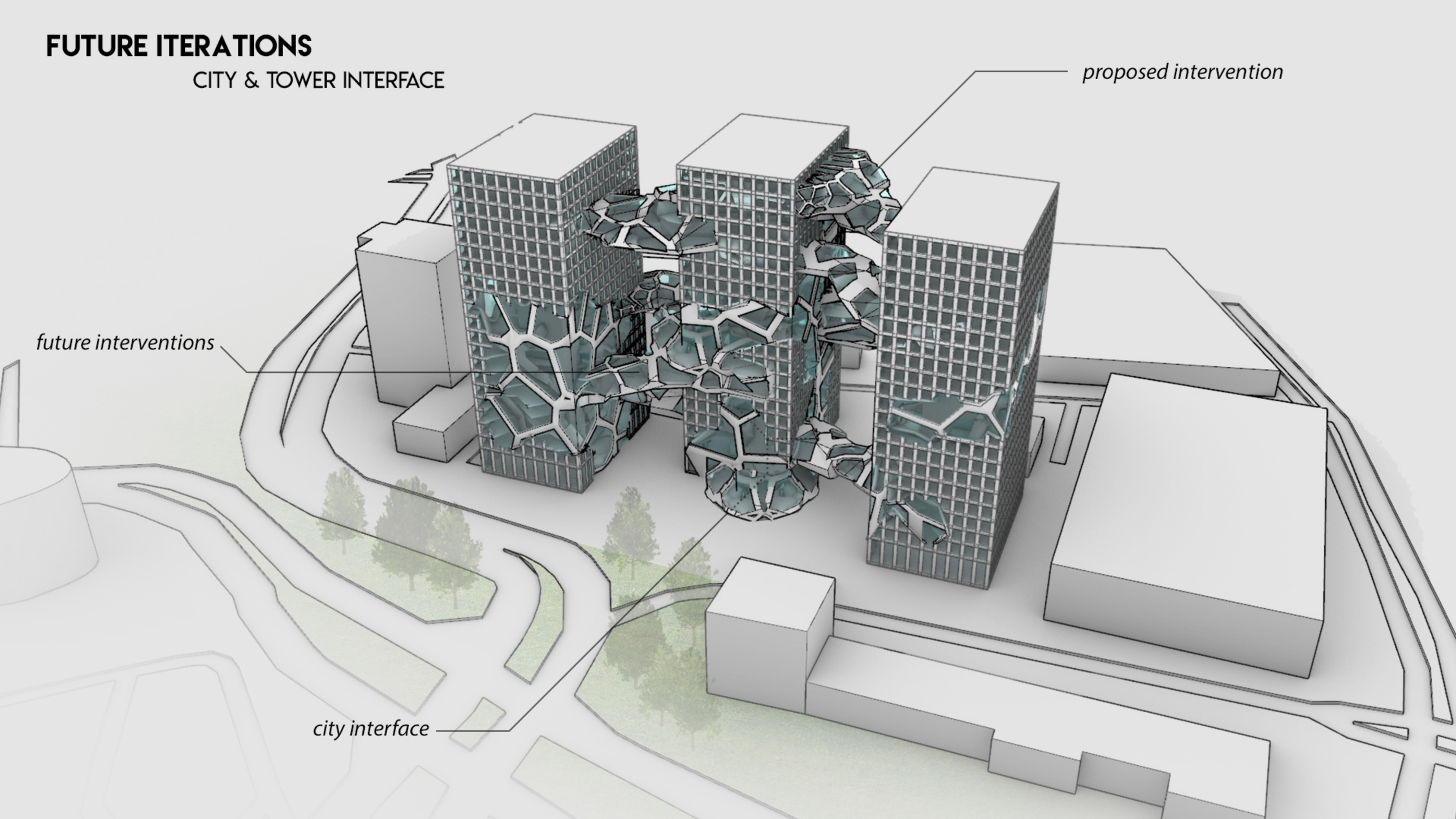

1:50

CIRCULATION



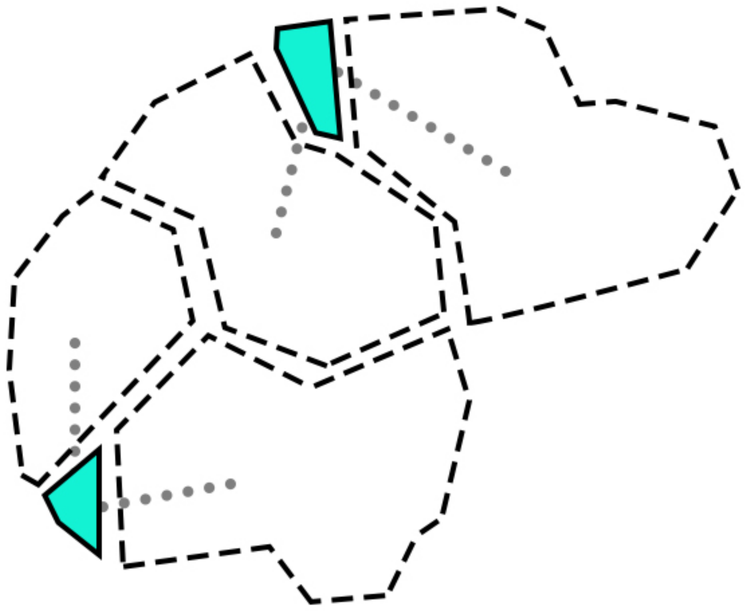
FUTURE ITERATIONS

CITY & TOWER INTERFACE

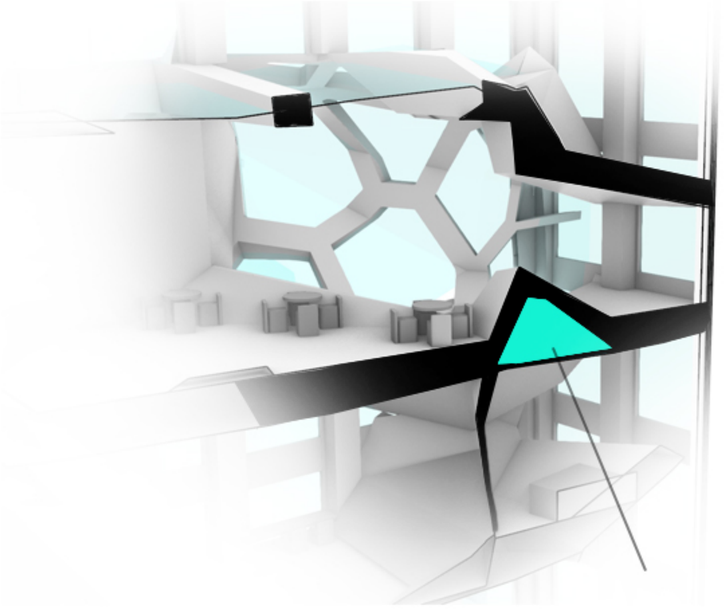


CLIMATE DESIGN

CLUSTERED REGULATION



Climate is controlled in local, activity based clusters



utilities placed in-between spaces

MATERIALS & FABRICATION

COMPOSITE MATERIALS
OBLIQUE QUALITIES

WOOD

Natural
Warm
Tension
Acoustic
Inviting

Cross laminated timber

Interior surfaces
Exterior surfaces
Structural

CONCRETE

Solid
Cool
Compression
Serious

3D printed concrete

FOAM

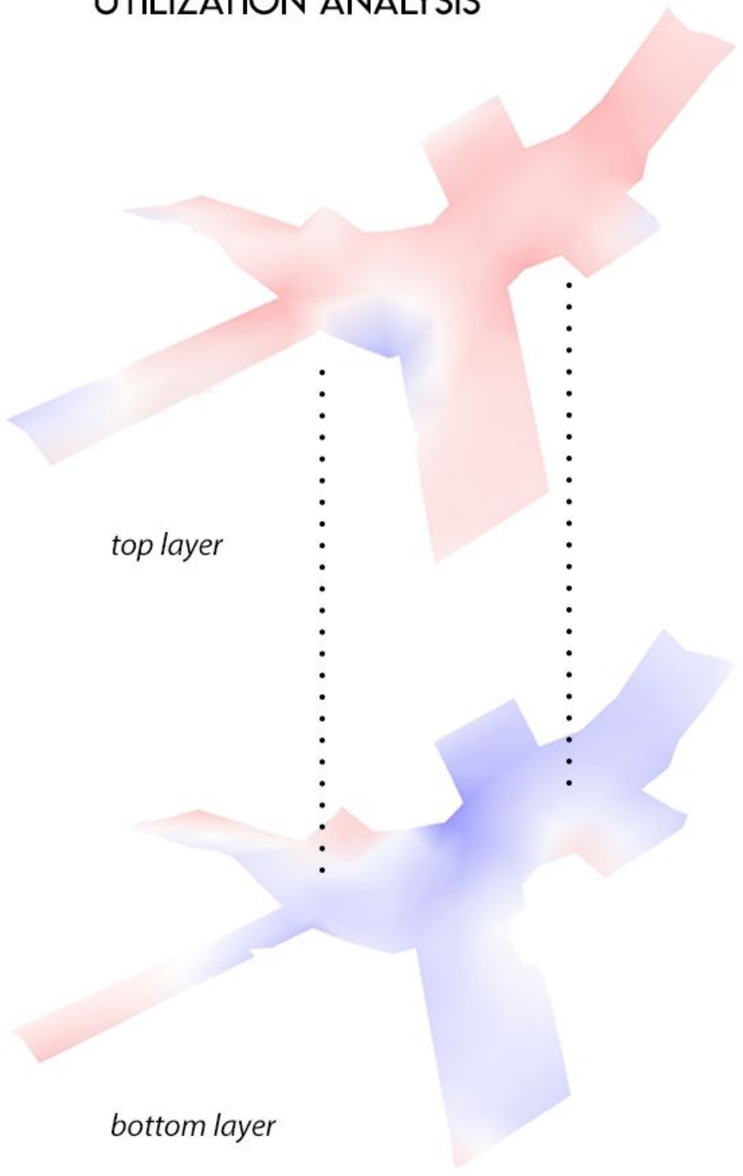
Soft
Tactile
Insulating
Acoustic
Playful
Comfort

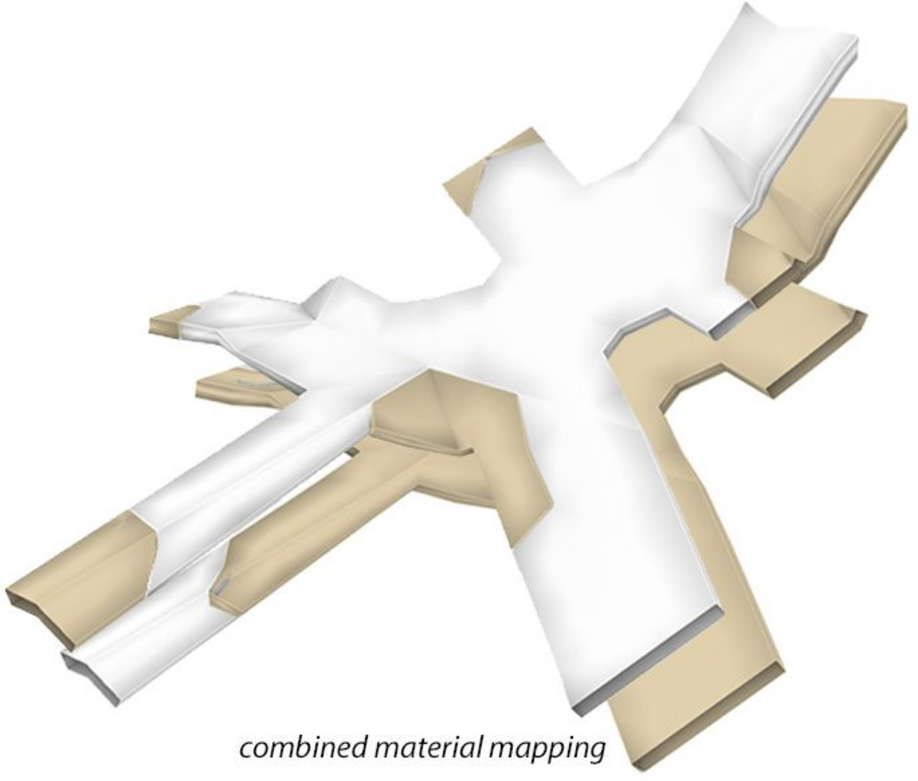
wirecut and milled foam/eps

Landscape furniture
seating
insulation

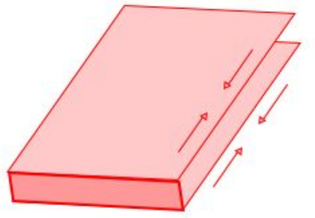
OBLIQUE COMPOSITE MATERIAL WITH TENSILE AND COMPRESSIVE STRENGTHS

MATERIAL MAPPING
UTILIZATION ANALYSIS

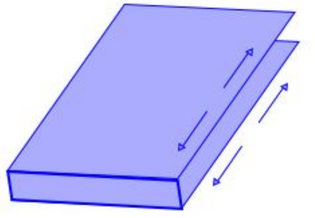




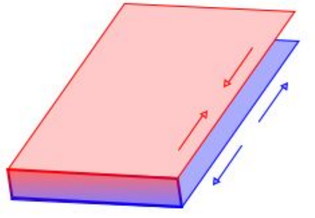
combined material mapping



Case 1: compression-compression

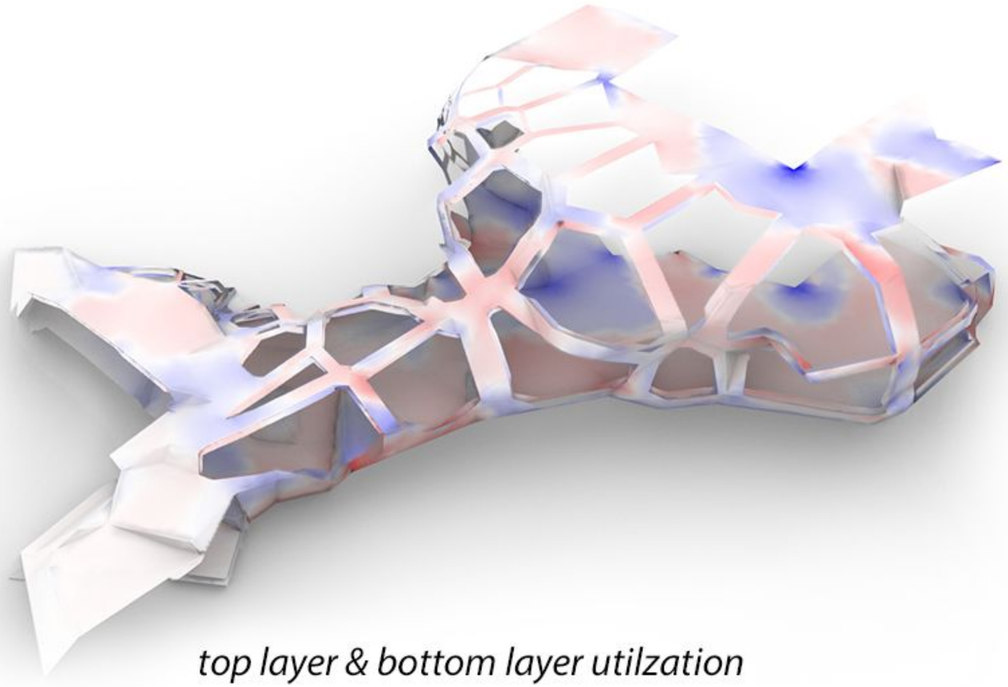


Case 2: tension-tension

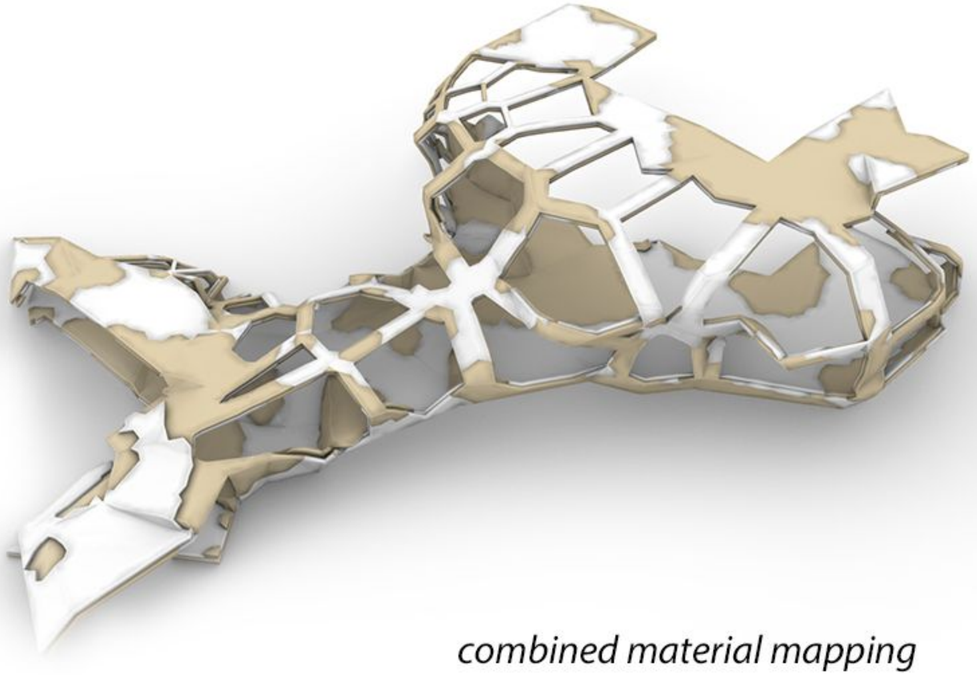


Case 3: compression-tension

MATERIAL MAPPING
UTILIZATION ANALYSIS

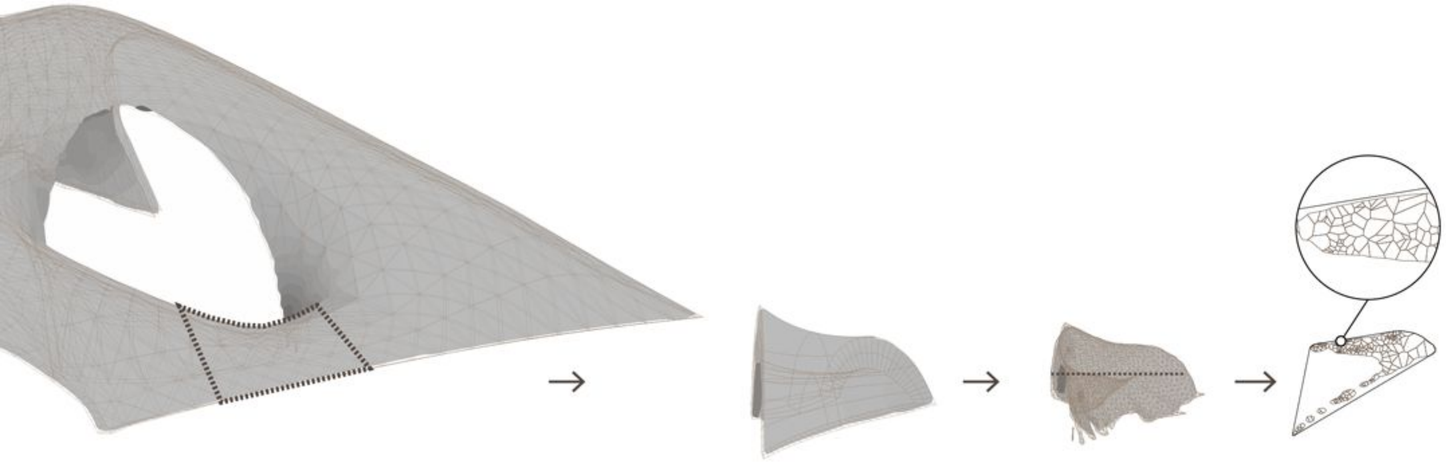


top layer & bottom layer utilzation

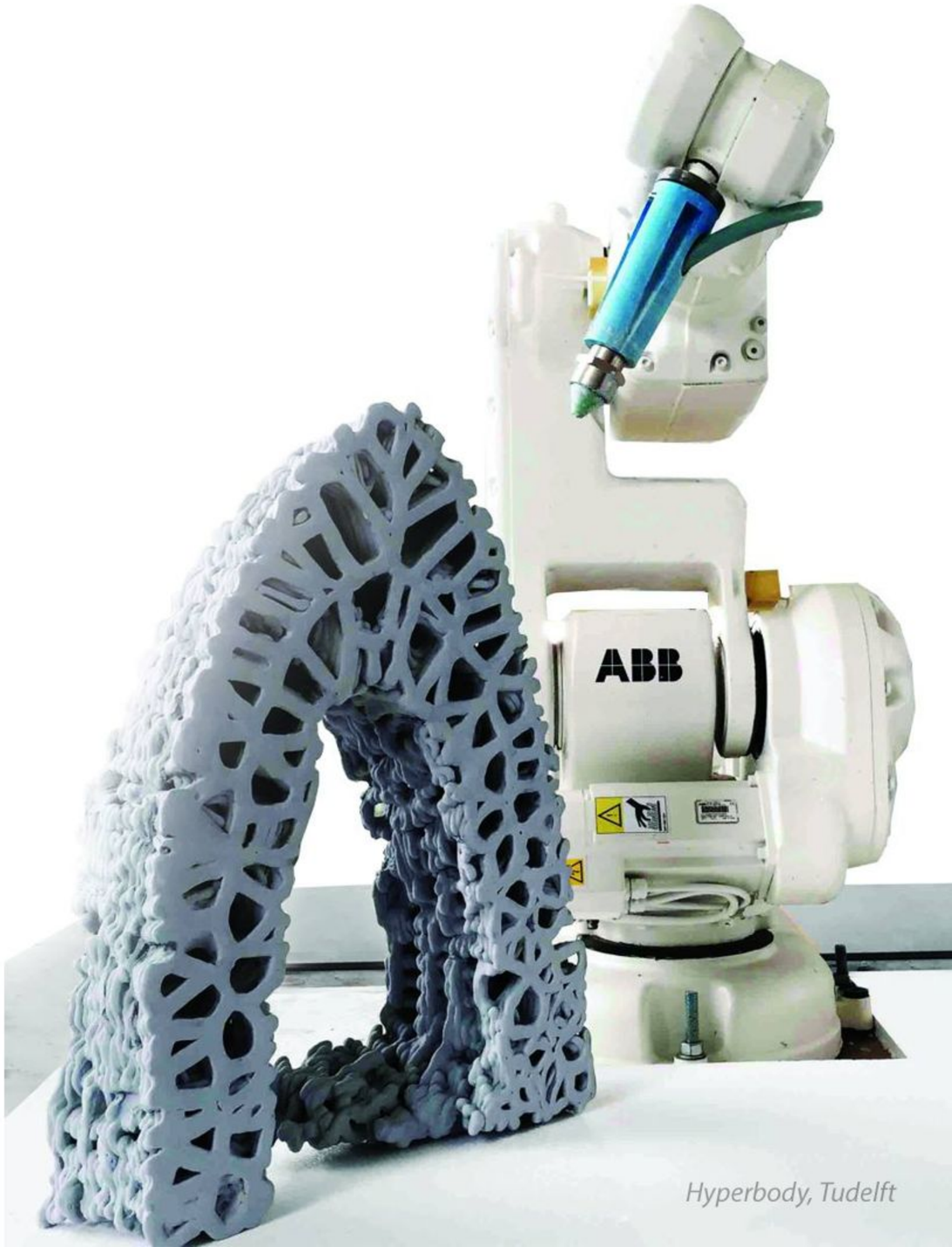


combined material mapping

3D PRINTING CONCRETE
SCALABLE POROSITY WORKSHOP

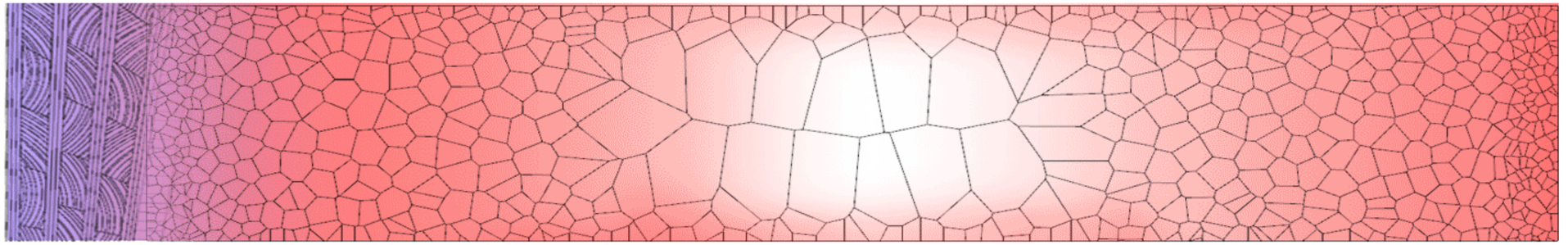


MACRO MESSO MICRO



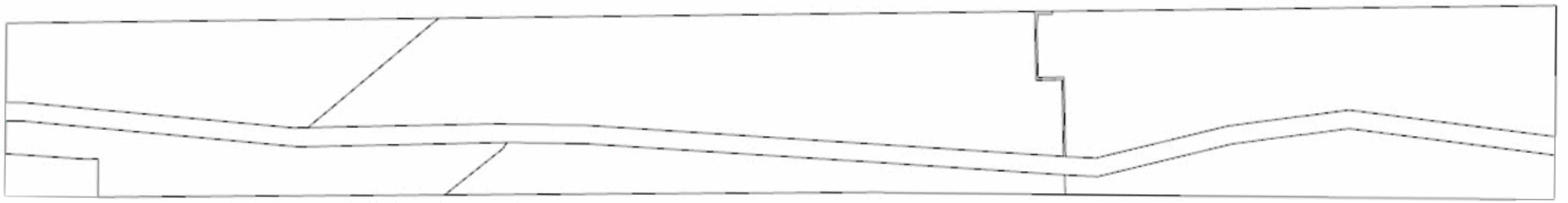
Hyperbody, Tudelft

POROSITY PATTERN CONCRETE

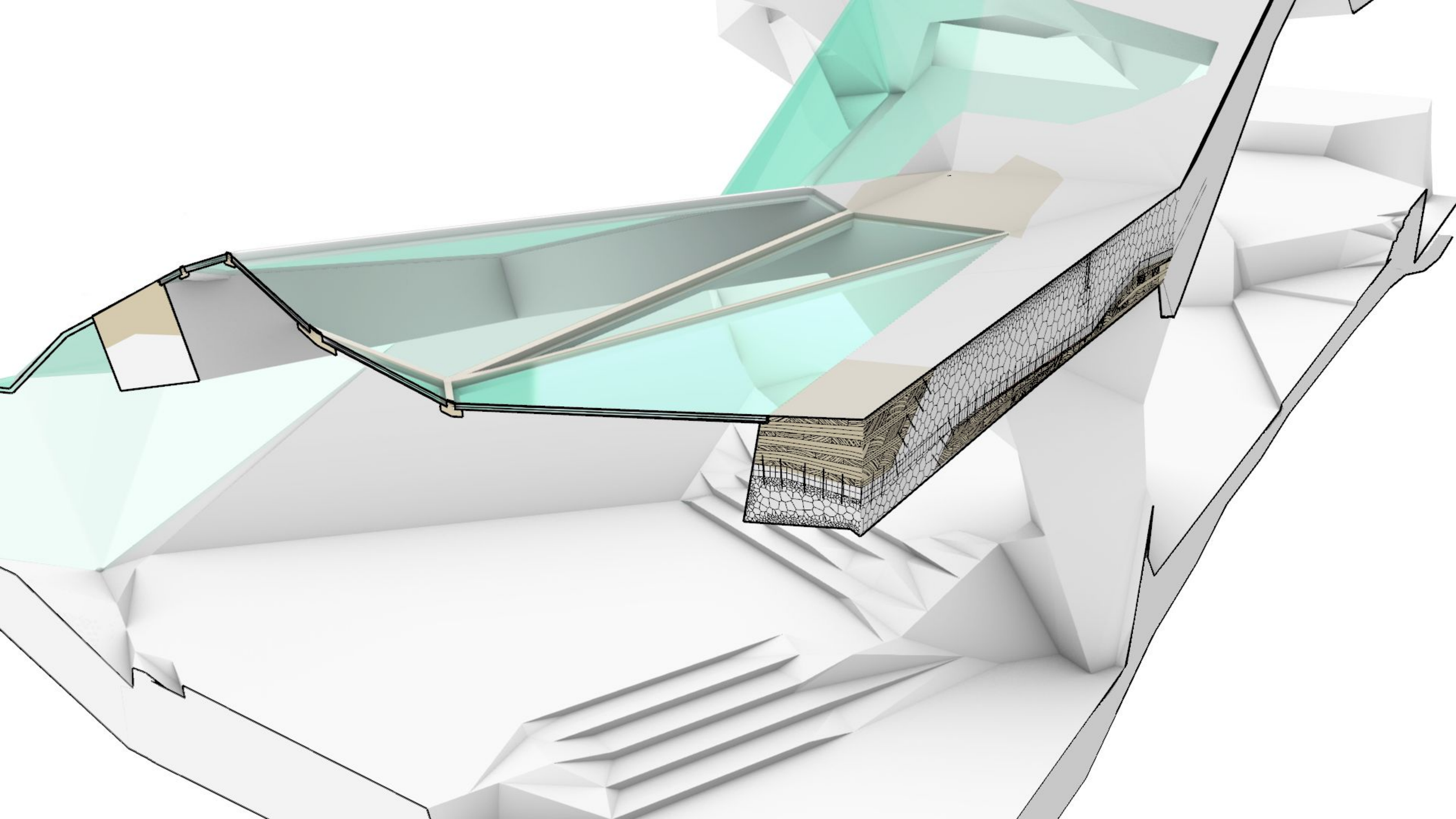


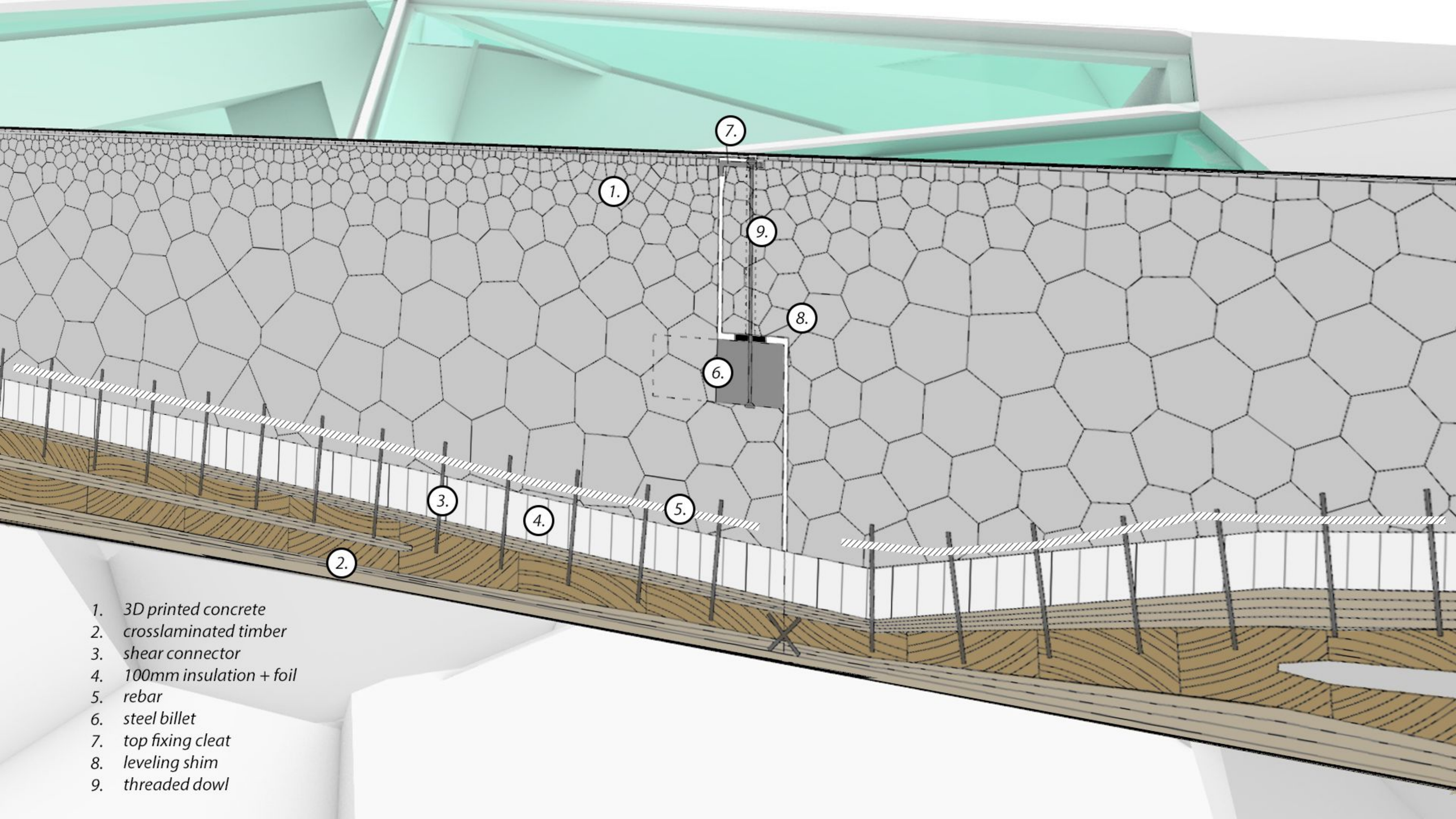
tension —— —— *compression* ——

% utilization/stresses determine the density pattern of the concrete

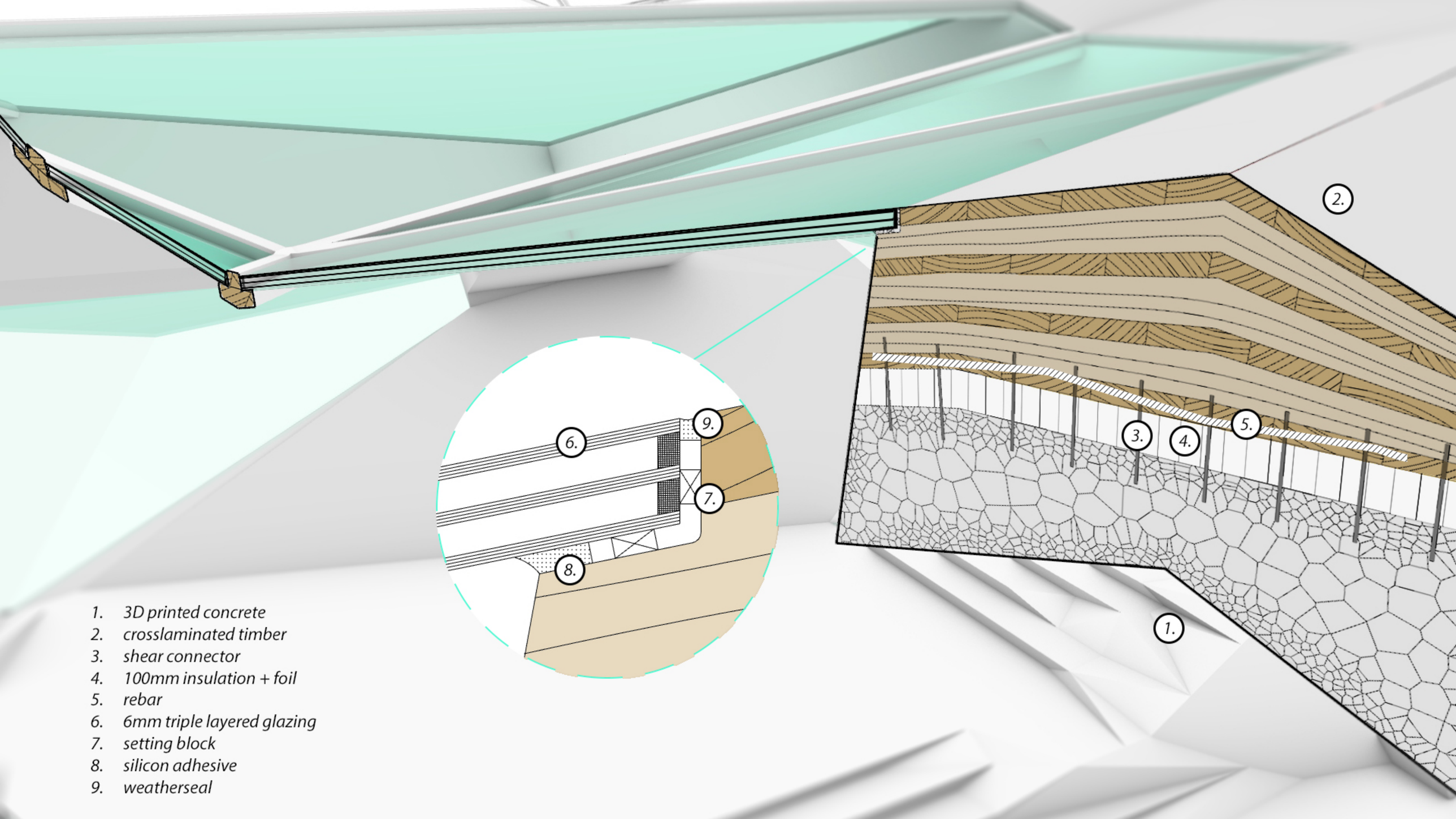


Section of composite fragment



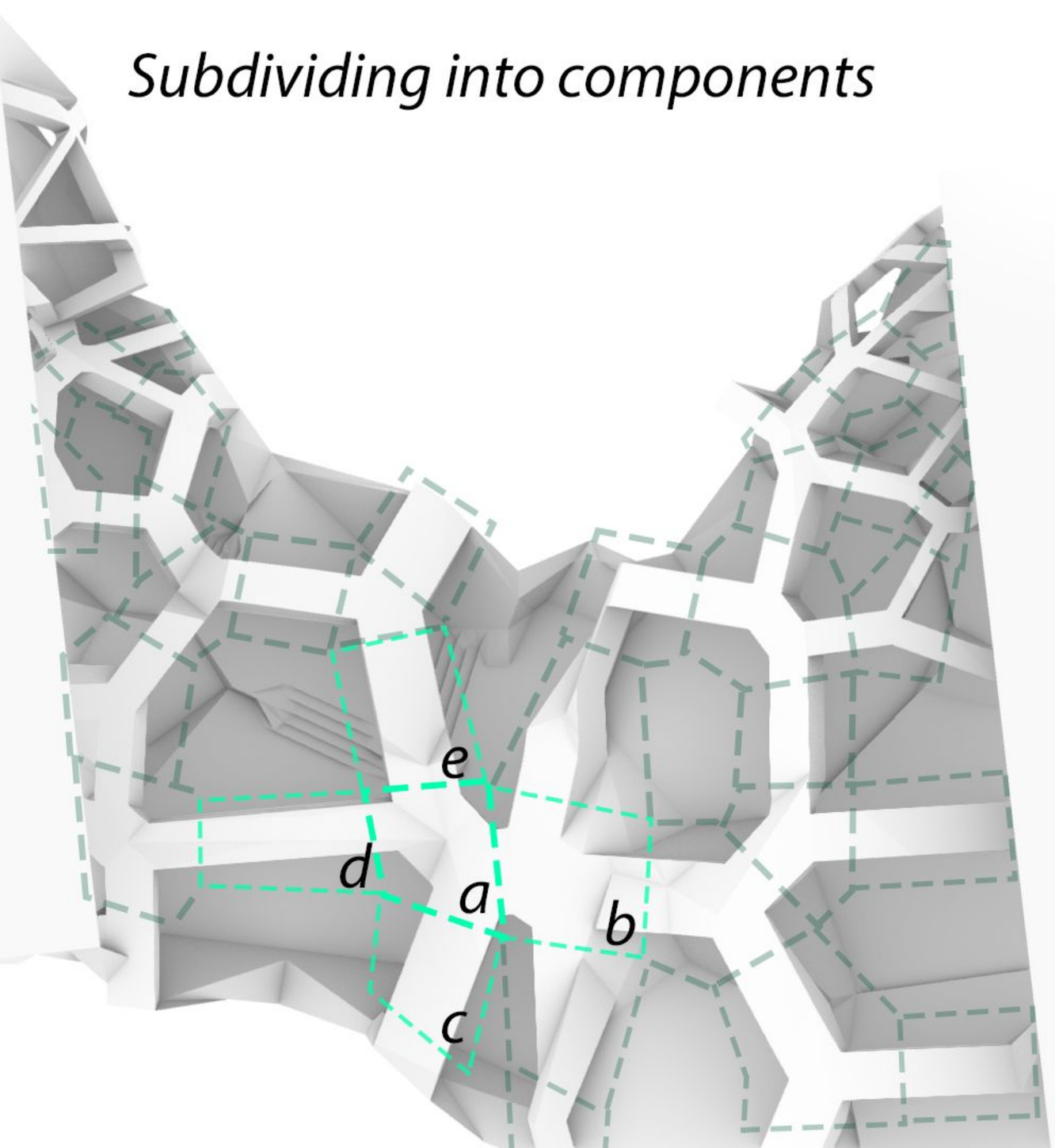


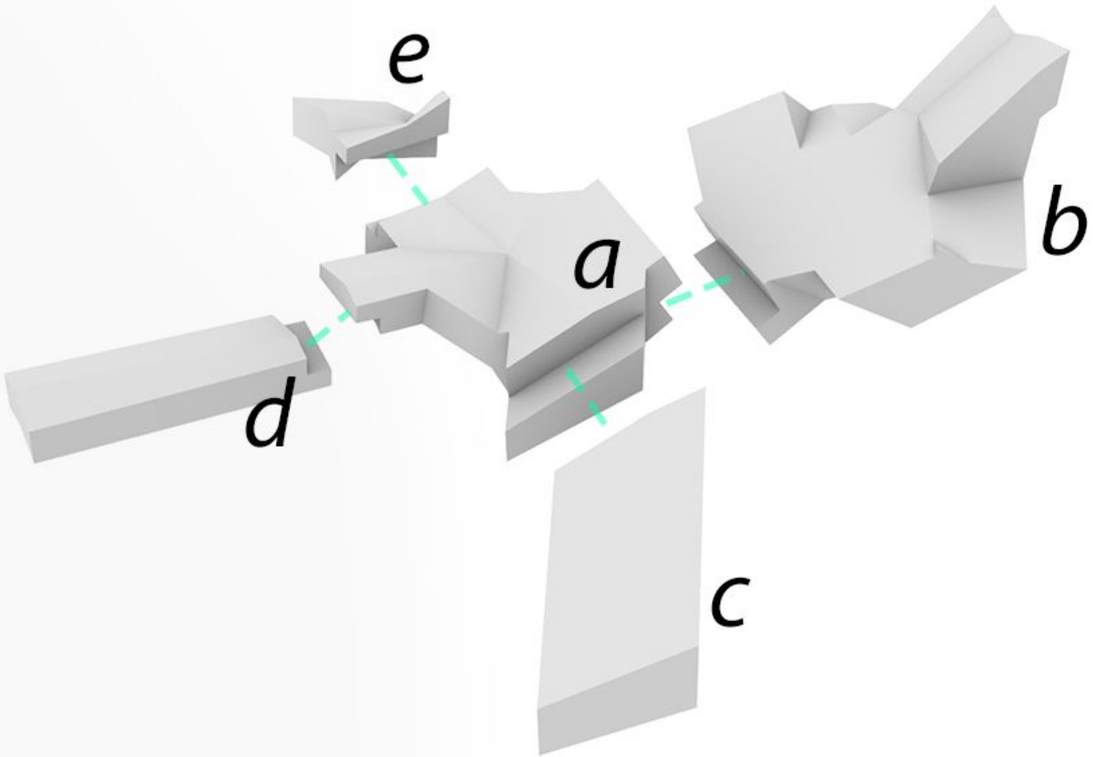
1. *3D printed concrete*
2. *crosslaminated timber*
3. *shear connector*
4. *100mm insulation + foil*
5. *rebar*
6. *steel billet*
7. *top fixing cleat*
8. *leveling shim*
9. *threaded dowl*



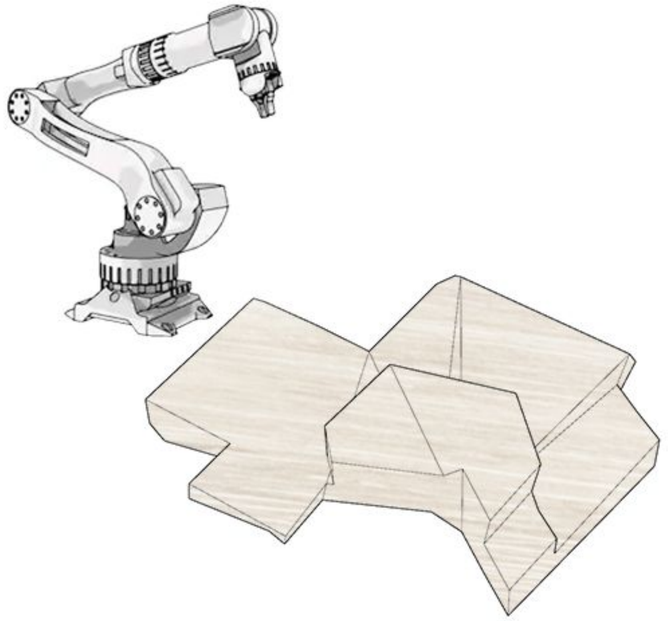
1. *3D printed concrete*
2. *crosslaminated timber*
3. *shear connector*
4. *100mm insulation + foil*
5. *rebar*
6. *6mm triple layered glazing*
7. *setting block*
8. *silicon adhesive*
9. *weatherseal*

Subdividing into components

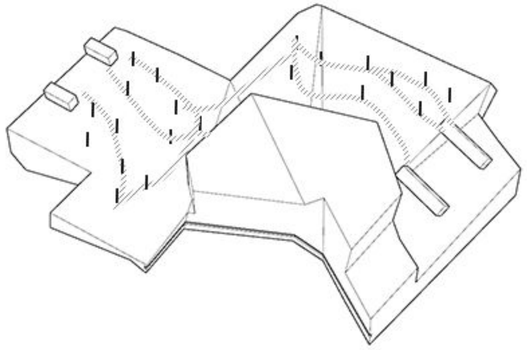




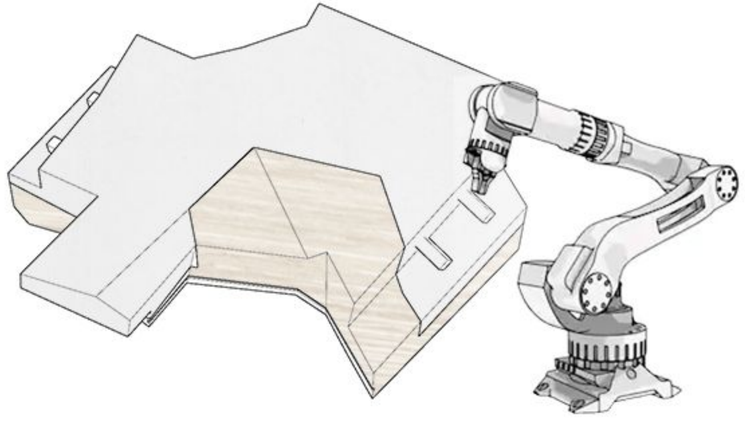
ROBOTIC PRODUCTION



lamination and CNC milling of timber

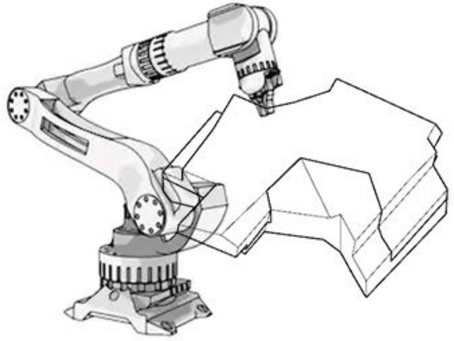


embedding connector hardware, rebar & insulation

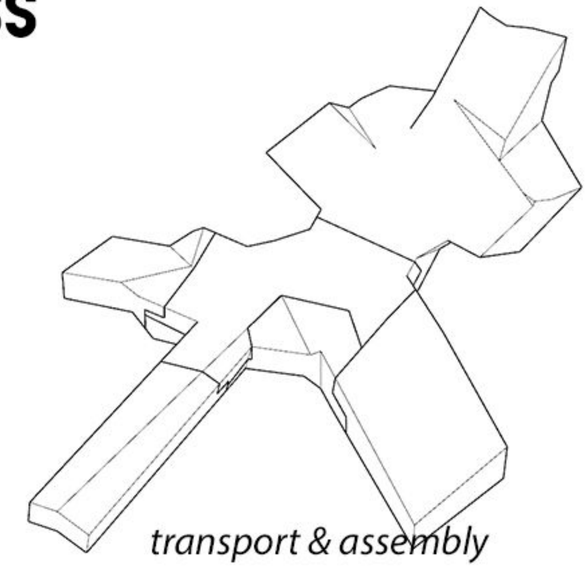


printing the concrete

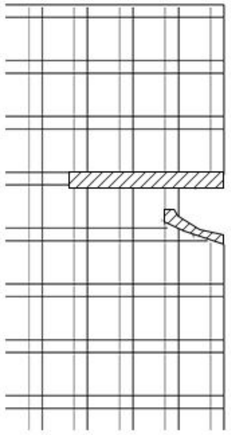
CONSTRUCTION PROCESS

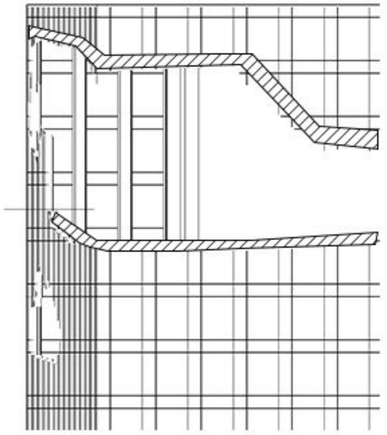


component prefrabication

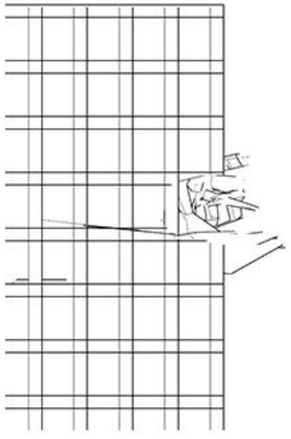


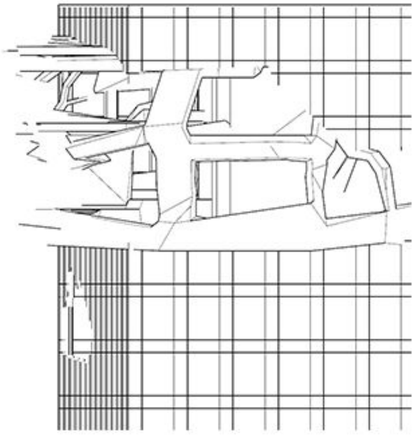
transport & assembly



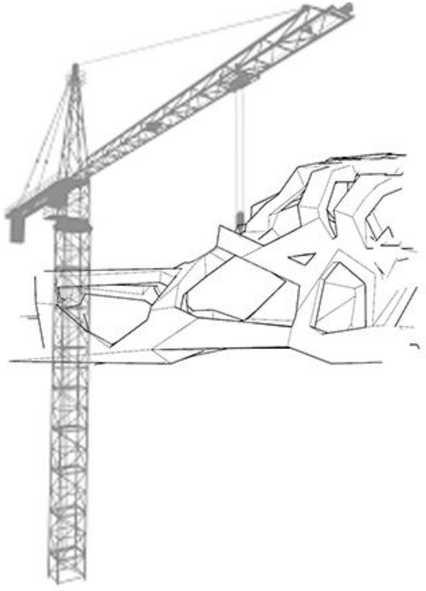


demolition & temporary support structure

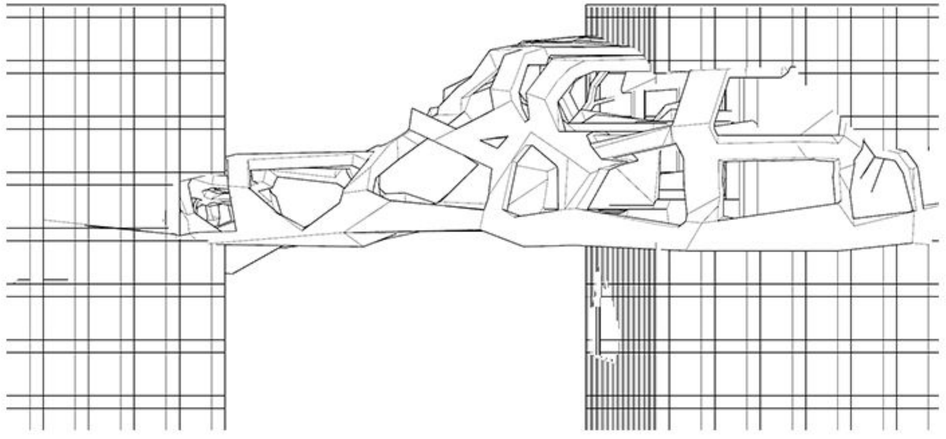




replacing structural integrity towers



assembly and positioning bridges



connecting bridges & towers


THANK YOU