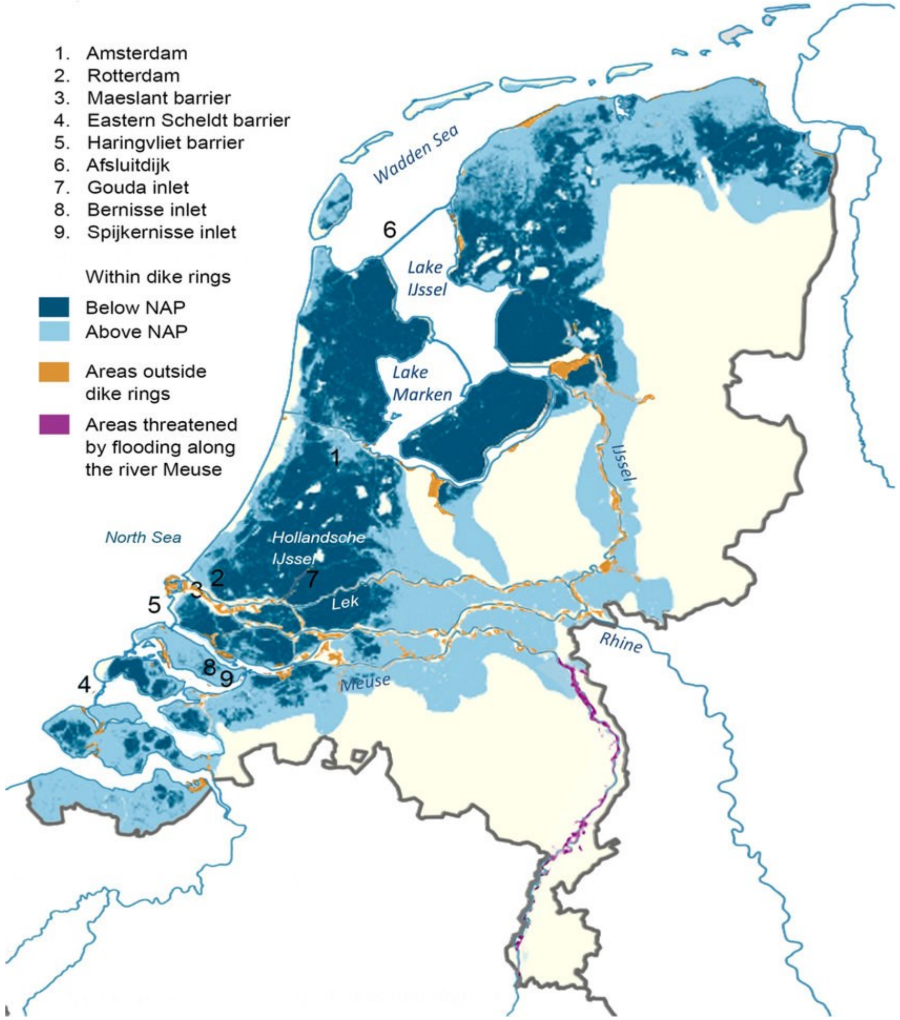
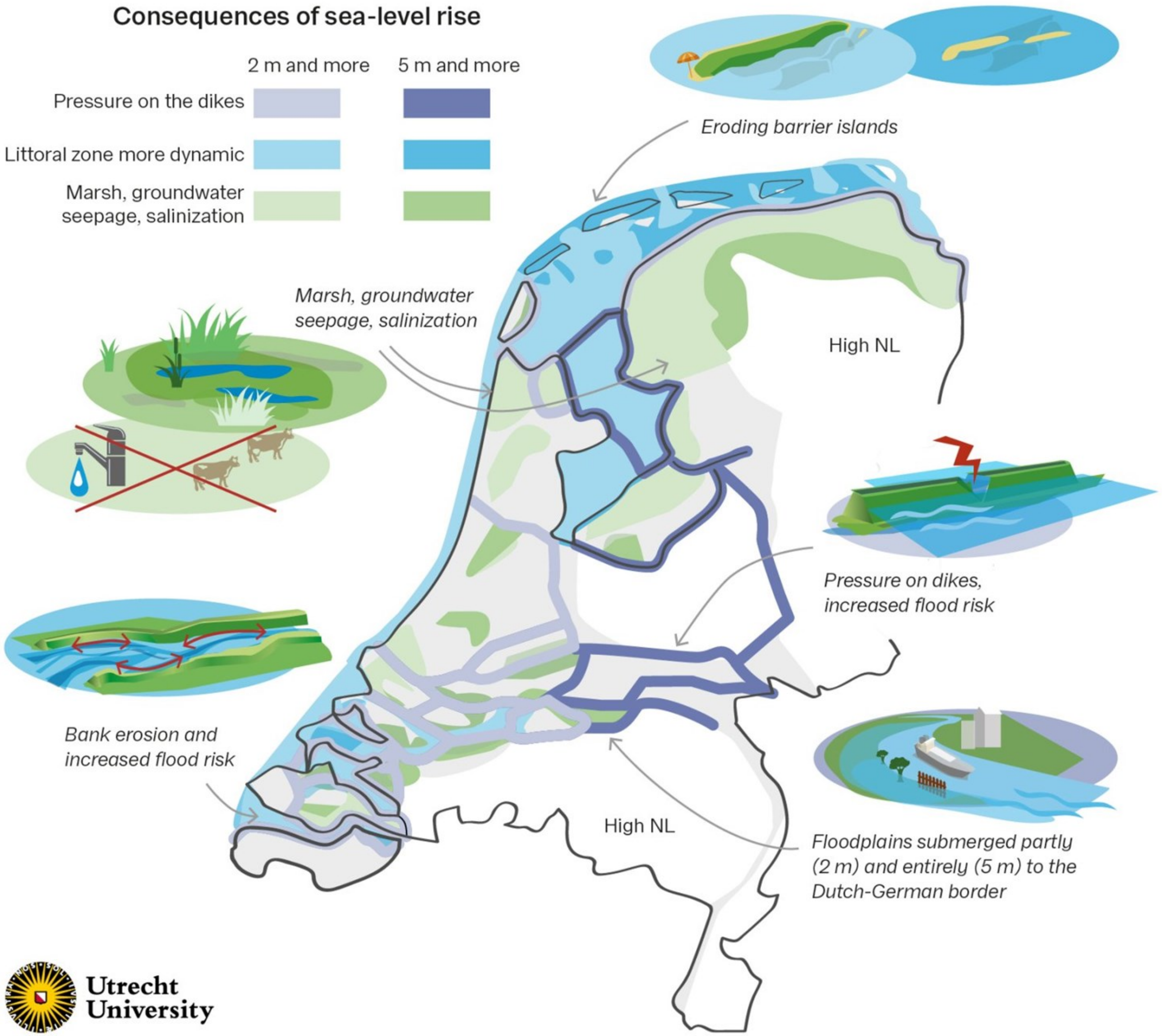
From a Dike House to Dike Architecture

Ann Ayad
19-6-2024
P5

The Netherlands & its Future


1. Amsterdam
2. Rotterdam
3. Maeslant barrier
4. Eastern Scheldt barrier
5. Haringvliet barrier
6. Afsluitdijk
7. Gouda inlet
8. Bernisse inlet
9. Spijkernisse inlet
Within dike rings
Below NAP
Above NAP
Areas outside dike rings
Areas threatened by flooding along the river Meuse
Wadden Sea
Lake IJssel
Lake Marken
IJssel
North Sea
Hollandsche IJssel
Lek
Rhine
Meuse
1
2
3
4
5
6
7
8
9

Consequences of sea-level rise



	2 m and more	5 m and more
Pressure on the dikes	▨	▨
Littoral zone more dynamic	▨	▨
Marsh, groundwater seepage, salinization	🟩	🟩

Eroding barrier islands

Marsh, groundwater seepage, salinization

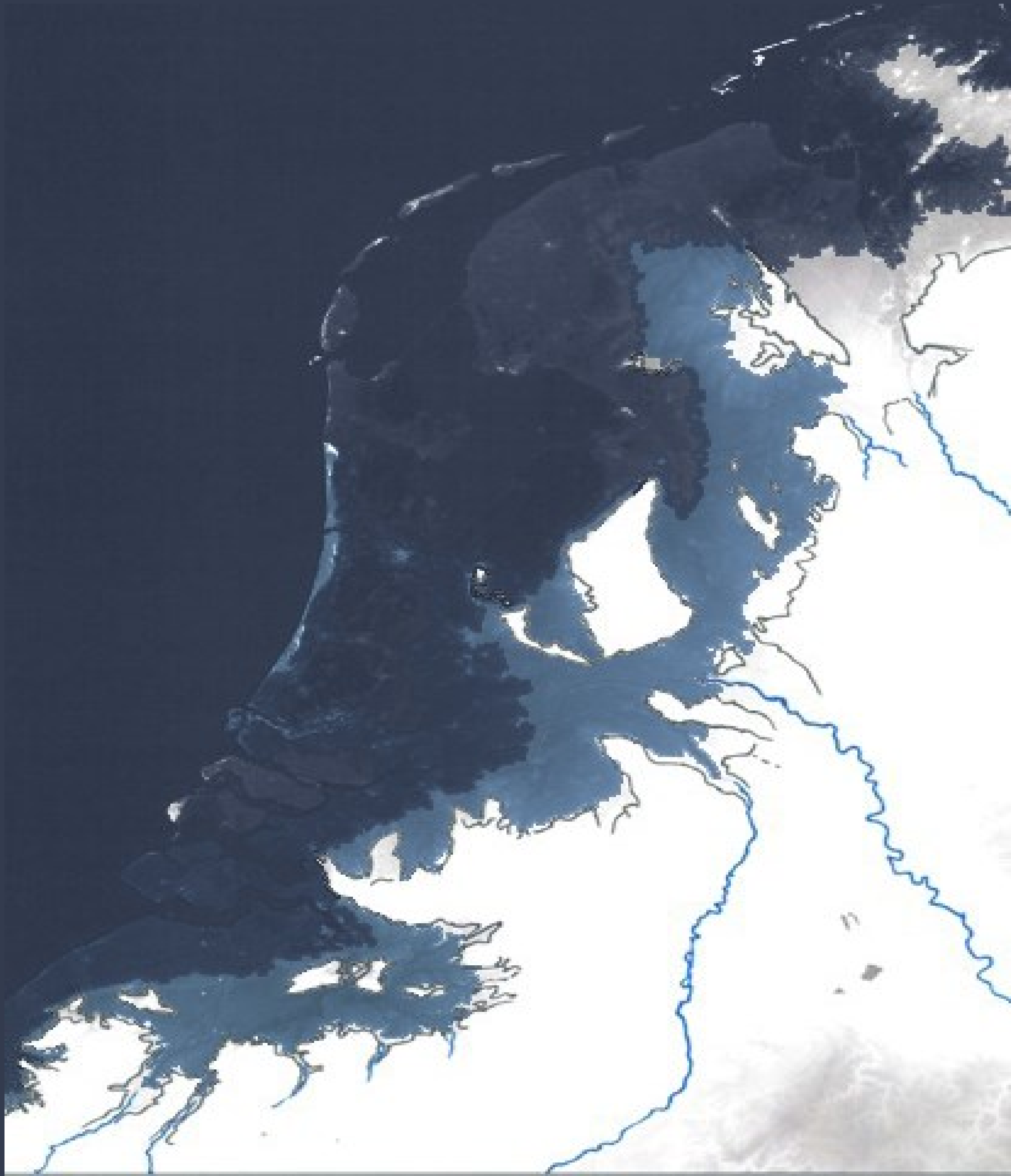
Pressure on dikes, increased flood risk

Bank erosion and increased flood risk

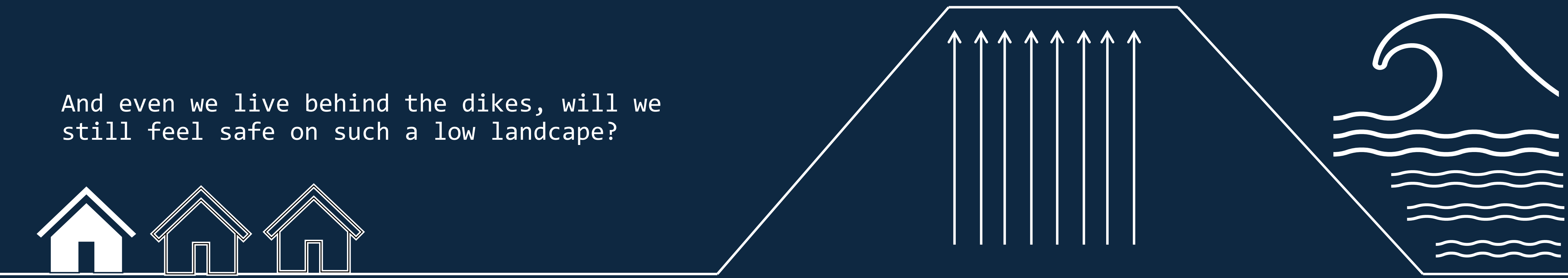
Floodplains submerged partly (2 m) and entirely (5 m) to the Dutch-German border

Utrecht University

Will this be the future of the Netherlands?



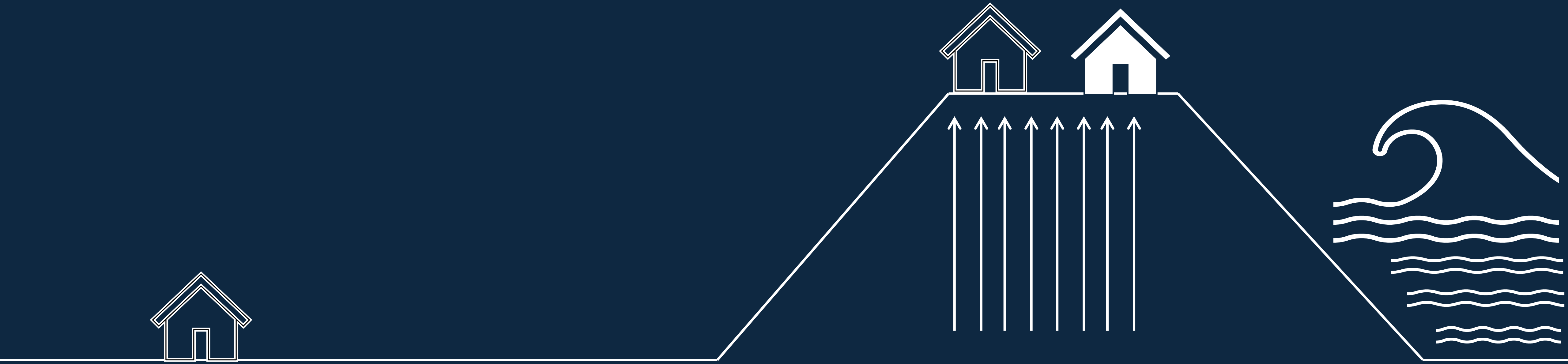
Or



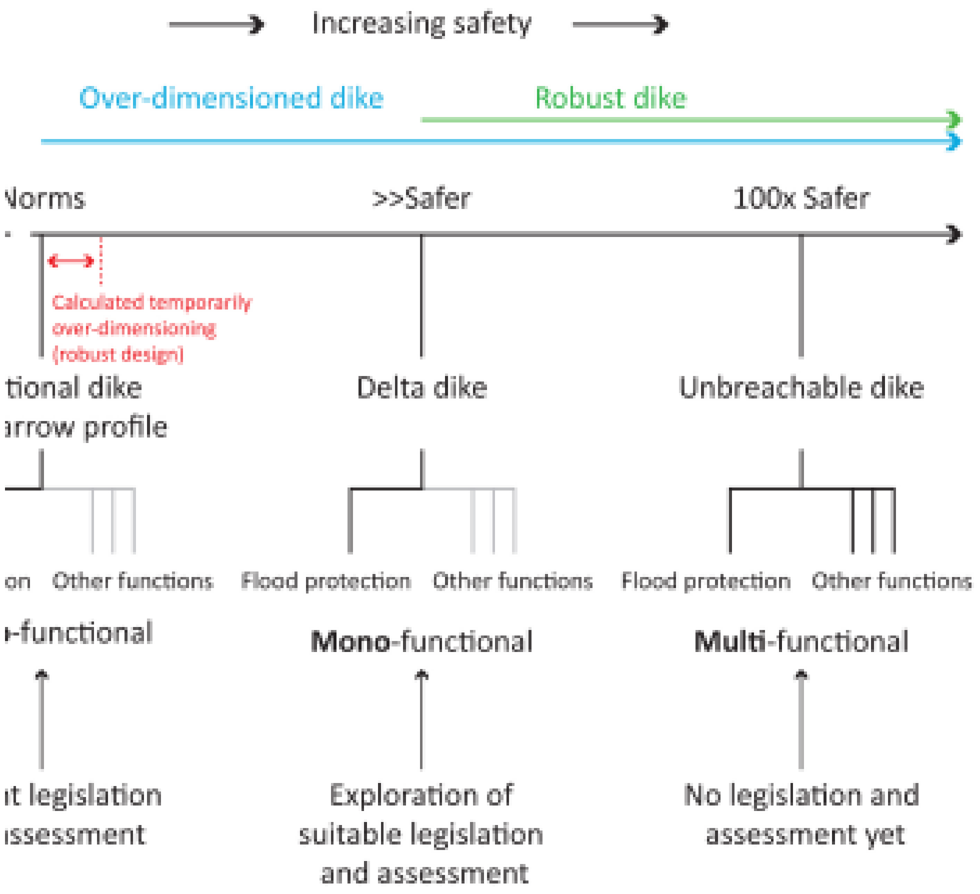
And even we live behind the dikes, will we
still feel safe on such a low landcape?

Will we build higher dikes? And can they
still protect us?

Why not living on the edge between water and land?



IS THAT EVEN POSSIBLE???


Increasing safety
Over-dimensioned dike
Robust dike
Norms
>>Safer
100x Safer
Calculated temporarily over-dimensioning (robust design)
tional dike
rrow profile
Delta dike
Unbreachable dike
on
Other functions
Flood protection
Other functions
Flood protection
Other functions
-functional
Mono-functional
Multi-functional
t legislation
ssessment
Exploration of suitable legislation and assessment
No legislation and assessment yet

isualization of the relation between the various dike con-
the Netherlands; these concepts are described in Table 1.

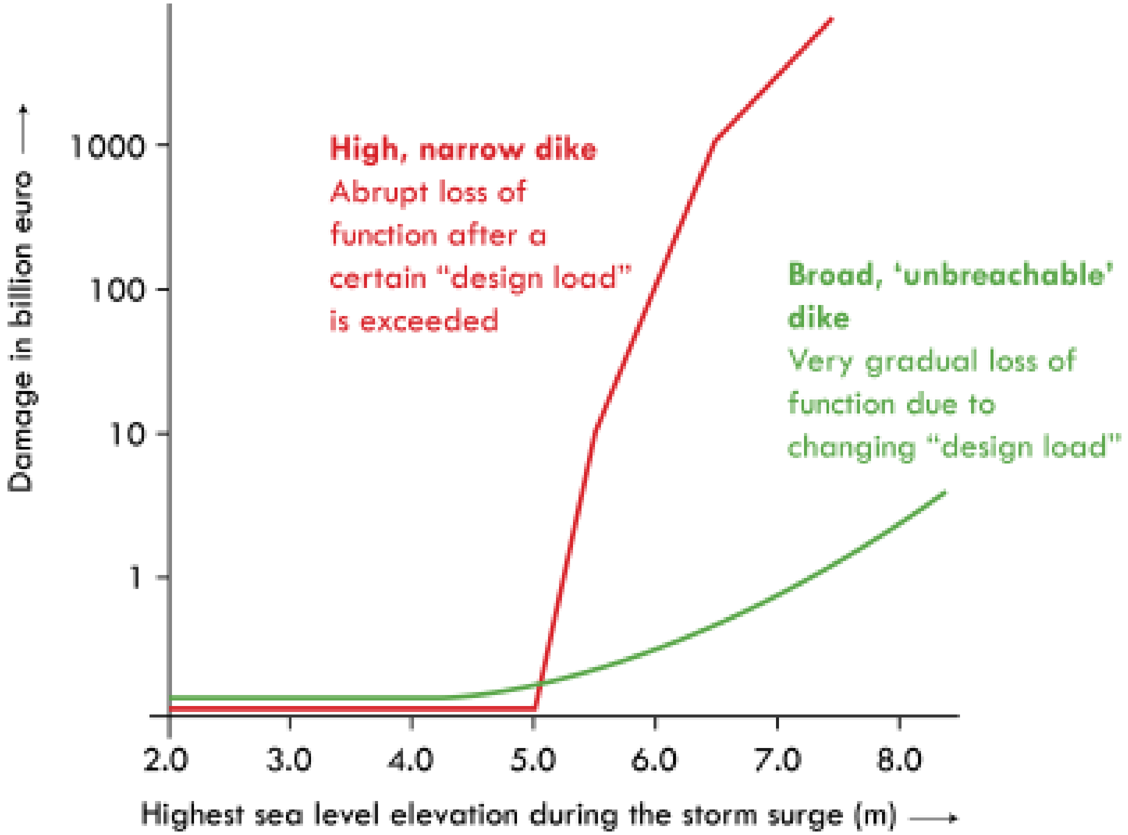
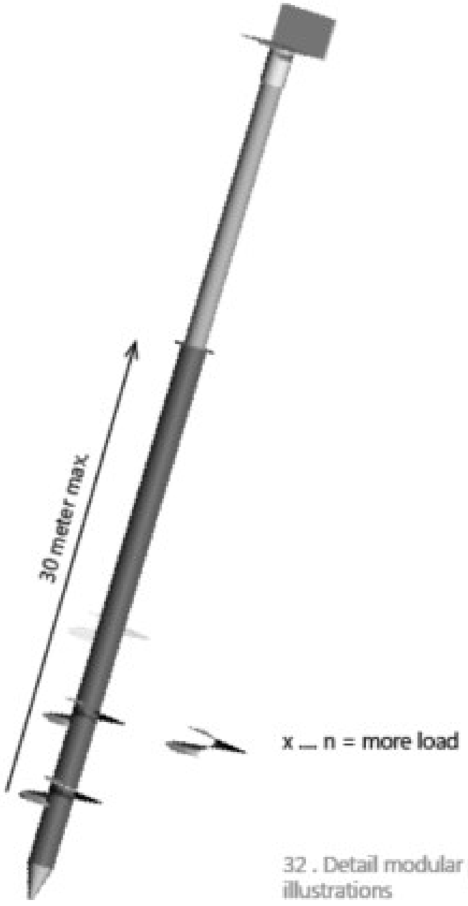


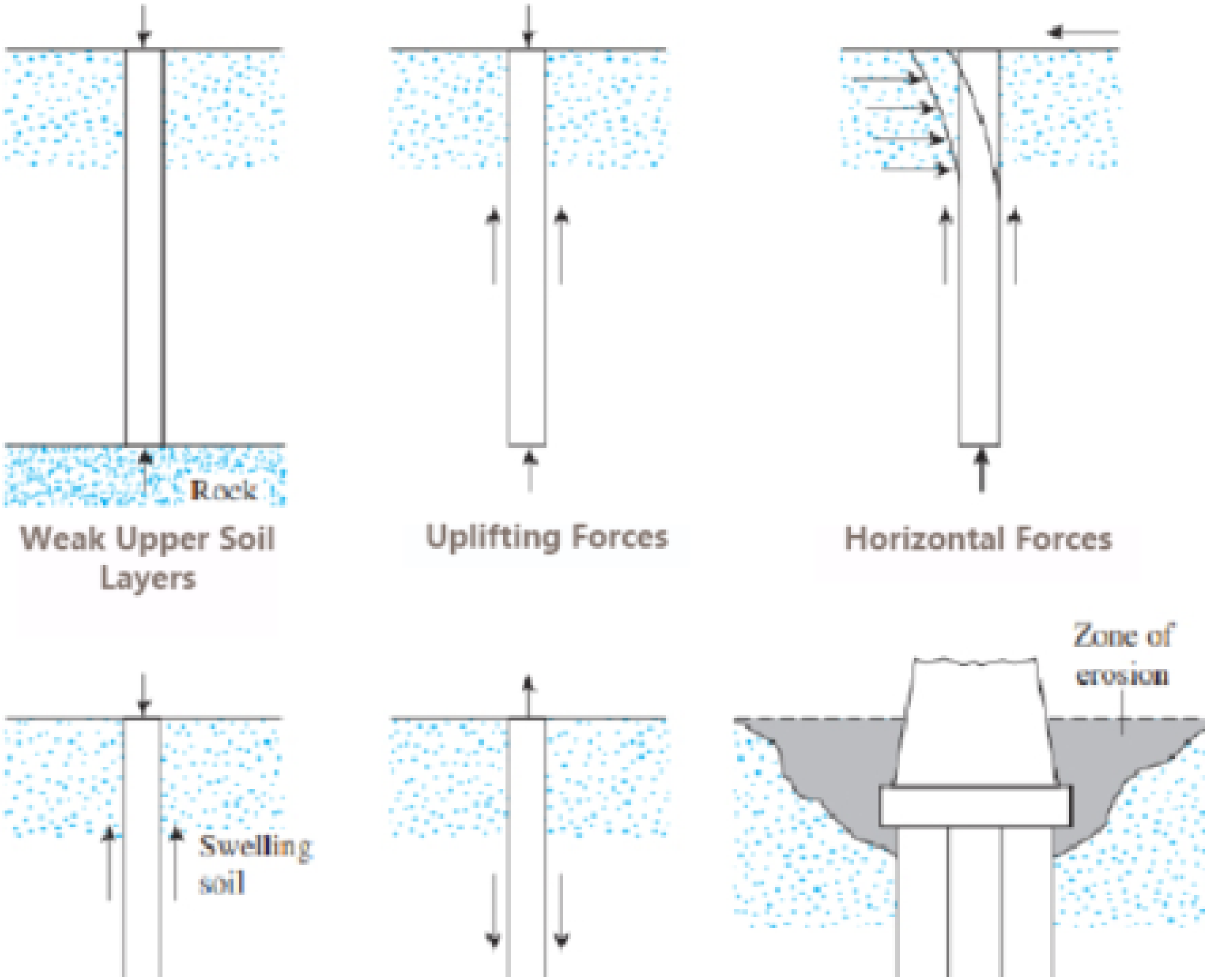
Fig. 2. Damage functions of narrow and broad dikes (Vellinga, 2008).

Research Question

In the context of an elevated sea dike, what foundation types and structural systems demonstrate the highest suitability for buildings on the dike?

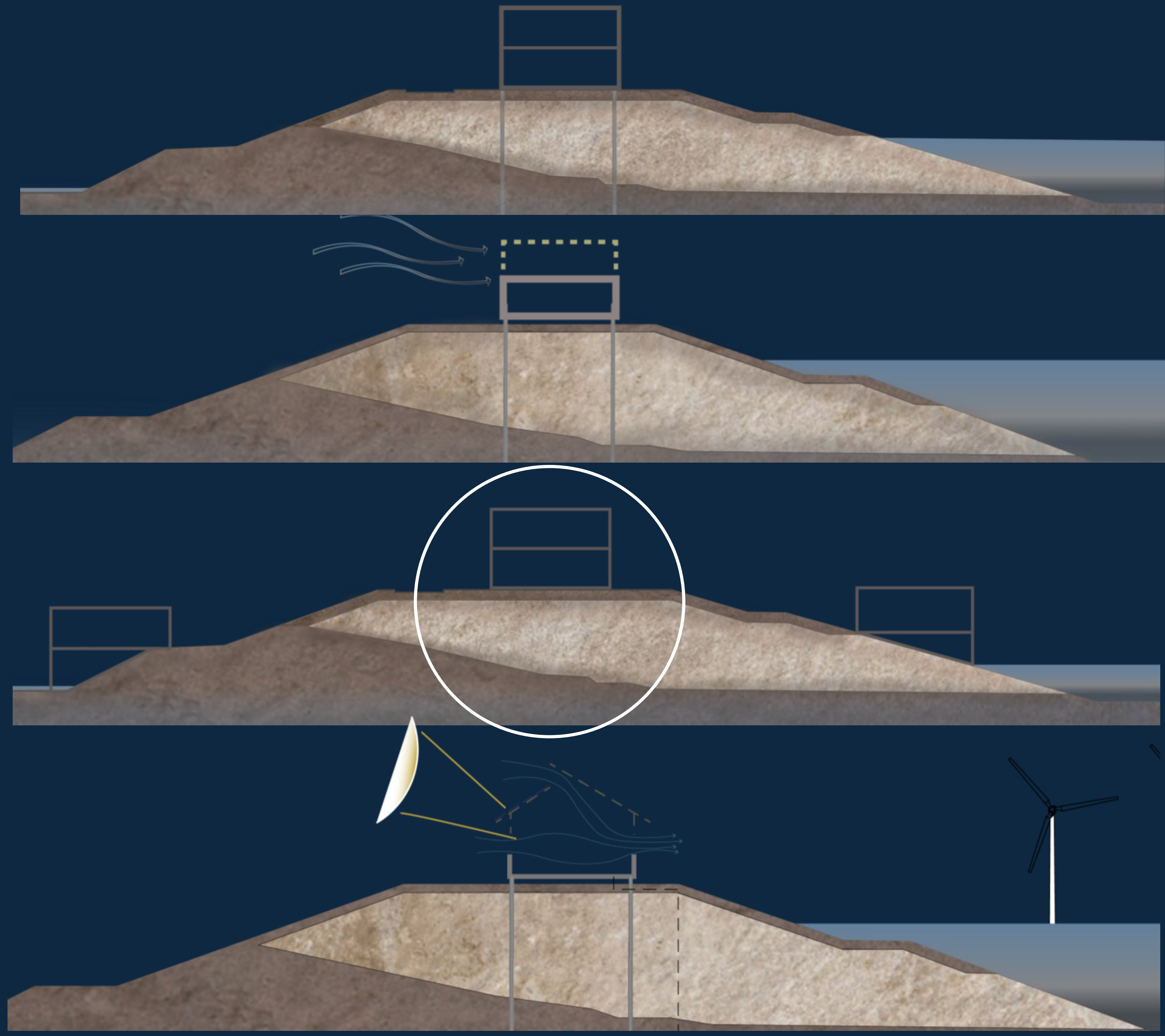

30 meter max
x .... n = more load

32 . Detail modular pile, ow
illustrations


Rock
Weak Upper Soil Layers
Uplifting Forces
Horizontal Forces
Swelling soil
Zone of erosion

Das, B. M. (1984). Principles of Foundation Engineering. http://ndl.ethernet.edu.et/bitstream/123456789/39193/1/51.pdf

Principles



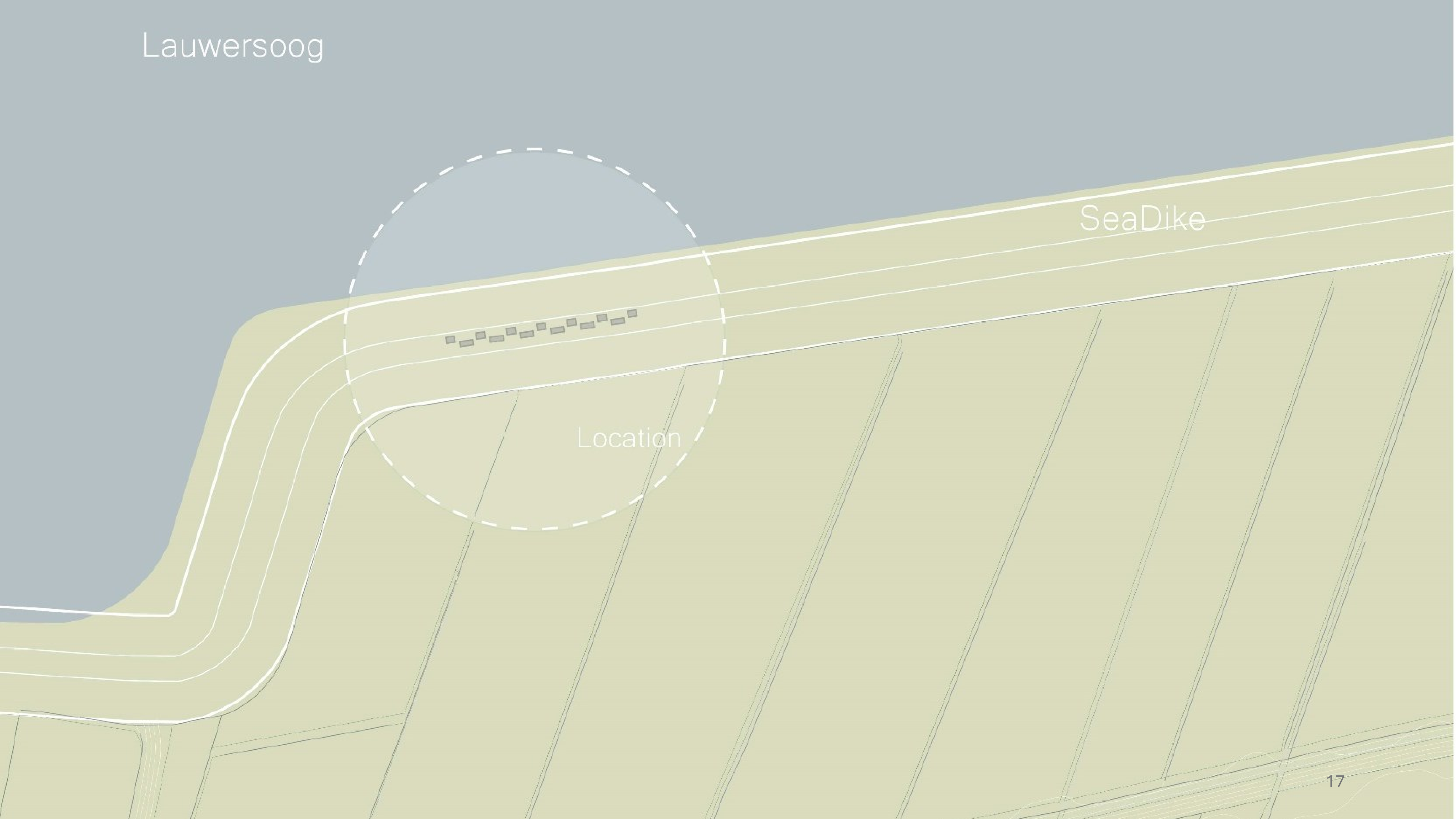
Steel foundation below dike body

Waterproof structure on the ground floor

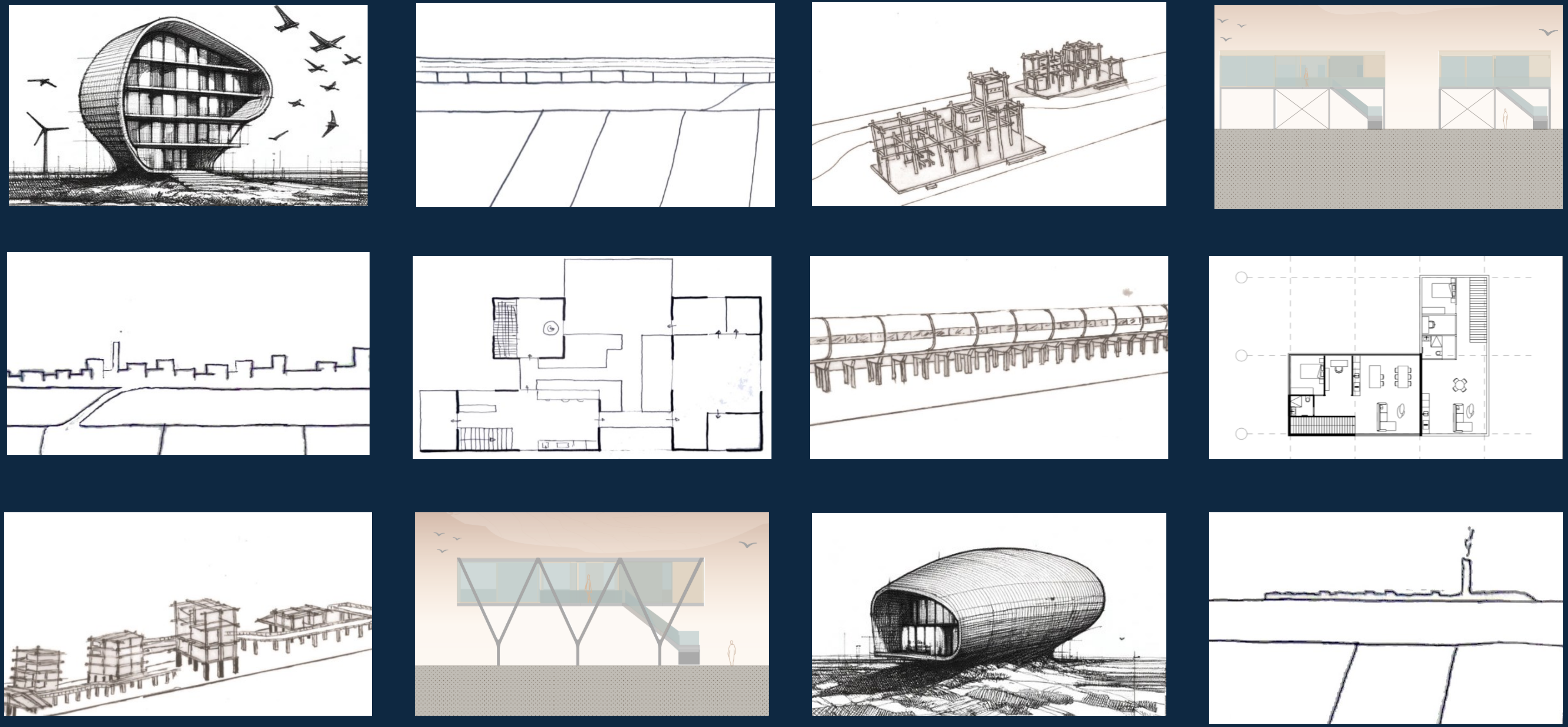
Building on the horizontal platform

Off-grid climate system

Location


Lauwersoog
SeaDike
Location

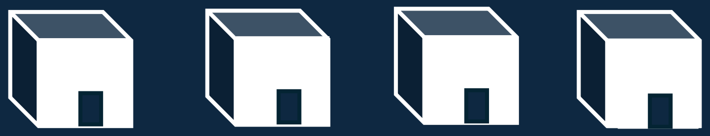
Which architectural language suits buildings on the dike?



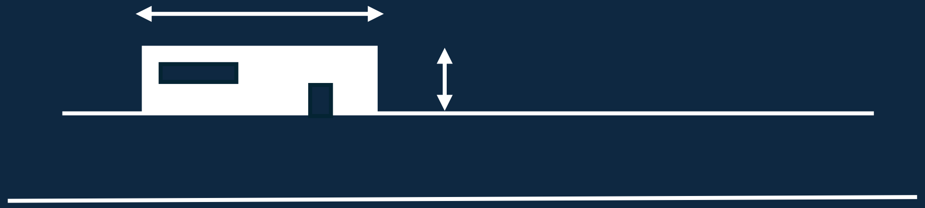
Research by design

What are the architectural principles?

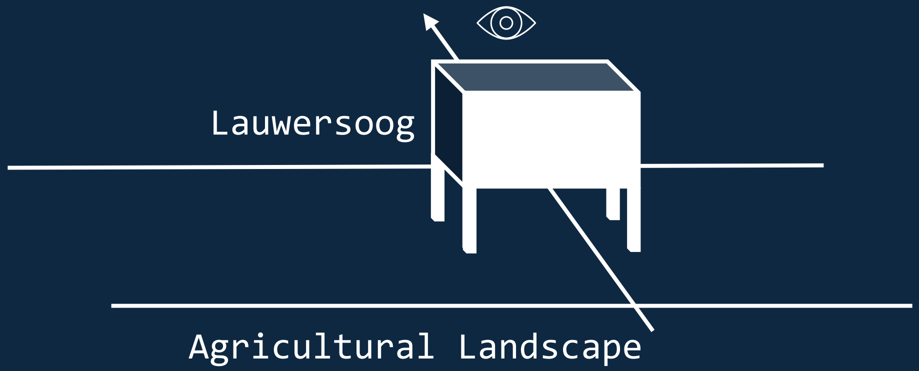
UNITY



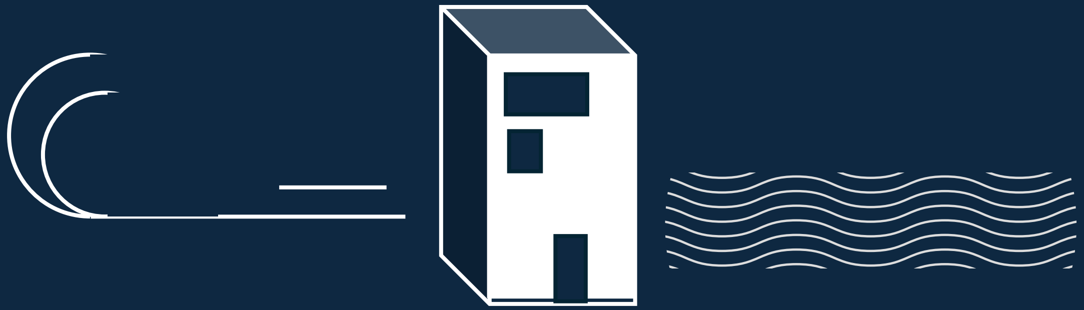
SCALE



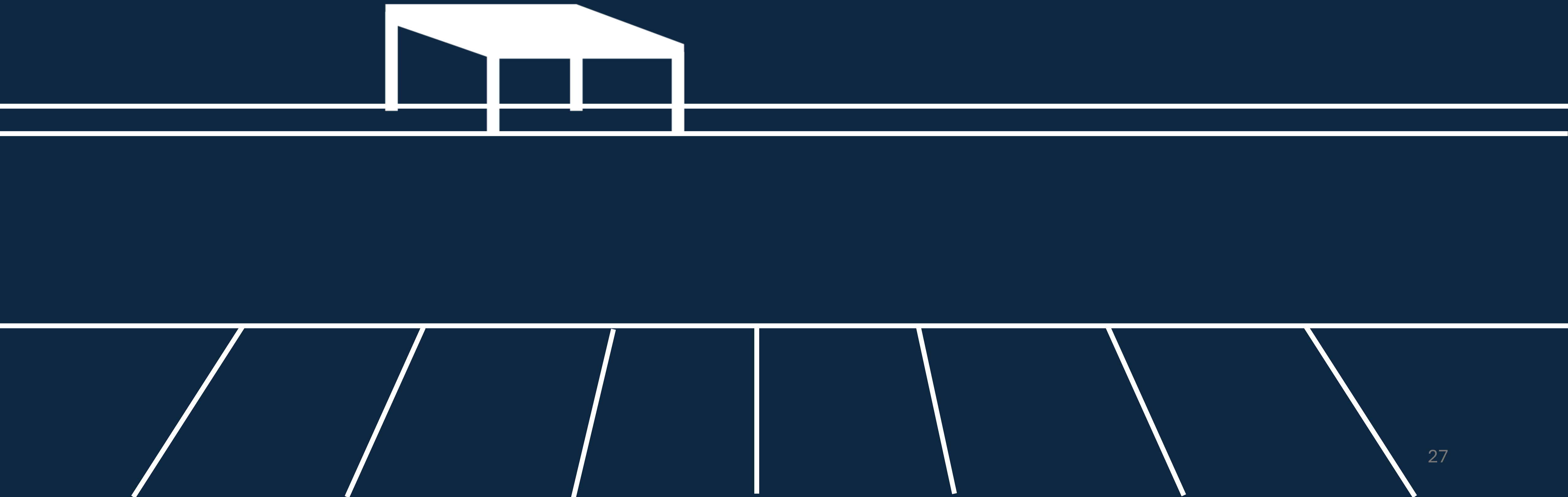
CONTEXT

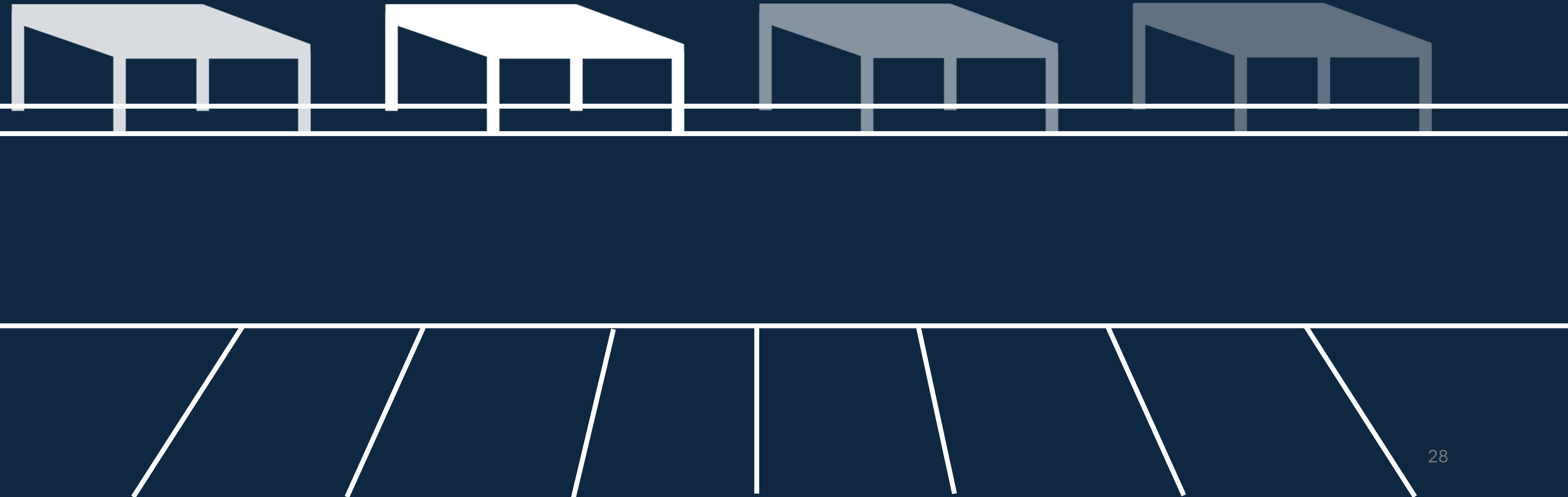

Lauwersoog
Agricultural Landscape

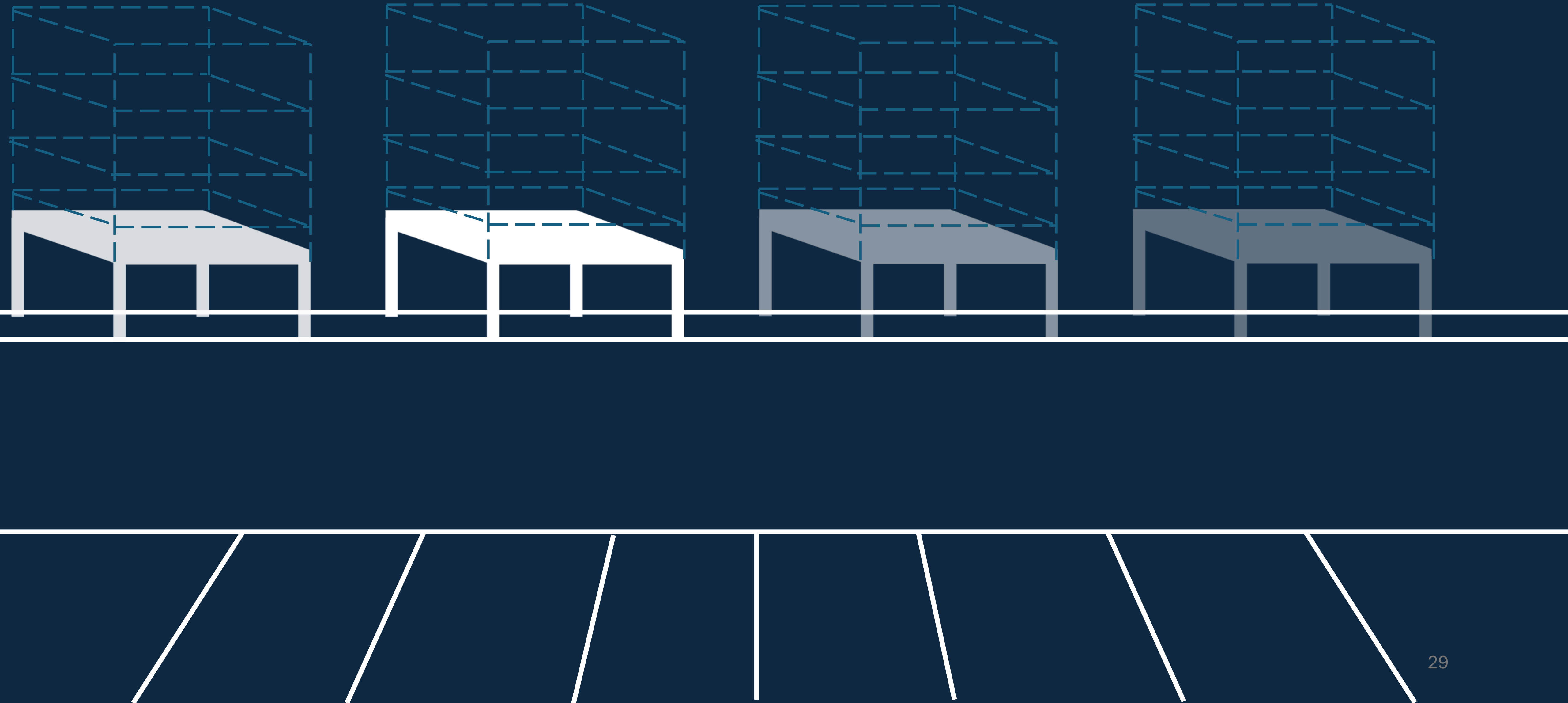
RESILIENCE

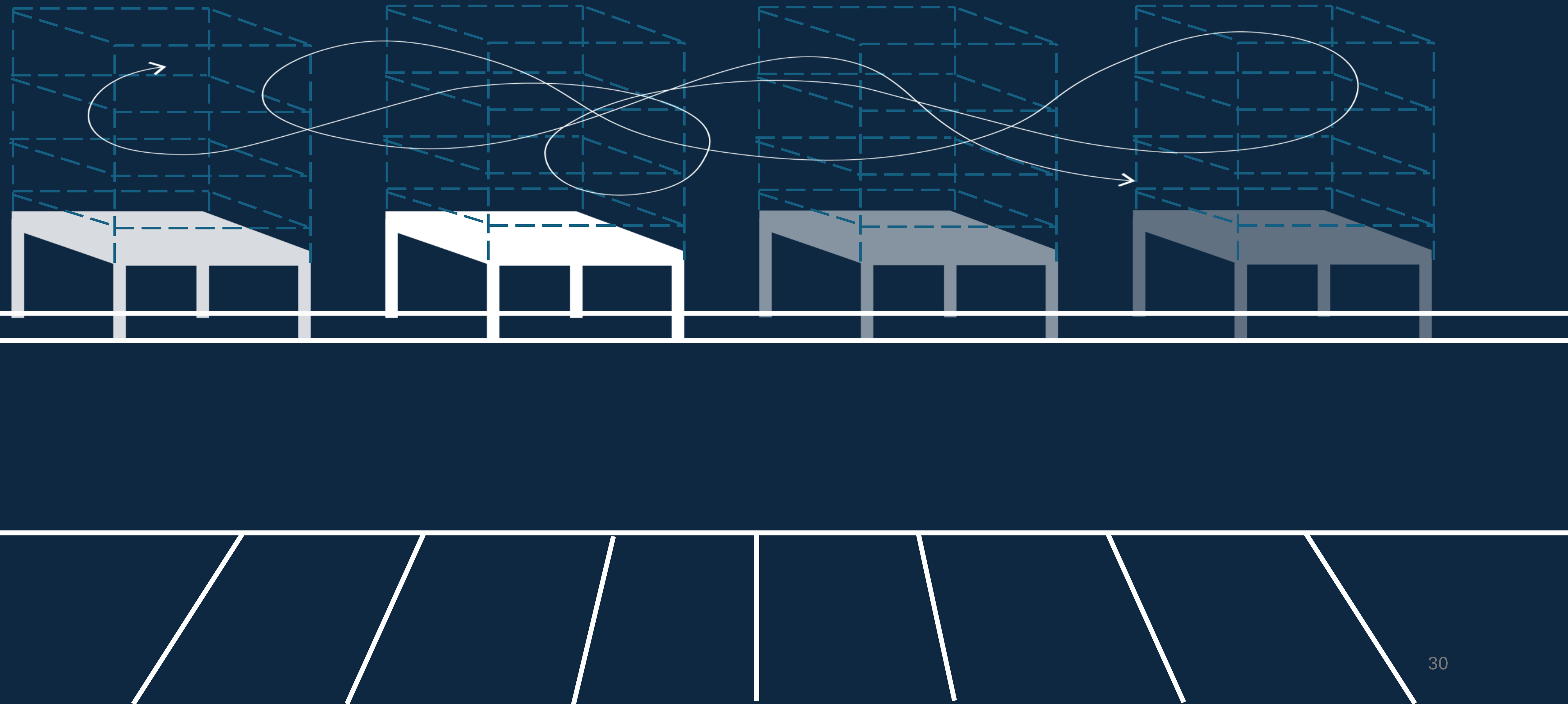


What is the concept on a big scale?

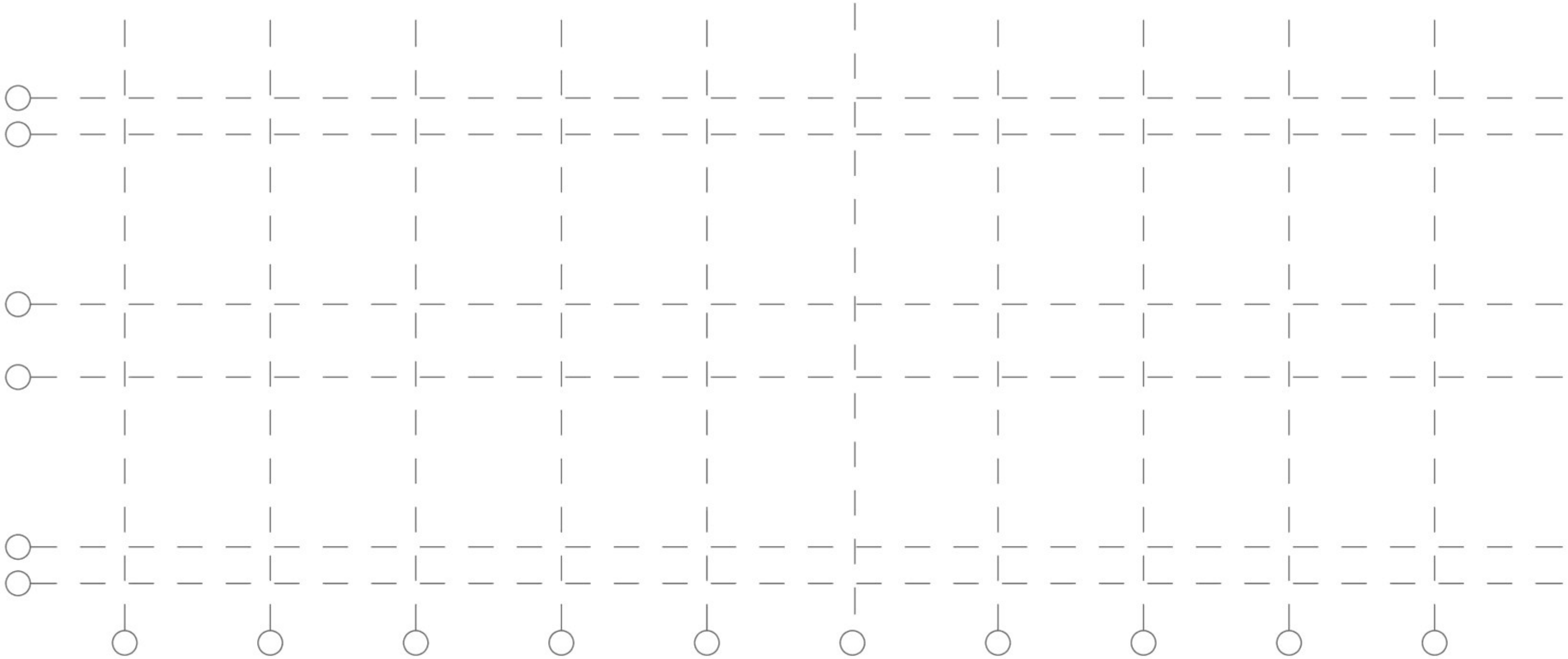


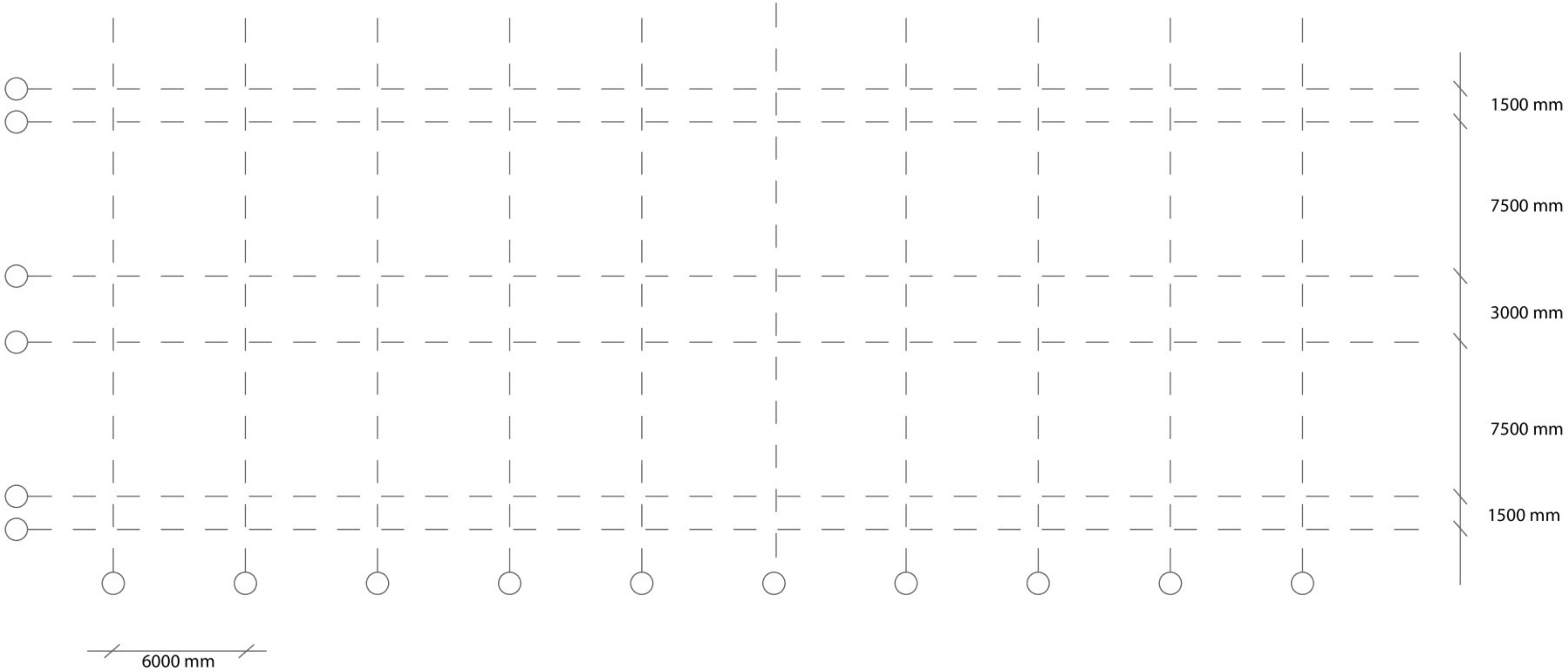


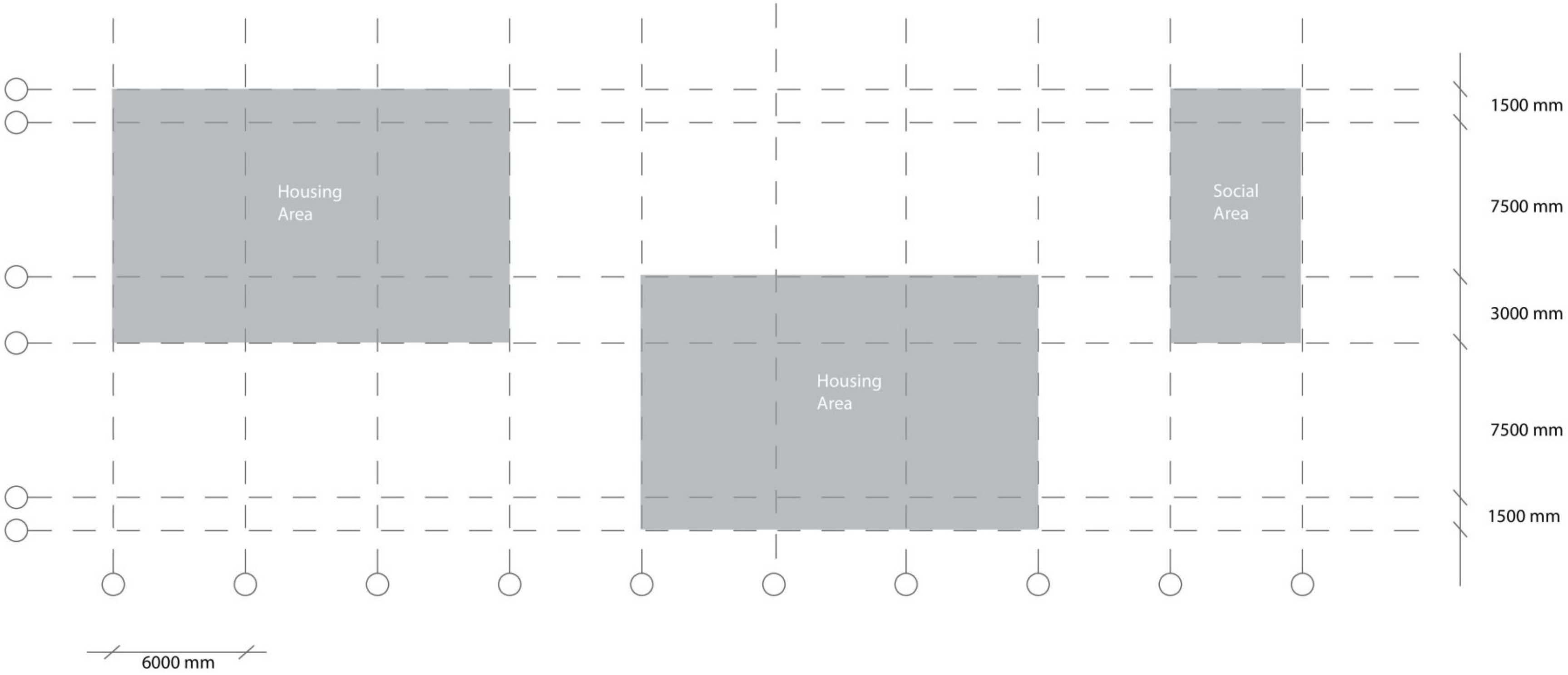


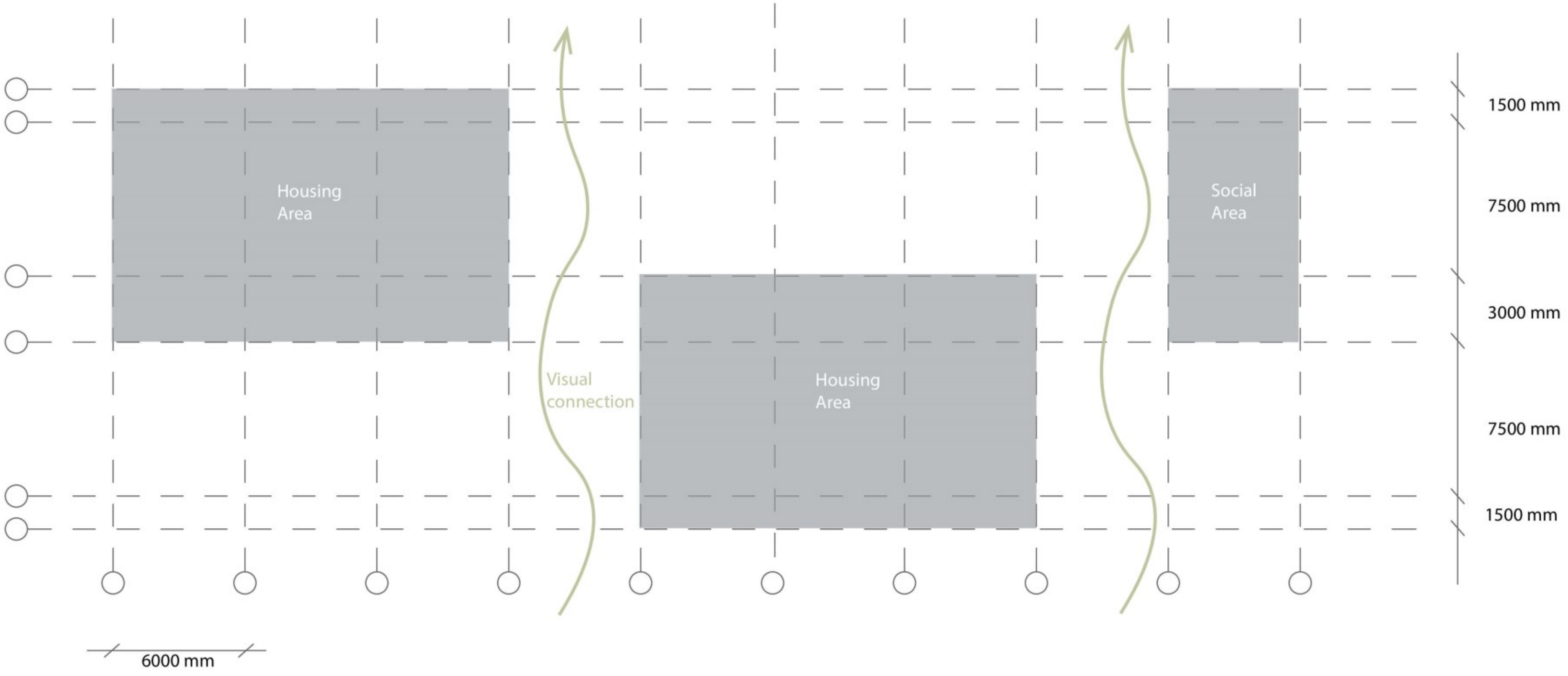


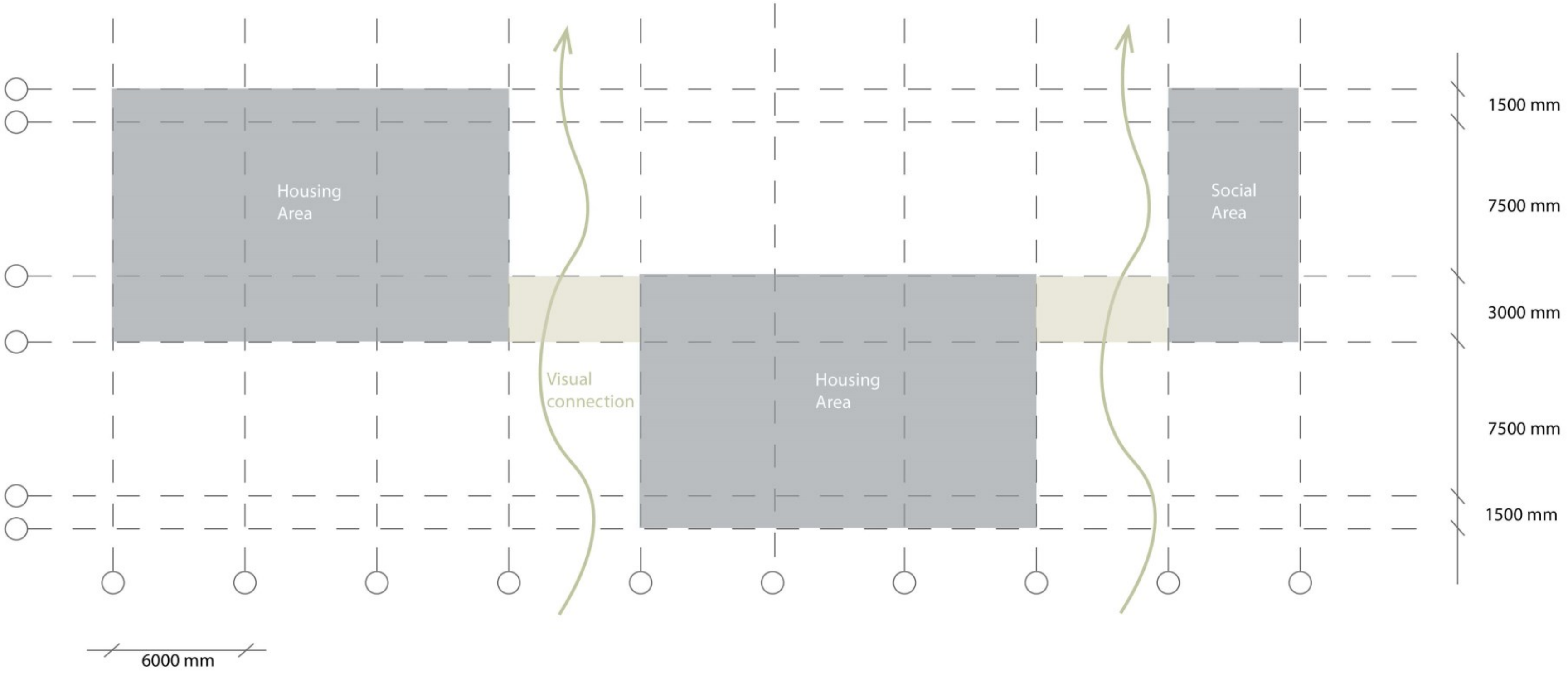
`Grid that can grow`

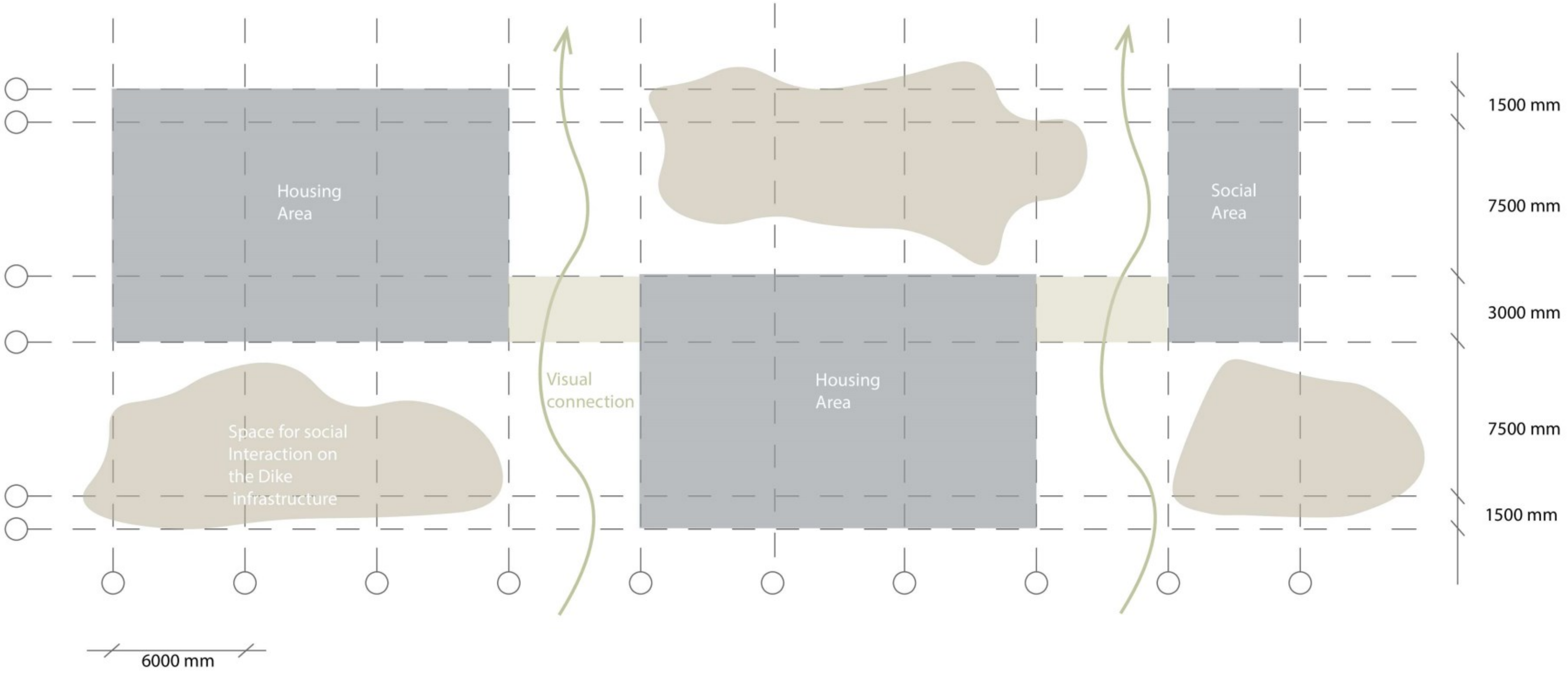


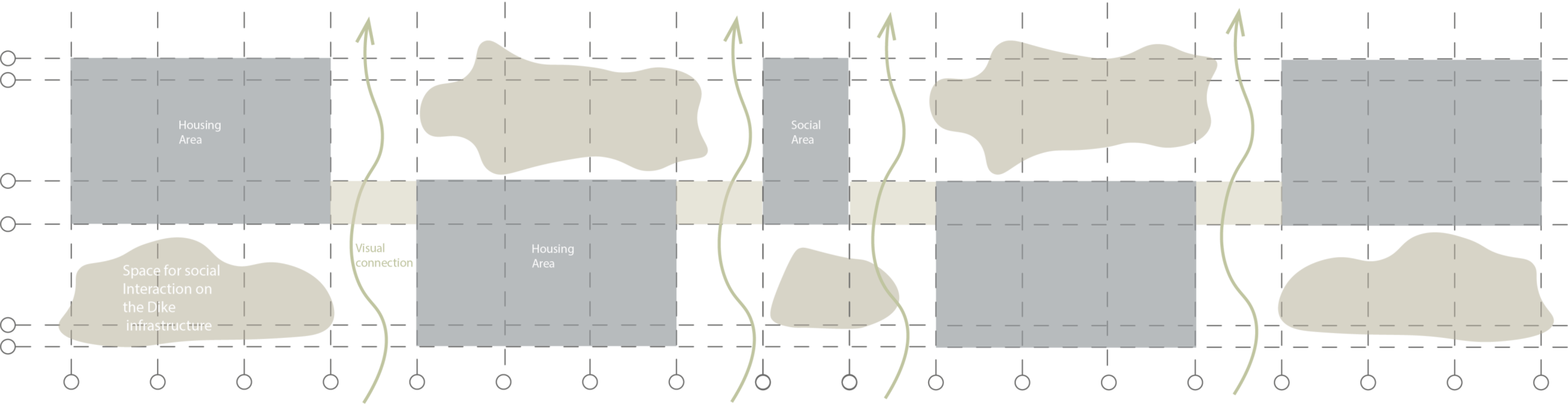

1500 mm
7500 mm
3000 mm
7500 mm
1500 mm
6000 mm


Housing
Area
Social
Area
Housing
Area
1500 mm
7500 mm
3000 mm
7500 mm
1500 mm
6000 mm

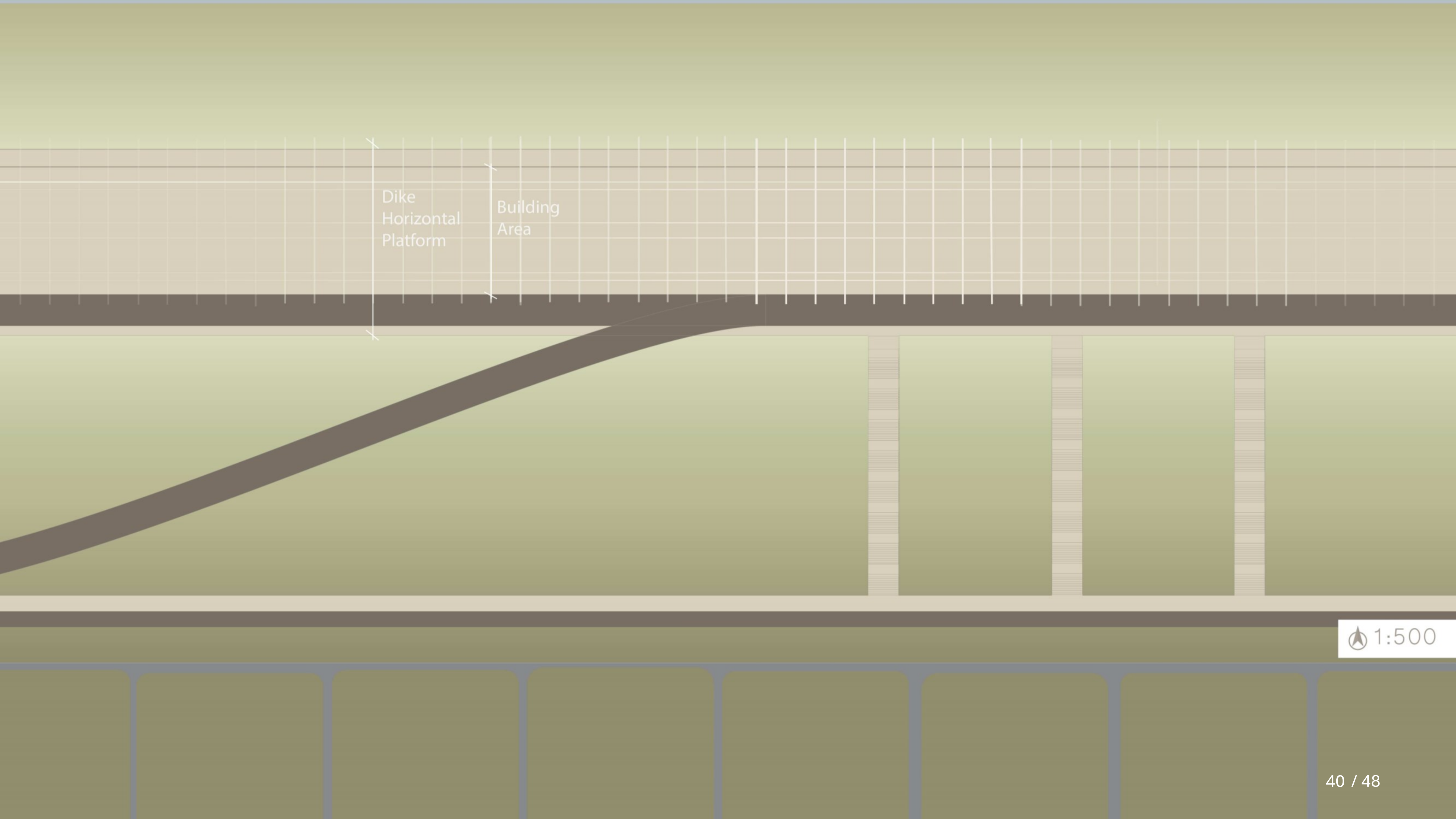

Housing
Area
Social
Area
Visual
connection
Housing
Area
1500 mm
7500 mm
3000 mm
7500 mm
1500 mm
6000 mm

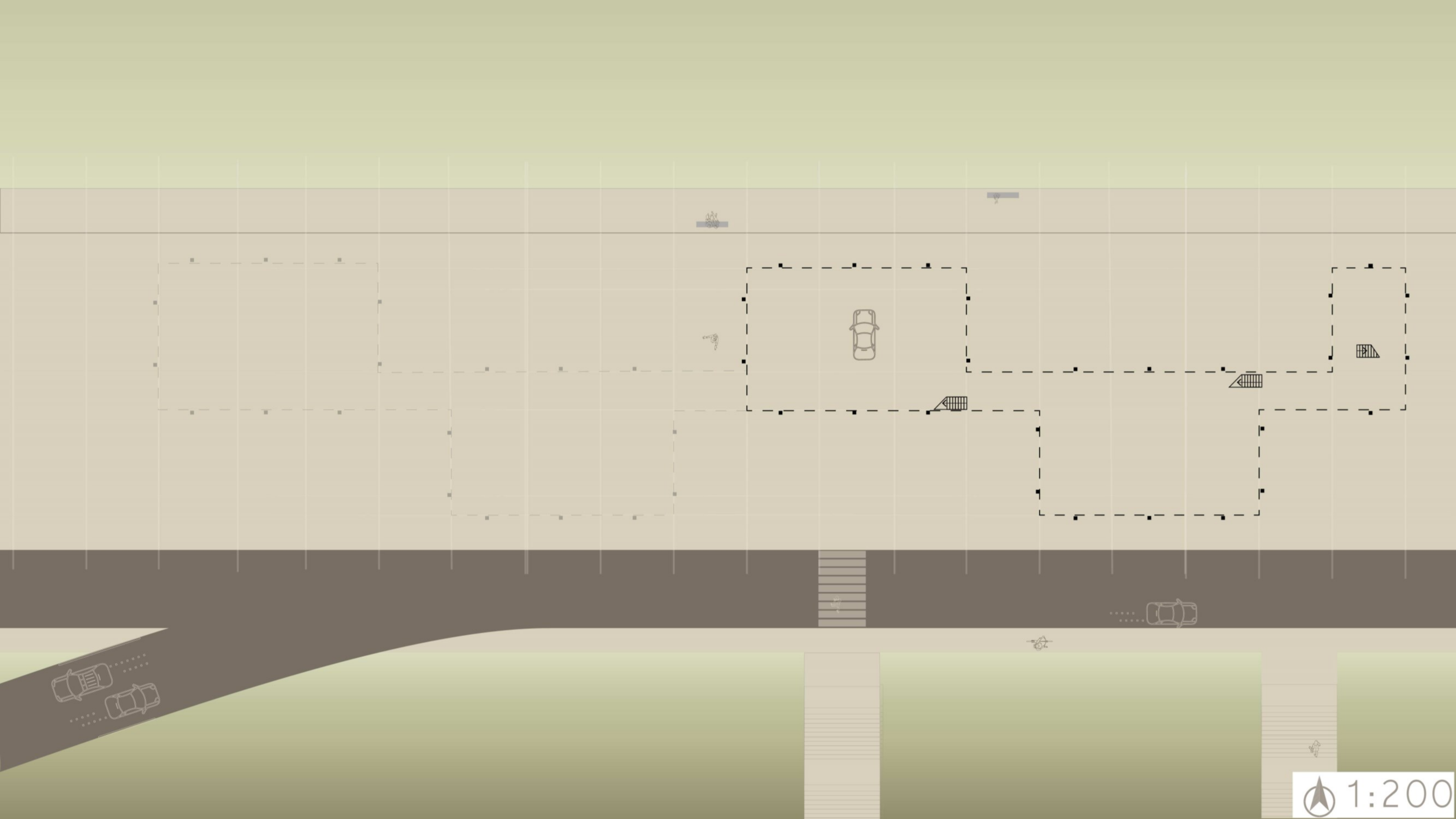

Housing
Area
Social
Area
Visual
connection
Housing
Area
1500 mm
7500 mm
3000 mm
7500 mm
1500 mm
6000 mm

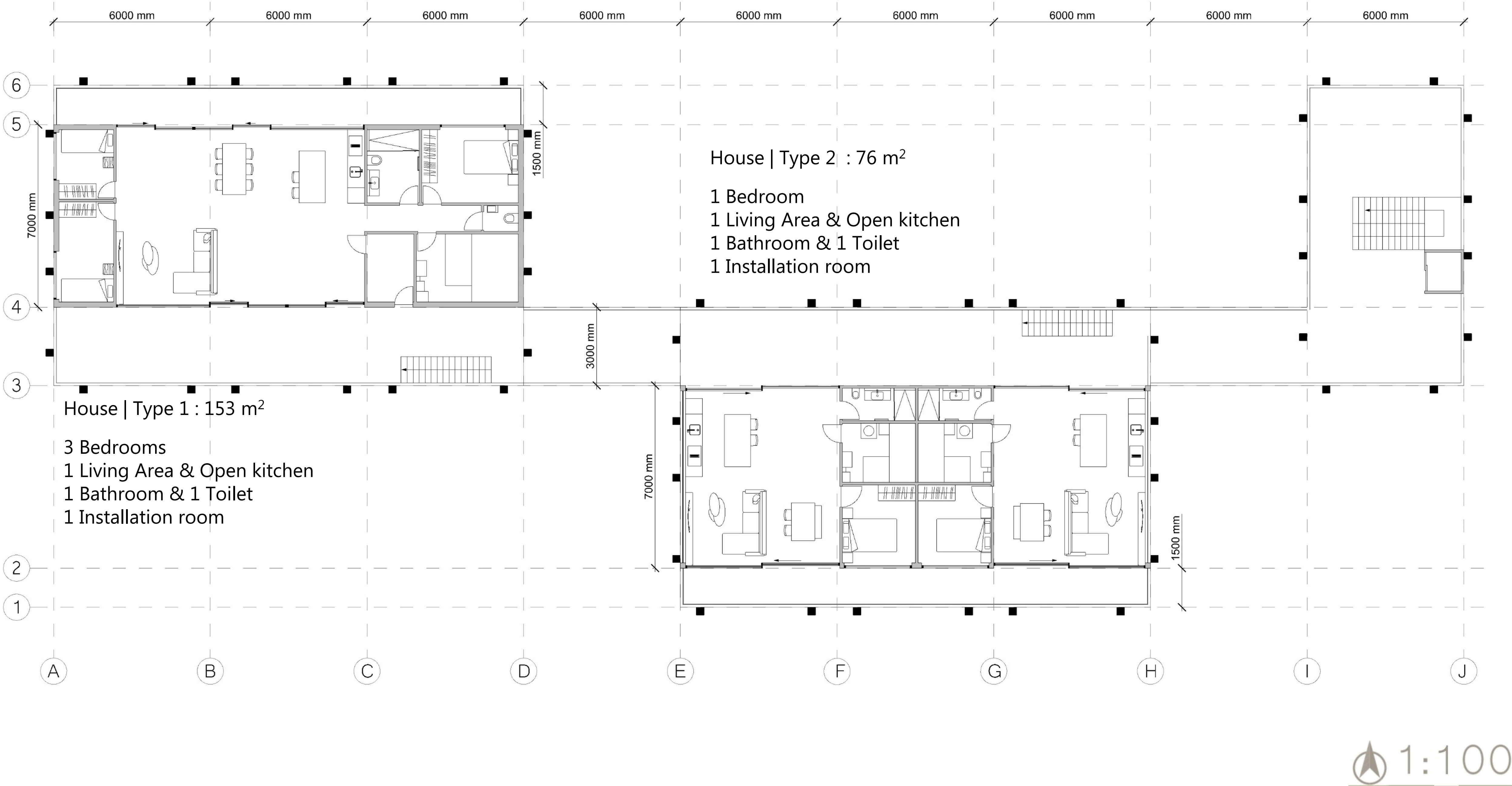

Housing
Area
Social
Area
Visual
connection
Housing
Area
Space for social
Interaction on
the Dike
infrastructure
1500 mm
7500 mm
3000 mm
7500 mm
1500 mm
6000 mm


Housing Area
Social Area
Space for social Interaction on the Dike infrastructure
Visual connection
Housing Area

Design


Dike
Horizontal
Platform
Building
Area
1:500


1:200

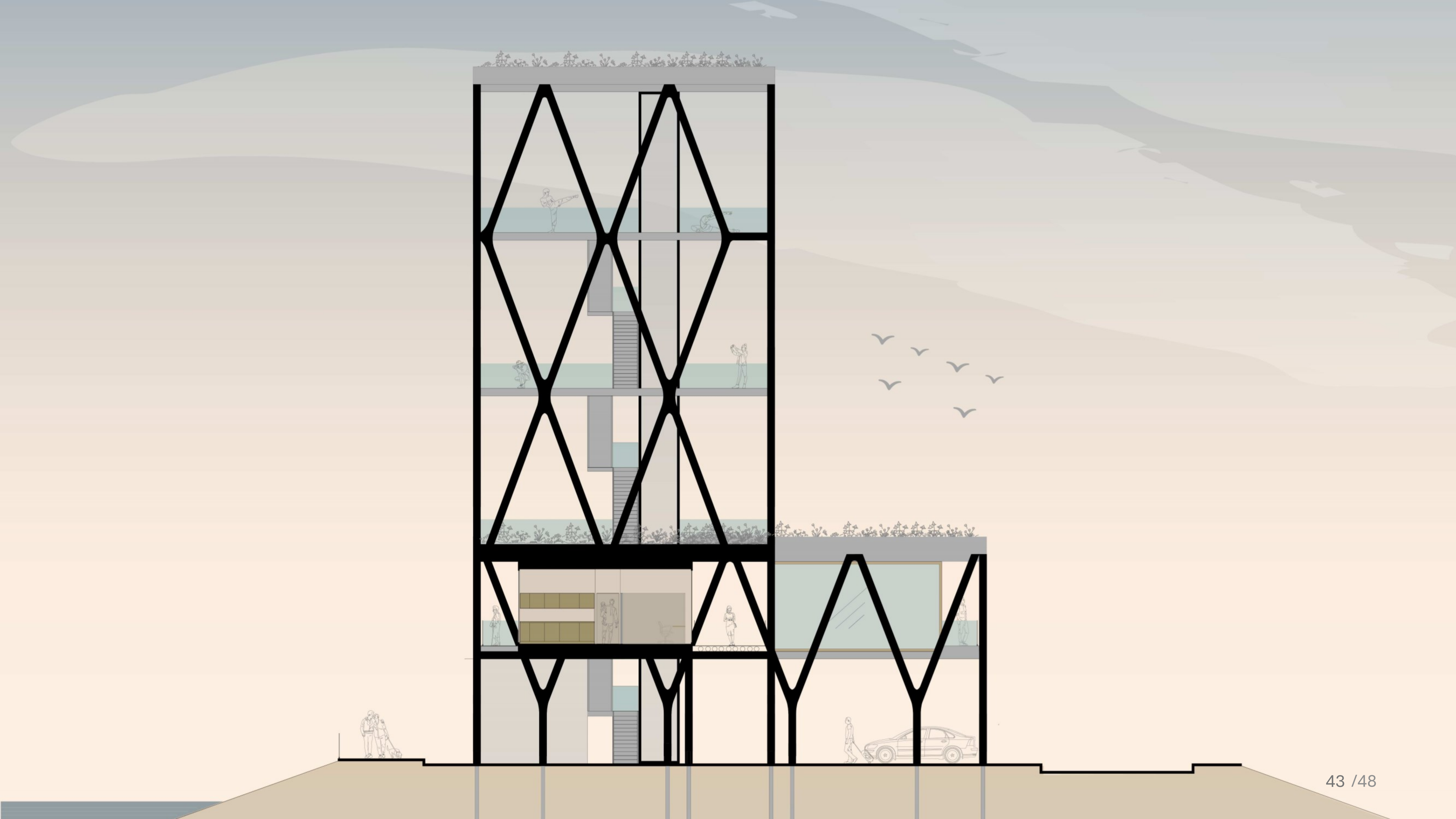

6000 mm
6000 mm
6000 mm
6000 mm
6000 mm
6000 mm
6000 mm
6000 mm
6000 mm
6
5
4
3
2
1
7000 mm
1500 mm
3000 mm
7000 mm
1500 mm
A
B
C
D
E
F
G
H
I
J
1:100

House | Type 2 : 76 m^2

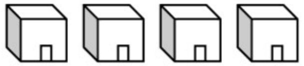
1 Bedroom
1 Living Area & Open kitchen
1 Bathroom & 1 Toilet
1 Installation room

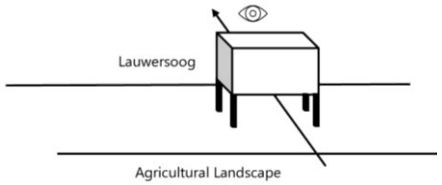
House | Type 1 : 153 m^2

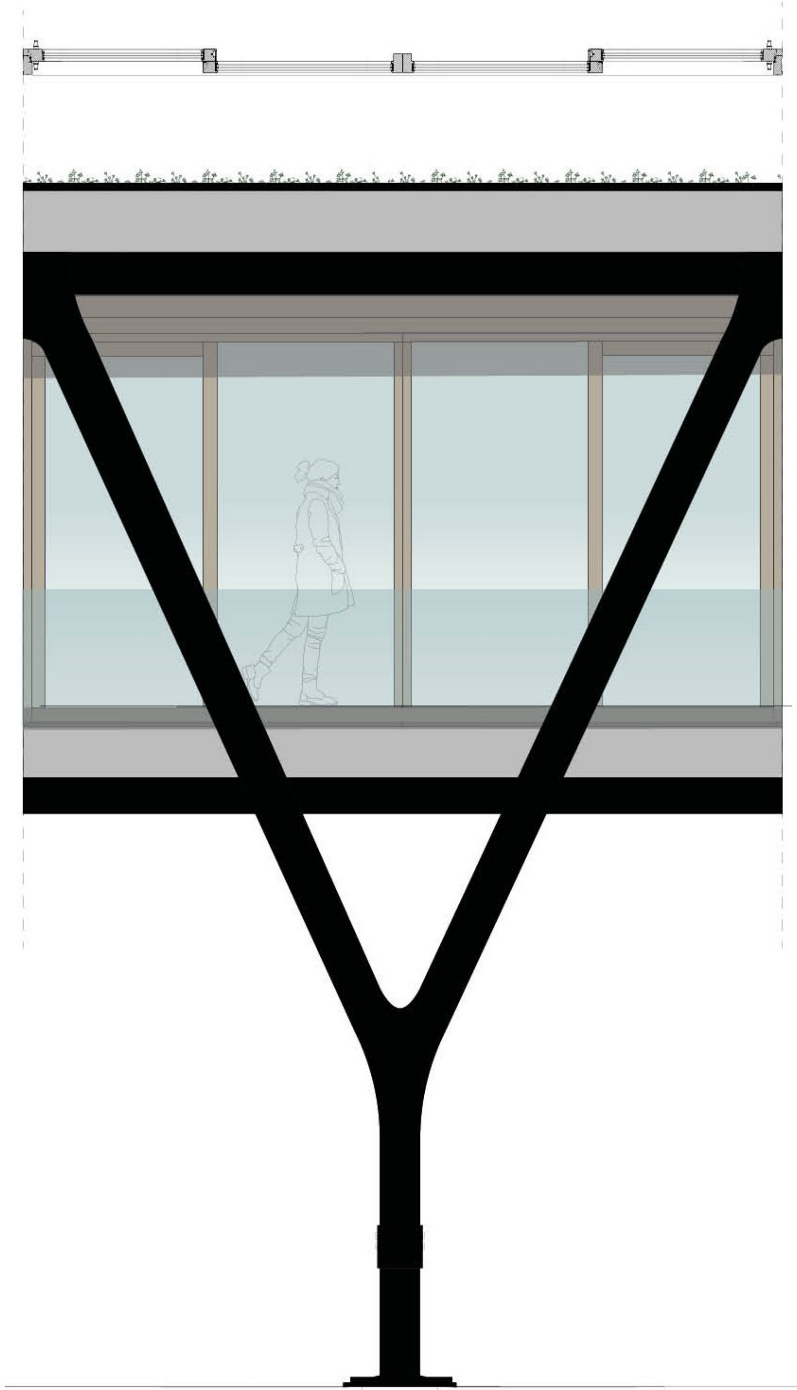
3 Bedrooms
1 Living Area & Open kitchen
1 Bathroom & 1 Toilet
1 Installation room

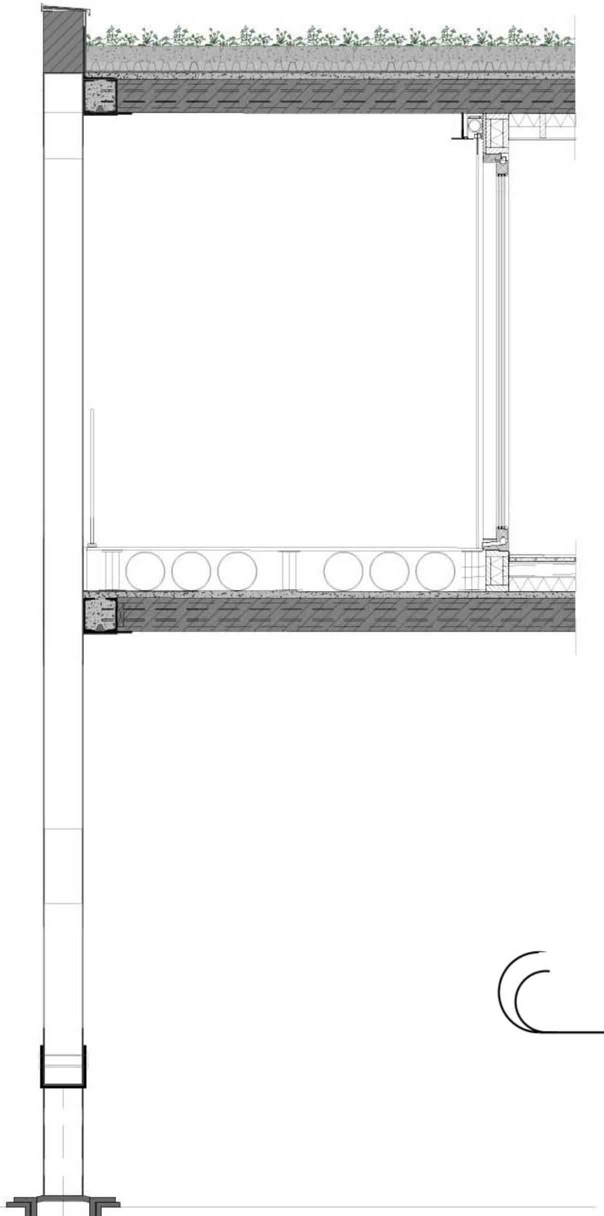


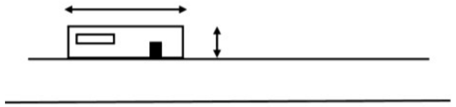
1: 20 | Facade fragment

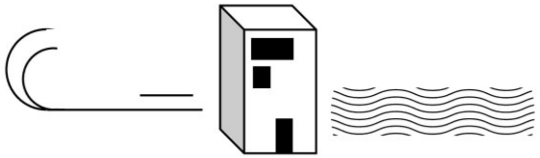



Lauwersoog
Agricultural Landscape

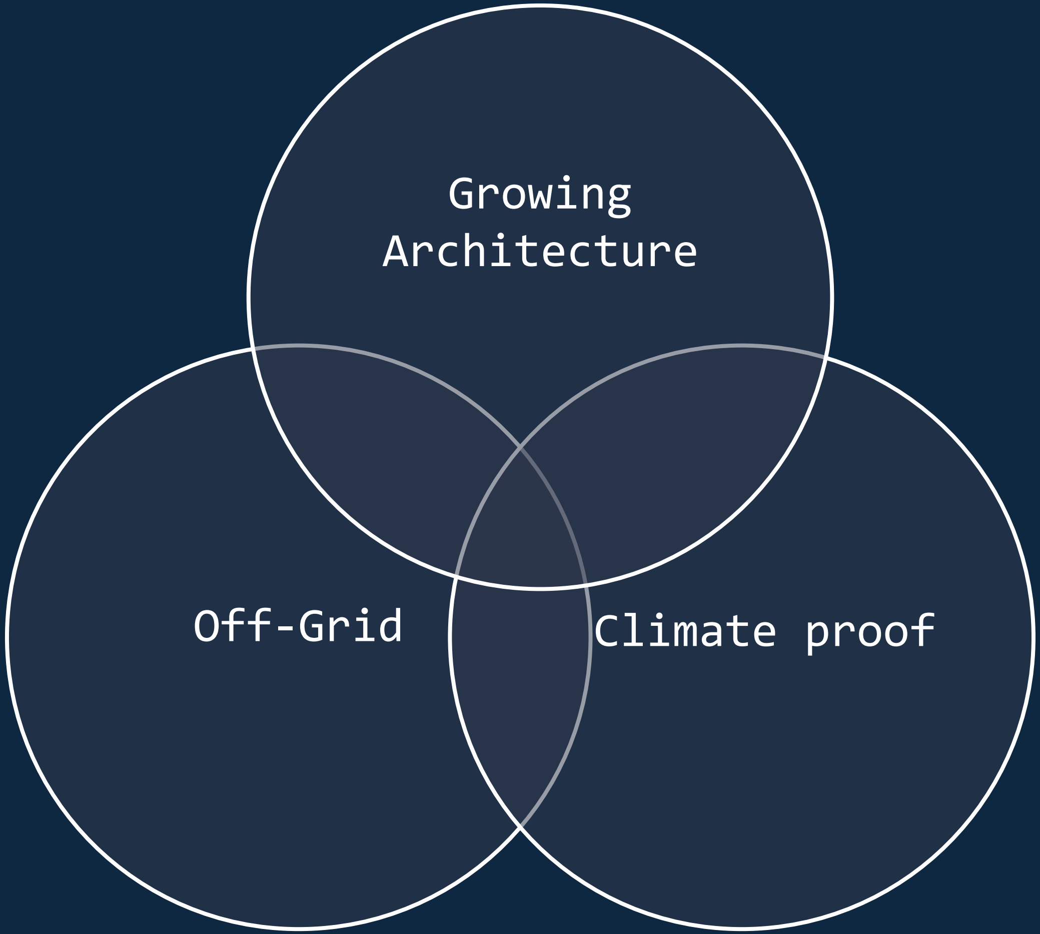








3 main qualities of the design

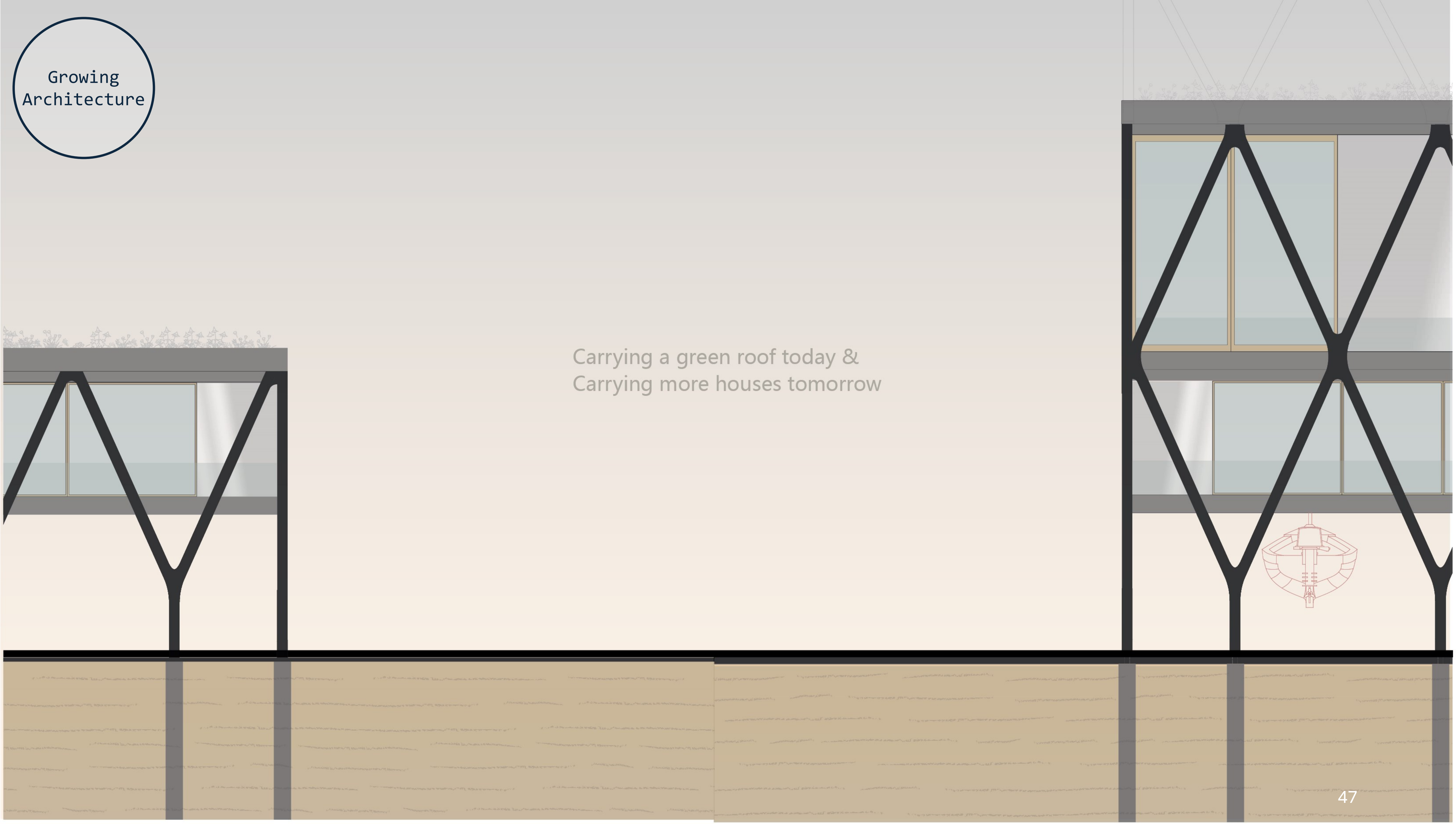


Growing Architecture

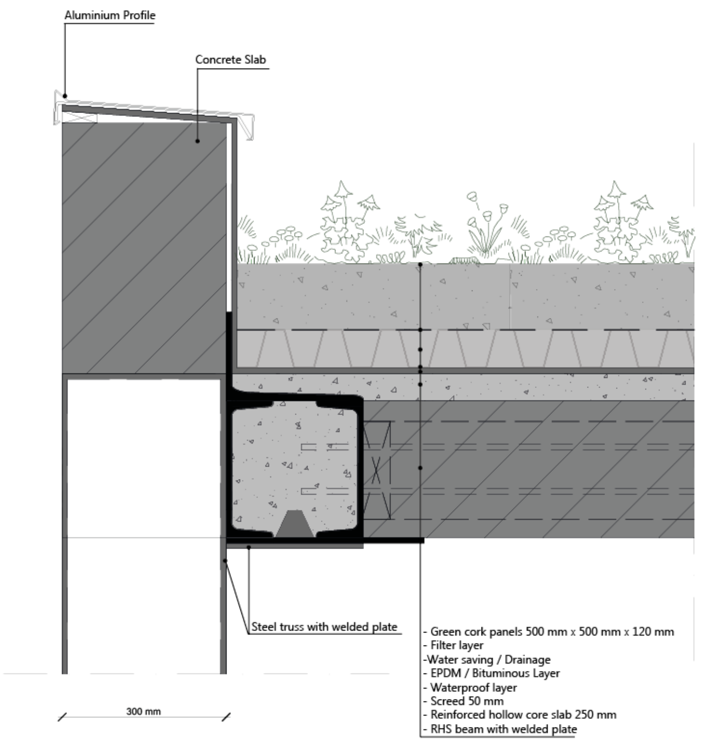
Off-Grid

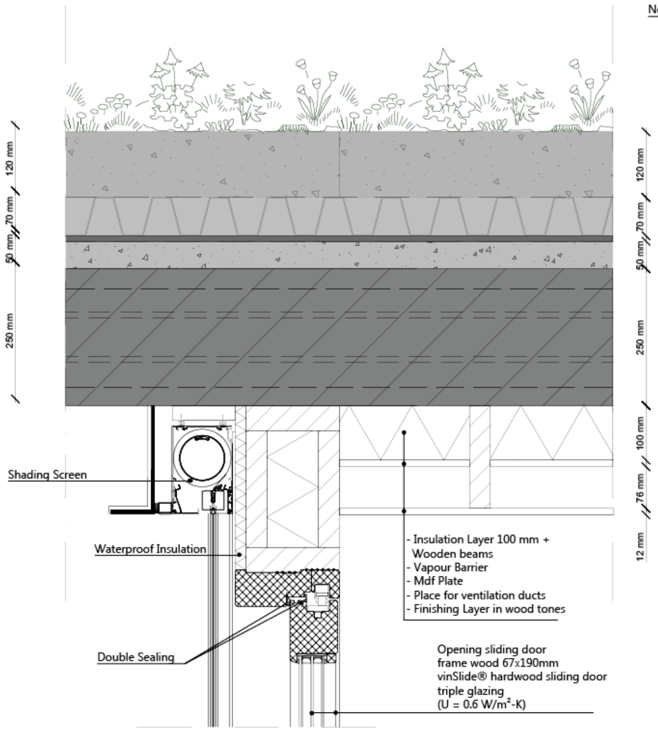
Climate proof

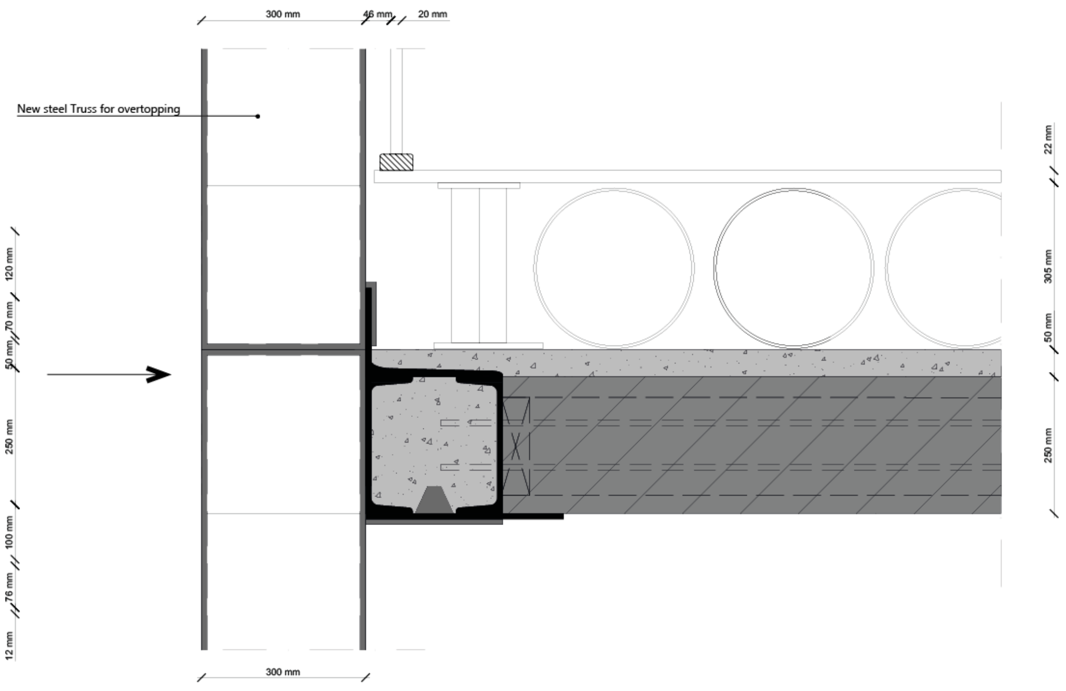
Growing
Architecture



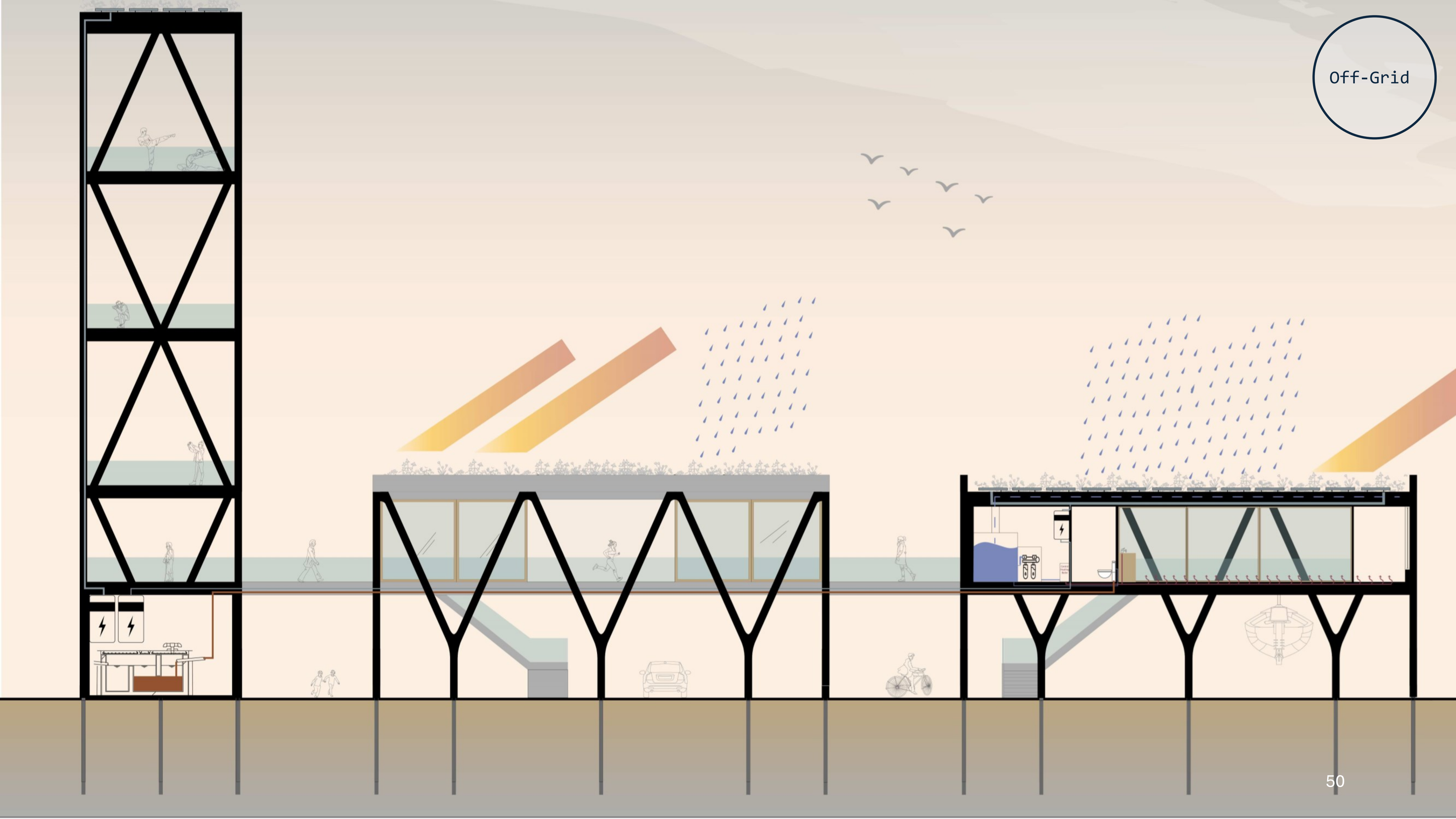
Carrying a green roof today &
Carrying more houses tomorrow

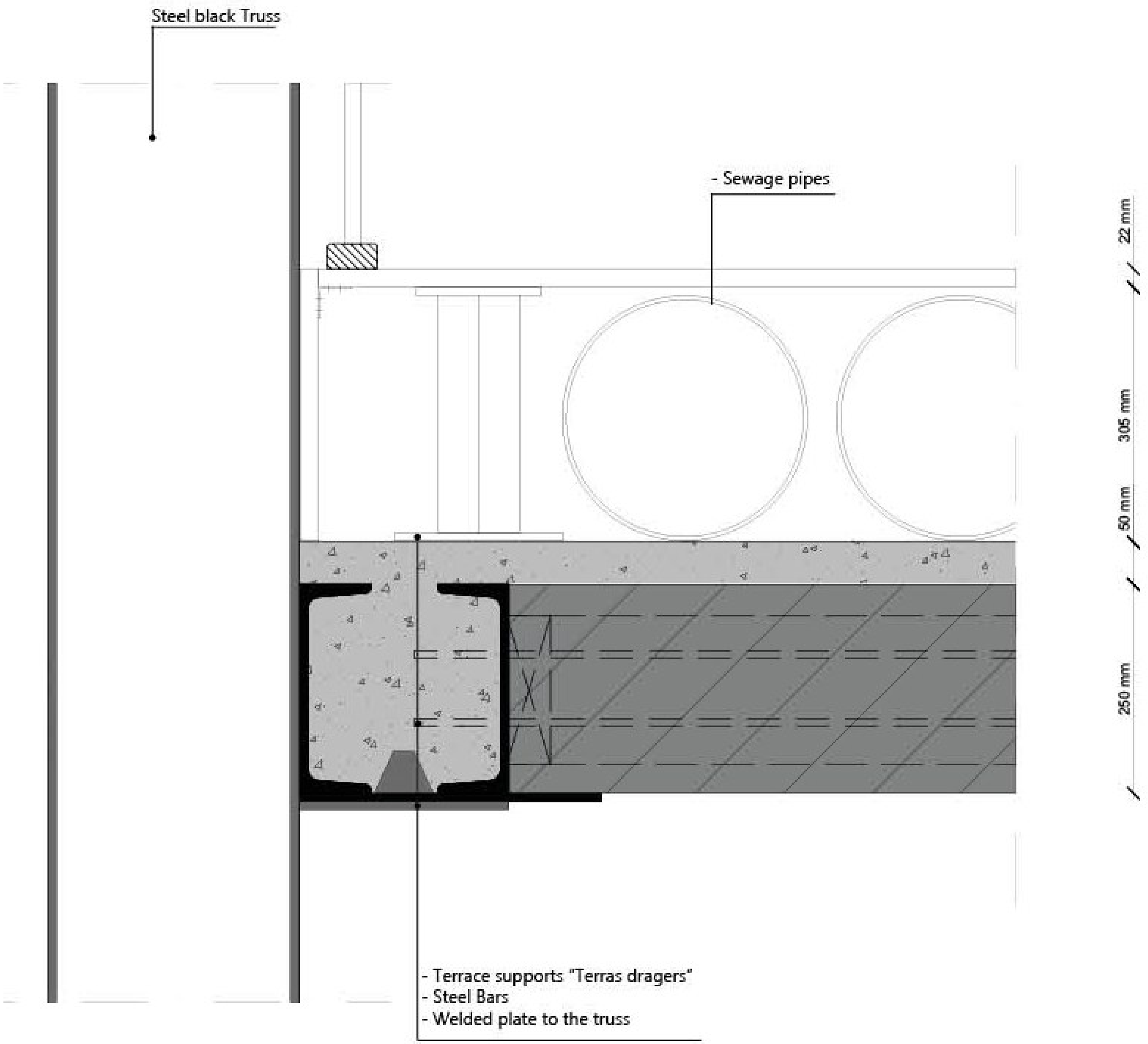

Aluminium Profile
Concrete Slab
Steel truss with welded plate
- Green cork panels 500 mm x 500 mm x 120 mm
- Filter layer
-Water saving / Drainage
- EPDM / Bituminous Layer
- Waterproof layer
- Screed 50 mm
- Reinforced hollow core slab 250 mm
- RHS beam with welded plate
300 mm

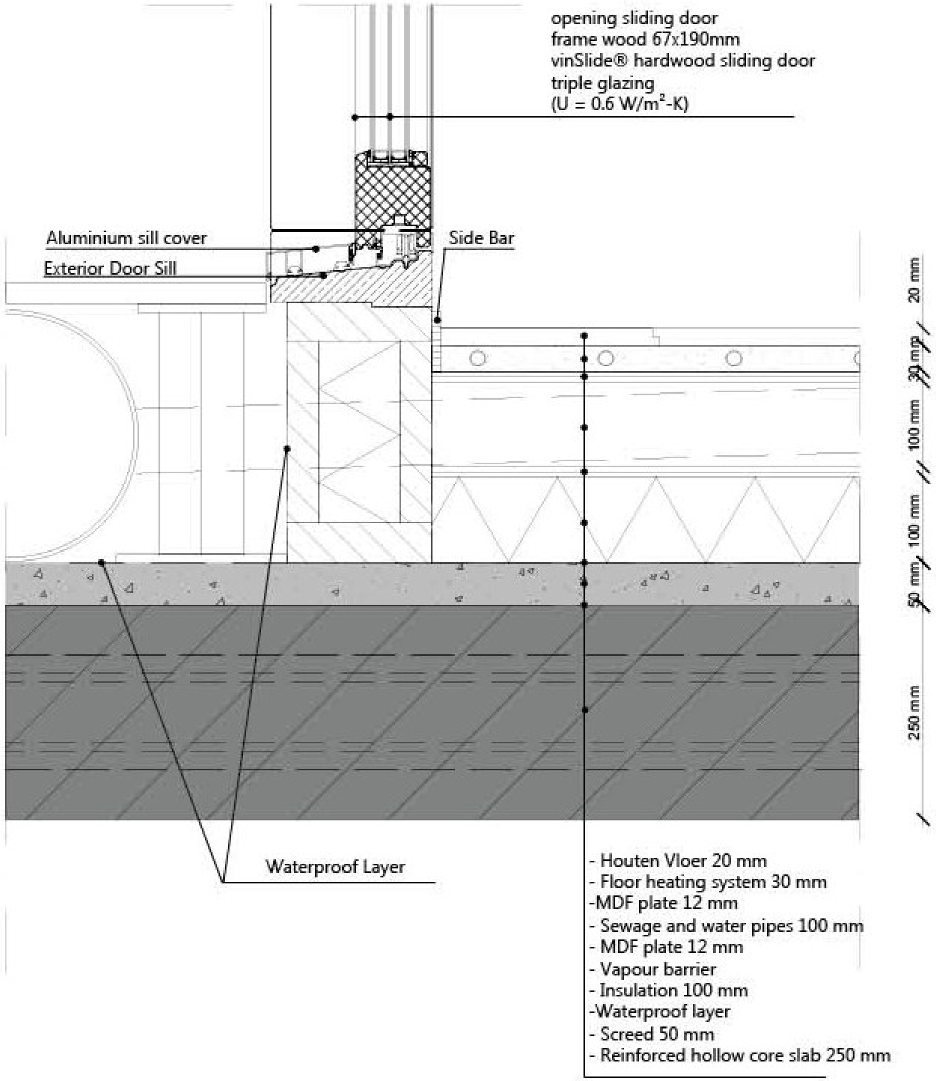

120 mm
70 mm
50 mm
250 mm
100 mm
76 mm
12 mm
Shading Screen
Waterproof Insulation
Double Sealing
- Insulation Layer 100 mm +
Wooden beams
- Vapour Barrier
- Mdf Plate
- Place for ventilation ducts
- Finishing Layer in wood tones
Opening sliding door
frame wood 67x190mm
vinSlide® hardwood sliding door
triple glazing
(U = 0.6 W/m²-K)


300 mm
46 mm
20 mm
New steel Truss for overtopping
22 mm
305 mm
50 mm
250 mm
300 mm

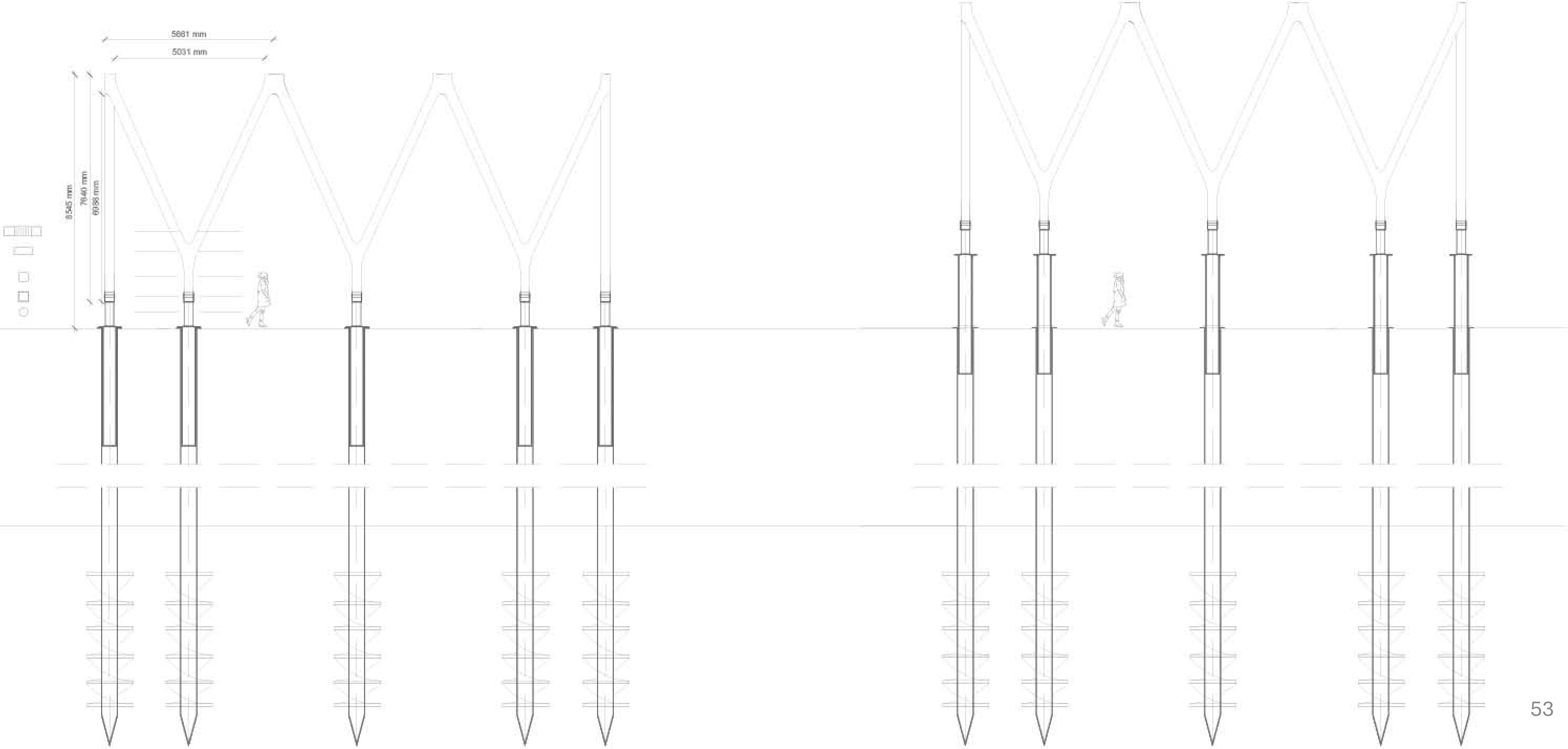
Off-Grid


Central
Heating
Boiler

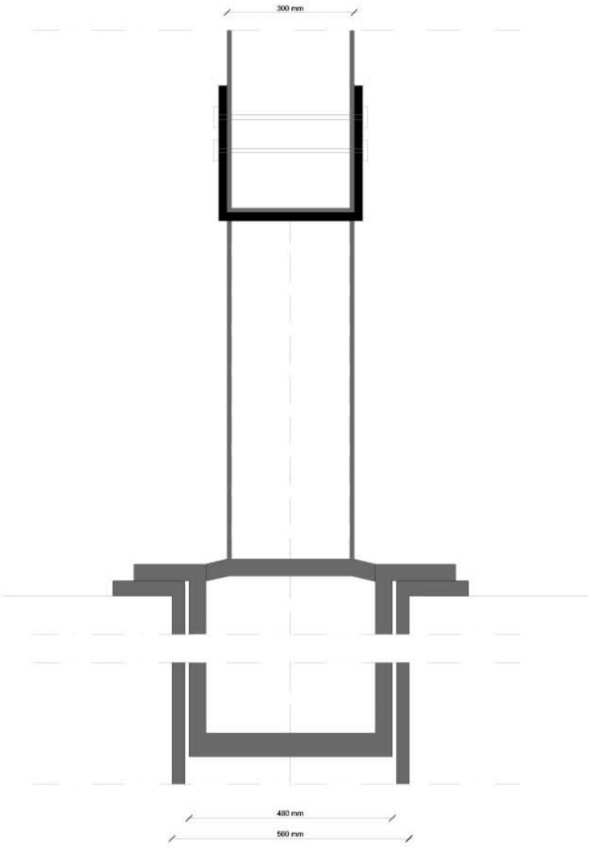

Steel black Truss
- Sewage pipes
22 mm
305 mm
50 mm
250 mm
- Terrace supports "Terras dragers"
- Steel Bars
- Welded plate to the truss

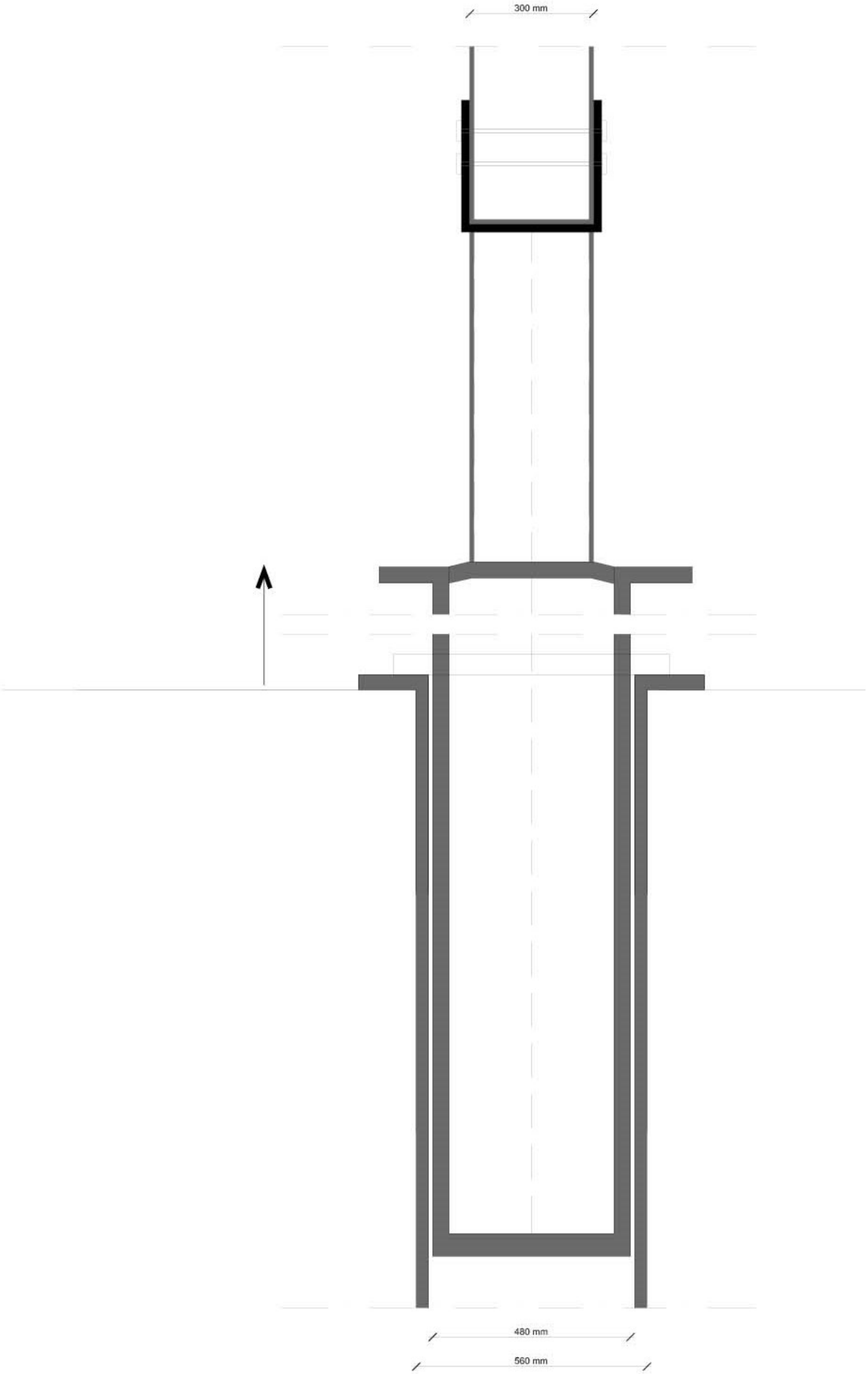

opening sliding door
frame wood 67x190mm
vinSlide® hardwood sliding door
triple glazing
(U = 0.6 W/m²-K)
Aluminium sill cover
Exterior Door Sill
Side Bar
20 mm
30 mm
100 mm
100 mm
50 mm
250 mm
Waterproof Layer
- Houten Vloer 20 mm
- Floor heating system 30 mm
-MDF plate 12 mm
- Sewage and water pipes 100 mm
- MDF plate 12 mm
- Vapour barrier
- Insulation 100 mm
-Waterproof layer
- Screed 50 mm
- Reinforced hollow core slab 250 mm

Climate Proof

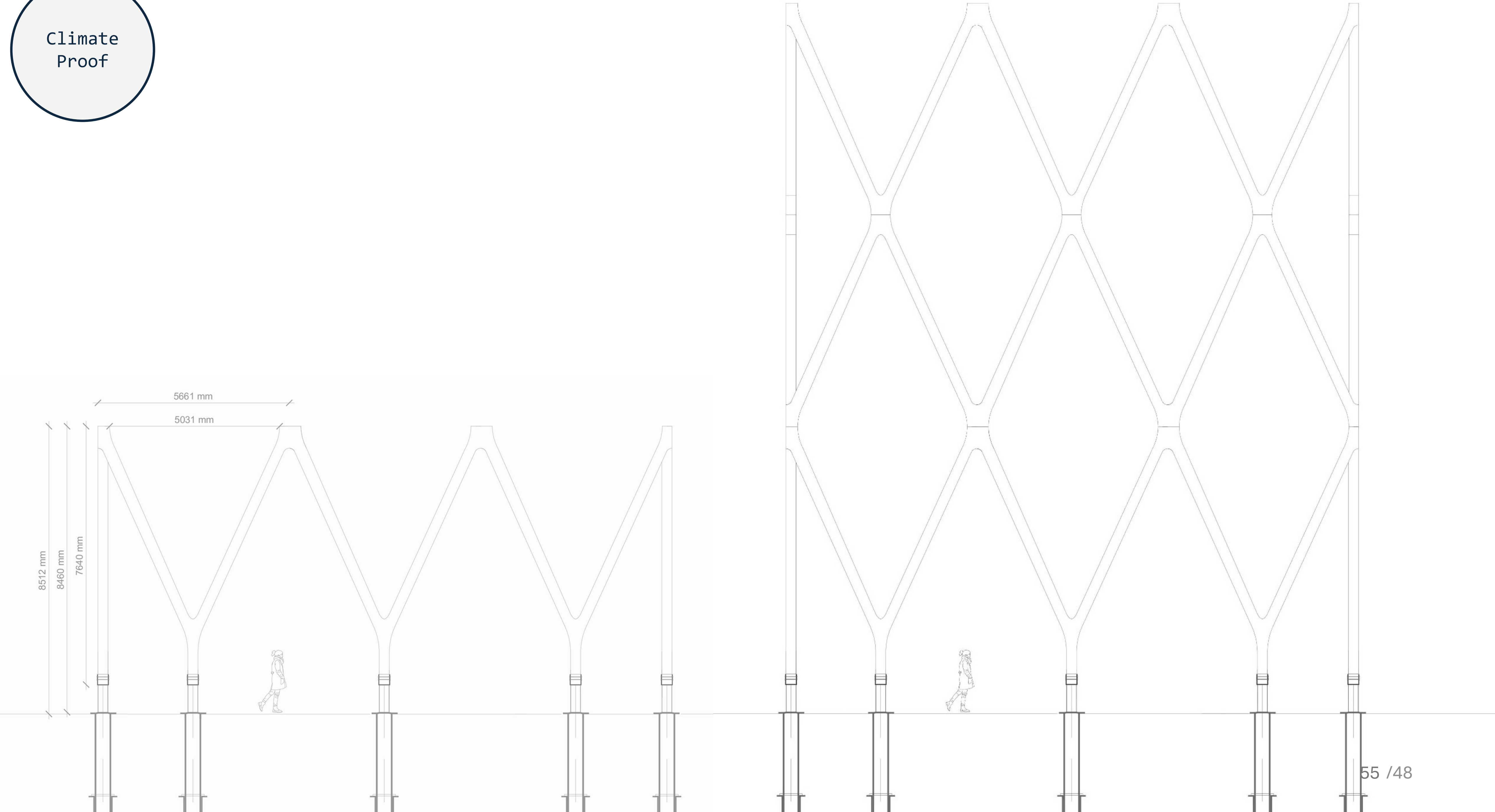

5661 mm
5031 mm
8545 mm
7640 mm
6938 mm

Climate
Proof

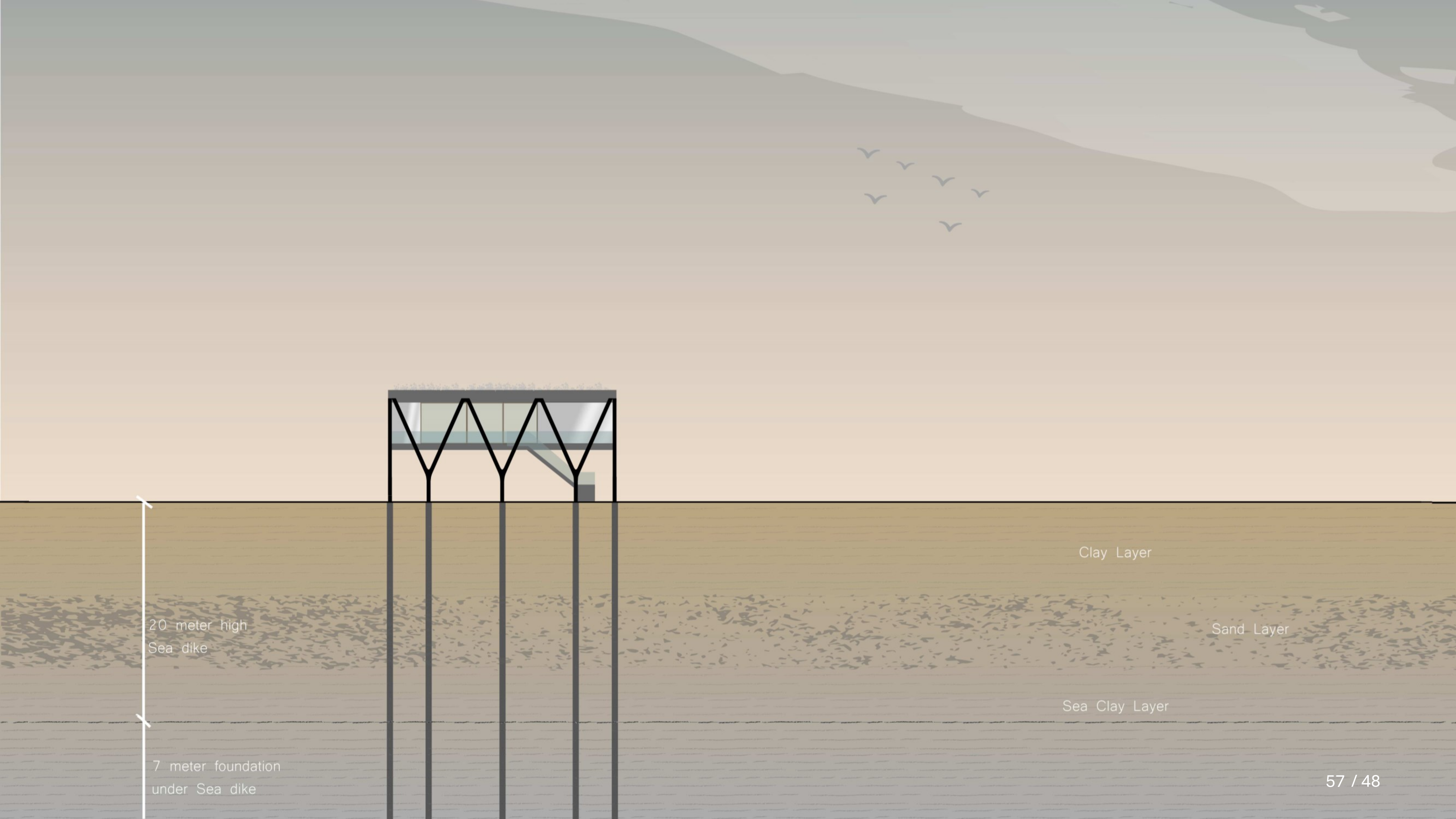

300 mm
480 mm
560 mm

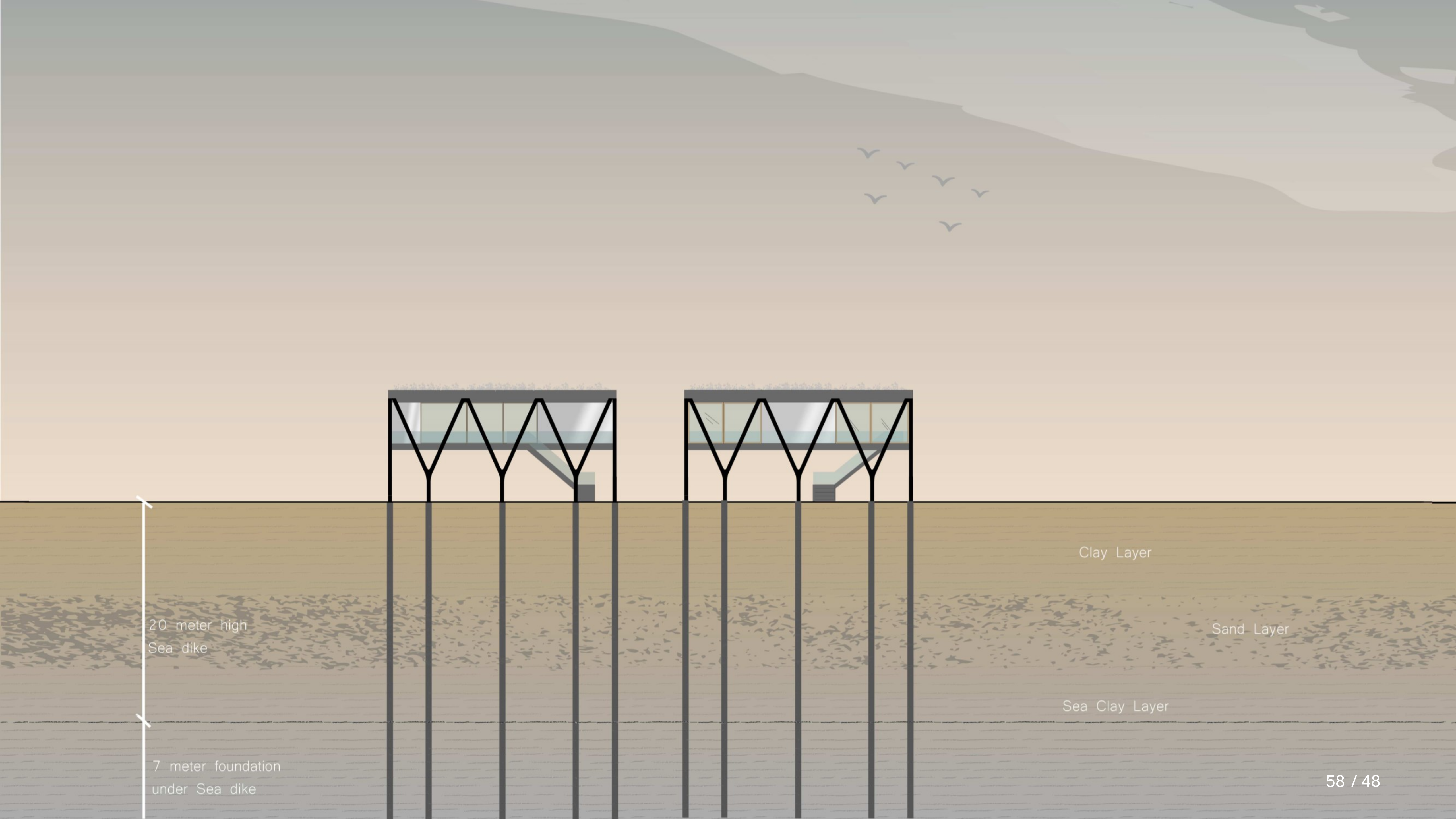

300 mm
480 mm
560 mm

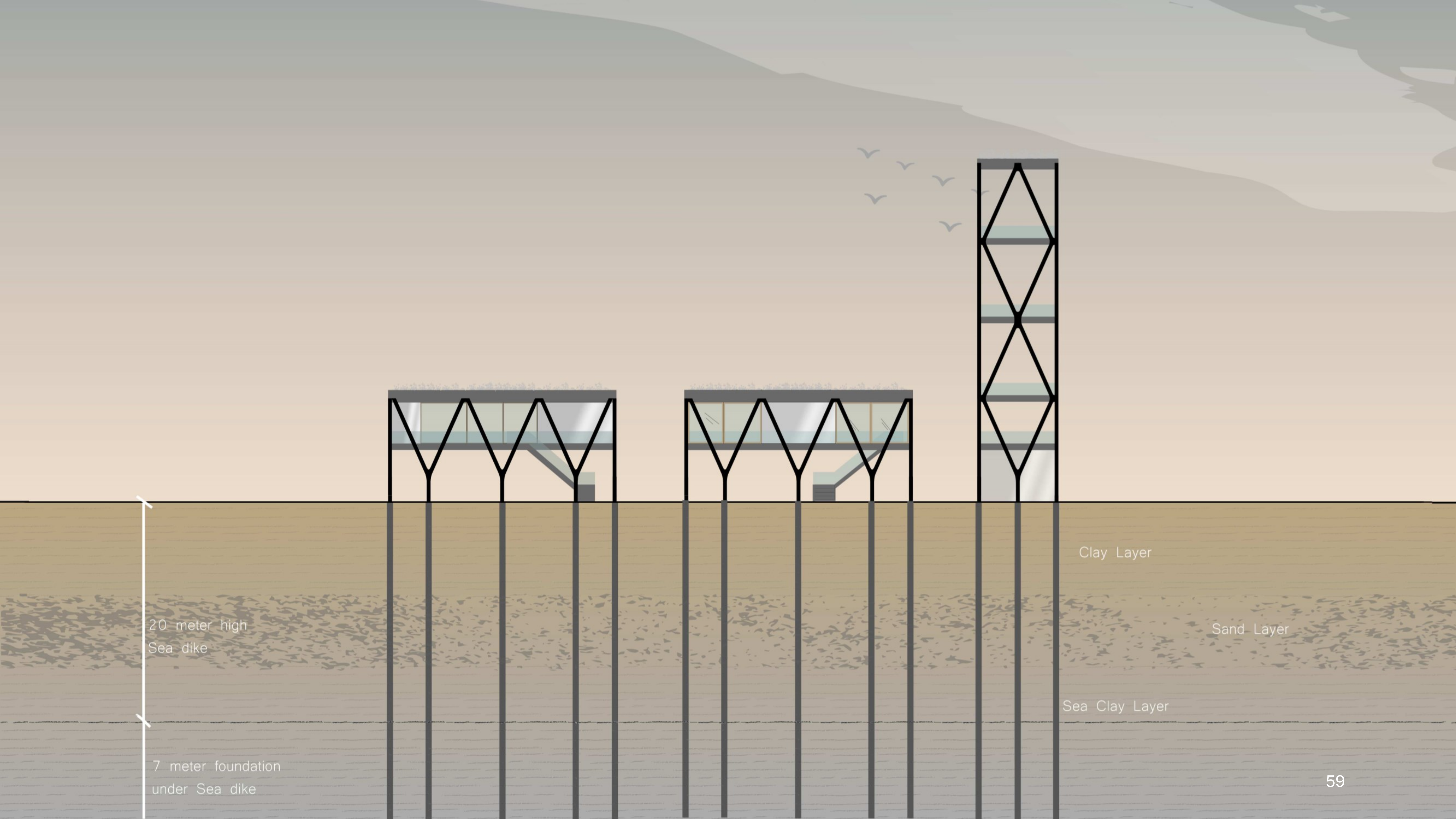
Climate
Proof


5661 mm
5031 mm
8512 mm
8460 mm
7640 mm

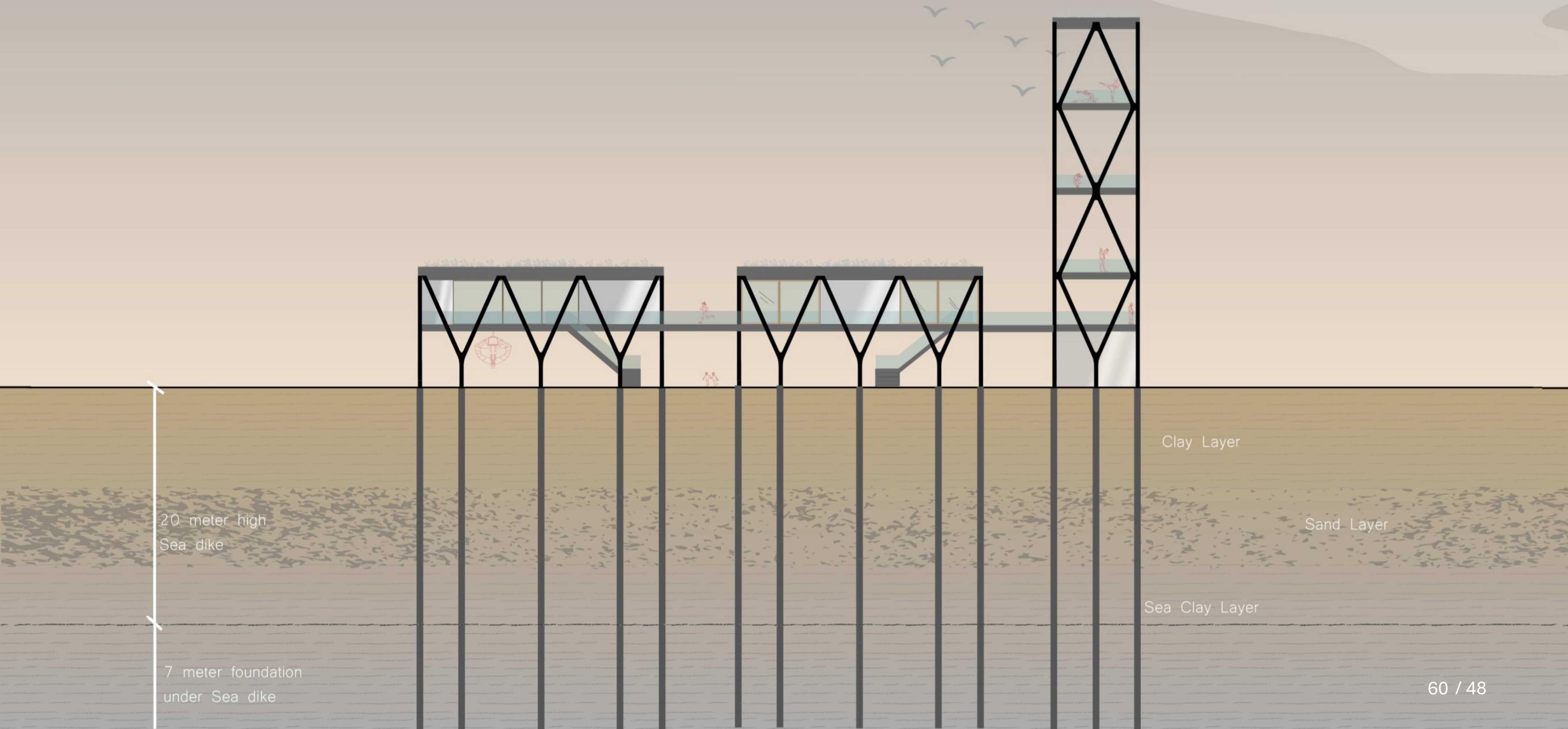
The story


Clay Layer
20 meter high
Sea dike
Sand Layer
Sea Clay Layer
7 meter foundation
under Sea dike


Clay Layer
20 meter high
Sea dike
Sand Layer
Sea Clay Layer
7 meter foundation
under Sea dike


20 meter high
Sea dike
7 meter foundation
under Sea dike
Clay Layer
Sand Layer
Sea Clay Layer

61 Houses per 1 Km
46.125 Houses per 750 Km (Sea dike of Groningen)


Clay Layer
20 meter high
Sea dike
Sand Layer
Sea Clay Layer
7 meter foundation
under Sea dike

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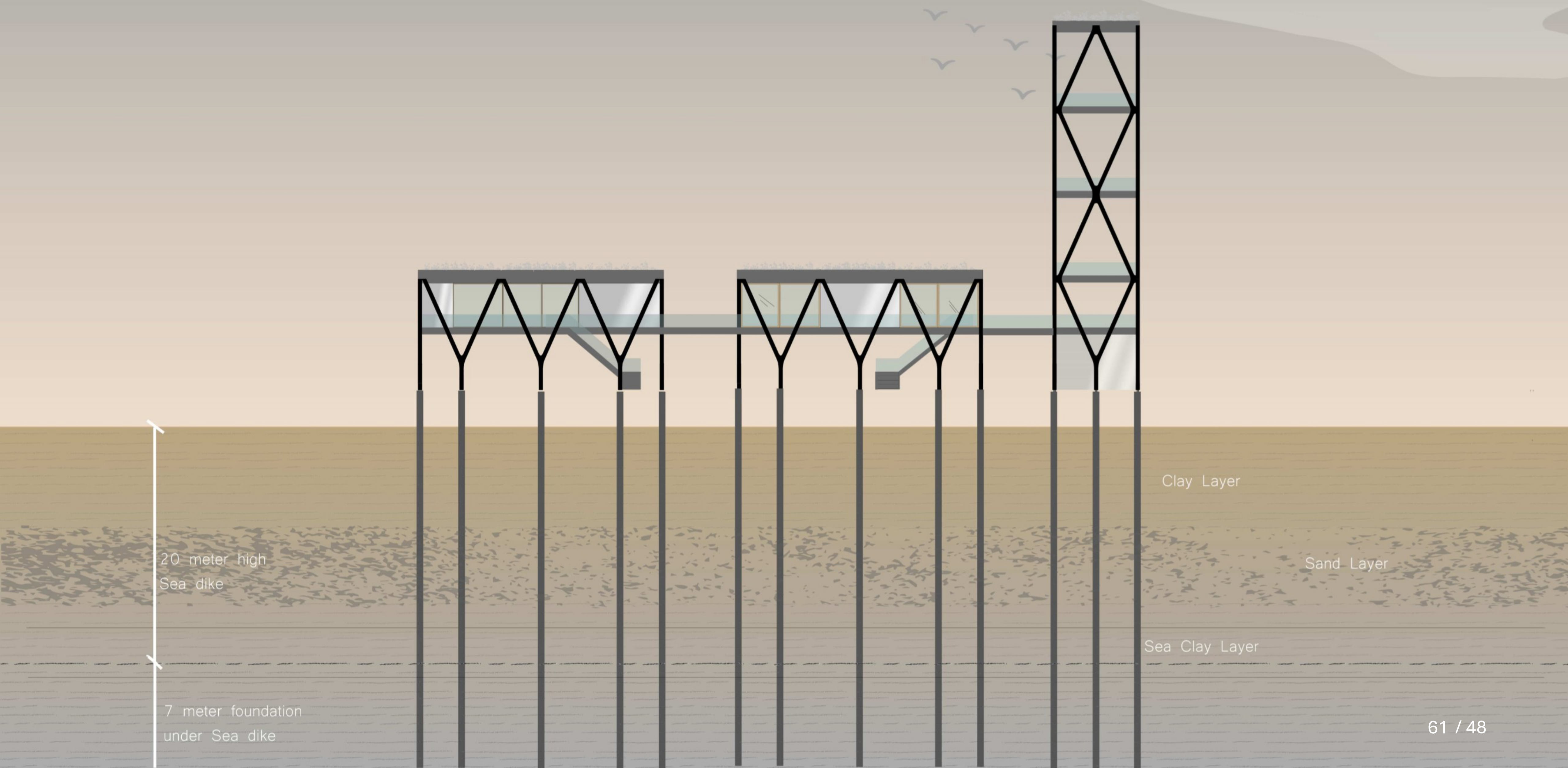
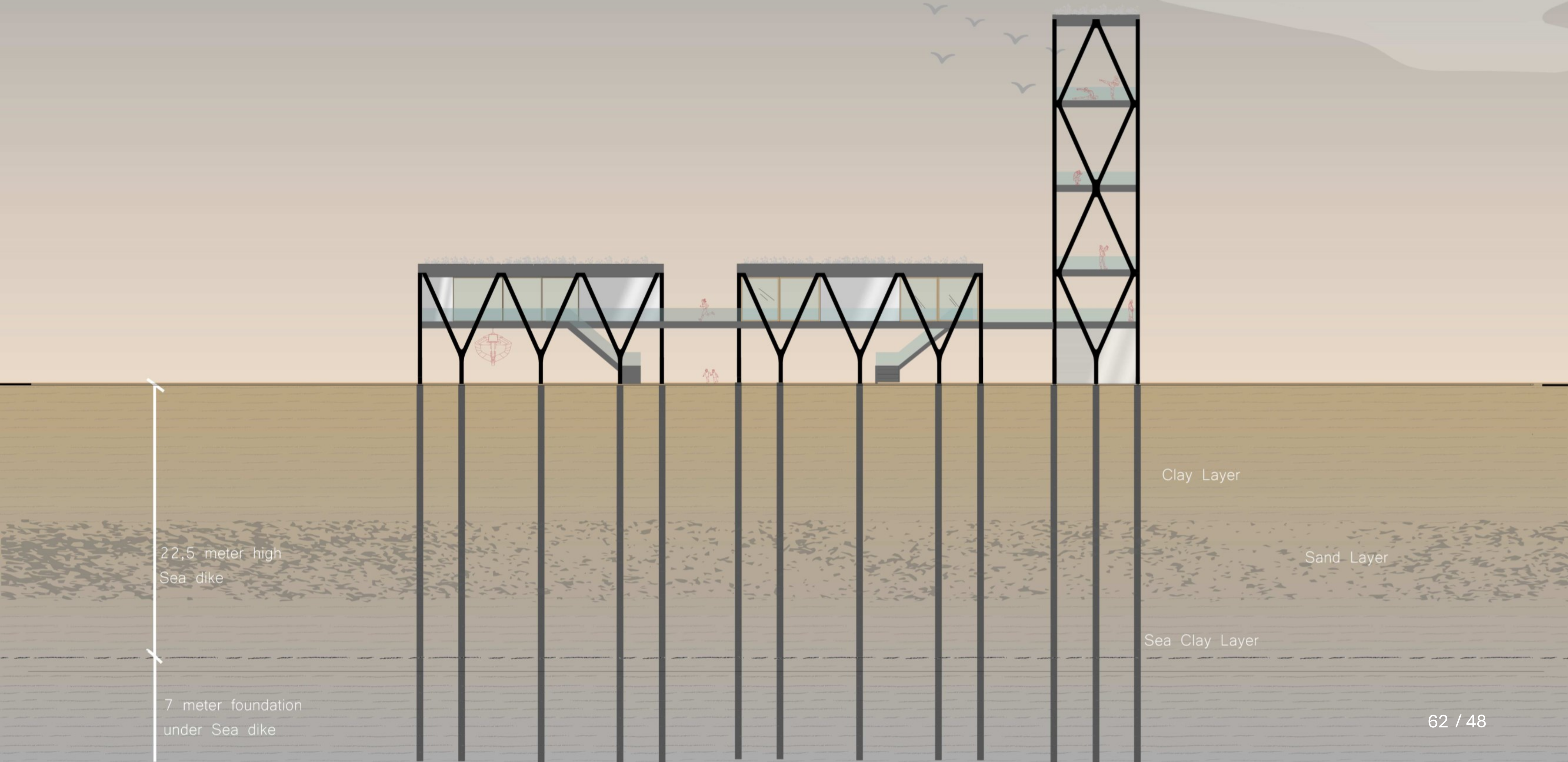
46.125 Houses per 750 Km (Sea dike of Groningen)

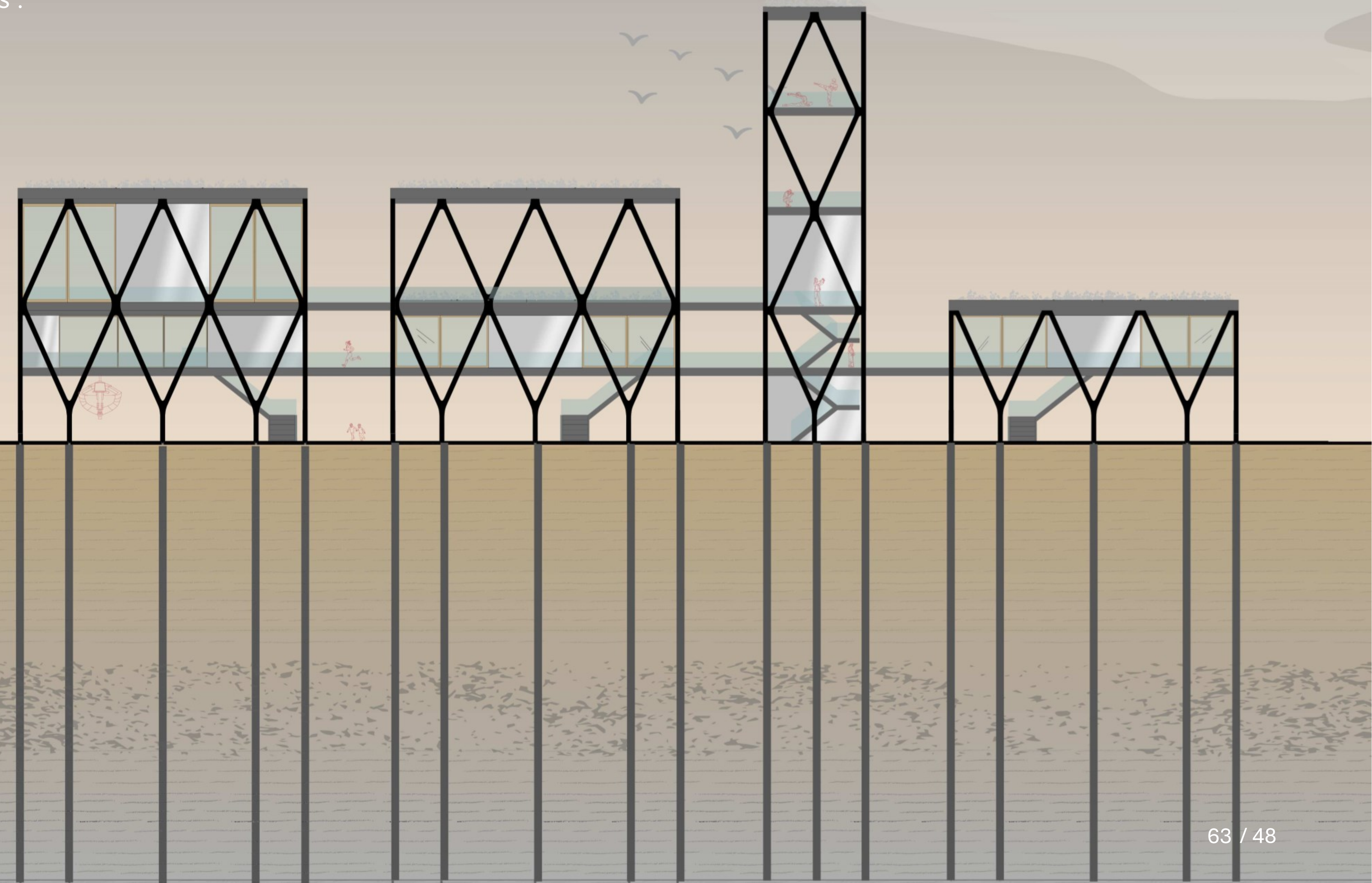

Clay Layer
20 meter high
Sea dike
Sand Layer
Sea Clay Layer
7 meter foundation
under Sea dike

61 Houses per 1 Km
46.125 Houses per 750 Km (Sea dike of Groningen)


Clay Layer
22,5 meter high
Sea dike
Sand Layer
Sea Clay Layer
7 meter foundation
under Sea dike

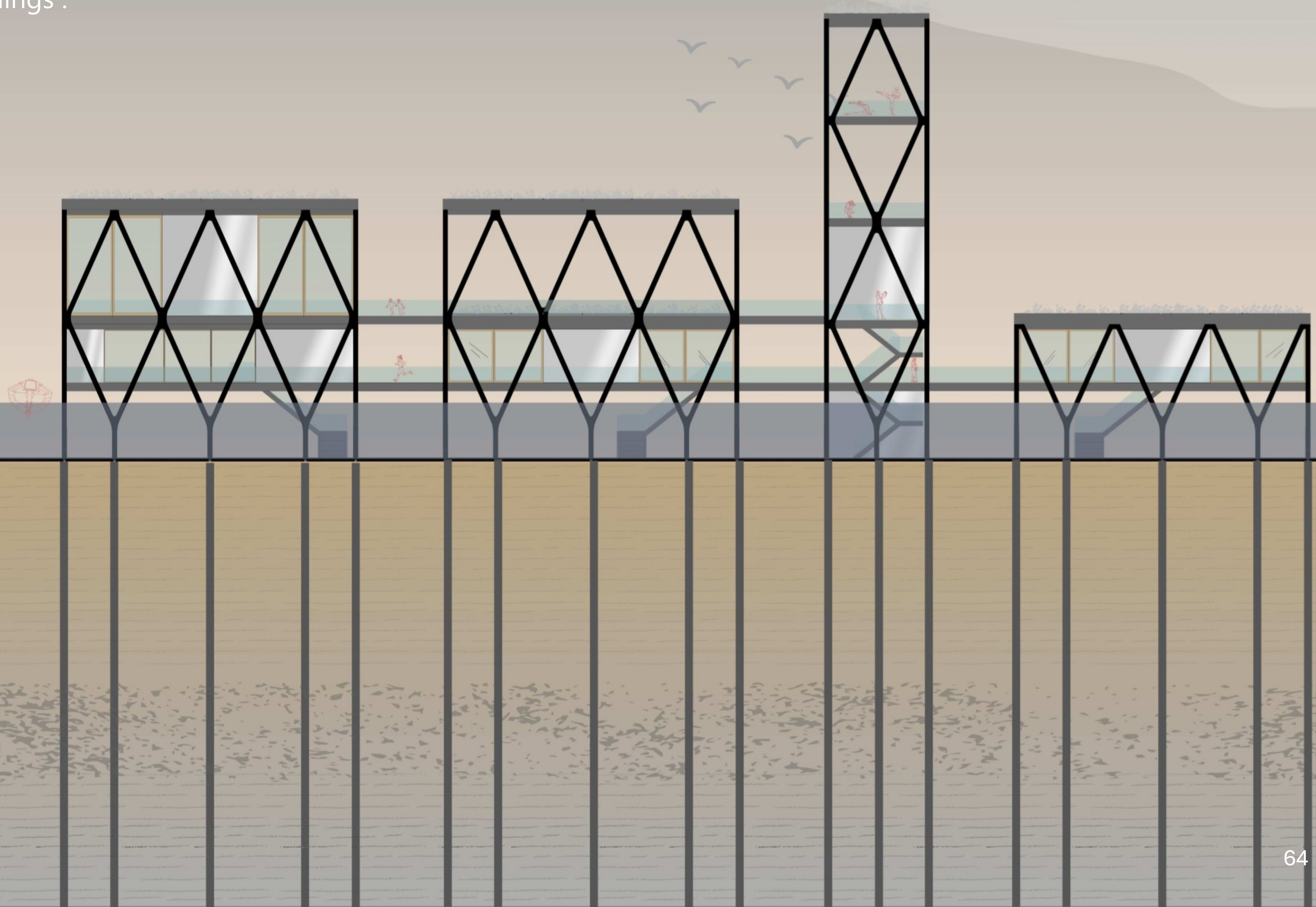
122 Houses per 1 Km with two floors buildings
91.500 Houses per 750 Km (Sea dike of Groningen)

And in case of three floors buildings :
183 Houses per 1 Km
137.250 Houses per 750 km

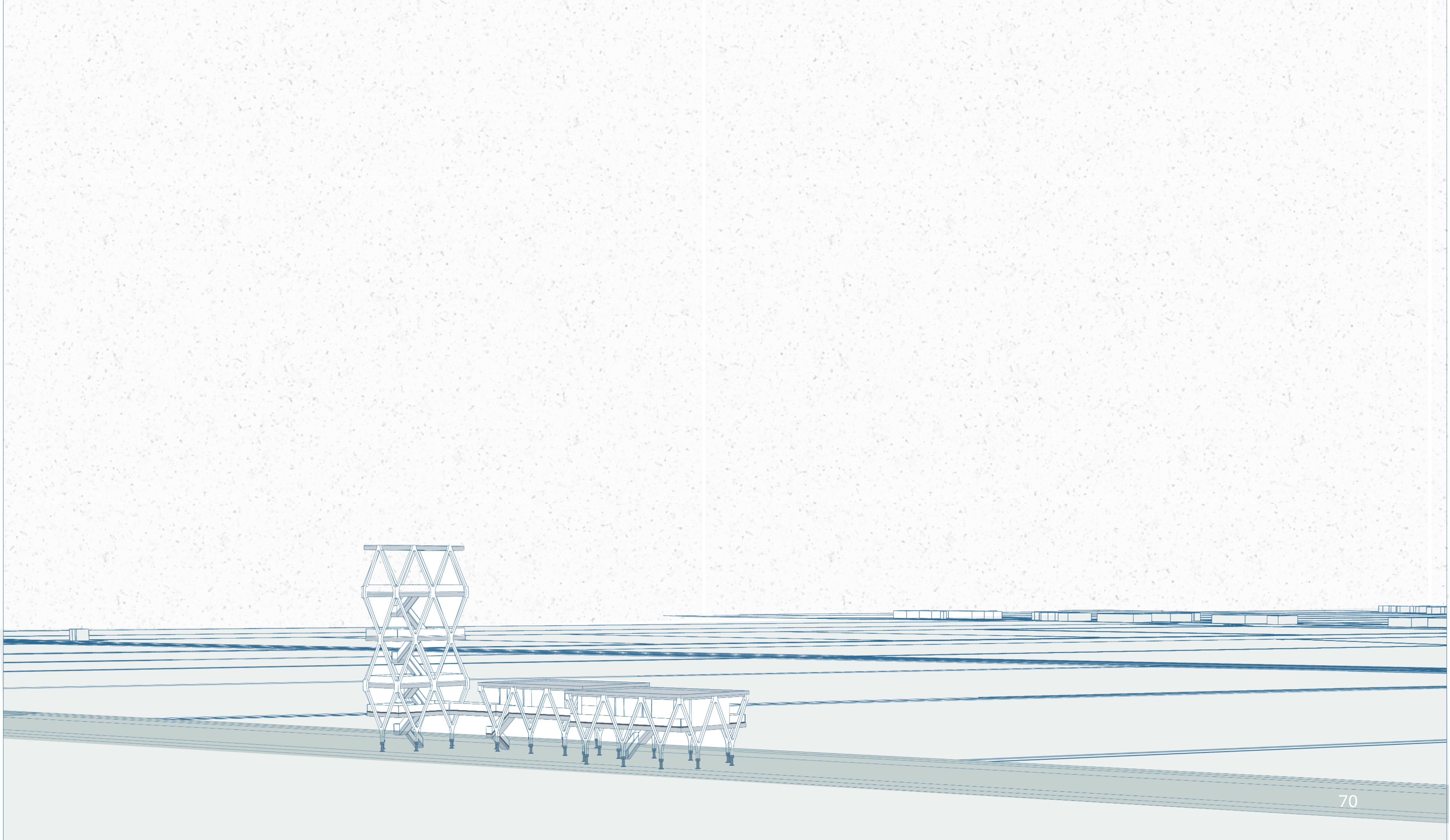


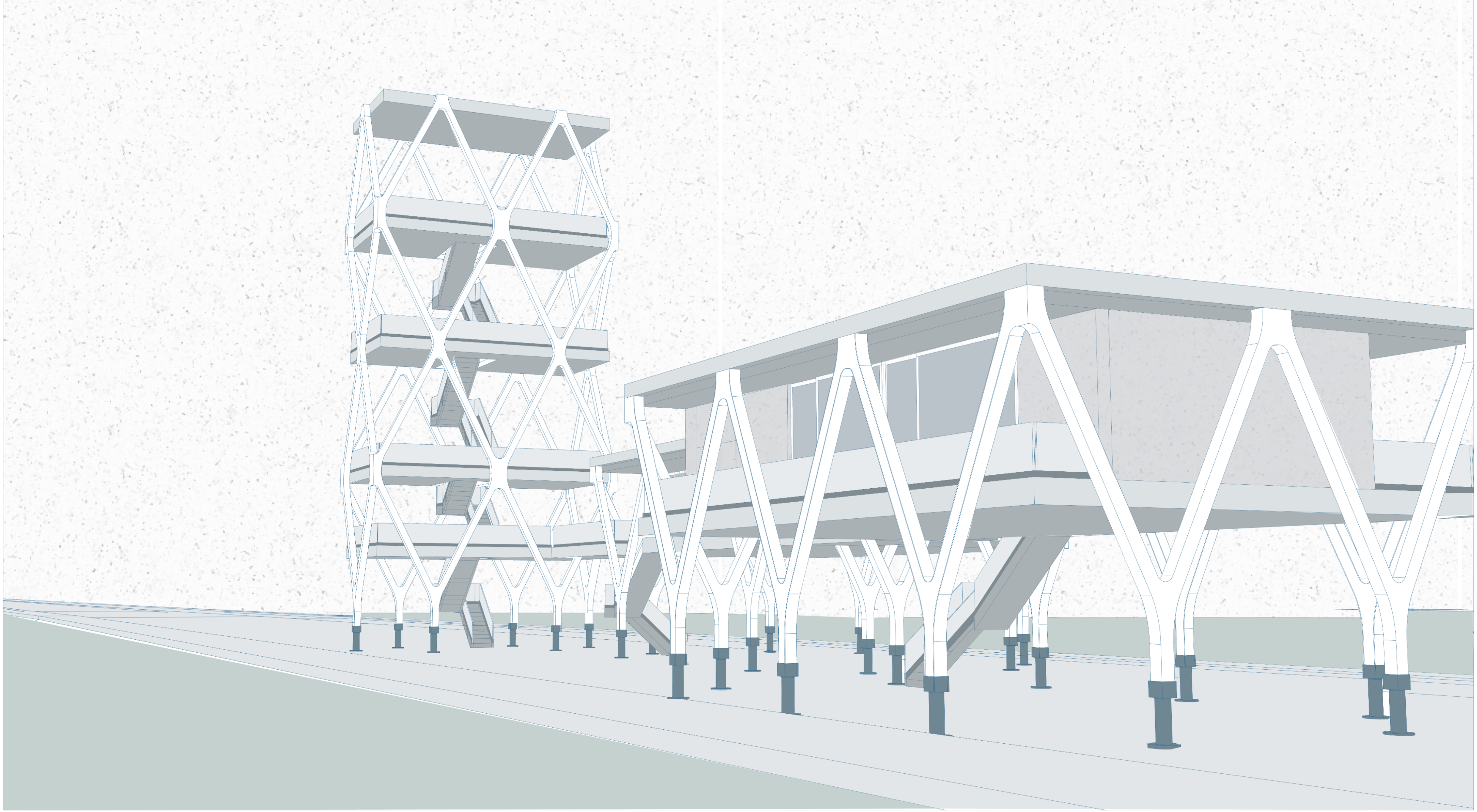
122 Houses per 1 Km with two floors buildings
91.500 Houses per 750 Km (Sea dike of Groningen)

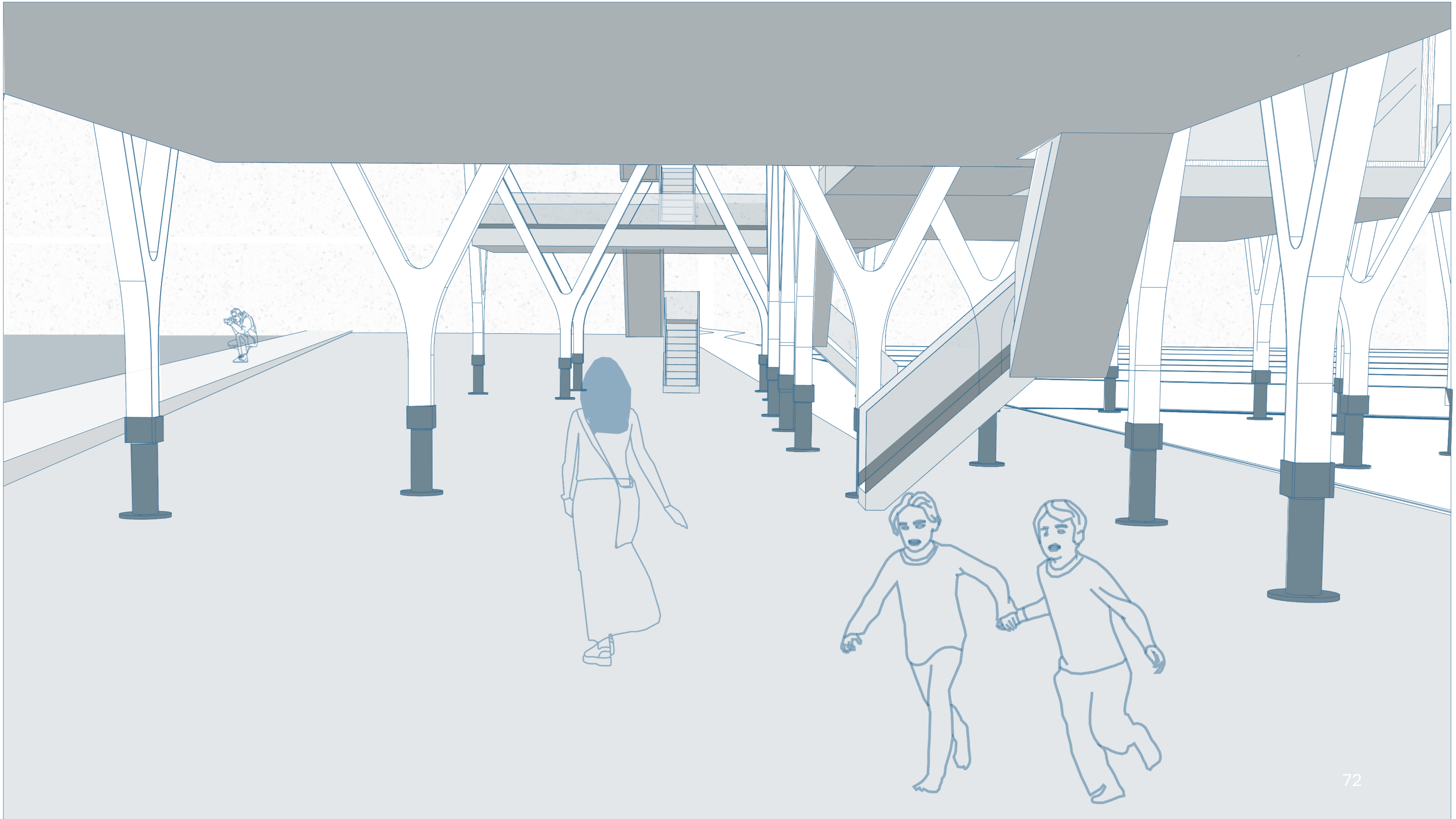
And in case of three floors buildings :
183 Houses per 1 Km
137.250 Houses per 750 km



Architecture in the Landscape







Reflection

Thank You