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An exploration of how vernacular building strategies in humid subtropical climates can provide a framework for heat prone areas in Eindhoven

Name

Roel Jacobs
6127320

Graduation Studio

Architectural Engineering
The Art of Making

Date

17th of June, 2026

Supervisors

Paddy Tomesen
Stephan Verkuijlen

Delegate

Stavros Kousoulas

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Problem Statement

Research Scope

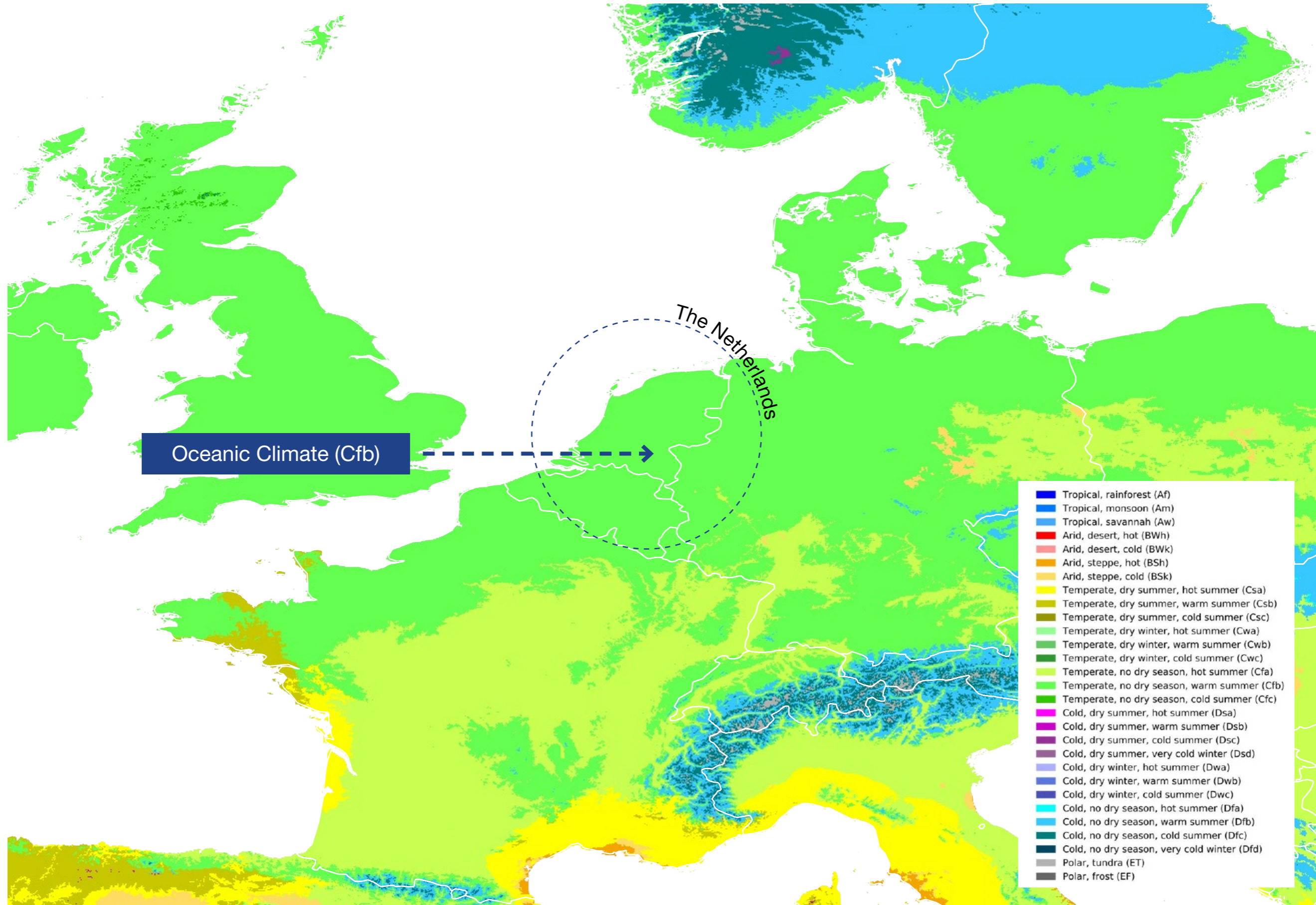
Testing Ground

Final Design

Problem Statement

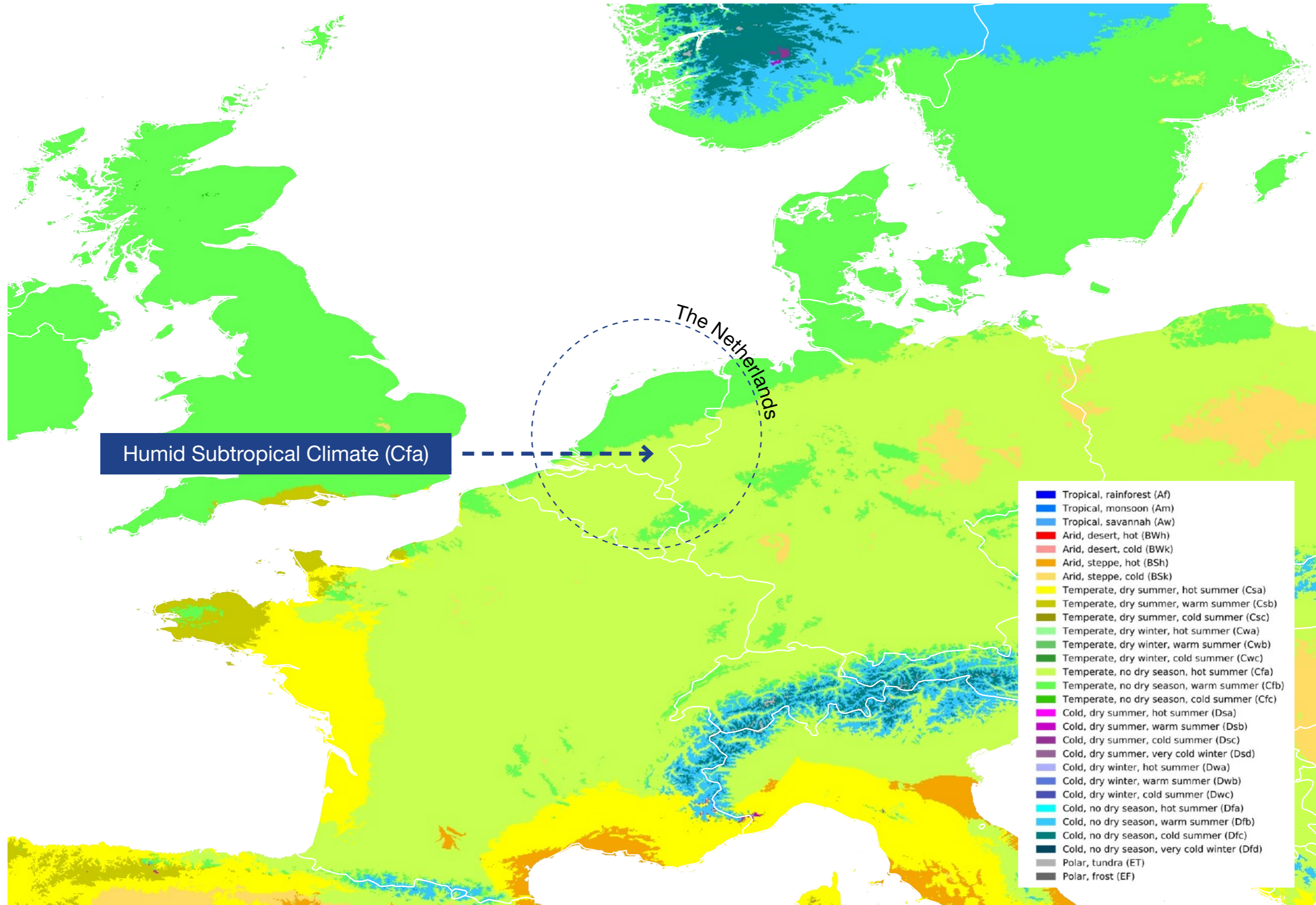
Shift in Climate Classification

Current Climate Classification



(Koppen-Geiger Climate Classification, Beck et al., 2018)

Future Climate Classification



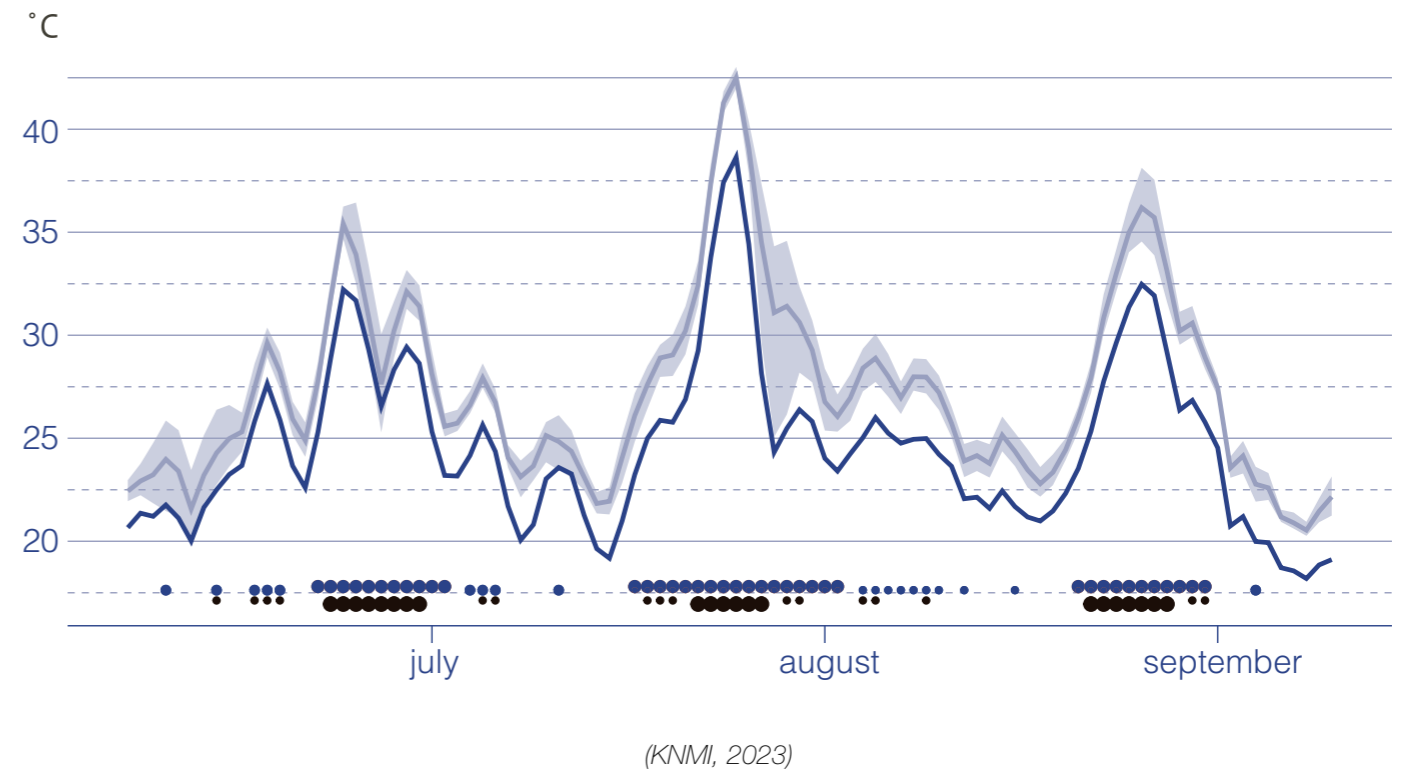
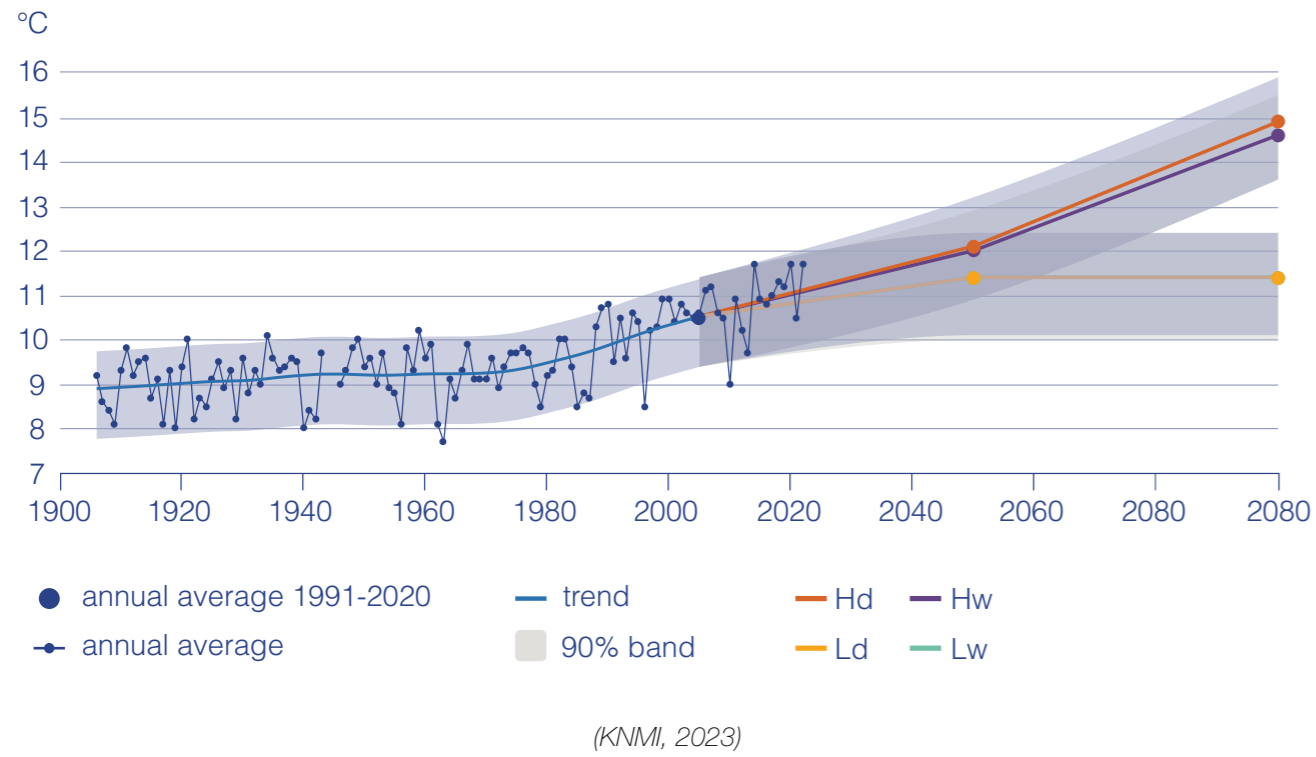
(Koppen-Geiger Climate Classification, Beck et al., 2018)

Cfa Climate?

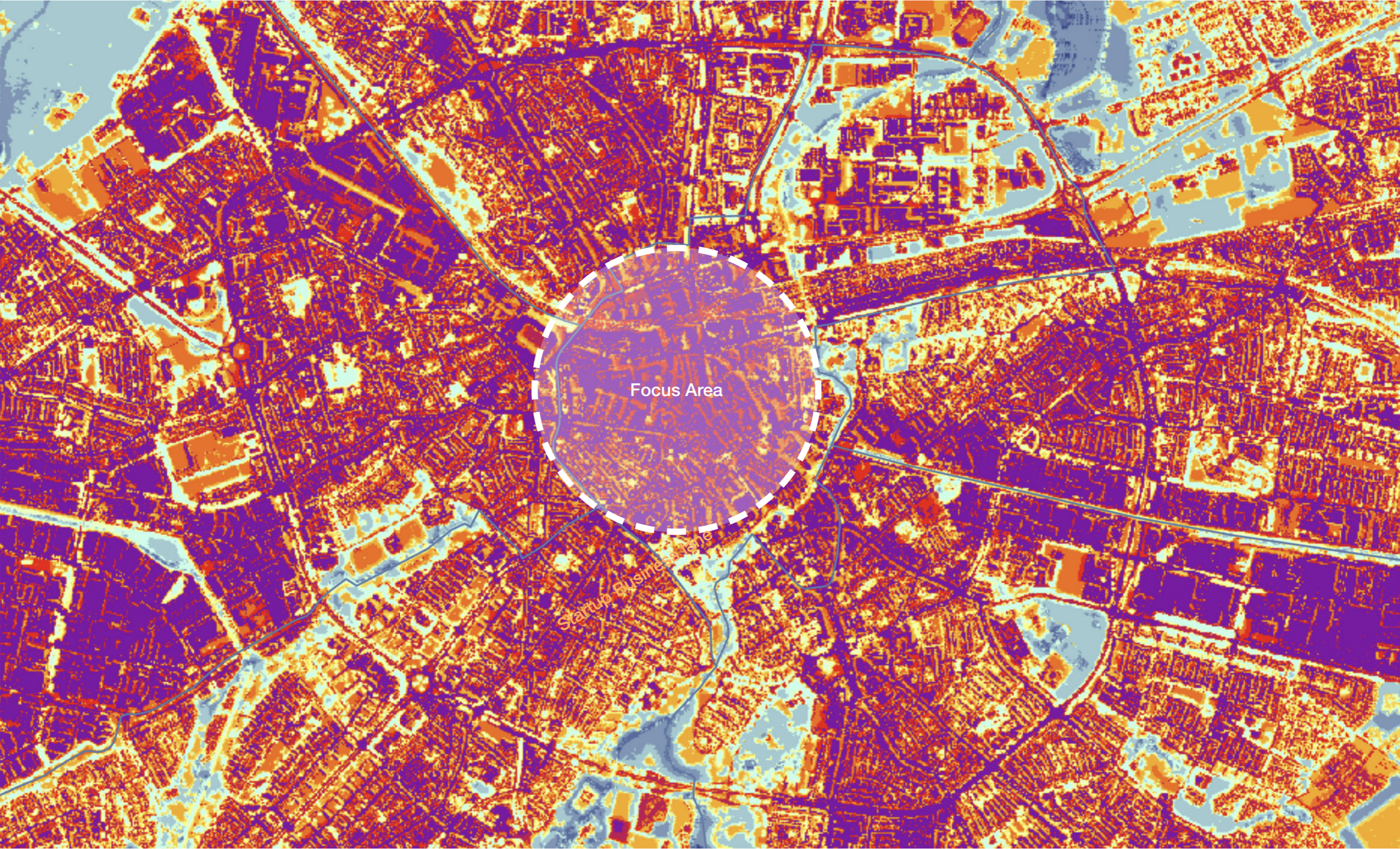
C = Warm Temperate **f** = fully humid **a** = hot summer

Future Rising Temperatures

Expected Heatwave Events



Heatstress Scenario in Eindhoven



(Klimaatatlas effect, n.d.)

Future Vision of Eindhoven

?



De Brainport laag
Nieuwe herkenbare
Brainport Identiteit

De Eindhovense laag
Versterking van de
bestaande stad

(Municipality of Eindhoven, 2020)



(Eindhovens Dagblad, 2020)

Fascination

“Vernacular architecture is a nineteenth-century intervention and defined as a building form based on local needs, the availability of construction materials and reflecting local traditions”

(Sayigh, A. (Ed.). (2019). Sustainable vernacular architecture: How the past can enrich the future. Springer.

“It has evolved over time through long-term adaptation due to its constant dialogue with specific environmental, cultural, technological, and historical contexts.”

L. Asquith & M. Vellinga (n.d.). Vernacular architecture in the twenty-first century: Theory, education and practice. Taylor & Francis.

“Rather than formal imitation, vernacular architecture calls for a critical translation, in which underlying principles are extracted and applied to context-specific, socially embedded, and future-oriented architectural solutions”

L. Asquith & M. Vellinga (n.d.). Vernacular architecture in the twenty-first century: Theory, education and practice. Taylor & Francis.

Research Scope

Humid Subtropical Climates Around the Globe

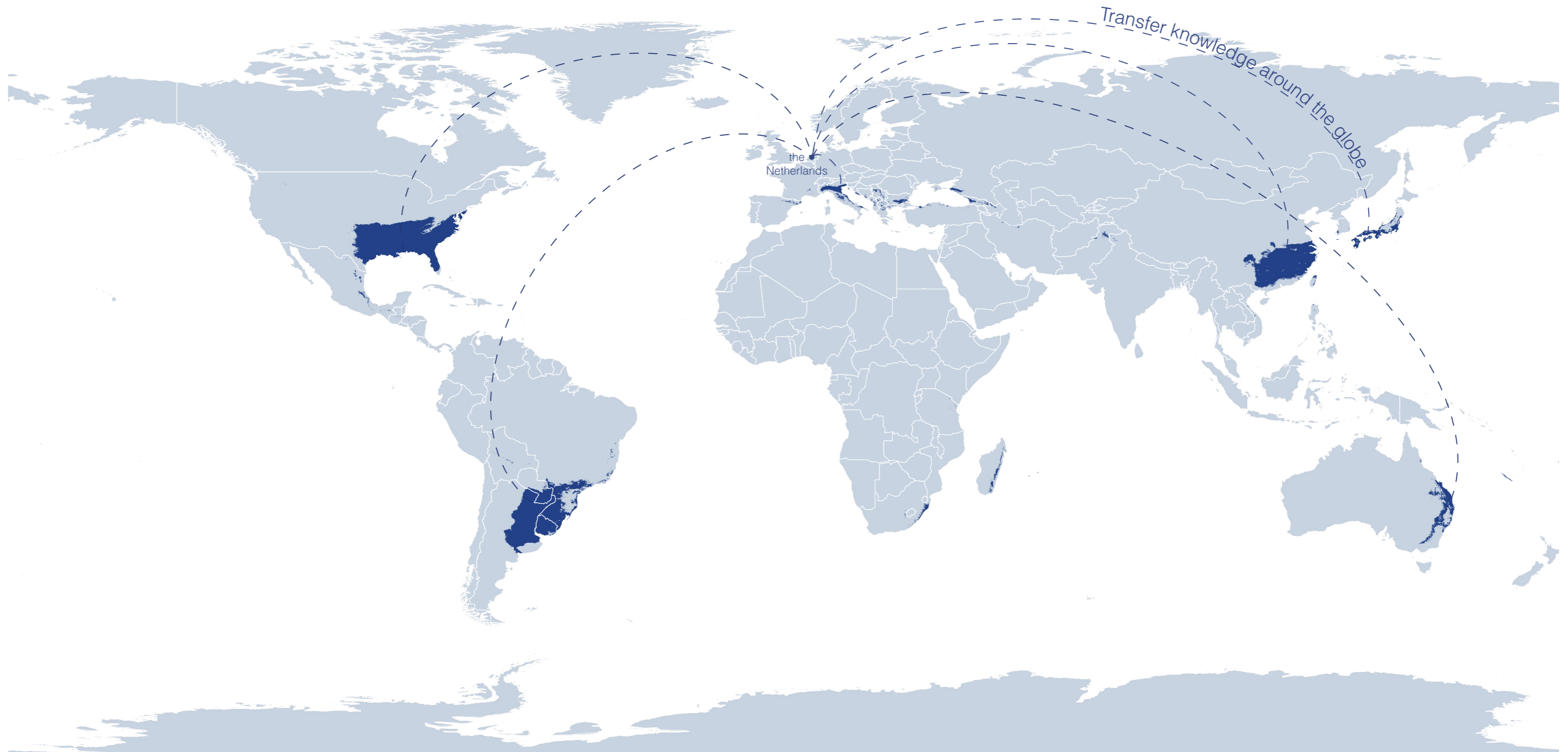
■ humid subtropical climate (Cfa)



(Beck et al., 2023)

Transfer Knowledge to the Dutch Context

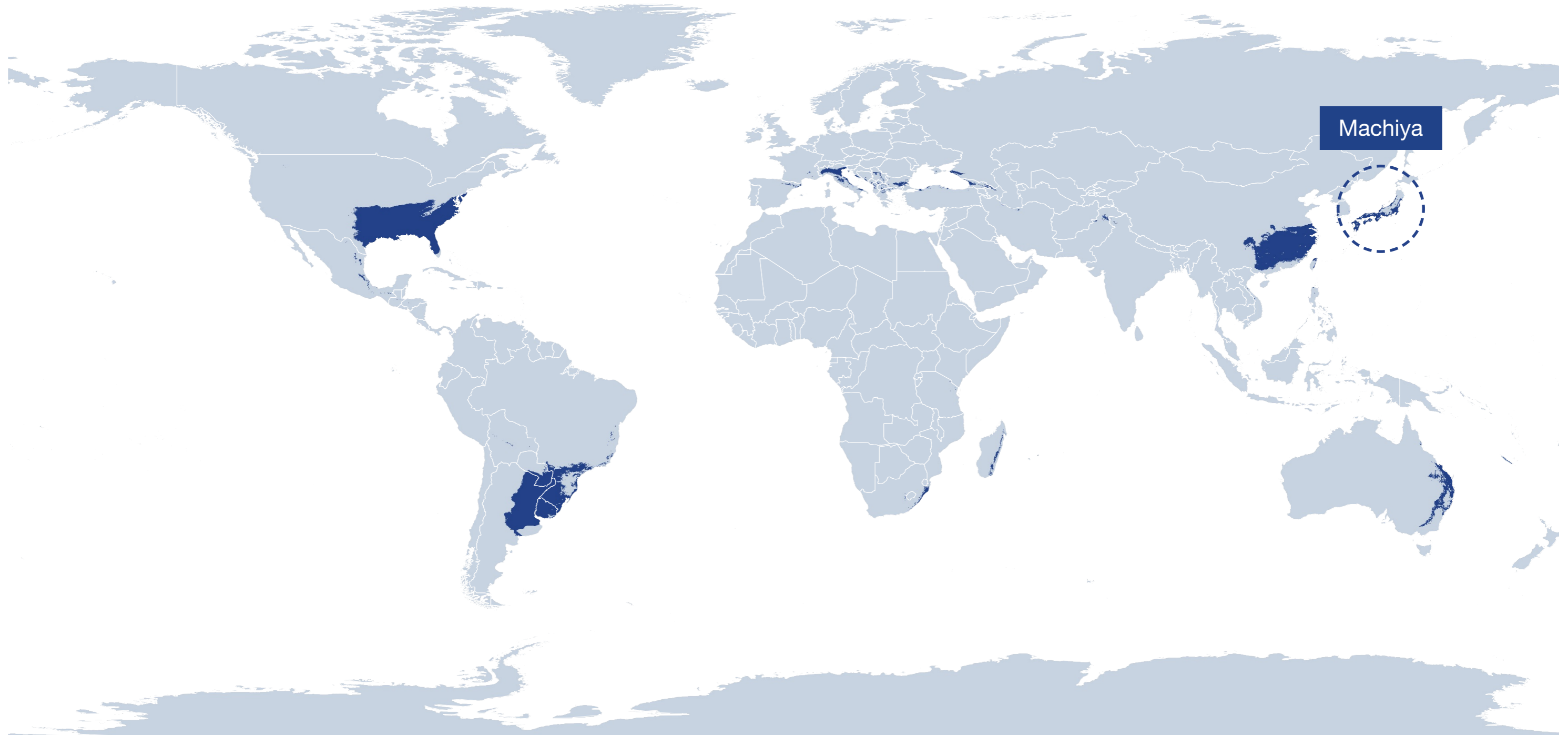
■ humid subtropical climate (Cfa)



(Beck et al., 2023)

Machiya Typology

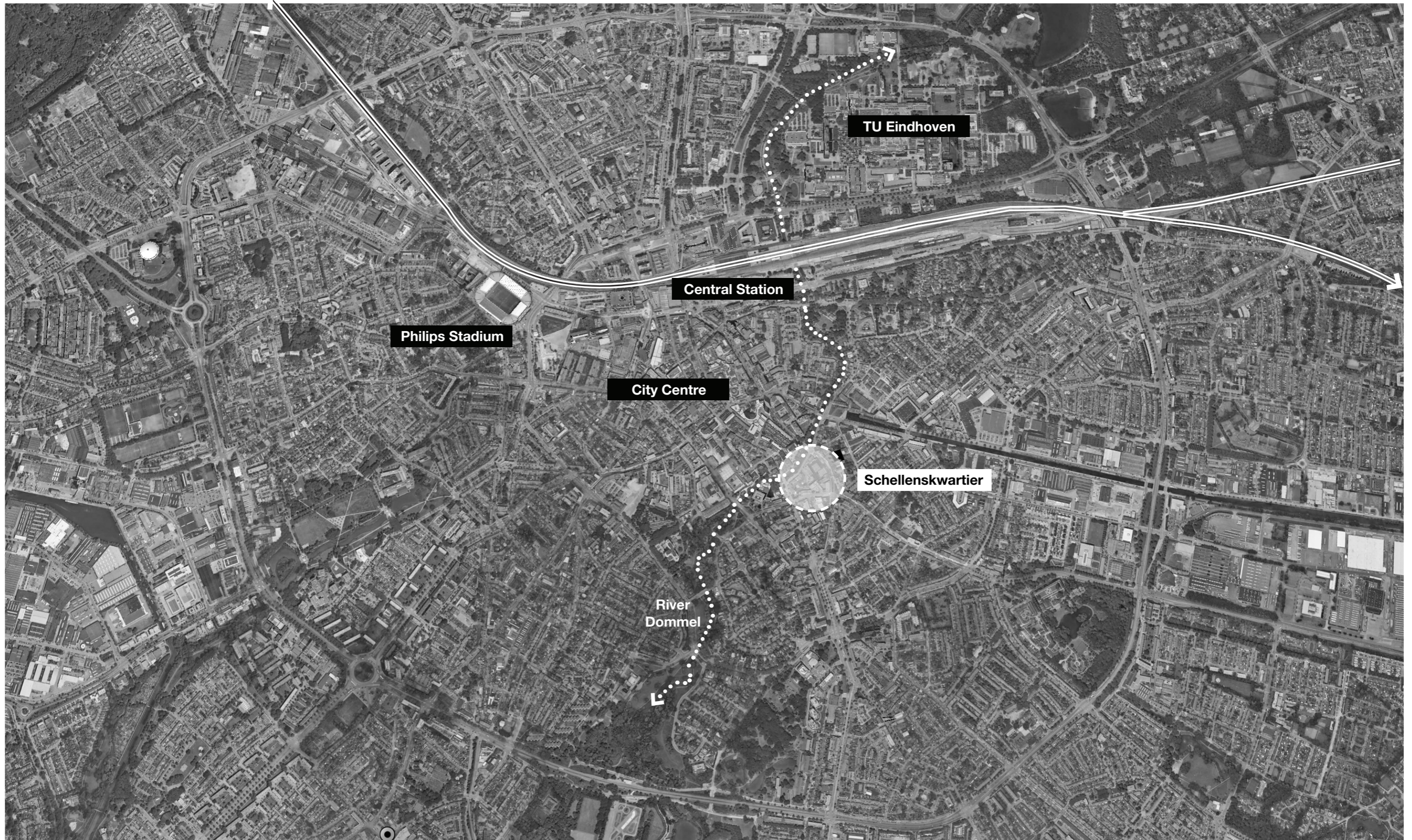
■ humid subtropical climate (Cfa)



(Beck et al., 2023)

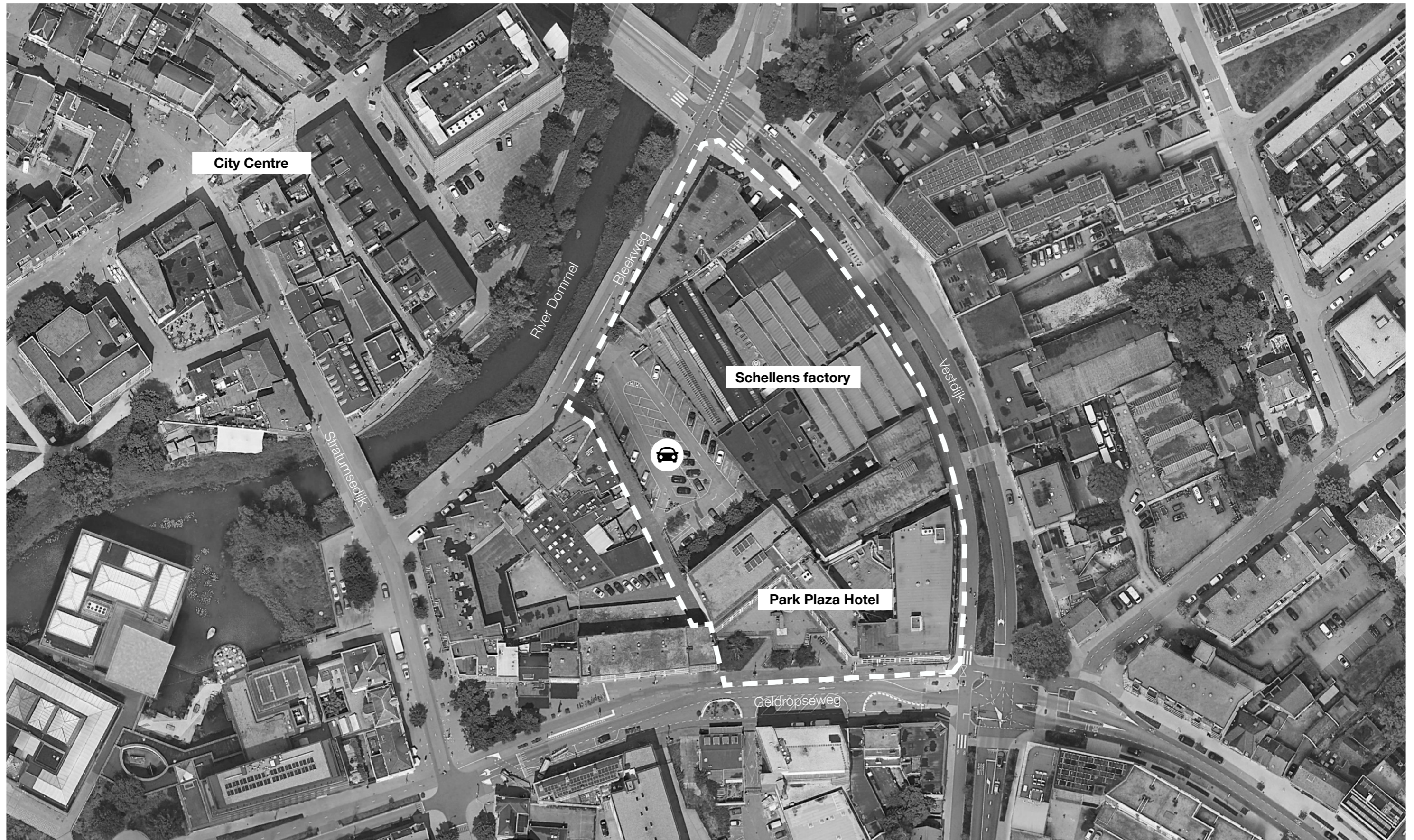
Context

Eindhoven



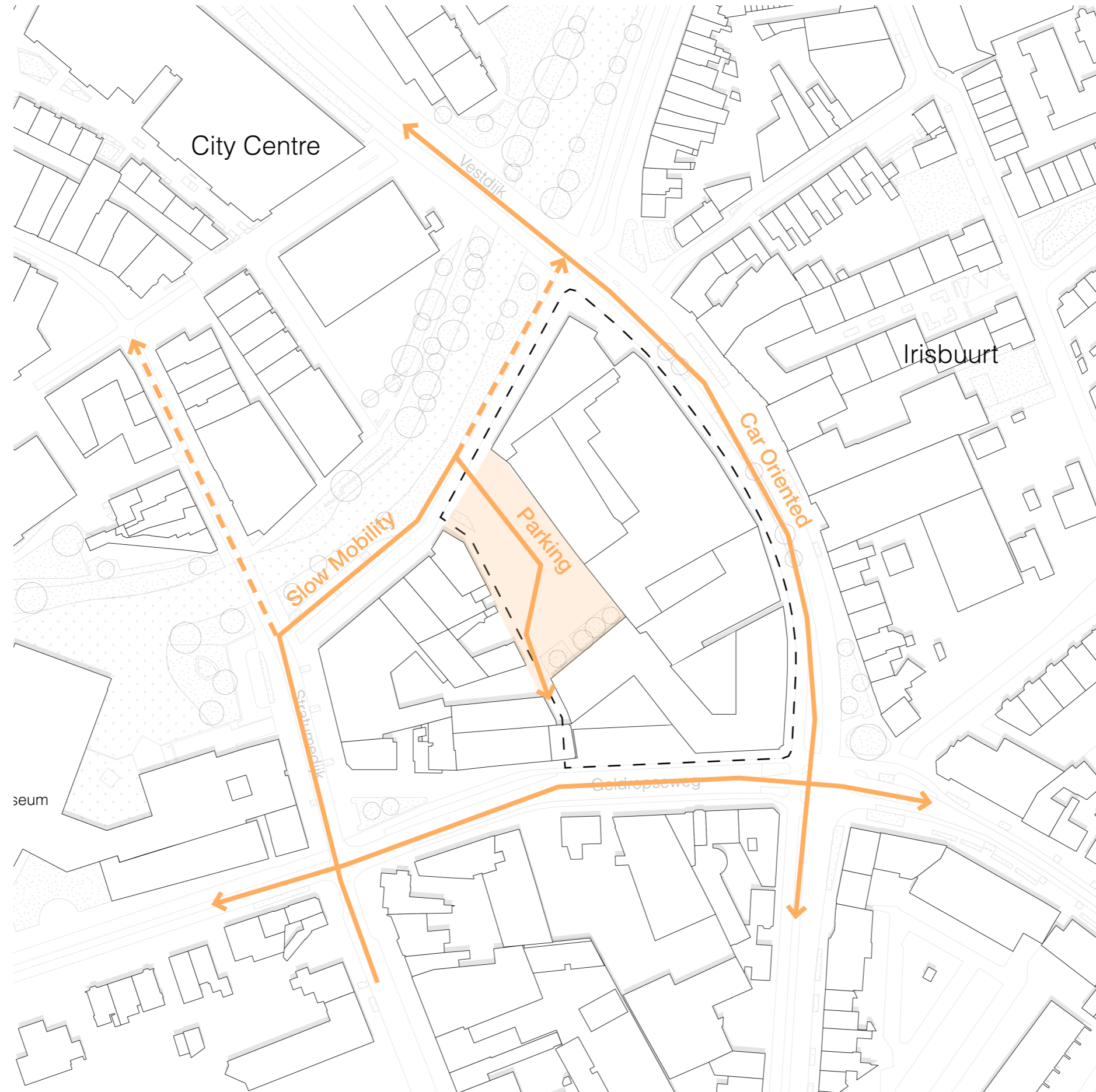
(Google Earth, n.d.)

Schellenskwartier



(Google Earth, n.d.)

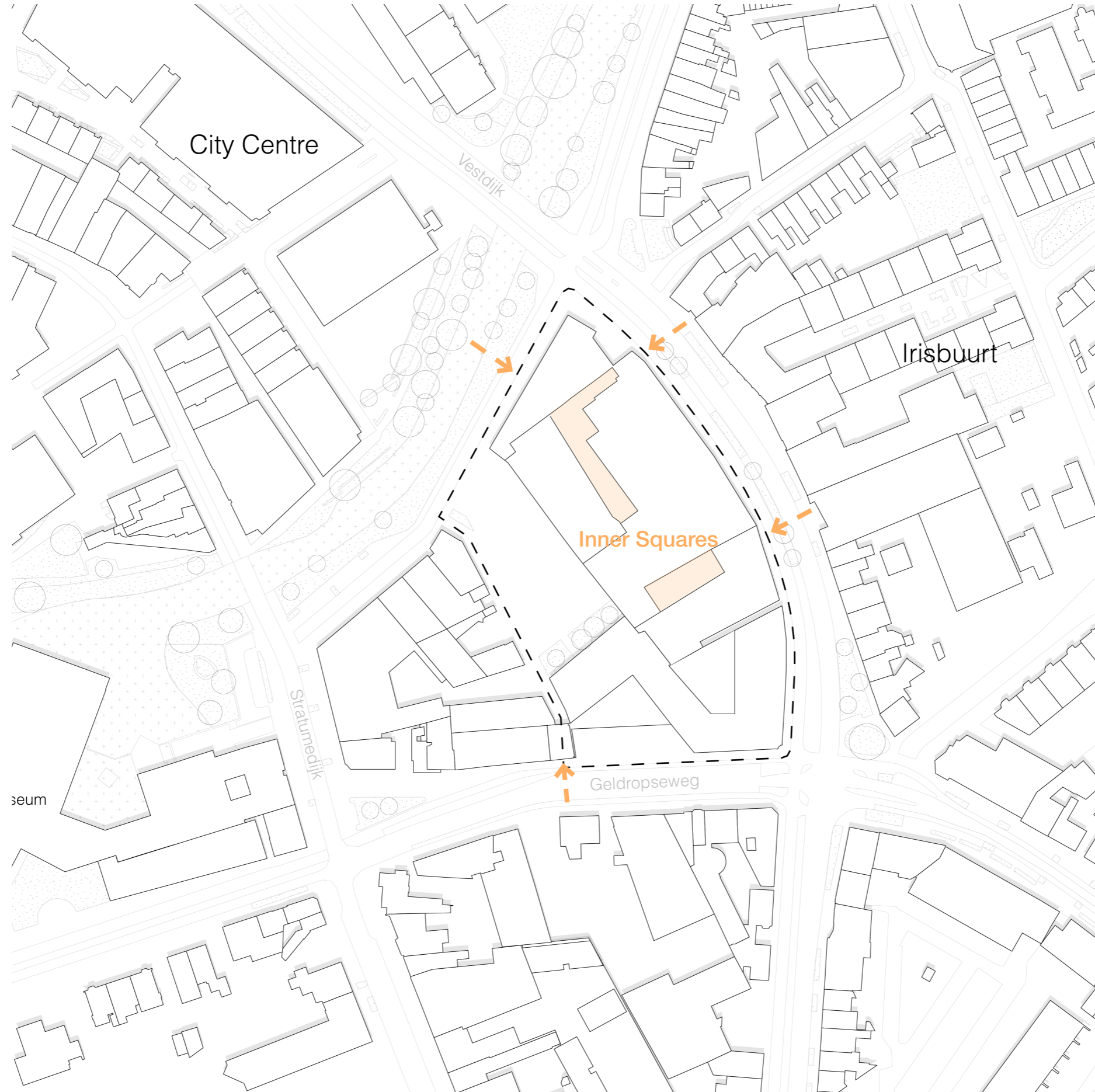
Accessibility



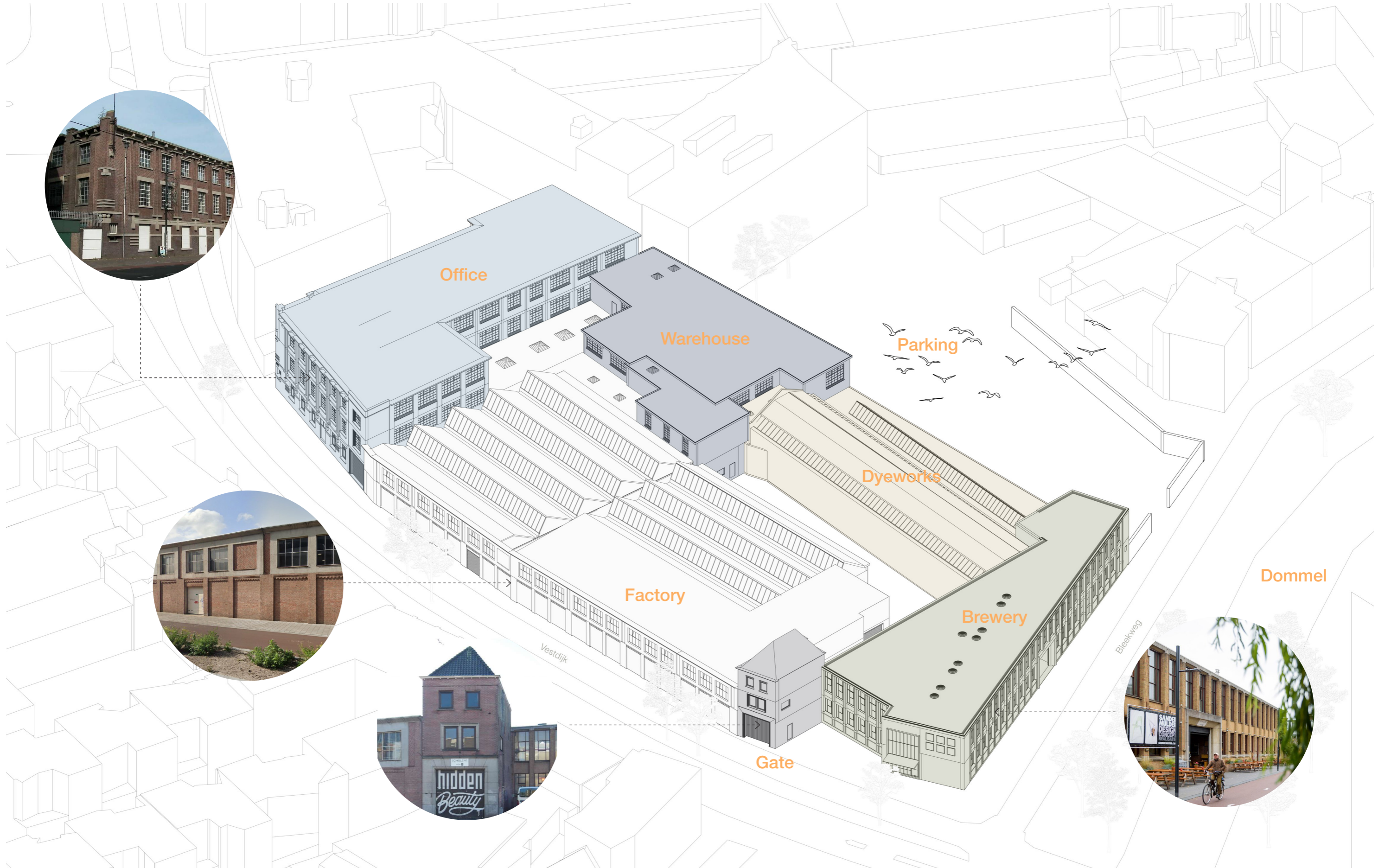
Public Lane



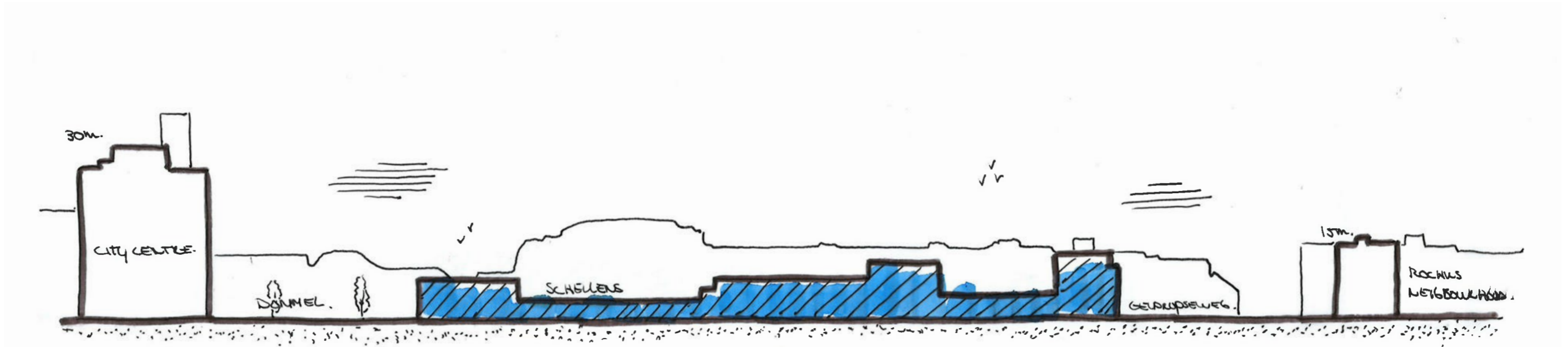
Entrances and Inner Squares



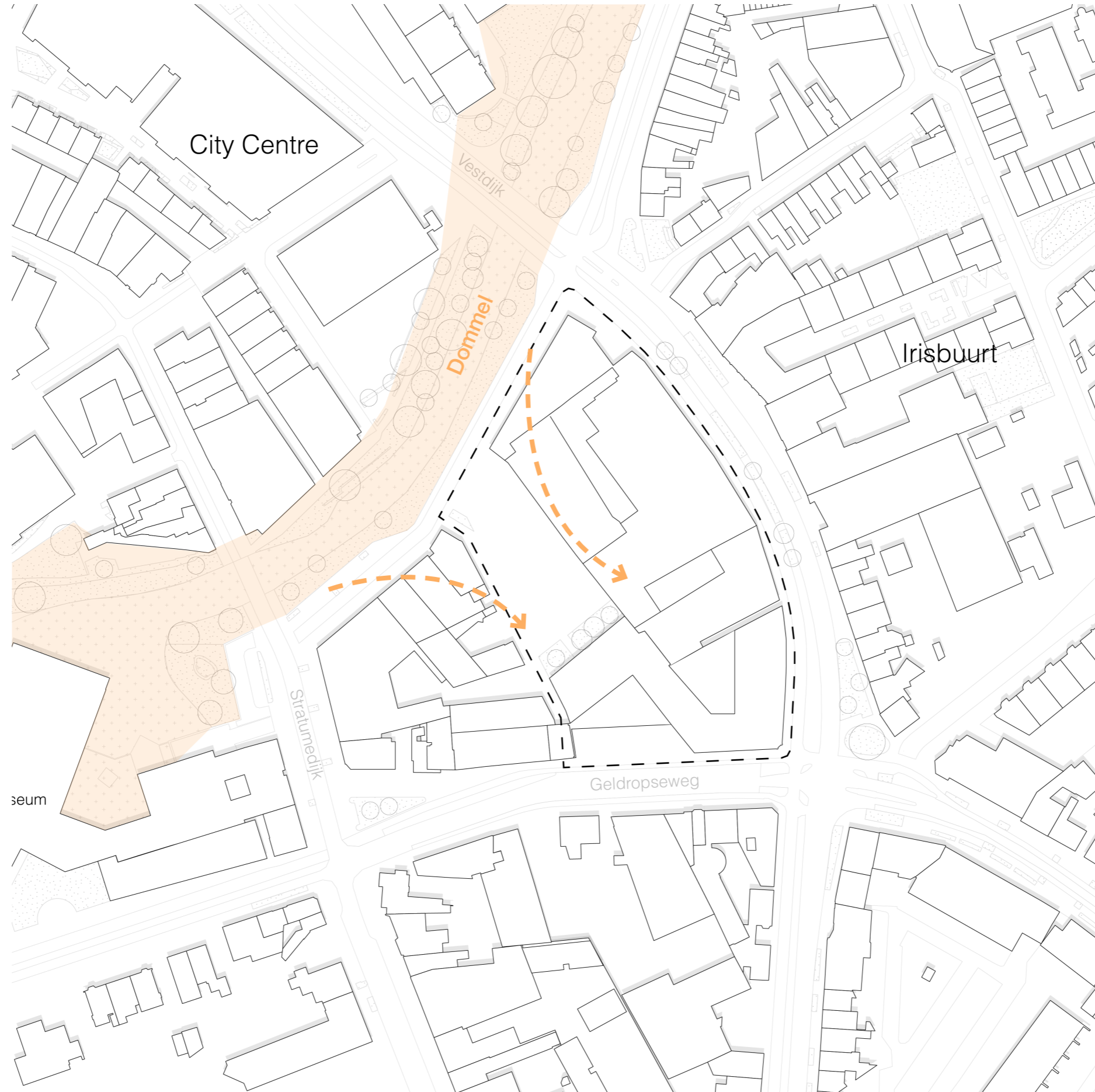
Cultural Heritage and Preservation



Urban Sections



Limited Green Infrastructure



Missing Link in Urban Structure

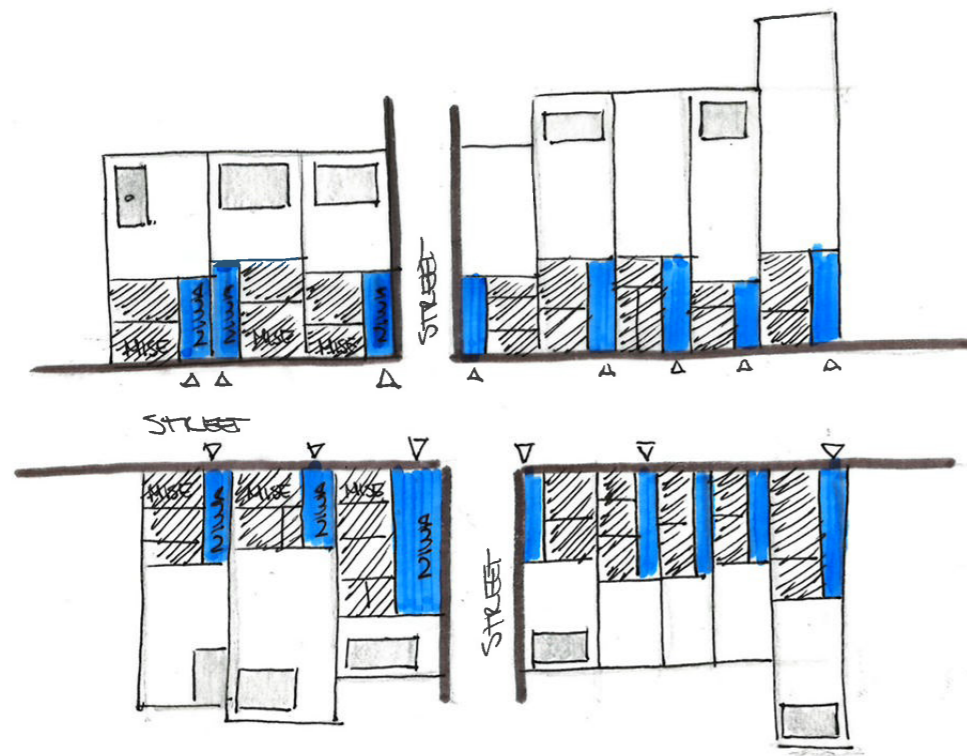
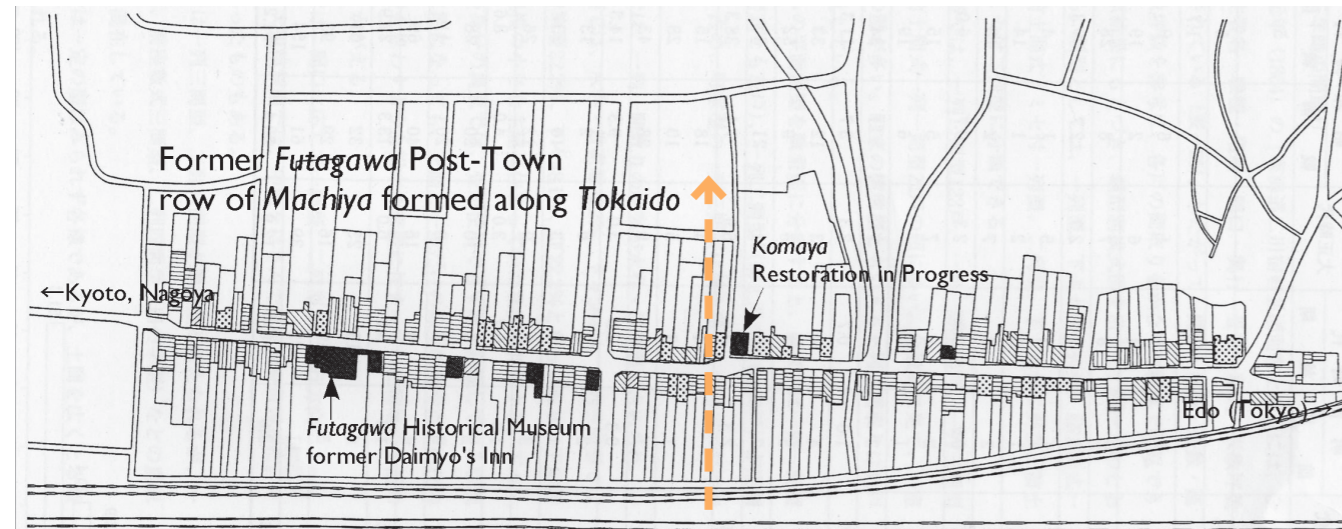


Final Design

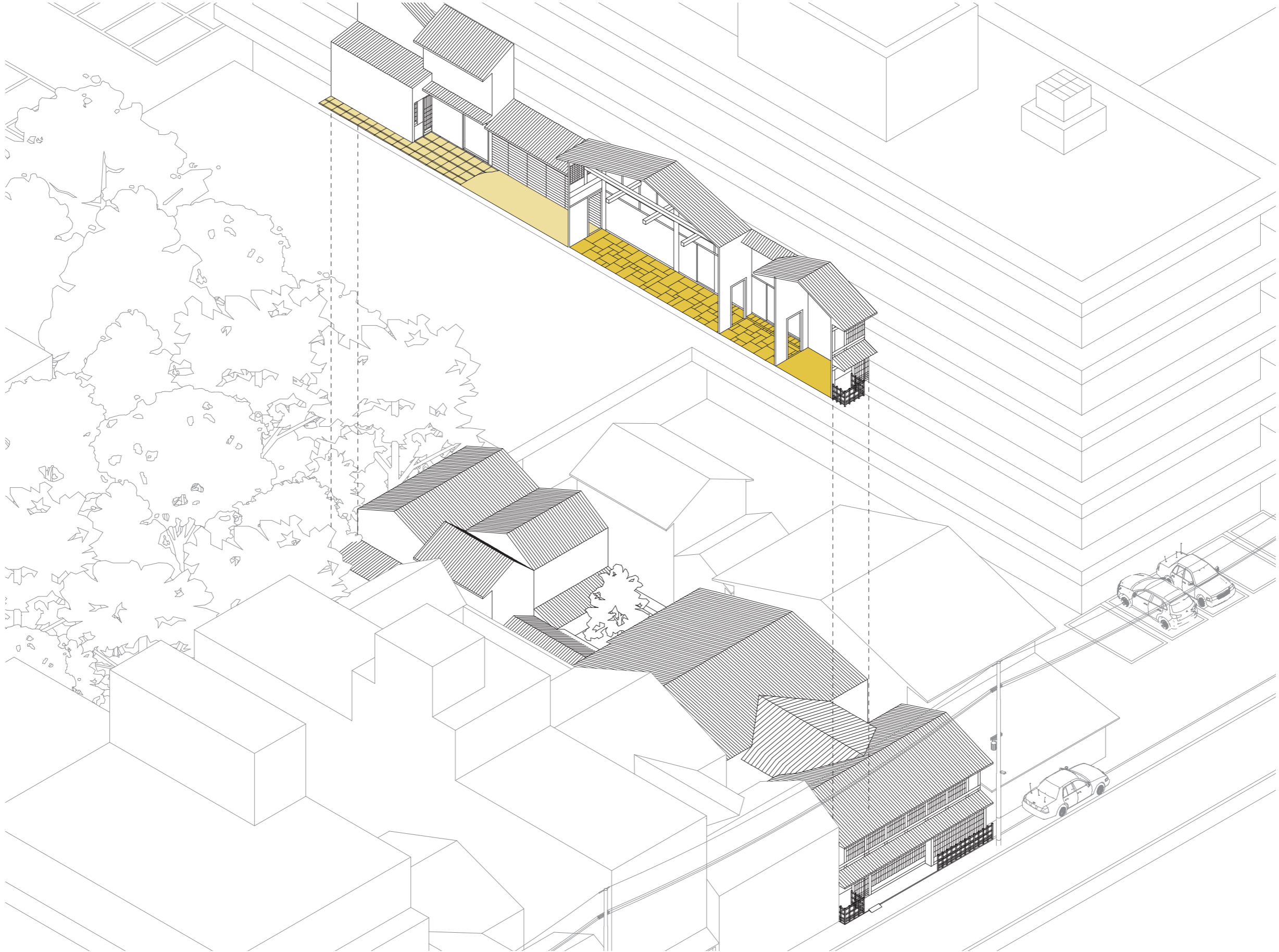
Urban scale

Machiya

Machiya Typology



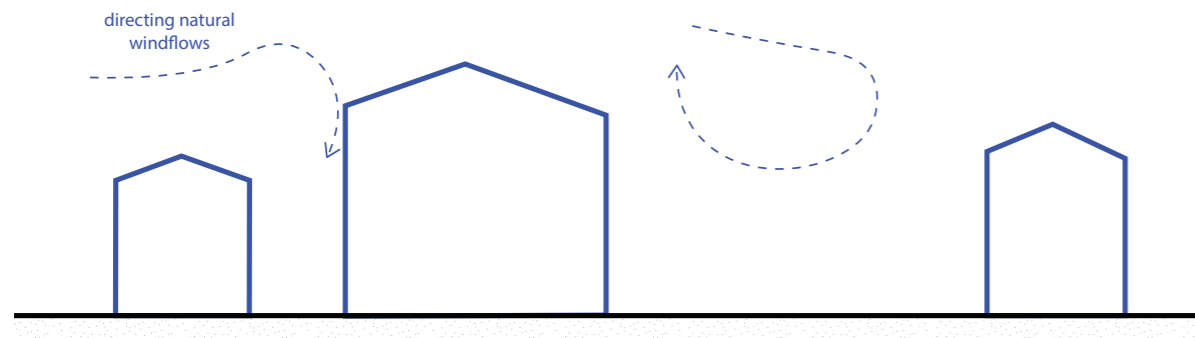
Integrated Toriniwa



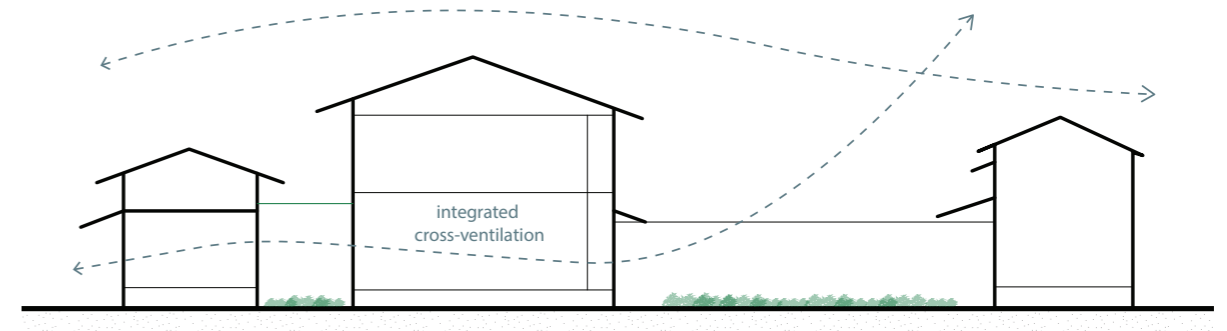
(Spoormans, 2023)

Urban Strategies

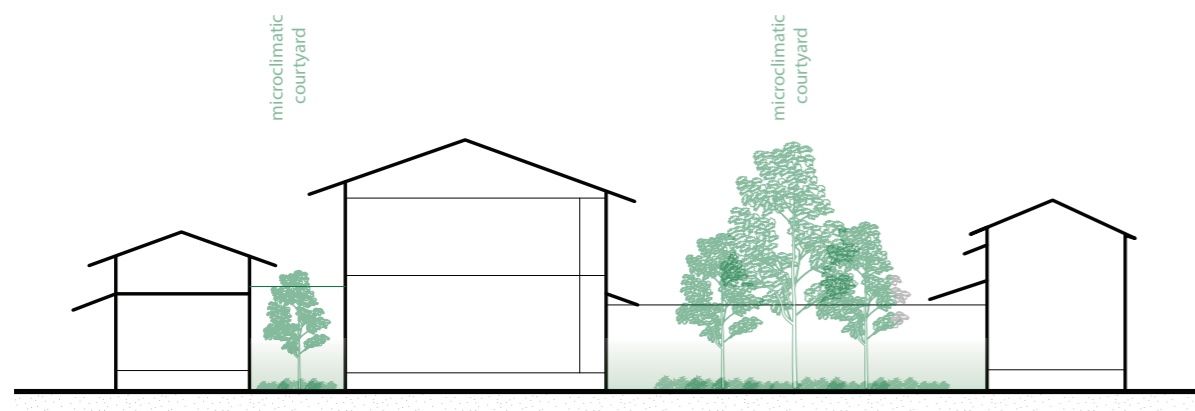
Building envelope



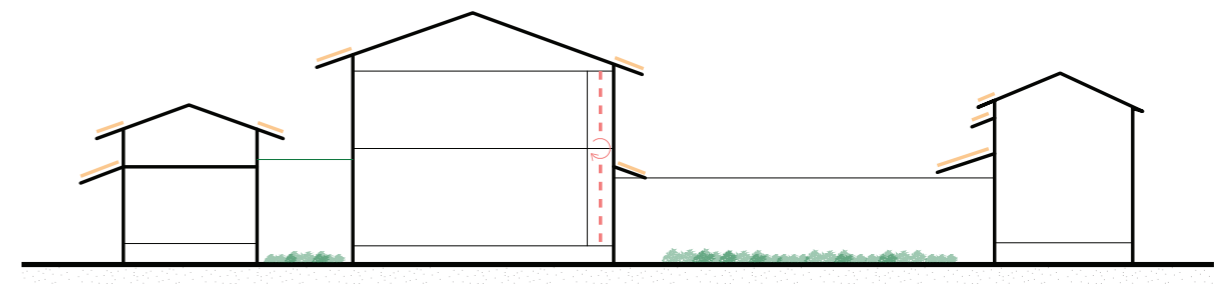
Cross ventilation



Inner courtyard



Overhang and bufferzones



Case Study Analysis

Case Study Analysis



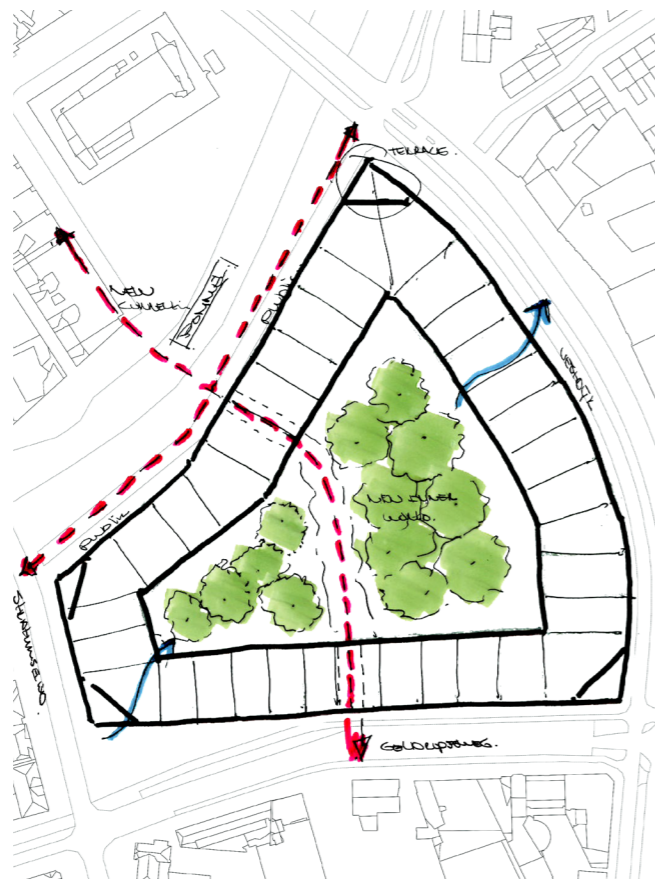
Via 57 West, New York



Funenpark, Amsterdam



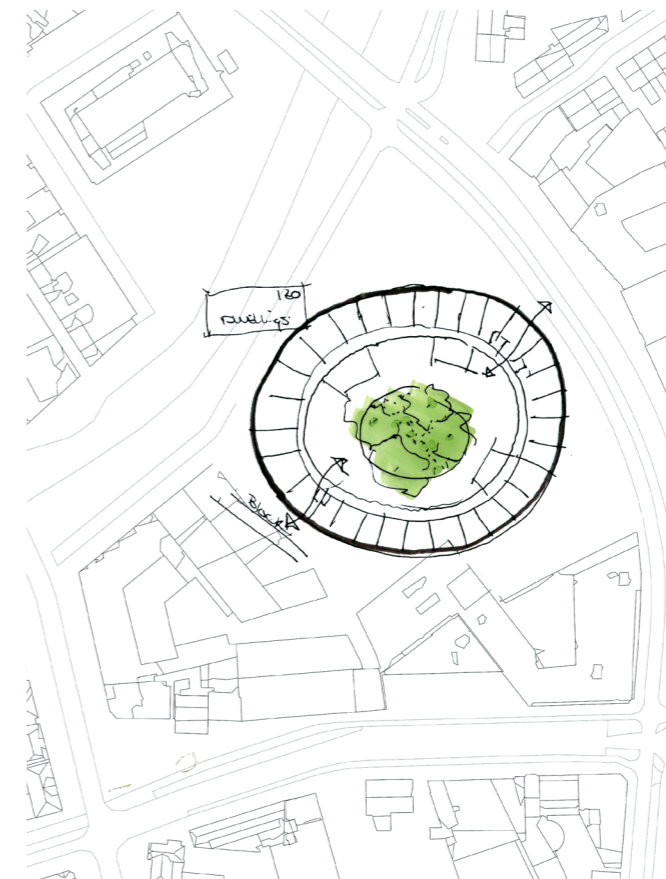
New Nexus Housing, Fukuoka



Eixample, Barcelona



Taoyuan Museum of Art, Taiwan



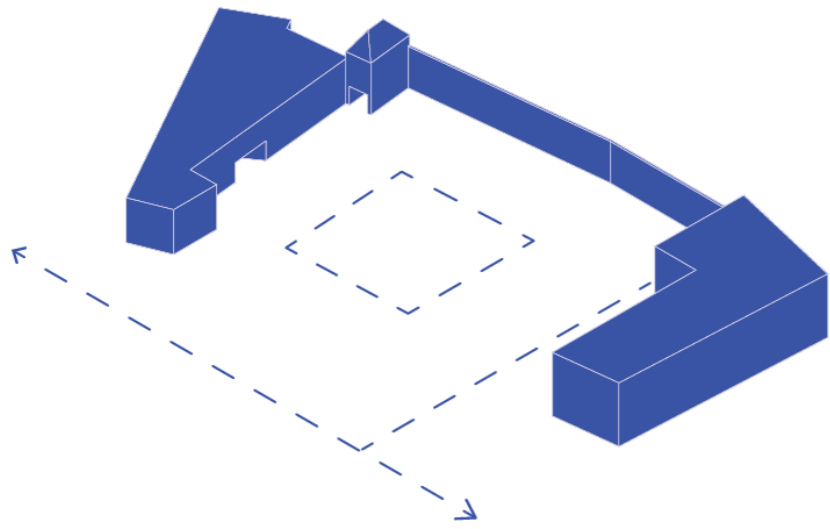
Tietgenkollegiet, Copenhagen

Maximum Potential On-site

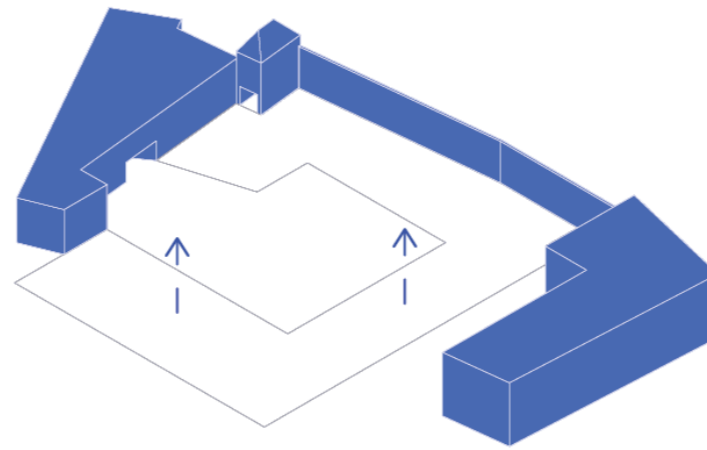


Schellenskwartier

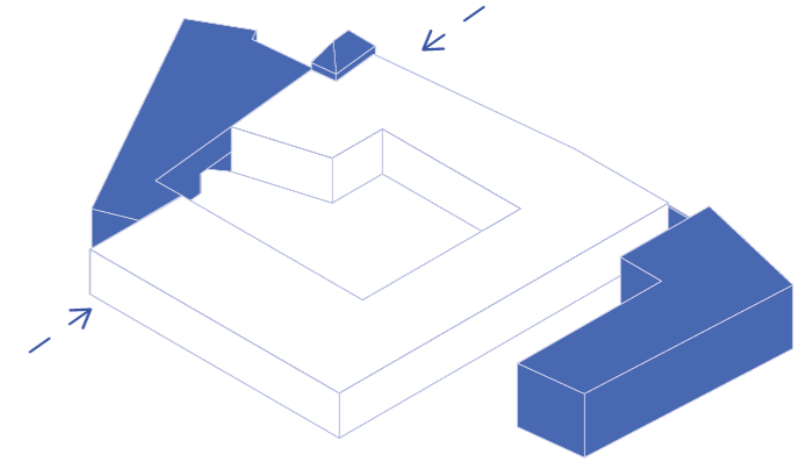
Design Sequence



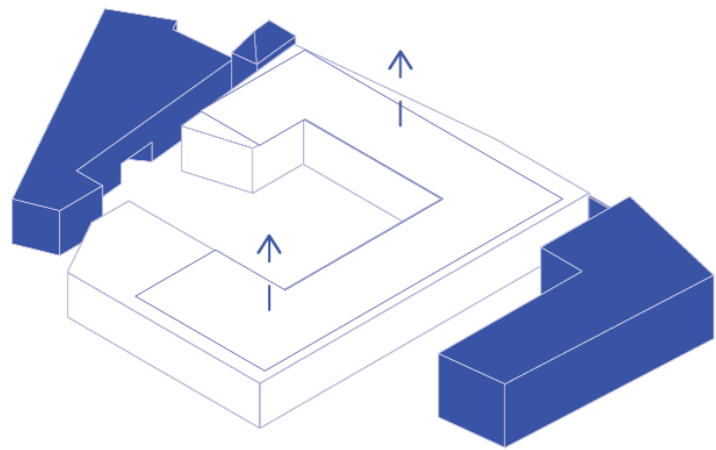
Creating enclosed inner courtyard and public lane



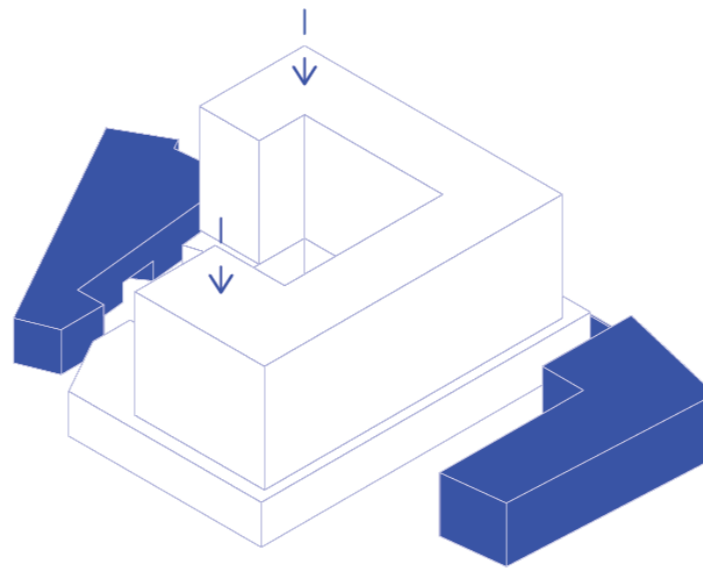
New Eindhoven layer



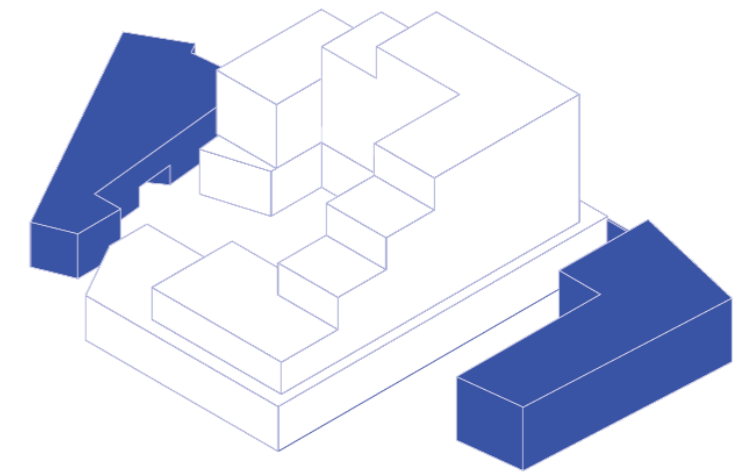
Introducing entrances to the inner courtyard



New compact building mass (10 storey)



Visual and spatial connection with the Dommel

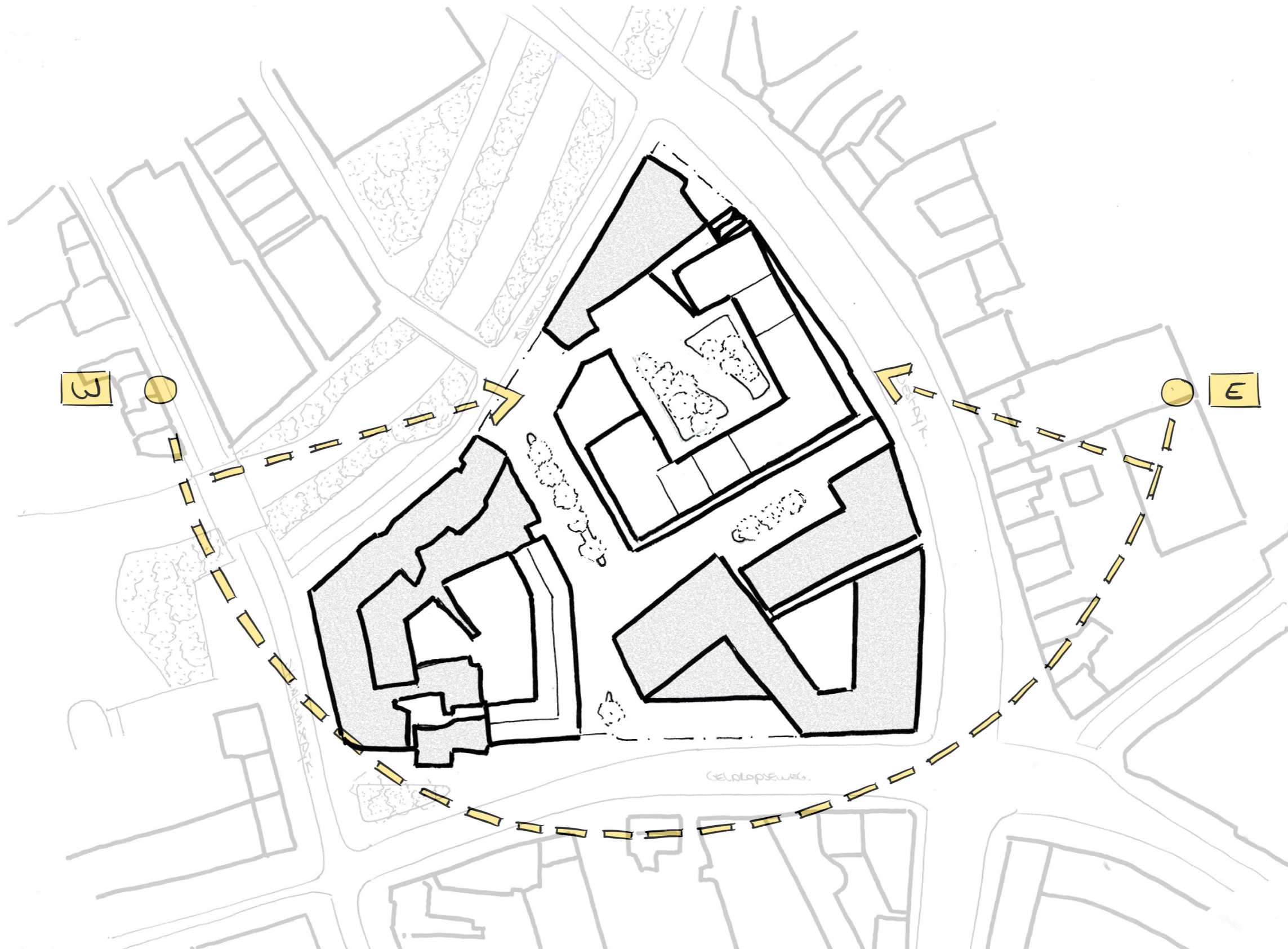


New building block

Total Isometric



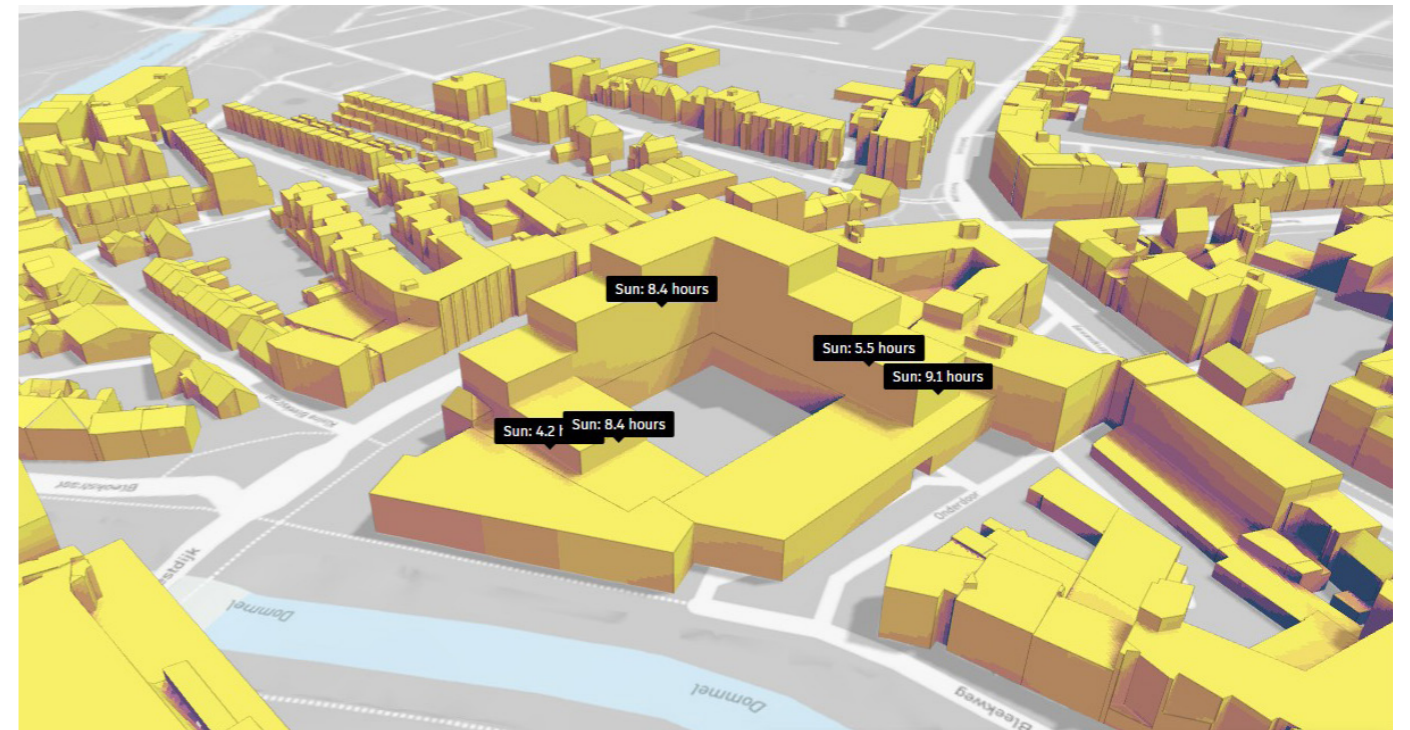
Sunpath Diagram



Daylight Potential



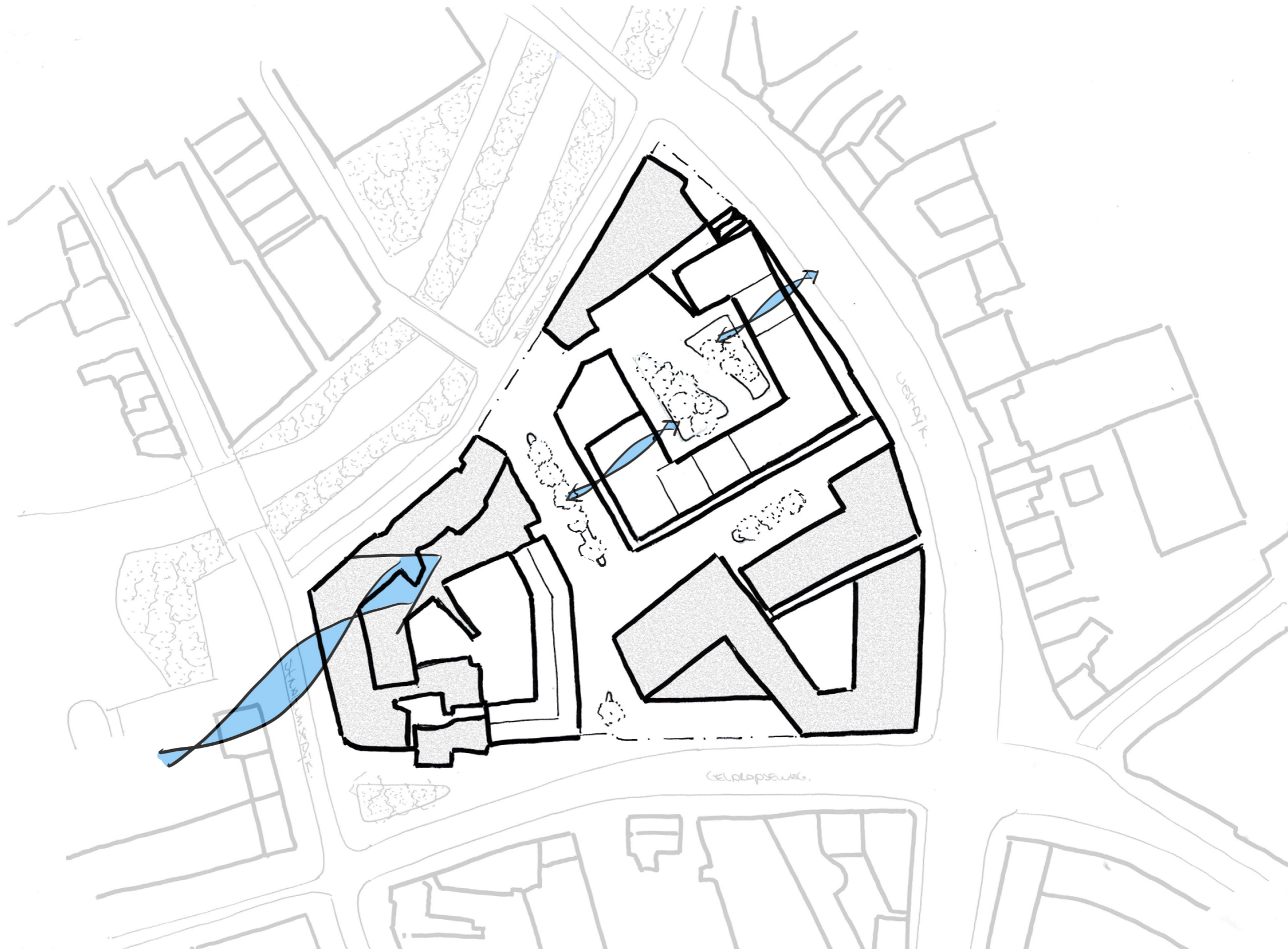
Winter



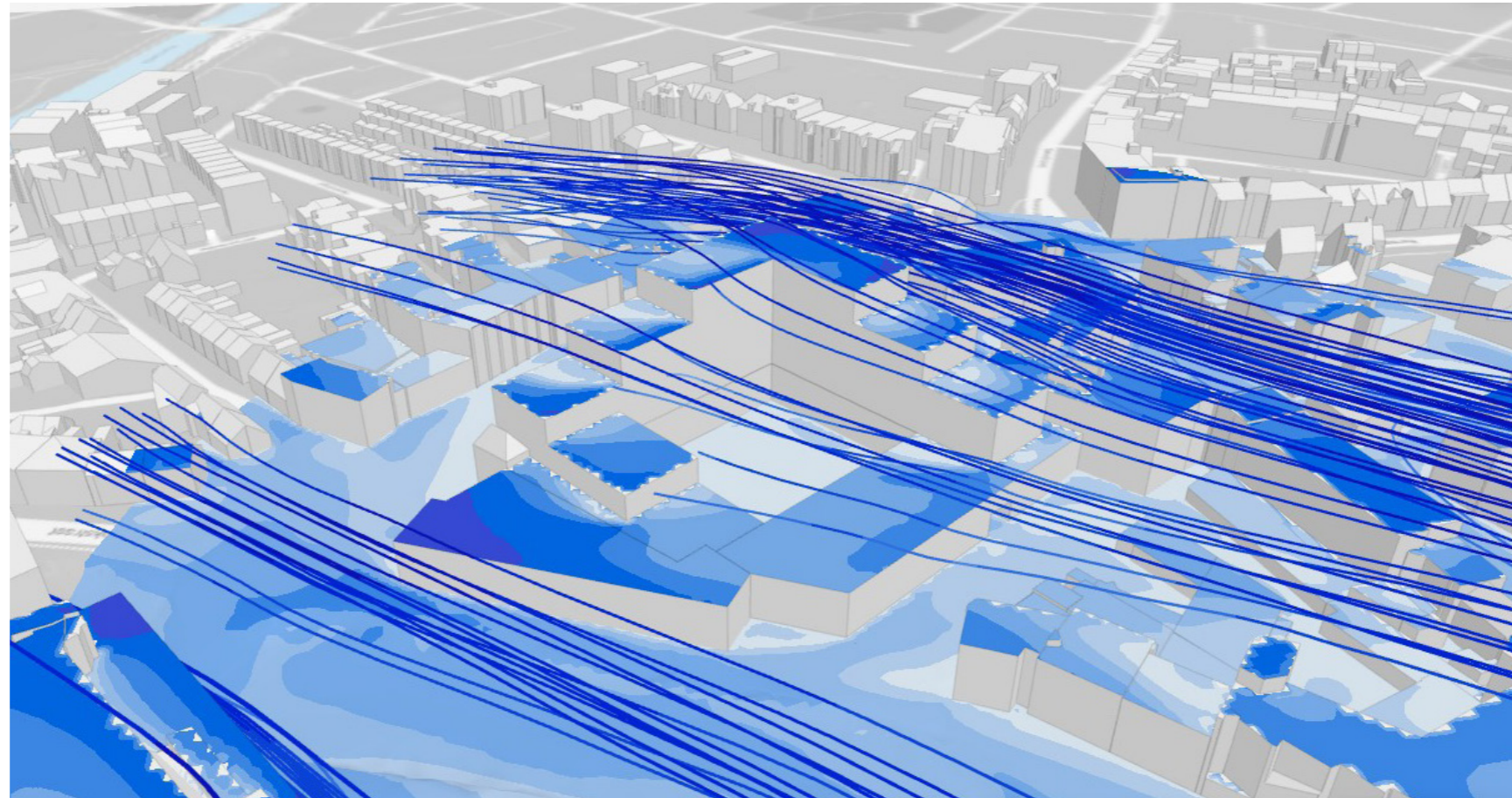
Summer

(Autodesk Forma, n.d.)

Wind Analysis



Wind Potential

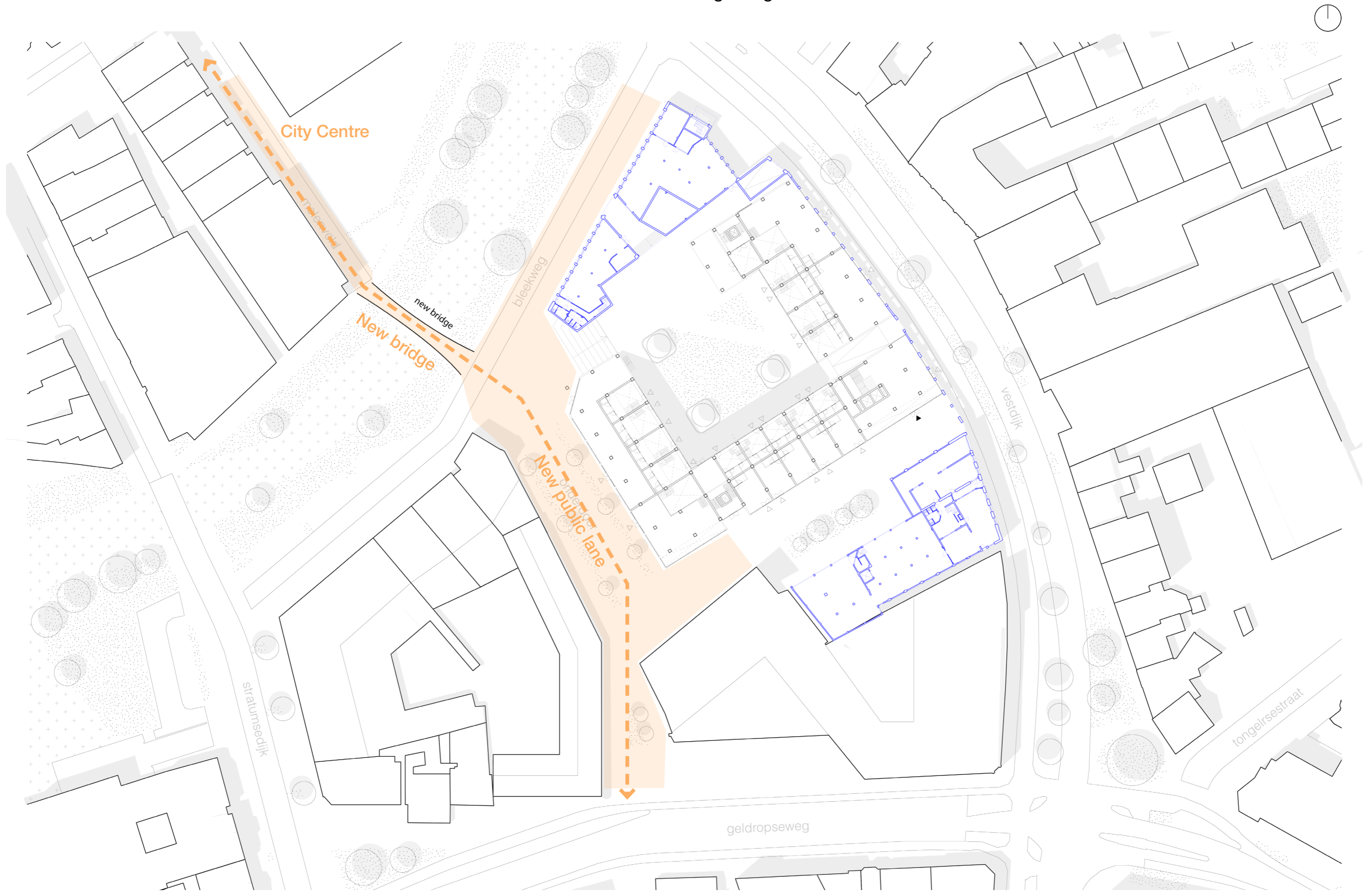


(Autodesk Forma, n.d.)

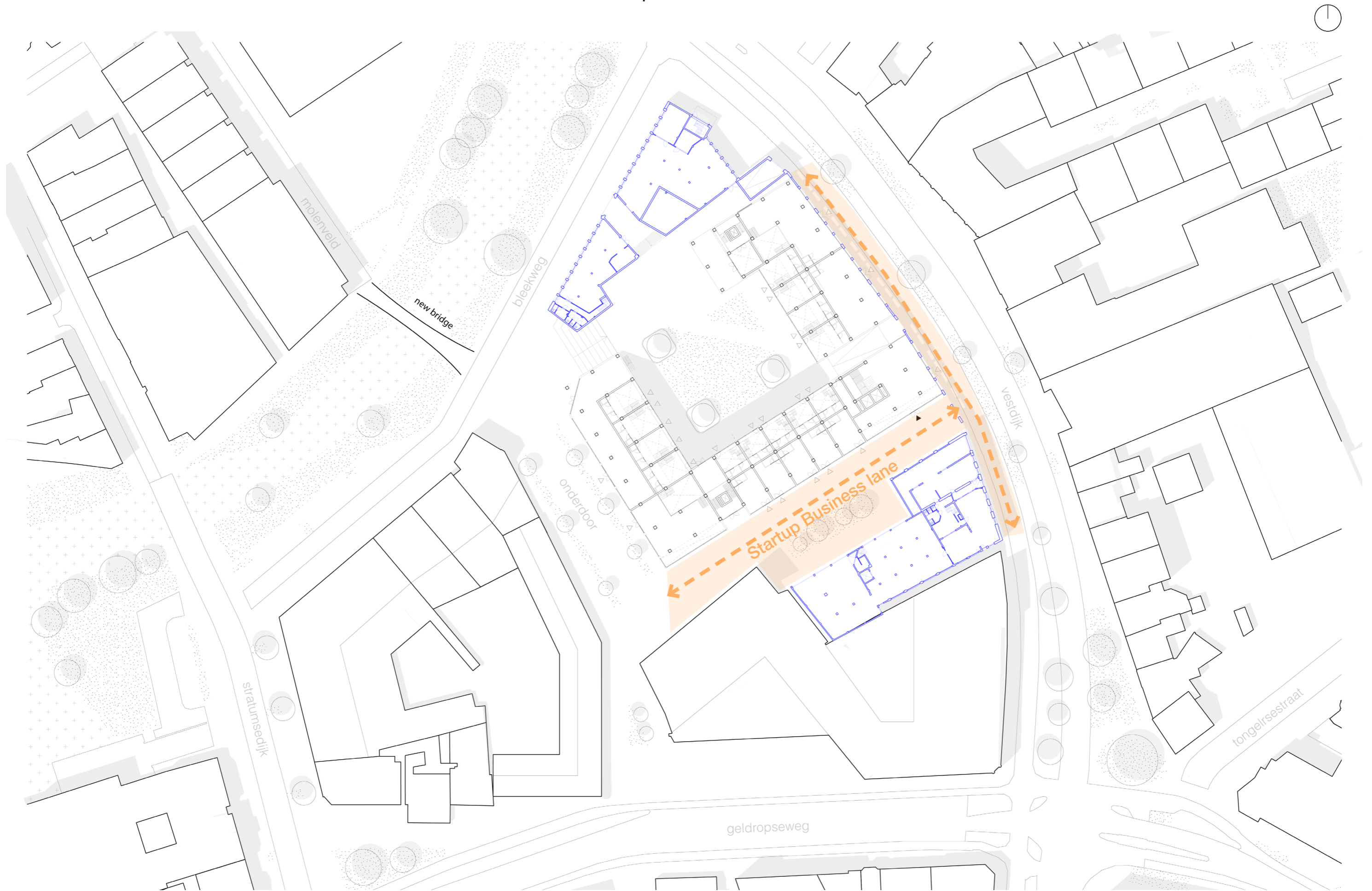
Urban Embedding



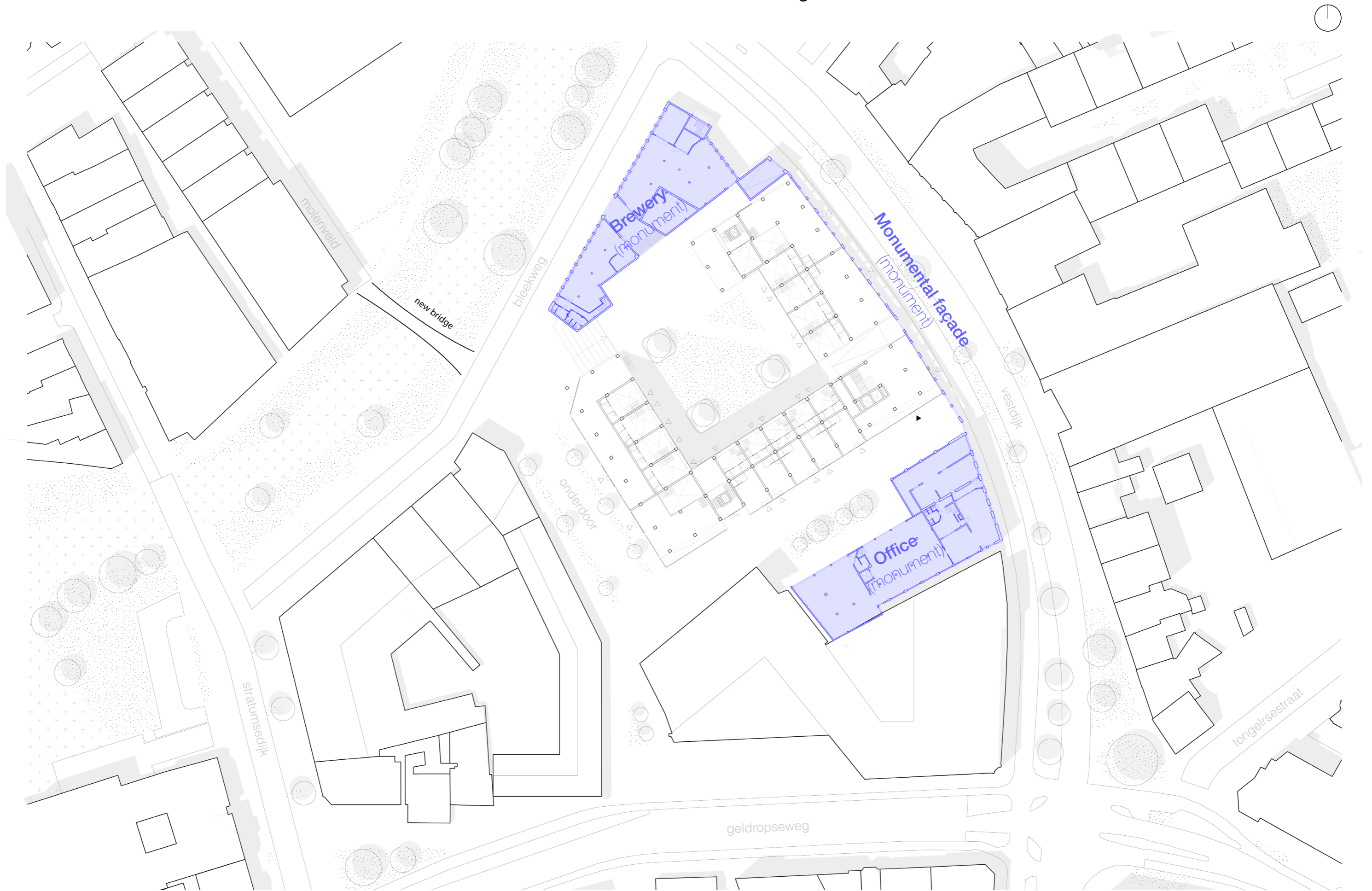
New Connecting Bridge



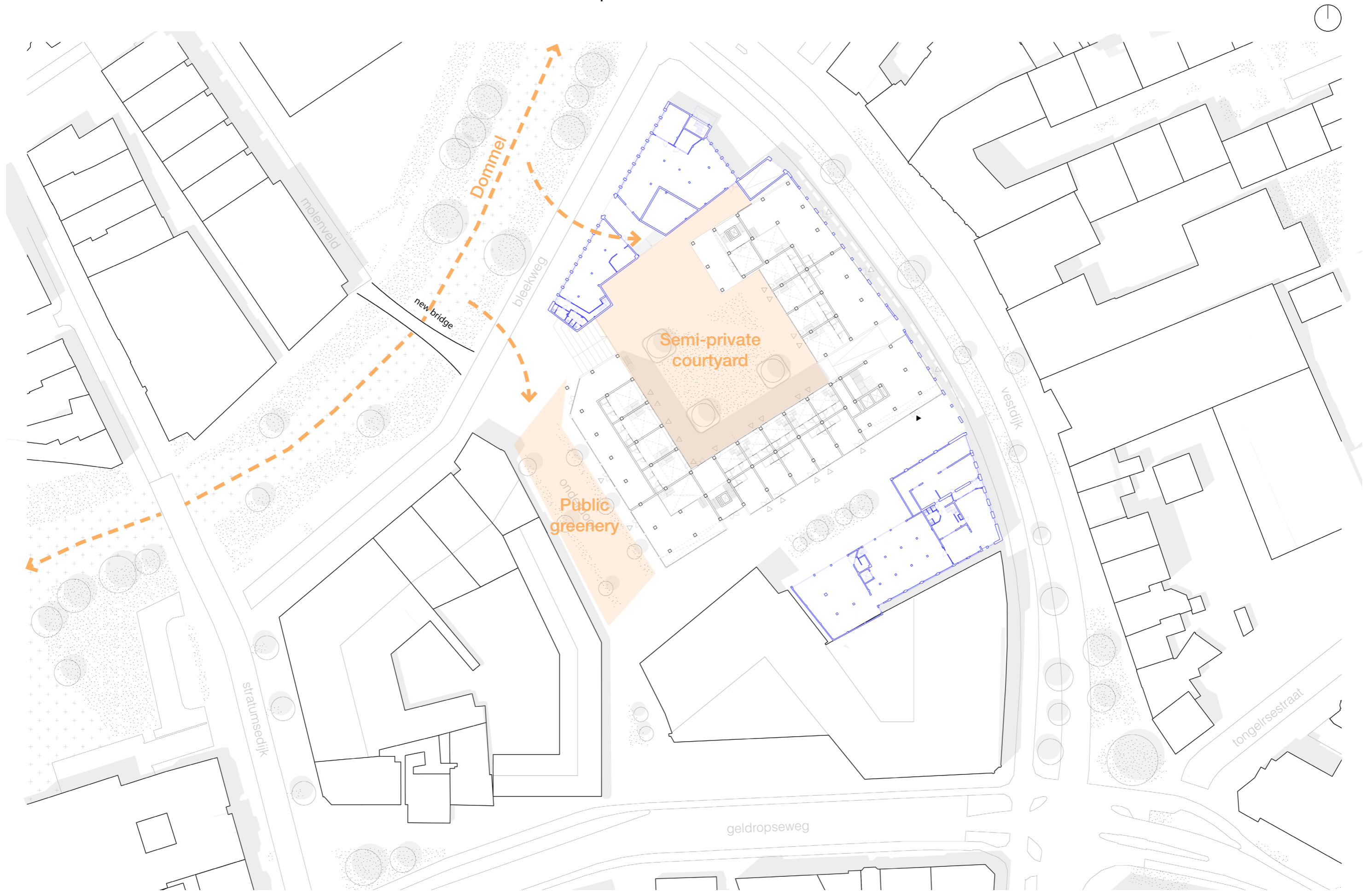
Startup Business Lane



Preservation of Cultural Heritage



Expansion of the Dommel



Design Approach



Bleekweg



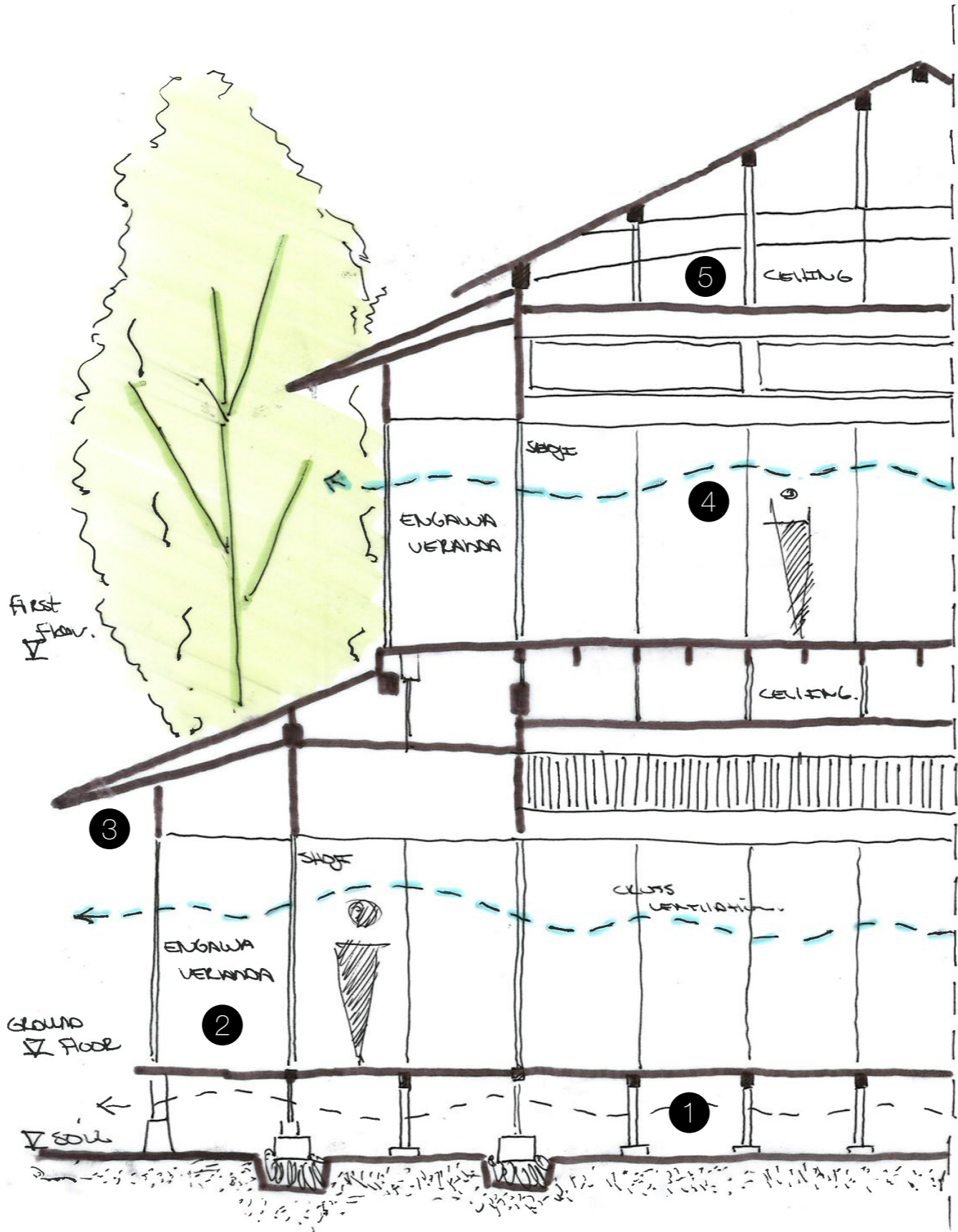
Vestdijk

Building scale

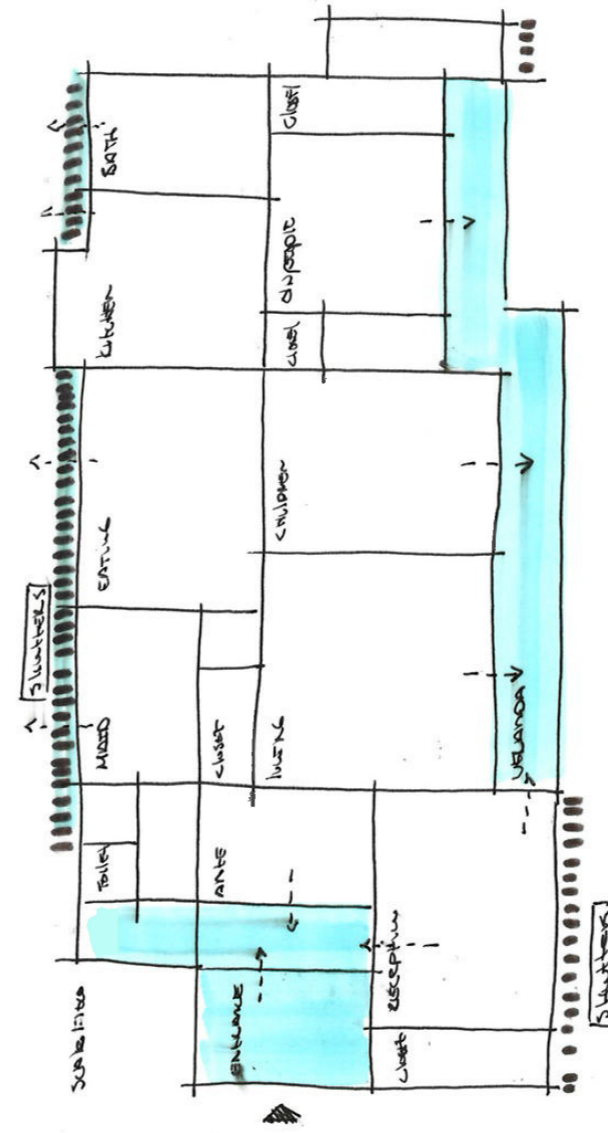
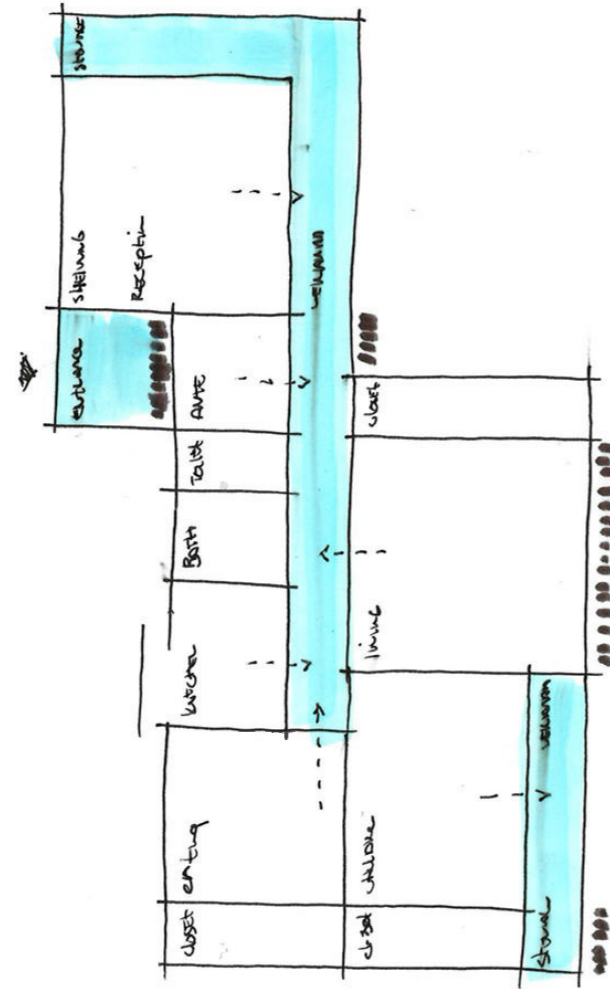
Machiya

Machiya Cross Section

- 1 lifted volume
- 2 engawa (bufferzone)
- 3 overhang
- 4 natural ventilation
- 5 lightweight structure



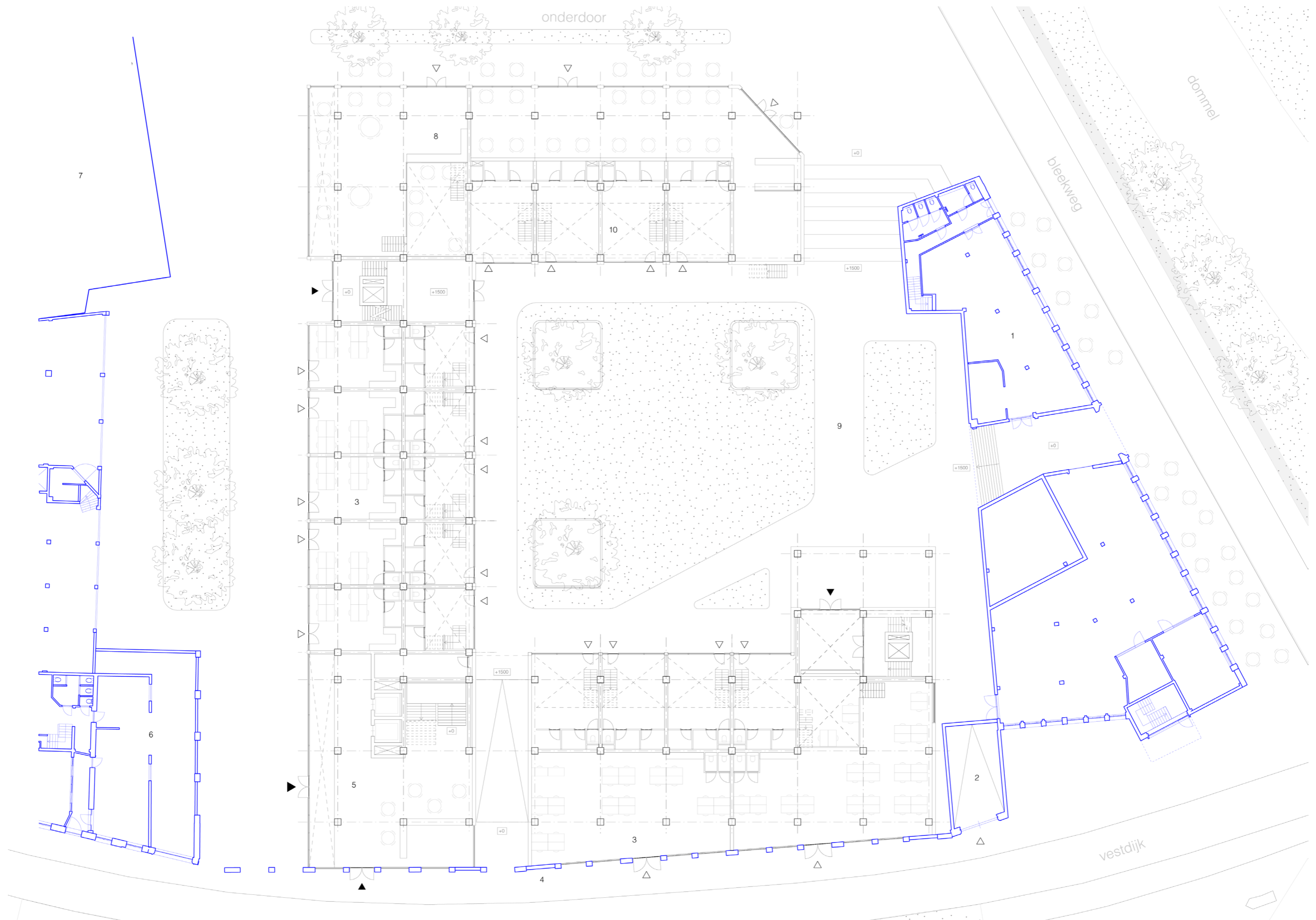
Typical Machiya Layout



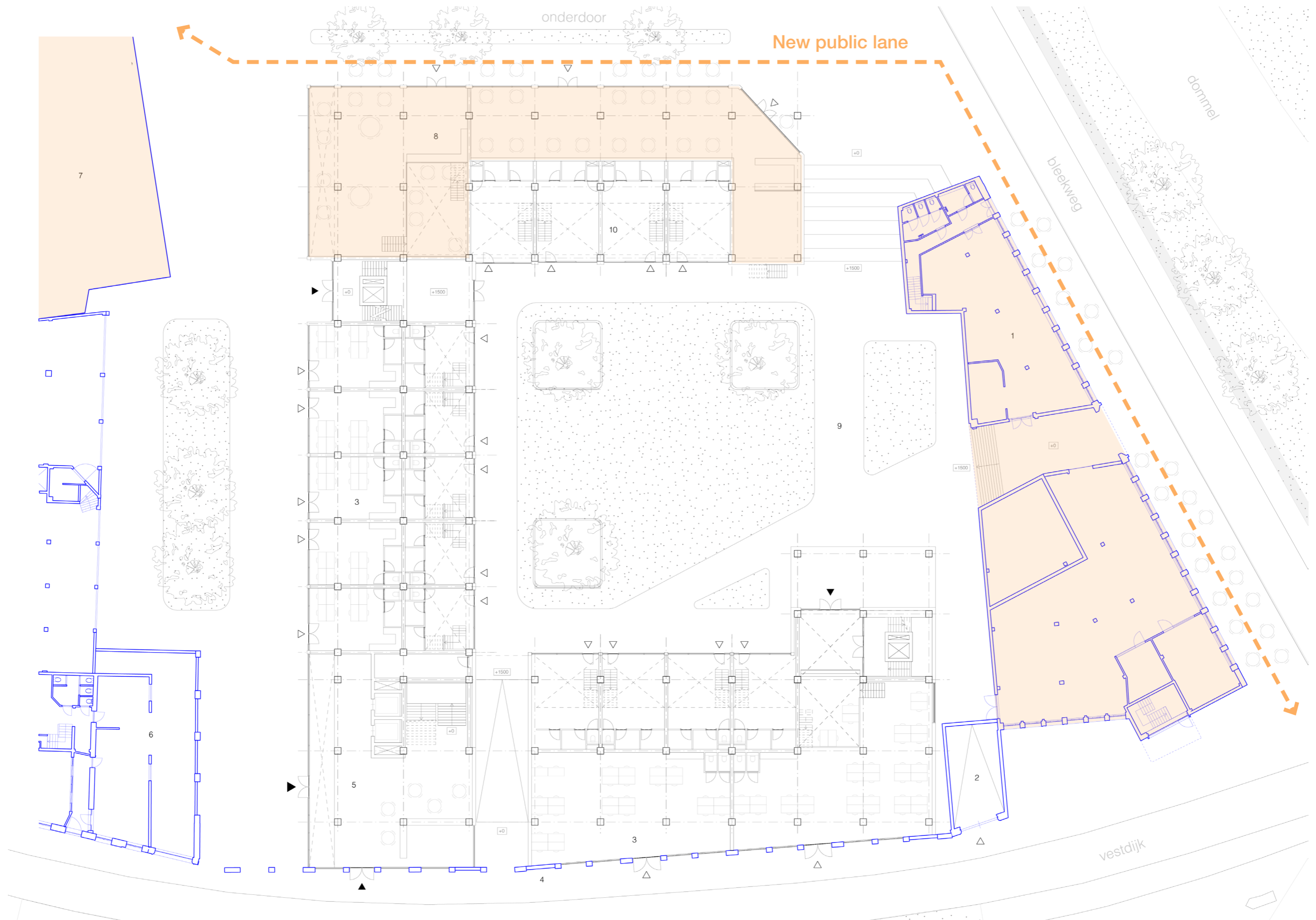
Layout

Schellenskwartier

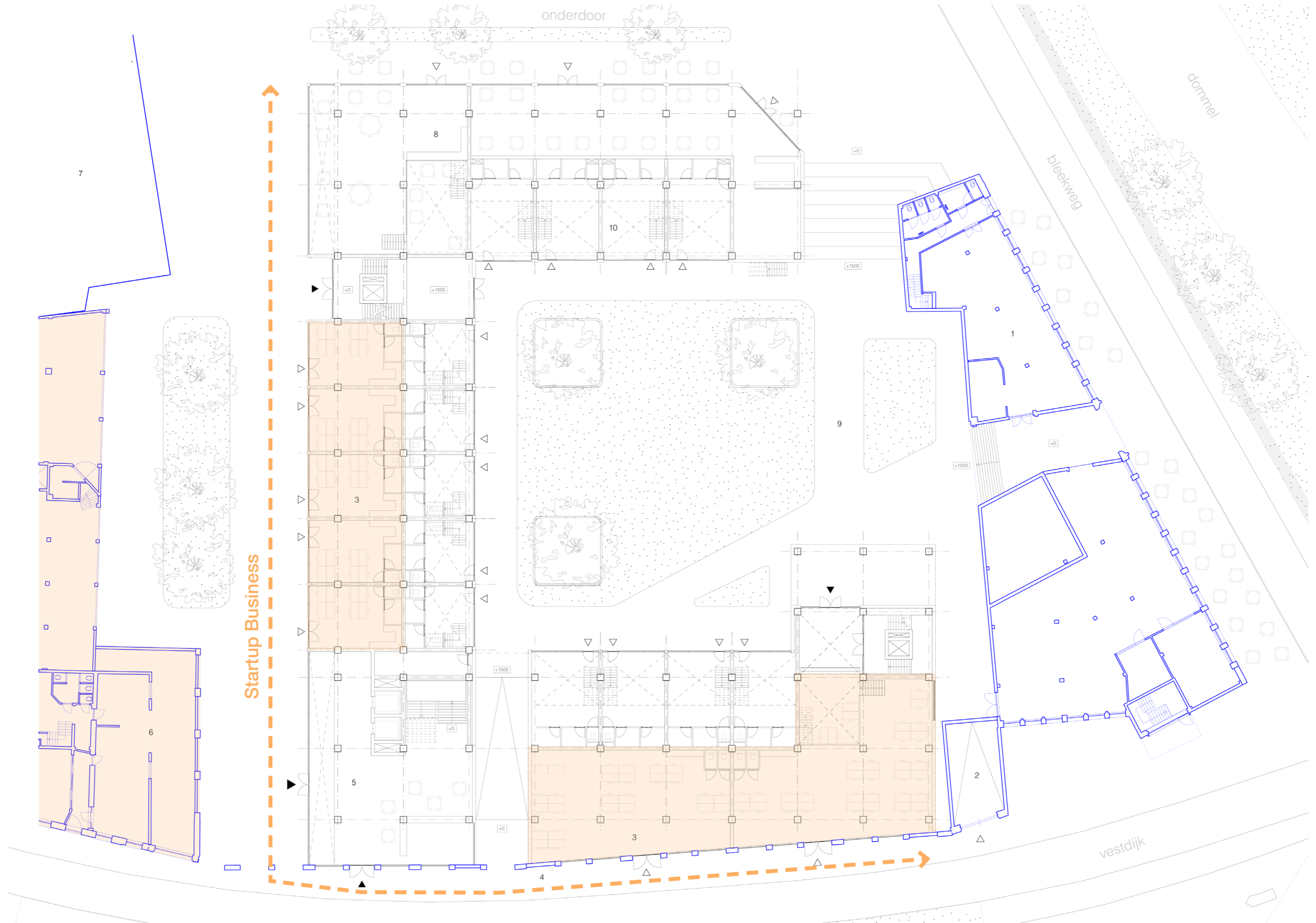
Ground Floor



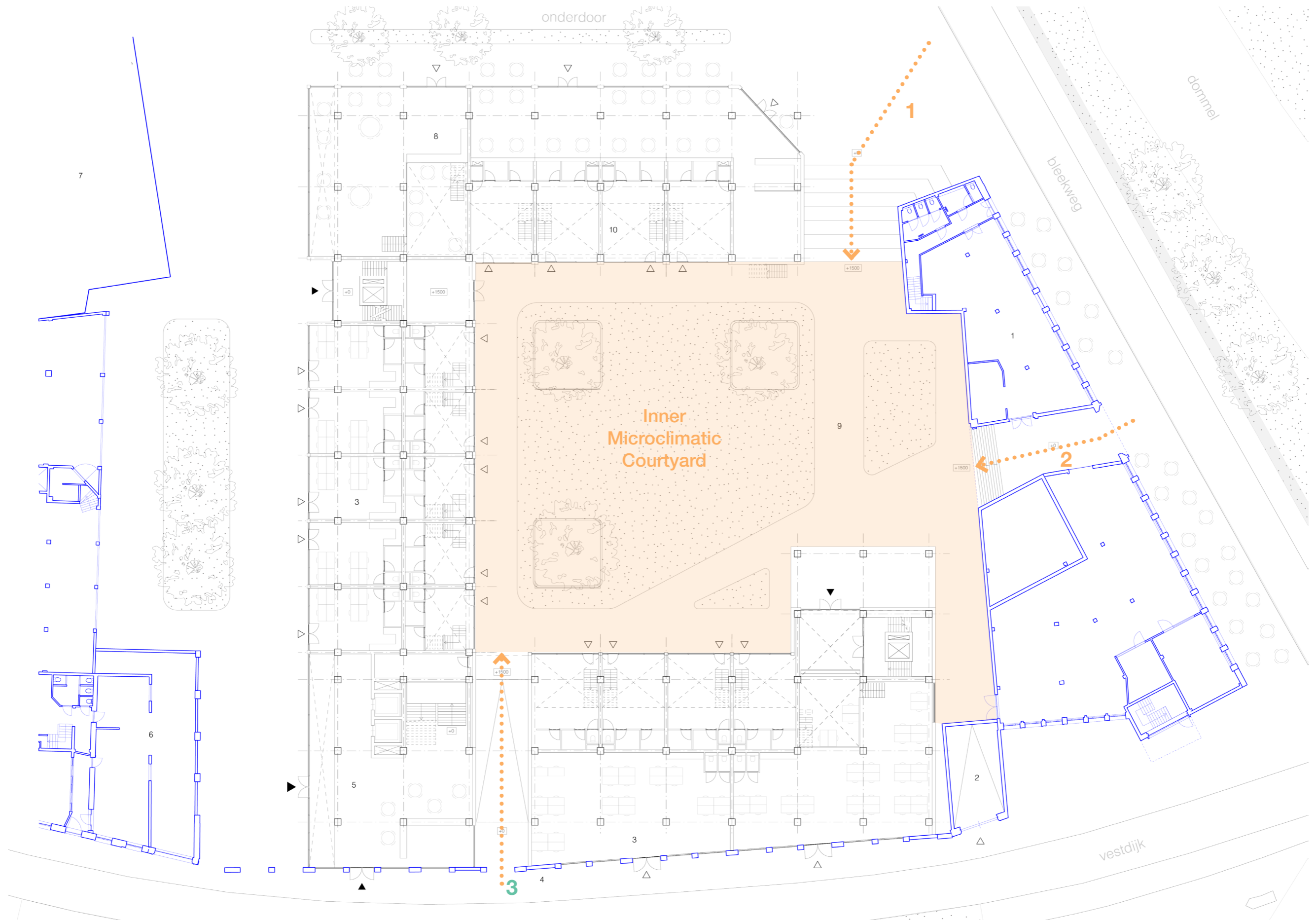
New Public Lane



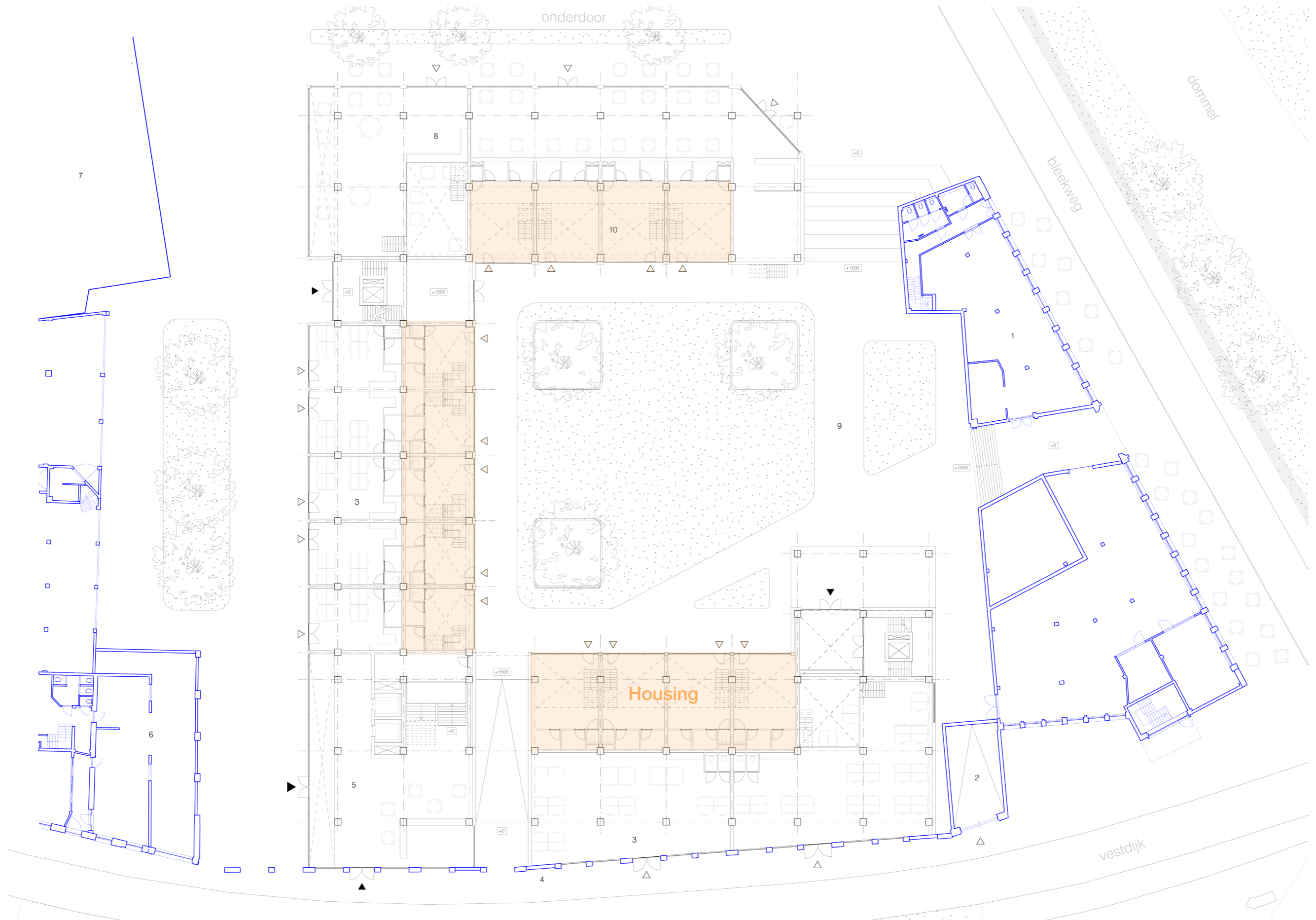
Startup Business Lane



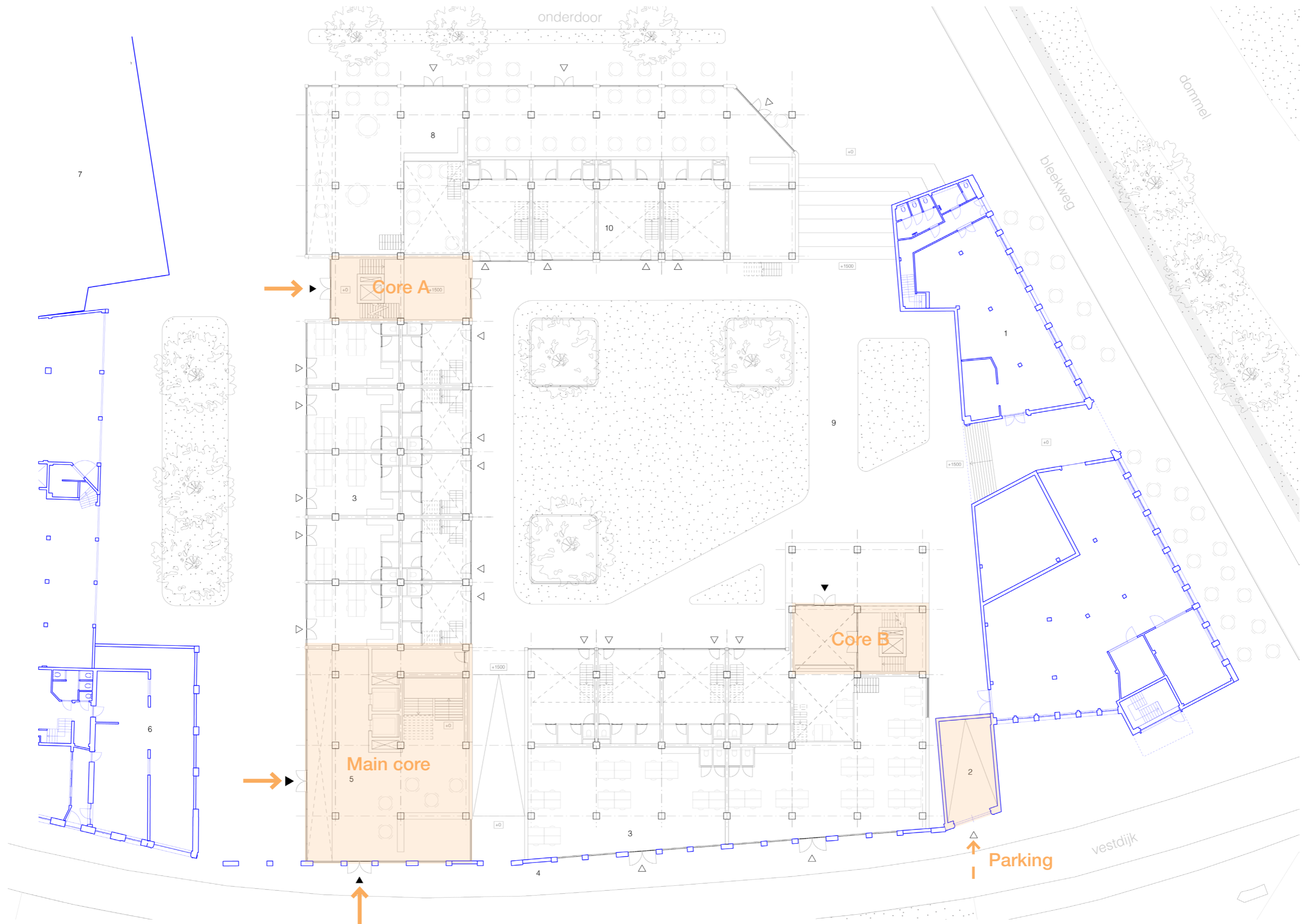
Inner Courtyard



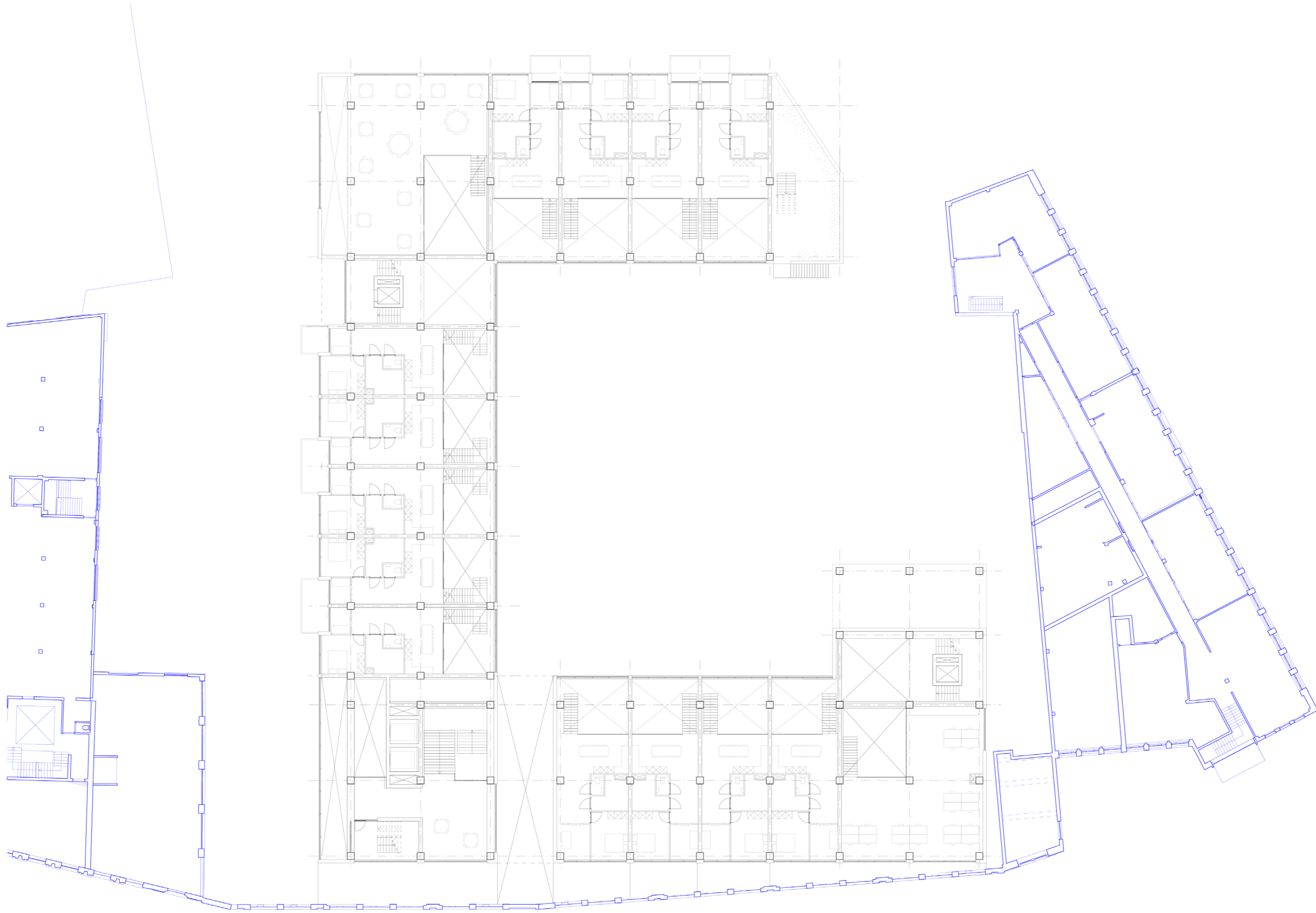
Housing



Cores



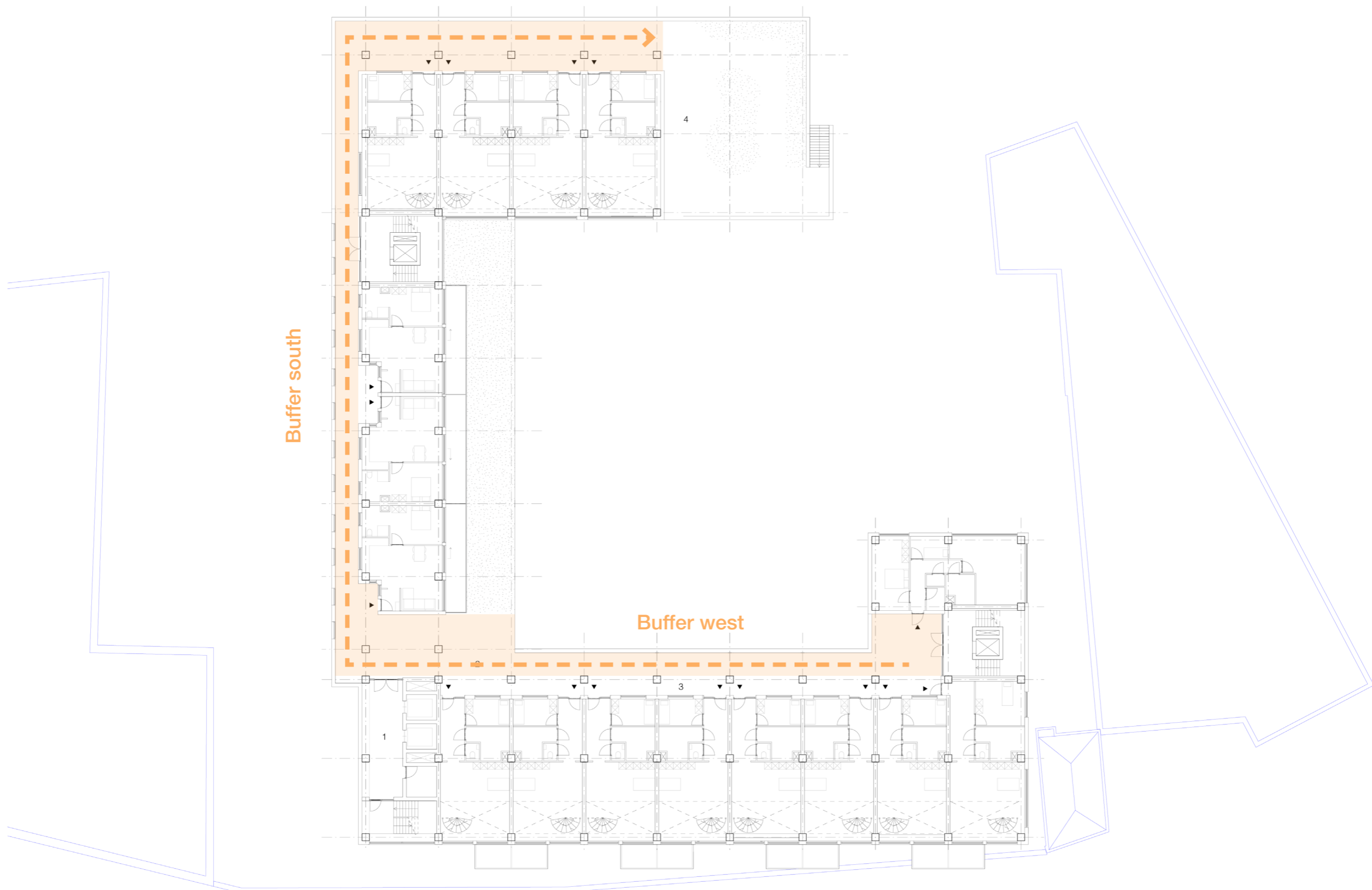
First Floor



Dwelling Configuration



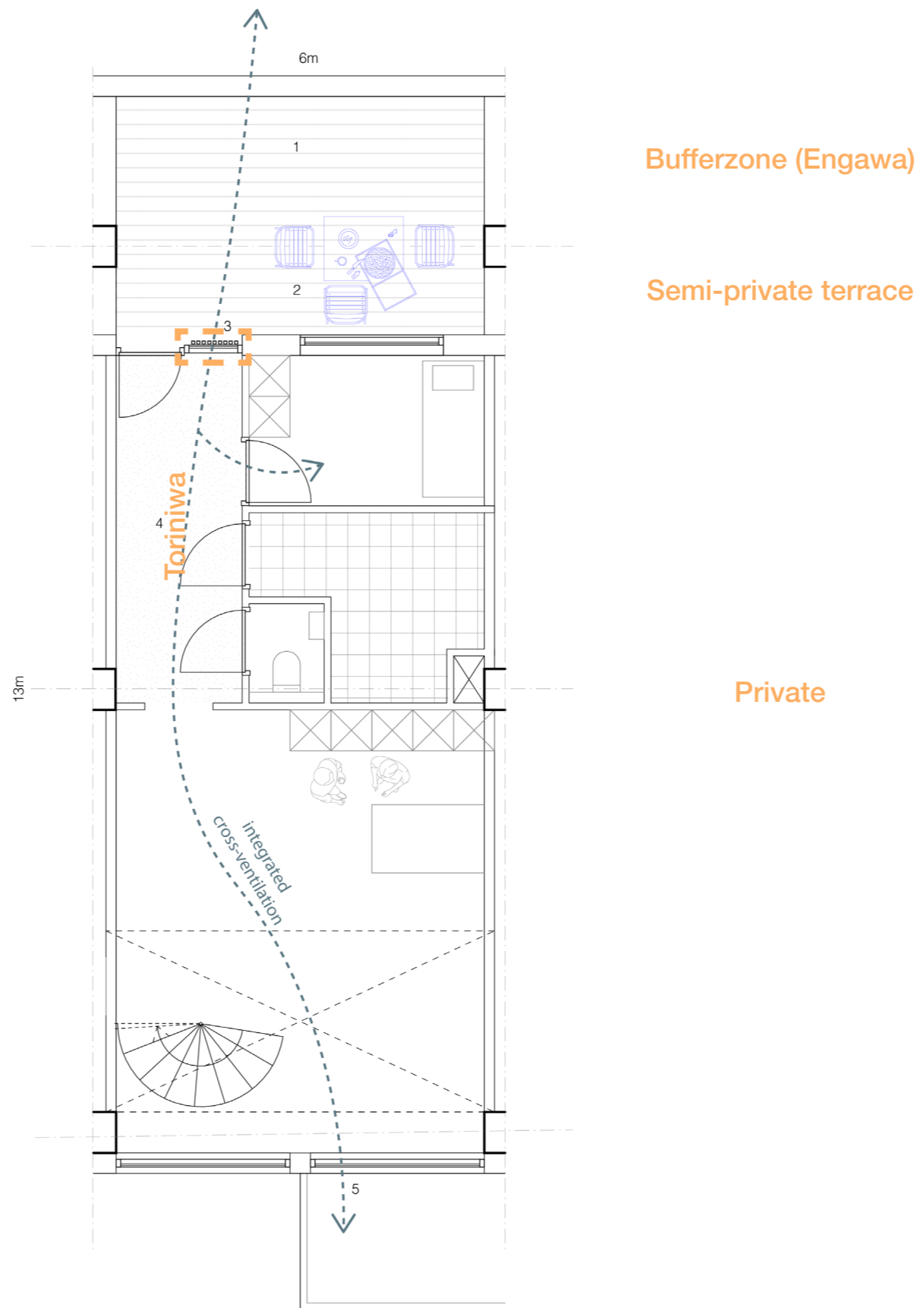
Bufferzones



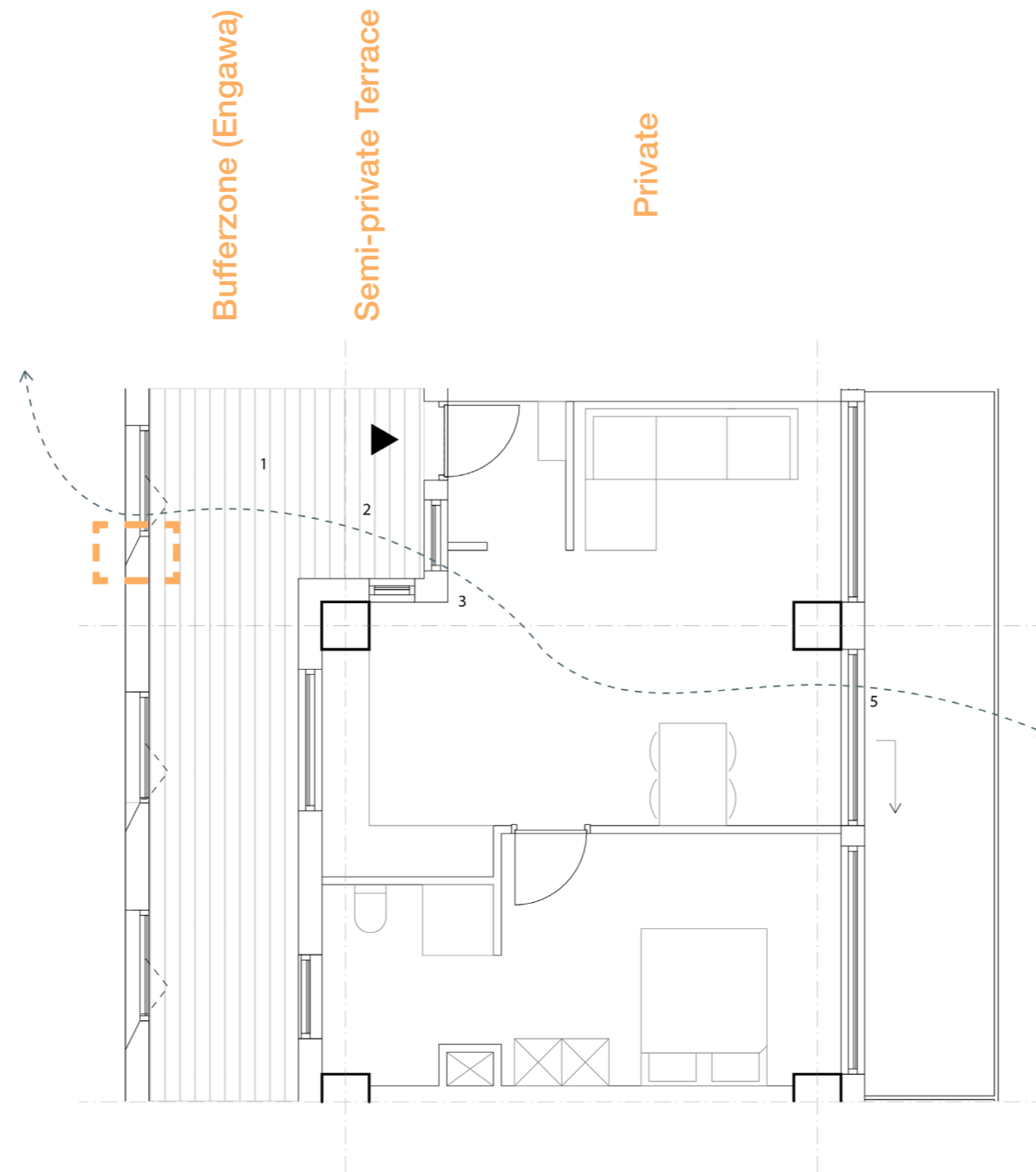
Semi-Private Spaces



Deep Layout

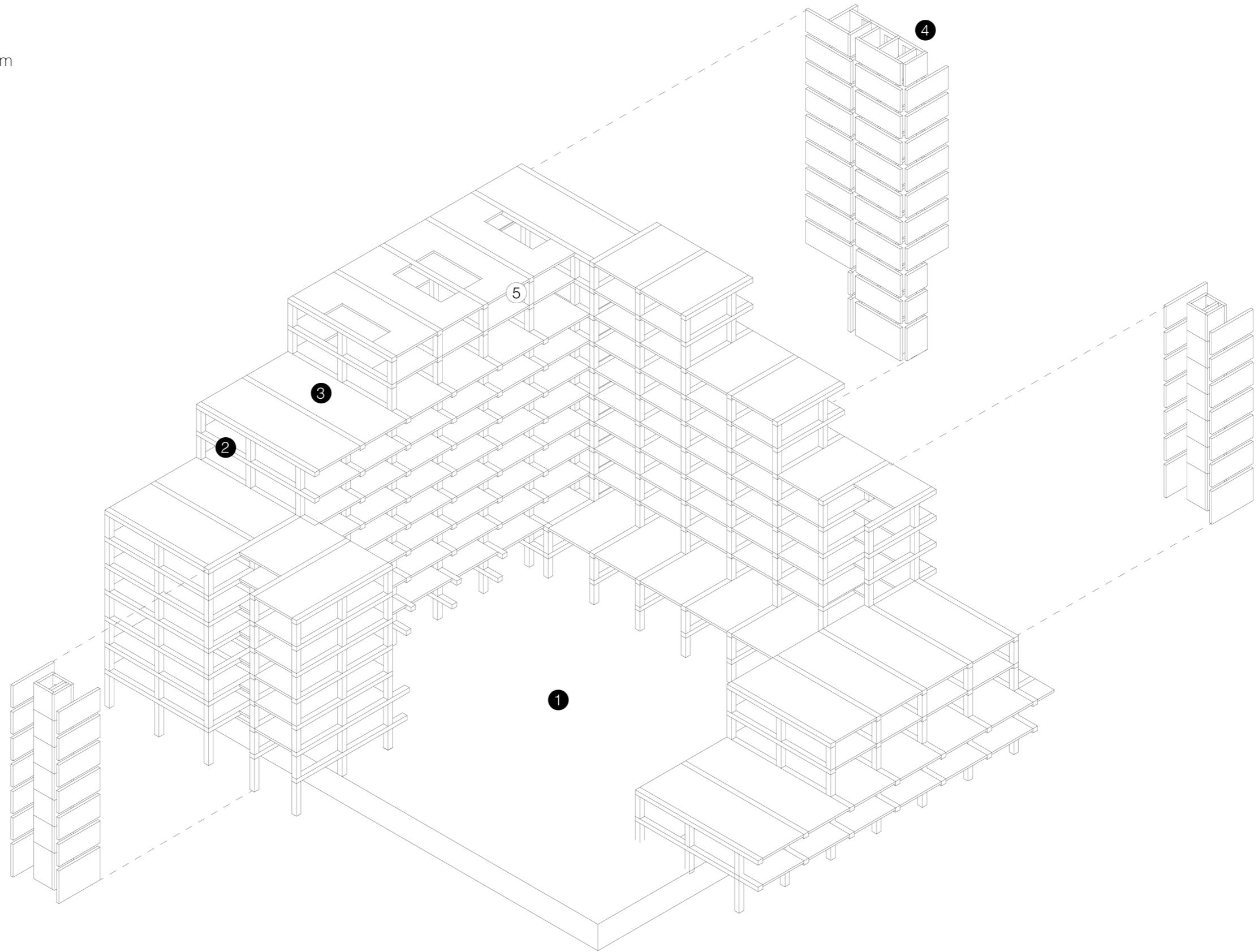


Wide Layout



Structure

- 1 concrete parking
- 2 glulam structure, 600x500mm
- 3 clt flooring, 240mm
- 4 stability core
- 5 stability walls

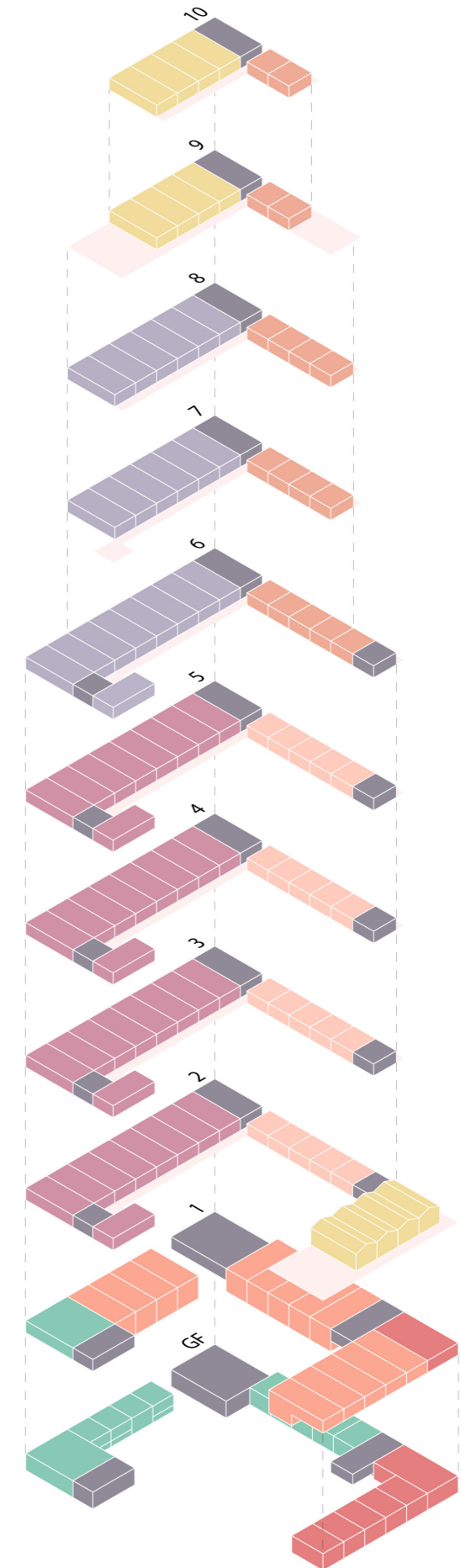


Programming

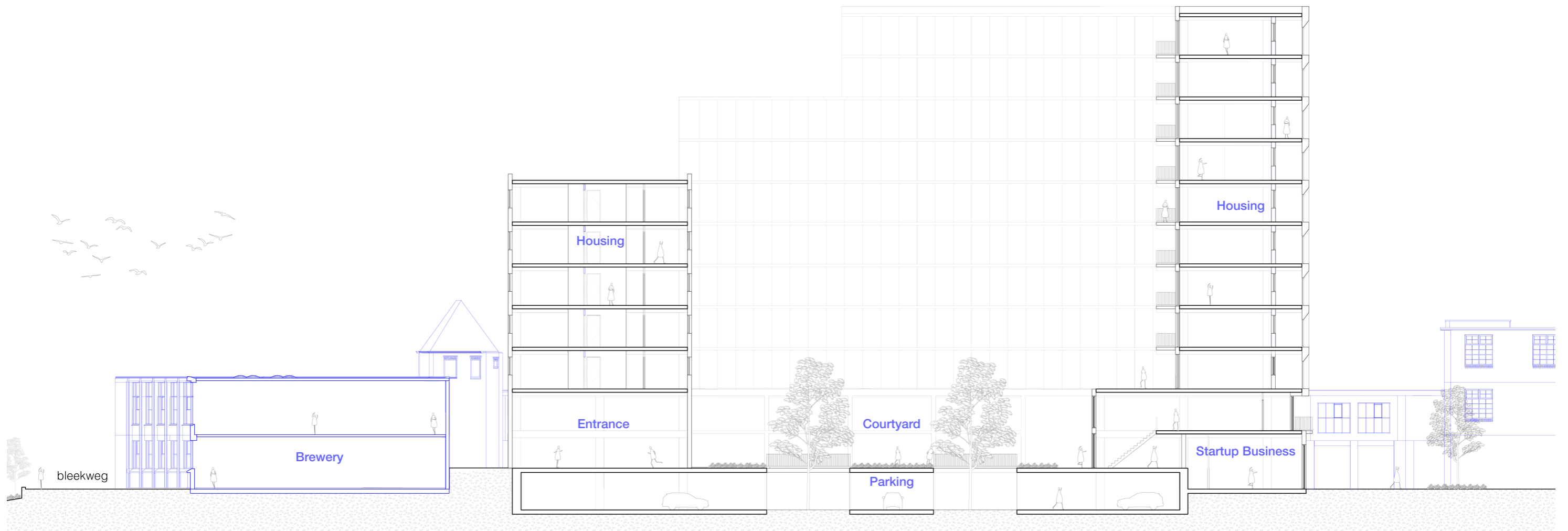
Target Groups

Target Group	Unite Size
Social Rental Housing	
Youth	35 m ²
Single-person household	50 m ²
Starters / young couples	60 m ²
Seniors	70 m ²
Middle-income Household (DINK - Dual Income, No Kids)	80 m ²
Seniors (Empty Nesters)	70 m ²
Status Holders (Refugees with residence permits)	60 m ²

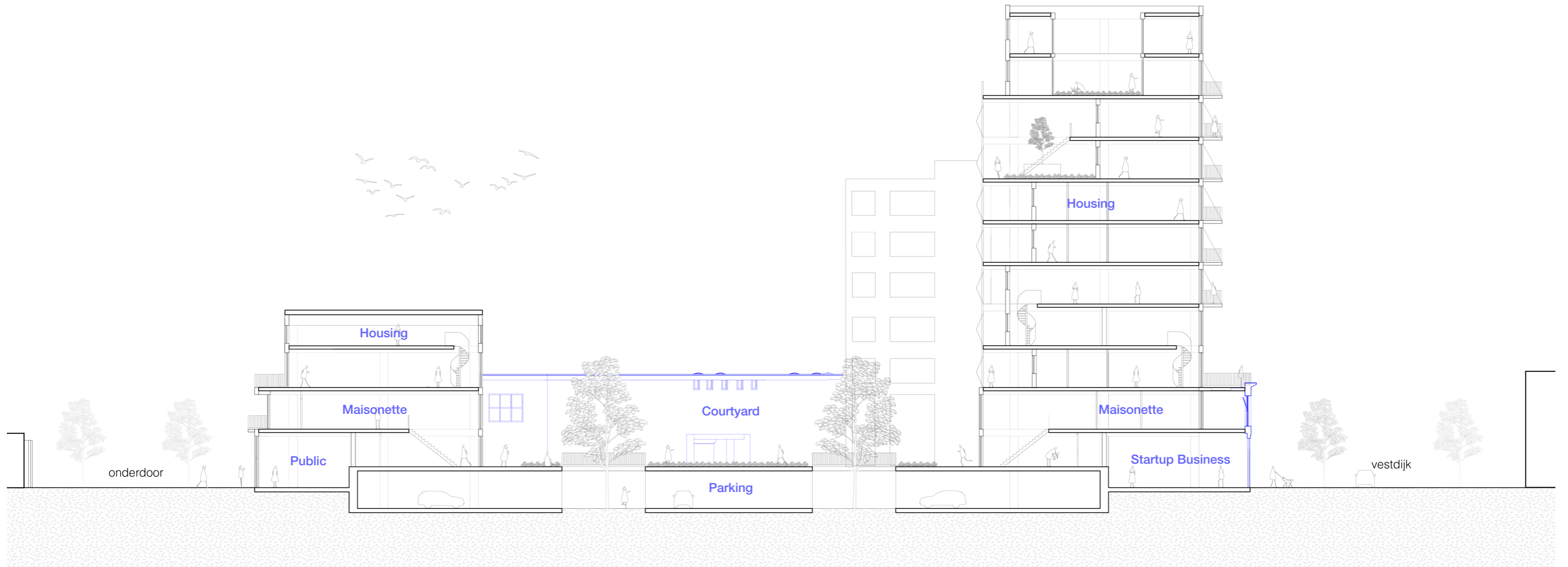
- building core
 - startup business
 - public
 - family
 - seniors
 - middle income, no kids
 - social rental
 - social rental
- 160 m²
120 m²
80 m²
50/60 m²
70 / 80 m²



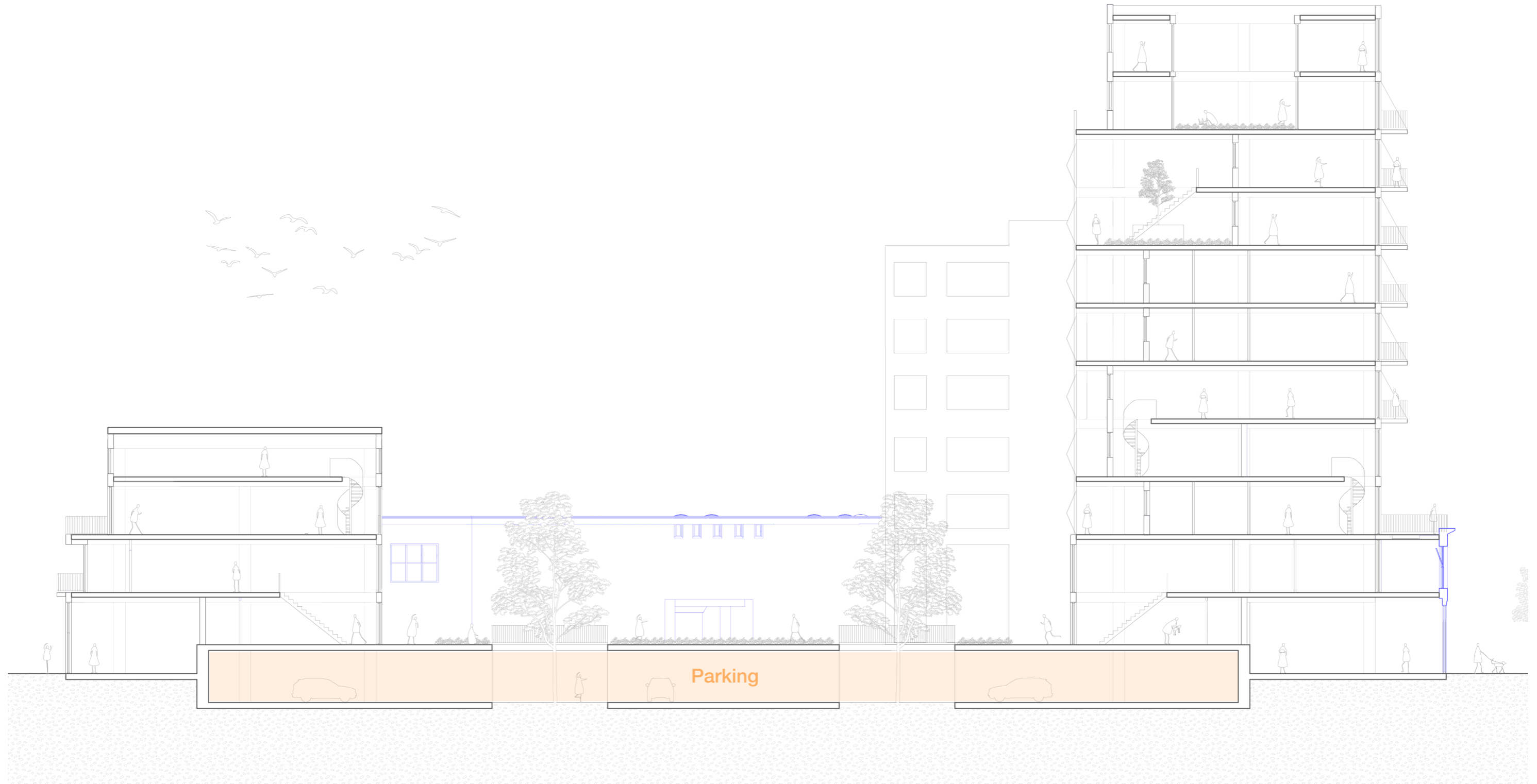
Cross Section



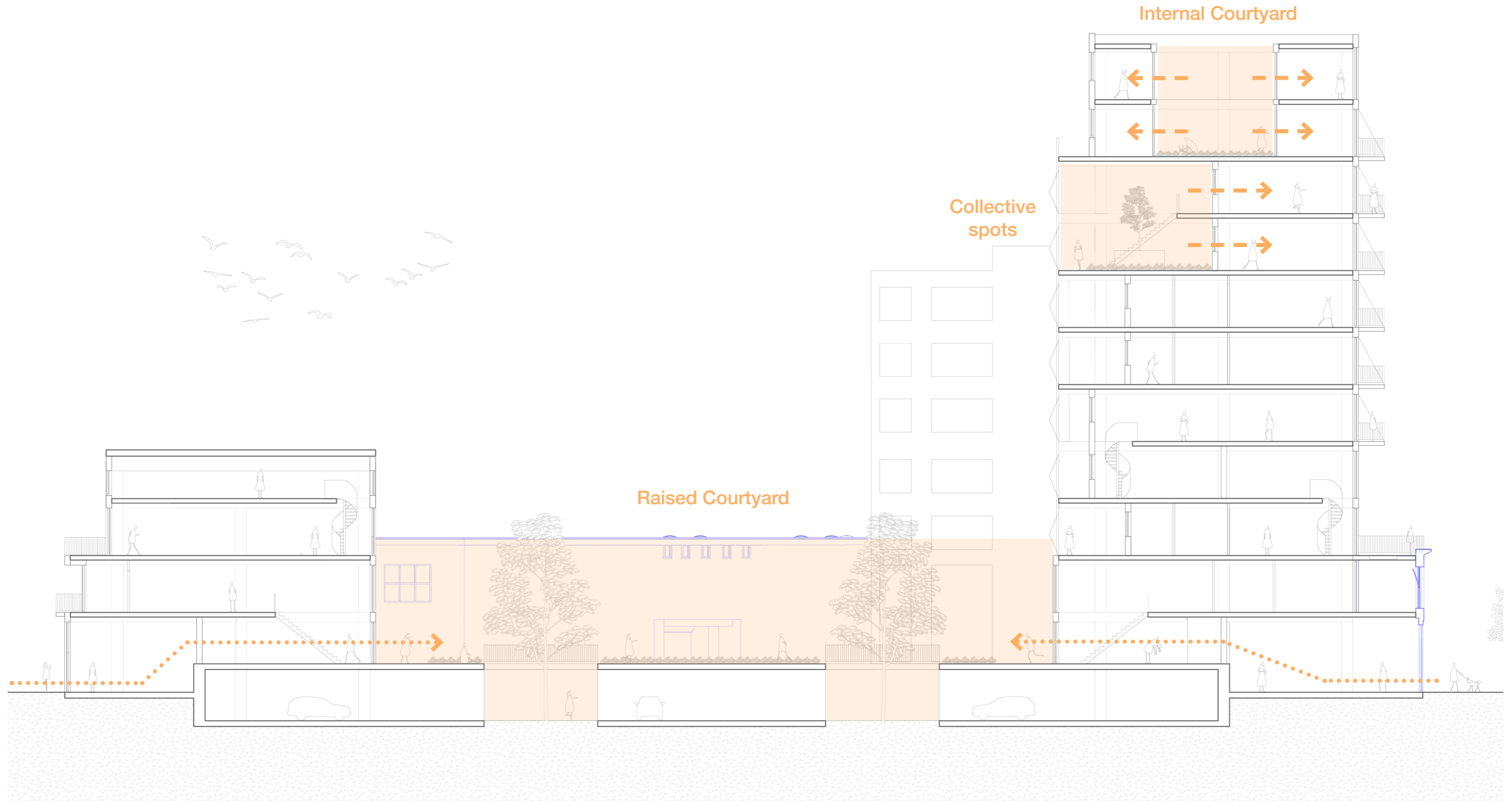
Longitudinal Section



Underground Parking



Collective Green Spaces



Future Scenario



Collective Green Spots



Housing Diversity



Detail Scale

Machiya

Interior

Lightweight shoji walls
Occupant play active role in adapting the thermal climate

Diffuse daylighting (translucent paper)

Lightweight wooden structure

Adaptive inner façade



(Engel, 1972)

Exterior



Tatami Mats

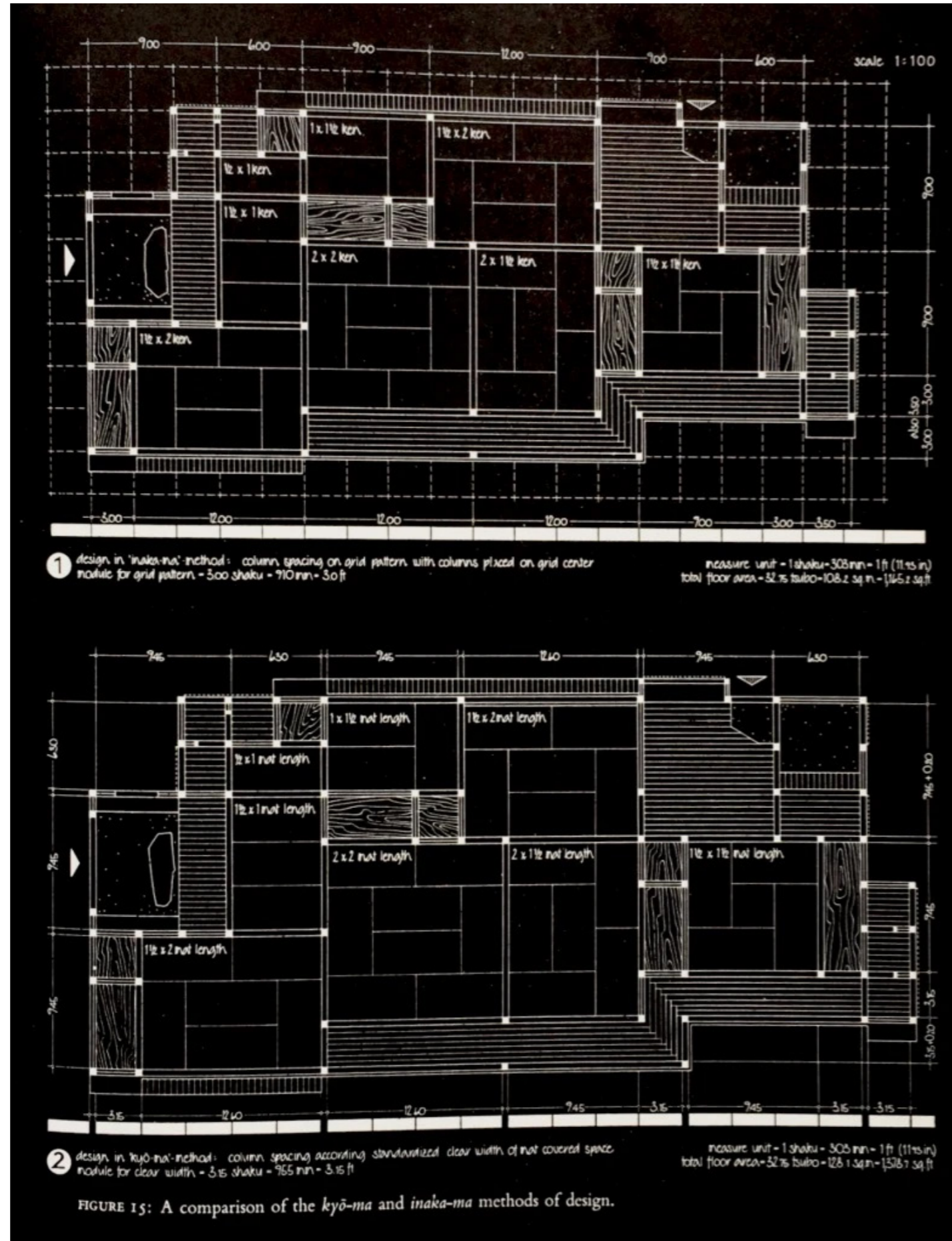
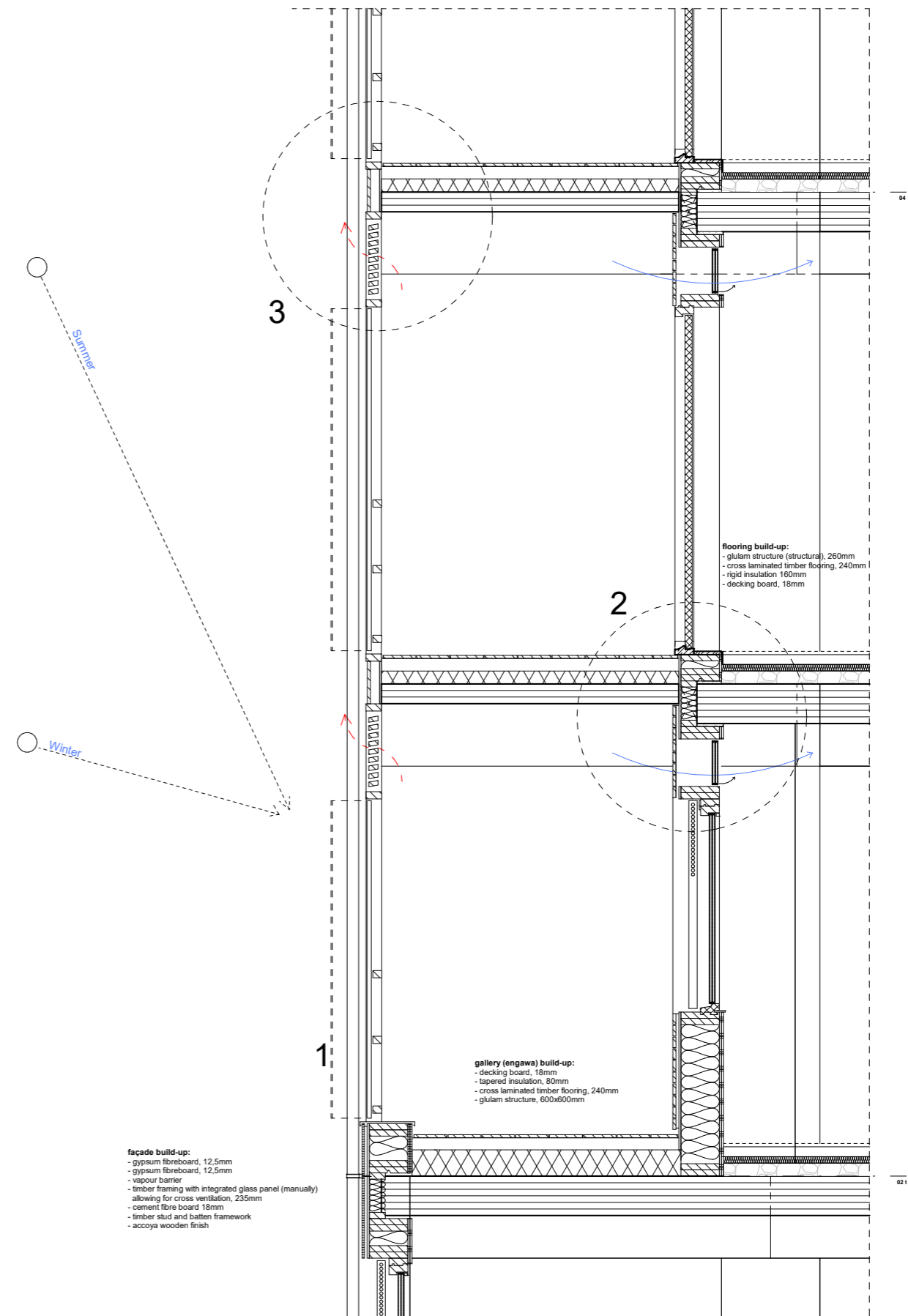


FIGURE 15: A comparison of the *kyō-ma* and *inaka-ma* methods of design.

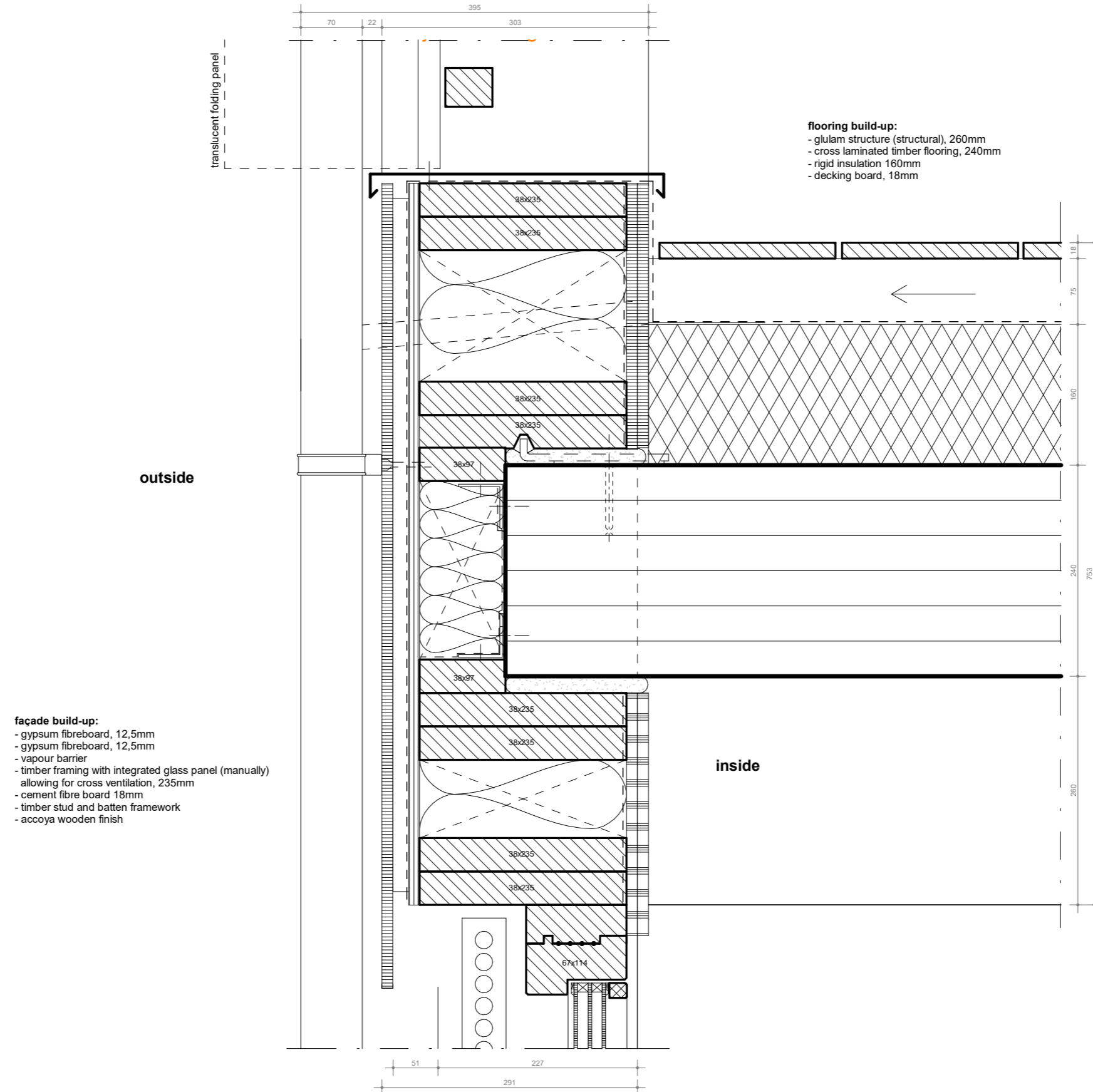
(Engel, 1972)

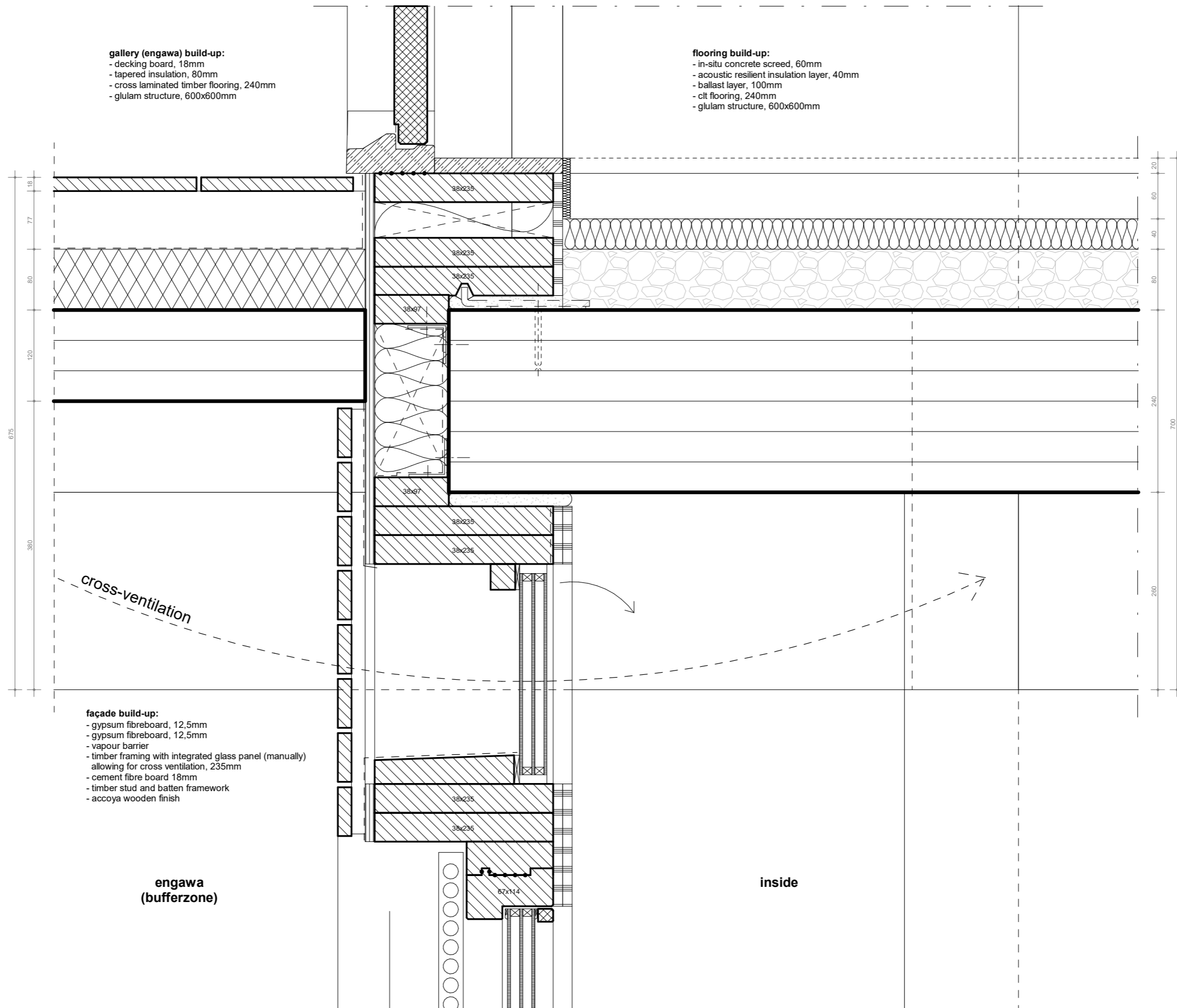
Schellenskwartier

West Fragment



Detailing





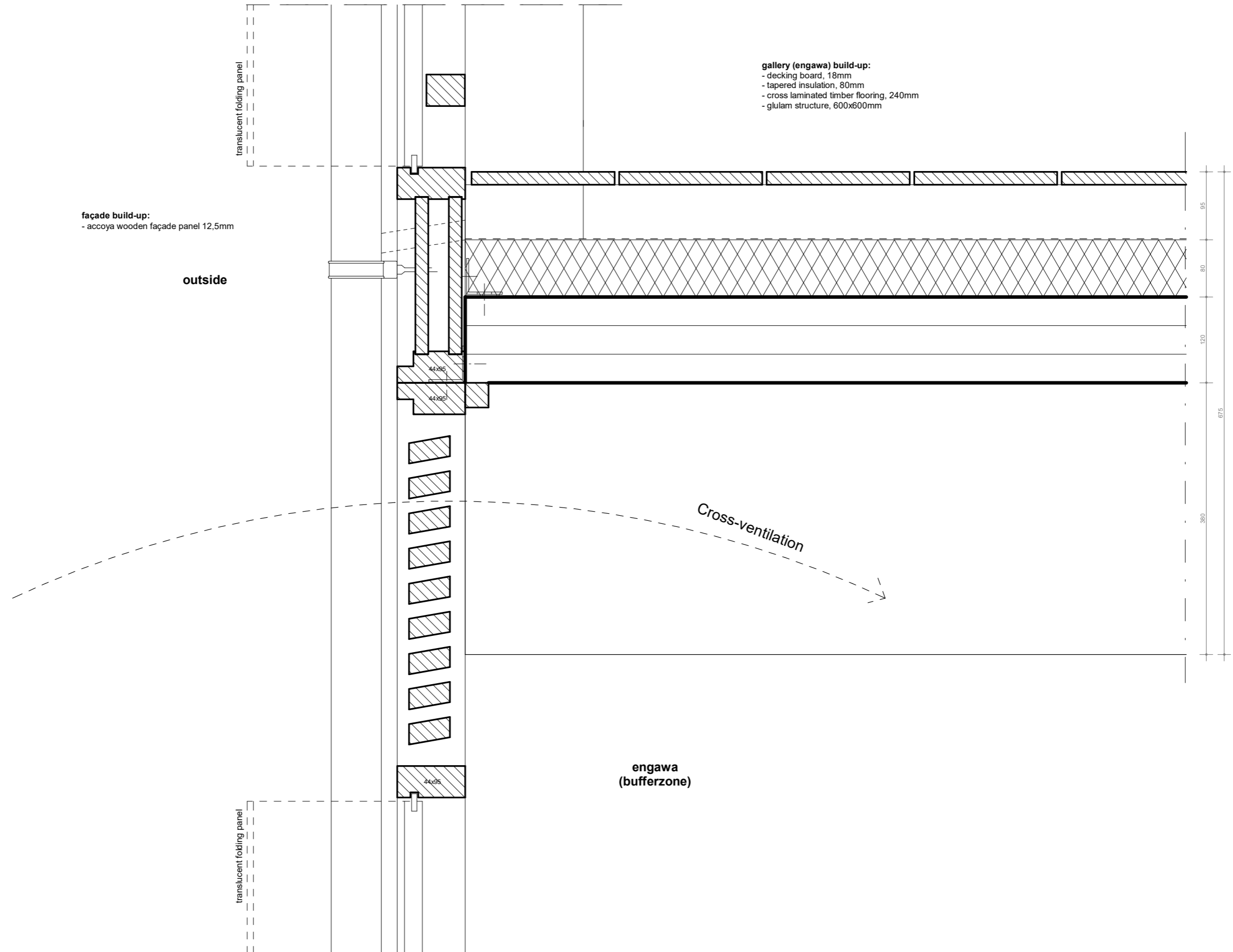
gallery (engawa) build-up:
 - decking board, 18mm
 - tapered insulation, 80mm
 - cross laminated timber flooring, 240mm
 - glulam structure, 600x600mm

flooring build-up:
 - in-situ concrete screed, 60mm
 - acoustic resilient insulation layer, 40mm
 - ballast layer, 100mm
 - ctt flooring, 240mm
 - glulam structure, 600x600mm

façade build-up:
 - gypsum fibreboard, 12,5mm
 - gypsum fibreboard, 12,5mm
 - vapour barrier
 - timber framing with integrated glass panel (manually) allowing for cross ventilation, 235mm
 - cement fibre board 18mm
 - timber stud and batten framework
 - accoya wooden finish

engawa (bufferzone)

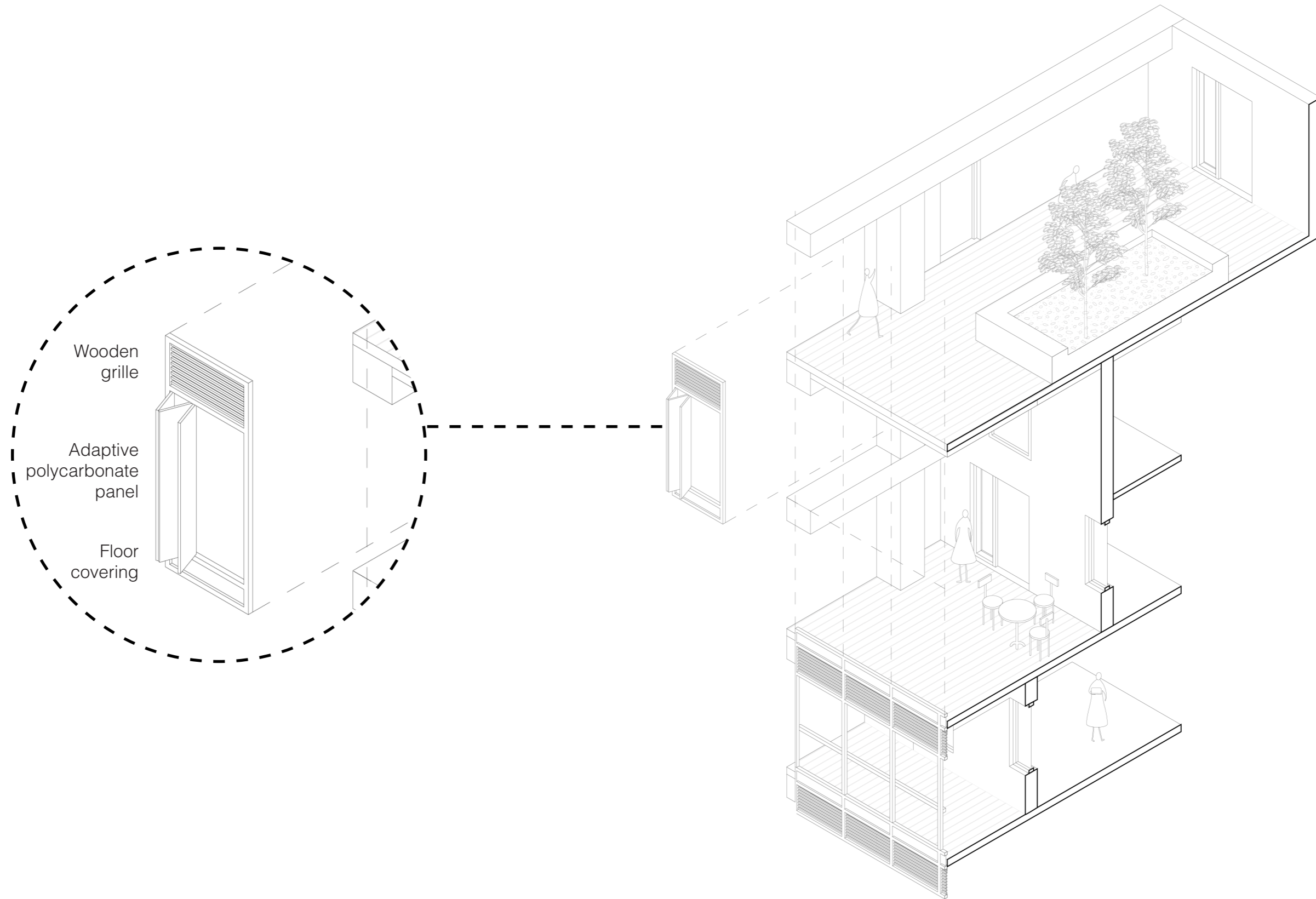
inside



West Elevation



Adaptive Translucent Façade



Adaptive Translucent Façade

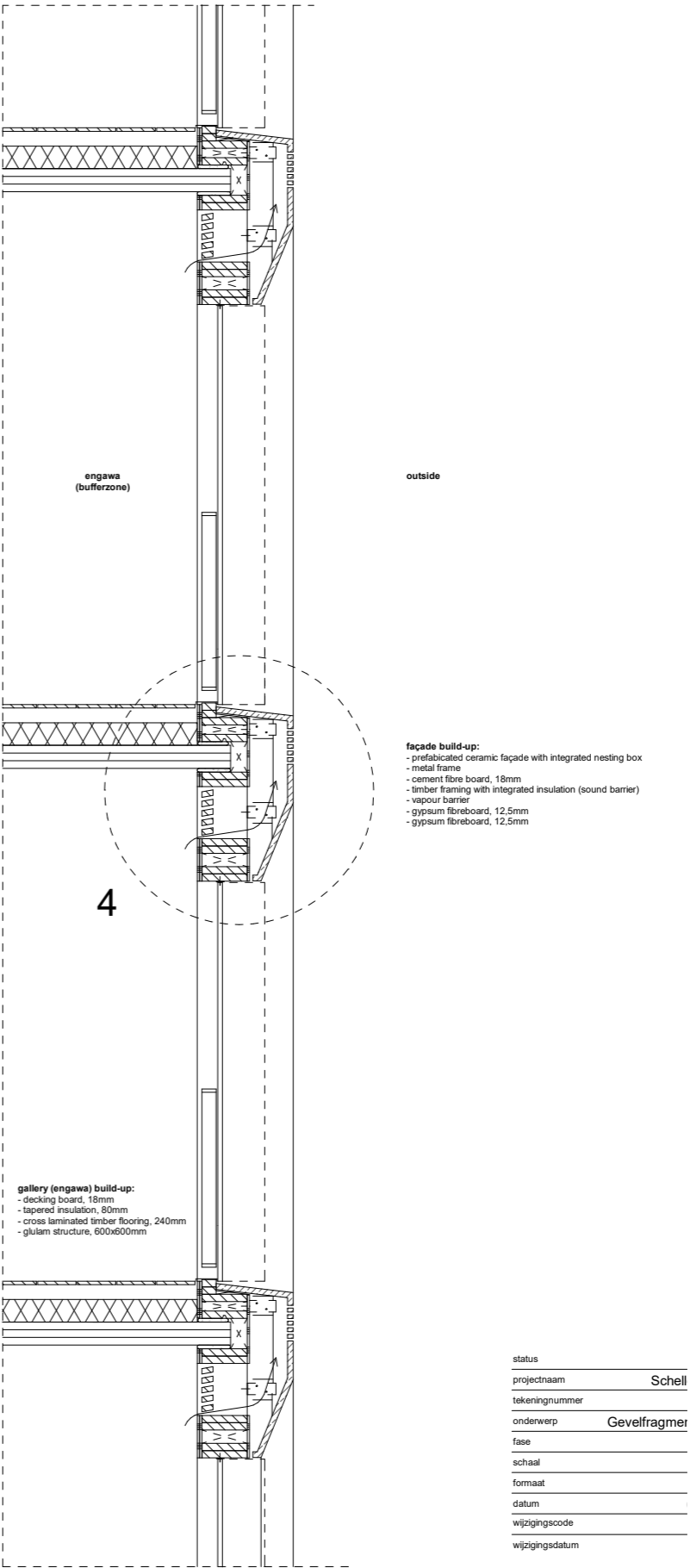


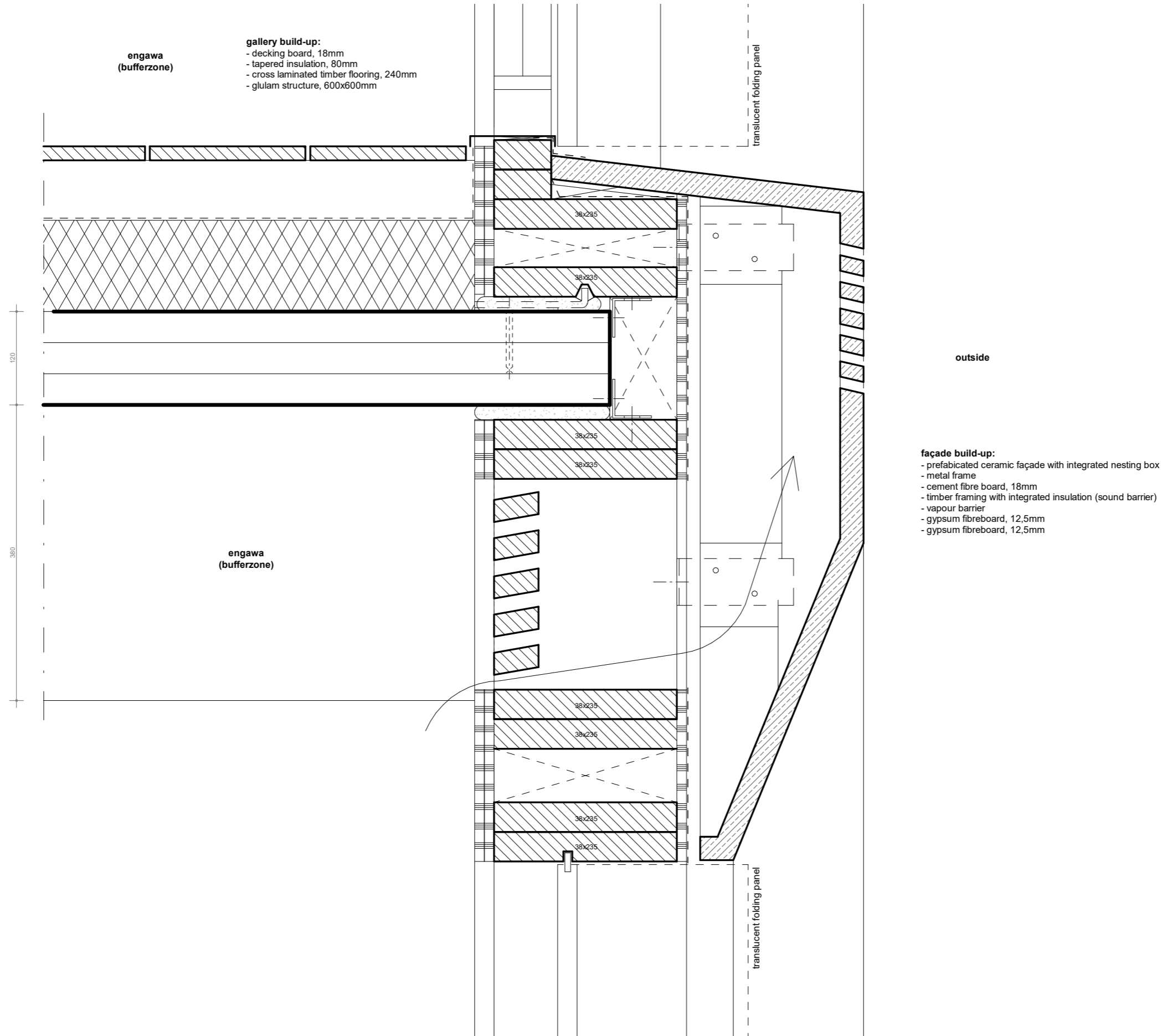


South Elevation



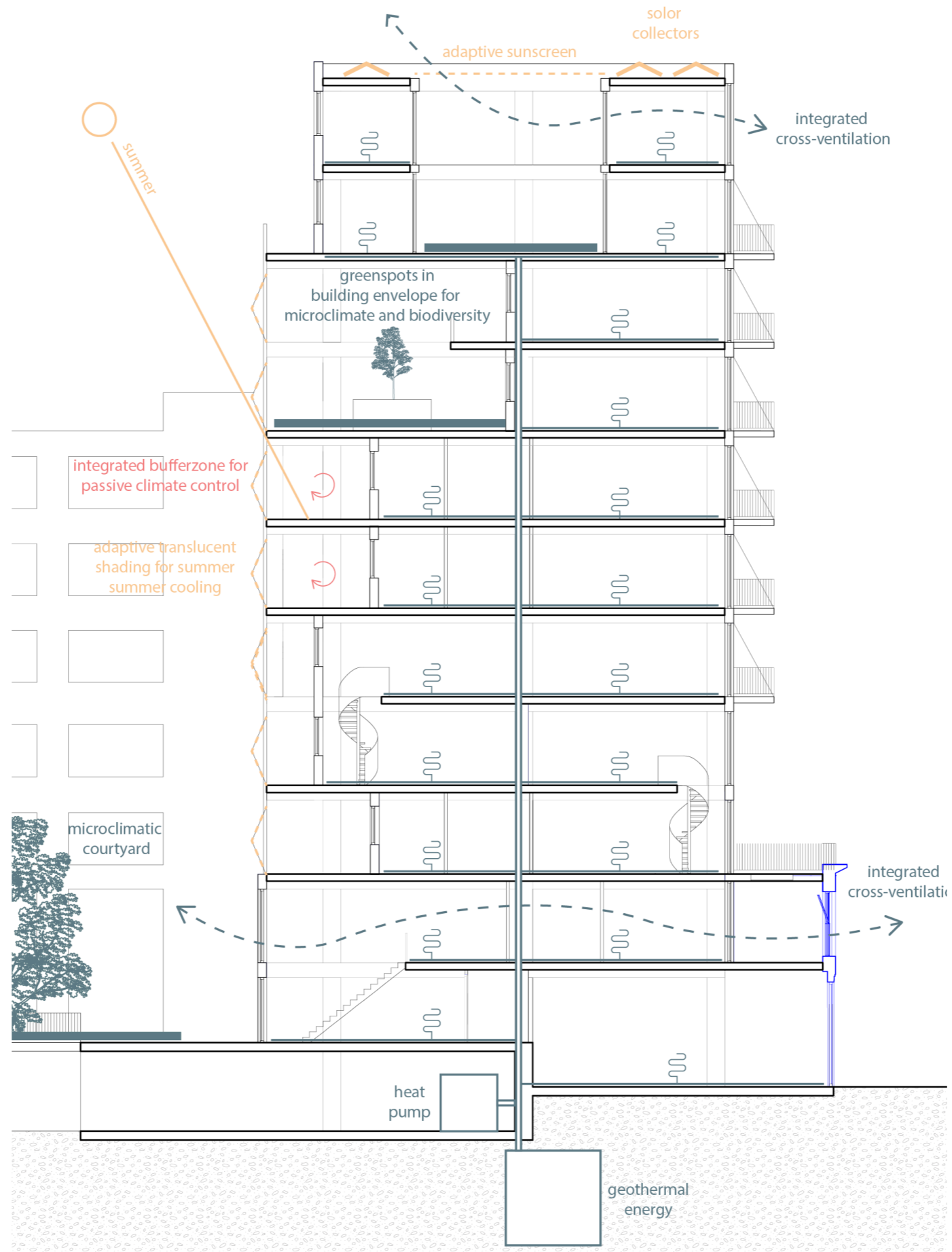
South Fragment



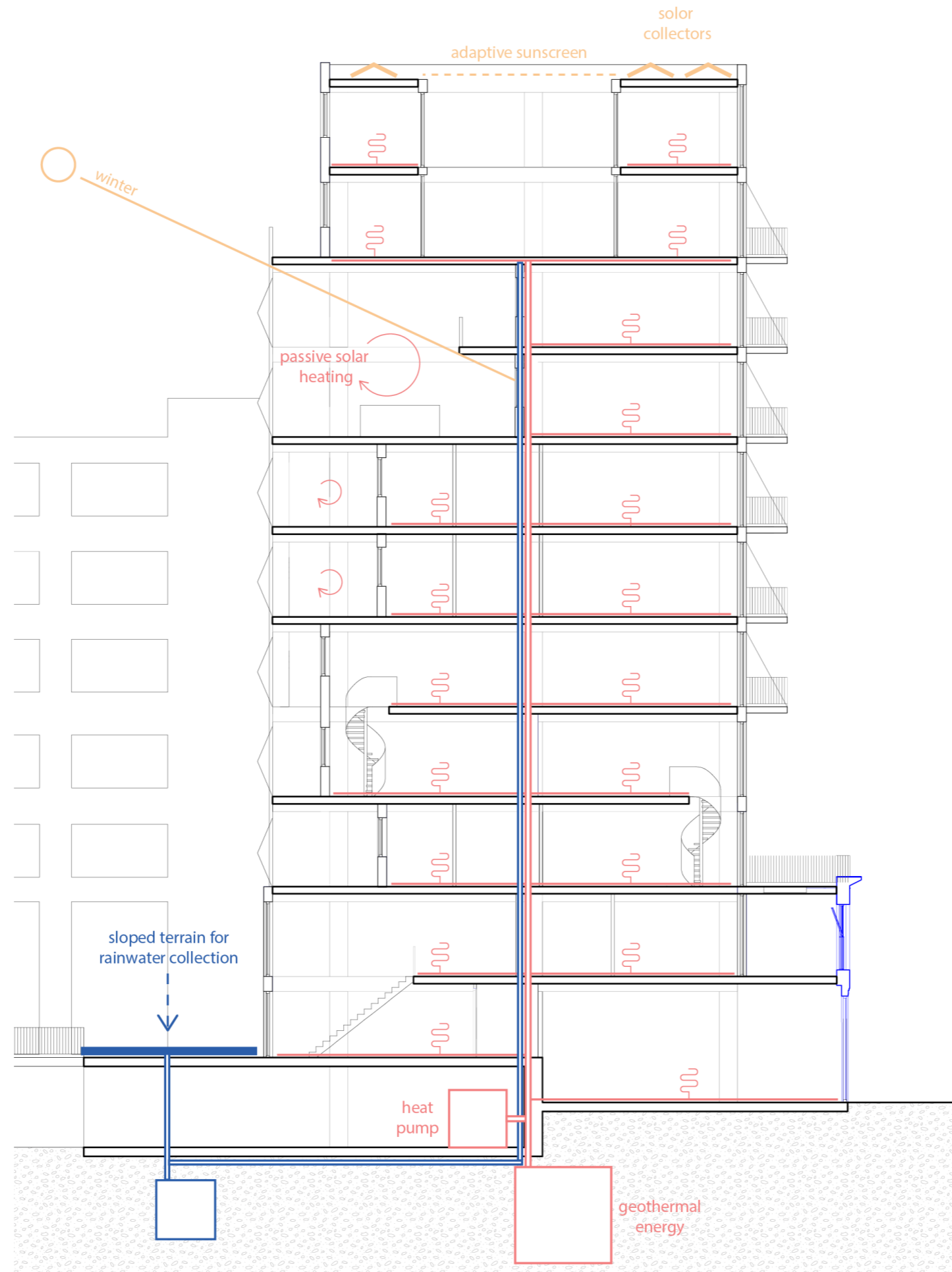




Summer Scheme



Winter Scheme



Total Isometric



