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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*

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Graduation Thesis report 2025-2026

Master of Architecture, Urbanism and Building Sciences
Track Architecture

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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

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Date

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FOREWORD

This report was written as part of my graduation research within the Architectural Engineering studio of the Architecture track. The research examines on how vernacular building strategies in humid subtropical climates can offer valuable insights for designing more heat adaptive architecture. The topic emerged from an interest in the increasing impact of climate change on the built environment, particularly the growing challenge of heat stress in dense urban areas. Throughout the research, I explored how architecture can respond to these changing condition with the application of passive, low-tech strategies.

I would like to thank my tutors, Stephan Verkuijlen and Paddy Tomesen for their guidance, feedback, and critical reflection during the process.

Roel Jacobs
17th of June, 2026

PART 1
Introduction

PROBLEM STATEMENT

Extreme heatwave event in July 2019

Heatwaves are extreme events with a large societal impact. During the summer of 2019, Western Europe experienced two exceptional heatwaves in June and July, leading to record-breaking temperatures exceeding 40 °C (Vautard et al., 2020). "In the Netherlands, the 40 °C level was reached for the first time ever, shattering the almost eighty-year-old national temperature record by more than 2 °C" (De Vries et al., 2024, p. 2). Climate studies indicate that the maximum temperatures during heatwaves will increase by 1.5 to 2.5 times the global warming rate, resulting in more intense periods of heat (De Vries et al., 2024). In the future, rising temperatures are strongly related to the emission of greenhouse gases. Under current emission trends, climate projections indicate a shift towards high-emission scenarios with warmer and drier conditions, characterized by higher average temperatures, more frequent heatwaves, and longer periods of drought (KNMI, 2023) (Figure 1).

Future heat scenario

A study by KNMI (2023) translated the warmest three days of the 2019 heatwave into a climate scenario in which the global mean temperature is 2 °C higher than current conditions. This approach provides a tangible illustration of how a comparable extreme heat event could manifest in the future. The results indicate that maximum temperatures would exceed 40 °C across large parts of the Netherlands, accompanied by a substantial increase in the occurrence of tropical nights (KNMI, 2023). The current climate in the Netherlands provides 3–5 tropical days per year, which could increase to 20–30 days per year in 2100 (KNMI, 2023) (Figure 2). These challenges are most pronounced in dense urban areas due to the urban heat island (UHI) effect. Temperatures can be 3–7 °C higher than in surrounding rural areas. According to De Vries et al. (2024), such events will become increasingly common under future climate scenarios and highlight the urgent need to reassess how buildings and urban spaces can respond to future heat scenarios.

Effects on mental well-being

Prolonged periods of heat can significantly influence human physical well-being, resulting in heat stress. Heat stress is a general term for health problems that arise when humans are unable to regulate their body temperature effectively due to high temperatures and humidity, resulting in symptoms such as discomfort, fatigue, and loss of concentration (RIVM, n.d.). Furthermore, studies indicate that mortality rates increase by 12 percent during heatwave events (RIVM, n.d.). It can therefore be concluded that the severity of these events substantially impacts daily life, cognitive functioning, and overall well-being.

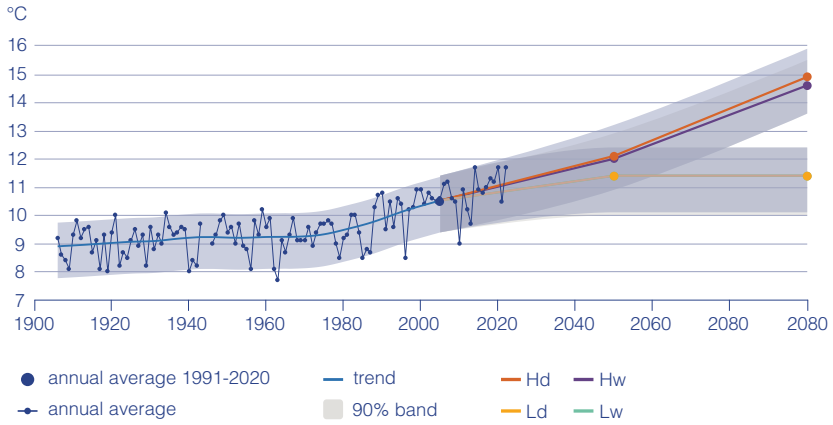


Figure 1: Average annual temperature of the past and the expected future trend, KMMI, 2023

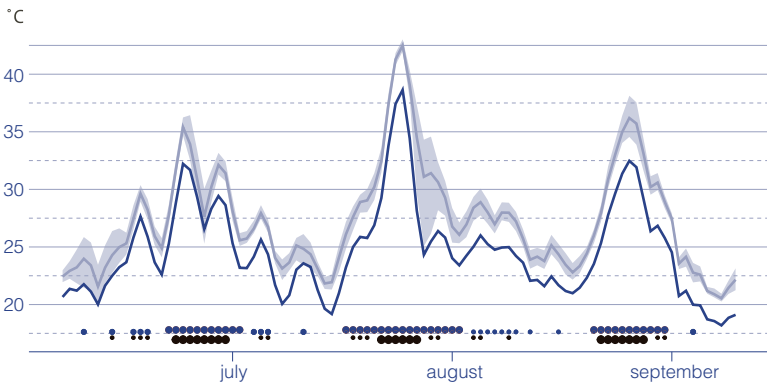


Figure 2: Three-days average maximum temperature in the summer of 2019, KMMI, 2023

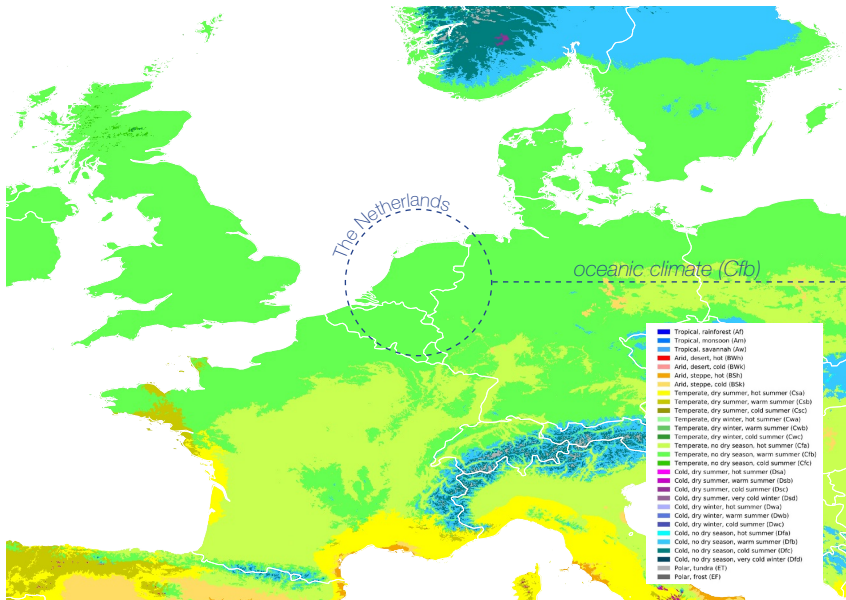


Figure 3: Climate classification from 1999-2020, Beck et al., 2023

Towards a humid subtropical climate

According to the Köppen-Geiger classification (2023), a gradual climate shift is projected for the Netherlands in the future. The Netherlands is currently categorised as having an oceanic (Cfb) climate, characterised by moderate temperatures, relatively cool summers, and mild winters (Beck et al., 2023) (Figure 3). However, by approximately 2071, the climate is projected to shift towards a humid subtropical (Cfa) climate, characterised by long, hot summers and cool to mild winters (Beck et al., 2023) (Figure 4). Therefore, it is urgent to prepare the built environment for this climatic change.

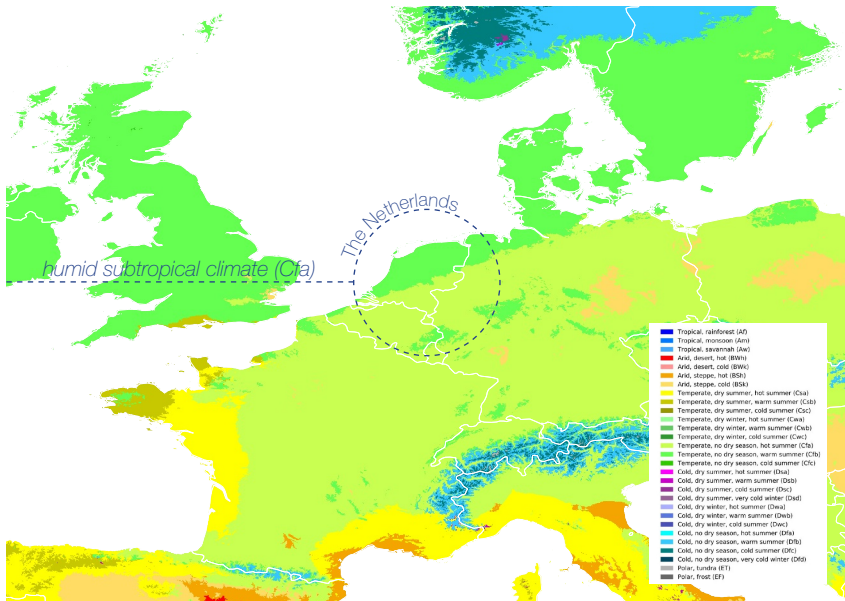


Figure 4: Climate classification from 2071-2099, Beck et al., 2023

RELEVANCE

This research addresses the urgent challenge of adapting current architectural practices to rising future temperatures and the transition towards a humid subtropical climate (Cfa). This subject is particularly relevant to the built environment in order to ensure thermal comfort, energy performance, and overall liveability under changing climate conditions. It is necessary to respond to these developments rather than neglecting them.

OBJECTIVE AND MOTIVATION

To address this future challenge, this research aims to investigate passive building strategies rooted in vernacular architecture in humid subtropical climates (Figure 5). To narrow the scope of the research, the study focuses specifically on a single vernacular building typology found across different regions of the world. These interventions have evolved over time through long-term adaptation to specific contextual conditions and provide valuable knowledge regarding passive and low-tech design strategies in response to heat and humidity. The analysis is conducted across three different scales (urban, building, and detail) to identify strategies at multiple levels of architectural design.

In the second phase, the transferability of these strategies to the context of the Netherlands will be critically assessed (Figure 6). This process bridges the gap between traditional practices and their application in contemporary architecture. The site-specific conditions, together with the limitations and regulations in the Netherlands, create a valuable framework for further research.

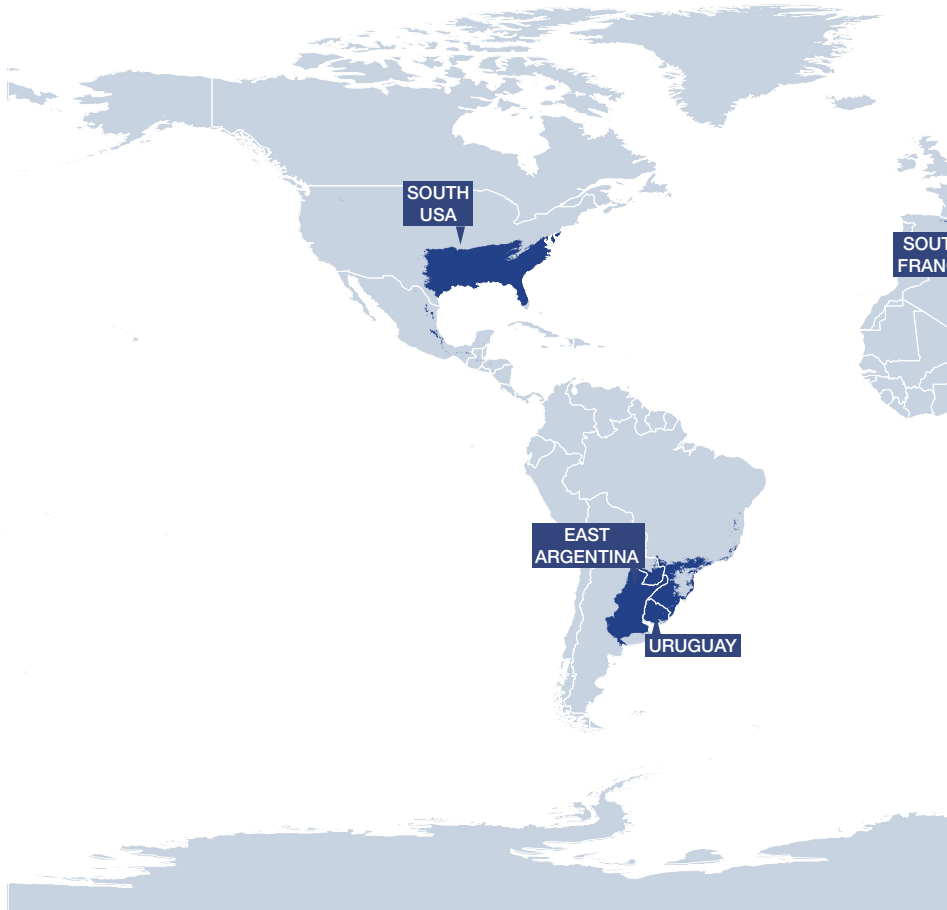
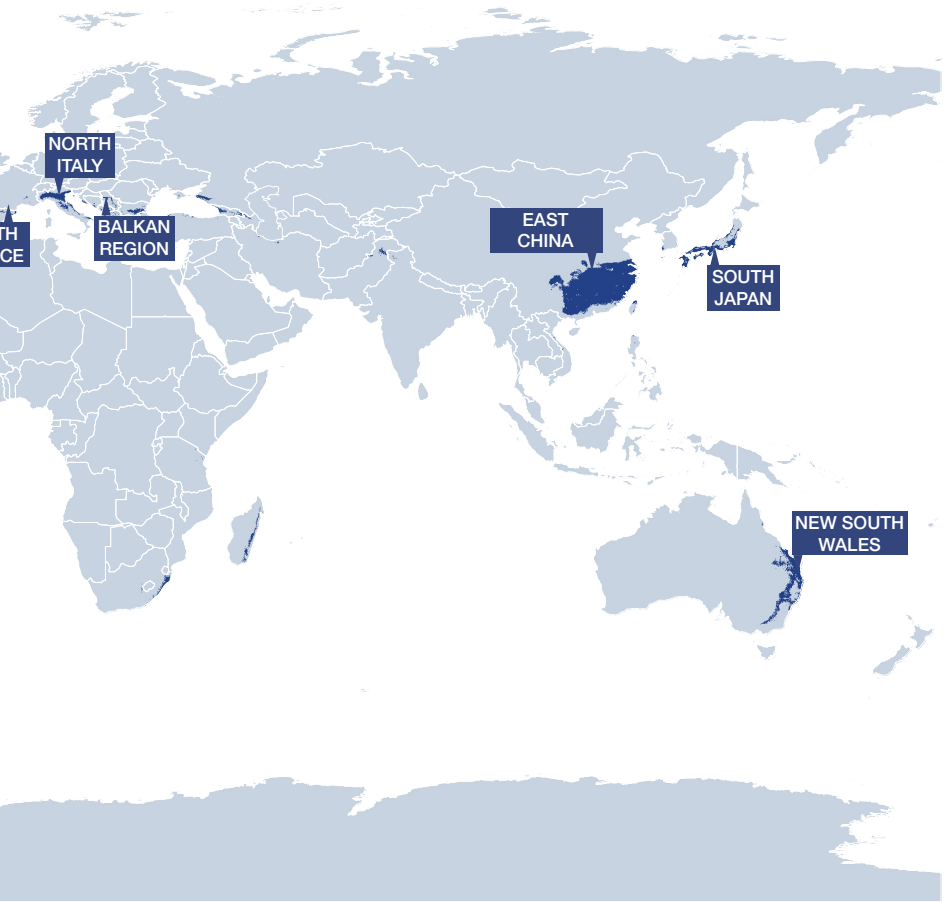


Figure 5: Countries rooted in a humid subtropical (Cfa) climate according to the Köppen-Geiger climate classification, 1991-2020, Beck et al., 2023

■ humid subtropical climate (Cfa)



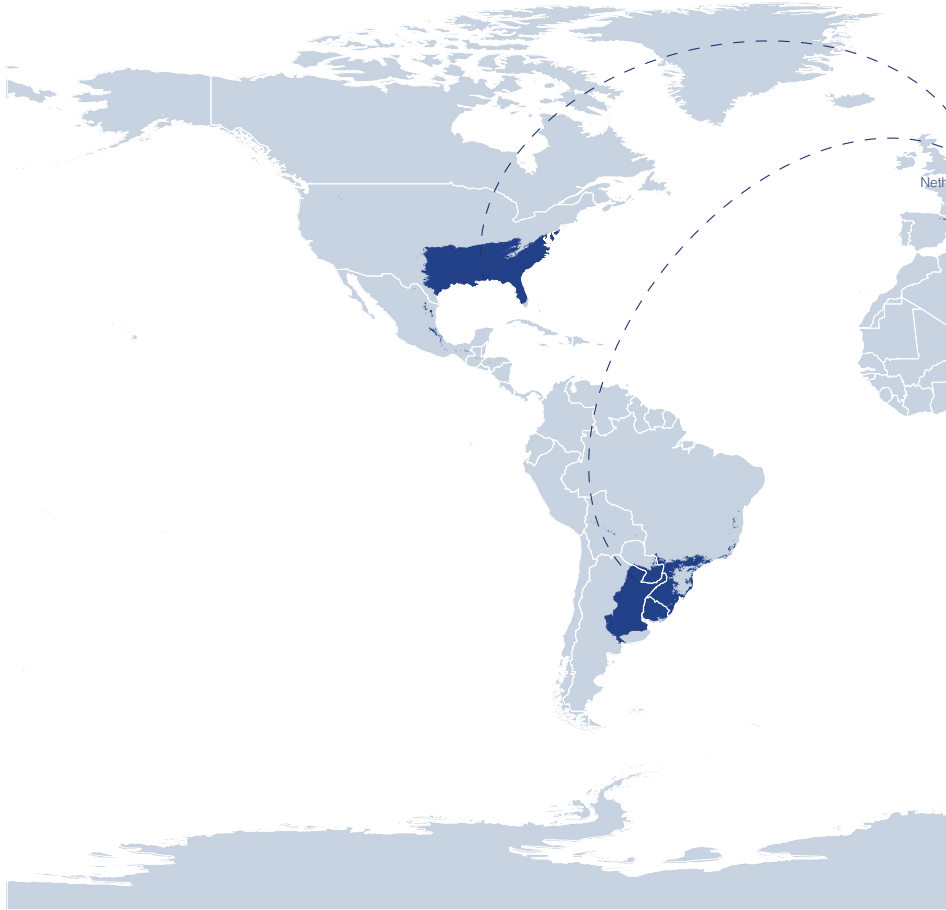
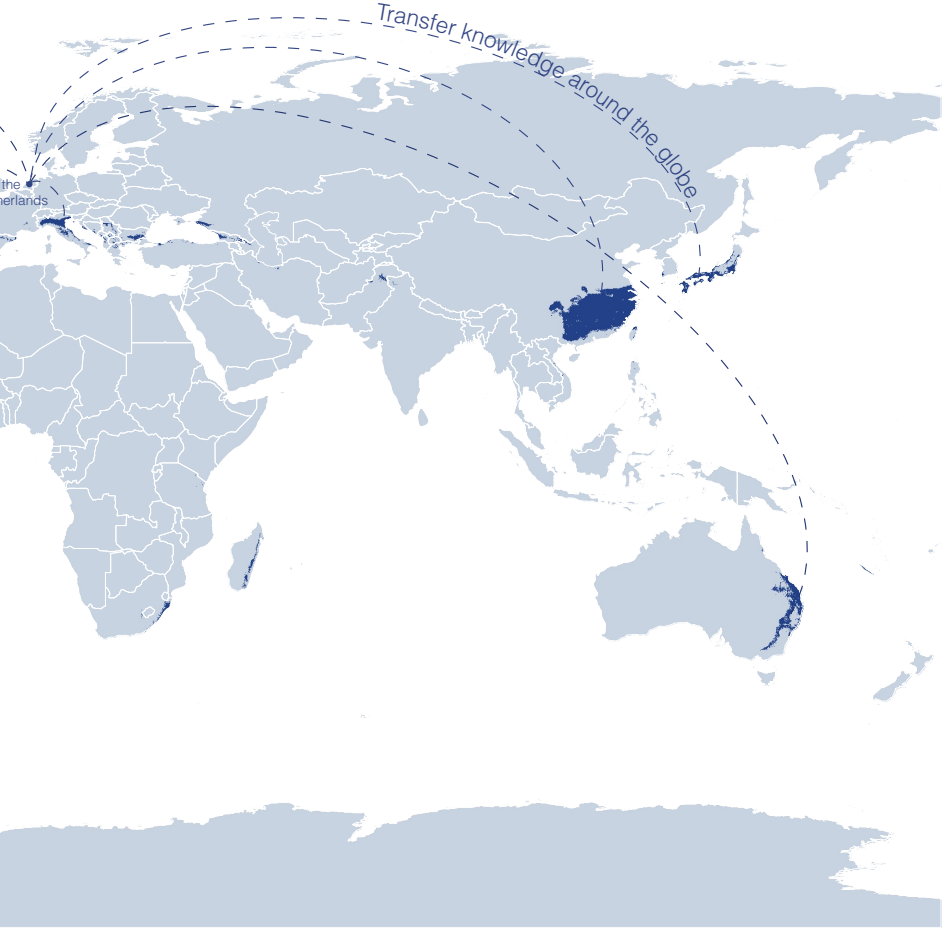


Figure 6: Transfer knowledge to the context of the Netherlands, Beck et al., 2023

■ humid subtropical climate (Cfa)



RESEARCH QUESTION

Main research question

How can vernacular building strategies developed in humid subtropical climates coping with heat and humidity be translated into scalable architectural design strategies for dense urban areas in the Netherlands that enhance thermal resilience under projected heat-stress scenarios?

Sub-research question

- (1) What can be learned from vernacular building strategies in humid subtropical climates addressing heat and humidity through passive, low-tech architectural design?
- (2) How can these vernacular climate-adaptive strategies be reinterpreted and translated to the urban context of the Schellenskwartier in Eindhoven?
- (3) To what extent can the translated design strategies at the building and detail scale contribute to thermal comfort and heat resilience within the design for the Schellenskwartier?

SCOPE

To frame the research, the city of Eindhoven has been selected as the primary focus of this study. Its southern geographic location, high urban density, and limited green infrastructure contribute to an intensified urban heat-island effect. Within this context, the Schellenskwartier has been selected as the testing ground for this research due to its redevelopment potential and its location in the city centre, where heat stress is most pronounced. Additionally, the site is located near the Dommel River, at the edge of the city centre, and forms part of Eindhoven's future urban development vision (Figure 7). The combination of these factors makes the Schellenskwartier a relevant site for further exploration.

The urban strategy is centred on high-rise densification and the integration of mixed-use programmes to accommodate the growing housing demand and support the future vision of the Brainport region. For the Schellenskwartier, this results in the integration of public functions within the plinth, and dwellings located above. The convergence of climatic vulnerability, inner-city intensification, and programmatic complexity makes the Schellenskwartier highly relevant for proposing strategies across multiple scales.

city centre



Densification vision
Added brainport layer +/- 100m

Dommel

Integration of the
river Dommel

Schellenskwartier

1:10000

Figure 7: Location of the Schellenskwartier in Eindhoven, by author, 2026

PART 2
Approach

METHODOLOGY

As mentioned in the research question, this research is structured into three parts.

Literature review

The literature review defines vernacular architecture and critically examines the relevance of its embedded knowledge for reinterpretation within contemporary architectural practice. Furthermore, it outlines the contribution of this research to the existing body of literature.

Part I - Case study analysis

In the first phase, vernacular architecture in a humid subtropical climate (Cfa) will be analysed, focusing on how it responds to climatic conditions through passive, low-tech building strategies. This concept refers to climate-responsive architectural design principles that regulate thermal comfort and environmental performance through natural means. Vernacular architecture will therefore be examined across a selection of regions where design practices have evolved over time through long-term adaptation to specific site conditions. The focus is placed on a particular building typology due to its repetitive applicability. These passive building strategies will be analysed across three different scales: urban, building, and detail scale (Figure 9). This approach provides valuable insights and reveals the underlying principles related to culture, climate, and material availability from which these strategies have emerged. As a result, this approach creates a framework of strategies that can be further developed for application within the Dutch context.

Part II - Translation to context in Eindhoven

Translation phase

In the second phase, the identified strategies will be critically examined for their transferability to the Dutch context, with the Schellenskwartier serving as the testing ground. This investigation primarily focuses on contextual conditions such as scale, density, and spatial integration within the urban fabric. In particular, the scalability of the identified principles constitutes a key component of the analysis. A critical question is whether these strategies remain effective when applied on a potentially larger scale. The constraints of the Schellens site therefore define the scope and boundaries of the research.

Prototyping

The prototyping phase within this research is based on a research-by-design approach. The extracted vernacular building strategies will serve as design tools and will be experimentally applied to the site of the Schellenskwartier under its specific contextual constraints. Drawings, computer models, and physical models will be produced to explore the theme and assess the transferability of the strategies to the Dutch context and their application within the final design.

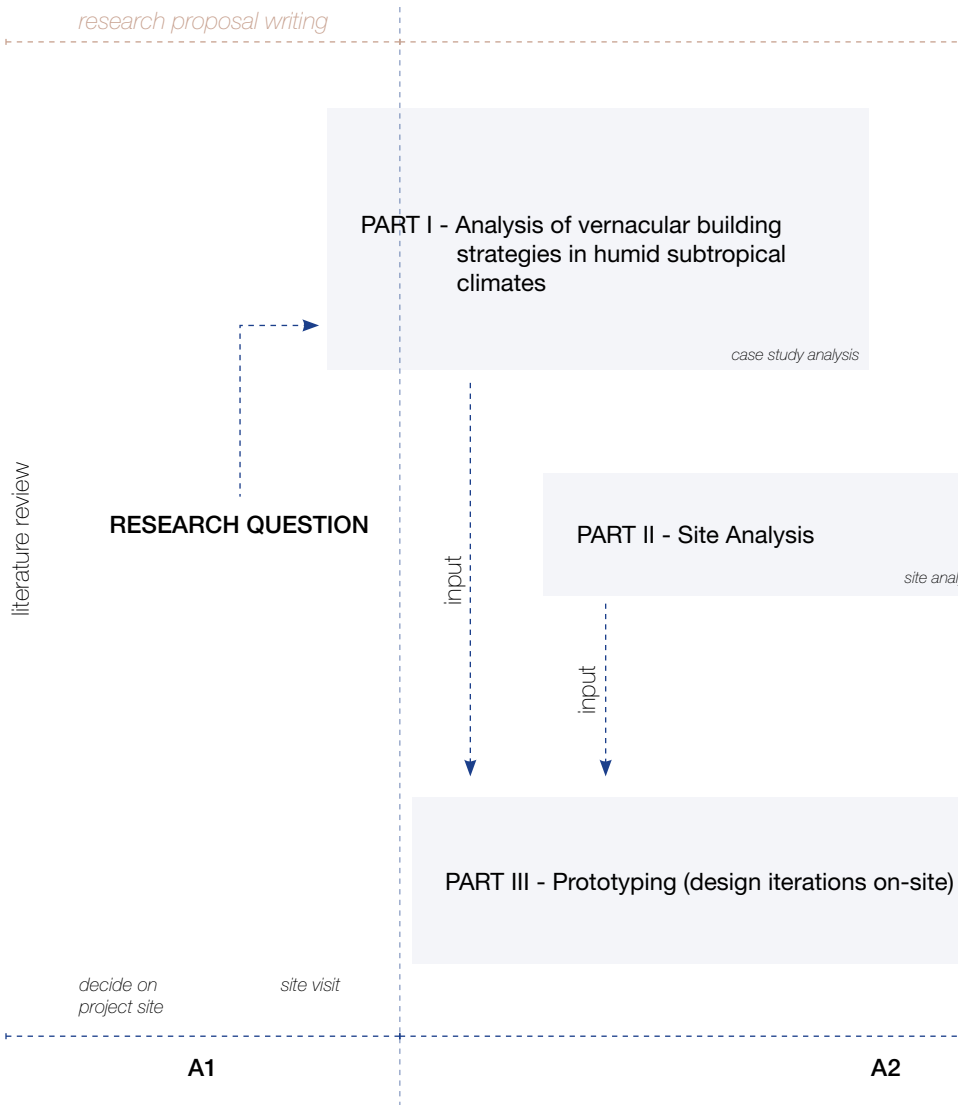
Part III – Contextual application

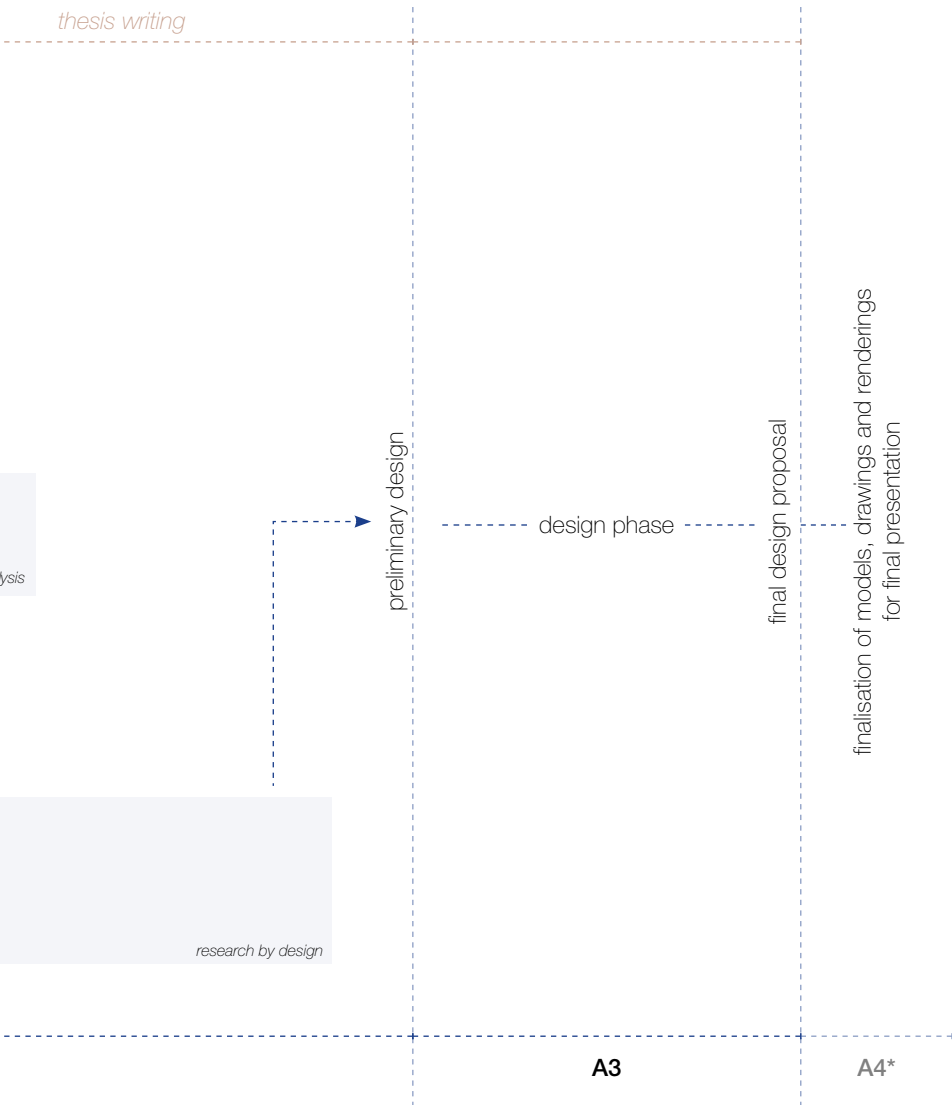
In the final phase, the proposed strategies and the outcomes of the research-by-design phase will be integrated into a final design for the site of the Schellenskwartier. A masterplan will be developed for the urban-scale interventions, while the proposed building will be elaborated through interventions at the building and detail scales. Although the Schellenskwartier functions as a testing ground, the research aims to develop interventions with broader and more generic applicability within the built environment. The primary objective of the study is to formulate strategic design interventions that can be applied within the architectural design process.

Additional Note

Artificial Intelligence (AI) is used to support the writing process by rewriting and rephrasing sentences into academically appropriate English. The tool is applied to improve clarity and accuracy, while all content and arguments remain the author's own.

Furthermore, at the final stage of the design process, AI is used as a post-production method to make the visuals more photorealistic.





THEORETICAL FRAMEWORK

This chapter defines vernacular architecture and examines why its embedded knowledge is particularly relevant for reinterpretation within contemporary architectural practice. It also highlights how this research contributes to the existing body of literature.

Vernacular architecture

Vernacular architecture is a nineteenth-century concept and is defined as a building form based on local needs, the availability of construction materials, and the reflection of local traditions (Sayigh, 2019, p. 1). It has evolved over time through long-term adaptation resulting from its constant dialogue with specific environmental, cultural, technological, and historical contexts. As stated by Rapoport (1969, p. 83): "The amazing skill shown by primitive and peasant builders in dealing with climatic problems, and their ability to use minimum resources for maximum comfort".

According to various authors, knowledge rooted in vernacular architecture can be regarded as a valuable source for future architectural practice. The integration of new materials, building techniques, and patterns of use is understood not as a degradation of vernacular principles, but as a continuation of living building traditions (Sayigh, 2019). "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" (Asquith & Vellinga, n.d.). As such, vernacular architecture constitutes an important knowledge base for addressing contemporary challenges, including climate adaptation, sustainability, and the pressures of globalization.

Existing literature identifies vernacular architecture as a valuable source for reinterpretation within contemporary architecture. However, despite this recognition, a critical gap remains in the literature regarding the transferability of vernacular principles, specifically within the context of the Netherlands.

PART 3
Results

MACHIYA TYPOLOGY

Introduction

The Machiya (Figure 9) is a traditional wooden Japanese wooden house where living and working are strongly intertwined. The Machiya is characterized by a narrow, deep building layout and is positioned in line with the prevailing wind direction (Figure 8). Its spatial organisation is structured through a gradual shift from public to private: the commercial space (mise) is positioned along the street, with the more private residential spaces in the back.

In this chapter, the Machiya is analysed from a climatic perspective across three scales: the urban-, building-, and detail scale.

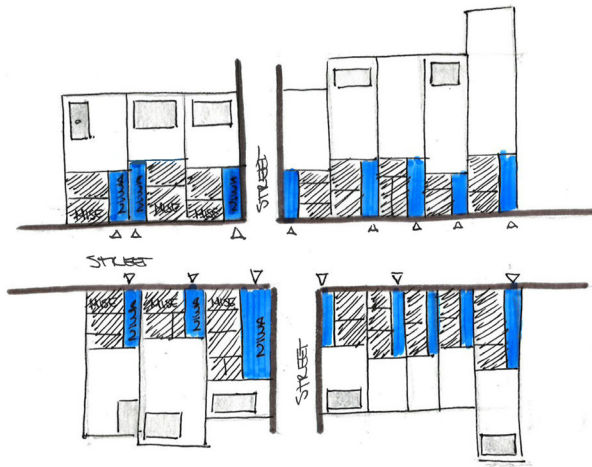


Figure 8: Urban morphology of the Machiya with the integrated toriwa (blue), by author, 2026



Figure 9: Front view of the Machiya, Spoomans, 2019



Figure 10: Toriniwa from the entrance, Spoomans, 2019



Figure 11: Toriniwa at courtyard side, Spoomans, 2019

Building envelope

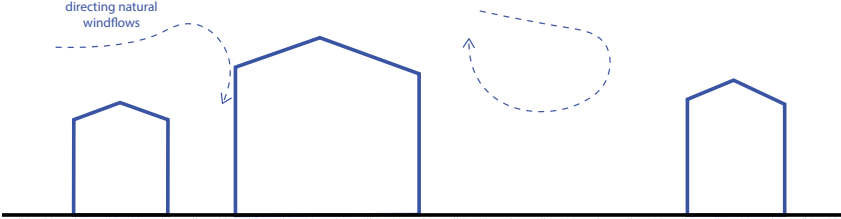


Figure 13: Redirecting the wind through the building envelope, by author, 2026

Microclimatic courtyard



Figure 12: Inner microclimatic courtyards, by author, 2026

Natural windflows

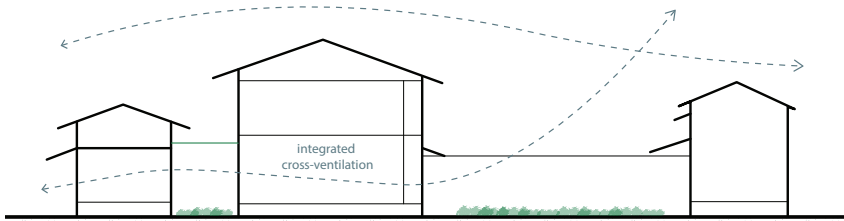


Figure 14: Building block positioned in line with the prevailing wind, by author, 2026

Overhang and bufferzones

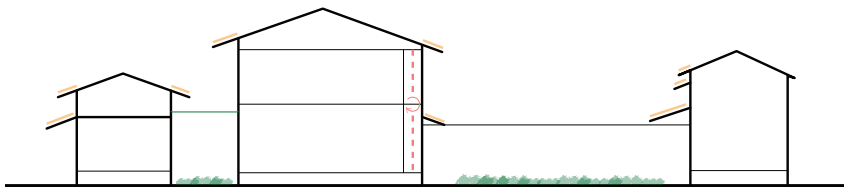


Figure 15: Large overhangs and integrated bufferzones to prevent for overheating, by author, 2026

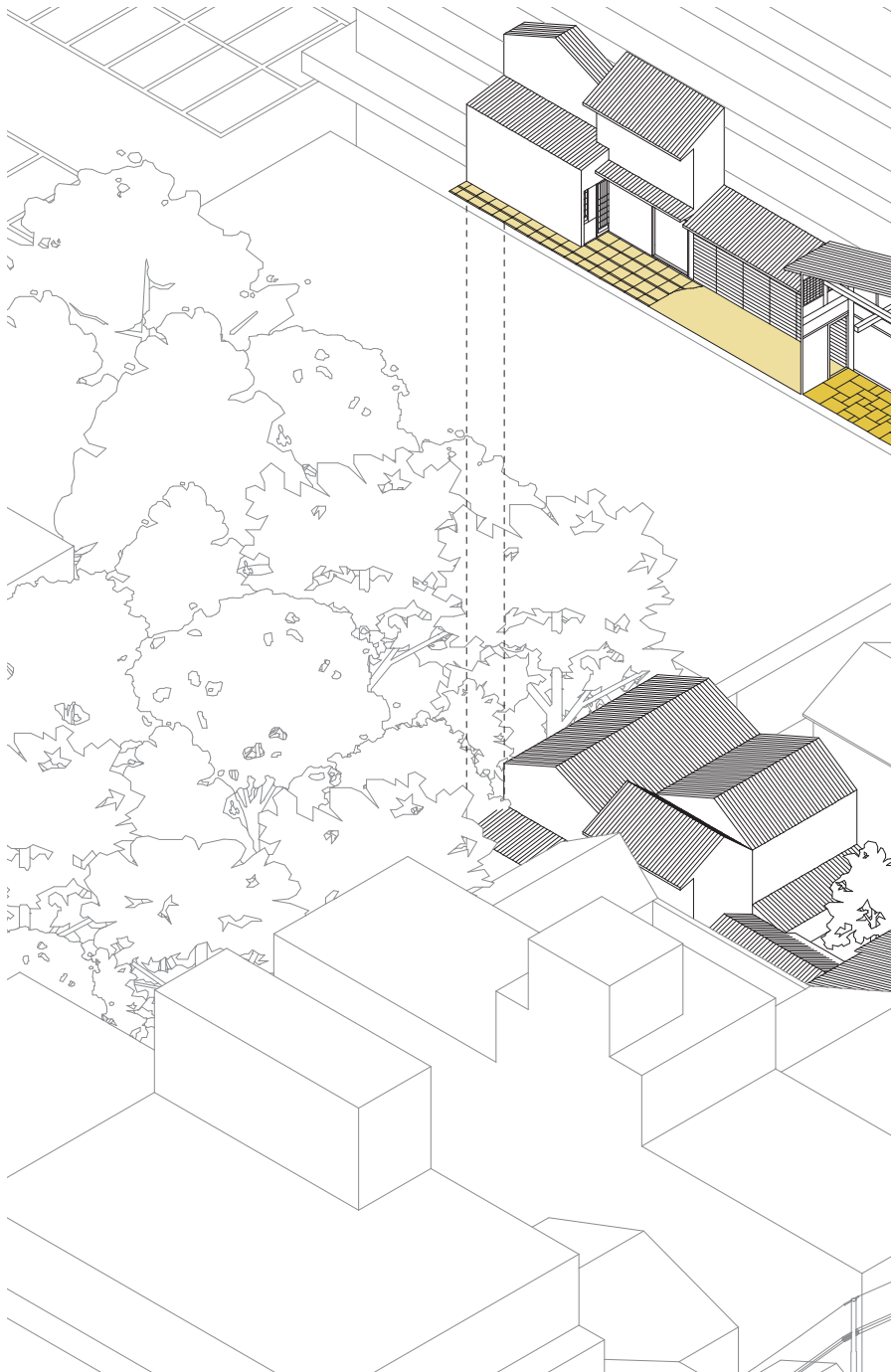
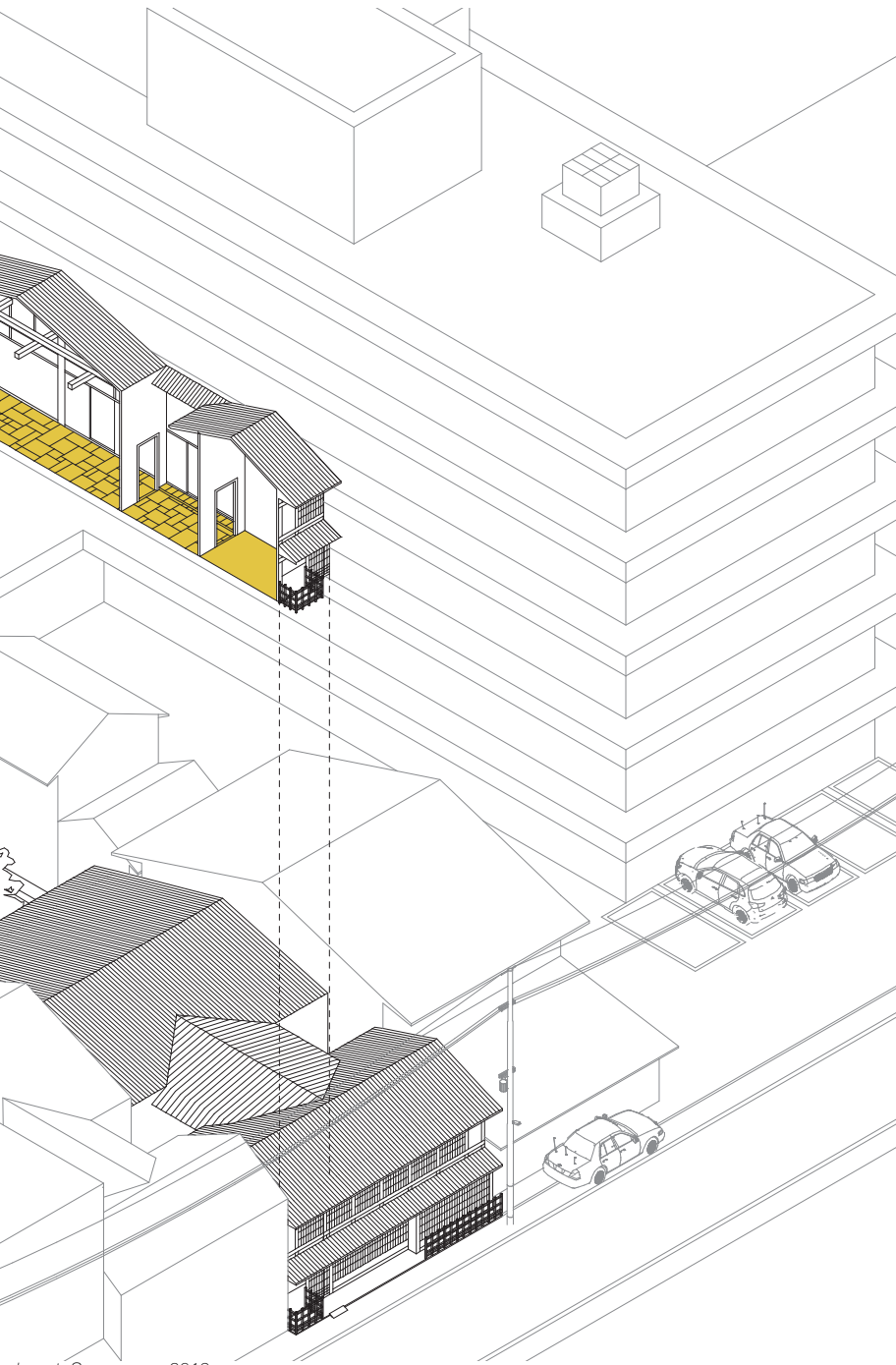


Figure 16: Exploded section of the Machiya with in yellow the torinawa, allowing for cross ventilation through the deep building



g layout, Spoormans, 2019

Machiya layout

1 climatic bufferzone connected to the private spaces of the Machiya (engawa)

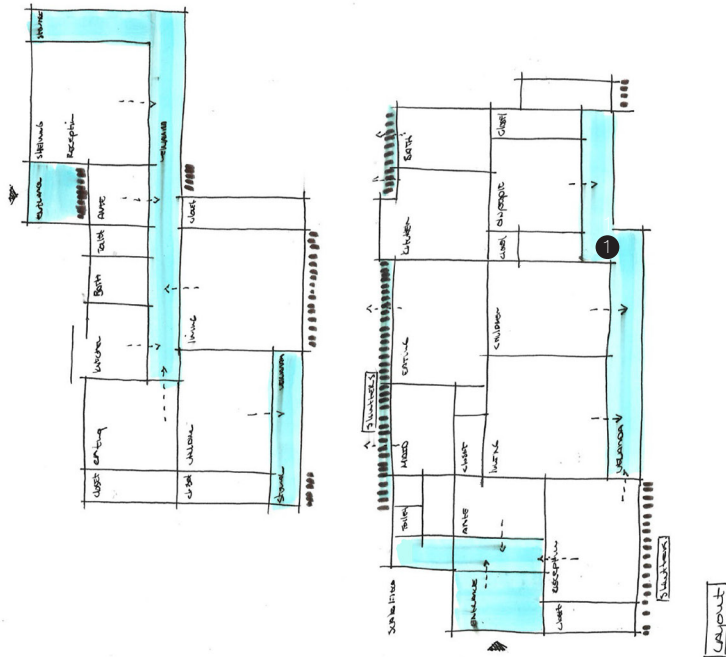


Figure 17: Typical Machiya layout, by author, 2026

Note. Adapted from *The Japanese House: A Tradition for Contemporary Architecture*, by H. Engel, 1972.

Cross section

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

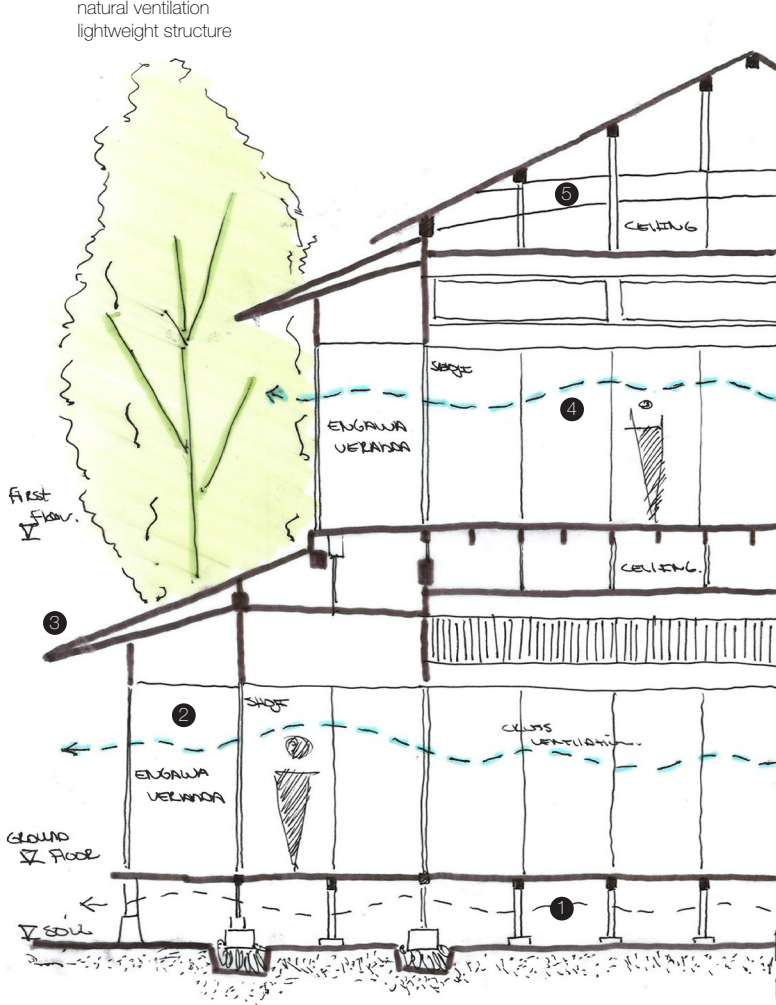


Figure 18: Detailed cross section of the Machiya, by author, 2026

Note. Adapted from *The Japanese House: A Tradition for Contemporary Architecture*, by H. Engel, 1972.

SITE ANALYSIS

Within this research, the site of the Schellenskwartier has been selected as a testing ground for further investigation. The former industrial site is positioned along the river Dommel, at the border of the city centre, and part of the future urban densification vision (Figure 19). However, densifying within the existing urban structures of Eindhoven appears to conflict with future heat stress scenarios.



Figure 19: The site positioned on the border of the city centre and part of the future densification vision of Eindhoven by author, 2026

The site as a missing link within the urban structure

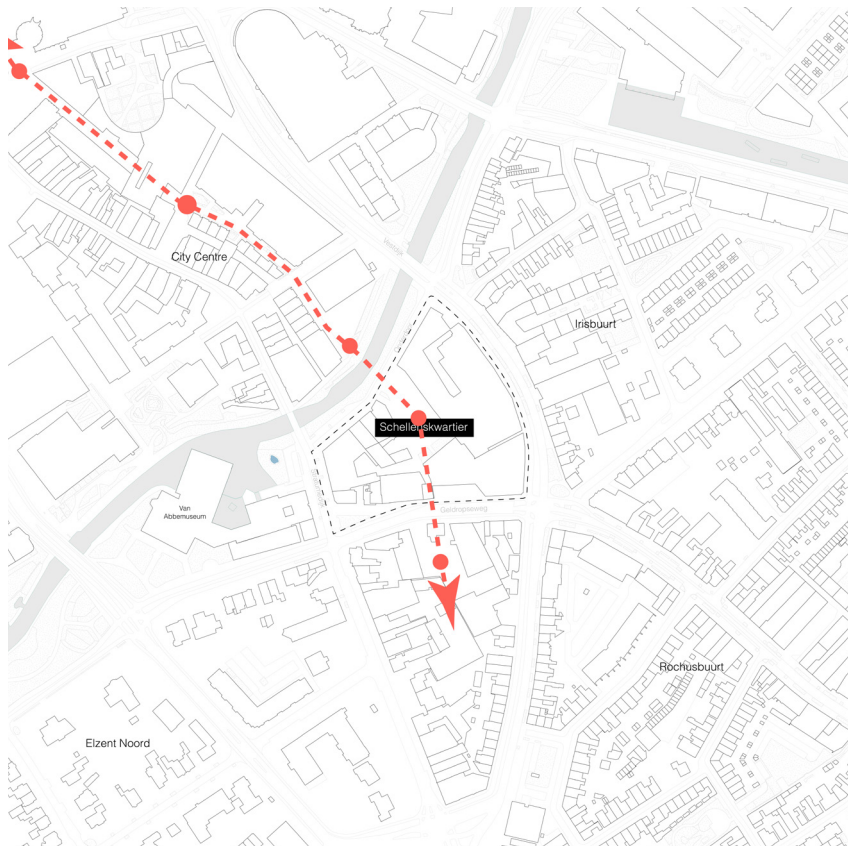


Figure 20: The site as a missing link within the urban structure of Eindhoven, by author, 2026

River Dommel through the city centre

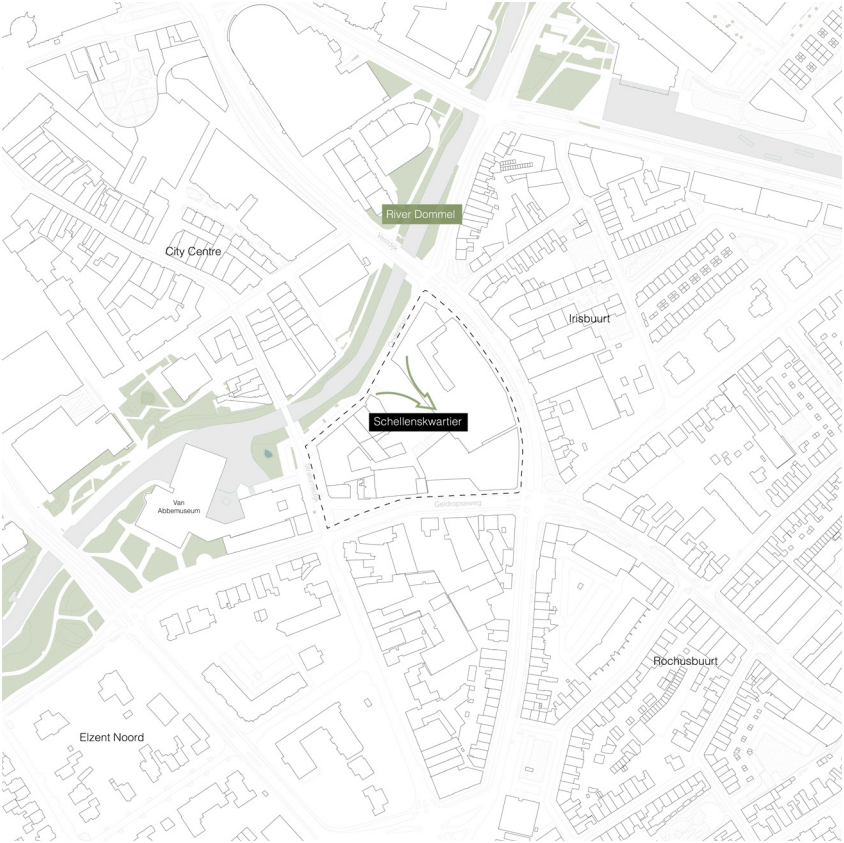


Figure 21: Limited green infrastructure within the centre of Eindhoven, by author, 2026

Current site

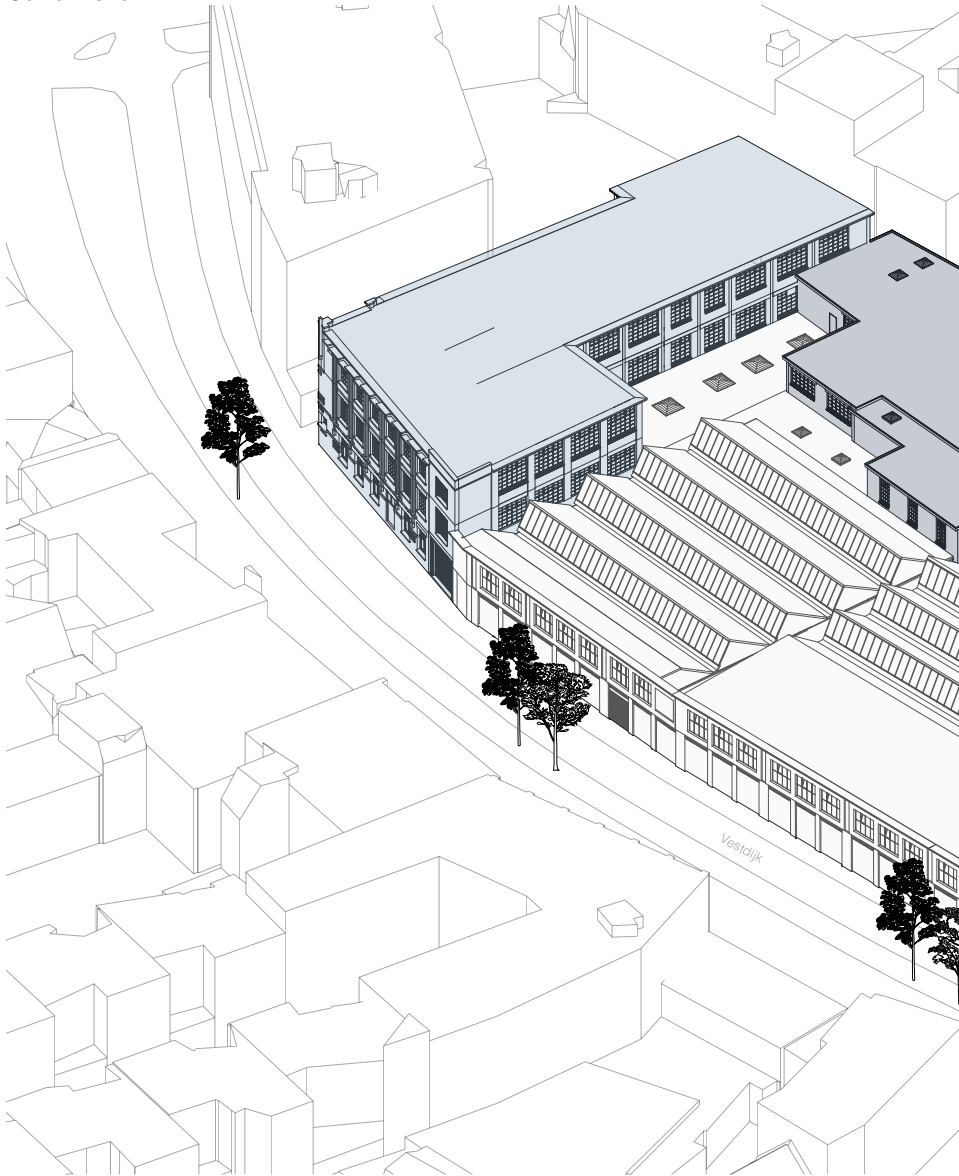
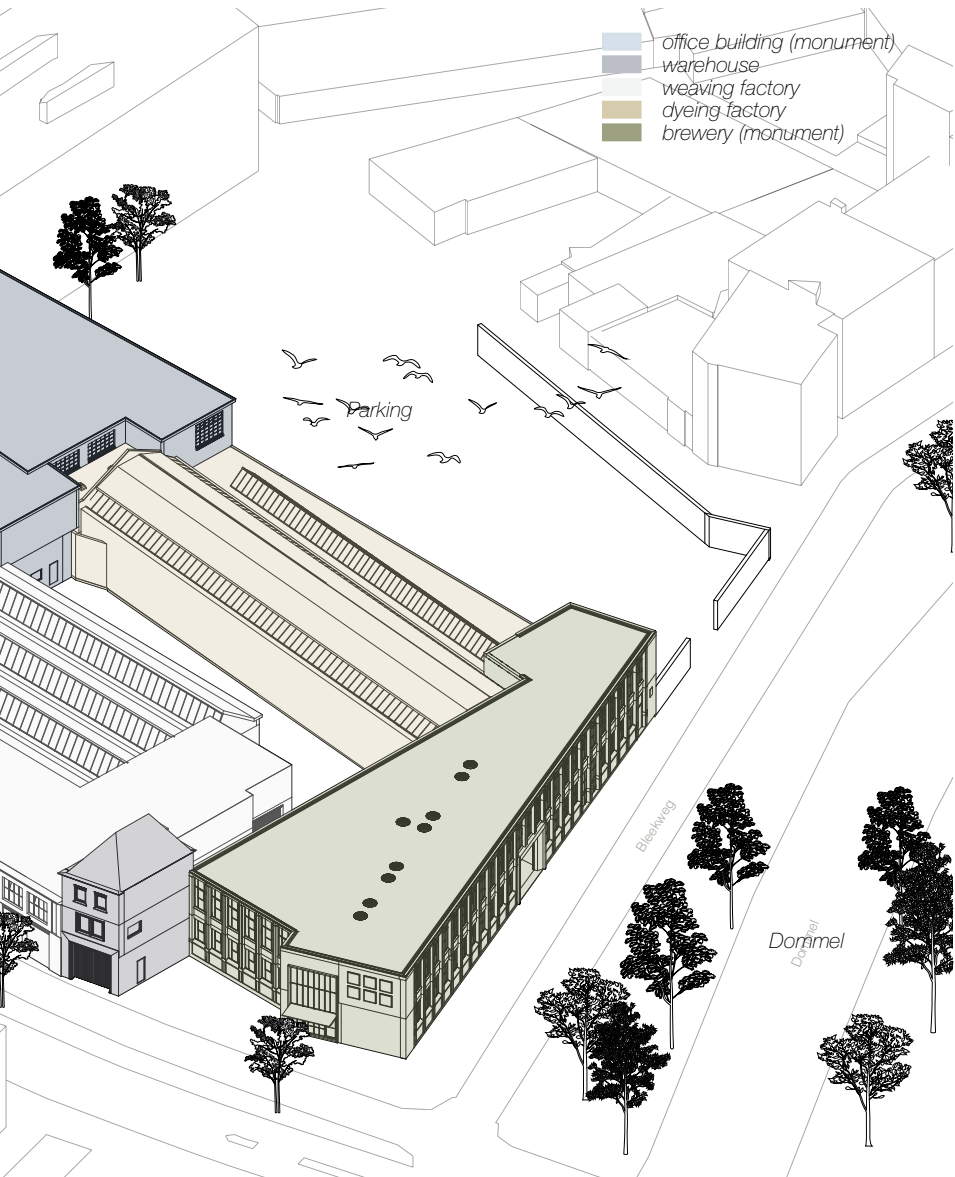


Figure 22: Bird-eye view of the site of the Schellenskwartier, by author, 2026



Urban sections

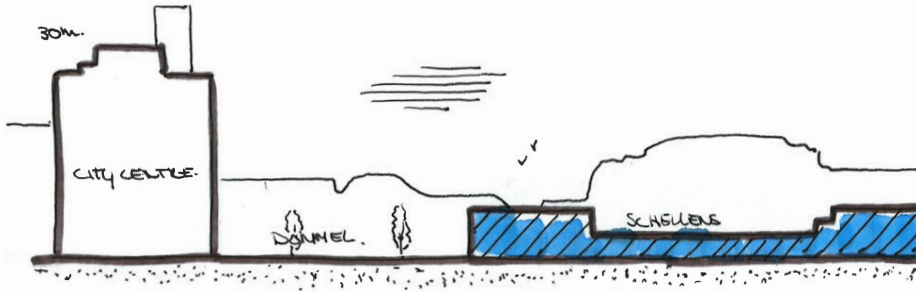


Figure 23: Urban cross section, by author, 2026

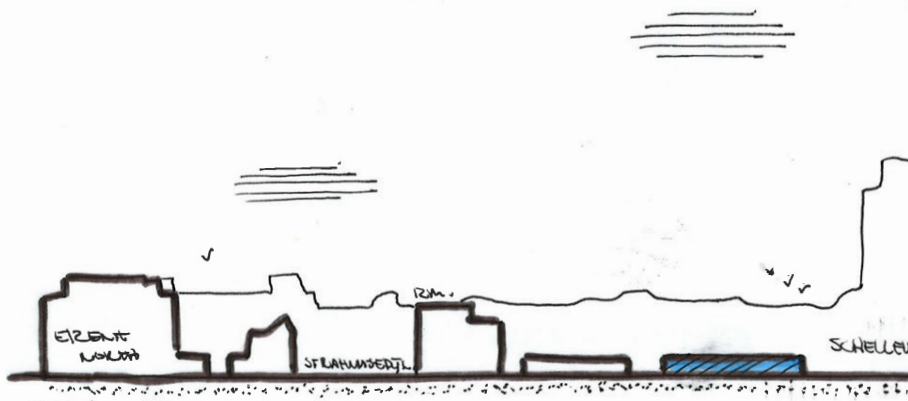
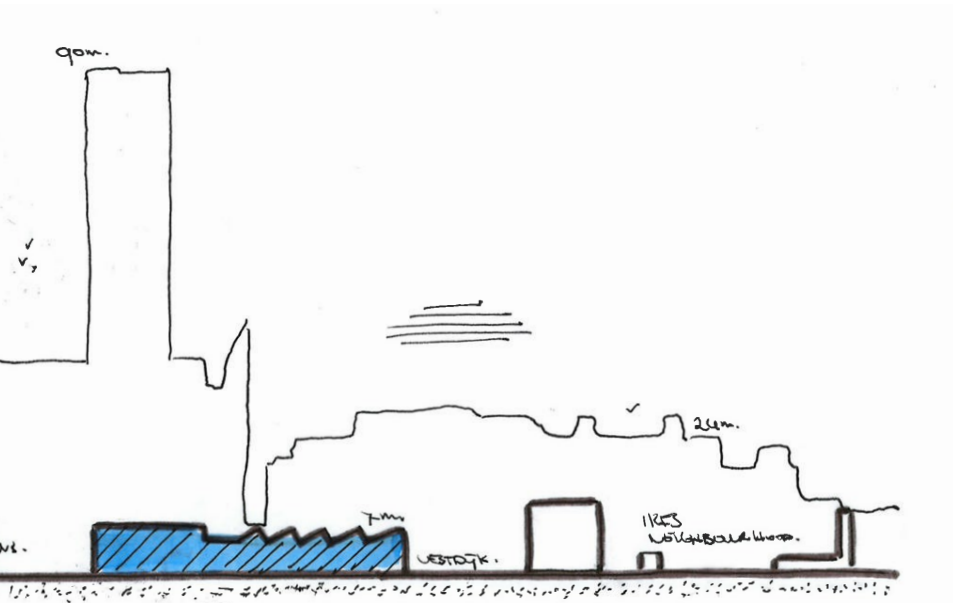
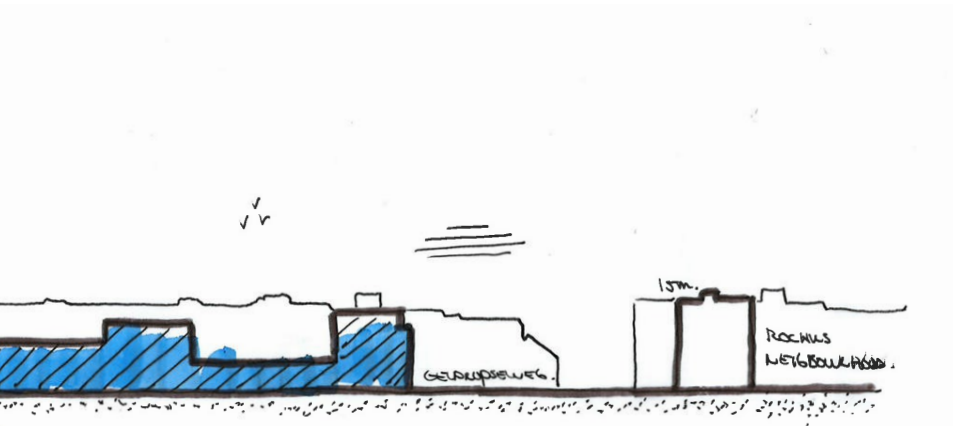


Figure 24: Urban cross section, by author, 2026



Urban fabric

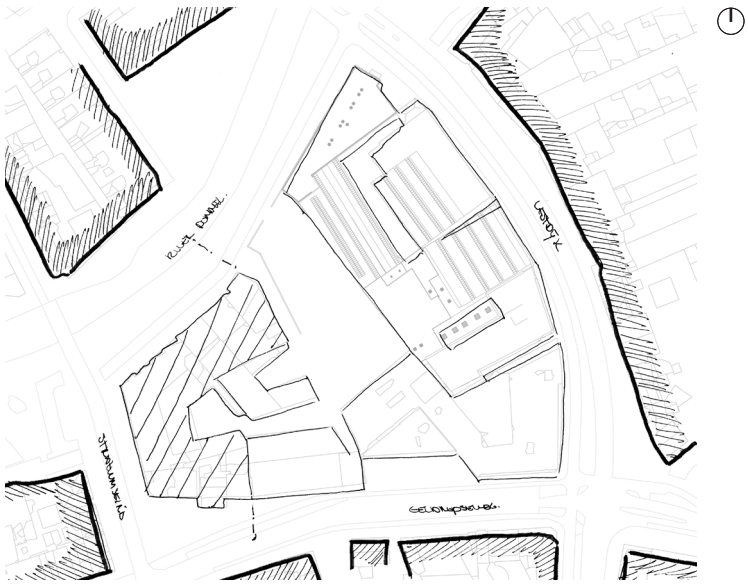


Figure 25: Embedding in the urban fabric, by author, 2026

Existing entrances and inner squares

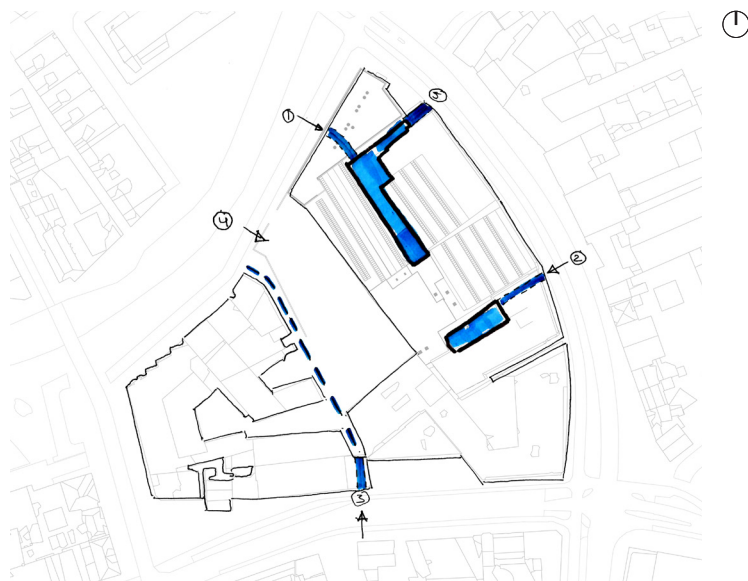


Figure 26: Inner squares and entrances, by author, 2026

Limited green infrastructure



Figure 27: Mobility and urban ecology, by author, 2026

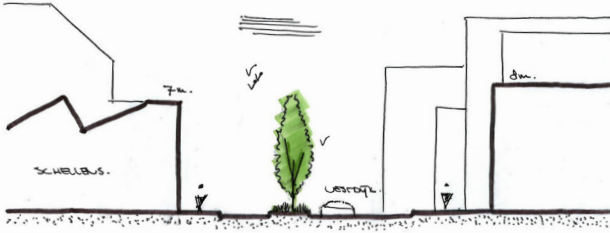


Figure 28: Street profile along Vestdijk, by author, 2026

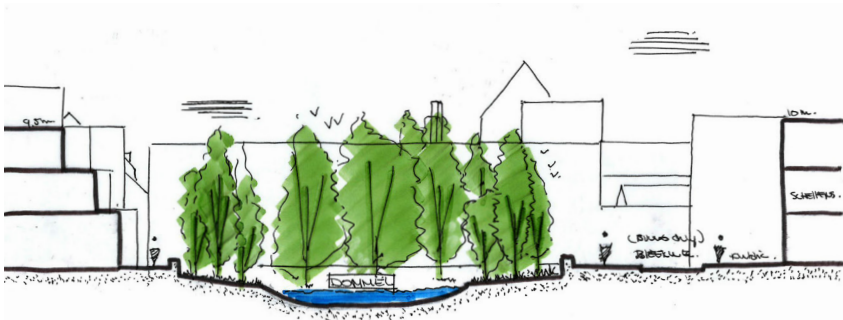
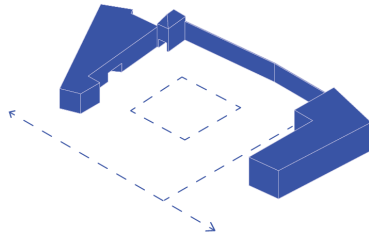


Figure 29: Street profile along Bleekweg, by author, 2026

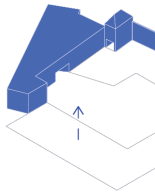
FINAL DESIGN

Design sequence

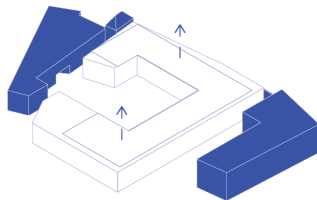
The conducted research (see appendix) and the site constraints have set the guidelines for the final design proposal.



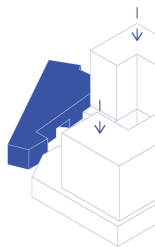
1.
Introducing courtyard and public lanes



2.
Creating new B

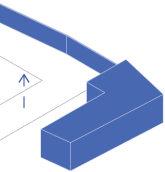


4.
New Brainport layer

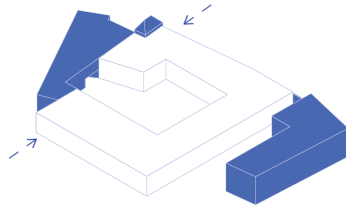


5.
Terraced towards the
for cross

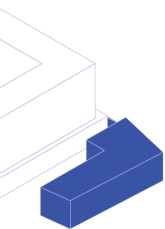
Figure 30: Design sequence of the final design, by author, 2026



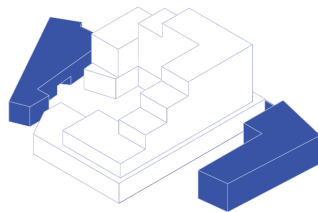
2.
Eindhoven layer



3.
Introducing entrances to the inner courtyard



4.
The Dommel and allow
ventilation



6.
New compact building envelope, embedded within
the urban fabric of the Schellens

Wind analysis

A lower building volume is positioned at the Onderdoor, allowing the wind to circulate throughout the whole building envelope. Along the Vestdijk, a higher volume is positioned to guide the airflow towards the courtyard, where it contributes to natural cooling.

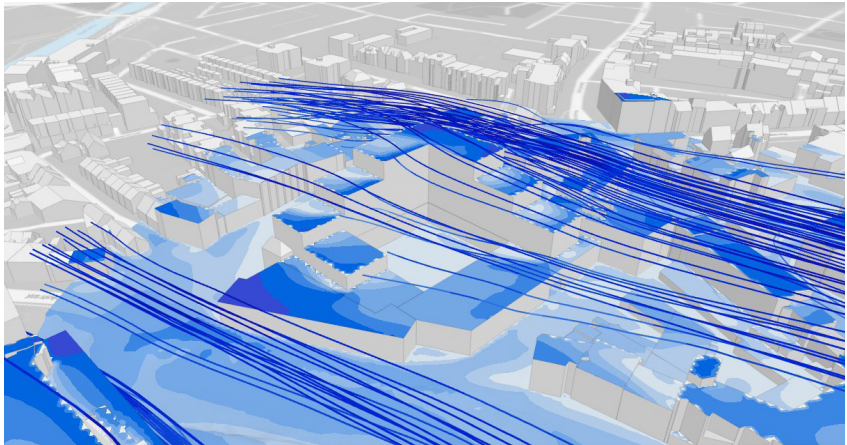


Figure 31: Wind analysis in Autodesk Forma, by author, 2026

Daylight potential

Within the design, solar exposure is addressed in a considered manner. The building volume prevent the dwellings from direct southern sunlight, while opening up towards the evening sun. The analysis below demonstrate that sufficient daylight is obtained in both seasons.



Figure 32: Daylight potential in winter (Autodesk Forma), by author, 2026

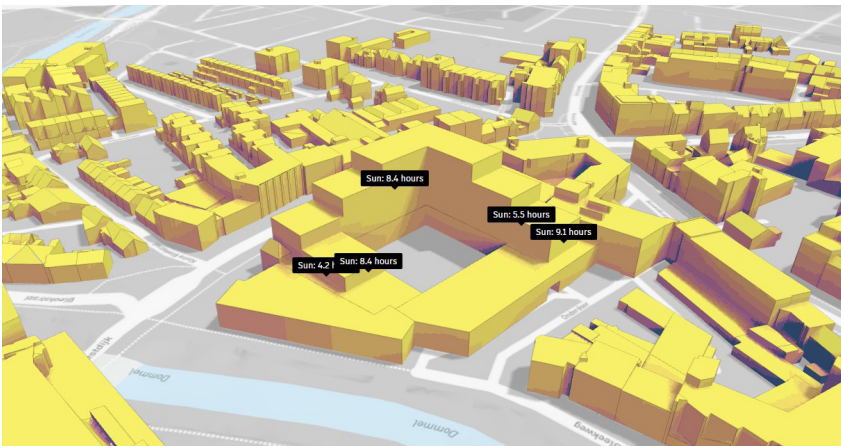
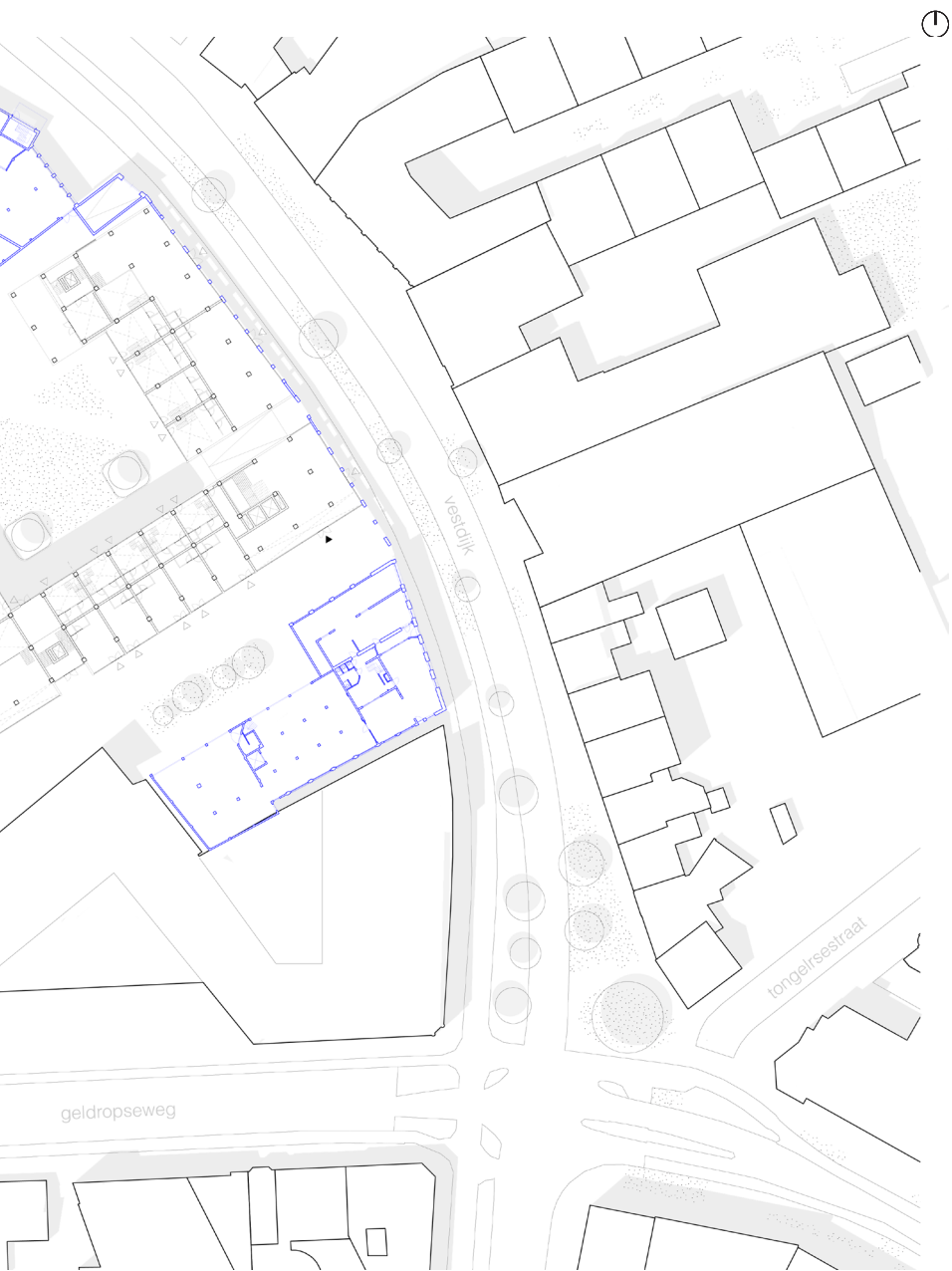


Figure 33: Daylight potential during summer (Autodesk Forma), by author, 2026



Figure 34: The final design embedded within the urban fabric of the Schellens, by author, 2026



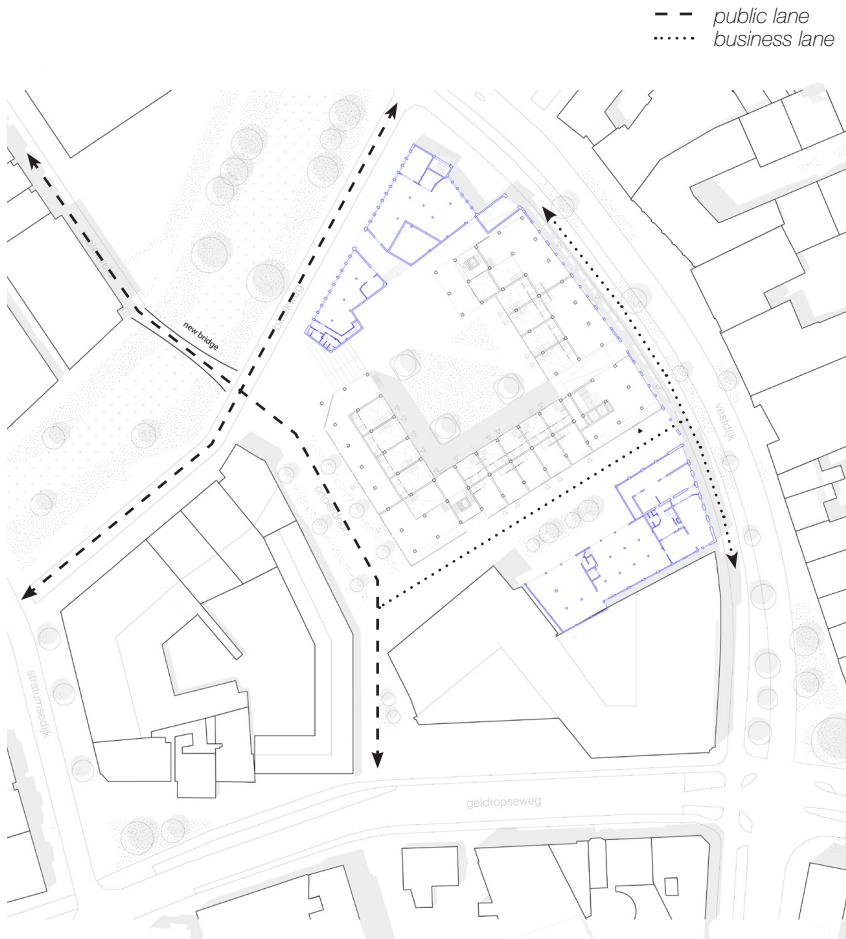


Figure 36: Introducing new lanes, by author, 2026



New lanes

The former parking area at the 'onderdoor' will be transformed into a new public street. This public lane will accommodate public amenities and will strengthen the visual and spatial relationship with the existing Park Plaza hotel. Between the new building envelope and the existing office building, a new passage will be introduced to provide space for startup businesses. This passage refers to the spatial typology of the existing squares of Schellens factory.

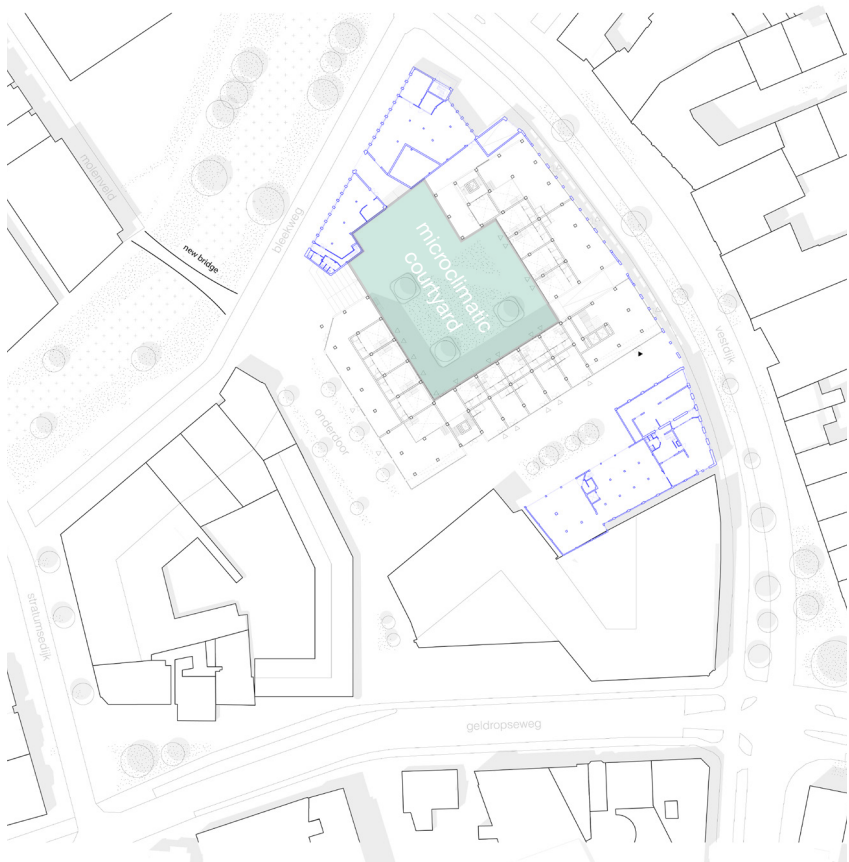


Figure 37: New enclosed microclimatic courtyard, by author, 2026



Microclimatic courtyard

The new envelope is designed to create an enclosed microclimatic courtyard at the heart of the site. This courtyard is elevated by 1,5 meter to create a clear spatial distinction between the urban environment and the protected inner microclimate. This space will create a cooler and more thermally moderated communal space, which refers to the Machiya typology.

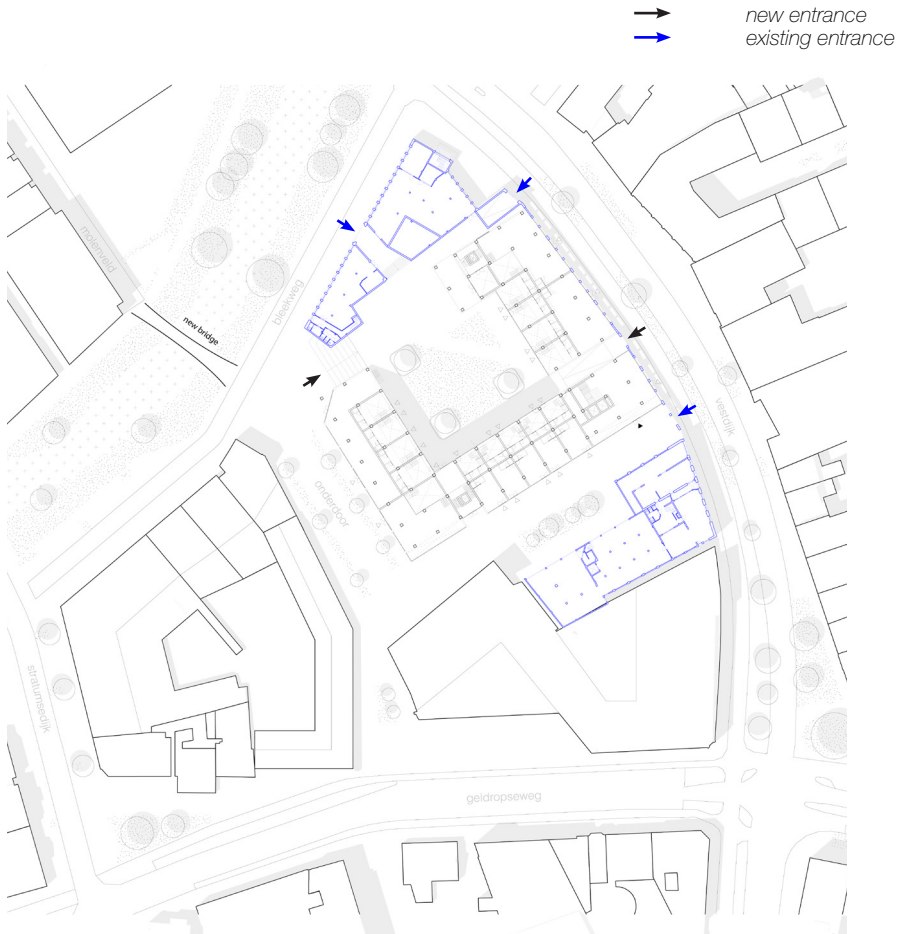


Figure 38: Accessibility, by author, 2026

Accessibility

The existing gates and entrances within the site will be retained in the new design to provide access to the inner courtyard. In addition, new openings will be introduced within the existing façade along the Vestdijk to improve the accessibility.



Figure 39: Bird-eye view of the final design embedded in the site of the Schellens, by author, 2026

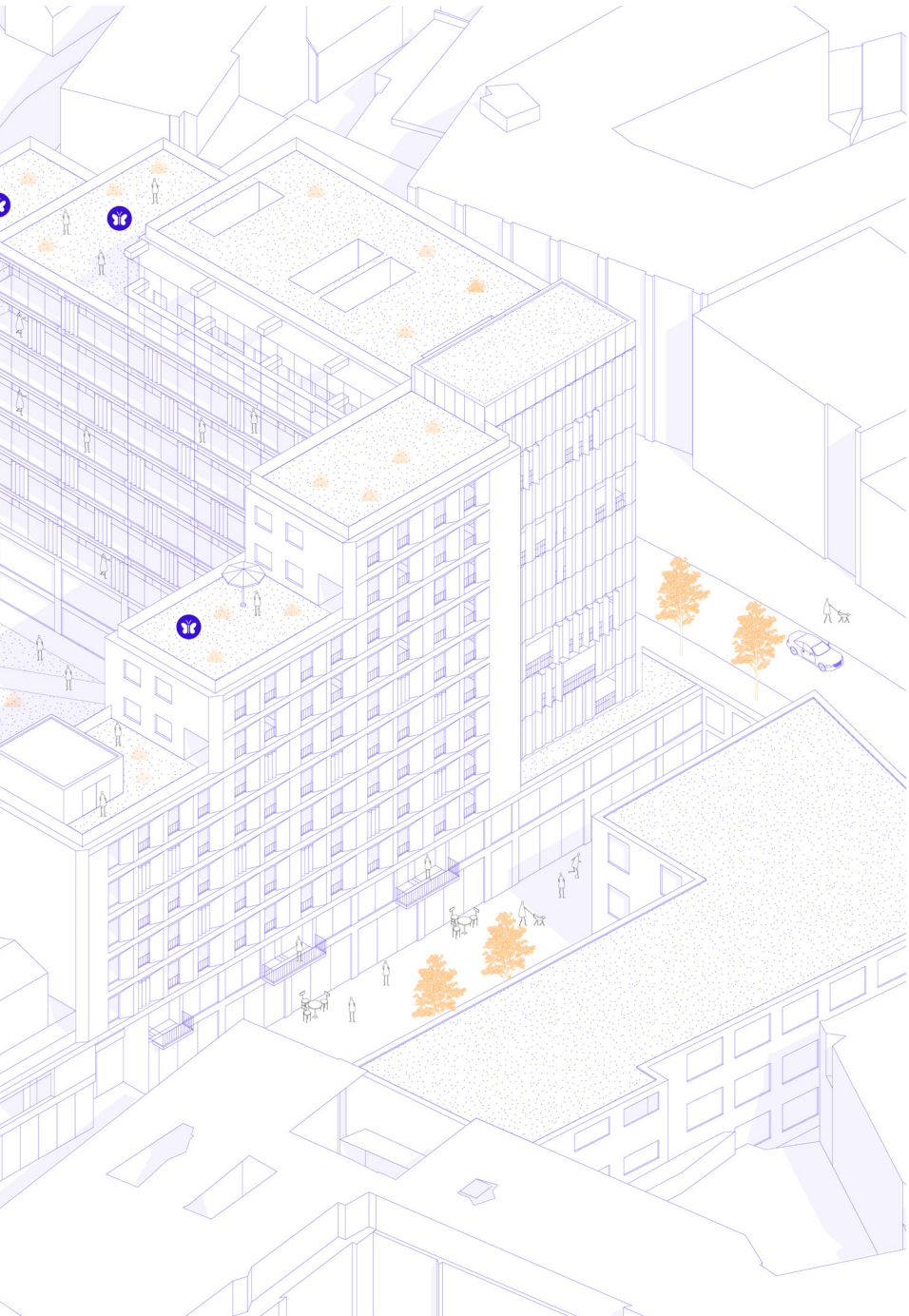




Figure 40: Approach at Bleekweg, 1:500 model, by author, 2026

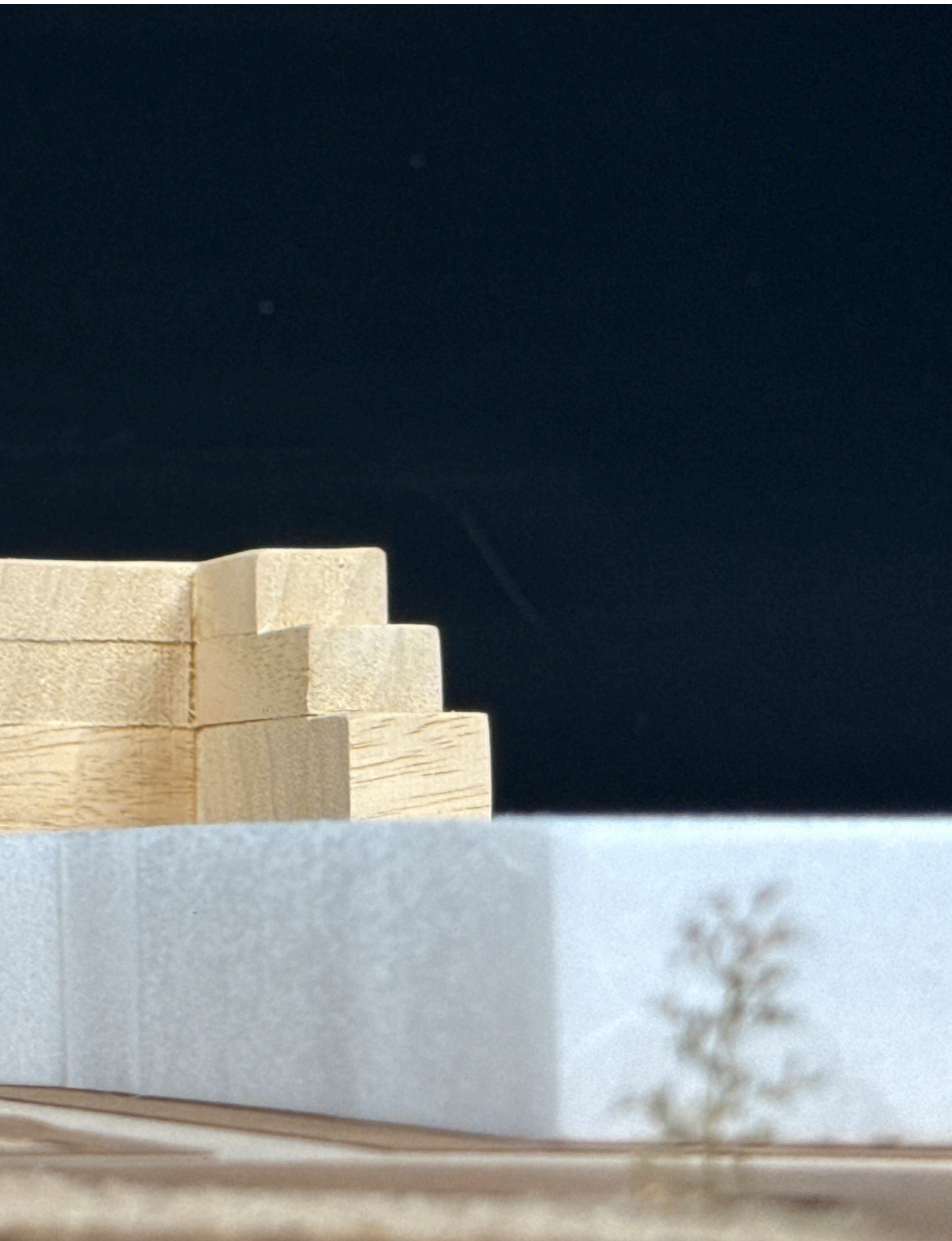




Figure 41: Approach at Vestdijk, 1:500 model, by author, 2026



Roof gardens

The building volume steps down towards the Dommel in order to maintain a strong spatial and visual relationship. Through the stepped configuration of the building volume, a collective roof emerges, offering shared outdoor spaces for the residents to enhance social interaction.



Figure 42: Collective roofgardens, by author, 2026

Ground floor

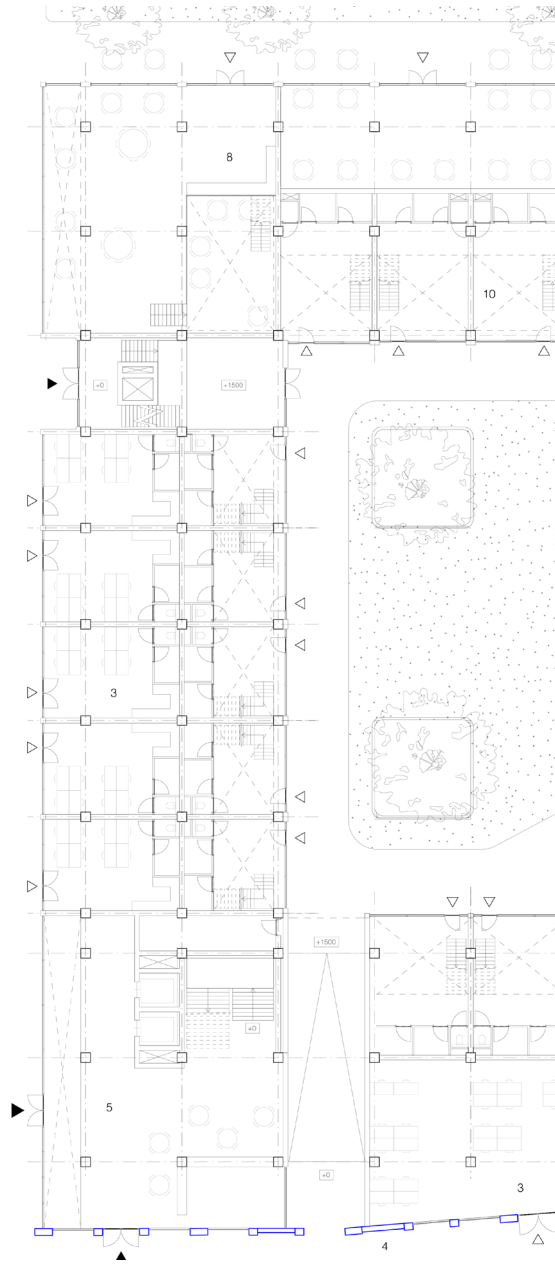
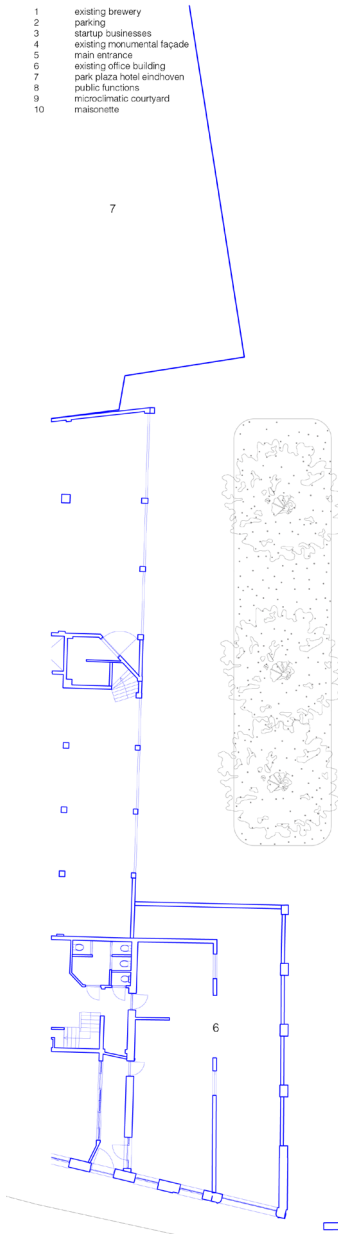
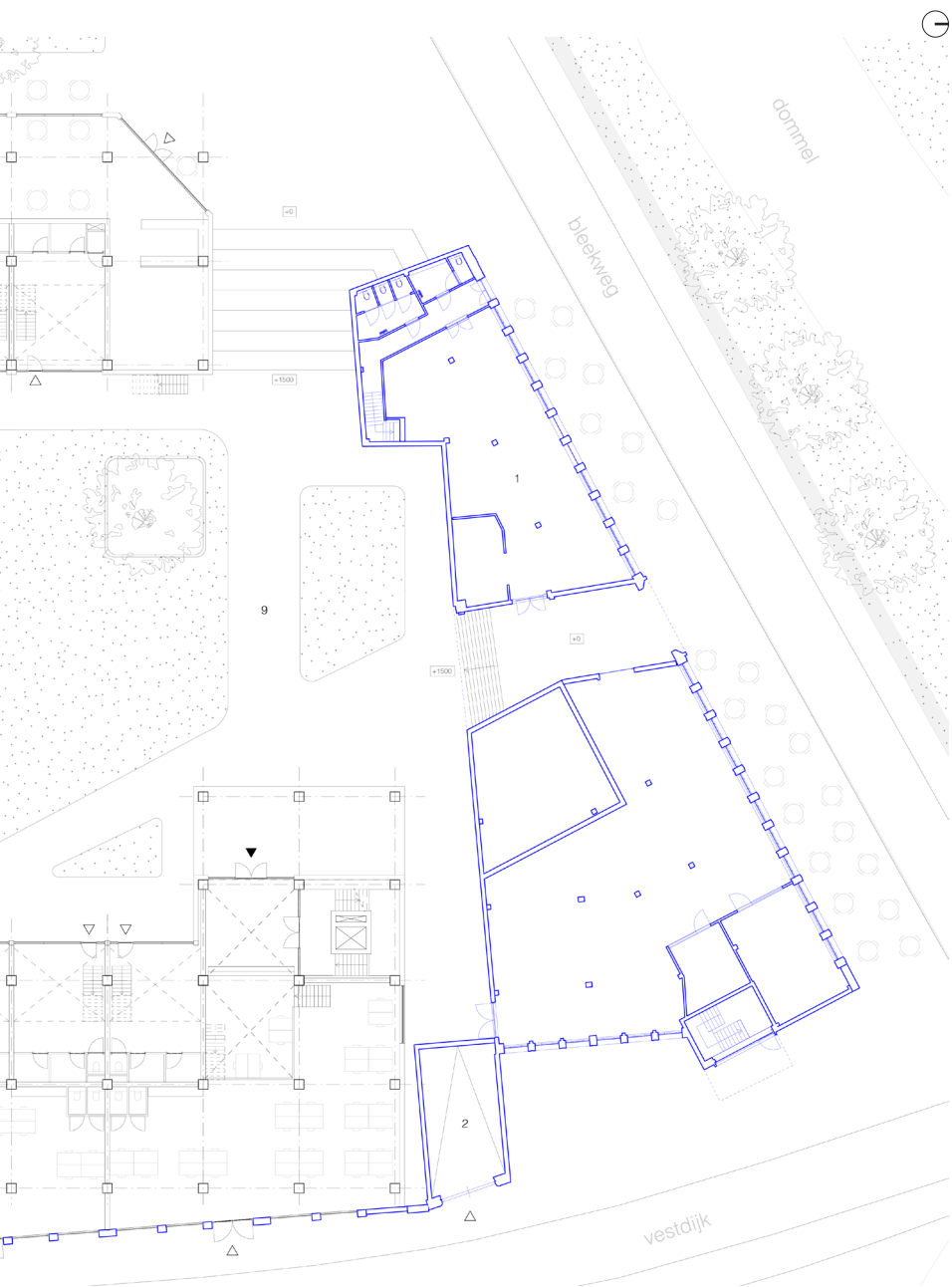


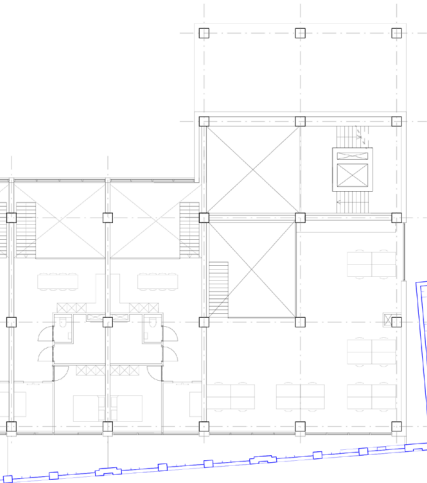
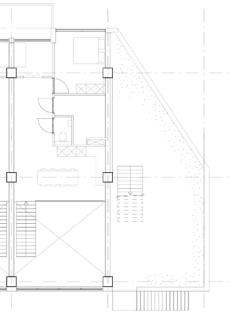
Figure 43: Plan view, ground floor, by author, 2026



First floor



Figure 44: Plan view, first floor, by author, 2026



Second floor

- 1 main core
- 2 bufferzone (engavia)
- 3 private terrace
- 4 collective garden

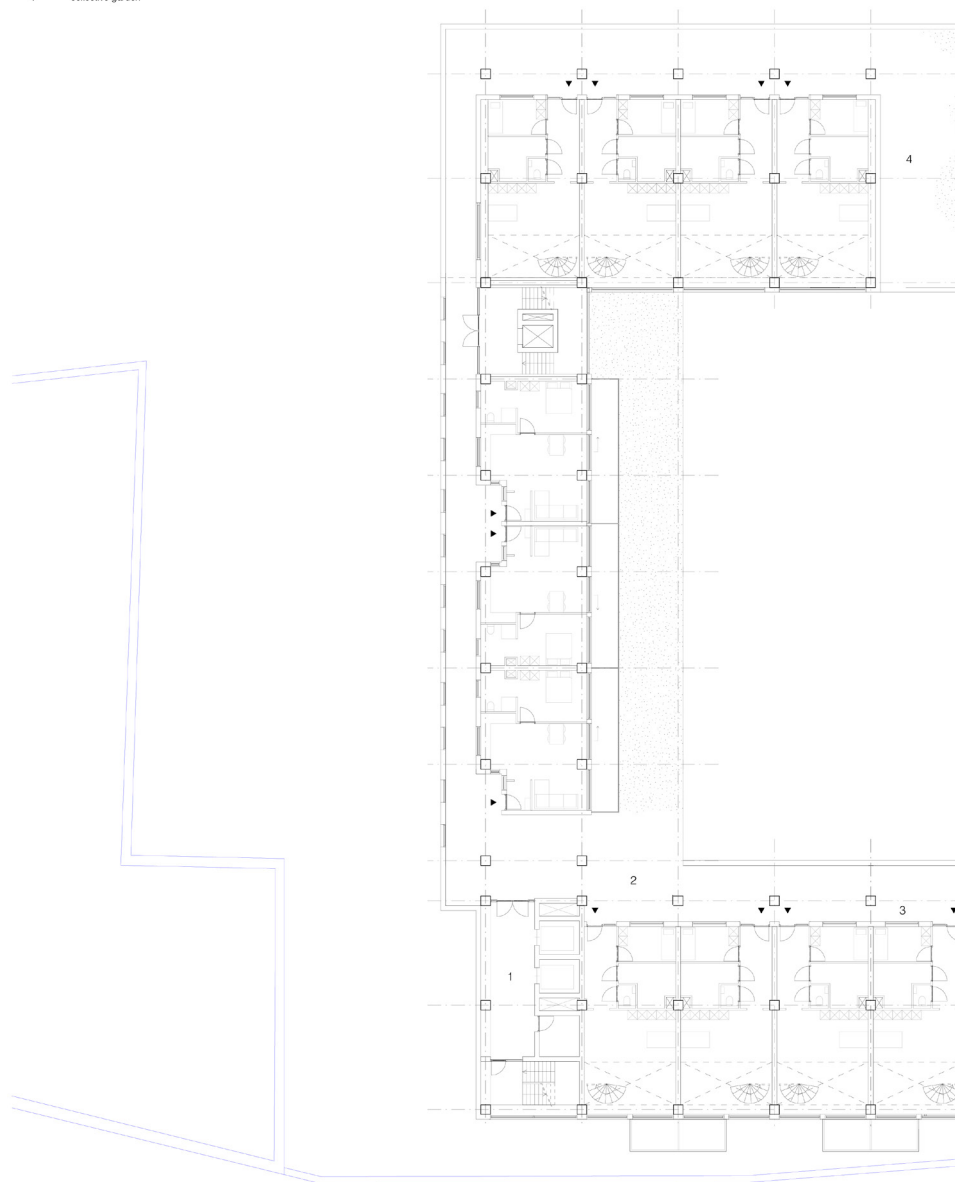
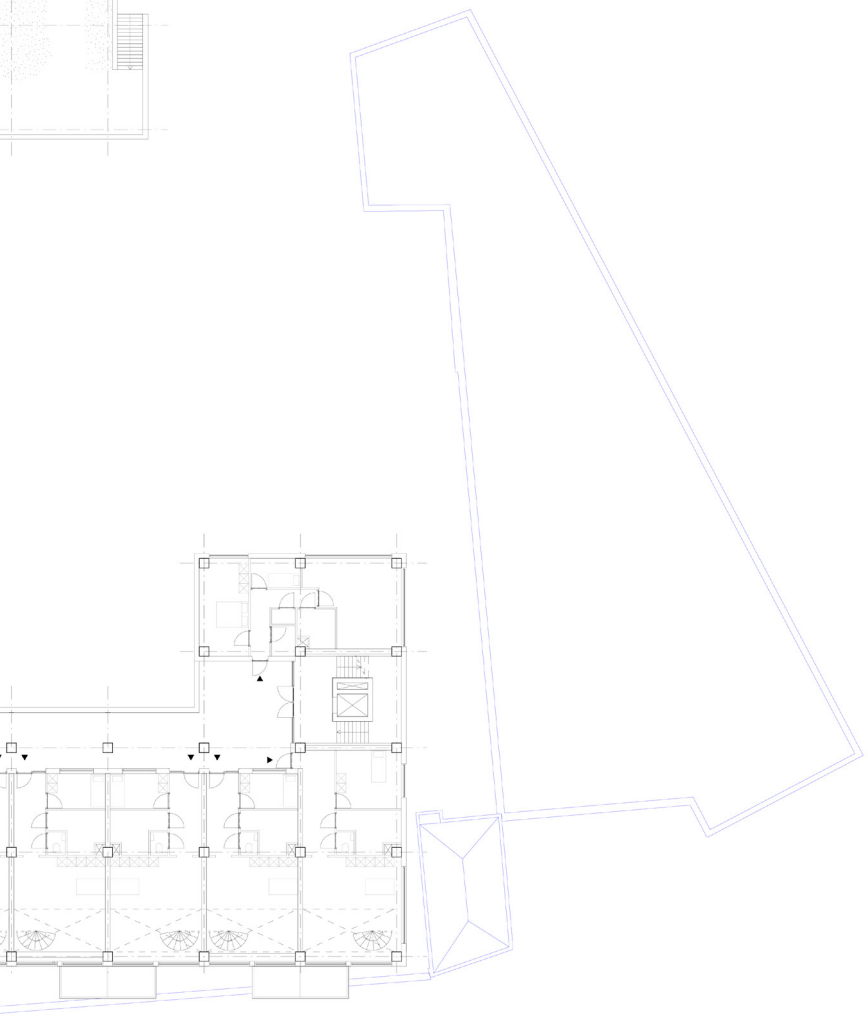
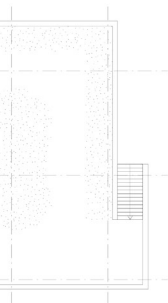


Figure 45: Plan view, second floor, by author, 2026



Integrated bufferzones

- 1 main core
- 2 bufferzone (engawa)
- 3 private terrace
- 4 collective garden

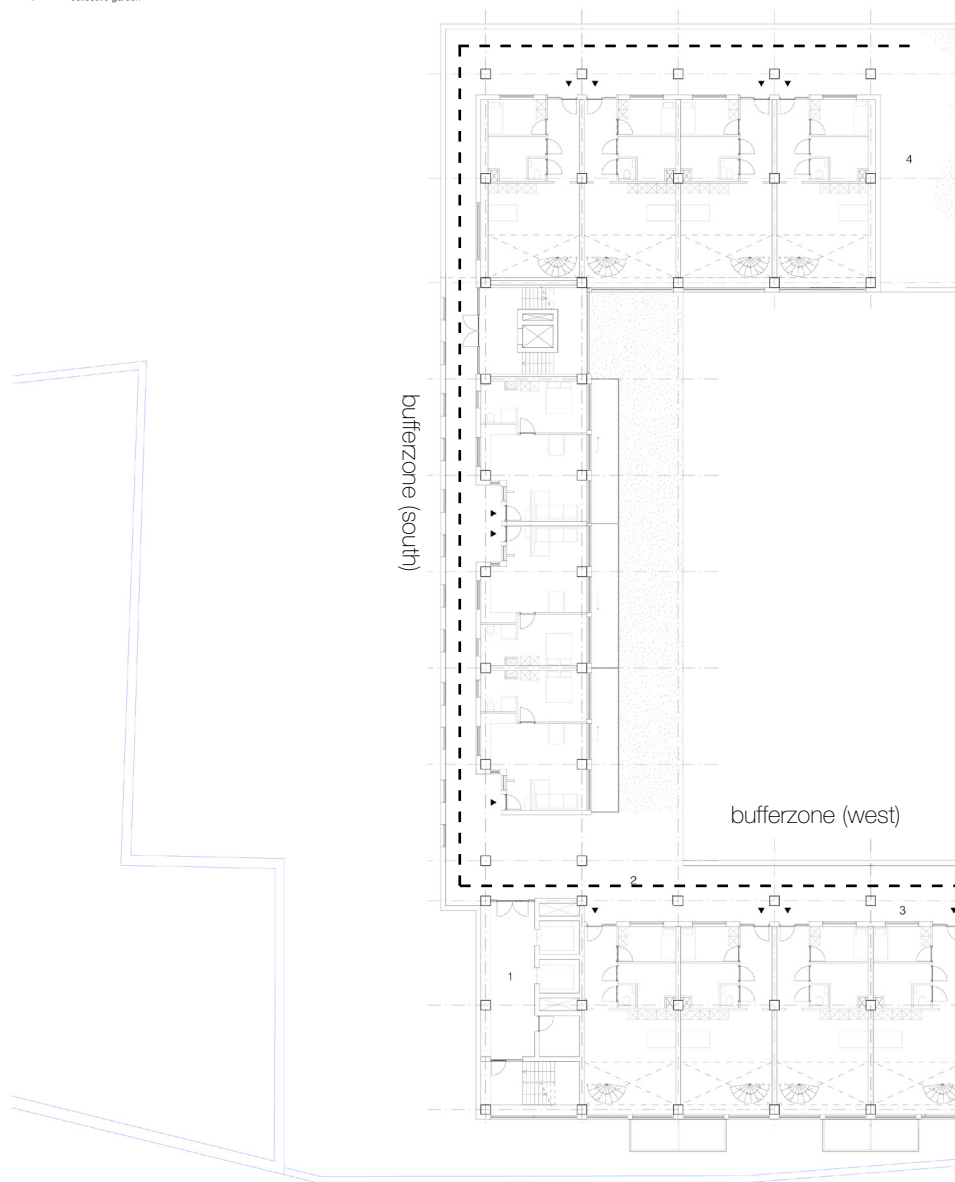
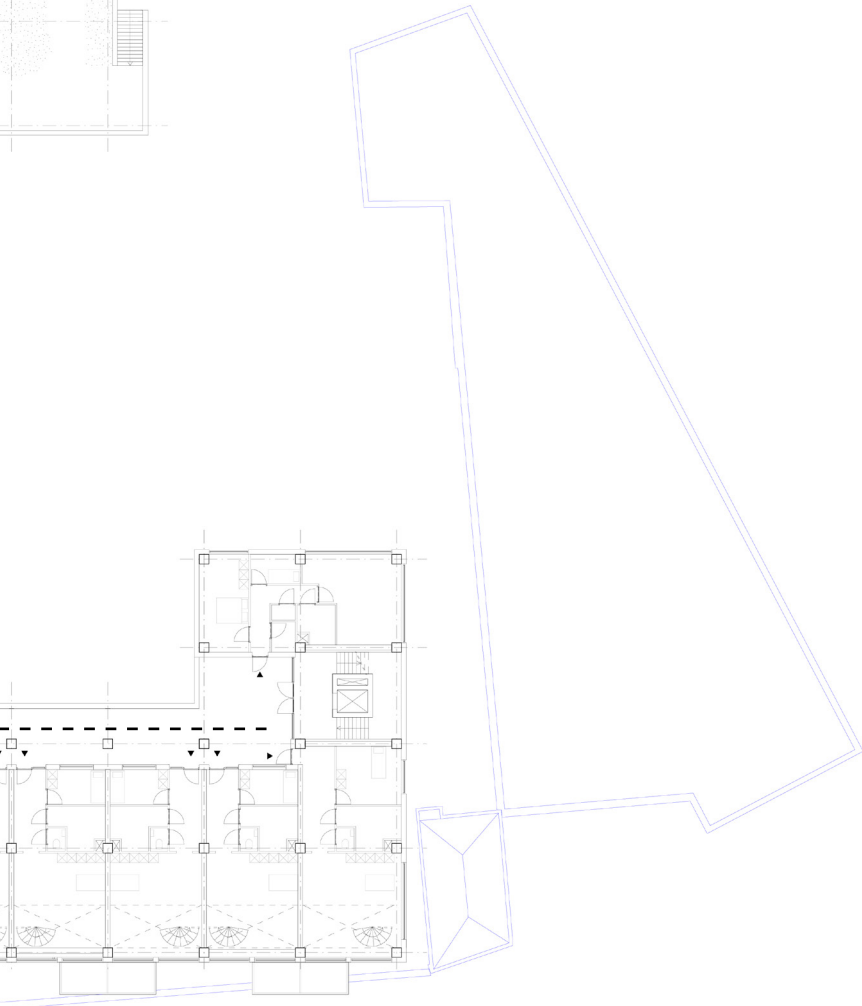
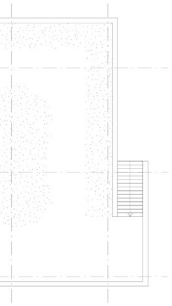


Figure 46: Plan view, first floor, by author, 2026



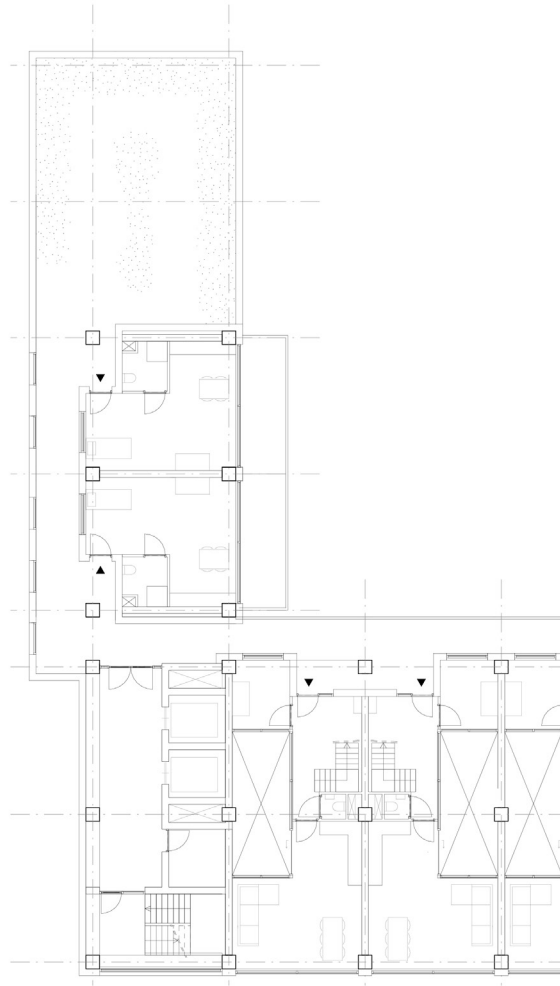
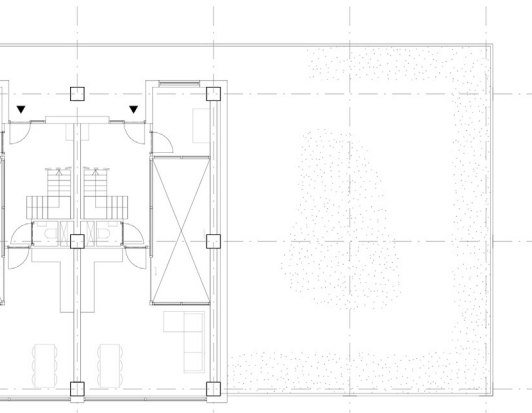


Figure 47: Plan view, ninth floor, by author, 2026



Tenth floor

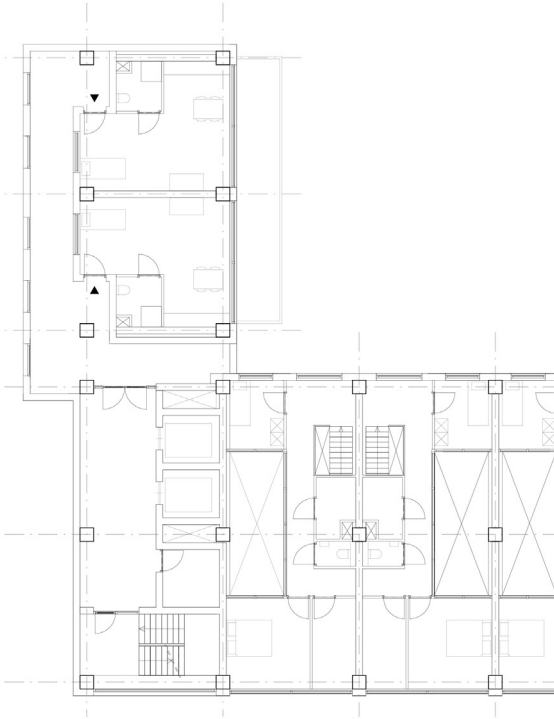
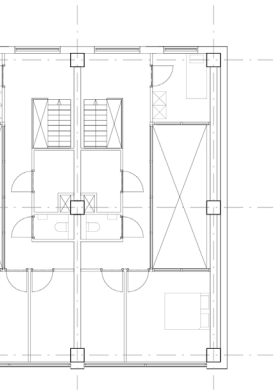


Figure 48: Plan view, tenth floor, by author, 2026



Proposed program

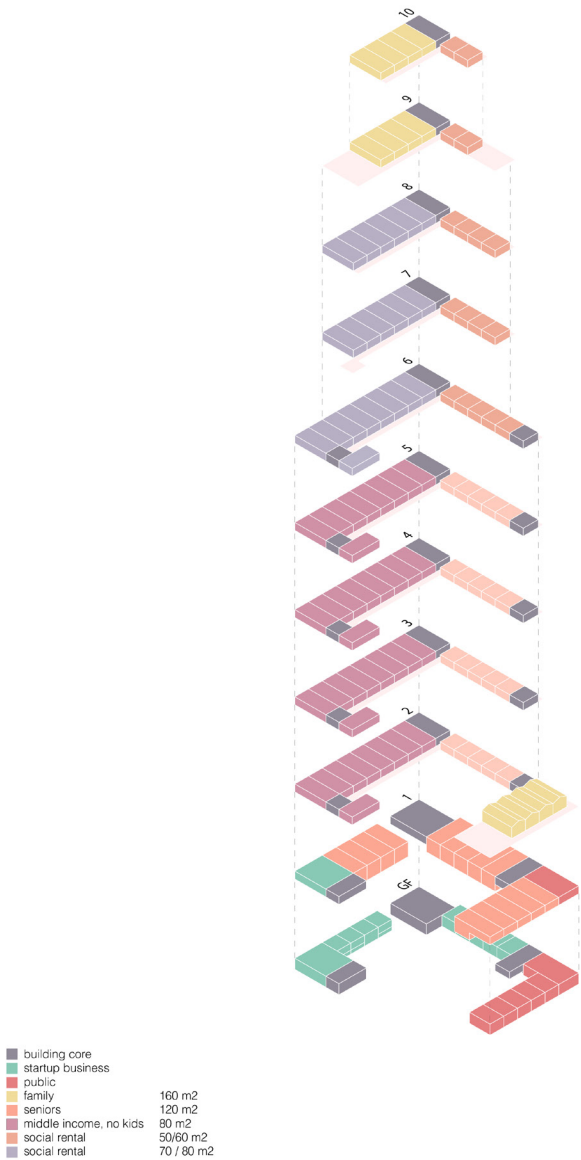


Figure 49: Program integration, by author, 2026

Spatial configuration

The layout and spatial configuration of the various dwelling types strongly refers to the traditional Japanese house. Within the design, a gradual transition between public and private domains has been carefully integrated. The corridor (1) functions as a public accessible circulation route, combined with semi-private outdoor spaces (2) for the residents. Behind these outdoor spaces, the private living areas are positioned.

Furthermore, within the layout of the dwellings, the principle of cross-ventilation has been intergrated. The dwellings aligned with the dominant wind direction include a wide corridor, referring to the toriwa, with window frames and inlets positioned on both sides to that constant airflow.

In the dwellings positioned perpendicular to the dominant wind direction, the wind is guided by the composition of the façade. In this way, the principle of natural ventilation is applied as effectively as possible within the spatial constraints of each dwelling type.

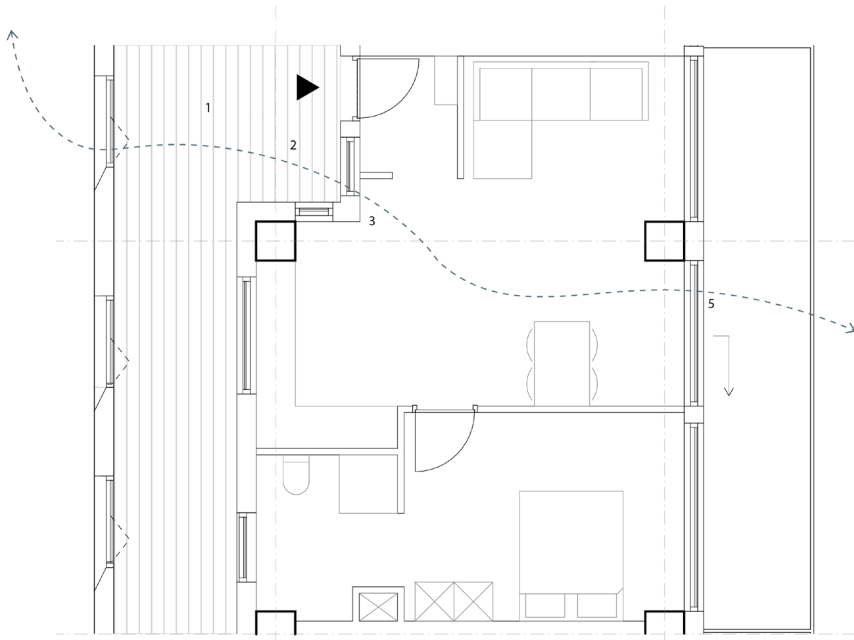


Figure 50: Redirecting the wind into the dwellings, by author, 2026

- 1 bufferzone (circulation)
- 2 private space
- 3 window opening (inlet)
- 4 toriwa
- 5 window opening (outlet)

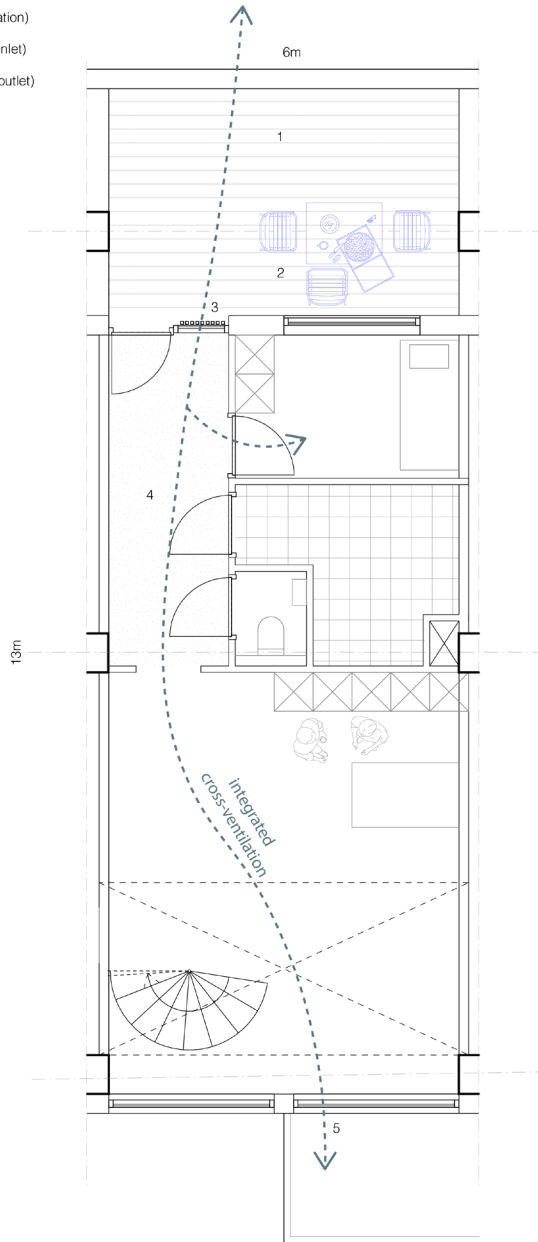
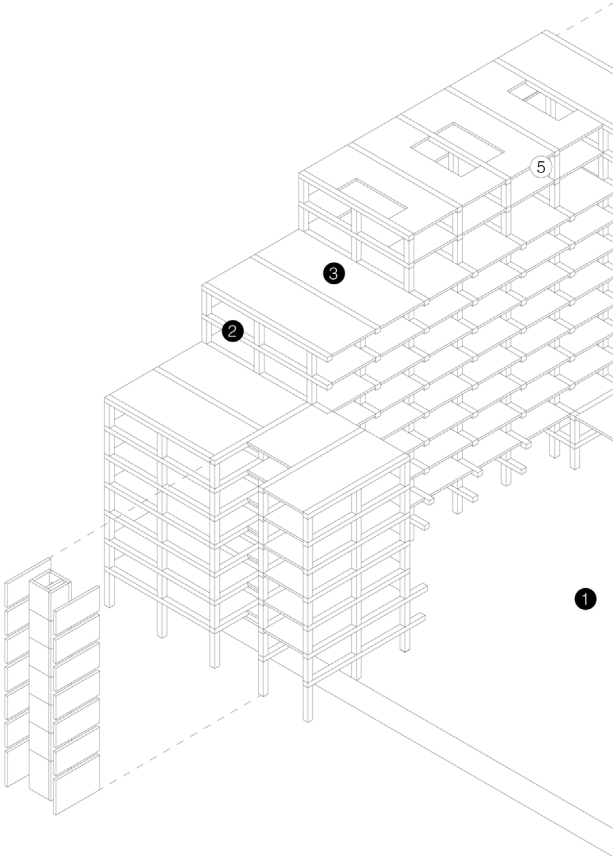
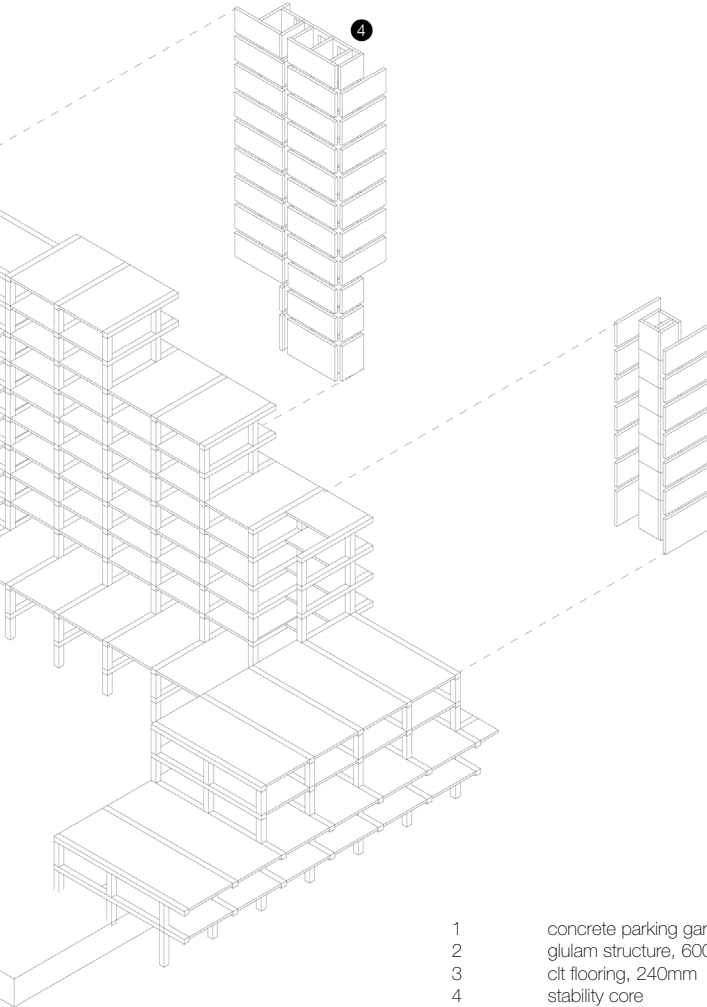


Figure 51: Dwellings in line with the prevailing wind direction, by author, 2026

Structure





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

Longitudinal section

- 1 public lane
- 2 underground parking
- 3 startup business
- 4 microclimatic courtyard

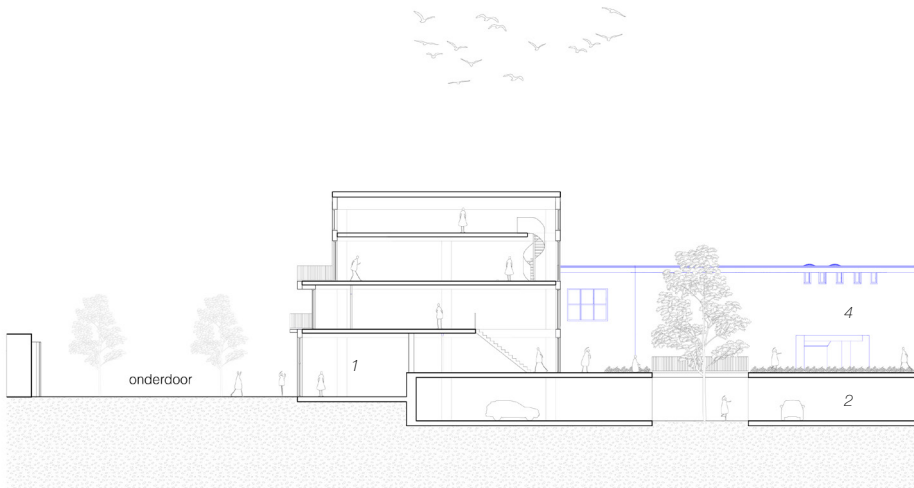


Figure 53: Longitudinal section with a large variation of dwelling types, by author, 2026

Housing diversity

The section above illustrates a wide range of different housing typologies. Despite its inefficient spatial configuration, the proposed structure provides the flexibility to adapt to changing needs over time.

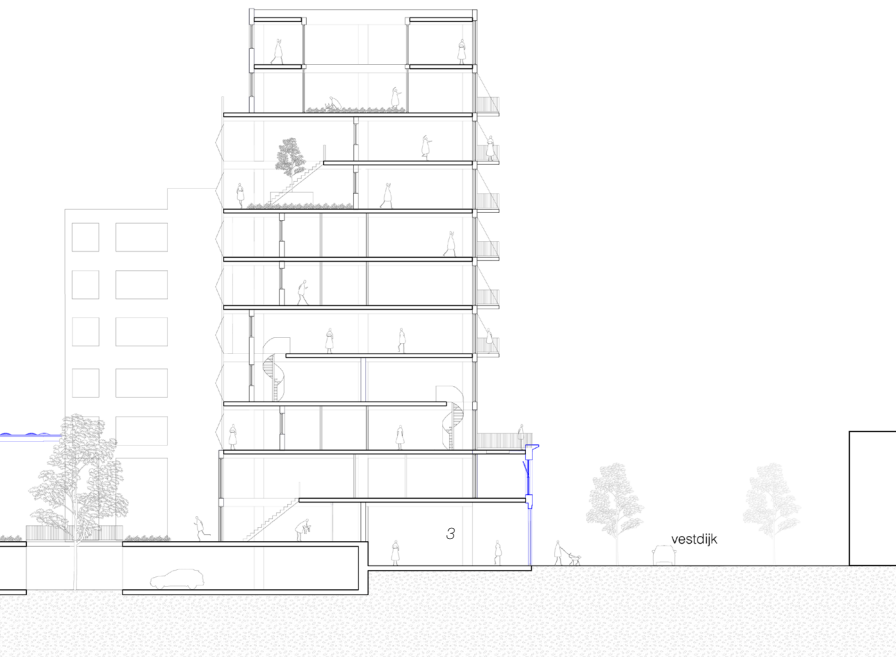




Figure 54: Housing diversity, 1:50 fragment model, by author, 2026





Figure 55: Integrated collective green spots, 1:50 fragment, by author, 2026



Cross section

- 1 existing brewery (public)
- 2 underground parking
- 3 startup business

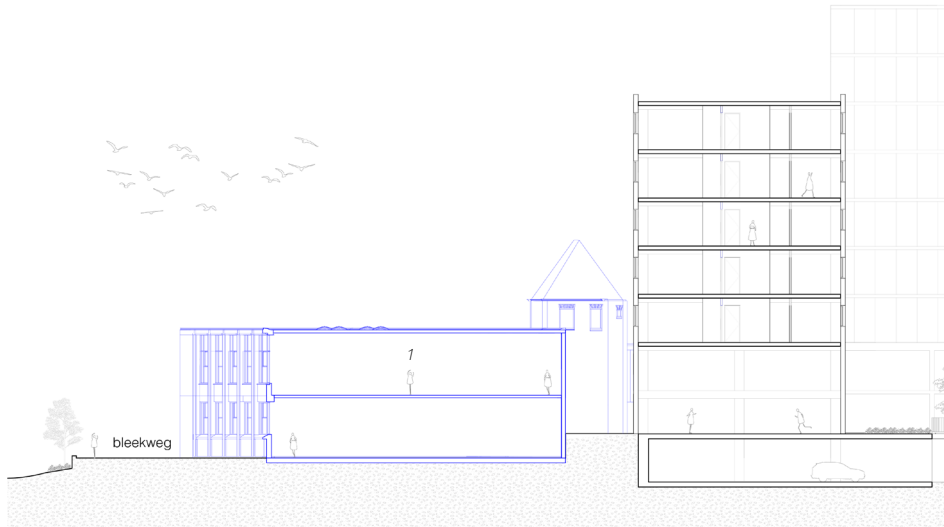
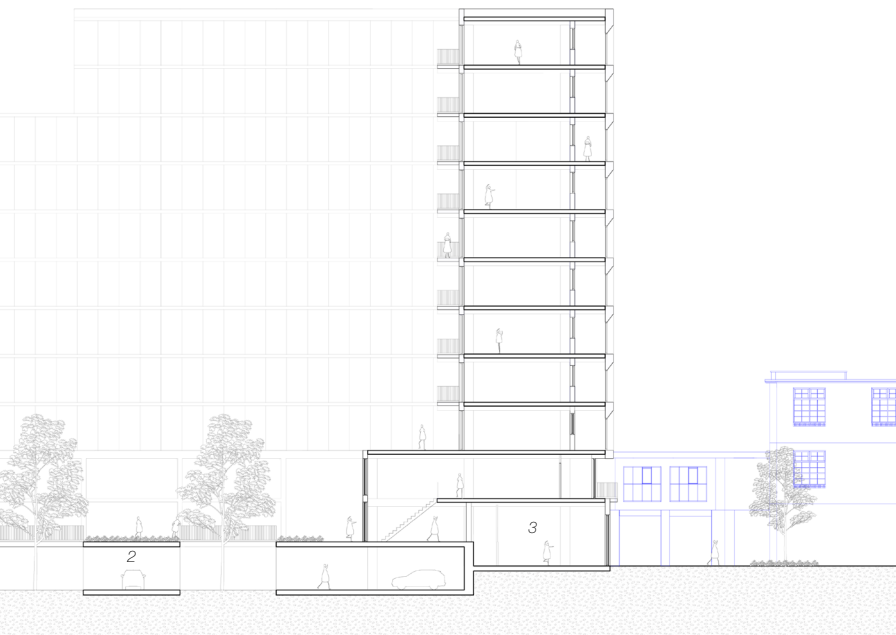


Figure 56: Cross section of the final design, by author, 2026



Climate schemes

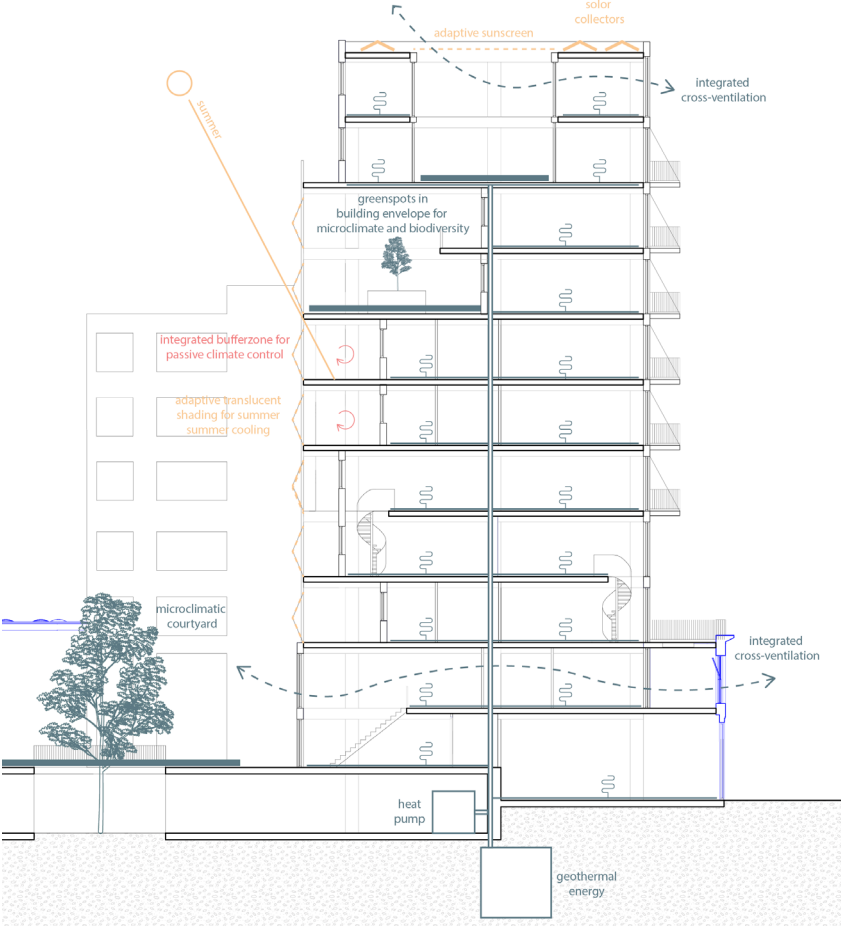


Figure 57: Climatic scheme, summer, by author, 2026

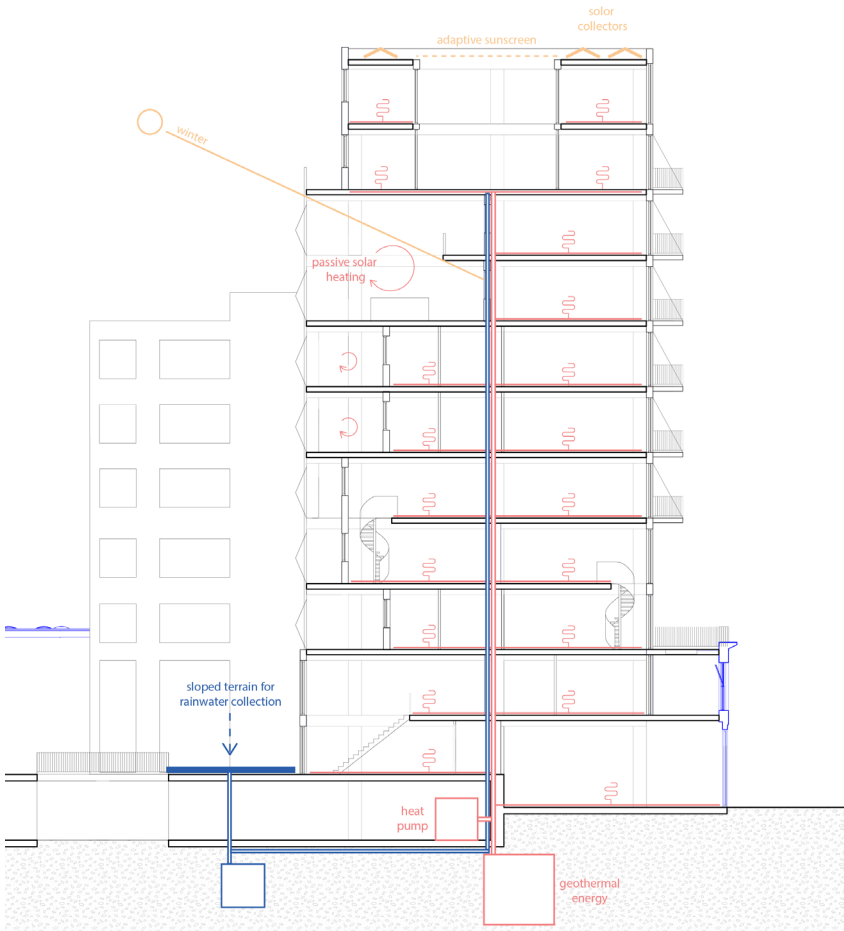


Figure 58: Climatic scheme, winter, by author, 2026

Fragment west façade



Figure 59: Fragment of the west façade, by author, 2026

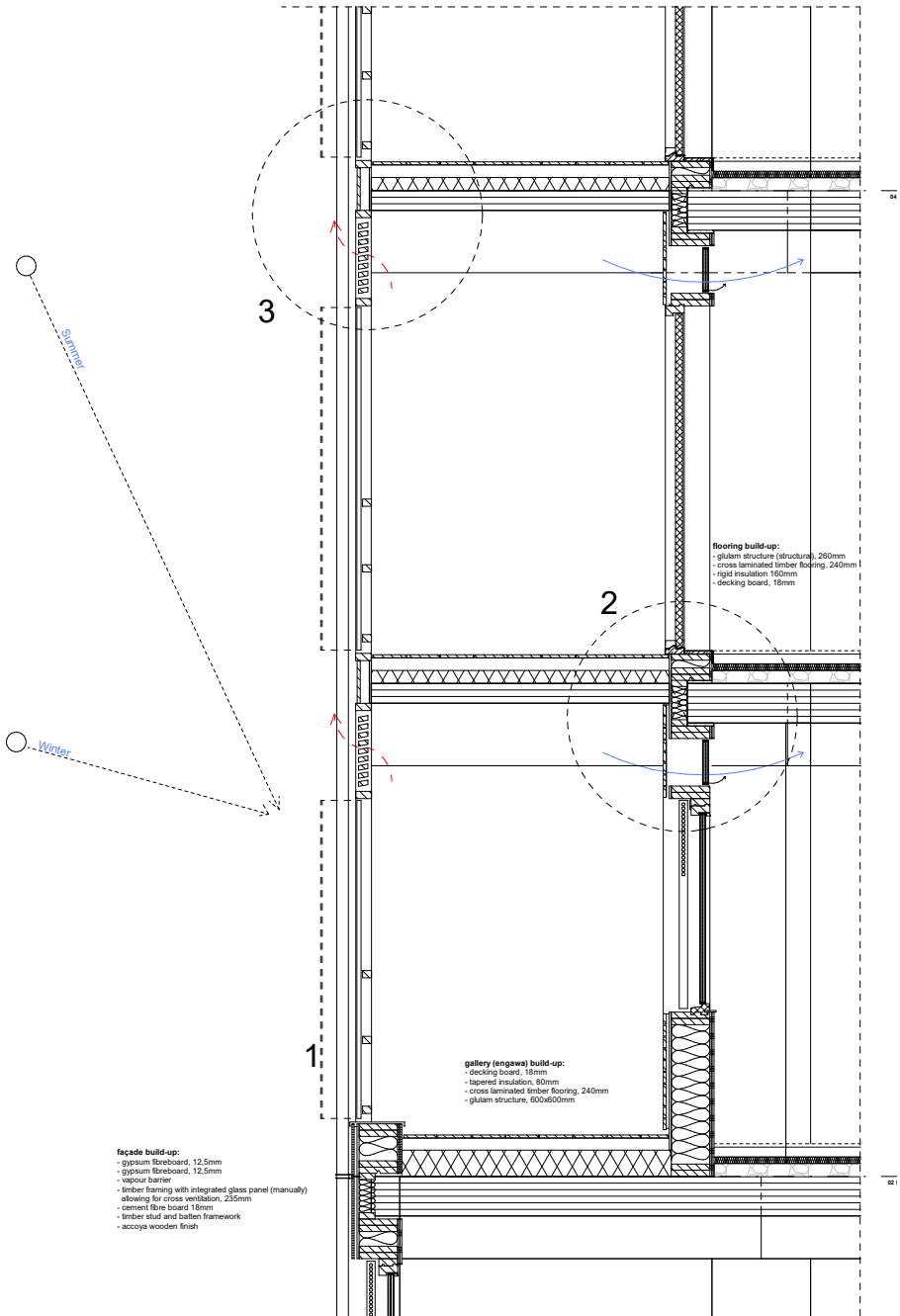


Figure 60: Detailed fragment of the west façade, scaled, by author, 2026

South elevation



Figure 61: South elevation, by author, 2026



West elevation



Figure 62: Elevation west, by author, 2026



Adaptive façade

Referring to the Machiya typology, an adaptive translucent façade has been designed along the western façade of the building. These panels can be manually operated by the occupants, allowing direct sunlight to be filtered into diffuse daylight while reducing overheating in summer periods. Above these panels, a wooden ventilation grille is integrated to allow for cross ventilation throughout the year.

- 1 wooden grille to allow for cross-ventilation
- 2 adaptive translucent façade panels (manually open / closed)
- 3 covering (floor)

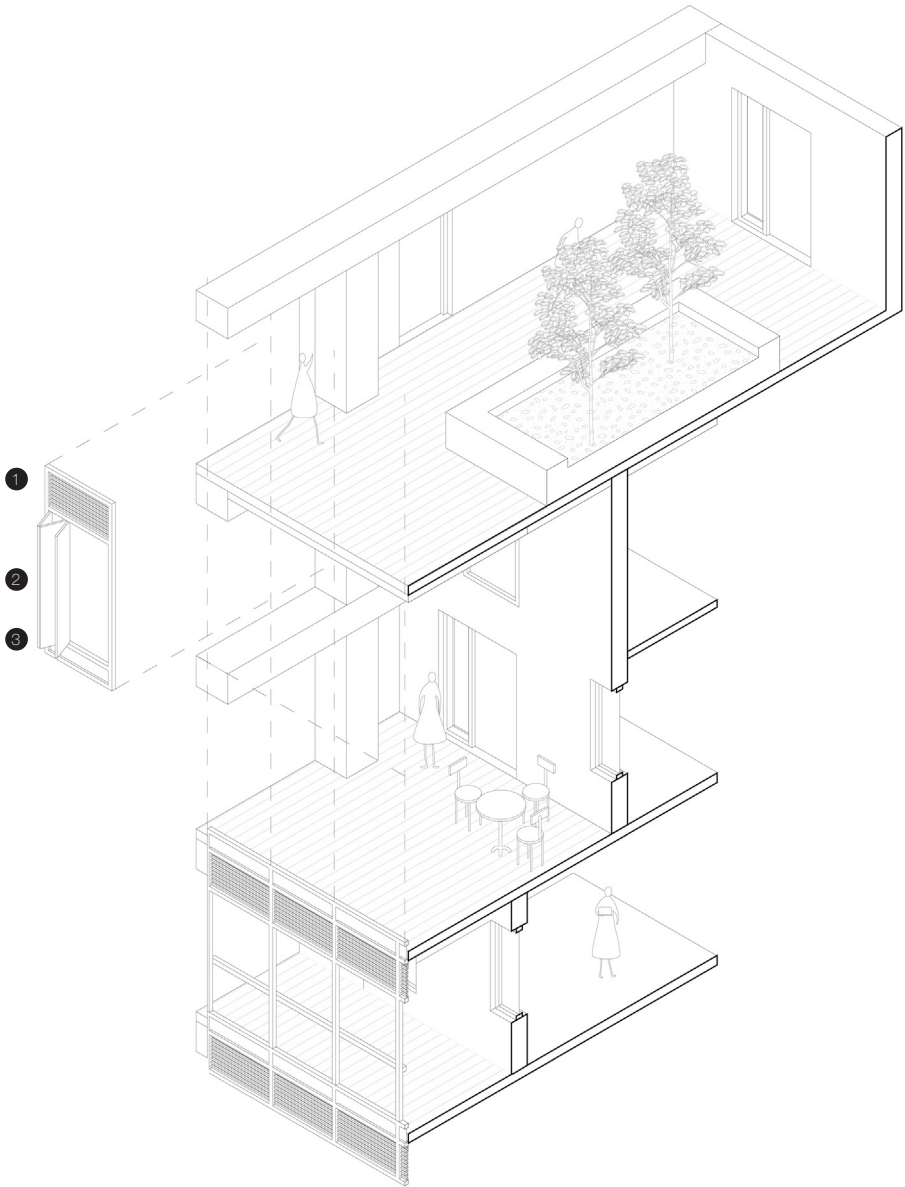
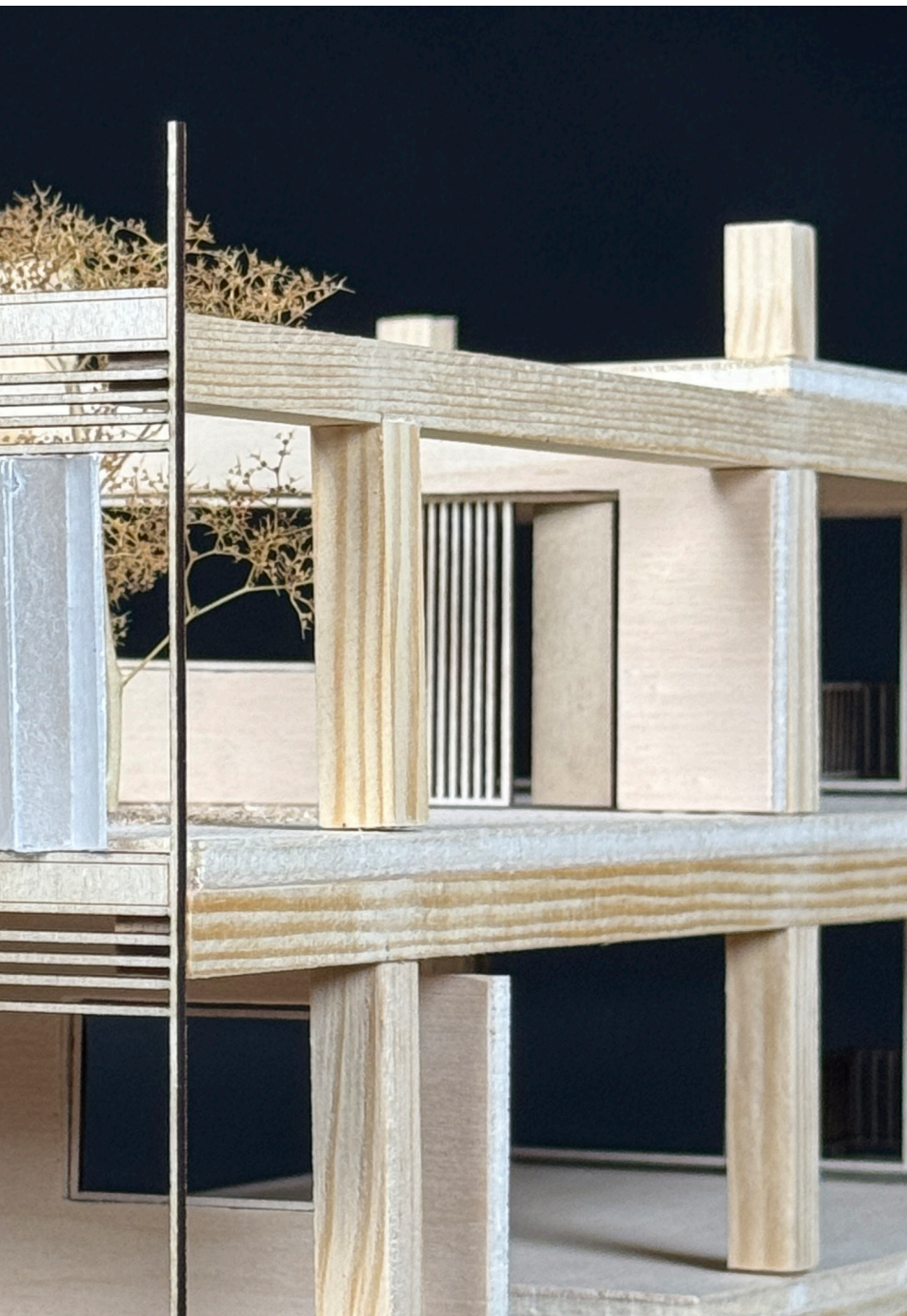


Figure 63: Isometric view of the west façade (courtyard), by author, 2026



Figure 64: Adaptive translucent façade, 1:50 fragment, by author, 2026



Detailing

outside

- 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

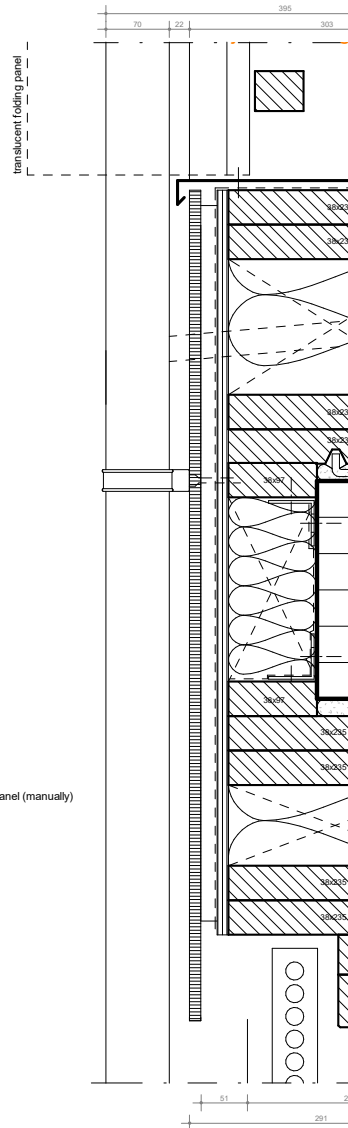
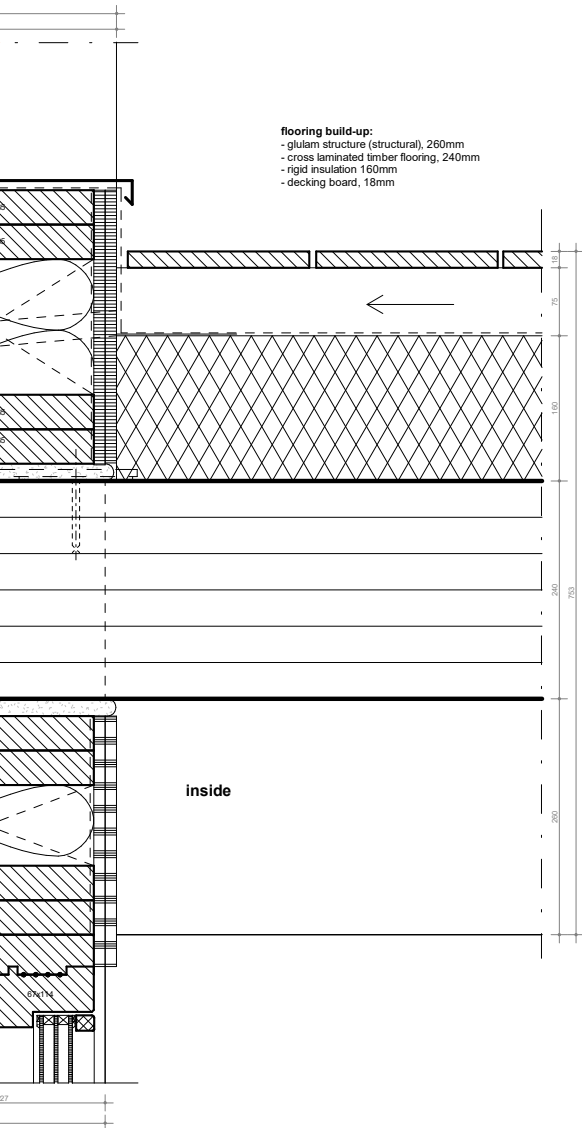
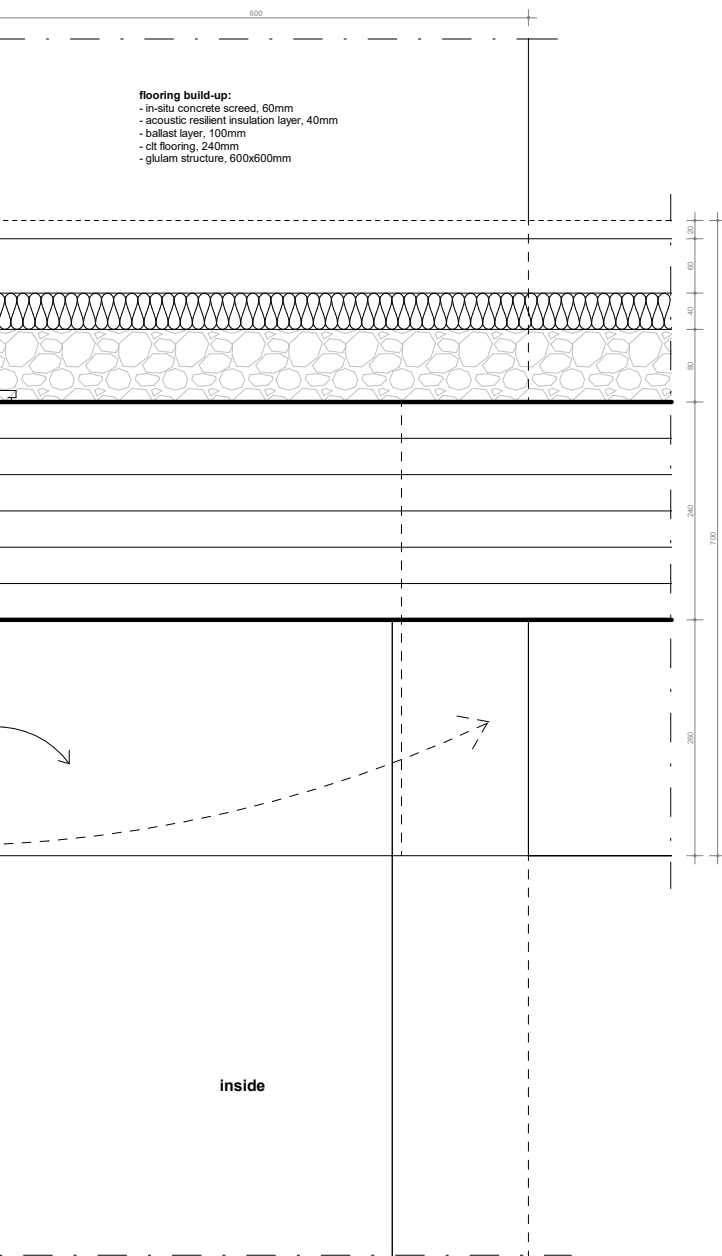


Figure 65: Detail V-01, by author, 2026





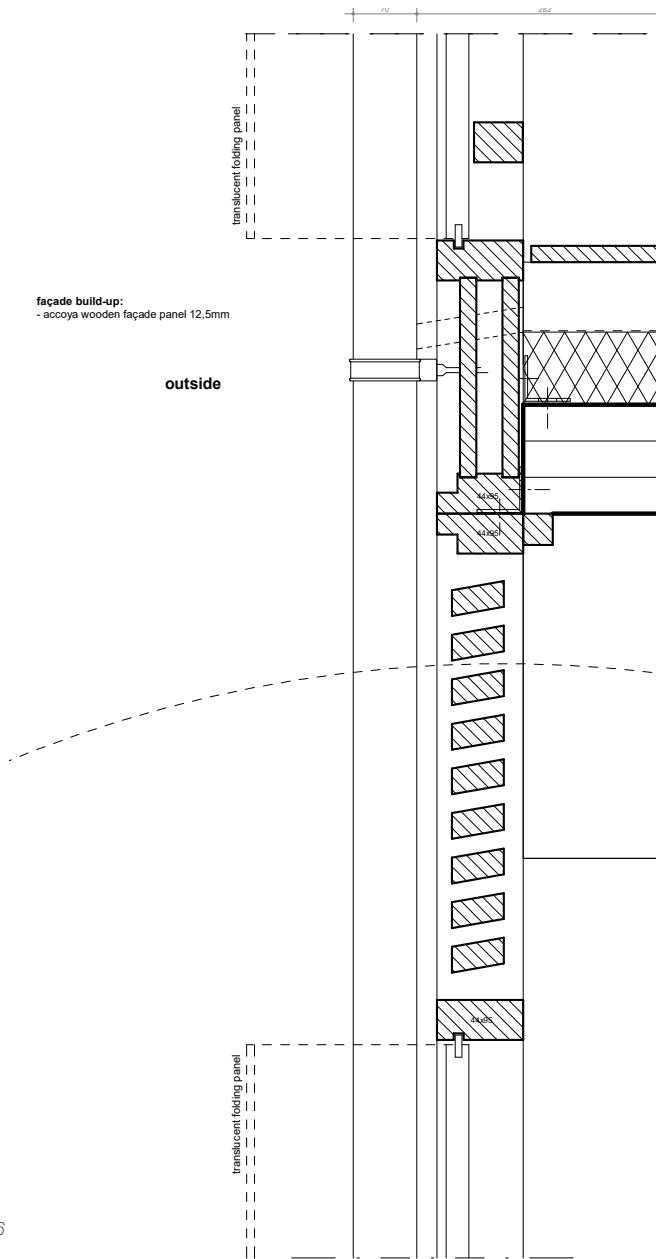
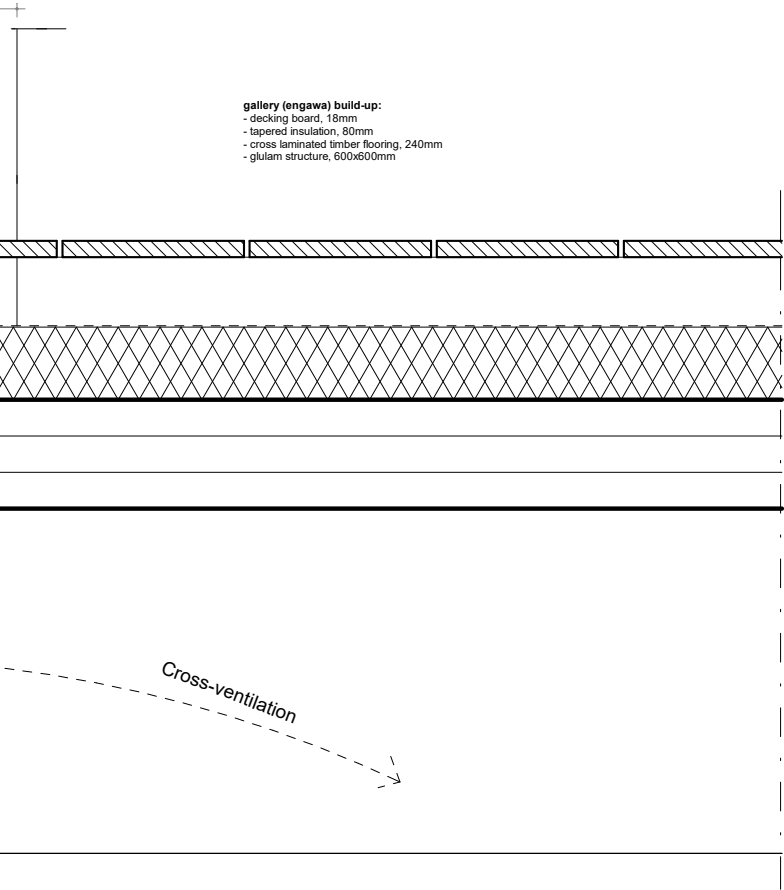


Figure 67: Detail V-03, by author, 2026

gallery (engawa) build-up:

- decking board, 18mm
- tapered insulation, 80mm
- cross laminated timber flooring, 240mm
- glulam structure, 600x600mm



**engawa
(bufferzone)**

Fragment south façade



Figure 68: Fragment of the south façade, by author, 2026

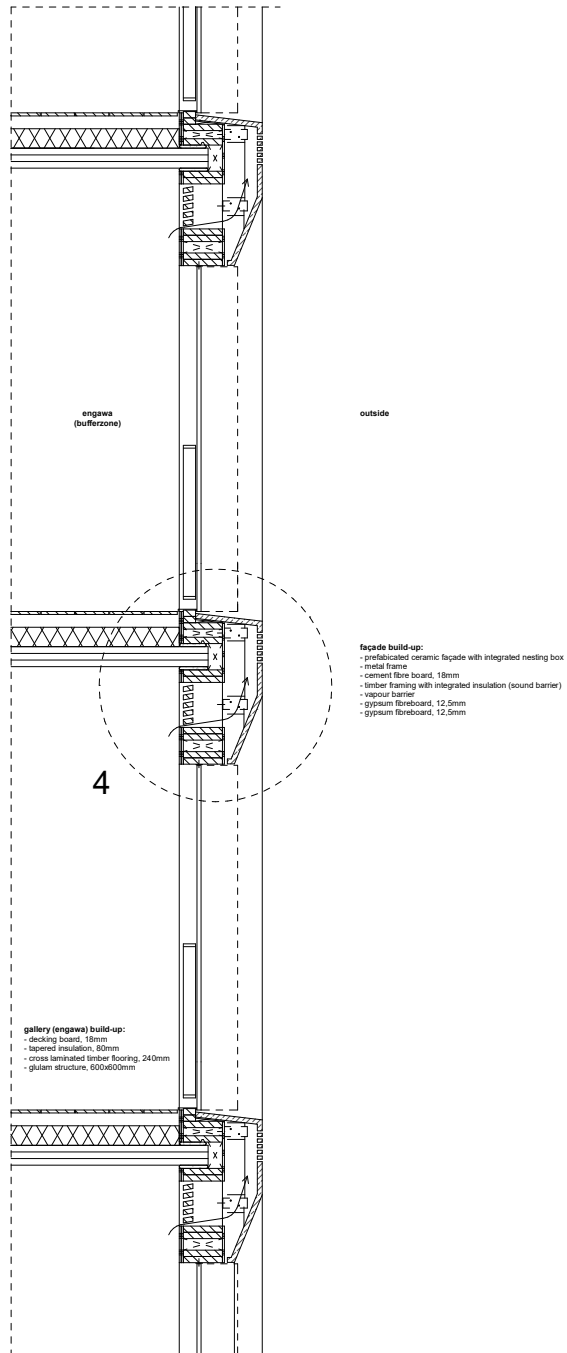
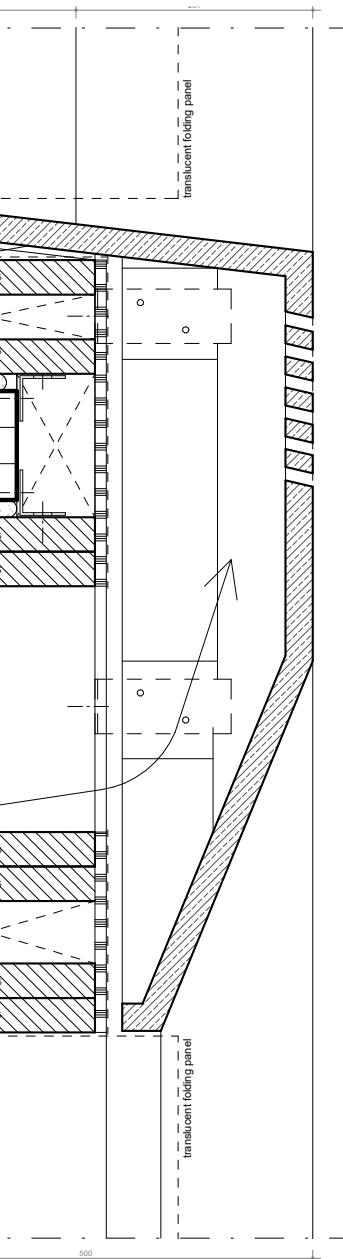


Figure 69: Detailed fragment of the south façade, scaled, by author, 2026



outside

façade build-up:

- prefabricated ceramic façade with integrated nesting box
- metal frame
- cement fibre board, 18mm
- timber framing with integrated insulation (sound barrier)
- vapour barrier
- gypsum fibreboard, 12,5mm
- gypsum fibreboard, 12,5mm

Figure 70: Detail V-04, by author, 2026

Exterior visual



Figure 71: New startup business lane with the new design and existing office building, by author, 2026



Interior visual



Figure 72: View of the gallery, by author, 2026



PART 3
Conclusion

CONCLUSION

This research demonstrates that historically developed knowledge embedded in vernacular architecture within humid subtropical climates offers valuable insights for addressing heat and humidity through passive, low-tech design solutions. The findings are derived from the analysis of the traditional Machiya typology in Kyoto, situated within a humid subtropical (Cfa) climate.

At the urban scale, the findings highlight the importance of urban configuration, where compactness, the strategic positioning of building volumes in relation to the prevailing wind direction, and the integration of an inner courtyard contribute to passively lowering temperatures. At the building scale, the investigated strategies demonstrate that a buffered transitional space, an adaptive building envelope, and the spatial organisation within the vernacular building typology effectively contribute to improved thermal comfort, allowing occupants to play a decisive and active role in adapting the indoor environment. Finally, at the detail scale, it can be argued that a lightweight structure, limited direct solar exposure, and diffuse daylight penetration help reduce heat accumulation within the building.

Furthermore, these outcomes demonstrate that vernacular architecture is not only a response to specific climatic conditions, but also an approach that supports adaptability, seasonal flexibility, and improved social interaction.

The second sub-question focuses on how the extracted vernacular strategies, rooted in these specific contextual conditions, can be reinterpreted and translated to the Dutch context. At the urban scale, the design explores a relatively high density within a compact building volume with a limited footprint, aligning with the existing urban fabric of the Schellenskwartier. The building mass is oriented in relation to the prevailing southwest wind and stepped towards the Dommel River. This strategy not only establishes a visual connection with the river, but also allows natural ventilation to penetrate throughout the entire building block. Centrally positioned within the design is the courtyard, which creates a localized micro-climate within the dense urban context and functions as a climatic buffer during the summer months by supporting airflow and passive cooling.

The research findings at the urban scale can be effectively implemented due to the high degree of design freedom present during the early stages of the design process. However, tension arises between the implementation of these strategies and Eindhoven's long-term urban densification vision. The application of these strategies requires additional spatial capacity, creating tension between densification and climatic responsiveness. Therefore, a balance is required between urban densification and the provision of spatial quality.

In addition, the application of cross-ventilation presents a complex design challenge due to the variable wind directions in the Netherlands. Wind conditions in the Netherlands are more variable than in many humid subtropical regions. As a result, positioning a building envelope in line with the prevailing wind cannot be considered a consistently effective solution within the Dutch context.

The third sub-question relates to the application of these principles at the building and detail scales. At the building scale, a buffer zone is integrated along the south and west façades to prevent dwellings from excessive solar heat gain. The spatial layout incorporates wider circulation corridors to promote cross-ventilation and enhance natural airflow. The structure is designed as a lightweight timbers construction, reducing thermal mass and limiting heat accumulation during periods of extreme heat. Referring to the principles of the Machiya, adaptive façade panels are integrated, allowing residents to actively regulate their indoor environment. Similar to the traditional Machiya, thermal comfort is not determined solely by the building itself, but is co-produced through occupant interaction. These façade panels reduce direct solar exposure during summer while allowing diffuse daylight penetration, thereby creating a responsive building envelope that can adapt to changing climatic conditions throughout the seasons.

It can be concluded that a building cannot be regulated entirely through passive design strategies alone. The fluctuating weather conditions and seasonal extremes require an approach in which passive design principles form the foundation, supplemented by supportive technical systems. Nevertheless, the integration of these design principles at an early stage of the design process can significantly reduce the dependency on technical installations.

IMPLICATIONS AND RECOMMENDATIONS

This research highlights the urgent need to respond proactively and strategically to the increasing consequences of climate change, specifically rising temperatures and the associated challenge of heat stress. The findings demonstrate that such an approach is essential, given the significant impact that architectural and urban design decisions can have on heat stress within dense urban fabrics. While contemporary Dutch architectural practice has evolved primarily in response to cold climatic conditions, substantial opportunities remain for developing design responses to increasing heat extremes. In many cases, thermal comfort is achieved through technically intensive and energy-demanding solutions, whereas the integration of passive climate-adaptive strategies presents clear opportunities for more sustainable and low-tech alternatives.

In addition, this research demonstrates that valuable lessons can be learned from regions where architectural and urban strategies have evolved over time in response to warm climatic conditions, as these are expected to become increasingly relevant within the future climate of the Netherlands. However, this research also demonstrates that such knowledge cannot be formally imitated, but instead requires critical translation in relation to spatial, climatic, and cultural conditions. The final design proposal for the Schellenskwartier functions as an initial exploration of this application, while simultaneously demonstrating the need for further refinement, evaluation, and optimisation. Therefore, it is recommended that future research be conducted within humid subtropical (Cfa) climates, as this climate type demonstrates important similarities with the projected future climate of the Netherlands. The combination of cold winters and increasingly warm summers makes this context particularly suitable for architectural reinterpretation and adaptation.

Within this research, an initial exploration has been conducted into the translation of these passive strategies to the site-specific constraints of the Schellenskwartier. The final design explores how these vernacular principles can be integrated across the urban, building, and detail scales to improve both thermal comfort and spatial quality. Moreover, these interventions primarily concern design decisions addressed during the early stages of the design process, precisely at the scale where architects and urban designers play a decisive role. This places a clear responsibility on architects and urban designers to regard climate adaptation not as an additional design measure, but as a fundamental starting point within the design process of the future built environment.

REFLECTION

Within this research, different research methods were used to translate climate-adaptive design principles to the Dutch context. The first phase consisted of a case study analysis of vernacular architecture. Due to time constraints, this analysis was limited to a single case study and building typology. To strengthen the reliability and applicability of these findings, further research is recommended that includes a broader range of reference projects. Comparing multiple case studies would allow for the identification of recurring principles, contextual differences, and contrasting strategies, thereby providing a stronger foundation for validation.

The second phase consisted of a research-by-design approach to investigate the translation of these principles to the Dutch context. This design-oriented methodology made it possible not only to analyze theoretical principles conceptually, but also to test their application within an urban design challenge. At the same time, this phase introduced methodological limitations. In particular, it proved challenging to quantitatively validate the precise effectiveness of the selected passive strategies. These strategies strongly depend on climatic performance and are difficult to measure within the exploratory nature of a design-based study. Although simulation models could have provided additional insights in this regard, an in-depth performance analysis fell beyond the scope and time constraints of this research.

BIBLIOGRAPHY

BIBLIOGRAPHY

- Asquith, L., & Vellinga, M. (Eds.). (2006). *Vernacular architecture in the 21st century: Theory, education and practice*. Taylor & Francis.
- Beck, H. E., Zimmermann, N. E., McVicar, T. R., Vergopolan, N., Berg, A., & Wood, E. F. (2018). Present and future Köppen–Geiger climate classification maps at 1-km resolution. *Scientific Data*, 5(1), 1–12. <https://doi.org/10.1038/sdata.2018.214>
- de Vries, H., Lenderink, G., van Meijgaard, E., van Ulft, B., & de Rooy, W. (2024). Western Europe's extreme July 2019 heatwave in a warmer world. *Environmental Research: Climate*, 3(3), 035005. <https://doi.org/10.1088/2752-5295/ad5c3a>
- Engel, H. (1972). *The Japanese house: A tradition for contemporary architecture*. C. E. Tuttle Company.
- Koninkrijk Nederlands Meteorologisch Instituut. (2023). *KNMI'23 klimaatscenario's: Gebruikersrapport* (KNMI'23). https://cdn.knmi.nl/system/ckeditor/attachment_files/data/000/000/357/original/KNMI23_klimaatscenarios_gebruikersrapport_23-03.pdf
- Rapoport, A. (2006). Vernacular design as a model system. In L. Asquith & M. Vellinga (Eds.), *Vernacular architecture in the twenty-first century: Theory, education and practice*. Taylor & Francis.
- Rijksinstituut voor Volksgezondheid en Milieu. (n.d.). *Gezondheidsklachten door hitte*. Retrieved January 12, 2026, from <https://www.rivm.nl/hitte/gezondheidsklachten-door-hitte>
- Sayigh, A. (Ed.). (2019). *Sustainable vernacular architecture: How the past can enrich the future*. Springer. <https://doi.org/10.1007/978-3-319-99545-3>
- Spoormans, L. (2019). Mumeisha Machiya Kyoto (JP). DASH | Delft Architectural Studies on Housing, 10(15), 90–97. Retrieved from <https://journals.open.tudelft.nl/dash/article/view/5096>
- Vautard, R., van Aalst, M., Boucher, O., Drouin, A., Haustein, K., Kreienkamp, F., ... Wehner, M. (2020). Human contribution to the record-breaking June and July 2019 heatwaves in Western Europe. *Environmental Research Letters*, 15(9), 094077. <https://doi.org/10.1088/1748-9326/aba3d4>

VI. DATA MANAGEMENT CHECKLIST

Instruction

This checklist is relevant for all graduation projects of the Master AUBS. The form is intended to highlight common aspects of graduation projects that require particular attention with regard to planning the research and data management. Relevant information and supplementary sources regarding each question are provided below each question.

With this checklist, the faculty wants to avoid that students unexpectedly find themselves in complex and stressful situations, in which ethical or privacy matters and/or other laws and regulations become an issue. In projects involving humans, certain types of data processing increase the risks to the human participants: planning such projects requires additional evaluations and advice from university staff before ethical approval can be received and the project can begin. In the case of a graduation project, obtaining additional advice or permits may delay the project with an extra education period or semester. To avoid this, it is recommended that students set up a graduation project with a low level of risk. Therefore, all students have to check their risk, by completing this checklist before their A1.

The first section of the checklist (A) should be completed by all students, together with their supervisor, during the planning of the graduation project, before the A1. It does not need to be submitted to anyone for review or approval. Please consider questions 1 to 3 carefully in relation to the intended graduation project, and answer with 'yes' or 'no'.

The second section of the checklist (B) should only be completed if the graduation project involves working with data from human participants. In that case, the student and their supervisor must apply for and receive ethical approval from the [Human Research Ethics Committee \(HREC\)](#) before the project can begin (see the paragraph 'Explanation and follow-up' after the questions). The student can submit the application to the HREC, but the supervisor is responsible for making sure that the project is compliant with relevant privacy regulations and ethical policies.

Section A. General considerations	yes	no
<p>1. Is the graduation project conducted as part of an internship (at a company), or as part of a research project at TU Delft?</p> <p>If a student's graduation project is conducted at a company or as part of a research project at the university, questions of data ownership and intellectual property rights need to be addressed in a written graduation or internship agreement before the project begins. Student and supervisor should consult the Intellectual Property Rights of Students webpage. Additional information can also be found in the Extended Personal Research Data Workflow. If applicable, complete the Confidentiality Agreement.</p>		X
<p>2. Does the project involve conducting (part of) the research outside the Netherlands?</p> <p>Students who intend to travel abroad (even to other EU countries) for study, exchange, research, internship, or graduation project purposes need to follow the Travel Safety Protocol. This includes attending a mandatory Travel Safety Training Session: see the Disclaimer.</p>		X
<p>3. Will the research involve processing data from humans, such as running a survey, conducting interviews or workshops, collecting data through social media or internet forums, or re-using existing datasets about humans provided by a third party? (If 'yes', see follow-up questions 4 to 13 in Checklist B.)</p> <p>Students who work with data from human participants must complete the next section and apply for and receive ethical approval from the Human Research Ethics Committee (HREC) before conducting the research.</p>		X

Section B. Extended risk factors (only if question 3 has been answered with 'yes'.)	yes	no
<p>4. Will the project involve participants who may be considered vulnerable, such as the elderly, refugees or asylum seekers, ethnic minorities, patients, or people with disabilities?</p> <p>Participants who may suffer very adverse consequences (for instance, due to discrimination) if their personal data became publicly available can be considered vulnerable.</p>		X
<p>5. Will the project involve participants who cannot themselves give informed consent for taking part in the project, but for whom consent must be obtained from a legal guardian?</p> <p>Participants who cannot give informed consent can include, for instance, children or participants with intellectual disabilities, mental disorders, or dementia. Such participants are also considered vulnerable in the context of the General Data Protection Regulation (GDPR).</p>		X
<p>6. Will the project involve processing any of the special categories of personal data below?</p> <ul style="list-style-type: none"> - Race - Ethnicity - Criminal offence data - Political opinion - Union membership - Religious or philosophical beliefs - Sex life and/or sexual orientation - Health data (including measurements such as heart rate) - Biometric or genetic data (including fingerprints, iris scanning, facial recognition) <p>The General Data Protection Regulation (GDPR) defines a stricter rules for processing special categories of personal data. If it is necessary to process these data in a project, it is it is important to provide additional safeguards.</p>		X
<p>7. Will the project involve processing personal data that could be considered sensitive, such as the ones listed below?</p> <ul style="list-style-type: none"> - Information about a person's income, debts, or other payments - Information about a person's (un-)employment status - Information about a person's performance at school or work - Information about relationship problems or (gambling) addiction - Information about poverty, domestic violence, or youth welfare/social work involvement <p>Some types of personal data are considered sensitive, because they can have a high impact on the privacy of the data subject if other persons gain access to these data. Sensitive personal data should only be processed if necessary: in such cases, additional safeguards need to be put in place.</p>		X
<p>8. Will the project involve processing video-recordings, or photographs of participants?</p> <p>TU Delft considers photographic and video-materials of research participants to be sensitive personal data. If such data need to be processed, additional safeguards must be put in place.</p>		X

Section B. Extended risk factors (only if question 3 has been answered with 'yes'.)	yes	no
<p>9. Will the project involve sharing or transferring personal data between multiple partners or collaborating organisations involved, such as between TU Delft and an internship company?</p> <p>According to privacy law, sharing personal data between organisations requires a privacy agreement to be in place: setting this up takes time, and requires support from additional university staff. Furthermore, personal data sharing can potentially expose research participants to different types of risks: these risks must be considered in the ethical application.</p>		X
<p>10. Will the project involve deception, or covert observation of participants?</p> <p>In some types of research, obtaining informed consent for processing participants' personal data is not an option: for instance, if the research involves deception, or the research is covert (conducted without participants knowing about it). In such situations, the steps to mitigate risks to participants are important, and an alternative legal basis for processing the participant's data needs to be established with the help of additional support staff.</p>		X
<p>11. Will the project involve working with social media data?</p> <p>Social media data are personal data, but since it is usually not possible to ask for informed consent for processing social media data, another legal basis for processing the participant's data needs to be established. Processing of social media data also involves legal considerations related to terms of use of data from third-party platforms: therefore, research with social media data requires expert support on privacy, ethics, and legal matters.</p>		X
<p>12. Will the project involve using learning algorithms or other AI to analyse, combine, or otherwise process data from participants?</p> <p>The use of AI in research involves many considerations in terms of data protection, ethics, security, and intellectual property: for more information, see TU Delft's Instructions for use of Generative AI.</p>		X
<p>13. Will the project involve participants who are based in a country or countries outside of the EU?</p> <p>Students affiliated with TU Delft must comply with Dutch and EU regulations of personal data processing (GDPR). Furthermore, the student and their supervisor must make sure that the research complies with local (privacy) legislations of any foreign destinations. Additional support from an external (local) expert may be required.</p>		X

Explanation and follow-up

If you have answered 'no' to all questions 4 to 13, your project is likely to be considered low or minimal-risk: see the paragraph 'Projects with minimal or low-risk' on the next page.

If you have answered 'yes' to one or more of the questions 4 to 13, your research likely involves extended or high risks to participants, according to the [General Data Protection Regulation](#) (GDPR) and TU Delft's privacy and ethical policies: for information regarding such projects, see the paragraph 'Projects with extended or high-risk' on the next pages.

Projects with minimal or low-risk

If you have answered 'no' to questions 4 to 13, your project is likely to be considered low-risk. This does not mean that the project involves no risks at all, but suggests that these risks can likely be addressed by the student and supervisor in the application to the [Human Research Ethics Committee](#) (HREC) within the timeline for a graduation project and without need for additional support.

Compiling the HREC application:

An application to the HREC generally involves a Data Management Plan (DMP), a risk-identification and mitigation checklist, and informed consent materials. Master's students at ABE who intend to compile a HREC application are advised to make use of the following support documents:

- the [student guide](#)
- the [Example Data Management Plan](#) for MSc projects

The graduation supervisor is [responsible](#) for the student's project and ethical application, and must provide support for compiling the HREC application documents.

Additional support

For low-risk student graduation projects, compiling of the HREC application documents should be done by the student in consultation with the supervisor. The Faculty Data Steward can be contacted for individual questions at datasteward-BK@tudelft.nl; however, the Data Steward does not provide detailed feedback on student DMPs for low-risk HREC applications.

Additional resources

The HREC has guides available for [completing the checklist](#) and for compiling [informed consent materials](#). Additionally, the [Guide to the Extended Personal Research Data Workflow](#) has been created to help researchers and students who work with human participants comply with both GDPR principles and TU Delft's policies on Data Management and Human Research Ethics.

Timeline

Minimal or low-risk HREC applications are generally processed faster than extended or high-risk applications (see the paragraph below). Nevertheless, the initial evaluation by the HREC usually takes approximately 2 weeks, and may take longer during busy periods or holiday: see the [HREC website](#) for up-to-date information. Additionally, the application may require revisions before final approval is granted. If you do not receive an initial response about your ethical application after 4 weeks from the time of submission, you may follow up with the HREC to enquire about an update.

Projects with extended or high-risk

If you have answered 'yes' to one or more of questions 4 to 13, there are potential increased risks related to how data from human participants will be processed in your project. These risks will need to be addressed in consultation with the Data Steward and other relevant support staff before submitting the ethical application to the [Human Research Ethics Committee](#) (HREC).

Compiling the HREC application

An application to the HREC generally involves a Data Management Plan (DMP), a risk-identification and mitigation checklist, and informed consent materials. Master's students at ABE who intend to compile a HREC application are advised to make use of the following support documents:

- the [Ethical Approval & Data Management Planning Student Information](#)
- the [Example Data Management Plan](#) for MSc projects

The graduation supervisor is [responsible](#) for the student's project and ethical application, and must provide support for compiling the HREC application documents.

Additional support

Once the DMP has been compiled and reviewed by the supervisor, feedback should be requested from the Data Steward via DMPonline. After this, any other necessary support staff will need to be contacted. Crucially, if the project involves one or multiple ways of personal data processing that could result in high-risk to the participants according to the GDPR, the TU Delft Privacy Team must be consulted to establish whether or not a [Data Protection Impact Assessment](#) (DPIA) is required.

Additional resources

The HREC has guides available for [completing the checklist](#) and for compiling [informed consent materials](#). Additionally, the [Guide to the Extended Personal Research Data Workflow](#) has been created to help researchers and students who work with human participants comply with both GDPR principles and TU Delft's policies on Data Management and Human Research Ethics.

Timeline

It can take a long time to compile a complete research plan and HREC application for projects involving extended risks. DMP feedback from the Data Steward usually takes around 2 weeks, but can take longer during busy periods or holidays. Receiving additional support from other staff, such as the Privacy Team, can take anywhere from a few days to multiple weeks, depending on the project and capacity of university staff. If a DPIA is deemed necessary, it can take anywhere from 4 weeks to several months.

It is important to note that advice from the Privacy Team or other support staff, as well as any additional documents (such as necessary contracts, or a DPIA, if needed) must be in place before the application is submitted to the HREC. The initial evaluation by the HREC can be processed in 2 weeks, but may take longer during busy periods or holidays: see the [HREC website](#) for up-to-date information. Additionally, the application may require revisions before final approval is granted. If you do not receive an initial response about your ethical application after 4 weeks from the time of submission, you may follow up with the HREC to enquire about an update.

Considering the limited time available for students conducting their graduation projects, students working with data from human participants are strongly advised to prioritise low-risk research projects. If a student project necessitates processing data in ways that are considered extended or high-risk, both student and supervisor need to be aware of the extended processing times involved in obtaining ethical approval and beginning the graduation project.

APPENDIX

CASE STUDY ANALYSIS

Project Details

Project:	VIA 57 West
Location:	New York
Architect:	Bjarke Ingels Group
Year:	2016

Advantages

- The sloped geometry is designed to maximize sunlight penetration into the building;
- Dwellings are positioned towards the Dommel (Hudson River in New York);
- A large central courtyard provides a calm, protected living environment in a dens urban fabric;
- Clear vertical distinction between public and private spaces;
- Building form creates a sheltered microclimate;

Disadvantages

- The courtyard is part of the residential complex and not accessible for public;
- Irregular floor plans and complex structure;
- High density in high-rise culture;





Project Details

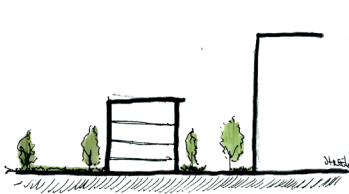
Project:	Funenpark
Location:	Amsterdam, the Netherlands
Architect:	de Architecten Cie
Year:	1999 - 2013

Advantages

- Landscape becomes the primary focus, built volumes the secondary element;
- Closed building block along the street which creates an inner public accessible park;
- Focus on slow mobility networks;
- Strong connection with greenery through integrated sightlines;

Disadvantages

- Lower density efficiency;
- Blurring boundaries between private, semi-public, and public domains;
- Limited programmatic intensity;





Project Details

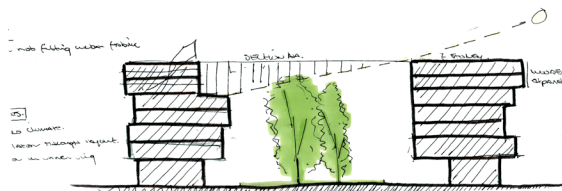
Project:	Tietgenkollegiet
Location:	Copenhagen, Denmark
Architect:	Lundgaard & Tranberg Architects
Year:	2006

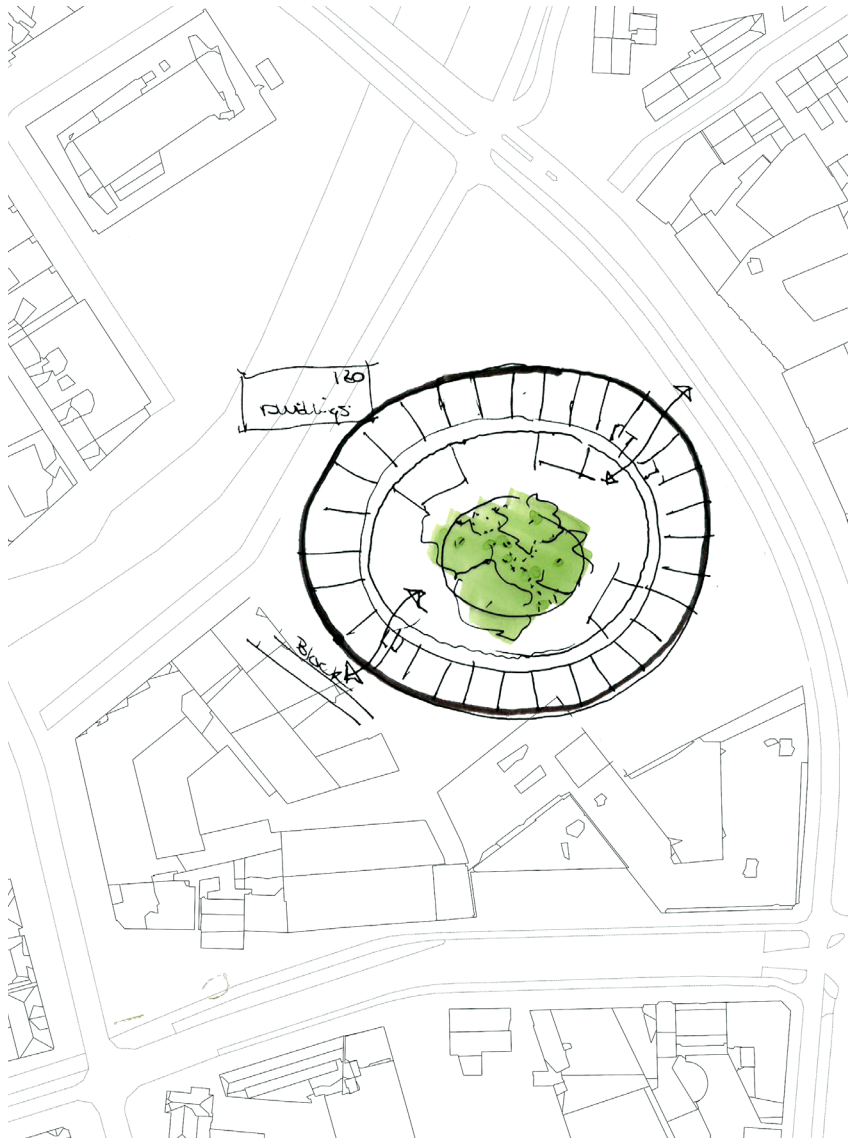
Advantages

- Semi-private circular courtyard functions as a collective space;
- High residential density within a compact circular form;
- Dwellings are oriented either towards the courtyard or the exterior landscape;
- Circular layout enhances social and spatial cohesion;
- Building form creates a sheltered microclimate, buffering against wind and external noise;

Disadvantages

- Less engagement with the surrounding urban context;
- Form of building not fitting in the urban fabric;





Project Details

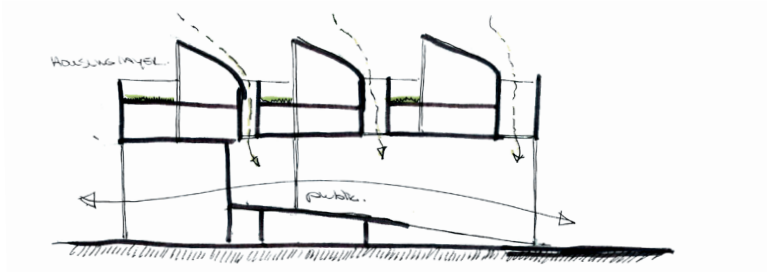
Project:	New World Housing
Location:	Fukuoka, Japan
Architect:	OMA Architects
Year:	1988-1991

Advantages

- Intimate private realm in dense urban fabric;
- Private units, semi-private terraces and shared courtyards;
- Maximum use the roof;
- Private vertical courtyard that introduces light and space into the centre;

Disadvantages

- Lower density efficiency;
- Limited programmatic intensity;





Project Details

Project:	Eixample
Location:	Barcelona, Spain
Architect:	Ildefons Cerdà
Year:	1860

Advantages

- high density, low-rise building block;
- inner courtyard which creates a microclimate in a dense urban fabric;
- building block that follows the urban morphology of the site;

Disadvantages

- Deep building layout in which daylight will be problematic in the core;
- lack of connection with the river Dommel;
- Incorporating natural ventilation throughout the building block;

Project Details

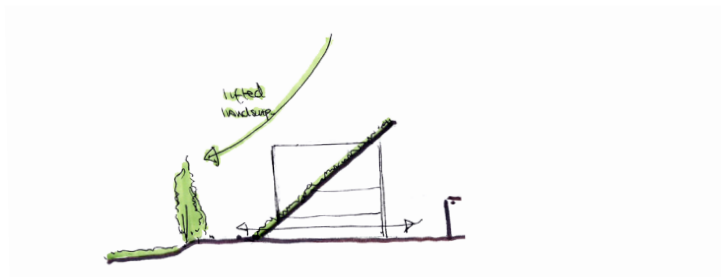
Project:	Taoyuan Museum of Art
Location:	Taoyuan, Taiwan
Architect:	Riken Yamamoto
Year:	2026

Advantages

- public accessibility of the roof;
- extension of the green infrastructure on the roof;
- Tilted garden which is integrated with the roof of the building;

Disadvantages

- function of the building not fitting the proposed program;





Potential of wind exposure



Combined model



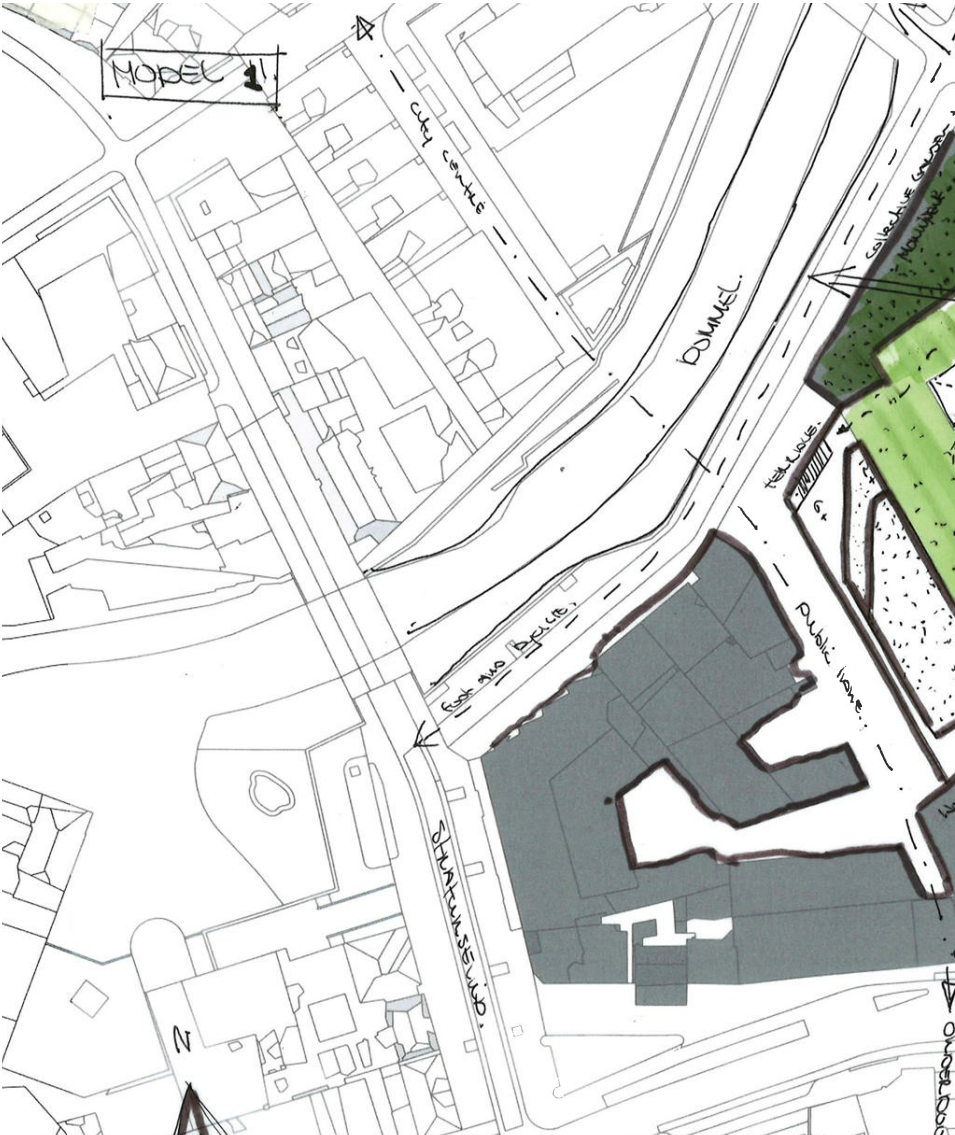


DESIGN ITERATIONS





Model I | Raised Garden





Advantages

- Combined courtyard and parking;
- Clear distinction in public and private spaces;
- Collective gardens on top of the existing;

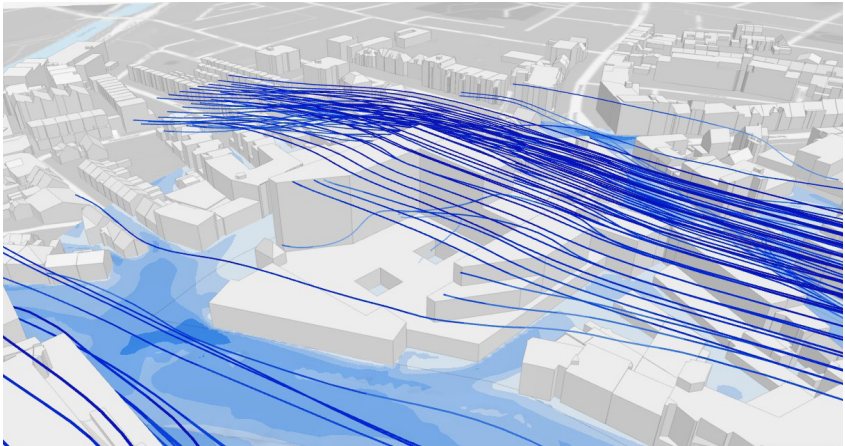
Disadvantages

- Direct connection of the new building to the existing monument and hotel;
- A pronounced separation between public and private domains.



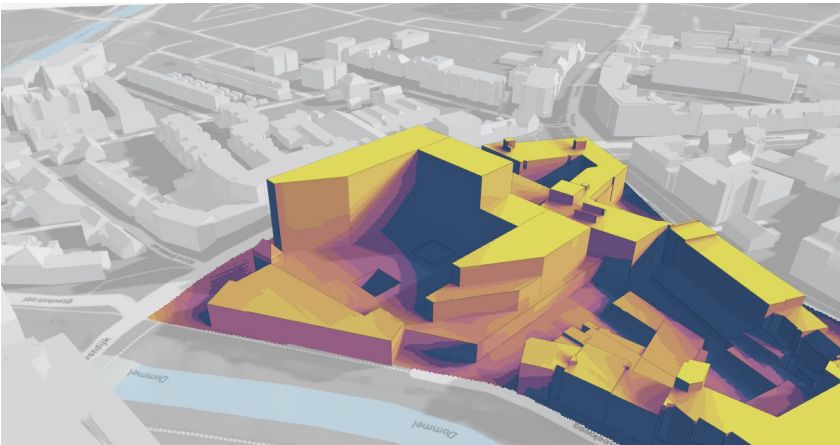
Wind exposure

- Design positioned in line with the prevailing wind direction;
- High potential of cross-ventilation;
- Lowering the volume on the south-west;



Daylight potential

- Reduce sun exposure on the south and make use of the morning and evening;
- Critical point: less daylight during winter period. Open-up on the west-side.

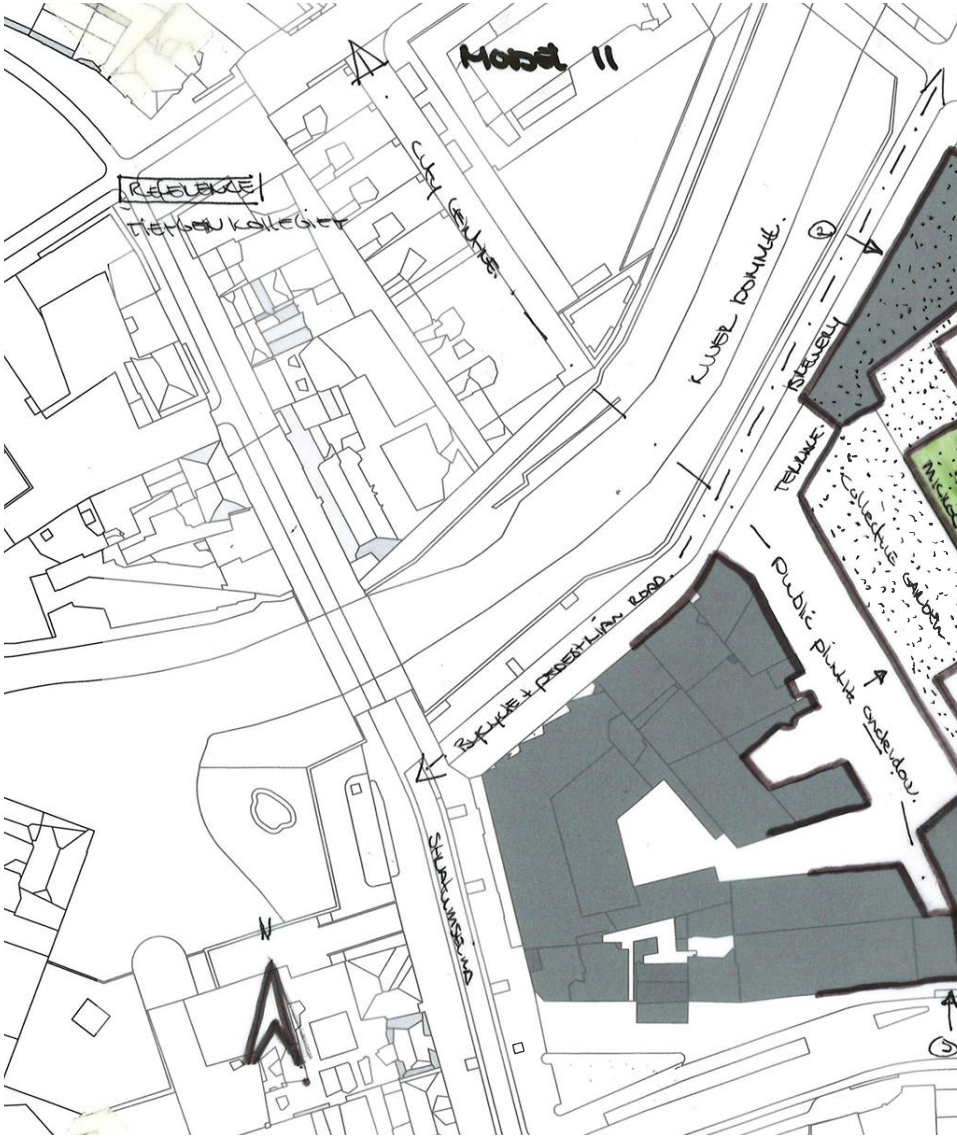


Daylight potential in February (winter)



Daylight potential in July (summer)

Model II | Inner Microclimate





Advantages

- The lower three levels (Eindhoven layer) adhere to the urban morphological principles of the city centre, thereby generating an enclosed courtyard condition;
- This courtyard facilitates the formation of an inner-city microclimate while simultaneously providing residents with a sense of spatial calm environment;
- Above the Eindhoven layer, an additional eight-storey volume is introduced, stepped towards the Dommel;
- The design is terraced towards the Dommel in order to enhance cross-ventilation.

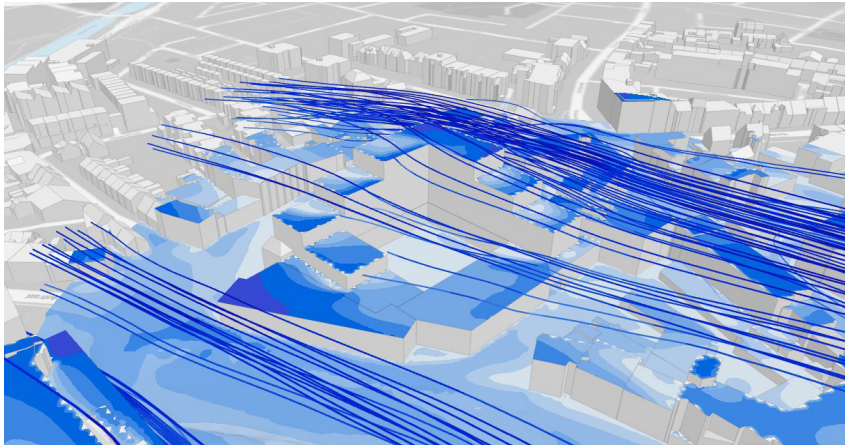
Disadvantages

- Direct connection of the new building to the existing monument and hotel;
- A pronounced separation between public and private domains;



Wind exposure

- Design positioned in line with the prevailing wind direction;
- High potential for the use of cross-ventilation;
- Lowering volume on the west-side to use the wind throughout the site;

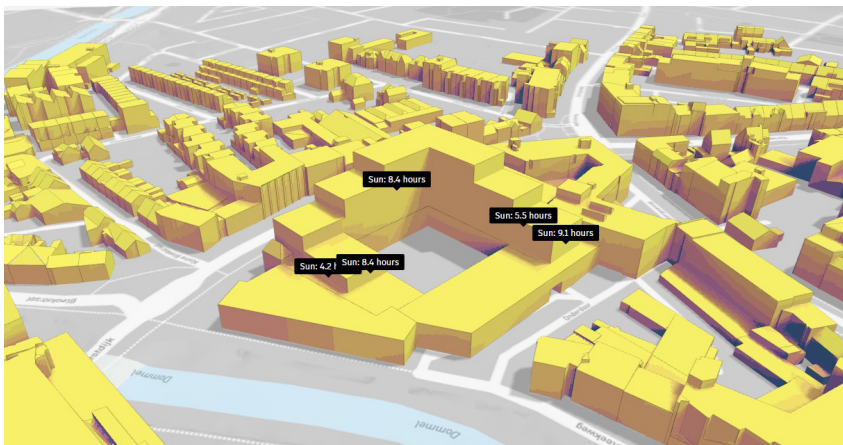


Daylight potential

- Open-up towards the westside to provide daylight in the courtyard and to make use of the sun in the morning and afternoon;
- Reduction of the sun on the south to avoid overheating;



Daylight potential in April

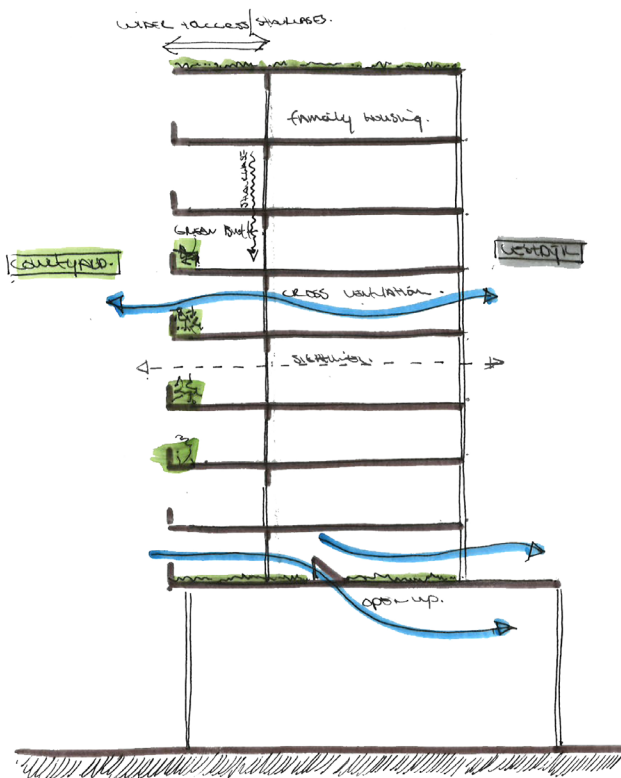


Daylight potential in July

BUILDING INTERVENTIONS

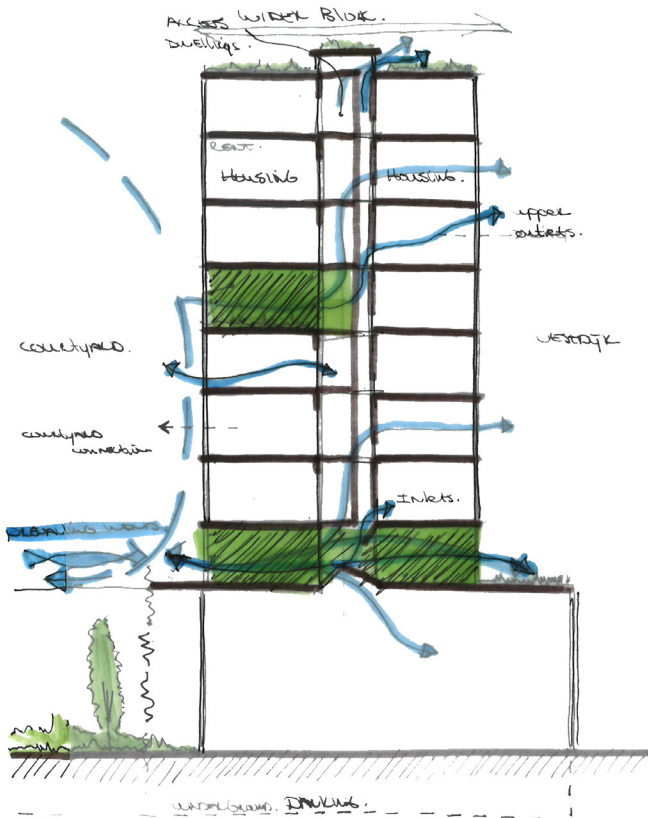
Bufferzone

- A reinterpretation of the 'engawa' to buffer direct sunlight and provide circulation;
- circulation has two functions: buffer the inside and outside, and as a social generator;
- One-sided living environment;
- Creating an overhang to reduce direct sunlight (overheating);



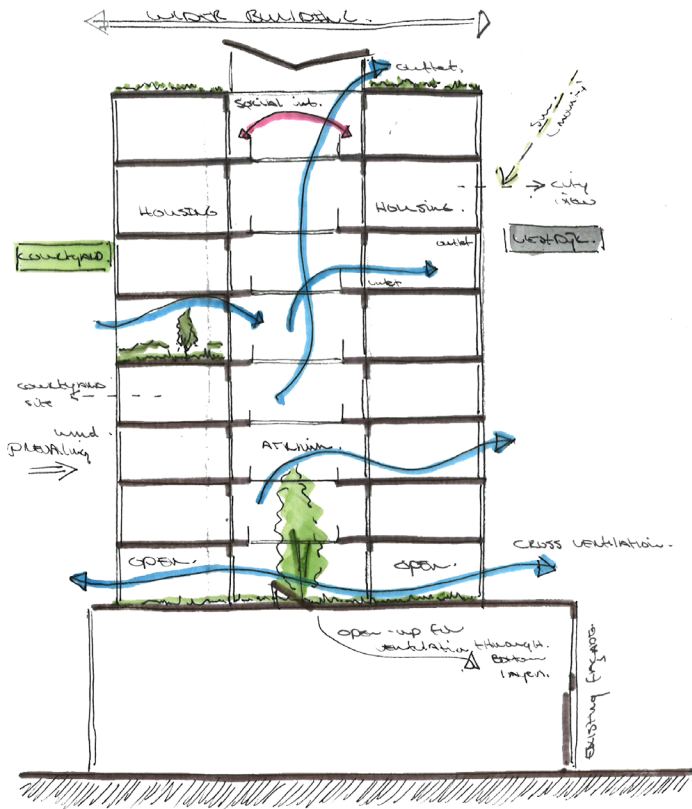
Chimney

- Double sided living environment;
- Introducing a chimney in the core of the building to provide natural airflows for the dwellings in the back;
- Open-up the building on the bottom layer to provide natural airflows in the core;
- Outlet in the top;



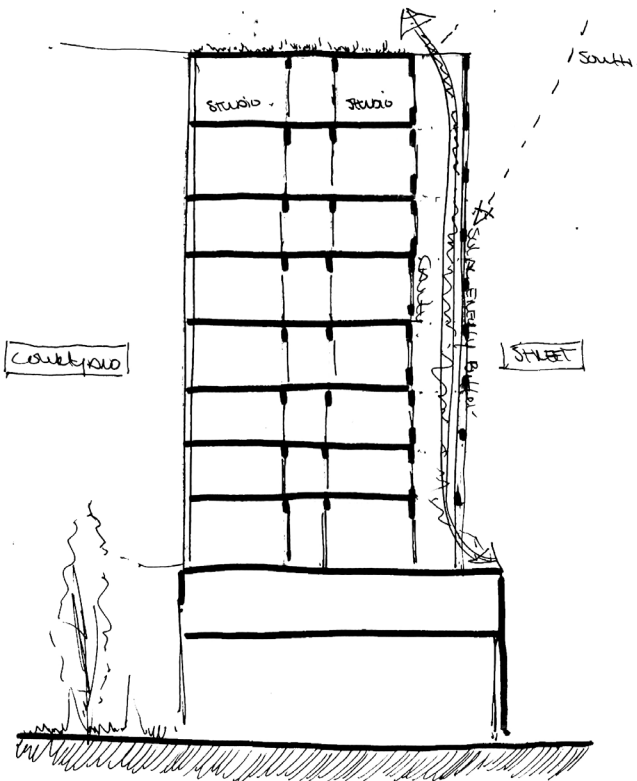
Atrium

- Central atrium in the core providing the circulation and natural airflows;
- lacking connection with the central courtyard;



Double Skin Façade

- Integrated solar chimney on the south;
- Double sided dwellings, compromising the high density of the site;
- Need for a wider building volume;



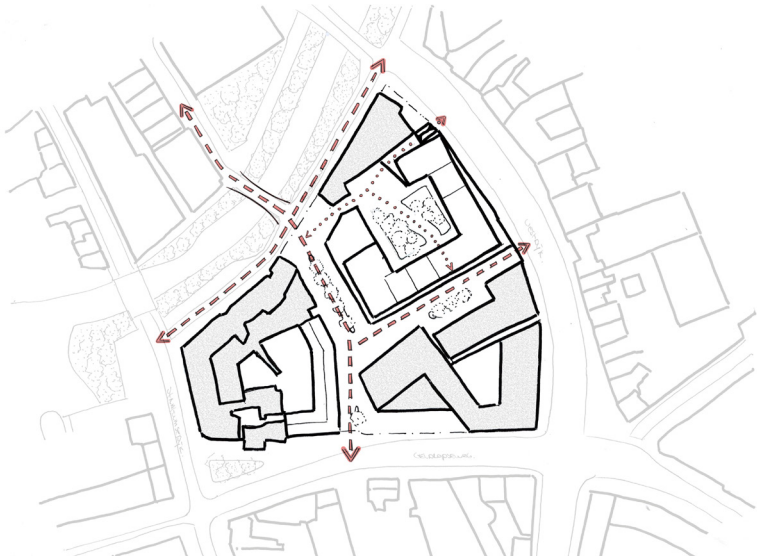
PRELIMINARY DESIGN

Circulation

- Car oriented zone, with a priority on slow mobility;
- New connecting bridge over the Dommel to connect the Schellensfactory with the city-centre;
- Preservation and activation of existing entrance gates which serves as a distinction between public and private;
- Reinterpretation of the small streets and squares of the existing factory;

Connection with river Dommel

- The Dommel is positioned as the central structuring element of the design.
- The building volume terraces down towards the Dommel, ensuring both spatial and social connectivity;
- A semi-private courtyard functions as a microclimatic environment, contributing to cooling, water retention, and providing a collective space for inhabitation within a densified urban context;

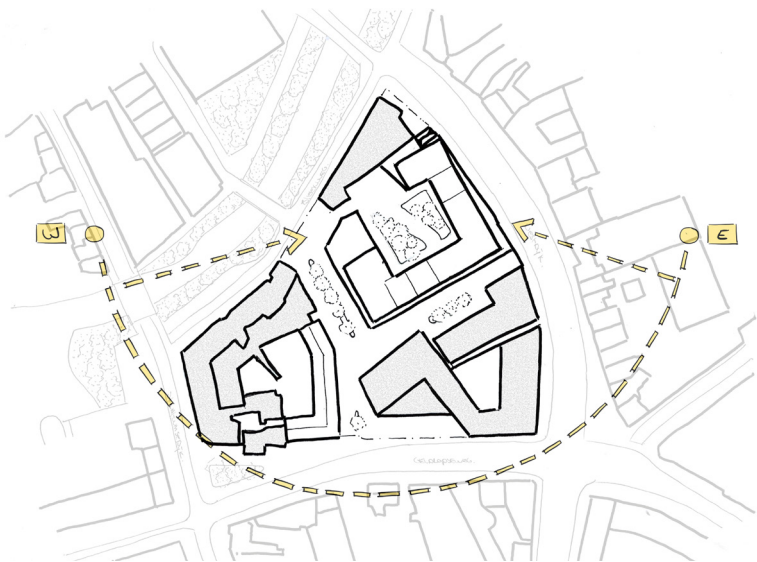
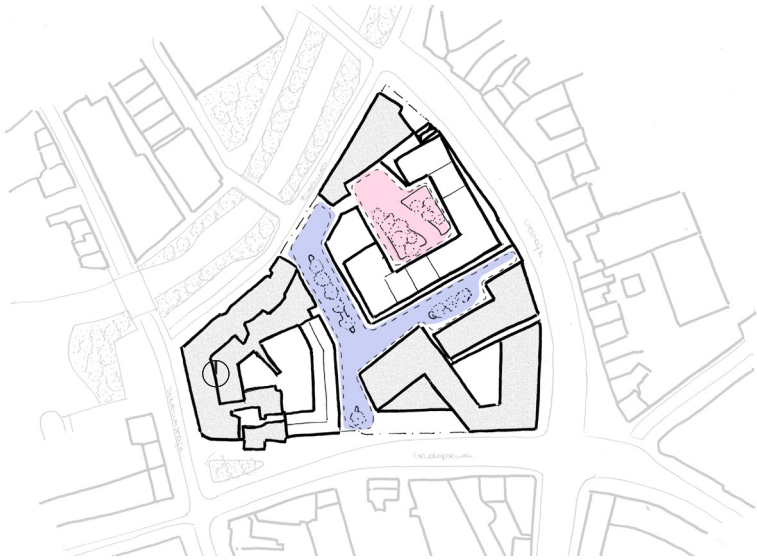


Public lane and semi-private courtyard

- The reintroduction and reinforcement of the Onderdoor as a public passage, establishing a connection between the project site and the Bleekweg.
- A semi-private courtyard conceived as a contrasting interior realm, providing intimate space;

Sunpath

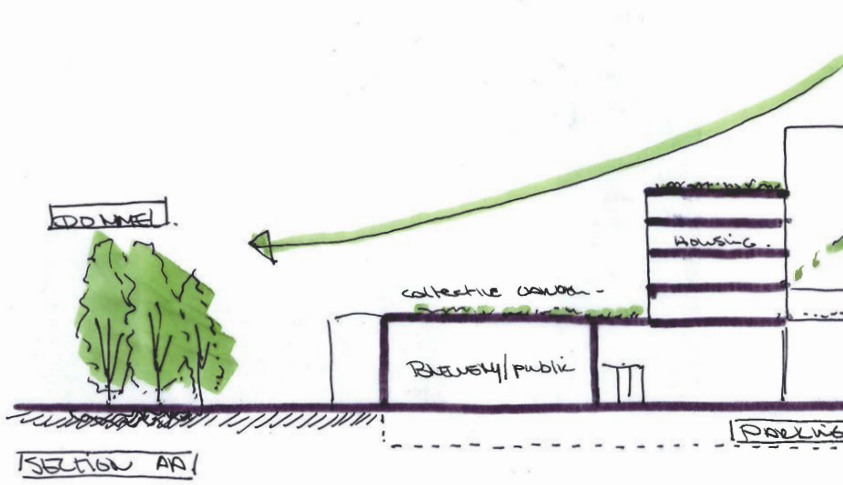
- The incorporation of a thermal buffer zone along the south-facing façade, functioning as a climatic envelope that limits heat gain in summer and utilises passive solar energy for heating in winter.



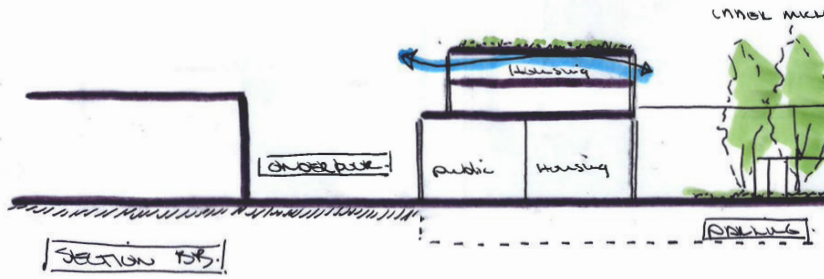
Prevailing wind

- The positioning of the building volume in relation to the prevailing south-west wind, allowing for natural ventilation;

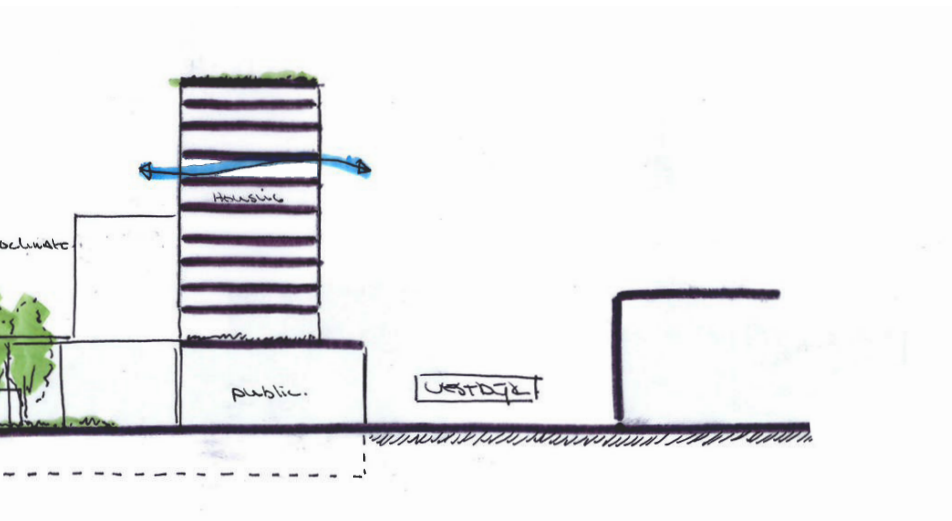
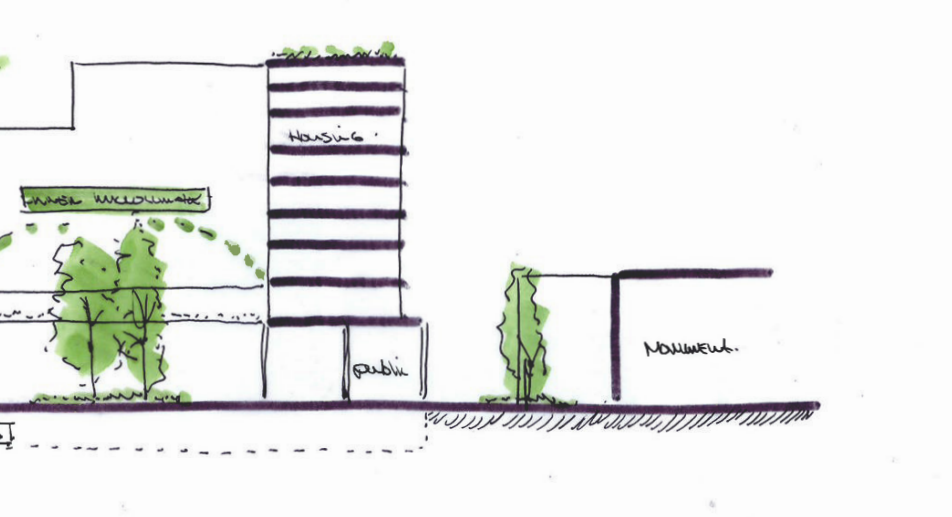
Sections

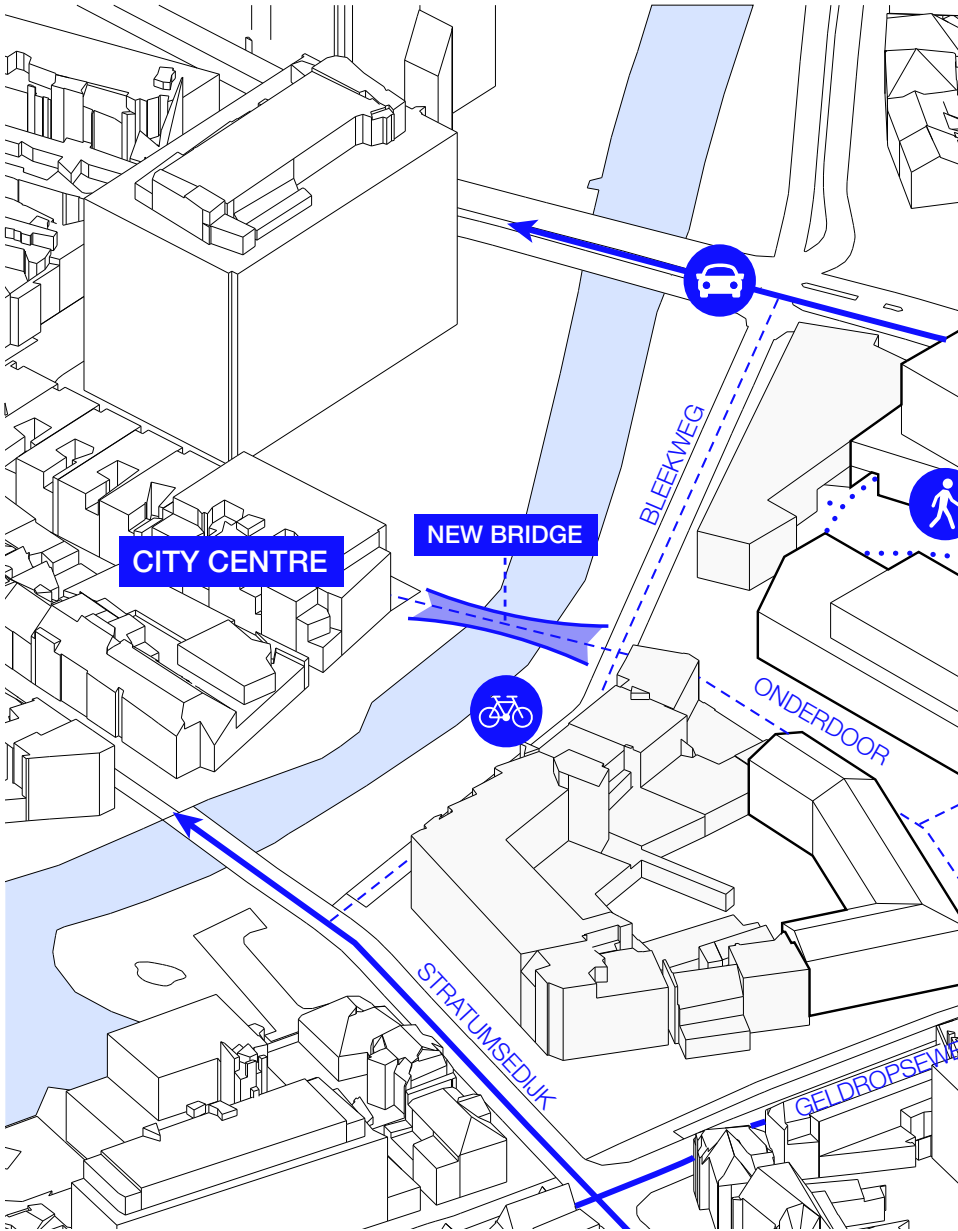


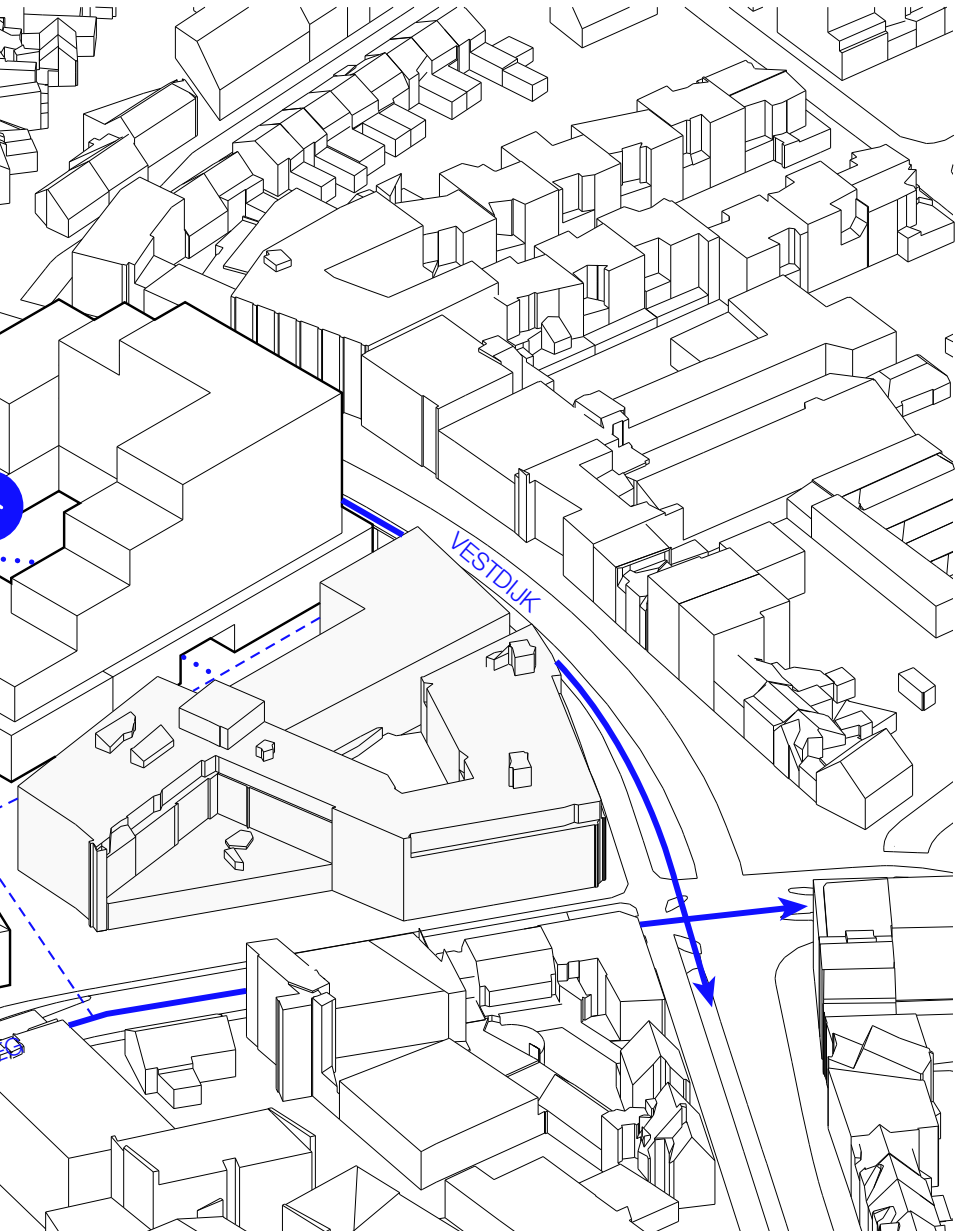
SECTION AA

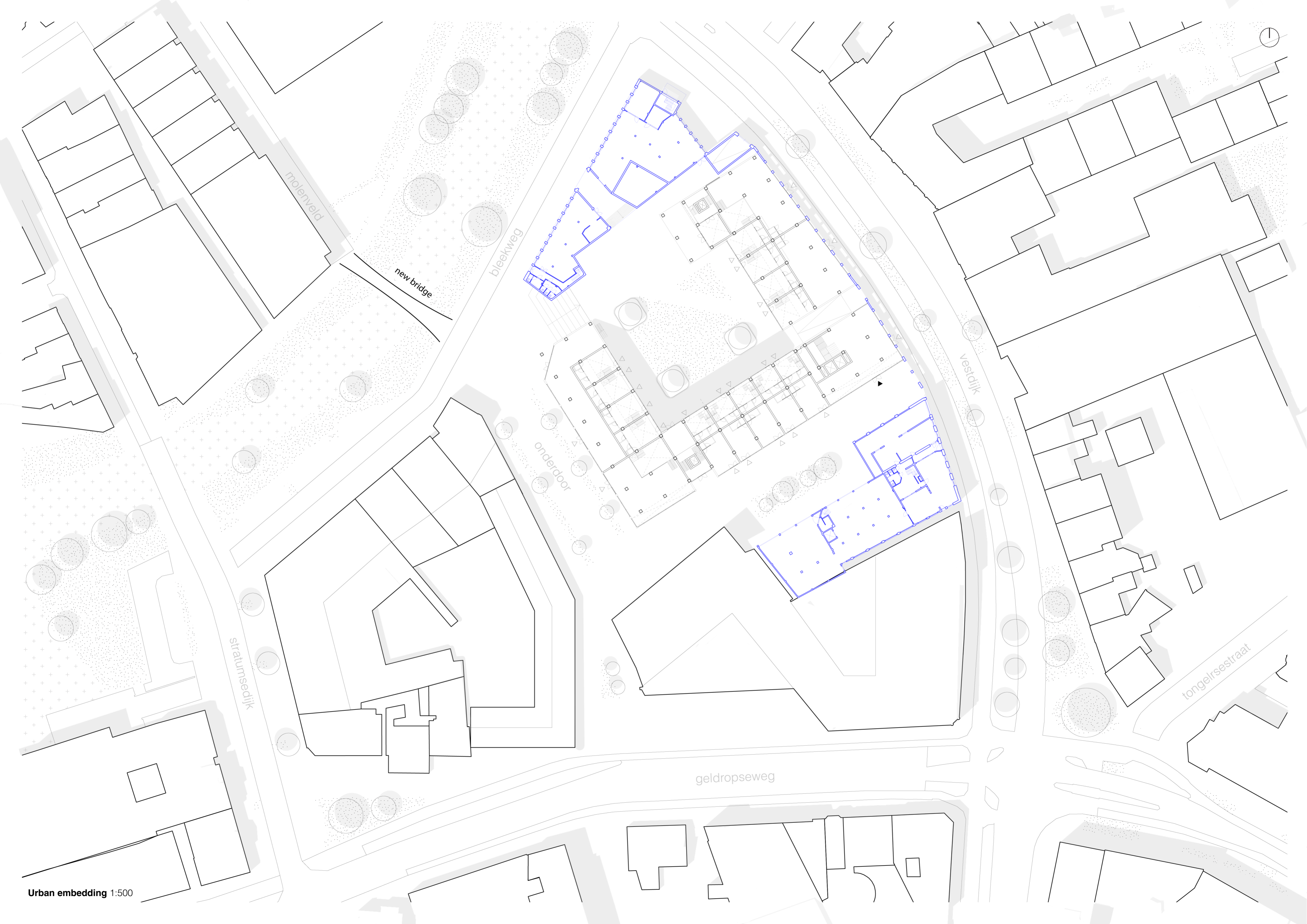


SECTION BB

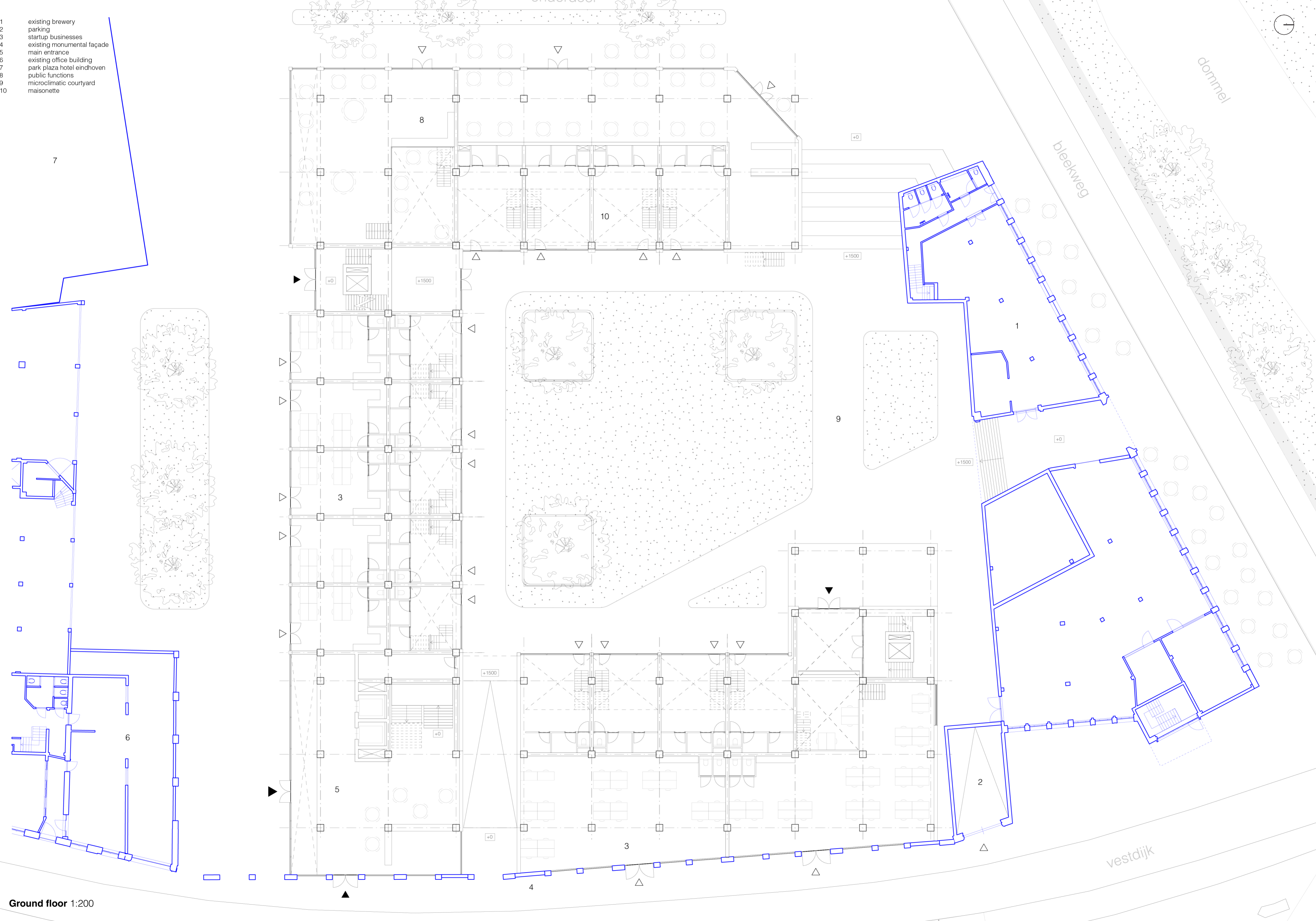




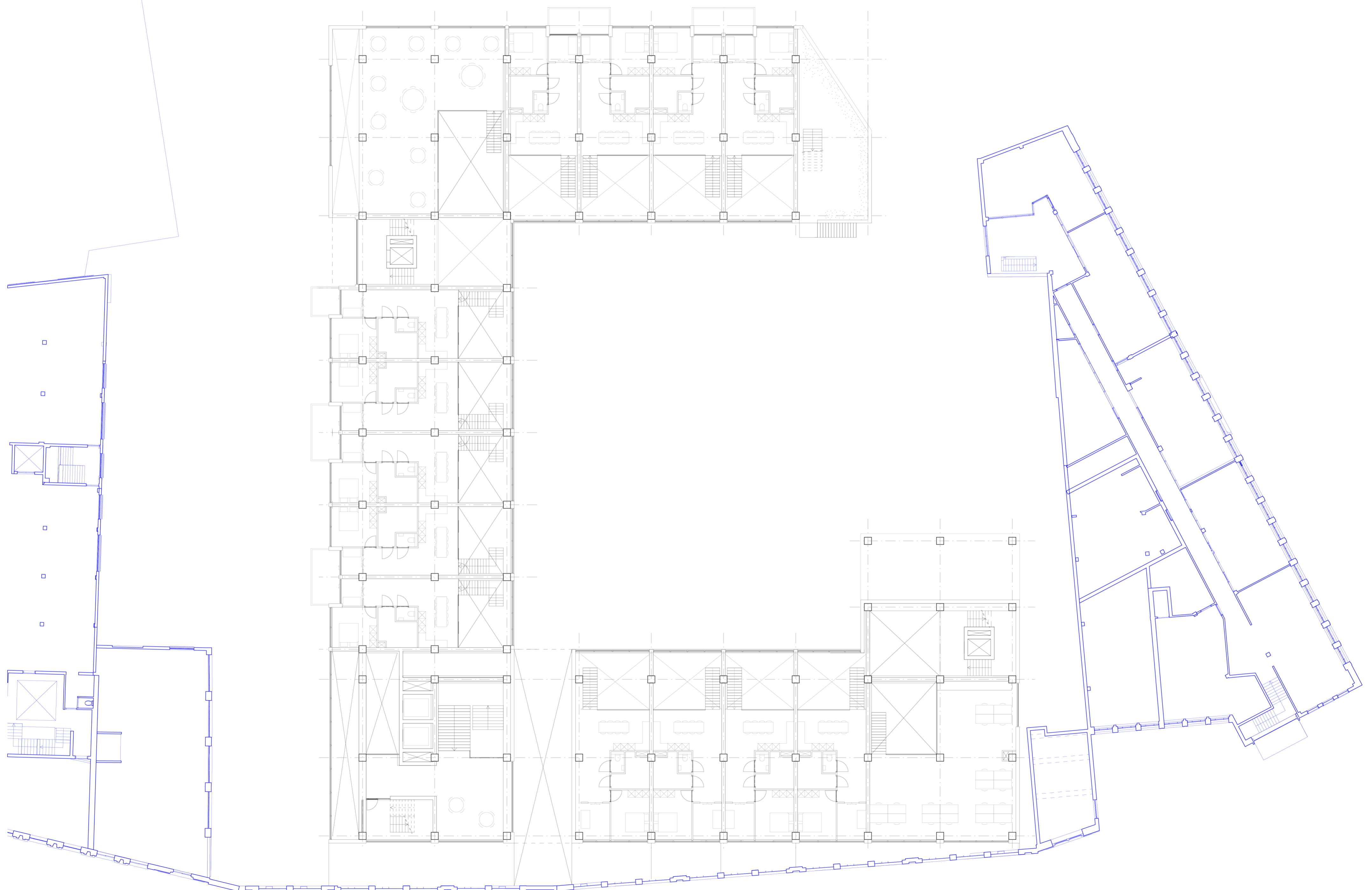
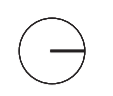




- 1 existing brewery
- 2 parking
- 3 startup businesses
- 4 existing monumental façade
- 5 main entrance
- 6 existing office building
- 7 park plaza hotel eindhoven
- 8 public functions
- 9 microclimatic courtyard
- 10 maisonette

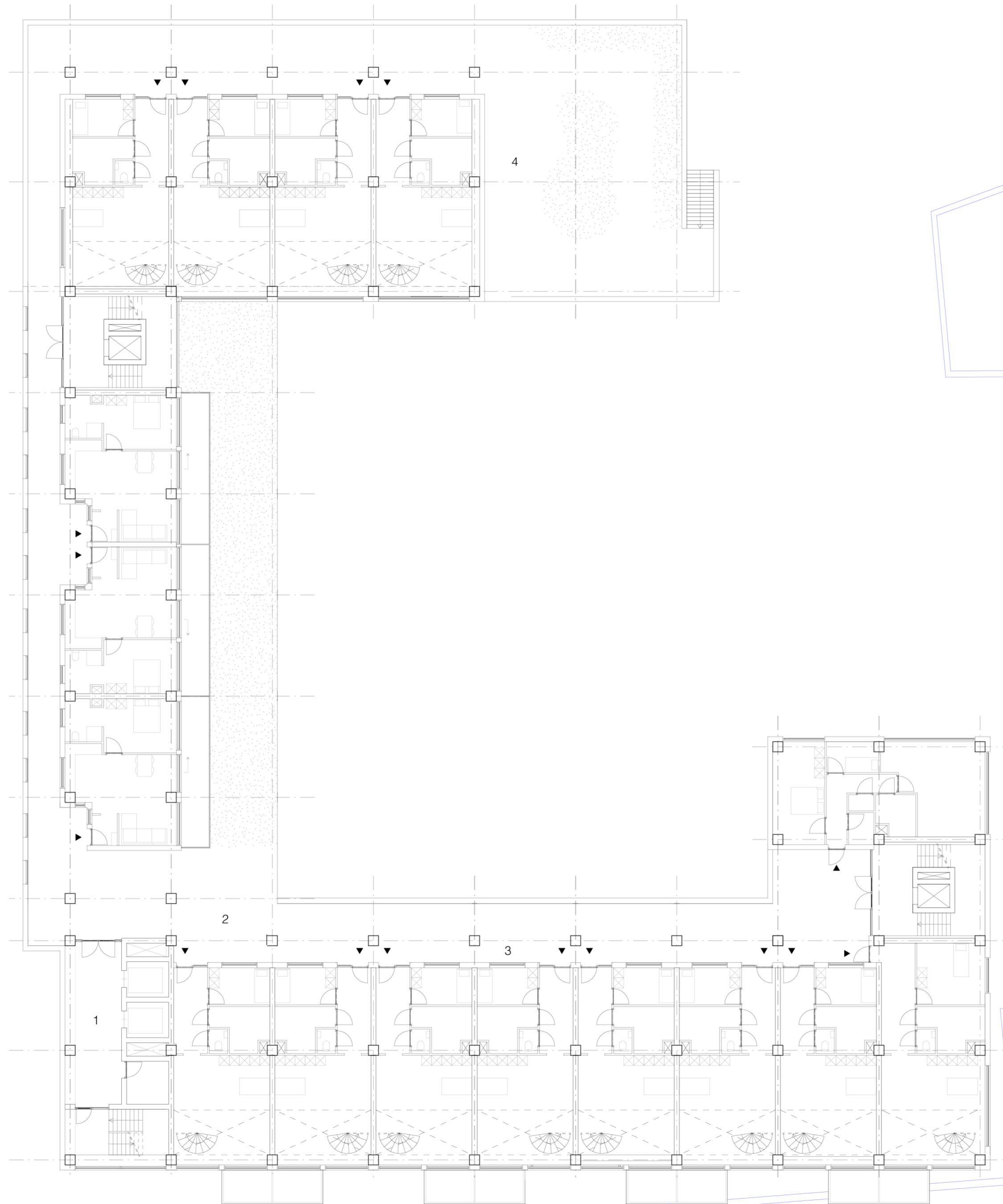


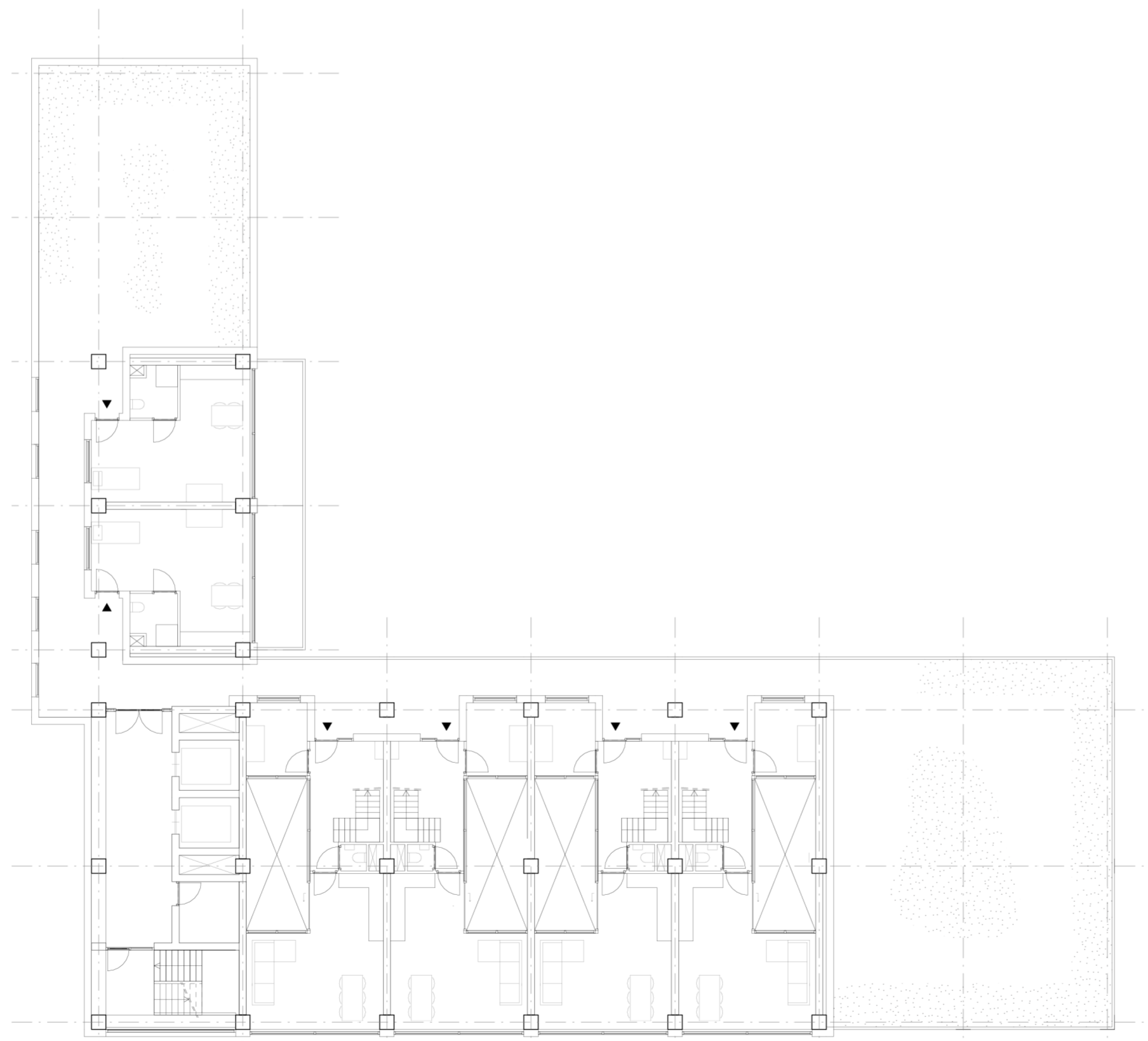
Ground floor 1:200

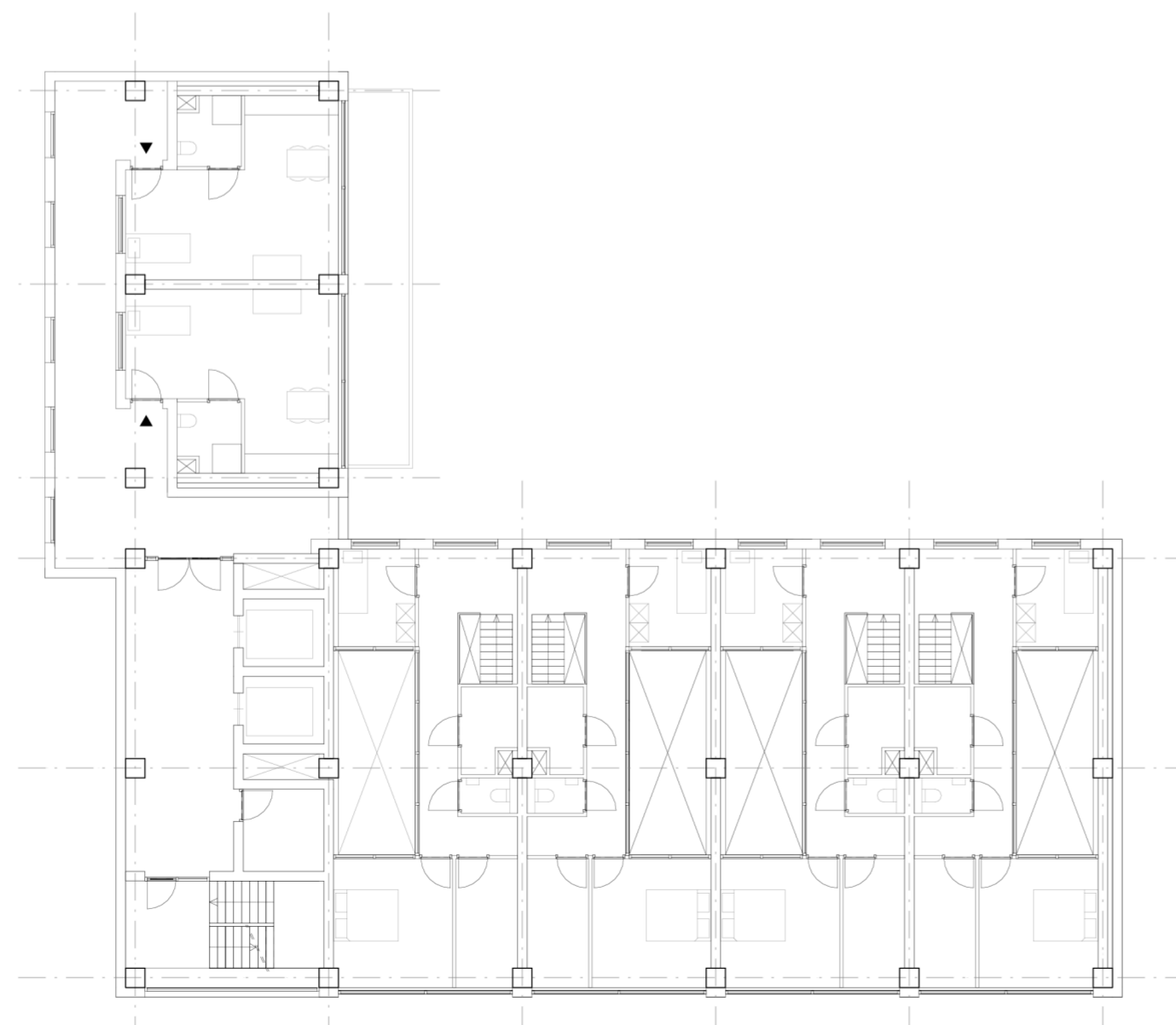


First floor 1:200

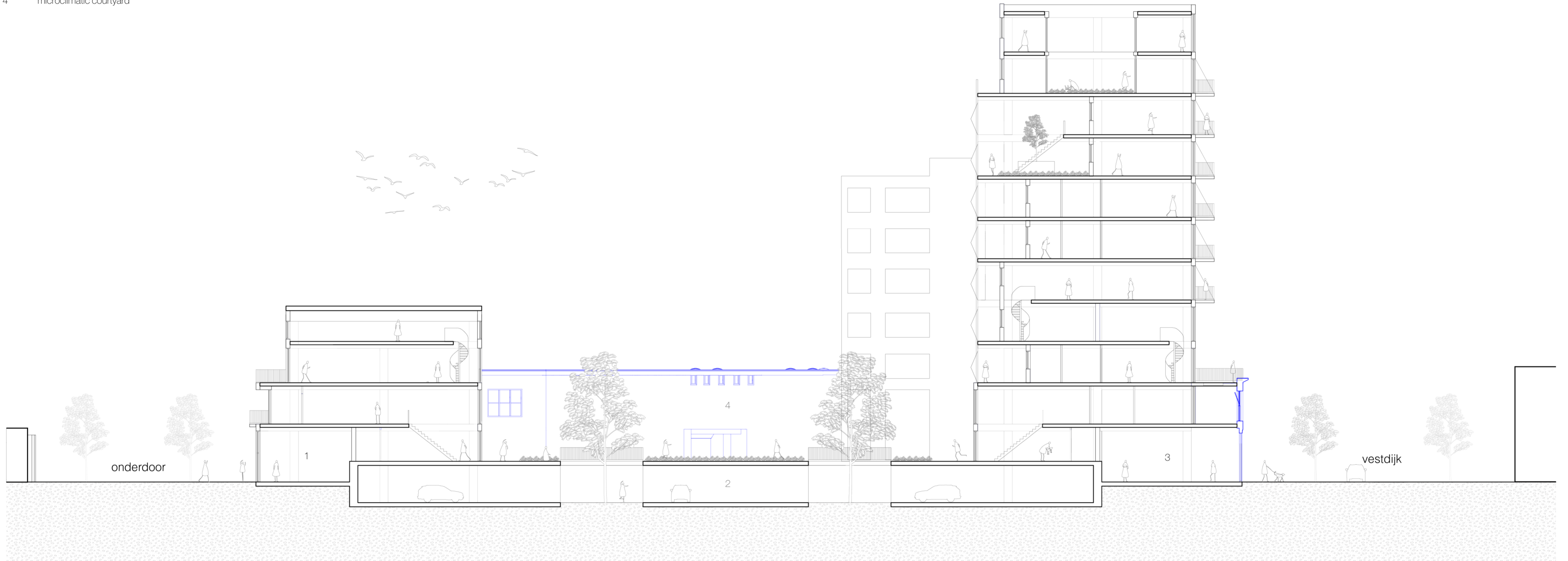
- 1 main core
- 2 bufferzone (engawa)
- 3 private terrace
- 4 collective garden





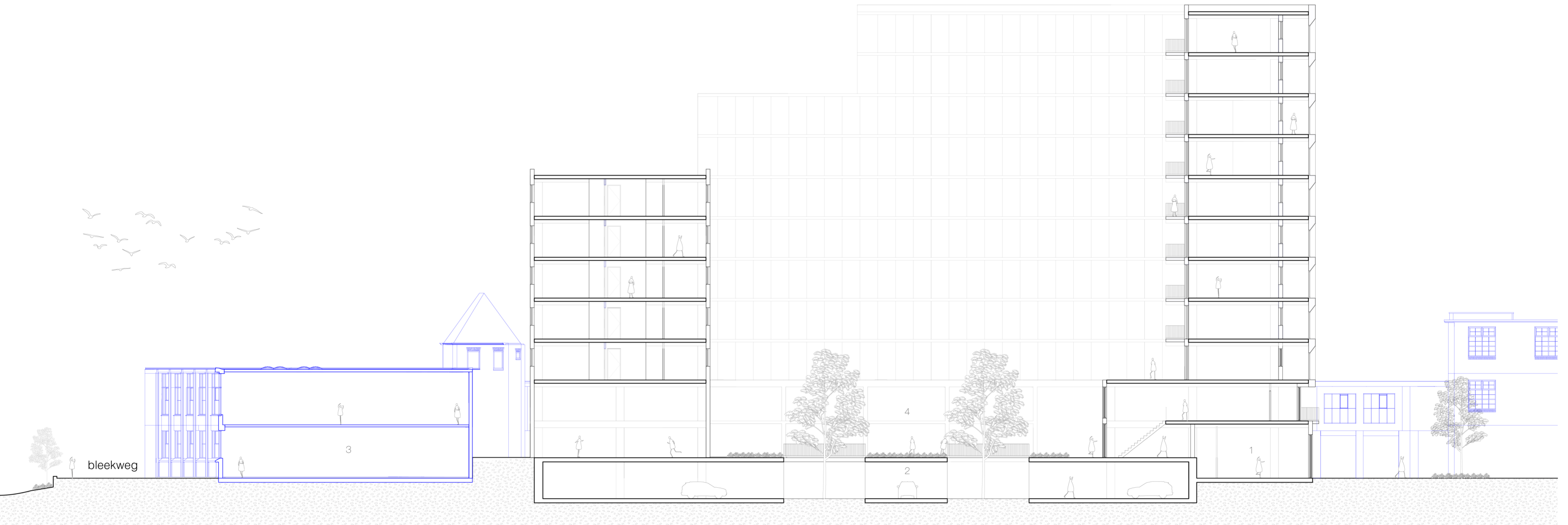


- 1 public lane
- 2 underground parking
- 3 startup business
- 4 microclimatic courtyard

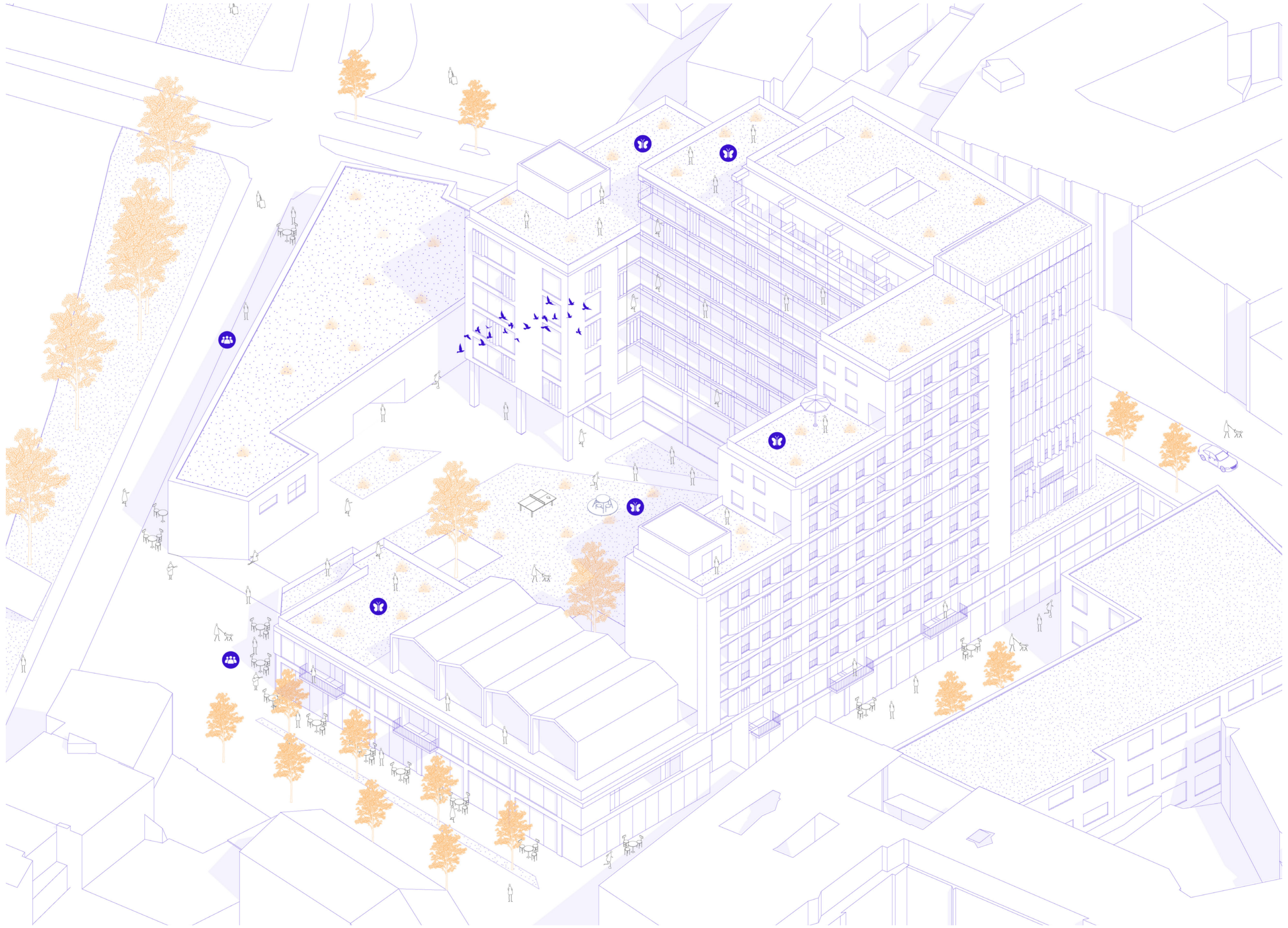


Longitudinal section 1:200

- 1 startup business
- 2 underground parking
- 3 existing brewery
- 4 microclimatic courtyard



Cross section 1:200

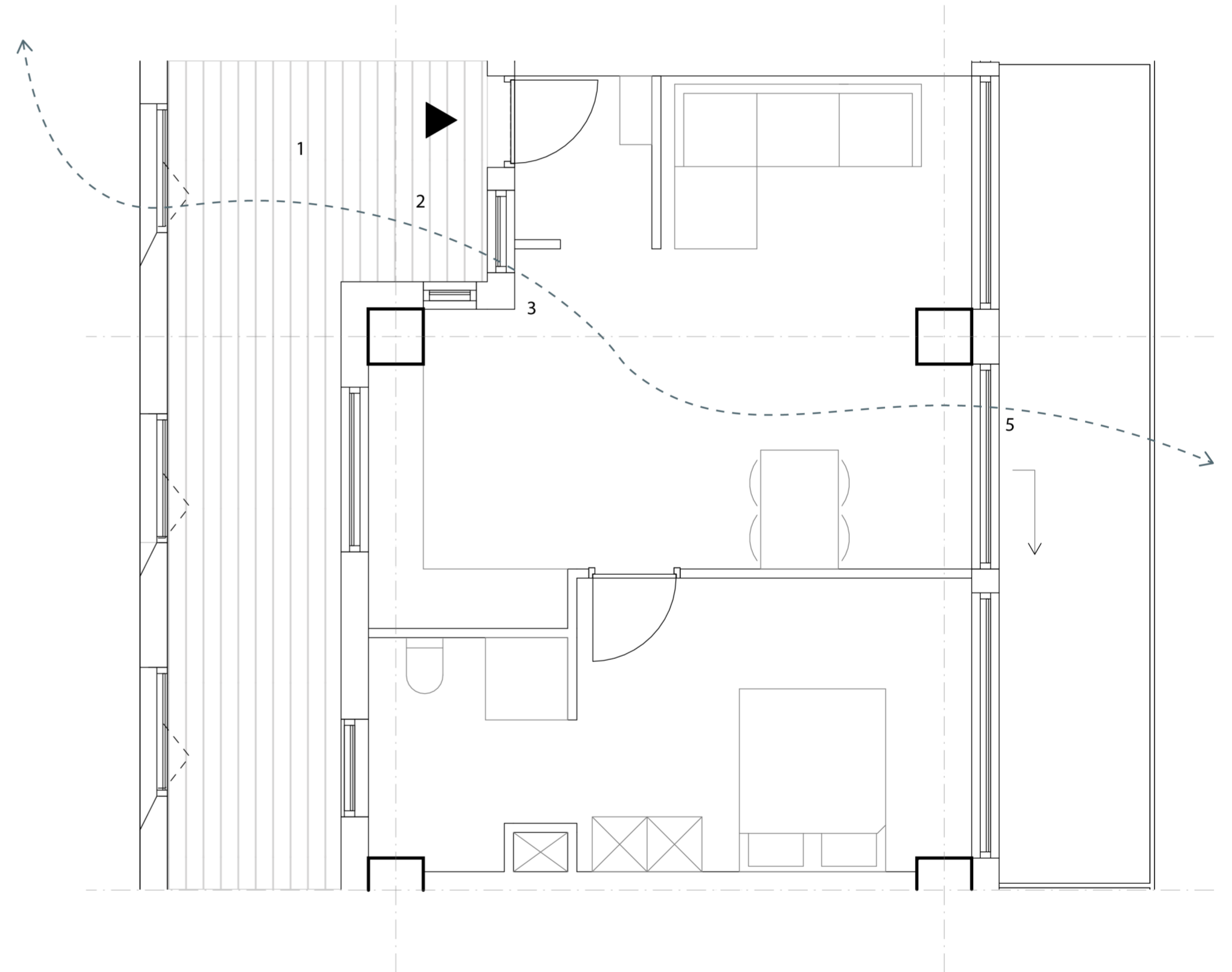
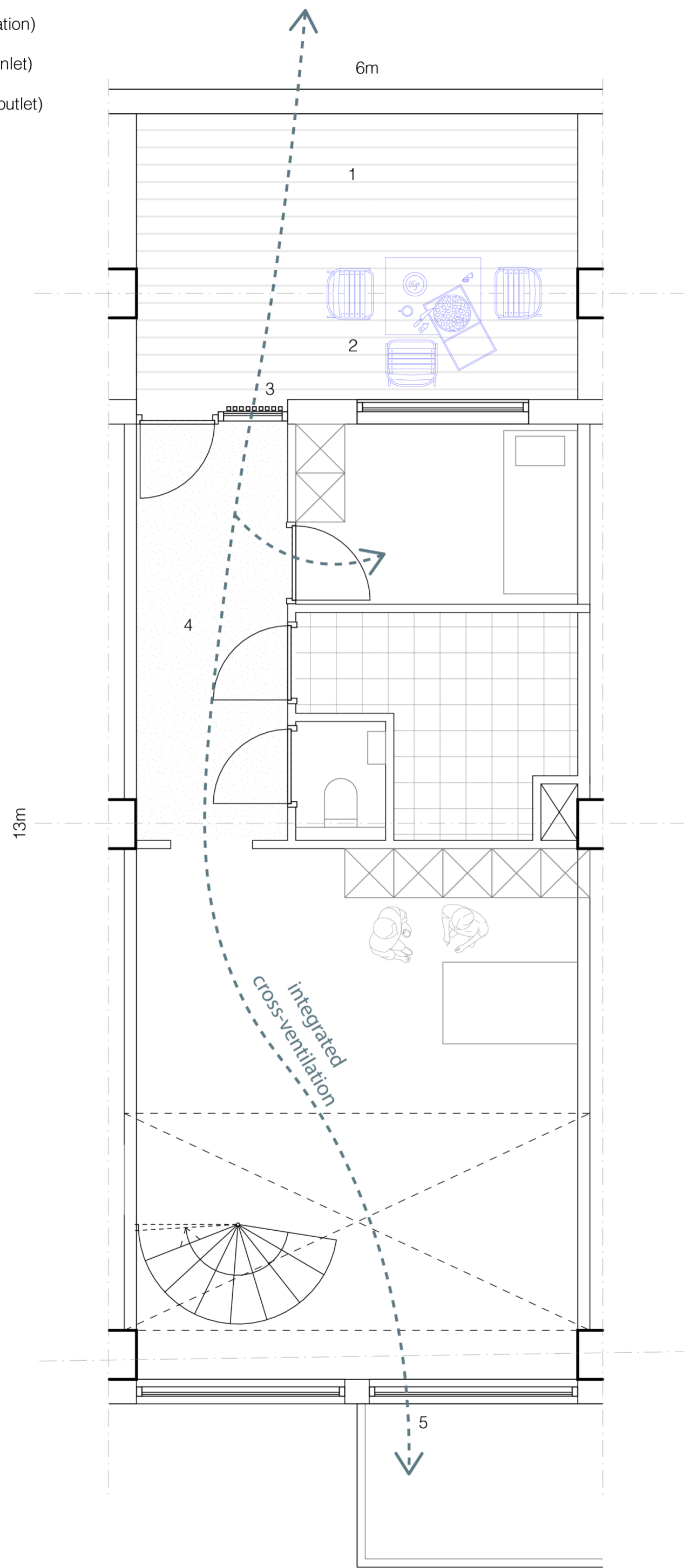


Isometric view



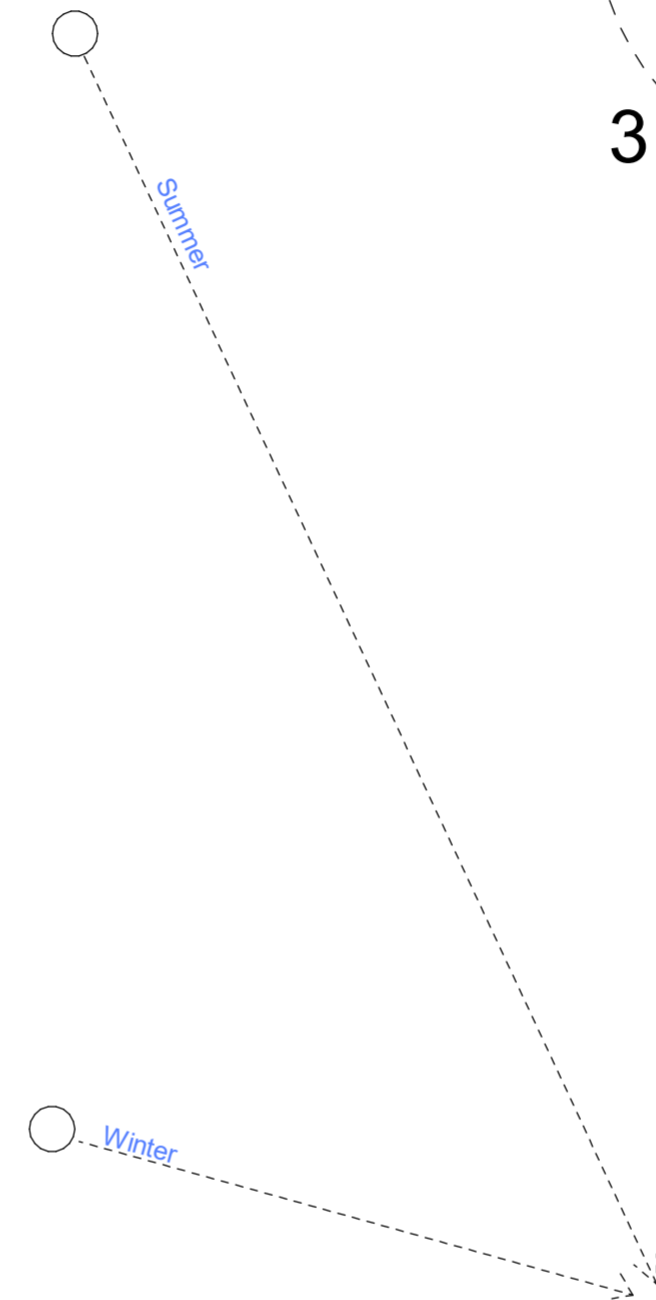


- 1 bufferzone (circulation)
- 2 private space
- 3 window opening (inlet)
- 4 toriwa
- 5 window opening (outlet)

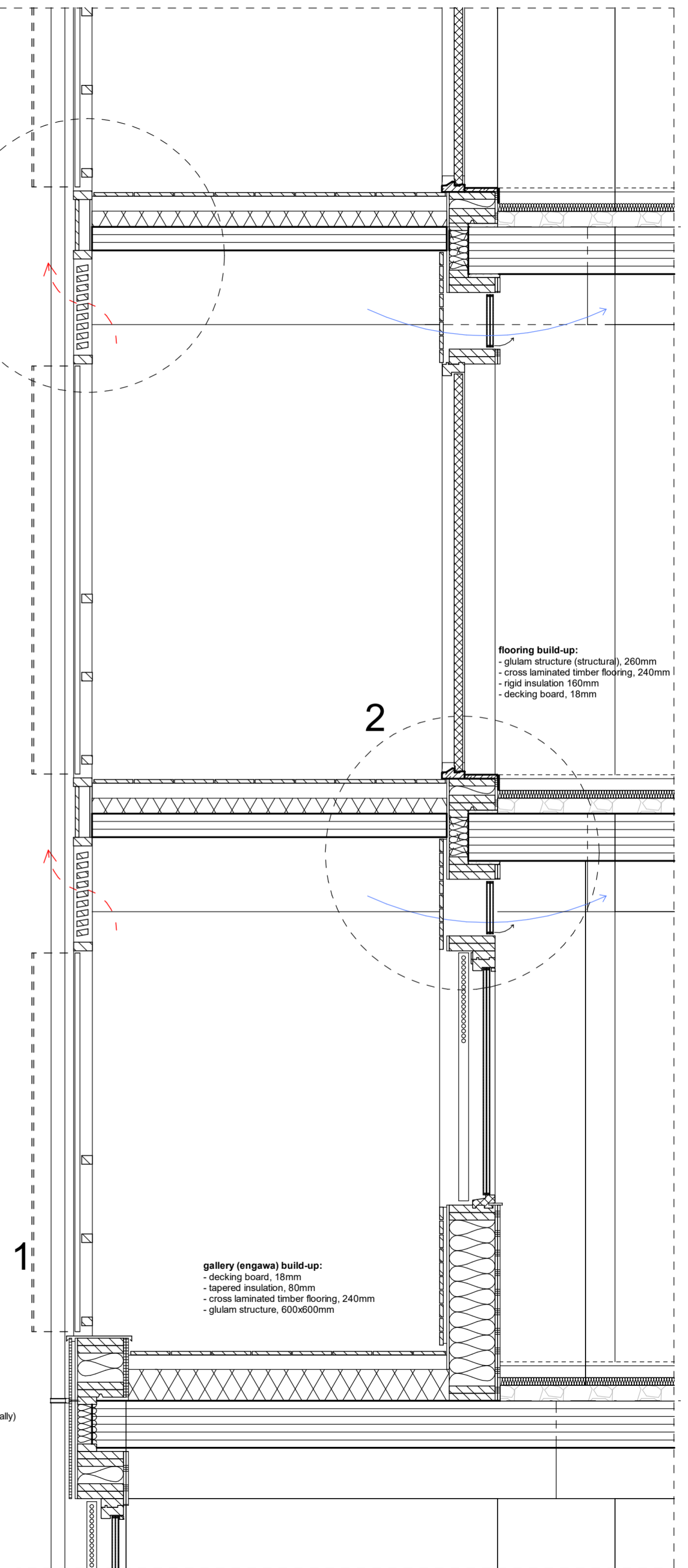




Façade fragment 1:20

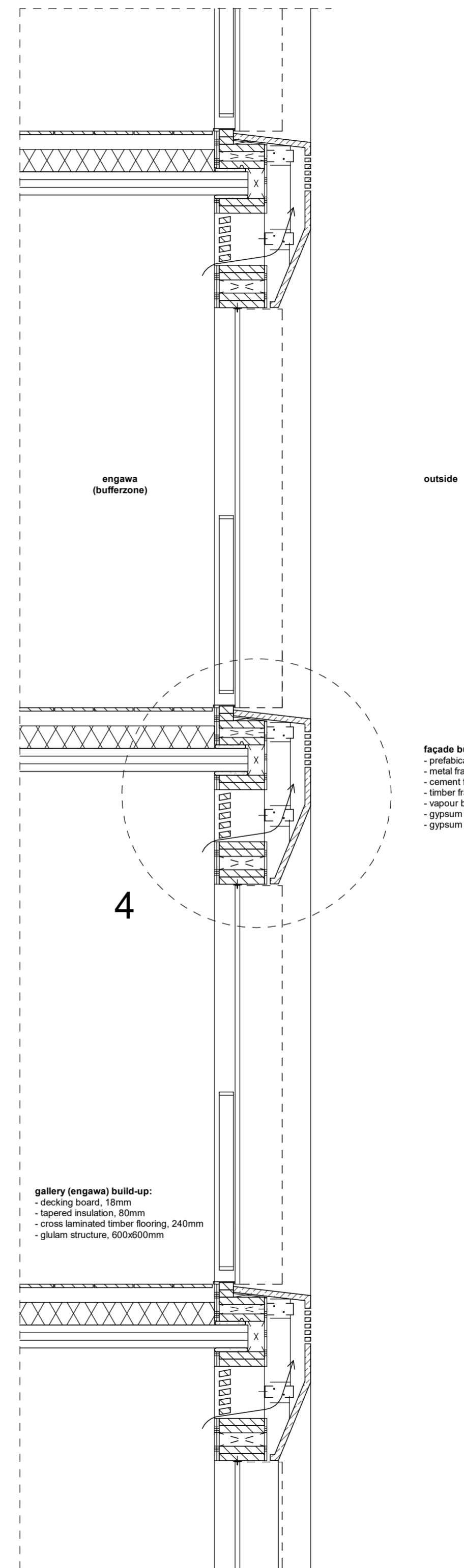


- façade build-up:**
- gypsum fibreboard, 12,5mm
 - gypsum fibreboard, 12,5mm
 - vapour barrier
 - timber framing with integrated glass panel (manually) allowing for cross ventilation, 235mm
 - cement fibre board 18mm
 - timber stud and batten framework
 - accoya wooden finish





Façade fragment 1:20



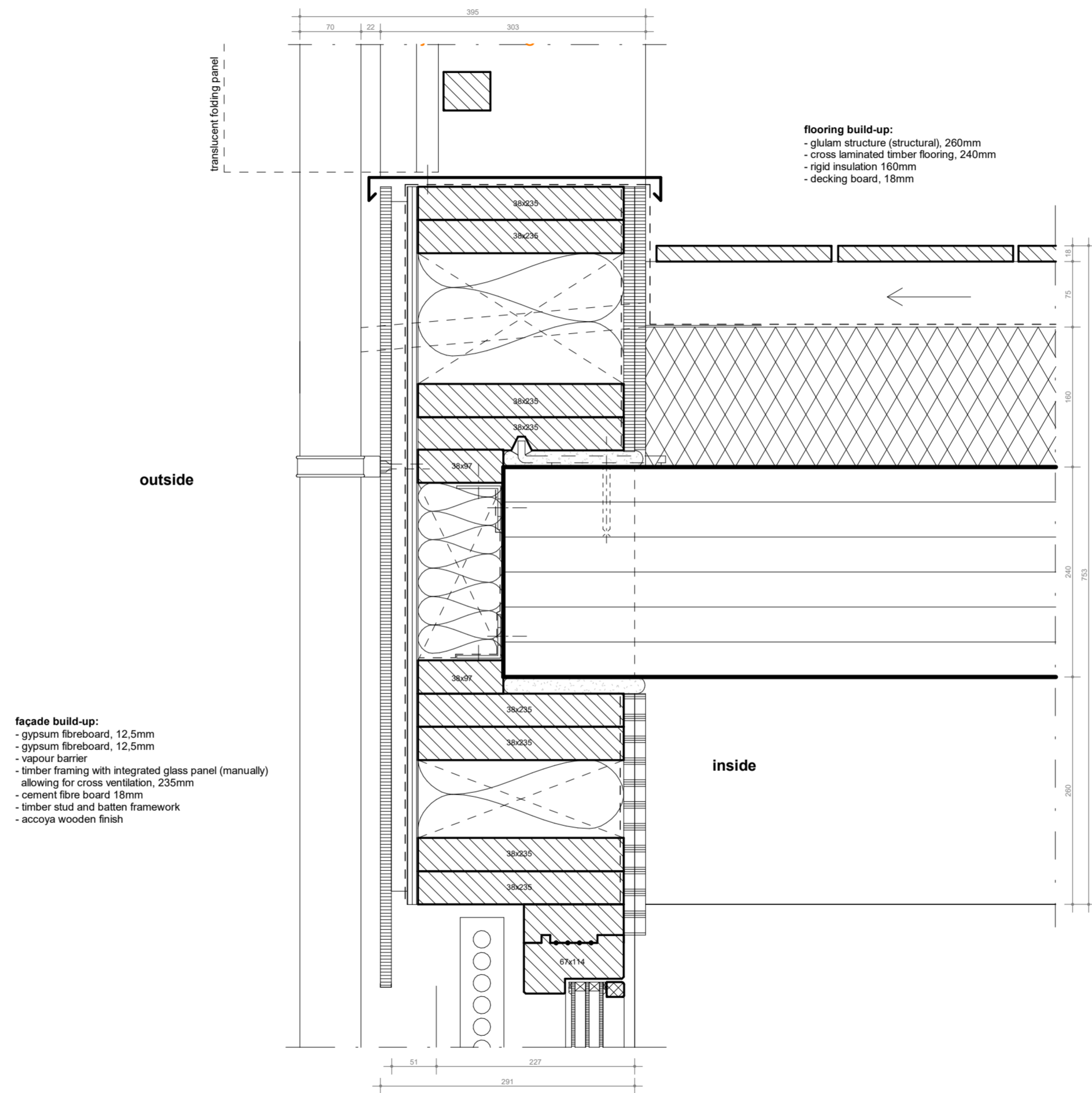
engawa
(bufferzone)

outside

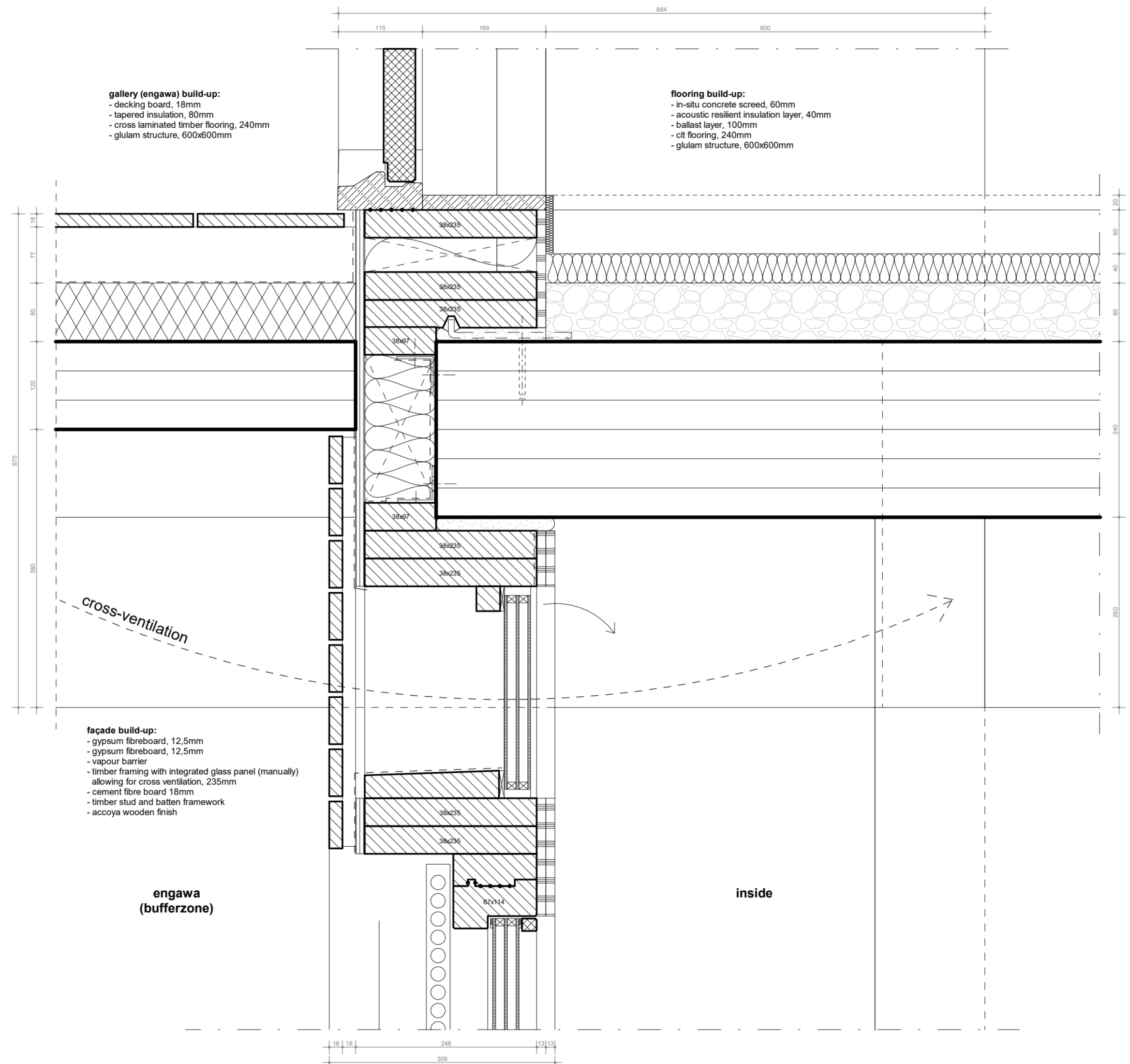
4

- façade build-up:**
- prefabricated ceramic façade with integrated nesting box
 - metal frame
 - cement fibre board, 18mm
 - timber framing with integrated insulation (sound barrier)
 - vapour barrier
 - gypsum fibreboard, 12,5mm
 - gypsum fibreboard, 12,5mm

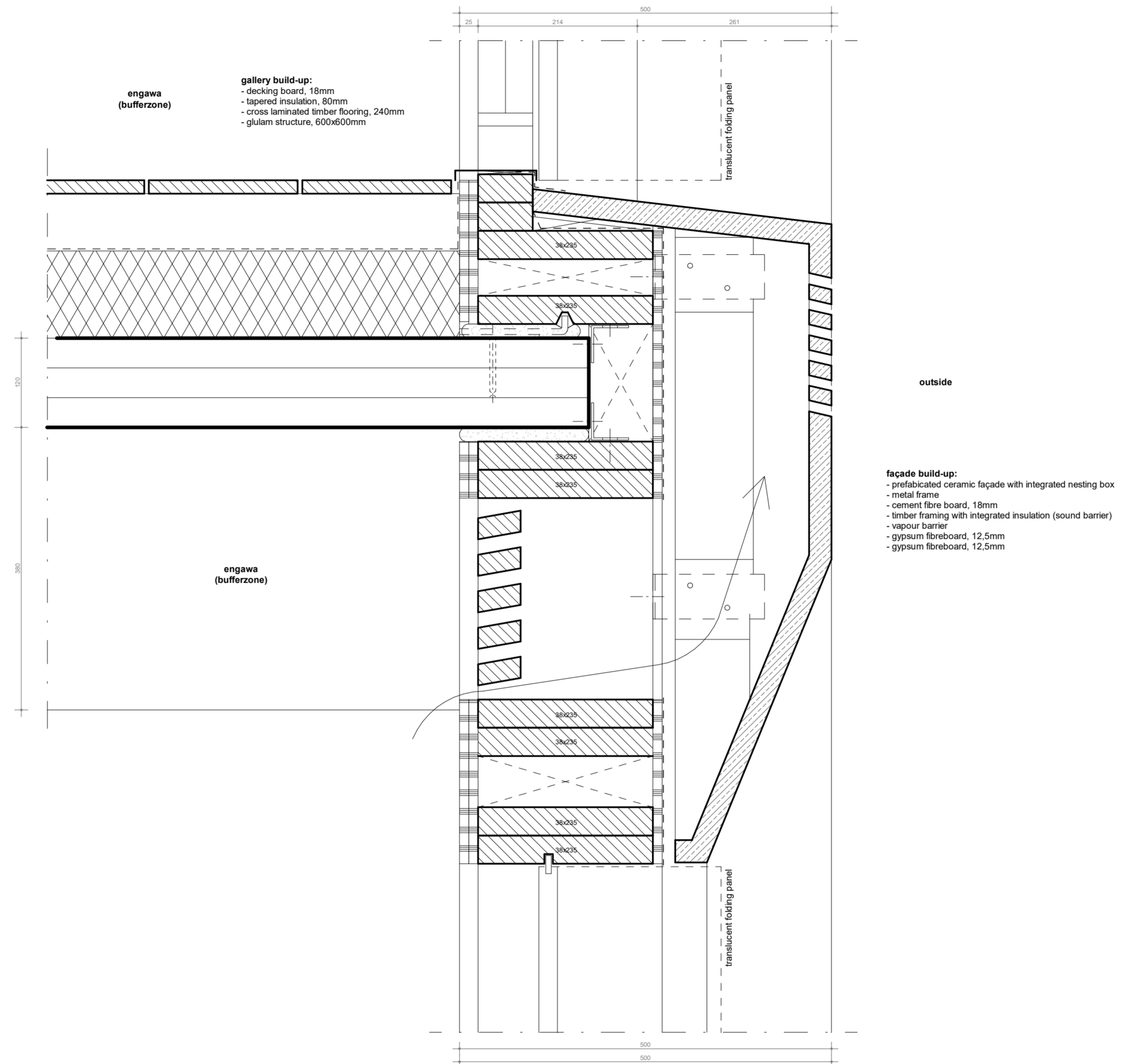
- gallery (engawa) build-up:**
- decking board, 18mm
 - tapered insulation, 80mm
 - cross laminated timber flooring, 240mm
 - glulam structure, 600x600mm



Detail V-01 1:5

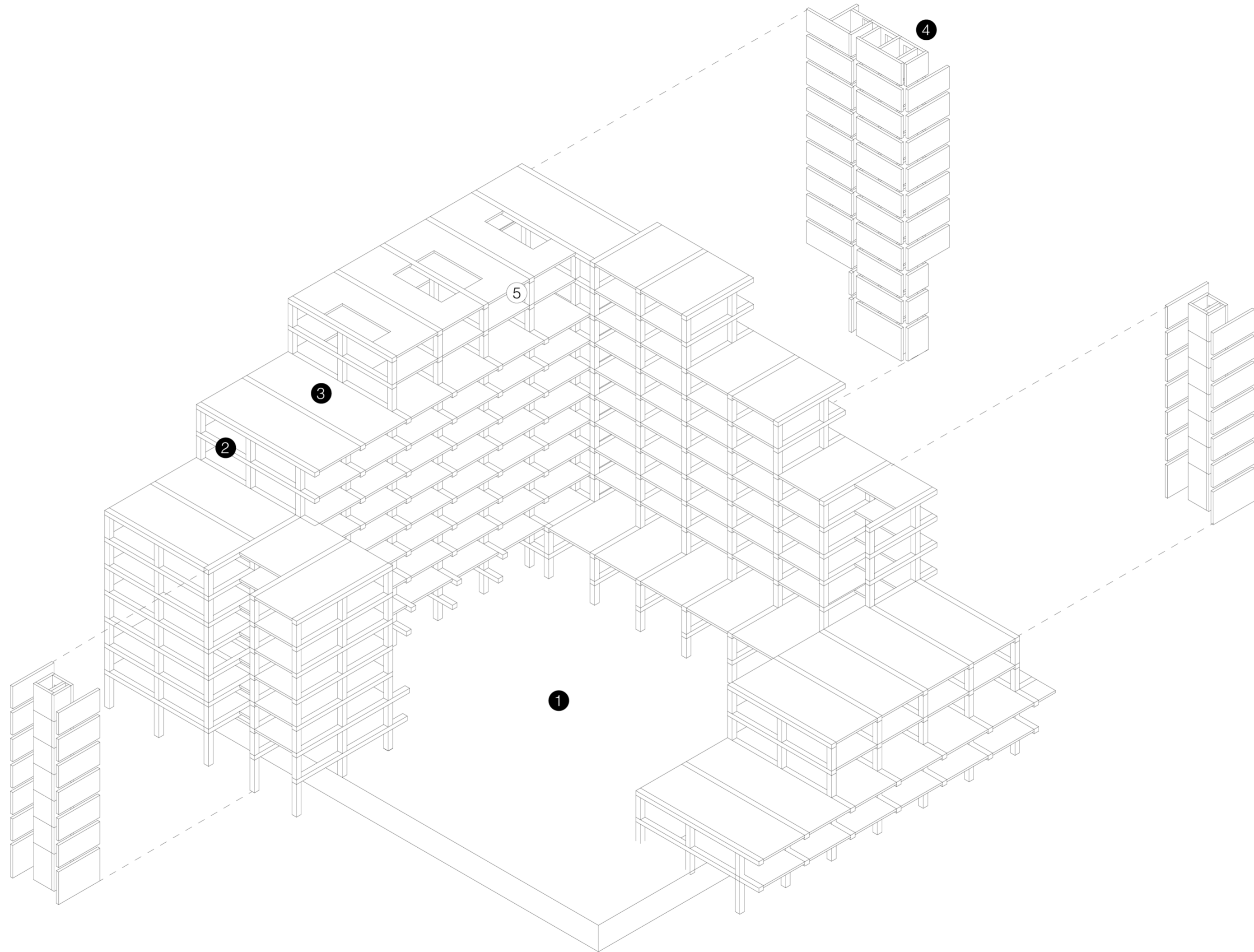


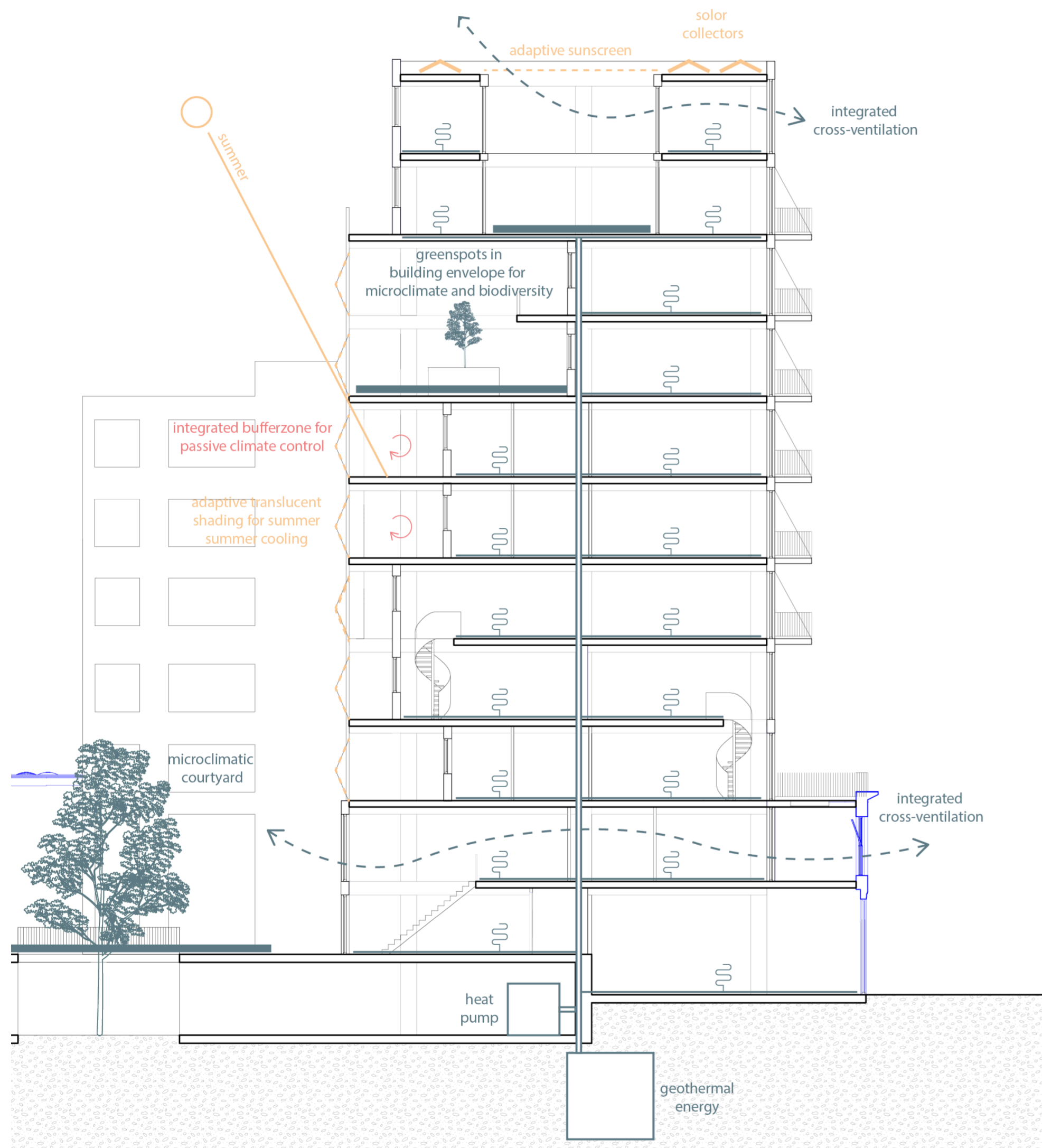
Detail V-02 1:5



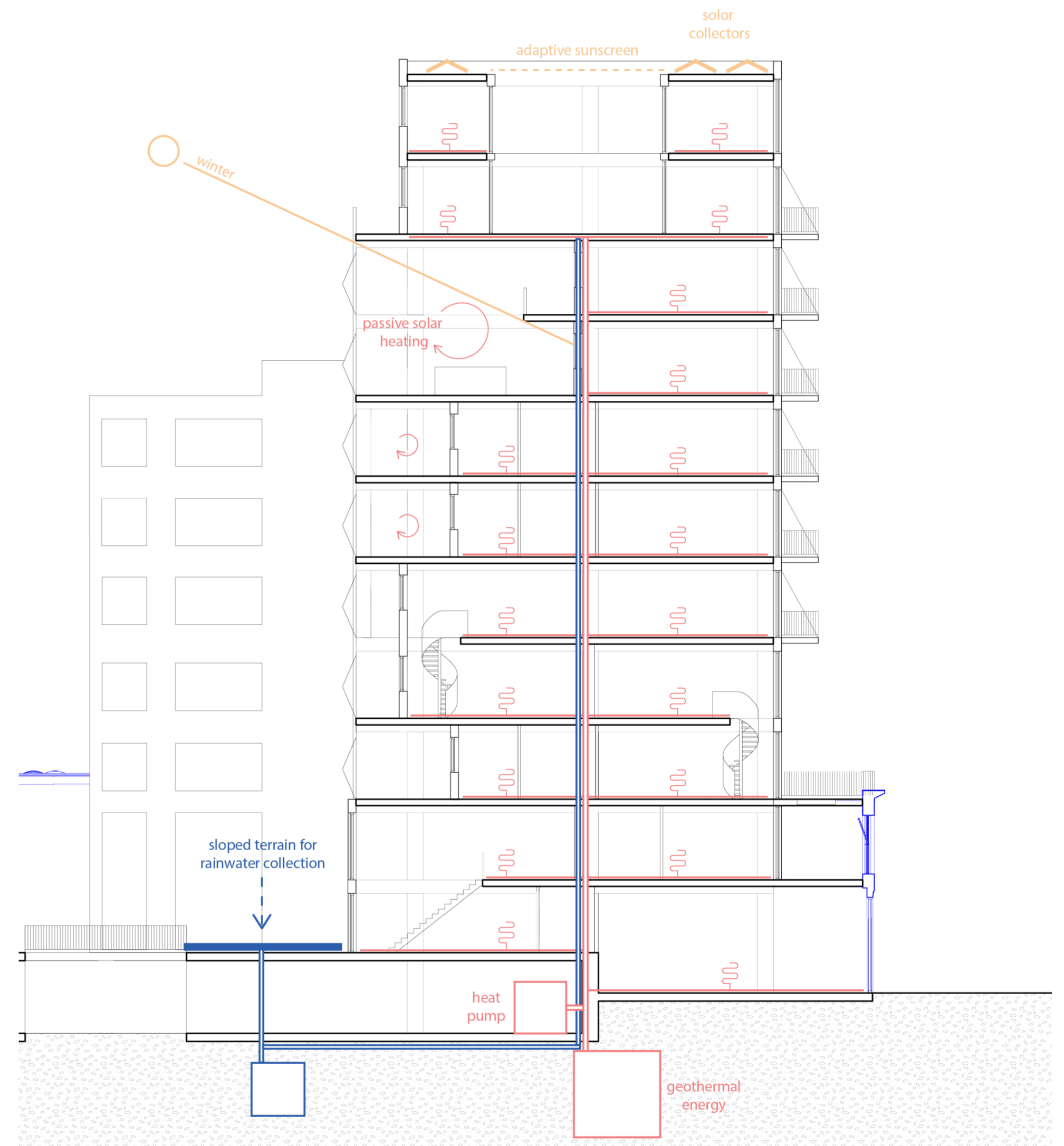
Detail V-04 1:5

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





Climate scheme summer



Climate scheme winter